

Florida Department of **Transportation**

Interchange Access Request User's Guide Safety Analysis Guidance

Florida Department of Transportation Systems Implementation Office, Mail Station 19 605 Suwannee Street Tallahassee, FL 32399

November 2020



Interchange Access Request – User's Guide

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IAR Safety Guidance

1.1 Introduction

The purpose of performing safety analyses in Interchange Access Requests (IARs) is to understand the impacts of the proposed modifications on safety and crash likelihood at an existing or proposed interchange. It is important that an appropriate safety analysis methodology is selected to analyze the proposed modifications in the IAR. The safety analysis method chosen for the IAR should be in concert with the purpose and need, alternatives analysis and other aspects of the study project. The objective of the safety analysis is to examine the effects of the IAR proposed modifications on the safety performance of the interchange. As such, the safety analysis should proactively aim at reducing or correcting potential safety concerns before recommendations are constructed. The safety analysis should include the analysis of the existing conditions using historic data and future safety analysis of the proposed modifications using statistical analysis techniques for crash prediction methods. The common methods to perform the future safety analysis are:

- i. the Countermeasure Crash Modification Factors (CMFs) and
- ii. the Highway Safety Manual (HSM) Part C Methodology.

These methodologies are based on the guidelines set by the <u>HSM</u>. The HSM is published by the American Association of State Highway and Transportation Officials (AASHTO) and includes methodologies to quantitatively predict a facility's safety performance. The "Predictive Method" in the HSM provides equations (Safety Performance Functions) that statistically predict the number of crashes on rural two-lane roads, rural multilane roads, urban/suburban roads, urban/rural freeways and ramps with specific geometric features and traffic volumes for a given period of time. Crash prediction methods offer a scientific and objective approach for predicting the quantitative safety differences of project alternatives. This allows analysts and reviewers to make sound engineering decisions regarding the proposed modifications in IARs.

The HSM was published in 2010 and, according to Volume 1, is "a resource that provides safety knowledge and tools in a useful form to facilitate improved decision making based on safety performance. ... The purpose of the HSM is to convey present knowledge regarding highway safety information for use by a broad array of transportation professionals." To present this information, the HSM is divided into four parts:

- Part A Introduction, Human Factors, and Fundamentals
- Part B Roadway Safety Management Process
- Part C Predictive Method
- Part D Crash Modification Factors

Per the HSM, "Part A describes the purpose and scope of the HSM and explains the relationship of the HSM to planning, design, operations, and maintenance activities. Part A also presents an overview of human factor principles for road safety and fundamentals of the processes and tools described in the HSM. ... Part B presents the steps that can be used to monitor and reduce crash frequency and severity on existing roadway networks. ... Part C of the HSM provides a predictive method for estimating expected

average crash frequency of a network, facility, or individual site. ... Part D summarizes the effects of various treatments such as geometric and operational modifications at a site. Some of the effects are quantified as CMFs. CMFs quantify the change in expected average crash frequency because of modifications to a site." The focus of this guidance will be on HSM Parts C and D. HSM Parts A and B are not covered in this guidance. For further information regarding HSM Parts A and B, please refer to the HSM.

1.2 Purpose

The purpose of this Safety Analysis Guidance is to provide:

- Direction for performing existing and future safety analysis in IARs using appropriate data and methods.
- Information to select and appropriately apply the Countermeasure CMF and HSM Part C methodologies.
- Consistent and uniform approach for completing safety analyses for IARs throughout the state.
- Analysis examples demonstrating the application of safety analysis methods for IARs.

This guidance is divided into the following sections:

- Methodology Letter of Understanding (MLOU)
- IAR Safety Analysis Process
- Existing Safety Analysis
- Future Safety Analysis
 - Guidance on the application of the Countermeasure CMF methodology: To perform a future safety analysis using the Countermeasure CMF methodology, sources such as the Federal Highway Administration (FHWA) CMF Clearinghouse, HSM and Florida Crash Reduction Factors (CRFs) can be used. Further information regarding Countermeasure CMF methodology is discussed in Section 1.6.1.
 - Guidance on the application of the HSM Part C methodology: The HSM Part C methodology is
 a multistep process to determine the predicted number of crashes at a location, based on the
 facility's roadway and traffic characteristics. Tools that support the HSM Part C methodology
 may be used to perform the safety analysis. Commonly available tools that are used to quantify
 safety include HSM spreadsheets, the Enhanced Interchange Safety Analysis Tool (ISATe) and
 the Interactive Highway Safety Design Model (IHSDM). Further information regarding the HSM
 Part C methodology is discussed in Section 1.6.2.
- Documentation of IAR safety analysis.

The Safety Analysis Guidance for IARs should be used by FDOT staff and consultants who perform and review safety analyses for IAR documents. The focus of this guidance is to assist the analyst in selecting the appropriate safety analysis techniques for IARs. It is assumed that the analyst has a basic knowledge of safety analysis and experience with HSM methods and tools.

1.3 Methodology Letter of Understanding (MLOU)

The safety analysis discussion provided in the MLOU should follow and be consistent with the MLOU template available on the <u>Systems</u> <u>Implementation Office website</u>. The following information is required in the safety section of the MLOU:

- Safety analysis years
- Historic crash data sources

The safety analysis discussion in the MLOU should be consistent with the MLOU template.

Safety analysis should be performed using the latest five years of historic crash data available at the MLOU stage. If data is not available for the latest five years, then three years of crash data can be used to perform the safety analysis. In case less than five years of data is used, it should be explained in the MLOU. If the project is put on hold and does not progress, then the crash data must be updated to the latest five years during the next project initiation. The second item to be included in the MLOU is the sources of historic crash data to be used in the safety analysis. Further discussion on the sources of historic crash data and their use is provided in **Section 1.5**.

The MLOU shall document an understanding that an existing and quantitative safety analysis will be performed and will be consistent with the safety guidance. If a known deviation from the safety guidance is expected during the MLOU stage, it should be documented in the MLOU. Additional deviations from the safety guidance that occur after the MLOU approval should be discussed with the State Interchange Review Coordinator (SIRC) and documented in the IAR.

An example of the safety discussion needed in the MLOU is provided below.

7.0 Safety AnalysisA. Detailed crash data within the study area will be analyzed and documented.Years: 2013-17Source: FDOT Safety Office

Crash data will be obtained from the FDOT Safety Office for the most recent five-year period on the mainline, interchanges and major cross streets within the area of influence. The data collected shall include the number, type and location of crashes and the crash severity. Actual crash rates along the facility will be compared with the statewide average rates for similar facilities to determine if any "high crash locations" exist within the study area.

The historic crash analysis will be used to inform the quantitative safety analysis of the future year alternatives utilizing Highway Safety Manual procedures. The safety analysis for the proposed conditions will document how the request will impact the facility's safety within the project study area. The quantitative safety analysis will comply with the guidelines of the FDOT Interchange Access Request User's Guide Safety Analysis Guidance to determine the estimated change in the expected number of crashes due to the proposed modifications of the project.

1.4 IAR Safety Analysis Process

The IAR Safety Analysis Process Flow Chart is depicted in **Figure 1**. The safety analysis methodology is determined based on the type of modifications that are being recommended.

The first step in the IAR safety analysis process is to perform the existing safety analysis. The existing safety analysis should be consistent with the guidance provided in **Section 1.5**.

Step two is to perform the future safety analysis. To begin the future safety analysis, determine if the proposed modifications have a CMF or Safety Performance Function (SPF) that is applicable. If a CMF or SPF is available, proceed to quantitative safety analysis. If a CMF or SPF is not available, proceed with qualitative safety analysis.

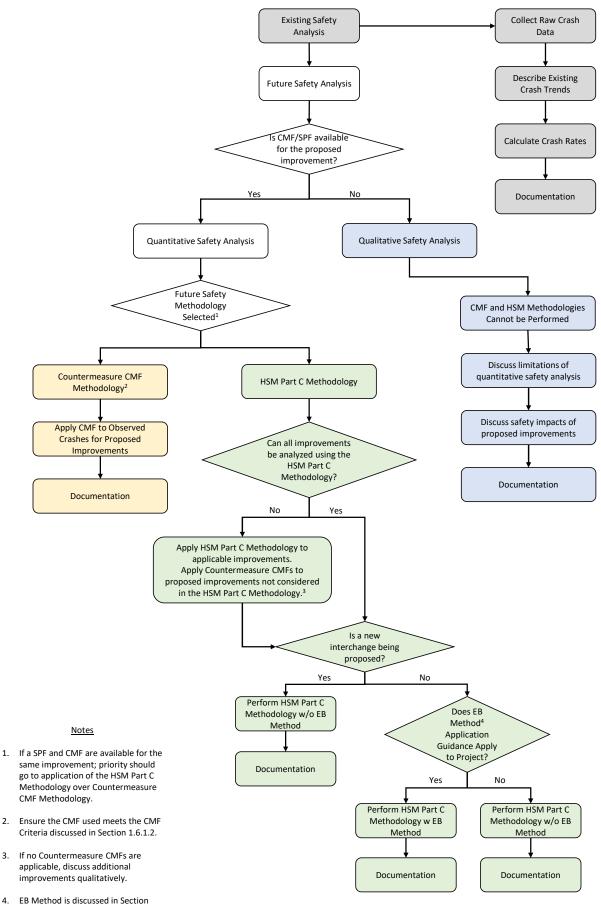
Qualitative safety analysis must only be selected if the quantitative safety analysis cannot be performed

using an applicable CMF or SPF. Qualitative safety analysis should include a discussion on the limitations of the quantitative safety analysis and the safety impacts of the proposed modifications. It is recommended that the discussion is supported by additional research and data, if available.

Qualitative safety analysis must only be selected if quantitative safety analysis cannot be performed.

If a CMF or SPF is available, a quantitative safety analysis should be performed. Depending on the proposed modification, the Countermeasure CMF methodology or HSM Part C methodology can be selected. If a CMF and SPF are available for the proposed modification, priority should be given to the application of the HSM Part C methodology over the Countermeasure CMF methodology.

Figure 1: IAR Safety Analysis Process Flow Chart



1.6.2.1.

1.5 Analysis of Existing Safety Conditions

The existing safety analysis helps identify safety issues within the project study area in the existing year. Along with traffic operations and other relevant factors, existing safety analysis helps develop the purpose and need for the project. An existing conditions safety analysis shall be performed for all IARs by analyzing the latest five years of historic crash data within the area of influence. If data is not available for the latest five

The study limits of the existing safety analysis are the same as for the operational analyses.

years, then three years of crash data can be used to perform the existing safety analysis. If a shorter study period is necessary due to nonavailability or discrepancies in data, it should be discussed in the IAR. The study limits of the existing safety analysis should be the same as for the operational analyses.

There are three main sources of historic crash data, as shown in **Figure 2**. These three sources should be used in the analysis, as per the hierarchical order of preference shown below.

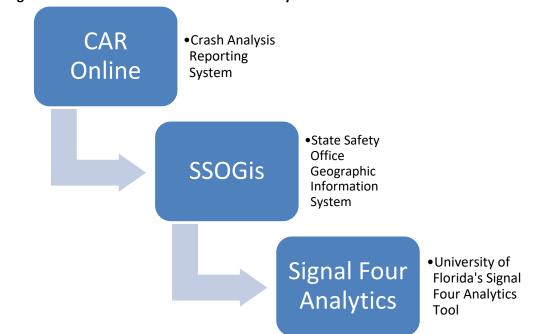


Figure 2: Historic Crash Data Sources Hierarchy

 <u>Crash Analysis Reporting System (CAR Online)</u> data can be requested from the District or State Safety Office or accessed from the FDOT mainframe. The CAR Online database includes crashes on all public roads, along with roadway and geolocation data. The data is subject to an extensive review by FDOT prior to publishing which typically results in a data entry lag. The approved CAR Online database should be the first source of crash data that is considered in the safety analysis prior to using other sources.

- 2. <u>The State Safety Office Geographic Information System (SSOGis)</u> is a publicly available crash database in the form of a web-based map, that is maintained by the FDOT Safety Office. The map can be accessed on the State Safety Office's traffic safety web portal. This database covers state highways and local roadways. SSOGis does not include the detailed crash data fields that are included in the CAR Online database, but the information provided is sufficient for safety analysis in IARs. Like the CAR Online database, the SSOGis also experiences delays in data entry due to the review process.
- 3. <u>The University of Florida's Signal Four Analytics tool</u> is an interactive, web-based geospatial crash analytical tool developed and maintained by the GeoPlan Center of the University of Florida. The tool provides up-to-date crash data for the entire state reported by law enforcement to the Department of Highway Safety and Motor Vehicles. The tool also has built in crash analysis functions to evaluate the data. It is a good source of crash data for non-state arterials. If the study interchange is on a local road, then data from Signal Four Analytics tool is required as information may not be available from CAR Online and the SSOGis. A limitation of this tool is that the locations and crash data are not subject to the same scrutiny as the CAR Online and SSOGis databases.

CAR Online or the SSOGis should be used as the primary sources of historic crash data. If data is missing for a local road, Signal Four Analytics can be used to supplement the CAR Online or SSOGis data. If multiple sources of crash data are used to cover the safety analysis study area, ensure that the data collected is for the same time period. It is common for the CAR

Crash data from multiple sources must be for the same time period.

Online and SSOGis crash data to lag behind the Signal Four Analytics database. If the most recent crash data used from CAR Online or the SSOGis is 2013–17, then the Signal Four Analytics crash data should also

Do not mix data sources to meet the five years of safety data requirement. be from 2013–17, even if the 2018–20 crash data is available. Also, do not mix data sources to meet the five years of safety data requirement. For example, do not take two years (2013–14) of crash data from CAR Online and three (2015–17) years of crash data from Signal Four Analytics.

In addition to ensuring the same data collection years are used, it is important to check and validate the crash data and ensure that crashes are not double-counted when using multiple sources.

The historic crash data collected should include all roadway elements (freeway segments, merge/diverge areas, weaving segments, arterial segments and intersections) within the area of influence.

The historic crash data collected should include at a minimum:

- Crash type
 - Overturns, rear-ends, angle, sideswipes, hitting fixed objects, etc.
- Prevalence of crash types
- Crash patterns and crash contributing factors
- Crash severity
 - Fatal injury, incapacitation injuries, non-incapacitation injury, possible injury, no injury (property damage only) — commonly referred to as KABCO

Existing conditions safety analysis uses observed crash data to determine crash severity for historic crashes, crash trends, crash types and major contributing factors. The existing conditions safety analysis' purpose is to identify areas where there may be a safety concern and should include:

a. Description of Existing Crash Trends

A written description of the crashes occurring over the analysis period, broken down by location, is required.

The descriptions must provide the following:

- Number of crashes occurred (crash frequency)
- The most frequent crash type
- Common crash cause
- Severity of crashes
- Pedestrian and bicycle crashes

An example of the written description of crashes that should be provided in the IAR is provided below.

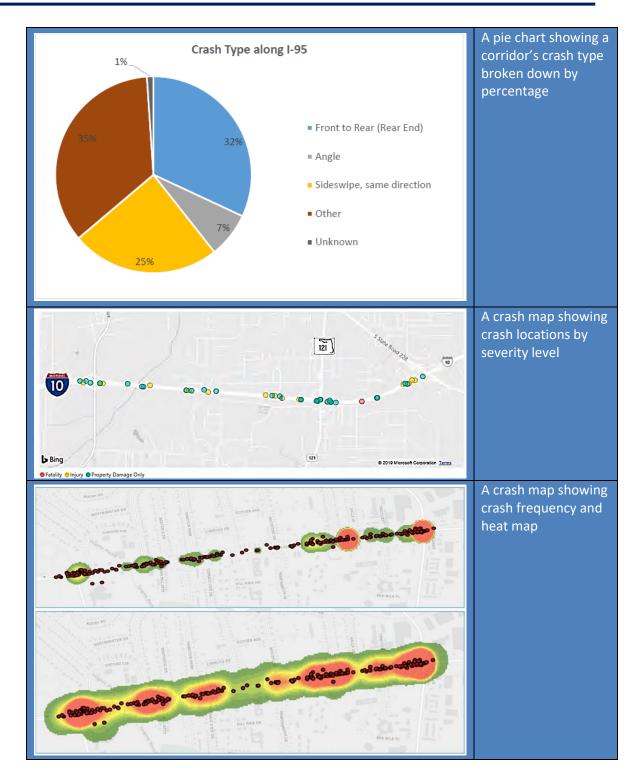
There were 354 reported crashes along the interstate within the study area during the fiveyear period; 66 occurred in 2014, 94 in 2015, 109 in 2016, 55 in 2017 and 30 in 2018. Based on crash severity, of the 354 reported crashes, 250 (70.6%) were property-damage-only crashes, 99 (28.0%) were injury-type crashes and five (1.4%) were fatal crashes. There were 95 (26.8%) night/dusk/dawn crashes reported, which is lower than the statewide average for all roadways of 30 percent, and 72 (20.3%) of the total crashes occurred under wet/slippery pavement conditions, which is higher than the statewide average for all roadways of 18 percent. Among the contributing causes documented in the crash data, work zone-related (95–27%), careless driving (90–25%) and improper lane change/passing (55–16%) were among the highest. There were no pedestrian or bicycle reported crashes. Rear end (139–39%), sideswipe (109–31%) and fixed object (52–15%) crash types had the highest frequencies.

b. Crash Tables and Diagrams

Crash tables and diagrams — such as heat maps, bar charts, pie charts or other maps graphically showing the common crash types, common crash causes, severity of crashes and high crash locations along a system or at an interchange — should be created. It is not required that each of these tables and diagrams be provided. It is recommended that a sufficient number of tables and diagrams are provided to adequately present the historic safety analysis. Examples of recommended tables and diagrams are shown in **Figure 3**.

Figure 3: Crash Table and Diagram Examples

Figure 3: Cra							-						A table showing eac
Crash Segment	Rear	Head		Roll		Crash T Left	ype Right	Off	Pedestrian			Total	—
175 SP Marga from SP	End	On	Sideswipe	Over	Angle	Turn	Turn	Road	& Bicycle	Animal	Other		crash segment
I-75 SB Merge from SR 82	4	0	1	0	0	0	0	7	0	0	3	15	broken down by
I-75 SB between SR 82 & SR 884	3	0	2	0	0	0	0	2	0	0	3	10	, crash type
I-75 SB Diverge to SR 884	4	0	3	0	0	0	0	3	0	0	3	13	crash type
I-75 & SR 884 SB Off-	9	0	4	0	1	0	0	1	0	0	1	16	
Ramp I-75 NB On-Ramp from	0	0	3	2	0	0	0	1	0	0	1	7	
WB SR 884 I-75 NB Merge from													
WB SR 884	2	0	4	0	0	0	0	5	0	0	3	14	
I-75 NB between SR 884 & SR 82	1	0	0	0	0	0	0	2	0	0	0	3	
I-75 NB Diverge to SR 82	2	0	1	0	0	0	0	2	0	0	2	7	
Total	25	0	18	2	1	0	0	23	0	0	16	85	
									0.0%	0.0%			
Percentage of Total	29.4%	0.0%	21.2%	2.4%	1.2%	0.0%	0.0%	27.1%	0.0%	0.0%	18.8%	100%	
							Cruck		O Date				A table showing eac
			-					<u>د</u>	icy & Rate egment	No. of		otal	crash segment
Crash S	egmen	T	s	everity		. of shes	Daily Volum		Length	Crashe	s C	rash	
							VOIDIN	e ((miles)	Per Yeo	ar 🔤	Rate	broken down by
I-75 between	004	8 CD 0	2	Total Fl		3 3	93,50	0	0.46	2.60		0.16	crash frequency and
-/ J between (/K 004	G JK 0.		PDO		0	73,30	~	0.40	2.00			
				Total		5							crash rate
I-75 SB Merg	je from	SR 82		FI		2	46,75	0	0.29	3.00		0.62	
				PDO		3							
175 CD D:		D 004	-	Total Fl	_	3 3		~	0.00	0 (0			
I-75 SB Dive	ge to S	K 884	-	PDO		0	46,75	0	0.29	2.60		0.53	
				Total		6							
I-75 & SR 884	4 SB Of	f-Ramp		FI	-	5	11,50	0	0.22	3.20		3.48	
				PDO	1	0							
1-75 NB	On-Ran	n		Total	_	7							
from W			-	FI			2,20	C	0.36	1.40		4.88	
				PDO Total	_	5 4					_		
I-75 NB Merge	from W	B SR 88	84	FI		3	46,75	0	0.29	2.80		0.58	
Ŭ				PDO	1								
				Total	7			-					
I-75 NB Dive	erge to	SR 82	-	FI PDO	_	3	46,75	0	0.29	1.40		0.29	
Note: *Daily vol	ume is 20	018 AA	DT from the				(FTO) W	ebsite					
													A bar chart showing
			Cras	hes by	/ Yeai	r and	Seve	rity					
35								·					yearly crashes
55													broken down by
30													crash severity
50													crush sevency
25													
25													
20													
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10 <u> </u>				-									
5	PDO	Eatality	Iniun - Di		lity being			ality Jein		Eatality	Injuga	PDO	
5	PDO I	Fatality	Injury PI 2014	DO Fata	ality Inju 20		DO Fat	ality Inju 20		Fatality	Injury 2017	PDO	



c. Calculation of Crash Rates

Crash rates are reported as a measure of the existing safety condition as they help neutralize the number of crashes relative to traffic exposure variables. Actual crash rates are compared to statewide average crash rates for comparable facilities to determine if a crash location is a high-crash location. If a location has a higher crash rate than the statewide average, it should be noted and considered when recommending modifications. The most recent statewide average crash rates

for Florida can be obtained from the FDOT Safety Office. Actual crash rates are calculated for roadway segments and intersections. The calculation of the roadway segment and intersection crash rates should be included in the existing safety analysis.

The roadway segment crash rate is calculated in crashes per million vehicle miles traveled. The roadway segment crash rate equation is:

 $Crash Rate = \frac{total \ number \ of \ crashes \ \times \ 1,000,000}{segment \ length \ \times \ AADT \ \times \ (number \ of \ years \ \times \ 365)}$

Where:

Total number of crashes: total number of crashes over the existing safety analysis study period (e.g., five years)

Segment length: length of roadway in miles

AADT: Annual Average Daily Traffic (Average Daily Traffic can be used if AADT is not available)

The intersection crash rate is calculated in crashes per million entering vehicles. The intersection crash rate equation is:

 $Crash Rate = \frac{total \ number \ of \ crashes \ \times \ 1,000,000}{total \ intersection \ entering \ AADT \ \times \ (number \ of \ years \ \times \ 365)}$

Where:

Total number of crashes: total number of crashes over the existing safety analysis study period (e.g., five years)

AADT: sum of daily traffic entering the intersection from each approach

Calculate the Freeway Crash Rate

An IAR is being performed along a 1.5-mile, six-lane urban interstate corridor. A review of the historic crash data shows 200 crashes have been reported between 2013 and 2017. The freeway segment has an AADT of 85,000. What is the segment's actual crash rate?

 $crash rate = \frac{total \ number \ of \ crashes \ \times \ 1,000,000}{segment \ length \ \times \ AADT \ \times \ (number \ of \ years \ \times \ 365)}$

 $crash \, rate = \frac{200 \times 1,000,000}{1.5 \times 85,000 \times ((2017 - 2013) \times 365)}$

 $crash\,rate = 1.074$

In Florida, the statewide average crash rate for a similar urban interstate facility is 0.976. Because the actual crash rate is higher than the statewide average, this segment should be noted as a high-crash location.

d. Documentation

The safety analysis of the existing conditions should be summarized in the existing conditions section of the IAR. It should summarize crash rates, crash types, crash trends, high crash locations and other safety concerns using the methods and graphics discussed above. Existing safety analysis

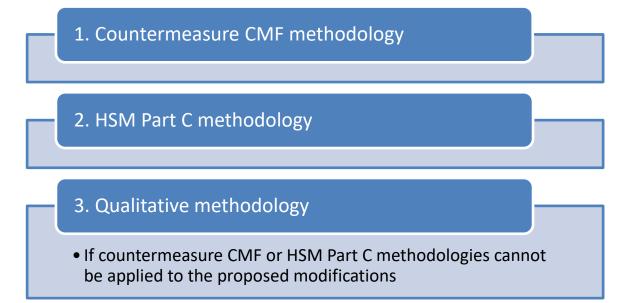
Existing safety analysis documentation should include discussion about fatal crashes and high-crash locations.

documentation should include a discussion about any fatal crashes and/or high-crash locations. Lastly, the discussion should include critical crashes involving pedestrians and cyclists since many of these crashes result in injury or fatality. It is not common practice in Florida to perform HSM Part C analysis for existing conditions. However, if the analyst deems it appropriate for the project, it can be performed. Any supporting data and calculations should be included in the appendix of the IAR.

1.6 Future Safety Analysis

The future safety analysis helps evaluate and compare the potential safety impacts of no-build and proposed alternatives in the IAR. Future safety analysis can be performed using the three methodologies shown in **Figure 4**.

Figure 4: Future Safety Analysis Methodologies



The three methodologies can be applied in isolation or in combination depending on the type of proposed modifications. There is no single method that is applicable to all project conditions. The method chosen

for future safety analysis depends on multiple factors such as availability of CMFs or SPFs, type of recommended modifications etc. It is possible that not all recommended modifications can be analyzed using the Countermeasure CMF or HSM Part C methodology. Hence a combination of

The three methodologies can be applied in isolation or in combination depending on the proposed modifications.

the three methods may be necessary in such situations. This is illustrated by the four project examples shown below.

Project	Modification	Future Analysis Approach
1	Diamond Interchange to DDI	Countermeasure CMF Methodology
2	Interstate Widened from Four to Six Lanes	HSM Part C Methodology
3	Diamond Interchange to DDI and Interstate Widened from Four to Six Lanes	Combination of Countermeasure CMF and HSM Part C Methodologies
4	Convert Single Point Urban Interchange to a Diverging Diamond Interchange	Qualitative Methodology

1.6.1 Countermeasure CMF Methodology

A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure. Therefore, CMFs are applied to the existing crashes observed without treatment to compute the expected crashes due to the proposed modification. For example, a project is recommending an intersection be converted to a high-speed roundabout. The existing intersection experiences a crash frequency of 10 crashes per year. A 4-star CMF from the CMF Clearinghouse, that is

applicable to the recommended modification, is selected. The CMF, with a value of 0.659, is multiplied by the existing 10 crashes per year to determine the predicted crash frequency due to the recommended modification. It is predicted the conversion to the high-speed roundabout will result in 6.59 crashes per year or a reduction of 3.41 crashes per year.

CMFs are applied to the existing crashes to compute the expected crashes after modification.

The value of a CMF indicates how effective or ineffective a proposed modification could be. If a CMF of 1.0 is applied, it implies the proposed modification will have no effect on the number of crashes. If a CMF of greater than 1.0 is applied, it implies the proposed modification will increase the number of crashes. If a CMF of less than 1.0 is applied, it implies the proposed modification will decrease the number of crashes.

Another way to represent the reduction in crashes is the Crash Reduction Factor (CRF). A CRF is an estimate of the percentage reduction in crashes due to implementation of a countermeasure. The CRF is equal to 100*(1-CMF).

There are two types of CMFs: Countermeasure CMFs and HSM Part C CMFs.

1. Countermeasure CMFs should be used when performing the Countermeasure CMF methodology for IARs. Countermeasure CMFs are used to estimate how a countermeasure will change crashes at a specific location. Countermeasure CMFs are developed using multiple sites, studies and statistical methods. An example of a Countermeasure CMF is provided below.

Recommended countermeasure: A deceleration lane on the off-ramp is being extended from 150 feet to 350 feet.

Step 1: Research CMFs

Step 2: Select applicable CMF

For this recommended modification, the following CMF from the FHWA Clearinghouse is recommended:

▼ Countermeasure: Change length of deceleration lane from 201-300 ft. to 601-700 ft.									
Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments	
	0.155	84.47	statat ainin	All	All	Not specified	CHEN, ZHOU, AND LIN, 2012		

The application process of the Countermeasure CMFs, along with examples of when to use Countermeasure CMFs, is discussed in **Sections 1.6.1.3** and **1.6.1.4**, respectively.

2. HSM Part C CMFs are used in the predictive models as adjustment factors for the SPFs. Each SPF is applicable to a set of base geometric design and traffic control features. CMFs are used to adjust the SPF estimate and determine the predicted number of crashes to account for differences between the base geometric design and actual geometric design of the site. Each SPF has unique HSM Part C CMFs that are applicable to the SPF. The predicted number of crashes is shown in general form using this equation:

$$N_{predicted} = N_{SPF} \times (CMF_1 \times CMF_2 \times CMF_n)$$

Where:

N_{predicted}: site-specific predicted number of crashes

 $N_{\mbox{\scriptsize SPF}}$: predicted number of crashes with base conditions

 CMF_n : crash modification factor for treatment i to adjust $\mathsf{N}_{\mathsf{SPF}}$ to site-specific geometric design and traffic control features

An example of the application of the HSM Part C CMFs is provided below.

Recommended modification: An off-ramp at the study interchange is being widened from one lane to two lanes.

Step 1: Select SPF equation — HSM Equation 19-20 (for multiple vehicle crashes):

 $N_{SPF \ Ramp} = L_r \times \exp\left(a + b \times \ln(c \times AADT_r) + d(c \times AADT_r)\right)$

Step 2: Determine initial number of crashes under base geometric design and traffic features using SPF equation in Step 1

Step 3: Calculate all HSM Part C CMFs applicable to this ramp segment SPF from HSM Chapter 19.7

Step 4: Apply CMFs to the base SPF calculation to determine the number of crashes for project location, accounting for its unique geometric design and traffic features:

 $N_{predicted} = N_{SPF_Ramp} \times (CMF_1 \times CMF_2 \times CMF_n)$

1.6.1.1. Countermeasure CMF Sources

Countermeasure CMFs for several treatments have been developed over the years and can be found in the following three sources. For IARs, these sources should be used when selecting a Countermeasure CMF.

- <u>Crash Modification Factors Clearinghouse</u>
 - The CMF Clearinghouse, available at <u>http://www.CMFClearinghouse.org</u>, offers transportation professionals a central, web-based repository of CMFs, as well as additional information and

resources related to CMFs. The CMFs developed for the Clearinghouse are from studies performed in several parts of the world. It is important to review the study and specifics for each CMF used from the Clearinghouse to ensure it is applicable to the IAR-proposed modifications. The CMF Clearinghouse is regularly updated with new CMFs and provides additional information on how to apply these CMFs appropriately. Research on new CMFs is continuously being performed, and they are included in the clearinghouse after a sufficient review of the associated study. CMFs and CRFs are presented in the clearinghouse.

HSM Part D

Part D of the HSM includes some of the highest quality and most common Countermeasure CMFs. The CMFs in Part D have gone through a literature review, inclusion process and expert

panel review. Part D includes all CMFs for a broad range of roadway segment and intersection facility types. The CMFs in the HSM Part D are also available on the CMF Clearinghouse portal. The HSM Part D CMFs are not updated as often as the CMF Clearinghouse.

HSM Part D CMFs are available on the CMF Clearinghouse portal.

An example of a Countermeasure CMF in the HSM Part D for converting an at-grade intersection into a grade-separated interchange is shown below. In this example, the applicable CMF from the table is 0.58 to estimate the expected crashes for all crash severities, converting the at-grade intersection to a grade-separated interchange with four-leg intersection, under signal control.

Separated Interchan	ge				
Treatment	Setting (Intersection Type)	Traffic Volume	Crash Type (Severity)	CMF	Std. Error
	Setting unspecified (four-leg		All crashes in the area of the intersection (all severities)	0.58	0.1
	intersection, traffic		All crashes in the area of the intersection (injury)	0.43	0.05
	control unspecified)	Unspecified	All crashes in the area of the intersection (noninjury)	0.64	0.1
Convert at-grade intersection into a grade-separated interchange	Setting unspecified (three-leg intersection, traffic control unspecified)		All crashes in the area of the intersection (all severities)	0.84	0.2
	Setting unspecified (three-leg or		All crashes in the area of the intersection (all severities)	0.73	0.08
	four-leg, signalized intersection)		All crashes in the area of the intersection (injury)	0.72	0.1

HSM Table 15-2: Potential Crash Effects of Converting an At-Grade Intersection into a Grade-Separated Interchange

Source: HSM Table 15-2

FDOT CRFs

 Florida began producing state-specific CRFs in April 2005. In 2005, the Lehman Center for Transportation Research at Florida International University produced the "Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects" final report for the state safety office. The report focused on developing CRFs using Florida crash data. In 2014, the CRFs were updated. The current Florida CRFs are available at: https://www.fdot.gov/docs/default-source/roadway/qa/tools/CRF.pdf.

1.6.1.2. CMF Selection Criteria

Many CMFs and CRFs have been developed and are available for use; however, not all CMFs and CRFs should be used. It is important when selecting a CMF or CRF that the following criteria are followed.

The CMFs in the CMF Clearinghouse include quality ratings. A five-star rating indicates a greater level of confidence on estimating safety performance. CMFs with a star rating of three or higher should be used. The use of a CMF with two or fewer stars is not recommended for the IAR safety analysis. The

CMFs with star rating of three or higher should be used in IARs analyst should refer to the CMF Clearinghouse when performing safety analysis to ensure the proper CMF and screening criteria are being applied to the project. It is important the analyst perform this check because the CMF Clearinghouse is updated on a regular basis. Consider the following project example.



CMF 3852 (top) will show a greater reduction in the number of crashes due to the proposed modification, but it has a two-star rating, while CMF 9104 (bottom) has a four-star rating. Because CMF 3852's star quality rating is two, it is not recommended for use in the predictive safety analysis.

Similar to the CMF Clearinghouse, the FDOT CRFs have limitations when selecting an FDOT CRF for IAR safety analysis. It is recommended, when using the FDOT CRFs, that a CRF based on fewer than five projects should not be used in the safety analysis. Take the following project example.

FDOT CRFs based on five or more studies should be used in IARs

Select the Appropriate CMF from the FDOT CRFs Spreadsheet

Question: Should the CRF from the FDOT CRFs Spreadsheet be used?

Modifications: Add a left turn at a T-intersection

Determine applicable CRFs:

ID	Modification	Number of Projects	CRF
20	Add LT (T-intersection)	3	42

FDOT CRF 20 could be used for this modification; however, the CRF is based on only three projects. Because the CRF is based on fewer than five studies, it is not recommended that this CRF be used for the predictive safety analysis.

1.6.1.3. Application of the Countermeasure CMF Methodology

The Countermeasure CMF methodology begins with research and the selection of a CMF that applies to the proposed modification. When determining if a CMF applies, the analyst must consider the CMF's project context (e.g., roadway characteristics, surrounding environment, traffic control and traffic volume). Often, there are CMFs for the same modification that have different project

Apply CMFs to conditions that closely match the conditions from which they were developed.

contexts. It is very important to apply CMFs to conditions that closely match those from which they were developed in order to ensure the reliability and accuracy of the safety performance estimates. The following example presents a situation in which the appropriate CMF must be selected based on area type.

Select the Appropriate CMF Based on Area Type

Question: How many crashes are expected after the proposed modification?

Modification: Convert a diamond interchange to a DDI in downtown Jacksonville (urban)

Historic crash data: total number of crashes in the interchange area = 30 crashes/year

Step 1: Determine applicable CMFs (the following CMFs are from the CMF Clearinghouse)

- CMF 8258 (four-star rating) 0.67
- CMF 9104 (four-star rating) 0.592

Step 2: Check the CMF area type:

- CMF 8258 suburban
- CMF 9104 urban

Step 3: Select the appropriate CMF based on area type:

• CMF 9104 - 0.592

CMF 8258 was not selected, because the proposed modification is recommended in downtown Jacksonville, which is considered an urban area. CMF 8258 was developed for a suburban area, and as a result, it may not have direct relevance to the same modifications in the urban area.

Step 4: Calculate the predicted number of crashes

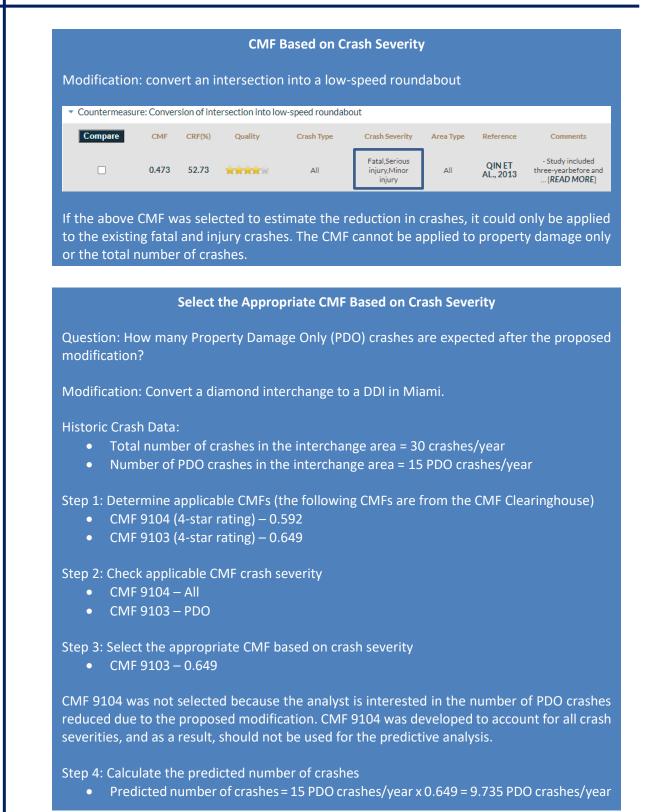
• Predicted number of crashes = 30 crashes/year x 0.592 = 17.76 crashes/year

It is important to note that both the studies in the above example have a star rating higher than the minimum requirement of three stars.

In addition to project context, each CMF is developed for a specific crash type and severity. The CMF selected for the IAR's proposed modifications should be applied to the crash type and severity for which the CMF was developed.

The following examples show the application of CMFs based on crash type and crash severity.

				C	MF Based on	Crash Type			
Modif	ication	: Conv	ert a y	ield signa	l control to a	signalized c	ontrol		
 Count 	ermeasun	e: Conver	t from vie	ld signal contr	ol to signalized cont	rol			
	pare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
COM	Julio	C.M.	chù (xò)	Quanty	crush type	endon bevenity	Area type	Reference	
C)	0.83	17	****	Head on,Rear end	All	Urban	JENSEN, 2010	This CMF is f intersection [/ MORE]
If the	above	CMF w	vas sele	ected to e	estimate the c	hange in cra	ashes, it o	could onl [,]	v be applie
the ex	isting I	head-c	on and	rear-end	crash types.				
to the	total n	numbe	r of cra	ashes.					
			Sele	ct the Ap	propriate CM	F Based on	Crash Ty	ре	
.									
Quest	on: Ho	ow mai	ny rear	r-end cras	shes are expe	cted after th	ie propos	sed modif	fication?
Modif	cation	: Conv	ert a d	liamond i	nterchange to	a DDI in su	burban T	ampa	
	ic Crasl					-	~ •		
•					the interchar				
•	Num	ber or	rear-e	end crashe	es in the inter	change area	i = 10 cra	isnes/yea	ſ
Step 1	: Deter	rmine	applica	able CMFs	s (the followir	g CMFs are	from the	CMF Cle	aringhouse
•				rating) –		0			U
•	CMF	8317	(4-star	rating) –	0.64				
Step 2	: Checl	k appli	cable (CMF crasł	n type				
•		8258 -							
•	CMF	8317 -	– Rear	-End					
Sten 3	Step 3: Select the appropriate CMF based on crash type								
•		8317 -				Shrtype			
					use the analy				
					sed modificati uld not be use				to accoun
dii Cra				Parada					
	Cale	loto th							
					mber of crash les = 10 crash		54 - E 40	roor ond	crachochy



It is very important to review the details of the CMF described in this section before applying it to the project. The CMF Clearinghouse and HSM Part D provide a summary of the research used to develop the CMF. The summary provided includes details on the CMF's project context and applicable crash type and

severity. It is crucial that this information is reviewed to ensure the selected CMF meets the minimum star rating and closely represents the project area conditions.

When multiple CMFs are applied in a project, the recommended HSM practice is to assume that CMFs are multiplicative, if they are assumed to be independent. Engineering judgement should be used to ensure that CMFs for similar treatments are not combined to estimate cumulative effects. Because there are limitations and uncertainties in combining multiple CMFs, it is suggested that no more than three CMFs should be used. The equation for combining multiple CMFs is:

$$N = N_B \times (CMF_1 \times CMF_2 \times CMF_3)$$

Where:

N: estimated crash frequency after application of CMF NB: crash frequency under existing conditions CMF_n: CMF associated with applicable modification

1.6.1.4 Examples of Countermeasure CMF Methodology Application

Common examples of modifications that can be evaluated using the Countermeasure CMF methodology are:

- Convert an unsignalized ramp terminal to a roundabout ramp terminal
- Convert a conventional signalized intersection to a signalized superstreet
- Convert a conventional signalized intersection to a continuous flow intersection
- Yield to signalized right-turn movements from an off-ramp to the arterial
- Add additional left- and/or right-turn lanes at adjacent arterial intersections
- Modify an adjacent arterial intersection
- Convert an at-grade signalized intersection to a grade-separated intersection at an interchange
- Convert a diamond interchange to a diverging diamond interchange (DDI)
- Add a right-turn lane and convert the yield to a signalized right-turn from an off-ramp to the arterial
- Convert a conventional signalized intersection to an RCUT-style intersection
- Increase the storage lane
- Add a turn bay

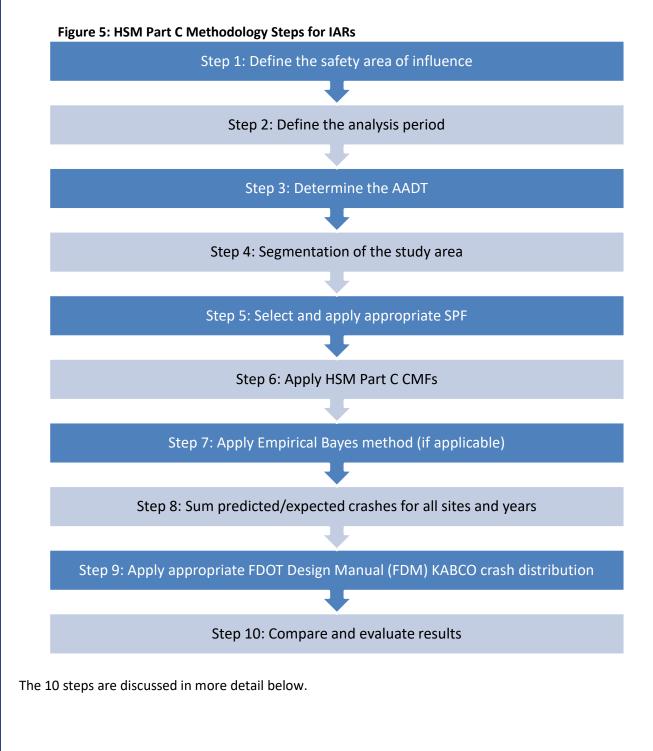
1.6.2 HSM Part C Methodology

The HSM Part C provides a predictive method for estimating the expected average crash frequency of freeway segments, merge/diverge segments, weaving segments, ramp segments, ramp terminals, arterial segments and arterial intersections. The predictive method is based on mathematical regression models known as Safety Performance Functions (SPFs). SPFs predict the crash frequency by facility type as a function of roadway characteristics and traffic volume for the existing and proposed conditions at a specific site.

SPFs predict the crash frequency by facility type as a function of roadway characteristics and traffic volume.

1.6.2.1 HSM Part C Methodology Analysis

This section discusses the application of the HSM Part C using SPF equations. The methodology discussed in this section should be used only when SPF equations applicable to the project modifications are available. The application of SPFs should be consistent with the HSM Part C. The SPF methodology for IARs can be summarized into 10 steps, as shown in **Figure 5**.



Step 1: Define the Safety Study Area of Influence

For IARs, it is recommended that the overall study area for the future safety analysis be the same as the project area of influence. However, the future safety analysis needs to be performed only for elements within the area of influence that are anticipated to be affected by the proposed modifications. If the proposed modifications will influence a roadway segment or intersection within the project area of influence, it should be included in the predictive safety analysis. For example, if a new interchange is

Future safety analysis needs to be performed only for elements within the area of influence that are anticipated to be affected by the proposed modifications.

proposed, then the adjacent interchanges should be included in the future safety analysis. This is because the traffic at the adjacent interchanges will most likely change due to the new interchange, resulting in a change in anticipated crashes at the existing adjacent interchanges. If a modification to an existing interchange is proposed, in most cases the adjacent interchanges are not affected and, therefore, no future safety analysis is needed at the adjacent interchanges.

Step 2: Define the Analysis Period

Future predictive safety analysis should be performed between the opening year and design year. The future predictive safety analysis should be performed between the opening year and design year of the project. The safety impacts due to the proposed project modifications should be evaluated for the entire life of the project. *There are some instances when it is not feasible to perform a safety analysis for the entire life of the project between the opening year and design year,* such as when the Empirical Bayes method is performed using ISATe tool. The ISATe tool can perform a safety analysis only up to a

24-year period. The Empirical Bayes method is used when the proposed modification does not create a major geometric modification; therefore, the analysis is performed starting from the existing year of the

project. This results in total analysis years being more than 24 years and cannot be analyzed in ISATe. When this situation occurs, it is recommended to perform an analysis for all the analysis years that are possible using the tool and the limitation discussed in the IAR document. It is not recommended to extrapolate the total crashes.

It is not recommended to extrapolate the total crashes.

Step 3: Determine AADT

A major input, in the SPF equations that predicts the number of crashes, is AADT. It is important to obtain the appropriate AADT needed to perform the safety analysis for the proposed changes. Typically, AADT is not developed for all the years between the opening year and design year of an IAR. To perform the safety

It is important to estimate the AADT for each year in the evaluation period. analysis, it is important to estimate the AADT for each year in the evaluation period. Some tools, such as ISATe and IHSDM, perform an AADT interpolation within the tool. Other tools, such as HSM spreadsheets, will require the analyst to develop AADTs for each year in the analysis period. If the Empirical Bayes method is used, AADT data is needed for each year, following the existing year and up to the design year.

Step 4: Segmentation of the Study Area

The next major step in determining the predicted number of crashes is the segmentation of the study area. The segmentation should follow the recommended procedures outlined in the HSM. For IAR documents, the segmentation only needs to occur for the areas where the proposed modifications are being implemented. After the study area is segmented, the appropriate SPFs can be selected for each segment, and the data needed to implement each SPF can be collected. Segmentation can be

For IARs, segmentation needs to occur for the areas where the proposed modifications are being implemented.

one of the most time-consuming parts of the HSM Part C analysis, but it can provide the analyst a lot of useful data needed to perform an accurate SPF analysis.

It is important to note that each HSM predictive model has different segmenting requirements; therefore, the analyst should refer to the appropriate HSM chapter for segmentation details. The following segmentation processes in the HSM should be followed:

- Rural two-lane, two-Way roads (Chapter 10)
- Rural multilane highways (Chapter 11)
- Urban and suburban arterials (Chapter 12)
- Freeways (Chapter 18)
- Ramps (Chapter 19)

When performing segmentation for roadway segments, the HSM recommends that segment lengths be between 0.1 and 1.0 miles When performing the segmentation process for roadway segments (arterials, highways and freeways), the HSM recommends that segment lengths be between 0.1 and 1.0 miles. The lengths in this range should be long enough to have statistical validity and short enough to be realistically homogenous. If the roadway segment length is outside the recommended range, it should be discussed in the safety analysis. Roadway segments are segmented into these homogenous sections, which have the similar attributes provided in **Figure 6**.

Figure 6: Segmentation Attributes

Traffic volume

Key geometric design features

Number of through lanes, lane width, outside and inside shoulder width, median width, presence/type of median, ramp presence, clear zone width, etc.

Land use type

Traffic control features

Intersection segmentations should be considered separately, because they are treated as points. For

intersections, crashes within 250 feet of the intersection are assigned to the intersection. It is important that all crashes counted within these 250 feet are not double-counted in the roadway segment. The segmentation of the ramp terminal intersections should also be considered separately in the analysis, and all crashes within the influence area of 250 feet of the ramp terminal should be assigned to the ramp terminal.

For intersections and ramp terminals, crashes within 250 feet are assigned to the intersection or ramp terminal.

Figure 7 provides an example of the arterial segmentation process at a study interchange.



Figure 7: Segmentation Example for an Arterial

Figure 8 provides an example of the freeway segmentation process at a study interchange.

Figure 8: Segmentation Example for a Freeway

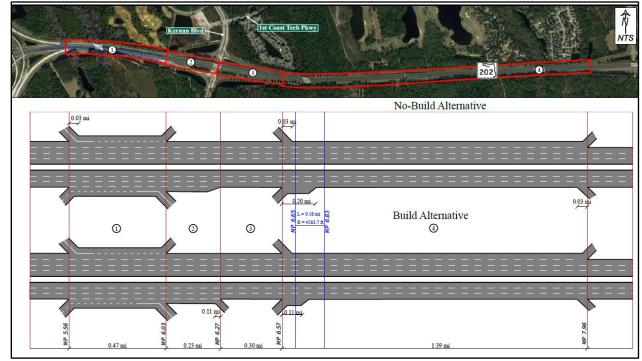
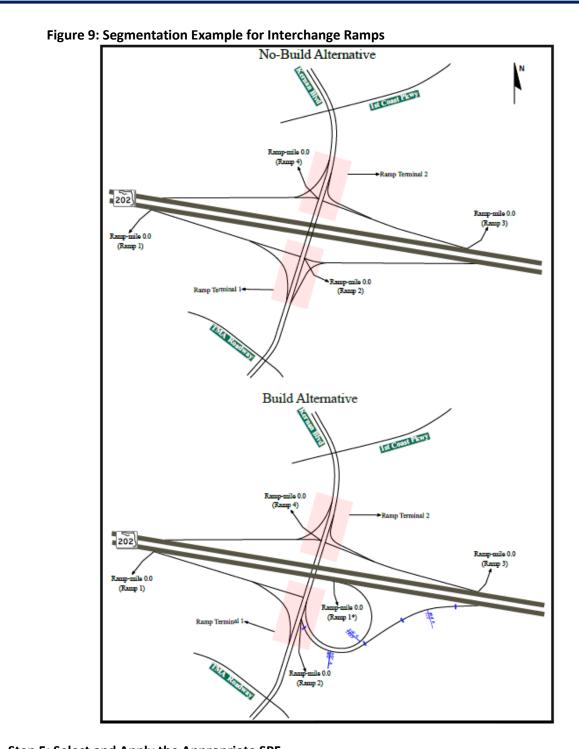


Figure 9 provides an example of the ramp segmentation process at a study interchange.



Step 5: Select and Apply the Appropriate SPF

The HSM has developed multiple SPFs based on different site conditions. In this step, the analyst should review the available SPF equations and determine which SPF equation represents the site conditions most appropriately. For example, SPF equations have been developed for varying ramp terminal configurations. If the study ramp terminal is at a four-leg diamond interchange, the four-leg terminals with diagonal ramps SPF should be applied.

When performing HSM Part C methodology analysis, it is important to note that arterial intersection SPF analysis should not be applied at the ramp terminals or vice versa. This is important, because independent SPF equations have been developed for each intersection type to account for the different operational characteristics.

Arterial intersection SPF analysis should not be applied to ramp terminals or vice versa.

It is important to review the site conditions being analyzed and ensure the appropriate SPF is used. The predicted number of crashes calculated using the SPF equations in this step are for base geometric and traffic characteristics.

Step 6: Apply the HSM Part C CMFs

To adjust the predicted number of crashes to the segment's specific geometric and traffic characteristics, HSM Part C CMFs are used to adjust the base condition's SPF crash estimate, as explained in **Section 1.6.1**. In Step 6, the CMF adjustments are applied to the base condition's predicted number of crashes. An example is provided below that shows how the HSM Part C CMFs are applied. The tools available to perform the HSM Part C safety analysis (HSM spreadsheets, ISATe or IHSDM) should include the CMFs from the HSM Part C. After determining the predicted number of crashes, the HSM recommends that regional calibration factors be applied to the predicted number of crashes to calibrate the crashes to regional conditions. FDOT has developed calibration factors for rural and urban arterial roadway segments and intersections. HSM calibration factors for Florida can be found in the FDOT Design Manual (FDM),

At this time, FDOT has not developed calibration factors for interstate analysis. <u>Chapter 122</u>. At this time, FDOT has not developed calibration factors for interstate analysis, and they should not be applied to arterials within the interchange area. The application of calibration factors to arterials outside the interchange area should be based on engineering judgment because they could have a disproportionate effect on results.

Determine the Predicted Number of Crashes on the Ramp Segment

Question: How many fatal injury crashes are predicted along the 2-lane urban off-ramp based on the following conditions?

Step 1: Collect the site specific conditions

- Ramp Type: Diverge
- Length of Segment: 0.2 miles
- Ramp AADT: 12,000
- Horizontal Curve: No
- Lane Width: 14 feet
- Right Shoulder Width: 12 feet
- Left Shoulder Width: 10 feet
- Right and Left Side Barrier: Not Present
- Ramp Speed Change Lane: No
- Lane Add or Drop: No

Step 2: Calculate the Base Conditions Fatal Injury SPFs

- Multiple Vehicle (MV) Fatal Injury Crashes: 0.019 crashes (calculated using HSM equation 19-20)
- Single Vehicle (SV) Fatal Injury Crashes: 0.222 (calculated using HSM equation 19-24)
- Total Fatal Injury Crashes: 0.241 crashes (sum of Multiple and Sigle Vehicle crashes)

Step 3: Calculate HSM Part C Fatal Injury CMFs using HSM equations from HSM Chapter 19.7:

CMF	Fatal Injury				
	Multiple Vehicle	Single Vehicle			
Horizontal Curve	1.000	1.000			
Lane Width	1.000	1.000			
Right Shoulder Width	0.806	0.806			
Left Shoulder Width	0.724	0.724			
Right Side Barrier	1.000	1.000			
Left Side Barrier	1.000	1.000			
Lane Add or Drop	1.000	1.000			
Ramp Speed-Change Lane	1.000				

Step 4: Apply HSM Part C CMF adjustments to calculate the site specific predicted number of crashes

 $N_{MV_predicted} = 0.019 \text{ x} (1.000 \text{ x} 1.000 \text{ x} 0.806 \text{ x} 0.724 \text{ x} 1.000 \text{ x} 1.000 \text{ x} 1.000 \text{ x} 1.000)$ $N_{MV_predicted} = 0.011 \text{ crashes}$

 $N_{SV_predicted} = 0.222 \times (1.000 \times 1.000 \times 0.806 \times 0.724 \times 1.000 \times 1.000 \times 1.000)$ $N_{SV_predicted} = 0.130 \text{ crashes}$

 $N_{predicted} = 0.011 + 0.130 = 0.141$ crashes

To calculate the property damage only (PDO) predicted number of crashes, the same process will be followed but using HSM Part C PDO CMFs from HSM Chapter 19.7. The total predicted number of crashes due to the modifications would be the sum of the Fatal Injury and PDO crashes.

Step 7: Apply the Empirical Bayes Method

The Empirical Bayes method combines the observed and predicted number of crashes to determine the expected number of crashes at the study segment. The Empirical Bayes method uses historic crash data and, therefore, can only be applied to proposed conditions that are not substantially different from the existing roadway geometry or land use context. For

Empirical Bayes method can only be applied to proposed conditions that are not substantially different from the existing conditions.

Interchange Operational Analysis Reports (IOARs) and Interchange Modification Reports (IMRs), the use of the Empirical Bayes method should be considered on a case-by-case basis. The Empirical Bayes method should only be used if site-by-site observed crash data is available and geometric features for the no-build and build conditions are comparable. The Empirical Bayes method should not be applied for Interchange Justification Reports (IJRs). If the Empirical Bayes method does not apply to all the considered alternatives,

If Empirical Bayes Method does not apply to all alternatives, it should not be incorporated in the predictive safety analysis. it should not be incorporated in the predictive safety analysis. For example, if the build alternative proposes major geometric modifications, the no-build alternative should not be analyzed using the Empirical Bayes method, because the build alternative will not be able to use the Empirical Bayes method. This is done to ensure a direct comparison of the predicted safety analysis between the alternatives.

Some examples of projects where the Empirical Bayes method should be applied include:

- Projects in which the roadway geometrics and traffic control are not being changed
- Projects in which the roadway cross-section is modified but the basic number of through lanes remains the same (e.g., widening of lanes or shoulders, but the number of through lanes stays consistent with the existing conditions)
- Projects in which minor changes in alignment are made (e.g., flattening horizontal curves)

The Empirical Bayes method would not be applied to the following project examples:

- Projects in which a new alignment is developed or a new interchange is proposed.
- Intersections at which the basic number of legs or type of traffic control is changed as part of the project (e.g. conversion of T intersection to a 4-legged intersection, stop control to signal control).
- Widening of a roadway (e.g., adding new lanes or median)

Engineering judgment should be applied when determining if the Empirical Bayes Method is applicable to the project.

Step 8: Combine the Predicted/Expected Crashes for All Sites and Years

Once the predicted safety analysis has been performed for all applicable sites and years, combine the crashes for each segment into a total number of crashes for the alternative. This will allow for a comparison of the alternatives.

Step 9: Apply the Appropriate FDM KABCO Crash Distribution

In addition to reporting the total number of crashes, it is recommended to distribute the total number of crashes using the KABCO injury classification scale. A summary of the KABCO scale is in **Table 1**.

Injury Severity	Abbreviation	Definition
Fatal Injury (within 30 days)	К	Any injury that results in death within 30 days after the crash occurred.
Incapacitating Injury	A	Disabling injuries, such as broken bones, severed limbs, etc. These injuries usually require hospitalization and transport to a medical facility
Non-Incapacitating Evident Injury	В	Non-disabling injuries, such as lacerations, scrapes, bruises, etc.
Possible Injury	С	
No Injury	0	Also known as property damage only (PDO)

Table 1: KABCO Injury Classification Scale for Florida

Various KABCO scales have been prepared, and tools such as ISATe will use a default KABCO scale that is based on national averages. For IAR projects in which the total crashes are broken down into the KABCO scale, the HSM Crash Distribution for Florida must be used. The HSM Crash Distribution for Florida can be found in FDM Chapter 122.

When crashes are broken down into KABCO scale, HSM Crash Distribution for Florida must be used.

Step 10: Compare and Evaluate the Results

After the analysis for all alternatives is complete, compare and evaluate the final results.

An example incorporating all ten steps of the HSM Part C Methodology is provided in **Appendix A-1**.

Benefit-Cost Analysis

Safety-based benefitcost analysis is not required in IARs. IARs are typically initiated to resolve congestion and operational concerns. The total project cost in most cases significantly outweighs the savings due to a reduction in crashes. Therefore, safety-based benefit-cost analysis is not required in IARs.

1.6.2.2. HSM Part C Methodology Analysis Tools

The manual application of the HSM Part C methodology is a cumbersome task and can lead to more analyst errors due to the complexity of the SPF equations and the high number of required inputs. To simplify and expedite the predictive safety analysis process, the following three tools in **Figure 10** are recommended to perform the predictive safety analysis using SPFs:

Figure 10: HSM Part C Methodology Analysis Tools

1. HSM spreadsheets

2. Enhanced Interchange Safety Analysis Tool

• ISATe

- 3. Interactive Highway Safety Design Model
- IHSDM

A description of each tool and its pros and cons is provided below.

HSM Spreadsheets

be performed

Various spreadsheets have been developed throughout the country and state to implement the HSM predictive method. The spreadsheets prepared apply the HSM Part C methodology and allow for simpler

calculations of the predicted number of crashes. Any HSM spreadsheets that are developed and used must be consistent with the methodology presented in the HSM Part C for predicting crashes for each facility type and checked for errors prior to their use. HSM Spreadsheets are available on the <u>AASHTO website</u>. The pros and cons of the HSM spreadsheets are in **Table 2**.

HSM spreadsheets that are developed and used must be consistent with the methodology in HSM Part C.

Table 2: Pros and Cons of the HSM Spreadsheets

Pros	Cons 🚽
 Simple data entry 	 Can perform one year of safety analysis
 Quick results for a small project area 	 Program does not summarize multiple
Analysis for all HSM SPE equations can	roadway segments

Spreadsheets can be cumbersome

Enhanced Interchange Safety Analysis Tool (ISATe)

The ISATe tool is intended to apply the HSM Part C methodology to freeway facilities, including freeway segments and interchanges in urban and rural areas. ISATe was developed as part of the National Cooperative Highway Research Program (NCHRP) Project 17-45. As part of this project, the <u>ISATe tool and</u> a <u>User Manual</u> were developed.

ISATe cannot be used to evaluate arterial segments outside of the interchange area and ramp terminals. If modifications are being recommended along the arterial or at adjacent intersections, another tool must be used to perform the predictive safety analysis.

ISATe cannot be used to evaluate arterial segments outside the interchange area and ramp terminals.

Cons

Does not perform arterial segment or

Can analyze a maximum of 24

Does not perform automatic

consecutive years

segmentation

analysis

areas

arterial intersection predictive safety

Can cause difficulties for large project

ISATe includes algorithms and equations that are implemented in a Microsoft Excel workbook as software (using the Visual Basic for Applications programming language). To perform the safety analysis in ISATe, the study area must be segmented into homogenous sections. The study area should be broken down into three categories: freeway segments, ramp segments and ramp terminals. Please refer to chapters 18 and 19 of the HSM or Chapter 2 of the ISATe User Manual for proper segmentation guidelines. After the segmentation is complete, the analyst enters the geometric and traffic data for the study segments. The pros and cons of the ISATe analysis tool are in **Table 3**.

Table 3: Pros and Cons of ISATe

Pros

- Validated safety analysis tool
- Extrapolates AADT
- Analyzes multiple years of safety analysis
- Analyzes multiple freeway segments
- Summarizes freeway segments
- Useful for small interchange projects
- Empirical Bayes method incorporated in program
- Provides user-friendly data entry and output sheets

Interactive Highway Safety Design Model (IHSDM)

The <u>IHSDM</u> is an FHWA software analysis tool that applies the HSM predictive method. The standalone software package has multiple modules that allow for different variants (station or site-based analyses) for the evaluation of rural highways (two-lane and multilane), arterials (urban and suburban), freeways (segments, ramps and interchanges) and intersections.

- The station-based analysis approach allows the user to either import roadway geometry features directly from a design alignment file or manually input the stationing and features. The stationbased analysis allows for the automation of the segmentation and improves the accuracy of the analysis, because alignments are directly imported without translation.
- The site-based analysis approach is more simplified. The user must manually input roadway data and must manually segment the study network.

Either analysis approach can be used, as long as the facility type is covered within the IHSDM. The output results are the same for either approach.

The following pros and cons of the IHSDM are in **Table 4**.

The analyst can select either one or a combination of the HSM Part C analysis tools

Table 4: Pros and Cons of IHSDM

Pros

- Extrapolates AADT
- Analyzes multiple years of safety analysis
- Analyzes multiple roadway segments
- Performs analysis for all HSM SPF equations
- Can perform automatic segmentation
- Useful for large study area
- Empirical Bayes method incorporated in program

Cons

Data intensive

- Must code and develop complete study area to perform analysis
- Takes a lot of time to code the network
- Making changes to the analysis could be time consuming and cumbersome

Based on the project conditions and alternatives, the analyst can utilize any one or a combination of the tools listed above to perform the predictive safety analysis in IARs.

1.6.2.3. HSM Part C Methodology Limitations

The HSM provides several predictive models that are helpful in the safety analysis and comparison of various alternatives. But there are some limitations that exist in the methodology. Some of these limitations of the HSM Part C encountered in IARs include:

- It does not account for traffic variability, because the HSM analysis uses AADT volumes.
- The HSM assumes the independence of geometric and traffic control features on crash occurrences.
- It does not account for the influence of freeways with eleven or more through lanes in urban areas.
- It does not account for the influence of freeways with nine or more through lanes in rural areas.
- It does not perform a safety analysis for freeways with high-occupancy vehicle lanes, toll plazas, reversible lanes, hard shoulders, ramp metering and managed lanes.
- It does not account for a ramp or collector-distributor roads with two or more lanes in rural areas or three or more lanes in urban areas.
- It does not account for the influence of unique or innovative intersection or roadway designs (e.g., DDI, continuous flow intersection, Texas U-turns, etc.).
- It does not account for the influence of a crossroad ramp terminal with three or more left-turn lanes on a crossroad approach.
- It does not account for the influence of a crossroad ramp terminal that provides one-way travel or when the ramp terminal is a single-point urban interchange (SPUI) or roundabout.

When performing a safety analysis, if one of the above listed limitations is experienced, discuss the limitation in the IAR and refer to the process flow chart in **Section 1.4** to perform the appropriate safety analysis for the project.

1.6.2.4. Examples of HSM Part C Methodology Application

Common examples of modifications that can be evaluated using the HSM Part C methodology are provided below:

- Implement a new interchange
- Complete basic movements at an existing partial interchange
- Convert a partial cloverleaf interchange to a diamond interchange
- Convert a diamond interchange to a partial cloverleaf interchange
- Modifications to freeway segments:
 - Addition or removal of general use lanes
 - Addition or removal of speed-change lanes (merge/diverge lanes)
 - Extension or shortening of speed-change lanes
 - Addition or removal of ramp segments
 - Widening a ramp segment from one to two lanes
 - Addition or removal of an auxiliary lane that creates or eliminates a weaving section
- Convert an unsignalized intersection to a signalized intersection at a ramp terminal
- Addition or removal of left- and/or right-turn lanes from the off-ramp to the arterial
- Addition or removal of left-turn lanes from the arterial to an on-ramp
- Convert a left-turn signal phase from permissive or protected/permissive to protected
- Addition of through lanes along the arterial
- Modifications to an existing diamond or partial cloverleaf interchange geometry
- Provide a non-ramp public street leg at a ramp terminal
- Reconfigure an adjacent arterial's unsignalized and/or signalized intersection
 - Convert an unsignalized intersection to signalized
 - Convert turn lanes to shared turn/through lanes
 - Convert shared turn/through lanes to turn lanes
- Addition or removal of an adjacent arterial intersection

1.6.3 Qualitative Safety Methodology

A qualitative safety analysis must only be performed if the quantitative safety analysis cannot be performed for the project modifications using the CMFs/CRFs or HSM Part C methodology. Priority should be given to the quantitative safety assessment of project alternatives. If quantitative assessment is not feasible, then qualitative safety methodology should be applied. A qualitative safety analysis should include a detailed discussion about the limitations of the quantitative safety analysis techniques in

Qualitative safety analysis should include a discussion about the limitations of the quantitative safety analysis techniques. evaluating the safety impacts of the proposed modifications. The qualitative discussion should then list the anticipated impacts on safety due to the recommended modifications. If appropriate, additional qualitative safety discussion can be provided to supplement quantitative safety analysis. A project example of qualitative discussion is in **Appendix A-2**. An excerpt from the discussion is below.

The I-95 at Glades Road IMR Re-Evaluation recommended that a partial cloverleaf interchange be converted to a diverging diamond interchange (DDI). This modification cannot be performed using CMFs or SPFs.

"Since no other tools can account for the DDI configuration, the safety benefits of converting a partial cloverleaf interchange to DDI was based on previous researches that are summarized below:

- The key safety benefits of the DDI configuration include:
 - Reduction of conflict points (14 conflict points and 2 crossing points, compared to the 26 conflict points found in the conventional diamond interchange) and improved sight distance at the turns.
 - Reduction in crash severity due to lower design speeds compared to other interchange designs.
 - Traffic calming effect that reduces vehicular speed (while maintaining the capacity) due to the small geometric deflection introduced by the DDI for through traffic.
 - Elimination of the wrong-way movements into ramps from the DDI interchange design.
 - o Crash reduction associated with the elimination of loop ramps, where applicable."

1.6.4 Common Safety Analysis Questions

Interchange designs can be innovative and complex, thereby creating uncertainties when performing the safety analysis in IARs. It is also common to prepare IAR re-evaluations. The following questions are commonly asked pertaining to quantitative safety analysis.

Question 1: What type of analysis can be performed if some, but not all, of the proposed modifications can be analyzed using the HSM Part C methodology?

If some of the proposed modifications can be analyzed using the HSM Part C, then those segments should be analyzed using the HSM Part C methodology. For the modifications that cannot be analyzed using the HSM, ask, "Is there a CMF for the proposed modification?" If there is a CMF for the proposed modification, apply the Countermeasure CMF methodology, and document the safety benefits of the proposed modification. It is also important to document in the IAR the limitations of the HSM Part C methodology and explain why the proposed modifications could not be analyzed using SPFs. If there are no Countermeasure CMFs that can be applied to the proposed modification, discuss qualitatively the expected safety benefits of the proposed modifications. It is recommended the qualitative discussion be backed with data and research, if available. An example of similar condition is in **Appendix A-2**.

Question 2: What type of safety analysis should be performed for an IAR re-evaluation?

First, a quantitative safety analysis is required for all IAR re-evaluations, and it must follow the safety analysis requirements discussed in this guidance. For re-evaluations, a safety analysis must be performed only for the proposed modifications discussed in the re-evaluation. For instance, if the original approved IAR recommended the conversion of a diamond interchaynge to a DDI, and the re-evaluation recommends the addition of lanes on the ramp segments, then the safety analysis in the re-evaluation should only be performed for the addition of lanes on the ramp segments. An IAR re-evaluation must follow the

guidelines for the future safety analysis. An example of safety analysis in IAR re-evaluation is in **Appendix A-3**.

Question 3: What if a quantitative safety analysis cannot be applied?

It is recommended to follow the safety analysis process flow chart when performing a quantitative safety analysis. If none of the proposed modifications can be analyzed using the Countermeasure CMF or HSM Part C methodologies, then document in the IAR and the limitations of the quantitative safety analysis and explain why the proposed modifications could not be analyzed using CMFs or SPFs. Then, as depicted in the process follow chart, provide a qualitative discussion of the expected safety benefits of the proposed modifications. It is recommended the qualitative discussion be backed with data and research, if available. Consider the following example:

A single-point urban interchange (SPUI) was evaluated to replace a diamond interchange. The following approach was followed to perform the future safety analysis:

SPF and CMFs were reviewed to ensure that the modifications could not be quantitatively analyzed. No SPF or CMFs were discovered to perform a quantitative safety analysis for the proposed modification of converting a diamond interchange to a SPUI. Because there are no SPFs or CMFs applicable, a literature review was conducted. The findings from the literature review were discussed qualitatively in the IAR document. The qualitative discussion included the expected safety benefits of the proposed modification, and information from the literature review to support the conclusions were provided.

Question 4: What if the Countermeasure CMF and HSM Part C methodologies are applicable to the proposed modification?

Some modifications could be analyzed using the Countermeasure CMF and HSM Part C methodologies. For example, Countermeasure CMFs are available for increasing the number of lanes from four to six in the CMF Clearinghouse. The same modification can be analyzed using SPFs from the HSM Part C methodology. It is important that Countermeasure CMFs and SPFs not be applied to the same modification. It is recommended that SPFs should be used over the CMFs in this situation, because they are developed based on the high level of research and undergo an extensive review process.

1.7 Documentation

Sufficient documentation must be provided for each step of the IAR safety analysis.

For existing safety analysis documentation, refer to the guidance in Section 1.5.

The future safety analysis documentation required in the IAR is determined by the method used to perform the analysis (Countermeasure CMF, HSM Part C or qualitative safety analysis). The safety analysis for proposed modifications should document how the IAR proposal would improve the identified safety problems.

1.7.1 Qualitative Safety Analysis

A qualitative safety analysis should include a discussion on the limitations of the quantitative safety analysis and the anticipated safety impacts of the proposed modifications. It is recommended that the discussion provided is supported by additional research and data, if available. Any supporting data should be included in the appendix of the IAR.

1.7.2 Countermeasure CMF Methodology

If the Countermeasure CMF methodology is applied, the documentation should discuss each applicable CMF to every proposed modification. The documentation for the selected CMFs should include:

- CMFs considered and selected for each proposed modification
- CMF characteristics (e.g., base conditions and CMF criteria)
- Summary and values of CMFs
- Justification for selected CMFs
- Source of the selected CMFs

The documentation should summarize the selected CMF and the results of applying the CMF to the proposed alternatives. The text should describe the interpretation of the results, any caveats and recommendations based on the analysis. All supporting data and calculations should be included in the appendix.

1.7.3 HSM Part C Methodology

If the HSM Part C methodology is applied to the no-build and build alternatives, the discussion should summarize the analysis, the results and the interpretation and conclusions based on the analysis. A discussion for each alternative evaluated should include:

- Discussion of the modifications analyzed, years analyzed and tool used in the analysis (e.g., HSM spreadsheets, ISATe or IHSDM)
- Explanation of assumptions needed to perform the analysis, the rationale for the assumptions and the potential implications to the results
- Discussion of the segmentation process for the reviewer to verify the approach
- Presentation, explanation and comparison of the results of the analysis for all alternatives. The
 results of the analysis will likely be presented as a mix of tables and text showing the
 predicted/expected crashes. The results should show how the individual components (e.g., ramp
 terminal intersections, freeway segments, ramp segments, etc.) will perform due to the

recommended modifications. The documentation should compare the results of the analysis for each alternative and present the safety outcomes associated with the estimated future crash conditions. The alternatives analyzed for the safety analysis should be consistent with the alternatives for which operational analysis was performed.

Any supporting data and calculations, such as safety analysis tool input and output data sheets, should be included in the appendix of the IAR.

1.7.4 Safety Analysis Types and Work Estimate

When preparing the IAR safety analysis, it is important to consider the tasks that will have to be performed and the time needed to perform these tasks. **Table 5** provides a brief summary of the safety analysis tasks required under each methodology and the approximate time required to complete them.

Analysis Type			S	afety Analysi	s Process			Time Estimate
HSM Part C Methodology	Calculation of Crash Rates	Crash Diagrams	Description of Existing Crash Trends	Safety Performance Functions	Empirical Bayes Method (if applicable)	Crash Reduction Estimation (CMFs/CRFs)	Documentation	80 - 160 Hours* (Including Existing Conditions)
Countermeasure CMF Methodology	Calculation of Crash Rates	Crash Diagrams	Description of Existing Crash Trends			Crash Reduction Estimation (CMFs/CRFs)	Documentation	30 - 60 Hours (Including Existing Conditions)
Existing Conditions	Calculation of Crash Rates	Crash Diagrams	Description of Existing Crash Trends				Documentation	20-40 Hours

Table 5: Safety Analysis Types and Work Estimate

*Hours will vary based on multiple factors such as analysis area, application of Empirical Bayes Method, etc.

Appendix A Example Safety Studies

Appendix A-1 Example Safety Studies – JTB at Kernan Boulevard IMR

Existing Safety Analysis

Florida Department of Transportation Interchange Modification Report



The total and denied delay per vehicle was documented at over 13 minutes during the AM peak hour and nearly 10 minutes during the PM peak hour. With the expected increase in traffic demand in the future within the study area limits, these delays can be expected to drastically increase as the facility reaches its capacity.

The Existing Year (2019) analyses output reports are provided in Appendix D.

3.6 Existing Crash Data

Crash data for the area of influence for the most recent five years (2015 to 2019) was obtained from Signal Four Analytics crash database. A crash data analysis was performed to quantify the frequency and severity of crashes along SR 202 and Kernan Boulevard within the project study area. A detailed summary of the crash data is provided below. Historical crash data is provided in **Appendix E**.

3.6.1 Crash Severity:

A safety analysis was conducted for SR 202 between I-295 and Hodges Boulevard ramps and for Kernan Boulevard between Betty Holzendorf Drive and south of the Kernan Boulevard and eastbound SR 202 ramp terminal intersection. Over the five-year span, this area experienced a total of 575 crashes of which 422 are Property Damage Only (PDO) crashes (73.4 percent), 151 are injury crashes (26.3 percent), and two are fatal crashes (0.3 percent). Both fatal crashes occurred along eastbound SR 202. Out of the two fatal crashes, one involved a driver under the influence of alcohol and the other was an off-road crash. **Table 3-11** summarizes the crash data for the study area by severity.

	ady Alca clash Data s	y anninar y		
Year	PDO Crashes [*]	Injury Crashes	Fatal Crashes	Total Crashes
2015	73	30	1	104
2016	76	23	0	99
2017	78	30	0	108
2018	100	36	0	136
2019	95	32	1	128
Total	422	151	2	575
Percentage	73.4%	26.3%	0.3%	100.0%

Table 3-11: Study Area Crash Data Summary

*Property Damage Only

3.6.2 Crash Location:

Out of the 575 crashes, a total of 261 crashes (approximately 45 percent) occurred along eastbound SR 202. This can be attributed to the weaving segment located between the I-295 northbound on-ramp and the eastbound SR 202 off-ramp to Kernan Boulevard. This weaving segment is highly congested during the PM peak hour. The summary of crashes by location is shown in **Figure 3-6**.

Florida Department of Transportation Interchange Modification Report



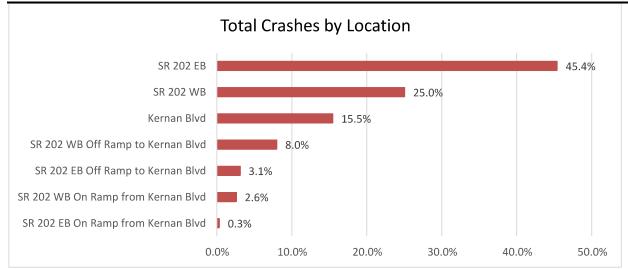


Figure 3-6. Summary of Total Crashes by Location

3.6.3 Crash Types

Crash types within the study area were evaluated to determine the most predominant crash type and its causes. **Table 3-12** summarizes all the crash types observed within the study area. Most of the incidents, approximately 57 percent, were rear-end collisions. The high number of rear-end crashes can be attributed to the congestion and stop-and-go conditions experienced by the study area during the peak hours.

	······································		, p = = =				
Crash Type	2015	2016	2017	2018	2019	Total	Percentage
Rear End	55	60	66	66	81	328	57.1%
Off Road	21	17	13	17	19	87	15.1%
Sideswipe	7	10	11	13	13	54	9.4%
Other	10	4	10	17	7	48	8.3%
Unknown	3	1	1	17	1	23	4.0%
Left Turn	2	3	1	3	3	12	2.1%
Rollover	2	4	3	1	0	10	1.7%
Angle	3	0	2	2	2	9	1.6%
Animal	0	0	1	0	2	3	0.5%
Head On	1	0	0	0	0	1	0.2%
Total	104	99	108	136	128	575	100.0%

Table 3-12: Summary of Crash Types

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3.6.4 Kernan Boulevard Crashes Severity

Kernan Boulevard experienced a total of 89 crashes, of which 64 were PDO (approximately 72 percent) and 25 were injury crashes (approximately 28 percent). A summary of crash severity on Kernan Boulevard is shown in **Table 3-13**.

		2414 2411141		
Year	PDO Crashes [*]	Injury Crashes	Fatal Crashes	Total Crashes
2015	14	3	0	17
2016	7	7	0	14
2017	15	5	0	20
2018	13	7	0	20
2019	15	3	0	18
Grand Total	64	25	0	89
Percentage	71.9%	28.1%	0.0%	100.0%

Table 3-13: Kernan Boulevard Crash Data Summary

*Property Damage Only

3.6.5 Kernan Boulevard Crash Types

Most of the incidents, approximately 53 percent, were rear-end collisions. The high number of rear-end crashes can be attributed to congestion and stop-and-go conditions experienced along Kernan Boulevard during the peak hours. **Table 3-14** provides a summary of crash types along Kernan Boulevard.

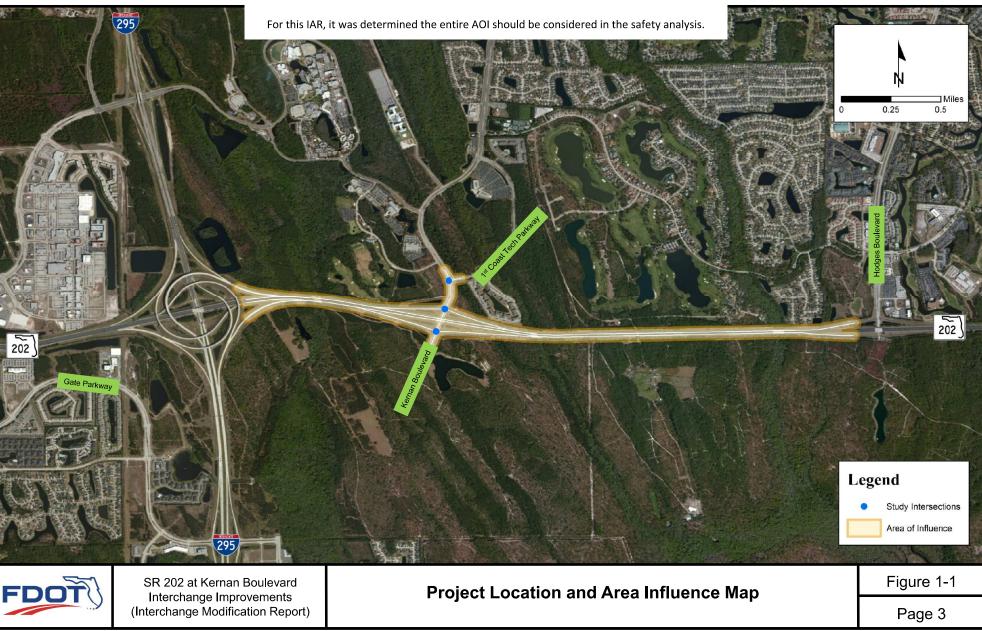
Crash Type	2015	2016	2017	2018	2019	Total	Percentage
Rear End	7	8	12	11	9	47	52.8%
Off Road	3	2	2	0	3	10	11.2%
Left Turn	2	2	0	1	3	8	9.0%
Other	2	0	3	1	0	6	6.8%
Unknown	1	0	0	4	0	5	5.6%
Sideswipe	0	0	1	2	2	5	5.6%
Angle	2	0	1	1	1	5	5.6%
Rollover	0	2	0	0	0	2	2.3%
Animal	0	0	1	0	0	1	1.1%
Total	17	14	20	20	18	89	100.0%

Table 3-14: Summary of Kernan Boulevard Crash Types

3.7 Environmental Constraints

A National Environmental Policy Act (NEPA) evaluation has been conducted by FDOT District Two for this project (2020). The roadway improvements proposed for this project are within the right-of-way limits. Details of the existing environmental constraints and an extensive examination of the natural, social and physical impacts associated with the Build Alternative are documented through the NEPA evaluation

HSM Part C Methodology - Step 1: Define the Safety Area of Influence



HSM Part C Methodology - Step 2: Define the Analysis Period

For this IAR, Opening Year 2025 and Design Year 2045 were considered.

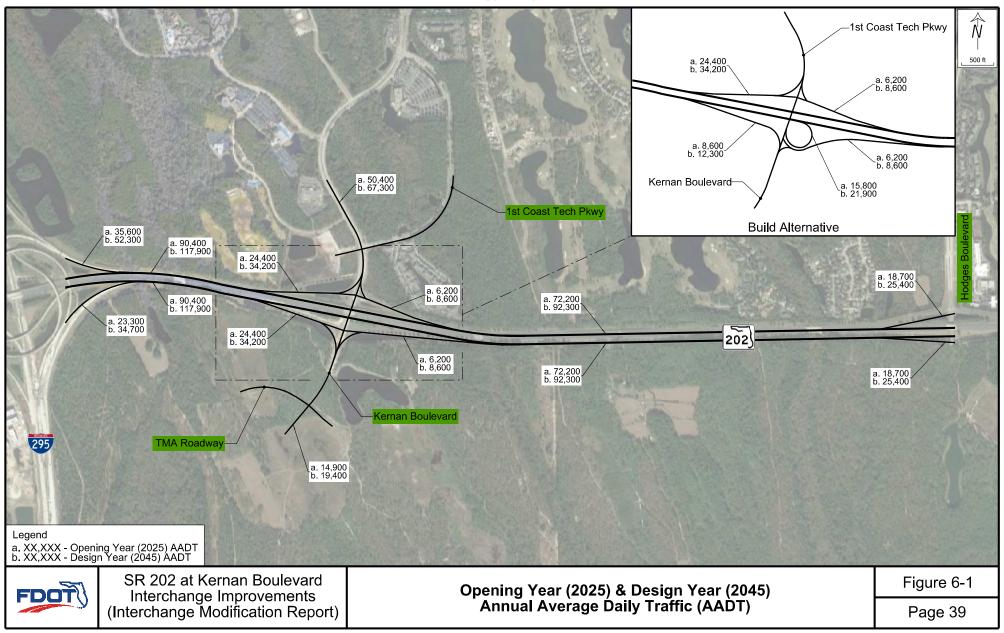
7.2 Predictive Safety Analysis

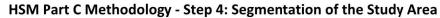
Predictive safety analysis was performed per Chapter 18 of the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) Supplement utilizing the Enhanced Interchange Safety Analysis Tool (ISATe) to obtain an estimate of the predicted average crash frequency during the Opening Year (2025) and the Design Year (2045) associated with the two alternatives: the No-Build Alternative and the Build Alternative. The No-Build Alternative uses the existing roadway with the improvements described in **Section 5**. The Build Alternative installs a new loop ramp access for the eastbound SR 202 to northbound Kernan Boulevard traffic as well as other improvements described in **Section 5**.

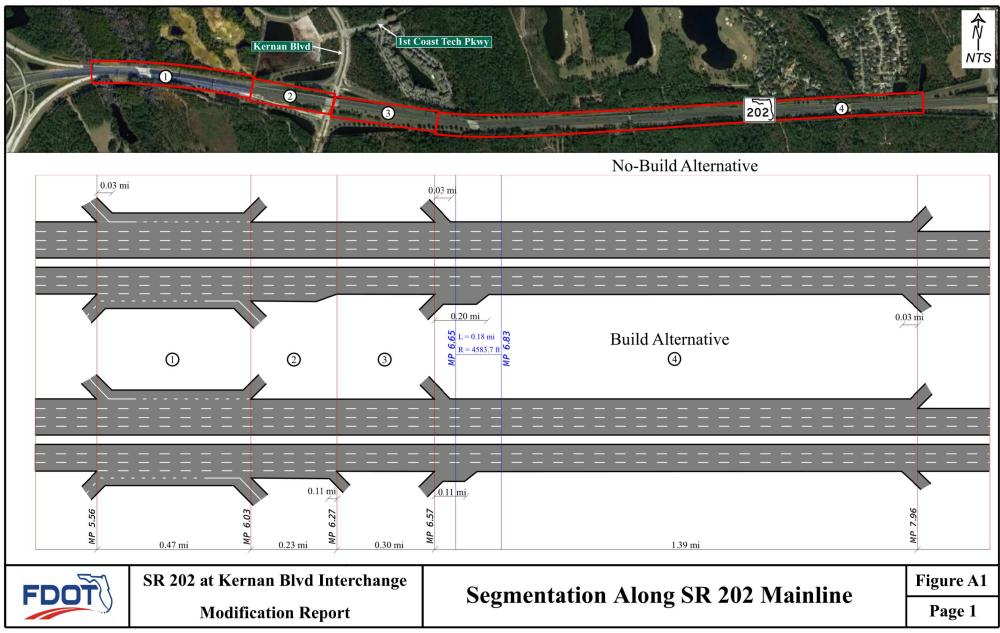
Since the Build Alternative requires significant changes in the geometric design, the Predictive Method for Freeways using the Empirical-Bayes Method was not applied for all alternatives to have consistent results.

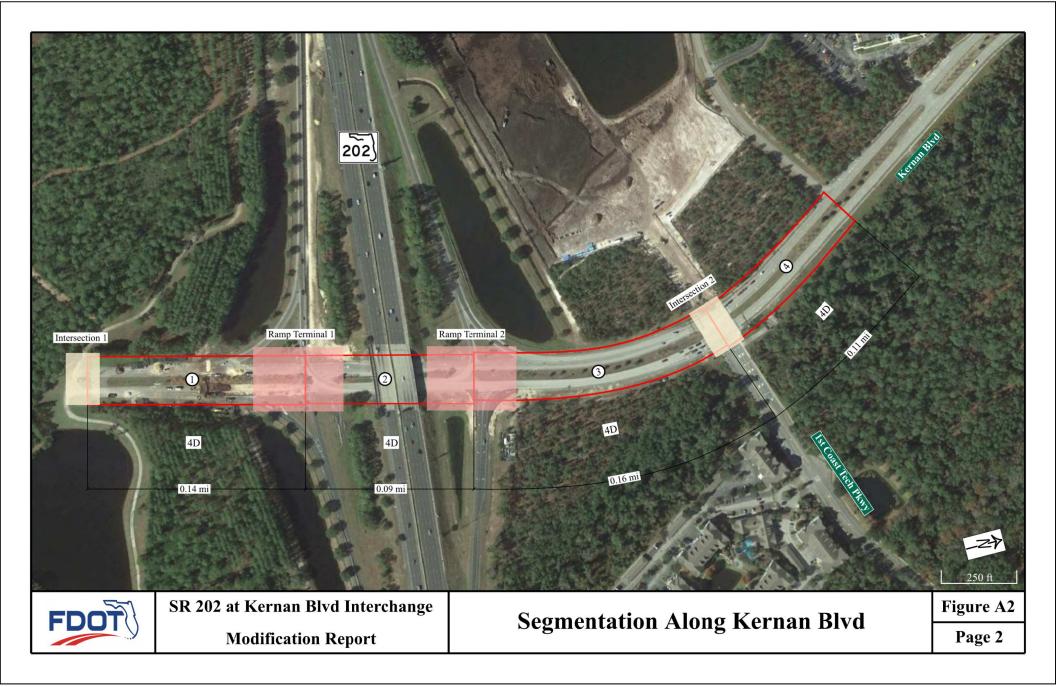
A summary of the predicted average crash frequency obtained by HSM analysis is presented in **Table 7-15**. **Appendix K** presents the input data used to perform the analysis and the output summary for the alternatives evaluated.

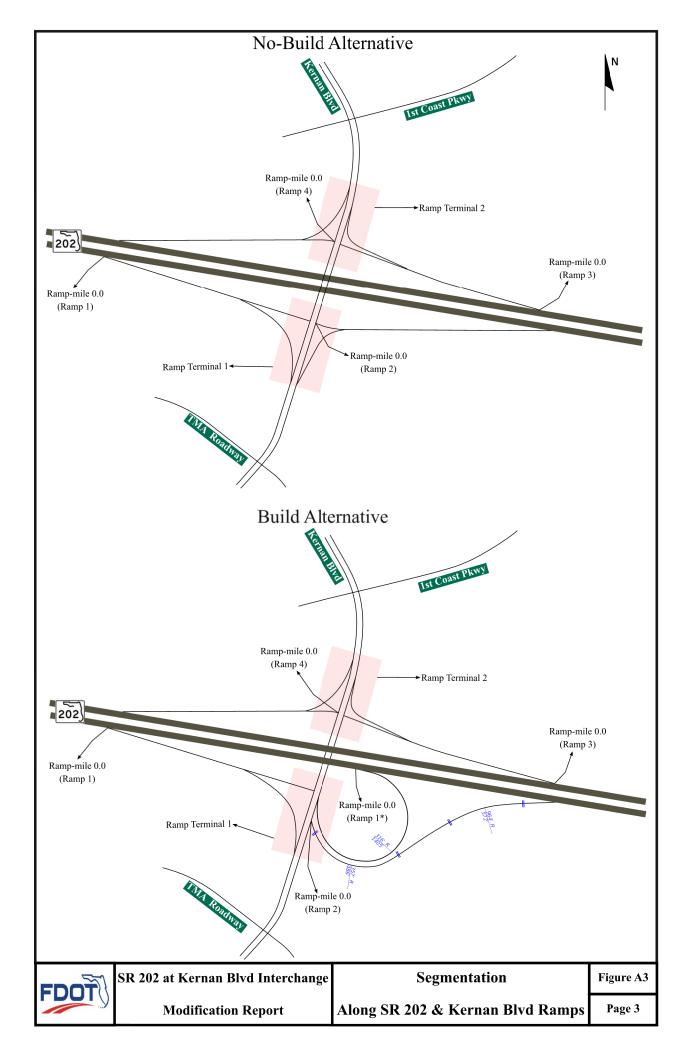
HSM Part C Methodology - Step 3: Determine AADT











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	Separation. For ROWARD, RELATION RELATI													
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	1 Gree 12000 1200 1200 1200 2200 12400 1240 124													

Segments Data (Ramps) No-Build Alternative

Segment No.	Regin Ramp Mile	End Ramp Mile	2025 No. of Lares	2045 No. of Lands	Length (mil)	Septient Type	Control	Carve 0	Nadius Ci Nj	urve Length [mi]	Curve Length in Sog. (ml)	Ramp-mile of beginning of Curve (mi)	Curve Radius (19	Curve Length (mi)	Curve Length in Seg. (ml)	Romp-mile of beginning of Curve (rel)	Lane Width (ht)	Pight Shoulder Width (R)	Left Shoulder Width (11)	Lone Add/Drap by Toper	Longth of Tape In Sog. (ml)	r Hight Barrier Lorgth (mi)	Right Barrier Offset (H)	Left Berrier Length (ml)	Left Rarrier Offset (71)	Segment No.	Ramp Fritrance in Seg.	Length of entrance s c in Seg. (mi)	Ramp fait in Seg.	Length of exit s c in Seg. (ml)	Weave Section in CD Road Segment	Longth of Weave Section (mi)	Length of Weave Section In Sec. (m)	2025 AADT	2015 AADT
1	0.00	0.53	1	~	0.33	- 60	5900	×	μa.	N/4	N/0.	4/A	N/A	840	N/A	M/A	12.0	7.0	4.0	Mo	N/A	0.25	20.0	0.00	0.0	1	Ne	N/A	No	M/A	M/A.	0/A	N/A	24,400	34,300
2	0.00	0.14	2	2	0.04	Entrance	None	N	ų x.	N/A	No	N/A	N/A	N/X	N/A	N/A	12.0	7.0	4.0	No	N/X.	0.14	25.0	0.00	0.0	2	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,500
3	0.14	627	1		0.13	Sectance	None	N	ja –	N/A	NO.	મળ	N/A	N/A	N/A	N/A	12.0	7.0	4.0	Mo	NO.	0.26	25.0	0.00	6.0	2	No	N/A	No	N/A	54A	N/A	N/A	6,260	8,600
4	0.00	0.25	1	~	0.25	51	5900	N	UA.	N/A	80	4/A	N/A	N/A	N/A	M/A	12.0	7.0	4.0	Mo	N/A	0.05	25.0	0.00	0.0	1	Ne	N/A	No	M/A	M/A	N/A	N/A	6,202	8,900
\$	0.00	0.29	-		0.29	Entrance	Stop	N	μa.	N/A	N/OL	M/A	N/A	N/A	N/A	8/8	12.0	7.0	4.0	No	NO.	0.20	25.0	0.00	0.0	5	No	N/A	No	N/A	N/A	NA	N/A	24,400	34,202

Segment No.	Begin Ramp Mile	End Rerep Mile	2025 No. of Lares	2065 No. of Laten	Longth (m3)	Segment Type	Control Type	Curve Radius (ft)	Curve Longi (mi)	h Curve Longth (Seg. (m)	Ramp-mile of beginning of Curve (mi)	Corve Radius (10	Curve Length (mi)	Curva Longth in Sog. (mi)	Ramp-mile of beginning of Carve (mi)	Lane Width (ht)	Right Shoulder Widsh (h)	Left Shoulder Width (ft)	Lone Add/Drop By Taper	Lorgth of Tapo in Seg. (m)	r Right Barrier Longth (mi)	Right Barrier Offset (h)	Left Barrier Length (mi)	Left Barrier Offset (H)	Segment No.	Ramp Entrance in Seg.	Longth of ontranco a c in Seg. (mi)	Ramp Soft in Sep.	Length of eask s < in Seg. (mi)	Weave Section in CD Road Segment	Leigth of Weave Section (mi)	Length of Weave Section In Seg. (ml)	2025 AADT	2545 AADT
2	0.00	0.33	2	2	0.33	DG.	Signal	N/X	N/A	N/X	M/A	N/A	N/A	N/A	N/A	12.0	7.0	4.0	No	NO.	0,25	20.0	0.00	0.0	1	No	N/A	No	N/A	N/A	N/A	N/A	8,600	12,300
2	0.00	634	1		0.38	- 60	None	3264	627	0.27	0.11	N/A	N/A	N/A	N/A	12.0	7.0	4.0	540	N/A	0.98	7.6	0.02	11.0	~	No	N/A	500	N/A	NA	0/A	N/A	15,800	21,923
,	0.00	014	2	2	0.04	Entrance	2424	357.0	0.02	0.09	0.00	N/A	N/A	N/A	N/A	12.0	7.0	4.0	M0	N/A	0.40	25.0	0.00	0.0	,	Né	NA	No	M/A	M/A	M/A	N/A	4,202	8,600
4	0.14	0.46	1	2	0.32	Entrance	Signal	357.0	0.09	0.00	0.00	954.00	0.11	0.11	0.22	12.0	7.0	4.0	No	N/A	0.40	25.0	0.00	0.0	4	No	N/A	No	NYA	N/A	N/A	N/A	6,200	8,600
5	0.00	0.26	1	3	0.35	6a	Signal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.0	7.0	4.0	No	N/A	0.03	35.0	0.00	0.0	ş	Nip	N/A	No	ni/A	N/A	0/A	N/A	6,200	8,600

Build Alternative

Segments Data (Ramp Terminals) No-Build Alternative

Ramp Termir No.	nal Rami Termi Centi	inal Control Ital Type	Public Street	Exit Ramp Skew Argle (Degrees)	Distance to Public Street Intersection	Distance to Adjacent Ramp Terminal	Left Turn Protected (Inside Approach)	Left Turn Protected (Outside Approach)	Exit Ramp Right Turn Control	Median Width (ft)	Crossroad Number of Lanes (Total)	Crossroad Number of Lanes (Inside Approach)	Crossroad Number of Lanes (Outside Approach)	Number of Lanes (Edit Ramp)	Crossread Right Turn Channelization (Inside Approach)	Crossroad Right Turn Channelization (Outside Approach)	Right Turn Channelization (Exit Ramp.)	Inside Approach Left Turn Bay	inside Approach Left Turn Bay Width (ft)	Outside Approach Left Turn Bay	Outside Approach Left Turn Bay Width (ft)	Inside Approach Right Turn Bay	Outside Approach Righ Turn Bay	Number of Driveways on the Outlide Leg	Number of Public Street Approaches on the Outlide Log	2025 AADT (Inside Leg)	2025 AADT (Outside Leg)	2025 AADT (Exit Ramp)	2025 AADT (Entrance Ramp)	2045AADT (Inside Leg)	2045 AADT (Outside Leg)	2045 AADT (Exit Ramp)	2045 AADT (Entrance Ramp)
1	D4	Signal Signal	No	0.0	0.14	0.14	Yes	N/A N/A	Signel	36.0	4	2	2	2	No	Yes	Yes	Yes	24.0	No	N/A N/A	N/A N/A	Yes	N/A M/A	0	43,400	37,200	24,400	6,200	60,700	52,500	34,200	8,600
	Build Alternative																																
Ramp Termir No.	nal Ram Termi Confi	inal Control Isal Type	Public Street	Exit Ramp Skew Angle (Degrees)	Distance to Public Street Intersection Outside (mi)	Distance to Adjacent Ramp Terminal	Left Turn Protected (Inside Approach)	Left Turn Protected (Outside Approach)	Exit Ramp Right Turn Control	Median Width (ft)	Crossroad Number of Lames (Total)	Crossroad Number of Lanes (Inside Approach)	Crossroad Number of Lanes (Outside Approach)	Number of Lanes (Exit Ramp)	Crossroad Right Turn Channelization (Inside Approach)	Crossroad Right Turn Channelization (Outside Approach)	Right Turn Channelization (Exit Ramp)	Inside Approach Left Turn Bay	inside Approach Left Turn Bay Width (ft)	Outside Approach Left Turn Bay	Outside Approach Left Turn Bay Width (ft)	Inside Approach Right Turn Boy	Outside Approach Righ Turn Bay	t Number of Driveways on the Outlide Leg	Number of Public Street Approaches on the Outlede Log	2025 AADT (Inside Leg)	2025 AADT (Outside Leg)	2025 AADT (Eait Romp)	2025 AADT (Entrance Ramp)	2045AADT (Inside Leg)	2045 AADT (Outside Leg)	2045 AADT (Exit Ramp)	2045 AADT (Entrance Ramp)
1	34	Signal	No	30.0	0.14	0.14	Yes	N/A	Signal	36.0	4	2	2	2	No	Yes	Yes	Yes	24.0	No	N/A	N/A	Yes	N/A	0	43,400	37,200	8,600	6,200	60,702	52,500	12,300	8,800

Segments Data (Arterials)

No-Build and Build Alternative

Segment No.	Roadway Type	Length (mi)	2025 AADT	2045 AADT	On-Street Parking	Proportion of Curb Length with Parking		Lighting	Auto Speed Enforcement	Major Commercia Driveway	l Minor Commercial Driveway	Major Industrial/Institutuional Driveway	Minor Industrial/Institutuional Driveway	Major Residential Driveway	Minor Residential Driveway	Other Driveways	Speed Category	Roadside Fixed Object Density (Fixed Objects/mi)	Offset to Roadside Fixed Objects	Calibration Factor
1	4D	0.14	37,200	52,500	None	N/A	36	Present	Not Present	0	0	0	0	0	0	0	Greater than 30 mph	104.6	30.0	1.0
2	4D	0.09	43,400	60,700	None	N/A	36	Present	Not Present	0	0	0	0	0	0	0	Greater than 30 mph	122.0	26.0	1.0
3	4D	0.16	53,400	71,700	None	N/A	36	Present	Not Present	0	0	0	0	0	0	0	Greater than 30 mph	124.9	30.0	1.0
4	4D	0.11	50,600	67,300	None	N/A	36	Present	Not Present	0	0	0	0	0	0	0	Greater than 30 mph	214.4	29.3	1.0

Segments Data (Intersections)

No-Build and Build Alternative

Intersection No.	Intersection Type	2025 AADT _{major}	2025 AADT _{minor}	2045 AADT _{major}	2045 AADT _{minor}	Intersection Lighting	Calibration Factor	Unsig. Major Approaches with LT Lane	Unsig. Major Approaches with RT Lane	Sig. Major Approaches with LT Lane		No. of Approaches with LT Signal Phasing		LT Phasing Leg 2	LT Phasing Leg 3	LT Phasing Leg 4	No. of approaches with prohibited RTOR	Intersection Red Light Cameras	Sig. Intersection Ped Crossing Volume/Day	Max. Lanes Crossed by Peds	No. of Bus Stops with 1000 ft.	Schools within 1000 ft.	No. of Alcohol Establishments within 1000 ft.
1	45G	37,200	19,200	52,500	23,600	Present	1.0	0	0	2	1	4	Protected	Protected	Protected	Protected	0	Not Present	N/A	5	0	Not Present	0
2	45G	53,400	4,400	71,700	6,600	Present	1.0	0	0	2	2	4	Protected/Permissive	Protected/Permissive	Protected/Permissive	Protected/Permissive	0	Not Present	N/A	4	0	Not Present	0

HSM Part C Methodology - Steps 5-6

For this IAR, Safety Analysis was performed using HSM Spreadsheets and ISATe.

		Enhar	nced Interc	hange Safety Analysis	s Tool			
General Information								
Project description:	SR 202 at	Kernan Blv	d IMR, Exis	ting Year 2019				
Analyst:	Arcadis		Date:	7/10/2020	Area type	э:	Urban	
First year of analysis:	2019							
Last year of analysis:	2019	•						
Crash Data Descripti	on							
Freeway segments	No crash d	Jata	-	· · · · · · · · · · · · · · · · · · ·	 			
Ramp segments	No crash d	Jata	-	·	<u> </u>	 	·	
Ramp terminals	No crash d	Jata	-		<u> </u>	 		
Program Control								
 Enter data in the Ma Click Perform Calcu 	•			ut Ramp Segments, Inp process.	ut Ramp	Terminals wo	rksheets.	
Perfor	rm Calculati	ions	Prin	nt Results (optional)	Pri	nt Site Sumn	nary (option:	al)
				otionally, click the Print t tput Freeway Segments				

Terminals worksheets

	Input Worksheet for Free	way Segm	ents Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
			Study	Study	Study	Study	Study	Study
Decis De	(View results in Column AV) (View results in Advisory Mer	ssages)	Period	Period	Period	Period	Period	Period
	adway Data of through lanes (n):		8	8	7	7	1	1
	segment description:			- MP. 6.03-6.2		MP 6.57-7.96	5	
	length (L), mi:		0.47	0.23	0.3	1.39		
Alignmer								
	al Curve Data See note 1 Horizontal curve in segment?:		Both Dir.	No	No	Both Dir.		
	Curve radius (R ₁), ft:		5730		110	4584		
	Length of curve (L _{c1}), mi:		0.46			0.18		
	Length of curve in segment (L _{c1,seg}), mi:		0.26			0.18		
1	2 Horizontal curve in segment?: Curve radius (R ₂), ft:		No			No		
	Length of curve (L _{c2}), mi:							
	Length of curve in segment (L _{c2,seg}), mi:							
:	3 Horizontal curve in segment?:							
	Curve radius (R ₃), ft:							
	Length of curve (L _{c3}), mi: Length of curve in segment (L _{c3.sea}), mi:							
Cross Se	action Data		I				L	
Lane widt			12	12	12	12		
Outside s	houlder width (W _s), ft:		10	10	10	10		
	pulder width (W _{is}), ft:		7	7	7	7		
	idth (W _m), ft:		17	17	17	17		
Rumble s	trips on outside shoulders?: Length of rumble strips for travel in increasing milepost direction, r	aai:	Yes 0.47	Yes 0.23	Yes 0.3	Yes 1.39		
	Length of rumble strips for travel in decreasing milepost direction, Length of rumble strips for travel in decreasing milepost direction,		0.47	0.23	0.3	1.39		
Rumble s	trips on inside shoulders?:		No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, r		<u> </u>					
Presence	Length of rumble strips for travel in decreasing milepost direction, of barrier in median:	mi:	Center	Center	Center	Center		
	1 Length of barrier (L _{ib,1}), mi:		0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face (Woff,in,	,1), ft:	7	7	7	7		
	2 Length of barrier (L _{ib.2}), mi:		0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face (W _{off.in} , 3 Length of barrier (L _{ib.3}), mi:	₂), ft:	7	7	7	7		
	Distance from edge of traveled way to barrier face (W _{off,in}	2). ft:						
4	4 Length of barrier ($L_{ib,4}$), mi:	w/1*						
	Distance from edge of traveled way to barrier face (W _{off,in}	,4), ft:						
	5 Length of barrier (L _{ib,5}), mi:							
Median ba	Distance from edge of traveled way to barrier face (W _{off,in} , arrier width (W _{ib}), ft:	.5), ft:	2	2	2	2		
	listance from edge of traveled way to barrier face (Wne	_{ar}), ft:	-	-	-	-		
Roadside	e Data			1				
	e width (W _{hc}), ft:		15	10	10	25		
	of barrier on roadside:		Some 0.07	Some 0.2	Some 0.27	Some 0.16		
	 Length of barrier (L_{ob,1}), mi: Distance from edge of traveled way to barrier face (\ 	N " ,) ft [.]	10	10	10	10		
	2 Length of barrier (L _{ob.2}), mi:	• off,o,1/, 10.	0.13	10	0.3	0.57		
	Distance from edge of traveled way to barrier face (N _{off,o,2}), ft:	10		10	10		
:	3 Length of barrier (L _{ob,3}), mi:							
	Distance from edge of traveled way to barrier face (N _{off,o,3}), ft:						
4	4 Length of barrier (L _{ob,4}), mi: Distance from edge of traveled way to barrier face (\	N						
	5 Length of barrier ($L_{ob,5}$), mi:	off,0,47, 10						
	Distance from edge of traveled way to barrier face (N _{off,o,5}), ft:						
	m edge of traveled way to barrier face, increasing milepost ($W_{\rm off,inc}$),							
	m edge of traveled way to barrier face, decreasing milepost (W _{off.dec})	, ft:						
	Increasing Milepost Direction							
Entrance	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	S-C Lane		
Ramp	Distance from begin milepost to upstream entrance ramp gore (X _b	, _{ent}), mi:		0.47	999			
	Length of ramp entrance (L _{en,inc}), mi:					0.2		
	Length of ramp entrance in segment (L _{en,seg,inc}), mi:					0.2		
Exit	Entrance side?: Ramp exit in segment? (If yes, indicate type.):		Lane Drop	No	No	Right S-C Lane		
Ramp	Distance from end milepost to downstream exit ramp gore ($X_{\text{e,ext}}$).	mi:		999	999			
	Length of ramp exit (L _{axinc}), mi:		<u> </u>			0.03		
	Length of ramp exit in segment (L _{ex.seg.inc}), mi: Exit side?:		<u> </u>			0.03 Right		
Weave	Type B weave in segment?:		No	No	No	No		
	Length of weaving section (Lwev,inc), mi:							
	Length of weaving section in segment (L _{wev,seg,inc}), m	ni:						
	Decreasing Milepost Direction					1.00	_	
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X _{e,en}	.), mi:	Lane Add	No 999	No 999	Lane Add		
p	Length of ramp entrance (L _{en,dec}), mi:							
	Length of ramp entrance in segment $(L_{en,seg,dec})$, mi:							
Exit	Entrance side?:		Lane Drop	No	No	S-C Lane		
Exit Ramp	Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{b.ox} ,), mi:	carre Drop	0.47	999	5-0 Lane		
	Length of ramp exit (L _{ex,dec}), mi:					0.03		
	Length of ramp exit in segment $(L_{ex,seg,dec})$, mi:					0.03		
\A/	Exit side?:		N.		N	Right		
Weave	Type B weave in segment?: Length of weaving section (L _{wev,dec}), mi:		Yes 0.47	No	No	No		
	Length of weaving section in segment (L _{wev,seg,dec}), m	ni:	0.47					
Traffic Da		Year						
	n of AADT during high-volume hours (P _{hv}):							
	Segment Data	2019	143400	114400	114400	121200		
	Ramp Data for Travel in Increasing Milepost Dir.	Year	20800	20800		3400		
	daily traffic (AADT _{b,ent}) by year, veh/d: b Data for Travel in Increasing Milepost Direction	2019 Year	20000	20000		3400		
	daily traffic (AADT _{e.ext}) by year, veh/d:	2019	14500			17200		
	Ramp Data for Travel in Decreasing Milepost Dir.	Year			1			
Exit Ramp	Data for Travel in Decreasing Milepost Direction	Year	·					
Average of	daily traffic (AADT _{b,ext}) by year, veh/d:	2019	31900	31900		3400		

Input Worksheet for Ramp Segmen	ts					
	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Study	Study	Study	Study	Study	Study
(View results in Column CJ) (View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
Basic Roadway Data						
Number of through lanes (n):	1	1	1	1		
	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column CJ) (View results in Advisory Messages)						
Basic Roadway Data						
Number of through lanes (n):	1	1	1	1		
				WB. On Ram	р	
Segment length (L), mi: 🔨 🔨 🥕	0.33	0.41	0.26	0.29		
Average traffic speed on the freeway (V _{frwy}), mi/h:	65	65	65	65		
Segment type (ramp or collector-distributor road):	Exit	Entrance	Exit	Entrance		
Type of control at crossroad ramp terminal:	Stop	Stop	Stop	Stop		
Alignment Data						
Horizontal Curve Data See notes						
1 Horizontal curve?:	No	No	No	No		
Curve radius (R ₁), it:						
Length of curve (L _{c1}), mi:						
Length of curve in segment (L _{c1,seg}), mi:						
Ramp-mile of beginning of curve in direction of travel (X1), mi.						
Cross Section Data						
Lane width (w _l), π:	12	12	12	12		
Right shoulder width (W _{rs}), ft:	7	7	7	7		
Left should <mark>e</mark> r width (W _{Is}), ft:	4	4	4	4		
Presence of lane add or lane drop by taper:	No	No	No	No		
Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi:						
Roadside Data						
Presence of barrier on right side of roadway:	Yes	Yes	Yes	Yes		
1 Length of barrier (L _{rb.1}), mi:	0.25	0.4	0.03	0.2		
Distance from edge of traveled way to barrier face (W _{off,r,1}), ft:	20	25	25	25		
2 Length of barrier (L _{rb,2}), mi:						
Distance from edge of traveled way to barrier face (W _{off,r,2}), ft:						
Presence of barrier on left side of roadway:	No	No	No	No		
i Length of barrier (L _{b,1}), mi:						
Distance from edge of traveled way to barrier face (W _{off,I,1}), ft:						
2 Length of barrier (L _{b,2}), mi:						
Distance from edge of traveled way to barrier face (W _{off,I,2}), ft:						
Ramp Access Data See note						
	No	No	No	No		
Ramp Ramp entrance in segment? (If yes, indicate type.):						
Ramp Ramp entrance in segment? (If yes, indicate type.): Entrance Length of entrance s-c lane in segment (L _{en,seq}), mi:						
	No	No	No	No		

	Inpu	t Worksheet for Crossroad Ramp T	erminals					
	(View results in Column T)	(View results in Advisory Messages)	Terminal 1 Study Period	Terminal 2 Study Period	Terminal 3 Study Period	Terminal 4 Study Period	Terminal 5 Study Period	Terminal 6 Study Period
Basic Inte	ersection Data							
Ramp terr	ninal configuration:		D4	D4				
Ramp terr	ninal description:		South Ramp	North Ramp T	Ferm.			
Ramp terr	ninal traffic control type:		One stop	One stop				
ls a non-ra	amp public street leg preser	it at the terminal (I _{ps})?:						
Alignmen	nt Data							
Exit ramp	skew angle (I _{sk}), degrees:		0	0				
		n the outside crossroad leg (L _{str}), mi:	999	0.17				
Distance t	o the adjacent ramp termin	al (L _{rmp}), mi:	0.09	0.09				
Traffic Co	ontrol							
Left-Turn	Operational Mode							
Crossroad	Inside approach	Protected-only mode (I _{p.lt.in})?:						
	Outside approach	Protected-only mode (I _{p,It,out})?:						
Right-Tur	n Control Type							
Ramp	Exit ramp approach	Right-turn control type:	Yield	Stop				
Cross Se	ction Data							
Crossroad	d median width (W _m), ft:		36	36				
Number c	of Lanes							
Crossroad	Both approaches	Lanes serving through vehicles (n _{th}):	4	4				
	Inside approach	Lanes serving through vehicles (n _{th.in}):						
	Outside approach	Lanes serving through vehicles (n _{th,out}):			0	0	0	0
Ramp	Exit ramp approach	All lanes (n _{ex}):	1	1				
Right-Tur	n Channelization	see note: 🔶						
Crossroad		Channelization present (I _{ch.in})?:						
	Outside approach	Channelization present (I _{ch,out})?:						
Ramp	Exit ramp approach	Channelization present (I _{ch.ex})?:						
•	Lane or Bay							
Crossroad	Inside approach	Lane or bay present (I _{bay,tt,in})?:	Yes	Yes				
erecercaa		Width of lane or bay $(W_{b,in})$, ft:	12	12				
	Outside approach	Lane or bay present (I _{bay,It,out})?:						
		Width of lane or bay $(W_{b,out})$, ft:						
Right-Tur	n Lane or Bay							
-	Inside approach	Lane or bay present (I _{bay,rt,in})?:					-	-
	Outside approach	Lane or bay present (I _{bay,rt,out})?:	Yes	Yes				
Access D								
	f driveways on the outside of	crossroad leg (n .):						
		on the outside crossroad leg (n_{dw}) .						
Traffic Da		Year 2010	17000	17900				
	ossroad Leg Data	2019	17900 0	30500				
	Crossroad Leg Data	2019						
Exit Ram		2019	14500	3400				
	Ramp Data	2019	3400	14500				
Average d	laily traffic (AADT _{en}) by year	r, veh/d: 2020						

			Ou	tput Summ	ary				
General Information									
Project description:	SR 202 at K	ernan Blvd	IMR, Existir	ng Year 2019)				
Analyst:	Arcadis		Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2019								
Last year of analysis:	2019								
Crash Data Descripti	on								
Freeway segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available?)	No	Last year o	f crash data	:	
Ramp segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available?)	No	Last year o	f crash data	:	
Ramp terminals	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available?)	No	Last year o	f crash data	:	
Estimated Crash Sta	tistics								
Crashes for Entire Fa	acility			Total	K	Α	В	С	PDO
Estimated number of crashe	s during Study	Period, crashe	es:	126.9	0.6	2.0	12.0	38.1	74.2
Estimated average crash fre	q. during Study	Period, crash	ies/yr:	126.9	0.6	2.0	12.0	38.1	74.2
Crashes by Facility (Component		Nbr. Sites	Total	K	Α	В	С	PDO
Freeway segments, cra	ashes:		4	96.4	0.5	1.3	7.5	20.1	67.1
Ramp segments, crash	nes:		4	2.8	0.0	0.1	0.5	0.7	1.5
Crossroad ramp termi	nals, crashe	s:	2	27.6	0.1	0.6	4.0	17.3	5.6
Crashes for Entire Fa	acility by Ye	ear	Year	Total	K	Α	В	С	PDO
Estimated number of o	rashes duri	ng	2019	126.9	0.6	2.0	12.0	38.1	74.2
Distribution of Crash	es for Entir	re Facility							
Crash Type	Cras	n Type Cat	0000	Estim	ated Numb	er of Crash	es During f	the Study F	Period
Crash Type	Clas	T Type Cau	egory	Total	K	Α	В	С	PDO
Multiple vehicle	Head-on cr	ashes:		0.7	0.0	0.0	0.1	0.4	0.2
	Right-angle	crashes:		13.7	0.1	0.3	2.0	8.4	3.0
	Rear-end c	rashes:		59.8	0.3	0.9	5.6	17.4	35.7
	Sideswipe	crashes:		17.9	0.1	0.2	1.1	3.1	13.5
	Other mult	iple-vehicle	e crashes:	2.3	0.0	0.0	0.2	0.8	1.3
	Total mu	tiple-vehicl	e crashes:	94.5	0.4	1.5	9.0	30.0	53.6
Single vehicle	Crashes wit	th animal:		0.4	0.0	0.0	0.0	0.0	0.4
		th fixed obj		23.6	0.1		2.2	6.0	14.9
		th other ob		3.1	0.0		0.1	0.3	2.6
		th parked v		0.5	0.0		0.0	0.1	0.4
	-	e-vehicle cr		4.8	0.0		0.6	1.8	2.2
	Total sing	le-vehicle c		32.4	0.2		3.0	8.1	20.6
		Total crash	ies:	126.9	0.6	2.0	12.0	38.1	74.2

MV = multiple-vehicle model SV = single-vehicle model			eet for Fr			Coor	Page 10	Pear	Page	Pag
	ENR = ra		ance mod model	el	Segment 1 Study	Segment 2 Study	Segment 3 Study	Segment 4 Study	Segment 5 Study	Segment 6 Study
			Models	(y)	Period	Period	Period	Period	Period	Period
Crash Modification Factors Fatal-and-Injury Crash CMFs										
Horizontal curve (CMF _{1,w,ac,y,fl}):	MV	1	ENR	EXR	1.010	1.000	1.000	1.003		
		SV			1.040	1.000	1.000	1.015		
Lane width (CMF _{2,w,ac,y,fi}):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Dutside shoulder width (CMF _{8,fs,ac,sy,fi}): Inside shoulder width (CMF _{3,w,ac,y,fi}):	M∨	SV SV	ENR	EXR	1.000	1.000	1.000	1.000		
Median width (CMF _{4,w,ac,y,fi}):	MV		ENR	EXR	1.151	1.151	1.151	1.151		
		SV			0.954	0.954	0.954	0.954		
Median barrier (CMF _{5.w.ac.y.fi}): Shoulder rumble strip (CMF _{9.fs.ac.av.fi}):	M∨	SV SV	ENR	EXR	1.191 0.958	1.191 0.906	1.191	1.191 0.918		
Outside clearance (CMF _{10,fs,ac,sv,fi}):		SV			1.074	1.093	1.091	1.041		
Outside barrier (CMF _{11,fs,ac,sv,fi}):		SV			1.041	1.083	1.181	1.050		
_ane change (CMF _{7,fs,ac,mv,fi}):	ΜV		N	2010	4 447	4 000	1 000	4.000		
Ramp entrance (CMF _{12,sc,nEN,at,fi}):	1		Year: ENR	2019	1.417	1.000	1.000	1.069		
			Year:	2019	1.000	1.000	1.000	1.494		
Ramp exit (CMF _{13,sc,nEX,at,fi}):				EXR	1.000	1.000	1.000	1.472		
High volume (CMF _{6,w,ac,y,fi}):	M∨	SV	ENR	EXR	1.207 0.964	1.101 0.982	1.166 0.971	1.192 0.967		
Property-Damage-Only Crash CMFs		0.						0.001		
Horizontal curve (CMF _{1,w,ac,y,pdo}):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
ane width (CMF _{2,w,ac,y,pdo}):	M∨	SV SV	ENR	EXR	1.035	1.000	1.000	1.013 1.000		
Dutside shoulder width (CMF _{8.fs.ac.sv.pdo}):	IVIV	SV	LINIX	LAR	1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,8c,y,pdo}):	M∨	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median width (CMF _{4,w,ac,y,pdo}):	M∨	<u> </u>	ENR	EXR	1.145	1.145	1.145	1.145		
Median barrier (CMF _{5,w,ac,y,pdo}):	M∨	SV SV	ENR	EXR	1.144 1.253	1.144 1.253	1.144	1.144 1.253		
Shoulder rumble strip (CMF _{9,fs,ac,sv,pdo}):		SV			1.000	1.000	1.000	1.000		
Outside clearance (CMF _{10,fs,ac,sv,pdo}):		SV	T		1.000	1.000	1.000	1.000		
Dutside barrier (CMF _{11,fs,ac,sv,pdo}):	M0.4	SV	<u> </u>		1.054	1.110	1.240	1.066		
_ane change (CMF _{7,fs,ac,mv,pdo}):	MV	I	Year:	2019	1.312	1.000	1.000	1.063		
Ramp entrance (CMF _{12,sc,nEN,at,pdo}):			ENR		1.000	1.000	1.000	1.134		
Ramp exit (CMF _{13,sc,nEX,at,pdp}):				EXR	1.000	1.000	1.000	1.000		
High volume (CMF _{6,w,ac,y,pdo}):	M∨	sv	ENR	EXR	1.165 0.720	1.081 0.845	1.132 0.765	1.153 0.736		
Predicted Average Crash Frequenc	y	01		<u> </u>	0.720	0.045	0.705	0.750		
Fatal-and-Injury Crash Frequency	-			1	1					
Freeway Segment Multiple-Vehicle Cr Overdispersion parameter (k _{fs.n.mv.fi}):	ash Anal	/sis		Year						
Dbserved crash count (N* _{o,fs,n,mv,fi}), cra	ashes:									
Reference year (r):										
Predicted average crash freq. for refer				hes/yr:						
Equivalent years associated with crash Expected average crash freq. for reference year				r						
Predicted average crash frequency		F17-76,8(17/19/10	,,,,	2019	6.444	1.436	2.030	10.191		
Freeway Segment Single-Vehicle Cra	sh Analys	sis		Year						
Overdispersion parameter (k _{fs,n,sv,fi}):	ahaa:									
Observed crash count (N* _{o,fs,n,sv,fi}), cra Reference year (r):	isries.									
Predicted average crash freq. for refer	rence yea	r (N _{p,fs,n,s}	_{w,fi,r}), crasł	nes/yr:						
Equivalent years associated with crash										
Expected average crash freq. for reference yea										
	al given iv.	(N _{a.ts.n.ov.ti.r}), crashes/yr		1 013	0 793	1.076	4 072		
Predicted average crash frequency		(N _{a.ts.n.sv.fl.r}), crashes/yr	2019 Year	1.913	0.793	1.076	4.072		
Predicted average crash frequency Ramp Entrance Crash Analysis Overdispersion parameter (k _{sc.EN.al.fi}):	ai given iv ,	(Na.ts.n.av.f.r), crashes/yr	2019	1.913	0.793	1.076	4.072		
Predicted average crash frequency Ramp Entrance Crash Analysis Overdispersion parameter ($k_{sc,EN,al.fi}$): Observed crash count ($N^*_{o.sc,EN,al.fi}$), cr		ı (N _{adanovda}), crashes/yr	2019	1.913	0.793	1.076	4.072		
Predicted average crash frequency Ramp Entrance Crash Analysis Overdispersion parameter (k _{sc.EN.at.fi}), cr Observed crash count (N* _{o.sc.EN.at.fi}), cr Reference year (r):	rashes:			2019 Year	1.913	0.793	1.076	4.072		
Predicted average crash frequency Ramp Entrance Crash Analysis Overdispersion parameter (K _{ec.EN.at.} h), cr Dbserved crash count (N* _{o.sc.EN.at.} h), cr Reference year (r): Predicted average crash freq. for refer	rashes: rence yea	r (N _{p.sc.EN}	_{v.at,fi,r}), cras	2019 Year	1.913	0.793	1.076	4.072		
Predicted average crash frequency Ramp Entrance Crash Analysis Dverdispersion parameter (k _{so.EN.at.fl}): Dbserved crash count (N ^N _{to.Sc.EN.at.fl}). Deserved crash count (N ^N _{to.Sc.EN.at.fl}). Reference year (r): Predicted average crash freq. for refer Equivalent years associated with crash Expected average crash freq. for reference yea	rashes: rence yea h count (0	г (N _{p,sc,EN}	_{v.at,fi,r}), cras	2019 Year shes/yr:						
Predicted average crash frequency Ramp Entrance Crash Analysis Voerdispersion parameter (K.e.s. Nauf). Diserved crash count (N [*] 0.56.EN.dt.), or Reference year (r): Fredicted average crash freq, for refer Equivalent years associated with crash Expected average crash freq, for reference yei redicted average crash frequency	rashes: rence yea h count (0	г (N _{p,sc,EN}	_{v.at,fi,r}), cras	2019 Year shes/yr: yr: 2019	0.000	0.793	0.000	4.072		
Predicted average crash frequency Ramp Entrance Orash Analysis Overdispersion parameter (K ₆₅ , Dual): Disserved crash count (N ⁺ _{0.56} , Ental): Disserved crash count (N ⁺ _{0.56} , Ental): Predicted average crash freq, for reference yea Equivalent years associated with crash Expected average crash freq, for reference yea Predicted average crash frequency Ramp Exit Crash Analysis	rashes: rence yea h count (0	г (N _{p,sc,EN}	_{v.at,fi,r}), cras	2019 Year shes/yr:						
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Predicted average crash frequency Ramp Entrance Crash Analysis Overdispersion parameter (K _{65,ENAM}); Dbserved crash count (N° _{0.06,ENAM}), or Reference year (r): "redicted average crash freq. for refer Equivalent years associated with crash Specied average crash frequency Predicted average crash frequency Ramp Exit Crash Analysis Deserved crash count (N° _{0.06,ENAM}), or Reference year (r):	rashes: rence yea h count ((ar given N*, rashes: rashes:	r (N _{p.sc.EN.at.} Cb.sc.En.at. (N _{a.sc.EN.at.} t	u _{lat,fi,r}), cras _{i(r}), yr: _{is}), crashes/ c _{at,fi,r}), cras	2019 Year shes/yr: yr: 2019 Year						
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (k.e.s. Diuth): Diserved crash count (N ⁺ 0.56.Diuth): Reference year (r): Equivalent years associated with crash predicted average crash freq. for reference yea redicted average crash frequency Ramp Exit Crash Analysis Diverdispersion parameter (k _{ac.EX.at.0}): Diserved crash count (N ⁺ 0.56.EX.at.0): Reference year (r): Predicted average crash freq. for referer Quivalent years associated with crash	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((r (N _{p.sc.EN.at.} Pb.sc.EN.at. (N _{a.sc.EN.at.}) r (N _{p.sc.EX}	_{v.at.fi,r}), cras I _i ,r), yr: _{k,r}), crashes/ _{k,s}), crashes/ _{k,s} , crashes/	2019 Year shes/yr: 2019 Year shes/yr:						
Predicted average crash frequency Ramp Entrance Crash Analysis Voerdispersion parameter (K.e. CNLAII): Disserved crash count (N ⁺ 0.0000 ENCLED AND Reference year (r): Fredicted average crash freq, for refere Equivalent years associated with crash specide average crash frequency Ramp Exit Crash Analysis Diverdispersion parameter (K.e. CXLAII): Disserved crash count (N ⁺ 0.0000 EXLAII): Disserved crash freq, for refere Equivalent years associated with crash Sizpecida average crash freq, for reference year Credicted average crash freq, for reference year	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*,	r (N _{p.sc.EN.at.} Pb.sc.EN.at. (N _{a.sc.EN.at.}) r (N _{p.sc.EX}	_{v.at.fi,r}), cras I _i ,r), yr: _{k,r}), crashes/ _{k,s}), crashes/ _{k,s} , crashes/	2019 Year shes/yr: 2019 Year shes/yr:						
Predicted average crash frequency Vardispersion parameter (k.c. Buah): Diserved crash count (N [*] _{0.06} ENAL); Diserved crash count (N [*] _{0.06} ENAL); Diserved crash count (N [*] _{0.06} ENAL); Caleference year (f): Predicted average crash freq, for reference year predicted average crash freq, for reference year Predicted average crash freq, for reference year (N [*] _{0.06} EXAL); Diserved crash count (N [*] _{0.06} EXAL); Costerved crash count (N [*] _{0.06} EXAL); Costerved crash count (N [*] _{0.06} EXAL); Costerved crash freq, for reference year Predicted average crash freq, for reference year Predicted average crash freq, for reference year Predicted average crash freq. for afference year Predicted average crash freq. for <i>B</i> for quency	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, uency	r (N _{p.sc,EN} D _{b.sc,EN.at.f} (N _{a.sc,EN.at.f} r (N _{p.sc,EX} C _{b.sc,EX.at.f}	_{v.at.fi,r}), cras I _i ,r), yr: _{k,r}), crashes/ _{k,s}), crashes/ _{k,s} , crashes/	2019 Year shes/yr: yr: 2019 Year shes/yr: yr: 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Vordispersion parameter (k.e. RUMAI): Disserved crash count (N° _{D.R.E.N.M.B.}), or Reference year (r): Predicted average crash freq. for refer- Equivalent years associated with crash special average crash frequency Predicted average crash frequency Predicted average crash frequency Vordispersion parameter (k.e. RUMAI): Disserved crash count (N° _{D.G.E.K.M.B}). Code crash count (N° _{D.G.E.K.M.B}), or Reference year (r): Predicted average crash freq. for refer- Equivalent years associated with crash Expected average crash freq. for refere- Equivalent years associated with crash Expected average crash freq. for reference year (Fredicted average crash freq. for reference year (Fredi	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, uency rash Anal)	r (N _{p.sc,EN} D _{b.sc,EN.at.f} (N _{a.sc,EN.at.f} r (N _{p.sc,EX} C _{b.sc,EX.at.f}	_{v.at.fi,r}), cras I _i ,r), yr: _{k,r}), crashes/ _{k,s}), crashes/ _{k,s} , crashes/	2019 Year shes/yr: 2019 Year shes/yr: yr:	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Sverdispersion parameter (k _{ec. Buth}): Disserved crash count (N ⁺ _{0.06,EN,db}), cr Reference year (r): Predicted average crash freq, for reference year predicted average crash freq, for reference year predicted average crash freq, for reference year (N ⁺ _{0.06,EX,db}), cr Reference year (r): Predicted average crash freq, for reference year (N ⁺ _{0.06,EX,db}), cr Reference year (r): Predicted average crash freq, for reference year Predicted average crash freq, for preference year Preference year (f); Preference	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, given N*, arsh Analy;	r (N _{p.sc,EN} D _{b.sc,EN.at.f} (N _{a.sc,EN.at.f} r (N _{p.sc,EX} C _{b.sc,EX.at.f}	_{v.at.fi,r}), cras I _i ,r), yr: _{k,r}), crashes/ _{k,s}), crashes/ _{k,s} , crashes/	2019 Year shes/yr: yr: 2019 Year shes/yr: yr: 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Dverdispersion parameter (k.e.C.N.M.R): Dbserved crash count (N ⁺ o.sc.EN.M.R), or Reference year (r): Predicted average crash freq. for refer- Equivalent years associated with crash ispected average crash frequency Ramp Exil Crash Analysis Dverdispersion parameter (k.e.C.X.M): Dbserved crash count (N ⁺ o.sc.EX.M); Dbserved crash count (N ⁺ o.sc.EX.M); Dbserved crash neq. for refer- Equivalent years associated with crash Specided average crash freq. for refer- Equivalent years associated with crash Specida average crash freq. for reference year (r): Property-Damage-Child Crash Frequency Property-Damage-Child Crash Frequency Prope	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, cuency rash Anal); crashes:	r (N _{p.sc.EN.at.} C _{b.sc.EN.at.} (N _{a.sc.EN.at.}) r (N _{p.sc.EX.at.} C _{b.sc.EX.at.} (N _{b.sc.EX.at.} (N _{b.sc.EX.at.})	N.at.fi.z), cras II.f.), yr: , crashes/ , crashes/ , crashes/ , yr: , crashes/	2019 Year shes/yr: 2019 Year shes/yr: yr: 2019 Year Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (k.c. Dutth): Diserved crash count (N ⁺ _{0.06,ENALD}), ci Reference year (r): Predicted average crash freq, for reference year redicted average crash freq, for reference year redicted average crash freq, for reference year predicted average crash freq, for reference year Diserved crash Analysis Overdispersion parameter (k.c., EX.ALD), ci Reference year (r): Predicted average crash freq, for reference year relivial average crash freq, for reference year relivial average crash freq, for reference year Predicted average crash freq, for reference year Disserved crash count (N ⁺ _{Distant}), ci Reference year (f): Disserved crash count (N ⁺ _{Distant}), ci Reference year (f): Predicted average crash freq, for reference year (f): Disserved crash count (N ⁺ _{Distant}), ci Reference year (f): Predicted average crash freq, for reference year (f): Disserved crash count (N ⁺ _{Distant}), ci Reference year (f): Predicted average crash freq, for reference year (f): Disserved crash count (N ⁺ _{Distant}), ci Reference year (f): Predicted average crash freq, for reference year (f): Disserved crash count (N ⁺ _{Distant}), ci Disserved	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, uency rash Anal); crashes: rence yea	r (N _{p.sc,EN} Cb.sc,EN.at.f (N _{a.sc,EN.at.}) r (N _{p.sc,EX} Cb.sc,EX.at.f (N _{a.sc,EX.at.}) vsis	(at.f.,z), crat (at.f.,z), vr: (at.f.,z), crashes/ (at.f.,z), crashes/ (at.f.,z), vr: (at.f.,z), vr: (at.f.,z), crashes/ (at.f.,z), crashes/	2019 Year shes/yr: 2019 Year shes/yr: yr: 2019 Year Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (K.e.o.Buth): Disserved crash count (N [*] 0.56.EN.06.B) Reference year (r): redicted average crash freq, for reference yea redicted average crash frequency Ramp Exit Crash Analysis Diverdispersion parameter (K.e., EX.06.B) Disserved crash count (N [*] 0.56.EX.06.B) Disserved crash count (N [*] 0.56.EX.06.B) Disserved crash count (N [*] 0.56.EX.06.B) Reference year (r): Predicted average crash freq. for reference yea (N [*] 0.56.EX.06.B) Reference year (r): Predicted average crash freq. for reference Equivalent years associated with crash Expended average crash freq. for reference Reference year (r): Predicted average crash freq. for reference yea (r): Predicted average crash freq. for referen	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((crash Anal) crash Anal) crashes: rence yea h count ((r (N _{p.sc.EN} 	(at.f.,z), crat (at.f.,z), vr: (at.f.,z), crashes/ (at.f.,z), crashes/ (at.f.,z), vr: (at.f.,z), vr: (at.f.,z), crashes/ (at.f.,z), crashes/	2019 Year shes/yr: yr: 2019 Year shes/yr: yr: 2019 Year Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Voerdispersion parameter (K _{isco, ENAM}); Diserved crash count (N° _{0.06,ENAM}); cr Reference year (r): Predicted average crash freq. for refer quivalent years associated with crash predicted average crash frequency Predicted average crash frequency Predicted average crash frequency Predicted average crash frequency Voerdispersion parameter (K _{isco, ENAM}); Diserved crash count (N° _{0.06,ENAM}); Credicted average crash frequency Reference year (r): Predicted average crash frequency Predicted average crash freq. for refer Quivalent years associated with crash Sizpected average crash freq. for reference year (r): Diserved crash count (N° _{0.06,00} ,reps); Reference year (r): Diserved crash count (N° _{0.06,00} ,reps); Reference year (r): Predicted average crash freq. for reference year (r): Predicted average crash freq. for reference year (r):	rashes: rence yea h count ((ar given N*, rashes: rence yea h count ((ar given N*, crashes: rence yea h count ((ar given N*,	r (N _{p.sc.E}) 2b.sc.EN att (N _{s.e.EP.att}) (N _{s.e.EP.att}) r (N _{p.sc.EX}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att})	(at.f.,r), cras a,r), yr: a,r), yr: (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/	2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (k.e. Runn): Disserved crash count (N ⁺ Disc. Runn): Disserved crash count (N ⁺ Disc. Runn): Predicted average crash freq, for reference yea (Predicted average crash freq, for reference yea redicted average crash freq, for reference yea Predicted average crash freq, for reference yea (N ⁺ Disserved crash Analysis Diserved crash count (N ⁺ Disc. Runn): Predicted average crash freq, for reference yea (P): Predicted average crash freq, for reference yea (P): Predicted average crash freq, for reference yea (P): Predicted average crash freq, for reference yea (P): Diserved crash count (N ⁺ Disc. Runn): Diserved crash requency Predicted average crash freq. for reference yea Predicted average crash freq. for preference yea Predicted average crash freq. for preference yea Predicted average crash freq. for prefere	rashes: rence yeaa r given N, rashes: rashes: rence yeaa h count ((uency uency rash Anal); sh Analy;	r (N _{p.sc.E}) 2b.sc.EN att (N _{s.e.EP.att}) (N _{s.e.EP.att}) r (N _{p.sc.EX}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att})	(at.f.,r), cras a,r), yr: a,r), yr: (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/	2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year 2019 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Sverdispersion parameter (K _{koc.NLMA}): Disserved crash count (N ⁺ _{0.06,EN.MLB}), or Reference year (r): Predicted average crash freq. for reference year interpret of the system of the system of the system Predicted average crash freq. for reference year Predicted average crash freq. for reference year Property-Diamage-Only Crash Frequency Property-Diamage-Only Crash Freq. Disserved crash count (N ⁺ to for reference year (f): Predicted average crash freq. for reference year Predicted average crash freq. for reference year Producted average crash freq. for refer	rashes: rence yeaa r given N, rashes: rashes: rence yeaa h count ((uency uency rash Anal); sh Analy;	r (N _{p.sc.E}) 2b.sc.EN att (N _{s.e.EP.att}) (N _{s.e.EP.att}) r (N _{p.sc.EX}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att}) r (N _{p.fs.D.att})	(at.f.,r), cras a,r), yr: a,r), yr: (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/ (at.f.,r), crashes/	2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year 2019 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (K _{isc, Distal)} : Reference year (f): Predicted average crash freq, for refer- Equivalent years associated with crash ispected average crash freq, for reference year redicted average crash frequency Ramp Exit Crash Analysis Diverdispersion parameter (K _{isc, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Predicted average crash freq, for reference year (f): Predicted average crash freq, for reference year (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, at, b)} : Diserved crash count (N ⁺ _{0.06, EX, AT, b)} : Predicted average crash freq, for reference year (f): Predicted average crash freq, for reference year (f): Diserved crash count (N ⁺ _{0.06, 0.07}); Diserved crash count (N ⁺	rashes: rence yeaes h count (d rashes: rashes: rashes: rence yeaes ar given N [*] , arashes: crashes: rence yeaes sh Analys sh Analys rashes:	f (Np.ac.E) *2.soEN at/ (N _{A.S.E.Ph.d.}) f (Np.ac.E) *2.soEX.at/ (N _{A.S.E.Ph.d.}) *2.soEX.at/ (N _{A.S.E.Ph.d.}) *2.soEX.at/ (N _{A.S.E.Ph.d.})	<pre>\u03ed_{add,b}, crashes/ \u03ed_{add,b}, crushes/ \u03ed_{add,b}, crushes/ \u03ed_{add,b},</pre>	2019 Year Shes/yr: 2019 Year Year 2019 Year 2019 Year 2019 Year Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Vardispersion parameter (K _{Ko.C.N.M.D}). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Reference year (r): Predicted average crash freq, for refere Equivalent years associated with crass ispecial expression parameter (K _{0.0.X.M.D}). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Predicted average crash freq. for reference year (N ⁻). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Reference year (r): Predicted average crash freq. for reference year (N ⁻). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Reference year (r): Predicted average crash freq. for reference year (N ⁻). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Reference year (r): Predicted average crash freq. for reference year (N ⁻). Disserved crash count (N ⁺ _{0.06.D.N.D}), or Disserved crash count (N ⁺ _{0.06.D.N.D}), or Reference year (r): Predicted average crash freq. for reference year (N ⁻). Predicted average crash freq. for reference year (N ⁻). Predicted average crash freq. for reference year (r): Predicted average crash freq. for reference year (r): Predicte	rashes: rence yea h count (C and the second of the secon	r (Np.scEN PoseENation (Ns.scEnation) r (Np.scEnation) PoseEnation (Ns.scEnation)	<pre>sats/). crashes/ i,b, yr. cats/). crashes/ cats/). crashes/ cats/). crashes/ i,b, reshes/ i,b, reshes/ i</pre>	2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Year Year Shes/yr: 2019 Year Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (k.c. Buah): Disserved crash count (N ⁺ DAGENALD), cr Reference year (f): Predicted average crash freq, for reference year (refuence) (Refuence) (Refuence) (Refuence) Predicted average crash freq, for reference year (Refuence) (Refuence) (Refuence) (Refuence) (Refuence) (Refuence) Predicted average crash freq, for reference year (Refuence) (Refuence) (Refuence	rashes: rence yea h count (C and the second of the secon	r (Np.scEN PoseENation (Ns.scEnation) r (Np.scEnation) PoseEnation (Ns.scEnation)	(att), crashes/ ,), ornshes/ (att), crashes/ ,), crashes/ ,), crashes/ ,), crashes/ ,), crashes/ ,), crashes/	2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Year Year Shes/yr: 2019 Year Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year Shes/yr: 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Verdispersion parameter (K _{icc, Dist}), Disserved crash count (N ⁺ _{Disc, Dist}), G Reference year (1): Predicted average crash freq, for reference year (Predicted average	rashes: rence yeaes h count ((f rashes: rashes: rence yeae h count (rashes: rence yeae h count (rashes: rence yeae h count (rashes: rence yeaes h count (rashes: rence yeaes rashes: rence yeaes rence yeaes rashes: rence yeaes rence yeaes ren	r (Np.scEN PoseENation (Ns.scEnation) r (Np.scEnation) PoseEnation (Ns.scEnation)	<pre>sats/). crashes/ i,), yr. (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr.</pre>	2019 Year yr: 2019 Year 2019 Year 2019 Year 2019 Year shes/yr: 2019 Year xy: 2019 Year yr: 2019 Year 2019 Year Year 2019 Year Year 2019 Year Year Year 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Amp Entrance Crash Analysis Sverdispersion parameter (K _{Ke, DLMA}), or Reference year (r): Predicted average crash freq, for refer- guivalent years associated with crash predicted average crash frequency Predicted average crash frequency Predicted average crash frequency Predicted average crash frequency Verdispersion parameter (K _{KE, DLM}), or Reference year (f): Predicted average crash frequency Predicted average crash freq. for reference year (f): Predicted averag	rashes: rence yea h count (C ar given N', rashes: rence yea h count (C ar given N', uency uency ash Analyc sh Analyc rashes: ra	r (Np.scEN PoseENation (Ns.scEnation) r (Np.scEnation) PoseEnation (Ns.scEnation)	<pre>sats/). crashes/ i,), yr. (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr.</pre>	2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year Year 2019 Year Year 2019 Year Year Year Year Year Year Year Year Year 2019 Year Year 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Verdispersion parameter (K _{Ko, ENLARD}). Coverdispersion parameter (K _{Ko, ENLARD}).	rashes: rence yea h count (C ar given N', rashes: rence yea h count (C ar given N', uency uency ash Analyc sh Analyc rashes: ra	r (Np.scEN PoseENation (Ns.scEnation) r (Np.scEnation) PoseEnation (Ns.scEnation)	<pre>sats/). crashes/ i,), yr. (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), crashes/ (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr. (ats/), yr.</pre>	2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year Year 2019 Year Year 2019 Year Year Year Year Year Year Year Year Year 2019 Year Year 2019	0.000	0.000	0.000	0.988		
Predicted average crash frequency Verdispersion parameter (K _{Ko, ENLARD}). Coverdispersion parameter (K _{Ko, ENLARD}). Reference year (1): Predicted average crash freq, for refere Equivalent years associated with crass ispected average crash freq, for reference yea (1): Verdispersion parameter (K _{Ko, EXLARD}). Disserved crash count (N ⁺ _{0.06, EXLARD}). Count dispersion parameter (K _{10, 0.07, 0.07}). Count dispersion parameter (K _{10, 0.07, 0.07}). Count dispersion parameter (K _{10, 0.07, 0.07}). Diserved crash count (N ⁺ _{0.06, 0.07}). Count dispersion parameter (K _{10, 0.07}). Diserved crash count (N ⁺ _{0.06, 0.07}). Count dispersion parameter (K _{10, 0.07}).	rashes: rence yea h count (C rarabes: rence yeas h count (N rashes: rence yeas h count (C rashes: rence yeas sh Analys sh Analys rashes: rence yeas h count (C count (C rashes:	r (N _{P.56-E}) 	Laste, j), Crashes/ μ, j, yr; μ, crashes/ (aste, j), crashes/ (aste	2019 Year yr: 2019 Year 2019 Year 2019 Year 2019 Year Shes/yr: 'yr: 2019 Year Year Year Year 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Verdispersion parameter (K.e., BLAILD): Disserved crash count (N ⁺ D.B.E.RULLD): Disserved crash count (N ⁺ D.B.E.RULLD): Aleference year (1): Predicted average crash freq, for reference parameter (K.e., C.LLD): Disserved crash count (N ⁺ D.B.E.RULLD): Disserved crash count (N ⁺ D.	rashes: rence yeas h count (0 ar given N*, rashes: rence yeas h count (0 rash Analy rash Analy rash Analy rashs; rence yeas h count (0 to count (0	r (N _{p.nc.E}) ² b.so.EN.at/, (N _{n.nc.EN.at/} r (N _{p.nc.EN}) ² c.so.EX.at/ (N _{n.ac.EX.at/} (N _{n.ac.EX.at/)} (N _{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/} (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/}}}}	v _{anth} /), crashes/ ,), cr	2019 Year Shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Vardispersion parameter (K.e., D.N.I.D. Vardispersion parameter (K.e., D.N.I.D. Disserved crash count (N ⁺ 0.56.2000) Reference year (r): Predicted average crash freq, for reference year redicted average crash freq, for reference year redicted average crash freq, for reference year Predicted average crash freq. for reference year (r): Predicted average crash freq. for reference feeding crash count (N ⁺ 0.56.3000) Predicted average crash freq. for reference feeding crash count (N ⁺ 0.56.30000) Predicted average crash freq. for reference feeding crash count (N ⁺ 0.56.300000) Predicted average crash freq. for reference feeding crash count (N ⁺ 0.56.30000000000000000000000000000000000	rashes: rence yeas h count (0 ar given N*, rashes: rence yeas h count (0 rash Analy rash Analy rash Analy rashs; rence yeas h count (0 to count (0	r (N _{p.nc.E}) ² b.so.EN.at/, (N _{n.nc.EN.at/} r (N _{p.nc.EN}) ² c.so.EX.at/ (N _{n.ac.EX.at/} (N _{n.ac.EX.at/)} (N _{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/} (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/}}}}	v _{anth} /), crashes/ ,), cr	2019 Year shes/yr: 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Amp Entrance Crash Analysis Sverdispersion parameter (K _{Ke, ENAM)}). Cherner and Crash Analysis Deserved crash count (N ⁺ _{0.06,ENAM}), cr Reference year (r): Predicted average crash freq, for reference yea Predicted average crash frequency Predicted average crash freq. for reference yea Predicted average crash freq. for reference yea (P). Deserved crash count (N ⁺ _{0.66,000} pr). Reference year (P): Predicted average crash freq. for reference yea (P). Predicted average crash	rashes: rence yea h count (C vi rashes: rence yea h count (C vi ar given N', uency uency ash Analy rashes: rence yea sh Analyc rashes: rence yea h count (C vi h count (C vi rashes) ; crashes: ; ; ; ; ; ; ; ; ; ; ; ; ;	r (N _{p.nc.E}) ² b.so.EN.at/, (N _{n.nc.EN.at/} r (N _{p.nc.EN}) ² c.so.EX.at/ (N _{n.ac.EX.at/} (N _{n.ac.EX.at/)} (N _{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/} (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/}}}}	v _{anth} /), crashes/ ,), cr	2019 2019 Year shes/yr: 2019 Year 20	0.000	0.000	0.000	0.988		
Predicted average crash frequency Verdispersion parameter (K _{Ko.C.N.M.D}). Coverdispersion parameter (K _{Ko.C.N.M.D}). Reference year (r): Predicted average crash freq. for reference year sociated with crass ispecial deverage crash freq. for reference year (r): Doserved crash count (N ⁺ o.sc.E.N.M.D). Doserved crash count (N ⁺ o.sc.E.N.M.D). Deserved crash count (N ⁺ o.sc.E.N.M.D). Deserved crash count (N ⁺ o.sc.E.N.M.D). Deserved crash count (N ⁺ o.sc.E.N.M.D). Doserved crash count	rashes: rence yea h count (C rashes: rashes: rence yeas h count (Q rashes: : crashes: : crashes: : crashes: : : : : : : : : : : : : :	r (N _{p.nc.E}) ² b.so.EN.at/, (N _{n.nc.EN.at/} r (N _{p.nc.EN}) ² c.so.EX.at/ (N _{n.ac.EX.at/} (N _{n.ac.EX.at/)} (N _{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/} (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/}}}}	v _{anth} /), crashes/ ,), cr	2019 Year shes/yr: 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Arang Entrance Crash Analysis Sverdispersion parameter (K.e. <u>BLAID</u>). Cardispersion parameter (K.e. <u>BLAID</u>). Reference year (1): Predicted average crash freq. for reference year redicted average crash freq. for reference year redicted average crash freq. for reference year redicted average crash freq. for reference year (1): Deserved crash count (N ⁺ o.s.E.N.L.E.N. Deserved crash count (N ⁺ o.s.E.N.L.E.	rashes: rence yea h count (C rashes: rashes: rence yeas h count (Q rashes: : crashes: : crashes: : crashes: : : : : : : : : : : : : :	r (N _{p.nc.E}) ² b.so.EN.at/, (N _{n.nc.EN.at/} r (N _{p.nc.EN}) ² c.so.EX.at/ (N _{n.ac.EX.at/} (N _{n.ac.EX.at/)} (N _{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/} (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/ (N_{n.ac.EX.at/)} (N_{n.ac.EX.at/}}}}	v _{anth} /), crashes/ ,), cr	2019 Year shes/yr: 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency lamp Entrance Crash Analysis Voerdispersion parameter ($N_{ex,E,R,at,At}$), of kelerence year (r): Predicted average crash freq, for refer- iquivalent years associated with crash spaced average crash freq, for refer- ency and the space of the space of the space predicted average crash freq, for refer- cipation of the space of the space of the space spaced average crash freq, for refer- spaced average crash freq, for refer- cipation parameter ($N_{x_{x_{x_{x_{x_{x_{x_{x_{x_{x_{x_{x_{x_$	rashes: rence yeas h count (C view of the second of the	r (N _{P.86.} E) ² 9 во EN atU (N _{4.66} prost) (N _{4.66} prost)	(44,6,7), Crashes/ (47,7), Crashes/ (47,	2019 Year shes/yr: 2019 Year shes/yr: 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year 2019 Year	0.000	0.000	0.000	0.988		
Predicted average crash frequency Ramp Entrance Crash frequency Ramp Entrance Crash Analysis Diverdispersion parameter (K.e. BLAILD): Diserved crash count (N ⁺ 0.6.ENALD): Diserved crash count (N ⁺ 0.6.ENALD): Predicted average crash freq. for reference yea Predicted average crash freq. for reference gluvialent years associated with crash Expedied average crash freq. for reference Predicted average crash freq. for reference Pr	rashes: rence yea h count (C ar given N', rashes: rence yea h count (C ar given N', gash Analy rashes: rence yea h count (C ar given N', sh Analyz rashes: rence yea h count (C ar given N', crashes: rence yea h count (C ar given N', h count (C ar given N', crashes: rence yea h count (C ar given N', h count (C ar given N	r (N _{p.sc.E}) - hose EN at the - hose EN at	(atto), Cfat (atto), Cfat (atto	2019 2019 Vear shes/yr: 2019 Year shes/yr: 2019 Year 201	0.000	0.000	0.000	0.988		

Output Works	sheet for F	amp Seo	ments					
MV = multiple-vehicle model		p 069	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model		icable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Horizontal curve (CMF _{1,w,x,y,fi}):	MV	<u> </u>	1.000	1.000	1.000	1.000		
Lane width (CMF _{2, w,x,y,fi}):	MV	SV SV	1.000 1.096	1.000 1.096	1.000 1.096	1.000 1.096		
Right shoulder width (CMF _{3.w.x.y.fi}):	MV	SV	1.090	1.098	1.055	1.096		
Left shoulder width (CMF _{4,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000		
Right side barrier (CMF _{5,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.008		
Left side barrier (CMF _{6,w,x,y,fi}):	MV	SV	1.000	1.000	1.001	1.000		
Weaving section (CMF _{9,cds.ac.at.fi}):	MV	SV		2.000				
	Year:	2019	1.000	1.000	1.000	1.000		
Ramp speed-change lane (CMF _{8,w,x,mv,fi}):	MV		1.000	1.000	1.000	1.000		
Lane add or drop (CMF _{7,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000		
Property-Damage-Only Crash CMFs	•							
Horizontal curve (CMF _{1,w,x,y,pdo}):	MV		1.000	1.000	1.000	1.000		
		SV	1.000	1.000	1.000	1.000		
Lane width (CMF _{2, w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000		
Right shoulder width (CMF _{3,w,x,y,pdo}):	MV	SV	1.026	1.026	1.026	1.026		
Left shoulder width (CMF _{4,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000		
Right side barrier (CMF _{5,w,x,y,pdo}):	MV	SV	1.011	1.011	1.001	1.007		
Left side barrier (CMF _{6,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000		
Weaving section (CMF _{9,cds,ac,at,pdo}):	MV	SV						
	Year:	2019	1.000	1.000	1.000	1.000		
Ramp speed-change lane (CMF _{8,w,x,mv,pdo}):	MV		1.000	1.000	1.000	1.000		
Lane add or drop (CMF _{7,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000		
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency		Mana	1					
Multiple-Vehicle Crash Analysis Overdispersion parameter (k _{w,x,mv,fi}):		Year		1		1		
Observed crash count ($N_{o,w,x,mv,h}^*$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N _{p,w,x,m}	, crash	es/vr:						
Equivalent years associated with crash count (C _{b.w.mv.fir}		,						
Expected average crash freq. for reference year given N^{\star}_{o} ($N_{a,w,x,mv,f_{i},r}$)								
Predicted average crash frequency		2019	0.030	0.035	0.005	0.114		
Single-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,sv,fl}):								
Observed crash count ($N^{*}_{o,w,x,sv,fi}$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year $(N_{\text{p,w,x,sw}}$		es/yr:						
Equivalent years associated with crash count $(C_{b,w,x,sv,fi,r})$								
Expected average crash freq. for reference year given N^*_{o} $(N_{a,w,x,sv,fi,r})$, crashes/yr:							
Predicted average crash frequency		2019	0.509	0.162	0.140	0.323		
Property-Damage-Only Crash Frequency		No an	1					
Multiple-Vehicle Crash Analysis Overdispersion parameter (k _{w,x,mv,pdo}):		Year						
Observed crash count ($N_{n,w,x,mv,pdo}^{*}$), crashes:								
		hes/vr:						
Reference year (r): Predicted average crash freq. for reference year (Nnwxm	_{v ndo} ,), cras		1					
Predicted average crash freq. for reference year ($N_{p,w,x,m}$,				1		
	_{o,r}), yr:							
Predicted average crash freq. for reference year ($N_{p,w,x,m}$ Equivalent years associated with crash count ($C_{b,w,x,mv,pd}$	_{o,r}), yr:		0.077	0.043	0.010	0.189		
Predicted average crash freq, for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,mv,pd}$ Expected average crash freq, for reference year given N* _o $(N_{a,w,x,mv,pd}$	_{o,r}), yr:		0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,mv,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,mv,pd}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$:	_{o,r}), yr:	2019	0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}, Equivalent years associated with crash count (Cb,w,x,m,pd)Expected average crash freq. for reference year given N*o (Na,w,x,m,pd)Predicted average crash frequencySingle-Vehicle Crash Analysis$	_{o,r}), yr:	2019	0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,m,v,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,m,v,pd}$ Predicted average crash frequency <i>Single-Vehicle Crash Analysis</i> Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r) :	_{o,r}), yr: _{o,r}), crashes/yr	2019 Year	0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,mv,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,mv,pd}$ Predicted average crash frequency <i>Single-Vehicle Crash Analysis</i> Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r) : Predicted average crash freq. for reference year $(N_{p,w,x,sv})$	_{o,(}), yr: ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2019 Year	0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,m,v,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,m,v,pd}$ Predicted average crash frequency <i>Single-Vehicle Crash Analysis</i> Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r) : Predicted average crash freq, for reference year $(N_{p,w,x,sv,pdo})$ Equivalent years associated with crash count $(C_{b,w,x,sv,pdo})$	_{o,r}), yr: , _r), crashes/yr , _r , _{pdo,r}), crasi	2019 Year hes/yr:	0.077	0.043	0.010	0.189		
Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,mv,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,mv,pd}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r) : Predicted average crash freq. for reference year $(N_{p,w,x,sv})$	_{o,r}), yr: , _r), crashes/yr , _r , _{pdo,r}), crasi	2019 Year hes/yr:	0.077	0.043	0.010	0.189		

Output Worksheet	for Crossr	oad Ram	p Terminals					
Signal = signalized intersection model			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
Unsig = unsignalized intersection model		cable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Non-ramp public street leg (CMF _{19,w,SG,at,fi}):	Signal							
Segment length (CMF _{14,w,x,at,fi}):	Signal	Unsig	0.859	0.791				
Protected left-turn operation (CMF _{16,w,SG,at,fi}):	Signal							
	Year:	2019						
Channelized right turn on crossroad (CMF _{17,w,SG,at,fi}):	Signal					-	-	
	Year:	2019						
Channelized right turn on exit ramp (CMF _{18,w,SG,at,fi}):	Signal					-	-	
	Year:	2019						
Access point frequency (CMF _{13,w,x,at,fi}):	Signal	Unsig						
	Year:	2019	1.000	1.000				
Crossroad left-turn lane (CMF _{11,w,x,at,fi}):	Signal	Unsig	1			1	1	r
	Year:	2019	0.795	0.889				
Crossroad right-turn lane (CMF _{12,w,x,at,fi}):	Signal	Unsig	1 000	0.040				1
Madian width (CNAE).	Year:	2019	1.000	0.940				
Median width (CMF _{15,w,x,at,fi}):	Signal	Unsig	1 250	4 440				r
Evit romp consolty /CNAE	Year:	2019	1.258	1.410				
Exit ramp capacity (CMF _{10,w,x,at,fi}):	Signal	Unsig	22,000	1 002				r
Skew angle (CMF _{20.w.ST.at.fi}):	Year:	2019 Unsig	32.899	1.092				
Skew angle (CIVIF _{20,w,ST,at,fi}).	Veer	2019	1.000	1.000		1	1	
All-way stop control (CMF _{awsc}):	Year:	Unsig	1.000	1.000				
Property-Damage-Only Crash CMFs		Unsig						
Non-ramp public street leg (CMF _{19,w,SG,at,pdo}):	Signal							-
	Signal							
Segment length (CMF _{14,w,x,at,pdo}): Protected left-turn operation (CMF _{16,w,SG,at,pdo}):	Signal							
Frotected left-turn operation (CMF _{16,w,SG,at,pdo}).	Signal	2019				1	1	
Channelized right turn on crossroad (CMF _{17.w.SG.at.pdo}):	Year: Signal	2019						
Channenzed right turn on clossioad (clwn 17,w,SG,at,pdo).	Year:	2019						
Channelized right turn on exit ramp (CMF _{18.w.SG.at.odo}):	Signal	2015						
	Year:	2019						
Access point frequency (CMF _{13,w,x,at,pdo}):	Signal	2015						
· · · · · · · · · · · · · · · · · · ·	Year:	2019						
Crossroad left-turn lane (CMF _{11.w.x.at.pdo}):	Signal	Unsig						
(H, W, Ad, POO	Year:	2019	0.790	0.887				
Crossroad right-turn lane (CMF _{12 w x at pdo}):	Signal	Unsig				l	l	
	Year:	2019	1.000	0.857				
Median width (CMF _{15,w,x,at,pdo}):	Signal							
	Year:	2019						
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency								
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,fi}):								
Observed crash count ($N^*_{o,w,x,at,fi}$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year $(N_{\text{p},\text{w},\text{x},\text{at}}$		s/yr:						
Equivalent years associated with crash count $(C_{b,w,x,at,fi,r})$,								
Expected average crash freq. for reference year given $N^{\star}_{o}(N_{a,w,x,at,fi,r}),$	crashes/yr:							
Predicted average crash frequency		2019	20.040	1.967				
Property-Damage-Only Crash Frequency								
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,pdo}):								
Observed crash count ($N^*_{o,w,x,at,pdo}$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year $(N_{\text{p,w,x,at}}$		nes/yr:						
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,}$								
Expected average crash freq. for reference year given $N^{\star}_{\ o}$ $(N_{a,w,x,at,pdo,t}$), crashes/yr:							
Predicted average crash frequency		2019	1.746	3.894				

		Enhanced	Interd	change Safety An	nalysis Too	ol			
General Information									
Project description:	SR 202 at	Kernan Blvd IMF	₹, Ope	ening Year 2025 N	lo-Build				
Analyst:	Arcadis	Date):	7/10/2020	Area	a type:		Urban	
First year of analysis:	2025								
Last year of analysis:	2025								
Crash Data Descripti	ion								
Freeway segments	No crash o	data	-						
Ramp segments	No crash	data	-	[<u>.</u>					 T
Ramp terminals	No crash o	data	-			1			т <u>т</u>
Program Control									
1. Enter data in the Ma 2. Click Perform Calcu					ts, Input Ra	amp Ter	minals wo	orksheets.	
			Prir	nt Results (option	al)	Print	Site Sum	mary (optior	nal)
 Review results in th Optionally, detailed Terminals worksheets 	results can								

			Segment 1 Study	Segment 2 Study	Segment 3 Study	Segment 4 Study	Segment 5 Study	Segmer Stud
Rasic Ro	(View results in Column AV) (View results in Advisory M adway Data	essages)	Period	Period	Period	Period	Period	Perio
	f through lanes (n):		8	8	7	7	[1
,	egment description:					MP. 6.57-7.96		
-	length (L), mi:		0.47	0.23	0.3	1.39		
Alignmen Horizonta	nl Curve Data See note	2						
1	Horizontal curve in segment?:	-	Both Dir.	No	No	Both Dir.		
	Curve radius (R1), ft:		5730			4584		
	Length of curve (L _{c1}), mi:		0.46			0.18		
	Length of curve in segment (L _{c1,seg}), mi: 2 Horizontal curve in segment?:		0.26 No			0.18 No		
4	Curve radius (R ₂), ft:		NO			INO		
	Length of curve (L_{c2}) , mi:							
	Length of curve in segment (L _{c2,seg}), mi:							
	ction Data			1	r	-		
Lane width			12	12	12	12		
	noulder width (W _s), ft: ulder width (W _{is}), ft:		10 7	10	10 7	10		
	dth (W _m), ft:		17	17	17	17		
	trips on outside shoulders?:		Yes	Yes	Yes	Yes		
	Length of rumble strips for travel in increasing milepost direction	, mi:	0.47	0.23	0.3	1.39		
	Length of rumble strips for travel in decreasing milepost direction	ı, mi:	0.47	0.23	0.3	1.39		
Rumble st	trips on inside shoulders?:	mi	No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction Length of rumble strips for travel in decreasing milepost direction							
Presence	of barrier in median:		Center	Center	Center	Center		
	Length of barrier (L _{ib,1}), mi:		0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face $(W_{\mbox{\scriptsize off,in}}$.1), ft:	7	7	7	7		
2	2 Length of barrier (L _{ib,2}), mi:) ft:	0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face (W _{off,in} B Length of barrier (L _{ib,3}), mi:	_{,2}), II:	7	7	7	7		
c	Distance from edge of traveled way to barrier face (W _{off,in}	.3), ft:						
Median ba	arrier width (W_{ib}), ft:		2	2	2	2		
Nearest di	istance from edge of traveled way to barrier face ($W_{\ensuremath{ne}}$	_{ear}), ft:						
Roadside								
	e width (W _{hc}), ft:		15	10	10	25		
	of barrier on roadside: Length of barrier (L _{ob.1}), mi:		Some 0.07	Some 0.2	Some 0.27	Some 0.16		
	Distance from edge of traveled way to barrier face (Woff o 1), ft:	10	10	10	10		
2	2 Length of barrier $(L_{ob,2})$, mi:	anja, 177	0.13		0.3	0.57		
	Distance from edge of traveled way to barrier face (W _{off,o,2}), ft:	10		10	10		
-	B Length of barrier (L _{ob,3}), mi:							
	Length of barrier (L _{ob,3}), mi.							
	Distance from edge of traveled way to barrier face (
Distance fror	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{off,nc} ,), ft:						
Distance fror Distance fror	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{off.pc} , m edge of traveled way to barrier face, decreasing milepost (W _{off.pc})), ft:						
Distance fror Distance fror Ramp Ac	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{off loc}) m edge of traveled way to barrier face, decreasing milepost (W _{off,de} cess Data), ft:						
Distance from Distance from Ramp Act Travel in A	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{off lec} m edge of traveled way to barrier face, decreasing milepost (W _{off de} cess Data Increasing Milepost Direction), ft:	Lane Add	No	No	S-C Lane		
Distance from Distance from Ramp Ac Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{off loc}) m edge of traveled way to barrier face, decreasing milepost (W _{off,de} cess Data), ft: c), ft:	Lane Add	No 0.47	No 999	S-C Lane		
Distance from Distance from Ramp Ac Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{ottee} , m edge of traveled way to barrier face, decreasing milepost (W _{ottee} , cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{en.inc}), mi:), ft: c), ft:	Lane Add			0.2		
Distance from Distance from Ramp Ac Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{ottxe}) m edge of traveled way to barrier face, decreasing milepost (W _{ottxe}) ccess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X Length of ramp entrance (L _{en.nec}), mi: Length of ramp entrance in segment (L _{en.seg.inc}), mi:), ft: c), ft:	Lane Add			0.2 0.2		
Distance fror Distance fror Ramp Act Travel in Entrance Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{office} m edge of traveled way to barrier face, decreasing milepost (W _{office} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{en,inc}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?:), ft: c), ft:		0.47	999	0.2 0.2 Right		
Distance from Distance from Ramp Ac Travel in Entrance Ramp Exit	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{ottxe}) m edge of traveled way to barrier face, decreasing milepost (W _{ottxe}) ccess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X Length of ramp entrance (L _{en.nec}), mi: Length of ramp entrance in segment (L _{en.seg.inc}), mi:), ft: _), ft: 	Lane Add			0.2 0.2		
Distance fror Distance fror Ramp Ac	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{edfac} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{en,inc}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.):), ft: _), ft: 		0.47 No	999	0.2 0.2 Right		
Distance from Distance from Ramp Ac Travel in Entrance Ramp Exit	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{edfac} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{en,inc}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.e.d})), ft: _), ft: 		0.47 No	999	0.2 0.2 Right S-C Lane		
Distance fror Distance fror Ramp Ac Travel in Entrance Ramp Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{offlec} m edge of traveled way to barrier face, decreasing milepost (W_{offlec} m edge of traveled way to barrier face, decreasing milepost (W_{offlec} cess Data increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($I_{en,inc}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{exet} Length of ramp exit ($L_{ex,inc}$), mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?:), ft: _), ft: 	Lane Drop	0.47 No 999	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Distance fror Distance fror Ramp Ac Travel in Entrance Ramp Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, decreasing milepost (W_{office} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (λ Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($L_{en,inc}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore ($\lambda_{e,ext}$) Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?:), ft: _), ft: 		0.47 No	999	0.2 0.2 Right S-C Lane 0.03 0.03		
Distance fror Distance fror Ramp Ac Travel in Entrance Ramp Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost ($W_{odt,ec}$) m edge of traveled way to barrier face, increasing milepost ($W_{odt,ec}$) m edge of traveled way to barrier face, decreasing milepost ($W_{odt,ec}$) cess Data increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance in segment ($L_{en,seg,inc}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore ($X_{e,ad}$ Length of ramp exit ($L_{ex,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wex,inc}$), mi:	, ft: _), ft: , ft: , ft: , mi: , mi:	Lane Drop	0.47 No 999	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Distance fror Distance fror Ramp Ac. Travel in . Entrance Ramp Exit Ramp Weave	Distance from edge of traveled way to barrier face. (" m edge of traveled way to barrier face, increasing milepost (W _{othec} , medge of traveled way to barrier face, increasing milepost (W _{othec} , edgess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2) Length of ramp entrance (L _{enine}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{exit}). Length of ramp entrance in segment (L _{en.seg.inc}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{exit}). Length of ramp exit in segment (L _{ex.seg.inc}), mi: Length of ramp exit is segment (L _{ex.seg.inc}), mi: Length of weaving section (L _{wev.inc}), mi: Length of weaving section (L _{wev.inc}), mi: Length of weaving section (L _{wev.inc}), mi: Length of weaving section in segment (L _{wev.seg.inc}), mi:	, ft: _), ft: , ft: , ft: , mi: , mi:	Lane Drop	0.47 No 999	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Distance fror Distance fror Ramp Ac. Travel in Entrance Ramp Exit Ramp Weave Travel in	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost ($W_{odt,ec}$) m edge of traveled way to barrier face, increasing milepost ($W_{odt,ec}$) m edge of traveled way to barrier face, decreasing milepost ($W_{odt,ec}$) cess Data increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance in segment ($L_{en,seg,inc}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore ($X_{e,ad}$ Length of ramp exit ($L_{ex,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wex,inc}$), mi:	, ft: _), ft: , ft: , ft: , mi: , mi:	Lane Drop	0.47 No 999	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Distance fror Distance fror Ramp Ac. Travel in J. Entrance Ramp Exit Ramp Weave Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, increasing milepost (W_{office} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (λ Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance in segment ($L_{en,seg,inc}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore ($\lambda_{e,ext}$) Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment? ($L_{wex,inc}$), mi: Length of weaving section ($L_{wex,inc}$), mi: Length of weaving section ($L_{wex,inc}$), mi: Length of weaving section in segment ($L_{wex,eg,inc}$), m Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X_{weat})), ft: , ft: , mi: , mi: , mi:	Lane Drop	0.47 No 999 No	999 No 999 No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Distance fror Distance fror Ramp Ac. Travel in J. Entrance Ramp Exit Ramp Weave Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{othec} m edge of traveled way to barrier face, increasing milepost (W _{othec} ecess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{eninec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{s.ext} Length of ramp exit in segment? (Lens, beginc), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{s.ext} Length of ramp exit in segment (L _{ex.inc.}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wex.inc.}), mi: Length of weaving section in segment (L _{wav.seg.inc.}), m Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X _w Length of ramp exit on segment? (If yes, indicate type.): Distance form end milepost to upstream entrance ramp gore (X _w).	, ft: , ft: , ft: , mi: , mi: , mi: , mi: , mi:	Lane Drop	0.47 No 999 No No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Distance fror Distance fror Ramp Ac. Travel in J. Entrance Ramp Exit Ramp Weave Travel in Entrance	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{othec} m edge of traveled way to barrier face, increasing milepost (W _{othec} ecess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{enine}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.ant}) Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.ant}) Length of ramp exit in segment (L _{ex.seg.inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wex.inc}), mi: Length of weaving section in segment (L _{wex.seg.inc}), m Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X _w Length of ramp entrance (L _{wan.dec}), mi: Length	, ft: , ft: , ft: , mi: , mi: , mi: , mi: , mi:	Lane Drop	0.47 No 999 No No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Distance fror Distance fror Ramp Act Travel in Entrance Ramp Exit Ramp Weave Travel in Entrance Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, decreasing milepost (W_{office} Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (U_{englen}), mi: Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($I_{en,inc}$), mi: Distance from end milepost to downstream exit ramp gore (X_{exat}) Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{exat}) Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wex,inc}$), mi: Length of weaving section ($L_{wex,inc}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), m Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X_{ex} Length of ramp entrance ($L_{en,dec}$), mi: Length of ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X_{ex} Length of ramp entrance ($L_{en,dec}$), m: Length of ramp entrance ($L_{en,dec}$), m: Entrance side?:	, ft: , ft: , ft: , mi: , mi: , mi: , mi: , mi:	Lane Drop No Lane Add	0.47 No 999 No 999	999 No 999 No No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add		
Distance fror Distance fror Ramp Ac. Travel in Entrance Ramp Exit Ramp Weave Travel in Entrance Ramp Exit	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{othec} m edge of traveled way to barrier face, increasing milepost (W _{othec} ecess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{enine}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.ant}) Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.ant}) Length of ramp exit in segment (L _{ex.seg.inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wex.inc}), mi: Length of weaving section in segment (L _{wex.seg.inc}), m Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X _w Length of ramp entrance (L _{wan.dec}), mi: Length	, ft: , ft: , mi: , mi: , mi: , mi:	Lane Drop	0.47 No 999 No No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
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Distance fror Distance fror Ramp Act Travel in J Entrance Ramp Exit Ramp Weave Travel in Entrance Ramp Exit Ramp Exit Ramp Exit Ramp Traffic Da Proportion Freeway : Entrance F Average d Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, decreasing milepost (W_{office} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (Σ Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($L_{en,inc}$), mi: Composition of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance in segment ($L_{en,seg,inc}$), mi: Length of ramp exit ($L_{ox,inc}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), mi: Length of ramp entrance ($L_{on,dec}$), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{ex} Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{ex} Length of ramp exit in segment? ($L_{ex,seg,dec}$), mi: Length of ramp exit in segment? ($L_{exx,seg,dec}$), mi: Exit side?: Type B weave in segment?: Length of ravel in segment?: Length of ravel in locreasing Milepost Dir. Taily traffic (AADT $L_{p,end}$) by year, veh/d: Date of Travel in Increasing Milepost Direction Taily traffic (AADT $L_{p,end}$) by year, veh/d: Date of travel in Increasing Milepost Direction Taily traffic (AADT $L_{p,end}$) by year, veh/d:	h, ft: , ft: 	Lane Drop No Lane Add Lane Drop Lane Dro	0.47 No 999 No No 999 No 0.47 No 132000	999 No 999 No 999 No 999 No 999 No	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No No 144400		
Distance fror Distance fror Ramp Ac. Travel in Entrance Ramp Weave Travel in Entrance Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W _{othec} m edge of traveled way to barrier face, decreasing milepost (W _{othec} ecess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (2 Length of ramp entrance (L _{en.inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{u.ent} Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{u.ent} Length of ramp exit in segment? (Lens, seg.inc), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wex.inc}), mi: Length of ramp entrance (L _{win.dec}), mi: Length of ramp entrance (If yes, indicate type.): Distance from edgin milepost to upstream entrance ramp gore (X _w Length of ramp entrance (L _{win.dec}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _w Length of ramp exit in segment? (L _{win.dec}), mi: Length of ramp exit in segment? Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length of weaving section in segment (L _{wex.seg.dec}), ri: Length o	h, ft: c), ft: (b,ared), mi: (b,ared), mi: (c), mi:	Lane Drop No Lane Add Lane Drop Lane Add Lane Drop Lane Add Lane Drop Lane Add Lane Drop Lane Dr	0.47 No 999 No No 999 No 0.47 No 132000	999 No 999 No 999 No 999 No 999 No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No S-C Lane 0.03 0.03 Right No 144400 6200		
Distance fror Distance fror Ramp Ac Entrance Ramp Exit Ramp Weave Travel in Entrance Ramp Exit Ramp	Distance from edge of traveled way to barrier face (m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, increasing milepost (W_{office} m edge of traveled way to barrier face, decreasing milepost (W_{office} cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (Σ Length of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance ($L_{en,inc}$), mi: Composition of ramp entrance ($L_{en,inc}$), mi: Length of ramp entrance in segment ($L_{en,seg,inc}$), mi: Length of ramp exit ($L_{ox,inc}$), mi: Length of ramp exit ($L_{ox,inc}$), mi: Length of ramp exit ($L_{ox,inc}$), mi: Length of waving section in segment ($L_{wex,seg,inc}$), mi: Length of weaving section ($L_{wex,inc}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), mi: Length of ramp entrance ($L_{un,dec}$), mi: Length of weaving section in segment ($L_{wex,seg,inc}$), mi: Length of ramp entrance ($L_{un,dec}$), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{cu} Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{cu} Length of ramp exit in segment? ($L_{wex,dec}$), mi: Length of ramp exit in segment? ($L_{wex,dec}$), mi: Length of ramp exit in segment? ($L_{wex,dec}$), mi: Length of ramp exit in segment? ($L_{wex,dec}$), mi: Length of rame in segment?: Length of weaving section in segment ($L_{wex,seg,dec}$), reitance the segment ($L_{wex,dec}$), mi: Length of weaving section in segment ($L_{wex,seg,dec}$), reitance the segment ($L_{wex,seg,dec}$), reitance thereasing Milep	h, ft: , ft: 	Lane Drop No Lane Add Lane Add Lane Add Vess Lane Add Lane Crop La	0.47 No 999 No No 999 No 0.47 No 132000	999 No 999 No 999 No 999 No 999 No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 144400 6200		

	Input Worksheet for Ramp Segm	ients					
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment
		Study	Study	Study	Study	Study	Study
	(View results in Column CJ) (View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
Basic Roa	adway Data						
Number of	f through lanes (n):	1	2	1	1	1	
Ramp segi	ment description:	EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ram	WB. On Ram	р
	ength (L), mi:	0.33	0.14	0.27	0.26	0.29	
Average tr	affic speed on the freeway (V _{frwy}), mi/h:	65	65	65	65	65	
Segment t	ype (ramp or collector-distributor road):	Exit	Entrance	Entrance	Exit	Entrance	
Type of co	ontrol at crossroad ramp terminal:	Signal	Signal	Signal	Signal	Signal	
Alignmen	t Data						
Horizonta	I Curve Data See notes -						
1	Horizontal curve?:	No	No	No	No	No	
	Curve radius (R ₁), ft:						
	Length of curve (L _{c1}), mi:						
	Length of curve in segment (L _{c1,seg}), mi:						
	Ramp-mile of beginning of curve in direction of travel (X1), mil	:					
Cross Se	ction Data						
Lane width	ו (W _I), ft:	12	12	12	12	12	
Right shou	Ilder width (W _{rs}), ft:	7	7	7	7	7	
Left should	der width (W _{Is}), ft:	4	4	4	4	4	
Presence	of lane add or lane drop by taper:	No	No	No	No	No	
	Length of taper in segment ($L_{add,seg}$ or $L_{drop,seg}$), mi:						
Roadside	Data						
Presence	of barrier on <u>right</u> side of roadway:	Yes	Yes	Yes	Yes	Yes	
1	Length of barrier (L _{rb,1}), mi:	0.25	0.14	0.26	0.03	0.2	
	Distance from edge of traveled way to barrier face (W _{off.r.1}), ft:	20	25	25	25	25	
2	Length of barrier (L _{rb.2}), mi:						
	Distance from edge of traveled way to barrier face (W _{off.r.2}), ft:						
Presence	of barrier on <u>left</u> side of roadway:	No	No	No	No	No	
1	Length of barrier (L _{b.1}), mi:						
	Distance from edge of traveled way to barrier face (W _{off,l,1}), ft:						
Ramp Ace	cess Data See note						
Ramp	Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	
Entrance	Length of entrance s-c lane in segment (L _{en,seg}), mi:						
Ramp	Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	
Exit	Length of exit s-c lane in segment (L _{ex,seq}), mi:						
Weaving	Weave section in collector-distributor road segment?:						
Section	Length of weaving section (L _{wav}), mi:		1	1	1	1	
	Length of weaving section in segment (L _{wev,seg}), mi:						
Traffic Da	ta Year						
	aily traffic (AADT, or AADT,) by year, veh/d: 2025	24400	6200	6200	6200	24400	1

	Input	Worksheet for Crossroad Ramp	Terminals					
			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
			Study	Study	Study	Study	Study	Study
	(View results in Column T)	(View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
	rsection Data				•	1	•	•
	ninal configuration:		D4	D4				
	ninal description:			North Ramp	Ferm.			
	ninal traffic control type:		Signal	Signal				
	mp public street leg presen	t at the terminal (I _{ps})?:						
Alignment			-			r	•	•
Exit ramp s	skew angle (I _{sk}), degrees:							
		the outside crossroad leg (L _{str}), mi:	0.14	0.17				
Distance to	o the adjacent ramp termina	al (L _{rmp}), mi:	0.14	0.14				
Traffic Co	ntrol							
	Operational Mode							
Crossroad	Inside approach	Protected-only mode (Ip,It,in)?:	Yes	No				
. <u> </u>	Outside approach	Protected-only mode (I _{p,lt,out})?:						
Right-Turr	n Control Type							
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Sec	tion Data							
Crossroad	median width (W _m), ft:		36	36				
Number o	f Lanes			•				
Crossroad	Both approaches	Lanes serving through vehicles (nth):	4	4				
	Inside approach	Lanes serving through vehicles (nth,in):	2	2				
	Outside approach	Lanes serving through vehicles (nth,out):	2	2	0	0	0	0
Ramp	Exit ramp approach	All lanes (n _{ex}):	2	1				
Right-Turr	h Channelization	see note: —						
Crossroad	Inside approach	Channelization present (I _{ch.in})?:						
	Outside approach	Channelization present (Ich,out)?:	Yes	Yes				
Ramp	Exit ramp approach	Channelization present (Ich,ex)?:	Yes	Yes				
Left-Turn	Lane or Bay							
	Inside approach	Lane or bay present (I _{bay,It,in})?:	Yes	Yes				
		Width of lane or bay (W _{h in}), ft:	24	12				
	Outside approach	Lane or bay present (I _{bav.lt.out})?:						
		Width of lane or bay (W _{b,out}), ft:						
Right-Turi	n Lane or Bay	5,000						
-	Inside approach	Lane or bay present (I _{bay,rt,in})?:						
	Outside approach	Lane or bay present (I _{bay,rt,in})?:	Yes	Yes				
Access Da		Coay, court				l		
	driveways on the outside o	rossroad leg (n .):			1		1	1
	•	n the outside crossroad leg (n _{ps}):						
Traffic Dat		Year		<u> </u>				
		2025	43400	43400	1		1	1
	ssroad Leg Data	2025	37200	43400 53400				
	rossroad Leg Data		24400	6200				
Exit Ramp		2025						
Entrance I	Ramp Data	2025	6200	24400				

			Ou	tput Summ	ary				
General Information									
Project description:	SR 202 at K	ernan Blvd	IMR, Openi	ing Year 202	5 No-Build				
Analyst:	Arcadis		Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2025								
Last year of analysis:	2025								
Crash Data Descripti	on								
Freeway segments	Segment cr	ash data av	vailable?		No	First year o	of crash data	:	
General Information									
Project description:									
Analyst:			Date:			Area type:			
First year of analysis:	2025								
Last year of analysis:	2025								
Crash Data Descripti	on								
Freeway segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available		No	Last year c	f crash data	:	
Ramp segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	1:	
	Project-lev	el crash dat	a available i		No	Last year c	f crash data	:	
Ramp terminals	Segment cr	ash data av	ailable?		No	First year o	f crash data	1:	
	Project-lev	el crash dat	a available i		No	Last year c	f crash data	:	
Estimated Crash Stat	tistics								
Crashes for Entire Fa	ncility			Total	K	A	В	С	PDO
Estimated number of crashe	s during Study	Period, crashe	s:	189.0	0.6	2.3	14.1	50.8	121.1
Estimated average crash fre	q. during Study	Period, crash	ies/yr:	189.0	0.6	2.3	14.1	50.8	121.1
Crashes by Facility C	omponent	Turne Cet	Nbr. Sites	T dfst im	ated N umb	oer of A Crash	nes D B ring	the SCCudy I	Peri BB O
Crashes by Facility C Crash Type Freeway segments, cra	ishes:	n Type Cat	egory 4	130.9	0.5	1.5	9.0	27.8	92.1
Ramp segments, crash			5	4.5	0.1	0.2	0.8	1.1	2.3
Crossroad ramp termin	hals, crashe	s:	2	53.7	0.0	0.7	4.4	21.9	26.7
Crashes for Entire Fa	cility by Ye	ear	Year	Total	K	Α	В	С	PDO
Estimated number of c	rashes durii	ng	2025	189.0	0.6	2.3	14.1	50.8	121.1
Distribution of Crash	es for Entir	e Facility							
		-							
				Total	К	A	В	С	PDO
Multiple vehicle	Head-on cr	ashes:		0.9	0.0	0.0	0.1	0.4	0.3
	Right-angle			15.1	0.0		1.3	6.3	7.2
	Rear-end c			104.0	0.3			29.7	64.7
	Sideswipe of			30.0				4.8	23.5
	Other mult		e crashes:	3.5	0.0	1		0.9	2.3
		tiple-vehicl		153.5				42.1	98.0

			et for Fre							
MV = multiple-vehicle model SV = single-vehicle model	EXR = ra	imp exit r			Segment 1 Study	Segment 2 Study	Segment 3 Study	Segment 4 Study	Segment 5 Study	Segment 6 Study
Crash Modification Factors	A	plicable	Models (y)	Period	Period	Period	Period	Period	Period
Fatal-and-Injury Crash CMFs										
Horizontal curve (CMF _{1,w,ac,y,fi}):	MV	sv	ENR	EXR	1.010 1.040	1.000	1.000	1.003 1.015		
Lane width (CMF _{2,w,ac,y,fi}):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width (CMF _{8,f8,ac,sv,fi}): Inside shoulder width (CMF _{3,w,ac,y,fi}):	MV	SV SV	ENR	EXR	1.000	1.000	1.000	1.000		
Median width (CMF _{4,w,ac,y,fi}):	MV		ENR	EXR	1.151	1.151	1.151	1.151		
Median barrier (CMF _{5,w.ac.y.fi}):	MV	SV SV	ENR	EXR	0.954	0.954	0.954 1.191	0.954		
Shoulder rumble strip (CMF _{9,fs,ac,sv,fl}):		SV			0.958	0.906	0.906	0.918		
Outside clearance (CMF _{10,fs,ac,sv,fi}): Outside barrier (CMF _{11,fs,ac,sv,fi}):		SV SV			1.074 1.041	1.093 1.083	1.091 1.181	1.041		
Lane change (CMF _{7,fs,ac,mv,fi}):	MV	.								
Ramp entrance (CMF _{12.sc,nEN,at,fi}):			Year: ENR	2025	1.400	1.000	1.000	1.062		
			Year:	2025	1.000	1.000	1.000	1.682		
Ramp exit (CMF _{13,sc,nEX,at,fi}): High volume (CMF _{6,w,ac,y,fi}):	MV		ENR	EXR EXR	1.000 1.296	1.000 1.170	1.000	1.472 1.264		
		sv	LINK	EXIT	0.951	0.970	0.961	0.956		
Property-Damage-Only Crash CMF Horizontal curve (CMF _{1,w,ac,y,pdo}):	-s MV		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width (CMF _{2,w,ac,y,pdo}): Outside shoulder width (CMF _{8,f8,ac,sv,pdo}):	MV	SV SV	ENR	EXR	1.000	1.000	1.000	1.000		
Inside shoulder width (CMF _{3,w,ac,y,pdo})		SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median width (CMF _{4,w,ac,y,pdo}):	MV	sv	ENR	EXR	1.145 1.144	1.145 1.144	1.145 1.144	1.145 1.144		
Median barrier (CMF _{5,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.253	1.253	1.253	1.253		
Shoulder rumble strip (CMF _{9,fs,ac,sv,pdo}):		SV SV			1.000 1.000	1.000	1.000	1.000		
Outside clearance (CMF _{10,fs,ac,sv,pdo}): Outside barrier (CMF _{11,fs,ac,sv,pdo}):	L	sv sv		L	1.000	1.000	1.000	1.000		L—
Lane change (CMF _{7,fs,ac,mv,pdo}):	MV			001-					1	
Ramp entrance (CMF _{12,sc,nEN,at,pdo}):			Year: ENR	2025	1.297 1.000	1.000	1.000	1.056 1.134		
Ramp exit (CMF _{13,sc,nEX,at,pdo}):				EXR	1.000	1.000	1.000	1.000		
High volume (CMF _{6,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.233	1.135 0.760	1.181 0.698	1.209 0.664		
Predicted Average Crash Frequence	cy									
Fatal-and-Injury Crash Frequency Freeway Segment Multiple-Vehicle C	rash Analı	rsis		Year						
Overdispersion parameter (k _{fs,n,mv,fi}):										
Observed crash count (N* _{o,fs,n,mv,fi}), co Reference year (r):	rashes:									
Predicted average crash freq. for refe				hes/yr:						
Equivalent years associated with cras), yr:							
Expected average crash freq. for reference ye Predicted average crash frequency	ear given N*,	(N _{e,1s,n,mv,fi,r}), crasnes/y	2025	9.661	1.889	2.650	13.944		
Freeway Segment Single-Vehicle Cra	ash Analys	is		Year						
Overdispersion parameter (k _{fs,n,sv,fi}): Observed crash count (N* _{o,fs,n,sv,fi}), cr.	ashes:									
Reference year (r):										
Predicted average crash freq. for refe Equivalent years associated with cras	erence yea	r (N _{p,fs,n,s}	_{/,fi,r}), crash	nes/yr:						
Expected average crash freq. for reference ye				:						
Predicted average crash frequency				2025	2.192	0.859	1.168	4.509		
Ramp Entrance Crash Analysis Overdispersion parameter (k _{sc,EN,at,fi}):				Year						
Observed crash count (N* _{o,sc,EN,at,fi}), o										
Reference year (r): Predicted average crash freq. for refe	erence yea	r (N _{n sc EN}	at fir.), cras	shes/yr:						
Equivalent years associated with cras	sh count (C	b,sc,EN,at,fi	,,), yr:							
Expected average crash freq. for reference ye Predicted average crash frequency	ear given N*。	(N _{a.sc,EN,at,1}	,), crashes/	/r: 2025	0.000	0.000	0.000	1.449		
Ramp Exit Crash Analysis				Year	0.000	0.000	010000			
Overdispersion parameter (k _{sc,EX,at,fi}):										
Observed crash count (N* _{o,sc,EX,at,fi}), o Reference year (r):	rasnes:									
Predicted average crash freq. for refe				shes/yr:						
Equivalent years associated with cras Expected average crash freq. for reference ye				n:						
Predicted average crash frequency				2025	0.000	0.000	0.000	0.494		
Property-Damage-Only Crash Freq Freeway Segment Multiple-Vehicle C		sis		Year						
Overdispersion parameter (k _{fs,n,mv,pdp})										
Observed crash count (N* _{o,fs,n,mv,pdo}), Reference year (r):										
Predicted average crash freq, for refe				shes/yr:						
Equivalent years associated with cras Expected average crash freq. for reference ye										
Predicted average crash frequency Freeway Segment Single-Vehicle Cra	ash Analys	is		2025 Year	23.198	4.302	6.440	35.011		
Overdispersion parameter (k _{fs,n,sv,pdo})	:									
Observed crash count (N* _{o,fs,n,sv,pdo}), Reference year (r):	crashes:									
Predicted average crash freq, for refe	erence yea	r (N _{p,fs,n,s} ,	_{/.pdo.r}), cra	shes/yr:						
Equivalent years associated with cras Expected average crash freq. for reference ye			_{o,r}), yr: ,,), crashes/	yr:						
Predicted average crash frequency Ramp Entrance Crash Analysis	• •			2025 Year	4.320	1.953	2.666	10.036		
Overdispersion parameter (ksc,EN,at,pdc				. odi						
Observed crash count (N* _{o,sc,EN,at,pdo}) Reference year (r):	, crashes:									
Predicted average crash freq. for refe	erence yea	r (N _{p,sc,EN}	_{.at.pdo,r}), cr	ashes/yr:						
Equivalent years associated with cras	sh count (C	b,sc,EN,at,p	_{do,r}), yr:					_		
Expected average crash freq, for reference ye Predicted average crash frequency	an given N* _o	1 ^{IN} a.sc.EN.al.p	_{do,r}), crashes	2025	0.000	0.000	0.000	3.202		
Ramp Exit Crash Analysis				2048 Year						
	.)·									
Overdispersion parameter (k _{sc,EX,at,pdc}										
Overdispersion parameter (k _{sc.EX.at.pdc}) Observed crash count (N* _{o.sc.EX.at.pdo}) Reference year (r):	, crashes:									
Observed crash count (N* _{o,sc,EX,at,pdo}) Reference year (r): Predicted average crash freq. for refe	, crashes: erence yea	r (N _{p.sc,EX}	at,pdo,r), cr.	ashes/yr:						
Observed crash count (N* _{o.sc,EX,at,pdo}). Reference year (r):	, crashes: erence yea sh count (C	b,sc,EX,at,p	_{do,r}), yr:		0.000	0,000	0,000	0.922		

Output Work	sheet for F	Ramp Seg	ments					
MV = multiple-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model		icable	Study	Study	Study	Study	Study	Study
Crash Modification Factors	MO	dels	Period	Period	Period	Period	Period	Period
Fatal-and-Injury Crash CMFs								
Horizontal curve (CMF _{1.w.x.v.fi}):	MV		1.000	1.000	1.000	1.000	1.000	
		SV	1.000	1.000	1.000	1.000	1.000	
Lane width (CMF _{2, w.x.y.fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Right shoulder width (CMF _{3,w,x,y,fi}):	MV	SV	1.055	1.055	1.055	1.055	1.055	
Left shoulder width (CMF _{4,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Right side barrier (CMF _{5,w,x,y,fi}):	MV	SV	1.012	1.012	1.011	1.001	1.008	
Left side barrier (CMF _{6,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Weaving section (CMF _{9,cds,ac,at,fi}):	MV	SV						
	Year:	2025	1.000	1.000	1.000	1.000	1.000	
Ramp speed-change lane (CMF _{8,w,x,mv,fi}):	MV		1.000	1.000	1.000	1.000	1.000	
Lane add or drop (CMF _{7,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Property-Damage-Only Crash CMFs								
Horizontal curve (CMF _{1,w,x,y,pdo}):	MV		1.000	1.000	1.000	1.000	1.000	
		SV	1.000	1.000	1.000	1.000	1.000	
Lane width (CMF _{2, w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Right shoulder width (CMF _{3,w,x,y,pdo}):	MV	SV	1.026	1.026	1.026	1.026	1.026	
Left shoulder width (CMF _{4,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Right side barrier (CMF _{5,w,x,y,pdo}):	MV	SV	1.011	1.011	1.010	1.001	1.007	
Left side barrier (CMF _{6,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Weaving section (CMF _{9,cds,ac,at,pdo}):	MV	SV						
	Year:	2025	1.000	1.000	1.000	1.000	1.000	
Ramp speed-change lane (CMF _{8,w,x,mv,pdo}):	MV	<u> </u>	1.000	1.000	1.000	1.000	1.000	
Lane add or drop (CMF _{7,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency		No. au	1					
Multiple-Vehicle Crash Analysis Overdispersion parameter (k _{w.x.mv.fi}):		Year						
Observed crash count (N* _{o,w,x,mv,fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N _{p.w.x.r}	", _{f.r}), crash	es/vr:						
Equivalent years associated with crash count (C_{b,w,w,f_i}		00/ 11						
Expected average crash freq. for reference year given N_{o}^{*} ($N_{a,w,x,mv,fi,l}$								
Predicted average crash frequency	,,.	2025	0.079	0.032	0.038	0.008	0.298	
Single-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,sv,fi}):								
Observed crash count (N* _{o,w,x,sv,fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year ($N_{\text{p,w,x,s}}$	_{sv,fi,r}), crashe	es/yr:						
Equivalent years associated with crash count ($C_{b,w,x,sv,\text{fi},r}$), yr:							
Expected average crash freq. for reference year given $N^{\star}_{\ o}$ $(N_{a,w,x,sv,fi,r},$), crashes/yr:							
Predicted average crash frequency		2025	0.739	0.082	0.164	0.215	0.469	
Property-Damage-Only Crash Frequency		ň.	ī					
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w.x.mv.pdo}):								
· · · · · · · · · · · · · · · · · · ·								
Observed crash count (N* _{o,w,x,mv,pdo}), crashes:								
Reference year (r):		her to						
Reference year (r): Predicted average crash freq. for reference year (N _{p.w.x.r}	1 1	shes/yr:						
Reference year (r): Predicted average crash freq, for reference year $(N_{p,w,x,r}, P_{r,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,mv,pc})$	_{do,r}), yr:							
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}, P_{r,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,rw,p}, P_{r,w,x,rw,p})$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rw,p}, P_{r,w,x,rw,p})$	_{do,r}), yr:	r:	0.149	0.072	0.061	0.021	0.264	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}, P_{p,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,rw,pd})$ Expected average crash freq. for reference year given N* _o (N _{a,w,x,rw,pd}) Predicted average crash frequency	_{do,r}), yr:	2025	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq, for reference year $(N_{p,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,rnv,pd})$ Expected average crash freq, for reference year given N* _o $(N_{a,w,x,rnv,pd})$ Predicted average crash frequency Single-Vehicle Crash Analysis	_{do,r}), yr:	r:	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,rnv,pd})$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rnv,pd})$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$:	_{do,r}), yr:	2025	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r})$ Equivalent years associated with crash count $(C_{b,w,x,rw,pd})$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rw,pd})$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes:	_{do,r}), yr:	2025	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}$ Equivalent years associated with crash count $(C_{b,w,x,rw,px}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rw,px}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r):	_{do,r}), yr: _{to,r}), crashes/y	2025 Year	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}$ Equivalent years associated with crash count $(C_{b,w,x,rnv,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rnv,pd}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,sv})$	_{do,r}), yr: _{to,r}), crashes/y _{to,r}), crashes/y	2025 Year	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}$ Equivalent years associated with crash count $(C_{b,w,x,rnv,p}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rnv,p}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,sv,pd})$ Equivalent years associated with crash count $(C_{b,w,x,sv,pd})$	_{io,r}), yr: _{io,r}), crashes/y _{iv,pdo,r}), cras _{o,r}), yr:	r: 2025 Year hes/yr:	0.148	0.073	0.061	0.021	0.364	
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,r}$ Equivalent years associated with crash count $(C_{b,w,x,rnv,pd}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,rnv,pd}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(k_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,sv})$	_{io,r}), yr: _{io,r}), crashes/y _{iv,pdo,r}), cras	r: 2025 Year hes/yr:	0.148	0.073	0.061	0.021	0.364	

Output Worksheet	IOF CROSSI	oau Ram			Tama' C	Taura' 1	Taur 1 . T
Signal = signalized intersection model Unsig = unsignalized intersection model	Ann	icable	Terminal 1 Study	Terminal 2 Study	Terminal 3 Study	Terminal 4 Study	Terminal 5 Study
		dels	Period	Period	Period	Period	Period
Crash Modification Factors							
Fatal-and-Injury Crash CMFs							
Non-ramp public street leg (CMF _{19,w,SG,at,fi}):	Signal		1.000	1.000			
Segment length (CMF _{14,w,x,at,fi}):	Signal	Unsig	0.772	0.791			
Protected left-turn operation (CMF _{16,w,SG,at,fi}):	Signal						
	Year:	2025	0.626	1.000			
Channelized right turn on crossroad (CMF _{17,w,SG,at,fi}):	Signal						
	Year:	2025	1.199	1.249			
Channelized right turn on exit ramp (CMF _{18,w,SG,at,fi}):	Signal						
	Year:	2025	1.372	1.083			
Access point frequency (CMF _{13,w,x,at,fi}):	Signal	Unsig					
Crossroad left-turn lane (CMF _{11,w,x,at,fi}):	Signal	Unsig					
	Year:	2025	0.863	0.881			
Crossroad right-turn lane (CMF _{12,w,x,at,fi}):	Signal	Unsig					
	Year:	2025	0.920	0.899			
Median width (CMF _{15,w,x,at,fi}):	Signal	Unsig					
	Year:	2025	0.994	0.880			
Exit ramp capacity (CMF _{10,w,x,at,fi}):	Signal	Unsig					
	Year:	2025	1.900	1.063			
Skew angle (CMF _{20,w,ST,at,fi}):		Unsig					
	Year:	2025					
All-way stop control (CMF _{awsc}):		Unsig					
Property-Damage-Only Crash CMFs	•						
Non-ramp public street leg (CMF _{19.w,SG,at,pdo}):	Signal		1.000	1.000			
Segment length (CMF _{14,w,x,at,pdo}):	Signal		0.771	0.790			
Protected left-turn operation (CMF _{16,w,SG,at,pdo}):	Signal		I				
	Year:	2025	0.739	1.000			
Channelized right turn on crossroad (CMF _{17.w.SG.at.pdo}):	Signal		I				
	Year:	2025	1.198	1.248			
Channelized right turn on exit ramp (CMF _{18.w.SG,at.pdo}):	Signal						
	Year:	2025	1.697	1.154			
Access point frequency (CMF _{13.w.x.at.pdo}):	Signal		I				
	Year:	2025	1.000	1.000			
Crossroad left-turn lane (CMF _{11.wx.at.pdo}):	Signal	Unsig					
- Arthough a sec	Year:	2025	0.875	0.891			
Crossroad right-turn lane (CMF _{12,w,x,at,pdo}):	Signal	Unsig	I				
	Year:	2025	0.980	0.975			
Median width (CMF _{15,w.x.at,pdo}):	Signal		I				
	Year:	2025	0.690	0.509			
Predicted Average Crash Frequency			·				
Fatal-and-Injury Crash Frequency							
Ramp Terminal Crash Analysis		Year					
Overdispersion parameter (k _{w.x.at.fi}):			l I				
Observed crash count (N* _{o.w.x.at,fi}), crashes:							
Reference year (r):							
Predicted average crash freq. for reference year (N _{p.w.x.at.}	_{fi.r}), crashe	s/yr:					
Equivalent years associated with crash count ($C_{b,w,x,at,fi,r}$),							
Expected average crash freq. for reference year given N^*_{o} ($N_{a,w,x,at,fi,r}$),							
Predicted average crash frequency		2025	14.755	12.186			
Property-Damage-Only Crash Frequency						1	
Ramp Terminal Crash Analysis		Year					
Overdispersion parameter (k _{w,x,at,pdo}):		1.001	l I				
Observed crash count (N* _{o.w.x.at.pdo}), crashes:							
Reference year (r):							
Predicted average crash freq. for reference year ($N_{p,w,x,al}$,	,) crael	nes/vr					
Equivalent years associated with crash count ($C_{b,w,x,at,atodo,i}$		100/yl.					
Expected average crash freq. for reference year given N* _o (N _{a,w,x,at,pdo,r}), crasnes/yr:		14 354	10 064			
Predicted average crash frequency		2025	14.354	12.364			

		Enhar	nced Interc	hange Safety Analysis	s Tool			
General Information								
Project description:	SR 202 at	Kernan Blv	d IMR, Desi	ign Year 2045 No-Build	í			
Analyst:	Arcadis		Date:	7/10/2020	Area ty	ype:	Urban	
First year of analysis:	2045							
Last year of analysis:		•						
Crash Data Descripti	ion							
Freeway segments	No crash o	data	-					
Ramp segments	No crash c	data	-	<u>.</u>			T	
Ramp terminals	No crash c	data	-	<u>. </u>				
Program Control								
1. Enter data in the Ma	ain, Input Fr	eeway Seg	ments, Inpu	ut Ramp Segments, Inp	out Ram	p Terminals wo	rksheets.	
Click Perform Calcu	lations butt	.on to start c	calculation p	process.				
							<i>i</i>	
	Anna (gages		Prin	t Results (optional)	F	Print Site Summ	nary (optiona	al)
	•		•	tionally, click the Print l		•		
4. Optionally, detailed	results can	be reviewe	d in the Ou	tput Freeway Segments	s, Outp	ut Ramp Segme	ents, Output	Ramp

Terminals worksheets

	Input Worksheet for Free	way Segm	ents Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
			Study	Study	Study	Study	Study	Study
Basic Roa	(View results in Column AV) (View results in Advisory Mes adway Data	ssages)	Period	Period	Period	Period	Period	Period
	f through lanes (n):		8	8	7	7		
	segment description: length (L), mi:		MP. 5.56-6.03 0.47	MP. 6.03-6.27 0.23	MP. 6.27-6.57 0.3	MP. 6.57-7.96 1.39		
Alignmen			0.47	0.25	0.5	1.55		
_	al Curve Data See note							
	1 Horizontal curve in segment?:		Both Dir.	No	No	Both Dir.		
	Curve radius (R ₁), ft:		5730			4584		
	Length of curve (L _{c1}), mi:		0.46			0.18		
	Length of curve in segment ($L_{c1,seg}$), mi:		0.26			0.18		
4	2 Horizontal curve in segment?: Curve radius (R ₂), ft:		No			No		
	Length of curve (L_{c2}) , mi:							
	Length of curve in segment (L _{c2,seg}), mi:							
Cross Se	ction Data							
Lane width			12	12	12	12		
	houlder width (W _s), ft:		10	10 7	10	10 7		
	bulder width (W _{is}), ft: idth (W _m), ft:		17	17	17	17		
	trips on outside shoulders?:		Yes	Yes	Yes	Yes		
Tumble 3	Length of rumble strips for travel in increasing milepost direction, m	ni:	0.47	0.23	0.3	1.39		
	Length of rumble strips for travel in decreasing milepost direction, r		0.47	0.23	0.3	1.39		
Rumble st	trips on inside shoulders?:		No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, m							
Presence	Length of rumble strips for travel in decreasing milepost direction, r of barrier in median;	mi:	Center	Center	Center	Center		
	1 Length of barrier (L _{ib.1}), mi:		0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face (W _{off,in,1}),	ft:	7	7	7	7		
2	2 Length of barrier (L _{ib,2}), mi:		0.47	0.23	0.3	1.39		
	Distance from edge of traveled way to barrier face (W _{off,in,2}),	ft:	7	7	7	7		
	3 Length of barrier ($L_{ib,3}$), mi:	4.						
Median ba	Distance from edge of traveled way to barrier face (W _{off,in,3}), arrier width (W _{ib}), ft:	ft:	2	2	2	2		
	istance from edge of traveled way to barrier face (W _{near}), ft:	-	-	-	~		
Roadside	Data	·					<u> </u>	
Clear zone	e width (W _{hc}), ft:		15	10	10	25		
	of barrier on roadside:		Some	Some	Some	Some		
	1 Length of barrier (L _{ob,1}), mi:		0.07	0.2	0.27	0.16		
	Distance from edge of traveled way to barrier face (W	off,o,1), ft:	10 0.13	10	10 0.3	10 0.57		
	2 Length of barrier (L _{ob.2}), mi: Distance from edge of traveled way to barrier face (W	(10		10	10		
	3 Length of barrier ($L_{ob,3}$), mi:	off,0,27, 10.	10		10	10		
	Distance from edge of traveled way to barrier face (W	off.o.3), ft:						
Distance fror	m edge of traveled way to barrier face, increasing milepost (W _{off,inc}), ft	5						
Distance fror	m edge of traveled way to barrier face, decreasing milepost ($W_{\mbox{\scriptsize off,dec}}$),	ft:						
	cess Data							
Entrance	Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	S-C Lane		
Ramp	Distance from begin milepost to upstream entrance ramp gore $(X_{b,i})$). mi:	Lane Auu	0.47	999	5-C Laile		
	Length of ramp entrance (L _{en,inc}), mi:	6107				0.2		
	Length of ramp entrance in segment (L _{en,seg,inc}), mi:							
						0.2		
Exit	Entrance side?:			NI-		Right		
	Ramp exit in segment? (If yes, indicate type.):	mi.	Lane Drop	No	No			
Ramp	Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{e.ext}), r	ni:	Lane Drop	No 999	No 999	Right		
	Ramp exit in segment? (If yes, indicate type.):	ni:	Lane Drop			Right S-C Lane		
	Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore ($X_{o.exl}$), r Length of ramp exit ($L_{ex,inc}$), mi:	ni:	Lane Drop			Right S-C Lane 0.03		
	Ramp exit in segment? (If yes, indicate type.): Distance from end miteposit to downstream exit ramp gore ($X_{o,ed}$, r Length of ramp exit ($L_{ex,inc}$, mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?:	ni:	Lane Drop			Right S-C Lane 0.03 0.03		
Ramp	$\label{eq:response} \begin{array}{l} Ramp exit in segment? (If yes, indicate type.): \\ Distance from end mitepost to downstream exit ramp gore (X_{u,ed}), r \\ Length of ramp exit (L_{ex,inc}), mi: \\ Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ Exit side?: \\ Type B weave in segment?: \\ Length of weaving section (L_{wev,inc}), mi: \\ \end{array}$			999	999	Right S-C Lane 0.03 0.03 Right		
Ramp Weave	$\label{eq:response} \begin{array}{l} Ramp exit in segment? (If yes, indicate type.): \\ Distance from end mlepost to downstream exit ramp gore (X_{o,ed}), r \\ Length of ramp exit (L_{ex,inc}), mi: \\ Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ Exit side?: \\ Type B weave in segment?: \\ Length of weaving section (L_{wev,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), \\ Length of weaving section $			999	999	Right S-C Lane 0.03 0.03 Right		
Ramp Weave Travel in	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment? (If yes, indicate type.):} \\ \mbox{Distance from end meposit to downstream exit ramp gore (X_{out}), r \\ \mbox{Length of ramp exit (L_{ex,nec}), mi:} \\ \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi:} \\ \mbox{Exit side?:} \\ \mbox{Type B weave in segment?:} \\ \mbox{Length of weaving section (L_{wev,seg,inc}), mi:} \\ \mbox{Length of weaving section in segment (L_{wev,seg,inc}), mi:} \\ \mbox{Decreasing Milepost Direction} \end{array}$		No	999 No	999 No	Right S-C Lane 0.03 0.03 Right No		
Ramp Weave	$\label{eq:response} \begin{array}{l} Ramp exit in segment? (If yes, indicate type.): \\ Distance from end mlepost to downstream exit ramp gore (X_{o,ed}), r \\ Length of ramp exit (L_{ex,inc}), mi: \\ Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ Exit side?: \\ Type B weave in segment?: \\ Length of weaving section (L_{wev,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ Length of weaving section in segment (L_{wev,seg,inc}), \\ Length of weaving section $			999	999	Right S-C Lane 0.03 0.03 Right		
Ramp Weave <i>Travel in</i> Entrance	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore ($X_{u,ed}$), ri- Length of ramp exit ($L_{ex,inc}$), mi: Length of ramp exit in segment ($L_{u,seg,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{uev,inc}$), mi: Length of weaving section in segment ($L_{uev,seg,inc}$), mi: Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end mlepost to upstream entrance ramp gore (X_{uent} Length of ramp entrance ($L_{un,dec}$), mi:		No	999 No No	999 No No	Right S-C Lane 0.03 0.03 Right No		
Ramp Weave <i>Travel in</i> Entrance	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment?} (If yes, indicate type.): \\ \mbox{Distance from end meposit o downstream exit ramp gore (X_{ued}), rise \\ \mbox{Length of ramp exit (L_{ex,reg.}), mi: \\ \mbox{Length of ramp exit in segment (L_{ex,seg.inc}), mi: \\ \mbox{Exit side?: \\ \hline Type B weave in segment?: \\ \mbox{Length of weaving section (L_{wev,reg.}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg.inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg.inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg.inc}), mi: \\ \mbox{Decreasing Milepost Direction \\ \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ \mbox{Distance from end mepost to upstream entrance ramp gore (X_{uent}, length of ramp entrance in segment (L_{en,seg.dec}), mi: \\ \mbox{Length of ramp entrance in segment (L_{en,seg.dec}), mi: \\ \end{tabular}$		No	999 No No	999 No No	Right S-C Lane 0.03 0.03 Right No		
Ramp Weave Travel in Entrance Ramp	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment? (If yes, indicate type.):} \\ \mbox{Distance from end meposit o downstream exit ramp gore (X_{und}), rise the segment (L_{ex,seg,inc}), mi: \\ \mbox{Length of ramp exit (L_{ex,inc}), mi: \\ \mbox{Exit side?:} \\ \mbox{Type B weave in segment?:} \\ \mbox{Length of weaving section (L_{wev,inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ \mbox{Decreasing Milepost Direction \\ \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ \mbox{Distance from end melposit o upstream entrance ramp gore (X_{uon}) \\ \mbox{Length of ramp entrance i segment (L_{en,dec}), mi: \\ \mbox{Length of ramp entrance in segment (L_{en,seg,dec}), mi: \\ \mbox{Entrance side?: } \end{array}$		No Lane Add	999 No No 999	999 No No 999	Right S-C Lane 0.03 0.03 Right No Lane Add		
Ramp Weave Travel in Entrance Ramp Exit	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore ($X_{o.ed}$, r Length of ramp exit ($L_{ex,inc}$), mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wev,inc}$), mi: Length of weaving section ($L_{wev,inc}$), mi: Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end mlepost to upstream entrance ramp gore (X_{uort}) Length of ramp entrance ($L_{en,dec}$), mi: Length of ramp entrance in segment? ($L_{en,seg,dec}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.):	: .), mi:	No	999 No 999 999 No	999 No 999 999 No	Right S-C Lane 0.03 0.03 Right No		
Ramp Weave Travel in Entrance Ramp	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment? (If yes, indicate type.):} \\ \mbox{Distance from end meposit o downstream exit ramp gore (X_{und}), rise the segment (L_{ex,seg,inc}), mi: \\ \mbox{Length of ramp exit (L_{ex,inc}), mi: \\ \mbox{Exit side?:} \\ \mbox{Type B weave in segment?:} \\ \mbox{Length of weaving section (L_{wev,inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ \mbox{Length of weaving section in segment (L_{wev,seg,inc}), mi: \\ \mbox{Decreasing Milepost Direction \\ \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ \mbox{Distance from end melposit o upstream entrance ramp gore (X_{uon}) \\ \mbox{Length of ramp entrance i segment (L_{en,dec}), mi: \\ \mbox{Length of ramp entrance in segment (L_{en,seg,dec}), mi: \\ \mbox{Entrance side?: } \end{array}$: .), mi:	No Lane Add	999 No No 999	999 No No 999	Right S-C Lane 0.03 0.03 Right No Lane Add		
Ramp Weave Travel in Entrance Ramp Exit	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore ($X_{o.ed}$), r Length of ramp exit ($L_{ex,inc}$), mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wev,sed}$), mi: Length of weaving section in segment ($L_{wev,seg,inc}$), mi: Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end mlepost to upstream entrance ramp gore ($X_{o.ed}$), mi: Length of ramp entrance ($L_{en,dec}$), mi: Length of ramp entrance in segment ($L_{en,seg,dec}$), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore ($X_{o.ed}$)	: .), mi:	No Lane Add	999 No 999 999 No	999 No 999 999 No	Right S-C Lane 0.03 Right No Lane Add S-C Lane		
Ramp Weave Travel in Entrance Ramp Exit Ramp	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore (X _{und}), ri Length of ramp exit (L _{ex.inc}), mi: Length of ramp exit in segment (L _{ex.seg.inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wev.inc}), mi: Length of weaving section in segment (L _{wev.seg.inc}), mi: Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end mlepost to upstream entrance ramp gore (X _{und}), mi: Length of ramp entrance (L _{en.dec}), mi: Length of ramp entrance (L _{en.dec}), mi: Length of ramp entrance (L _{en.dec}), mi: Length of ramp entrance (t _{en.dec}), mi: Length of ramp entrance in segment (L _{en.seg.dec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{und}) Length of ramp exit (L _{ex.dec}), mi: Length of ramp exit in segment (L _{ex.seg.dec}), mi: Exit side?:	: .), mi:	No Lane Add	999 No 999 999 No	999 No 999 999 No	Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03		
Ramp Weave Travel in Entrance Ramp Exit	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore ($X_{o.ed}$, ri- Length of ramp exit ($L_{ex,inc}$), mi: Length of ramp exit in segment ($L_{ex,seg,inc}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wev,inc}$), mi: Length of weaving section in segment ($L_{wev,seg,inc}$), mi: Decreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end mlepost to upstream entrance ramp gore ($X_{o.ed}$). Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore ($X_{o.ed}$). Distance from begin milepost to downstream exit ramp gore ($X_{o.ed}$). Distance from begin milepost to downstream exit ramp gore ($X_{o.ed}$). Length of ramp exit (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore ($X_{o.ed}$). Length of ramp exit ($L_{ex,dec}$), mi: Length of ramp exit ($L_{ex,dec}$), mi: Length of ramp exit in segment ($L_{ex,seg,dec}$), mi: Exit side?: Type B weave in segment?:	: .), mi:	No Lane Add	999 No 999 999 No	999 No 999 999 No	Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03		
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Ramp Weave Travel in Entrance Ramp Exit Ramp Weave	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment? (If yes, indicate type.):} \\ \mbox{Distance from end meposit to downstream exit ramp gore (X_{out}), rise that the the segment (L_{ex, seg, inc}), mi: \\ \mbox{Length of ramp exit (L_{ex, inc}), mi: \\ \mbox{Length of waving section (L_{wev, inc}), mi: \\ \mbox{Length of waving section (L_{wev, inc}), mi: \\ \mbox{Length of waving section in segment (L_{wev, seg, inc}), mi: \\ \mbox{Decreasing Milepost Direction \\ \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ \mbox{Distance from end melposit to upstream entrance ramp gore (X_{uont}), mi: \\ \mbox{Length of ramp entrance (L_{en,dec}), mi: \\ \mbox{Length of ramp entrance in segment (L_{en,seg,dec}), mi: \\ \mbox{Entrance side?: \\ \mbox{Ramp exit in segment? (If yes, indicate type.): \\ \mbox{Distance from begin mileposit to downstream exit ramp gore (X_{uont}), \\ \mbox{Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (Length of waving section (L_{wev,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}$: .), mi: . mi: :	No Lane Add	999 No 999 No 0.47	999 No 999 No 999	Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Ramp Weave Travel in Entrance Ramp Exit Ramp Weave Traffic Da	$\label{eq:response} \begin{array}{l} \mbox{Ramp exit in segment? (If yes, indicate type.):} \\ \mbox{Distance from end meposit to downstream exit ramp gore (X_{out}), rise that the the segment (L_{ex, seg, inc}), mi: \\ \mbox{Length of ramp exit (L_{ex, inc}), mi: \\ \mbox{Length of waving section (L_{wev, inc}), mi: \\ \mbox{Length of waving section (L_{wev, inc}), mi: \\ \mbox{Length of waving section in segment (L_{wev, seg, inc}), mi: \\ \mbox{Decreasing Milepost Direction \\ \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ \mbox{Distance from end melposit to upstream entrance ramp gore (X_{uont}), mi: \\ \mbox{Length of ramp entrance (L_{en,dec}), mi: \\ \mbox{Length of ramp entrance in segment (L_{en,seg,dec}), mi: \\ \mbox{Entrance side?: \\ \mbox{Ramp exit in segment? (If yes, indicate type.): \\ \mbox{Distance from begin mileposit to downstream exit ramp gore (X_{uont}), \\ \mbox{Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (Length of ramp exit in segment (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (L_{ex,dec}), mi: \\ \mbox{Length of ramp exit in segment? (Length of waving section (L_{wev,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}), mi: \\ \mbox{Length of weaving section in segment (L_{wex,seg,dec}$: .), mi: . mi:	Lane Add Lane Drop Yes 0.47	999 No 999 No 0.47	999 No 999 No 999	Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Ramp Weave Travel in Entrance Ramp Exit Ramp Weave Traffic Da Proportion	Ramp exit in segment? (If yes, indicate type.): Distance from end mlepost to downstream exit ramp gore (X _{und}), ri Length of ramp exit (L _{ex,inc}), mi: Length of ramp exit in segment (L _{ex,seg,inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wev,inc}), mi: Length of weaving section in segment (L _{wev,seg,inc}), mi: Distance from end mlepost to upstream entrance ramp gore (X _{uon}). Length of ramp entrance (L _{en,dec}), mi: Length of ramp entrance (L _{en,dec}), mi: Length of ramp entrance (L _{en,dec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{uon}). Length of ramp exit in segment? (Length of ramp gore (X _{uon}). Length of ramp exit in segment? (Lex,seg,dec), mi: Length of ramp exit in segment?: Length of weaving section (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in segment (L _{wev,seg,dec}), mi: Length of weaving section in	: .), mi: . mi: :	Lane Add Lane Drop Yes 0.47	999 No 999 No 0.47	999 No 999 No 999	Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
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Ramp Weave Intrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway Entrance F Average d Exit Ramp Average d Exit Ramp Average d	Ramp exit in segment? (If yes, indicate type.): Distance from end meposit o downstream exit ramp gore (X_{oucl} , r Length of ramp exit ($L_{ex,seg.inc.}$), mi: Length of ramp exit in segment ($L_{ex,seg.inc.}$), mi: Exit side?: Type B weave in segment?: Length of weaving section ($L_{wev,seg.inc.}$), mi: Length of weaving section in segment ($L_{wev,seg.inc.}$), mi: Detract from end metpost to upstream entrance ramp gore (X_{ourl}) Distance from end metpost to upstream entrance ramp gore (X_{ourl}) Distance from entrance ($L_{en,deg.}$), mi: Length of ramp entrance ($L_{en,deg.}$), mi: Length of ramp entrance in segment ($L_{un,seg.dec.}$), mi: Length of ramp entrance in segment ($L_{un,seg.dec.}$), mi: Length of ramp exit in segment ($L_{uev,seg.dec.}$), mi: Length of ramp exit in segment ($L_{uev,seg.dec.}$), mi: Length of ramp exit in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi: Length of weaving section in segment ($L_{uev,seg.dec.}$), mi), mi: , mi: ; Year 2045 Year 2045 Year 2045 Year 2045	No Lane Add Lane Drop Yes 0.47	999 No 999 No 0.47 No 167400	999 No 999 No 999 No 999	Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 S-C Lane 0.03 Right No S-C Lane 0.03 Right No 184600 8600		
Ramp Weave Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway Entrance F Average d Entrance F Average d Entrance F Average d Extrage d	Ramp exit in segment? (If yes, indicate type.): Distance from end meposit to downstream exit ramp gore (X _{und}), ri Length of ramp exit (L _{exi,eng,inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section (L _{wev,inc}), mi: Length of weaving section in segment (L _{wev,seg,inc}), mi: Detrace from end melposit Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end melposit ou pstream entrance ramp gore (X _{uore}), mi: Length of ramp entrance (L _{en,dec}), mi: Length of ramp entrance in segment (L _{en,dec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin mileposit to downstream exit ramp gore (X _{uore}). Length of ramp exit (L _{ex,dec}), mi: Length of ramp exit in segment (L _{ex,dec}), mi: Length of ramp exit in segment? (Lengdec), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}), mi: Length of weaving section in segment (L _{wev,dec}),), mi: , mi: , mi: Year 2045 Year 2045 Year 2045 Year 2045 Year	No Lane Add Lane Drop Yes 0.47 0.47 235800 34200 34200	999 No 999 No 0.47 No 167400 34700	999 No 999 No 999 No 999	Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 S-C Lane 0.03 0.03 0.03 0.03 No 10.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 8600 25400		
Ramp Weave Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway Exit Ramp Average d Entrance F Average d Entrance F Average d Entrance F Average d Entrance F Average d Exit Ramp	Ramp exit in segment? (If yes, indicate type.): Distance from end meposit o downstream exit ramp gore (X_{oucl} , r Length of ramp exit ($L_{ex,seg.inc.}$), mi: Length of ramp exit in segment ($L_{ex,seg.inc.}$), mi: Length of weaving section ($L_{wex,seg.inc.}$), mi: Length of weaving section in segment ($L_{wex,seg.inc.}$), mi: Length of weaving section in segment ($L_{wex,seg.inc.}$), mi: Detaceasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from end metpost to upstream entrance ramp gore (X_{ourt}) Length of ramp entrance ($L_{en,dec.}$), mi: Length of ramp entrance in segment ($L_{wex,seg.inc.}$), mi: Length of ramp entrance in segment ($L_{wex,seg.inc.}$), mi: Length of ramp entrance in segment ($L_{wex,seg.inc.}$), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{oucl}) Length of ramp exit in segment? ($L_{wex,seg.idec.}$), mi: Length of weaving section in segment ($L_{wex,seg.idec.}$), mi: Length of weaving section in segment ($L_{wex,seg.idec.}$), mi: Length of weaving section in segment ($L_{wex,seg.idec.}$), mi: Length of weaving section in segment ($L_{wex,seg.idec.}$), mi: Length of weaving section in segment ($L_{wex,seg.idec.}$), mi:), mi: , mi: ; Year 2045 Year 2045 Year 2045 Year 2045	No Lane Add Lane Drop Yes 0.47 0.47 235800 34700 34200	999 No 999 No 0.47 No 167400	999 No 999 No 999 No 999	Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 S-C Lane 0.03 Right No No 184600 8600 25400		

	Input Worksheet for Ramp Seg	ments					
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
		Study	Study	Study	Study	Study	Study
	(View results in Column CJ) (View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
Basic Roa	adway Data						
Number o	f through lanes (n):	1	2	1	1	1	
Ramp seg	ment description:	EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ram	WB. On Ram	<u>с</u>
	length (L), mi:	0.33	0.14	0.27	0.26	0.29	
Average tr	raffic speed on the freeway (V _{frwy}), mi/h:	65	65	65	65	65	
Segment t	type (ramp or collector-distributor road):	Exit	Entrance	Entrance	Exit	Entrance	
Type of co	ontrol at crossroad ramp terminal:	Stop	Stop	Stop	Stop	Stop	
Alignmen	nt Data						
Horizonta	al Curve Data See notes 🛹						
	1 Horizontal curve?:	No	No	No	No	No	
	Curve radius (R ₁), ft:						
	Length of curve (L _{c1}), mi:						
	Length of curve in segment (L _{c1,seg}), mi:						
	Ramp-mile of beginning of curve in direction of travel (X1), n	ni:					
Cross Se	ction Data			1	1		
Lane width	h (W ₁), ft:	12	12	12	12	12	
Right shou	ulder width (W _{rs}), ft:	7	7	7	7	7	
Left should	der width (W _{ls}), ft:	4	4	4	4	4	
	of lane add or lane drop by taper:	No	No	No	No	No	
	Length of taper in segment (L _{add.seg} or L _{drop.seg}), mi:						
Roadside	P Data				1		1
	of barrier on <u>right</u> side of roadway:	Yes	Yes	Yes	Yes	Yes	
	1 Length of barrier (L _{rb 1}), mi:	0.25	0.14	0.26	0.03	0.2	
	Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft:		25	25	25	25	
	2 Length of barrier ($L_{th,2}$), mi:						
4	Distance from edge of traveled way to barrier face ($W_{off r,2}$), ft.						
Presence	of barrier on left side of roadway:	No	No	No	No	No	
	Length of barrier ($L_{lb 1}$), mi:	NU	NO	NU	NO	NO	
	Distance from edge of traveled way to barrier face ($W_{off,l,1}$), ft:						
Daman Aa							
		No	No	No	No	No	1
Ramp	Ramp entrance in segment? (If yes, indicate type.):	INO	INO	110	INO	INO	
Entrance	Length of entrance s-c lane in segment (L _{en,seg}), mi:	Ne	NI-	Ne	Ne	NI-	
Ramp	Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	
Exit	Length of exit s-c lane in segment (L _{ex,seg}), mi:						
Weaving	Weave section in collector-distributor road segment?:						
Section	Length of weaving section (L _{wev}), mi:						
	Length of weaving section in segment (L _{wev,seg}), mi:						
Traffic Da							
Average d	laily traffic (AADT, or AADT _c) by year, veh/d: 2045	5 34200	8600	8600	8600	34200	

	Inpu	t Worksheet for Crossroad Ram	p Terminals					
			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
	(View results in Column T)	() (iau see die in Advison (Messenne)	Study Period	Study	Study	Study	Study	Study
Basic Into	rsection Data	(View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
	inal configuration:		D4	D4	1		1	
•	inal description:		South Ramp	North Ramp	[
· ·	inal traffic control type:		Signal	Signal				
	mp public street leg preser	nt at the terminal (I _{ps})?:	- gria	0.9.00				
Alignment		. 64						
	kew angle (I _{sk}), degrees:			I	1			
		n the outside crossroad leg (L _{str}), mi:	0.14	0.17				
	the adjacent ramp termin		0.14	0.14				
Traffic Col		•						
	Operational Mode							
	Inside approach	Protected-only mode (I _{o.lt.in})?:	Yes	No				
	Outside approach	Protected-only mode (I _{p,lt,in})?:	103	110				
Right-Turr	Control Type	(·p,it,out) · ·	I	1				
-	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Sec		Inght turn control type.	0.8.1.1	0.8.10.1				
	median width (W _m), ft:		36	36	1		1	
Number of	(iii):							
		La construction de la constructi	4	4				
Crossroad	Both approaches	Lanes serving through vehicles (n _{th}):		2				
1	Inside approach	Lanes serving through vehicles (n _{th,in})		2	0	0	0	0
Pomp	Outside approach Exit ramp approach	Lanes serving through vehicles (n _{th,out} All lanes (n _{ex}):	2	1	0	U	0	0
Ramp		see note: -	_	-				
-	Channelization			1				
Clossidau	Inside approach	Channelization present (I _{ch,in})?		Vee				
	Outside approach	Channelization present (I _{ch,out}) Channelization present (I _{ch,eu})?		Yes Yes				
Ramp	Exit ramp approach	Charmenzation present (I _{ch,ex})	. res	res				
	Lane or Bay	- I		1				
Crossroad	Inside approach	Lane or bay present (I _{bay,It,in})?:	Yes	Yes				
		Width of lane or bay (W _{b,in}), ft		12				
1	Outside approach	Lane or bay present (I _{bay,lt,out})?						
		Width of lane or bay (W _{b,out}), f	t:					
-	Lane or Bay							-
Crossroad	Inside approach	Lane or bay present (I _{bay,rt,in})?:						
1	Outside approach	Lane or bay present (I _{bay,rt,out})?	: Yes	Yes				
Access Da	ta							
	driveways on the outside							
Number of	public street approaches of	on the outside crossroad leg (n _{ps}):						
Traffic Dat	a	Yea	r 🔤					
Inside Cro	ssroad Leg Data	204	5 60700	60700				
Outside C	rossroad Leg Data	204	5 52500	71700				
Exit Ramp	-	204	5 34200	8600				
Entrance k	Ramp Data	204	5 8600	34200				

			Out	tput Summ	ary				
General Information									
Project description:	SR 202 at K	ernan Blvd	IMR, Design	Year 2045	No-Build				
Analyst:	Arcadis		Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2045								
Last year of analysis:	2045								
Crash Data Descripti	on								
Freeway segments	Segment cr	ash data av	/ailable?		No	First year o	f crash data	ı:	
	Project-lev	el crash dat	a available?		No	Last year o	f crash data	ı:	
Ramp segments	Segment cr	ash data av	/ailable?		No	First year o	f crash data	1:	
	Project-lev	el crash dat	a available?		No	Last year o	f crash data	:	
Ramp terminals	Segment cr	ash data av	/ailable?		No	First year o	f crash data	1:	
	Project-lev	el crash dat	a available?		No	Last year o	f crash data	1:	
Estimated Crash Stat	tistics								
Crashes for Entire Fa	ncility			Total	K	A	В	C	PDO
Estimated number of crashe	s during Study	Period, crashe	es:	289.6	0.8	3.4	20.4	82.6	182.4
Estimated average crash fre	q. during Study	Period, crashe	es/yr:	289.6	0.8	3.4	20.4	82.6	182.4
Crashes by Facility C	Component		Nbr. Sites	Total	К	A	В	С	PDO
Freeway segments, cra	ashes:		4	199.9	0.7	1.9	11.6	41.8	143.8
Ramp segments, crash	es:		5	6.3	0.1	0.2	1.2	1.7	3.1
Crossroad ramp termin	nals, crashes	5:	2	83.5	0.0	1.2	7.6	39.1	35.5
Crashes for Entire Fa	cility by Ye	ar	Year	Total	К	A	В	C	PDO
Estimated number of c	rashes durir	ng	2045	289.6	0.8	3.4	20.4	82.6	182.4
Distribution of Crash	es for Entir	e Facility							
Creek Turne	Creat	h Turna Cat		Estim	ated Numb	per of Crash	es During	the Study P	eriod
Crash Type	Crasi	h Type Cate	egory	Total	К	A	В	C	PDO
Multiple vehicle	Head-on cr	ashes:		1.4	0.0	0.0	0.2	0.7	0.5
	Right-angle	crashes:		23.9	0.0	0.4	2.3	11.2	10.0
	Rear-end c	rashes:		168.1	0.5	2.0	12.1	50.1	103.5
	Sideswipe of	crashes:		48.3	0.1	0.3	2.1	7.8	38.0
	Other mult	iple-vehicle	crashes:	5.7	0.0	0.1	0.4	1.5	3.7
	Total mul	tiple-vehicl	e crashes:	247.4	0.6	2.8	17.0	71.2	155.8
Single vehicle	Crashes wit	th animal:		0.5	0.0	0.0	0.0	0.0	0.5
	Crashes wit	th fixed obj	ect:	30.5	0.1	0.4	2.4	8.0	19.6
	Crashes wit	th other obj	ject:	3.9	0.0	0.0	0.1	0.5	3.3
	Crashes wit	th parked v	ehicle:	0.7	0.0	0.0	0.1	0.2	0.4
	Other singl	e-vehicle cr	rashes	6.6	0.0	0.1	0.8	2.7	2.9
	Total sing	le-vehicle c		42.3	0.2	0.6	3.4	11.4	26.7
		Total crash	ies:	289.6	0.8	3.4	20.4	82.6	182.4

MV = multiple-vehicle model			eet for Fre			e	Somerical	Same	Same	Segment (
SV = single-vehicle model	EXR = ra	mp exit n	nodel		Segment 1 Study	Segment 2 Study	Segment 3 Study	Segment 4 Study	Segment 5 Study	Segment
Owner Mardiffertier Fraterie	A	oplicable	Models (y)	Period	Period	Period	Period	Period	Period
Crash Modification Factors Fatal-and-Injury Crash CMFs										
Horizontal curve (CMF _{1,w,ac,y,fi}):	MV		ENR	EXR	1.010	1.000	1.000	1.003		
Lane width (CMF _{2,w,ac,y,fi}):	MV	SV SV	ENR	EXR	1.040	1.000	1.000	1.015		
Dutside shoulder width (CMF _{8 fs an sy fi}):	IVIV	sv	ENR	EAR	1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,fi}):	MV	sv	ENR	EXR	0.983	0.983	0.983	0.983		
Median width (CMF _{4,w,ac,y,fi}):	MV		ENR	EXR	1.151	1.151	1.151	1.151		
Median barrier (CMF _{5.w,ac,y,fl}):	MV	SV SV	ENR	EXR	0.954	0.954	0.954 1.191	0.954		
Shoulder rumble strip (CMF _{9,6,ac,8v,5}):	NIV V	sv		LAN	0.958	0.906	0.906	0.918		
Dutside clearance (CMF _{10,fs,ac,sv,fi}):		SV			1.074	1.093	1.091	1.041		
Dutside barrier (CMF _{11,fs,ac,sv,fi}):		SV			1.041	1.083	1.181	1.050		
ane change (CMF _{7,fs,ac,mv,fi}):	MV		Year:	2045	1.384	1.000	1.000	1.056		
Ramp entrance (CMF _{12,sc,nEN,at,fi}):	1		ENR	2045	1.304	1.000	1.000	1.050		
			Year:	2045	1.000	1.000	1.000	1.795		
Ramp exit (CMF _{13,sc,nEX,at,fi}):				EXR	1.000	1.000	1.000	1.472		
ligh volume (CMF _{6,w,ac,y,fi}):	MV	sv	ENR	EXR	1.365 0.942	1.269 0.955	1.314 0.949	1.341 0.945		
Property-Damage-Only Crash CMFs	5	57			0.842	0.855	0.848	0.945		
lorizontal curve (CMF _{1,w,ac,y,pdo}):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
ane width (CMF _{2,w,ac,y,pdo}):	MV	SV SV	ENR	EXR	1.035	1.000	1.000	1.013		
Dutside shoulder width (CMF _{8,f8,ac,sv,pdo}):	IVIV	sv	LINK	EAR	1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,pdo}):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Nedian width (CMF _{4,w,ac,y,pdo}):	MV		ENR	EXR	1.145	1.145	1.145	1.145		
		SV			1.144	1.144	1.144	1.144		
fedian barrier (CMF _{5,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.253	1.253	1.253	1.253		
houlder rumble strip (CMF _{9,fs,ac,sv,pdo}): Dutside clearance (CMF _{10,fs,ac,sv,pdo}):	-	SV SV	-		1.000	1.000	1.000	1.000		
Outside barrier (CMF _{11,fs,ac,sv,pdo}):	1	sv			1.054	1.110	1.240	1.066		
ane change (CMF _{7,fs,ac,mv,pdo}):	MV									·
· · · · · · · · · · · · · · · · · · ·			Year:	2045	1.282	1.000	1.000	1.051		
Ramp entrance (CMF _{12,sc,nEN,at,pdo}): Ramp exit (CMF _{13,sc,nEX,at,pdo}):			ENR	EXR	1.000	1.000	1.000	1.134		
High volume (CMF _{13,sc,nEX,at,pdo}):	MV		ENR	EXR	1.000	1.000	1.000	1.000		
ngri volunio (oni 6,w,ac,y,poo).	1010	SV		EXIT	0.581	0.659	0.621	0.599		
Predicted Average Crash Frequency	y						<u> </u>			
Fatal-and-Injury Crash Frequency										
reeway Segment Multiple-Vehicle Cr. Overdispersion parameter (k _{fs.n.mv.fi}):	asn Analys	sis		Year						
Observed crash count (N* _{o,fs,n,mv,fi}), cra	ashes:									
Reference year (r):										
Predicted average crash freq. for refer				əs/yr:						
Equivalent years associated with crash										
expected average crash freq, for reference yea Predicted average crash frequency	ar given N* _o (N _{e/s.n.mv.fi,r}).	crashes/yr:	2045	14.942	2.920	4.039	21.232		
Freeway Segment Single-Vehicle Cras	sh Analvsi:	3		Year	14.042	2.020	4.000	LILOL		
Overdispersion parameter (k _{fs,n,sv,fi}):										
Observed crash count (N* _{o,fs,n,sv,fi}), cra	shes:									
Reference year (r): Predicted average crash freq. for refer		(N) craebo	ehr:						
Equivalent years associated with crash				Sryi.						
Expected average crash freq. for reference year										
Predicted average crash frequency				2045	2.576	0.986	1.345	5.225		
Ramp Entrance Crash Analysis				Year						
Overdispersion parameter (k _{sc,EN,at,fi}): Observed crash count (N* _{o,sc,EN,at,fi}), cr	ashes:									
Reference year (r):	401100.									
Predicted average crash freq. for refer				ies/yr:						
Equivalent years associated with crash										
xpected average crash freq. for reference yea	ar given N* _o (N _{a,sc,EN,al,A,r})	, crashes/yr:							
Predicted average crash frequency Ramp Exit Crash Analysis				2045 Year	0.000	0.000	0.000	2.187		
Dverdispersion parameter (k _{sc,EX,at,fi}):				rear						
Dbserved crash count (N* _{o,sc,EX,at,fi}), cr	ashes:									
Reference year (r):										
Predicted average crash freq. for refer				es/yr:						
quivalent years associated with crash										
xpected average crash freq. for reference yea Predicted average crash frequency	n given N*₀ (waast,EX,at,t,r)	, crashes/yr:	2045	0.000	0.000	0.000	0.654		
Property-Damage-Only Crash Frequ				•	0.000	0.000	0.000	5.054		
reeway Segment Multiple-Vehicle Cri	ash Analys	sis		Year						
Overdispersion parameter (k _{fs.n.mv.pdo}): Observed crash count (N* _{o.fs.n.mv.pdo}), c										
Reference year (r):										
redicted average crash freq. for refer	ence year	(N _{p,fs,n,mv,j}	_{pdo,r}), cras	hes/yr:						
quivalent years associated with crash	n count (C	,fs,n,mv,pdo,	,), yr:							
xpected average crash freq. for reference yea redicted average crash frequency), crasnes/yr	2045	39.995	7.278	10.769	58.799		
reeway Segment Single-Vehicle Cra	sh Analysi:	6		Year						
overdispersion parameter (k _{fs.n.sv.pdo}): Observed crash count (N* _{o.fs.n.sv.pdo}), ci	rashee:									
eference year (r):										
redicted average crash freq. for refer				nes/yr:						
quivalent years associated with crash	n count (C	, fs.n.sv.pdo,r), yr:							
xpected average crash freq. for reference yea redicted average crash frequency	# given N* _o (Na/s,n,sv,pdo,r)	, crashes/yr:	2045	4.980	2.087	2.920	11.230		
amp Entrance Crash Analysis				Year						
verdispersion parameter (k _{sc,EN,st,pdo})										
Observed crash count (N* _{o.sc,EN,at,pdo}), Reference year (r):	crashes:									
redicted average crash freq. for refer	ence year	(N _{p,sc,EN,at}	t,pdo,r), cras	shes/yr:						
quivalent years associated with crash	n count (C	.sc.EN.at.pdc	_{o.r}), yr:							
xpected average crash freq. for reference yea redicted average crash frequency	ar given N* _o (Na,sc, EN,at,pdo,	,), crashes/y	/r: 2045	0.000	0.000	0.000	4.526		
amp Exit Crash Analysis				Year	0.000	0.000	0.000	+.020	·	
Overdispersion parameter (k _{sc,EX,at,pdo})										
Observed crash count (N* _{o,sc,EX,at,pdo}),	crashes:									
Reference year (r): Predicted average crash freq. for refer	ence voor	(N	1 0100	shee/w						
quivalent years associated with crash				oaryl .						
xpected average crash freq. for reference yea	ar given N* _o (N _{a,ao,EX,at,pdo}	,), crashes/v	r:						
				2045	0.000	0.000	0.000	1.216		1
redicted average crash frequency										

Output W	orksheet for F	Ramp Sec	ments					
MV = multiple-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model		icable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Horizontal curve (CMF _{1,w,x,y,fi}):	MV		1.000	1.000	1.000	1.000	1.000	
		SV	1.000	1.000	1.000	1.000	1.000	
Lane width (CMF _{2, w,x,y,fi}):	MV	SV	1.096	1.096	1.096	1.096	1.096	
Right shoulder width (CMF _{3,w,x,y,fi}):	MV	SV	1.055	1.055	1.055	1.055	1.055	
Left shoulder width (CMF _{4,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Right side barrier (CMF _{5,w,x,y,fi}):	MV	SV	1.012	1.012	1.011	1.001	1.008	
Left side barrier (CMF _{6,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Weaving section (CMF _{9,cds,ac,at,fi}):	MV	SV						
	Year:	2045	1.000	1.000	1.000	1.000	1.000	
Ramp speed-change lane (CMF _{8.w.x.mv.fi}): Lane add or drop (CMF _{7.w.x.v.fi}):	MV	CV/	1.000	1.000	1.000	1.000	1.000	
	MV	SV	1.000	1.000	1.000	1.000	1.000	
Property-Damage-Only Crash CMFs		1	1 000	1 000	1 000	1 000	1 000	
Horizontal curve (CMF _{1,w,x,y,pdo}):	MV	C 1	1.000	1.000	1.000	1.000	1.000	
Lano width (CME):	N 41 /	SV SV	1.000	1.000	1.000	1.000	1.000	
Lane width (CMF _{2, w.x.y.pdo}): Right shoulder width (CMF _{3,w.x.y.pdo}):	MV MV	SV SV	1.000 1.026	1.000 1.026	1.000 1.026	1.000 1.026	1.000 1.026	
Left shoulder width (CMF _{4,w,x,y,pdo}):	MV	SV SV	1.026	1.026	1.026	1.026	1.026	
Right side barrier (CMF _{5,w,x,y,pdo}):	MV	SV SV	1.000	1.000	1.000	1.000	1.000	
Left side barrier (CMF _{6,w,x,y,pdo}):	MV	SV	1.011	1.000	1.010	1.001	1.007	
Weaving section (CMF _{9,cds,ac,at,odo}):	MV	SV SV	1.000	1.000	1.000	1.000	1.000	
veaving section (Civil _{9,cds,ac,at,pdo}).	Year:	2045	1.000	1.000	1.000	1.000	1.000	
Ramp speed-change lane (CMF _{8,w,x,mv,pdo}):	MV	2045	1.000	1.000	1.000	1.000	1.000	
Lane add or drop (CMF _{7,w,x,v,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	
Predicted Average Crash Frequency	1010		1.000	1.000	1.000	1.000	1.000	
Fatal-and-Injury Crash Frequency								
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w.x.mv.fi}):		lioui						
Observed crash count (N* _{o,w.x.mv.fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N_p	w.x.mv.fir), crash	es/yr:						
Equivalent years associated with crash count (C _{b.w.x.}								
Expected average crash freq. for reference year given N^*_{o} ($N_{a,w,x}$	1111							
Predicted average crash frequency		2045	0.186	0.045	0.053	0.012	0.706	
Single-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,sv,fi}):								
Observed crash count (N* _{o,w,x,sv,fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N $_{\rm p}$	_{,w,x,sv,fi,r}), crashe	es/yr:						
Equivalent years associated with crash count ($C_{b,w,x,s}$	_{sv,fi,r}), yr:							
Expected average crash freq. for reference year given $N^{\star}_{\ o}$ $(N_{a,w,x})$	_{sv,fi,r}), crashes/yr:							
Predicted average crash frequency		2045	0.942	0.104	0.207	0.272	0.598	
Property-Damage-Only Crash Frequency								
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,mv,pdo}):								
Observed crash count (N* _{o,w,x,mv,pdo}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N _p		shes/yr:						
Equivalent years associated with crash count ($C_{\text{b,w,x,i}}$								
Expected average crash freq. for reference year given N^*_{o} ($N_{a,w,x}$	_{.mv,pdo,r}), crashes/yi							
Predicted average crash frequency		2045	0.226	0.110	0.092	0.031	0.556	
Single-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,sv,pdo}):								
Observed crash count (N* _{o,w,x,sv,pdo}), crashes:								
Reference year (r): Predicted average crash freq. for reference year (N_p	1 0100	bos//m						
Equivalent years associated with crash count ($C_{b,w,x,s}$)		nes/yr:						
Expected average crash freq. for reference year given N_{o}^{*} ($N_{a,w,x}$)	_{sv,pdo,r}), crashes/yr	2045	0.864	0.158	0.222	0.260	0.615	
Predicted average crash frequency		2040	0.804	0.138	0.222	0.200	0.012	

Output Worksheet	for Crossr	oad Ram	p Terminals					
Signal = signalized intersection model		ouu num	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
Unsig = unsignalized intersection model		icable	Study	Study	Study	Study	Study	Study
Crash Modification Factors	Mo	dels	Period	Period	Period	Period	Period	Period
Fatal-and-Injury Crash CMFs								
Non-ramp public street leg (CMF _{19,w,SG,at,fi}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,fi}):	Signal	Unsig	0.772	0.791				
Protected left-turn operation (CMF _{16,w,SG,at,fi}):	Signal	-						
Channelized right turn on crossroad (CMF _{17,w,SG,at,fi}):	Signal							
	Year:	2045	1.200	1.243				
Channelized right turn on exit ramp (CMF _{18,w,SG,at,fi}):	Signal							
	Year:	2045	1.372	1.083				
Access point frequency (CMF _{13,w,x,at,fi}):	Signal	Unsig						1
	Year:	2045	1.000	1.000				
Crossroad left-turn lane (CMF _{11,w,x,at,fi}):	Signal	Unsig	0.004	0.070				1
Crossroad right-turn lane (CMF _{12.w.x.at.fi}):	Year: Signal	2045 Unsig	0.864	0.879				
Crossi dad fight-turn lane (Civir _{12,w,x,at,fi}).	Year:	2045	0.919	0.902				1
Median width (CMF _{15.w.x.at.fi}):	Signal	Unsig	0.919	0.902				
	Year:	2045	0.865	0.777				
Exit ramp capacity (CMF _{10.w.x.at.fi}):	Signal	Unsig	0.000					
	Year:	2045	2.934	1.106				
Skew angle (CMF _{20,w,ST,at,fi}):		Unsig	I	I				
	Year:	2045						
All-way stop control (CMF _{awsc}):		Unsig						
Property-Damage-Only Crash CMFs								
Non-ramp public street leg (CMF _{19,w,SG,at,pdo}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,pdo}):	Signal		0.771	0.790				
Protected left-turn operation (CMF _{16,w,SG,at,pdo}):	Signal							
	Year:	2045	0.739	1.000				
Channelized right turn on crossroad (CMF $_{17,w,SG,at,pdo}$):	Signal							1
	Year:	2045	1.199	1.242				
Channelized right turn on exit ramp (CMF _{18,w,SG,at,pdo}):	Signal	2068						
Charmenzed right turn on exit ramp (Civir _{18,w,SG,at,pdo}).	Signal Year:	2045	1.696	1.156				
	Teal.	2043	1.090	1.130				
Access point frequency (CMF _{13.w.x.al.pdo}):	Signal	2000						
	Year:	2045	1.000	1.000				
Crossroad left-turn lane (CMF _{11,w,x,at,pdo}):	Signal	Unsig	I					
	Year:	2045	0.875	0.889				
Crossroad right-turn lane (CMF _{12,w,x,at,pdo}):	Signal	Unsig						
	Year:	2045	0.980	0.975				
		2068						
Median width (CMF _{15,w,x,at,pdo}):	Signal							1
	Year:	2045	0.546	0.447				
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency		Verr						
Ramp Terminal Crash Analysis Overdispersion parameter (k _{w.x.at.fi}):		Year	 					
Observed crash count (N* _{o.w.x.at,fi}).								
Reference year (r):								
Predicted average crash freq. for reference year (N _{p.w.x.at}	fir), crashe	s/yr:						
Equivalent years associated with crash count (C _{b,w,x,at,fi} ,r),	2 T -	,						
Expected average crash freq. for reference year given N* _o (N _{a.w.x.at.fi.r}),	-							
Predicted average crash frequency		2045	31.062	16.920				
Property-Damage-Only Crash Frequency			· I	I				•
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,pdo}):								
Observed crash count ($N^*_{o,w,x,at,pdo}$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (Np.w.x.at	A	nes/yr:						
								1
Equivalent years associated with crash count ($C_{b,w,x,at,pdo}$								
Equivalent years associated with crash count ($C_{b,w,x,at,pdo}$, Expected average crash freq. for reference year given N* ₀ (N _{a,w,xat,pdo} , Predicted average crash frequency		2045	18.381	17.103				

		Enhanced	Interd	change Safety Analys	sis To	ol			
General Information									
Project description:	SR 202 at	Kernan Blvd IMF	R, Ope	ening Year 2025 Build					
Analyst:	Arcadis	Date	:	7/10/2020	Area	a type:		Urban	
First year of analysis:	2025								
Last year of analysis:	2025								
Crash Data Descript	ion								
Freeway segments	No crash o	Jata	-						
Ramp segments	No crash o	data	-						
Ramp terminals	No crash o	data	-						<u> </u>
Program Control									
 Enter data in the Ma 2. Click Perform Calcu 					nput R	amp Te	rmina l s wo	orksheets.	
			Prir	nt Results (optional)		Print	Site Sumr	mary (optio	nal)
 Review results in th Optionally, detailed Terminals worksheets 	results can	•						-	

			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	
			Segment 1 Study	Segment 2 Study	Segment 3	Segment 4 Study	Segment 5	Segment 6 Study	
	(View results in Column AV) (View results in Advisory Mess	sages)	Period	Period	Period	Period	Period	Period	
Basic Ro	adway Data	• /							
lumber c	f through lanes (n):		8	8	7	7			0
reeway	segment description:		MP. 5.56-6.03	MP. 6.03-6.31	MP. 6.31-6.57	MP. 6.57-7.96			
Segment	length (L), mi:		0.47	0.28	0.26	1.39			0
lignmei									
	al Curve Data See note								
	1 Horizontal curve in segment?:		Both Dir.	No	No	Both Dir.			0
	Curve radius (R ₁), ft:		5730			4584			0
	Length of curve (L _{c1}), mi:		0.46			0.18			0
	Length of curve in segment (L _{c1,seg}), mi:		0.26			0.18			0
	2 Horizontal curve in segment?:		No			No			0
	Curve radius (R ₂), ft:								0
	Length of curve (L_{c2}) , mi: Length of curve in segment $(L_{c2,860})$, mi:								0
	ection Data								0
	h (W ₁), ft:		12	12	12	12			0
	houlder width (W _s), ft:		10	10	10	10			0
	pulder width (W _{is}), ft:		7	7	7	7			0
	idth (W _m), ft:		17	17	17	17			0
	trips on outside shoulders?:		Yes	Yes	Yes	Yes			0
umble s	Length of rumble strips for travel in increasing milepost direction, mi:		0.47	0.28	0.26	1.39			0
			0.47	0.28	0.26	1.39			0
umb l e e	Length of rumble strips for travel in decreasing milepost direction, mi trips on inside shoulders?:		0.47 No	0.28 No	0.26 No	1.59 No			0
	Length of rumble strips for travel in increasing milepost direction, mi:								0
	Length of rumble strips for travel in increasing milepost direction, mil								0
resence	of barrier in median:		Center	Center	Center	Center			0
	1 Length of barrier (L _{ib.1}), mi:		0.47	0.28	0.26	1.39			0
	Distance from edge of traveled way to barrier face (W _{off,in,1}), f	ft:	7	7	7	7			0
	2 Length of barrier (L _{b,2}), mi:		0.47	0.28	0.26	1.39			0
	Distance from edge of traveled way to barrier face (W _{off,in,2}), f	ft:	7	7	7	7			0
	3 Length of barrier ($L_{b,3}$), mi:								0
	Distance from edge of traveled way to barrier face (Woff.in.3), f	ft:							0
ledian b	arrier width (W _{ib}), ft:		2	2	2	2			0
earest c	listance from edge of traveled way to barrier face (W _{near}),	ft:							0
oadside	e Data								
ear zon	e width (W _{hc}), ft:		15	10	10	25			0
resence	of barrier on roadside:		Some	Some	Some	Some			0
	1 Length of barrier (L _{ob,1}), mi:		0.07	0.18	0.26	0.16			0
	Distance from edge of traveled way to barrier face (Wo	_{off,o,1}), ft:	10	10	10	10			0
	2 Length of barrier (L _{ob,2}), mi:		0.13	0.16	0.11	0.57			0
	Distance from edge of traveled way to barrier face (Wo	_{ff,o,2}), ft:	10	10	10	10			0
	3 Length of barrier (L _{ob,3}), mi:								0
	S Length of barrier (L _{ob,3}), mil								, v
	Distance from edge of traveled way to barrier face (W _{ol}	_{ff,o,3}), ft:							0
listance fro	Distance from edge of traveled way to barrier face ($W_{off,inc}$), ft: m edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:								0
istance fro istance fro	Distance from edge of traveled way to barrier face (Wolf and the state of traveled way to barrier face, increasing milepost (Wolf, and the medge of traveled way to barrier face, decreasing milepost (Wolf, and the state), fit								0
istance fro istance fro Camp Ac	Distance from edge of traveled way to barrier face (W_{ol} m edge of traveled way to barrier face, increasing milepost ($W_{olt,oic}$), ft m edge of traveled way to barrier face, decreasing milepost ($W_{olt,oic}$), ft ccess Data								0
istance fro istance fro amp Ac iravel in	Distance from edge of traveled way to barrier face (W_{ol} m edge of traveled way to barrier face, increasing milepost ($W_{olt,ole.}$), ft: m edge of traveled way to barrier face, decreasing milepost ($W_{olt,ole.}$), ft: ccess Data Increasing Milepost Direction								000000000000000000000000000000000000000
istance fro istance fro Camp Ac iravel in ntrance	Distance from edge of traveled way to barrier face (W _{ol} m edge of traveled way to barrier face, increasing milepost (W _{ottae}), ft: m edge of traveled way to barrier face, decreasing milepost (W _{ottae}), ft: treess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.):	t:	Lane Add	No	No	S-C Lane			000000000000000000000000000000000000000
istance fro istance fro Camp Ac iravel in ntrance	Distance from edge of traveled way to barrier face (W _{of} m edge of traveled way to barrier face, increasing milepost (W _{off,ke}), ft: m edge of traveled way to barrier face, decreasing milepost (W _{off,ke}), ft access Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _{ber})	t:	Lane Add	No 0.47	No 999				0 0 0
istance fro istance fro Camp Ac iravel in ntrance	$\label{eq:constraint} \begin{split} \hline Distance from edge of traveled way to barrier face (W_{off}) \\ m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft: \\ \hline m edge of traveled way to barrier face, increasi$	t:	Lane Add			0.2			0 0 0 0
istance fro istance fro Camp Ac iravel in ntrance	$\label{eq:constraint} \begin{split} & \mbox{Distance from edge of traveled way to barrier face (W_{off}) \\ & \mbox{m edge of traveled way to barrier face, increasing milepost (W_{off,ole}), ft; \\ & \mbox{m edge of traveled way to barrier face, decreasing milepost (W_{off,ole}), ft; \\ & \mbox{recassing Milepost Direction} \\ & \mbox{Ramp entrance in segment? (If yes, indicate type.):} \\ & \mbox{Distance from begin milepost to upstream entrance ramp gore (X_{0,ort}) \\ & \mbox{Length of ramp entrance in segment (L_{en,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi:} \\ & Length of ramp entrance in segment entrance ent$	t:	Lane Add			0.2 0.2			0 0 0 0 0 0 0 0
stance fro stance fro amp Ad ravel in ntrance amp	$\label{eq:linear_state} \begin{split} & \mbox{Distance from edge of traveled way to barrier face (W_{ot}) \\ & \mbox{m edge of traveled way to barrier face, increasing milepost (W_{ot,out}), fit: \\ & \mbox{m edge of traveled way to barrier face, decreasing milepost (W_{ot,out}), fit: \\ & \mbox{cess Data} \\ \hline & \mbox{Increasing Milepost Direction} \\ & \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ & \mbox{Distance from begin milepost to upstream entrance ramp gore (X_{u,ord}) \\ & \mbox{Length of ramp entrance (L_{en,inc}), mi: \\ & \mbox{Length of ramp entrance in segment (L_{en,seg,inc}), mi: \\ & \mbox{Entrance side?: } \\ \hline \end{array}$	t:		0.47	999	0.2 0.2 Right			0 0 0 0 0 0 0 0 0 0 0
stance fro stance fro amp Ac ravel in ntrance amp xit	$\label{eq:second} \hline \begin{tabular}{lllllllllllllllllllllllllllllllllll$	t: "), mi:	Lane Add		999 No	0.2 0.2			0 0 0 0 0 0 0 0 0 0 0
istance fro istance fro camp Ad iravel in ntrance amp xit	$\label{eq:second} \hline \begin{tabular}{lllllllllllllllllllllllllllllllllll$	t: "), mi:		0.47	999	0.2 0.2 Right			0 0 0 0 0 0 0 0 0 0 0
istance fro istance fro camp Ad iravel in ntrance amp xit	$\label{eq:constraint} \begin{split} \hline Distance from edge of traveled way to barrier face (W_{cr} m edge of traveled way to barrier face, increasing milepost (W_{ottoel}), ft: m edge of traveled way to barrier face, decreasing milepost (W_{ottoel}), ft: crees Data traveled way to barrier face, decreasing milepost (W_{ottoel}), ft: crees Data traveled way to barrier face, decreasing milepost (If yes, indicate type.): Distance from begin milepost to upstream entrance ramg gore (X_{ourt}). Length of ramp entrance (L_{en,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{ourt}), mi: Length of ramp entrance (L_{ex,inc}), mi: creater (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{ourt}), mi (Length of ramp exit (Lex,inc), mi: creater (X_{ourt}), mi (X_{ourt}),$	t: "), mi:		0.47	999 No	0.2 0.2 Right S-C Lane			0 0 0 0 0 0 0 0 0 0 0 0 0 0
istance fro istance fro camp Ad iravel in ntrance amp xit	$\label{eq:linear_states} \begin{split} & \mbox{Distance from edge of traveled way to barrier face (W_{cl}) \\ & \mbox{m edge of traveled way to barrier face, increasing milepost (W_{ut,uc}), ft: \\ & \mbox{m edge of traveled way to barrier face, decreasing milepost (W_{ut,uc}), ft: \\ & \mbox{cess Data} \\ \hline \mbox{Increasing Milepost Direction} \\ & \mbox{Ramp entrance in segment? (If yes, indicate type.): \\ & \mbox{Distance from begin milepost to upstream entrance ramp gore (X_{user}), th: \\ & \mbox{Length of ramp entrance (L_{en,inc}), mi: \\ & \mbox{Entrance side?: \\ & \mbox{Ramp exit in segment? (If yes, indicate type.): \\ & \mbox{Distance from ent metapost to downstream exit ramp gore (X_{user}), mi: \\ & \mbox{Length of ramp exit (Insegment? (If yes, indicate type.): \\ & \mbox{Distance from ent metapost to downstream exit ramp gore (X_{user}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: \\ & \mbox{Length of ramp exit in segment (L_{ex,seg,inc}), mi: $	t: "), mi:		0.47	999 No	0.2 0.2 Right S-C Lane 0.03 0.03			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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stance from amp Acd amp Acd amp Acd amp Acd amp Acd Action Arrange Action Actio	$\label{eq:second} \hline Distance from edge of traveled way to barrier face (W_{ot} m edge of traveled way to barrier face, increasing milepost (W_{ot,osc}), ft: m edge of traveled way to barrier face, decreasing milepost (W_{ot,osc}), ft: ceess Data traveled way to barrier face, decreasing milepost (W_{ot,osc}), ft: Ceess Data traveled way to barrier face, decreasing milepost (W_{ot,osc}), ft: Ceess Data traveled way to barrier face, decreasing milepost (W_{ot,osc}), ft: Ceess Data traveled way to barrier face, decreasing milepost (W_{ot,osc}), ft: Ceess Data traveled way to upstream entrance tramp gore (X_{oscr}). Length of ramp entrance (L_{en,inc}), mi: Centrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{oscr}), mi: Length of ramp exit in segment? (Length of, mi: Ceets decreasing Milepost Direction travel in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramp gore (X_{oscr}), mi: Length of weaving section in segment (L_{wex,seg,inc}), mi: Length of weaving section (L_{wex,seg,inc}), mi: Length of famp entrance (L_{en,dec}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{oscr}), Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{oscr}), Length of ramp exit in segment (L_{wex,seg,dec}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{oscr}), Length of weaving section in segment (L_{wex,seg,dec}), mi: Exit side?: Type B weave in segment? (If yes, yes, yes, yes, yes, yes, yes, yes,$	t: a), mi: ii: mi: mi: Year 2025 Year	Lane Drop Lane Add Lane Drop Yes 0.47 0.47 180800	0.47 Lane Drop No 999 No 0.47 No No No 147800	999 No 999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 144400			
stance from stance from amp Acd amp Acd amp Acd amp /leave	$\label{eq:second} \hline Distance from edge of traveled way to barrier face (W_{ot} m edge of traveled way to barrier face, increasing milepost (W_{ot,exc}), ft: m edge of traveled way to barrier face, decreasing milepost (W_{ot,exc}), ft: ceress Data traveled way to barrier face, decreasing milepost (W_{ot,exc}), ft: Ceress Data traveled way to barrier face, decreasing milepost (W_{ot,exc}), ft: Ceress Data traveled way to barrier face, decreasing milepost (W_{ot,exc}), ft: Ceress Data traveled way to barrier face, decreasing milepost (W_{ot,exc}), ft: Ceress Data traveled way to upstream entrance ramg gore (X_{ourn}). Length of ramp entrance (L_{en,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{ourn}), mi: Length of ramp exit in segment (L_{ex,esg,inc}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{ourn}), there there is egreent? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{ourn}), there there is egreent? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{ourn}), there there is egreent? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{ourn}), thength of ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{ourn}), thength of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{ourn}), thength of ramp exit in segment? (If yes, seguent, mile therance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{ourn}), thength of ramp exit in segment? (If yes, seguent, mile therance side?), mile therance side?: Type B weave in segment?: Length of weaving section (L_{wex,eeg}, mile, therance side?), mile there there way therance mentance ramp gore (X_{ourn}), thengt h$	t: a), mi: ii: ii: mi: mi: Year 2025 Year 2025	Lane Drop No Lane Add Lane Drop Yes 0.47 0.47	0.47 Lane Drop No 999 No 0.47 No 0.47	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 Right S-C Lane 0.03 Right No S-C Lane 0.03 0.03 Right No			
stance from Action Stance for Action Stance for Action Stance for Action Stance for Action Stance St	Distance from edge of traveled way to barrier face (W _{ot} m edge of traveled way to barrier face, increasing milepost (W _{ottue}), ft: m edge of traveled way to barrier face, increasing milepost (W _{ottue}), ft: cess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _{ouen}). R: Length of ramp entrance (L _{on,inc}), mi: Entraces ide?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{ouen}), mi: Length of ramp exit in segment (L _{ex.seg.inc}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{ouen}), mi: Length of ramp exit in segment (L _{ex.seg.inc}), mi: Length of ramp exit in segment?: Length of weaving section (L _{wev.seg.inc}), mi: Distance from end milepost to upstream entrance ramg gore (X _{ouen}). Length of ramp entrance in segment (L _{ex.seg.inc}), mi: Distance from end milepost to upstream entrance ramg gore (X _{ouen}). Length of ramp entrance in segment (L _{ex.seg.inc}), mi: Length of ramp entrance in segment (L _{ex.seg.inc}), mi: Length of ramp entrance in segment (L _{ex.seg.inc}), mi: Length of ramp entin segment?	t: a), mi: ii: ii: mi: Year 2025 Year 2025 Year	Lane Drop No Lane Add Lane Drop Lane Add Lane Add Lane Drop 180800 23300	0.47 Lane Drop No 999 No 0.47 No No No 147800	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 Right S-C Lane 0.03 0.03 Right No 0.03 0.03 Right No 144400 6200			
stance from and a standard and a standa	$\label{eq:second} \hline Distance from edge of traveled way to barrier face (W_{or} m edge of traveled way to barrier face, increasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: Distance from begin milepost to upstream entrance ramg gore (X_{o,ent}). The performance for map entrance (L_{en,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Length of ramp entrance in segment (L_{ex,eeg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side$	t: a), mi: ii: ii: mi: mi: Year 2025 Year 2025	Lane Drop Lane Add Lane Drop Yes 0.47 0.47 180800	0.47 Lane Drop No 999 No 0.47 No No No 147800	999 No 999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 144400			
stance from a stance st	Distance from edge of traveled way to barrier face (W _{or} m edge of traveled way to barrier face, increasing milepost (W _{ottoel}), ft: m edge of traveled way to barrier face, decreasing milepost (W _{ottoel}), ft: m edge of traveled way to barrier face, decreasing milepost (W _{ottoel}), ft: m edge of traveled way to barrier face, decreasing milepost (W _{ottoel}), ft: ceess Data Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _{ourn}). Length of ramp entrance (L _{en.inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X _{ourn}), mi: Length of ramp exit (L _{ex.inc}), mi: Length of weaving section in segment (L _{ewex.seg.inc}), mi: Length of weaving section in segment (L _{ewex.seg.inc}), mi: Detance from end milepost to upstream entrance ramp gore (X _{ourn}), Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramg gore (X _{ourn}), Length of ramp entrance (l _{en.dec}), mi: Length of ramp entrance (l _{en.dec}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin mileposto to downstream exit ramg gore (X _{ourn}),	t: a), mi: a), mi:	Lane Drop Lane Add Lane Drop Yes 0.47 0.47 180800 23300 8600	0.47 Lane Drop No 999 No 0.47 No No No 147800	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 144400 6200 18700			
stance from a stance st	$\label{eq:second} \hline Distance from edge of traveled way to barrier face (W_{or} m edge of traveled way to barrier face, increasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: m edge of traveled way to barrier face, decreasing milepost (W_{ort,ex}). ft: Distance from begin milepost to upstream entrance ramg gore (X_{o,ent}). The performance for map entrance (L_{en,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Exit side?: Type B weave in segment? (If yes, indicate type.): Distance from end milepost to upstream entrance ramg gore (X_{o,ent}), mi: Length of ramp entrance in segment (L_{ex,eeg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side?: Type B weave in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{o,ent}), mi: Entrance side$	rmi: mi: 2025 Year 2025 Year 2025	Lane Drop No Lane Add Lane Drop Lane Add Lane Add Lane Drop 180800 23300	0.47 Lane Drop No 999 No 0.47 No No No 147800	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 Right S-C Lane 0.03 0.03 Right No 0.03 0.03 Right No 144400 6200			

Lane width (W), ft: 12 Right shoulder width (W _{1s}), ft: 7 Left shoulder width (W _{1s}), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: 8 Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb,1}), mi: 0.25 0 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 20 2 Length of barrier (L _{tb,2}), mi: 0.25 0 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: 9 Presence of barrier on left side of roadway: No 1 1 Length of barrier (L _{tb,2}), mi: 0 1 0 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: No 1 Length of barrier (L _{tb,2}), mi: 0 1 0 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 2 2 Length of barrier (L _{tb,2}), mi: 0 1 0 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: 1 Ramp Acccess Data See note See note	Segment 2				-
V/tew results in Column C.1) V/tew results in Advisory Messages) Period Basic Roadway Data 2 Number of through lanes (n): 2 Ramp segment description: EB. Off Ram Segment Length (L), mi: 0.33 Average traffic speed on the freeway (V _{frwy}), mi/h: 65 Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes Curve radius (R), ft: Length of curve (L _{c1}), mi: Length of curve (l _{c1}), mi: Curve radius (R), ft: Length of curve (l _{c2}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Length of curve (l _{c3}), ft: Length of taper in segment (L _{c3,seg}), mi: Ramp or Mitin (M ₁₀		Segment 3	Segment 4	Segment 5	Segment
Basic Roadway Data Number of through lanes (n): 2 Ramp segment description: EB. Off Ram Segment length (L), mi: 0.33 Average traffic speed on the freeway (V _{twy}), mi/h: 65 Segment tength (L), mi: 0.33 Average traffic speed on the freeway (V _{twy}), mi/h: 65 Segment tength (L), mi: Signal Alignment Data ◆See notes Horizontal curve?: No Curve radius (R ₁), ft: Ength of curve (L _{c1}), mi: Length of curve (L _{c2}), mi: Length of curve (L _{c2}), mi: Length of curve in segment (L _{c2,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Qurve radius (R ₂), ft: Length of curve (L _{c2}), mi: Length of curve (L _{c2}), mi: Curve radius (R ₃), ft: Length of curve (L _{c3}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-m	Study	Study	Study	Study	Study
Number of through lanes (n): 2 Aamp segment description: EB. Off Ram Segment length (L), mi: 0.33 Warrage traffic speed on the freeway (V _{trwy}), mi/h: 65 Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes 1 Horizontal curve?: No Curve radius (R ₁), ft: Length of curve (L _{c1}), mi: Length of curve (L _{c2}), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: Length of curve (L _{c2}), mi: Length of curve (L _{c2}), mi: 2 Horizontal curve?: Curve radius (R ₂), ft: Length of curve in segment (L _{c2,aeg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve (L ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Length of curve in segment (L _{c3,aeg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of taper in segment (L _{c3,aeg}), mi: Anor other width (W _{b1}), ft: 7 7 4 Presence of lane add or lane drop by taper: <	Period	Period	Period	Period	Period
Ramp segment description: EB. Off Ramp Segment length (L), mi: 0.33 Average traffic speed on the freeway (V _{rwy}), mi/h: 65 Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes Curve radius (R ₁), ft: Length of curve in segment (L _{c1,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: Curve radius (R ₂), ft: Length of curve in segment (L _{c2,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (L _{c2,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Curve radius (R ₃), ft: 1 Length of curve in segment (L _{c3,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: 1 Length of taper in segment (L _{c3,seg}), mi: 7 .eff shoulder width (W ₁₆), ft: 7 .eff shoulder width (W ₁₆), ft: 7 <td>1</td> <td>2</td> <td>1</td> <td>1</td> <td>2</td>	1	2	1	1	2
Begment length (L), mi: 0.33 Average traffic speed on the freeway (V _{trwy}), mi/h: 65 Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes 1 Horizontal curve (L _{c1}), mi: Length of curve (L _{c1}), mi: Length of curve (L _{c2}), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: Curve radius (R ₂), ft: Length of curve (L _{c2}), mi: Length of curve (L _{c2}), mi: Length of curve in segment (L _{c2,ang}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (L _{c2,ang}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (L _{c2,ang}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Carve radius (R ₃), ft: Length of curve in segment (L _{c2,ang}), mi: Ramp wile of beginning of curve in direction of travel (X ₃), mi: Length of bergin on gode turveled way to barrier face (W _{attri}), ft: O Curve radius	1	2	1	1	2
Average traffic speed on the freeway (V _{rwy}), m/h: 65 Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes 1 Horizontal curve?: No Curve radius (R ₁), ft: Length of curve (L _{c1}), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: 2 Horizontal curve?: Curve radius (R ₂), ft: Length of curve (L _{c2}), mi: 2 Horizontal curve?: Curve radius (R ₂), ft: Length of curve (L _{c2}), mi: 2 Horizontal curve?: Curve radius (R ₃), ft: Length of curve (L _{c2}), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (L _{c3,seg}), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: 12 4 Expendent (W ₁), ft: 7 12 5 Horizontal or segment (L _{c3,seg}), mi: 7 12 6 Fashoulder width (W _{nb}), ft: 7 12 4 Presence of lane add or lane drop by taper: No No 1 Length of barrier (L _n				-	
Segment type (ramp or collector-distributor road): Exit Type of control at crossroad ramp terminal: Signal Alignment Data See notes Horizontal Curve Data See notes 1 Horizontal curve?: No Curve radius (R1), ft: Length of curve (In-1), mi: Horizontal Curve?: Curve radius (R2), ft: Curve radius (R2), ft: Curve radius (R2), ft: Length of curve in segment (Lc2,seg), mi: Ramp-mile of beginning of curve in direction of travel (X2), mi: Horizontal curve?: Curve radius (R3), ft: Curve radius (R3), ft: Length of curve in segment (Lc2,seg), mi: Ramp-mile of beginning of curve in direction of travel (X2), mi: Horizontal curve?: Curve radius (R3), ft: Curve radius (R3), ft: Length of curve in segment (Lc3,seg), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi: Presence of lane add or lane drop by taper: Length of taper in segment (Laddseg or Larop,seg), mi: Presence of barrier on right side of roadway: Yes 1 Length of barrier (Ln,1), mi: 0.25 Distance from edge of traveled way to barrier face (Waff,1), ft: 20 2 Length of barrier (Ln,2), mi: </td <td>0.38</td> <td>0.14</td> <td>0.46 65</td> <td>0.26</td> <td>0.29</td>	0.38	0.14	0.46 65	0.26	0.29
Type of control at crossroad ramp terminal: Alignment Data Horizontal Curve Data Curve radius (R ₁), ft: Length of curve (L _{c1}), mi: Length of curve (L _{c1}), mi: Length of curve (L _{c2}), mi: Length of curve (L _{c3}), mi: Length of taper in segment (L _{c3}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Cross Section Data Presence of lane add or lane drop by taper: No RoadSide Data Presence of lane add or lane drop by taper: No Length of barrier (L _{t0}), mi: Distance from edge of traveled way to barrier face (W _{off,1}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{t0}), mi: Distance from edge of traveled way to barrier face (W _{off,1}), ft: 2 Length of barrier (L _{t0}), mi: Distance from edge of traveled way to barrier face (W _{off,1}), ft: 2 Length of barrier (L _{t0}), mi: Distance from edge of traveled way to barrier face (W _{off,1}), ft: Curve tapet of tarve to any to barrier face (W _{off,1}), ft: Distance from edge of traveled way to barrier face (W _{off,1}), ft: Distance from edge of traveled way to barrier face (W _{off,1}), ft: Distance from edge of traveled way to barrier face (W _{off,1}), ft: Distance from edge of traveled way to barrier fac					
Alignment Data See notes Horizontal Curve Data See notes 1 Horizontal curve?: No Curve radius (R ₁), ft: Length of curve (Inc1, mi: Length of curve in segment (Lc1,seg), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: Length of curve (Inc2), mi: Length of curve (Inc2), mi: Length of curve (Inc2), mi: Length of curve in segment (Lc2,seg), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (Lc3,seg), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Length of curve in segment (Lc3,seg), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Totes Section Data Lane width (W), ft: 12 Right shoulder width (W ₁₆), ft: 7 Left shoulder width (W ₁₆), ft: 7 Left shoulder width (W ₁₆), ft: 7 Length of barrier (L _{b,1}), mi: 0.25 Distance from edge of traveled way to barrier face (Exit	Entrance	Entrance	Exit	Entrand
Horizontal Curve Data See notes 1 Horizontal curve?: No Curve radius (R ₁), ft: Length of curve (L _{c1}), mi: No Length of curve in segment (L _{c1,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₁), mi: 2 Horizontal curve?: Curve radius (R ₂), ft: Length of curve (L _{c2}), mi: Length of curve (L _{c2}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: 3 Horizontal curve?: Curve radius (R ₃), ft: Length of curve in segment (L _{c3,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Length of curve in segment (L _{c3,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: To the second (X ₃), mi: Ramp of tape in segment (L _{c3,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Rapt shoulder width (W ₁₅), ft: 7 Length of tape in segment (L _{add,seg} or L _{drop,seg}), mi: No Length of barrier (L _{b1}), mi: 0.25	Signal	Signal	Signal	Signal	Signa
1 Horizontal curve?: No Curve radius (R1), ft: Length of curve (Lc1), mi: Length of curve in segment (Lc1.seg), mi: Ramp-mile of beginning of curve in direction of travel (X1), mi: 2 Horizontal curve?: Curve radius (R2), ft: Length of curve in segment (Lc2.seg), mi: Ramp-mile of beginning of curve in direction of travel (X2), mi: 3 Horizontal curve?: Curve radius (R3), ft: Curve radius (R3), ft: Length of curve (Lc2), mi: Length of curve in segment (Lc3.seg), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi: Curve radius (R3), ft: 12 Right shoulder width (W1), ft: 7 Length of taper in segment (Lc3.seg), mi: 7 Left shoulder width (W1), ft: 7 Presence of lane add or lane drop by taper: No Length of barrier (Lnb, 1), mi: 0.25 Distance from edge of traveled way to barrier face (Waff, 1), ft: 20 2 Length of barrier (Lnb, 2), mi: No Distance from edge of traveled way to barrier face (Waff, 2), ft: No Presence of bar					
Curve radius (R1), ft:Image: Curve in segment (Lc1.seg), mi:Length of curve in segment (Lc1.seg), mi:Ramp-mile of beginning of curve in direction of travel (X1), mi:2Horizontal curve?:Curve radius (R2), ft:Length of curve (Lc2), mi:Length of curve (Lc2), mi:Length of curve (Lc2), mi:Curve radius (R3), ft:Length of curve (Lc2), mi:Curve radius (R3), ft:Length of curve (Lc3), mi:Curve radius (R3), ft:Length of curve (Lc3), mi:Curve radius (R3), ft:Length of curve in segment (Lc3,seg), mi:Ramp-mile of beginning of curve in direction of travel (X3), mi:Curve radius (R3), ft:12Length of curve in segment (Lc3,seg), mi:Ramp-mile of beginning of curve in direction of travel (X3), mi:Cross Section Data12Lane width (W1), ft:12Right shoulder width (W1s), ft:4Presence of lane add or lane drop by taper:NoLength of taper in segment (Laddseg or Ldrop.seg), mi:Raddside DataPresence of barrier on night side of roadway:Yes1Length of barrier (L10,2), mi:0.25Distance from edge of traveled way to barrier face (W _{offL1} ,1), ft:202Length of barrier (L10,2), mi:1Distance from edge of traveled way to barrier face (W _{offL1} ,1), ft:202Length of barrier (L10,2), mi:1Distance from edge of traveled way to barrier face (W _{offL1} ,1), ft:22Length of barrier (L10,2), mi:1Distance from edge of traveled way to barrier face (W _{offL1} ,1), ft:2					
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	In Seg.	In Seg.	Off Seg.	No	No
Length of curve in segment $(L_{c1,seg})$, mi: Ramp-mile of beginning of curve in direction of travel (X_1) , mi:2Horizontal curve?: Curve radius (R_2) , ft: Length of curve (L_{c2}) , mi: 	316	357	357		
Ramp-mile of beginning of curve in direction of travel (X1), mi:2Horizontal curve?:Curve radius (R2), ft:Length of curve (Lc2), mi:Length of curve (Lc2), mi:Ramp-mile of beginning of curve in direction of travel (X2), mi:3Horizontal curve?:Curve radius (R3), ft:Length of curve (Lc3), mi:Length of curve in segment (Lc3,seg), mi:Ramp-mile of beginning of curve in direction of travel (X3), mi:Total curve?Curve radius (R3), ft:12Right shoulder width (W1), ft:12Right shoulder width (W1), ft:7Length of taper in segment (Ladd,seg or Ldrop,seg), mi:NoRoadside DataPresence of lane add or lane drop by taper:NoPresence of barrier on right side of roadway:Yes1Length of barrier (Lt5,1), mi:0.25Distance from edge of traveled way to barrier face (Woff,1), ft:202Length of barrier (Lt5,2), mi:Distance from edge of traveled way to barrier face (Woff,2), ft:Presence of barrier on left side of roadway:No1Length of barrier (Lt5,2), mi:Distance from edge of traveled way to barrier face (Woff,2), ft:Presence of barrier on left side of roadway:No1Length of barrier (Lt5,2), mi:Distance from edge of traveled way to barrier face (Woff,2), ft:Presence of barrier on might side of roadway:No1Length of barrier (Lt5,2)	0.27	0.09	0.09		
2 Horizontal curve?: Image: Curve radius (R ₂), ft: Curve radius (R ₂), ft: Length of curve in segment (L _{c2,seg}), mi: Ramp-mile of beginning of curve in direction of travel (X ₂), mi: Image: Curve radius (R ₃), ft: Curve radius (R ₃), ft: Image: Curve radius (R ₃), ft: Length of curve (L _{c3}), mi: Image: Curve radius (R ₃), ft: Length of curve (L _{c3}), mi: Image: Curve radius (R ₃), ft: Length of curve (L _{c3}), mi: Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Lang width of the of beginning of curve in direction of travel (X ₃), mi: Image: Cross Section Data Lane width (W ₁), ft: 12 Right shoulder width (W ₁₈), ft: 7 Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: 7 Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: 7 Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb,1}), mi: 0.25 Distance from edge of traveled way to barrier face (W _{off,12}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{tb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,11}), ft: 20 2 Length of barr	0.27	0.09			
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	0.11	0	0		
Length of curve (L_{c2}) , mi:Image: curve in segment $(L_{c2,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_2) , mi:3Horizontal curve?:Curve radius (R_3) , ft:Length of curve in segment $(L_{c3,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_3) , mi:Corves Section DataLane width (W_1) , ft:Right shoulder width (W_{rs}) , ft:Presence of lane add or lane drop by taper:NoLength of barrier $(L_{c3,1})$, mi:Roadside DataPresence of lane add or lane drop by taper:NoLength of barrier $(L_{rb,1})$, mi:Output of the per in segment $(L_{add,seg} \text{ or } L_{drop,seg})$, mi:Roadside DataPresence of barrier on night side of roadway:Yes1Length of barrier $(L_{rb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,11})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,12})$, ft:Ramp Access DataRamp entrance in segment? (If yes, indicate type.):NoLength of entrance s-c lane in se	No	No	In Seg.		
Length of curve in segment $(L_{c2,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_2) , mi:3Horizontal curve?:Curve radius (R_3) , ft:Length of curve (L_{c3}) , mi:Length of curve in segment $(L_{c3,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_3) , mi:Cross Section DataLane width (W_1) , ft:12Right shoulder width (W_{rs}) , ft:Presence of lane add or lane drop by taper:NoLength of taper in segment $(L_{add,seg} \text{ or } L_{drop,seg})$, mi:Roadside DataPresence of barrier on right side of roadway:Yes1Length of barrier $(L_{rb,1})$, mi:0.25Distance from edge of traveled way to barrier face $(W_{off,r,1})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,11})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,12})$, ft:Ramp Access DataRamp entrance in segment? (If yes, indicate type.):NoLength of entrance s-c lane in segment $(L_{en,seg})$, mi:Ramp Ramp exit in segment? (If yes, indicate type.):NoExitLength of exit s-			964		
Length of curve in segment $(L_{c2,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_2) , mi:3Horizontal curve?:Curve radius (R_3) , ft:Length of curve (L_{c3}) , mi:Length of curve in segment $(L_{c3,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_3) , mi:Cross Section DataLane width (W_1) , ft:12Right shoulder width (W_{rs}) , ft:Presence of lane add or lane drop by taper:NoLength of taper in segment $(L_{add,seg} \text{ or } L_{drop,seg})$, mi:Roadside DataPresence of barrier on right side of roadway:Yes1Length of barrier $(L_{rb,1})$, mi:0.25Distance from edge of traveled way to barrier face $(W_{off,r,1})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,11})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,12})$, ft:Ramp Access DataRamp entrance in segment? (If yes, indicate type.):NoLength of entrance s-c lane in segment $(L_{en,seg})$, mi:Ramp Ramp exit in segment? (If yes, indicate type.):NoExitLength of exit s-	1	1	0.11		
Ramp-mile of beginning of curve in direction of travel (X2), mi:3Horizontal curve?: Curve radius (R3), ft: Length of curve (Lc3), mi: Length of curve in segment (Lc3,seg), mi: Ramp-mile of beginning of curve in direction of travel (X3), mi:Cross Section DataLane width (W1), ft:12Right shoulder width (W1), ft:12Reget of lane add or lane drop by taper:NoLength of taper in segment (Ladd,seg or Ldrop,seg), mi:Roadside DataPresence of barrier on right side of roadway:Yes1Length of barrier (Lt0,1), mi:Distance from edge of traveled way to barrier face (W10,1,1), ft:20Length of barrier (Lt0,2), mi:Distance from edge of traveled way to barrier face (W10,1,1), ft:2Length of barrier (Lt0,2), mi:Distance from edge of traveled way to barrier face (W10,1,1), ft:Distance from edge of traveled way to barrier face (W10,1,2), ft:Ramp Access Data			0.11		<u> </u>
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			0.22		
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		+	No		<u> </u>
Length of curve (L_{c3}) , mi:Image: curve in segment $(L_{c3,seg})$, mi:Ramp-mile of beginning of curve in direction of travel (X_3) , mi:Cross Section DataLane width (W_i) , ft:12Right shoulder width (W_{rs}) , ft:7Left shoulder width (W_{rs}) , ft:7Left shoulder width (W_{rs}) , ft:4Presence of lane add or lane drop by taper:NoLength of taper in segment $(L_{add,seg}$ or $L_{drop,seg})$, mi:Roadside DataPresence of barrier on right side of roadway:Yes1Length of barrier $(L_{rb,1})$, mi:0.250Distance from edge of traveled way to barrier face $(W_{off,r,1})$, ft:202Length of barrier $(L_{rb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft:Presence of barrier on left side of roadway:No1Length of barrier $(L_{lb,2})$, mi:No2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,1})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,1})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,1})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,1})$, ft:2Length of barrier $(L_{lb,2})$, mi:Distance from edge of traveled way to barrier face $(W_{off,1})$, ft:3Length of entrance in segment? (If yes, indicate type.):No4Length of entrance s-c lane in segme			110		
Length of curve in segment ($L_{c3,seg}$), mi: Ramp-mile of beginning of curve in direction of travel (X_3), mi: Cross Section Data 12 Lane width (W_i), ft: 12 Right shoulder width (W_{rs}), ft: 7 Left shoulder width (W_{rs}), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment ($L_{add,seg}$ or $L_{drop,seg}$), mi: Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier ($L_{rb,1}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{rb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: Presence of barrier on left side of roadway: No 1 Length of barrier ($L_{b,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: Presence of barrier on left side of roadway: No No 1 Length of barrier ($L_{b,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 2 Length of barrier ($L_{b,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,12}$), ft: Ramp Access Data See note See note					
Ramp-mile of beginning of curve in direction of travel (X ₃), mi: Cross Section Data Lane width (W ₁), ft: 12 Right shoulder width (W _{1s}), ft: 7 Left shoulder width (W _{1s}), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: No Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb,1}), mi: 0.25 0 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 20 2 Length of barrier (L _{tb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,14}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,14}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,14}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to b					
Cross Section Data Lane width (W ₁), ft: 12 Right shoulder width (W _{1s}), ft: 7 Left shoulder width (W _{1s}), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: 8 Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb,1}), mi: 0.25 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 20 2 Length of barrier (L _{tb,2}), mi: 0.25 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{tb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{b,1}), mi: Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 2 2 Length of barrier (L _{b,2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 2 2 Length of barrier (L _{b,2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Ramp Access Data Ramp Ramp entrance in segment? (If yes, indi					
Lane width (W), ft: 12 Right shoulder width (Wrs), ft: 7 Left shoulder width (Wrs), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi: 8 Roadside Data 7 Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb,1}), mi: 0.25 1 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 20 2 Length of barrier (L _{tb,2}), mi: 10 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: 10 Presence of barrier on left side of roadway: No 1 Length of barrier (L _{b,1}), mi: 10 1 Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: 11 Presence of barrier on left side of roadway: No 11 1 Length of barrier (L _{b,2}), mi: 12 1 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 12 2 Length of barrier (L _{b,2}), mi: 12 12 1 Length of barrier (L _{b,2}), mi: 12 12 2					
Right shoulder width (W_{rs}), ft: 7 Left shoulder width (W_{rs}), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment ($L_{add,seg}$ or $L_{drop,seg}$), mi: 8 Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier ($L_{tb,1}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: 9 Presence of barrier on left side of roadway: No 1 Length of barrier ($L_{b,2}$), mi: 0.25 0 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: 9 Presence of barrier on left side of roadway: No 1 1 Length of barrier ($L_{b,1}$), mi: 0 1 0 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: No 2 Length of barrier ($L_{b,2}$), mi: 0 1 0 Distance from edge of traveled way to barrier face ($W_{off,r,4}$), ft: 1 Ramp Access Data See note S	1 10		10	1.	
Left shoulder width (Wis), ft: 4 Presence of lane add or lane drop by taper: No Length of taper in segment (Ladd.seg or Ldrop.seg), mi: Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (Ltb.1), mi: 0.25 1 Distance from edge of traveled way to barrier face (Worff,r,1), ft: 20 2 Length of barrier (Ltb.2), mi: Distance from edge of traveled way to barrier face (Worff,r,2), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (Ltb.2), mi: Distance from edge of traveled way to barrier face (Worff,r,2), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (Ltb.1), mi: Distance from edge of traveled way to barrier face (Worff,1), ft: 2 Length of barrier (Ltb.2), mi: Distance from edge of traveled way to barrier face (Worff,11), ft: 2 Length of barrier (Ltb.2), mi: Distance from edge of traveled way to barrier face (Worff,12), ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (Len,seg), mi: Exit Length of exit s-c lane in segment (Len,seg), mi	12	12	12	12	12
Presence of lane add or lane drop by taper: No Presence of lane add or lane drop by taper: No Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier (L _{tb.1}), mi: 0.25 0 Distance from edge of traveled way to barrier face (W _{off,r,1}), ft: 20 2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No No 1 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,11}), ft: 2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,12}), ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en.seg}), mi: Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex.seg}), mi:	7	7	7	7	7
Length of taper in segment ($L_{add,seg}$ or $L_{drop,seg}$), mi: Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier ($L_{tb,1}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: No 1 Length of barrier ($L_{b,2}$), mi: No 2 Length of barrier ($L_{b,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,L1}$), ft: 2 Length of barrier ($L_{b,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,L2}$), ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment ($L_{en,seg}$), mi: No Exit Length of exit s-c lane in segment ($L_{ex,seg}$), mi: No	4	4	4	4	4
Roadside Data Presence of barrier on right side of roadway: Yes 1 Length of barrier ($L_{tb,1}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: Presence of barrier on left side of roadway: No 1 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,1}$), ft: No 1 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,1}$), ft: No 2 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,1}$), ft: 2 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,1,2}$), ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Length of entrance s-c lane in segment ($L_{en,seg}$), mi: Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment ($L_{ex,seg}$), mi: No	No	No	No	No	No
Presence of barrier on right side of roadway: Yes 1 Length of barrier ($L_{tb,1}$), mi: 0.25 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 0 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 0 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: No 1 Length of barrier ($L_{lb,1}$), mi: 0 0 Distance from edge of traveled way to barrier face ($W_{off,L1}$), ft: No 2 Length of barrier ($L_{lb,2}$), mi: 0 0 Distance from edge of traveled way to barrier face ($W_{off,L2}$), ft: Ramp Access Data Ramp Access Data Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment ($L_{en,seg}$), mi: No Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment ($L_{ex,seg}$), mi: No					
1 Length of barrier ($L_{tb,1}$), mi: 0.25 1 Distance from edge of traveled way to barrier face ($W_{off,r,1}$), ft: 20 2 Length of barrier ($L_{tb,2}$), mi: 1 Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft: No 1 Length of barrier ($L_{tb,2}$), mi: No 1 Length of barrier ($L_{tb,1}$), mi: Distance from edge of traveled way to barrier face ($W_{off,L1}$), ft: 2 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,L2}$), ft: 2 Length of barrier ($L_{tb,2}$), mi: Distance from edge of traveled way to barrier face ($W_{off,L2}$), ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment ($L_{en,seg}$), mi: No Exit Length of exit s-c lane in segment ($L_{ex,seg}$), mi: No					
Distance from edge of traveled way to barrier face $(W_{off,r,1})$, ft: 20 2 Length of barrier $(L_{tb,2})$, mi: Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft: Presence of barrier on left side of roadway: No 1 Length of barrier $(L_{tb,1})$, mi: Distance from edge of traveled way to barrier face $(W_{off,r,2})$, ft: Presence of barrier on left side of roadway: No 1 Length of barrier $(L_{tb,1})$, mi: Distance from edge of traveled way to barrier face $(W_{off,L1})$, ft: 2 Length of barrier $(L_{tb,2})$, mi: Distance from edge of traveled way to barrier face $(W_{off,L2})$, ft: Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment $(L_{en,seg})$, mi: No Exit Length of exit s-c lane in segment $(L_{ex,seg})$, mi: No	Yes	Yes	Yes	Yes	Yes
2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,r.2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{tb.1}), mi: Distance from edge of traveled way to barrier face (W _{off,L1}), ft: No 2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en,seg}), mi: No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No	0.32	0.14	0.32	0.03	0.2
2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,r.2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{tb.1}), mi: Distance from edge of traveled way to barrier face (W _{off,L1}), ft: No 2 Length of barrier (L _{tb.2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en,seg}), mi: No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No	7	25	25	25	19
Distance from edge of traveled way to barrier face (W _{off,r,2}), ft: Presence of barrier on left side of roadway: No 1 Length of barrier (L _{lb,1}), mi: Distance from edge of traveled way to barrier face (W _{off,L1}), ft: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data See note Ramp Entrance Ramp entrance in segment? (If yes, indicate type.): No Entrance Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex.seg}), mi: No					
Presence of barrier on left side of roadway: No 1 Length of barrier (L _{lb,1}), mi: Distance from edge of traveled way to barrier face (W _{off,L1}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data Ramp entrance in segment? (If yes, indicate type.): No Length of entrance s-c lane in segment (L _{en,seg}), mi: Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No					
1 Length of barrier (L _{lb,1}), mi: Distance from edge of traveled way to barrier face (W _{off,11}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,12}), ft: Ramp Access Data Ramp Access Data Ramp entrance in segment? (If yes, indicate type.): Length of entrance s-c lane in segment (L _{en,seg}), mi: Ramp Exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi:	Yes	No	No	No	No
Distance from edge of traveled way to barrier face (W _{off,L1}), ft: 2 Length of barrier (L _{lb,2}), mi: Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data Ramp entrance in segment? (If yes, indicate type.): No Entrance Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex.seg}), mi:	0.02	NO	NO	NO	NO
2 Length of barrier (L _{b,2}), mi: Distance from edge of traveled way to barrier face (W _{off,12}), ft: Ramp Access Data Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi:	11				
Distance from edge of traveled way to barrier face (W _{off,L2}), ft: Ramp Access Data Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en,seg}), mi: No Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No					
Ramp Access Data See note Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en,seg}), mi: Ramp Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No			ļ		
Ramp Ramp entrance in segment? (If yes, indicate type.): No Entrance Length of entrance s-c lane in segment (L _{en.seg}), mi: No Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex.seg}), mi: No					
Entrance Length of entrance s-c lane in segment (L _{en.seg}), mi: Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex.seg}), mi: No					
Ramp Ramp exit in segment? (If yes, indicate type.): No Exit Length of exit s-c lane in segment (L _{ex,seg}), mi: No	No	No	No	No	No
Exit Length of exit s-c lane in segment (L _{ex,seg}), mi:					
Exit Length of exit s-c lane in segment (L _{ex,seg}), mi:	No	No	No	No	No
Weaving Weave section in collector-distributor road segment?:					
Section Length of weaving section (L _{wev}), mi:	1	1			
Length of weaving section in segment (L _{wev,seg}), mi:					
Traffic Data Year	1				1
Average daily traffic (AADT _r or AADT _c) by year, veh/d: 2025 8600		6200	6200	6200	244

	Inpu	t Worksheet for Crossroad Ramp	Terminals					
			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
			Study	Study	Study	Study	Study	Study
Decis Inte	(View results in Column T)	(View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
	rsection Data		B4	D4	1		1	1
	iinal configuration: iinal description:		South Ramp	North Ramp 1				
•	inal traffic control type:		South Ramp	Signal	lenn.			
	mp public street leg preser	at the terminal $(I_{-})^{2}$	Olgria	Signal				
Alignment		te de cree certifica (ips/						
	kew angle (I _{sk}), degrees:		-		1		1	1
· · ·			0.14	0.17				
	the adjacent ramp termin	n the outside crossroad leg (L _{str}), mi:	0.14	0.17				
		ar (Emp), ini.	0.14	0.14				
Traffic Co								
	Operational Mode	1						
Crossroad	Inside approach	Protected-only mode (I _{p,lt,in})?:	Yes	Yes				
	Outside approach	Protected-only mode (I _{p,lt,out})?:						
	Control Type							
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Sec								
Crossroad	median width (W _m), ft:		36	36				
Number o	f Lanes							
Crossroad	Both approaches	Lanes serving through vehicles (n _{th}):	4	4				
	Inside approach	Lanes serving through vehicles (n _{th,in}):	2	2				
	Outside approach	Lanes serving through vehicles (n _{th,out}):	2	2	0	0	0	0
Ramp	Exit ramp approach	All lanes (n _{ex}):	2	1				
Right-Turr	Channelization	see note: —	-					
Crossroad	Inside approach	Channelization present (Ich,in)?:						
	Outside approach	Channelization present (I _{ch,out})?	Yes	Yes				
Ramp	Exit ramp approach	Channelization present (Ich,ex)?:		Yes				
Left-Turn	Lane or Bay		I					
	Inside approach	Lane or bay present (I _{bay.lt.in})?:	Yes	Yes				
		Width of lane or bay (W _{b,in}), ft:	24	24				
	Outside approach	Lane or bay present (I _{bay,t.out})?:						
		Width of lane or bay $(W_{b.out})$, ft:						
Right-Tur	Lane or Bay	7, 5,007,		1				
_	Inside approach	Lane or bay present (Ibay,rt,in)?:		1				
	Outside approach	Lane or bay present (I _{bay,rt,in})?:	Yes	Yes				
Access D		Land of bay prosent (ibay,rt,out):.		1.03				
Access Da		execution (n):		1				
	driveways on the outside							
		on the outside crossroad leg (n _{ps}):						
Traffic Dat		Year		1 10:55				_
	ssroad Leg Data	2025	43400	43400				
	rossroad Leg Data	2025	37200	53400				
Exit Ramp	Data	2025	8600	6200				
Entrance I	Ramp Data	2025	6200	24400				

			Out	tput Summ	ary				
General Information									
Project description:	SR 202 at K	ernan Blvd	IMR, Openir	ng Year 2025	5 Build				
Analyst:	Arcadis		Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2025								
Last year of analysis:	2025								
Crash Data Descripti	on								
Freeway segments	Segment cr	ash data av	vailable?		No	First year o			
	Project-lev	el crash dat	a available?		No	Last year o	crash data:		
Ramp segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available?		No	Last year o	crash data:	:	
Ramp terminals	Segment cr	ash data av	vailable?		No	First year o	f crash data	:	
	Project-lev	el crash dat	a available?		No	Last year o	crash data:	:	
Estimated Crash Stat	tistics								
Crashes for Entire Fa	ncility			Total	K	Α	В	С	PDO
Estimated number of crashe	s during Study	Period, crashe	is:	169.4	0.7	2.2	12.4	39.6	114.5
Estimated average crash fre	q. during Study	Period, crashe	es/yr:	169.4	0.7	2.2	12.4	39.6	114.5
Crashes by Facility C	Component		Nbr. Sites	Total	K	Α	В	С	PDO
Freeway segments, cra	ashes:		4	134.1	0.6	1.5	9.1	28.6	94.4
Ramp segments, crash	es:		6	12.1	0.1	0.4	1.8	3.0	6.8
Crossroad ramp termin	nals, crashes	5:	2	23.2	0.0	0.2	1.5	8.1	13.4
Crashes for Entire Fa	ncility by Ye	ar	Year	Total	K	A	В	С	PDO
Estimated number of c	rashes durir	ng	2025	169.4	0.7	2.2	12.4	39.6	114.5
Distribution of Crash	es for Entir	e Facility	· · · · · · · · · · · · · · · · · · ·				· · · · ·		
Creek Time	Creat	h Turna Cat		Estim	ated Numb	per of Crash	es During t	the Study P	eriod
Crash Type	Crasi	h Type Cate	egory	Total	К	A	В	С	PDO
Multiple vehicle	Head-on cr	ashes:		0.6	0.0	0.0	0.1	0.3	0.3
	Right-angle	crashes:		7.8	0.0	0.1	0.6	2.8	4.3
	Rear-end c	rashes:		88.8	0.3	1.0	6.3	21.8	59.3
	Sideswipe of	crashes:		28.3	0.1	0.2	1.4	4.3	22.3
	Other mult	iple-vehicle	crashes:	3.3	0.0	0.0	0.3	0.8	2.2
	Total mul	tiple-vehicl	e crashes:	128.7	0.4	1.4	8.6	29.9	88.3
Single vehicle	Crashes wit	th animal:		0.5	0.0	0.0	0.0	0.0	0.5
	Crashes wit	th fixed obj	ect:	29.8	0.2	0.5	2.7	6.9	19.5
	Crashes wit	th other obj	ject:	3.5	0.0	0.0	0.1	0.4	2.9
	Crashes wit	th parked v	ehicle:	0.6	0.0	0.0	0.1	0.1	0.4
	Other singl	e-vehicle cr	ashes	6.2	0.1	0.2	0.9	2.2	2.9
	Total sing	le-vehicle c	rashes:	40.7	0.3	0.7	3.8	9.7	26.2
		Total crash	es:	169.4	0.7	2.2	12.4	39.6	114.5

MV = multiple-vehicle model			eet for Fre		gments Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment
SV = single-vehicle model	EXR = ra	mp exit n	nodel		Study	Study	Study	Study	Study	Study
Crash Modification Factors	A	oplicable	Models (y)	Period	Period	Period	Period	Period	Period
Fatal-and-Injury Crash CMFs										
Horizontal curve (CMF _{1,w,ac,y,fi}):	MV		ENR	EXR	1.010	1.000	1.000	1.003		
ane width (CMF _{2,w,ac,y,fi}):	MV	SV SV	ENR	EXR	1.040	1.000	1.000	1.015		
Dutside shoulder width (CMF _{8/8.ac.sv.fl}):		SV			1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,fi}):	MV	SV	ENR	EXR	0.983	0.983	0.983	0.983		
Median width (CMF _{4,w,ac,y,fi}):	MV	sv	ENR	EXR	1.151 0.954	1.151 0.954	1.151 0.954	1.151 0.954		
Median barrier (CMF _{5,w,ac,y,fi}):	MV	SV	ENR	EXR	1.191	1.191	1.191	1.191		
Shoulder rumble strip (CMF _{9,fs,sc,sv,fi}):		SV			0.958	0.906	0.906	0.918		
Dutside clearance (CMF _{10,fs,ac,sv,fi}):		SV			1.074	1.092	1.092	1.041		
Dutside barrier (CMF _{11,fs,ac,sv,fi}): .ane change (CMF _{7,fs,ac,mv,fi}):	MV	SV			1.041	1.116	1.136	1.050		
			Year:	2025	1.413	1.065	1.000	1.062		
Ramp entrance (CMF _{12,sc,nEN,at,fi}):			ENR							
Ramp exit (CMF _{13,sc,nEX,at,fi}):			Year:	2025 EXR	1.000	1.000	1.000	1.682 1.472		
tigh volume (CMF _{6,w,ac,y,fi}):	MV		ENR	EXR	1.296	1.220	1.229	1.264		
		SV			0.951	0.962	0.961	0.956		
Property-Damage-Only Crash CMFs Horizontal curve (CMF _{1.w.ac.y.pdo}):	MV			EVD	1.010	1 000	1 000	1 007		1
IONZONIA CUIVE (CIVII 1,w,ac,y,pdo).	INIV	sv	ENR	EXR	1.019 1.035	1.000 1.000	1.000	1.007		
ane width (CMF _{2,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Dutside shoulder width (CMF _{8,fs,ac,sv,pdo}):		SV			1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,pdo}):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
fedian width (CMF _{4,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.145 1.144	1.145 1.144	1.145 1.144	1.145 1.144		<u> </u>
fedian barrier (CMF _{5,w,ac,y,pdo}):	MV	sv	ENR	EXR	1.144	1.253	1.144	1.144		
Shoulder rumble strip (CMF _{9,fs,ac,sv,pdo}):		SV			1.000	1.000	1.000	1.000		
Dutside clearance (CMF _{10,fs,ac,sv,pdo}):		SV			1.000	1.000	1.000	1.000		
Dutside barrier (CMF _{11,fs,ac,sv,pdo}):	N.0 /	SV			1.054	1.153	1.180	1.066		
ane change (CMF _{7,fs,ac,mv,pdo}):	MV		Year:	2025	1.309	1.060	1.000	1.056		
Ramp entrance (CMF _{12,sc,nEN,at,pdo}):			ENR	2020	1.000	1.000	1.000	1.134		
Ramp exit (CMF _{13,sc,nEX,at,pdo}):				EXR	1.000	1.000	1.000	1.000		
ligh volume (CMF _{6.w.ac,y.pdo}):	MV		ENR	EXR	1.233	1.175	1.181	1.209		
Predicted Average Crash Frequency		SV			0.636	0.706	0.698	0.664		
Fredicted Average Crash Frequency Fatal-and-Injury Crash Frequency	/									
Freeway Segment Multiple-Vehicle Cr.	ash Analys	sis		Year						
Overdispersion parameter (k _{fs,n,mv,fi}):										
Dbserved crash count (N* _{o,fs,n,mv,fi}), cra	ishes:									
Reference year (r): Predicted average crash freq. for refer	ence vear	(N ₂ 4, 2, 200	.) crashe	as/vr						
Equivalent years associated with crash				Joryn.						
Expected average crash freq. for reference year										
Predicted average crash frequency				2025	9.747	3.023	2.296	13.944		
Freeway Segment Single-Vehicle Cras	sh Analysis	6		Year						
Overdispersion parameter (k _{fs,n,sv,fi}): Observed crash count (N* _{o,fs,n,sv,fi}), cra	shes:									
Reference year (r):	01100.									
Predicted average crash freq. for refer	ence year	(N _{p,fs,n,sv,fi}	,,), crashe	s/yr:						
Equivalent years associated with crash										
Expected average crash freq. for reference yea	ır given N* _o (N _{a/s.n.sv,1,r}), (crashes/yr:	0005	0.400	4 4 5 0	0.074	4.500		
Predicted average crash frequency Ramp Entrance Crash Analysis				2025 Year	2.192	1.150	0.974	4.509		
Overdispersion parameter (k _{sc,EN,at,fi}):				. ou.						
Observed crash count (N* _{o,sc,EN,al,fi}), cr	ashes:									
Reference year (r):										
Predicted average crash freq. for refer				ies/yr:						
Equivalent years associated with crash expected average crash freq. for reference yea										
Predicted average crash frequency	ii giveii iv _o (Na.sc.EN.at.A.r/	, crasnesryr.	2025	0.000	0.000	0.000	1.449		
Ramp Exit Crash Analysis				Year						
Overdispersion parameter (k _{sc,EX,at,fi}):										
Observed crash count (N* _{o,sc,EX,at,fi}), cr	ashes:									
Reference year (r): Predicted average crash freq. for refer	ence veer	(N_ ~~) rrach	es/vr						
Equivalent years associated with crash										
expected average crash freq. for reference year										
Predicted average crash frequency				2025	0.000	0.000	0.000	0.494		
Property-Damage-Only Crash Freque Freeway Segment Multiple-Vehicle Cra		is		Year	_					
Dverdispersion parameter (k _{fs,n,mv,pdo}):		-			I					
Observed crash count (N* _{o,fs,n,mv,pdo}), c	rashes:									
Reference year (r):										
Predicted average crash freq. for refer quivalent years associated with crash	ence year	(INp,fs,n,mv,	_{pdo,r}), cras .) vr:	nes/yr:						
expected average crash freq, for reference yea	r given N* _o (N _{a/s.n.mv.pdo}), crashes/yr							L
redicted average crash frequency			,	2025	23.407	7.143	5.581	35.011		
reeway Segment Single-Vehicle Cras Overdispersion parameter (k _{fs.n.sv.pdp}):	sı Analysis	>		Year			I			<u> </u>
Diserved crash count (N* _{o,fs,n,sv,pdo}), cl	rashes:									
Reference year (r):										
redicted average crash freq. for refer				nes/yr:						
quivalent years associated with crash xpected average crash freq. for reference year	i count (C _t	, fs.n.sv.pdo.r), yr: . crashes/w	:						
redicted average crash frequency	o	aloch, Sir pdo, r)	, e. condoryl.	2025	4.320	2.536	2.198	10.036		
amp Entrance Crash Analysis				Year						
Overdispersion parameter (k _{sc,EN,at,pdo})										
Observed crash count (N* _{o.sc,EN,at,pdo}), Reference year (r):	ordones:									<u> </u>
redicted average crash freq. for refer	ence year	(N _{p.sc,EN,at}	t.pdo,r), cras	shes/yr:						
quivalent years associated with crash	n count (Ct	.sc.EN.at.pdc	_{o.r}), yr:							
xpected average crash freq. for reference yea redicted average crash frequency	ir given N* _o (N _{a.sc.EN.al.pdo}	,), crashes/y	/r: 2025	0.000	0.000	0.000	3.202		-
Ramp Exit Crash Analysis				Year	0.000	0.000	0.000	0.202		
Overdispersion parameter (k _{sc,EX,at,pdo})										
Observed crash count (N* _{o,sc,EX,at,pdo}),	crashes:									
Reference year (r):		(N) cras	shoe/wr						<u> </u>
redicted average crash free for refer										
redicted average crash freq. for refer	n count (C-	(Pp.sc,EX,at	.,pdo,r), crae	siloo/yi						
Predicted average crash freq. for refer Equivalent years associated with crash Expected average crash freq. for reference year	n count (Ct	.sc,EX,at,pdp	,,), yr:	n:						
quivalent years associated with crash	n count (Ct	.sc,EX,at,pdp	,,), yr:		0.000	0.000	0.000	0.922		

Output Wo	orksheet for F	Ramp Seg	ments					
MV = multiple-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model		icable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Horizontal curve (CMF _{1,w,x,y,fi}):	MV		1.000	1.989	1.059	1.039	1.000	1.000
		SV	1.000	4.054	1.183	1.120	1.000	1.000
Lane width (CMF _{2, w,x,y,fi}):	MV	SV	1.096	1.096	1.096	1.096	1.096	1.096
Right shoulder width (CMF _{3,w,x,y,fi}):	MV	SV	1.055	1.055	1.055	1.055	1.055	1.055
Left shoulder width (CMF _{4,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Right side barrier (CMF _{5,w,x,y,fi}):	MV	SV	1.012	1.272	1.012	1.008	1.001	1.012
Left side barrier (CMF _{6,w,x,y,fl}):	MV	SV	1.000	1.002	1.000	1.000	1.000	1.000
Weaving section (CMF _{9,cds,ac,at,fi}):	MV	SV						
	Year:	2025	1.000	1.000	1.000	1.000	1.000	1.000
Ramp speed-change lane (CMF _{8,w,x,mv,fi}):	MV		1.000	1.000	1.000	1.000	1.000	1.000
Lane add or drop (CMF _{7,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Property-Damage-Only Crash CMFs		1						
Horizontal curve (CMF _{1,w,x,y,pdo}):	MV		1.000	1.692	1.042	1.027	1.000	1.000
		SV	1.000	4.981	1.239	1.156	1.000	1.000
Lane width (CMF _{2, w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Right shoulder width (CMF _{3,w,x,y,pdo}):	MV	SV	1.026	1.026	1.026	1.026	1.026	1.026
Left shoulder width (CMF _{4,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Right side barrier (CMF _{5,w,X,y,pdo}):	MV	SV	1.011	1.247	1.011	1.007	1.001	1.011
Left side barrier (CMF _{6,w,x,y,pdo}):	MV	SV	1.000	1.001	1.000	1.000	1.000	1.000
Weaving section (CMF _{9,cds,ac,at,pdo}):	MV	SV						
	Year:	2025	1.000	1.000	1.000	1.000	1.000	1.000
Ramp speed-change lane (CMF _{8,w,x,mv,pdo}):	MV		1.000	1.000	1.000	1.000	1.000	1.000
Lane add or drop (CMF _{7,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency		1						
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,mv,fi}):								
Observed crash count (N* _{o,w,x,mv,fi}), crashes:								
Reference year (r):) araah	~~ <i>h</i> m						
Predicted average crash freq. for reference year ($N_{p,w}$ Equivalent years associated with crash count ($C_{b,w,x,m}$		es/yr.						
Expected average crash freq. for reference year given N^*_{o} ($N_{a,w,x,m}$ Predicted average crash frequency	_{iv,fi,r}), crasnes/yr:	2025	0.024	0.099	0.034	0.067	0.008	0.485
Single-Vehicle Crash Analysis		Year	0.024	0.099	0.034	0.007	0.008	0.465
Overdispersion parameter (k _{wx.sv.fi}):		Tear						
Observed crash count (N* _{o.w.x.sv.fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N _{p.w}		es/vr:						
Equivalent years associated with crash count (C _{b.w.s.sv}	1 1							
Expected average crash freq. for reference year given N_{o}^{*} ($N_{a,w,x,s}$)								
Predicted average crash frequency	v,ii,i); =:===; ; ::	2025	0.338	3.179	0.097	0.312	0.215	0.456
Property-Damage-Only Crash Frequency			1 1		1			
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w.x.mv.pdo}):								
Observed crash count (N* _{o,w.x.mv.pdo}), crashes:								
Observed crash count (N* _{o,w.x,mv.pdo}), crashes: Reference year (r):								
	_{v,x,mv,pdo,r}), cras	shes/yr:						
Reference year (r):		shes/yr:						
Reference year (r): Predicted average crash freq, for reference year (N _{p,M}	_{v,pdo,r}), yr:							
Reference year (r): Predicted average crash freq. for reference year ($N_{\rm p,w}$ Equivalent years associated with crash count ($C_{\rm b,w,x,m}$	_{v,pdo,r}), yr:		0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w})$ Equivalent years associated with crash count $(C_{b,w,x,m})$ Expected average crash freq. for reference year given N [*] ₀ $(N_{a,w,x,m})$ Predicted average crash frequency Single-Vehicle Crash Analysis	_{v,pdo,r}), yr:	r:	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w})$ Equivalent years associated with crash count $(C_{b,w,x,m})$ Expected average crash freq. for reference year given N* _o $(N_{a,w,x,m})$ Predicted average crash frequency	_{v,pdo,r}), yr:	2025	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w})$ Equivalent years associated with crash count $(C_{b,w,x,m})$ Expected average crash freq. for reference year given N [*] ₀ $(N_{a,w,x,m})$ Predicted average crash frequency Single-Vehicle Crash Analysis	_{v,pdo,r}), yr:	2025	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,m}$ Expected average crash freq. for reference year given N* ₀ $(N_{a,w,x,m}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{0,w,x,sv,pdo})$, crashes: Reference year (r):	_{v,pdo,r}), yr: _{w,pdo,r}), crashes/yr	r: 2025 Year	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,m}$ Expected average crash freq. for reference year given N* ₀ $(N_{a,w,x,m}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w})$	_{v,pdo,r}), yr: _{w.pdo,r}), crashes/yr _{/,x,sv,pdo,r}), cras	r: 2025 Year	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,xm}$ Equivalent years associated with crash count $(C_{b,w,x,m}$ Expected average crash freq. for reference year given N* _o $(N_{a,w,xm}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,xsv}$ Equivalent years associated with crash count $(C_{b,w,x,sv}$	v,pdo,r), yr: w,pdo,r), crashes/yr ,y,x,sv,pdo,r), cras	r: 2025 Year hes/yr:	0.092	0.206	0.076	0.106	0.021	0.842
Reference year (r): Predicted average crash freq. for reference year $(N_{p,w,x,m}$ Equivalent years associated with crash count $(C_{b,w,x,m}$ Expected average crash freq. for reference year given N* ₀ $(N_{a,w,x,m}$ Predicted average crash frequency Single-Vehicle Crash Analysis Overdispersion parameter $(K_{w,x,sv,pdo})$: Observed crash count $(N^*_{o,w,x,sv,pdo})$, crashes: Reference year (r): Predicted average crash freq. for reference year $(N_{p,w})$	v,pdo,r), yr: w,pdo,r), crashes/yr ,y,x,sv,pdo,r), cras	r: 2025 Year hes/yr:	0.092	0.206	0.076	0.106	0.021	0.842

Output Worksheet	for Crossr	oad Ram	i – – – – – –					
Signal = signalized intersection model Unsig = unsignalized intersection model		cable dels	Terminal 1 Study Period	Terminal 2 Study Period	Terminal 3 Study Period	Terminal 4 Study Period	Terminal 5 Study Period	Terminal 6 Study Period
Crash Modification Factors	1110		Tenou	Tenou	Tenou	renou	T entou	Tenou
Fatal-and-Injury Crash CMFs								
Non-ramp public street leg (CMF _{19 w SG at f}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,fi}):	Signal	Unsig	0.772	0.791				
Protected left-turn operation (CMF _{16,w.SG,at,fi}):	Signal	011318	0.772	0.751				
The contract of the contract o	Year:	2025	0.564	0.608				
	Teal.	2023	0.504	0.008				
Channelized right turn on crossroad (CMF _{17.w.SG.at.fi}):	Signal	2040						
	Year:	2025	1.231	1.249				
Channelized right turn on exit ramp (CMF _{18.w.SG.at.fi}):	Signal	2025	1.231	1.245				
enalitienzea fight tarri on exit ramp (enit 18,w,sG,at,h).	Year:	2025	1.000	1.083				
	rear.	2023	1.000	1.005				
Access point frequency (CMF _{13.w.x.at.fi}):	Signal	Unsig						
Access point inequency (civil 13,w,x,at,h).	Year:	2025	1.000	1.000				
Crossroad left-turn lane (CMF _{11.w.x.at.fi}):	Signal	Unsig	1.000	1.000				
erossroad iere turn iane (eivin 11,w,x,at,fi).	Year:	2025	0.841	0.881				
Crossroad right-turn lane (CMF _{12.w.x.at.fi}):	1		0.641	0.001				
Crossroad fight-turn lane (Civil _{12,w,x,at,fi}).	Signal	Unsig	0.006	0 000				
Median width (CMF _{15 wx at fi}):	Year:	2025	0.906	0.899				
Wedian width (CIVIF _{15,w,x,at,fi}).	Signal	Unsig	0.002	0.002				
Evit roma conscitu (CME):	Year:	2025	0.993	0.892				
Exit ramp capacity (CMF _{10,w,x,at,fi}):	Signal	Unsig	1.070	1.002				
Skow angle (CME):	Year:	2025	1.070	1.063				
Skew angle (CMF $_{20,w,ST,at,fi}$):		Unsig						
All-way stop control (CMF _{awsc}):	Year:	2025						
		Unsig						
Property-Damage-Only Crash CMFs	1							
Non-ramp public street leg (CMF _{19,w,SG,at,pdo}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,pdo}):	Signal		0.771	0.790				
Protected left-turn operation (CMF _{16,w,SG,at,pdo}):	Signal							
	Year:	2025	0.696	0.727				
Channelized right turn on crossroad (CMF _{17,w,SG,at,pdo}):	Signal							
	Year:	2025	1.231	1.248				
Channelized right turn on exit ramp (CMF _{18,w,SG,at,pdo}):	Signal							
	Year:	2025	1.000	1.154				
Access point frequency (CMF _{13,w,x,at,pdo}):	Signal		ļ					
	Year:	2025	1.000	1.000				
Crossroad left-turn lane (CMF _{11,w,x,at,pdo}):	Signal	Unsig						
	Year:	2025	0.854	0.891				
Crossroad right-turn lane (CMF _{12,w,x,at,pdo}):	Signal	Unsig						
	Year:	2025	0.977	0.975				
Median width (CMF _{15,w,x,at,pdo}):	Signal							
	Year:	2025	0.644	0.564				
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency								
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,fi}):								
Observed crash count (N* _{o,w,x,at,fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year ($N_{p,w,x,at}$		s/yr:						
Equivalent years associated with crash count (C _{b,w,x,at,fi,r}),	yr:							
Expected average crash freq. for reference year given N* _o (N _{a.w.x.at.fi.r}),								
Predicted average crash frequency	·	2025	2.307	7.507				
_ · ·		2048						
Property-Damage-Only Crash Frequency								
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,pdo}):		•						
Observed crash count (N* _{o,w,x,at,pdo}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year ($N_{p,w,x,at}$	_{.pdo,r}), crash	nes/yr:						
Equivalent years associated with crash count (C _{b,w,x,at,pdo}		-						
Expected average crash freq. for reference year given N* _o (N _{a,w,x,at,pdo,}								
Predicted average crash frequency	, , ,,	2025	3.406	9.950				
				2.000				

		Enhanc	ed Interc	hange Safety Ana	alysis Too	bl		
General Information								
Project description:	SR 202 at	Kernan Blvd I	IMR, Desi	gn Year 2045 Buil	ld			
Analyst:	Arcadis)ate:	7/10/2020	Area	i type:	Urban	
First year of analysis:	2045							
Last year of analysis:	2045							
Crash Data Descripti	ion							
Freeway segments	No crash o	Jata	•					
Ramp segments	No crash o	data	-					
Ramp terminals	No crash o	data	•	•				
					•	•		
Program Control								
 Enter data in the Ma 2. Click Perform Calcu 					s, Input Ra	amp Termin	als worksheets	
			Prin	t Results (optiona	al)	Print Site	Summary (opti	ional)
 Review results in th Optionally, detailed Terminals worksheets 	results can	•					•	

	Input Worksheet for Free	way Segm	ents Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
		,	Study	Study	Study	Study	Study	Study
Basic Roa	(View results in Column AV) (View results in Advisory Mes adway Data	ssages)	Period	Period	Period	Period	Period	Period
Number of	through lanes (n):		8	8	7	7		
	egment description: ength (L), mi:		MP. 5.56-6.03 0.47	MP. 6.03-6.31 0.28	MP. 6.31-6.57 0.26	MP. 6.57-7.96 1.39		
Alignmen			0.47	0.20	0.20	1.55	<u> </u>	
-	I Curve Data See note							
1	Horizontal curve in segment?:		Both Dir.	No	No	Both Dir.		
	Curve radius (R ₁), ft: Length of curve (L _{c1}), mi:		5730 0.46			4584 0.18		
	Length of curve in segment ($L_{c1,seg}$), mi:		0.40			0.18		
2	Horizontal curve in segment?:		No			No		
	Curve radius (R ₂), ft:							
	Length of curve (L _{c2}), mi: Length of curve in segment (L _{c2 seg}), mi:							
Cross Sec								
Lane width	n (W _I), ft:		12	12	12	12		
	noulder width (W _s), ft:		10	10	10	10		
	ulder width (W _{is}), ft:		7 17	7 17	7 17	7		
	dth (W _m), ft: rips on outside shoulders?:		Yes	Yes	Yes	Yes		
	Length of rumble strips for travel in increasing milepost direction, m	ni:	0.47	0.28	0.26	1.39		
	Length of rumble strips for travel in decreasing milepost direction, r	mi:	0.47	0.28	0.26	1.39		
Rumble str	rips on inside shoulders?:		No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, m Length of rumble strips for travel in decreasing milepost direction, r							
	of barrier in median:		Center	Center	Center	Center		
1	Length of barrier (L _{ib,1}), mi:		0.47	0.28	0.26	1.39		
	Distance from edge of traveled way to barrier face ($W_{off,in,1}$), c Length of barrier ($L_{ib,2}$), mi:	rt:	7 0.47	7 0.28	7 0.26	7 1.39		
2	Distance from edge of traveled way to barrier face (W _{off.in.2}),	ft:	7	7	7	7		
3	Length of barrier (L _{ib,3}), mi:							
Madiana kao	Distance from edge of traveled way to barrier face (W _{off,in,3}),	ft:	2	2	2	2		
	rrier width (W _{ib}), ft: stance from edge of traveled way to barrier face (W _{near}), ft:	2	2	2	2		
Roadside		,,						
C l ear zone	e width (W _{ho}), ft:		15	10	10	25		
	of barrier on roadside:		Some	Some	Some	Some		
1	Length of barrier ($L_{ob,1}$), mi: Distance from edge of traveled way to barrier face (W	(0.07	0.18 10	0.26 10	0.16		
2	Length of barrier ($L_{ob,2}$), mi:	оп,о,17, тс	0.13	0.16	0.11	0.57		
	Distance from edge of traveled way to barrier face (W	off,o,2), ft:	10	10	10	10		
3	Length of barrier (L _{ob,3}), mi:							
Distance from	Distance from edge of traveled way to barrier face (W n edge of traveled way to barrier face, increasing milepost (W _{orfline}), ft							
	n edge of traveled way to barrier face, decreasing milepost (W _{off,inc}), in							
		π:						
Ramp Acc		π:				[
Travel in l	ncreasing Milepost Direction	t.		NI-	N-	C.C.Lara		
Travel in I Entrance	ncreasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No 0.47	No 999	S-C Lane		
Travel in l	ncreasing Milepost Direction		Lane Add	No 0.47	No 999	S-C Lane		
Travel in I Entrance	$\label{eq:received_state} \begin{array}{l} \hline \textbf{A} \end{tabular} \textbf{A} tabula$		Lane Add			0.2 0.2		
<i>Travel in I</i> Entrance Ramp	Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _u , Length of ramp entrance (L _{en,inc}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?:			0.47	999	0.2 0.2 Right		
Travel in I Entrance	$\label{eq:received_state} \begin{array}{l} \hline \textbf{A} \end{tabular} \textbf{A} tabula$	_{ent}), mi:	Lane Add			0.2 0.2		
Travel in I Entrance Ramp Exit	$\label{eq:received_state} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi:		0.47	999	0.2 0.2 Right S-C Lane 0.03		
Travel in I Entrance Ramp Exit	$\label{eq:received_segment} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi:		0.47	999	0.2 0.2 Right S-C Lane 0.03 0.03		
Travel in I Entrance Ramp Exit Ramp	$\label{eq:constraint} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi:	Lane Drop	0.47 Lane Drop	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit	$\label{eq:received} $$ Provide the transformation of trans$	_{ent}), mi: mi:		0.47	999	0.2 0.2 Right S-C Lane 0.03 0.03		
Travel in I Entrance Ramp Exit Ramp Weave	$\label{eq:received} $$ Provide the transformation of tra$	_{ent}), mi: mi:	Lane Drop	0.47 Lane Drop	999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I	$\label{eq:receasing Milepost Direction \\ \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi: mi:	Lane Drop	0.47 Lane Drop No	999 No 999 No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance	$\label{eq:received_static} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi: ni:	Lane Drop	0.47 Lane Drop No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I	$\label{eq:receasing Milepost Direction} \\ \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi: ni:	Lane Drop	0.47 Lane Drop No	999 No 999 No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance	$\label{eq:received_states} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi: ni:	Lane Drop	0.47 Lane Drop No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	_{ent}), mi: ni:	Lane Drop No	0.47 Lane Drop No 999	999 No 999 No No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit	$\label{eq:received_states} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	ent), mi; ni: : :	Lane Drop	0.47 Lane Drop No	999 No 999 No No	0.2 0.2 Right S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp	$\label{eq:received} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	ent), mi; ni: : :	Lane Drop No	0.47 Lane Drop No 999	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	ent), mi; ni: : :	Lane Drop No	0.47 Lane Drop No 999	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	ent), mi; ni: : :	Lane Drop No Lane Add Lane Drop	0.47 Lane Drop No 999 No 0.47	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	ent), mi; ni: : :	Lane Drop No	0.47 Lane Drop No 999	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	een), mi:	Lane Drop No Lane Add Lane Drop Lane Add Yes	0.47 Lane Drop No 999 No 0.47	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da	$\label{eq:response} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	een), mi:	Lane Drop No Lane Add Lane Drop Lane Drop Lane Add Vess 0.47	0.47 Lane Drop No 999 No 0.47	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Exit Ramp Traffic Da Proportion	$\label{eq:response} $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	ent), mi:	Lane Drop No Lane Add Lane Drop Lane Drop Ves 0.47 0.47	0.47 Lane Drop No 999 No 0.47 No	999 No 999 No 999 No 999 No 999	0.2 0.2 Night S-C Lane No Lane Add S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Exit Ramp Exit Ramp Weave Traffic Da Proportion Freeway S	$\label{eq:response} $$ Direction$$$ Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X_w, Length of ramp entrance [in segment (L_{en,ned}, mi: Length of ramp entrance [in segment (L_{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X_{w,wd}), r Length of ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X_{w,wd}), r Length of ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X_{w,wd}), r Length of ramp exit in segment? (Lex,seg,inc), mi: Length of ramp exit in segment?: Length of weaving section in segment (L_wex,seg,inc), mi: Distance from end miepost to upstream entrance ramp gore (X_{w,wd}), mi: Length of ramp entrance (L_{en,dec}), mi: Length of ramp entrance (L_{en,dec}), mi: Length of ramp entrance (L_{en,dec}), mi: Length of ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{w,ed}), mi: Length of ramp entrance (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{w,ed}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{w,ed}), mi: Length of ramp exit in segment? (Lex,seg,dec), mi: Length of ramp exit in segment (L_{wex,seg,dec}), mi: Length of weaving section (L_{wex,dec}), mi: Length of weaving section (L_{wex,dec}), mi: Length of weaving section in segment (L_{wex,seg,dec}), mi: Length of weaving section in segment (L_{wex,seg,dec}), mi: ta $	eet), mi: ni:), mi: , mi: ; Year 2045	Lane Drop No Lane Add Lane Drop Lane Drop Lane Add Vess 0.47	0.47 Lane Drop No 999 No 0.47	999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R	$\label{eq:response} $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	ent), mi:	Lane Drop No Lane Add Lane Drop Lane Drop Ves 0.47 0.47	0.47 Lane Drop No 999 No 0.47 No	999 No 999 No 999 No 999 No 999	0.2 0.2 Night S-C Lane No Lane Add S-C Lane 0.03 0.03 Right No		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R Average di	$\label{eq:response} $$ Direction$$$ Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X_{w,l} Length of ramp entrance (L_{un,inc)}, mi: Length of ramp entrance in segment (L_{un,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X_{u,nd}), or Length of ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X_{u,nd}), or Length of ramp exit in segment (L_{ux,seg,inc}), mi: Length of ramp exit in segment (L_{ux,seg,inc}), mi: Length of ramp exit in segment? (Length of weaving section in segment (L_{uev,seg,inc}), mi: Length of weaving section in segment (L_{uev,seg,inc}), mi: Length of weaving section in segment (L_{uev,seg,inc}), mi: Length of ramp entrance (L_{u,nde}), mi: Length of ramp entrance (L_{un,dec}), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{u,ed}) Length of ramp exit in segment (L_{ux,seg,dec}), mi: Exit side?: Type B weave in segment? (L_{ux,seg,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section (L_{uwv,dec}), mi: Length of weaving section in segment (L_{uev,seg,dec}), mi: $	ent), mi: ni:), mi:), mi: ; Year 2045 Year	Lane Drop No Lane Add Lane Drop Lane Add Vess 0.47 0.47 235800	0.47 Lane Drop No 999 No 0.47 No No 189300	999 No 999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 184600		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R Average di Average di	$\label{eq:response} $$ Direction$$$ Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X_w) Length of ramp entrance (L_{un,ue}), mi: Length of ramp entrance (L_un,ue), mi: Length of ramp entrance in segment (L_{un,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{u,ud}), Length of ramp exit in segment? (If yes, indicate type.): Distance from end milepost to downstream exit ramp gore (X_{u,ud}), Length of ramp exit in segment (L_{ux,seg,inc}), mi: Exit side?: Type B weave in segment?: Length of weaving section in segment (L_{uvex,seg,inc}), mi: Distance from end milepost to upstream entrance ramp gore (X_{u,un}) for a magnetic transformer (L_{uvex,seg,inc}), mi: Length of weaving section in segment (L_{uvex,seg,inc}), mi: Distance from end milepost to upstream entrance ramp gore (X_{u,un}). Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{u,un}). Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X_{u,un}). Length of ramp exit in segment (L_{ux,seg,dec}), mi: Exit side?: Type B weave in segment? (Lux,seg,dec), mi: Exit side?: Type B weave in segment? (Lux,seg,dec), mi: Length of weaving section in segment (L_{uvex,seg,dec}), mi: Isem of weaving section in segment (L_{uvex,seg,dec}), mi: Isem of weaving section in segment (L_{uvex,seg,dec}), mi: Isem of AADT during high-volume hours (P_h_v): Segment Data for Travel in Increasing Milepost Direction ally traffic (AADT 0,exi) by year, veh/d: Data for Travel in Increasing Milepost Direction ally traffic (AADT 0,exi) by year, veh/d: Data for Travel in Increasing Milepost Direction ally traffic (AADT 0,exi) by year, veh/d: Data for Travel in Increasing Milepost Direction ally traffic (AADT 0,exi) by year, veh/d: Data for Travel in Increasing Milepost Direction ally traffic (AADT 0,exi) by y$	ent), mi: mi: , mi: , mi: Year 2045 Year 2045	Lane Drop No Lane Add Lane Drop Lane Add Vess 0.47 0.47 235800	0.47 Lane Drop No 999 No 0.47 No No 189300	999 No 999 No 999 No 999 No 999	0.2 0.2 Right S-C Lane 0.03 Right No Lane Add S-C Lane 0.03 0.03 Right No 184600		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R Average d Exit Ramp Average d Exit Ramp	Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _w , Length of ramp entrance [In segment (L _{en,ned}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X _{w,mb}), r Length of ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X _{w,mb}), r Length of ramp exit in segment?: Length of waving section (L _{wex,inc}), mi: Length of weaving section in segment (L _{wex,seg,inc}), mi: Distance from end miepost to upstream entrance ramp gore (X _{w,wd}), r Length of ramp entrance in segment? (If yes, indicate type.): Distance from end miepost to upstream entrance ramp gore (X _{w,wd}), mi: Length of ramp entrance (L _{en,dec}), mi: Length of ramp entrance in segment (L _{ex,seg,dec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{w,wd}) Length of ramp exit in segment (L _{ex,seg,dec}), mi: Lexit side?: Type B weave in segment?: Length of ramp exit in segment?:	eet), mi: ni:), mi:), mi: ; Year 2045 Year 2045 Year 2045 Year	Lane Drop No Lane Add Lane Drop Lane Drop Yes 0.47 0.47 235800 34700 12300	0.47 Lane Drop No 999 No 0.47 No 189300 34700	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 0.3 0.03 0.03 0.03 No Lane Add S-C Lane 0.03 0.03 0.03 0.03 0.03 Right No 184600 8600		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R Average di Exit Ramp Average di Exit Ramp	Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _w , Length of ramp entrance [n segment (L _{en,seg,inc}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X _{w,mb}), r Length of ramp exit in segment? (Lex,seg,inc), mi: Length of ramp exit in segment? Length of ramp exit in segment? Length of waving section in segment (L _{wex,seg,inc}), mi: Length of weaving section in segment (L _{wex,seg,inc}), mi: Length of waving section in segment (L _{wex,seg,inc}), mi: Distance from end mlepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _{w,wl}) Length of ramp entrance (len,dec), mi: Length of ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{w,wl}) Length of ramp exit in segment? (Lex,seg,dec), mi: Length of ramp exit in segment (L _{wex,seg,dec}), mi: Exit side?: Type B weave in segment?: Length of weaving section in segment (L _{wex,seg,dec}), mi:	ent), mi: mi: , mi: , mi: Year 2045 Year 2045 Year 2045 Year	Lane Drop No Lane Add Lane Drop Lane Add Lane Ad	0.47 Lane Drop No 999 No 0.47 No 189300 34700	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 Right S-C Lane 0.03 0.03 Right No 0.03 0.03 Right No 184600 8600		
Travel in I Entrance Ramp Exit Ramp Weave Travel in I Entrance Ramp Exit Ramp Weave Traffic Da Proportion Freeway S Entrance R Average d: Exit Ramp Average d: Entrance R	Increasing Milepost Direction Ramp entrance in segment? (If yes, indicate type.): Distance from begin milepost to upstream entrance ramp gore (X _w , Length of ramp entrance [In segment (L _{en,ned}), mi: Length of ramp entrance in segment (L _{en,seg,inc}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X _{w,mb}), r Length of ramp exit in segment? (If yes, indicate type.): Distance from end miepost to downstream exit ramp gore (X _{w,mb}), r Length of ramp exit in segment?: Length of waving section (L _{wex,inc}), mi: Length of weaving section in segment (L _{wex,seg,inc}), mi: Distance from end miepost to upstream entrance ramp gore (X _{w,wd}), r Length of ramp entrance in segment? (If yes, indicate type.): Distance from end miepost to upstream entrance ramp gore (X _{w,wd}), mi: Length of ramp entrance (L _{en,dec}), mi: Length of ramp entrance in segment (L _{ex,seg,dec}), mi: Entrance side?: Ramp exit in segment? (If yes, indicate type.): Distance from begin milepost to downstream exit ramp gore (X _{w,wd}) Length of ramp exit in segment (L _{ex,seg,dec}), mi: Lexit side?: Type B weave in segment?: Length of ramp exit in segment?:	eet), mi: ni:), mi:), mi: ; Year 2045 Year 2045 Year 2045 Year	Lane Drop No Lane Add Lane Drop Lane Drop Yes 0.47 0.47 235800 34700 12300	0.47 Lane Drop No 999 No 0.47 No 189300 34700	999 No 999 No 999 No 999 No 999	0.2 0.2 0.2 0.3 0.03 0.03 0.03 No Lane Add S-C Lane 0.03 0.03 0.03 0.03 0.03 Right No 184600 8600		

Input Worksheet for Ramp Segr	-					
	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment
	Study	Study	Study	Study	Study	Study
(View results in Column CJ) (View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
Basic Roadway Data				-		-
Number of through lanes (n):	2	1	2	1	1	2
Ramp segment description:				EB. On Ramp		
Segment length (L), mi:	0.33	0.38	0.14	0.46	0.26	0.29
Average traffic speed on the freeway (V _{frwy}), mi/h:	65	65	65	65	65	65
Segment type (ramp or collector-distributor road):	Exit	Exit	Entrance	Entrance	Exit	Entranc
Type of control at crossroad ramp terminal:	Signal	Signal	Signal	Signal	Signal	Signa
Alignment Data						
Horizontal Curve Data See notes 🛹						
1 Horizontal curve?:	No	In Seg.	In Seg.	Off Seg.	No	No
Curve radius (R ₁), ft:		316	357	357		
Length of curve (L _{c1}), mi:		0.27	0.09	0.09		
Length of curve in segment (L _{c1,seq}), mi:		0.27	0.09			
Ramp-mile of beginning of curve in direction of travel (X ₁), m	ni:	0.11	0	0		
2 Horizontal curve?:		No	No	In Seg.		
Curve radius (R ₂), ft:				964		
Length of curve (L_{c2}) , mi:				0.11		
Length of curve in segment ($L_{c2,seg}$), mi:				0.11		
Ramp-mile of beginning of curve in direction of travel (X_2) , m	ni:			0.22		
3 Horizontal curve?:				No		
Curve radius (R ₃), ft:				NO		
Length of curve (L_{c3}), mi:						
Length of curve in segment ($L_{c3,seg}$), mi:						
Ramp-mile of beginning of curve in direction of travel (X_3) , m	11:					
Cross Section Data						
Lane width (W _I), ft:	12	12	12	12	12	12
Right shoulder width (W _{rs}), ft:	7	7	7	7	7	7
Left shoulder width (W _{is}), ft:	4	4	4	4	4	4
Presence of lane add or lane drop by taper:	No	No	No	No	No	No
Length of taper in segment (L _{add,seg} or L _{drop,seg}), mi:						
Roadside Data						
Presence of barrier on <u>right</u> side of roadway:	Yes	Yes	Yes	Yes	Yes	Yes
1 Length of barrier (L _{rb.1}), mi:	0.25	0.23	0.14	0.32	0.03	0.2
Distance from edge of traveled way to barrier face (W _{off,r,1}), ft:	20	7	25	25	25	19
2 Length of barrier (L _{rb.2}), mi:						
Distance from edge of traveled way to barrier face ($W_{off,r,2}$), ft:						
Presence of barrier on <u>left</u> side of roadway:	No	Yes	No	No	No	No
1 Length of barrier ($L_{b,1}$), mi:	NO	0.02	NO	NO	NO	NO
Distance from edge of traveled way to barrier face ($W_{off,l,1}$), ft:		11				
2 Length of barrier ($L_{lb,2}$), mi:	_					
Distance from edge of traveled way to barrier face (W _{off,l,2}), ft:						
Ramp Access Data See note						
Ramp Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	No
Entrance Length of entrance s-c lane in segment (L _{en,seg}), mi:						
Ramp Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	No
Exit Length of exit s-c lane in segment (L _{ex,seg}), mi:						
Weaving Weave section in collector-distributor road segment?:						
Section Length of weaving section (L _{wev}), mi:						
Length of weaving section in segment (L _{wev,seg}), mi:						
Traffic Data Year						

	Inpu	t Worksheet for Crossroad Ramp	Terminals					
	•	•	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
			Study	Study	Study	Study	Study	Study
	(View results in Column T)	(View results in Advisory Messages)	Period	Period	Period	Period	Period	Period
Basic Inte	ersection Data							
Ramp tern	ninal configuration:		B4	D4				
Ramp tern	ninal description:		South Ramp	North Ramp 1	Ferm.			
	ninal traffic control type:		Signal	Signal				
ls a non-ra	amp public street leg preser	it at the terminal (I _{ps})?:						
Alignmen	t Data							
Exit ramp :	skew angle (I _{sk}), degrees:							
Distance to the	he next public street intersection of	n the outside crossroad leg (L _{str}), mi:	0.14	0.17				
Distance to	o the adjacent ramp termin	al (L _{mp}), mi:	0.14	0.14				
Traffic Co	ontrol		•					
Left-Turn	Operational Mode							
Crossroad	•	Protected-only mode (I _{p.lt.in})?:	Yes	Yes				
	Outside approach	Protected-only mode (I _{p,it,in})?:						
Right-Tur	n Control Type	- C Pinjour		1				
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
· .	ction Data		-		1		1	
	median width (W _m), ft:		36	36	1	1	1	
Number o	(m/·							
Crossroad	Both approaches	Lanes serving through vehicles (nth):	4	4				
010001000	Inside approach	Lanes serving through vehicles (n _{th in}):	2	2				
	Outside approach	Lanes serving through vehicles (n _{th,in}):	2	2	0	0	0	0
Ramp	Exit ramp approach	All lanes (n _{ex}):	2	2				5
	n Channelization	see note:	•					
	Inside approach	Channelization present (I _{ch.in})?:						
	Outside approach	Channelization present (I _{ch,ut})?:	Yes	Yes				
Ramp	Exit ramp approach	Channelization present (I _{ch.ex})?:		Yes				
	Lane or Bay	enannenzation precent (ich,ex)						
		Long of how propert (1)2:	Yes	Yes				
Crossroad	Inside approach	Lane or bay present (I _{bay,It,in})?:	24	24				
		Width of lane or bay (W _{b,in}), ft:	24	24				
	Outside approach	Lane or bay present (I _{bay,It,out})?: Width of lane or bay (W _{b out}), ft:						
		width of falle of bay (w _{b,out}), it.						
-	n Lane or Bay							
Crossroad	Inside approach	Lane or bay present (I _{bay,rt,in})?:	Vaa					
	Outside approach	Lane or bay present (I _{bay,rt,out})?:	Yes	Yes				
Access D				_		1		-
	f driveways on the outside							
Number o	f public street approaches o	on the outside crossroad leg (n _{ps}):						
Traffic Da	ta	Year						
Inside Cro	ossroad Leg Data	2045	60700	60700				
Outside C	crossroad Leg Data	2045	52500	71700				
		2068						
Exit Ramp	o Data	2045	12300	8600				
Entrance	Ramp Data	2045	8600	34200				

			Out	tput Summa	ary				
General Information									
Project description:	SR 202 at K	ernan Blvd	IMR, Design	Year 2045 I	Build				
Analyst:	Arcadis		Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2045								
Last year of analysis:	2045								
Crash Data Description									
Freeway segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	ı:	
	Project-lev	el crash dat	a available?		No	Last year o	f crash data	:	
Ramp segments	Segment cr	ash data av	vailable?		No	First year o	f crash data	1:	
	Project-level crash data availa					Last year o	f crash data	:	
Ramp terminals	vailable?		No	First year o	f crash data	ı:			
	Project-lev	el crash dat	a available?		No	Last year o	f crash data	1:	
Estimated Crash Stat	tistics								
Crashes for Entire Fa	ncility			Total	K	A	В	С	PDO
Estimated number of crashe	s during Study	Period, crashe	is:	252.6	0.9	2.8	16.3	57.9	174.6
Estimated average crash fre	q. during Study	Period, crashe	es/yr:	252.6	0.9	2.8	16.3	57.9	174.6
Crashes by Facility C	Component		Nbr. Sites	Total	K	Α	В	С	PDO
Freeway segments, cra	ashes:		4	205.3	0.7	2.0	11.9	43.0	147.7
Ramp segments, crash	es:		6	15.7	0.2	0.5	2.4	3.9	8.6
Crossroad ramp termin	nals, crashes	5:	2	31.6	0.0	0.3	2.0	11.0	18.3
Crashes for Entire Fa	ncility by Ye	ar	Year	Total	K	A	В	С	PDO
Estimated number of c	rashes durir	ıg	2045	252.6	0.9	2.8	16.3	57.9	174.6
Distribution of Crash	es for Entir	e Facility							
Creeh Turne	Croo	- Turne Cet		Estim	ated Numb	per of Crash	es During	the Study P	eriod
Crash Type	Crasi	h Type Cate	egory	Total	К	A	В	С	PDO
Multiple vehicle	Head-on cr	ashes:		0.9	0.0	0.0	0.1	0.4	0.4
	Right-angle	crashes:		11.2	0.0	0.1	0.8	3.9	6.3
	Rear-end c	rashes:		141.6	0.5	1.5	8.8	33.6	97.4
	Sideswipe of	crashes:		45.9	0.1	0.3	1.9	6.8	36.8
	Other mult	iple-vehicle	crashes:	5.3	0.0	0.1	0.4	1.3	3.6
	Total mul	tiple-vehicl	e crashes:	205.0	0.6	2.0	12.0	46.0	144.4
Single vehicle	Crashes wit	th animal:		0.6	0.0	0.0	0.0	0.0	0.5
	Crashes wit	th fixed obj	ect:	35.0	0.2	0.6	3.1	8.5	22.6
	Crashes wit	th other obj	ject:	4.0	0.0	0.0	0.2	0.5	3.4
	Crashes wit	th parked ve	ehicle:	0.7	0.0	0.0	0.1	0.2	0.5
	Other singl	e-vehicle cr	ashes	7.3	0.1	0.2	1.0	2.7	3.3
	Total sing	le-vehicle c		47.6	0.3	0.8	4.4	11.8	30.3
		Total crash	es:	252.6	0.9	2.8	16.3	57.9	174.6

MV = multiple-vehicle model SV = single-vehicle model					gments	Some 1	Source 1	Sogram	Some	e
	EXR = ra	mp exit n			Segment 1 Study	Segment 2 Study	Segment 3 Study	Segment 4 Study	Segment 5 Study	Segment 6 Study
Crash Modification Factors	Ap	oplicable	Models (y)	Period	Period	Period	Period	Period	Period
Fatal-and-Injury Crash CMFs										
lorizontal curve (CMF _{1,w,ac,y,fi}):	MV	CV/	ENR	EXR	1.010	1.000	1.000	1.003		
ane width (CMF _{2,w,ac,y,fi}):	MV	SV SV	ENR	EXR	1.040	1.000 1.000	1.000	1.015		
Dutside shoulder width (CMF _{8,fs,ac,sv,fl}):		SV			1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,fi}): Median width (CMF _{4,w,ac,y,fi}):	MV MV	SV	ENR ENR	EXR EXR	0.983	0.983 1.151	0.983	0.983		
	1414	sv	ENIX	EAR	0.954	0.954	0.954	0.954		
Nedian barrier (CMF _{5,w,ac,y,fi}):	MV	SV	ENR	EXR	1.191	1.191	1.191	1.191		
Shoulder rumble strip (CMF _{9,fs,ac,sv,fi}): Dutside clearance (CMF _{10,fs,ac,sv,fi}):		SV SV			0.958	0.906	0.906	0.918		
Dutside barrier (CMF _{11,fs,ac,sv,fi}):		SV			1.041	1.116	1.136	1.050		
ane change (CMF _{7,fs,ac,mv,fi}):	MV			2045	4 205	1.000	1 000	4.050		
Ramp entrance (CMF _{12,sc,nEN,at,fi}):			Year: ENR	2045	1.395	1.060	1.000	1.056		
			Year:	2045	1.000	1.000	1.000	1.795	-	
Ramp exit (CMF _{13,sc,nEX,at,fi}): ligh volume (CMF _{6,w,ac,y,fi}):	MV		ENR	EXR EXR	1.000	1.000 1.311	1.000 1.314	1.472 1.341		
ngi volunio (oni _{6,w,ac,y,n)} .	1414	sv	LINIX	LAN	0.942	0.949	0.949	0.945		
Property-Damage-Only Crash CMFs	10/			EVD	4.040	4 000	4 000	4 007		
Horizontal curve (CMF _{1,w,ac,y,pdo}):	MV	sv	ENR	EXR	1.019	1.000	1.000	1.007		
ane width (CMF _{2,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Dutside shoulder width (CMF _{8,/s,ac,sv,pdo}):		SV	5110	51/0	1.000	1.000	1.000	1.000		
nside shoulder width (CMF _{3,w,ac,y,pdo}): //edian width (CMF _{4,w,ac,y,pdo}):	MV MV	SV	ENR ENR	EXR EXR	0.985	0.985 1.145	0.985	0.985		
		SV			1.144	1.144	1.144	1.144		
Median barrier (CMF _{5,w,ac,y,pdo}):	MV	SV	ENR	EXR	1.253	1.253	1.253	1.253		
Shoulder rumble strip (CMF _{9,fs,ac,sv,pdo}): Dutside clearance (CMF _{10,fs,ac,sv,pdo}):		SV SV			1.000	1.000	1.000	1.000		
Outside barrier (CMF _{11,fs,ac,sv,pdo}):		sv			1.054	1.153	1.180	1.066		
ane change (CMF _{7,fs,ec,mv,pdo}):	MV									
Ramp entrance (CMF _{12,sc,nEN,at,pdo}):			Year: ENR	2045	1.293	1.054	1.000	1.051 1.134		
Ramp exit (CMF _{13,sc,nEX,at,pdo}):				EXR	1.000	1.000	1.000	1.000		
ligh volume (CMF _{6,w,ac,y,pdo}):	MV		ENR	EXR	1.286	1.245	1.247	1.268		
Predicted Average Crash Frequency		SV			0.581	0.623	0.621	0.599		
Fatal-and-Injury Crash Frequency										
reeway Segment Multiple-Vehicle Cra	sh Analys	is		Year						
Overdispersion parameter (k _{fs.n.mv.fi}): Observed crash count (N* _{o.fs.n.mv.fi}), cras	shes:									
Reference year (r):										
redicted average crash freq. for refere				əs/yr:						
Equivalent years associated with crash expected average crash freq. for reference year										
Predicted average crash frequency	g	*e/s,n/mv/t(7/	ordonioor jr.	2045	15.061	4.673	3.500	21.232		
reeway Segment Single-Vehicle Cras	h Analysis	3		Year						
Dverdispersion parameter (k _{fs.n.sv.fi}): Dbserved crash count (N* _{o.fs.n.sv.fi}), cras	hes:									
Reference year (r):										
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Equivalent years associated with crash expected average crash freq. for reference year										
Predicted average crash frequency	given iv _o (i	Na/s,n/sv/l//h	arasnesi yi.	2045	2.576	1.331	1.121	5.225		
Ramp Entrance Crash Analysis				Year						
Overdispersion parameter (k _{sc,EN,at,fi}):										
bserved crash count (N*) cra	ishes:									
Dbserved crash count (N* _{o,sc,EN,at,fi}), cra Reference year (r):	ashes:									
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Reference year (r): Predicted average crash freq. for refere Equivalent years associated with crash ixpected average crash freq. for reference year	ence year count (C _e	,sc,EN,at,fi,r)	, yr:	es/yr: 2045	0.000	0.000	0.000	2.187		
Reference year (r): redicted average crash freq. for refere Equivalent years associated with crash xpected average crash freq. for reference year redicted average crash frequency Ramp Exit Crash Analysis	ence year count (C _e	,sc,EN,at,fi,r)	, yr:		0.000	0.000	0.000	2.187		
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Reference year (r): Predicted average crash freq. for refere Equivalent years associated with crash incred average crash freq. for reference year Predicted average crash frequency Ramp Exit Crash Analysis Duerdispersion parameter (K _{NEEX,410}); Dbserved crash count (N* _{0,50} EX,410);	ence year count (C _b r given N* ₀ (I	,sc,EN,at,fi,r)	, yr:	2045	0.000	0.000	0.000	2.187		
Reference year (r): producted average crash freq. for refere quivalent years associated with crash xpected average crash freq. for reference year predicted average crash frequency Ramp Exit Crash Analysis Pordispersion parameter (K _{MEEXath}), cra Reference year (r): redicted average crash freq. for reference year (r):	ence year count (C _b r given N* _o (I ashes:	(N _{p,sc,EX,at})	, yr: .crashes/yr: .,,r), crash	2045 Year	0.000	0.000	0.000	2.187		
Reference year (r): redicted average crash freq, for refere iquivalent years associated with crash spected average crash freq. for reference year redicted average crash frequency Ramp Exit Crash Analysis Voerdispersion parameter (K _{MeLEXALI}), cra Reference year (r): redicted average crash freq, for refere iquivalent years associated with crash	ence year count (C ₂ r given N* _o (I ashes: ence year count (C ₂	(Np.sc,EX.at,fi,r)	, yr: .crashes/yr: .,,r), crash , yr:	2045 Year es/yr:	0.000	0.000	0.000	2.187		
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keference year (r): redicted average crash freq, for refere quivalent years associated with crash xpected average crash freq. for reference year redicted average crash freq. for reference year terdispersion parameter (k _{e.E.X.at.}): Diserved crash count (N [*] _{0.06,E.X.at.}), cra keference year (r): redicted average crash freq. for refere quivalent years associated with ortherence year redicted average crash freq. for reference yeard average crash freq. for reference years and the term of the term of the term redicted average crash freq. The term redicted average crash frequency troperty-Damage-Only Crash Frequency troperty-Damage-Only Crash Frequency terway Segment Multiple-Vehicle Cra	ence year count (C _b r given N [*] _o (f ashes: ence year count (C _b r given N [*] _o (f ency	.sc,EN.at,fi,r) N _{asc,EN.at,fi} ,r) (N _{p.sc,EX.at,fi} ,r) N _{asc,EX.at,fi} ,r)	, yr: .crashes/yr: .,,r), crash , yr:	2045 Year es/yr:						
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telerence year (r): redicted average crash freq, for refere quivalent years associated with crash xpected average crash freq. for reference year redicted average crash freq. for reference year mp <i>Exit</i> Crash Analysis Diverdispersion parameter ($k_{u.C.EX.nt.}$): Diserved crash Count ($N_{o.s.E.EX.nt.}$), cra- deference year (r): redicted average crash freq. for reference year redicted average crash freq. For forence year redicted average crash freq. For forence year redicted average crash freq. Nor for the tence year redicted average result frequency <i>troperty-Damage-Only Crash Frequency</i> Diserved crash count ($N_{o.fsn.mw.pdo}$), or feference year (r):	ance year count (C_{tr} given N° ₀ (I ashes: ance year count (C_{tr} ency year N° ₀ (I ency ash Analys rashes:	.sc, EN.at, fi, r/ N _{asc, EN.at, fi} , r/ (N _{p.sc, EX.at, fi, r}) N _{asc, EX.at, fi, r}) N _{asc, EX.at, fi} , r/ is	, yr: crashes/yr: ,fi,r), crash , yr: crashes/yr:	2045 Year es/yr: 2045 Year						
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Reference year (r): aredicted average crash freq, for refere grivalant years associated with crash speede average crash freq, for reference year aredicted average crash frequency amp <i>Exit</i> Crash Analysis Diserved crash count (N* _{0.56,EX,40,0}), cra Reference year (r): redicted average crash freq, for refere iquivalent years associated with crash speede average crash freq, for refere iquivalent years associated with crash speeder average crash freq, for refere required average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere (squivalent years associated with crash speeder average crash freq, for refere squivalent years associated with crash speeder average crash freq, for refere squivalent years associated with crash speeder average crash freq, for reference year (star crash count (N* _{0.56,0.00} , or fedicted average crash freq, for reference squivalent years associated with crash speeder average crash freq, for reference squivalent years cash count (N* _{0.56,0.00} , or (star speed crash count (N* _{0.56,0.00} , or fedicted average crash freq, for reference squivalent years associated with crash speeder average crash freq, for reference squivalent years cash count (N* _{0.56,0.00} , or (star speed crash count (N* _{0.56,0.00} , or (star speed cra	nnce year $C_{\alpha_i}^{\alpha_i}$ ashes: and $C_{\alpha_i}^{\alpha_i}$ are $C_{\alpha_i}^{\alpha_i}$ and $C_{\alpha_i}^{\alpha_i}$ and $C_{\alpha_i}^{\alpha_i}$ ashes: ance year $C_{\alpha_i}^{\alpha_i}$ and $C_{\alpha_i}^{\alpha_i}$ ashes: ance year $C_{\alpha_i}^{\alpha_i}$ ashes: ash	sec.Enatle.V Non-track/ Soc.Exatle/ Non-track/ Non-trac	, ۲۲: , ۲۲), crashes/yr: , ۲۲), crashes/yr: , ۲۲), crashes/yr: , ۲۲), crashes/yr: , ۲۲), crashes/yr: , 77), crashes/	2045 Year 2045 Year Year 2045 Year 2045 Year	0.000	0.000	9.333	0.654		
Reference year (r): Predicted average crash freq, for refere (quivalent years associated with crash xpected average crash freq, for reference year Predicted average crash freq, for reference year (reference year) (r): Predicted average crash freq, for reference (subscription of the subscription of the subscription Reference year) (r): Predicted average crash freq, for reference year subscription of the subscription of the subscription reference year) (r): Predicted average crash freq, for reference year Predicted average crash freq, for reference year Speriod crash count (N ⁺ osten.mydob). Cr Reference year (r): Predicted average crash freq, for reference year Speriod crash count (N ⁺ osten.mydob). Cr Reference year (r): Predicted average crash freq. for reference year Reference year (r): Predicted average crash frequency Reference year (r): Predicted average crash frequence year Reference year (r): Predicted average crash frequence year Reference year (r): Predicted average crash frequence year Reference year (r): Predicted average crash freq (reference year Reference ye	ance year count (C ₆ , C ₇ r given N [*] , (r shahes: ashes: ashes: ashes: ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r)	ssc.ENat.fs/ Nature for the second s	, yr:, , yr:, , , , , , , , , , , , , , , , , , ,	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year	40.317	0.000	9.333	0.654		
Reference year (r): a solution of the second secon	ance year count (C ₆ , C ₇ r given N [*] , (r shahes: ashes: ashes: ashes: ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r h Analysis ashes: r given N [*] , (r)	ssc.ENat.fs/ Nature for the second s	, yr:, _n , _n), crashes/yr:, _n , _n), crashes/yr;, yr:, yr:, _n , _n), crashes/yr;, _n , _n , _n), crashes/yr;, _n , _n	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year	0.000	0.000	9.333	0.654		
Reference year (r): requivalent years associated with crash xpected average crash freq. for reference year redicted average crash freq. for reference year redicted average crash freq. for reference year the second second second second second second second participation parameter (k _{ec.EX.41.0}), cra Reference year (r): redicted average crash freq. for reference year years associated with crash xpected average crash freq. for reference year years associated with crash xpected average crash freq. for reference years freq. for reference year redicted average crash freq. for reference years associated with crash xpected average crash freq. for reference years begreint Multiple-Vehicle Cras XVerdispersion parameter (k _{ha,DWX,000}), cri Reference year (r): reducted average crash freq. for reference year (r):	nnce year $C_{cont} (C_{cont} C_{cont} C_{cont}$	ssc.ENat.fs/ Nature for the second s	, yr:, _n , _n), crashes/yr:, _n , _n), crashes/yr;, yr:, yr:, _n , _n), crashes/yr;, _n , _n , _n), crashes/yr;, _n , _n	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year	40.317	0.000	9.333	0.654		
Reference year (r): a second	nnce year $C_{cont} (C_{cont} C_{cont} C_{cont}$	ssc.ENat.fs/ Nature for the second s	, yr:, _n , _n), crashes/yr:, _n , _n), crashes/yr;, yr:, yr:, _n , _n), crashes/yr;, _n , _n , _n), crashes/yr;, _n , _n	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year	40.317	0.000	9.333	0.654		
Reference year (r): redicted average crash freq, for refere quivalent years associated with crash xpected average crash freq, for reference year redicted average crash frequency byerdispersion parameter (k _{R.E.EX.RIL}). Charles (K.E.EX.RIL) Deserved crash count (N* os.E.EX.RIL) redicted average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected average crash freq. for refere iquivalent years associated with crash hypected crash count (N* of is.E.M.P.P.D.) Deserved crash count (N* os.E.N.P.P.D.) Deserved crash frequency Predicted average crash freq. for reference per Predicted average crash freq. For forence per Predicted average crash freq. F	nnce year count (C ₆ , C ₇ green N ⁺ ₆ (r green N ⁺ ₆ (r	yee,ENat,Fu/N Nace Product 2 Nace Pr	, yr: (۲۵), crashes/yr: (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr (۲۵), crashes/yr	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 2045 Year	40.317	0.000	9.333	0.654		
Reference year (r): Predicted average crash freq, for refere (quivalent years associated with crash xpected average crash freq, for reference year Predicted average crash freq, for reference year (reference year) (r): Predicted average crash freq, for reference (quivalent years associated with crash xpected average crash freq, for reference (quivalent years associated with crash xpected average crash freq, for reference year (r): Predicted average crash freq, for reference years (r): Predicted average crash freq, for reference years (r): Predicted average crash freq, for reference years Predicted average crash freq, for reference years Predicted average crash freq, for reference years Yeredicted average crash freq, for reference year (r): Yeredicted average crash freq, for reference year (r): Yeredicted average crash freq, for reference year (r): Yeredicted average crash freq. for reference year (r): Yeredicted average crash frequency Xerefiserence year (r): Yeredicted average crash frequency Xerefiserence year (r): Yeredicted average crash frequency Xerefiserence year (r): Yeredicted average crash frequency Yerefiserence year (r): Yeredicted average crash frequency Xerefiserence year (r): Yeredicted average crash frequency Yerefiserence year (r): Yerefiserence ye	nnce year $C_{0,0}$ as the set of the set o	sec.ENat.fs/v National Action of the State o	, yr: 	2045 Year 2045 Year 2045 Year 2045 Year 2045 Year 3045 Year 2045 Year 2045 Year	40.317	0.000	9.333	0.654		

Output	Vorksheet for F	Ramp Sec	iments					
MV = multiple-vehicle model	VOIRSHEELIOIT	tamp beg	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model		icable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Horizontal curve (CMF _{1,w,x,y,fi}):	MV		1.000	1.989	1.059	1.039	1.000	1.000
· · · · · · · · · · · · · · · · · · ·		SV	1.000	4.054	1.183	1.120	1.000	1.000
Lane width (CMF _{2, w,x,y,fi}):	MV	SV	1.096	1.096	1.096	1.096	1.096	1.096
Right shoulder width (CMF _{3,w,x,y,fi}):	MV	SV	1.055	1.055	1.055	1.055	1.055	1.055
Left shoulder width (CMF _{4,w,x,y,fi}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Right side barrier (CMF _{5,w,x,y,fi}):	MV	SV	1.012	1.196 1.002	1.012	1.008	1.001 1.000	1.012
Left side barrier (CMF _{6,w,x,y,fi}): Weaving section (CMF _{9,cds,ac,at,fi}):	MV MV	SV SV	1.000	1.002	1.000	1.000	1.000	1.000
weaving section (Civil _{9,cds,ac,at,fi}).	Year:	2045	1.000	1.000	1.000	1.000	1.000	1.000
Ramp speed-change lane (CMF _{8,w,x,mv,fi}):	MV	2045	1.000	1.000	1.000	1.000	1.000	1.000
Lane add or drop ($CMF_{7,w,x,v,fi}$):	MV	sv	1.000	1.000	1.000	1.000	1.000	1.000
Property-Damage-Only Crash CMFs	1010	57	1.000	1.000	1.000	1.000	1.000	1.000
Horizontal curve (CMF _{1,w,x,y,pdo}):	MV		1.000	1.692	1.042	1.027	1.000	1.000
1,w,x,y,pao/		SV	1.000	4.981	1.239	1.156	1.000	1.000
Lane width (CMF _{2, w.x.y.pdo}):	MV	SV SV	1.000	1.000	1.239	1.000	1.000	1.000
Right shoulder width (CMF _{3,w,x,y,pdo}):	MV	SV SV	1.026	1.000	1.000	1.000	1.000	1.000
Left shoulder width (CMF _{4,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Right side barrier (CMF _{5,w,x,y,pdo}):	MV	SV	1.011	1.178	1.011	1.007	1.001	1.011
Left side barrier (CMF _{6,w,x,y,pdo}):	MV	SV	1.000	1.001	1.000	1.000	1.000	1.000
Weaving section (CMF _{9.cds.ac.at.pdo}):	MV	SV						
	Year:	2045	1.000	1.000	1.000	1.000	1.000	1.000
Ramp speed-change lane (CMF _{8,w,x,mv,pdo}):	MV		1.000	1.000	1.000	1.000	1.000	1.000
Lane add or drop (CMF _{7,w,x,y,pdo}):	MV	SV	1.000	1.000	1.000	1.000	1.000	1.000
Predicted Average Crash Frequency								
Fatal-and-Injury Crash Frequency								
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,mv,fi}):								
Observed crash count $(N^*_{o,w,x,mv,fi})$, crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N	10.00.00	es/yr:						
Equivalent years associated with crash count ($C_{b,w,}$	1 111 1							
Expected average crash freq. for reference year given N_{o}^{*} ($N_{a,w}$, _{x,mv,fi,r}), crashes/yr:							
Predicted average crash frequency		2045	0.038	0.169	0.048	0.094	0.012	1.148
Single-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,sv,fi}): Observed crash count (N* _{o,w,x,sv,fi}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N	() crashe	os/vr						
Equivalent years associated with crash count ($C_{b.w.}$	harded a state							
Expected average crash freq. for reference year given N_{o}^{*} ($N_{a,w}$								
Predicted average crash frequency	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2045	0.437	3.777	0.123	0.394	0.272	0.581
Property-Damage-Only Crash Frequency		1						
Multiple-Vehicle Crash Analysis		Year						
Overdispersion parameter (k _{w,x,mv,pdo}):								
Observed crash count (N* _{o,w,x,mv,pdo}), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year (N		shes/yr:						
Equivalent years associated with crash count ($C_{b,w,}$								
Expected average crash freq. for reference year given $N^{\star}_{_0}(N_{a,w}$,x,mv,pdo,r), crashes/y	1						
Predicted average crash frequency		2045	0.145	0.294	0.114	0.160	0.031	1.287
Single-Vehicle Crash Analysis		Year	 					
Overdispersion parameter (k _{w,x,sv,pdo}):								
Observed crash count ($N^*_{o,w,x,sv,pdo}$), crashes:								
Reference year (r):	· · · · ·	hoo/						
Predicted average crash freq. for reference year (N		nes/yr:						
Equivalent years associated with crash count ($C_{b,w}$								
Expected average crash freq. for reference year given N_{o}^{\star} ($N_{a,w}$ Predicted average crash frequency	_{r,x,sv,pdo,r}), crashes/yr	2045	0.585	4.253	0.195	0.436	0.260	0.846
r roulotou average orașn nequency		2040	0.365	4.235	0.195	0.430	0.200	0.040

Output Worksheet	for Crossr	oad Ram	p Terminals					
Signal = signalized intersection model			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
Unsig = unsignalized intersection model		cable dels	Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Crash Modification Factors								
Fatal-and-Injury Crash CMFs								
Non-ramp public street leg (CMF _{19,w,SG,at,fi}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,fi}):	Signal	Unsig	0.772	0.791				
Protected left-turn operation (CMF _{16,w,SG,at,fi}):	Signal							
	Year:	2045	0.564	0.610				
Channelized right turn on crossroad (CMF _{17,w,SG,at,fi}):	Signal							
	Year:	2045	1.232	1.243				
Channelized right turn on exit ramp (CMF _{18,w,SG,at,fi}):	Signal						1	1
Access point froguency (CNAF):	Year:	2045	1.000	1.083				
Access point frequency (CMF _{13,w,x,at,fi}):	Signal	Unsig	1.000	1 000			I	I
Crossroad left-turn lane (CMF _{11,w,x,at,fi}):	Year:	2045	1.000	1.000				
Clossidad left-turn lane (Clorr _{11,w,x,at,fi}).	Signal Year:	Unsig 2045	0.842	0.879				
Crossroad right-turn lane (CMF _{12.w.x.at.fi}):	Signal	Unsig	0.842	0.879				
	Year:	2045	0.906	0.902				
Median width (CMF _{15.w.x.at,fi}):	Signal	Unsig	0.500	0.502				
(IV,W,X,dCII).	Year:	2045	0.844	0.820				
Exit ramp capacity (CMF _{10.w.x.at.fi}):	Signal	Unsig						
	Year:	2045	1.117	1.038				
Skew angle (CMF _{20,w,ST,at,fi}):		Unsig		I				
	Year:	2045						
All-way stop control (CMF _{awsc}):		Unsig						
Property-Damage-Only Crash CMFs								
Non-ramp public street leg (CMF _{19,w,SG,at,pdo}):	Signal		1.000	1.000				
Segment length (CMF _{14,w,x,at,pdo}):	Signal		0.771	0.790				
Protected left-turn operation (CMF _{16,w,SG,at,pdo}):	Signal							
	Year:	2045	0.696	0.728				
Channelized right turn on crossroad ($CMF_{17,w,SG,at,pdo}$):	Signal							
	Year:	2045	1.232	1.242				
Channelized right turn on exit ramp (CMF _{18,w,SG,at,pdo}):	Signal					r		
	Year:	2045	1.000	1.156				
Access point frequency (CMF _{13,w,x,at,pdo}):	Signal	2045	1.000	1 000		1	1	1
Croccroad loft turn lana (CME):	Year:	2045	1.000	1.000				
Crossroad left-turn lane (CMF _{11,w,x,at,pdo}):	Signal Year:	Unsig 2045	0.955	0.889			1	1
Crossroad right-turn lane (CMF _{12.w.x.at.pdo}):	Signal	Unsig	0.855	0.889				
clossioud right turn tune (clossioud right turn tune (clossioud right).	Year:	2045	0.977	0.975				
Median width (CMF _{15,w,x,at,pdo}):	Signal	2045	0.577	0.575				
	Year:	2045	0.484	0.498				
Predicted Average Crash Frequency							1	1
Fatal-and-Injury Crash Frequency								
Ramp Terminal Crash Analysis		Year						
Overdispersion parameter (k _{w,x,at,fi}):		•						
Observed crash count ($N^*_{o,w,x,at,fi}$), crashes:								
Reference year (r):								
Predicted average crash freq. for reference year $(N_{\text{p,w,x,at}}$		s/yr:						
Equivalent years associated with crash count ($C_{b,w,x,at,fi,r}$),	yr:							
Expected average crash freq. for reference year given $N^{\star}_{\ o} \ (N_{a,w,x,at,fi,r}),$	crashes/yr:							
Predicted average crash frequency		2045	3.068	10.224				
Property-Damage-Only Crash Frequency			1					
Ramp Terminal Crash Analysis		Year	ļ,			1	1	1
Overdispersion parameter ($k_{w,x,at,pdo}$):								
Observed crash count (N* _{o,w,x,at,pdo}), crashes:								
Reference year (r):)	noch m	├					
Predicted average crash freq. for reference year ($N_{p,w,x,at}$		ies/yf:						
Equivalent years associated with crash count ($C_{b,w,x,at,pdo}$,			├					
Expected average crash freq. for reference year given N^*_{o} ($N_{a,w,x,at,pdo,r}$ Predicted average crash frequency), crasnes/yr:	2045	4.419	13.868				
r redicted average crash hequelley		2045	1 4.419	13.000				

HSM Part C Methodology - Step 7: Apply EB Method (if applicable)

For this IAR, the EB Method was not applied

7.2 Predictive Safety Analysis

Predictive safety analysis was performed per Chapter 18 of the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) Supplement utilizing the Enhanced Interchange Safety Analysis Tool (ISATe) to obtain an estimate of the predicted average crash frequency during the Opening Year (2025) and the Design Year (2045) associated with the two alternatives: the No-Build Alternative and the Build Alternative. The No-Build Alternative uses the existing roadway with the improvements described in **Section 5**. The Build Alternative installs a new loop ramp access for the eastbound SR 202 to northbound Kernan Boulevard traffic as well as other improvements described in **Section 5**.

Since the Build Alternative requires significant changes in the geometric design, the Predictive Method for Freeways using the Empirical-Bayes Method was not applied for all alternatives to have consistent results.

A summary of the predicted average crash frequency obtained by HSM analysis is presented in **Table 7-15**. **Appendix K** presents the input data used to perform the analysis and the output summary for the alternatives evaluated.

HSM Part C Methodology - Step 8: Sum Predicted/Expected Crashes for All Sites and Years

Mainline

					Mainline					
					FI			Р	DO	
			MV	sv	Ramp Ent.	Ramp Ext.	MV	sv	Ramp Ent.	Ramp Ext.
	2019	Existing	6.444	1.913	0.000	0.000	14.143	3.993	0.000	0.000
		No-Build	9.661	2.192	0.000	0.000	23.198	4.320	0.000	0.000
Seg 1.	2025	Build	9.747	2.192	0.000	0.000	23.407	4.320	0.000	0.000
(I-295 to		Percent Change	0.9%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%
Kernan Blvd)		No-Build	14.942	2.576	0.000	0.000	39.995	4.980	0.000	0.000
	2045	Build	15.061	2.576	0.000	0.000	40.317	4.980	0.000	0.000
		Percent Change	0.8%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%
					•				•	•
	2019	Existing	1.436	0.793	0.000	0.000	3.105	1.915	0.000	0.000
T		No-Build	1.889	0.859	0.000	0.000	4.302	1.953	0.000	0.000
Seg 2.	2025	Build	3.023	1.150	0.000	0.000	7.143	2.536	0.000	0.000
(Between		Percent Change	60.0%	33.8%	0.0%	0.0%	66.0%	29.8%	0.0%	0.0%
Kernan Blvd		No-Build	2.920	0.986	0.000	0.000	7.278	2.087	0.000	0.000
Ramps)	2045	Build	4.673	1.331	0.000	0.000	12.160	2.780	0.000	0.000
		Percent Change	60.0%	34.9%	0.0%	0.0%	67.1%	33.2%	0.0%	0.0%
										•
	2019	Existing	2.030	1.076	0.000	0.000	4.678	2.578	0.000	0.000
T		No-Build	2.650	1.168	0.000	0.000	6.440	2.666	0.000	0.000
Seg 3.	2025	Build	2.296	0.974	0.000	0.000	5.581	2.198	0.000	0.000
(Between		Percent Change	-13.3%	-16.6%	0.0%	0.0%	-13.3%	-17.5%	0.0%	0.0%
Kernan Blvd		No-Build	4.039	1.345	0.000	0.000	10.769	2.920	0.000	0.000
Ramps)	2045	Build	3.500	1.121	0.000	0.000	9.333	2.407	0.000	0.000
		Percent Change	-13.3%	-16.6%	0.0%	0.0%	-13.3%	-17.5%	0.0%	0.0%
										•
	2019	Existing	10.191	4.072	0.988	0.398	23.934	9.539	2.469	0.747
6 m 4		No-Build	13.944	4.509	1.449	0.494	35.011	10.036	3.202	0.922
Seg 4.	2025	Build	13.944	4.509	1.449	0.494	35.011	10.036	3.202	0.922
(Kernan Blvd		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
to Hodges Blvd)		No-Build	21.232	5.225	2.187	0.654	58.799	11.230	4.526	1.216
Bivuj	2045	Build	21.232	5.225	2.187	0.654	58.799	11.230	4.526	1.216
		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

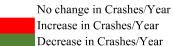
No change in Crashes/Year

Increase in Crashes/Year

Decrease in Crashes/Year

Ramps

				FI	PE	00
			MV	sv	MV	SV
I	2019	Existing	0.030	0.509	0.077	0.479
-	2015	No-Build	0.079	0.739	0.148	0.685
	2025	Build	0.024	0.338	0.092	0.458
Seg 1.	2025	Percent Change	56.9%	375.9%	101.7%	491.9%
(EB Off Ramp)		No-Build	0.186	0.942	0.226	0.864
	2045	Build	0.038	0.437	0.145	0.585
	2045	Percent Change	11.3%	347.4%	93.7%	459.7%
			11.570	547.470	55.770	435.770
	2019	Existing	-	-	-	_
-	2015	No-Build		_		
	2025	Build	0.099	3.179	0.206	3.596
Seg 1 [*] . (Loop	2025	Percent Change	0.055	5.175	0.200	-
Ramp)		No-Build		_		
	2045	Build	0.169	3.777	0.294	4.253
	2043	Percent Change		-	0.234	-
_		r ercent change		-	<u> </u>	-
I	2019	Existing	0.035	0.162	0.043	0.178
F	2010	No-Build	0.032	0.082	0.073	0.126
	2025	Build	0.034	0.097	0.076	0.156
Seg 2.		Percent Change	5.9%	18.3%	4.2%	23.9%
(EB On Ramp)		No-Build	0.045	0.104	0.110	0.158
	2045	Build	0.048	0.123	0.114	0.195
		Percent Change	5.9%	18.3%	4.2%	23.9%
			01070	2010/0	11270	201070
	2019	Existing	-	-	-	-
		No-Build	0.038	0.164	0.061	0.177
Seg 2 [*] .	2025	Build	0.067	0.312	0.106	0.348
(EB On Ramp,		Percent Change	76.4%	90.2%	74.5%	96.5%
2nd part)		No-Build	0.053	0.207	0.092	0.222
. ,	2045	Build	0.094	0.394	0.160	0.436
		Percent Change	76.4%	90.2%	74.5%	96.5%
		- · ·				
	2019	Existing	0.005	0.140	0.010	0.137
		No-Build	0.008	0.215	0.021	0.208
	2025	Build	0.008	0.215	0.021	0.208
Seg 3.		Percent Change	0.0%	0.0%	0.0%	0.0%
(WB Off Ramp)		No-Build	0.012	0.272	0.031	0.260
	2045	Build	0.012	0.272	0.031	0.260
		Percent Change	0.0%	0.0%	0.0%	0.0%
	2019	Existing	0.114	0.323	0.189	0.341
		No-Build	0.298	0.469	0.364	0.487
	2025	Build	0.485	0.456	0.842	0.670
Seg 4.		Percent Change	62.6%	-2.9%	131.6%	37.5%
(WB On Ramp)		No-Build	0.706	0.598	0.556	0.615
	2045	Build	1.148	0.581	1.287	0.846
		Percent Change	62.6%	-2.9%	131.6%	37.5%



Increase in Crashes/Year Decrease in Crashes/Year

Ramp Terminals

			FI	PDO
	2019	Existing	20.040	1.746
		No-Build	14.755	14.354
Terminal 1	2025	Build	2.307	3.406
(EB Off Ramp)		Percent Change	-84.4%	-76.3%
		No-Build	31.062	18.381
	2045	Build	3.068	4.419
		Percent Change	-90.1%	-76.0%
	2019	Existing	1.967	3.894
		No-Build	12.186	12.364
Terminal 2	2025	Build	7.507	9.950
(WB Off Ramp)		Percent Change	-38.4%	-19.5%
		No-Build	16.920	17.103
	2045	Build	10.224	13.868
		Percent Change	-39.6%	-18.9%

No change in Crashes/Year Increase in Crashes/Year Decrease in Crashes/Year

HSM Part C Methodology - Step 9: Apply Appropriate FDM KABCO Crash Distribution

					Severity			Total
			К	Α	В	C	PDO	
	2019	Existing	0.463	1.252	7.546	20.080	67.100	96.442
Г		No-Build	0.546	1.493	8.958	27.818	92.051	130.866
	2025	Build	0.557	1.524	9.145	28.552	94.357	134.136
Mainline		Percent Change	2.1%	2.1%	2.1%	2.6%	2.5%	2.5%
Г		No-Build	0.702	1.945	11.625	41.833	143.799	199.904
	2045	Build	0.718	1.989	11.888	42.964	147.748	205.307
		Percent Change	2.2%	2.2%	2.3%	2.7%	2.7%	2.7%
	2019	Existing	0.032	0.097	0.491	0.697	1.454	2.770
F		No-Build	0.051	0.154	0.784	1.137	2.349	4.475
	2025	Build	0.134	0.407	1.816	2.959	6.780	12.096
Ramps		Percent Change	165.0%	165.0%	131.7%	160.1%	188.6%	170.3%
		No-Build	0.073	0.223	1.156	1.674	3.134	6.261
	2045	Build	0.178	0.541	2.429	3.946	8.607	15.702
		Percent Change	142.9%	142.9%	110.1%	135.7%	174.6%	150.8%
I	2019	Existing	0.117	0.613	3.958	17.319	5.640	27.647
F		No-Build	0.028	0.696	4.354	21.864	26.718	53.659
_	2025	Build	0.009	0.225	1.475	8.105	13.356	23.170
Ramp		Percent Change	-67.7%	-67.7%	-66.1%	-62.9%	-50.0%	-56.8%
Terminal		No-Build	0.048	1.209	7.634	39.090	35.484	83.466
	2045	Build	0.012	0.305	1.998	10.978	18.286	31.579
		Percent Change	-74.8%	-74.8%	-73.8%	-71.9%	-48.5%	-62.2%
	2019	Existing	0.031	0.180	0.555	0.914	3.646	5.326
F		No-Build	0.101	0.583	1.799	2.965	12.299	17.747
	2025	Build	0.101	0.583	1.799	2.965	12.299	17.747
Arterials		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		No-Build	0.137	0.790	2.438	4.018	16.678	24.060
	2045	Build	0.137	0.790	2.438	4.018	16.678	24.060
		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ſ	2019	Existing	0.643	2.141	12.550	39.011	77.840	132.185
F		No-Build	0.725	2.926	15.894	53.784	133.417	206.747
	2025	Build	0.801	2.739	14.235	42.581	126.792	187.148
Total		Percent Change	10.5%	-6.4%	-10.4%	-20.8%	-5.0%	-9.5%
		No-Build	0.961	4.167	22.853	86.615	199.095	313.691
	2045	Build	1.046	3.624	18.753	61.906	191.319	276.648
		Percent Change	8.8%	-13.0%	-17.9%	-28.5%	-3.9%	-11.8%

No change in Crashes/Year Increase in Crashes/Year

Decrease in Crashes/Year

HSM Part C Methodology - Step 10: Compare and Evaluate Results

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7.2 Predictive Safety Analysis

Predictive safety analysis was performed per Chapter 18 of the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) Supplement utilizing the Enhanced Interchange Safety Analysis Tool (ISATe) to obtain an estimate of the predicted average crash frequency during the Opening Year (2025) and the Design Year (2045) associated with the two alternatives: the No-Build Alternative and the Build Alternative. The No-Build Alternative uses the existing roadway with the improvements described in **Section 5**. The Build Alternative installs a new loop ramp access for the eastbound SR 202 to northbound Kernan Boulevard traffic as well as other improvements described in **Section 5**.

Since the Build Alternative requires significant changes in the geometric design, the Predictive Method for Freeways using the Empirical-Bayes Method was not applied for all alternatives to have consistent results.

A summary of the predicted average crash frequency obtained by HSM analysis is presented in **Table 7-15**. **Appendix K** presents the input data used to perform the analysis and the output summary for the alternatives evaluated.

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Table 7-15: Predicted Average Crash Frequency (Crashes/Year)

				-	Severity	-		Total
			К	Α	В	С	PDO	Total
	2019	Existing	0.463	1.252	7.546	20.080	67.100	96.442
ne	2025	No-Build	0.546	1.493	8.958	27.818	92.051	130.866
Mainline	2025	Build	0.557	1.524	9.145	28.552	94.357	134.136
Σ	2045	No-Build	0.702	1.945	11.625	41.833	143.799	199.904
	2043	Build	0.718	1.989	11.888	42.964	147.748	205.307
	2019	Existing	0.032	0.097	0.491	0.697	1.454	2.770
S	2025	No-Build	0.051	0.154	0.784	1.137	2.349	4.475
Ramps	2025	Build	0.134	0.407	1.816	2.959	6.780	12.096
8	2045	No-Build	0.073	0.223	1.156	1.674	3.134	6.261
	2045	Build	0.178	0.541	2.429	3.946	8.607	15.702
				I		Γ	Γ	
lar	2019	Existing	0.117	0.613	3.958	17.319	5.640	27.647
Ramp Terminal	2025	No-Build	0.028	0.696	4.354	21.864	26.718	53.659
o Te	2023	Build	0.009	0.225	1.475	8.105	13.356	23.170
amp	2045	No-Build	0.048	1.209	7.634	39.090	35.484	83.466
8	2013	Build	0.012	0.305	1.998	10.978	18.286	31.579
	2019	Existing	0.031	0.180	0.555	0.914	3.646	5.326
als	2025	No-Build	0.101	0.583	1.799	2.965	12.299	17.747
Arterials	2025	Build	0.101	0.583	1.799	2.965	12.299	17.747
Ar	2045	No-Build	0.137	0.790	2.438	4.018	16.678	24.060
	2045	Build	0.137	0.790	2.438	4.018	16.678	24.060
	2019	Existing	0.643	2.141	12.550	39.011	77.840	132.185
		No-Build	0.725	2.926	15.894	53.784	133.417	206.747
_	2025	Build	0.801	2.739	14.235	42.581	126.792	187.148
Total		Percent Change	10.5%	-6.4%	-10.4%	-20.8%	-5.0%	-9.5%
		No-Build	0.961	4.167	22.853	86.615	199.095	313.691
	2045	Build	1.046	3.624	18.753	61.906	191.319	276.648
		Percent Change	8.8%	-13.0%	-1 7.9 %	-28.5%	-3.9%	-11.8%

The analysis shows the total predicted average crash frequency along the SR 202 mainline is approximately 131 crashes per year in Opening Year (2025) and approximately 200 crashes per year in

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Design Year (2045) if no improvements are made. The additional loop ramp with the Build Alternative increases crashes along SR 202 to approximately 134 crashes per year in Opening Year (2025) and approximately 205 crashes per year in Design Year (2045). The increase in predicted crash frequency is attributed to the additional traffic volume in the segment upstream of the eastbound SR 202 to northbound Kernan Boulevard off-ramp.

Similarly, the analysis shows the total predicted average crash frequency along the SR 202 at Kernan Boulevard interchange ramps to be approximately four crashes per year in Opening Year (2025) and approximately six crashes per year in Design Year (2045) if no improvements are made. However, the Build Alternative shows approximately 12 crashes per year and approximately 16 crashes per year for Opening (2025) and Design (2045) Years, respectively. This increase in predicted crash frequency can be attributed to the new ramp configuration. Although crashes are reduced along the eastbound SR 202 to southbound Kernan Boulevard off-ramp with the Build Alternative, the addition of the proposed loop ramp increases the total length of roadway considered when compared to the No-Build Alternative. In addition to the increased length of roadway, the new configuration introduces curves not present with the No-Build ramp configuration. This combination of roadway characteristics with the Build Alternative increases the predicted crash frequency by approximately 150 percent for both Opening (2025) and Design (2045) Years.

The No-Build Alternative analysis shows a total predicted average crash frequency at the ramp terminal intersections of SR 202 with Kernan Boulevard as approximately 54 crashes per year and approximately 83 crashes per year for Opening (2025) and Design (2045) Years, respectively. With the improvements proposed with the Build Alternative, the predicted average crash frequency reduces to approximately 23 crashes per year for Opening Year (2025) and approximately 32 crashes per year for Design Year (2045). The proposed improvements provide a crash reduction of over 50 percent for both years.

The arterial segments along Kernan Boulevard between TMA Roadway and the eastbound SR 202 ramp terminal intersection as well as Kernan Boulevard between the westbound SR 202 ramp terminal intersection and First Coast Technology Parkway do not have any proposed improvements with the Build Alternative. Due to no changes in roadway characteristics between the No-Build and Build Alternatives, the predicted average crash frequencies for both Opening Year (2025) and Design Year (2045) do not vary.

Thus, for the entire facility evaluated, the total average crash frequency is predicted to be approximately 207 crashes per year in Opening Year (2025) and approximately 314 crashes per year in Design Year (2045) if no improvements are made to the corridor. The entire facility evaluated with the proposed improvements is predicted to experience approximately 187 crashes per year in Opening Year (2025) and approximately 277 crashes per year in Design Year (2045). The improvements are predicted to reduce crashes by approximately 10 percent for both years.

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The Build Alternative shows safety improvement within the study area when compared to the No-Build Alternative. A detailed segment by segment comparison between the analyzed alternatives is presented in **Appendix K**.

Appendix A-2 Example Safety Studies – I-95 at Glades Road IMR Re-Evaluation



5.5 Safety Analysis of the DDI Alternative

An analysis of the predicted number of crashes along mainline I-95 was conducted for both the RFP and the DDI concepts to assess and compare the safety conditions between the two. The study area limits for the safety analysis on I-95 are:

• I-95 between W Palmetto Park Road (northbound entrance ramp gore point) and Yamato Rod (southbound entrance ramp gore point)

The analysis was done for 2040 conditions.

5.5.1 Data Collection

- The 2040 traffic volumes for all the basic freeway segments and ramps were used.
- All the required geometric design and traffic control data were obtained from the design files that were provided.

5.5.2 Methodology

The analysis followed the procedures from Chapters 18 and 19 of the Highway Safety Manual (HSM) – 1st Edition Supplement 2014 by the American Association of State Highway and Transportation Officials (AASHTO). The Enhanced Interchange Safety Analysis Tool (ISATe) was used for performing the analysis. The methodology discussed in the ISATe user manual was followed in the current analysis.

5.5.3 Analysis

The project was divided into freeway segments and ramps segments. All the freeway segments within the study limits were included in the freeway analysis whereas the ramps at the interchange were included in the ramp analysis. However, the ramp terminals were not included in the analysis. The RFP alternative was segmented into 24 freeway and 9 ramp segments. The DDI alternative was segmented into 21 freeway and 8 ramp segments. The results from the analysis are summarized in Table 5.4.

Crash	FDM Crash	FDM Crash		Predicte	l Crashes		
Severity	Distribution	Distribution	RFP C	oncept	DDI Concept		
Туре	Factors (Freeway)	Factors (Ramps)	Freeway	Ramp	Freeway	Ramp	
K	0.006	0.004	0.93	0.03	0.85	0.02	
А	0.035	0.032	5.40	0.25	4.98	0.15	
В	0.113	0.107	17.45	0.83	16.09	0.51	
С	0.206	0.210	31.81	1.64	29.33	1.01	
PDO	0.641	0.647	98.97	5.05	91.28	3.11	
	Total (Rounded)		162		162 147		

 Table 5.4:
 RFP and DDI Concepts - Summary of Predicted Crashes (2040)



As presented in Table 5.4, the DDI concept is predicted to have 147 crashes within the study area whereas the RFP concept is predicted to have 162 crashes. The DDI concept is predicted to have 15 less crashes, which equates to a 9 percent crash reduction when compared to the RFP concept.

5.5.4 Assumptions and Limitations

- A calibration factor of 1.00 was used for both the concepts.
- A 30-feet clear zone was assumed for both the designs.
- Freeway free flow speed of 65 mph was used for both the designs.
- The analysis did not include the ramp terminals due to the limitations of the HSM in predicting crashes at a DDI interchange ramps terminals.

5.5.5 Safety Research on DDIs

The HSM and ISATe tool do not account for the unique configuration of a DDI and therefore, ISATe methods could not be used to predict the safety benefits for the ramp terminal intersections at Glades Road. Since there are no other tools that account for the DDI configuration either, the safety benefits of the DDI based on previous researches are summarized below:

The key safety benefits of the DDI configuration include:

- Reduction of conflict points (14 conflict points and 2 crossing points, compared to the 26 conflict points found in the conventional diamond interchange) and improved sight distance at the turns.
- Reduction in crash severity due to lower design speeds compared to other interchange designs.
- Traffic calming effect that reduces vehicular speed (while maintaining the capacity) due to the small geometric deflection introduced by the DDI for through traffic.
- Elimination of the wrong-way movements into ramps from the DDI interchange design.
- Crash reduction associated with the elimination of loop ramps, where applicable.

Several research papers and before-after studies support the safety benefits of the DDIs. Hummer, Joseph E., et al.¹ recommended a Crash Modification Factor (CMF) of 0.67 for conversion of a conventional Diamond Interchange to a DDI. This implies that the DDI design is estimated to reduce crashes by 33 percent compared to the conventional Diamond Interchange. The research team analyzed seven of the earliest DDIs in the US - four of which were in Missouri and the rest in Kentucky, New York, and Tennessee. The team collected over 28 site-years of "before" (conversion to DDI) data and over 19 site-years of "after" (conversion to DDI) data. The overall crash reduction was found to be 33 percent, while the reduction in injury crashes was found to be 41 percent. Additionally, the analyses indicated that DDI installation could reduce angle and turning crashes substantially. The research team recommended that agencies consider DDI strongly as replacements for conventional diamonds. The Glades Road interchange is not completely a conventional diamond due to its loop ramps. Based on the study by Elvik, Rune, et al.², replacing the loop ramps with straight ramps or short ramps would reduce the crashes by 45 percent and 30 percent respectively.

This CMFs from these studies can be found in the Crash Modification Factors Clearinghouse, developed by the US Department of Transportation (USDOT) Federal Highway Administration



(FHWA) and maintained by the University of North Carolina Highway Safety Research Center (UNC HSRC).

5.5.6 Conclusions

The DDI configuration at Glades Road results in reduced ramp access points along the I-95 freeway. Based on the ISATe analysis results, the DDI concept is predicted to have 15 less crashes, which equates to a 9 percent crash reduction when compared to the RFP concept. The before and after comparison presented in the research study indicates that the DDIs (in comparison to the conventional Diamond Interchanges) are predicted to reduce the overall crashes by 33 percent while significantly reducing the injury crashes. Additionally, the elimination of the existing loop ramps would further improve the safety conditions for the DDI. Therefore, the DDI configuration at Glades Road is predicted to have lower than the total number of predicted crashes as well as reduce the severity of crashes.

5.5.7 References

- Hummer, Joseph E., et al. "Safety evaluation of seven of the earliest diverging diamond interchanges installed in the United States." Transportation research record 2583.1 (2016): 25-33.
- Elvik, Rune, et al. "Traffic Control', The Handbook of Road Safety Measures." (2009): 397-541.

Appendix A-3 Example Safety Studies – I-75 at SR 884 IMR Re-Evaluation

6.5 Safety Comparison

 Table 10 summarizes the expected crashes for the study alternatives.
 Appendix E contains the safety

 performance analysis worksheets and crash data utilized for this study.

Due to the geometric configuration of the No-Build and Build alternatives, and as noted in **Table 10**, the application of HSM methodologies is limited in that there is not a distinct difference in the estimated crash frequencies per year between the two (2) alternatives. Based on the safety analysis, there is a slight increase in expected number of crashes in the Build alternative compared to the No Build alternative for the ramp segments. However, there is a slight reduction in expected number of crashes in the Build alternative for the freeway segment. Based on estimated average crash frequency during the study period (2018-2038) for the No Build and Build alternatives, the Build alternative is expected to have slightly more crashes per year (0.19) compared to the No Build alternative.

Crash Segment Type	Crash Segment	No Build	Build	Difference (Build minus No Build)
Ramp	NB On-Ramp & SB Off-Ramp at I-75/SR 884 NB Off-Ramp at I-75/SR 82	36.81	46.43	9.62
Freeway	I-75 between SR 884 and SR 82	321.28	315.68	-5.60
Es	timated Number of Crashes during Study Period	358.09	362.11	4.02
Estim	ated Average Crash Frequency during Study Period (crashes/year)	17.05	17.24	0.19

Table 10: Expected Num	ber of Crashes for Years	2018 through 2038
------------------------	--------------------------	-------------------

Even though the expected number of crashes and expected crash frequencies resulting from the HSM analysis are similar between the two alternatives, the proposed improvements from the Build Alternative provide for a safer operation because of the following:

- Under the No Build alternative, a merge condition is present on the I-75 NB on-ramp before the freeway-ramp gore point, whereas the Build alternative will provide an additional 1,650 feet distance for the outside ramp lane to merge with the inside lane. The enhanced merge condition under the Build alternative is anticipated to provide safer operations with more distance and smooth merging.
- The lane balance provided under the Build alternative because of choice lane at the I-75 exit ramps (NB off-ramp to SR 82 and SB off-ramp to SR 884) will provide safer operations as evidenced by the freeway operational results. The freeway operational results show that the demand on I-75

segment between SR 884 and SR 82 will exceed capacity resulting in LOS F under the No Build alternative, which may contribute to a higher number of crashes compared to the Build alternative.

• The Build condition does not need a lane change from the freeway to ramp and this condition is anticipated to reduce the sideswipe crashes.