Florida Department of

Transportation

Interchange Access Request User's Guide

Systems Implementation Office

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Interchange Access Request

User's Guide

Florida Department of Transportation
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Preface

The Florida Department of Transportation (FDOT) and the Federal Highway Administration (FHWA) have a substantial investment in limited access facilities, particularly the interstate system. An FHWA Policy Statement related to the justification and document preparation of the need for additional access to the interstate system was published in the Federal Register on October 22, 1990, (55 FR 42670) and subsequently modified February 11, 1998, (63 FR 7045), August 27, 2009, (74 FR 20679) and May 22, 2017. The FHWA Policy on Access to the Interstate System, effective May 22, 2017, can be found at https://www.fhwa.dot.gov/design/interstate/170522.cfm.

Any proposal to modify the access to these facilities potentially can have an adverse impact on their ability to effectively and safely accommodate travel demand in a corridor. To ensure access decisions are properly administered, FHWA and FDOT have adopted policies and requirements regarding interchange access requests and approvals on limited access facilities. The acceptability determination shall be determined by FHWA through the process outlined in FHWA's Interstate Access Policy, which went into effect May 22, 2017, or by the FDOT Chief Engineer through an expedited approval process, as agreed upon in the Programmatic Agreement (PA) executed April 24, 2020, between the FHWA Florida Division and FDOT.

The FHWA Interstate System Access Informational Guide can be found at https://transportationops.org//publications/interstate-system-access-informational-guide.

Purpose

FDOT Procedure 525-030-160, New or Modified Interchanges, defines the state and federal requirements and processes to be followed in the development of an Interchange Access Request (IAR). Full compliance with the requirements and process defined in 525-030-160 is required for the consideration of any interchange access proposal. This User's Guide and 525-030-160 are applicable to new or modified access to the following facilities:

- Interstate System,
- Florida's Turnpike Enterprise (FTE) and
- Non-interstate limited access facilities on the State Highway System (SHS).

The purpose of this User's Guide is to provide guidance on how to prepare documents that support requests for new or modified access to the Florida Interstate system, FTE and non-interstate limited access facilities on the SHS. This User's Guide also provides information on the IAR process that shall consider the needs of the system at a regional level while maintaining the integrity of the highway network.

This User's Guide provides guidance on preparing and processing IARs.

This User's Guide shall be used by local agencies, consultants, FHWA, FDOT and staff from other agencies when developing and reviewing Safety, Operational and Engineering (SO&E) acceptability of new or modified interchange access proposals on limited access facilities.

Scope

Any proposed change in access to the interstate system must be submitted by FDOT to the FHWA Florida Division Office for a determination of SO&E acceptability under Title 23, United States Code, (23 U.S.C.) Highways Sections 106 and 111 and 23 CFR 625.2(a). The acceptability determination shall be determined by FHWA through the process outlined in FHWA's Interstate Access Policy, which went into effect May 22, 2017, or by the FDOT Chief Engineer through an expedited approval process, as agreed upon in the PA between the FHWA Florida Division Office and FDOT, executed April 24, 2020.

This expedited approval process between FHWA and FDOT for access requests regarding certain types of projects on the interstate system allows the FDOT Chief Engineer or acting Chief Engineer to make a determination of SO&E acceptability for IARs. FDOT will allow the FHWA Florida Division Office five business days (or as agreed upon by the Division and FDOT) to object to the determination. The FHWA Florida Division Office's lack of objections to the FDOT's determination within this period will constitute FHWA's concurrence and the approval required under 23 U.S.C. 111(a).

Organization

This User's Guide is organized into seven chapters and nine appendices:

- **Chapter 1: IAR Overview and Process —** This chapter discusses FHWA and FDOT policies supporting the need for the IARs and related Florida statutes, rules and procedures, and the PA between FHWA and FDOT regarding review and approval of IARs. Finally, this chapter defines the various stakeholders involved in this process.

- **Chapter 2: Types of Access Requests and Approval Process** — This chapter discusses where the IAR process applies and various types of IARs and examples. In addition, it discusses other access requests that are potentially not associated with the interchange. Lastly, this chapter explains the access request review process and defines who has the authority to sign and accept the IARs.

- **Chapter 3: Methodology Letter of Understanding (MLOU)** — This chapter provides guidance on the preparation of the MLOU. Elements of the MLOU are discussed in detail.

- **Chapter 4: Explanation of FHWA Policy Points** — This chapter explains what must be included in the IAR to fulfill FHWA's policy points. The two points are discussed.

- **Chapter 5: Documentation Requirements** — This chapter provides guidance on developing documentation required for an IAR. The contents of the IAR are discussed in detail.

- **Chapter 6: Safety Analysis Guidance** — This chapter provides information to help in selecting and appropriately applying existing and predictive safety analysis methodologies.

- **Chapter 7: IAR Re-evaluations** — This chapter discusses the different conditions that trigger re-evaluation of the previously approved IARs. Documentation required to support re-evaluation is also discussed.

- **Appendix A:** Affirmative Determination Letter Templates

- **Appendix B:** MLOU Template
- **Appendix C:** Locked Gate Access Request Technical Documentation Template
- **Appendix D:** DocuSign Process
- **Appendix E:** Template for Statement of Technical Review (QC Certification) and Quality Control Checklist Template
- **Appendix F:** QAR Process, Checklist and Templates
- **Appendix G:** Sample Signing Plans
- **Appendix H:** Example Safety Studies
- **Appendix I:** Traffic Validation Template
- **Appendix J:** Acronyms and Definitions

Distribution, Updates and Contact

This document is available online at Systems Implementation Office (SIO) under Document Repository.

For updates and questions regarding this User's Guide and example studies, contact:

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ATTN: State Interchange Review Coordinator (SIRC)

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The FDOT SIO has developed the Florida Interchange Portal (FIP), a web-based data repository. The Portal provides central storage that serves as a library for information and data associated with the IARs prepared in Florida. The Portal can be accessed by clicking on the following link https://fip.fdot.gov.

For more information regarding District Interchange Review Coordinators (DIRC), visit https://fip.fdot.gov/About.

Users of this guide are encouraged to submit questions and requests for modifications to the SIRC at the above address. The User's Guide will be revised to incorporate all current addenda and any other updates every two years or as needed. This effort will be coordinated through the DIRC and the FTE. Users of this guide are encouraged to check the website prior to using this guide to ensure the latest process and technical requirements are being followed.

Chapter 1 IAR Overview and Process

1.1 FHWA's Interstate System Access Policy

According to Title 23, United States Code, Highways Sections 106 and 111 (23 U.S.C. 111), all agreements between the Secretary of the U.S. Department of Transportation (USDOT) and the state departments of transportation regarding the construction of projects on the Interstate system shall contain a clause that the state will not add points of access to or exit from the project, in addition to those approved by the Secretary in the plans for such a project, without prior approval of the Secretary. The Secretary has delegated the authority to administer 23 U.S.C. 111 to the Federal Highway Administrator, pursuant to Title 49, Code of Federal Regulations, Section 1.48(b)(10) (49 CFR 1.48(b)(10)). A policy statement consolidating a series of policy memoranda, including guidance for justifying and documenting the need for additional access to the existing sections of the interstate system, was published in the Federal Register on October 22, 1990, titled "Access to the Interstate System," and was modified February 11, 1998, August 27, 2009, and May 22, 2017.

1.1.1 FHWA's Interest with Changes in Interstate System Access

It is in the national interest to preserve and enhance the interstate system to meet the needs of the 21st century by assuring that it provides the highest level of service in terms of safety and mobility. FHWA's interest is to ensure all new or revised access points:

- Are considered using a decision-making process that is based on information and analysis of the planning, environmental, design, safety and operational effects of the proposed change;
- Support the intended purpose of the interstate system;
- Do not have an adverse impact on the safety or operations of the interstate system;
- Connect to the local roadway networks or other elements of the transportation system; and
- Are designed to applicable standards.

1.1.2 FHWA's Policy Requirements

FHWA's policy points are required to be fulfilled to substantiate any access request that is submitted for approval considerations. The policy points are outlined in the FHWA's "Policy on Access to the Interstate System," effective May 22, 2017. FHWA's decision to approve a request is dependent on the request proposal satisfying and documenting the policy points' requirements. As such, the two policy points shall be documented appropriately in the IAR document.

The policy points are listed and discussed in detail in **Chapter 4** of this guide.

1.1.3 FHWA Policy Implementation

The FHWA Florida Division Office requires that all requests for new or revised access submitted for FHWA consideration contain sufficient information to allow FHWA to independently evaluate the request and ensure all pertinent factors and alternatives have been appropriately considered. The level of approval for an IAR document varies with the type of request and the complexity of the project and its impact. To streamline the review process, the IAR document is required to include a section that describes how the proposed access is consistent with FHWA's policy points.

1.2 Florida Statutes, FDOT Rules, Policies and Procedures

Several Florida statutes, FDOT rules, policies and procedures apply to access requests. FDOT provides specific direction for the development of IARs through rules, policies and procedures outlined in this User's Guide. This direction is provided to ensure statewide consistency in the technical analysis, documentation and review processes.

1.2.1 Florida Statute

Requests for new or modified interchanges must meet the requirements of §338.01, F.S., "Authority to Establish and Regulate Limited Access Facilities," which authorizes transportation and expressway authorities of the state, counties and municipalities to provide and regulate limited access facilities for public use.

1.2.2 FDOT Rules

Rule Chapter 14-97 Florida Administrative Code (F.A.C.), "State Highway System Access Management Classification System and Access Management Standards," provides guidance on the adoption of an access classification system and standards to implement the State Highway System Access Management Act of 1988 for the regulation and control of vehicular ingress to and egress from the SHS. This includes interchange spacing standards and other criteria for medians and driveways adjacent to the interchange.

The spacing of existing interchanges on highway facilities may preclude exact conformance and do not require a design variation. Access management spacing standards should always be a project goal. Therefore, a discussion on compliance with standards and mitigation strategies must be provided within the IAR document.

New interchanges on existing facilities that do not meet spacing requirements outlined in Rule Chapter 14-97 F.A.C. shall require a design variation at the discretion of the Department.

Interchanges for new limited access facilities shall be reviewed by the DIRC during the planning and Project Development and Environment (PD&E) phases for operational performance, safety and compliance with Rule Chapter 14-97 F.A.C.

1.2.3 FDOT Policies and Procedures

Various procedures that must be considered during the preparation of an IAR document are referenced in this section.

- **Topic 000-525-015**: Approval of New or Modified Access to Limited Access Highways on the State Highway System (SHS) – this policy is to minimize the addition of new access points to limited access highway facilities to maximize the operation and safety of transportation movements.

- **Topic 000-525-006**: Level of Service (LOS) Targets for the State Highway System — This policy establishes specific minimum acceptable targets for the State Highway System based on the area type. The targets shall be responsive to all users, for context, roadway function, network design and user safety.

- **Topic 000-525-045**: Managed Lanes Policy — This policy provides guidance for employing managed lanes on appropriate facilities that experience significant congestion in existing or projected future conditions.

- **Topic 525-030-120**: Project Traffic Forecasting — This procedure provides instructions for using design traffic criteria to forecast corridor traffic and project traffic. The selection of the most appropriate analysis method(s) must be coordinated with FDOT before conducting the study. District planning offices will be responsible for carrying out the traffic forecasting process.

- **Topic 525-030-160**: New or Modified Interchanges — This procedure sets forth the state and federal requirements and processes to be used for determination of SO&E acceptability associated with adding or modifying interchange access to limited access facilities on Florida's SHS. Full compliance with the requirements and processes in this procedure is required for any IAR document.

- **Topic 525-030-260**: Strategic Intermodal System (SIS) Highway Component Standards and Criteria — This procedure addresses the responsibilities of the various offices within FDOT to develop and implement the SIS. It also defines the requirements for coordination with the local government and Metropolitan Planning Organization (MPO) transportation planning process. Such coordination is needed to ensure IARs are consistent with the SIS Master Plan and Action Plan for the affected facilities.

- **Topic 650-000-001**: Project Development and Environment (PD&E) Manual — This manual describes in detail the process by which transportation projects are developed by the department to fully meet the requirements of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) and other related federal and state laws, rules and regulations. The manual aids project analysts and project managers in understanding all aspects of the project development process and its requirements, such as engineering and environmental analyses, public involvement and documentation.

1.2.4 IAR Approval Process

The IAR approval process consists of two parts: the determination of the SO&E acceptability and the approval of the NEPA document that covers the environmental requirements for the proposed improvements. After completion of these two parts, FDOT submits a letter to FHWA notifying that the SO&E and NEPA approval parts are complete. The letter also confirms that the recommended alternative concept is the same in the SO&E and the NEPA documents. The NEPA evaluation can be conducted concurrently with the SO&E or following the approval of the SO&E document.

The two parts in an IAR approval process are discussed in detail below.

1. The first part constitutes an acceptance of the SO&E by complying with FHWA's two policy points and FDOT's Procedure 525-030-160 for new or modified interchanges. The determination of SO&E acceptability indicates the access proposal is a viable alternative to include in the environmental analysis stage of the project. It should be noted, however, that full compliance with the guidelines and process outlined in this User's Guide does not ensure approval. The approval decision on each IAR document is based on SO&E acceptability and FDOT and FHWA policies.

The process for completing NEPA/PD&E procedure is beyond the scope of this User's Guide and FDOT Procedure 525-030-160.

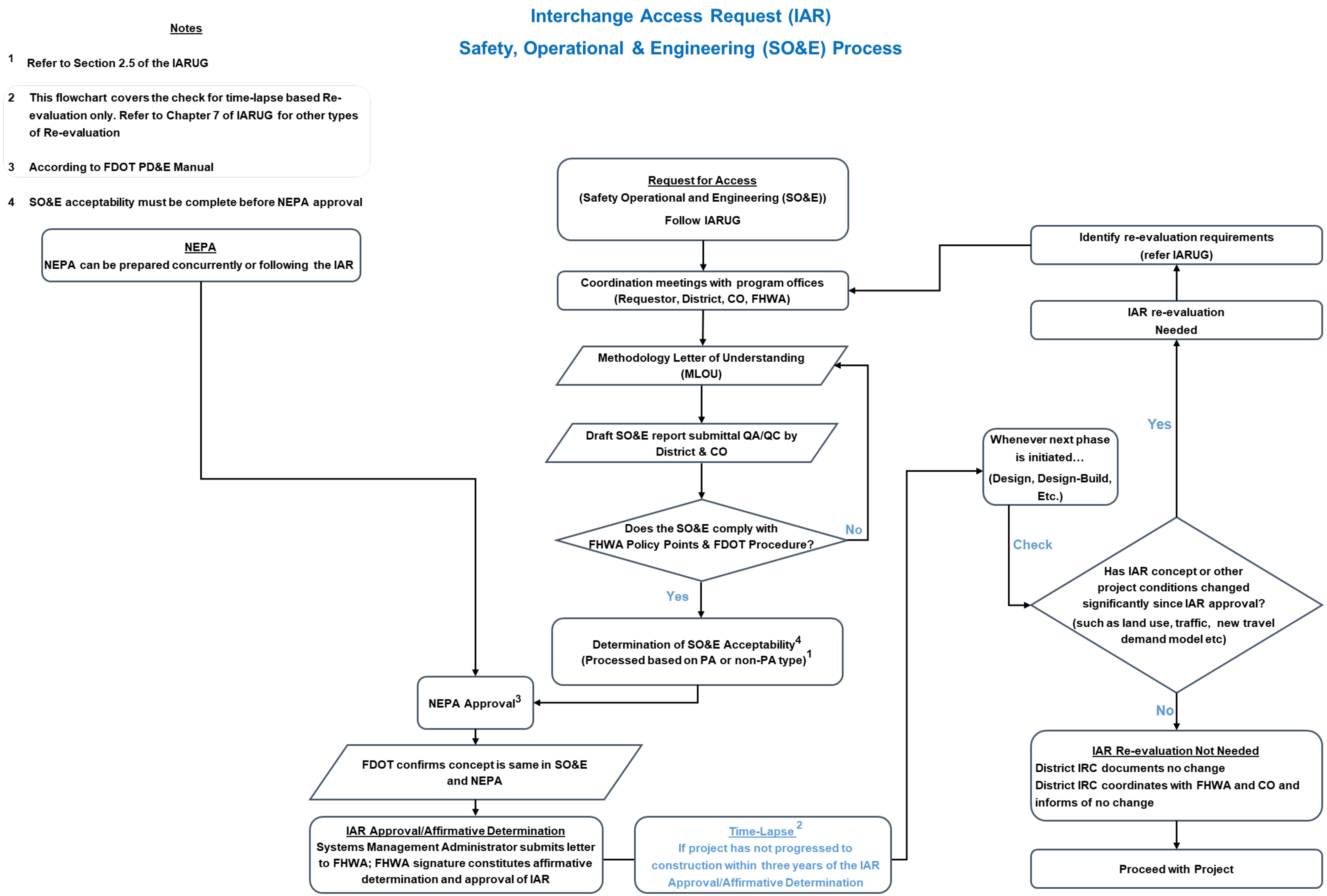
2. The second part constitutes the completion of the NEPA document (PD&E study). The NEPA document can be prepared concurrently or following the SO&E acceptance. However, NEPA approval can occur only after SO&E acceptability is complete. Projects involving interstate right of way are federal actions and, as such, must follow the NEPA procedures. In Florida, the NEPA documents are prepared per the guidelines and requirements outlined in the PD&E Manual. After the NEPA document is approved, FDOT notifies the FHWA Florida Division Office and submits the IAR approval request to the Florida Division Office. This letter will reference the previously completed SO&E acceptability and approval of the NEPA document. The letter will include verification that the location design concept of the preferred alternative in the NEPA document matches the design of the accepted SO&E proposal. FHWA's signature on this document constitutes the Affirmative Determination of the SO&E and approval of the IAR document. For non-interstate limited access facilities on the SHS, a State Environmental Impact Report (SEIR) is required. The process for completing a PD&E study can be found in the PD&E Manual.

The SIRC certifies the NEPA document has been completed and that the preferred alternative evaluated in NEPA in the Statewide Environmental Project Tracker (SWEPT) is the same alternative as was assessed in the SO&E acceptability determination prior to sending the letter for approval. Letter templates for this process are provided in **Appendix A**.

The two-part process offers flexibility to obtain the SO&E acceptability prior to completing the environmental review and approval process, in which case requestors can determine if an access proposal is acceptable for inclusion as an alternative in the environmental review process.

The major steps involved in the SO&E preparation of an IAR document and its relationship to NEPA are depicted in **Figure 1-1**. The IAR re-evaluation due to time-lapse is also covered in **Figure 1-1.** The remaining IAR re-evaluation types are discussed in **Chapter 7** of this IARUG. The NEPA (PD&E) phase can either start after the determination of SO&E acceptability or be developed concurrently. However, the SO&E acceptability must be obtained prior to NEPA approval. This User's Guide covers the procedure for preparation and review of IAR documents. The process for completing NEPA/PD&E is beyond the scope of this User's Guide. The guidelines and requirements outlined in the PD&E Manual shall be followed while preparing the NEPA document.

Figure 1-1 Interchange Access Request (IAR) Safety, Operational & Engineering (SO&E) Process



If three years have passed since affirmative determination of the SO&E acceptability and NEPA, and the project has not progressed to construction, then a re-evaluation of the IAR may be needed at the initiation of the next project phase such as design, design-build or any other project phase. The need for a re-evaluation shall be determined based on the change in project conditions since approval of the SO&E request. If significant changes in conditions have occurred in land use, traffic volumes (release of a new travel demand model), roadway configuration, design or environmental commitments, then a re-evaluation will be needed. Engineering judgement will be needed in determining a significant change. Some examples of significant change in conditions include change in travel conditions or patterns resulting in a modification of project need, and a change in approved design or change in traffic volumes resulting in a different LOS grade. The DIRC will evaluate the need for the re-evaluation at the initiation of the project phase and notify the SIRC. For further information on re-evaluations, please refer to **Chapter 7** of this guide. The intent should be to avoid long gaps between the affirmative determination of SO&E acceptability, NEPA approval and initiation of the subsequent project phases. Requirements and guidance for performing NEPA re-evaluations are in the PD&E Manual.

1.3 Interchange Access Points

Each break in the control of access to the interstate system right of way is considered an access point. Per FHWA policy, each entrance or exit point, including locked gate access and access to collector-distributor roads or ramps, is considered an access point. For example, a diamond interchange configuration has four access points.

Per FHWA policy, ramps providing access to rest areas, information centers and weigh stations within the interstate system are not considered access points. Access to or from these facilities and local roads and adjoining property is prohibited. The only allowed exception is for access to adjacent publicly owned conservation and recreation areas, if access to these areas is only available through the rest area, as allowed under 23 CFR 752.5(d).

Each entrance or exit point is an access point.

Interchange reconfiguration is considered to be a change in access even though the number of actual points of access may not change. For example, changing a cloverleaf interchange into a diamond interchange is considered a revised access. Slip ramps to/from general lanes and express lanes are not considered interchange access points unless a direct connection is provided to/from the express lanes and the interchange ramp.

1.4 Stakeholders

A fundamental component of the IAR process is its management and coordination. Close coordination between stakeholders at various stages of the IAR process is necessary for a successful approval of the IAR document. The various stakeholders involved in the IAR process are described in this section.

1.4.1 Requestor

A requestor shall be FDOT, a local government entity or a transportation authority (e.g., toll authority, port authority, etc.). For projects initiated by private developers, the local government becomes the requestor. The DIRC must be more involved in development-driven projects and must involve the SIRC early in the project.

A requestor shall be FDOT, a local government entity or a transportation authority.

In all cases, the requestor is responsible for collecting any data required, documenting the need for the new or modified interchange access and developing the SO&E analysis required by the approval authority to make a decision on the IAR. Additionally, the requestor is responsible for conducting quality control reviews for the IAR deliverables before submitting them to the DIRC. Specifically, the requestor must:

- Reach an agreement with the DIRC and other applicable approval authorities on the type of IAR document to better define study design or scope of work;
- Develop, sign and submit to the DIRC a Methodology Letter of Understanding (MLOU) documenting the agreed-upon study methodology;
- Perform appropriate quality control;
- Develop and submit to the DIRC a draft Interchange Access Report containing the results documenting the analysis of safety and operation of the access proposal, as agreed in the MLOU;
- Respond to or resolve all comments and requests for additional information from reviewers and revise the IAR documents accordingly; and
- Sign and submit a final IAR document to the DIRC for an approval decision.

1.4.2 District Interchange Review Coordinator (DIRC)

Each District and Florida's Turnpike Enterprise (FTE) appoint a DIRC. The DIRC is the primary point of contact for all requestors, inside and outside the Department, requesting new or modified interchanges on the existing SHS limited access facilities within their Districts. The DIRC acts as a liaison to other offices within the District. The DIRC should notify the District Secretary when the requestor for the IAR is non-FDOT. The DIRC also serves in a review and processing role for IARs. The DIRC and the requestor are responsible for quality control of the IAR documents. By serving in the review-and-processing role, the DIRC is responsible for ensuring the IARs meet quality objectives.

The DIRC is the point of contact for all requestors and is responsible for quality control.

For all IARs, the DIRC is responsible for establishing and documenting in the MLOU the basis for approval, evaluation criteria, level of coordination needed and scope of the technical analysis and documentation. The DIRC arranges a technical review for the SO&E and environmental impacts of the IAR document. Every District shall coordinate with the following offices during the IAR process: Environmental Management, Design, Traffic Operations, Safety, Structures, Right of Way (ROW), Maintenance and Program Management. The DIRC shall seek assistance from these offices in reviewing portions of the IAR document relevant to their disciplines and/or through feedback received during DIRC coordination meetings. The DIRC determines if a request can continue in the access-request process based on the information submitted with the IAR document and the outcome of the technical review.

The DIRC is required to conduct regular meetings to discuss milestones and statuses for the IAR projects.

1.4.3 State Interchange Review Coordinator (SIRC)

The SIRC's role is to provide guidance for rules, policies and procedures related to IAR reviews, ensure consistency and coordinate with the FHWA, District and FTE DIRCs. For IARs that are reviewed and approved through the PA process, the SIRC will be responsible for notifying FHWA about the approval decision. The SIRC also confirms that the concept is the same in the IAR document and in the NEPA documents in SWEPT.

1.4.4 Systems Management Administrator (SMA)

The SMA is responsible for the approval of IARs after they have been reviewed by the SIRC. The SMA also coordinates with FHWA on matters related to interchange projects and FDOT processes.

1.4.5 FHWA

FHWA is responsible for protecting the structural and operational integrity of the interstate system. The FHWA District Transportation Engineer (DTE) representing the District in which the IAR is located is the FHWA Florida Division Office's point of contact for that project. The DTE is also responsible for reviewing the IAR document and making a recommendation on the approval.

1.4.6 Interchange Coordination Meetings

Interchange coordination meetings must be held for each IAR proposal.

Development of an IAR document should take an interdisciplinary approach that combines the strengths of different technical staff within the District. As such, it is recommended that the DIRCs hold at least quarterly District interchange coordination meetings to discuss proposals for change-in-access requests. Staff from other division offices within the District such as Environmental Management, Design, Traffic Operations, Structures, Safety, ROW, Maintenance and Program Management must be invited to the coordination meetings. Every IMR and IJR must be presented in at least three DIRC meetings listed below:

- An initial kickoff meeting to discuss contents of the methodology, determine type of access request and approval process.
- An alternatives meeting, to discuss the preferred alternative and of other alternatives considered early on before major analysis has been completed. It is understood that the preferred alternative may not be finalized at this stage.
- A final project meeting to show the preferred alternative results before the document is submitted for review.

FHWA’s DTE and SIRC must also be invited to the interchange coordination meetings. Meeting notes should be prepared and distributed to all parties invited to the meetings.

Chapter 2 Types of Access Requests and Approval Process

An IAR's purpose is to demonstrate that the project is viable based on traffic, engineering and safety criteria. Any IAR document should start by developing an analysis approach that is followed to determine the impact of the access proposal to the mobility and safety of the limited access facility.

A Methodology Letter of Understanding (MLOU) is required for an Interchange Justification Report (IJR) and an Interchange Modification Report (IMR). The MLOU is optional for an Interchange Operational Analysis Report (IOAR) and is determined on a case-by-case basis by the DIRC, in consultation with the SIRC. The decision to prepare an MLOU for IOAR is based on the scope of the project and the level of traffic analysis effort. Such a decision is reached after discussions between the requestor, DIRC and SIRC. See **Chapter 3** for details regarding contents of an MLOU and **Appendix B** for a template of an MLOU.

2.1 Types of Interchange Access Requests

2.1.1 Interchange Justification Report (IJR)

An IJR is required when the proposed action is intended to provide a new access to a limited access facility. Such action requires the highest level of analysis and documentation to justify the need for and operational impacts of the proposed access. The IJR quantifies the magnitude and significance of impacts of the proposed new access on the mainline and mitigation, if needed.

An IJR is required for the following situations:

- New system interchanges providing access between two limited access facilities;
- New service interchanges providing access between a non-limited access local roadway network (e.g., arterial, collector or local road) and the limited access facility; and
- New partial interchanges or new ramps to and from continuous frontage roads that create a partial interchange within the existing limited access right of way.

2.1.2 Interchange Modification Report (IMR)

An IMR is required for a proposed action to modify configuration or travel patterns at an existing interchange. The extent and complexity of the proposed modification will determine the level of analysis and documentation required. The level of analysis and documentation requirements are determined and agreed upon in the MLOU.

A Systems Interchange Modification Report (SIMR) may be needed when a series of closely spaced interchanges that are operationally interrelated are analyzed for an IAR document. Such an effort may be used to support the development of a corridor PD&E study, either following or concurrently with the SIMR development. It is important to understand that the purpose of an SIMR is to evaluate impacts of closely spaced interchanges. If an IMR is prepared for an interchange included in a previously approved SIMR, it shall follow the requirements outlined in this guide. The limits of a SIMR should be carefully chosen and discussed with the SIRC and FHWA. As a guide, reasonable limits of a SIMR are from four to seven miles in length and contain three to five interchanges.

An IMR or SIMR may be required for the following situations (where examples are provided, they are not intended to be all-inclusive):

- Modification to the geometric configuration of an interchange.
  - Adding new ramp(s)
  - Abandoning/removing ramp(s)
- Completion of basic movements at an existing partial interchange.
- Modification of existing interchange ramp to provide access to a different local road that requires a break in the limited access right of way.
- Managed lanes access to an existing interchange that provides direct connection to the crossroad or express-to-express lane ramp connections.
- Any changes that result in an increase in the number of lanes at the gore point of an on-ramp within a weaving area, as determined by the Highway Capacity Manual (HCM) weaving methodology.

2.1.3 Interchange Operational Analysis Report (IOAR)

An IOAR is prepared to document traffic and safety analysis of minor modifications to the existing access points that do not change existing interchange configuration or travel patterns. For this reason, innovative interchanges and intersection design concepts should be discussed prior to determination of the type of document (IOAR vs. IMR). The examples of interchange improvements that require an IOAR are listed below. The determination of an IOAR versus IMR requirement is critical because the level of effort could significantly vary. Therefore, the requestor shall coordinate with the DIRC, SIRC and FHWA in making this determination. The determination to prepare an IOAR or IMR shall be done at the beginning of the project, during the MLOU stage.

The following types of interchange improvements require an IOAR:

- Addition of a lane (or lanes) to an existing **on-ramp** while maintaining existing lanes at gore point.
- Any proposal that results in the shortening of an **off-ramp**.
- Replacement of an unsignalized free-flow, right-turn lane on an **off-ramp** with a signalized right turn or installation of a signal or roundabout to a stop-controlled ramp terminal intersection.
- Any changes that result in an increase in the number of lanes at the gore point of an on-ramp outside the weaving area as determined by the HCM weaving methodology.

When adding a pedestrian phase, an IOAR may be required. Analysis should be performed as appropriate and the results should then be discussed and presented at a DIRC meeting to determine the need for an IOAR. If it is determined that an IOAR is not required, then the results of the analysis should be documented in a technical memorandum.

2.1.4 Affirmative Determination

There are two steps to get an IAR approval. The first step is SO&E acceptance, and the second step constitutes the completion of the NEPA documents. FDOT will verify that the IAR is justified and well documented and that the request satisfies FHWA's two policy points. The process of SO&E acceptance depends on whether the IAR is programmatic or non-programmatic.

The second step of the IAR document approval is the completion of the NEPA documents. The Office of Environmental Management (OEM) approves NEPA documents under 23 U.S.C. 327 and the corresponding implementing Memorandum of Understanding (MOU) signed by FHWA and FDOT on May 26, 2022. Once NEPA documents are approved, final approval for the IAR document can be requested. The District notifies the SIRC that the NEPA documents are approved. The SIRC confirms in the SWEPT that the approved concept is the same in the SO&E and the NEPA documents. FDOT then submits the letter to FHWA seeking Affirmative Determination for the IAR document. This Affirmative Determination is the final approval of the IAR document. FHWA's signature on this letter constitutes the Affirmative Determination of the SO&E and approval of the IAR document. The two-step process option allows FDOT flexibility to determine SO&E acceptability prior to making the required modifications to the transportation plan and prior to completing the environmental review and approval process. The Affirmative Determination is required for both the PA and non-PA projects. Templates of the Affirmative Determination Letters can be found in **Appendix A**. The Affirmative Determination is required for projects that have a NEPA document and it is not required when a SEIR is prepared.

2.2 Non-Interchange Access Request (Non-IAR)

Non-IARs are improvements that may not require an IAR document. Policy Point 1 infers that an operational and safety analysis has concluded that the proposed change in access to the Interstate System does not have an adverse impact. Coordination for non-IARs shall be scheduled at the start of the project to determine the level of analysis effort if it is required. It is the responsibility of the DIRC to ensure operational analyses for the non-IAR improvements are conducted and documented if needed.

A presentation at the DIRC Meeting should include the following: reason for improvement/modification, concept showing the non-IAR improvement and slides showing the analysis that was pre-determined in early coordination. Documentation of meeting notes along with the presentation will be sent to FHWA for their file.

The following are examples of non-IARs:

- Access (slip ramps) between express lanes and general use lanes on the interstate highway. The existing interchanges are not modified, in which case no direct connection between express lanes and crossroad is provided. This does not constitute preparation of an IAR, per FHWA's Interstate System Access Informational Guide. The operations and safety of the access points shall be evaluated and documented.
- Addition or removal of through lane(s) on a crossroad at a ramp terminal.
- Interchanges that are proposed with a new limited access facility. (If the new limited access facility is connecting to an existing limited access facility or interstate, an IAR document will be required.)

- Implementation of transit services such as bus rapid transit along the arterial.
- Addition of storage lanes at the terminus of existing **off-ramps** with the crossroad.
- Relocation or shifting of the ramp termini (i.e., moving the ramp end that connects with the crossroad) along the same roadway, which does not result in a shortening of an **off-ramp**.
- Extension of an acceleration lane, deceleration lane or recovery lane at the interstate connection point not within the weaving area of an adjacent interchange.
- Extension of an **on-ramp** as an auxiliary lane extending to downstream interchange.
- Widening of an existing **off-ramp** to add lane(s) at the diverge point from the mainline.

Traffic and safety analysis may not be required for the following improvements:

- Implementation of ramp metering or other active control of vehicles entering the interstate highway.
- Construction of overpasses or grade-separated structures without ramps along interstate facilities.
- Construction of new signing, striping and/or resurfacing of an interstate **on-ramp** or **off-ramp**, where geometric features are not changed.
- Installation of roadside guardrail and concrete barriers (such as for resurfacing and safety projects).
- In-kind bridge replacement/modification without changing laneage.
- Rest areas, information centers and weigh stations within the interstate system.

2.3 Break in Limited Access

Breaks in limited access, or new facilities fully contained within the limited access, can be to provide either vehicular access or non-vehicular access, such as sidewalks and transit hubs. Either of these breaks will require coordination with FHWA for review and approval.

2.3.1 Vehicular Access

A vehicular break in limited access could be on the interstate system, a ramp or a crossroad. An IAR document may be required if the vehicular access proposal requires any changes to the interchange geometry or signal timings of the intersections within the limited access. The need and type of the IAR shall be determined in coordination with the DIRC and SIRC. The guidelines provided in this IARUG shall be followed in preparation of the IAR document. The IAR document shall satisfy FHWA's policy points.

If vehicular access is made within the limited access right of way, but it has been determined that an IAR document is not required, then a general use permit needs to be submitted through the District Office of Maintenance. The request needs to clearly state the purpose of the vehicular access and explain the proposed modifications through illustrations and text.

The District Office of Maintenance is responsible for coordinating with all the relevant agencies for review and approval of vehicular access requests. The District Office of Maintenance shall also inform and coordinate with the DIRC regarding such a request. The DIRC shall coordinate with SIRC and upon satisfaction of the proposal's SO&E, the District Maintenance Engineer shall submit the request to the appropriate FHWA division for review and approval. Vehicular access breaks due to temporary construction activities should be discussed with the DIRC and SIRC to determine the need and type of document. Coordination with FHWA should be performed and submit the request to the appropriate FHWA division for review and approval as needed.

2.3.2 Non-Vehicular Access

Examples of non-vehicular access include provision of new sidewalks or bike lanes on a roadway. It could also include constructing an access connection sidewalk from an intersecting minor street to the major roadway that already has an existing sidewalk. The construction of a sidewalk system and accessibility improvements to the remaining sidewalk systems improve public access, pedestrian public safety and encourage sidewalk usage.

If such non-vehicular access upgrades are made within the limited access right of way or require a break in limited access of the existing interchange, then a general use permit needs to be submitted through the District Office of Maintenance. The request needs to clearly state the purpose of the non-vehicular access and explain the proposed modifications through illustrations and text.

The District Office of Maintenance is responsible for coordinating with all the relevant agencies for review and approval of non-vehicular access requests. The District Office of Maintenance shall also inform and coordinate with the DIRC regarding such a request. The DIRC shall coordinate with SIRC and upon satisfaction with the proposal, the District Maintenance Engineer shall submit the request to the appropriate FHWA division for review and approval. An IAR document is not needed if the proposed changes do not impact the operations of the interchange.

An IAR document may be required if the non-vehicular access proposal requires any changes to the interchange geometry or signal timings of the intersections within the limited access. The need and type of the IAR document shall be determined in coordination with the DIRC and SIRC. The guidelines provided in this IARUG shall be followed in preparation of the IAR document. The IAR document shall satisfy FHWA's policy points.

2.4 Locked Gate Access

All requests for a locked gate access require submission of a general use permit through the District Office of Maintenance. The District Office of Maintenance works with the requestor on establishing the purpose and need and the documentation for the locked gate access.

Information and factors to consider and include in the request to make a recommendation for a locked gate access include but are not limited to:

- Purpose and need for the locked gate access;
- Review of possible access alternatives to confirm the feasibility of the proposed access;

- Number, type, duration and frequency of vehicles proposed to use the locked gate;
- Ownership and lessee of the property contiguous to the locked gate; and
- Satisfy FHWA's Access Policy Points

The Locked Gate Access Request Template providing more information about the contents of the documentation package is included in **Appendix C** of this IARUG.

The process for a locked gate access request can be divided into three main steps: Request, Locked Gate Access Review and Final Determination by FHWA. A detailed description of each step in a locked gate access request is provided below along with a flowchart of the process shown in **Figure 2-1**.

Step 1: Request

- A locked gate access request is submitted for the District Office's Review.

Step 2: Locked Gate Access Review

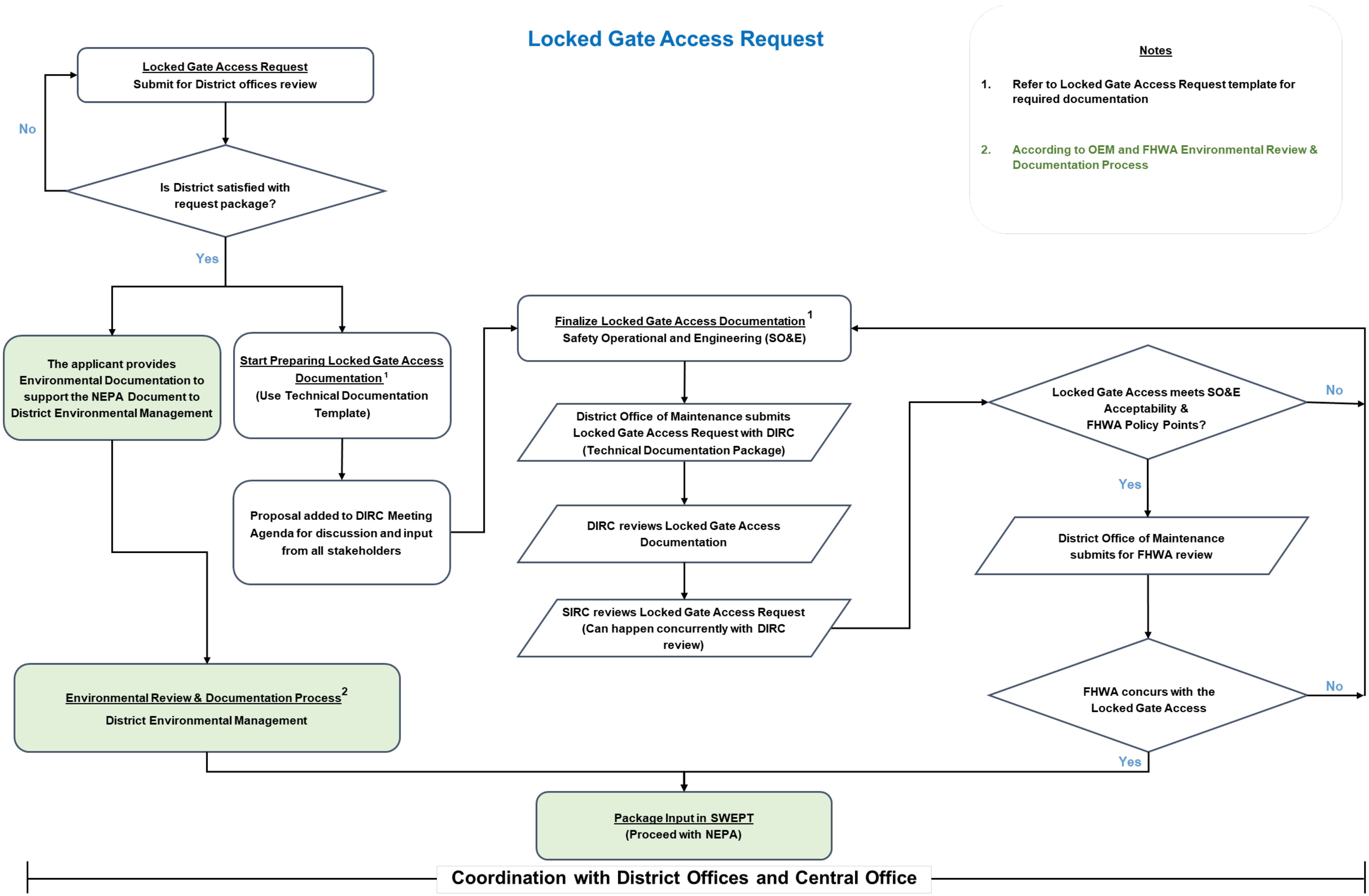
- The request and other documents related to the submittal are sent for review. Reviews are performed by the District and Central Office.

  1. District Review: The first review is done at the District level as part of the initial coordination and preliminary site determination.
  2. Central Office Review: If the District staff is satisfied with the request, the environmental review and locked gate access review can be done concurrently.
     a. Environmental Review and Documentation Process: Central Office submits the request and the related environmental documentation to the District Environmental Management Office.
     b. Locked Gate Access Documentation: The District Office of Maintenance starts preparing Locked Gate Access Technical Document using the Locked Gate Access Request Template in **Appendix C** of this IARUG. The DIRC adds the proposal to the DIRC meeting agenda for discussion and input from all stakeholders. DIRC and SIRC review the final Technical Document to verify if the request meets SO&E Acceptability and FHWA Policy Points. The District Office of Maintenance then submits the Locked Gate Access Request Technical Document to FHWA for review and concurrence.

Step 3: Final Determination by FHWA

- District Environmental Management Office submits NEPA document in SWEPT, acknowledging completion of the locked gate access analysis.
- Following FHWA approval, District Environmental Management Office prepares Environmental Certification.

Figure 2-1 Locked Gate Access Request Process



2.5 Approval Authorities

2.5.1 DIRC Authority

The DIRC has the primary responsibility for all IAR coordination with the requestor and coordination with the SIRC and FHWA (when applicable) during all phases of the IAR. It is essential for the DIRC to seek inputs from all applicable District offices, such as Environmental Management, Design, Traffic Operations, Structures, Safety, ROW, Maintenance and Program Management in the IAR review process.

Where the IAR affects a limited access facility of more than one District (including FTE), or if the interchange access is near a District boundary, all affected DIRCs shall be involved during the IAR process. It is required that IARs developed by the FTE or other expressway authorities involve the local FDOT District.

2.5.2 FDOT and FHWA Authorities

FDOT recognizes three forms of IAR document approvals:

- Programmatic IARs that apply to projects on interstate highways identified in the PA between FHWA Florida Division Office and FDOT regarding the review and approval of specific types of changes in interstate system access. (The PA was executed April 24, 2020 and was originated from Section 1505 of MAP-21.)
- IARs for projects on interstate highways that are not included in the PA between FHWA Florida Division Office and FDOT. These IARs are referred to as non-Programmatic IARs in this User's Guide.
- IARs for projects on non-interstate limited access facilities on the SHS.

Programmatic IARs Approval

Section 1505 of MAP-21 has provided the USDOT Secretary the option to allow state DOTs to review and approve IARs on the interstate system. FHWA and FDOT have entered into the PA to allow FDOT to review and approve certain types of IARs. The PA will expedite the IAR document review process and streamline the project delivery process.

Under the PA, the FDOT Chief Engineer is authorized to determine the SO&E acceptability for certain types of IARs that will receive an expedited FHWA approval. **Figure 2-2** shows how to determine projects that shall be reviewed under the PA. IARs that are to be included in the PA review process shall be determined early on during the project's conceptualization and initiation. The following IARs are included in the PA:

a. New freeway-to-crossroad (service) interchanges outside of Transportation Management Areas (TMAs);

b. Modifications to existing service interchanges; and

c. Completion of basic movements at existing partial interchanges.

All IOARs will qualify for Programmatic IAR document approval. The level of environmental documentation or severity of the impacts associated with the implementation of the project affects project qualification for the Programmatic IAR. As such, FHWA has determined that the following conditions will exempt the PA and require FHWA access review and approval:

- Projects requiring an Environmental Impact Statement (EIS) under NEPA. Types of projects that require an EIS are listed in the FDOT PD&E Manual;
- Projects with issues related to national policy or substantial controversy; and
- Any other project, as required by FHWA.

It is recommended that IAR features related to social, natural, economic and physical environment are initially screened through the Efficient Transportation Decision Making (ETDM) process. The ETDM screening should be performed at the beginning of the IAR process, even though environmental impacts are not documented in the SO&E acceptability. Coordination with FHWA DTE is required to ensure projects with substantial controversy or requiring an EIS are flagged early during the MLOU development stage.

The approval authority for programmatic IAR document is the FDOT Chief Engineer, as shown in **Table 2-1**. SMA and the DIRC must approve the IAR document before it is routed to the Chief Engineer for signature. The Assistant Secretary for Strategic Development also will sign IARs for new access requests (or IJRs). FDOT will allow the FHWA Florida Division Office five business days (or as agreed upon by the Division and FDOT) to object to the determination. The FHWA Florida Division Office's lack of objections to the FDOT's determination within this period will constitute FHWA's concurrence and the approval required under 23 U.S.C. 111(a).

Table 2-1: Programmatic Interchange Access Request Approval Authorities

Approval Authority		MLOU			IAR		
		IJR	IMR	IOAR[1]	IJR	IMR	IOAR
Requestor		✓	✓	✓	✓	✓	✓
DIRC		✓	✓	✓	✓	✓	✓
Central Office	Systems Management Administrator	✓	✓	✓	✓	✓	✓
	Chief Engineer (or Delegate)				✓	✓	✓
	Assistant Secretary for Strategic Development (or Delegate)				✓		
FHWA					●	●	●

Note: ✓ Review and approve the document
1 For an IOAR, the DIRC will determine the need for an MLOU in consultation with SIRC
● Concurs with FDOT Chief Engineer's determination of safety, operational and engineering acceptability, as agreed upon in the PA and grants Affirmative Determination after completion of the second step. FHWA transportation engineers should be involved when developing the MLOU.

Non-Programmatic IARs Approval

Projects on the Florida Interstate system that are not included in the PA will be fully reviewed and approved by the FHWA Florida Division Office, as summarized in **Table 2-2**. IARs involving system interchanges, all new partial interchanges and new interchanges within a TMA require concurrence by FHWA headquarters in Washington, D.C.

The following IARs on interstate highways are not approved through the PA process and require full FHWA review and approval:

a. New or modified freeway-to-freeway (system) interchanges;

b. New service interchanges inside of TMAs;

c. New partial interchanges;

d. Closure of individual access points that result in partial interchanges or closure of entire interchanges; and

e. Locked gate access.

FHWA will review and provide comments in the ERC. When all comments have been addressed, and FHWA has indicated that the document is ready for signature, the DIRC will route the document for signatures. The signing process can be found in **Appendix D**.

Table 2-2: Non-Programmatic Interchange Access Request Approval Authorities

Approval Authority	MLOU		Interchange Access Request Interstate	
	IJR	IMR	IJR	IMR
Requestor	✓	✓	✓	✓
DIRC	✓	✓	✓	✓
Systems Management Administrator	✓	✓	✓	✓
Assistant Secretary Strategic Development			✓	
FHWA	✓	✓	✓	✓

Note: ✓ Review and approve the document

Non-Interstate System IARs Approval

FHWA is not involved in IARs for projects that are on non-interstate facilities. Approval authorities for non-interstate IARs are summarized in **Table 2-3**. The DIRC, SMA and District Secretary approve all non-interstate IARs.

Table 2-3: Non-Interstate Interchange Access Request Approval Authorities

Approval Authority	MLOU			Interchange Access Request Non-Interstate		
	IJR	IMR	IOAR[1]	IJR	IMR	IOAR
Requestor	✓	✓	✓	✓	✓	✓
DIRC	✓	✓	✓	✓	✓	✓
Systems Management Administrator	✓	✓	✓	✓	✓	✓
District Secretary	*	*	*	✓	✓	✓

Note: ✓ Review and approve the document
1 The DIRC will determine the need for an MLOU in consultation with SIRC.
* The District Secretary does not have to approve the MLOU document.

Non-Interstate Toll Facility IARs Approval

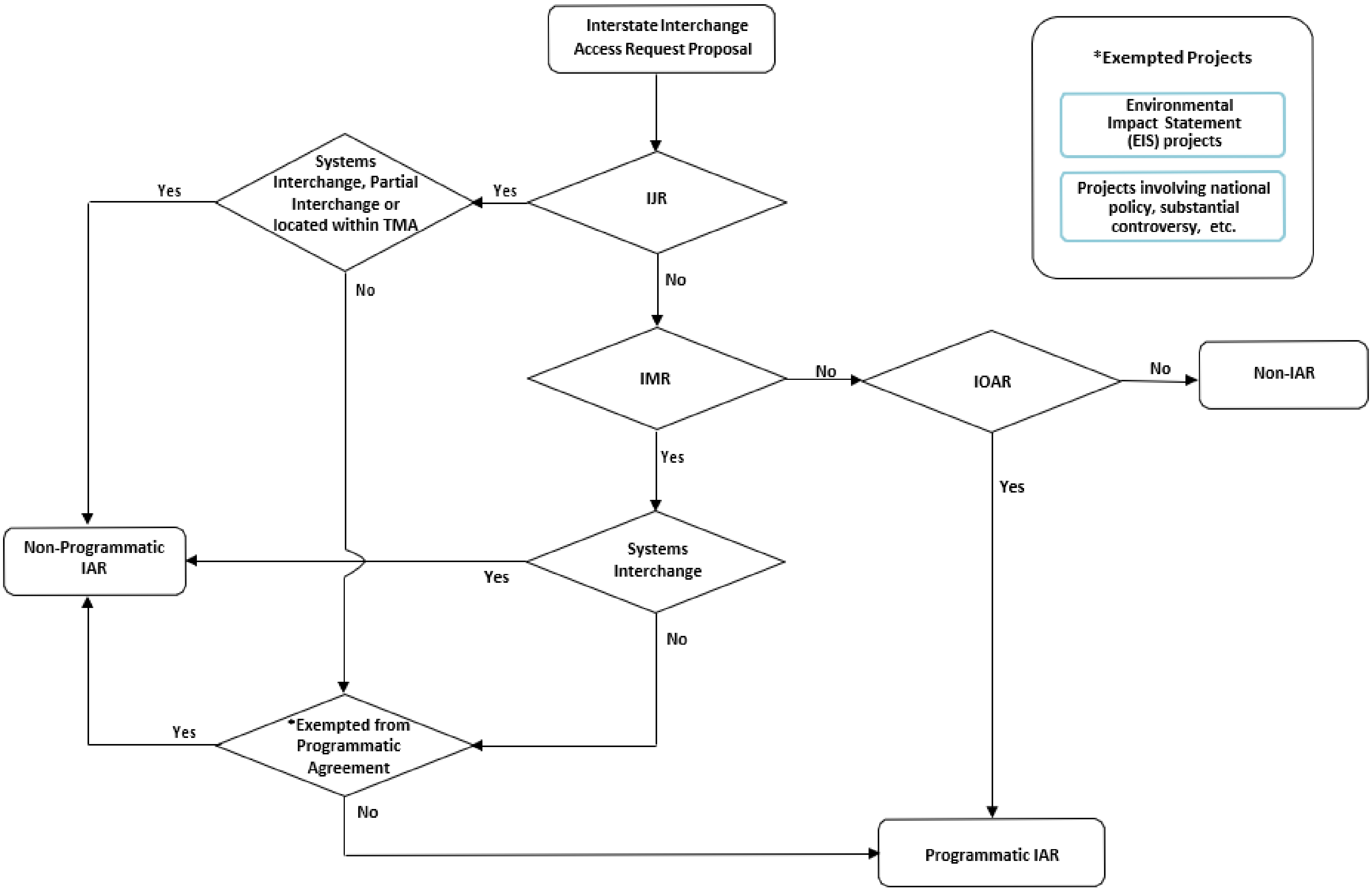
FHWA is not involved in IARs for projects that are on non-interstate toll facilities. Approval authorities for non-interstate toll facility IARs are summarized in **Table 2-4.** For interchanges with Turnpike, the Turnpike DIRC should be included on the approvals. The MLOU approvals for non-interstate toll facilities are done as per approval authorities shown in **Table 2-3**.

Table 2-4: Non-Interstate Toll Facility Interchange Access Request Approval Authorities

Approval Authority	Florida's Turnpike			Other Expressway Authorities		
	IJR*	IMR*	IOAR	IJR*	IMR*	IOAR
Requestor	✓	✓	✓	✓	✓	✓
Turnpike DIRC	✓	✓	✓			
DIRC	✓	✓		✓	✓	✓
Systems Management Administrator	✓			✓		

Note: ✓ Review and approve the document
MLOUs for these IARs will be reviewed and approved by the same approval authorities shown in **Table 2-4**
* DIRC approval will not be needed for IJRs, IMRs not on the SHS or IJRs, IMRs not affecting state highways. This determination will be made in coordination with DIRC and SIRC during the project.

Figure 2-2 Determination of Programmatic versus Non-Programmatic Interchange Access Request



2.6 IAR document Review Process

Review of IAR document deliverables is necessary to ensure they are of appropriate quality. The requestor shall ensure that the IAR's schedule includes adequate times for reviews. (See **Section 2.7** for review time frame.) The review process that is documented in this User's Guide must be followed. Tight schedules or pressure to maintain project schedules shall never compromise the quality of the documents, because poor quality deliverables eventually lead to project delays. Whenever an expedited review is needed due to project schedules, the DIRC must coordinate in advance with the SIRC. For IARs that involve complex projects, interim reviews of technical documents, such as model calibration reports and future traffic forecast reports are strongly recommended. Interim review requirements should be determined at the MLOU development stage of the IAR on a case-by-case basis.

Every IAR submittal must be reviewed through the ERC system.

All documents related to IARs must be reviewed utilizing the FDOT ERC System. The ERC system is a web-based application used to track the review process (comments and responses) for the project documents in a database. All IAR documents shall be submitted under the Interchange Access Request submittal category of the ERC system. Use of ERC system allows requestors, DIRCs, SIRC, FHWA and other users to track all comments and responses from the reviewers at any time during the project development process. Information about the ERC application is available at the FDOT ERC website. The DIRC shall coordinate with the requestor to ensure the IAR documents are first reviewed at the District level before requesting Central Office review through the ERC system. IARs that are not processed through the PA process (or non-programmatic IAR) shall be submitted to FHWA for review after the review by the Central Office is completed and all comments have been addressed or resolved. The SIRC shall utilize the ERC system to request IAR document reviews from FHWA.

The review process is summarized as follows.

For Programmatic IARs:

1. The requestor produces the IAR document and submits it to the DIRC.
2. The DIRC conducts a District internal review through ERC and returns it to the requestor with comments.
3. The requestor reviews the comments, addresses and resolves the comments and resubmits the document to the DIRC.
4. Upon verification that all comments were resolved, the DIRC requests the SIRC to review the IAR document through the ERC. The SIRC review takes two weeks.
5. The SIRC conducts review and returns it to the DIRC with comments.
6. The DIRC reviews the comments and forwards them to the requestor.

7. A second round of reviews in ERC (or email) is performed to ensure that all comments have been addressed. A comment resolution call is sometimes required. The SIRC second review takes one week.

8. After corrections are made, the DIRC will route the IAR document for signatures (as per approval authority tables shown earlier). (Refer to the DocuSign process in **Appendix D.**)

9. The SIRC submits the Programmatic IARs to FHWA to obtain concurrence with the FDOT Chief Engineer's determination of SO&E acceptability. The concurrence period for FHWA is five days.

For Non-Programmatic IARs:

1. The requestor produces the IAR document and submits it to the DIRC.

2. The DIRC conducts a District internal review through ERC and returns it to the requestor with comments.

3. The requestor reviews the comments, addresses and resolves the comments and resubmits the document to the DIRC.

4. Upon verification that all comments were resolved, the DIRC requests the SIRC to review the IAR document through the ERC. The SIRC review takes two weeks.

5. The SIRC conducts review and returns it to the DIRC with comments.

6. The DIRC reviews the comments and forwards them to the requestor.

7. A second round of reviews in ERC (or email) is performed to ensure that all comments have been addressed. A comment resolution call is sometimes required. The SIRC second round of review takes one week.

8. Upon verification that all comments were resolved, the SIRC submits the document in ERC for FHWA to review.

9. FHWA reviews the document and submits comments in ERC. FHWA review time frames are discussed in **Section 2.7**.

10. SIRC forwards the comments to the DIRC for incorporation and then resubmits the document in ERC for FHWA review and approval. A comment resolution call may be required.

11. When FHWA notifies the SIRC that the document is ready for signature, the DIRC will route the IAR document for signatures. (Refer to the signing process in **Appendix D.**)

The above review process is for a sequential review of the project performed first by the District, followed by CO and FHWA. DIRC can request that concurrent reviews be performed between District, CO and FHWA.

Reviewers should exercise good professional judgment when reviewing the documents. Comments that are personal preference are discouraged.

2.7 IAR document Review Time Frame

The following review time frames apply to all IARs:

- The SIRC shall review and submit comments on the IAR document within 10 business days.
- The FHWA Florida Division Office will review and submit comments within 20 business days for non-PA IARs.

There are normally two reviews done in ERC by SIRC and FHWA per IAR document. The review times may be longer than the time frames outlined above, depending on the number of project submittals by FDOT to FHWA and conflicting production schedules. For projects that the Districts have as high priority, the DIRC shall coordinate with FHWA and SIRC about the schedule constraints and priorities early on during the MLOU development stage.

System interchanges, all new partial interchanges and new interchanges within a TMA require concurrence by FHWA headquarters in Washington, D.C. FHWA Florida Division Office shall make an IAR document SO&E acceptability determination and forward it to the FHWA headquarters for approval within 40 to 60 business days.

2.8 Performance Management of Programmatic IAR

As part of the requirements of the programmatic agreement, FDOT will conduct annual reviews of the performance of the IAR process and submit a report to FHWA consisting of:

- A summary of the results of all IARs that were processed and approved under the terms of the PA.
- Verification that the IARs were processed and complied with the PA.
- An identification and implementation plan for IAR process improvements.
- A summary of potential IARs in the coming year.

Chapter 3 Methodology Letter of Understanding (MLOU)

An MLOU is optional for an IOAR and is determined on a case-by-case basis.

The MLOU provides a dialogue among the requestor, DIRC, SIRC and FHWA to identify the parameters and primary areas of focus for preparing an IAR document. The purpose of the MLOU is to document the procedures to be followed in the IAR document development and mitigate risk. The MLOU is intended to define the project's type of IAR document and establish the analysis assumptions and traffic analysis approach required to prepare the IAR document. The MLOU is not a scope of work for the project. The requestor must understand that any work done prior to signing of the MLOU is at the risk and responsibility of the requestor.

3.1 Project Initiation

The IAR document process begins with a formal determination of the need for the project. The determination of the need for the project helps identify performance criteria or deficiencies that are to be addressed by the project. The determination of the need for the project involves coordination between the requestor, DIRC, SIRC and FHWA Florida Division Office to define the scope of the IAR document and to verify the project is in the MPO's adopted Long Range Transportation Plan (LRTP). The FHWA DTE shall be informed of all projects at their initiation. Coordination also is needed to identify type of project (IJR, IMR or IOAR), project objectives, determination of Programmatic or non-Programmatic process, performance measures and FHWA involvement. Coordination with project stakeholders is required, even for non-IAR projects.

3.2 Methodology Meetings

Methodology meetings shall be conducted to discuss various aspects of the access proposal and to reach an agreement regarding the contents of the MLOU for the IAR document. The DIRC meetings to discuss methodology for the project shall include the DIRC, SIRC, FHWA, the requestor and other project stakeholders, including representatives from affected or interested local agencies, regional planning councils and other state agencies. When it is determined that the need for the project is reasonable, the requestor and DIRC may start drafting the MLOU. The objective of the MLOU is to reach a consensus among the requestor, DIRC, SIRC and FHWA on the process and analysis to be followed in developing the IAR document. The purpose and intent of the MLOU is not to arrive at a predetermined concept and it should not prohibit the evaluation of viable alternatives. The MLOU shall be signed by all parties to demonstrate agreement on the IAR document process.

It is essential to discuss any anticipated exceptions or variations to FDOT or FHWA policies, criteria or standards to ensure they will not create a fatal flaw to the IAR document approval. Any fatal flaws shall be identified and resolved in the preliminary meetings prior to execution of the MLOU to determine whether the requestor should proceed with the IAR document proposal. For these reasons, the DIRC meetings should be held at least quarterly. The MLOU does not serve as scope of work for the project. Any work done prior to signing the MLOU is at the risk and responsibility of the requestor.

DIRC meetings ensure proper project coordination with the SIRC, FHWA DTE and representatives from other offices within the District such as Planning, Environmental Management, Design, Traffic Operations, Structures, Safety, ROW, Maintenance and Program Management. The meeting notes, along with the list of attendees, shall be documented, distributed to meeting attendees for concurrence and kept in the project files.

3.3 Determination of the Need for MLOU and Type of IAR

The development of an MLOU is guided by the need for the project. It is recommended that the requestor gather all project data and information sufficient to determine the type of the IAR document prior to preparing the MLOU. FDOT's Environmental Screening Tool (EST) may be used to gather environmental information and data about the IAR project. The environmental information may help the DIRC determine the type of IAR document, as per the guidance provided in **Section 2.1** of this User's Guide. Coordination with the approval authorities is required to ensure appropriate report type, review process and documentation before finalizing the preparation of the MLOU.

3.4 Contents of MLOU

The contents of an MLOU are detailed in this section. The required format of the MLOU is provided in **Appendix B**.

3.4.1 Project Purpose and Need

Identification of the purpose and need for adding new or modifying access to a limited access facility is essential to providing appropriate analysis and documentation to justify the approval of the change in access.

The purpose and need for the IAR document should be the foundation for the purpose and need in the PD&E study. The purpose identifies the primary goals of the project and guides the range of alternatives that will be developed and considered in response to the established need. The purpose should be broad enough to encompass a reasonable range of alternatives, but not so broad that it encompasses every possible alternative. Conversely, the purpose should not be so narrow as to preclude a range of alternatives that could reasonably meet the defined objectives or restrict decision-makers' flexibility in resolving conflicting interests.

The need for the IAR document provides a rationale for how it addresses the transportation problems identified in the purpose statement. The need for the project arises from deficiencies, issues and/or concerns that currently exist or are expected to occur within the project area. The need serves as the foundation for the proposed project and provides the principal information upon which the "no-build" alternative discussion is based. It establishes the rationale for pursuing the action and is generally reflected in local, state or MPO/TPO transportation plans. The need should consist of a factual, objective description of the specific transportation problem supported by data and analysis. Detailed analysis supporting the need should be referenced in the purpose and need discussion.

3.4.2 Area of Influence (AOI)

Once the purpose and need for the project have been identified, the next step is to identify the analysis AOI. The AOI is defined as the area that is anticipated to experience significant changes in traffic operating characteristics as the result of the access proposal. The AOI shall reflect current and anticipated operational and safety concerns associated with the IAR document. The AOI for the IAR document shall be finalized in the MLOU phase. Factors such as interchange spacing, cross street signal locations, the extent of congestion, the presence of system interchanges, planned transportation systems and anticipated traffic impacts should be considered when identifying the AOI.

The following guidelines shall be used when defining the AOI:

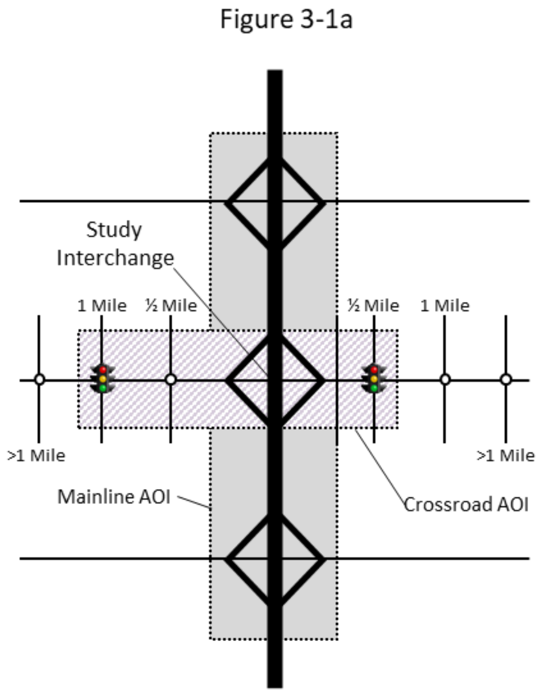
- **AOI along a limited access mainline —** The AOI for IJRs shall include at least the first adjacent interchange on either side of the proposed access change as shown in **Figure 3-1a**. In rural areas, where interchanges are far apart and the proposed access is isolated, extension to adjacent interchanges may not be necessary.

  For IMRs in rural areas and in under-saturated conditions, the AOI can extend only to the on- and off-ramp gore points of the adjacent interchanges shown in **Figure 3-1b**. For IMRs in areas where the mainline is over-saturated, full adjacent interchanges should be included in the AOI as shown in **Figure 3-1a**. The limits should be determined through discussion with the DIRC, SIRC and FHWA (if applicable).

  For IOARs, the mainline and interchange merge/diverge areas are not required to be included in the AOI as most of the times improvements are focused on the ramp terminal and other adjacent intersections. If modifications to the interchange ramp or gore points are made in the IOAR, then these need to be included in the AOI accordingly.

- **AOI along a crossroad —** The AOI along the crossroad shall extend at a minimum up to one half-mile in either direction of the proposed access change. If there are signalized intersections along the crossroad, the need to extend the AOI beyond the half-mile to include at least one signalized intersection in either direction shall be determined by the DIRC based on the project purpose and need. The AOI along the crossroad shall be determined by the DIRC during the MLOU stage of the project.

Figure 3-1 AOI Along Mainline and Crossroad



3.4.3 Analysis Years

All IARs shall consider existing year, opening year, interim year and design year as traffic analysis years. The need for analysis of interim years shall be decided and agreed when developing the MLOU. The interim year shall be included in projects that have phased construction or fail prior to the design year. If the project is proposed as interim or to be constructed in phases, then a detailed description of the ultimate design and future planned projects should be included in the IAR document. Additionally, the analysis methodology and procedure for each analysis year must be agreed to by the requestor, DIRC, SIRC and FHWA (if applicable) during the MLOU phase. The requestor must analyze build alternatives and the no-build alternative for all analysis years, as defined in the MLOU. The analysis years are described below.

- **Existing year —** The year the IAR document is prepared or a prior year from which acceptable data is available. The operational and safety aspects of the existing mainline, interchanges and adjacent arterial system within the AOI are determined and documented in the existing year analysis. This analysis is used to document existing conditions and deficiencies.
- **Opening year —** The first year in which the proposed improvements will be opened to traffic. If the proposed improvements are to be phased, the opening year is the year the first phase of the project will be opened to traffic.
- **Interim year(s) —**The opening year of the phased project. This is not required in every interchange proposal. Phased interchange improvements require additional interim analysis for the year each phase is anticipated to open to traffic. An interim year also is required when an alternative shows failure prior to the design year. In this situation, the interim year is the year of failure of the

proposed improvements. An interim year may not be required if no phased improvements are planned, or the preferred alternative provides acceptable operations until the design year.

- **Design year —** The design year for IMR and IJR projects normally is 20 years after the opening year. The design year is used for all subsequent project phases, such as PD&E study and design. If the proposed project phasing extends beyond the 20-year horizon, the requestor is required to show the improvements that will be in place in the design year and beyond the 20-year period. However, FDOT will only consider alternative phases completed within the 20-year horizon. The design year for an IOAR is at least 10 years after the opening year.

The MLOU should include the base and planning years of the travel demand model.

Two additional analysis years are considered for travel demand forecasting. These are the base year and planning horizon year, which are documented when preparing data and traffic forecasts. The outputs from the travel demand forecasting model for the base and planning years are used as the basis to forecast opening, interim and design year travel demand. Techniques to interpolate or extrapolate travel demand model data to the analysis years shall be documented in the MLOU.

- **Base year —** The year for which the selected travel demand forecasting model was calibrated. The most current version (as close to the existing year as possible) of the adopted travel demand forecasting model shall be used.

- **Planning horizon year —** The approved forecast or horizon year of the selected travel demand forecasting model.

3.4.4 Coordination

Coordination with other agencies, such as MPOs and other affected entities, is part of the IAR document process. Proper coordination helps avoid conflicts with other new or proposed changes in access or corridor improvements within the vicinity of the IAR project. Additionally, coordination with other agencies could lead to the adjustment of design concepts to meet permitting requirements in later phases of project development. As such, the MLOU shall identify all coordination efforts that will be performed in the IAR process.

3.4.5 Data Collection

Data to be collected for the IAR analysis includes roadway geometrics, travel demand and traffic control. Existing traffic data includes daily and turning movement counts, queue data, origin-destination data and heavy vehicle data; speed and travel time data; traffic control data; transit data; crash data; and information on bicycles and pedestrians. Efforts to use existing databases and studies are emphasized. However, field observations should be performed to confirm the reasonableness of the existing data. For further details on the data collection requirements, the requestor should refer to the FDOT Traffic Analysis Handbook.

In the event additional data collection is necessary after the MLOU has been approved, the requestor is required to develop a supplemental methodology as an amendment to the MLOU. The supplemental methodology for additional data collection shall be approved by the DIRC prior to the initiation of data collection. The methodology shall contain the justification for any additional data need, the collection techniques and limitations on use of data.

3.4.6 Travel Demand Model Selection and Forecasting

Model selection and development of demand volume projections shall be done based on the guidelines and techniques published in FDOT's Project Traffic Forecasting Handbook, Project Traffic Forecasting Procedure Topic 525-030-120 and Traffic Analysis Handbook. The adopted regional travel demand model to be used in the analysis shall be identified in the MLOU. Any deviation from the use of the District's and MPO's approved models or methods shall include documentation to support justification for such deviation. All assumptions used to determine future traffic demand shall also be identified. The technique recommended to validate the base year model shall be discussed in the MLOU. The base year model shall be validated to replicate existing year traffic volumes and trends.

3.4.7 Traffic Operational Analysis

Defining the scope of traffic operational analysis is part of the MLOU. The scope of the traffic analysis should, therefore, be supported by the area type, existing traffic operating conditions and analysis tools. Additionally, prior to finalizing the scope of the analysis, an IAR coordination meeting called by the DIRC should be held. The coordination meeting also is used to define the purpose and need for the IAR document, the goals and objectives of the IAR and the operational analysis limits. Composition of the coordination meeting should include the requestor, DIRC, SIRC, FHWA DTE and technical staff from the various disciplines in the District.

Area type is defined as rural, transitioning into urban areas or urbanized areas. The requestor should reference the FDOT Quality/Level of Service Handbook for more discussion about the area type.

Knowledge of existing operational conditions is essential to determine if the existing facility is oversaturated or undersaturated. Such knowledge is useful to establish the analysis AOI and to select the type of analysis tool.

Knowledge of existing conditions is essential to determine operating conditions.

Proper selection of a traffic analysis tool and approach determines the success of any analysis effort. As such, the requestor must possess sufficient knowledge of traffic flow analysis and limitations (strengths and weaknesses) of the traffic analysis tools. The requestor should be aware that no single tool can analyze or model all project scenarios. It is recommended that the analysis effort correlate the magnitude of the problem. The use of sophisticated tools and approaches should match the complexity of the problem that the analysis is intended to evaluate. Further guidance for tool selection is provided in the FDOT Traffic Analysis Handbook.

3.4.8 Safety Analysis

The safety analysis methodology shall be documented and agreed to in the MLOU. The safety analysis discussion provided in the MLOU should follow and be consistent with the MLOU template available on the Systems Implementation Office website. For further information regarding the safety analysis discussion in the MLOU, please refer to **Section 6.3**.

3.4.9 Performance Measures

Performance measures must be chosen to meet the need for the IAR.

Performance measures are Measures of Effectiveness (MOEs) used to evaluate the operations and safety performance of an IAR. Identification of the performance measures in the MLOU enhances the focus of the analysis to quantify the benefits and impacts of the IAR. Performance measures must be selected to meet the purpose and need for the IAR document. For the performance measures to be useful they must ultimately provide information that can be used to make investment and management decisions.

LOS Targets for Interchanges

Interchange modifications should result in improved traffic operations. The build alternative shall result in operating conditions equal to or better than the no-build. Florida LOS requirements are defined in FDOT Policy 000-525-006 and are detailed in the current Quality/Level of Service Handbook. Within the LOS Policy and Quality/Level of Service Handbook, specific minimum acceptable targets are given for limited access highways based on the area type and lane restrictions. Proving the access proposal would meet minimum LOS targets does not guarantee its acceptability.

Other Performance Measures

Other performance measures that may be evaluated include, but are not limited to, speed and travel time, queue length, person/vehicle served, control delay, trip length, number of phase failures, percent demand served in peak hour, volume to capacity (v/c) ratio, crash rates and frequency, reduction in crashes, density, network-wide MOEs (such as vehicle miles traveled, total vehicle delay, etc.) and travel time reliability. It is recommended to establish all MOEs by analysis type that will be used to evaluate the performance of an IAR in the MLOU. Guidance for performance MOEs selection is provided in the FDOT Traffic Analysis Handbook.

3.4.10 Environmental Considerations

The MLOU should identify a status and schedule of the PD&E study. Environmental documentation in an IAR document is minimal and limited to fatal impacts and known environmental impacts used to compare build alternatives. Known or potential environmental issues shall be documented in the IAR document because they affect the IAR approval process. Additionally, known environmental information may be used to identify any fatal-flaw conditions that may affect the selection of the improvement alternative and NEPA decision. Any environmental fatal impacts shall be identified as early as possible to determine whether the requestor should proceed with the IAR proposal. If a previous ETDM screening has been completed, then the results should be summarized in the IAR document. These results help determine if there are any significant or fatal environmental impacts.

3.4.11 Design Exceptions and Variation

The geometry of the roadway is important to the overall operation and safety of the highway network. The geometry of the roadway is affected by traffic and environmental variables, such as volumes, speeds, right of way, environmental impacts, etc. Therefore, the geometry of the roadway is an important part of the IAR document. While detailed geometric design is performed in later phases of the project, geometric information and conceptual design developed in the IAR document should be consistent with the FDOT design criteria and standards outlined in the FDOT Design Manual (FDM). It should be noted that compliance with design standards and criteria does not guarantee SO&E acceptability of the IAR document. Rather, the acceptability determination is based on a full evaluation of FHWA's two policy points.

When developing the MLOU, the requestor shall take the following into consideration:

- For all new construction; reconstruction; and resurfacing, restoration and rehabilitation (3R) projects on the SHS, FDOT design standards (FDM, Structures Manual, Standard Specifications for Road and Bridge Construction) apply. For design standards not listed in these manuals, American Association of State Highway and Transportation Officials (AASHTO) design standards shall apply.
- When it becomes necessary to deviate from the department's criteria and standards, early documentation and approval are required. As such, the MLOU shall identify any anticipated exceptions and variations to FDOT or FHWA design standards, criteria, rules and procedures.

3.4.12 Conceptual Signing Plan

The MLOU shall contain a requestor's commitment to prepare a conceptual signing plan. The Manual on Uniform Traffic Control Devices (MUTCD) serves as guidance for preparing the signing plan. At a minimum, the conceptual signing plan will address the following:

- Give directions to cities and other destinations (including distances)
- Give adequate advance notice of the upcoming or downstream interchanges based on MUTCD criteria
- Direct drivers to the correct lanes for lane change movements.
- Include a scale and symbols for signalized intersections.

The signing sequence for managed lanes may require additional signing in advance of access points. Please refer to the Managed Lanes Guidebook and the Traffic Engineering Manual for further guidance for signing managed lanes.

It is very important to note that adequate signing is not a replacement for sound geometry design and engineering judgment. The conceptual signing plan in IARs is intended for planning purposes only and not for design or construction. The level of detail will provide enough information to determine if a driver can safely navigate the facility and any innovative designs throughout the AOI.

Signing plans prepared in projects that are beyond the conceptual phase (such as design, design-build and re-evaluations) will be accepted in the IAR document in lieu of the conceptual signing plan. Please refer to **Appendix G** for examples of conceptual signing plans for common types of IARs. These examples are not all inclusive and depending on the proposed concept in the IAR or innovative interchange, some changes might be required to meet MUTCD.

3.4.13 FHWA's Policy Points

The MLOU shall include a commitment to meet FHWA's two policy points. The FHWA policy points are listed and discussed in **Chapter 4** of this User's Guide.

3.5 Review and Approval of MLOU

The review and consideration for approval of the MLOU is performed according to FDOT Procedure 525-030-160 and discussed in **Chapter 1** of this User's Guide. The ERC system shall be used when reviewing the MLOU. For proposals affecting more than one District (i.e., FTE proposals or proposals near District boundaries), all affected DIRCs shall be part of the signatories of the MLOU. It is important for the MLOU to clarify any review time frame expectation, especially for high-priority projects.

The DIRC, SMA and FHWA (according to **Section 2.5**) shall accept and sign the MLOU after they concur with the MLOU requirements and need to proceed with the IAR document. The signed MLOU serves as the notice to proceed for the requestor, unless otherwise stipulated by the DIRC. Any work performed by the requestor prior to the approval of the MLOU is considered "at risk" and may not be accepted by the DIRC. If a change to the agreed methodology is proposed during the IAR process, then an amendment to the approved MLOU shall be required. The requestor shall prepare the amendment only for sections of the MLOU that have changed and submit for approval. The amendment approval shall follow a similar process as of the original MLOU. All parties that signed the original MLOU shall also approve the amendment. An IAR re-evaluation shall require submittal of a new MLOU for approval. This is discussed in more detail in **Chapter 7** of this guide.

3.6 MLOU Addendum

Some changes to the executed MLOU may require an Addendum to be prepared, for example, a change in analysis years. It is recommended that the DIRC discuss the changes with the SIRC for a decision on whether an Addendum is required.

The approval of the Addendum will follow the same review and approval authority process as the original MLOU. The only required sections of the MLOU template to be updated are the sections that are being modified; all other sections can be noted as "no change." Minor deviations do not require an addendum; once discussed with the SIRC they can be documented in the IAR document.

3.7 MLOU Qualifying Provisions

The following qualifying provisions shall be stated in each MLOU:

- Coordination of assumptions, procedures, data, networks and outputs for project traffic review during the access request process will be maintained throughout the evaluation process.
- Full compliance with all MLOU requirements does not obligate the Approval Authorities to accept the IAR document.
- The Requestor shall inform the approval authorities of any changes to the approved methodology in the MLOU and an amendment shall be prepared if determined to be necessary.

Chapter 4 Explanation of FHWA Policy Points

4.1 FHWA Policy Points

Adequate access control to limited access facilities is critical to provide the highest LOS in terms of safety and mobility in these facilities. The new and revised access points shall meet FHWA's two policy point requirements listed in this section. The policy points are included in the FHWA Policy on Access to the Interstate System, which can be found at: https://www.fhwa.dot.gov/design/interstate/ 170522.cfm.

Policy Point 1

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

Policy Point 2

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

Chapter 5 Documentation Requirements

The Interchange Access Report is developed as a stand-alone document consistent with the requirements of the MLOU. If a feasibility study or any other previous report has been prepared, then relevant information from such documents should be summarized and provided in appropriate sections of the report or in the appendices. Most importantly, the report should be clearly written for a reviewer not familiar with the project to understand the intent of the report.

FDOT and FHWA will use the information contained in the report to determine the SO&E acceptability of the report. The determination of SO&E acceptability shall only be given when justification and documentation provided in the report successfully address FHWA's two policy points, as stated in the updated Policy on Access to the Interstate System, May 22, 2017.

Acceptability of an IAR is based on full evaluation of the FHWA's two policy points.

The Interchange Access Report shall address and document the following items in detail:

- Executive summary (FHWA's two policy points)
- Background
- Purpose and need covering operational and safety deficiencies
- Methodology
- Existing conditions
- Traffic forecasting
- Future conditions
- Alternatives analysis
- Funding plan and schedule
- Recommendations and conclusions

The documentation requirements will be determined by the DIRC in cooperation with the approval authority during the MLOU development phase. When microsimulation analysis techniques are used, a calibration report shall be prepared and included in the report. The final IAR document must be signed and sealed by a Professional Engineer registered in Florida.

5.1 Analysis of Existing Conditions

All IARs must include an existing year analysis. The purpose of this analysis is to support the need for the project should there be existing operational issues. Also, the analysis of existing conditions provides the baseline operational characteristics for comparison of build and no-build alternatives.

The existing conditions analysis should include the common elements such as traffic volumes, multimodal mobility, land use, safety and roadway characteristics. The existing conditions analysis should also identify any known or potential environmental impacts that could be a fatal flaw to the access proposal or would result in significant mitigation efforts. This analysis includes navigable waterways, wetlands, public lands, contaminated sites, noise-sensitive sites, historical or archaeological sites, threatened and/or endangered species, contamination, air quality, Section 4(f) lands and impacts to neighborhoods or any other environmental issues. The requestor shall be responsible for identifying any such fatal flaws as soon as possible and bringing them to the attention of the DIRC.

5.2 Safety Analysis

The purpose of the safety analysis is to understand how geometric designs will impact safety and crash likelihood at an existing or proposed interchange. The appropriate methodology for a project will depend on the type of project, the scope of the project and the historical crashes. The safety analysis method chosen for an IAR analysis should be in concert with other analyses, such as Purpose and Need, Alternative Analysis, Design Exception and Value Engineering, which are done during PD&E Study or Design phase. It is recommended that the level of safety analysis effort be discussed and agreed upon during the MLOU stage of the project. The safety analysis shall include the analysis of existing conditions using historical data and quantitative analysis of the proposed modification based on the Highway Safety Manual (HSM). **Chapter 6** of this IARUG provides the guidance needed to perform appropriate safety analyses in IARs.

5.3 Considered Alternatives

The alternatives to be considered and analysis years required are identified in **Table 5-1**.

Once the existing and no-build conditions are known, the requestor develops potential improvement concepts that address the purpose and need for the project. It is recommended that the requestor schedule a meeting or a workshop with the DIRC and approval authority to review the considered alternatives. The DIRC shall invite staff from other offices such as Environmental Management, Design, Traffic Operations, Construction, etc., to review and determine the viability of the alternatives in addressing the need for the project.

Details of all reasonable build alternatives considered, including those eliminated from further consideration, shall be documented in the Interchange Access Report. The documentation for the alternatives eliminated can be minimal, such as a brief description of what was considered and reasons (fatal flaws) for elimination. Build alternatives meeting requirements of the project will have a more detailed description and be carried forward for evaluation.

Similarly, alternatives considered during the Alternative Technical Concepts (ATCs) process in a design-build (D-B) project shall be documented in the report. It is understood that not all of these alternatives can be evaluated in the report, but the report should include discussion of all reasonable alternatives that were considered and reasons for not carrying them further for evaluation.

Table 5-1: Considered Alternatives

Considered Alternatives		Year of Analysis		
		Opening Year	Interim Year	Design Year
No-Build Alternative		✓	*	✓
Build	Preferred Alternative	✓	*	✓
	Other Alternatives	✓	*	✓
TSM&O Alternative**		✓	*	N/A

Note: ✓ Required
* May be required as determined by DIRC and approval authorities
N/A Not applicable
** Does not apply to D-B and P3 projects, need determined by DIRC

The no-build alternative is the existing conditions plus any committed projects in the adopted MPO's Transportation Improvement Program (TIP), Statewide Transportation Improvement Program (STIP), Local Government Comprehensive Plan (LGCP), MPO LRTP and Cost Feasible Plan (CFP), FDOT's Adopted Five-Year Work Program, SIS Second Five-Year Work Program and SIS Modal Plan. The committed projects also may include mitigation improvement projects that are elements of approved development orders. Privately funded projects that relieve traffic on state and local highways may be considered if agreed to by the DIRC.

The requestor must consider the implementation of Transportation Systems Management and Operations (TSM&O) strategies as an alternative in the Interchange Access Report. TSM&O alternatives are relatively low-cost approaches that can satisfy the traffic needs without having to construct or modify an interchange. TSM&O alternatives that may be considered include adding crossroad turn lanes, improving signalization strategies or increasing the number of lanes dropped along a ramp segment in advance of the mainline ramp terminal.

The TSM&O alternative by itself may not always satisfy the project needs, especially in case of D-B and Public-Private Partnership (P3) projects. In such a situation, the build alternatives evaluated in the Interchange Access Report shall incorporate elements of TSM&O in the analysis.

5.4 Travel Demand Forecasting

Analysis of future conditions involves the preparation of future traffic volumes for all agreed-upon alternatives utilizing the travel demand projection models, input data and adjustment procedures, as documented in the MLOU. If no travel demand model is available, historic traffic data may be used to develop design traffic by trend analysis.
The specific FDOT procedures and technical criteria for future-year traffic forecasting are discussed in

detail in the Project Traffic Forecasting Handbook.

Documentation of the future conditions forecast should include, at a minimum:

- Methodology techniques, model refinement and results of the network and project (subarea) model validation efforts. The technique recommended to validate the base year model shall be discussed in the IAR document. The base year model shall be validated to replicate existing year traffic volumes and trends. Any adjustments made to base year model volumes should be carried over to design year.
- Travel-demand forecasts within the AOI for the proposed opening, interim (if applicable) and design years for all alternatives depicted on maps, line drawings and tables, as agreed to in the MLOU.
- Historical traffic data (trend analysis).
- Bureau of Economic and Business Research (BEBR) population projections.
- Summary of modifications to land use or socio-economic data files and networks for all analysis years.
- Model output smoothing techniques applied, the method used and the extent of adjustments.
- Post-processing of travel demand model volumes.
- Consistency with major developments affecting the traffic within the AOI.
- Traffic factors agreed to in the MLOU.

5.5 Evaluation of Alternatives

The evaluation of alternatives for an IAR document is a thorough technical investigation to compare the performance of alternative improvements that are developed to meet the need for the project. Performance measures or MOEs that were identified in the MLOU are used to compare the alternatives. Guidance for selection of appropriate traffic analysis tools used for evaluation of alternatives is provided in the FDOT Traffic Analysis Handbook and agreed to in the MLOU.

The evaluation of alternatives should address, at a minimum:

- Safety,
- Operational and engineering performance and
- Environmental considerations.

The evaluation of alternatives should be documented to allow independent review of the IAR.

The evaluation of alternatives must be consistent with the MLOU. The SO&E analyses performed in the evaluation of alternatives shall demonstrate that the IAR does not have significant negative impact on the operation of the mainline and adjacent network. The build alternative shall not result in conditions worse than the no-build alternative at any analysis year. Additionally, the analysis should use sufficient data and its documentation should be of sufficient detail to allow independent review of the IAR document. During the alternatives evaluation stage, the DIRC should schedule an alternatives meeting with the SIRC, FHWA and other District offices to discuss the preferred alternative and which other alternatives were considered early in the study, before major analysis has been completed. It is understood that the preferred alternative may not be finalized at this stage.

If the project will be constructed in phases, the analysis must demonstrate that each phase can function independently and does not affect the safety and operational efficiency of the facility. If the project is proposed as interim or to be constructed in phases, then a detailed description of the ultimate design and future planned projects should be included in the IAR document.

5.6 Design Exceptions and Design Variations

Any request for design exceptions or design variations must be submitted with sufficient engineering, safety and operational analyses in accordance with FDM design controls and criteria. All known requests for exceptions must be fully documented and justified by the requestor during the Interchange Access Request process. Design exception and design variation approvals shall be obtained as described in the FDM. It is noteworthy that approval of an exception does not ensure approval of an IAR document.

5.7 Local Transportation Plans and Planning Studies

An IAR document shall be consistent with the adopted statewide and local transportation plans and other planning documents. The MPO or other local government plans must support the IAR proposal, and any inconsistencies shall be resolved prior to its submittal for approval.

It is recommended that an interchange master plan or a planning study be prepared prior to developing the IAR proposal. The planning study includes the existing and financially feasible planned interchanges from the MPO or other local government plans and identifies the future multimodal transportation development needs in the corridor. This assists in prioritizing the interchange needs and helps determine the impacts of new access or modification of an existing access to other interchanges in the corridor. An interchange master plan, if prepared, does not replace the formal IAR document.

If the access proposal is not consistent with the adopted local transportation plan, the DIRC shall examine the discrepancy and determine which access (proposed or local transportation plan access) better serves the public interests safety and operational performance of the limited access facility. If both are needed, the DIRC shall investigate how they can be corrected or reconciled to minimize operational and safety problems.

If the access proposal is not contained in the current local transportation plan, the DIRC shall determine the reason and need for the proposed access and determine its impact on the mainline and adjacent interchange operations. If it is decided to move forward with the proposed access, then it will be required to be included in the local transportation plan to ensure planning consistency. In all the above cases, the IAR proposal shall be prepared per the requirements outlined in this guide.

5.8 Funding Plan

A commitment of funding and inclusion of projects as part of the planning process in the adopted plans (LRTP, STIP or TIP) prior to final approval of the IAR document are part of the requirements for determination of the SO&E acceptability.

When the project is included in the FDOT Five-Year Work Program or MPO TIP, subsequent phases of the project must be included in the work program. If this is not the case, the funding for successive phases must be identified. The TIP may include a project that is not fully funded only if full funding for the time period to complete the project is identified and fiscally committed in the LRTP.

For projects proposed by a developer, a financial plan prepared by the developer must provide the DIRC with enough detail to determine the source of all funds available to finance the access proposal. The DIRC should be more involved in development-driven projects and include SIRC early in the IAR process.

5.9 Access Management Agreement for the Interchange Cross Streets

When the DIRC determines it is necessary, the requestor may be required to develop an access management agreement with all necessary parties. The agreement will be between FDOT, the local government, the requestor and individual property owners. It may be necessary to include other affected parties. This documented agreement will be based on an access management plan for the property located up to a minimum distance from the end of the interchange ramps, depending on the access classification of the crossroad. The access management plan shall provide reasonable access to the public road system and maintain the long-term safety and operation of the interchange area. Any planned access to the SHS within the interchange area shall conform to Rules 14-96 and 14-97, F.A.C., and be based on criteria outlined in the FDOT Access Management Guidebook. Failure to develop and execute the agreement may result in FDOT stopping the IAR review process and/or denying the IAR.

Access management standards require more stringent regulation of driveway connections and median openings in interchange areas. Interchange areas are defined as either ¼ mile from the interchange if the crossroad is a controlled-access facility, or up to the first intersection with an arterial road, whichever is less. The distance is measured from the end of the ramp that is farthest from the interchange. These distances may be increased at the discretion of FDOT to improve the operations and safety of the facility.

5.10 Intergovernmental Coordination

It is important to consider coordination with other agencies during the IAR process. Coordination with stakeholders performed during the IAR process shall be documented.

The DIRC shall determine the level of coordination required and the federal, state, regional and local agencies that must be contacted. The DIRC also shall define the role of the requestor to ensure the required coordination is properly carried out and addresses all appropriate intergovernmental comments. Areas where intergovernmental coordination may be needed include:

- Local policies,
- Data sources,
- Environmental information,
- Methodology development,
- Proposal review,
- Infrastructure and IAR funding commitments,
- Consistency with local land use and transportation plans,
- Project-related issues to include access management and land use coordination in the interchange area,
- Signal progression and timing and
- Public-involvement information.

5.11 Environment Considerations

Environmental documentation in an IAR document should be kept to a minimum and limited to any fatal flaws and known environmental impacts used to compare the build alternatives. Known or potential environmental issues shall be documented in the IAR document because they affect the IAR approval process. Additionally, known environmental information may be used to identify any fatal-flaw conditions that may affect the selection of the improvement alternative and NEPA decision. The requirements for documentation of environmental considerations as part of an IAR document will vary by project and location. The purpose of providing environmental information is to support the informed decision-making process on the potential environmental consequences that may affect future NEPA decisions.

Projects involving IJRs and IMRs that are the result of the standard MPO or local government planning process are subject to the planning screen of the ETDM process. This screening helps to understand the environmental impacts of the proposed improvement and determine if any fatal flaws exist.

For projects that are not included in any local government plan, the DIRC shall work with the District ETDM coordinator to ensure the inclusion of these projects in the planning and/or programming screens. This process is required for all qualifying projects as defined in the ETDM Manual. The DIRC shall provide the ETDM coordinator with any information regarding the project, including location, limits of study area and need for the project. The ETDM coordinator shall load the project information into the ETDM database and notify the Environmental Technical Advisory Team (ETAT) members of the project for review and comment.

The DIRC shall act as the project manager with regard to the ETDM process. It is the DIRC’s responsibility to ensure that the requestor receives any comments from the ETAT members resulting from the screening analysis. These comments shall be addressed in the IAR process and also during the subsequent NEPA phase of the project.

The IAR document shall identify the environmental considerations that influenced the outcome of the alternative development and selection process. Environmental discussion should be brief because environmental considerations will be discussed in detail in the PD&E document.

5.12 Review of the Report

When completed, the report is forwarded to the DIRC for review and comment, as agreed to in the MLOU. Once the DIRC's comments are addressed, the report is forwarded to the SIRC for review, comment and approval recommendations. The Interchange Access Report is reviewed to ensure compliance with FHWA's policy points, the requirements set forth in the MLOU, sufficiency, completeness, correctness and consistency of the data, analysis and recommendations. The review must be done utilizing the ERC system. All IARs shall be reviewed per authority tables in **Chapter 2**.

5.13 Quality Control and Quality Assurance

FDOT requires Quality Control (QC) and Quality Assurance (QA) processes to be employed for all deliverables. The implementation of QA/QC procedures is a critical part of the development of IARs. An adequate QA/QC plan helps ensure that all FDOT and FHWA procedures are followed, as well as transparency, completeness and consistency of IAR documents. The project schedule should allow adequate time for QA/QC reviews. The QA/QC guidelines provided in this section will help the project team develop alternatives that are operationally viable, safe and constructible. QA/QC procedures shall be followed for every document, regardless of schedule. All documents and deliverables shall be checked for QC, and all QC documentation must be provided to the District DIRC upon request.

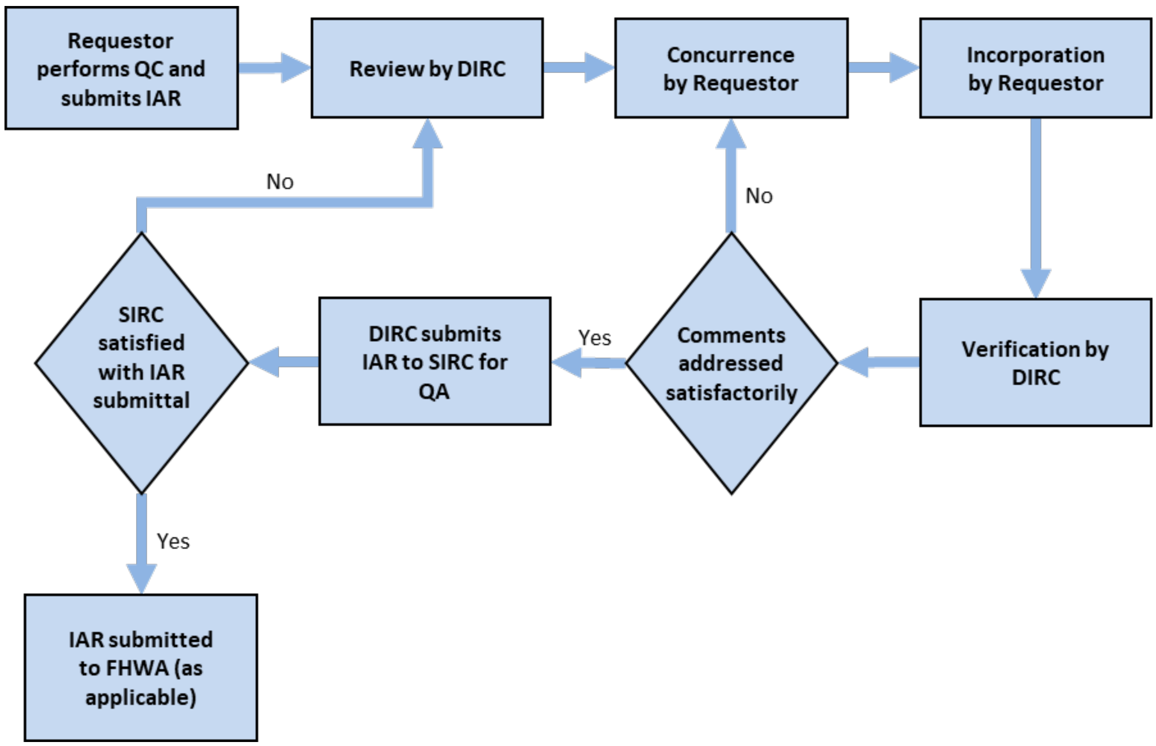
QC shall be performed by the DIRC. QC is a detailed review involving checking, incorporating and verifying the analysis and documentation prior to submittal of any project items or the IAR document. The DIRC and FDOT discipline leads involved in the IAR are responsible for ensuring that the QC review is adequately performed.

Two important roles of the DIRC are (1) to ensure the requestor's QA/QC plan is being adequately followed and (2) to review project deliverables to ensure they are of appropriate quality and conform to FDOT standards and procedures and FHWA policy points. It is the responsibility of the DIRC to ensure that the IAR document submittal is reviewed by experienced and qualified staff. The DIRC shall include the following District offices in review of the IAR document: Environmental Management, Design, Traffic Operations, Structures, Right of Way, Maintenance and Program Management. The FDOT project manager (PM) and DIRC should meet with the consultant PM early in the project to reach a common understanding of QA/QC plan to be followed and submittal requirements. A record of all QA/QC activities shall be kept. QC documentation, including completed checklists, certifications or the reviewers' check set of the reviewed documents, should be provided upon request.
QA is performed by the Central Office SIO. QA is the overall review and confirmation of the quality control process to ensure a quality product. The SIRC, on behalf of the SMA, reviews each report submitted for

approval consideration and its associated analyses to ensure compliance with policies, procedures, standards, guidelines and processes.

The QA/QC process for IARs is shown in **Figure 5-1**.

Figure 5-1 QA/QC Process for IARs



If there are any outstanding comments that cannot be resolved between requestor and checker after one round of review, then the issue resolution protocol will be followed.

All IAR document submittals to the DIRC shall have a QC review log or stamp showing that a review has been completed prior to submittal. A sample QC checklist and review log is shown in **Table 5-2**. The major review items are listed in the table and it should not be considered an all-inclusive list. It is the responsibility of the QC checker to perform a complete review of the IAR document prior to submittal, and additional review items shall be added to the checklist as needed. Finally, these items must be checked for completion as well as reviewed for correctness in the IAR document.

Table 5-2: Quality Control Checklist and Review Log (Sample) Interchange Access Request Proposals

Project Name: | **FDOT Project Manager:**

FPID No. | **DIRC:**

No.	ITEM	READY FOR REVIEW	
		CHECKED BY	DATE
1	**Travel Demand Forecasting**		
	Has the latest version of approved model been used? Have all adjustments been made, per FDOT guidelines and MLOU, and reviewed?		
	Have the traffic factors been reviewed and checked to make sure K, D and T factors are reasonable?		
	Did the project traffic development follow FDOT Traffic Forecasting Handbook and MLOU?		
	Have existing and future traffic volumes been checked for reasonableness?		
2	**Operational Analysis**		
	Are the inputs into traffic software, correct?		
	Has the validation/calibration of microsimulation been properly documented?		
	Are operational analysis results reasonable?		
3	**Safety Analysis**		
	Has appropriate safety analysis been performed to quantify impacts of the recommended improvements?		
4	**Concept Design**		
	Does the proposed design meet minimum design standards?		
	Have the exceptions and variations, if any, been justified?		
5	**Conceptual Signing Plan**		
	Has a conceptual signing plan been reviewed and checked to make sure it can be signed and meets MUTCD?		
6	**FHWA's Two Policy Points**		
	Does the proposal satisfy FHWA's policy points?		
7	**Report Review**		
	Has the report been reviewed for grammatical and editorial errors?		

The DIRC shall submit a written statement of technical review for each IAR document certifying that appropriate QC reviews were conducted and the report satisfies the requirements of FHWA's policy points and FDOT's procedure for new or modified interchanges. The statement shall be signed by the requestor and the DIRC.

The recommended format of the statement of technical review is provided in **Appendix E**.

5.14 Quality Assurance Reviews (QARs)

Quality Assurance Reviews (QARs) of the District's IAR process are conducted by CO SIO. The purpose of the QAR is to ensure that the Districts follow the procedures and guidelines for the preparation of the IAR document. For projects processed under the PA, the QARs will be the expansion of the annual review required by FHWA. The QAR satisfies a requirement for the SO&E delegation under the IAR-PA. At a minimum, one District QAR will be done annually. The frequency may be increased as needed.

The District QAR Memorandum will be prepared and submitted to:

- Chief Planner
- District Secretary
- District Planning and Environmental Management Office (PLEMO) Manager
- DIRC

The SIO has developed a standard process that will be used for District QARs. The QAR Process, List of Requested Items and Memorandum Template can be found in **Appendix F**.

The DIRC will submit a written response to the SMA within 30 days after receipt of the QAR Memorandum addressing any findings, including a reasonable solution to the areas identified for improvement. Any comments and questions concerning the QAR Memorandum should be discussed with the SMA or SIRC prior to submitting the written response to the SMA. QARs are valuable tools for identifying areas that need improvement and/or lack training. QARs are also an opportunity to learn new ideas or good practices from the Districts.

CO SIO and FHWA develop and facilitate IAR training for the Districts and their consultants. The training will be scheduled and located dependent on the need and budget.

5.15 Processing for Approval Decision

The IAR document is deemed ready for signature from the approval authority when it complies with FHWA's policy points and FDOT's policies and procedures. Additionally, all comments and issues raised in ERC during document reviews must be resolved to their satisfaction before the DIRC transmits the report for signatures (the signing process can be found in **Appendix D**).

The SIRC is responsible for notifying the FHWA Florida Division Office about FDOT's review and determination of safety, engineering and operational acceptability decision for programmatic IARs. The notification to FHWA will include:

1. Location and type of change on the interstate system,
2. Location where information validating acceptability of the IAR document may be accessed,
3. Verification that the required analysis, review and actions taken in considering and processing the IAR document comply with FHWA's policy points and PA and
4. Acceptability determination by the FDOT Chief Engineer.

The FHWA Florida Division Office's expedited approval of programmatic IARs will involve concurrence with or objection to the Chief Engineer's determination of SO&E acceptability within five business days of receipt of notification. After receiving FHWA's approval decision, SIRC will inform the DIRC about the final decision.

Chapter 6 Safety Analysis Guidance

6.1 Introduction

The purpose of performing safety analyses in 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 document. 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:

1. The Countermeasure Crash Modification Factors (CMFs) and
2. The Highway Safety Manual (HSM) Part C Methodology.

These methodologies are based on the guidelines set by the HSM. The HSM is published by 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
  - Describes the purpose and scope of the HSM and explains the relationship of the HSM to planning, design, operations and maintenance activities.
  - Presents an overview of human factor principles for road safety and fundamentals of the processes and tools described in the HSM.

- Part B – Roadway Safety Management Process
  - Presents the steps that can be used to monitor and reduce crash frequency and severity on existing roadway networks.

- Part C – Predictive Method
  - Provides a predictive method for estimating expected average crash frequency of a network, facility, or individual site.

- Part D – Crash Modification Factors
  - 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.

In March 2022, the FDOT Safety Office published the Safety Crash Data Guidance. The Safety Crash Data Guidance provides in-depth detail into the five-step process of performing a safety analysis. The safety analysis performed in IARs should follow the guidance provided in the Safety Crash Data Guidance. A summary of the five steps is provided below.

- Step 1 – Download the Data
  - Obtain most recent crash data and crash reports.

- Step 2 – Merge Data
  - When comparing datasets for duplication, maintain data for the primary dataset by removing the duplicated crash data from the secondary and tertiary datasets. CAR Online should be the primary dataset when comparing datasets, with SSOGis being the secondary and Signal Four being the tertiary dataset.

- Step 3 – Clean Data
  - Remove crashes based on the following characteristics: occurred outside the project limits, in parking lots or outside the study AOI.

- Step 4 – Summarize Data
  - Summarize the clean crash dataset in a spreadsheet tool.

- Step 5 – Safety Analysis
  - Begin safety analysis with clean dataset.

6.2 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:

- 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 FHWA CMF Clearinghouse, HSM and Florida Crash Reduction Factors (CRFs) can be used. Further information regarding Countermeasure CMF methodology is discussed in **Section 6.6.1**.
  - 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 6.6.2**.
- 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.

6.3 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 SIO website. The following information is required in the safety section of the MLOU:

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

- Safety analysis years
- Historic crash data sources

The safety analysis should be performed using the latest five full calendar years of historic crash data available at the MLOU stage as well as the current year up to the day before the MLOU is being prepared. For example, if the MLOU is being prepared on 3/17/2022, data should be pulled from 1/1/2017 to 3/16/2022. The current year crash data (1/1/2022 to 3/16/2022) is typically used to verify crash trends and patterns. If data is not available for the latest five full calendar years, then a minimum of three years of crash data can be used to perform the safety analysis. If less than five years of data are 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 6.5**.

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 SIRC and documented in the IAR document.

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

7.0 Safety Analysis

A. Detailed crash data within the study area will be analyzed and documented. The latest five calendar years of crash data shall be used.
Years: January 1, 2017 – March 16, 2022
Source: FDOT Crash Analysis Reporting System Online (CAR Online); Signal Four Analytics

Crash data from CAR Online and Signal Four Analytics will be used to support a quantitative safety assessment of the alternative design concepts. CAR Online will be used as the primary data source when comparing Signal Four Analytics data.

B. Identify the level of safety analysis to be performed, along with any software and tools to be used.

A quantitative safety assessment will be performed consistent with the FDOT's Interchange Access Request User's Guide, Safety Analysis Guidance. The safety analysis guidance incorporates the quantitative crash analysis procedures contained in the Highway Safety Manual (HSM) developed by the American Association of State Highway and Transportation

6.4 IAR Safety Analysis Process

The IAR Safety Analysis Process is depicted in **Figure 6-1**. 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 6.5**.

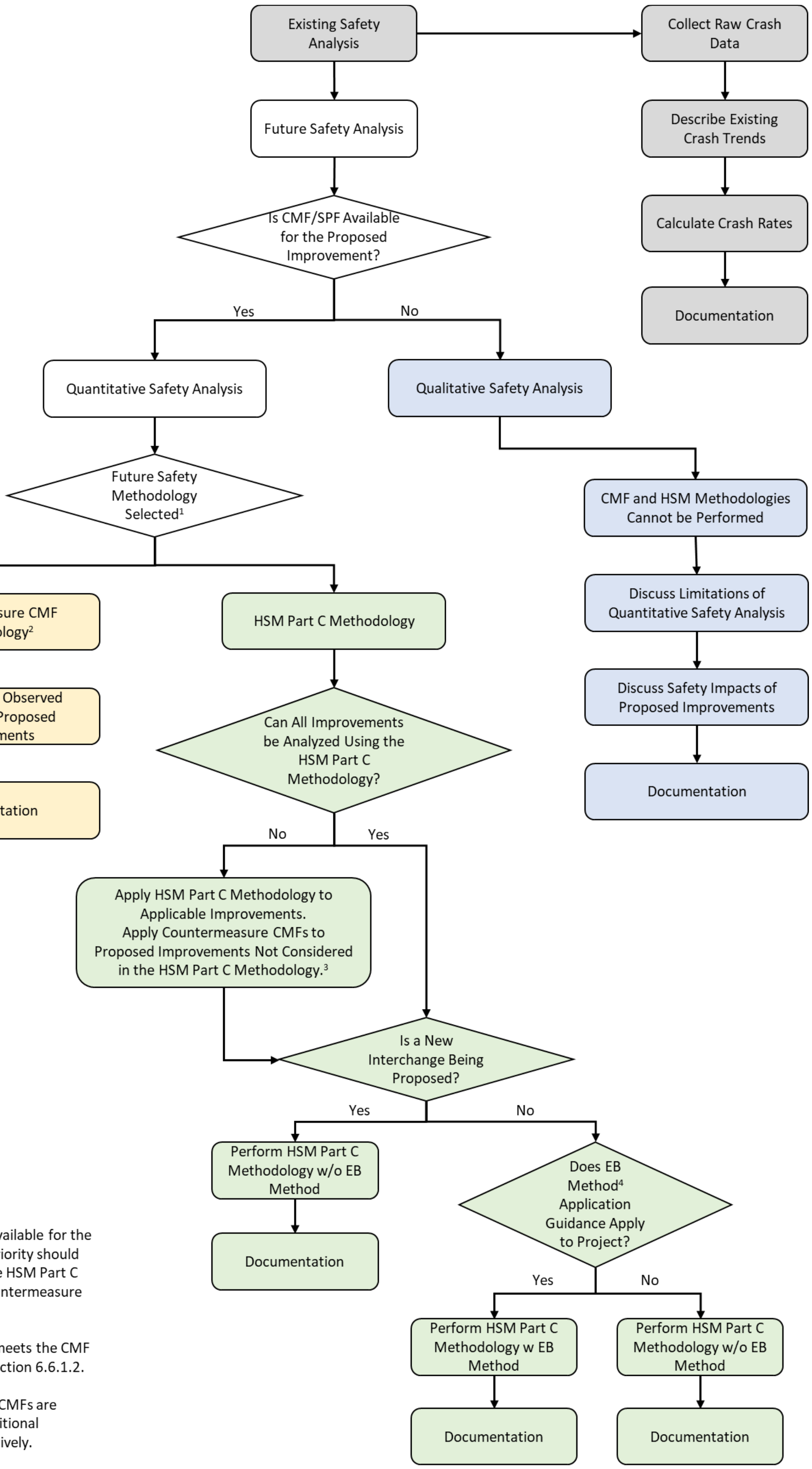
Step two is to perform the future safety analysis. To begin the future safety analysis, determine if the proposed modifications have a CMF or Safety Performance Function (SPF) that is applicable. If a CMF or SPF is available, proceed to quantitative safety analysis. If a CMF or SPF is not available, 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 6-1 IAR Safety Analysis Process



Notes

1. If a SPF and CMF are available for the same improvement; priority should go to application of the HSM Part C Methodology over Countermeasure CMF Methodology.
2. Ensure the CMF used meets the CMF Criteria discussed in Section 6.6.1.2.
3. If no Countermeasure CMFs are applicable, discuss additional improvements qualitatively.
4. EB Method is discussed in Section 6.6.2.1.

6.5 Analysis of Existing Safety Conditions

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

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, the 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 calendar years of historic crash data within the AOI. If data is not available for the latest five calendar 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 document. The study limits of the existing safety analysis should be the same as for the operational analyses. When retrieving historic crash data and performing an existing safety analysis, the steps outlined in the Safety Crash Data Guidance should be followed.

Per the Safety Crash Data Guidance, the first step in the safety analysis process is to download data. There are three main sources of historic crash data that can be downloaded, as shown in **Figure 6-2**.

Figure 6-2 Historic Crash Data Sources

CAR Online	• Crash Analysis Reporting System
SSOGis	• State Safety Office Geographic Information System
Signal Four	• Signal Four Analytics Tool

CAR Online, SSOGis and Signal Four receive the same crash records. However, the databases have different timelines, geolocation processes and data features. CAR Online and Signal Four are restricted to authorized users while SSOGis is publicly available. The CAR Online and Signal Four systems will be integrated into one system by operating from one copy of the FLHSMV crash records. This integrated system is anticipated to be available in late 2022 and will improve the data's processing speed.

1. **Crash Analysis Reporting System (CAR Online)** data can be requested from the District or State Safety Office or accessed from the FDOT mainframe with authorized access. The CAR Online database includes crashes on all public roads on and off the SHS, along with roadway and geolocation data. The data is subject to a review of fatal or incapacitating injury crash locations by FDOT prior to publishing. The main benefit of CAR Online compared to Signal Four is the manual systematic geolocation verification process.

2. **The State Safety Office Geographic Information System (SSOGis)** is a publicly available crash database in the form of a web-based map, which 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 all public roads on and off the SHS. Like the CAR Online database, the SSOGis crash data goes through a review process to verify fatal or incapacitating injury crash location, and the main benefit compared to Signal Four is the manual systematic geolocation verification process. In addition, the main benefit of the SSOGis compared to CAR Online is the geographical user interface. Therefore, non-state highway system crashes can be more easily extracted.

3. **The Signal Four Analytics tool** is an interactive, web-based geospatial crash analytical tool developed and hosted by the State of Florida at the University of Florida GeoPlan Center. 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. The main benefit of the Signal Four system compared to CAR Online and SSOGis is the crash records are available sooner.

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

Any of three sources of historic crash data can be used to perform the safety analysis. Combining the three data sources can provide a greater level of completeness when pulling crash data. If multiple sources of crash data are used to cover the safety analysis study area, ensure that the same data range is collected. It is possible for the CAR Online and SSOGis crash data to lag behind the Signal Four Analytics database. Also, do not mix data sources to meet the five years of safety data requirement. For example, do not take two years (2017–2018) of crash data from CAR Online and three years (2019–2021) of crash data from Signal Four Analytics.

Do not mix data sources to meet the five years of safety data requirement.

The next step in the Safety Crash Data Guidance is to merge data. If multiple sources of crash data are used, it is important to check and validate the crash data and ensure that crashes are not double counted. Duplicate crashes can be identified by using the unique crash numbers. When comparing the crash data sources, it is recommended CAR Online be the primary data source, with SSOGis being the secondary and Signal Four being the tertiary source.

The third step in the Safety Crash Data Guidance is to clean data. The data is cleaned by removing crashes that occurred outside the project limits. For safety analysis purposes, the project limits are based on the AOI of the intersection or segment. It is recommended to remove crashes that occurred in parking lots or outside the study area. Next, reclassify any crash severities that are classified as "unknown," "none" or "non-traffic fatality" as a property damage only (PDO) crash.

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

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 (K), severe injury (A), moderate injury (B), minor injury (C), property damage only (O) — commonly referred to as KABCO

An 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)
- 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 document is provided below.

There were 354 reported crashes along the interstate within the study area during the five-year period; 66 occurred in 2017, 94 in 2018, 109 in 2019, 55 in 2020 and 30 in 2021. 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 night/dusk/dawn crashes reported, and 72 crashes occurred under wet/slippery pavement conditions. 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; however, 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 6-3**.

Figure 6-3 Crash Table and Diagram Examples

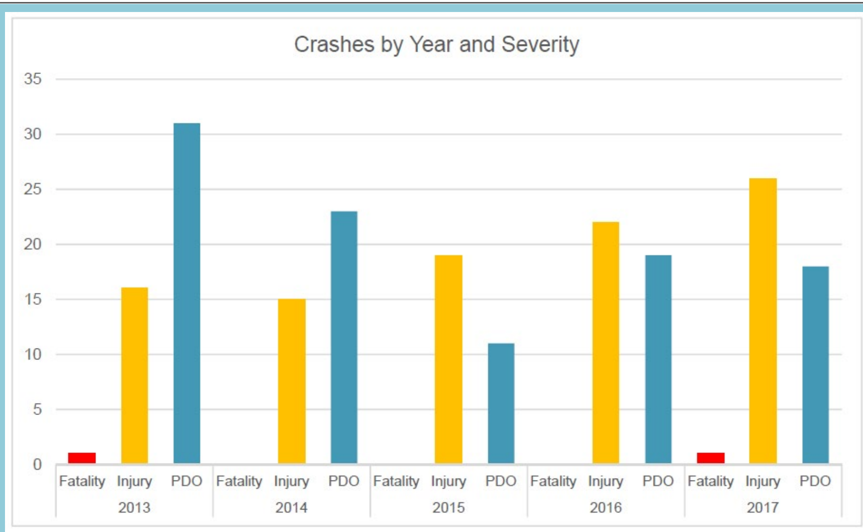
Crash Segment	Crash Type											Total
	Rear End	Head On	Sideswipe	Roll Over	Angle	Left Turn	Right Turn	Off Road	Pedestrian & Bicycle	Animal	Other	
I-75 SB Merge from SR 82	4	0	1	0	0	0	0	7	0	0	3	15
I-75 SB between SR 82 & SR 884	3	0	2	0	0	0	0	2	0	0	3	10
I-75 SB Diverge to SR 884	4	0	3	0	0	0	0	3	0	0	3	13
I-75 & SR 884 SB Off-Ramp	9	0	4	0	1	0	0	1	0	0	1	16
I-75 NB On-Ramp from WB SR 884	0	0	3	2	0	0	0	1	0	0	1	7
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**
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%

A table showing each crash segment broken down by crash type

Crash Segment	Crash Frequency & Rate					
	Severity	No. of Crashes	Daily Volume*	Segment Length (miles)	No. of Crashes Per Year	Total Crash Rate
I-75 between SR 884 & SR 82	Total	**13**	93,500	0.46	2.60	0.16
	FI	3				
	PDO	10				
I-75 SB Merge from SR 82	Total	**15**	46,750	0.29	3.00	0.62
	FI	2				
	PDO	13				
I-75 SB Diverge to SR 884	Total	**13**	46,750	0.29	2.60	0.53
	FI	3				
	PDO	10				
I-75 & SR 884 SB Off-Ramp	Total	**16**	11,500	0.22	3.20	3.48
	FI	6				
	PDO	10				
I-75 NB On-Ramp from WB SR 884	Total	**7**	2,200	0.36	1.40	4.88
	FI	1				
	PDO	6				
I-75 NB Merge from WB SR 884	Total	**14**	46,750	0.29	2.80	0.58
	FI	3				
	PDO	11				
I-75 NB Diverge to SR 82	Total	**7**	46,750	0.29	1.40	0.29
	FI	3				
	PDO	4				

Note: *Daily volume is 2018 AADT from the Florida Traffic Online (FTO) Website

A table showing each crash segment broken down by crash frequency and crash rate

<table>
<tr>
<td>
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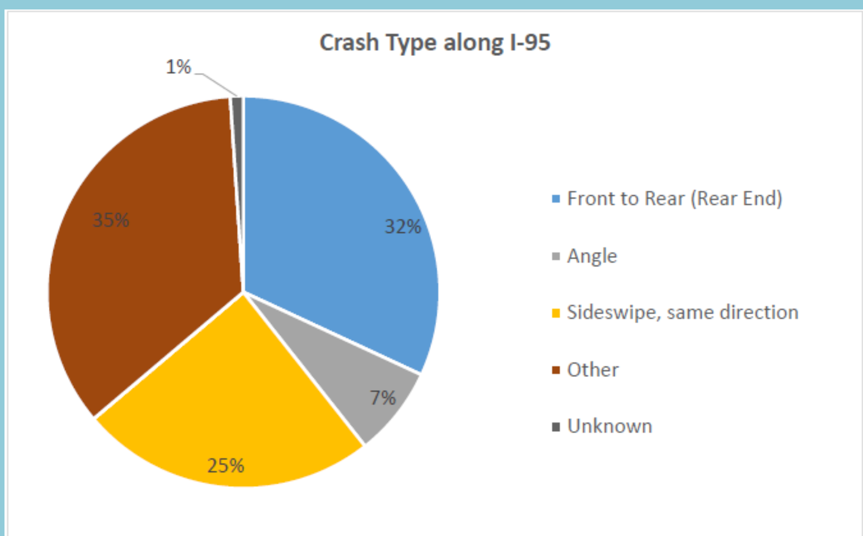
<td>A bar chart showing yearly crashes broken down by crash severity</td>
</tr>
<tr>
<td>
</td>
<td>A pie chart showing a corridor's crash type broken down by percentage</td>
</tr>
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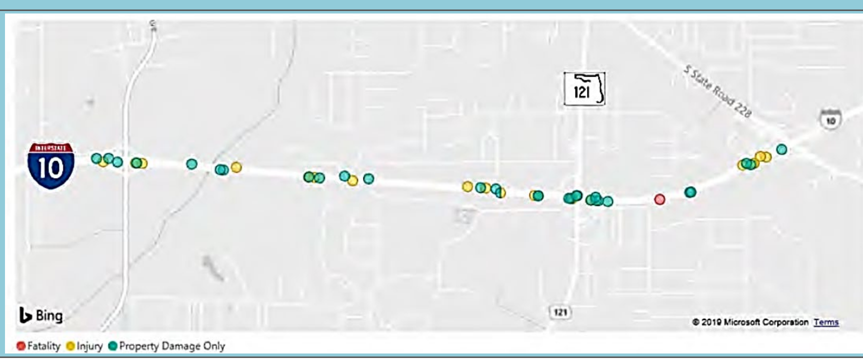
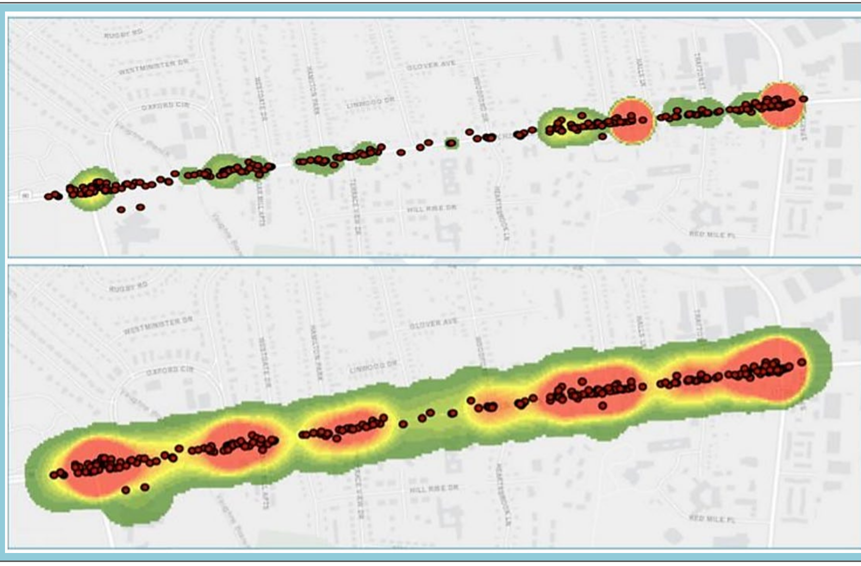
<td>
</td>
<td>A crash map showing crash locations by severity level</td>
</tr>
</table>



A crash map showing crash frequency and heat map

c. <u>Calculation of Crash Rates</u>

Crash rates are reported as a measure of the existing safety condition as they help normalize 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)
Total intersection entering 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 2017 and 2021. The freeway segment has an AADT of 85,000. What is the segment's actual crash rate?

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

$$crash\ rate = \frac{200\ \times 1{,}000{,}000}{1.5\ \times 85{,}000 \times ((2021 - 2017) \times 365)}$$

$$crash\ rate = 1.074$$

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

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

The safety analysis of the existing conditions should be summarized in the existing conditions section of the IAR document. 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 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 document.

6.6 Future Safety Analysis

The future safety analysis helps evaluate and compare the potential safety impacts of no-build and proposed alternatives in the IAR document. The future safety analysis can be performed using the three methodologies shown in **Figure 6-4**.

Figure 6-4 Future Safety Analysis Methodologies

1. Countermeasure CMF methodology

2. HSM Part C methodology

3. Qualitative methodology
   - If Countermeasure CMF or HSM Part C methodologies cannot be applied to the proposed modifications

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

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

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 DDI	Qualitative Methodology

6.6.1 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, which is applicable to the recommended modification, is selected. The CMF, with a value of 0.659, is

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

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.

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 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	★★★☆☆	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 6.6.1.3** and **6.6.1.4**, 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_{SPF}= predicted number of crashes with base conditions
CMF_n= crash modification factor for treatment i to adjust N_{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:

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

6.6.1.1 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.

- CMF Clearinghouse
  The CMF Clearinghouse, available at http://www.CMFClearinghouse.org, 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 new CMFs 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.

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

<table>
<tr><th>Treatment</th><th>Setting (Intersection Type)</th><th>Traffic Volume</th><th>Crash Type (Severity)</th><th>CMF</th><th>Std. Error</th></tr>
<tr><td rowspan="6">Convert at-grade intersection into a grade-separated interchange</td><td rowspan="3">Setting unspecified (four-leg intersection, traffic control unspecified)</td><td rowspan="6">Unspecified</td><td>All crashes in the area of the intersection (all severities)</td><td>0.58</td><td>0.1</td></tr>
<tr><td>All crashes in the area of the intersection (injury)</td><td>0.43</td><td>0.05</td></tr>
<tr><td>All crashes in the area of the intersection (noninjury)</td><td>0.64</td><td>0.1</td></tr>
<tr><td>Setting unspecified (three-leg intersection, traffic control unspecified)</td><td>All crashes in the area of the intersection (all severities)</td><td>0.84</td><td>0.2</td></tr>
<tr><td rowspan="2">Setting unspecified (three-leg or four-leg, signalized intersection)</td><td>All crashes in the area of the intersection (all severities)</td><td>0.73</td><td>0.08</td></tr>
<tr><td>All crashes in the area of the intersection (injury)</td><td>0.72</td><td>0.1</td></tr>
</table>

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/roadway/qa/tools.shtm.

6.6.1.2 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 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.

CMFs with star rating of three or higher should be used in IARs.

Select the Appropriate CMF from the CMF Clearinghouse

Question: Which CMF from the CMF Clearinghouse should be used?

Modification: Convert a diamond interchange to a DDI in downtown Jacksonville

Determine applicable CMFs:

Countermeasure: Convert diamond interchange to Diverging Diamond Interchange (DDI) or Double Crossover Diamond (DCD)

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.592	40.8	★★☆☆☆	All	All	Urban	CLAROS ET AL., 2015	This CMF applies to the ... [READ MORE]

Countermeasure: Convert diamond interchange to Diverging Diamond Interchange (DDI) or Double Crossover Diamond (DCD)

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.858	14.2	★★★★☆	All	All	Urban and suburban	ABDELRAHMAN ET AL., 2021	The AADT values mentioned are ... [READ MORE]

CMF 9104 (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 10761 (bottom) has a four-star rating. Because CMF 9104'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. When using the FDOT CRFs, it is recommended 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

6.6.1.3 Application of the Countermeasure CMF Methodology

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

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 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 (three-star rating) – 0.67
- CMF 10761 (four-star rating) – 0.858

Step 2: Check the CMF area type:

- CMF 8258 – suburban
- CMF 10761 – urban and suburban

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

- CMF 10761 – 0.858

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 0.858 = 25.74 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.

CMF Based on Crash Type

Modification: Install a traffic signal and left turn lanes

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.505	49.5	★★★★☆	Rear end	All	All	SRINIVASAN ET AL., 2014	The CMF was developed for ... [READ MORE]

If the above CMF was selected to estimate the change in crashes, it could only be applied to the existing rear-end crash types. It would be inappropriate to apply this CMF to the total number of crashes.

Select the Appropriate CMF Based on Crash Type

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

Modification: Convert a diamond interchange to a DDI in suburban Tampa

Historic Crash Data:

- Total number of crashes in the interchange area = 30 crashes/year
- Number of rear-end crashes in the interchange area = 10 crashes/year

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

- CMF 10761 (four-star rating) – 0.858
- CMF 10764 (four -star rating) – 0.887

Step 2: Check applicable CMF crash type

- CMF 10761 – All
- CMF 10764 – Rear-End

Step 3: Select the appropriate CMF based on crash type

- CMF 10764 – 0.887

CMF 10761 was not selected because the analyst is interested in the number of rear-end crashes reduced due to the proposed modification. CMF 10761 was developed to account for all crash types and, as a result, should not be used for the predictive analysis.

Step 4: Calculate the predicted number of crashes

- Predicted number of crashes = 10 crashes/year x 0.887 = 8.87 rear-end crashes/year

CMF Based on Crash Severity

Modification: Conversion of an intersection to a roundabout

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.509	49.1	★★★☆☆	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	GBOLOGAH ET AL., 2019	Applies to the conversion of ... [*READ MORE*]

If the above CMF was selected to estimate the reduction in crashes, it could only be applied to the existing fatal and injury crashes. The CMF cannot be applied to property damage only or the total number of crashes.

Select the Appropriate CMF Based on Crash Severity

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

Modification: Convert a diamond interchange to a DDI in Miami.

Historic Crash Data:

- Total number of crashes in the interchange area = 30 crashes/year
- Number of PDO crashes in the interchange area = 15 PDO crashes/year

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

- CMF 10761 (four -star rating) – 0.858
- CMF 10763 (four -star rating) – 0.920

Step 2: Check applicable CMF crash severity

- CMF 10761 – All
- CMF 10763 – PDO

Step 3: Select the appropriate CMF based on crash severity

- CMF 10763 – 0.920

CMF 10761 was not selected because the analyst is interested in the number of PDO crashes reduced due to the proposed modification. CMF 10761 was developed to account for all crash severities, and as a result, should not be used for the predictive analysis.

Step 4: Calculate the predicted number of crashes

- Predicted number of crashes = 15 PDO crashes/year x 0.920 = 13.800 PDO crashes/year

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
N_B= crash frequency under existing conditions
CMF_n= CMF associated with applicable modification

6.6.1.4 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
- Convert an at-grade signalized intersection to a grade-separated intersection at an interchange
- Convert a diamond interchange to a 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

6.6.2 HSM Part C Methodology

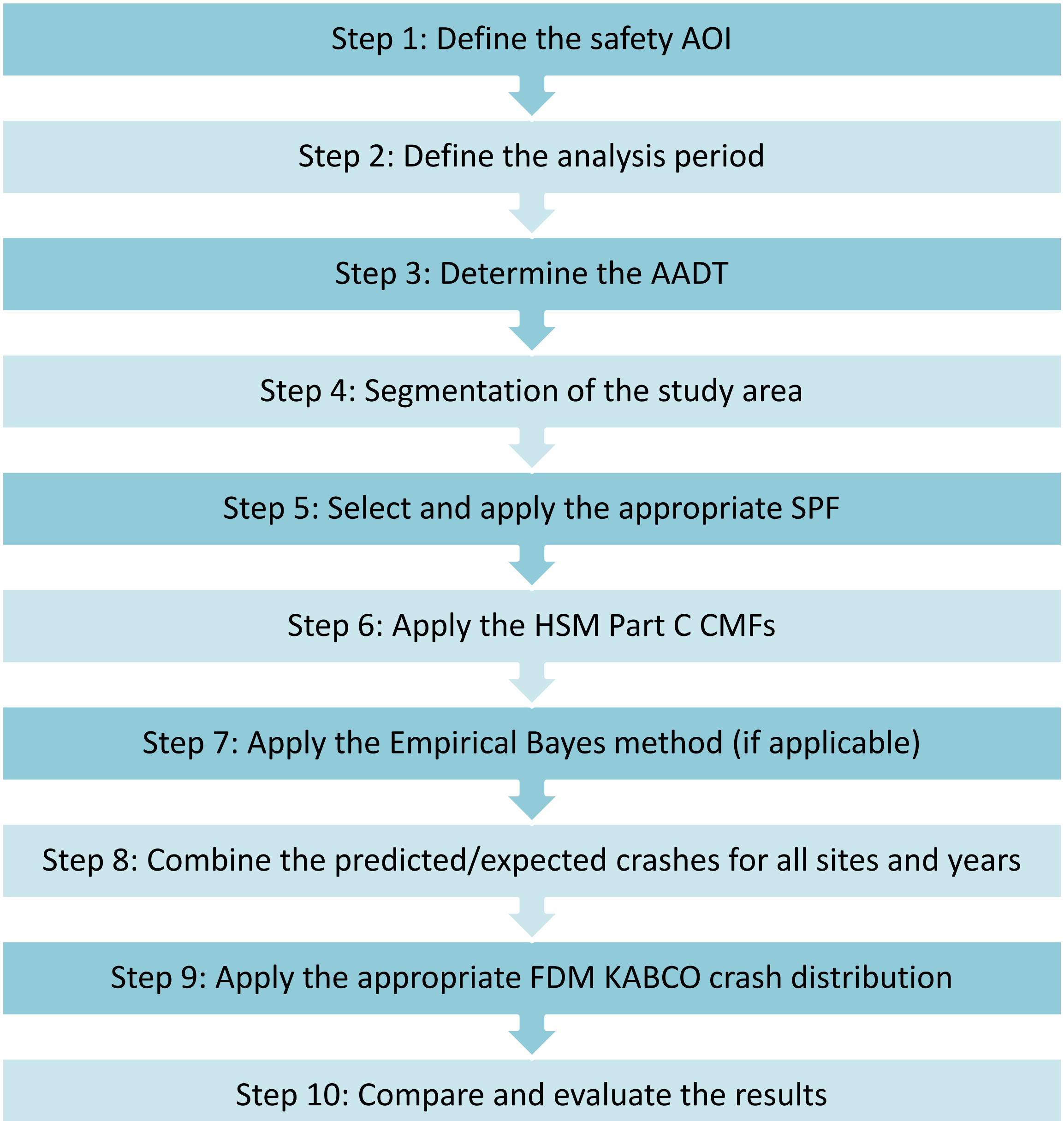
The HSM Part C provides a predictive method for estimating the expected average crash frequency of freeway segments, merge/diverge segments, weaving segments, ramp segments, ramp terminals, arterial segments and arterial intersections. The predictive method is based on mathematical regression models 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.

6.6.2.1 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 6-5**.

Figure 6-5 HSM Part C Methodology Steps for IARs



The 10 steps are discussed in more detail below.

Step 1: Define the Safety Study AOI

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

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.

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 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 a period of analysis greater 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 the 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 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.

It is important to estimate the AADT for each year in the evaluation period.

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 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.

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

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 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 6-6**.

When performing segmentation for roadway segments, the HSM recommends that segment lengths be between 0.1 and 1.0 miles

Figure 6-6 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

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

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. **Figure 6-7** provides an example of the arterial segmentation process at a study interchange and Figure **6-8** provides an example of the freeway segmentation process at a study interchange. **Figure 6-9** provides an example of the ramp segmentation process at a study interchange.

Figure 6-7 Segmentation Example for an Arterial

Figure 6-8 Segmentation Example for a Freeway

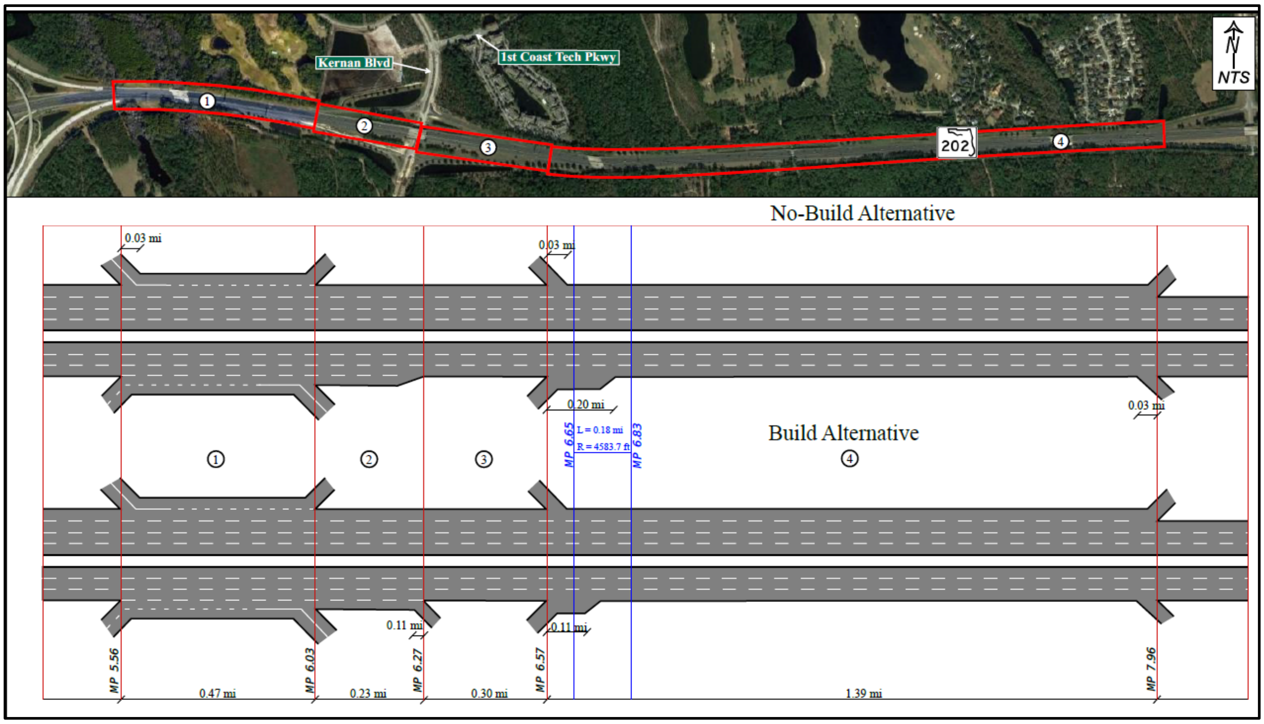
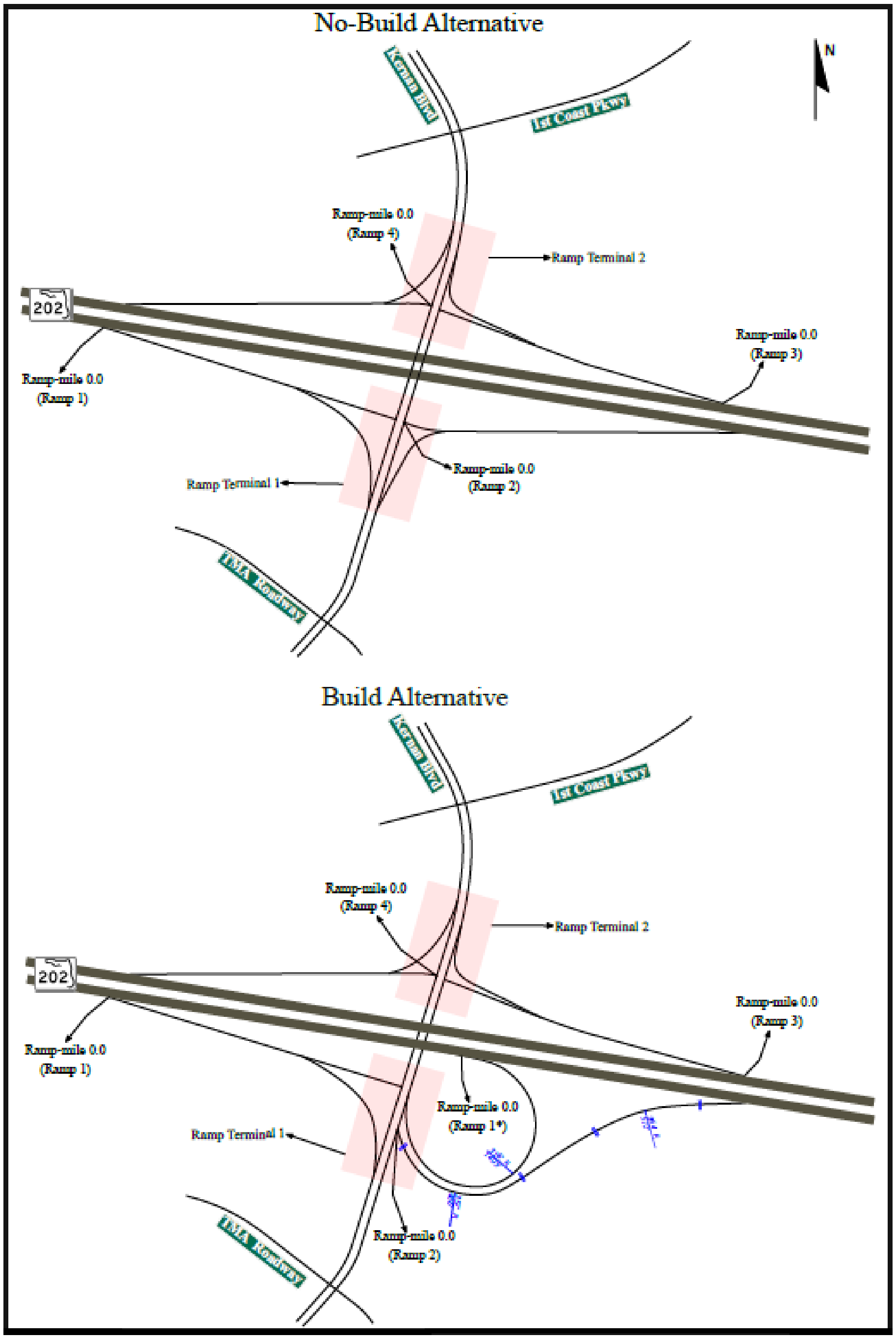


Figure 6-9 Segmentation Example for Interchange Ramps



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 6.6.1**. 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 FDM Chapter 122. 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.

At this time, FDOT has not developed calibration factors for interstate analysis.

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	N/A

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

$$N_{MV\_predicted} = 0.019 \times (1.000 \times 1.000 \times 0.806 \times 0.724 \times 1.000 \times 1.000 \times 1.000 \times 1.000)$$
$$N_{MV\_predicted} = 0.011 \text{ crashes}$$

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

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

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 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, 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.

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

If Empirical Bayes Method does not apply to all alternatives, it should not be incorporated in the predictive safety analysis.

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 6-1**.

Table 6-1: KABCO Injury Classification Scale for Florida

Injury Severity	Abbreviation	Definition
Fatal Injury (within 30 days)	K	Any injury that results in death within 30 days after the crash occurred.
Incapacitation 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	B	Non-disabling injuries, such as lacerations, scrapes, bruises, etc.
Possible Injury	C	
No Injury	O	Also known as property damage only (PDO)

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 H-1**.

Benefit-Cost Analysis

Safety-based benefit-cost 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.

6.6.2.2 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 6-10** are recommended to perform the predictive safety analysis using SPFs:

Figure 6-10 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

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 AASHTO website. The pros and cons of the HSM spreadsheets are in **Table 6-2**.

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

Table 6-2: Pros and Cons of the HSM Spreadsheets

Pros	Cons
▪ Simple data entry ▪ Quick results for a small project area ▪ Analysis for all HSM SPF equations can be performed	▪ Can perform one year of safety analysis ▪ Program does not summarize multiple 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 ISATe tool and a User Manual were developed.

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

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 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 6-3**.

Table 6-3: Pros and Cons of ISATe

Pros	Cons
▪ 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	▪ Does not perform arterial segment or arterial intersection predictive safety analysis ▪ Can analyze a maximum of 24 consecutive years ▪ Does not perform automatic segmentation ▪ Can cause difficulties for large project areas

Interactive Highway Safety Design Model (IHSDM)

The IHSDM 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 station-based 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.

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

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 pros and cons of the IHSDM are in **Table 6-4**.

Table 6-4: Pros and Cons of IHSDM

Pros	Cons
▪ 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	▪ 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.

6.6.2.3 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 in **Section 6.4** to perform the appropriate safety analysis for the project.

6.6.2.4 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

6.6.3 Qualitative Safety Methodology

Qualitative safety analysis should include a discussion about the limitations of the quantitative safety analysis techniques.

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 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 H-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 research 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.
  - Crash reduction associated with the elimination of loop ramps, where applicable."

6.6.4 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.

<u>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?</u>

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 H-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 interchange 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 H-3**.

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

It is recommended to follow the safety analysis process 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.

6.7 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 6.5**.

The future safety analysis documentation required in the IAR document 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.

6.7.1 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 document.

6.7.2 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.

6.7.3 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 document.

6.7.4 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 6-5** provides a brief summary of the safety analysis tasks required under each methodology and the approximate time required to complete them.

Table 6-5: Safety Analysis Types and Work Estimate

Analysis Type	Safety Analysis 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

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

Chapter 7 IAR Re-evaluations

7.1 Re-evaluation

A re-evaluation is performed to document compliance with the state and federal requirements and processes as the result of changes in the project since the approval of the original IAR document. Re-evaluations are required for one or more of the following conditions:

- Change in an approved IAR design concept,
- Significant change in conditions (traffic characteristics, land use type, environment) or
- Failure of an IAR to progress to the construction phase within three years of approval (time lapse). The approval of the IAR occurs after SO&E affirmative determination and NEPA parts are complete.

Changes in the project that would affect safety, operations and environment compared to the approved IAR shall be considered when determining the need and scope for the re-evaluation. It is, therefore, strongly recommended that the requestor coordinate with the DIRC, SIRC and FHWA to determine the level of effort required prior to proceeding with the re-evaluation process.

Analysis and documentation prepared for an IAR re-evaluation shall fulfill the requirements identified in FHWA's policy points. The IAR re-evaluation format is similar to the original IAR document.

A new MLOU documenting the assumptions and methodology shall be prepared for an IAR re-evaluation.

A new MLOU shall be prepared for an IAR re-evaluation.

The applicability of PA or non-PA process must be re-established during the re-evaluation.

The conditions requiring an IAR re-evaluation and the associated documentation requirements are discussed in detail in the sections below.

7.1.1 Change in Approved Access Design Concept

Changes in design features or design concept that occur after an IAR document is accepted shall necessitate the need for re-evaluation of the IAR. The common reasons for design changes of an approved IAR and the minimum requirements for re-evaluation are discussed below.

1. NEPA or final design phases in which the requestor can improve the approved IAR concept. An IAR re-evaluation during NEPA could occur prior to Affirmative Determination stage if the IAR recommended concept changes during NEPA. This type of re-evaluation is most likely to occur if the NEPA is initiated following the IAR acceptability and the concept changes due to environmental impacts.
2. Alternative Technical Concept (ATC) or post-contract design change proposed by the D-B firm.
3. P3 project in which the selected team proposes a concept different from the request for proposal (RFP).

In all the above conditions, the approved IAR concept serves as the no-build, or baseline, in the re-evaluation and is used as the basis of comparison with the proposed concept. In the case of D-B and P3 projects, the approved IAR concept is included with the RFP and referred to as the RFP concept. It is important that the requestor preparing the re-evaluation have a clear understanding of the level of effort that will be required when proposing a change in the approved design concept.

Design Changes Due to Environmental Impacts

When the change of an approved design concept occurs during NEPA because of environmental impacts, the re-evaluation shall show the new concept satisfies the SO&E requirements and FHWA policy points. An IAR re-evaluation during NEPA could occur prior to Affirmative Determination stage if the IAR recommended concept changes during NEPA. This type of re-evaluation is most likely to occur if the NEPA is initiated following the IAR acceptability and the concept changes due to environmental impacts. An MLOU documenting the methodology and procedures to be followed in the re-evaluation shall be prepared and signed by all applicable parties. The new proposed concept shall be compared with the no-build concept for evaluation purposes.

Design Changes During Design Phase

When the change of an approved design concept occurs during NEPA or the final design phase of the project, in which a new concept is proposed as an improvement over the IAR approved concept, the re-evaluation shall demonstrate that the new concept satisfies the SO&E requirements and FHWA's policy points. The new proposed concept shall meet the LOS targets and operate equal to or better than the original IAR approved concept. It is highly recommended that the requestor have meetings with DIRC, SIRC and FHWA early in the process to come to an agreement over the traffic forecasting methodology to be used in the re-evaluation. The agreed methodology shall be documented in the MLOU and signed by applicable authorities.

The new concept must perform equal to or better than the original approved concept.

Design Changes Due to D-B or P3 Alternative Concept

When a change in the approved design concept occurs during D-B or P3 projects, in which a new concept is proposed as an improvement over the IAR approved concept, the re-evaluation shall show that the new concept satisfies the SO&E requirements and FHWA's policy points. In these projects, the approved IAR concept is included in the RFP and serves as the no-build alternative for comparison purposes. The new concept proposed by the D-B or P3 team shall perform equal to or better than the original RFP concept and satisfy the FHWA policy points. This means the re-evaluation shall show that the proposed new concept operates at acceptable LOS targets and satisfies the other MOEs used in the evaluation of the original concept. It is critical that the requestor involve the DIRC, SIRC and FHWA early in the process to agree upon the re-evaluation methodology. An MLOU documenting the methodology and procedures to be followed in the re-evaluation shall be prepared and signed by all applicable parties. The analysis performed for the re-evaluation shall, at a minimum, use the same MOEs that were identified in the original RFP evaluation.

7.1.2 Change in Conditions

An IAR document shall be re-evaluated whenever a significant change in conditions occurs. Changes in projected traffic demand because of a proposed major development or other land use changes that were not part of the original IAR document can necessitate a re-evaluation if it is determined that the design traffic has substantially changed to affect the operation of the interchange. If significant changes in conditions have occurred such as land use, traffic volumes (release of a new travel demand model), roadway configuration or design or environmental commitments, then a re-evaluation will be needed. Engineering judgement will be needed in determining a significant change. Some examples of significant change in conditions include change in travel conditions or patterns resulting in a modification of project need, change in approved design or change in traffic volumes resulting in a different LOS grade.

If the development traffic changes within the interchange AOI, resulting in a change in LOS or a need for the improvement, an IAR re-evaluation shall be required. The re-evaluation shall show that the need for the improvement or modification is justified under the new traffic conditions and satisfies the FHWA policy points. The re-evaluation document shall follow the outline of the original IAR document. A new MLOU shall be prepared and signed by applicable authorities.

7.1.3 Time-Lapse before Construction

The need for re-evaluation will be determined if construction does not begin within three years of IAR approval.

The IAR document proposal may be re-evaluated if the project has not progressed to construction within three years of receiving the IAR document approval/affirmative determination. The IAR document approval occurs upon FHWA signing the letter that confirms SO&E acceptability and PD&E approval steps are complete. The need for the re-evaluation will be determined by the DIRC in coordination with SIRC and FHWA (for non-PA projects). If it is determined that a re-evaluation is not needed, the DIRC will document and inform SIRC and FHWA of the decision. It is noteworthy that an IAR document re-evaluation is different than a NEPA re-evaluation.

The re-evaluation shall demonstrate the project need still is viable by considering any changes in the project and conditions that would affect the safety, operations, environment or design criteria used in the original approval. The original access design and any approved design exceptions shall be reviewed. Justification for the design exception or variation for any design elements that do not conform to the current design criteria must be performed during the re-evaluation. The re-evaluation, because of time lapse, shall update analysis years and traffic data used for the original IAR document. Other items to be updated in the re-evaluations include the funding plan, project schedule and compliance with FHWA's two policy points. The re-evaluation document shall follow the outline of the original IAR document. A new MLOU shall be prepared and signed by applicable authorities.

Depending on the amount of time lapsed and change in project area conditions, a new IAR document could be required in lieu of the re-evaluation. The DIRC shall coordinate with SIRC and FHWA to determine the appropriate document and analyses requirements at the beginning of the process if a project has not progressed to construction within three years of affirmative determination of SO&E and NEPA approval.

7.2 Traffic Validation

Traffic validation is required for all IAR re-evaluations. Existing and future traffic volumes should be validated prior to their use in the analysis of the alternatives in the IAR re-evaluation. The intent of the validation effort is to ensure that the traffic volumes available from the original approved IAR document still reflect the project area's travel conditions and pattern. Historic traffic growth and the latest adopted travel demand model are good sources for this validation effort. A traffic validation template has been developed by SIRC and included in the **Appendix I** of this IARUG. If the traffic validation exercise reveals that the existing or future forecasts from the original approved IAR document are not valid, then a methodology needs to be developed in order to update the traffic. The validation results and proposed traffic forecasting methodology need to be agreed to by the DIRC and SIRC prior to moving forward with the analysis. If the traffic validation exercise reveals that the traffic from the approved IAR are valid, then a traffic update is not required. In this case, an email should be sent to the SIRC and SMA stating that the approved IAR traffic is still valid.

The traffic validation template and methodology should also be used for IARs that proceed to the next phase after a three-year time frame from the previous document approval. Traffic volumes should be updated if the validation exercise reveals that the existing or future forecasts from the previous approved document are not valid. In instances where the IAR re-evaluation design year is different from the design year of the approved IAR, then the IAR re-evaluation design year should be used in the traffic validation. This can occur if the re-evaluation is started after the opening year of the approved IAR has passed. It should be discussed in the traffic validation memorandum if the recommended alternative in the approved IAR will operate acceptably with the new design year traffic from the IAR re-evaluation.

7.3 Safety Analysis

A quantitative safety analysis is required for all IAR re-evaluations comparing the original approved concept with the recommended alternative in the re-evaluation. If a quantitative safety analysis was not performed during approval of the original IAR, then it shall be done as part of the re-evaluation for comparison. The quantitative safety analysis for the re-evaluation shall follow requirements outlined in **Chapter 6** of this IARUG.

7.4 Documentation

The requestor is encouraged to contact the DIRC and approval authorities to discuss specifics and determine whether an IAR re-evaluation is required. If re-evaluation is required, the DIRC shall coordinate with the approval authorities to determine the type of re-evaluation documents required to update the IAR. After additional coordination with the approval authority, the DIRC notifies the requestor to update the Interchange Access Report. The notification shall include specific items of the previously approved IAR document that must be updated. An appropriate IAR document will be included as an appendix to the NEPA document to ensure that technical information relevant during NEPA analysis is readily available to all parties.

The IAR re-evaluation shall follow the outline of the original IAR document and conform to the requirements of this guide. An MLOU shall be prepared and signed by all applicable entities for all re-evaluations. A quantitative safety analysis is required for all re-evaluations with the latest five-year crash data available. The re-evaluation shall be signed per the approval authorities identified in **Chapter 2** of this guide. The IAR re-evaluation scenarios discussed in sections above and the level of effort required is summarized in **Table 7-1** below.

Table 7-1: Re-evaluation Types and Requirements for IARs

Re-evaluation type	Primary reason for re-evaluation	MLOU required	Traffic update required*	Quantitative safety analysis required	Basis for comparison	Documentation level	Satisfy FHWA policy points
NEPA	Environmental impacts	Yes	*	Yes	No-build	Update relevant sections in the IAR document such as alternatives, analysis, environmental, FHWA policy points	Yes
NEPA or design phase	Modified design	Yes	*	Yes	Approved IAR concept	Revised IAR document	Yes
Design-build or P3	Modified design	Yes	*	Yes	RFP	Revised IAR document	Yes
Change in conditions	Change in traffic	Yes	Yes	Yes	No-build	Revised IAR document	Yes
Time lapse	More than three years since IAR document approval	Yes	*	Yes	No-build and previously approved IAR concept	Revised or new IAR document	Yes

* To be determined on a case-by-case basis depending on change in conditions, to be discussed during preparation of the MLOU. If significant changes have occurred since approval of the original IAR document (for example, an increase or change in traffic resulting in change in approved design concept), then an updated traffic and analyses shall be required.

7.5 Technical Memorandum in lieu of Re-evaluation

Sometimes changes can happen to the recommended design concept that does not require preparation of an IAR document. If there is a change proposed to the design within the AOI that does not impact the interchange operations, then a re-evaluation of the IAR document is not required. For example, a design change could be proposed at an intersection adjacent to the ramp terminal that does not have an impact on the interchange. In such a situation, instead of a re-evaluation, a technical memorandum can be prepared and included as an appendix to the approved IAR document. The memorandum should include a new analysis and show that the proposed change will not impact interchange operations and safety. The requestor is encouraged to contact the DIRC and approval authorities to discuss specifics and determine whether a technical memorandum can be prepared in lieu of an IAR re-evaluation.

Appendix A – Affirmative Determination Letter Templates

Letter to FHWA Requesting Final Approval of Interchange Access Request for Proposals with a PD&E Study

Florida Department of Transportation

RON DESANTIS
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JARED W. PERDUE, P.E.
SECRETARY

Date

Dear Mr. Stevenson,

This letter serves as notification that the Florida Department of Transportation (FDOT) has completed the two (2) parts needed to obtain an affirmative determination by Federal Highway Administration (FHWA) of safety, operational, and engineering (SO&E) acceptability for the subject project. FDOT is submitting a request to formally approve a change in access to FHWA.

Project Name, FM number and Location: XXX

Interchange Access Request Type: IJR/IMR/IOAR

Regarding this Interchange Access Request, this letter signifies that the SO&E acceptability determination has been completed. FDOT also certifies the National Environmental Policy Act (NEPA) document has been completed and that the preferred alternative selected under NEPA is consistent with the SO&E determination. Also, the conditions in the SO&E determination are still valid, and a re-evaluation is not required.

The SO&E acceptability determination was completed on -date-. The Location Design Concept Acceptance (LDCA) for this project was granted by FDOT Office of Environmental Management on -date-, pursuant to Title 23 United States Code Section 327 and the implementing Memorandum of Understanding executed on May 26, 2022 by FDOT and FHWA.

FHWA's signature on this letter constitutes the affirmative determination of the SO&E and approval of this Interchange Access Request.

Sincerely,

Jenna M. Bowman, P.E.
Systems Management Administrator

____________________________________ _______________

James Stevenson — Date
Director, Office of Project Delivery, FHWA Florida Division

Improve Safety, Enhance Mobility, Inspire Innovation
www.fdot.gov

Letter to FHWA Requesting Final Approval of Interchange Access Request for Type 1 Categorical Exclusion Proposals

Florida Department of Transportation

RON DESANTIS **GOVERNOR**	605 Suwannee Street Tallahassee, FL 32399-0450	**JARED W. PERDUE, P.E.** **SECRETARY**

Date

Dear Mr. Stevenson,

This letter serves as notification that the Florida Department of Transportation (FDOT) has completed the two (2) parts needed to obtain an affirmative determination by Federal Highway Administration (FHWA) of safety, operational, and engineering (SO&E) acceptability for the subject project. FDOT is submitting a request to formally approve a change in access to FHWA.

Project Name, FM number and Location: XXX

Interchange Access Request Type: IMR/IOAR

Regarding this Interchange Access Request, this letter signifies that the SO&E acceptability determination and the environmental review process have completed. The SO&E acceptability determination was completed on -date-. The project meets the criteria for Type 1 Categorical Exclusion (CE) and the requirements of the Council on Environmental Quality regulations (Title 40 Code of Federal Regulation Section 1508.4 and Title 23 Code of Federal Regulation Section 771.117(a)). The Type 1 CE Checklist was approved by FDOT on -date-, pursuant to Title 23 United States Code Section 327 and the implementing Memorandum of Understanding executed on May 26, 2022 by FDOT and FHWA.

FDOT also certifies the National Environmental Policy Act (NEPA) document has been completed and that the preferred alternative selected under NEPA is consistent with the SO&E determination. Also, the conditions in the SO&E determination are still valid, and a re-evaluation is not required.

FHWA's signature on this letter constitutes the affirmative determination of the SO&E and approval of this Interchange Access Request.

Sincerely,

Jenna M. Bowman, P.E.
Systems Management Administrator

____________________________________ __________________
James Stevenson Date
Director, Office of Project Delivery, FHWA Florida Division

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www.fdot.gov

Appendix B – MLOU Template

Florida Department of Transportation Interchange Access Request Methodology Letter of Understanding (MLOU)

Type of Request: ☐ IJR ☐ IMR ☐ IOAR ☐ SIMR

Type of Process: ☐ Programmatic ☐ Non-Programmatic ☐ Other

[Project Name]

FPID: ________________________

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

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

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

Requestor	______________________ [Type Name Here] [Type Title Here]	________ Date
Interchange Review Coordinator	______________________ Choose an item. Choose an item.	________ Date
Systems Management Administrator	______________________ Jenna Bowman, PE Systems Implementation Office-Central Office	________ Date
Federal Highway Administration (if applicable)	______________________ Choose an item. Choose an item.	________ Date

1.0 Project Description

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

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

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

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

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

2.0 Analysis Years

A. *Travel Demand Model*
- Base year
- Horizon year

B. *Traffic Operational Analysis*
- Existing year
- Opening year
- Design year

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

3.0 Alternatives

The No-Build and Build alternatives shall be analyzed in the IAR. Details of all reasonable build alternatives considered, including those eliminated from further considerations, shall be documented. The documentation for the alternatives eliminated can be minimal like a summary of what was considered, reasons for elimination etc. Build Alternatives meeting purpose and need of the project shall have a more detailed description and evaluated in the IAR.

The implementation of TSM&O elements will be incorporated in the IAR Recommended Alternative.

4.0 Data Collection

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

A. *Transportation System Data*

B. *Existing and Historical Traffic Data*

C. *Land Use Data*

D. *Environmental Data*

E. *Planned and Programmed Projects*

5.0 Travel Demand Forecasting

A. *Selected Travel Demand Model(s)*

B. *Project Traffic Forecast Development Methodology*

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

C. *Validation Methodology*

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

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

D. *Adjustment Procedures*

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

E. *Traffic Factors*

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

Roadway	K	D	T	T_f	PHF	MOCF	PHF

Source:

If any of the above traffic factors are modified during the IAR due to additional information becoming available, then CO will be informed and supporting information will be provided in the IAR.

6.0 Traffic Operational Analysis

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

A. *Existing Area Type/Traffic Conditions*

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

B. *Traffic Analysis Software Used*

Software		System Component					
		Freeway				Crossroad	
Name	Version	Basic Segment	Weaving	Ramp Merge	Ramp Diverge	Arterials	Intersections
HCS/HCM	☐	☐	☐	☐	☐	☐	☐
Synchro	☐	☐	☐	☐	☐	☐	☐
Corsim	☐	☐	☐	☐	☐	☐	☐
Vissim	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐

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

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

7.0 Safety Analysis

A. *Detailed crash data within the study area will be analyzed and documented. The latest five year of crash data shall be used.*
Years:
Source:

B. Identify the level of safety analysis to be performed, along with any software and tools to be used.

8.0 Consistency with Other Plans/Projects

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

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

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

9.0 Environmental Considerations

A. Status of Environmental Approval and permitting process.

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

10.0 Coordination

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

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

11.0 Anticipated Design Exceptions and Variations

Any known exceptions/variations to FDOT, AASHTO or FHWA rules, policies, standards, criteria or procedures will be listed in the IAR document.

12.0 Conceptual Signing Plan

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

13.0 Access Management Plan

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

☐ *The improvement will affect the access management within the area of influence that will require a change to the access management plan. An access management plan will be developed within the area of influence to complement the improvements to the interchange.*

14.0 FHWA Policy Points

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

Appendix C – Locked Gate Access Request Technical Documentation Template

.

Florida Department of Transportation
Locked Gate Access Request

Technical Documentation

[Project Name]

FPID: ______________________

District Office of Maintenance	[Type Name Here] [Type Title Here]	Date
Federal Highway Administration	Choose an item. Choose an item.	Date

1.0 Project Description

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

A. *What is the purpose and need of the locked gate access request?*

B. *What is the project schedule for the proposed locked gate access? Identify the schedule of production activities.*

C. How will the site be secured? Who will maintain the site?

2.0 Existing Conditions

Provide a description of the existing conditions. With the following existing conditions information, please provide a project location map on an aerial background.

A. *Where is the Locked Gate Access? Provide a brief description of the project location. Include project location map, figures and other information such as latitude and longitude, as needed.*

B. *Who is the owner and lessee of the property contiguous to the access?*

C. *What is the project area type (urban, rural)?*

D. *What are the existing roadway characteristics (geometry, speed limit, is there adequate sight distance, etc.)?*

E. *What are the existing traffic volumes for the roadway or ramp providing access to the site? Provide daily or peak hour existing traffic volumes.*

F. *What is the existing peak hour of travel at the proposed access location (during AM and PM peak hours)?*

3.0 Impact of Locked Gate Access – Operational

Provide a description of the operational impacts of the proposed locked gate access.

A. *How many trips are anticipated to access (enter and exit) the site? Who will have access to the site? Please list all parties and include the frequency of trips (per month, per day, etc.)*

B. *How many vehicles are anticipated per trip to access the site?*

C. *How will vehicles exit and enter the flow of traffic? Include language that explains how vehicles will accel/decel when entering/exiting the site.*

D. *What time of day is it anticipated the trips will occur? Also, specify if the trips to the site will occur during the peak hour.*

E. *What will be the duration of the trip to the access site?*

F. *What is the V/C Ratio for the roadway or ramp providing access to the site? Also, discuss the change in V/C Ratio as a result of the additional trips to the site.*

G. *If the access is in a rest area, how will the site vehicles avoid the operations of the rest area?*

H. *Were other sites considered and why were they rejected? This information confirms the feasibility of the proposed access.*

I. *Please discuss any other anticipated impacts of the trips on the operations of the interstate or local roadway.*

4.0 Impact of Locked Gate Access – Safety

Provide a description of the safety impacts of the proposed locked gate access.

A. *Is the roadway providing access to the site considered a high crash location? Please provide a comparison of the actual crash rate with the statewide average crash rate, if applicable. List safety measures that will be implemented if this is a high crash location.*

High Crash Location?	
Yes	No
☐	☐
Existing Crash Rate:	
Statewide Average Crash Rate:	

B. *What safety precautions are recommended during trips to the site? Provide a list.*

5.0 Signing and Lighting

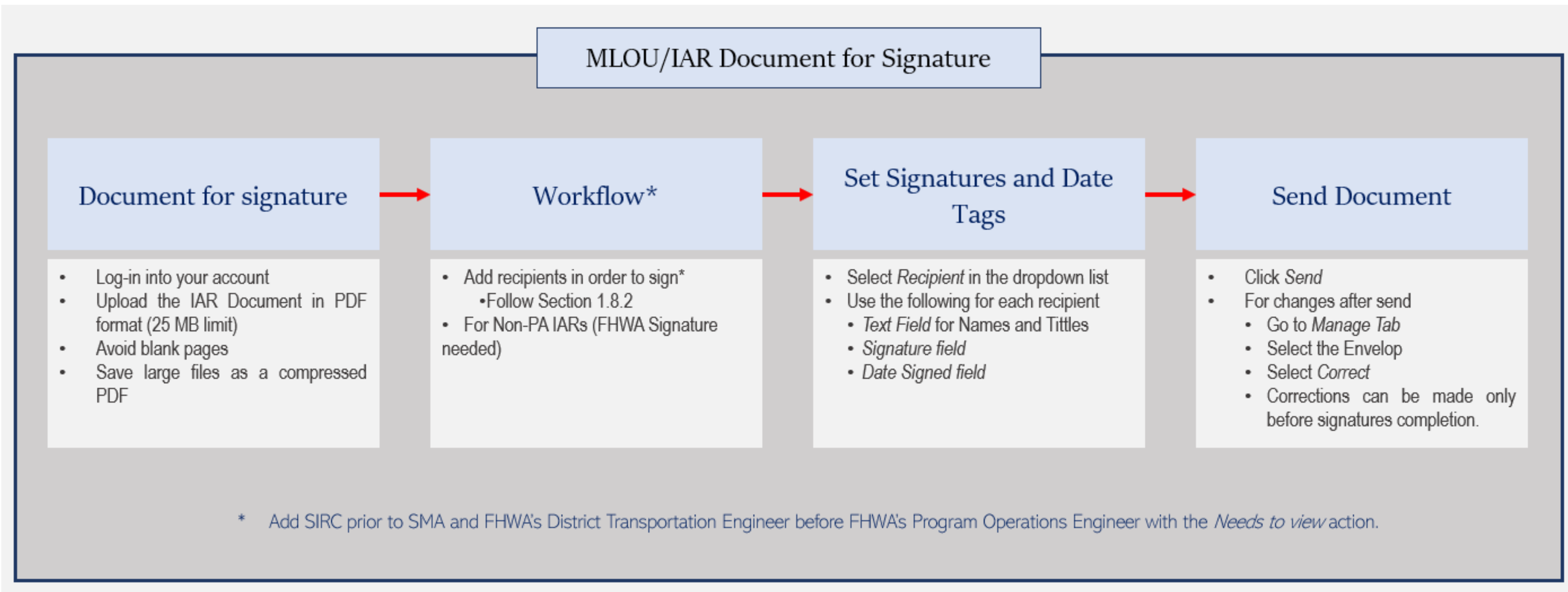
A. *What are the anticipated signing elements (temporary and permanent) to be included in the site? Who is responsible for preparing a temporary traffic control setup, as applicable? If it is anticipated that daily trips will occur, a permanent signage plan may be needed.*

B. *What are the anticipated lighting elements (temporary and permanent) to be included in the site?*

6.0 Recommendation

Based on the technical information provided in the above sections, the District Office of Maintenance is recommending for concurrence this locked gate access. This locked gate access meets FHWA's two policy points and is safety, operational and engineering acceptable. This proposed request will provide controlled and safe access without any negative impacts to the mainline, roadway or ramp being used to access the site.

Appendix D – DocuSign Process


MLOU/IAR Document for Signature
Document for signature
• Log-in into your account
• Upload the IAR Document in PDF format (25 MB limit)
• Avoid blank pages
• Save large files as a compressed PDF
Workflow*
• Add recipients in order to sign*
•Follow Section 1.8.2
• For Non-PA IARs (FHWA Signature needed)
Set Signatures and Date Tags
• Select *Recipient* in the dropdown list
• Use the following for each recipient
• *Text Field* for Names and Tittles
• *Signature field*
• *Date Signed field*
Send Document
• Click *Send*
• For changes after send
• Go to *Manage Tab*
• Select the Envelop
• Select *Correct*
• Corrections can be made only before signatures completion.
* Add SIRC prior to SMA and FHWA's District Transportation Engineer before FHWA's Program Operations Engineer with the *Needs to view* action.

Appendix E – Template for Statement of Technical Review (QC Certification) and Quality Control Checklist Template

SYSTEMS IMPLEMENTATION OFFICE

QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL

Submittal Date: Click or tap to enter a date.

FM Number: _________________

Project Title: ____

District: Choose an item.

Requestor: __________________________ Phone: _________________

District IRC: Choose an item. Phone: Choose an item.

Document Type: ☐ MLOU ☐ IJR ☐ IMR ☐ IOAR ☐ OTHER______(Specify)_____________

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

Quality Control (QC) Statement

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

Requestor_______________________________________ Date: _________________

[SIGN NAME]

IRC ____ Date: _________________

[SIGN NAME]

Quality Control Checklist and Review Log (Sample)
Interchange Access Request Proposals

Project Name: **FDOT Project Manager:**

FPID No. **DIRC:**

No.	ITEM	READY FOR REVIEW	
		CHECKED BY	DATE
1	**Travel Demand Forecasting**		
	Has the latest version of approved model been used? Have all adjustments been made per FDOT guidelines and MLOU and reviewed?		
	Have the traffic factors been reviewed and checked to make sure K, D and T factors are reasonable?		
	Did the project traffic development follow FDOT Traffic Forecasting Handbook and MLOU?		
	Have existing and future traffic volumes been checked for reasonableness?		
2	**Operational Analysis**		
	Are the inputs into traffic software, correct?		
	Has the validation/calibration of microsimulation been properly documented?		
	Are operational analysis results reasonable?		
3	**Safety Analysis**		
	Has appropriate safety analysis been performed to quantify impacts of the recommended improvements?		
4	**Concept Design**		
	Does the proposed design meet minimum design standards?		
	Have the exceptions and variations, if any, been justified?		
5	**Conceptual Signing Plan**		
	Has a conceptual signing plan been reviewed, checked to make sure it can be signed and meets MUTCD?		
6	**FHWA's Two Policy Points**		
	Does the proposal satisfy FHWA's policy points?		
7	**Report Review**		
	Has the report been reviewed for grammatical and editorial errors?		

Appendix F – QAR Process, Checklist and Templates

QAR Process

Florida Department of Transportation
Systems Implementation Office
Quality Assurance Review

QAR Process

1. At a minimum, one District QAR will be done annually. The frequency may be increased as needed.
2. Projects will be randomly selected: 2 MLOUs, 2 IARs and 1 Re-eval (if applicable) per QAR. These projects will be selected from the prior 2-year period.
3. Districts will have 20 business days to upload the information in the folder provided by SIRC. This folder will be read/write protected for each district. A list of the information to be uploaded for the QAR will be provided.
4. The SIRC will have 20 business days to complete the QAR checklist.
    a. The SIRC will have a teleconference with the District to discuss the findings before the upload to the Department's QAR Site.
5. Upload the findings to the FDOT's QAR Site.
6. A QAR Report will be prepared by SIO and submitted to the Chief Engineer, Chief Planner, District Secretary, District Planning and Environmental Office Manager, and DIRC per IARUG 4.14
7. The DIRC will submit a written response to the SMA within 30 days after receipt of the QAR report addressing any findings, including, a reasonable solution to the areas identified for improvement per IARUG 4.14
8. QARs will be summarized in the annual report to FHWA.

QAR List

Florida Department of Transportation
Systems Implementation Office
Quality Assurance Review

QAR List

MLOU

- DIRC Meeting in which the project was initiated: meeting log, sign in sheet (including offices represented) and meeting notes.
- DIRC Meeting logs, sign in sheets (including offices represented) and meeting notes for all meetings after initial project meeting.
- ERC comment and response downloads.
- Executed MLOU.

IAR

- DIRC Meeting logs, sign in sheets (including offices represented) and meeting notes for all meetings.
- ERC comment and response downloads.
- ERC comment and response downloads for FHWA review (if applicable).
- Executed IAR.
- SO&E notification letter to FHWA.
- Affirmative Determination letter and approval to FHWA (if applicable).
- PD&E documents showing that the concept is the same as in the IAR (if applicable).

Re-evaluation

- DIRC Meeting logs, sign in sheets (including offices represented) and meeting notes for all meetings.
- Provide relevant write up and tables referring to the traffic from the re-eval.
- Provide relevant write up and tables and analysis to the safety analysis showing that it was brought up to the current standards required by the IARUG.
- Executed re-eval.

QAR Initiation Memorandum

FDOT

Florida Department of Transportation

RON DESANTIS
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JARED W. PERDUE, P.E.
SECRETARY

MEMORANDUM

DATE:

TO: Enter District IRC Here

FROM: Amy L. Causseaux, State Interchange Review Coordinator

COPIES: Enter Name, District Planning and Environmental Office Manager
Jenna Bowman, PE, Systems Management Administrator
Chris Edmonston, Systems Implementation Office Manager

SUBJECT: District XX Quality Assurance Review (QAR) for Interchange Access Requests for the Years 20XX-20XX

Dear Mr./Ms. (District IRC Name),
The Systems Implementation Office has randomly selected the following projects to perform the QAR for your district:

- Methodology Letter of Understanding Project #1
- Methodology Letter of Understanding Project #2
- Interchange Access Request Project #1
- Interchange Access Request Project #2
- Re-Evaluation Project

The QAR will be performed to ensure that the process outlined in the following publications have been followed:

- Procedure 525-030-160, New or Modified Interchanges
- Interchange Access Request User's Guide 20XX

This QAR will be performed as a desk QAR and all items that the district provides will be uploaded to a secure site that can be accessed via this link. For the district's convenience, enclosed is the QAR process and a list of items that will need to be uploaded for each project to complete the QAR.

Your assistance in this process is appreciated.

Enclosures

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www.fdot.gov

QAR Report Memorandum (Page 1)

Florida Department of Transportation
605 Suwannee Street
Tallahassee, FL 32399-0450

RON DESANTIS
GOVERNOR

JARED W. PERDUE, P.E.
SECRETARY

MEMORANDUM

DATE:

TO: Enter District Secretary Here

FROM: Chris Edmonston, Manager Systems Implementation Office

COPIES: Huiwei Shen, Chief Planner
Enter Name, District IRC
Enter Name, District Planning and Environmental Office Manager

SUBJECT: District XX Quality Assurance Review (QAR) for Interchange Access Reports for the Years 20XX-20XX

A QAR was performed for District XX in Month Year for the Interchange Access Requests (IARs) that were prepared in the calendar years XX through XX. The District Interchange Access Request Process was reviewed for adherence to the procedures and guidelines set forth by the Systems Implementation Office. The following projects were reviewed:

- Methodology Letter of Understanding Project #1
- Methodology Letter of Understanding Project #2
- Interchange Access Request Project #1
- Interchange Access Request Project #2
- Re-Evaluation Project

Summary of Findings:
A summary from the QAR checklist will be done here.

Recommendations:
A summary of recommendations, if any will be addressed in this section.

Special Recognition:
All recognition will be summarized in this section.

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QAR Report Memorandum (Page 2)

Close-out Meeting/Teleconference:

A close-out meeting will be held with the District prior to the QAR results being entered into the Department's QAR site and this QAR report being sent to the District Secretary. This will be an opportunity for the District to bring up any questions/discussions and needs that may need to be addressed with process improvements or future training. Central Office is looking to this process as a team effort to make the entire IAR process one that works well for all involved and this QAR effort can be used to identify areas where we can do that and also work towards the goal of satisfying FHWA's needs on the Interstate System. The District Interchange Review Coordinator (DIRC) will submit a written response to the Systems Management Administrator (SMA) within 30 days after receipt of the QAR report.

QAR Findings and Recognition:

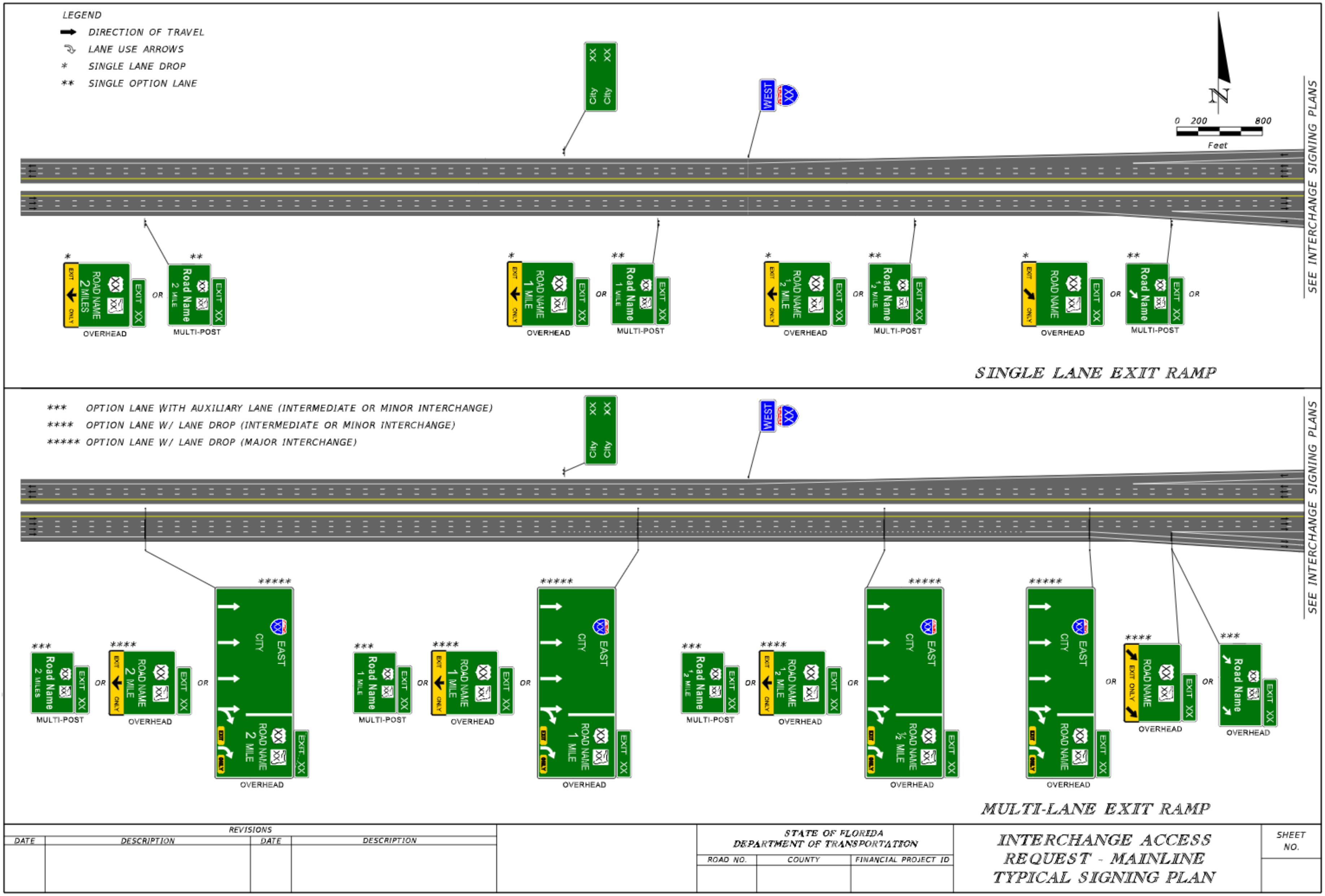
The findings of the QAR and corrective action taken by the District will also be shared *with FHWA in our Annual Report on the Programmatic Agreement.*

Enclosures – the QAR checklist will be the enclosure – this will be what is used to do the inputs into the Department's QAR site.

Appendix G – Sample Signing Plans

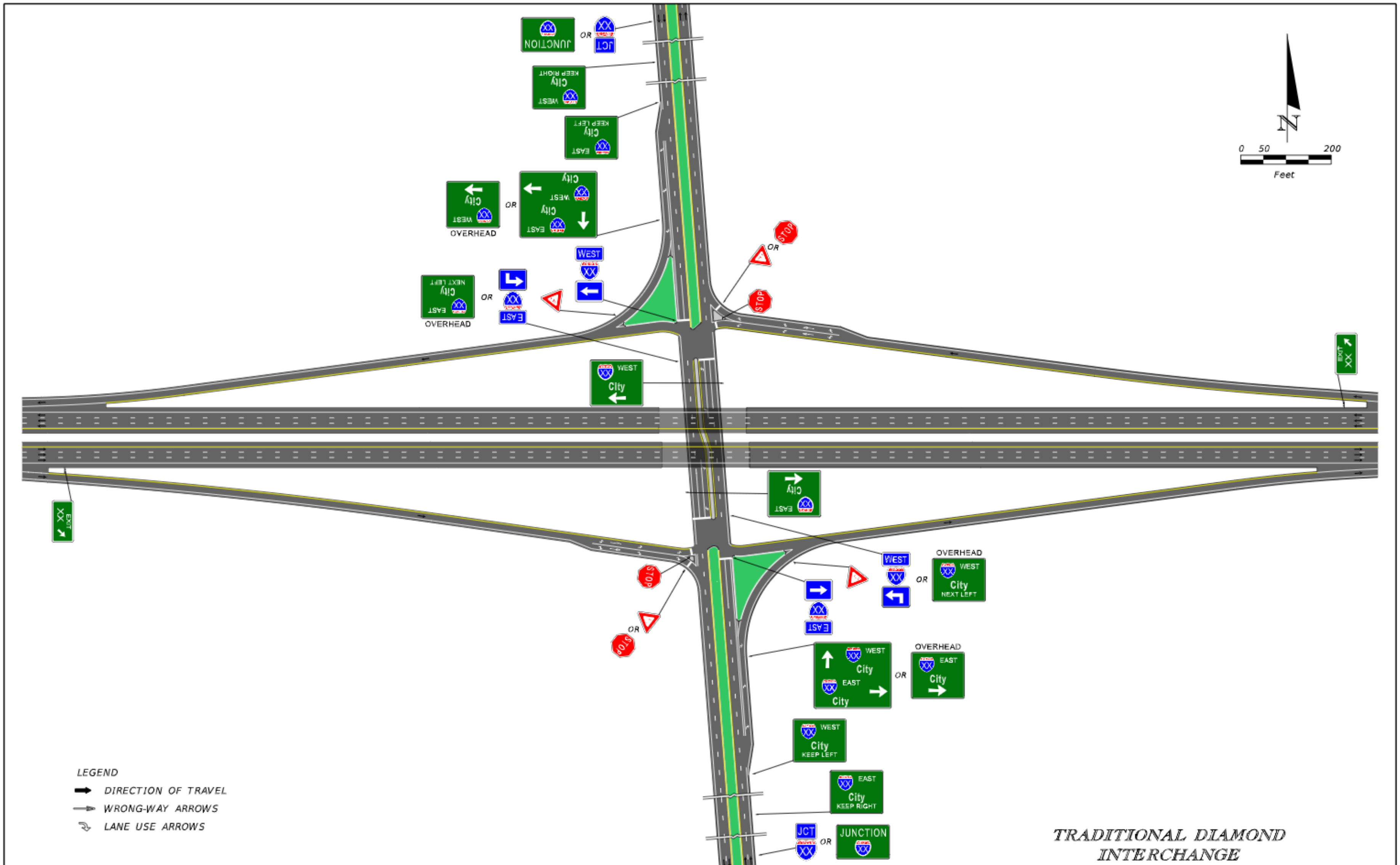
Appendix G-1

Mainline Typical Signing Plan


LEGEND
DIRECTION OF TRAVEL
LANE USE ARROWS
* SINGLE LANE DROP
** SINGLE OPTION LANE
N
0 200 800
Feet
OVERHEAD
MULTI-POST
OR
SINGLE LANE EXIT RAMP
*** OPTION LANE WITH AUXILIARY LANE (INTERMEDIATE OR MINOR INTERCHANGE)
**** OPTION LANE W/ LANE DROP (INTERMEDIATE OR MINOR INTERCHANGE)
***** OPTION LANE W/ LANE DROP (MAJOR INTERCHANGE)
MULTI-LANE EXIT RAMP
SEE INTERCHANGE SIGNING PLANS
REVISIONS
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
INTERCHANGE ACCESS REQUEST - MAINLINE TYPICAL SIGNING PLAN
SHEET NO.

Appendix G-2

Conventional Diamond Interchange Signing Plan



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

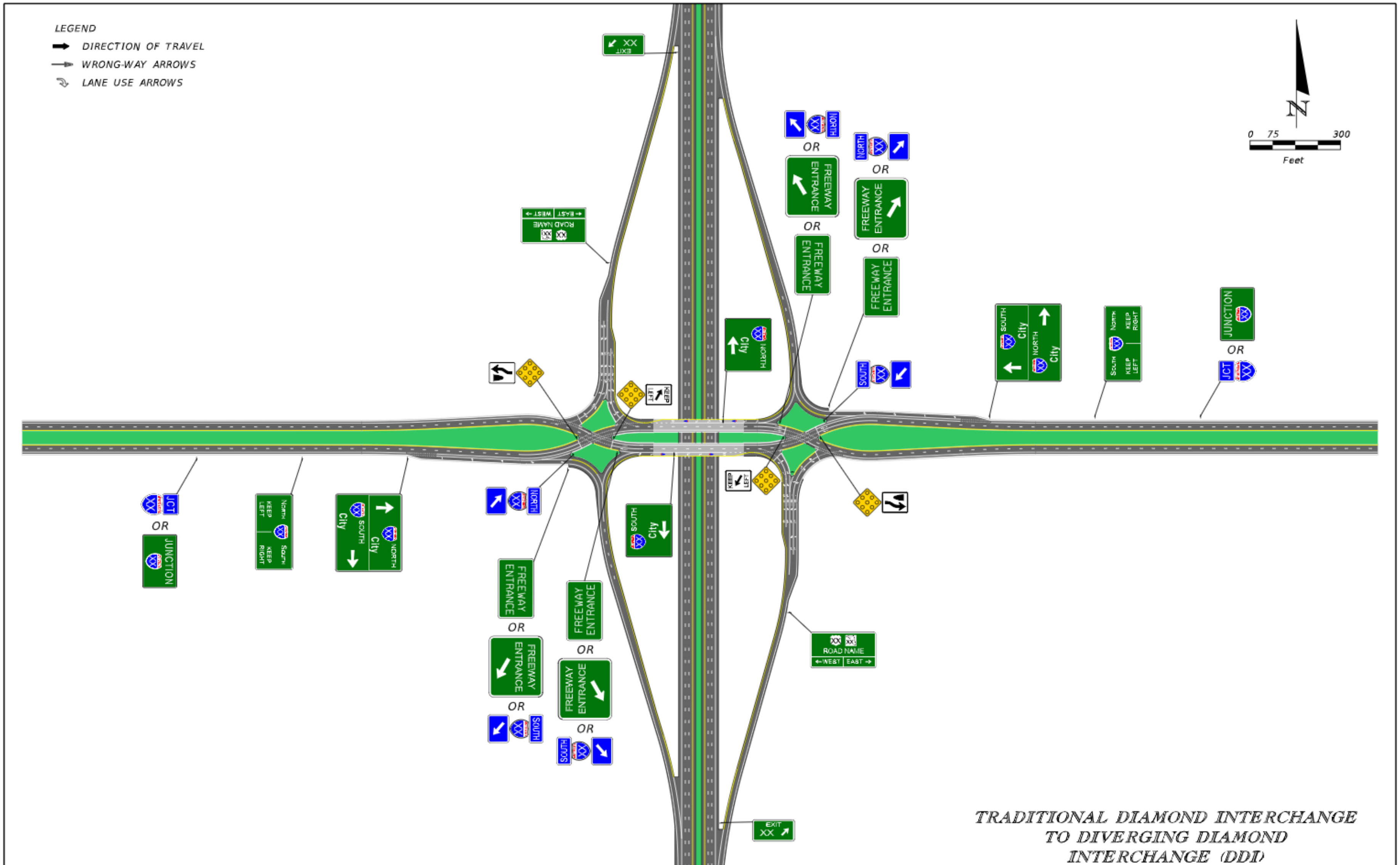
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 75	BAY	445631-1-52-01

INTERCHANGE JUSTIFICATION REPORT
TYPICAL SIGNING PLAN

SHEET NO.

Appendix G-3

Diverging Diamond Interchange Signing Plan



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 75	BAY	445631-1-52-01

INTERCHANGE MODIFICATION REPORT
TYPICAL SIGNING PLAN

SHEET NO.

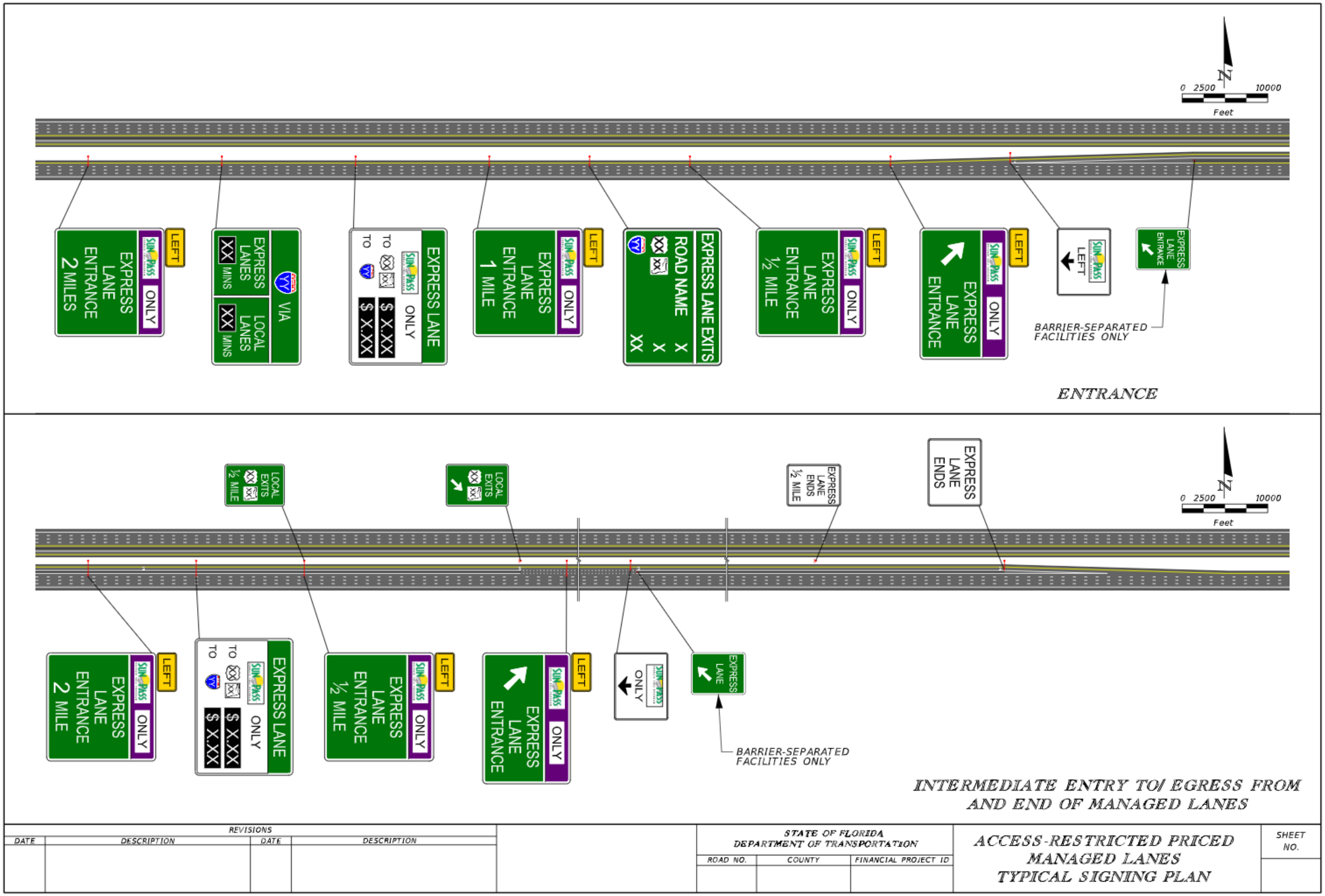
Appendix G-4

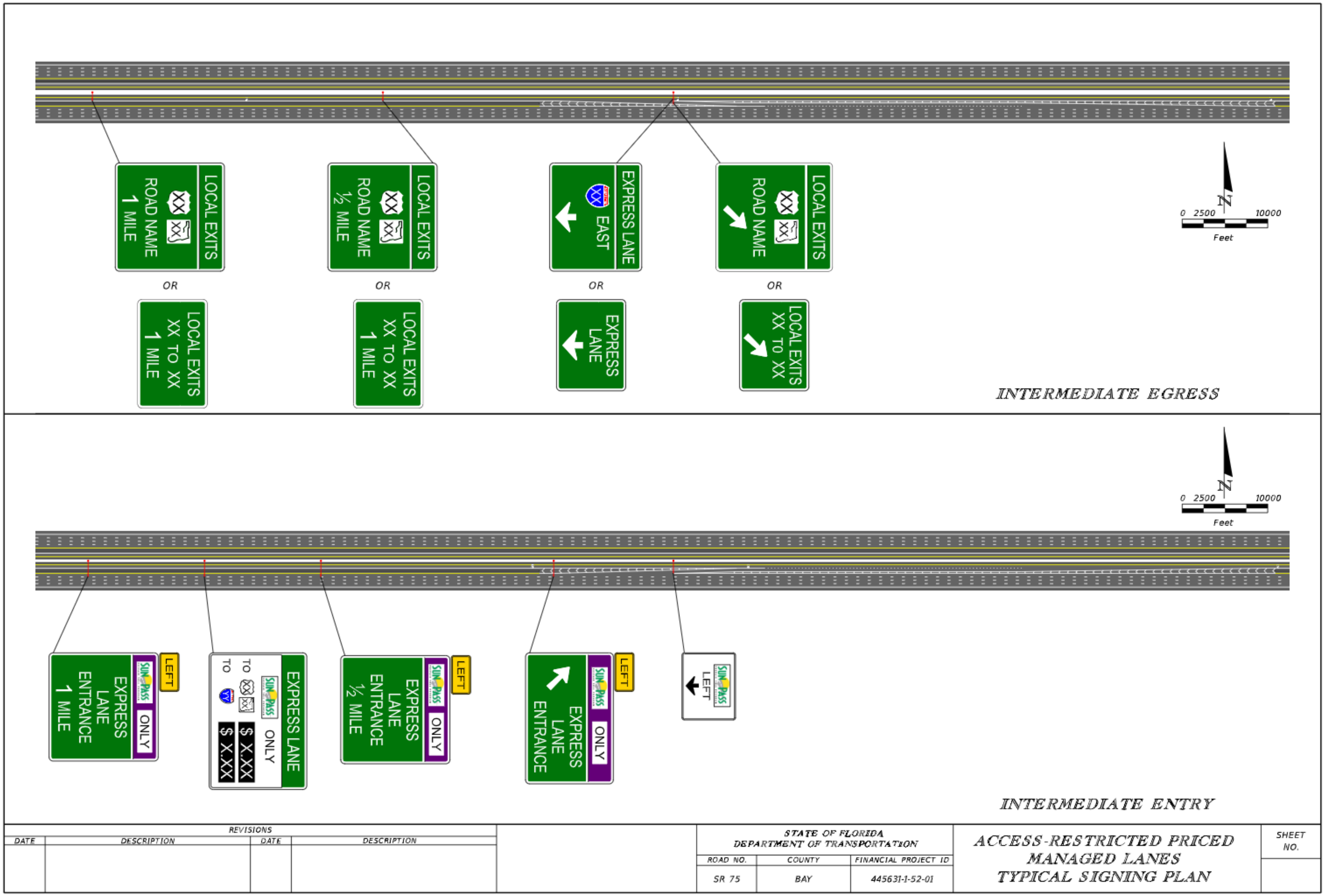
System-to-System Interchange Signing Plan

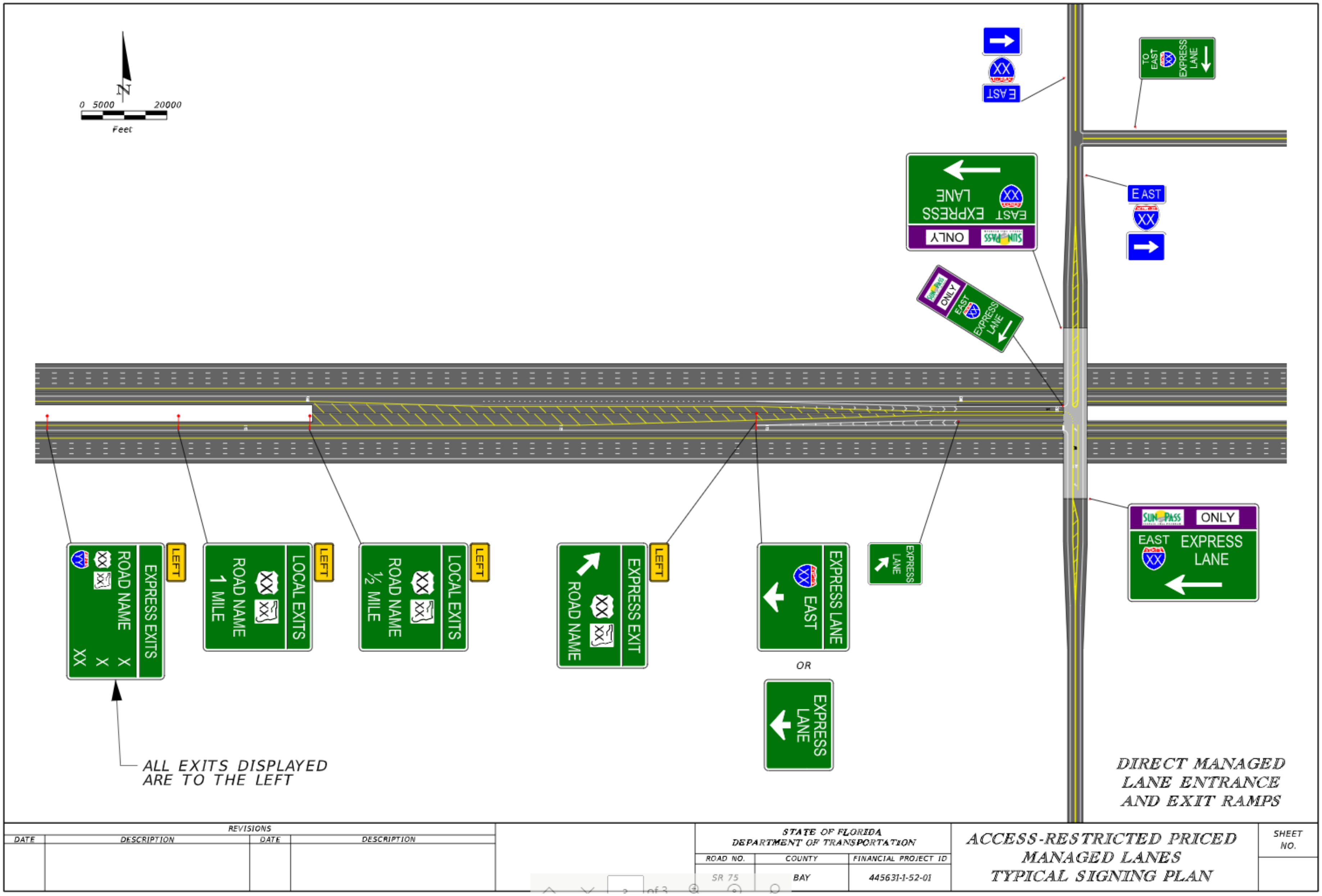

N
0 3500 17500
Feet
I-XX
I-YY
I-XX
MIRROR SIGNAGE FOR SOUTHBOUND AND WESTBOUND TRAFFIC
* SINGLE LANE DROP
** OPTION LANE W/ LANE DROP
NORTH
CITY
EXIT XX
OR
EAST
WEST
SOUTH
SYSTEM TO SYSTEM INTERCHANGE
REVISIONS
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
SR 75
BAY
445631-1-52-01
INTERCHANGE MODIFICATION REPORT
TYPICAL SIGNING PLAN
SHEET NO.

Appendix G-5

Managed Lanes Typical Signing Plan

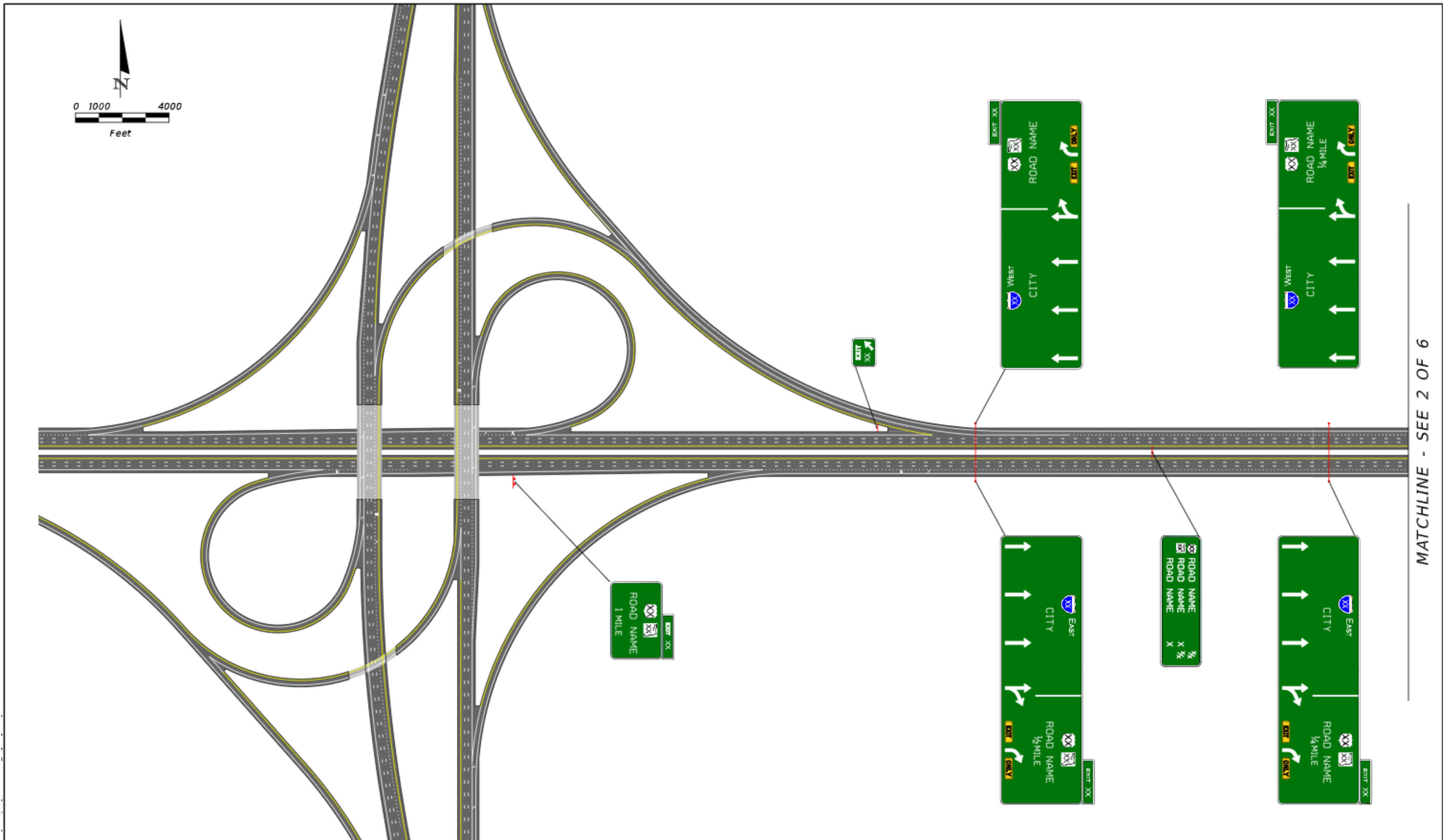

N
0 2500 10000
Feet
BARRIER-SEPARATED FACILITIES ONLY
ENTRANCE
N
0 2500 10000
Feet
BARRIER-SEPARATED FACILITIES ONLY
INTERMEDIATE ENTRY TO/ EGRESS FROM AND END OF MANAGED LANES
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
ACCESS-RESTRICTED PRICED MANAGED LANES TYPICAL SIGNING PLAN
SHEET NO.


LOCAL EXITS
XX
XX
ROAD NAME
1 MILE
OR
LOCAL EXITS
XX TO XX
1 MILE
LOCAL EXITS
XX
XX
ROAD NAME
½ MILE
OR
LOCAL EXITS
XX TO XX
1 MILE
EXPRESS LANE
XX
EAST
OR
EXPRESS
LANE
LOCAL EXITS
XX
XX
ROAD NAME
OR
LOCAL EXITS
XX TO XX
0 2500 10000
Feet
INTERMEDIATE EGRESS
0 2500 10000
Feet
LEFT
SUNPASS
ONLY
EXPRESS
LANE
ENTRANCE
1 MILE
EXPRESS LANE
SUNPASS
ONLY
TO
TO
$ X.XX
$ X.XX
LEFT
SUNPASS
ONLY
EXPRESS
LANE
ENTRANCE
½ MILE
LEFT
SUNPASS
ONLY
EXPRESS
LANE
ENTRANCE
SUNPASS
LEFT
INTERMEDIATE ENTRY
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
SR 75
BAY
445631-1-52-01
ACCESS-RESTRICTED PRICED
MANAGED LANES
TYPICAL SIGNING PLAN
SHEET
NO.


0 5000 20000
Feet
N
EAST
XX
TO EAST XX EXPRESS LANE
EAST XX EXPRESS LANE
SUNPASS ONLY
EAST
XX
SUNPASS ONLY EAST XX EXPRESS LANE
EXPRESS EXITS
ROAD NAME
XX
X X XX
LEFT
LOCAL EXITS
ROAD NAME
1 MILE
LEFT
LOCAL EXITS
ROAD NAME
½ MILE
LEFT
EXPRESS EXIT
ROAD NAME
LEFT
EXPRESS LANE
EAST
XX
EXPRESS LANE
OR
EXPRESS LANE
SUNPASS ONLY
EAST XX EXPRESS LANE
ALL EXITS DISPLAYED ARE TO THE LEFT
DIRECT MANAGED LANE ENTRANCE AND EXIT RAMPS
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
SR 75
BAY
445631-1-52-01
ACCESS-RESTRICTED PRICED MANAGED LANES TYPICAL SIGNING PLAN
SHEET NO.

Appendix G-6

SIMR with Closely Spaced Interchanges Signing Plan



INTERCHANGE SEQUENCE SIGNAGE FOR CLOSELY-SPACED INTERCHANGES

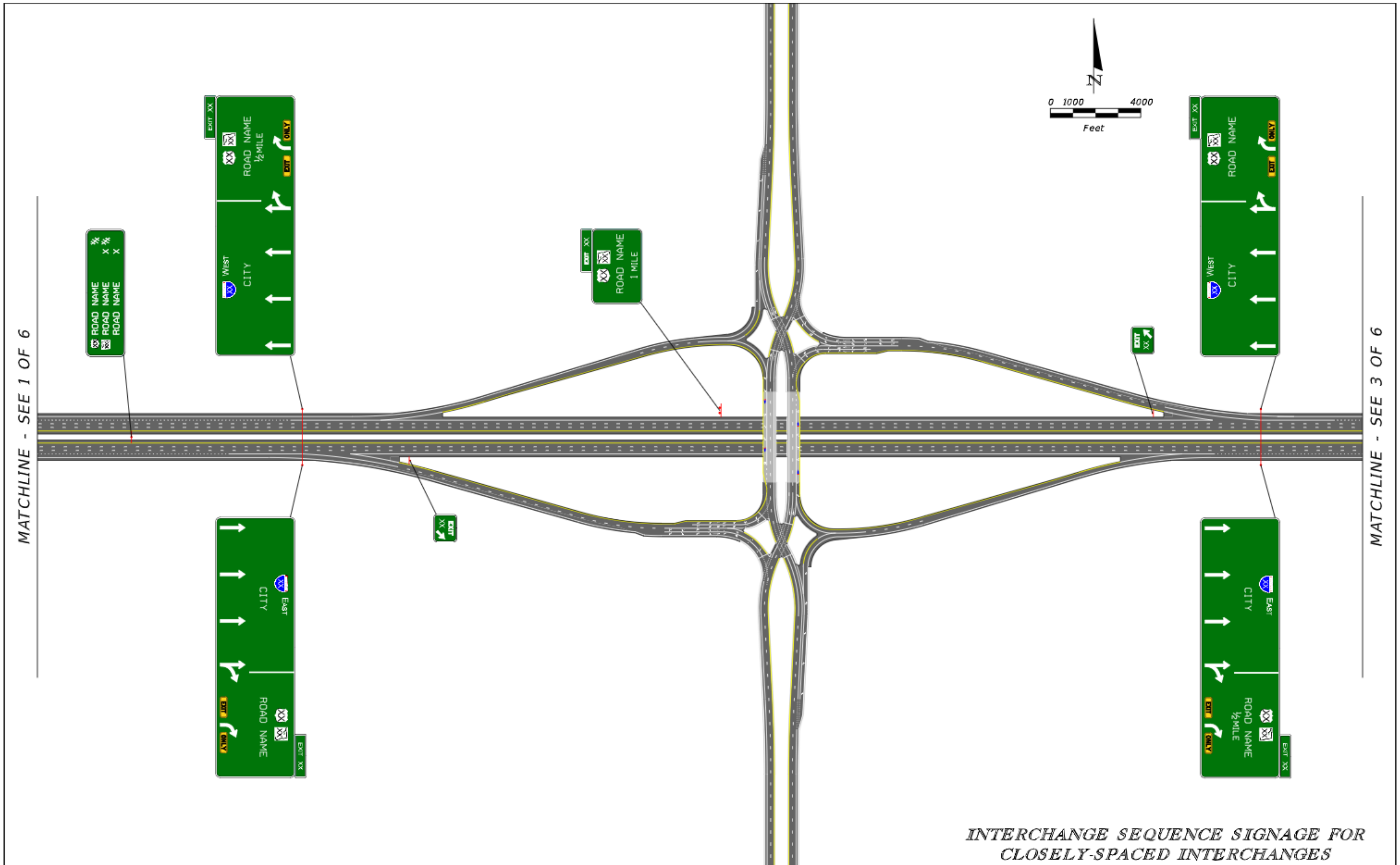
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 75	BAY	445631-1-52-01

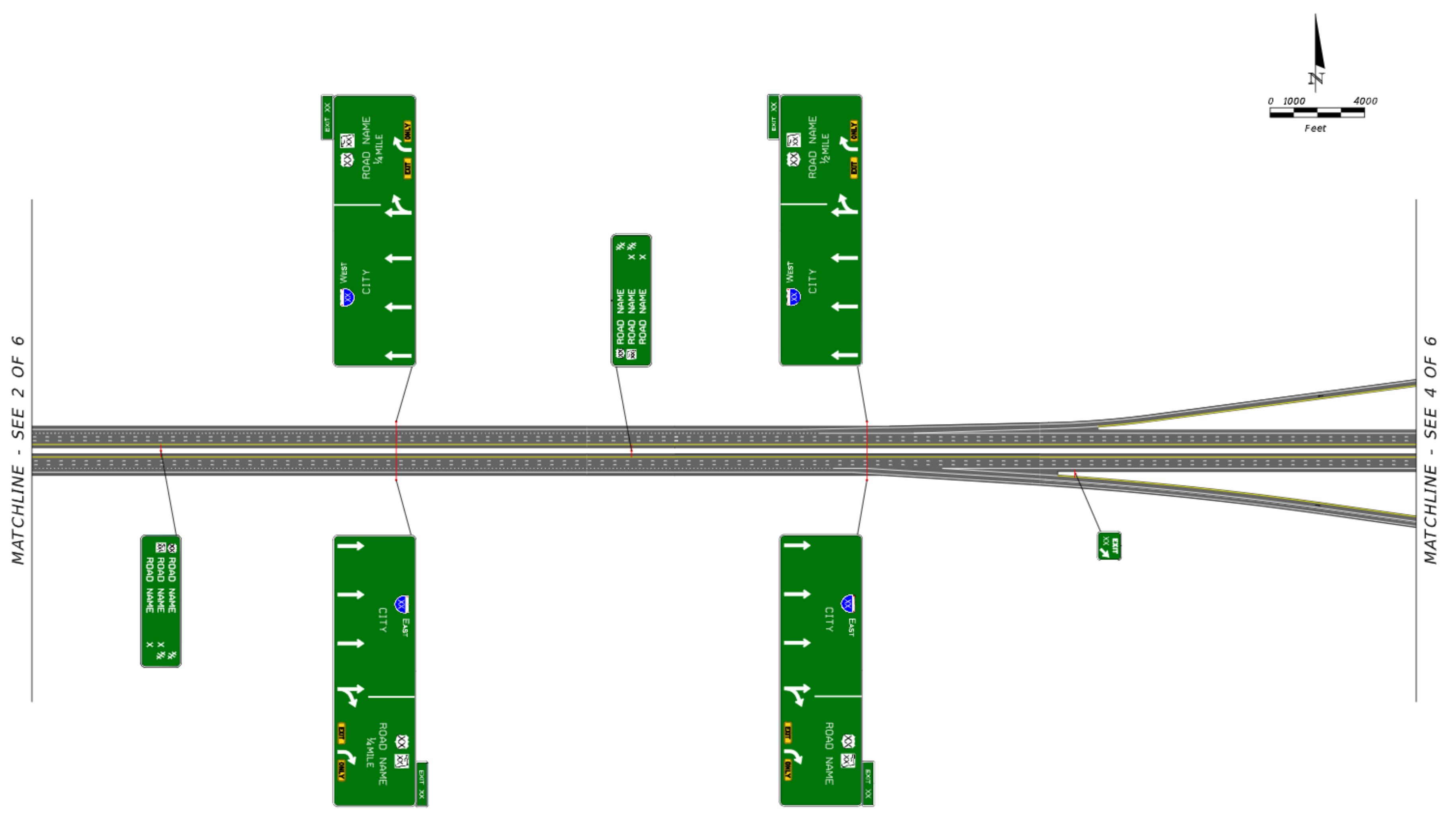
SYSTEM INTERCHANGE MODIFICATION REPORT TYPICAL SIGNING PLAN

SHEET NO. 1



INTERCHANGE SEQUENCE SIGNAGE FOR CLOSELY-SPACED INTERCHANGES

REVISIONS					STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SYSTEM INTERCHANGE MODIFICATION REPORT TYPICAL SIGNING PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		2



INTERCHANGE SEQUENCE SIGNAGE FOR CLOSELY-SPACED INTERCHANGES

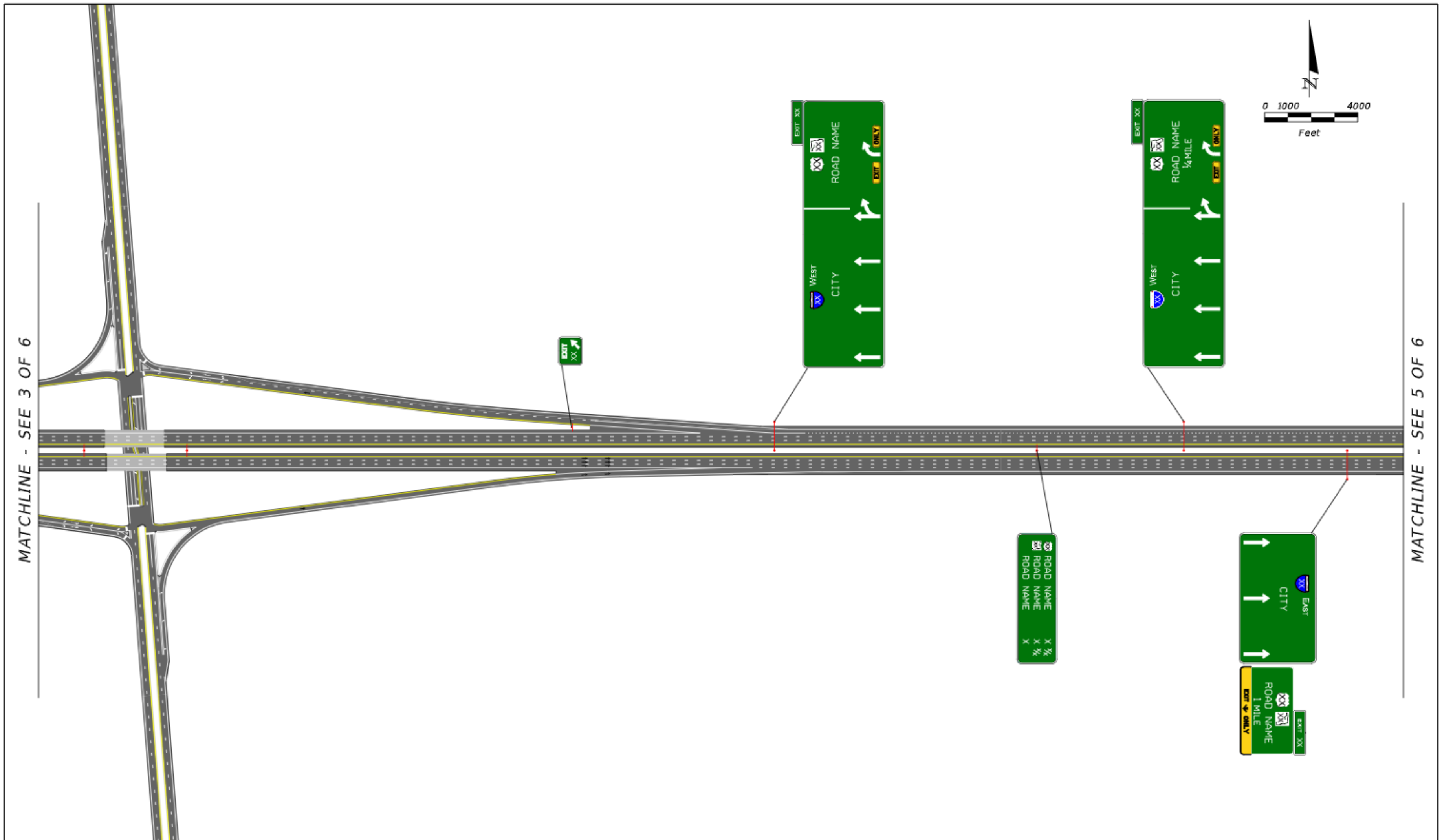
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID

SYSTEM INTERCHANGE MODIFICATION REPORT TYPICAL SIGNING PLAN

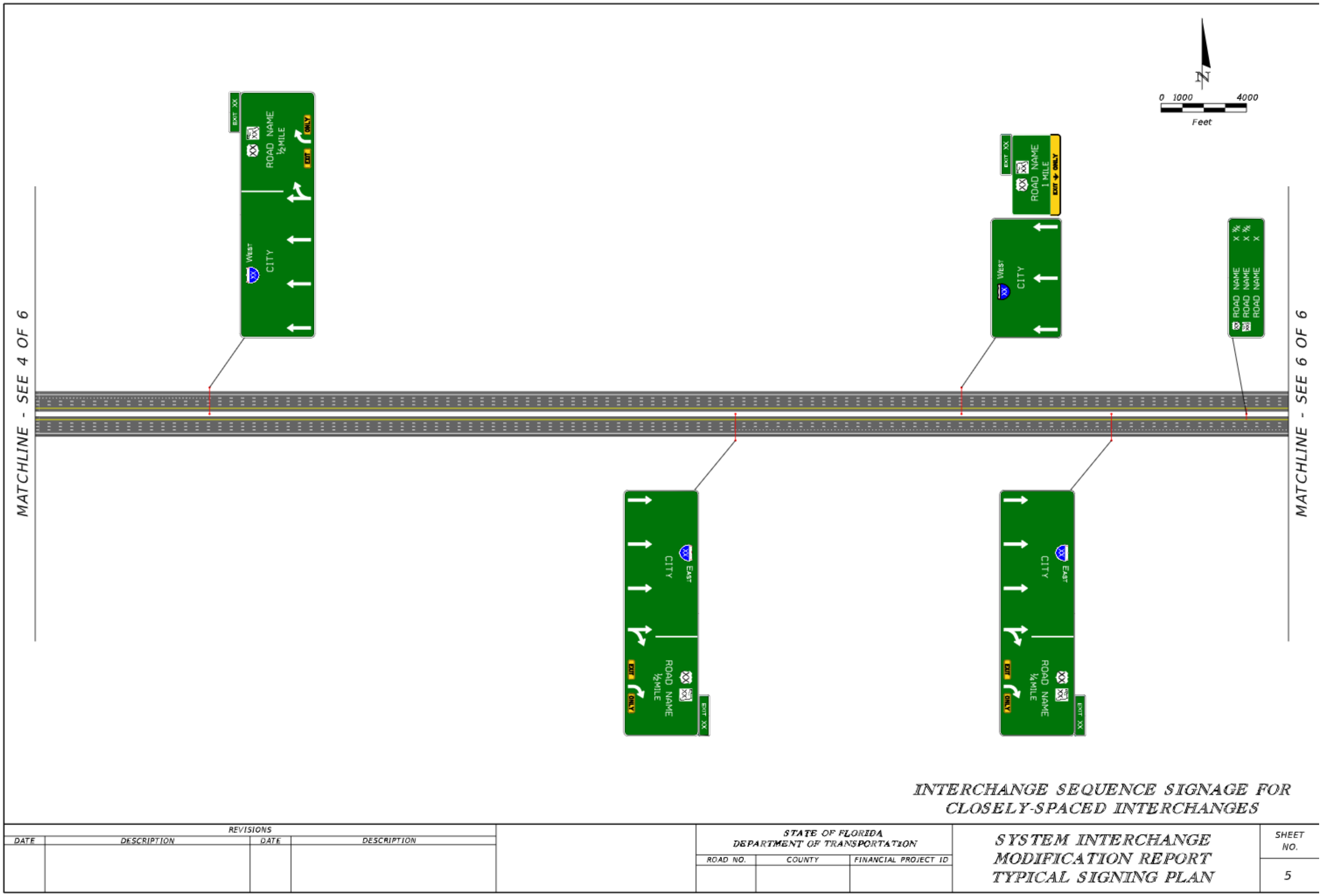
SHEET NO. 3



INTERCHANGE SEQUENCE SIGNAGE FOR CLOSELY-SPACED INTERCHANGES

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SYSTEM INTERCHANGE MODIFICATION REPORT TYPICAL SIGNING PLAN	SHEET NO.
ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
SR 75	BAY	445631-1-52-01		4


N
0 1000 4000
Feet
MATCHLINE - SEE 4 OF 6
MATCHLINE - SEE 6 OF 6
EXIT XX
ROAD NAME
½ MILE
EXIT ONLY
WEST
CITY
ROAD NAME
1 MILE
EXIT ONLY
ROAD NAME X ½
ROAD NAME X ½
ROAD NAME X
EAST
CITY
INTERCHANGE SEQUENCE SIGNAGE FOR
CLOSELY-SPACED INTERCHANGES
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
SYSTEM INTERCHANGE
MODIFICATION REPORT
TYPICAL SIGNING PLAN
SHEET NO.
5


MATCHLINE - SEE 5 OF 6
0 1000 4000
Feet
N
EXIT XX
ROAD NAME
EXIT ONLY
¼ MILE
West
CITY
EAST
INTERCHANGE SEQUENCE
SIGNAGE FOR
CLOSELY-SPACED INTERCHANGES
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO.
COUNTY
FINANCIAL PROJECT ID
SR 75
BAY
445631-1-52-01
SYSTEM INTERCHANGE
MODIFICATION REPORT
TYPICAL SIGNING PLAN
SHEET NO.
6

Appendix H – Example Safety Studies

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

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.

Table 3-11: Study Area Crash Data Summary

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%**

*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**.

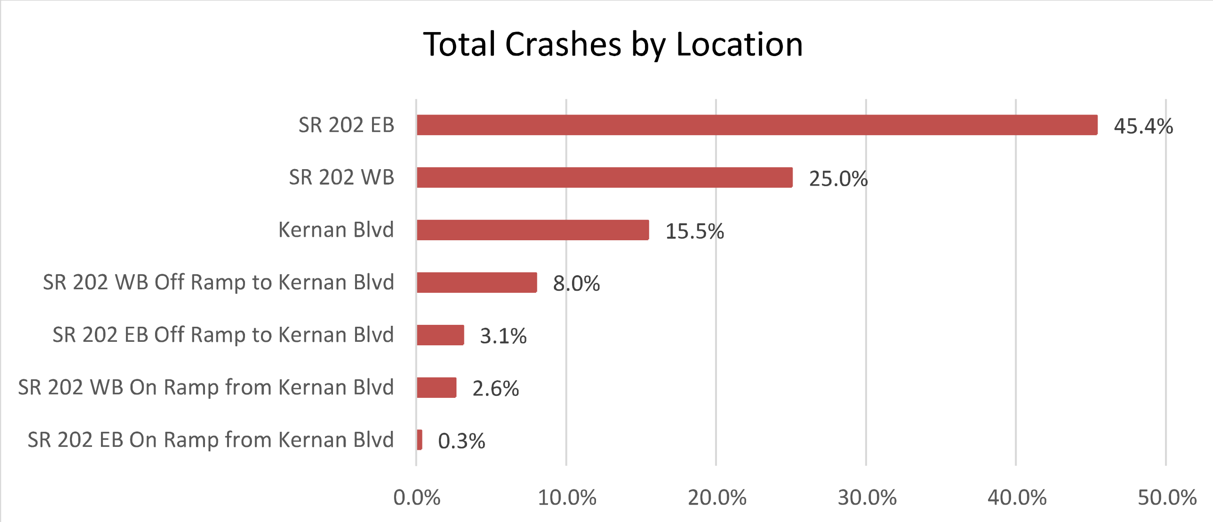


Figure 3-6. Summary of Total Crashes by Location

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.

Table 3-12: Summary of Crash Types

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%

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**.

Table 3-13: Kernan Boulevard Crash Data Summary

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%**

*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.

Table 3-14: Summary of Kernan Boulevard Crash Types

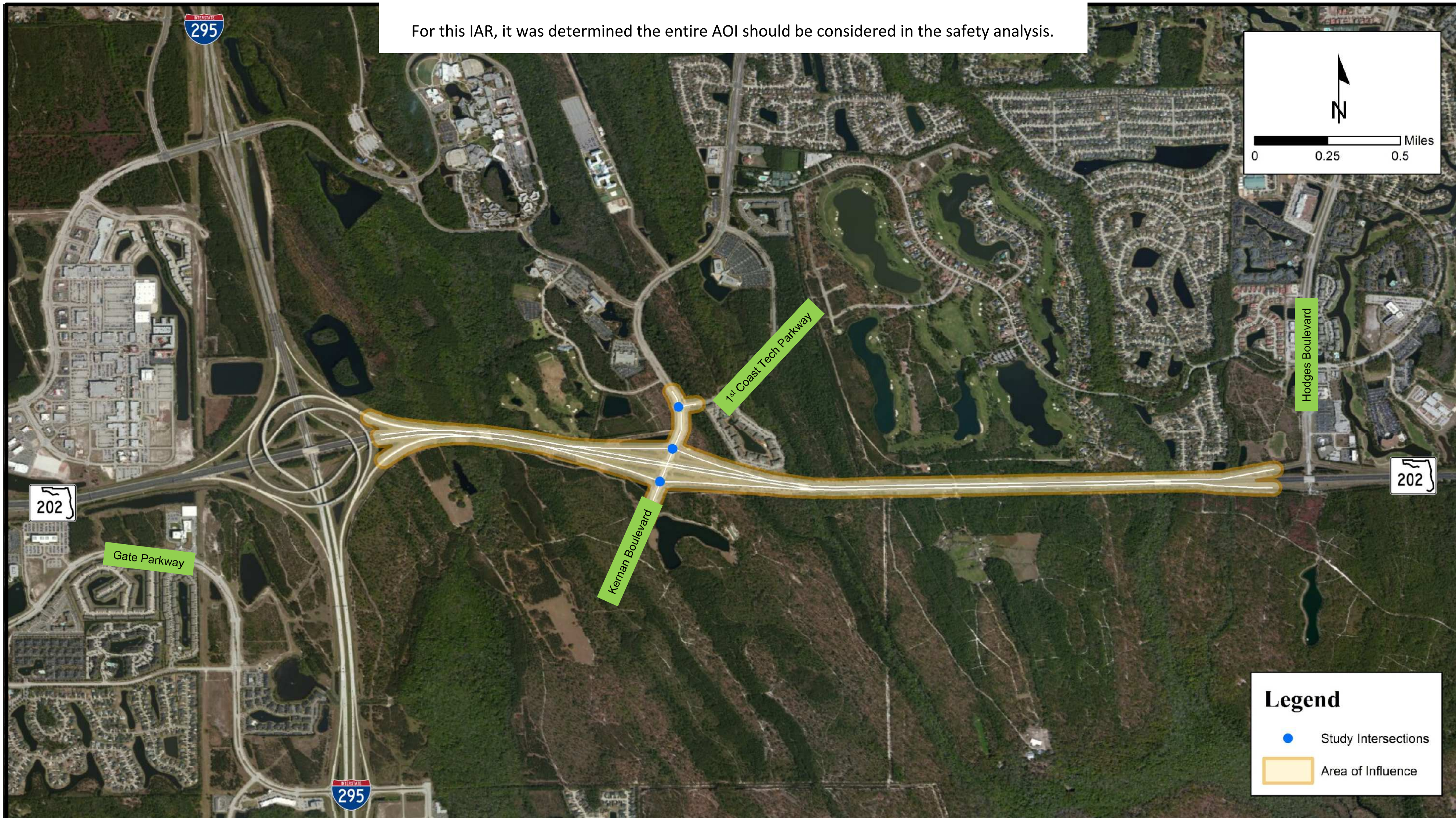
Crash Type	2015	2016	2017	2018	2019	Total	Percentage
Rear End	7	8	12	11	9	47	52.8%
Off Road	3	2	2	0	3	10	11.2%
Left Turn	2	2	0	1	3	8	9.0%
Other	2	0	3	1	0	6	6.8%
Unknown	1	0	0	4	0	5	5.6%
Sideswipe	0	0	1	2	2	5	5.6%
Angle	2	0	1	1	1	5	5.6%
Rollover	0	2	0	0	0	2	2.3%
Animal	0	0	1	0	0	1	1.1%
Total	17	14	20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

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

For this IAR, it was determined the entire AOI should be considered in the safety analysis.



FDOT	SR 202 at Kernan Boulevard Interchange Improvements (Interchange Modification Report)	**Project Location and Area Influence Map**	Figure 1-1
			Page 3

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

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

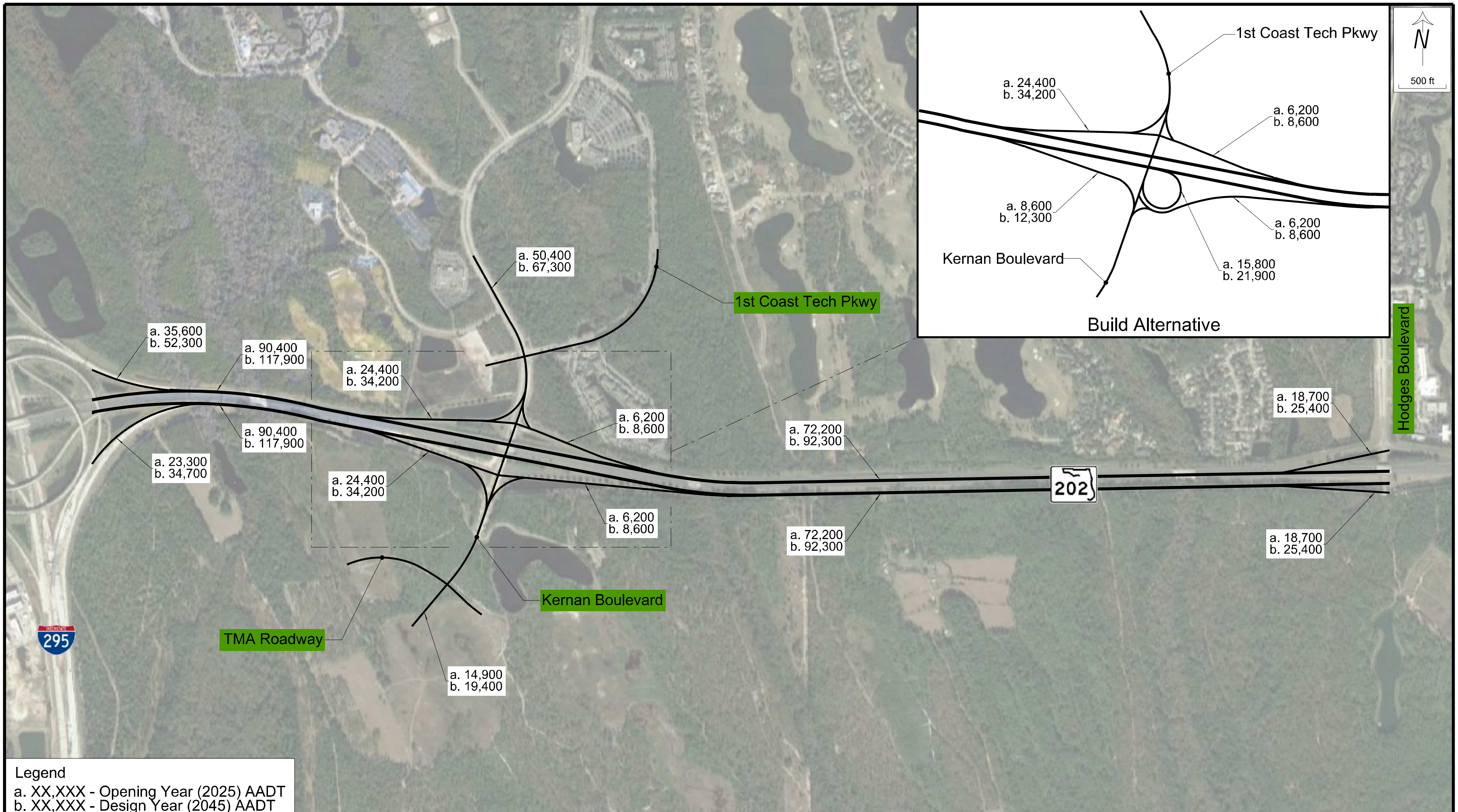
7.2 Predictive Safety Analysis

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.

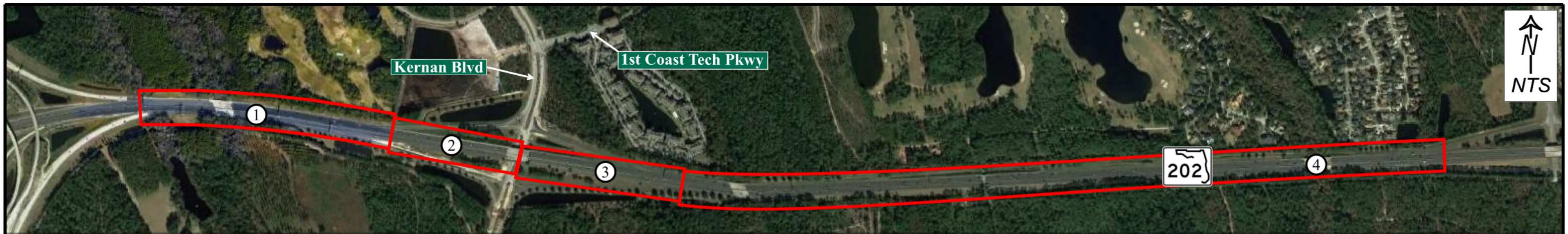
A summary of the predicted average crash frequency obtained by HSM analysis is presented in **Table 7-15**. **Appendix K** presents the input data used to perform the analysis and the output summary for the alternatives evaluated.

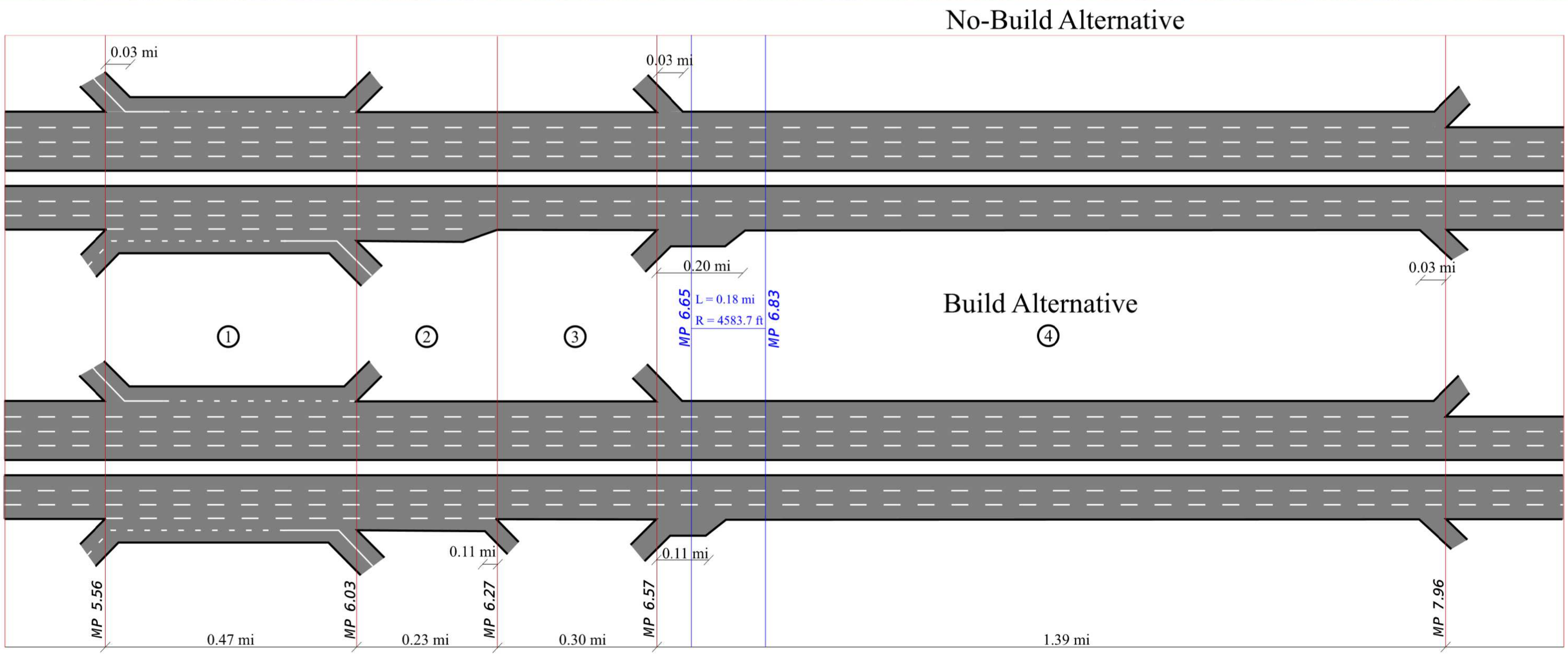
HSM Part C Methodology - Step 3: Determine AADT



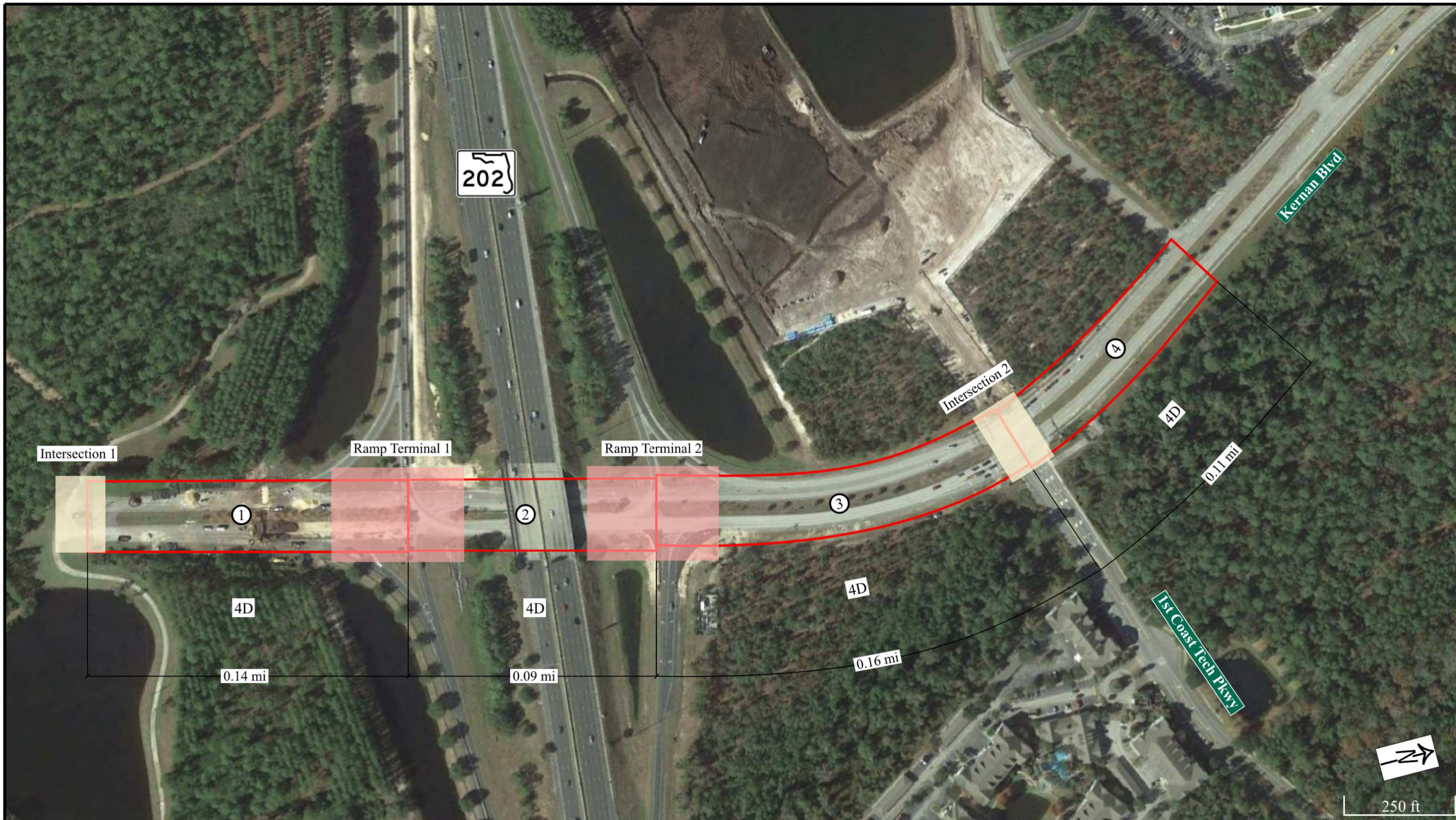
FDOT	SR 202 at Kernan Boulevard Interchange Improvements (Interchange Modification Report)	**Opening Year (2025) & Design Year (2045) Annual Average Daily Traffic (AADT)**	Figure 6-1

HSM Part C Methodology - Step 4: Segmentation of the Study Area



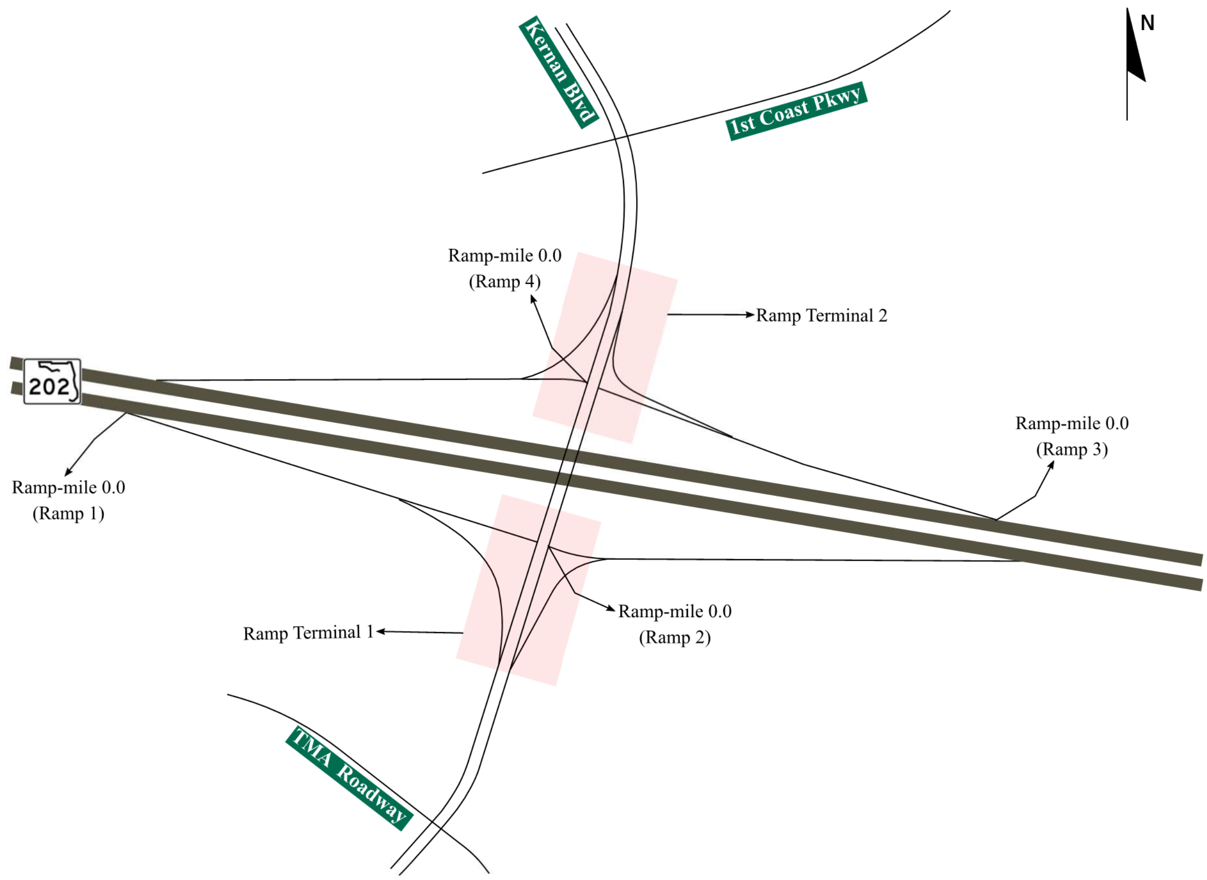


FDOT	SR 202 at Kernan Blvd Interchange Modification Report	Segmentation Along SR 202 Mainline	Figure A1
			Page 1

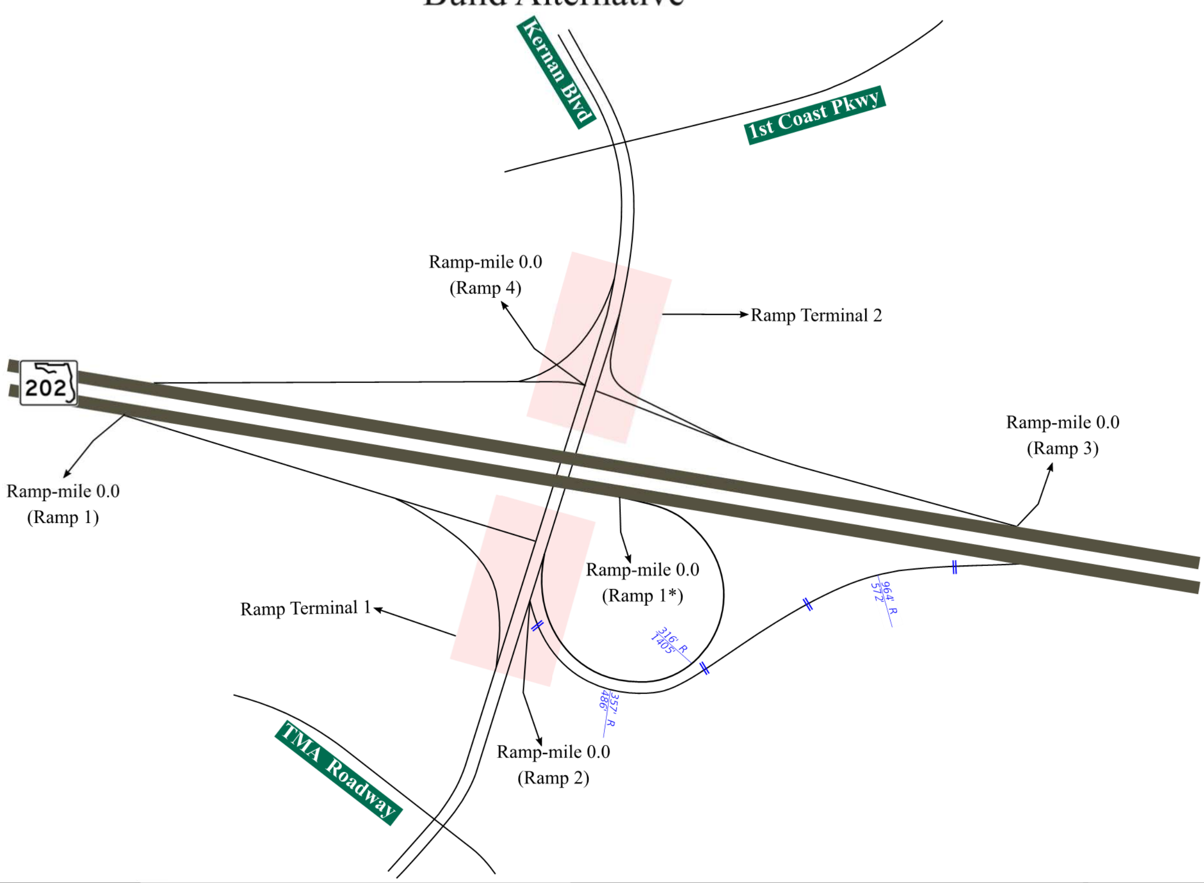


FDOT	SR 202 at Kernan Blvd Interchange Modification Report	**Segmentation Along Kernan Blvd**	**Figure A2**
			Page 2

No-Build Alternative



Build Alternative



FDOT	SR 202 at Kernan Blvd Interchange Modification Report	Segmentation Along SR 202 & Kernan Blvd Ramps	Figure A3
			Page 3

Segments Data

No-Build Alternative

Segment No.	Begin MP	End MP	2025 No. of Lanes	2045 No. of Lanes	Length (mi)	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Lane Width (ft)	Outside Shoulder Width (ft)	Inside Shoulder Width (ft)	Median Width (ft)	Outside Rumble Strip Incr. MP (mi)	Outside Rumble Strip Dcr. MP (mi)	Inside Rumble Strip Incr. MP (mi)	Inside Rumble Strip Dcr. MP (mi)	Median Barrier Length (mi)	Median Barrier Offset (ft)	Median Barrier Width (ft)	Clear Zone Width (ft)	Roadside Barrier Length (mi)	Roadside Barrier Offset (ft)
1	5.56	6.03	8	8	0.47	5729.6	0.46	0.26	12.0	10.0	7.0	17.0	0.47	0.47	N/A	N/A	Full	7.0	2.0	15.0	0.07, 0.13	10.0
2	6.03	6.27	8	8	0.23	N/A	N/A	N/A	12.0	10.0	7.0	17.0	0.23	0.23	N/A	N/A	Full	7.0	2.0	10.0	0.2	10.0
3	6.27	6.57	7	7	0.30	N/A	N/A	N/A	12.0	10.0	7.0	17.0	0.30	0.30	N/A	N/A	Full	7.0	2.0	10.0	0.27, 0.30	10.0
4	6.57	7.96	7	7	1.39	4583.7	0.18	0.18	12.0	10.0	7.0	17.0	1.39	1.39	N/A	N/A	Full	7.0	2.0	25.0	0.16, 0.57	10.0

Segment No.	Ramp Entrance in Seg.	$X_{b,ent}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Entrance Side	Ramp Exit in Seg.	$X_{b,ext}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Exit Side	Type B Weave	Length of Weave (mi)	Length of Weave in Seg. (mi)	Ramp Entrance in Seg.	$X_{e,ent}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Entrance Side	Ramp Exit in Seg.	$X_{e,ext}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Exit Side	Type B Weave	Length of Weave (mi)	Length of Weave in Seg. (mi)
1	Lane Add	0.00	N/A	N/A	Right	Lane Drop	0.00	N/A	N/A	Right	No	N/A	N/A	Lane Add	0.00	N/A	N/A	Right	Lane Drop	0.00	N/A	N/A	Right	Yes	0.47	0.47
2	No	0.47	N/A	N/A	Right	No	999.00	N/A	N/A	Right	No	N/A	N/A	No	999.00	N/A	N/A	Right	No	0.47	N/A	N/A	Right	No	N/A	N/A
3	No	999.00	N/A	N/A	Right	No	999.00	N/A	N/A	Right	No	N/A	N/A	No	999.00	N/A	N/A	N/A	No	999.00	N/A	N/A	Right	No	N/A	N/A
4	S-C Lane	0.00	0.2	0.2	Right	SC	0.00	0.03	0.03	Right	No	N/A	N/A	Lane Add	0.00	N/A	N/A	Right	SC	0.00	0.03	0.03	Right	No	N/A	N/A

Segment No.	P_{hv}	2025 AADT	2025 $AADT_{b,ent}$	2025 $AADT_{b,ext}$	2025 $AADT_{e,ent}$	2025 $AADT_{e,ext}$	2045 AADT	2045 $AADT_{b,ent}$	2045 $AADT_{b,ext}$	2045 $AADT_{e,ent}$	2045 $AADT_{e,ext}$
1	Comp.	180,800	23,300	24,400	24,400	35,600	235,800	34,700	[illegible]	[illegible]	[illegible]
2	Comp.	132,000	23,300	18,700	18,700	35,600	167,400	34,700	[illegible]	[illegible]	[illegible]
3	Comp.	132,000	23,300	18,700	18,700	35,600	167,400	34,700	[illegible]	[illegible]	[illegible]
4	Comp.	144,400	6,200	18,700	18,700	6,200	184,600	8,600	[illegible]	[illegible]	[illegible]

Build Alternative

Segment No.	Begin MP	End MP	2025 No. of Lanes	2045 No. of Lanes	Length (mi)	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Lane Width (ft)	Outside Shoulder Width (ft)	Inside Shoulder Width (ft)	Median Width (ft)	Outside Rumble Strip Incr. MP (mi)	Outside Rumble Strip Dcr. MP (mi)	Inside Rumble Strip Incr. MP (mi)	Inside Rumble Strip Dcr. MP (mi)	Median Barrier Length (mi)	Median Barrier Offset (ft)	Median Barrier Width (ft)	Clear Zone Width (ft)	Roadside Barrier Length (mi)	Roadside Barrier Offset (ft)
1	5.56	6.03	8	8	0.47	5729.6	0.46	0.26	12.0	10.0	7.0	17.0	0.47	0.47	N/A	N/A	Full	7.0	2.0	15.0	0.07, 0.13	10.0
2	6.03	6.31	8	8	0.28	N/A	N/A	N/A	12.0	10.0	7.0	17.0	0.28	0.28	N/A	N/A	Full	7.0	2.0	10.0	0.18, 0.16	10.0
3	6.31	6.57	7	7	0.26	N/A	N/A	N/A	12.0	10.0	7.0	17.0	0.26	0.26	N/A	N/A	Full	7.0	2.0	10.0	0.26, 0.11	10.0
4	6.57	7.96	7	7	1.39	4583.7	0.18	0.18	12.0	10.0	7.0	17.0	1.39	1.39	N/A	N/A	Full	7.0	2.0	25.0	0.16, 0.57	10.0

Segment No.	Ramp Entrance in Seg.	$X_{b,ent}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Entrance Side	Ramp Exit in Seg.	$X_{b,ext}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Exit Side	Type B Weave	Length of Weave (mi)	Length of Weave in Seg. (mi)	Ramp Entrance in Seg.	$X_{e,ent}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Entrance Side	Ramp Exit in Seg.	$X_{e,ext}$ (mi)	Length of Ramp (mi)	Length of Ramp in Seg. (mi)	Exit Side	Type B Weave	Length of Weave (mi)	Length of Weave in Seg. (mi)
1	Lane Add	0.00	N/A	N/A	Right	Lane Drop	0.00	N/A	N/A	Right	No	N/A	N/A	Lane Add	0.00	N/A	N/A	Right	Lane Drop	0.00	N/A	N/A	Right	Yes	0.47	0.47
2	No	0.47	N/A	N/A	Right	Lane Drop	0.00	N/A	N/A	Right	No	N/A	N/A	No	999.00	N/A	N/A	Right	No	0.47	N/A	N/A	Right	No	N/A	N/A
3	No	999.00	N/A	N/A	Right	No	999.00	N/A	N/A	Right	No	N/A	N/A	No	999.00	N/A	N/A	N/A	No	999.00	N/A	N/A	Right	No	N/A	N/A
4	S-C Lane	0.00	0.2	0.2	Right	SC	0.00	0.03	0.03	Right	No	N/A	N/A	Lane Add	0.00	N/A	N/A	Right	SC	0.00	0.03	0.03	Right	No	N/A	N/A

Segment No.	P_{hv}	2025 AADT	2025 $AADT_{b,ent}$	2025 $AADT_{b,ext}$	2025 $AADT_{e,ent}$	2025 $AADT_{e,ext}$	2045 AADT	2045 $AADT_{b,ent}$	2045 $AADT_{b,ext}$	2045 $AADT_{e,ent}$	2045 $AADT_{e,ext}$
1	Comp.	180,800	23,300	8,600	24,400	35,600	235,800	34,700	[illegible]	[illegible]	[illegible]
2	Comp.	147,800	23,300	15,800	18,700	35,600	189,300	34,700	[illegible]	[illegible]	[illegible]
3	Comp.	132,000	23,300	18,700	18,700	35,600	167,400	34,700	[illegible]	[illegible]	[illegible]
4	Comp.	144,400	6,200	18,700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Segments Data (Ramps)

No-Build Alternative

Segment No.	Begin Ramp Mile	End Ramp Mile	2025 No. of Lanes	2045 No. of Lanes	Length (mi)	Segment Type	Control Type	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Ramp-mile of beginning of Curve (mi)	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Ramp-mile of beginning of Curve (mi)	Lane Width (ft)	Right Shoulder Width (ft)	Left Shoulder Width (ft)	Lane Add/Drop by Taper	Length of Taper in Seg. (mi)	Right Barrier Length (mi)	Right Barrier Offset (ft)	Left Barrier Length (mi)	Left Barrier Offset (ft)	Segment No.	Ramp Entrance in Seg.	Length of entrance s-c in Seg. (mi)	Ramp Exit in Seg.	Length of exit s-c in Seg. (mi)	Weave Section in CD Road Segment	Length of Weave Section (mi)	Length of Weave Section in Seg. (mi)	2025 AADT	2045 AADT
1	0.00	0.33	1	1	0.33	Exit	Stop	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	0.25	20.0	0.00	0.0	1	No	N/A	No	N/A	N/A	N/A	N/A	24,400	34,200
2	0.00	0.14	2	2	0.14	Entrance	None	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	0.14	25.0	0.00	0.0	2	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,600
3	0.14	0.27	1	1	0.13	Entrance	None	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	0.26	25.0	0.00	0.0	3	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,600
4	0.00	0.26	1	1	0.26	Exit	Stop	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	25.0	0.00	0.0	4	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,600
5	0.00	0.29	1	1	0.29	Entrance	Stop	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	0.20	25.0	0.00	0.0	5	No	N/A	No	N/A	N/A	N/A	N/A	24,400	34,200

Build Alternative

Segment No.	Begin Ramp Mile	End Ramp Mile	2025 No. of Lanes	2045 No. of Lanes	Length (mi)	Segment Type	Control Type	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Ramp-mile of beginning of Curve (mi)	Curve Radius (ft)	Curve Length (mi)	Curve Length in Seg. (mi)	Ramp-mile of beginning of Curve (mi)	Lane Width (ft)	Right Shoulder Width (ft)	Left Shoulder Width (ft)	Lane Add/Drop by Taper	Length of Taper in Seg. (mi)	Right Barrier Length (mi)	Right Barrier Offset (ft)	Left Barrier Length (mi)	Left Barrier Offset (ft)	Segment No.	Ramp Entrance in Seg.	Length of entrance s-c in Seg. (mi)	Ramp Exit in Seg.	Length of exit s-c in Seg. (mi)	Weave Section in CD Road Segment	Length of Weave Section (mi)	Length of Weave Section in Seg. (mi)	2025 AADT	2045 AADT
1	0.00	0.33	2	2	0.33	Exit	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	0.25	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	0.38	1	1	0.38	Exit	None	316.0	0.27	0.27	0.11	N/A	N/A	N/A	N/A	12.0	7.0	4.0	No	N/A	0.38	7.0	0.02	11.0	2	No	N/A	No	N/A	N/A	N/A	N/A	15,800	21,900
3	0.00	0.14	2	2	0.14	Entrance	Signal	357.0	0.09	0.09	0.00	N/A	N/A	N/A	N/A	12.0	7.0	4.0	No	N/A	0.40	25.0	0.00	0.0	3	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,600
4	0.14	0.46	1	1	0.32	Entrance	Signal	357.0	0.09	0.00	0.00	964.00	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	N/A	N/A	N/A	N/A	6,200	8,600
5	0.00	0.26	1	1	0.26	Exit	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	25.0	0.00	0.0	5	No	N/A	No	N/A	N/A	N/A	N/A	6,200	8,600
6	0.00	0.29	2	2	0.29	Entrance	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	0.20	19.0	0.00	0.0	6	No	N/A	No	N/A	N/A	N/A	N/A	24,400	34,200

Segments Data (Ramp Terminals)

No-Build Alternative

Ramp Terminal No.	Ramp Terminal Config.	Control Type	Public Street Leg	Exit Ramp Skew Angle (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 (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 Bay	Outside Approach Right Turn Bay	Number of Driveways on the Outisde Leg	Number of Public Street Approaches on the Outisde Leg	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	No	0.0	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	24,400	6,200	60,700	52,500	34,200	8,600
2	D4	Signal	No	0.0	0.17	0.14	No	N/A	Signal	36.0	4	2	2	1	No	Yes	Yes	Yes	12.0	No	N/A	N/A	Yes	N/A	0	43,400	53,400	6,200	24,400	60,700	71,700	8,600	34,200

Build Alternative

Ramp Terminal No.	Ramp Terminal Config.	Control Type	Public Street Leg	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 Lanes (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 Bay	Outside Approach Right Turn Bay	Number of Driveways on the Outisde Leg	Number of Public Street Approaches on the Outside Leg	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	B4	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	60,700	52,500	12,300	8,600
2	D4	Signal	No	0.0	0.17	0.14	Yes	N/A	Signal	36.0	4	2	2	1	No	Yes	Yes	Yes	24.0	No	N/A	N/A	Yes	N/A	0	43,400	53,400	6,200	24,400	60,700	71,700	8,600	34,200

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	Median Width	Lighting	Auto Speed Enforcement	Major Commercial Driveway	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	Sig. Major Approaches with RT Lane	No. of Approaches with LT Signal Phasing	LT Phasing Leg 1	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	4SG	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	4SG	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.

Enhanced Interchange Safety Analysis Tool					
General Information					
Project description:	SR 202 at Kernan Blvd IMR, Existing Year 2019				
Analyst:	Arcadis	Date:	7/10/2020	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2019				
Crash Data Description					
Freeway segments	No crash data				
Ramp segments	No crash data				
Ramp terminals	No crash data				
Program Control					

1. Enter data in the Main, Input Freeway Segments, Input Ramp Segments, Input Ramp Terminals worksheets.
2. Click Perform Calculations button to start calculation process.

Perform Calculations | Print Results (optional) | Print Site Summary (optional)

3. Review results in the Output Summary worksheet. Optionally, click the Print buttons to print the summary worksheets.
4. Optionally, detailed results can be reviewed in the Output Freeway Segments, Output Ramp Segments, Output Ramp Terminals worksheets.

Input Worksheet for Freeway Segments

		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	(View results in Column AV) (View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Roadway Data							
Number of through lanes (n):		8	8	7	7		
Freeway segment description:		MP. 5.56-6.03	MP. 6.03-6.27	MP. 6.27-6.57	MP. 6.57-7.96		
Segment length (L), mi:		0.47	0.23	0.3	1.39		
Alignment Data							
Horizontal 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		
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:						
3	Horizontal curve in segment?:						
	Curve radius (R_3), ft:						
	Length of curve (L_{c3}), mi:						
	Length of curve in segment ($L_{c3,seg}$), mi:						
Cross Section Data							
Lane width (W_l), ft:		12	12	12	12		
Outside shoulder width (W_s), ft:		10	10	10	10		
Inside shoulder width (W_{is}), ft:		7	7	7	7		
Median width (W_m), ft:		17	17	17	17		
Rumble strips 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, mi:	0.47	0.23	0.3	1.39		
Rumble strips on inside shoulders?:		No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, mi:						
	Length of rumble strips for travel in decreasing milepost direction, mi:						
Presence of barrier in median:		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	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:						
	Distance from edge of traveled way to barrier face ($W_{off,in,3}$), ft:						
4	Length of barrier ($L_{ib,4}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,in,4}$), ft:						
5	Length of barrier ($L_{ib,5}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,in,5}$), ft:						
Median barrier width (W_{ib}), ft:		2	2	2	2		
Nearest distance from edge of traveled way to barrier face (W_{near}), ft:							
Roadside Data							
Clear zone width (W_{hc}), ft:		15	10	10	25		
Presence 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	10	10	10		
2	Length of barrier ($L_{ob,2}$), mi:	0.13		0.3	0.57		
	Distance from edge of traveled way to barrier face ($W_{off,o,2}$), ft:	10		10	10		
3	Length of barrier ($L_{ob,3}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,o,3}$), ft:						
4	Length of barrier ($L_{ob,4}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,o,4}$), ft:						
5	Length of barrier ($L_{ob,5}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,o,5}$), ft:						
Distance from edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:							
Distance from edge of traveled way to barrier face, decreasing milepost ($W_{off,dec}$), ft:							
Ramp Access Data							
Travel in Increasing Milepost Direction							
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):	Lane Add	No	No	S-C Lane		
	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		
	Entrance side?:				Right		
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):	Lane Drop	No	No	S-C Lane		
	Distance from end milepost to downstream exit ramp gore ($X_{e,ext}$), mi:		999	999			
	Length of ramp exit ($L_{ex,inc}$), mi:				0.03		
	Length of ramp exit in segment ($L_{ex,seg,inc}$), mi:				0.03		
	Exit side?:				Right		
Weave	Type B weave in segment?:	No	No	No	No		
	Length of weaving section ($L_{wev,inc}$), mi:						
	Length of weaving section in segment ($L_{wev,seg,inc}$), mi:						
Travel in Decreasing Milepost Direction							
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):	Lane Add	No	No	Lane Add		
	Distance from end milepost to upstream entrance ramp gore ($X_{e,ent}$), mi:		999	999			
	Length of ramp entrance ($L_{en,dec}$), mi:						
	Length of ramp entrance in segment ($L_{en,seg,dec}$), mi:						
	Entrance side?:						
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):	Lane Drop	No	No	S-C Lane		
	Distance from begin milepost to downstream exit ramp gore ($X_{b,ext}$), mi:		0.47	999			
	Length of ramp exit ($L_{ex,dec}$), mi:				0.03		
	Length of ramp exit in segment ($L_{ex,seg,dec}$), mi:				0.03		
	Exit side?:				Right		
Weave	Type B weave in segment?:	Yes	No	No	No		
	Length of weaving section ($L_{wev,dec}$), mi:	0.47					
	Length of weaving section in segment ($L_{wev,seg,dec}$), mi:	0.47					
Traffic Data	**Year**						
Proportion of AADT during high-volume hours (P_{hv}):							
Freeway Segment Data	2019	143400	114400	114400	121200		
Entrance Ramp Data for Travel in Increasing Milepost Dir.	**Year**						
Average daily traffic ($AADT_{b,ent}$) by year, veh/d:	2019	20800	20800		3400		
Exit Ramp Data for Travel in Increasing Milepost Direction	**Year**						
Average daily traffic ($AADT_{e,ext}$) by year, veh/d:	2019	14500			17200		
Entrance Ramp Data for Travel in Decreasing Milepost Dir.	**Year**						
Exit Ramp Data for Travel in Decreasing Milepost Direction	**Year**						
Average daily traffic ($AADT_{b,ext}$) by year, veh/d:	2019	31900	31900		3400		

Input Worksheet for Ramp Segments							
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column CJ)	(View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study 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		
Ramp segment description:		EB. Off Ramp	EB. On Ramp	WB. Off Ram	WB. On Ramp		
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), 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 (X_1), mi:							
Cross Section Data							
Lane width (W_l), ft:		12	12	12	12		
Right shoulder width (W_{rs}), ft:		7	7	7	7		
Left shoulder width (W_{ls}), 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 <u>right</u> 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 <u>left</u> side of roadway:		No	No	No	No		
1 Length of barrier ($L_{lb,1}$), mi:							
Distance from edge of traveled way to barrier face ($W_{off,l,1}$), ft:							
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 Entrance: Ramp entrance in segment? (If yes, indicate type.):		No	No	No	No		
Length of entrance s-c lane in segment ($L_{en,seg}$), mi:							
Ramp Exit: Ramp exit in segment? (If yes, indicate type.):		No	No	No	No		
Length of exit s-c lane in segment ($L_{ex,seg}$), mi:		14500	3400	3400	14500		

Input Worksheet for Crossroad Ramp Terminals			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
(View results in Column T)	(View results in Advisory Messages)		**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Intersection Data								
Ramp terminal configuration:			D4	D4				
Ramp terminal description:			South Ramp T	North Ramp Term.				
Ramp terminal traffic control type:			One stop	One stop				
Is a non-ramp public street leg present at the terminal (I_{ps})?:								
Alignment Data								
Exit ramp skew angle (I_{sk}), degrees:			0	0				
Distance to the next public street intersection on the outside crossroad leg (L_{str}), mi:			999	0.17				
Distance to the adjacent ramp terminal (L_{rmp}), mi:			0.09	0.09				
Traffic Control								
Left-Turn Operational Mode								
Crossroad	Inside approach	Protected-only mode ($I_{p,lt,in}$)?:						
	Outside approach	Protected-only mode ($I_{p,lt,out}$)?:						
Right-Turn Control Type								
Ramp	Exit ramp approach	Right-turn control type:	Yield	Stop				
Cross Section Data								
Crossroad median width (W_m), ft:			36	36				
Number 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-Turn Channelization		see note: →						
Crossroad	Inside approach	Channelization present ($I_{ch,in}$)?:						
	Outside approach	Channelization present ($I_{ch,out}$)?:						
Ramp	Exit ramp approach	Channelization present ($I_{ch,ex}$)?:						
Left-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,lt,in}$)?:	Yes	Yes				
		Width of lane or bay ($W_{b,in}$), ft:	12	12				
	Outside approach	Lane or bay present ($I_{bay,lt,out}$)?:						
		Width of lane or bay ($W_{b,out}$), ft:						
Right-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,rt,in}$)?:						
	Outside approach	Lane or bay present ($I_{bay,rt,out}$)?:	Yes	Yes				
Access Data								
Number of driveways on the outside crossroad leg (n_{dw}):								
Number of public street approaches on the outside crossroad leg (n_{ps}):								
Traffic Data		**Year**						
Inside Crossroad Leg Data		2019	17900	17900				
Outside Crossroad Leg Data		2019	0	30500				
Exit Ramp Data		2019	14500	3400				
Entrance Ramp Data		2019	3400	14500				
Average daily traffic ($AADT_{en}$) by year, veh/d:		2020						

Output Summary

General Information

Project description:	SR 202 at Kernan Blvd IMR, Existing Year 2019				
Analyst:	Arcadis	Date:	7/10/2020	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2019				

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility		Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:		126.9	0.6	2.0	12.0	38.1	74.2
Estimated average crash freq. during Study Period, crashes/yr:		126.9	0.6	2.0	12.0	38.1	74.2
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	4	96.4	0.5	1.3	7.5	20.1	67.1
Ramp segments, crashes:	4	2.8	0.0	0.1	0.5	0.7	1.5
Crossroad ramp terminals, crashes:	2	27.6	0.1	0.6	4.0	17.3	5.6
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during	2019	126.9	0.6	2.0	12.0	38.1	74.2

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	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 crashes:	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 multiple-vehicle crashes:	2.3	0.0	0.0	0.2	0.8	1.3
	Total multiple-vehicle crashes:	94.5	0.4	1.5	9.0	30.0	53.6
Single vehicle	Crashes with animal:	0.4	0.0	0.0	0.0	0.0	0.4
	Crashes with fixed object:	23.6	0.1	0.4	2.2	6.0	14.9
	Crashes with other object:	3.1	0.0	0.0	0.1	0.3	2.6
	Crashes with parked vehicle:	0.5	0.0	0.0	0.0	0.1	0.4
	Other single-vehicle crashes	4.8	0.0	0.1	0.6	1.8	2.2
	Total single-vehicle crashes:	32.4	0.2	0.5	3.0	8.1	20.6
	Total crashes:	126.9	0.6	2.0	12.0	38.1	74.2

Output Worksheet for Freeway Segments										
MV = multiple-vehicle model SV = single-vehicle model	ENR = ramp entrance model EXR = ramp exit model				Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models (*y*)				**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Crash Modification Factors										
Fatal-and-Injury Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,fi}$):	MV		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		
Outside shoulder width ($CMF_{8,fs,ac,sv,fi}$):		SV			1.000	1.000	1.000	1.000		
Inside 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		
		SV			0.954	0.954	0.954	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 ($CMF_{9,fs,ac,sv,fi}$):		SV			0.958	0.906	0.906	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		
Lane change ($CMF_{7,fs,ac,mv,fi}$):	MV									
			Year:	2019	1.417	1.000	1.000	1.069		
Ramp entrance ($CMF_{12,sc,nEN,at,fi}$):			ENR							
			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 ($CMF_{6,w,ac,y,fi}$):	MV		ENR	EXR	1.207	1.101	1.166	1.192		
		SV			0.964	0.982	0.971	0.967		
Property-Damage-Only Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,pdo}$):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width ($CMF_{2,w,ac,y,pdo}$):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width ($CMF_{8,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Inside shoulder width ($CMF_{3,w,ac,y,pdo}$):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median 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		
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			1.000	1.000	1.000	1.000		
Outside clearance ($CMF_{10,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Outside barrier ($CMF_{11,fs,ac,sv,pdo}$):		SV			1.054	1.110	1.240	1.066		
Lane change ($CMF_{7,fs,ac,mv,pdo}$):	MV									
			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 ($CMF_{13,sc,nEX,at,pdo}$):				EXR	1.000	1.000	1.000	1.000		
High volume ($CMF_{6,w,ac,y,pdo}$):	MV		ENR	EXR	1.165	1.081	1.132	1.153		
		SV			0.720	0.845	0.765	0.736		
Predicted Average Crash Frequency										
Fatal-and-Injury Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,fi}$):										
Observed crash count ($N^*_{o,fs,n,mv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2019	6.444	1.436	2.030	10.191		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,fi}$):										
Observed crash count ($N^*_{o,fs,n,sv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,sv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2019	1.913	0.793	1.076	4.072		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,fi}$):										
Observed crash count ($N^*_{o,sc,EN,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EN,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2019	0.000	0.000	0.000	0.988		
Ramp Exit Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EX,at,fi}$):										
Observed crash count ($N^*_{o,sc,EX,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EX,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EX,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2019	0.000	0.000	0.000	0.398		
Property-Damage-Only Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,mv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2019	14.143	3.105	4.678	23.934		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,sv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,sv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2019	3.993	1.915	2.578	9.539		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,pdo}$):										
Observed crash count ($N^*_{o,sc,EN,at,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EN,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2019	0.000	0.000	0.000	2.469		
Ramp Exit Crash Analysis				**Year**						
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 reference year ($N_{p,sc,EX,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EX,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2019	0.000	0.000	0.000	0.747		

Output Worksheet for Ramp Segments								
MV = multiple-vehicle model SV = single-vehicle model	Applicable Models		Segment 1 Study Period	Segment 2 Study Period	Segment 3 Study Period	Segment 4 Study Period	Segment 5 Study Period	Segment 6 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		
		SV	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		
Right shoulder width ($CMF_{3,w,x,y,fi}$):	MV	SV	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		
Right side barrier ($CMF_{5,w,x,y,fi}$):	MV	SV	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		
Weaving section ($CMF_{9,cds,ac,at,fi}$):	MV	SV						
	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								
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 ($N_{p,w,x,mv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,fi,r}$), crashes/yr:								
Predicted average crash frequency		2019	0.030	0.035	0.005	0.114		
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 ($N_{p,w,x,sv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,fi,r}$), yr:								
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								
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 ($N_{p,w,x,mv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2019	0.077	0.043	0.010	0.189		
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 ($N_{p,w,x,sv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,sv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2019	0.479	0.178	0.137	0.341		

Output Worksheet for Crossroad Ramp Terminals								
Signal = signalized intersection model Unsig = unsignalized intersection model	Applicable Models		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								
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						
	Year:	2019	0.795	0.889				
Crossroad right-turn lane ($CMF_{12,w,x,at,fi}$):	Signal	Unsig						
	Year:	2019	1.000	0.940				
Median width ($CMF_{15,w,x,at,fi}$):	Signal	Unsig						
	Year:	2019	1.258	1.410				
Exit ramp capacity ($CMF_{10,w,x,at,fi}$):	Signal	Unsig						
	Year:	2019	32.899	1.092				
Skew angle ($CMF_{20,w,ST,at,fi}$):		Unsig						
	Year:	2019	1.000	1.000				
All-way stop control (CMF_{awsc}):		Unsig						
Property-Damage-Only Crash CMFs								
Non-ramp public street leg ($CMF_{19,w,SG,at,pdo}$):	Signal							
Segment length ($CMF_{14,w,x,at,pdo}$):	Signal							
Protected left-turn operation ($CMF_{16,w,SG,at,pdo}$):	Signal							
	Year:	2019						
Channelized right turn on crossroad ($CMF_{17,w,SG,at,pdo}$):	Signal							
	Year:	2019						
Channelized right turn on exit ramp ($CMF_{18,w,SG,at,pdo}$):	Signal							
	Year:	2019						
Access point frequency ($CMF_{13,w,x,at,pdo}$):	Signal							
	Year:	2019						
Crossroad left-turn lane ($CMF_{11,w,x,at,pdo}$):	Signal	Unsig						
	Year:	2019	0.790	0.887				
Crossroad right-turn lane ($CMF_{12,w,x,at,pdo}$):	Signal	Unsig						
	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 ($N_{p,w,x,at,fi,r}$), crashes/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 ($N_{a,w,x,at,fi,r}$), 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 ($N_{p,w,x,at,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,at,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2019	1.746	3.894				

Enhanced Interchange Safety Analysis Tool					
General Information					
Project description:	SR 202 at Kernan Blvd IMR, Opening Year 2025 No-Build				
Analyst:	Arcadis	Date:	7/10/2020	Area type:	Urban
First year of analysis:	2025				
Last year of analysis:	2025				
Crash Data Description					
Freeway segments	No crash data				
Ramp segments	No crash data				
Ramp terminals	No crash data				

Program Control

1. Enter data in the Main, Input Freeway Segments, Input Ramp Segments, Input Ramp Terminals worksheets.
2. Click Perform Calculations button to start calculation process.

Print Results (optional) | Print Site Summary (optional)

3. Review results in the Output Summary worksheet. Optionally, click the Print buttons to print the summary worksheets.
4. Optionally, detailed results can be reviewed in the Output Freeway Segments, Output Ramp Segments, Output Ramp Terminals worksheets.

Input Worksheet for Freeway Segments

		Year	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column AV)	(View results in Advisory Messages)		**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Roadway Data								
Number of through lanes (n):			8	8	7	7		
Freeway segment description:			MP. 5.56-6.03	MP. 6.03-6.27	MP. 6.27-6.57	MP. 6.57-7.96		
Segment length (L), mi:			0.47	0.23	0.3	1.39		
Alignment Data								
Horizontal 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		
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 Section Data								
Lane width (W_l), ft:			12	12	12	12		
Outside shoulder width (W_s), ft:			10	10	10	10		
Inside shoulder width (W_{is}), ft:			7	7	7	7		
Median width (W_m), ft:			17	17	17	17		
Rumble strips 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, mi:		0.47	0.23	0.3	1.39		
Rumble strips on inside shoulders?:			No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, mi:							
	Length of rumble strips for travel in decreasing milepost direction, mi:							
Presence of barrier in median:			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	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:							
	Distance from edge of traveled way to barrier face ($W_{off,in,3}$), ft:							
Median barrier width (W_{ib}), ft:			2	2	2	2		
Nearest distance from edge of traveled way to barrier face (W_{near}), ft:								
Roadside Data								
Clear zone width (W_{hc}), ft:			15	10	10	25		
Presence 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	10	10	10		
2	Length of barrier ($L_{ob,2}$), mi:		0.13		0.3	0.57		
	Distance from edge of traveled way to barrier face ($W_{off,o,2}$), ft:		10		10	10		
3	Length of barrier ($L_{ob,3}$), mi:							
	Distance from edge of traveled way to barrier face ($W_{off,o,3}$), ft:							
Distance from edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:								
Distance from edge of traveled way to barrier face, decreasing milepost ($W_{off,dec}$), ft:								
Ramp Access Data								
Travel in Increasing Milepost Direction								
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	S-C Lane		
	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		
	Entrance side?:					Right		
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	No	No	S-C Lane		
	Distance from end milepost to downstream exit ramp gore ($X_{e,ext}$), mi:			999	999			
	Length of ramp exit ($L_{ex,inc}$), mi:					0.03		
	Length of ramp exit in segment ($L_{ex,seg,inc}$), mi:					0.03		
	Exit side?:					Right		
Weave	Type B weave in segment?:		No	No	No	No		
	Length of weaving section ($L_{wev,inc}$), mi:							
	Length of weaving section in segment ($L_{wev,seg,inc}$), mi:							
Travel in Decreasing Milepost Direction								
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	Lane Add		
	Distance from end milepost to upstream entrance ramp gore ($X_{e,ent}$), mi:			999	999			
	Length of ramp entrance ($L_{en,dec}$), mi:							
	Length of ramp entrance in segment ($L_{en,seg,dec}$), mi:							
	Entrance side?:							
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	No	No	S-C Lane		
	Distance from begin milepost to downstream exit ramp gore ($X_{b,ext}$), mi:			0.47	999			
	Length of ramp exit ($L_{ex,dec}$), mi:					0.03		
	Length of ramp exit in segment ($L_{ex,seg,dec}$), mi:					0.03		
	Exit side?:					Right		
Weave	Type B weave in segment?:		Yes	No	No	No		
	Length of weaving section ($L_{wev,dec}$), mi:		0.47					
	Length of weaving section in segment ($L_{wev,seg,dec}$), mi:		0.47					
Traffic Data		**Year**						
Proportion of AADT during high-volume hours (P_{hv}):								
Freeway Segment Data		2025	180800	132000	132000	144400		
Entrance Ramp Data for Travel in Increasing Milepost Dir.		**Year**						
Average daily traffic ($AADT_{b,ent}$) by year, veh/d:		2025	23300	23300		6200		
Exit Ramp Data for Travel in Increasing Milepost Direction		**Year**						
Average daily traffic ($AADT_{e,ext}$) by year, veh/d:		2025	24400			18700		
Entrance Ramp Data for Travel in Decreasing Milepost Dir.		**Year**						
Average daily traffic ($AADT_{e,ent}$) by year, veh/d:		2025	24400			18700		
Exit Ramp Data for Travel in Decreasing Milepost Direction		**Year**						
Average daily traffic ($AADT_{b,ext}$) by year, veh/d:		2025	35600	35600		6200		

Input Worksheet for Ramp Segments

(View results in Column CJ) (View results in Advisory Messages)	Segment 1 Study Period	Segment 2 Study Period	Segment 3 Study Period	Segment 4 Study Period	Segment 5 Study Period	Segment 6 Study Period
Basic Roadway Data						
Number of through lanes (n):	1	2	1	1	1	
Ramp segment description:	EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ram	WB. On Ramp	
Segment length (L), mi:	0.33	0.14	0.27	0.26	0.29	
Average traffic speed on the freeway (V_{frwy}), mi/h:	65	65	65	65	65	
Segment type (ramp or collector-distributor road):	Exit	Entrance	Entrance	Exit	Entrance	
Type of control at crossroad ramp terminal:	Signal	Signal	Signal	Signal	Signal	
Alignment Data						
Horizontal 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 (X_1), mi:						
Cross Section Data						
Lane width (W_l), ft:	12	12	12	12	12	
Right shoulder width (W_{rs}), ft:	7	7	7	7	7	
Left shoulder width (W_{ls}), 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 ($L_{lb,1}$), mi:						
Distance from edge of traveled way to barrier face ($W_{off,l,1}$), ft:						
Ramp Access Data ← See note						
Ramp Entrance: Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	
Length of entrance s-c lane in segment ($L_{en,seg}$), mi:						
Ramp Exit: Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	
Length of exit s-c lane in segment ($L_{ex,seg}$), mi:						
Weaving Section: Weave section in collector-distributor road segment?:						
Length of weaving section (L_{wev}), mi:						
Length of weaving section in segment ($L_{wev,seg}$), mi:						
Traffic Data — Year						
Average daily traffic ($AADT_r$ or $AADT_c$) by year, veh/d: — 2025	24400	6200	6200	6200	24400	

Input Worksheet for Crossroad Ramp Terminals			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
(View results in Column T)		(View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Intersection Data								
Ramp terminal configuration:			D4	D4				
Ramp terminal description:			South Ramp T	North Ramp Term.				
Ramp terminal traffic control type:			Signal	Signal				
Is a non-ramp public street leg present at the terminal (I_{ps})?:								
Alignment Data								
Exit ramp skew angle (I_{sk}), degrees:								
Distance to the next public street intersection on the outside crossroad leg (L_{str}), mi:			0.14	0.17				
Distance to the adjacent ramp terminal (L_{rmp}), mi:			0.14	0.14				
Traffic Control								
Left-Turn Operational Mode								
Crossroad	Inside approach	Protected-only mode ($I_{p,lt,in}$)?:	Yes	No				
	Outside approach	Protected-only mode ($I_{p,lt,out}$)?:						
Right-Turn Control Type								
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Section Data								
Crossroad median width (W_m), ft:			36	36				
Number of 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-Turn Channelization		see note: →						
Crossroad	Inside approach	Channelization present ($I_{ch,in}$)?:						
	Outside approach	Channelization present ($I_{ch,out}$)?:	Yes	Yes				
Ramp	Exit ramp approach	Channelization present ($I_{ch,ex}$)?:	Yes	Yes				
Left-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,lt,in}$)?:	Yes	Yes				
		Width of lane or bay ($W_{b,in}$), ft:	24	12				
	Outside approach	Lane or bay present ($I_{bay,lt,out}$)?:						
		Width of lane or bay ($W_{b,out}$), ft:						
Right-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,rt,in}$)?:						
	Outside approach	Lane or bay present ($I_{bay,rt,out}$)?:	Yes	Yes				
Access Data								
Number of driveways on the outside crossroad leg (n_{dw}):								
Number of public street approaches on the outside crossroad leg (n_{ps}):								
Traffic Data		**Year**						
Inside Crossroad Leg Data		2025	43400	43400				
Outside Crossroad Leg Data		2025	37200	53400				
Exit Ramp Data		2025	24400	6200				
Entrance Ramp Data		2025	6200	24400				

Output Summary

General Information

Project description:	SR 202 at Kernan Blvd IMR, Opening Year 2025 No-Build				
Analyst:	Arcadis	Date:	7/10/2020	Area type:	Urban
First year of analysis:	2025				
Last year of analysis:	2025				

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	

General Information

Project description:			
Analyst:	Date:	Area type:	
First year of analysis:	2025		
Last year of analysis:	2025		

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility		Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:		189.0	0.6	2.3	14.1	50.8	121.1
Estimated average crash freq. during Study Period, crashes/yr:		189.0	0.6	2.3	14.1	50.8	121.1
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	4	130.9	0.5	1.5	9.0	27.8	92.1
Ramp segments, crashes:	5	4.5	0.1	0.2	0.8	1.1	2.3
Crossroad ramp terminals, crashes:	2	53.7	0.0	0.7	4.4	21.9	26.7
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during	2025	189.0	0.6	2.3	14.1	50.8	121.1

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.9	0.0	0.0	0.1	0.4	0.3
	Right-angle crashes:	15.1	0.0	0.2	1.3	6.3	7.2
	Rear-end crashes:	104.0	0.3	1.3	8.0	29.7	64.7
	Sideswipe crashes:	30.0	0.1	0.2	1.4	4.8	23.5
	Other multiple-vehicle crashes:	3.5	0.0	0.0	0.3	0.9	2.3
	Total multiple-vehicle crashes:	153.5	0.5	1.8	11.1	42.1	98.0

Output Worksheet for Freeway Segments										
MV = multiple-vehicle model SV = single-vehicle model	ENR = ramp entrance model EXR = ramp exit model				Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models (*y*)				**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Crash Modification Factors										
Fatal-and-Injury Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,fi}$):	MV		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		
Outside shoulder width ($CMF_{8,fs,ac,sv,fi}$):		SV			1.000	1.000	1.000	1.000		
Inside 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		
		SV			0.954	0.954	0.954	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 ($CMF_{9,fs,ac,sv,fi}$):		SV			0.958	0.906	0.906	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		
Lane change ($CMF_{7,fs,ac,mv,fi}$):	MV									
			Year:	2025	1.400	1.000	1.000	1.062		
Ramp entrance ($CMF_{12,sc,nEN,at,fi}$):			ENR							
			Year:	2025	1.000	1.000	1.000	1.682		
Ramp exit ($CMF_{13,sc,nEX,at,fi}$):				EXR	1.000	1.000	1.000	1.472		
High volume ($CMF_{6,w,ac,y,fi}$):	MV		ENR	EXR	1.296	1.170	1.229	1.264		
		SV			0.951	0.970	0.961	0.956		
Property-Damage-Only Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,pdo}$):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width ($CMF_{2,w,ac,y,pdo}$):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width ($CMF_{8,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Inside shoulder width ($CMF_{3,w,ac,y,pdo}$):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median 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		
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			1.000	1.000	1.000	1.000		
Outside clearance ($CMF_{10,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Outside barrier ($CMF_{11,fs,ac,sv,pdo}$):		SV			1.054	1.110	1.240	1.066		
Lane change ($CMF_{7,fs,ac,mv,pdo}$):	MV									
			Year:	2025	1.297	1.000	1.000	1.056		
Ramp entrance ($CMF_{12,sc,nEN,at,pdo}$):			ENR		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		
High volume ($CMF_{6,w,ac,y,pdo}$):	MV		ENR	EXR	1.233	1.135	1.181	1.209		
		SV			0.636	0.760	0.698	0.664		
Predicted Average Crash Frequency										
Fatal-and-Injury Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,fi}$):										
Observed crash count ($N^*_{o,fs,n,mv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	9.661	1.889	2.650	13.944		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,fi}$):										
Observed crash count ($N^*_{o,fs,n,sv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	2.192	0.859	1.168	4.509		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,fi}$):										
Observed crash count ($N^*_{o,sc,EN,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	1.449		
Ramp Exit Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EX,at,fi}$):										
Observed crash count ($N^*_{o,sc,EX,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EX,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	0.494		
Property-Damage-Only Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,mv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,mv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	23.198	4.302	6.440	35.011		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,sv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	4.320	1.953	2.666	10.036		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,pdo}$):										
Observed crash count ($N^*_{o,sc,EN,at,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	3.202		
				2048						
Ramp Exit Crash Analysis				**Year**						
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 reference year ($N_{p,sc,EX,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	0.922		

Output Worksheet for Ramp Segments								
MV = multiple-vehicle model SV = single-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models		**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:	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		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								
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 ($N_{p,w,x,mv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,fi,r}$), crashes/yr:								
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 ($N_{p,w,x,sv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_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								
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 ($N_{p,w,x,mv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.148	0.073	0.061	0.021	0.364	
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 ($N_{p,w,x,sv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,sv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.685	0.126	0.177	0.208	0.487	
		2048						

Output Worksheet for Crossroad Ramp Terminals							
Signal = signalized intersection model Unsig = unsignalized intersection model			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5
	Applicable Models		**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:	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						
	Year:	2025	0.739	1.000			
Channelized right turn on crossroad ($CMF_{17,w,SG,at,pdo}$):	Signal						
	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						
	Year:	2025	1.000	1.000			
Crossroad left-turn lane ($CMF_{11,w,x,at,pdo}$):	Signal	Unsig					
	Year:	2025	0.875	0.891			
Crossroad right-turn lane ($CMF_{12,w,x,at,pdo}$):	Signal	Unsig					
	Year:	2025	0.980	0.975			
Median width ($CMF_{15,w,x,at,pdo}$):	Signal						
	Year:	2025	0.690	0.509			
Predicted Average Crash Frequency							
Fatal-and-Injury Crash Frequency							
Ramp Terminal Crash Analysis		**Year**					
Overdispersion parameter ($k_{w,x,at,fi}$):							
Observed crash count ($N^*_{o,w,x,at,fi}$), crashes:							
Reference year (r):							
Predicted average crash freq. for reference year ($N_{p,w,x,at,fi,r}$), crashes/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 ($N_{a,w,x,at,fi,r}$), crashes/yr:							
Predicted average crash frequency		2025	14.755	12.186			
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 ($N_{p,w,x,at,pdo,r}$), crashes/yr:							
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,r}$), yr:							
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,at,pdo,r}$), crashes/yr:							
Predicted average crash frequency		2025	14.354	12.364			

Enhanced Interchange Safety Analysis Tool					
General Information					
Project description:	SR 202 at Kernan 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 Description					
Freeway segments	No crash data				
Ramp segments	No crash data				
Ramp terminals	No crash data				
Program Control					

1. Enter data in the Main, Input Freeway Segments, Input Ramp Segments, Input Ramp Terminals worksheets.
2. Click Perform Calculations button to start calculation process.

Print Results (optional) | Print Site Summary (optional)

3. Review results in the Output Summary worksheet. Optionally, click the Print buttons to print the summary worksheets.
4. Optionally, detailed results can be reviewed in the Output Freeway Segments, Output Ramp Segments, Output Ramp Terminals worksheets.

Input Worksheet for Freeway Segments

		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	(View results in Column AV) (View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Roadway Data							
Number of through lanes (n):		8	8	7	7		
Freeway segment description:		MP. 5.56-6.03	MP. 6.03-6.27	MP. 6.27-6.57	MP. 6.57-7.96		
Segment length (L), mi:		0.47	0.23	0.3	1.39		
Alignment Data							
Horizontal 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		
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 Section Data							
Lane width (W_l), ft:		12	12	12	12		
Outside shoulder width (W_s), ft:		10	10	10	10		
Inside shoulder width (W_{is}), ft:		7	7	7	7		
Median width (W_m), ft:		17	17	17	17		
Rumble strips 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, mi:	0.47	0.23	0.3	1.39		
Rumble strips on inside shoulders?:		No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, mi:						
	Length of rumble strips for travel in decreasing milepost direction, mi:						
Presence of barrier in median:		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	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:						
	Distance from edge of traveled way to barrier face ($W_{off,in,3}$), ft:						
Median barrier width (W_{ib}), ft:		2	2	2	2		
Nearest distance from edge of traveled way to barrier face (W_{near}), ft:							
Roadside Data							
Clear zone width (W_{hc}), ft:		15	10	10	25		
Presence 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	10	10	10		
2	Length of barrier ($L_{ob,2}$), mi:	0.13		0.3	0.57		
	Distance from edge of traveled way to barrier face ($W_{off,o,2}$), ft:	10		10	10		
3	Length of barrier ($L_{ob,3}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,o,3}$), ft:						
Distance from edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:							
Distance from edge of traveled way to barrier face, decreasing milepost ($W_{off,dec}$), ft:							
Ramp Access Data							
Travel in Increasing Milepost Direction							
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):	Lane Add	No	No	S-C Lane		
	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		
	Entrance side?:				Right		
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):	Lane Drop	No	No	S-C Lane		
	Distance from end milepost to downstream exit ramp gore ($X_{e,ext}$), mi:		999	999			
	Length of ramp exit ($L_{ex,inc}$), mi:				0.03		
	Length of ramp exit in segment ($L_{ex,seg,inc}$), mi:				0.03		
	Exit side?:				Right		
Weave	Type B weave in segment?:	No	No	No	No		
	Length of weaving section ($L_{wev,inc}$), mi:						
	Length of weaving section in segment ($L_{wev,seg,inc}$), mi:						
Travel in Decreasing Milepost Direction							
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):	Lane Add	No	No	Lane Add		
	Distance from end milepost to upstream entrance ramp gore ($X_{e,ent}$), mi:		999	999			
	Length of ramp entrance ($L_{en,dec}$), mi:						
	Length of ramp entrance in segment ($L_{en,seg,dec}$), mi:						
	Entrance side?:						
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):	Lane Drop	No	No	S-C Lane		
	Distance from begin milepost to downstream exit ramp gore ($X_{b,ext}$), mi:		0.47	999			
	Length of ramp exit ($L_{ex,dec}$), mi:				0.03		
	Length of ramp exit in segment ($L_{ex,seg,dec}$), mi:				0.03		
	Exit side?:				Right		
Weave	Type B weave in segment?:	Yes	No	No	No		
	Length of weaving section ($L_{wev,dec}$), mi:	0.47					
	Length of weaving section in segment ($L_{wev,seg,dec}$), mi:	0.47					
Traffic Data	**Year**						
Proportion of AADT during high-volume hours (P_{hv}):							
Freeway Segment Data	2045	235800	167400	167400	184600		
Entrance Ramp Data for Travel in Increasing Milepost Dir.	**Year**						
Average daily traffic ($AADT_{b,ent}$) by year, veh/d:	2045	34700	34700		8600		
Exit Ramp Data for Travel in Increasing Milepost Direction	**Year**						
Average daily traffic ($AADT_{e,ext}$) by year, veh/d:	2045	34200			25400		
Entrance Ramp Data for Travel in Decreasing Milepost Dir.	**Year**						
Average daily traffic ($AADT_{e,ent}$) by year, veh/d:	2045	34200			25400		
Exit Ramp Data for Travel in Decreasing Milepost Direction	**Year**						
Average daily traffic ($AADT_{b,ext}$) by year, veh/d:	2045	52300	52300		8600		

Input Worksheet for Ramp Segments							
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column CJ)	(View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Roadway Data							
Number of through lanes (n):		1	2	1	1	1	
Ramp segment description:		EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ramp	WB. On Ramp	
Segment length (L), mi:		0.33	0.14	0.27	0.26	0.29	
Average traffic speed on the freeway (V_{frwy}), mi/h:		65	65	65	65	65	
Segment type (ramp or collector-distributor road):		Exit	Entrance	Entrance	Exit	Entrance	
Type of control at crossroad ramp terminal:		Stop	Stop	Stop	Stop	Stop	
Alignment Data							
Horizontal 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 (X_1), mi:						
Cross Section Data							
Lane width (W_l), ft:		12	12	12	12	12	
Right shoulder width (W_{rs}), ft:		7	7	7	7	7	
Left shoulder width (W_{ls}), 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 right 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 left side of roadway:		No	No	No	No	No	
1	Length of barrier ($L_{lb,1}$), mi:						
	Distance from edge of traveled way to barrier face ($W_{off,l,1}$), ft:						
Ramp Access Data	See note						
Ramp Entrance	Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	
	Length of entrance s-c lane in segment ($L_{en,seg}$), mi:						
Ramp Exit	Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	
	Length of exit s-c lane in segment ($L_{ex,seg}$), mi:						
Weaving Section	Weave section in collector-distributor road segment?:						
	Length of weaving section (L_{wev}), mi:						
	Length of weaving section in segment ($L_{wev,seg}$), mi:						
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or $AADT_c$) by year, veh/d:	2045	34200	8600	8600	8600	34200	

Input Worksheet for Crossroad Ramp Terminals

			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
(View results in Column T)		(View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Intersection Data								
Ramp terminal configuration:			D4	D4				
Ramp terminal description:			South Ramp T	North Ramp Term.				
Ramp terminal traffic control type:			Signal	Signal				
Is a non-ramp public street leg present at the terminal (I_{ps})?:								
Alignment Data								
Exit ramp skew angle (I_{sk}), degrees:								
Distance to the next public street intersection on the outside crossroad leg (L_{str}), mi:			0.14	0.17				
Distance to the adjacent ramp terminal (L_{rmp}), mi:			0.14	0.14				
Traffic Control								
Left-Turn Operational Mode								
Crossroad	Inside approach	Protected-only mode ($I_{p,lt,in}$)?:	Yes	No				
	Outside approach	Protected-only mode ($I_{p,lt,out}$)?:						
Right-Turn Control Type								
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Section Data								
Crossroad median width (W_m), ft:			36	36				
Number of 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-Turn Channelization		see note: →						
Crossroad	Inside approach	Channelization present ($I_{ch,in}$)?:						
	Outside approach	Channelization present ($I_{ch,out}$)?:	Yes	Yes				
Ramp	Exit ramp approach	Channelization present ($I_{ch,ex}$)?:	Yes	Yes				
Left-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,lt,in}$)?:	Yes	Yes				
		Width of lane or bay ($W_{b,in}$), ft:	24	12				
	Outside approach	Lane or bay present ($I_{bay,lt,out}$)?:						
		Width of lane or bay ($W_{b,out}$), ft:						
Right-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,rt,in}$)?:						
	Outside approach	Lane or bay present ($I_{bay,rt,out}$)?:	Yes	Yes				
Access Data								
Number of driveways on the outside crossroad leg (n_{dw}):								
Number of public street approaches on the outside crossroad leg (n_{ps}):								
Traffic Data		**Year**						
Inside Crossroad Leg Data		2045	60700	60700				
Outside Crossroad Leg Data		2045	52500	71700				
Exit Ramp Data		2045	34200	8600				
Entrance Ramp Data		2045	8600	34200				

Output Summary

General Information							
Project description:	SR 202 at Kernan 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 Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility		**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:		289.6	0.8	3.4	20.4	82.6	182.4
Estimated average crash freq. during Study Period, crashes/yr:		289.6	0.8	3.4	20.4	82.6	182.4
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	4	199.9	0.7	1.9	11.6	41.8	143.8
Ramp segments, crashes:	5	6.3	0.1	0.2	1.2	1.7	3.1
Crossroad ramp terminals, crashes:	2	83.5	0.0	1.2	7.6	39.1	35.5
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during	2045	289.6	0.8	3.4	20.4	82.6	182.4

Distribution of Crashes for Entire Facility

Crash Type	**Crash Type Category**	**Estimated Number of Crashes During the Study Period**					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	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 crashes:	168.1	0.5	2.0	12.1	50.1	103.5
	Sideswipe crashes:	48.3	0.1	0.3	2.1	7.8	38.0
	Other multiple-vehicle crashes:	5.7	0.0	0.1	0.4	1.5	3.7
	Total multiple-vehicle crashes:	247.4	0.6	2.8	17.0	71.2	155.8
Single vehicle	Crashes with animal:	0.5	0.0	0.0	0.0	0.0	0.5
	Crashes with fixed object:	30.5	0.1	0.4	2.4	8.0	19.6
	Crashes with other object:	3.9	0.0	0.0	0.1	0.5	3.3
	Crashes with parked vehicle:	0.7	0.0	0.0	0.1	0.2	0.4
	Other single-vehicle crashes	6.6	0.0	0.1	0.8	2.7	2.9
	Total single-vehicle crashes:	42.3	0.2	0.6	3.4	11.4	26.7
	Total crashes:	289.6	0.8	3.4	20.4	82.6	182.4

Output Worksheet for Freeway Segments										
MV = multiple-vehicle model SV = single-vehicle model	ENR = ramp entrance model EXR = ramp exit model				Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models (y)				**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Crash Modification Factors										
Fatal-and-Injury Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,fi}$):	MV		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		
Outside shoulder width ($CMF_{8,fs,ac,sv,fi}$):		SV			1.000	1.000	1.000	1.000		
Inside 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		
		SV			0.954	0.954	0.954	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 ($CMF_{9,fs,ac,sv,fi}$):		SV			0.958	0.906	0.906	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		
Lane change ($CMF_{7,fs,ac,mv,fi}$):	MV									
			Year:	2045	1.384	1.000	1.000	1.056		
Ramp entrance ($CMF_{12,sc,nEN,at,fi}$):			ENR							
			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		
High volume ($CMF_{6,w,ac,y,fi}$):	MV		ENR	EXR	1.365	1.269	1.314	1.341		
		SV			0.942	0.955	0.949	0.945		
Property-Damage-Only Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,pdo}$):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width ($CMF_{2,w,ac,y,pdo}$):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width ($CMF_{8,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Inside shoulder width ($CMF_{3,w,ac,y,pdo}$):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median 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		
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			1.000	1.000	1.000	1.000		
Outside clearance ($CMF_{10,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Outside barrier ($CMF_{11,fs,ac,sv,pdo}$):		SV			1.054	1.110	1.240	1.066		
Lane change ($CMF_{7,fs,ac,mv,pdo}$):	MV									
			Year:	2045	1.282	1.000	1.000	1.051		
Ramp entrance ($CMF_{12,sc,nEN,at,pdo}$):			ENR		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		
High volume ($CMF_{6,w,ac,y,pdo}$):	MV		ENR	EXR	1.286	1.213	1.247	1.268		
		SV			0.581	0.659	0.621	0.599		
Predicted Average Crash Frequency										
Fatal-and-Injury Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,fi}$):										
Observed crash count ($N^*_{o,fs,n,mv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	14.942	2.920	4.039	21.232		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,fi}$):										
Observed crash count ($N^*_{o,fs,n,sv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,sv,fi,r}$), crashes/yr:										
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 ($N^*_{o,sc,EN,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EN,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	2.187		
Ramp Exit Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EX,at,fi}$):										
Observed crash count ($N^*_{o,sc,EX,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EX,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EX,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	0.654		
Property-Damage-Only Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,mv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	39.995	7.278	10.769	58.799		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,sv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,sv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	4.980	2.087	2.920	11.230		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,pdo}$):										
Observed crash count ($N^*_{o,sc,EN,at,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EN,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	4.526		
Ramp Exit Crash Analysis				**Year**						
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 reference year ($N_{p,sc,EX,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,sc,EX,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	1.216		

Output Worksheet for Ramp Segments								
MV = multiple-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
SV = single-vehicle model	**Applicable Models**		**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 ($CMF_{8,w,x,mv,fi}$):	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:	2045	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	
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								
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 ($N_{p,w,x,mv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,fi,r}$), crashes/yr:								
Predicted average crash frequency		2045	0.186	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 ($N_{p,w,x,sv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_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 ($N_{p,w,x,mv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,pdo,r}$), crashes/yr:								
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 ($N_{p,w,x,sv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,sv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2045	0.864	0.158	0.222	0.260	0.615	

Output Worksheet for Crossroad Ramp Terminals								
Signal = signalized intersection model Unsig = unsignalized intersection model			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
	Applicable Models		**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							
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						
	Year:	2045	1.000	1.000				
Crossroad left-turn lane ($CMF_{11,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	0.864	0.879				
Crossroad right-turn lane ($CMF_{12,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	0.919	0.902				
Median width ($CMF_{15,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	0.865	0.777				
Exit ramp capacity ($CMF_{10,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	2.934	1.106				
Skew angle ($CMF_{20,w,ST,at,fi}$):		Unsig						
	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							
	Year:	2045	1.199	1.242				
		2068						
Channelized right turn on exit ramp ($CMF_{18,w,SG,at,pdo}$):	Signal							
	Year:	2045	1.696	1.156				
		2068						
Access point frequency ($CMF_{13,w,x,at,pdo}$):	Signal							
	Year:	2045	1.000	1.000				
Crossroad left-turn lane ($CMF_{11,w,x,at,pdo}$):	Signal	Unsig						
	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							
	Year:	2045	0.546	0.447				
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 ($N_{p,w,x,at,fi,r}$), crashes/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 ($N_{a,w,x,at,fi,r}$), crashes/yr:								
Predicted average crash frequency		2045	31.062	16.920				
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 ($N_{p,w,x,at,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,at,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2045	18.381	17.103				

Enhanced Interchange Safety Analysis Tool					
General Information					
Project description:	SR 202 at Kernan Blvd IMR, Opening Year 2025 Build				
Analyst:	Arcadis	Date:	7/10/2020	Area type:	Urban
First year of analysis:	2025				
Last year of analysis:	2025				
Crash Data Description					
Freeway segments	No crash data				
Ramp segments	No crash data				
Ramp terminals	No crash data				
Program Control					

1. Enter data in the Main, Input Freeway Segments, Input Ramp Segments, Input Ramp Terminals worksheets.
2. Click Perform Calculations button to start calculation process.

Print Results (optional) | Print Site Summary (optional)

3. Review results in the Output Summary worksheet. Optionally, click the Print buttons to print the summary worksheets.
4. Optionally, detailed results can be reviewed in the Output Freeway Segments, Output Ramp Segments, Output Ramp Terminals worksheets.

Input Worksheet for Freeway Segments									
			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	
	(View results in Column AV) (View results in Advisory Messages)		**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	
Basic Roadway Data									
	Number of through lanes (n):		8	8	7	7			0
	Freeway 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
Alignment Data									
Horizontal 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:								0
	Length of curve in segment ($L_{c2,seg}$), mi:								0
Cross Section Data									
	Lane width (W_l), ft:		12	12	12	12			0
	Outside shoulder width (W_s), ft:		10	10	10	10			0
	Inside shoulder width (W_{is}), ft:		7	7	7	7			0
	Median width (W_m), ft:		17	17	17	17			0
	Rumble strips on outside shoulders?:		Yes	Yes	Yes	Yes			0
	Length of rumble strips for travel in increasing milepost direction, mi:		0.47	0.28	0.26	1.39			0
	Length of rumble strips for travel in decreasing milepost direction, mi:		0.47	0.28	0.26	1.39			0
	Rumble strips on inside shoulders?:		No	No	No	No			0
	Length of rumble strips for travel in increasing milepost direction, mi:								0
	Length of rumble strips for travel in decreasing milepost direction, mi:								0
	Presence 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 ($W_{off,in,1}$), ft:		7	7	7	7			0
2	Length of barrier ($L_{ib,2}$), mi:		0.47	0.28	0.26	1.39			0
	Distance from edge of traveled way to barrier face ($W_{off,in,2}$), ft:		7	7	7	7			0
3	Length of barrier ($L_{ib,3}$), mi:								0
	Distance from edge of traveled way to barrier face ($W_{off,in,3}$), ft:								0
	Median barrier width (W_{ib}), ft:		2	2	2	2			0
	Nearest distance from edge of traveled way to barrier face (W_{near}), ft:								0
Roadside Data									
	Clear zone width (W_{hc}), ft:		15	10	10	25			0
	Presence 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 ($W_{off,o,1}$), 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 ($W_{off,o,2}$), ft:		10	10	10	10			0
3	Length of barrier ($L_{ob,3}$), mi:								0
	Distance from edge of traveled way to barrier face ($W_{off,o,3}$), ft:								0
	Distance from edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:								0
	Distance from edge of traveled way to barrier face, decreasing milepost ($W_{off,dec}$), ft:								0
Ramp Access Data									
Travel in Increasing Milepost Direction									
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	S-C Lane			0
	Distance from begin milepost to upstream entrance ramp gore ($X_{b,ent}$), mi:			0.47	999				0
	Length of ramp entrance ($L_{en,inc}$), mi:					0.2			0
	Length of ramp entrance in segment ($L_{en,seg,inc}$), mi:					0.2			0
	Entrance side?:					Right			0
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	Lane Drop	No	S-C Lane			0
	Distance from end milepost to downstream exit ramp gore ($X_{e,ext}$), mi:				999				0
	Length of ramp exit ($L_{ex,inc}$), mi:					0.03			0
	Length of ramp exit in segment ($L_{ex,seg,inc}$), mi:					0.03			0
	Exit side?:					Right			0
Weave	Type B weave in segment?:		No	No	No	No			0
	Length of weaving section ($L_{wev,inc}$), mi:								0
	Length of weaving section in segment ($L_{wev,seg,inc}$), mi:								0
Travel in Decreasing Milepost Direction									
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	Lane Add			0
	Distance from end milepost to upstream entrance ramp gore ($X_{e,ent}$), mi:			999	999				0
	Length of ramp entrance ($L_{en,dec}$), mi:								0
	Length of ramp entrance in segment ($L_{en,seg,dec}$), mi:								0
	Entrance side?:								0
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	No	No	S-C Lane			0
	Distance from begin milepost to downstream exit ramp gore ($X_{b,ext}$), mi:			0.47	999				0
	Length of ramp exit ($L_{ex,dec}$), mi:					0.03			0
	Length of ramp exit in segment ($L_{ex,seg,dec}$), mi:					0.03			0
	Exit side?:					Right			0
Weave	Type B weave in segment?:		Yes	No	No	No			0
	Length of weaving section ($L_{wev,dec}$), mi:		0.47						0
	Length of weaving section in segment ($L_{wev,seg,dec}$), mi:		0.47						0
Traffic Data		**Year**							
	Proportion of AADT during high-volume hours (P_{hv}):								
Freeway Segment Data		2025	180800	147800	132000	144400			
Entrance Ramp Data for Travel in Increasing Milepost Dir.		**Year**							
	Average daily traffic ($AADT_{b,ent}$) by year, veh/d:	2025	23300	23300		6200			
Exit Ramp Data for Travel in Increasing Milepost Direction		**Year**							
	Average daily traffic ($AADT_{e,ext}$) by year, veh/d:	2025	8600	15800		18700			
Entrance Ramp Data for Travel in Decreasing Milepost Dir.		**Year**							
	Average daily traffic ($AADT_{e,ent}$) by year, veh/d:	2025	24400			18700			
Exit Ramp Data for Travel in Decreasing Milepost Direction		**Year**							
	Average daily traffic ($AADT_{b,ext}$) by year, veh/d:	2025	35600	35600		6200			

Input Worksheet for Ramp Segments							
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column CJ) (View results in Advisory Messages)		**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Roadway Data							
Number of through lanes (n):		2	1	2	1	1	2
Ramp segment description:		EB. Off Ramp	EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ramp	WB. 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	Entrance
Type of control at crossroad ramp terminal:		Signal	Signal	Signal	Signal	Signal	Signal
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 ($L_{c1,seg}$), mi:		0.27	0.09			
	Ramp-mile of beginning of curve in direction of travel (X_1), mi:		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), mi:				0.22		
3	Horizontal curve?:				No		
	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 Data							
Lane width (W_l), ft:		12	12	12	12	12	12
Right shoulder width (W_{rs}), ft:		7	7	7	7	7	7
Left shoulder width (W_{ls}), 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 right side of roadway:		Yes	Yes	Yes	Yes	Yes	Yes
1	Length of barrier ($L_{rb,1}$), mi:	0.25	0.32	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 left side of roadway:		No	Yes	No	No	No	No
1	Length of barrier ($L_{lb,1}$), mi:		0.02				
	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 Entrance	Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	No
	Length of entrance s-c lane in segment ($L_{en,seg}$), mi:						
Ramp Exit	Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	No
	Length of exit s-c lane in segment ($L_{ex,seg}$), mi:						
Weaving Section	Weave section in collector-distributor road segment?:						
	Length of weaving section (L_{wev}), mi:						
	Length of weaving section in segment ($L_{wev,seg}$), mi:						
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or $AADT_c$) by year, veh/d:	2025	8600	15800	6200	6200	6200	24400

Input Worksheet for Crossroad Ramp Terminals				Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
	(View results in Column T)	(View results in Advisory Messages)		Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Basic Intersection Data									
Ramp terminal configuration:				B4	D4				
Ramp terminal description:				South Ramp T	North Ramp Term.				
Ramp terminal traffic control type:				Signal	Signal				
Is a non-ramp public street leg present at the terminal (I_{ps})?:									
Alignment Data									
Exit ramp skew angle (I_{sk}), degrees:									
Distance to the next public street intersection on the outside crossroad leg (L_{str}), mi:				0.14	0.17				
Distance to the adjacent ramp terminal (L_{rmp}), mi:				0.14	0.14				
Traffic Control									
Left-Turn Operational Mode									
Crossroad	Inside approach	Protected-only mode ($I_{p,lt,in}$)?:		Yes	Yes				
	Outside approach	Protected-only mode ($I_{p,lt,out}$)?:							
Right-Turn Control Type									
Ramp	Exit ramp approach	Right-turn control type:		Signal	Signal				
Cross Section Data									
Crossroad median width (W_m), ft:				36	36				
Number of 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-Turn Channelization		see note: →							
Crossroad	Inside approach	Channelization present ($I_{ch,in}$)?:							
	Outside approach	Channelization present ($I_{ch,out}$)?:		Yes	Yes				
Ramp	Exit ramp approach	Channelization present ($I_{ch,ex}$)?:			Yes				
Left-Turn Lane or Bay									
Crossroad	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 ($I_{bay,lt,out}$)?:							
		Width of lane or bay ($W_{b,out}$), ft:							
Right-Turn Lane or Bay									
Crossroad	Inside approach	Lane or bay present ($I_{bay,rt,in}$)?:							
	Outside approach	Lane or bay present ($I_{bay,rt,out}$)?:		Yes	Yes				
Access Data									
Number of driveways on the outside crossroad leg (n_{dw}):									
Number of public street approaches on the outside crossroad leg (n_{ps}):									
Traffic Data			**Year**						
Inside Crossroad Leg Data			2025	43400	43400				
Outside Crossroad Leg Data			2025	37200	53400				
Exit Ramp Data			2025	8600	6200				
Entrance Ramp Data			2025	6200	24400				

Output Summary								
General Information								
Project description:	SR 202 at Kernan Blvd IMR, Opening Year 2025 Build							
Analyst:	Arcadis	Date:	7/10/2020		Area type:		Urban	
First year of analysis:	2025							
Last year of analysis:	2025							
Crash Data Description								
Freeway segments	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Ramp segments	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Ramp terminals	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Estimated Crash Statistics								
Crashes for Entire Facility			**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:			169.4	0.7	2.2	12.4	39.6	114.5
Estimated average crash freq. during Study Period, crashes/yr:			169.4	0.7	2.2	12.4	39.6	114.5
Crashes by Facility Component		**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:		4	134.1	0.6	1.5	9.1	28.6	94.4
Ramp segments, crashes:		6	12.1	0.1	0.4	1.8	3.0	6.8
Crossroad ramp terminals, crashes:		2	23.2	0.0	0.2	1.5	8.1	13.4
Crashes for Entire Facility by Year		**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during		2025	169.4	0.7	2.2	12.4	39.6	114.5
Distribution of Crashes for Entire Facility								
Crash Type	**Crash Type Category**		**Estimated Number of Crashes During the Study Period**					
			Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:		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 crashes:		88.8	0.3	1.0	6.3	21.8	59.3
	Sideswipe crashes:		28.3	0.1	0.2	1.4	4.3	22.3
	Other multiple-vehicle crashes:		3.3	0.0	0.0	0.3	0.8	2.2
	Total multiple-vehicle crashes:		128.7	0.4	1.4	8.6	29.9	88.3
Single vehicle	Crashes with animal:		0.5	0.0	0.0	0.0	0.0	0.5
	Crashes with fixed object:		29.8	0.2	0.5	2.7	6.9	19.5
	Crashes with other object:		3.5	0.0	0.0	0.1	0.4	2.9
	Crashes with parked vehicle:		0.6	0.0	0.0	0.1	0.1	0.4
	Other single-vehicle crashes		6.2	0.1	0.2	0.9	2.2	2.9
	Total single-vehicle crashes:		40.7	0.3	0.7	3.8	9.7	26.2
Total crashes:			169.4	0.7	2.2	12.4	39.6	114.5

Output Worksheet for Freeway Segments										
MV = multiple-vehicle model SV = single-vehicle model	ENR = ramp entrance model EXR = ramp exit model Applicable Models (*y*)				Segment 1 **Study Period**	Segment 2 **Study Period**	Segment 3 **Study Period**	Segment 4 **Study Period**	Segment 5 **Study Period**	Segment 6 **Study 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		
		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		
Outside shoulder width ($CMF_{8,fs,ac,sv,fi}$):		SV			1.000	1.000	1.000	1.000		
Inside 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		
		SV			0.954	0.954	0.954	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 ($CMF_{9,fs,ac,sv,fi}$):		SV			0.958	0.906	0.906	0.918		
Outside clearance ($CMF_{10,fs,ac,sv,fi}$):		SV			1.074	1.092	1.092	1.041		
Outside barrier ($CMF_{11,fs,ac,sv,fi}$):		SV			1.041	1.116	1.136	1.050		
Lane change ($CMF_{7,fs,ac,mv,fi}$):	MV									
			Year:	2025	1.413	1.065	1.000	1.062		
Ramp entrance ($CMF_{12,sc,nEN,at,fi}$):			ENR							
			Year:	2025	1.000	1.000	1.000	1.682		
Ramp exit ($CMF_{13,sc,nEX,at,fi}$):				EXR	1.000	1.000	1.000	1.472		
High volume ($CMF_{6,w,ac,y,fi}$):	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		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width ($CMF_{2,w,ac,y,pdo}$):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width ($CMF_{8,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Inside shoulder width ($CMF_{3,w,ac,y,pdo}$):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median 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		
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			1.000	1.000	1.000	1.000		
Outside clearance ($CMF_{10,fs,ac,sv,pdo}$):		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		
Lane 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		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		
High volume ($CMF_{6,w,ac,y,pdo}$):	MV		ENR	EXR	1.233	1.175	1.181	1.209		
		SV			0.636	0.706	0.698	0.664		
Predicted Average Crash Frequency										
Fatal-and-Injury Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,fi}$):										
Observed crash count ($N^*_{o,fs,n,mv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	9.747	3.023	2.296	13.944		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,fi}$):										
Observed crash count ($N^*_{o,fs,n,sv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	2.192	1.150	0.974	4.509		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,fi}$):										
Observed crash count ($N^*_{o,sc,EN,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	1.449		
Ramp Exit Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EX,at,fi}$):										
Observed crash count ($N^*_{o,sc,EX,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EX,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	0.494		
Property-Damage-Only Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,mv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,mv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	23.407	7.143	5.581	35.011		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,sv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	4.320	2.536	2.198	10.036		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,pdo}$):										
Observed crash count ($N^*_{o,sc,EN,at,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	3.202		
Ramp Exit Crash Analysis				**Year**						
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 reference year ($N_{p,sc,EX,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2025	0.000	0.000	0.000	0.922		

Output Worksheet for Ramp Segments

MV = multiple-vehicle model SV = single-vehicle model	Applicable Models		Segment 1 **Study Period**	Segment 2 **Study Period**	Segment 3 **Study Period**	Segment 4 **Study Period**	Segment 5 **Study Period**	Segment 6 **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 ($CMF_{6,w,x,y,fi}$):	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								
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								
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 ($N_{p,w,x,mv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,fi,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.024	0.099	0.034	0.067	0.008	0.485
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 ($N_{p,w,x,sv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,fi,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,sv,fi,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.338	3.179	0.097	0.312	0.215	0.456
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 ($N_{p,w,x,mv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,mv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,mv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.092	0.206	0.076	0.106	0.021	0.842
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 ($N_{p,w,x,sv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,sv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,sv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2025	0.458	3.596	0.156	0.348	0.208	0.670

Output Worksheet for Crossroad Ramp Terminals								
Signal = signalized intersection model Unsig = unsignalized intersection model	Applicable Models		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								
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	0.564	0.608				
		2048						
Channelized right turn on crossroad ($CMF_{17,w,SG,at,fi}$):	Signal							
	Year:	2025	1.231	1.249				
Channelized right turn on exit ramp ($CMF_{18,w,SG,at,fi}$):	Signal							
	Year:	2025	1.000	1.083				
		2048						
Access point frequency ($CMF_{13,w,x,at,fi}$):	Signal	Unsig						
	Year:	2025	1.000	1.000				
Crossroad left-turn lane ($CMF_{11,w,x,at,fi}$):	Signal	Unsig						
	Year:	2025	0.841	0.881				
Crossroad right-turn lane ($CMF_{12,w,x,at,fi}$):	Signal	Unsig						
	Year:	2025	0.906	0.899				
Median width ($CMF_{15,w,x,at,fi}$):	Signal	Unsig						
	Year:	2025	0.993	0.892				
Exit ramp capacity ($CMF_{10,w,x,at,fi}$):	Signal	Unsig						
	Year:	2025	1.070	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							
	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							
	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 ($N_{p,w,x,at,fi,r}$), crashes/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 ($N_{a,w,x,at,fi,r}$), crashes/yr:								
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 ($N_{p,w,x,at,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,at,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2025	3.406	9.950				

Enhanced Interchange Safety Analysis Tool					
General Information					
Project description:	SR 202 at Kernan Blvd IMR, Design Year 2045 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	No crash data				
Ramp segments	No crash data				
Ramp terminals	No crash data				
Program Control					

1. Enter data in the Main, Input Freeway Segments, Input Ramp Segments, Input Ramp Terminals worksheets.
2. Click Perform Calculations button to start calculation process.

Print Results (optional) | Print Site Summary (optional)

3. Review results in the Output Summary worksheet. Optionally, click the Print buttons to print the summary worksheets.
4. Optionally, detailed results can be reviewed in the Output Freeway Segments, Output Ramp Segments, Output Ramp Terminals worksheets.

Input Worksheet for Freeway Segments

		Year	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
(View results in Column AV)	(View results in Advisory Messages)		Study Period	Study Period	Study Period	Study Period	Study Period	Study Period
Basic Roadway Data								
Number of through lanes (n):			8	8	7	7		
Freeway 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		
Alignment Data								
Horizontal 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		
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 Section Data								
Lane width (W_l), ft:			12	12	12	12		
Outside shoulder width (W_s), ft:			10	10	10	10		
Inside shoulder width (W_{is}), ft:			7	7	7	7		
Median width (W_m), ft:			17	17	17	17		
Rumble strips on outside shoulders?:			Yes	Yes	Yes	Yes		
	Length of rumble strips for travel in increasing milepost direction, mi:		0.47	0.28	0.26	1.39		
	Length of rumble strips for travel in decreasing milepost direction, mi:		0.47	0.28	0.26	1.39		
Rumble strips on inside shoulders?:			No	No	No	No		
	Length of rumble strips for travel in increasing milepost direction, mi:							
	Length of rumble strips for travel in decreasing milepost direction, mi:							
Presence 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 ($W_{off,in,1}$), ft:		7	7	7	7		
2	Length of barrier ($L_{ib,2}$), mi:		0.47	0.28	0.26	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:							
	Distance from edge of traveled way to barrier face ($W_{off,in,3}$), ft:							
Median barrier width (W_{ib}), ft:			2	2	2	2		
Nearest distance from edge of traveled way to barrier face (W_{near}), ft:								
Roadside Data								
Clear zone width (W_{hc}), ft:			15	10	10	25		
Presence of barrier on roadside:			Some	Some	Some	Some		
1	Length of barrier ($L_{ob,1}$), mi:		0.07	0.18	0.26	0.16		
	Distance from edge of traveled way to barrier face ($W_{off,o,1}$), ft:		10	10	10	10		
2	Length of barrier ($L_{ob,2}$), mi:		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 edge of traveled way to barrier face ($W_{off,o,3}$), ft:							
Distance from edge of traveled way to barrier face, increasing milepost ($W_{off,inc}$), ft:								
Distance from edge of traveled way to barrier face, decreasing milepost ($W_{off,dec}$), ft:								
Ramp Access Data								
Travel in Increasing Milepost Direction								
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	S-C Lane		
	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		
	Entrance side?:					Right		
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	Lane Drop	No	S-C Lane		
	Distance from end milepost to downstream exit ramp gore ($X_{e,ext}$), mi:				999			
	Length of ramp exit ($L_{ex,inc}$), mi:					0.03		
	Length of ramp exit in segment ($L_{ex,seg,inc}$), mi:					0.03		
	Exit side?:					Right		
Weave	Type B weave in segment?:		No	No	No	No		
	Length of weaving section ($L_{wev,inc}$), mi:							
	Length of weaving section in segment ($L_{wev,seg,inc}$), mi:							
Travel in Decreasing Milepost Direction								
Entrance Ramp	Ramp entrance in segment? (If yes, indicate type.):		Lane Add	No	No	Lane Add		
	Distance from end milepost to upstream entrance ramp gore ($X_{e,ent}$), mi:			999	999			
	Length of ramp entrance ($L_{en,dec}$), mi:							
	Length of ramp entrance in segment ($L_{en,seg,dec}$), mi:							
	Entrance side?:							
Exit Ramp	Ramp exit in segment? (If yes, indicate type.):		Lane Drop	No	No	S-C Lane		
	Distance from begin milepost to downstream exit ramp gore ($X_{b,ext}$), mi:			0.47	999			
	Length of ramp exit ($L_{ex,dec}$), mi:					0.03		
	Length of ramp exit in segment ($L_{ex,seg,dec}$), mi:					0.03		
	Exit side?:					Right		
Weave	Type B weave in segment?:		Yes	No	No	No		
	Length of weaving section ($L_{wev,dec}$), mi:		0.47					
	Length of weaving section in segment ($L_{wev,seg,dec}$), mi:		0.47					
Traffic Data		Year						
Proportion of AADT during high-volume hours (P_{hv}):								
Freeway Segment Data		2045	235800	189300	167400	184600		
Entrance Ramp Data for Travel in Increasing Milepost Dir.		Year						
Average daily traffic ($AADT_{b,ent}$) by year, veh/d:		2045	34700	34700		8600		
Exit Ramp Data for Travel in Increasing Milepost Direction		Year						
Average daily traffic ($AADT_{e,ext}$) by year, veh/d:		2045	12300	21900		25400		
Entrance Ramp Data for Travel in Decreasing Milepost Dir.		Year						
Average daily traffic ($AADT_{e,ent}$) by year, veh/d:		2045	34200			25400		
Exit Ramp Data for Travel in Decreasing Milepost Direction		Year						
Average daily traffic ($AADT_{b,ext}$) by year, veh/d:		2045	52300	52300		8600		

Input Worksheet for Ramp Segments

(View results in Column CJ)	(View results in Advisory Messages)	Segment 1 Study Period	Segment 2 Study Period	Segment 3 Study Period	Segment 4 Study Period	Segment 5 Study Period	Segment 6 Study Period
Basic Roadway Data							
Number of through lanes (n):		2	1	2	1	1	2
Ramp segment description:		EB. Off Ramp	EB. Off Ramp	EB. On Ramp	EB. On Ramp	WB. Off Ramp	WB. 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	Entrance
Type of control at crossroad ramp terminal:		Signal	Signal	Signal	Signal	Signal	Signal
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 ($L_{c1,seg}$), mi:		0.27	0.09			
	Ramp-mile of beginning of curve in direction of travel (X_1), mi:		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), mi:				0.22		
3	Horizontal curve?:				No		
	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 Data							
Lane width (W_l), ft:		12	12	12	12	12	12
Right shoulder width (W_{rs}), ft:		7	7	7	7	7	7
Left shoulder width (W_{ls}), 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 ($L_{lb,1}$), mi:		0.02				
	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 Entrance	Ramp entrance in segment? (If yes, indicate type.):	No	No	No	No	No	No
	Length of entrance s-c lane in segment ($L_{en,seg}$), mi:						
Ramp Exit	Ramp exit in segment? (If yes, indicate type.):	No	No	No	No	No	No
	Length of exit s-c lane in segment ($L_{ex,seg}$), mi:						
Weaving Section	Weave section in collector-distributor road segment?:						
	Length of weaving section (L_{wev}), mi:						
	Length of weaving section in segment ($L_{wev,seg}$), mi:						
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or $AADT_c$) by year, veh/d:	2045	12300	21900	8600	8600	8600	34200

Input Worksheet for Crossroad Ramp Terminals

			Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
	(View results in Column T)	(View results in Advisory Messages)	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Basic Intersection Data								
Ramp terminal configuration:			B4	D4				
Ramp terminal description:			South Ramp T	North Ramp Term.				
Ramp terminal traffic control type:			Signal	Signal				
Is a non-ramp public street leg present at the terminal (I_{ps})?:								
Alignment Data								
Exit ramp skew angle (I_{sk}), degrees:								
Distance to the next public street intersection on the outside crossroad leg (L_{str}), mi:			0.14	0.17				
Distance to the adjacent ramp terminal (L_{rmp}), mi:			0.14	0.14				
Traffic Control								
Left-Turn Operational Mode								
Crossroad	Inside approach	Protected-only mode ($I_{p,lt,in}$)?:	Yes	Yes				
	Outside approach	Protected-only mode ($I_{p,lt,out}$)?:						
Right-Turn Control Type								
Ramp	Exit ramp approach	Right-turn control type:	Signal	Signal				
Cross Section Data								
Crossroad median width (W_m), ft:			36	36				
Number of 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	2				
Right-Turn Channelization		see note: →						
Crossroad	Inside approach	Channelization present ($I_{ch,in}$)?:						
	Outside approach	Channelization present ($I_{ch,out}$)?:	Yes	Yes				
Ramp	Exit ramp approach	Channelization present ($I_{ch,ex}$)?:		Yes				
Left-Turn Lane or Bay								
Crossroad	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 ($I_{bay,lt,out}$)?:						
		Width of lane or bay ($W_{b,out}$), ft:						
Right-Turn Lane or Bay								
Crossroad	Inside approach	Lane or bay present ($I_{bay,rt,in}$)?:						
	Outside approach	Lane or bay present ($I_{bay,rt,out}$)?:	Yes	Yes				
Access Data								
Number of driveways on the outside crossroad leg (n_{dw}):								
Number of public street approaches on the outside crossroad leg (n_{ps}):								
Traffic Data		**Year**						
Inside Crossroad Leg Data		2045	60700	60700				
Outside Crossroad Leg Data		2045	52500	71700				
		2068						
Exit Ramp Data		2045	12300	8600				
Entrance Ramp Data		2045	8600	34200				

Output Summary							
General Information							
Project description:	SR 202 at Kernan Blvd IMR, Design Year 2045 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 crash data available?		No	First year of crash data:			
	Project-level crash data available?		No	Last year of crash data:			
Ramp segments	Segment crash data available?		No	First year of crash data:			
	Project-level crash data available?		No	Last year of crash data:			
Ramp terminals	Segment crash data available?		No	First year of crash data:			
	Project-level crash data available?		No	Last year of crash data:			
Estimated Crash Statistics							
Crashes for Entire Facility		**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:		252.6	0.9	2.8	16.3	57.9	174.6
Estimated average crash freq. during Study Period, crashes/yr:		252.6	0.9	2.8	16.3	57.9	174.6
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	4	205.3	0.7	2.0	11.9	43.0	147.7
Ramp segments, crashes:	6	15.7	0.2	0.5	2.4	3.9	8.6
Crossroad ramp terminals, crashes:	2	31.6	0.0	0.3	2.0	11.0	18.3
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during	2045	252.6	0.9	2.8	16.3	57.9	174.6
Distribution of Crashes for Entire Facility							
Crash Type	**Crash Type Category**	**Estimated Number of Crashes During the Study Period**					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	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 crashes:	141.6	0.5	1.5	8.8	33.6	97.4
	Sideswipe crashes:	45.9	0.1	0.3	1.9	6.8	36.8
	Other multiple-vehicle crashes:	5.3	0.0	0.1	0.4	1.3	3.6
	Total multiple-vehicle crashes:	205.0	0.6	2.0	12.0	46.0	144.4
Single vehicle	Crashes with animal:	0.6	0.0	0.0	0.0	0.0	0.5
	Crashes with fixed object:	35.0	0.2	0.6	3.1	8.5	22.6
	Crashes with other object:	4.0	0.0	0.0	0.2	0.5	3.4
	Crashes with parked vehicle:	0.7	0.0	0.0	0.1	0.2	0.5
	Other single-vehicle crashes	7.3	0.1	0.2	1.0	2.7	3.3
	Total single-vehicle crashes:	47.6	0.3	0.8	4.4	11.8	30.3
	Total crashes:	252.6	0.9	2.8	16.3	57.9	174.6

Output Worksheet for Freeway Segments										
MV = multiple-vehicle model SV = single-vehicle model	ENR = ramp entrance model EXR = ramp exit model				Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models (y)				**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**	**Study Period**
Crash Modification Factors										
Fatal-and-Injury Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,fi}$):	MV		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		
Outside shoulder width ($CMF_{8,fs,ac,sv,fi}$):		SV			1.000	1.000	1.000	1.000		
Inside 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		
		SV			0.954	0.954	0.954	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 ($CMF_{9,fs,ac,sv,fi}$):		SV			0.958	0.906	0.906	0.918		
Outside clearance ($CMF_{10,fs,ac,sv,fi}$):		SV			1.074	1.092	1.092	1.041		
Outside barrier ($CMF_{11,fs,ac,sv,fi}$):		SV			1.041	1.116	1.136	1.050		
Lane change ($CMF_{7,fs,ac,mv,fi}$):	MV									
			Year:	2045	1.395	1.060	1.000	1.056		
Ramp entrance ($CMF_{12,sc,nEN,at,fi}$):			ENR							
			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		
High volume ($CMF_{6,w,ac,y,fi}$):	MV		ENR	EXR	1.365	1.311	1.314	1.341		
		SV			0.942	0.949	0.949	0.945		
Property-Damage-Only Crash CMFs										
Horizontal curve ($CMF_{1,w,ac,y,pdo}$):	MV		ENR	EXR	1.019	1.000	1.000	1.007		
		SV			1.035	1.000	1.000	1.013		
Lane width ($CMF_{2,w,ac,y,pdo}$):	MV	SV	ENR	EXR	1.000	1.000	1.000	1.000		
Outside shoulder width ($CMF_{8,fs,ac,sv,pdo}$):		SV			1.000	1.000	1.000	1.000		
Inside shoulder width ($CMF_{3,w,ac,y,pdo}$):	MV	SV	ENR	EXR	0.985	0.985	0.985	0.985		
Median 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		
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			1.000	1.000	1.000	1.000		
Outside clearance ($CMF_{10,fs,ac,sv,pdo}$):		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		
Lane change ($CMF_{7,fs,ac,mv,pdo}$):	MV									
			Year:	2045	1.293	1.054	1.000	1.051		
Ramp entrance ($CMF_{12,sc,nEN,at,pdo}$):			ENR		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		
High volume ($CMF_{6,w,ac,y,pdo}$):	MV		ENR	EXR	1.286	1.245	1.247	1.268		
		SV			0.581	0.623	0.621	0.599		
Predicted Average Crash Frequency										
Fatal-and-Injury Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,fi}$):										
Observed crash count ($N^*_{o,fs,n,mv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{e,fs,n,mv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	15.061	4.673	3.500	21.232		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,fi}$):										
Observed crash count ($N^*_{o,fs,n,sv,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	2.576	1.331	1.121	5.225		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,fi}$):										
Observed crash count ($N^*_{o,sc,EN,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	2.187		
Ramp Exit Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EX,at,fi}$):										
Observed crash count ($N^*_{o,sc,EX,at,fi}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EX,at,fi,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,fi,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,fi,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	0.654		
Property-Damage-Only Crash Frequency										
Freeway Segment Multiple-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,mv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,mv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,mv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,mv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,mv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	40.317	12.160	9.333	58.799		
Freeway Segment Single-Vehicle Crash Analysis				**Year**						
Overdispersion parameter ($k_{fs,n,sv,pdo}$):										
Observed crash count ($N^*_{o,fs,n,sv,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,fs,n,sv,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,fs,n,sv,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,fs,n,sv,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	4.980	2.780	2.407	11.230		
Ramp Entrance Crash Analysis				**Year**						
Overdispersion parameter ($k_{sc,EN,at,pdo}$):										
Observed crash count ($N^*_{o,sc,EN,at,pdo}$), crashes:										
Reference year (r):										
Predicted average crash freq. for reference year ($N_{p,sc,EN,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EN,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EN,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	4.526		
Ramp Exit Crash Analysis				**Year**						
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 reference year ($N_{p,sc,EX,at,pdo,r}$), crashes/yr:										
Equivalent years associated with crash count ($C_{b,sc,EX,at,pdo,r}$), yr:										
Expected average crash freq. for reference year given N^*_o ($N_{a,sc,EX,at,pdo,r}$), crashes/yr:										
Predicted average crash frequency				2045	0.000	0.000	0.000	1.216		

Output Worksheet for Ramp Segments								
MV = multiple-vehicle model SV = single-vehicle model			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
	Applicable Models		**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	1.012	1.008	1.001	1.012
Left side barrier (CMF$_{6,w,x,y,fi}$):	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:	2045	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								
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	1.178	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$_{p,w,x,mv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count (C$_{b,w,x,mv,fi,r}$), yr:								
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$_{p,w,x,sv,fi,r}$), crashes/yr:								
Equivalent years associated with crash count (C$_{b,w,x,sv,fi,r}$), yr:								
Expected average crash freq. for reference year given N*$_o$ (N$_{a,w,x,sv,fi,r}$), crashes/yr:								
Predicted average crash frequency		2045	0.437	3.777	0.123	0.394	0.272	0.581
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$_{p,w,x,mv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count (C$_{b,w,x,mv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N*$_o$ (N$_{a,w,x,mv,pdo,r}$), crashes/yr:								
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):								
Predicted average crash freq. for reference year (N$_{p,w,x,sv,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count (C$_{b,w,x,sv,pdo,r}$), yr:								
Expected average crash freq. for reference year given N*$_o$ (N$_{a,w,x,sv,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2045	0.585	4.253	0.195	0.436	0.260	0.846

Output Worksheet for Crossroad Ramp Terminals

Signal = signalized intersection model Unsig = unsignalized intersection model	Applicable Models		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								
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							
	Year:	2045	1.000	1.083				
Access point frequency ($CMF_{13,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	1.000	1.000				
Crossroad left-turn lane ($CMF_{11,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	0.842	0.879				
Crossroad right-turn lane ($CMF_{12,w,x,at,fi}$):	Signal	Unsig						
	Year:	2045	0.906	0.902				
Median width ($CMF_{15,w,x,at,fi}$):	Signal	Unsig						
	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						
	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							
	Year:	2045	1.000	1.156				
Access point frequency ($CMF_{13,w,x,at,pdo}$):	Signal							
	Year:	2045	1.000	1.000				
Crossroad left-turn lane ($CMF_{11,w,x,at,pdo}$):	Signal	Unsig						
	Year:	2045	0.855	0.889				
Crossroad right-turn lane ($CMF_{12,w,x,at,pdo}$):	Signal	Unsig						
	Year:	2045	0.977	0.975				
Median width ($CMF_{15,w,x,at,pdo}$):	Signal							
	Year:	2045	0.484	0.498				
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 ($N_{p,w,x,at,fi,r}$), crashes/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 ($N_{a,w,x,at,fi,r}$), crashes/yr:								
Predicted average crash frequency		2045	3.068	10.224				
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 ($N_{p,w,x,at,pdo,r}$), crashes/yr:								
Equivalent years associated with crash count ($C_{b,w,x,at,pdo,r}$), yr:								
Expected average crash freq. for reference year given N^*_o ($N_{a,w,x,at,pdo,r}$), crashes/yr:								
Predicted average crash frequency		2045	4.419	13.868				

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

			FI				PDO			
			MV	SV	Ramp Ent.	Ramp Ext.	MV	SV	Ramp Ent.	Ramp Ext.
Seg 1. (I-295 to Kernan Blvd)	2019	Existing	6.444	1.913	0.000	0.000	14.143	3.993	0.000	0.000
	2025	No-Build	9.661	2.192	0.000	0.000	23.198	4.320	0.000	0.000
		Build	9.747	2.192	0.000	0.000	23.407	4.320	0.000	0.000
		Percent Change	0.9%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%
	2045	No-Build	14.942	2.576	0.000	0.000	39.995	4.980	0.000	0.000
		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%
Seg 2. (Between Kernan Blvd Ramps)	2019	Existing	1.436	0.793	0.000	0.000	3.105	1.915	0.000	0.000
	2025	No-Build	1.889	0.859	0.000	0.000	4.302	1.953	0.000	0.000
		Build	3.023	1.150	0.000	0.000	7.143	2.536	0.000	0.000
		Percent Change	60.0%	33.8%	0.0%	0.0%	66.0%	29.8%	0.0%	0.0%
	2045	No-Build	2.920	0.986	0.000	0.000	7.278	2.087	0.000	0.000
		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%
Seg 3. (Between Kernan Blvd Ramps)	2019	Existing	2.030	1.076	0.000	0.000	4.678	2.578	0.000	0.000
	2025	No-Build	2.650	1.168	0.000	0.000	6.440	2.666	0.000	0.000
		Build	2.296	0.974	0.000	0.000	5.581	2.198	0.000	0.000
		Percent Change	-13.3%	-16.6%	0.0%	0.0%	-13.3%	-17.5%	0.0%	0.0%
	2045	No-Build	4.039	1.345	0.000	0.000	10.769	2.920	0.000	0.000
		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%
Seg 4. (Kernan Blvd to Hodges Blvd)	2019	Existing	10.191	4.072	0.988	0.398	23.934	9.539	2.469	0.747
	2025	No-Build	13.944	4.509	1.449	0.494	35.011	10.036	3.202	0.922
		Build	13.944	4.509	1.449	0.494	35.011	10.036	3.202	0.922
		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	2045	No-Build	21.232	5.225	2.187	0.654	58.799	11.230	4.526	1.216
		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		PDO	
			MV	SV	MV	SV
Seg 1. (EB Off Ramp)	2019	Existing	0.030	0.509	0.077	0.479
	2025	No-Build	0.079	0.739	0.148	0.685
		Build	0.024	0.338	0.092	0.458
		Percent Change	56.9%	375.9%	101.7%	491.9%
	2045	No-Build	0.186	0.942	0.226	0.864
		Build	0.038	0.437	0.145	0.585
		Percent Change	11.3%	347.4%	93.7%	459.7%
Seg 1*. (Loop Ramp)	2019	Existing	-	-	-	-
	2025	No-Build	-	-	-	-
		Build	0.099	3.179	0.206	3.596
		Percent Change	-	-	-	-
	2045	No-Build	-	-	-	-
		Build	0.169	3.777	0.294	4.253
		Percent Change	-	-	-	-
Seg 2. (EB On Ramp)	2019	Existing	0.035	0.162	0.043	0.178
	2025	No-Build	0.032	0.082	0.073	0.126
		Build	0.034	0.097	0.076	0.156
		Percent Change	5.9%	18.3%	4.2%	23.9%
	2045	No-Build	0.045	0.104	0.110	0.158
		Build	0.048	0.123	0.114	0.195
		Percent Change	5.9%	18.3%	4.2%	23.9%
Seg 2*. (EB On Ramp, 2nd part)	2019	Existing	-	-	-	-
	2025	No-Build	0.038	0.164	0.061	0.177
		Build	0.067	0.312	0.106	0.348
		Percent Change	76.4%	90.2%	74.5%	96.5%
	2045	No-Build	0.053	0.207	0.092	0.222
		Build	0.094	0.394	0.160	0.436
		Percent Change	76.4%	90.2%	74.5%	96.5%
Seg 3. (WB Off Ramp)	2019	Existing	0.005	0.140	0.010	0.137
	2025	No-Build	0.008	0.215	0.021	0.208
		Build	0.008	0.215	0.021	0.208
		Percent Change	0.0%	0.0%	0.0%	0.0%
	2045	No-Build	0.012	0.272	0.031	0.260
		Build	0.012	0.272	0.031	0.260
		Percent Change	0.0%	0.0%	0.0%	0.0%
Seg 4. (WB On Ramp)	2019	Existing	0.114	0.323	0.189	0.341
	2025	No-Build	0.298	0.469	0.364	0.487
		Build	0.485	0.456	0.842	0.670
		Percent Change	62.6%	-2.9%	131.6%	37.5%
	2045	No-Build	0.706	0.598	0.556	0.615
		Build	1.148	0.581	1.287	0.846
		Percent Change	62.6%	-2.9%	131.6%	37.5%

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

Ramp Terminals

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

(white)	No change in Crashes/Year
(red)	Increase in Crashes/Year
(green)	Decrease in Crashes/Year

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

			Severity					Total
			K	A	B	C	PDO	
Mainline	2019	Existing	0.463	1.252	7.546	20.080	67.100	96.442
	2025	No-Build	0.546	1.493	8.958	27.818	92.051	130.866
		Build	0.557	1.524	9.145	28.552	94.357	134.136
		Percent Change	2.1%	2.1%	2.1%	2.6%	2.5%	2.5%
	2045	No-Build	0.702	1.945	11.625	41.833	143.799	199.904
		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%
Ramps	2019	Existing	0.032	0.097	0.491	0.697	1.454	2.770
	2025	No-Build	0.051	0.154	0.784	1.137	2.349	4.475
		Build	0.134	0.407	1.816	2.959	6.780	12.096
		Percent Change	165.0%	165.0%	131.7%	160.1%	188.6%	170.3%
	2045	No-Build	0.073	0.223	1.156	1.674	3.134	6.261
		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%
Ramp Terminal	2019	Existing	0.117	0.613	3.958	17.319	5.640	27.647
	2025	No-Build	0.028	0.696	4.354	21.864	26.718	53.659
		Build	0.009	0.225	1.475	8.105	13.356	23.170
		Percent Change	-67.7%	-67.7%	-66.1%	-62.9%	-50.0%	-56.8%
	2045	No-Build	0.048	1.209	7.634	39.090	35.484	83.466
		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%
Arterials	2019	Existing	0.031	0.180	0.555	0.914	3.646	5.326
	2025	No-Build	0.101	0.583	1.799	2.965	12.299	17.747
		Build	0.101	0.583	1.799	2.965	12.299	17.747
		Percent Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	2045	No-Build	0.137	0.790	2.438	4.018	16.678	24.060
		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%
Total	2019	Existing	0.643	2.141	12.550	39.011	77.840	132.185
	2025	No-Build	0.725	2.926	15.894	53.784	133.417	206.747
		Build	0.801	2.739	14.235	42.581	126.792	187.148
		Percent Change	10.5%	-6.4%	-10.4%	-20.8%	-5.0%	-9.5%
	2045	No-Build	0.961	4.167	22.853	86.615	199.095	313.691
		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

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.

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

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

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

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**.

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 H-2
Example Safety Studies –
I-95 at Glades Road IMR 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**.**

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

Crash Severity Type	FDM Crash Distribution Factors (Freeway)	FDM Crash Distribution Factors (Ramps)	Predicted Crashes			
			RFP Concept		DDI Concept	
			Freeway	Ramp	Freeway	Ramp
K	0.006	0.004	0.93	0.03	0.85	0.02
A	0.035	0.032	5.40	0.25	4.98	0.15
B	0.113	0.107	17.45	0.83	16.09	0.51
C	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**		**147**	

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

1. 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.
2. Elvik, Rune, et al. "Traffic Control', The Handbook of Road Safety Measures." (2009): 397-541.

Appendix H-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 compared to the No 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.

Table 10: Expected Number of Crashes for Years 2018 through 2038

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
Estimated Number of Crashes during Study Period		**358.09**	**362.11**	**4.02**
Estimated Average Crash Frequency during Study Period (crashes/year)		**17.05**	**17.24**	**0.19**

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.

Appendix I – Traffic Validation Template

Traffic Validation at ______________________ Interchange

STA	Location	FDOT Traffic Count *Year*[1] AADT	FDOT Traffic Count *Year*[2] AADT	*IAR Existing Year*[3] AADT	*Year*[2] AADT vs. *Year*[3] AADT	*IAR* Design Year AADT	TDM Horizon Year AADT	TDM vs. *IAR Design Year AADT*
	All Locations							

Notes -

1) FDOT Traffic Count Year [1] AADT - This should be at least 5 years before FDOT Traffic Count Year [2] AADT to understand historic growth
2) FDOT Traffic Count Year [2] AADT - Same year data as the IAR Existing Year [3] AADT
3) IAR Existing Year 3 AADT - This is the existing year AADT of the approved IAR
4) TDM - Current adopted Travel Demand Model
5) IAR Design Year AADT might need to be estimated if it doesn't match the horizon year of the TDM. For example, if approved IAR Design Year is 2035 and TDM horizon year is 2040,

Appendix J – Acronyms and Definitions

Term	Acronym	Definition
American Association of State Highway and Transportation Officials	AASHTO	A nonprofit, nonpartisan association representing state highway and transportation departments that advocates for transportation-related policies and provides technical services to support states in their efforts to efficiently and safely move people and goods.
Annual Average Daily Traffic	AADT	A measurement of the number of vehicles that use a highway over a period of a year divided by 365 to obtain the average for a 24-hour period.
Area of Influence	AOI	The area that is anticipated to experience significant changes in traffic volumes resulting from the interchange proposal and from changes in land use and/or roadway network (i.e., freeway main line, ramps, crossroads, immediate off-system intersections and local roadway system).
Average Daily Traffic	ADT	The number of vehicles that traverse a segment of roadway over a 24-hour period.
Crash Modification Factor	CMF	An index of how much crash experience is expected to change following a modification in design or traffic control. CMF is the ratio between the number of crashes per unit of time expected after a modification or measure is implemented and the number of crashes per unit of time estimated if the change does not take place.
Crash Modification Factor Clearinghouse	CMF Clearinghouse	The Crash Modification Factors Clearinghouse is a web-based database of CMFs along with supporting documentation to help transportation practitioners identify the most appropriate countermeasure for their safety needs. Click here for more information on the Clearinghouse.
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).
Design Hour Volume	DHV	The traffic volume expected to use a highway segment during the 30th highest hour of the design year.
Directional Design Hour Volume	DDHV	The traffic volume expected to use a highway segment during the 30th highest hour of the design year in peak direction.
District Interchange Review Coordinator	DIRC	FDOT District personnel responsible for ensuring all interchange access requests are prepared according to the state and federal guidance
Empirical Bayes Method	EB	Method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency.
Express Lanes	EL	A type of managed lane where dynamic pricing through electronic tolling is applied to lanes with through traffic, having fewer access points. Express lanes can co-locate within an existing non-tolled or tolled facility to manage congestion and provide a more reliable trip time.
Florida Administrative Code	FAC	The official compilation of the administrative rules and regulations of state agencies.
Federal Highway Administration	FHWA	The approval authority for IJRs on Interstate system projects and serves in an advisory role on non-interstate proposals.
Florida Department of Transportation	FDOT	An executive agency, which means it reports directly to the governor. FDOT’s primary statutory responsibility is to coordinate the planning and development of a safe, viable and balanced state transportation system serving all regions of the state, and to assure the compatibility of all components, including multimodal facilities.

Term	Acronym	Definition
Florida Department of Transportation Electronic Review Comments	ERC	An application used to track the entire review process (comments and responses) for plan reviews and project submittals in a database. All comments and responses reside in one location allowing any user easy access to all or partial review data on demand. The system allows Project Managers to easily track all comments and responses from all Reviewers and Consultants at any time during the process.
Florida Standard Urban Transportation Modeling Structure	FSUTMS	A standard modeling structure used in Florida for travel-demand forecasting approved by FDOT Model Task Force.
FDOT Design Manual	FDM	Sets forth geometric and other design criteria, as well as procedures, for FDOT projects.
High Occupancy Vehicle	HOV	A vehicle carrying two or more passengers.
Highway Capacity Manual	HCM	Compiles methodologies and procedures used to analyze highway capacity and quality of service.
Highway Capacity Software	HCS	Software that implements most of the HCM methodologies.
Highway Safety Manual	HSM	A resource that provides safety knowledge and tools in a useful form to facilitate improved decision making based on safety performance.
Interactive Highway Safety Design Model	IHSDM	The IHSDM is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on highways. It performs the predictive method for the facilities in Part C of the first edition of the HSM (i.e., two-lane, two-way rural roads, rural multilane highways and urban and suburban arterials).
Interchange		A system that provides for the movement of traffic between intersecting roadways via one or more grade separations.
Interchange Access Request	IAR	Prepared to demonstrate that a proposed interchange access proposal is engineering and operationally viable based on traffic, geometry, financial and other criteria.
Interchange Justification Report	IJR	The primary document developed to evaluate FHWA's two policy points and the document submitted to FDOT and FHWA to gain approval to add access to the Interstate system.
Interchange Modification Report	IMR	A report documenting a request for approval to modify access points to an existing interstate interchange or approved interchange but not yet constructed.
Interchange Operational Analysis Report	IOAR	Prepared for analysis of specific, low-cost aspects of an interchange modification, mostly within an existing right of way where a full IMR is not required.
Interchange Review Coordinator	IRC	An FDOT District personnel responsible for ensuring all interchange access requests are prepared according to the state and federal guidance.
Interstate or Interstate system		A highway that is part of the Dwight D. Eisenhower National System of Interstate and Defense Highways.
Interchange Safety Analysis Tool	ISATe	The ISATe helps new users understand how to apply the predictive method included in Part C of the HSM. The spreadsheets demonstrate the crash prediction procedure for rural two-lane two-way roads (HSM Chapter 10), rural multilane highways (HSM Chapter 11) and urban and suburban arterials (HSM Chapter 12). It can be used to evaluate freeway and interchange safety.

Term	Acronym	Definition
Level of Service	LOS	A qualitative measure describing operational conditions within a traffic stream, based upon service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience; LOS A represents a complete free flow of traffic, allowing traffic to maneuver unimpeded; LOS F represents a complete breakdown in traffic flow, resulting in stop-and-go travel; LOS is typically calculated based upon peak-hour conditions.
Local Government Comprehensive Plan	LGCP	The plan (and amendments thereto) developed and approved by the local governmental entity pursuant to Chapter 163, F.S., and Rule Chapter 9J-5, Florida Administrative Code, and found in compliance by the Florida Department of Community Affairs.
Long Range Transportation Plan	LRTP	A plan adopted by the DOT, a metropolitan planning organization or a regional planning affiliation. For the purposes of an IJR and this policy and procedure, only the currently approved LRTP is considered.
Managed Lanes	ML	Highway facilities or sets of lanes within a highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools. These tools may include accessibility, vehicle eligibility, pricing, or a combination thereof. Types of managed lanes include truck only lanes, truck only toll lanes, bus rapid transit lanes, reversible lanes and express lanes.
Manual of Uniform Traffic Control Devices	MUTCD	The MUTCD contains the national standards governing all traffic control devices. All public agencies and owners of private roads open to public travel across the nation rely on the MUTCD to bring uniformity to the roadway. The MUTCD plays a critical role in improving safety and mobility of all road users.
Master Plan	MP	A document identifying short- and long-term capacity improvements to limited-access highways mainline and interchanges consistent with SIS policies and standards to allow for high-speed and high-volume travel.
Measures of Effectiveness	MOEs	Parameters indicating the performance of a transportation facility or service.
Methodology Letter of Understanding	MLOU	Documents the agreements reached between the requestor, DIRC, SPO and FHWA during the study design development of the project.
Metropolitan Planning Organization	MPO	An organization made up of local elected and appointed officials responsible for the development and coordination of transportation plans and programs, in cooperation with the state, for metropolitan areas containing 50,000 or more residents.
National Environmental Policy Act	NEPA	A United States environmental law that established national policy promoting enhancement of the environment.
National Highway System	NHS	Includes the Interstate system as well as other roads important to the nation’s economy, defense and mobility. The NHS was developed by the United States Department of Transportation (USDOT) in cooperation with the states, local officials and metropolitan planning organizations (MPOs).
Project Development & Environment Study	PD&E study	Prepared to ensure that FDOT’s procedure for complying with environmental regulations is followed.
Safety Performance Function	SPF	An equation used to estimate or predict the expected average cash frequency per year at a location as a function of traffic volume and in some cases roadway or intersection characteristics (e.g., number of lanes, traffic control, or type of median).

Term	Acronym	Definition
Safety, Operational & Engineering	SO&E	The SO&E process is performed to document the existing, no-build and build traffic safety and operations of an IAR.
State Environmental Impact Report	SEIR	Required on all major state-funded projects in which FDOT becomes the owner of the document and no federal funding is involved in the project.
State Highway System	SHS	A network of approximately 12,000 miles of roads owned and maintained by the state of Florida or state-created authorities.
State Interchange Review Coordinator	SIRC	Responsible for the review of IAR documents at Central Office. The SIRC reviews documents and briefs the Central Office approval authorities on each project. The SIRC is responsible for revisions and updates to the IAR user's guide.
Systems Management Administrator	SMA	Responsible for the approval of Interchange Access Requests after they have been reviewed by the SIRC. The SMA ensures the implementation of this user's guide.
Statewide Transportation Improvement Program	STIP	A federally mandated document that must list projects planned with federal participation in the next four fiscal years.
Strategic Intermodal System	SIS	Facilities and services of statewide or interregional significance that meet high levels of people and goods movement, generally supporting the major flows of interregional, interstate and international trips.
Systems Interchange Modification Report	SIMR	Prepared when an interchange proposal is prepared for a series of closely spaced interchanges that are operationally interrelated.
Travel Demand Model	TDM	A computer model that forecasts traffic volumes on the major transportation grid. For purposes of an IJR, the travel-demand model must be the official model maintained by the MPO/RPA and is adopted as part of the LRTP.
Transportation Improvement Program	TIP	The MPO's agreed-upon list of priority projects that intend to use federal funds, along with non-federally funded capital projects. TIP is mandated by federal law for the MPO to receive and spend federal transportation funds.
Transportation Management Area	TMA	TMAs are urbanized areas with a population over 200,000. These areas are subject to special planning and programming requirements.
Transportation Systems Management & Operation	TSM&O	Integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to preserve capacity and improve the security, safety and reliability of our transportation system

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