# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

December 2020

***Prepared for:***
Florida Department of Transportation
District 3
1074 Highway 90
Chipley, FL 32428-2162

**FINAL**

# System Interchange Modification Report(SIMR)

## SR 8 (I-10) from E of Alabama State Line to W of SR 95 (US 29)

## Systems Interchange Modification Report

FPID: 437905-1-22-01

**Type of Request** ☐ IJR ☒ SIMR ☐ IOAR

**Type of Process** ☒ Programmatic ☐ Non-Programmatic

## Florida Department of Transportation

### Determination of Safety, Operational, and Engineering Acceptability

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

| | | |
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# SYSTEM INTERCHANGE MODIFICATION REPORT

Florida Department of Transportation

District Three

SR 8 (I-10) Project Development and Environment (PD&E) Study

Limits of Project: E of Alabama State Line to W of SR 95 (US 29)

Escambia County, Florida

Financial Management Number: 437905-1-22-01

ETDM Number: 14240

Date: December 2020

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by FDOT pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated December 14, 2016 and executed by FHWA and FDOT.

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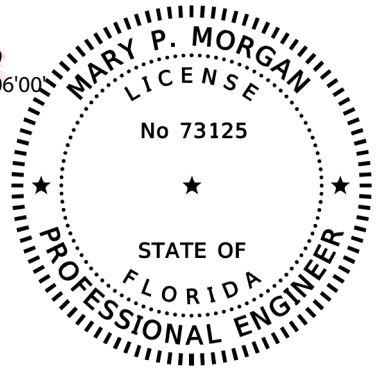


Seal

This item has been digitally signed and sealed by Mary P. Morgan, PE on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

SYSTEMS IMPLEMENTATION OFFICE

# QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL

Submittal Date: 4/27/2020

FM Number: 437905-1-22-01

Project Title: SR 8 (I-10) Project Development and Environment (PD&E) Study, E of Alabama State Line to W of SR 95 (US 29)

District: 3

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Document Type: ☐ MLOU ☐ IJR ☐ IMR ☐ IOAR ☒ OTHER SIMR

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Quality Control (QC) Statement

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

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IRC DocuSigned by: Starsky Harrell E3F2EA2D0E5440D... Date: 1/26/2021 | 1:54 PM EST

Starsky Harrell

# Quality Control Checklist and Review Log
# Interchange Access Request Proposals

**Project Name:** I-10 SIMR from E of Alabama State Line to W of SR 95 (US 29)

**FPID No.** 437905-1-22-01

**FDOT Project Manager:** Iris Waters, FDOT D3

**IRC:** Starsky Harrell, FDOT D3

| No. | ITEM | READY FOR REVIEW | |
|---|---|---|---|
| | | CHECKED BY | DATE |
| 1 | **Travel Demand Forecasting** | | MM/YYYY |
| | *Has the latest version of approved model been used? Have all adjustments been made per FDOT guidelines and MLOU and reviewed?* | N. Praba | 08/2019 |
| | *Have the traffic factors been reviewed and checked to make sure K, D and T factors are reasonable?* | N. Praba | 08/2019 |
| | *Did the project traffic development follow FDOT Traffic Forecasting Handbook and MLOU?* | N. Praba | 08/2019 |
| | *Have existing and future traffic volumes been checked for reasonableness?* | N. Praba | 08/2019 |
| 2 | **Operational Analysis** | | |
| | *Are the inputs into traffic software correct?* | J. Jackson | 07/2019, 03/2020 |
| | *Has the validation/calibration of microsimulation been properly documented?* | J. Jackson | 10/2019 |
| | *Are operational analysis results reasonable?* | J. Jackson | 03/2020 |
| 3 | **Safety Analysis** | | |
| | *Has appropriate safety analysis been performed to quantify impacts of the recommended improvements?* | M. Morgan | 07/2020 |
| 4 | **Concept Design** | | |
| | *Does the proposed design meet minimum design standards?* | J. Burchfield | 08/2020 |
| | *Have the exceptions and variations, if any, been justified?* | J. Burchfield | 08/2020 |
| 5 | **Conceptual Signing Plan** | | |
| | *Has a conceptual signing plan been reviewed, checked to make sure it can be signed and meets MUTCD?* | J. Burchfield | 08/2020 |
| 6 | **FHWA's Two Policy Points** | | |
| | *Does the proposal satisfy FHWA's policy points?* | M. Morgan | 08/2020 |
| 7 | **Report Review** | | |
| | *Has the report been reviewed for grammatical and editorial errors?* | J. Jackson | 08/2020 |

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## APPENDICES

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**Appendix E** – Existing Year Detailed Intersection Movement Results
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## EXECUTIVE SUMMARY

This Systems Interchange Modification Report (SIMR) documents the proposed improvements to the existing interchanges along SR 8 (I-10) at Nine Mile Road and at Pine Forest Road. The Florida Department of Transportation (FDOT) District 3 is conducting a Project Development and Environment (PD&E) Study for I-10 from east of the Alabama State Line to west of SR 95 (US 29) (FPID 437905-1). As a part of the PD&E Study, this section of I-10, a distance of approximately ten miles, is being assessed for widening from a four-lane to a six-lane typical section. This section of I-10 encompasses two existing interchanges – at Nine Mile Road and at Pine Forest Road – and one future planned interchange – at Beulah Beltway.

This project (FPID 437905-1) is being developed concurrently with a separate PD&E Study (FPID 433113-1) for the Beulah Interchange ("Beulah Interchange PD&E") that includes an associated segment of I-10 from the Alabama State Line (MP 0.357) to the existing Weigh Station (MP 3.461), and Beulah Road (CR 99) from US 90A (West Nine Mile Road) to West of Kingsfield Road (CR 186). To avoid duplication of recommendations, this project (437905-1) considers only no-build and build alternatives from the east end of the Beulah Interchange PD&E (MP 3.461) to west of SR 95 (MP 9.926).

Project 437905-1 has been further divided into three segments for design and construction, including work on I-10 proposed as part of the Beulah Interchange PD&E:

- FPID 433113-1: I-10 from the Alabama State Line (MP 0.357) to the existing Weigh Station (MP 3.461) including a new interchange at Beulah Road
- FPID 437905-2: I-10 from the existing Weigh Station (MP 3.461) to east of US 90A (West Nine Mile Road (MP 6.211) including interchange reconstruction at US 90A (West Nine Mile Road)
- FPID 437905-3: I-10 from east of US 90A (West Mile Road) (MP 6.211) to west of SR 95 (MP 9.926) including interchange reconstruction at SR 297 (Pine Forest Road).

**Figure A** shows the location of the Beulah Interchange PD&E, the limits of analysis, and the segments identified for design and construction. This SIMR document serves to provide determination of safety, operational, and engineering (SO&E) acceptability per Federal Highway Administration (FHWA) to advance the project and for inclusion in

subsequent National Environmental Policy Act (NEPA) documentation with the PD&E study.

**Figure A. Project Segments and Limits of Analysis**


## E.1 BACKGROUND

I-10 is a Strategic Intermodal System (SIS) facility and is the only east-west limited access highway in the region. This section of I-10 is partly within the urban boundary; the urban boundary extends from just west of Nine Mile Road to the east through the project limits. The remaining section from the Alabama State line to just west of Nine Mile Road is outside of the urban boundary.

This section of I-10 encompasses two existing interchanges – at Nine Mile Road and at Pine Forest Road – and one future planned interchange – at Beulah Beltway. The existing I-10 interchanges at Nine Mile Road and at Pine Forest Road are approximately 1.5 miles apart. In addition to the interchanges being closely spaced, Nine Mile Road and Pine Forest Road intersect at a signalized intersection located about one (1) mile away from both interchanges. This signalized intersection currently experiences operational and

queuing issues which impede the operation of the two interchanges during peak times of congestion. Due to existing operational issues, improvements at both interchanges will be evaluated as a part of this PD&E project.

## E.2 PURPOSE AND NEED

The purpose and need of the PD&E study is provided below, from the April 25, 2018 Efficient Transportation Decision Making (ETDM) Summary Report for Project 14240.

### *Purpose*

The purpose of this project is to address capacity and safety issues on I-10 between the Alabama State Line and US 29 in Escambia County. Currently, I-10 is a four-lane limited access roadway (two travel lanes in each direction) from the Alabama State Line to US 29, a distance of approximately ten miles. This project is intended to address existing and future congestion and delay on I-10 with the goal of making the I-10 corridor operate safer and more efficiently throughout Escambia County.

### *Need*

This project is needed to address capacity and safety issues on I-10 from east of the Alabama State Line to US 29 in Escambia County.

## E.3 METHODOLOGY

The traffic methodology for this analysis is consistent with the approved Methodology Letter of Understanding (MLOU) (see **Appendix A**). The Area of Influence (AOI) includes the two existing interchanges at Nine Mile Road and at Pine Forest Road, and also includes the proposed Beulah Beltway Interchange. The analysis years are Existing 2018, Opening 2026, and Design 2046. The analysis tool is Vissim 11 which was used to conduct detailed operational analyses for the freeway, interchanges, and intersections.

## E.4 ALTERNATIVES

Consistent with the approved MLOU, the following alternatives were considered in this SIMR:

- No-Build Alternative: The No-Build (no action) alternative includes planned and programmed improvements (as of April 2020), including the recommended Beulah Road interchange alternative from the I-10 and Beulah Road IJR.
- Build Alternative: Based on the project goals, objectives, and in coordination with FDOT, one Build Alternative was developed for the SIMR AOI.

Based on the results of the Vissim analysis, the preliminary conceptual design, surrounding project status as of April 2020, and in coordination with FDOT, the following improvements were selected for the Build Alternative:

- **Interchange of I-10 at Pine Forest Road**
  - A Diverging Diamond Interchange at I-10 and Pine Forest Road.
  - Realign Wilde Lake Boulevard further south.
  - Eliminate left turns from W. Detroit Boulevard and install a northbound Median U-turn north of W. Detroit Boulevard along Pine Forest Road.
- **Interchange of I-10 at Nine Mile Road**
  - A Diverging Diamond Interchange at I-10 and Nine Mile Road.
- **Intersection of Nine Mile Road and Pine Forest Road**
  - Operational improvements at this intersection, e.g., eliminate left turns at main intersection and install Median U-turns east and west of the intersection along Nine Mile Road.
- **Intersection of Nine Mile Road at Navy Federal Way**
  - A signalized intersection at Navy Federal Way.
  - A six-lane cross-section along Nine Mile Road between Navy Federal Way and the I-10 interchange. (2026 Build Alternative only)
  - A six-lane cross-section along Nine Mile Road from east of Beulah Road to Pine Forest Road. (2046 Build Alternative only)

Note the intersection of Nine Mile Road and Navy Federal Way and the intersection of Nine Mile Road and Pine Forest Road are within the AOI, but outside of the scope of the PD&E. Both intersections will be addressed by separate FDOT projects (FPIDs 218605-4, 218519-2, 421012-2, and 441056-1). The intersections were evaluated to determine the feasibility of solutions that would not adversely impact operations at the I-10 and Nine Mile Road, and the I-10 and Pine Forest Road interchanges. These improvements were included for analysis purposes; however, they will be determined by separate projects and are subject to change as those projects progress.

## E.5 COMPLIANCE WITH FHWA GENERAL REQUIREMENTS

The FHWA Policy on Access to the Interstate System provides the requirements for the justification and documentation necessary to substantiate any proposed changes in access to the Interstate System. The policy is published under the Federal Register, Volume 74, Number 43743, dated May 22, 2017. The responses provided herein for each of the two policy statements demonstrate compliance with these requirements and justification for the proposed SIMR in support of the I-10 from east of the Alabama State Line to west of SR 95 (US 29) PD&E Study in Escambia County, Florida. The following two FHWA Policy Criteria (effective May 22, 2017) are addressed below:

### *Policy*

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

### *Policy Point 1: The proposal does not adversely impact operations or safety of the existing freeway.*

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

**Response**:

*Operational Analysis*

This SIMR consists of existing interchanges at Nine Mile Road and at Pine Forest Road that are planned to be modified. An in-depth traffic operational analysis for the Existing Year (2018), Opening Year (2026) and Design Year (2046) conditions was conducted to study the impacts of the Build Alternative within the AOI. Analyses were conducted for the mainline, and the intersections at the ramp terminals and crossroads.

Several performance measures were used to compare the operations of the existing system under No-Build and Build conditions. Key measures included network travel time, freeway speeds, intersection delays, and queues. Based on the operational analysis conducted for the SIMR, the following high-level operational analysis observations were made and detailed results are provided in Future Traffic Operational Analysis section of this report:

- The operational analysis shows that the Design Year 2046 Build Alternative does not adversely impact the operations of the interstate network or the local streets.
- The Design Year 2046 No-Build Alternative cannot accommodate the future traffic growth and results in sharp speed drops along I-10 in both the eastbound and westbound directions, primarily due to off-ramp queuing at the interchanges locations and the mainline merge locations.
- Intersection LOS E or worse is expected at 10 of the 19 study intersections in the Design Year 2046 No-Build AM or PM peaks.
- The Design Year 2046 Build Alternative is able to accommodate the future traffic and I-10 speeds remain consistently near 70 mph.
- Only one of the study intersections operates at LOS E or worse in the Design Year 2046 Build Alternative, and that location is outside of the scope of this project.
- The proposed Build interchange configurations provide benefit to the network and do not adversely impact operations.

### *Safety Analysis*

A safety analysis was completed for this project and includes an existing conditions safety analysis to review the crash history, and a quantitative safety analysis using the Highway Safety Manual (HSM) predictive method to assess future conditions. The Enhanced Interchange Safety Analysis Tool (ISATe) was used for the HSM predictive analysis to assess future conditions. The future proposed diverging diamond interchanges (DDI) were modeled to the extent possible in ISATe since it does not include an interchange option specifically for DDI's nor does it include crash modification factors (CMF) to predict crashes.

Using this methodology, analysis results found that the total crashes decrease in the future Build Alternative compared to the No-Build Alternative. The mainline crashes decrease in the Build Alternative due to a lower density of traffic spread across more lanes and the ability to maneuver more freely. There is a slight increase in predicted ramp crashes due to the longer ramps that were modeled, consistent with the proposed DDI design.

Although the ISATe does not address DDI's, a recent addition to the CMF Clearinghouse shows a significant safety increase when converting a diamond interchange to a DDI. This specific CMF applies to the overall interchange and has a star rating of 4/5 stars (i.e. high reliability) and a value of 0.59 (i.e. 41% decrease in crashes). Thus, a DDI should result in safety improvements at crossroad ramp terminals, and along the crossroads serviced by the ramps.

A benefit / cost analysis showed a favorable B/C ratio (greater than 1.0) for both future years 2026 and 2046 with the proposed improvements in place. The B/C ratios were determined by comparing the predicted crashes for the No-Build and Build Alternatives, per HSM methodologies. The 2026 annual benefit cost ratio is 1.792, and the 2046 annual benefit cost ratio is 3.525.

### *Conceptual Signing Plan*

Conceptual signing plans were developed and are included in **Appendix J**.

### *Policy Point 2: A full interchange with all traffic movements at a public road is provided.*

> *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.*

**Response**:

I-10 is a public facility and all interchanges within the AOI provide full access. The interchange improvements will occur at the I-10 at Nine Mile Road and Pine Forest Road interchanges. Additional improvements are also being proposed at the adjacent intersections to improve traffic flow at the interchanges. All basic movements are currently provided at both interchanges. The proposed improvements at the interchanges will continue to provide full access.

# 1.0 INTRODUCTION AND PROJECT DESCRIPTION

FDOT District Three is conducting a PD&E Study for SR 8 (I-10) from east of the Alabama State Line to west of SR 95 (US 29) (**Figure 1–1**). As a part of the PD&E Study, this section of I-10, a distance of approximately ten miles, is being assessed for widening from a four-lane to a six-lane typical section. This section of I-10 encompasses two existing interchanges – at Nine Mile Road and at Pine Forest Road – and one future planned interchange – at Beulah Beltway. The project was evaluated through the FDOT ETDM as Project 14240, with a Final Programming Screen Summary Report published on April 25, 2018 resulting in a Class of Action Determination of a Type 2 Categorical Exclusion under the NEPA.

**Figure 1-1. Project Location**

This project (FPID 437905-1) is being developed concurrently with a separate PD&E Study (FPID 433113-1) for the Beulah Interchange ("Beulah Interchange PD&E") that includes an associated segment of I-10 from the Alabama State Line (MP 0.357) to the existing Weigh Station (MP 3.461), and Beulah Road (CR 99) from US 90A (West Nine Mile Road) to West of Kingsfield Road (CR 186). To avoid duplication of recommendations, this project (437905-1) considers only no-build and build alternatives from the east end of the Beulah Interchange PD&E (MP 3.461) to west of SR 95 (MP 9.926).

Project 437905-1 has been further divided into three segments for design and construction, including work on I-10 proposed as part of the Beulah Interchange PD&E:

- FPID 433113-1: I-10 from the Alabama State Line (MP 0.357) to the existing Weigh Station (MP 3.461) including a new interchange at Beulah Road
- FPID 437905-2: I-10 from the existing Weigh Station (MP 3.461) to east of US 90A (West Nine Mile Road (MP 6.211) including interchange reconstruction at US 90A (West Nine Mile Road)
- FPID 437905-3: I-10 from east of US 90A (West Mile Road) (MP 6.211) to west of SR 95 (MP 9.926) including interchange reconstruction at SR 297 (Pine Forest Road).

**Figure 1-2** shows the location of the Beulah Interchange PD&E, the limits of analysis, and the segments identified for design and construction.

This SIMR documents the proposed improvements to the existing interchanges at Nine Mile Road and at Pine Forest Road. This report reviews the traffic forecasting and operational analysis for the Existing Year 2018, the Opening Year 2026, and the Design Year 2046.

**Figure 1-2. Project Segments and Limits of Analysis**


## 1.1 BACKGROUND

I-10 is a Strategic Intermodal System (SIS) facility and is the only east-west limited access highway in the region. This section of I-10 is partly within the urban boundary; the urban boundary extends from just west of Nine Mile Road to the east through the project limits. The remaining section from the Alabama State line to just west of Nine Mile Road is outside of the urban boundary.

This section of I-10 encompasses two existing interchanges – at Nine Mile Road and at Pine Forest Road – and one future planned interchange – at Beulah Beltway. The existing I-10 interchanges at Nine Mile Road and at Pine Forest Road are approximately 1.5 miles apart. In addition to the interchanges being closely spaced, Nine Mile Road and Pine Forest Road intersect at a signalized intersection located about one (1) mile away from both interchanges. This signalized intersection currently experiences operational and queuing issues which impede the operation of the two interchanges during peak times of congestion. Due to existing operational issues, improvements at both interchanges will be evaluated as a part of this PD&E project.

Rapid growth in this area, driven in part by the addition of 10,000 new jobs by Navy Federal Credit Union (NFCU), the future development of Navy Outlying Field 8, and land use changes identified in the Escambia County Sector Plan, has created traffic operational issues on I-10 and surrounding roadways. As a result, westbound traffic exiting at Nine Mile Road has been observed queuing along the I-10 shoulder while waiting to exit. In addition, traffic delays on Nine Mile Road and Pine Forest Road have a metering effect on traffic traveling to I-10, influencing the travel time on the interstate. As such, there is a need for mainline and interchange improvements to accommodate existing traffic volumes as well as the anticipated future growth in the area.

Based on FL-AL TPO Congestion Management Process 2016 Level of Service (LOS) Analysis, the study roadways are currently operating at LOS D or better. However, congestion currently exists along I-10 in the westbound direction at the interchanges with Pine Forest Road and Nine Mile Road in both the AM and PM peak hours. Therefore, this SIMR provides a detailed operational analysis and identifies solutions.

## 1.2 PURPOSE AND NEED

The purpose and need of the PD&E study is provided below, from the April 25, 2018 ETDM Summary Report for Project 14240.

### *Purpose*

The purpose of this project is to address capacity and safety issues on I-10 between the Alabama State Line and US 29 in Escambia County. Currently, I-10 is a four-lane limited access roadway (two travel lanes in each direction) from the Alabama State Line to US 29, a distance of approximately ten miles. This project is intended to address existing and future congestion and delay on I-10 with the goal of making the I-10 corridor operate safer and more efficiently throughout Escambia County.

### *Need*

This project is needed to address capacity and safety issues on I-10 from east of the Alabama State Line to US 29 in Escambia County.

## 1.3 PLANNED AND PROGRAMMED TRANSPORTATION PROJECTS

The planned and programmed improvements within the AOI are discussed below. Please note that there are several complex and overlapping ongoing projects within the AOI including:

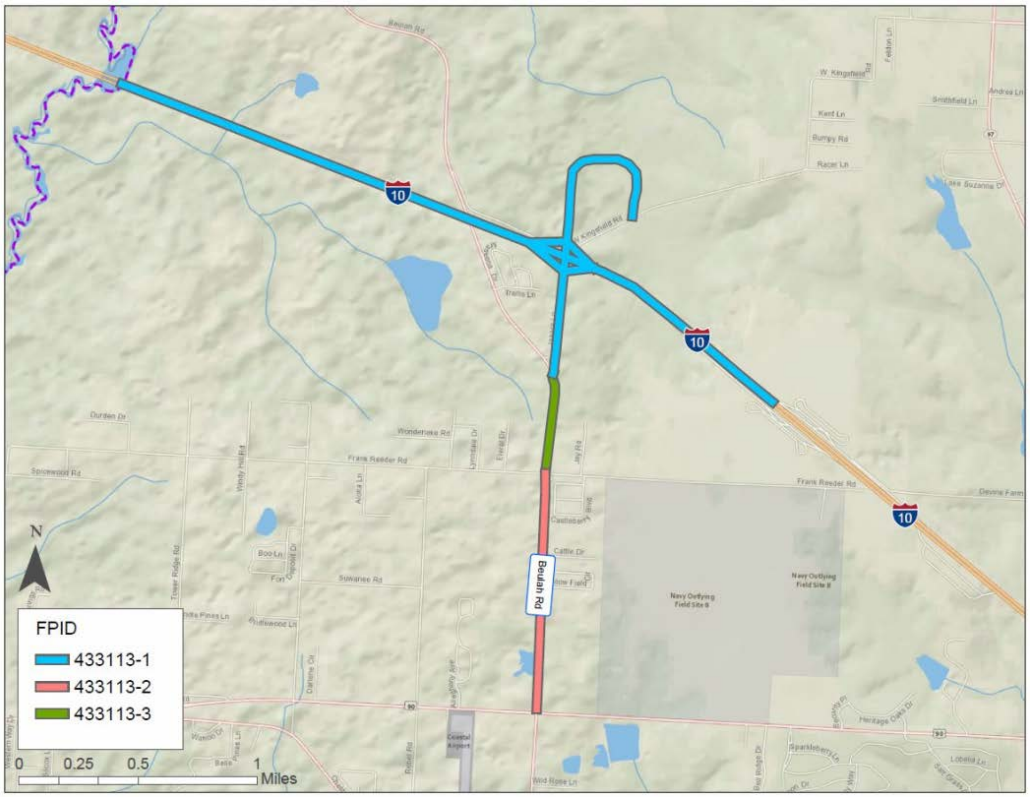
- The I-10 at Beulah Road Interchange Justification Report (IJR)
- The Beulah Beltway Project to connect Nine Mile Road to US 29
- Ultimate improvements to the I-10 at US 29 interchange
- Nine Mile Road capacity improvement projects from Mobile Highway to US 29
- Pine Forest Road Widening Feasibility Study from I-10 to Nine Mile Road

**The latest surrounding project information available at the time of initial analysis, April 2020, was included in this SIMR. However, assumed improvements and ultimate configurations of the other projects are subject to change as the separate projects progress. Details for each planned and programmed project within the AOI are described in the next subsections.**

### 1.3.1 BEULAH ROAD INTERCHANGE

FDOT is conducting an IJR for the proposed new interchange at I-10 and Beulah Road (FPIDs 433113-1, -2, and -3). As depicted in **Figure 1–3**, the scope of the project is to widen Beulah Road to four lanes from Nine Mile Road to Kingsfield Road and provide a new interchange at I-10, including widening of I-10 from the Florida/Alabama state line to the Pensacola weigh station. Future phases to extend the beltway beyond Kingsfield Road to US 29 are being evaluated under a separate study (discussed next). As of April 2020, the new interchange and associated I-10 widening is funded through construction for 2031 (FPIDs 433113-1). The widening along Beulah Road is only funded through the PD&E phase (FPIDs 433113-2 and -3). Consistent with the Beulah Road IJR dated January 2019, FPID 433113-1, -2, and -3 were assumed to be in place in 2026 and 2046. The assumed improvements are consistent with the Beulah Road IJR dated January 2019, however note that as of April 2020, the Beulah IJR has NOT been approved ultimate configurations are subject to change.

**Figure 1-3. Beulah Road Interchange**




Source: FDOT PD&E White Papers, April 2020

### 1.3.2 BEULAH BELTWAY

The planned Beulah Beltway project consists of a new four-lane divided highway, approximately 11 miles in length, to connect Nine Mile Road to US 29. The new roadway will improve the roadway network and connectivity in this area, and connect to the new interchange at I-10 to help alleviate nearby existing congested interchanges. Escambia County recently completed the Alternative Corridor Evaluation Report (ACER) and a preferred corridor has been selected (ETDM Project 14059, January 2018). A PD&E for the Beulah Beltway is underway by Escambia County. Consistent with the Beulah Road IJR dated January 2019, the Beulah Beltway was assumed to be in place by 2046.

### 1.3.3 I-10 AT US 29 INTERCHANGE

Ultimate improvements to the I-10 at US 29 interchange are planned (FPID 222476-1), as detailed in the I-10 at US 29 Interchange Ultimate Interchange Modification Report (IMR) approved by the FHWA on March 15, 2016 and will be included in this SIMR.

Construction of the ultimate improvements are funded for the 2026-2030 timeframe in the Cost Feasible Plan (CFP) and include the following:

- Construct six new mainline lanes on I-10 through the center of the interchange (requires 6 bridges)
- Convert existing I-10 mainline bridges to serve as proposed ramps.
- Construct extended two-lane ramps east of the interchange.
- Replace the existing North Palafox Street and CSX bridges to provide room for the extended ramps on I-10.
- Modify the intersection of Diamond Dairy Road at US 29 to allow access to the eastbound and westbound I-10 ramps from Diamond Dairy Road.
- Construct stormwater ponds.

The I-10 at US 29 Interchange improvements were assumed to be in place in 2026 and 2046.

### 1.3.4 NINE MILE ROAD

There are multiple projects underway along Nine Mile Road within the AOI. These are discussed below.

1. Nine Mile Road from Beulah Road to US 29 is being widened to four (4) lanes. This project (FPIDs 218605-2, -3, -5, -6, -7) is funded through construction for year 2020. The project includes widening from two (2) lanes to four (4) lanes, construction of a new bridge over Eleven Mile Creek, new sidewalks, new stormwater ponds, signalization improvements, drainage improvements, and buffered bike lanes. The work is planned to be completed the summer of 2020 and was assumed to be in place in 2026 and 2046.
2. Nine Mile Road from Mobile Highway to Beulah Road is planned to be widened to four (4) lanes. This project is funded for construction in 2030 and was assumed to be in place in Design Year 2046.
3. Improvements are proposed for Nine Mile Road to address existing and future capacity issues along Nine Mile Road in the vicinity of the NFCU campus from Beulah Road to east of I-10. Long term improvements (FPID 218605-4) include the ultimate improvements of widening Nine Mile Road to six (6) lanes from Beulah Road to east of I-10. This project is funded for preliminary engineering only, which is underway as of April 2020. For analysis purposes, the improvements were assumed to be in place in Design Year 2046 only. However, the assumed improvements will be determined under FPID 218605-4 and are subject to change as the separate project progresses.
4. Interim improvements are also planned (FPID 218519-2) from Security Place to west of Eleven Mile Creek which include adding an eastbound auxiliary lane and intersection improvements. Preliminary engineering and design are funded and underway as of April 2020. This project was assumed to be in place for Design Year 2046; however, the assumed improvements will be determined by FPID 218519-2 and are subject to change as the separate projects progress.

### 1.3.5 PINE FOREST ROAD

Pine Forest Road is planned to be widened to four (4) lanes from I-10 to Nine Mile Road. A feasibility study is underway by FDOT (FPID 441056-1) for Pine Forest Road from Blue Angel Parkway to Nine Mile Road for widening. The improvements for Pine Forest Road include widening from four (4) lanes to six (6) lanes, and improvements for multimodal, pedestrian, and safety features. The intersection of Nine Mile Road at Pine Forest Road is included in this feasibility study. The project is funded for construction in the 2031-2040 timeframe and was assumed to be in place for Design Year 2046. However, the assumed improvements will ultimately be determined under FPID 441056-1 and are subject to change as the separate project progresses.

# 2.0 METHODOLOGY

The methodology for this analysis is consistent with the approved MLOU in **Appendix A.**

## 2.1 AREA OF INFLUENCE

The AOI for the project is depicted in **Figure 2–1** and is consistent with the approved MLOU. The AOI extends from east of the Alabama State Line to west of SR 95 (US 29). The AOI includes two existing interchanges at Nine Mile Road and at Pine Forest Road, and also includes the proposed Beulah Beltway Interchange. The AOI encompasses the on- and off-ramps for Nine Mile Road, Pine Forest Road, the future Beulah Beltway interchanges, and the US 29 westbound merge and US 29 eastbound diverge areas. The on- and off-ramps for the Weigh Station, Welcome Center, and Agriculture Station are included. The list of study intersections is:

1. Beulah Road at I-10 Eastbound Ramps (future year intersection)
2. Nine Mile Road & I-10 Westbound Ramps (future year intersection)
3. Beulah Road & W. Kingsfield Road
4. Beulah Road & Frank Reeder Road
5. Nine Mile Road & Beulah Road
6. Nine Mile Road & Bell Ridge Drive
7. Nine Mile Road & Foxtail Loop
8. Nine Mile Road & Security Place
9. Nine Mile Road & Heritage Oaks Boulevard
10. Nine Mile Road & Navy Federal Way
11. Nine Mile Road & I-10 Eastbound Ramps
12. Nine Mile Road & I-10 Westbound Ramps
13. Nine Mile Road & Pine Cone Drive
14. Nine Mile Road & Pine Forest Road
15. Pine Forest Road & Detroit Boulevard
16. Pine Forest Road & I-10 Westbound Ramps
17. Pine Forest Road & Wilde Lake Boulevard / I-10 Eastbound On-Ramp

Note that the intersection of Chellie Road was originally included in the MLOU for traffic data collection, however, the counts indicated an ADT of under 1,000. Furthermore, the eastbound approach of this driveway is currently signed as a right out only. Given the minor volume of the roadway, the prohibited eastbound left turns onto Pine Forest Road, and the roadway functioning more as a driveway, Chellie Road was not included in the study area analysis.


# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 2-1 : Area of Influence

## 2.2 ANALYSIS YEARS

The analysis years for this study are consistent with the approved MLOU. The analysis years for this project are as follows:

- Existing Year 2018
- Opening Year 2026
- Design Year 2046

## 2.3 ANALYSIS PERIODS

Per the MLOU, the traffic operational analysis includes the AM and PM peak hours.

## 2.4 ANALYSIS TOOLS

Vissim (version 11) microsimulation software was used to conduct detailed operational analyses for the freeway, interchanges, and intersections. HCS analysis was conducted initially for screening of alternatives, per the MLOU, however this SIMR stage of the analysis uses Vissim.

## 2.5 CONSIDERED ALTERNATIVES

Consistent with the approved MLOU, the following alternatives were considered in this SIMR:

- No-Build Alternative: The No-Build (no action) alternative includes planned and programmed improvements (as of April 2020), including the recommended Beulah Road interchange alternative from the I-10 and Beulah Road IJR.
- Build Alternative: Based on the project goals, objectives, and in coordination with FDOT, one Build Alternative was developed for the SIMR AOI.

## 2.6 ANALYSIS APPROACH

### 2.6.1 TRAVEL DEMAND FORECASTING

Future traffic volumes were developed as a part of the approved 'Phase I Traffic Memorandum'. The Northwest Florida Regional Planning Model (NWFRPM) version 2.1 is the adopted model for the Emerald Coast Regional Council (ECRC). The NWFRPM includes areas within the ECRC jurisdiction as well as Jackson, Calhoun, Gulf, Franklin, and

Wakulla Counties. The adopted NWFRPM was validated for Base Year 2010 and has a model Horizon Year 2040.

As a part of the proposed I-10 at Beulah Road Interchange and Beulah Beltway studies, a subarea validation for 2016 and demographic updates were completed (by others). As detailed in the FDOT approved Memorandum, the calculated model volume-over-count ratios exceeded the acceptable standards for many locations within the AOI. As such, compound annual growth rates were derived from the model output and applied to Existing Year 2018 volumes. This methodology was utilized to account for future changes in travel patterns due to background improvements, such as the new Beulah interchange and Beulah Beltway.

### 2.6.2 TRAFFIC OPERATIONAL ANALYSIS

Traffic simulation software (PTV's Vissim version 11) was selected for the analysis. The below sources were used as guidelines for the Vissim model development:

- The FHWA Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software
- The 2014 FDOT Traffic Analysis Handbook

Vissim was selected as the simulation tool for use in the analysis because of its ability to accommodate complex geometry and to allow highly customized inputs for a wide range of variables; including signal timing schemes and origin-destination input for better lane utilization.

Three-hour AM and PM peak-period analyses were conducted using 15-minute flow rates for all analysis years. A 30-minute seeding period was used, based on a lower percentage of the counted volumes. Vissim models were developed and calibrated to existing year conditions. The calibration of the existing AM and PM models was based on the thresholds including traffic volume and speed, as specified in the MLOU. Calibration parameters from the existing year Vissim models were carried forward to the future year Vissim models.

The Measures of Effectiveness (MOEs) assessed from the Vissim models include the following:

- Intersection Node Evaluation: Volume, delay, and max queue length for the study area intersections for all movements.
- Link Evaluation Segments: Volume, density, and speed information for I-10, displayed with temporal and spatial volume and speed profiles
- Network-Wide Output: Total travel time, total delay time, average delay time, vehicle-miles of travel, latent volume and latent delay.

In this analysis, the intersection LOS is computed by comparing the intersection delay from the microsimulation analysis to the signalized intersection control delay thresholds in the Highway Capacity Manual (HCM) 6$^{th}$ Edition Exhibit 19-8. Since actual LOS is not an output from the microsimulation analysis, the reported LOS is an 'estimated LOS'. Vissim

tracks individual vehicle movements and interactions and quantifies overall intersection delays more realistically than HCM methods, but for the purposes of this analysis the estimated intersection LOS is based on HCM criteria for signalized and unsignalized intersections.

### 2.6.3 SAFETY ANALYSIS

A safety analysis was completed for this project and is included in **Appendix B**. The analysis includes an existing conditions safety analysis to review the crash history, and a quantitative safety analysis using the HSM predictive method. The past five years of crash history was obtained and reviewed for the study intersections and roadway segments using data obtained from FDOT's Crash Analysis Reporting (CAR) Online System. Signal Four Analytics data was also obtained and reviewed, however, only CAR Online data was utilized for the analysis. The safety analysis documents crash rates, crash patterns, crash types, and their contributing causes for existing conditions. The potential safety impacts of the proposed improvements for the design year were assessed based on the HSM procedure as discussed in the FDOT Interchange Access Request Users Guide (2018). This entailed a quantitative analysis with an existing conditions safety analysis, Empirical Bayes Method, and crash reduction estimations.

# 3.0 EXISTING CONDITIONS

## 3.1 DATA COLLECTION

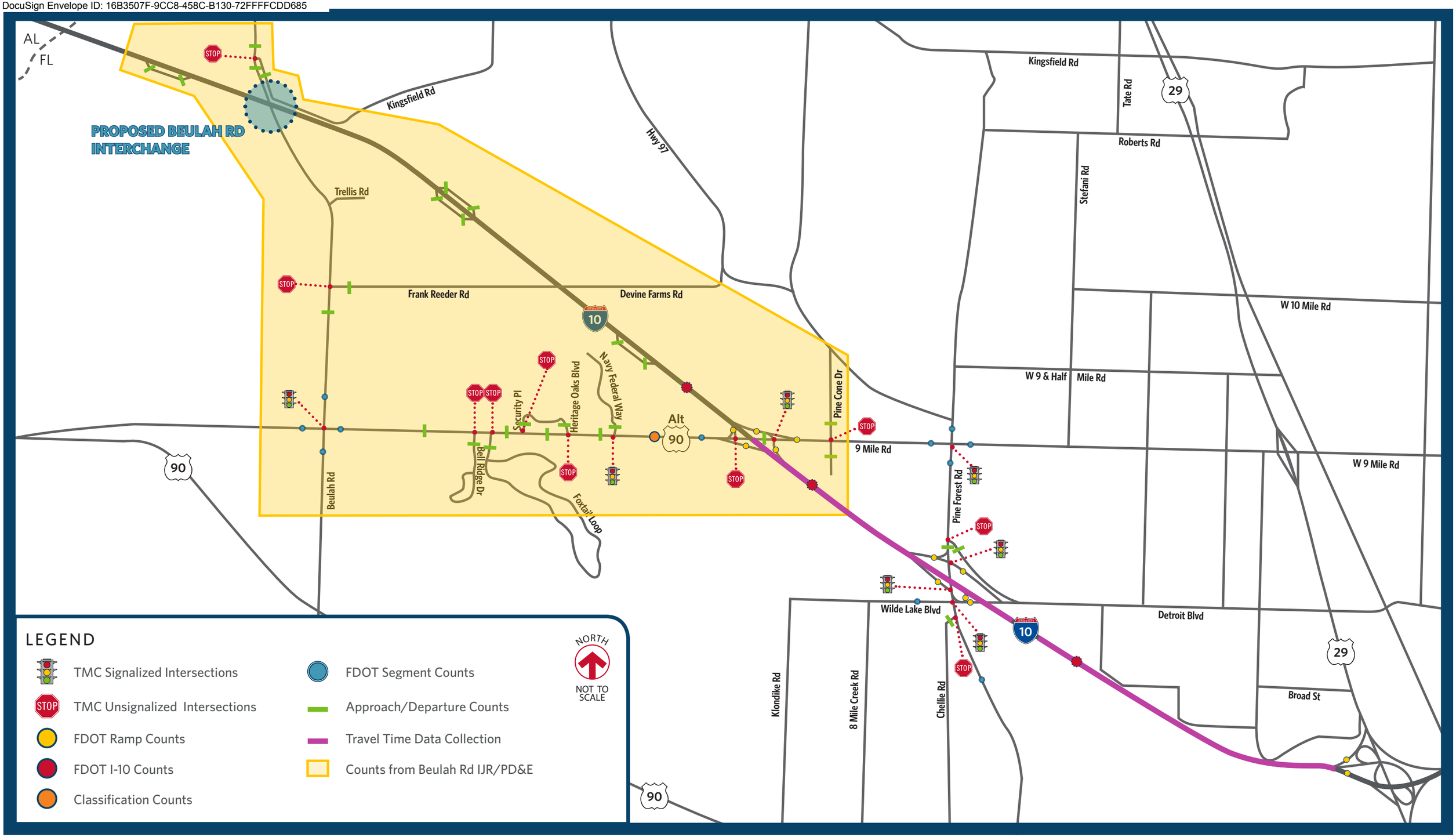
### 3.1.1 TRAFFIC DATA

Traffic data was obtained from several sources during the PD&E Study. I-10 mainline counts, ramp counts, classification historical counts and seasonal factors were obtained from the 2017 FDOT Traffic Online (FTO) Web Application. Existing traffic data collection was coordinated with the adjacent I-10 and Beulah Road Interchange Access Request (IAR)/PD&E (FPID 433113-1) project. **Figure 3–1** shows the locations where existing traffic data was collected from 2017 FTO, as well as the I-10 and Beulah Road IAR/PD&E and traffic data collected as part of this study. **Figure 3–2** displays the existing year lane configurations.

The 2017 FTO Web Application shows that the I-10 mainline within the AOI consists of two Telemetered traffic monitoring sites (Site ID #s 480156 and 489949) and a Portable traffic monitoring site (Site ID # 482001). All entrance and exit ramps are monitored with Portable traffic monitoring sites. The Portable traffic monitoring sites provide traffic volume by direction for 24 hours in 15-minute increments for one day and was collected in February 2017. The Telemetered traffic monitoring site provides traffic volume by direction for 24 hours in one-hour increments for the entire year.

Intersection turning movement count data was collected from 6:00 AM to 9:00 AM and from 4:00 PM to 7:00 PM in March 2018. A classification count was collected on Nine Mile Road west of I-10. Additionally, several approach counts were collected within the AOI for a 24-hour period. The raw count data is included in **Appendix C**.

The measured traffic factors obtained from the data collection are summarized in **Table 3-1**.

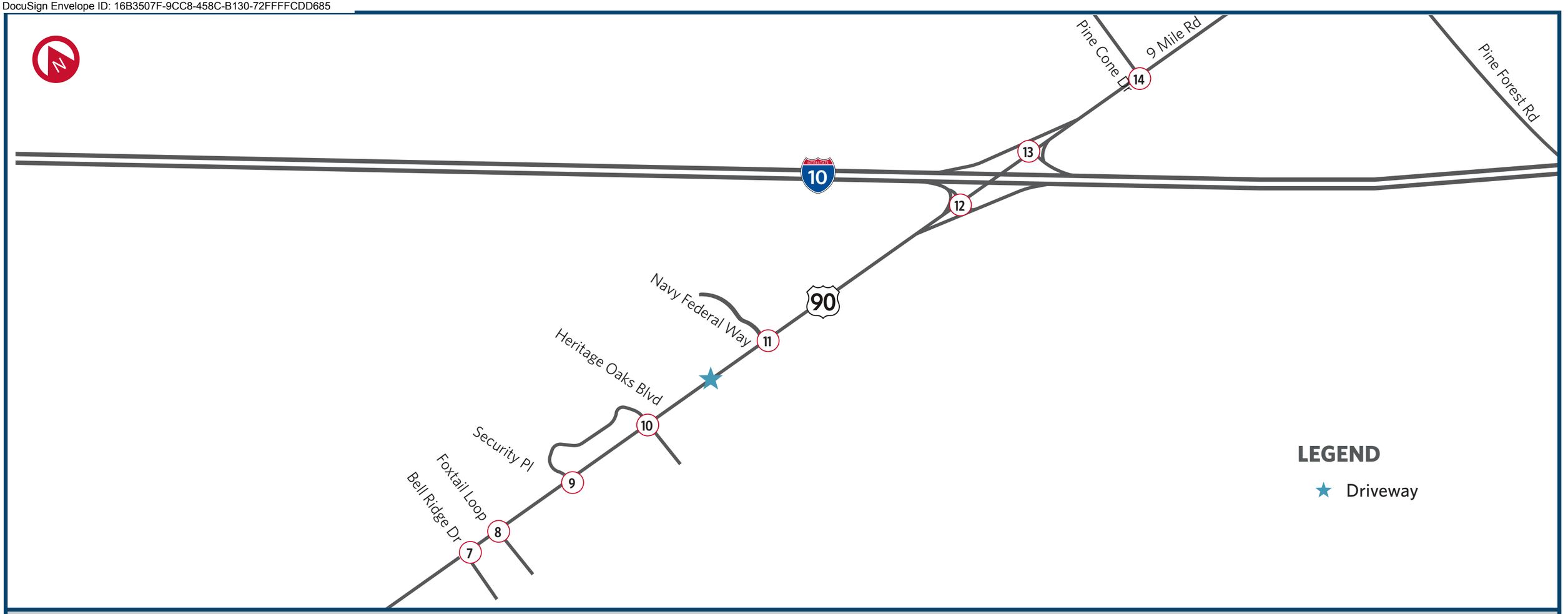


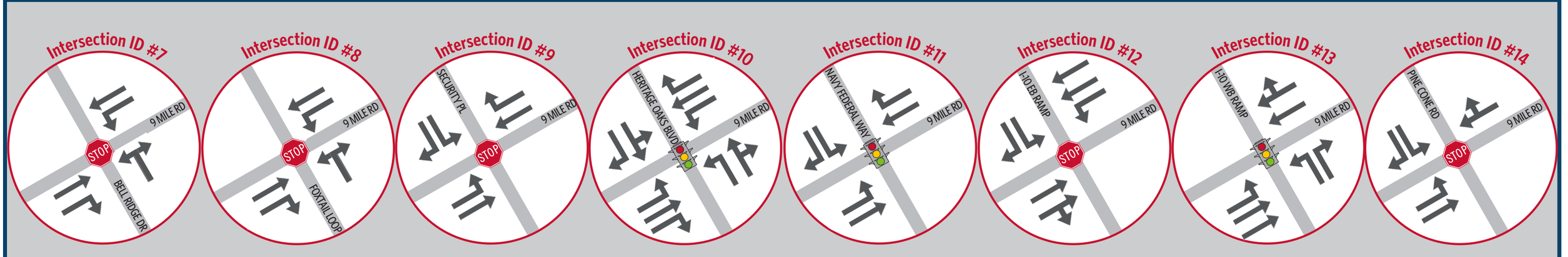

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 3-1 : Proposed Counts Locations


# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

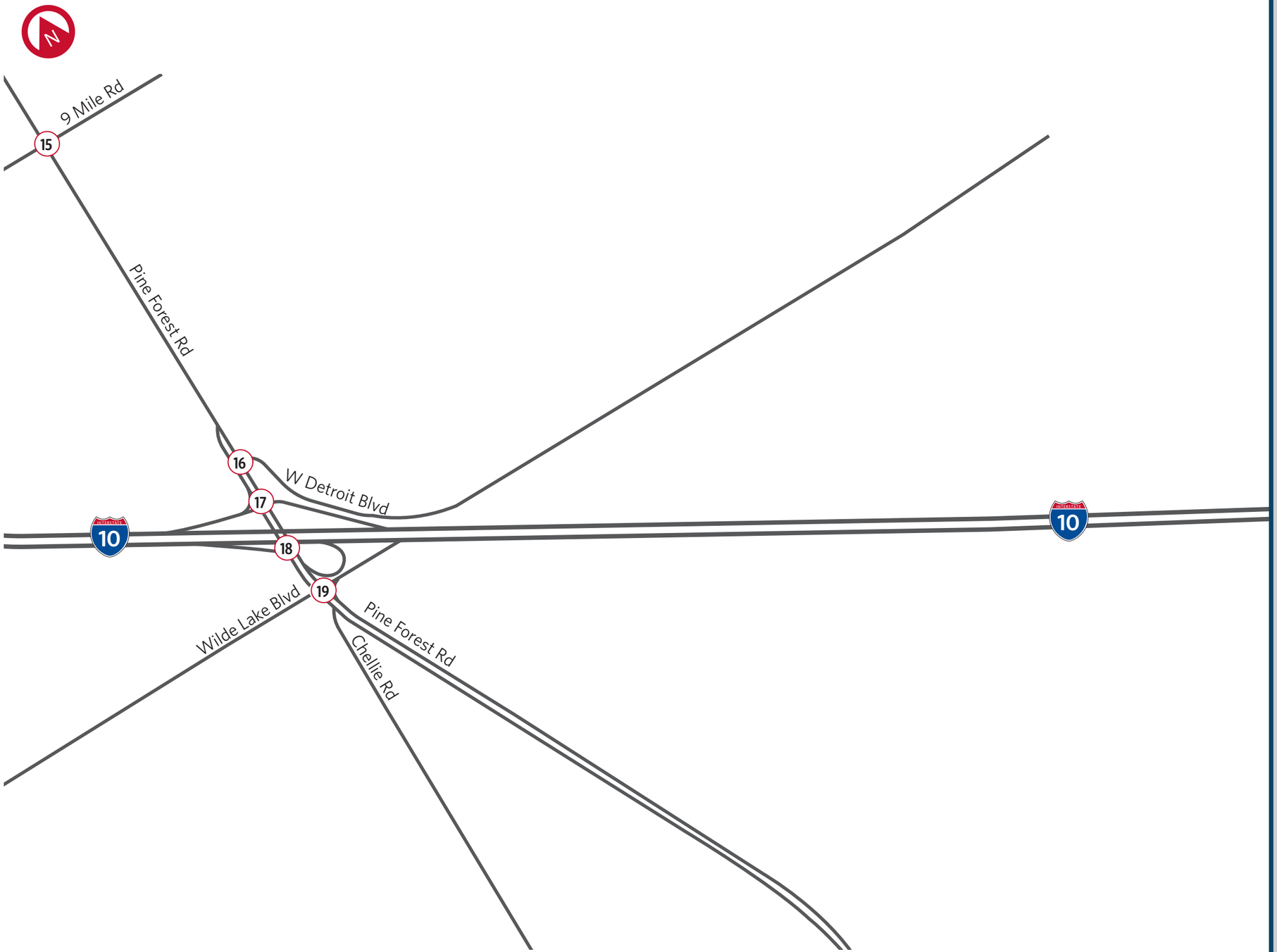
Figure 3-2: Existing (2018) Year Lane Configurations

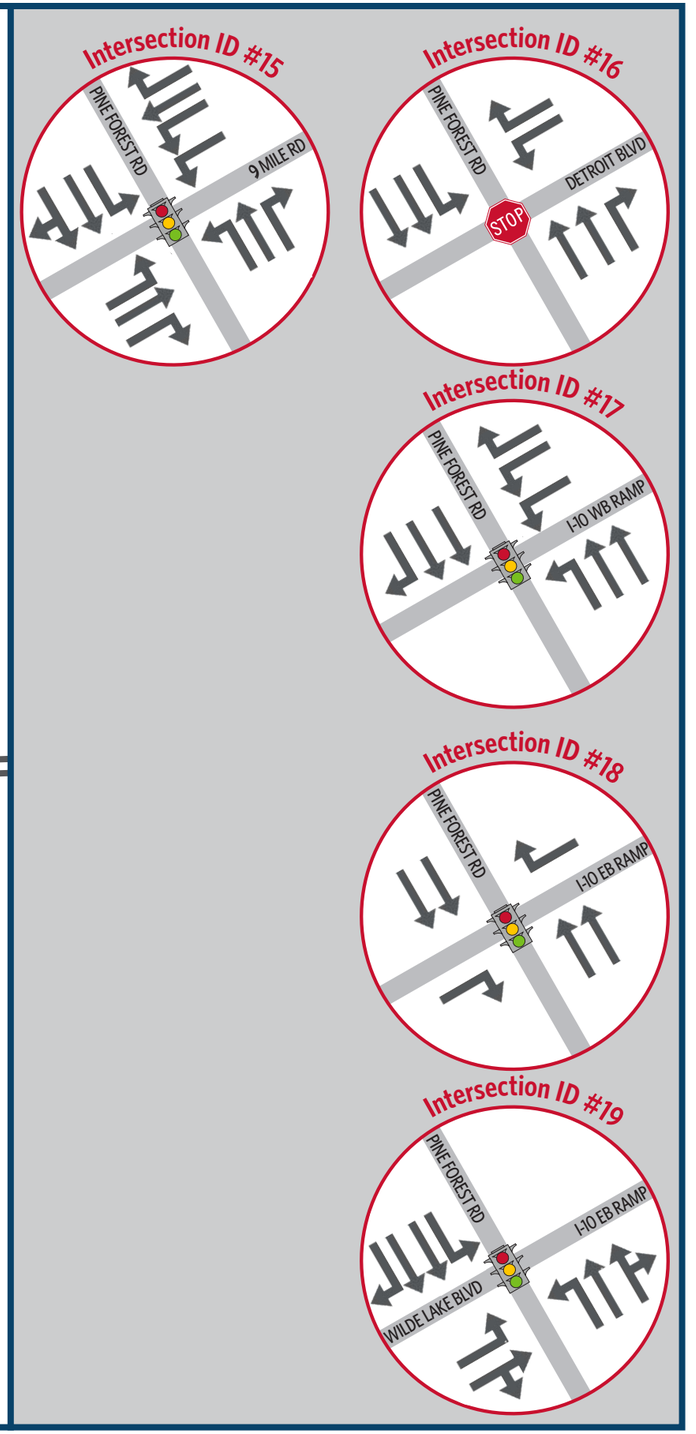



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

## Figure 3-2: Existing (2018) Year Lane Configurations




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 3-2: Existing (2018) Year Lane Configurations

**Table 3-1. Existing Traffic Factors**

| Road | Facility | Count Location | K | D | $T_{24}$ |
|---|---|---|---|---|---|
| I-10 | Freeway | West of Nine Mile Rd | 6.3% | 51.0% | 20.5% |
| | | Between Nine Mile Rd and Pine Forest Rd | 7.9% | 54.6% | 14.8% |
| | | East of Pine Forest Rd | 8.2% | 56.4% | 11.5% |
| 9 Mile Rd | Arterial | West of I-10, Between Beulah Rd and I-10 | 8.0% | 56.1% | 9.0% |
| | | East of I-10, Between I-10 and Pine Forest Rd | 8.4% | 52.5% | 7.9% |
| Pine Forest Rd | Arterial | South of I-10, Between I-10 and Kersey Rd | 8.5% | 52.0% | 6.8% |
| | | North of I-10, Between I-10 and Nine Mile Rd | 8.2% | 56.1% | 5.0% |
| Beulah Rd | Arterial | Between 9 Mile Rd and Frank Reeder Rd | 9.7% | 52.6% | 10.6% |

### 3.1.2 ORIGIN DESTINATION DATA

Origin-Destination (OD) data was collected using StreetLight Insight. StreetLight uses Big Data derived from navigation-GPS data and other Location-Based data to identify travel patterns and provide OD information. The OD data was used to develop peak hour OD matrices for vehicle routing in Vissim.

### 3.1.3 MICROSIMULATION DATA

Additional data was collected to support the Vissim modeling and calibration. This data included:

- I-10 spot speed data from RITIS (Regional Integrated Transportation Information System) during the peak periods
- Field observations for the I-10 Westbound off-ramp queue lengths

The speed data was used to develop speed distribution profiles for I-10 to account for any study area specific driving characteristics, such as determining if the 85$^{th}$ percentile speed is over or under the posted speed limit. Similarly, the queue length observations were used to ensure the model was replicating real-world conditions. Both metrics were

used in calibration and validation of the existing conditions model. The calibration report is provided in **Appendix D**.

### 3.1.4 CRASH DATA

A safety analysis was completed for this project and is provided in **Appendix B**. The safety analysis includes an existing conditions safety analysis to review the crash history, and a quantitative safety analysis using HSM predictive method.

## 3.2 EXISTING TRAFFIC OPERATIONAL ANALYSIS

Traffic operational analyses were conducted for existing conditions using Vissim 11.00-09, a widely-used, behavior-based multi-purpose traffic microsimulation program. Vissim tracks individual vehicle movements and interactions more realistically than typical HCM methods and quantifies the performance of individual movements and overall delays and queue lengths for freeways, ramps, and intersections. Model assumptions, parameters, and network coding techniques are discussed in the following subsections.

### 3.2.1 EXISTING TRAFFIC

Annual Average Daily Traffic (AADT) and Directional Design Hour Volumes (DDHV) were developed as part of the approved Phase I Traffic Memorandum. This section summarizes the approach.

#### *Existing AADT & DDHV*

Existing AADT volumes were obtained from 2017 FTO Web Application as well as 2018 field-collected data. The AADTs estimated from FTO and field-collected counts were balanced along I-10. A global peak hour was determined to develop Existing Year 2018 AM and PM peak hour volumes for the AOI. Hourly traffic volumes were balanced and checked for reasonableness against the traffic data obtained from 2017 FDOT Traffic Online Web count data. The resulting AM and PM Existing Year 2018 AADT and DDHV volumes are depicted in **Figure 3–3**.

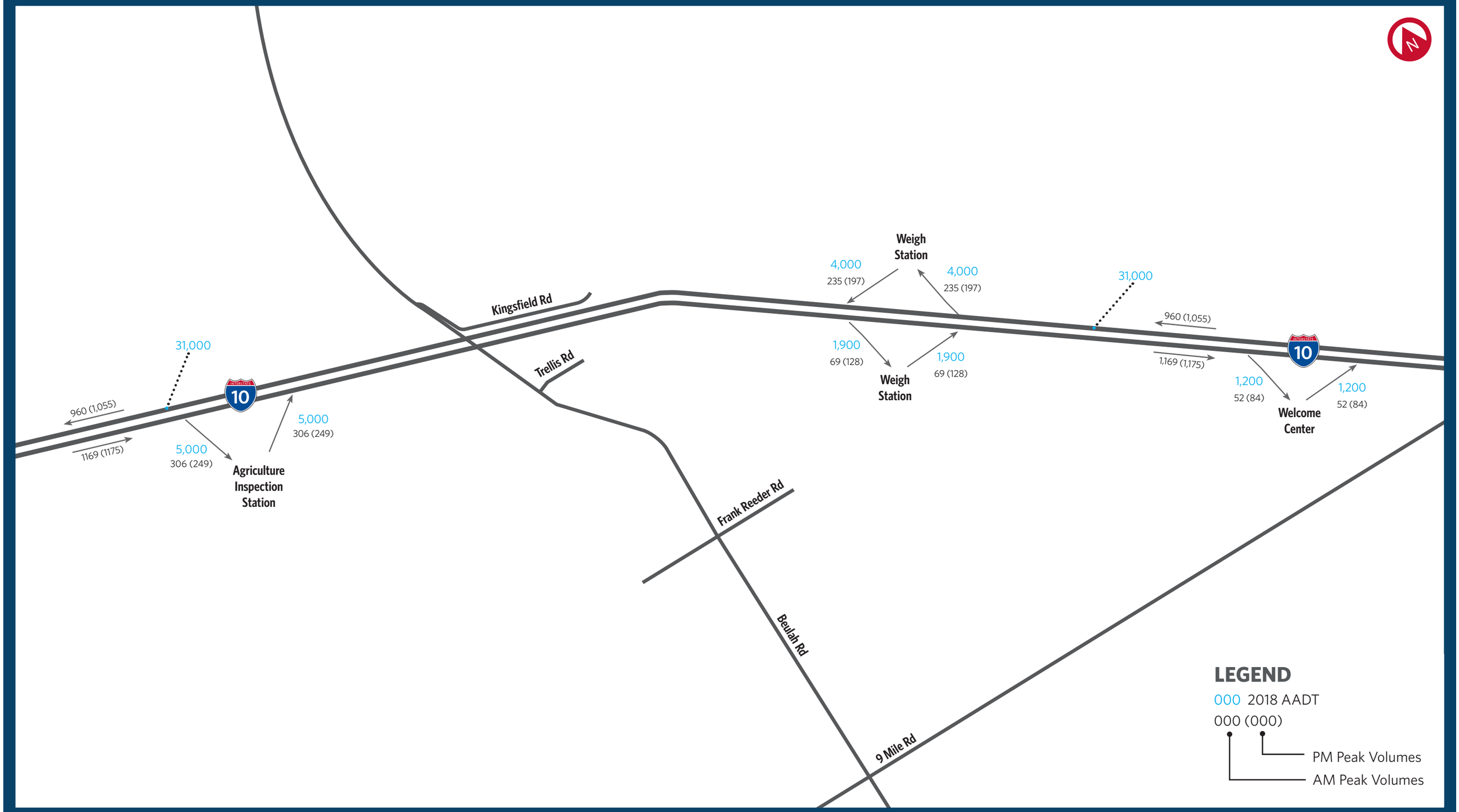
#### *Existing Peak Hour Turning Movement Volumes*

Traffic volumes were balanced for the entire AOI by utilizing turning movement data for the ramps and intersections. Balanced peak hour traffic volumes were checked for reasonableness against the traffic data obtained from 2017 FDOT Traffic Online Web

count data. The resulting AM and PM Existing Year (2018) peak hour volumes are depicted in **Figure 3–4**.

### *Pre- and Post-Peak Hour Adjustment Factors*

A three-hour morning and three-hour afternoon period was used for analysis to capture the effects of congestion building before the peak hour and dissipating after the peak hour. The volumes of the hours adjacent to the peak hour were determined by applying an adjustment factor to the peak hour volumes to proportionately scale down the balanced peak hour volumes. Traffic count proportions were used to determine global scale factors for both the AM and PM peak periods. Scale factors of 0.69 and 0.87 were used for the pre-peak hour adjustment for the AM and PM peak period, respectively. Scale factors of 0.91 and 0.80 were used for the post-peak hour adjustment for the AM and PM peak periods, respectively.

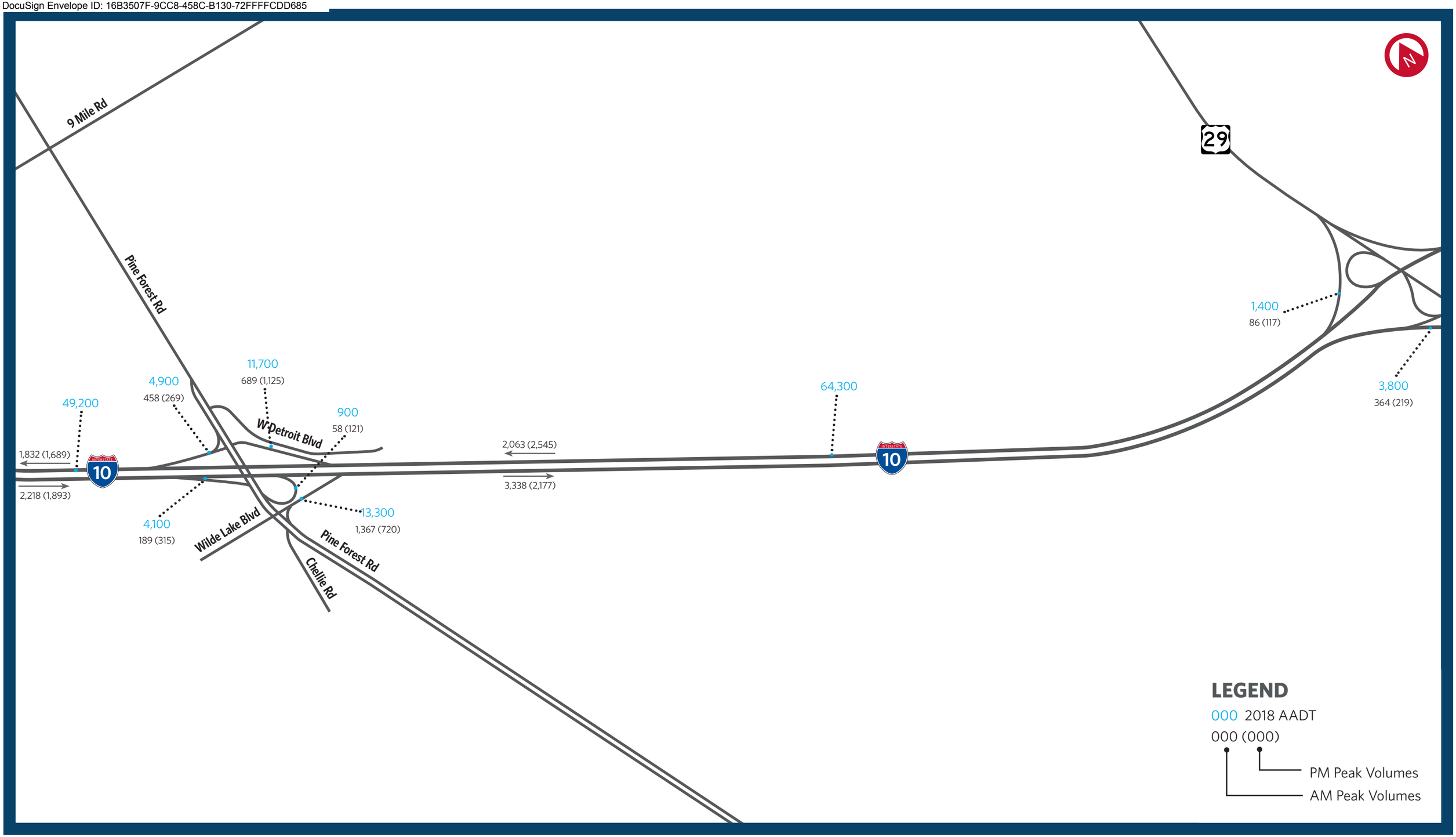



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 3-3:** Existing Year (2018) AADT & DDHV

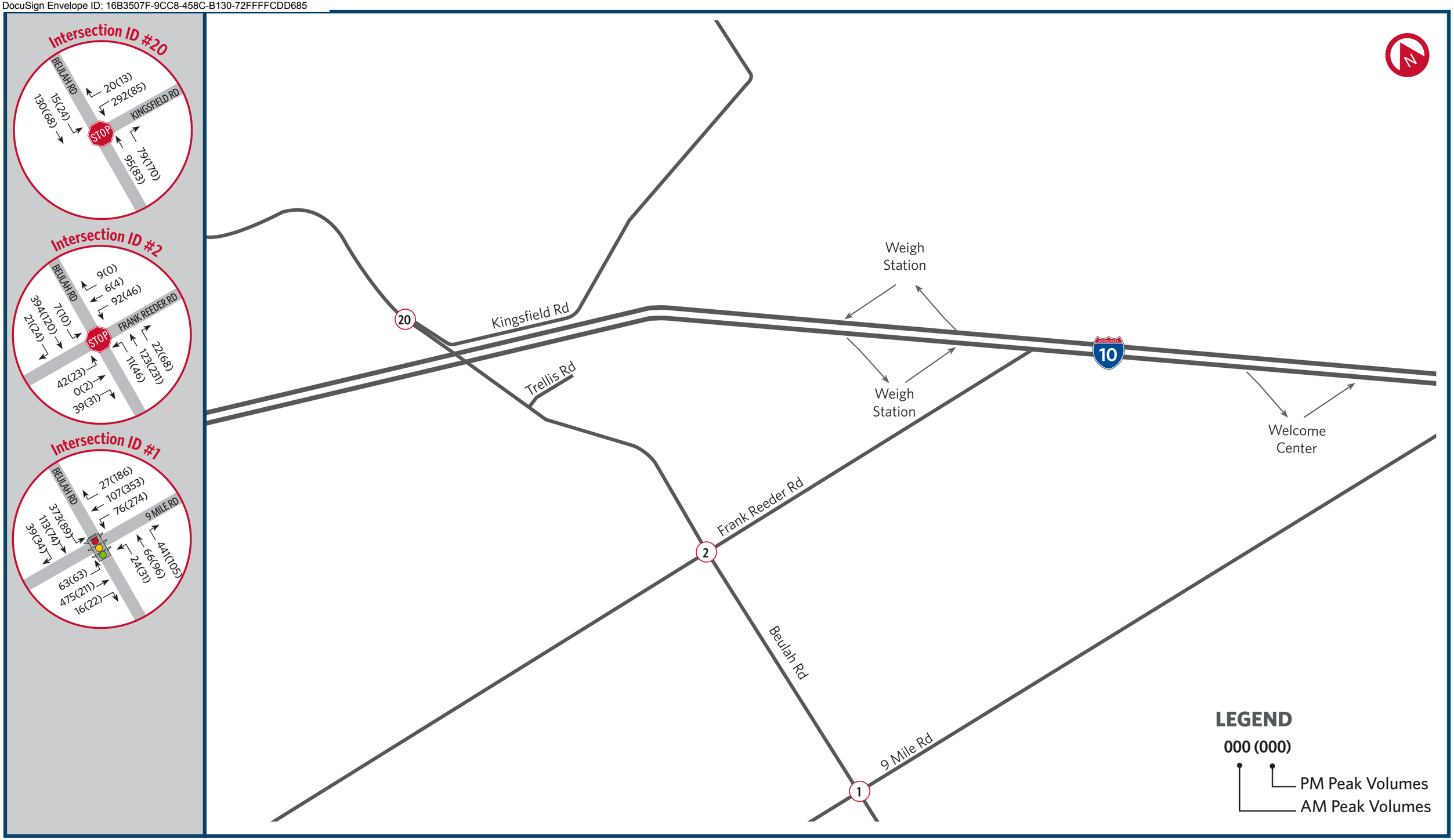

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 3-3:** Existing Year (2018) AADT & DDHV



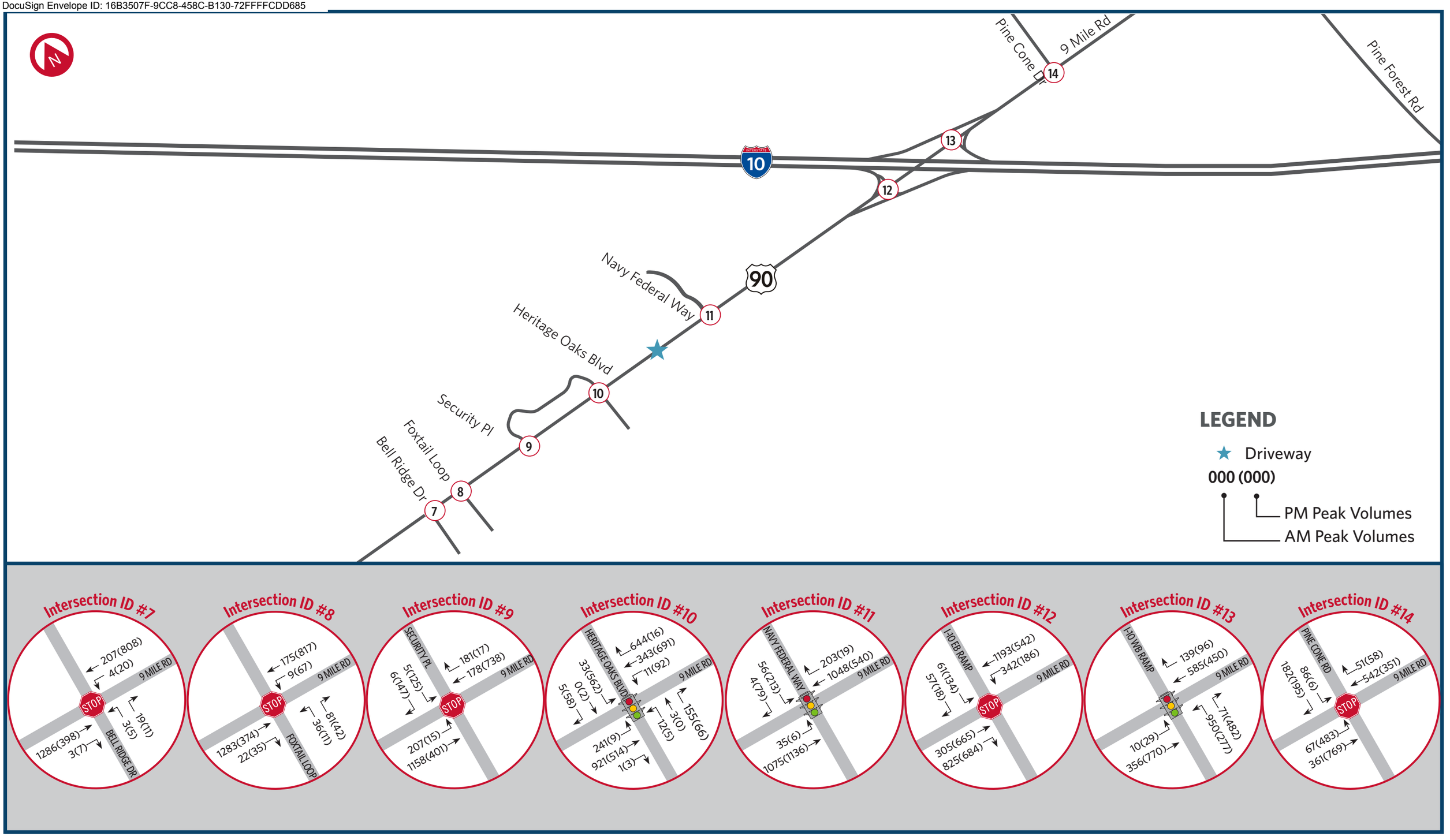

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 3-3:** Existing Year (2018) AADT & DDHV



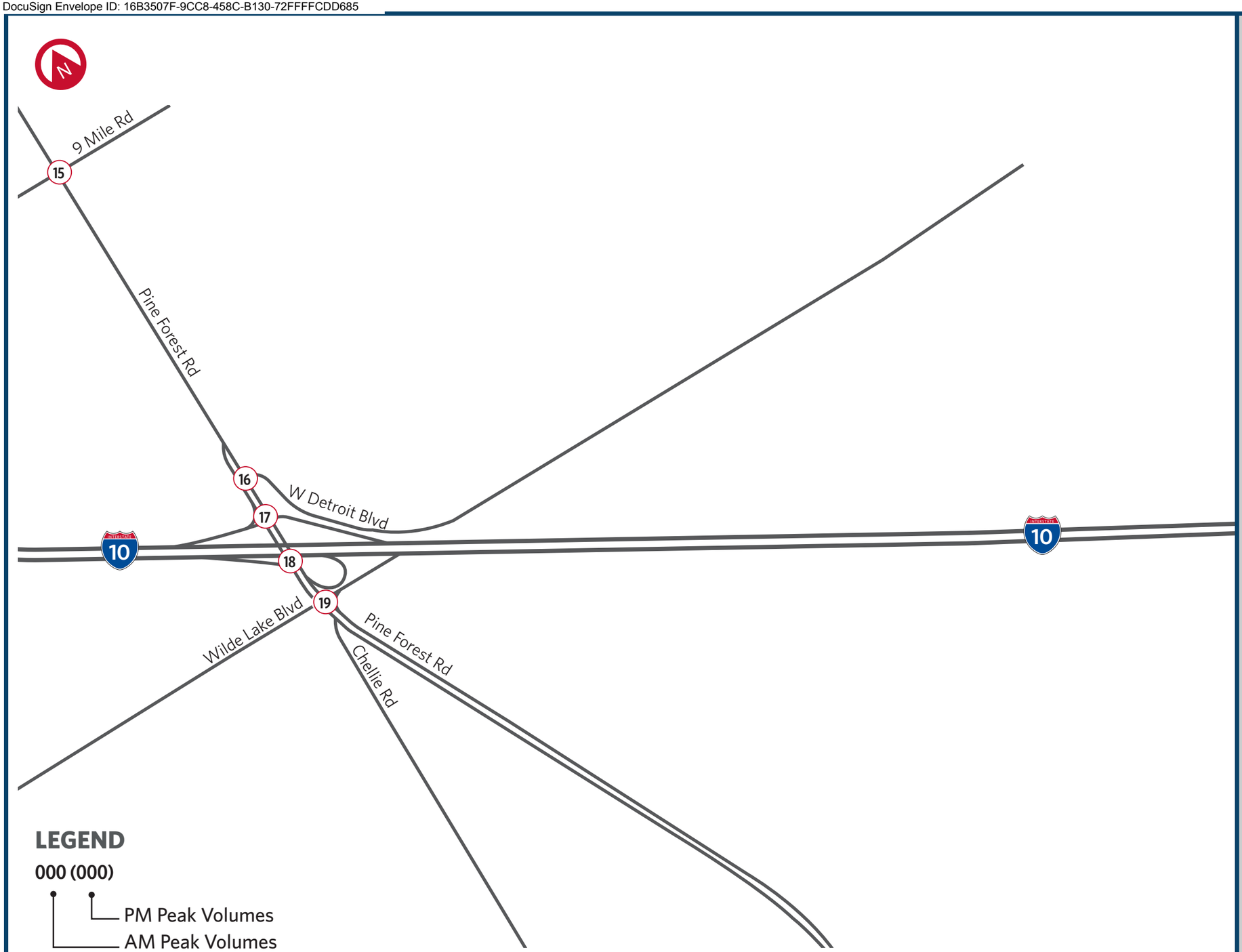

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

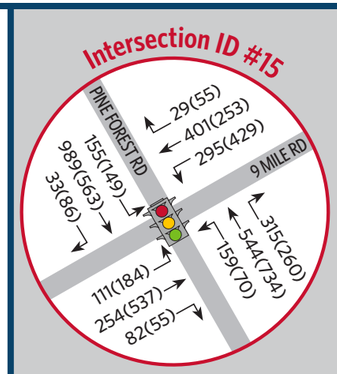
**Figure 3-4:** Existing (2018) Peak Hour Turning Movement Volumes

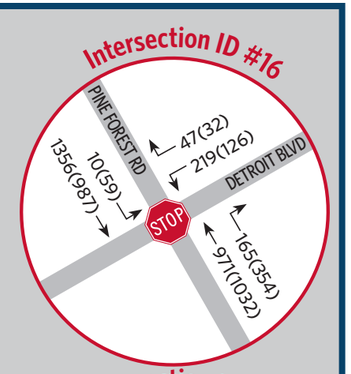


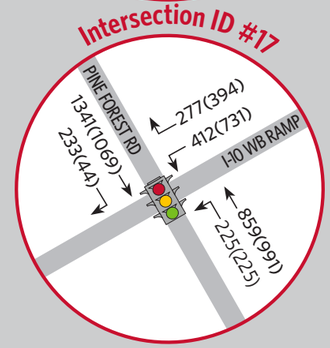

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

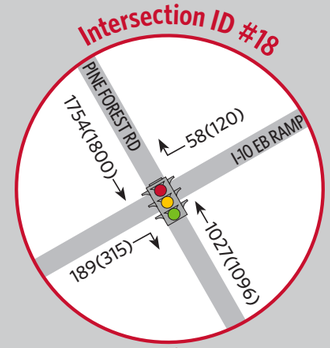
Figure 3-4: Existing (2018) Peak Hour Turning Movement Volumes

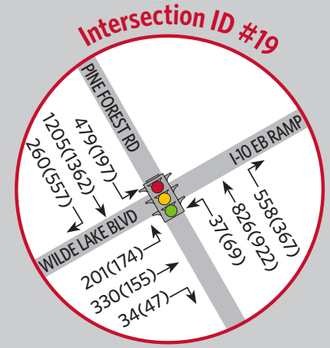



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 3-4: Existing (2018) Peak Hour Turning Movement Volumes

### 3.2.2 VISSIM MODEL DEVELOPMENT AND CALIBRATION

Vissim models were developed and calibrated to 2018 Existing Conditions following FDOT and FHWA guidelines for determining the acceptability of model results as compared to existing operations. Calibration targets used were speed, traffic volume, and visual audits, as specified in the MLOU. The Vissim model development, calibration, and validation is documented in the calibration report located in **Appendix D**.

Vissim Vehicle Inputs were coded in 15-minute intervals to represent traffic fluctuations during simulated peak hours. The Vissim simulation time was three hours, which included a 1-hour shoulder period before the peak hour and a 1-hour shoulder period after the peak hour. The shoulder hours allow congestion to build prior to the peak hour and dissipate after the peak hour. This traffic loading helps ensure that simulated congestion does not extend beyond the boundary limits of the analysis and that the first and last simulation periods are undersaturated. Additionally, a 30-minute seeding period was used so vehicles could be loaded into the network before recording simulation results.

Visum's TFlowFuzzy matrix estimation tool was used to generate the OD matrices and StreetLight Insight data was used to validate the matrices. The OD matrices were developed based on the peak hour volumes and were applied throughout the peak period. Vehicle routing was coded using static routes throughout the entire model.

### 3.2.3 NETWORK PERFORMANCE

The Existing Year network performance results are presented in **Table 3-2**. The network results provide an overview of how the study area is serving traffic and the extent of any latent demand within the network. In the existing condition, there is no latent demand in either peak. The PM peak, however, experiences more delay than the AM peak.

**Table 3-2. Existing Year 2018 Network Performance Summary**

| Parameter | AM Peak Hour | PM Peak Hour |
|---|---|---|
| **Total Travel Time (hr)** | 1,109 | 1,110 |
| **Total Delay Time (hr)** | 255 | 307 |
| **Average Delay Time (s/veh)** | 83 | 99 |
| **Latent Delay Time (hr)** | 0 | 0 |
| **Vehicles Left the Network** | 9,955 | 9,950 |
| **Latent Demand (veh)** | 0 | 0 |
| **Vehicle Miles Traveled (mi)** | 50,971 | 48,297 |

### 3.2.4 I-10 MAINLINE OPERATIONS

The volume and speed results for I-10 were reported using the Vissim link evaluation output. Average volume and average speed profiles typically provide a good representation of traffic flow along the corridor. **Figure 3–5** through **Figure 3–8** depict these results for the existing condition. The results indicate that for both peak periods, travel speeds are at or near 70 mph except for at interchange merge and diverge areas, where the speeds can range between 55 mph and 70 mph. The sharpest speed drop occurs in the westbound direction approaching Pine Forest Rd during the PM Peak. The speed drop is due to exit ramps backing up to the I-10 mainline and causing vehicles to decelerate. The ramp queues back up onto the shoulder, rather than obstructing mainline traffic. There is also a speed drop during the AM peak hour in the westbound direction at the off-ramp at Nine Mile Road. This is likely due to the high volume of traffic exiting at this ramp. The I-10 volume results show that the facility is under capacity, with a maximum of just over 3,000 vehicles per hour carried on any two-lane directional segment. It should be noted that while the Existing conditions show that I-10 is under capacity, the Phase 1 No-Build Memo showed that I-10 will not meet LOS targets in the Opening Year 2026 east of Pine Forest Road, and in Design Year 2046 conditions, LOS targets will not be met on the mainline for areas east of the planned Beulah interchange. To further visualize the traffic operations, link-level density is summarized in **Table 3-3** and **3-4.**

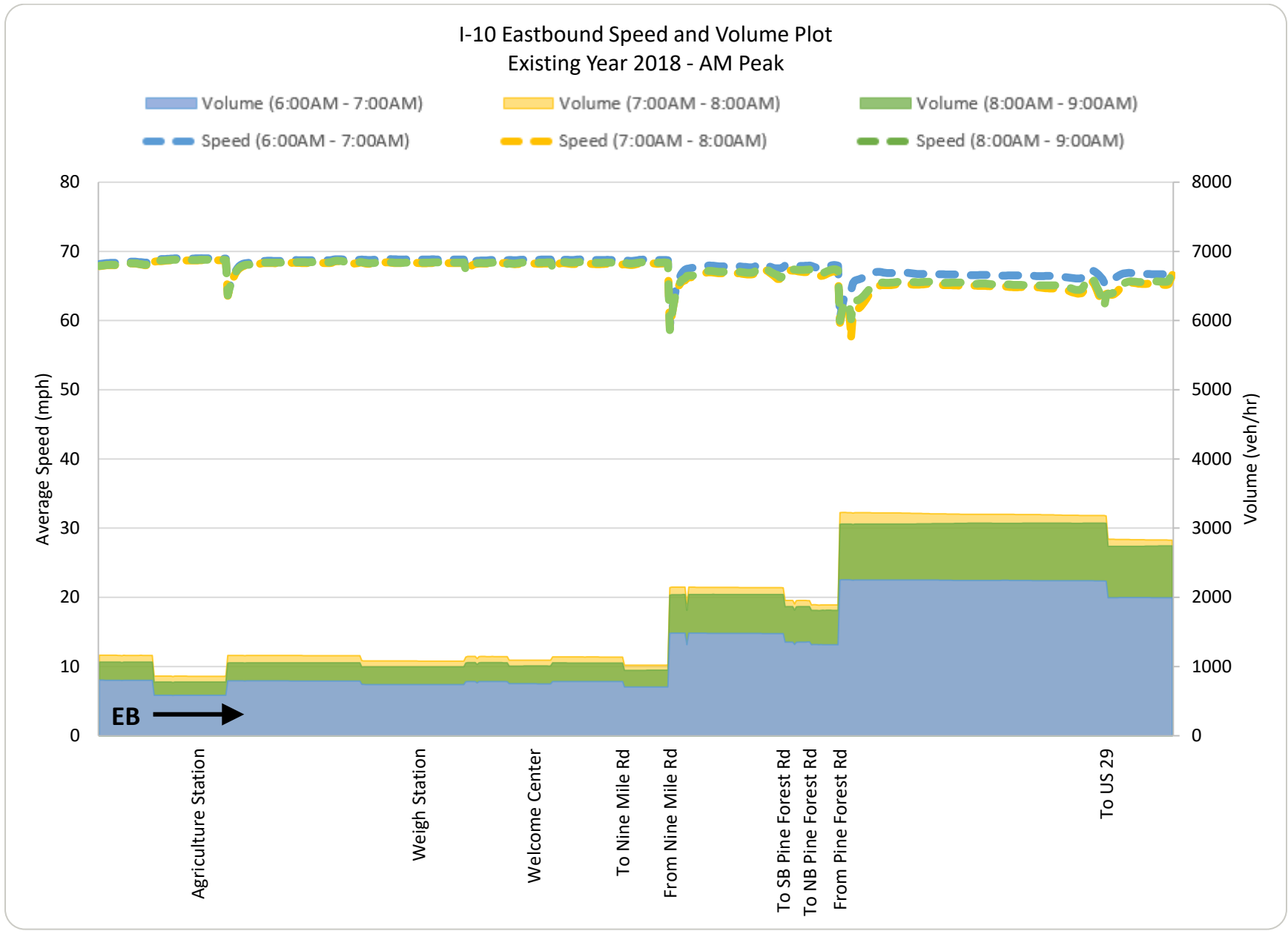



**Figure 3-5. I-10 Eastbound Speed and Volume Plot – Existing Year 2018 AM Peak**

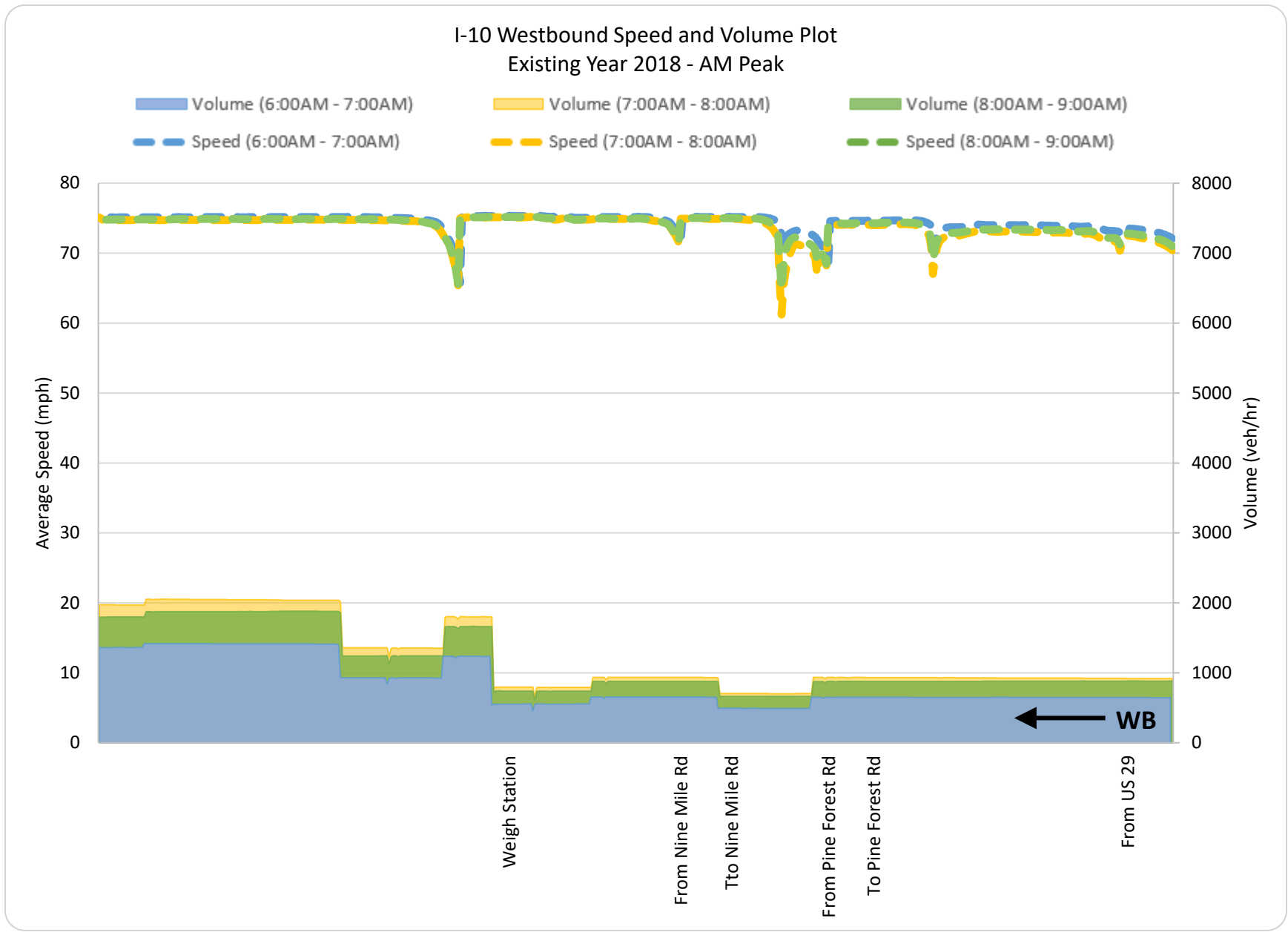



**Figure 3-6. I-10 Westbound Speed and Volume Plot – Existing Year 2018 AM Peak**

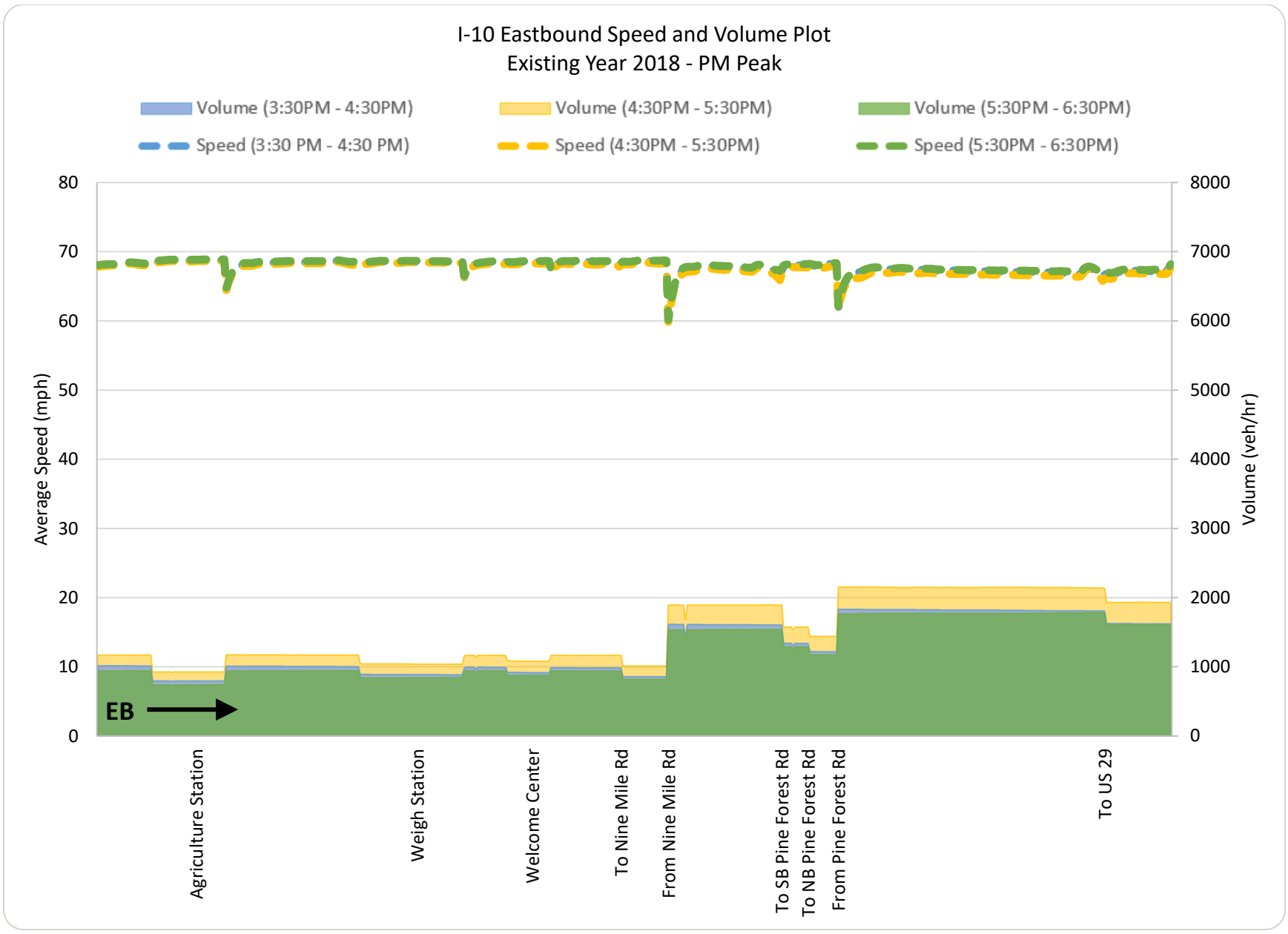



**Figure 3-7. I-10 Eastbound Speed and Volume Plot – Existing Year 2018 PM Peak**

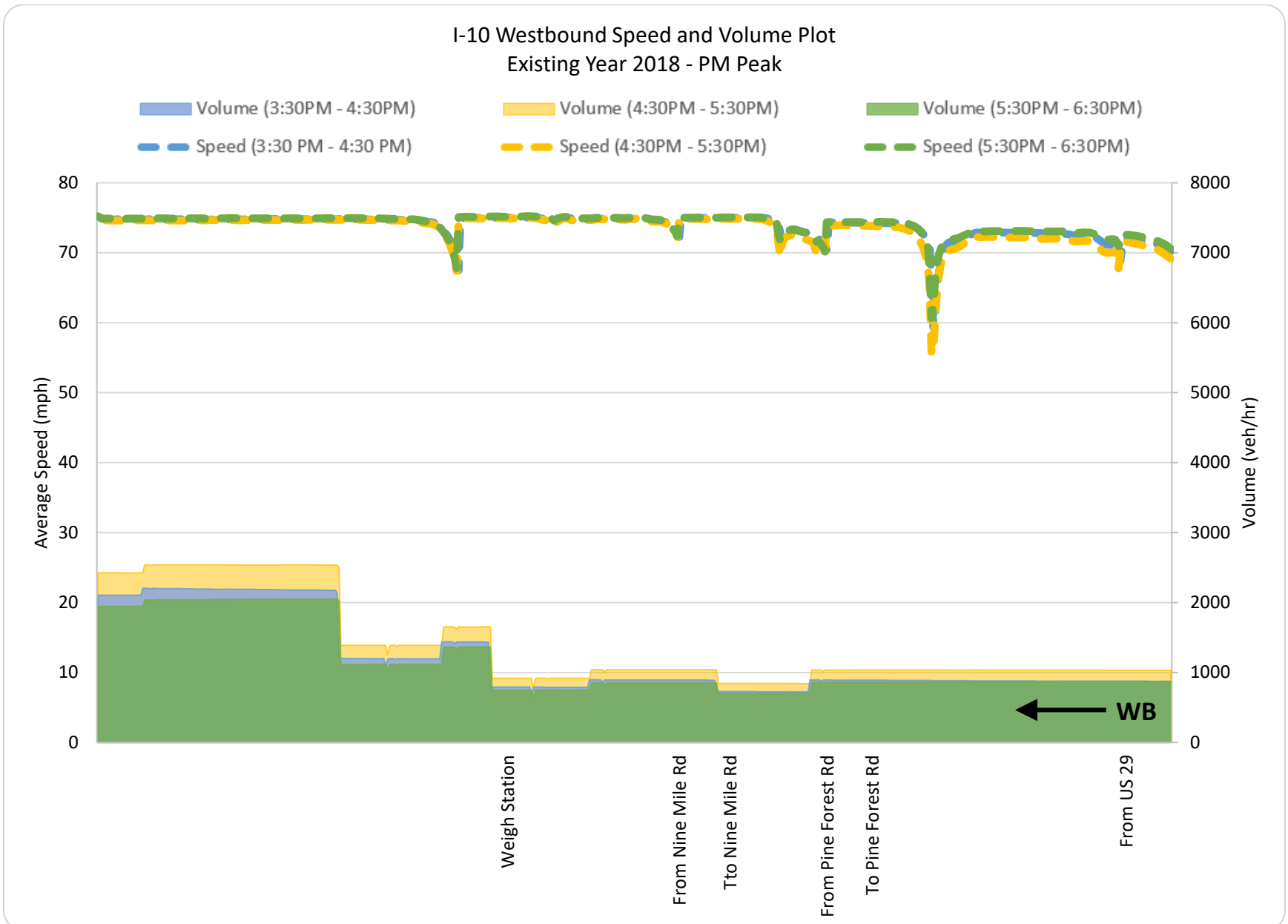



**Figure 3-8. I-10 Westbound Speed and Volume Plot – Existing Year 2018 PM Peak**

**Table 3-3. I-10 Eastbound Link Density – Existing Year 2018**

| I-10 Eastbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| West of Weigh Station to Weigh Station On-Ramp | 1.00 | 3 | 11.5 | 17.0 | 15.4 | 14.7 | 17.2 | 13.7 |
| Weigh Station Merge | 0.00 | 4 | 11.4 | 16.8 | 15.5 | 14.7 | 17.2 | 13.9 |
| Weigh Station On-Ramp to Welcome Center Off-Ramp | 0.25 | 3 | 11.4 | 16.8 | 15.5 | 14.5 | 17.1 | 13.8 |
| Welcome Center Off-Ramp to Welcome Center On-Ramp | 0.50 | 2 | 10.9 | 16.0 | 14.8 | 13.4 | 15.8 | 12.8 |
| Welcome Center Merge | 0.25 | 3 | 11.4 | 16.7 | 15.4 | 14.5 | 17.1 | 13.7 |
| Welcome Center Merge to Nine Mile Rd Off-Ramp | 0.50 | 2 | 11.4 | 16.7 | 15.4 | 14.4 | 17.1 | 13.7 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 10.3 | 15.0 | 13.8 | 12.5 | 14.8 | 11.9 |
| Nine Mile Rd Merge | 0.25 | 3 | 22.7 | 33.3 | 31.6 | 24.5 | 28.9 | 23.2 |
| Nine Mile Rd Merge to Pine Forest Rd Off-Ramp | 1.00 | 2 | 21.8 | 32.0 | 30.4 | 23.8 | 28.2 | 22.7 |
| Pine Forest Rd SB Off-Ramp to Pine Forest Rd NB Off-Ramp | 0.25 | 2 | 19.9 | 29.1 | 27.7 | 19.7 | 23.2 | 18.9 |
| Pine Forest Rd NB Off-Ramp to Pine Forest Rd On-Ramp | 0.25 | 2 | 19.4 | 28.4 | 27.1 | 17.9 | 21.2 | 17.2 |
| Pine Forest Rd Merge | 0.25 | 3 | 35.5 | 53.2 | 49.6 | 28.2 | 33.4 | 27.1 |
| Pine Forest Rd Merge to US 29 Diverge | 2.00 | 2 | 33.7 | 49.5 | 47.0 | 27.1 | 32.2 | 26.3 |
| US 29 Diverge | 0.50 | 4 | 33.6 | 49.4 | 47.5 | 26.9 | 32.0 | 26.4 |

[1]*Rounded to the nearest 0.25 miles*

**Table 3-4. I-10 Westbound Link Density – Existing Year 2018**

| I-10 Westbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| East of US 29 Westbound On-Ramp | 0.75 | 3 | 18.6 | 34.3 | 27.0 | 18.6 | 34.3 | 27.0 |
| US 29 Westbound Merge | 0.25 | 5 | 19.5 | 28.8 | 26.2 | 19.5 | 28.8 | 26.2 |
| US 29 Westbound Merge to Pine Forest Rd Diverge | 1.75 | 2 | 19.2 | 28.2 | 25.7 | 19.2 | 28.2 | 25.7 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 1.00 | 2 | 12.4 | 18.3 | 16.8 | 12.4 | 18.3 | 16.8 |
| Pine Forest Rd Merge | 0.25 | 3 | 17.5 | 26.2 | 23.9 | 17.5 | 26.2 | 23.9 |
| Pine Forest Rd Merge to Nine Mile Rd Diverge | 0.75 | 2 | 17.0 | 26.1 | 23.4 | 17.0 | 26.1 | 23.4 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 7.4 | 10.6 | 9.8 | 7.4 | 10.6 | 9.8 |
| Nine Mile Rd Merge | 0.25 | 3 | 8.9 | 12.7 | 11.9 | 8.9 | 12.7 | 11.9 |
| Nine Mile Rd Merge to Weigh Station Diverge | 1.00 | 2 | 8.7 | 12.5 | 11.7 | 8.7 | 12.5 | 11.7 |
| Weigh Station Diverge | 0.25 | 2 | 8.7 | 12.5 | 11.7 | 8.7 | 12.5 | 11.7 |
| Weigh Station Off-Ramp to Weigh Station On-Ramp | 1.00 | 2 | 6.5 | 9.4 | 8.8 | 6.5 | 9.4 | 8.8 |
| Weigh Station Merge to West of Weigh Station | 0.25 | 5 | 9.4 | 13.5 | 12.6 | 9.4 | 13.5 | 12.6 |

[1]*Rounded to the nearest 0.25 miles*

### 3.2.5 INTERSECTION OPERATIONS

Node evaluation output from Vissim was used for reporting intersection delay, estimated LOS, and queue lengths. An estimated LOS was based on the HCM 6th edition signalized control delay thresholds (HCM Exhibit 19-8). The peak hour results are summarized in **Table 3–2**. Detailed results by movement, including queue length results, are in **Appendix E.**

The results show that there are three intersections operating at LOS E or worse, all of which are intersections along Nine Mile Road. Those three intersections are major feeders to Nine Mile Road, which connect to the NFCU campus. In the PM Peak, the intersection of Pine Forest Road at Nine Mile Road results in queuing that extends back to both the Pine Forest Road and the Nine Mile Road ramp terminal intersections, which then causes queuing onto the I-10 mainline. Furthermore, there is delay and queuing in the AM peak hour on the westbound off-ramp at Nine Mile Road. All other intersections within the study area operate at LOS D or better.

**Table 3-5. Existing Year 2018 Intersection Results Summary**

| Major Rd | Intersection | Control Type | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay[1] (s/veh) | Estimated LOS | Delay[1] (s/veh) | Estimated LOS |
| Beulah Rd | Kingsfield Rd | STOP | 7.6 | A | 3.5 | A |
| | Frank Reeder Rd | STOP | 2.7 | A | 2.2 | A |
| Nine Mile Rd | Beulah Rd | | 94.5 | F | 19.0 | B |
| | Bell Ridge Dr | STOP | 0.8 | A | 0.4 | A |
| | Foxtail Loop | STOP | 1.4 | A | 1.1 | A |
| | Security Pl | STOP | 1.5 | A | 3.6 | A |
| | Heritage Oaks Blvd | | 10.6 | B | 29.7 | C |
| | Navy Federal Way | | 8.6 | A | 16.4 | B |
| | I-10 EB Ramp | STOP | 3.8 | A | 2.9 | A |
| | I-10 WB Ramps | | 68.6 | E | 25.4 | C |
| | Pine Cone Dr | STOP | 5.7 | A | 12.5 | B |
| | Pine Forest Rd | | 43.5 | D | 113.9 | F |
| Pine Forest Rd | Detroit Blvd | STOP | 10.8 | B | 19.4 | C |
| | I-10 WB Ramps | | 24.8 | C | 46.5 | D |
| | I-10 EB Off-Ramp* | | 20.0 | C | 13.7 | B |
| | I-10 EB On-Ramp/Wilde Lake Blvd* | | 30.8 | C | 16.9 | B |

*[1]The reported delay for stop controlled intersections is the worst movement delay; *The I-10 EB On-Ramp is the East Leg of Wilde Lake Blvd in No-Build*

The movement-level intersection results for the interchanges is summarized in **Table 3-6**.

**Table 3-6. Existing Year 2018 Ramp Terminal Movement and Queue Results**

| Major Rd | Intersection and Movement | | 2018 Existing Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | AM Peak | | | | PM Peak | | | |
| | | | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] |
| Nine Mile Road | West Ramp Terminal | EBT | 1 | A | 25 | - | 1 | A | 27 | - |
| | | EBR | Free | - | - | - | - | - | - | - |
| | | WBL | 10 | A | 472 | - | 8 | A | 257 | - |
| | | WBT | 1 | A | 0 | - | 1 | A | 0 | - |
| | | SBL | 31 | D | 120 | 300 | 14 | B | 138 | 300 |
| | | SBR | Free | - | 0 | 300 | Free | - | 0 | 300 |
| | East Ramp Terminal | EBL | 40 | D | 48 | - | 18 | B | 60 | - |
| | | EBT | 34 | C | 342 | - | 22 | C | 584 | - |
| | | WBT | 49 | D | 433 | - | 30 | C | 284 | - |
| | | WBR | Free | - | - | - | - | - | - | - |
| | | NBL | 93 | F | 3376 | 600 | 39 | D | 1,000 | 600 |
| | | NBR | 87 | F | 13 | 600 | 18 | B | 289 | 600 |
| Pine Forest Road | North Ramp Terminal | WBL | 77 | E | 441 | 850 | 58 | E | 1385 | 850 |
| | | WBR | 17 | B | 298 | 850 | 57 | E | 1511 | 850 |
| | | NBL | 31 | C | 304 | - | 42 | D | 687 | - |
| | | NBT | 7 | A | 246 | - | 34 | C | 785 | - |
| | | SBT | 25 | C | 554 | - | 49 | D | 563 | - |
| | | SBR | 4 | A | 193 | - | 6 | A | 202 | - |
| | South Ramp Terminal | EBL | N/A | - | - | - | - | - | - | - |
| | | EBR | 111 | F | 507 | 925 | 70 | E | 612 | 925 |
| | | NBT | Free | - | - | - | - | - | - | - |
| | | NBR | Free | - | - | - | - | - | - | - |
| | | SBL | N/A | - | - | - | - | - | - | - |
| | | SBT | 10 | B | 590 | - | 4 | A | 210 | - |

*[1]Approximate storage is measured from the stop bar to the end of the storage bay; does not include deceleration distance*

## 4.0 FUTURE TRAFFIC FORECASTS

The NWFRPM version 2.1 is the adopted model for the Emerald Coast Regional Council. The NWFRPM I includes areas within the ECRC jurisdiction as well as Jackson, Calhoun, Gulf, Franklin, and Wakulla Counties. The adopted NWFRPM was validated for Base Year 2010 and has a model Horizon Year 2040.

There are two ongoing studies within the AOI for the proposed I-10 at Beulah Road Interchange and Beulah Beltway studies. As a part of these studies, a subarea validation for 2016 and demographic updates were completed (by others), and documented in **Appendix F**. Additionally, the Design Traffic Report for the Beulah Road at I-10 project (FPID 433113-1), dated January 2019, was recently approved and is included in **Appendix F**. The model from this approved study was reviewed as further discussed below.

## 4.1 SOCIOECONOMIC MODEL DATA REVIEW

The updated NWFRPM model was reviewed for reasonableness. As part of the update, several Transportation Analysis Zones (TAZ) were split and changes were made to the roadway network. A technical memorandum (by others) summarizing TAZ modifications to the adopted NWFRPM version 2.1 is included in **Appendix F**.

## 4.2 FUTURE ROADWAY NETWORK REVIEW

The updated model included revisions to the future roadway network to reflect the latest Cost Feasible Plan (CFP), as adopted by the Florida-Alabama Transportation Planning Organization (FL-AL TPO), and in coordination with FDOT. Future changes to the roadway network were incorporated into the model including:

- Beulah Interchange at I-10 (FPID 433113-1) – assumed to be in place by 2026.
- Beulah Beltway (US 29 Connector) from Beulah Road Interchange to US 29 – assumed to be in place by 2046.

It should be noted that Nine Mile Road improvements (in the vicinity of Navy Federal) were not included as background improvements.

## 4.3 SUBAREA MODEL VALIDATION

A subarea model validation was performed for the 2016 validation year model utilized in the approved Design Traffic Report for Beulah Road at I-10 project (FPID 433113-1). The 2016 validation model year was reviewed to ensure the model's ability to replicate 2016 conditions. The 2016 AADT model output volumes were compared to 2016 AADTs (counts) obtained from FTO. The results are shown in **Table 4–1.**

As shown in **Table 4–1**, a volume-over-count ratio was calculated by comparing 2016 model AADT outputs to count data. The 2014 FDOT Project Traffic Forecasting Handbook

provides acceptable and preferable ratios by facility type. As shown, the calculated volume-over-count ratios exceed the acceptable standards for many locations within the study area.

## 4.4 MODEL GROWTH RATE

Given the validation year 2016 model outputs do not meet validation standards for this study area, the direct model outputs were not utilized for traffic forecasting for this project. Instead, compound annual growth rates were derived from the model output and applied to Existing Year 2018 volumes. This methodology was utilized to account for future changes in travel patterns due to background improvements, such as the new Beulah interchange and Beulah Beltway.

The model growth rates were reviewed for reasonableness and adjustments were made as needed. For instance, calculated model growth rates that yielded negative growth rates or extremely high growth rates were reviewed to determine whether the context and future land use or roadway network warranted the respective growth rate. The calculated average historic growth rate from the FDOT Trends Analysis Tool was used as a baseline for these situations, with the exception of Pine Forest Road north of Nine Mile Road, where the calculated growth rate for 2045 (0.46%) was also used for 2025 due to the 2025 model growth rate yielding -0.79%. The **Table 4–2** summarizes the calculated model growth rates as well as the adjusted growth rates.

**Table 4-1. Subarea Model Validation**

| Road | Facility | Count Location | 2016 AADT Model Output | 2016 AADT (FTO) | Measured Volume-Over-Count Ratios | Acceptable Volume-Over-Count Ratios* | Preferable Volume-Over-Count Ratios* |
|---|---|---|---|---|---|---|---|
| I-10 | Freeway | West of Nine Mile Rd | 29,336 | 28,500 | 2.93% | 7% | 6% |
| | | Between Nine Mile Rd and Pine Forest Rd | 38,227 | 43,754 | 12.63% | 7% | 6% |
| | | East of Pine Forest Rd | 49,093 | 56,048 | 12.41% | 7% | 6% |
| 9 Mile Rd | Arterial | West of Beulah Rd. | 4,352 | 4,700 | 7.40% | 15% | 10% |
| | | West of Bell Ridge Dr | 12,471 | 14,500 | 13.99% | 15% | 10% |
| | | West of I-10 (East of Navy Federal Wy.) | 15,371 | 22,500 | 31.68% | 15% | 10% |
| | | West of Pine Forest Rd. | 11,118 | 13,600 | 18.25% | 15% | 10% |
| | | East of Pine Forest Rd. | 19,437 | 23,500 | 17.29% | 15% | 10% |
| Pine Forest Rd | Arterial | North of Nine Mile Rd. | 17,373 | 21,500 | 19.20% | 15% | 10% |
| | | South of Nine Mile Rd. | 23,881 | 26,500 | 9.88% | 15% | 10% |
| | | South of I-10 (South of Chellie Rd.) | 30,083 | 31,500 | 4.50% | 15% | 10% |
| Beulah Rd | Arterial | North of 9 Mile | 9,595 | 4,800 | 99.90% | 15% | 10% |
| | | South of 9 Mile | 6,531 | 5,200 | 25.60% | 15% | 10% |

*Per the FDOT Project Traffic Forecasting Handbook, 2014

**Table 4-2. Model Growth Rates**

| Road | Facility | Count Location | NWFRPM Output - Beulah IJR | | | | | Adjusted Growth Rates | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2016 Validation Year Model Output | 2025 Build Model Output | 2045 Build Model Output | 2016/2025 Model Growth | 2016/2045 Model Growth | 2016/2025 Growth | 2016/2045 Growth |
| I-10 | Freeway | West of Beulah Rd. | 29,336 | 34,142 | 39,688 | 1.70% | 1.05% | 1.70% | 1.05% |
| | | West of Nine Mile Rd | 29,336 | 43,577 | 64,500 | 4.49% | 2.75% | 4.49% | 2.75% |
| | | Between Nine Mile Rd and Pine Forest Rd | 38,227 | 53,007 | 74,026 | 3.70% | 2.31% | 3.70% | 2.31% |
| | | East of Pine Forest Rd | 49,093 | 56,916 | 76,198 | 1.66% | 1.53% | 1.66% | 1.53% |
| 9 Mile Rd | Arterial | West of Beulah Rd. | 4,352 | 10,157 | 14,332 | 9.87% | 4.20% | 9.87% | 4.20% |
| | | East of Beulah Rd. | 12,471 | 16,427 | 30,725 | 3.11% | 3.16% | 3.11% | 3.16% |
| | | West of Bell Ridge Dr | 12,471 | 16,427 | 30,725 | 3.11% | 3.16% | 3.11% | 3.16% |
| | | East of Foxtail Loop | 12,471 | 16,427 | 30,725 | 3.11% | 3.16% | 3.11% | 3.16% |
| | | West of Heritage Oaks Blvd | 14,476 | 19,244 | 33,776 | 3.21% | 2.96% | 3.21% | 2.96% |
| | | West of Navy Federal Way | 14,476 | 19,244 | 33,776 | 3.21% | 2.96% | 3.21% | 2.96% |
| | | East of Navy Federal Way | 15,371 | 27,646 | 37,409 | 6.74% | 3.11% | 6.74% | 3.11% |
| | | West of I-10 (East of Navy Federal Wy.) | 15,371 | 27,646 | 37,409 | 6.74% | 3.11% | 6.74% | 3.11% |
| | | Between I-10 ramps | 12,830 | 23,175 | 32,843 | 6.79% | 3.29% | 6.79% | 3.29% |
| | | West of Pine Forest Rd. | 11,118 | 18,705 | 26,664 | 5.95% | 3.06% | 5.95% | 3.06% |
| | | East of Pine Forest Rd. | 19,437 | 31,917 | 39,611 | 5.67% | 2.49% | 5.67% | 2.49% |
| | Ramps | WB off-ramp | 6,702 | 8,235 | 8,570 | 2.32% | 0.85% | 2.32% | 0.85% |
| | | WB on-ramp | 1,987 | 3,089 | 3,419 | 5.02% | 1.89% | 5.02% | 1.89% |
| | | EB off-ramp | 2,042 | 3,081 | 3,694 | 4.68% | 2.07% | 4.68% | 2.07% |
| | | EB on-ramp | 6,218 | 7,366 | 8,068 | 1.90% | 0.90% | 1.90% | 0.90% |
| Pine Forest Rd | Arterial | North of Nine Mile Rd. | 17,373 | 16,181 | 19,852 | -0.79% | 0.46% | 0.46% | 0.46% |
| | | South of Nine Mile Rd. | 23,881 | 24,874 | 33,375 | 0.45% | 1.16% | 0.45% | 1.16% |
| | | South of Detroit Blvd | 26,232 | 29,978 | 36,104 | 1.49% | 1.11% | 1.49% | 1.11% |
| | | South of I-10 (South of Chellie Rd.) | 30,083 | 33,026 | 39,292 | 1.04% | 0.93% | 1.04% | 0.93% |
| | Ramps | WB off-ramp | 7,151 | 5,601 | 7,931 | -2.68% | 0.36% | 1.69% | 1.69% |
| | | WB on-ramp | 2,151 | 3,981 | 6,748 | 7.08% | 4.02% | 7.08% | 4.02% |
| | | EB off-ramp (to SB Pine Forest Rd) | 1,432 | 4,354 | 7,429 | 13.15% | 5.84% | 1.69% | 1.69% |
| | | EB off-ramp (loop to NB Pine Forest Rd) | - | - | - | - | - | 1.69% | 1.69% |
| | | EB on-ramp | 7,299 | 6,643 | 8,419 | -1.04% | 0.49% | 1.69% | 1.69% |
| Wilde Lake Blvd | Arterial | West of Pine Forest | - | - | - | - | - | 1.69% | 1.69% |
| Beulah Rd | Arterial | South of Frank Reeder Rd | 9,595 | 7,262 | 23,940 | -3.05% | 3.20% | 3.20% | 3.20% |
| | | North of 9 Mile | 9,595 | 7,262 | 23,940 | -3.05% | 3.20% | 3.20% | 3.20% |
| | | South of 9 Mile | 6,531 | 8,722 | 18,368 | 3.27% | 3.63% | 3.27% | 3.63% |
| US 29 | Ramps | WB on-ramp | 89 | 135 | 191 | 4.74% | 2.67% | 4.74% | 2.67% |
| | | EB off-ramp | 5,259 | 5,449 | 6,802 | 0.40% | 0.89% | 1.69% | 1.69% |

## 4.5 FUTURE AADT

Opening Year 2026 and Design Year 2046 AADT volumes were estimated by applying the adjusted compound annual model growth rates to the 2018 AADT volumes. Opening Year 2026 and Design Year 2046 AADT volumes were then balanced and adjusted, as appropriate. Traffic volumes from the approved Design Traffic Report for the Beulah IJR were used as a baseline at the proposed interchange. The resulting volumes are shown in **Figure 4–1** and **Figure 4–2**.

## 4.6 FUTURE DDHV

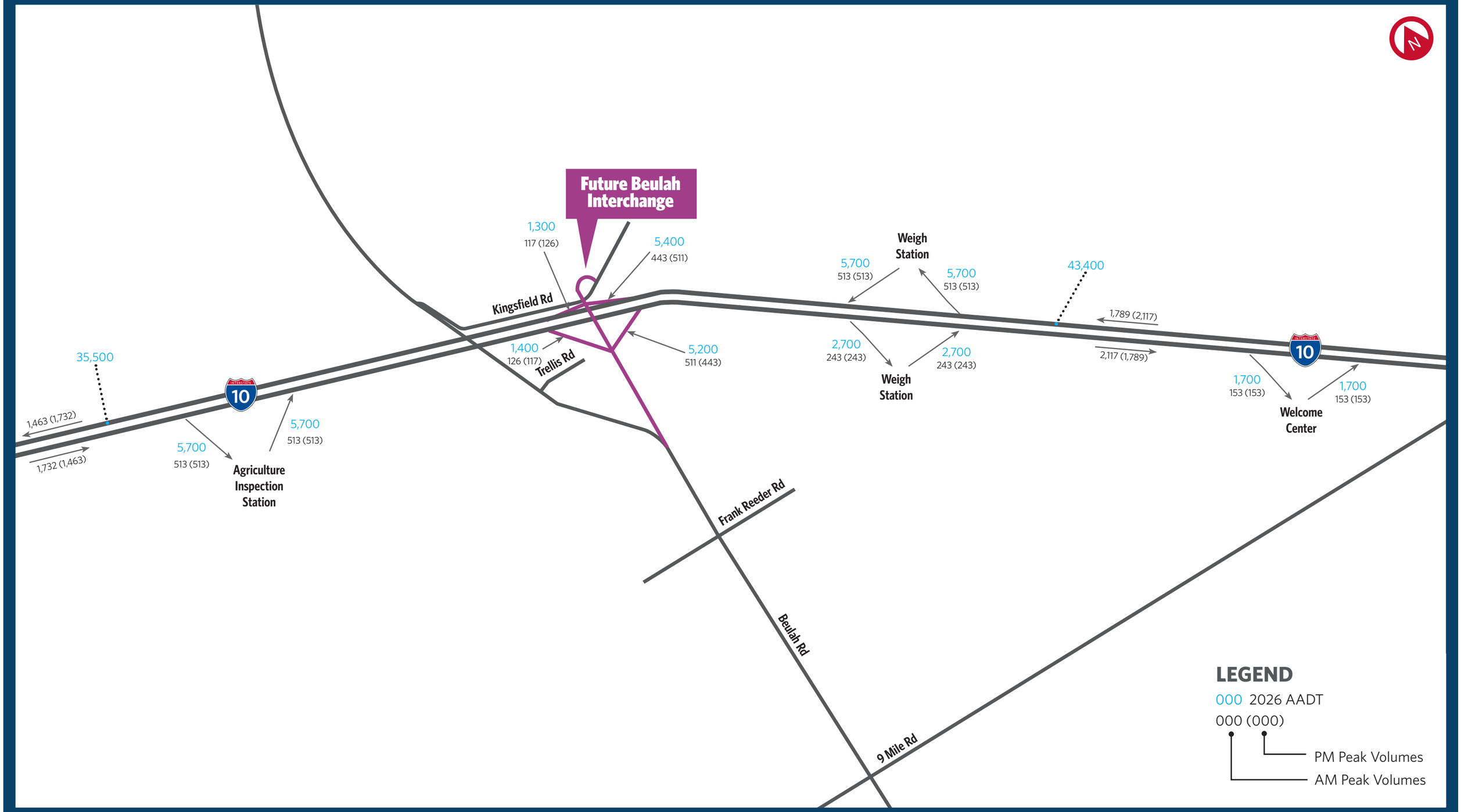
The design traffic development for this study is consistent with the procedures outlined in the FDOT 2014 Project Traffic Forecasting Handbook. Consistent with the MLOU, a standard K factor of 0.09 was used and D factors obtained from FTO were within acceptable ranges. The factors utilized along the mainline are summarized in **Table 4–3**. Future DDHV volumes were estimated by applying the K and D factors to the future AADT volumes. Volumes were checked for reasonableness and then balanced along the ramps and mainline. The resulting future DDHV volumes are shown in **Figure 4–1** and **Figure 4–2**.

**Table 4-3. K and D Factors**

| Road | Facility | Count Location | K | D |
|---|---|---|---|---|
| I-10 | Freeway | West of Beulah Rd. | 9.00% | 54.20% |
| | | West of Nine Mile Rd | 9.00% | 54.20% |
| | | Between Nine Mile Rd and Pine Forest Rd | 9.00% | 53.50% |
| | | East of Pine Forest Rd | 9.00% | 51.70% |

## 4.7 FUTURE PEAK HOUR TURNING MOVEMENT VOLUMES

The FDOT approved TMTool was used to develop future turn volumes for both AM and PM peak hours at each study intersection. The TMTool worksheets are provided in **Appendix G**. Traffic volumes from the approved Design Traffic Report for the Beulah IJR were used as a baseline at the proposed interchange. Additionally, the proposed future expansion of the NFCU campus to 10,000 employees by Opening Year 2026 was accounted for in future traffic volumes. Specifically, volumes along Nine Mile Road at the campus' access points were increased for year 2026 and distributed throughout the study area based on existing travel patterns and model results. No additional NFCU campus expansions were assumed for year 2046. Volumes were checked for reasonableness and then balanced along the study intersections. Opening Year 2026 and Design Year 2046 turning movement volumes are provided in **Figure 4–3** and **Figure 4–4**, respectively.

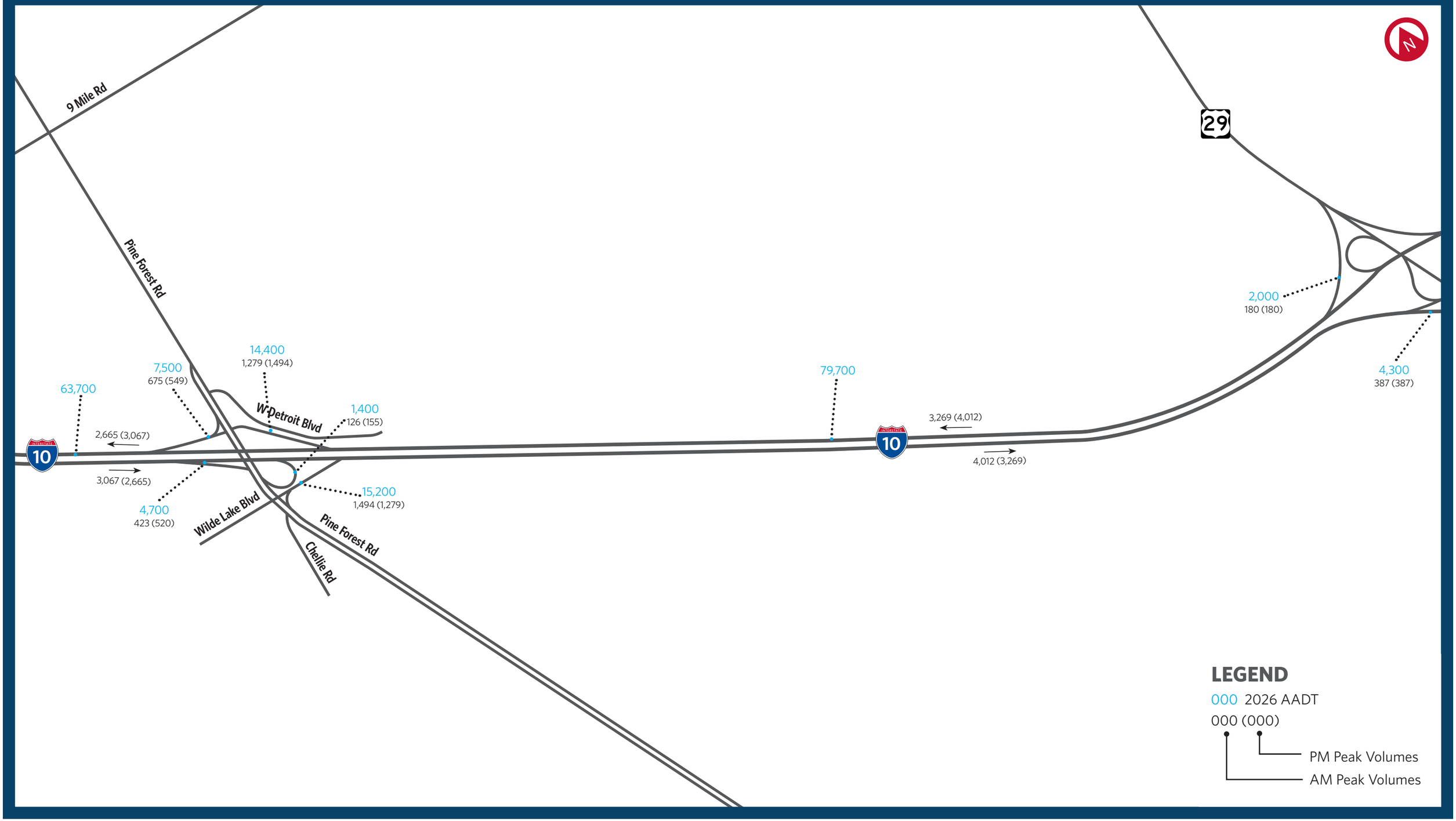



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 4-1: Opening Year (2026) AADT + DDHV

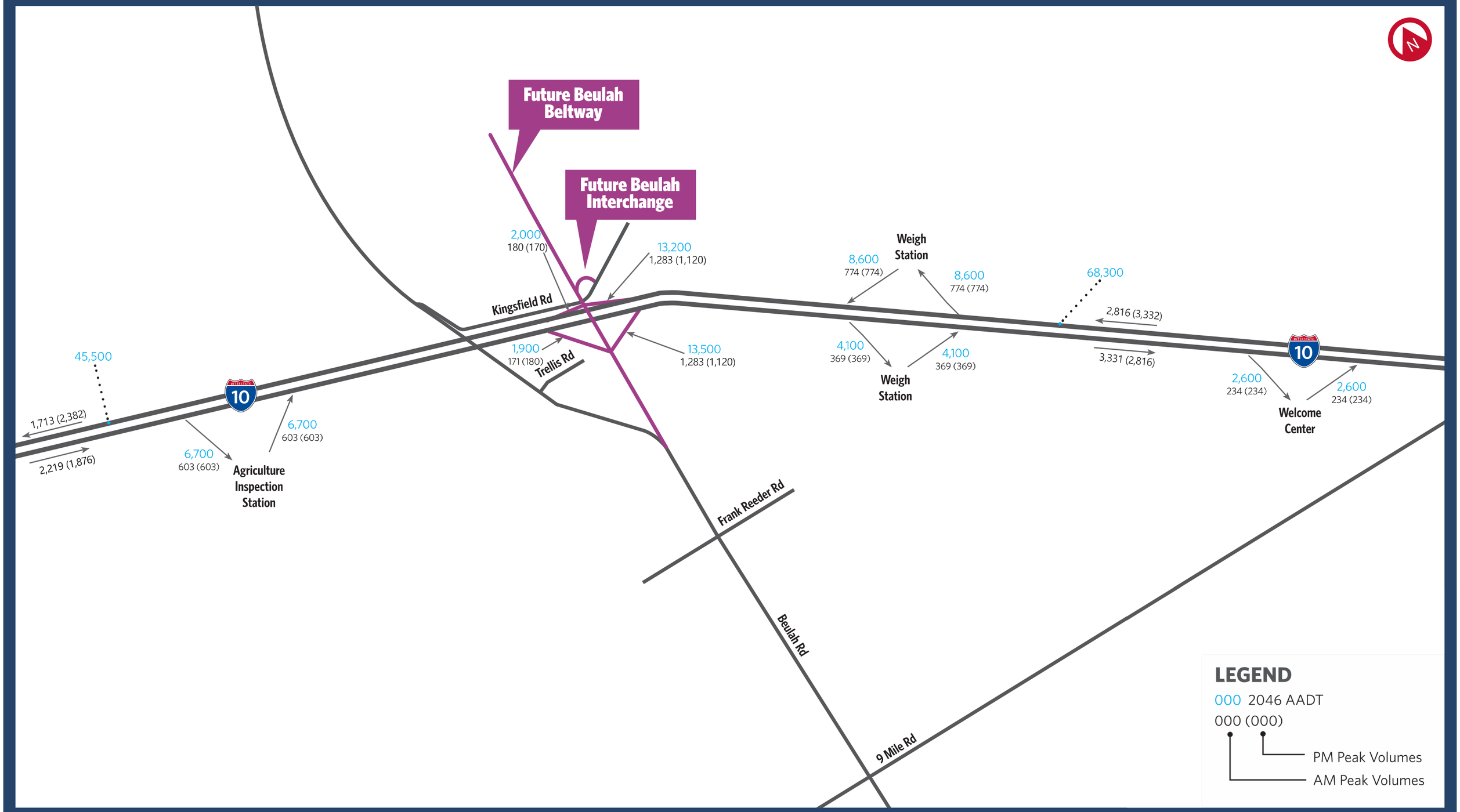

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 4-1:** Opening Year (2026) AADT + DDHV




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 4-1:** Opening Year (2026) AADT + DDHV

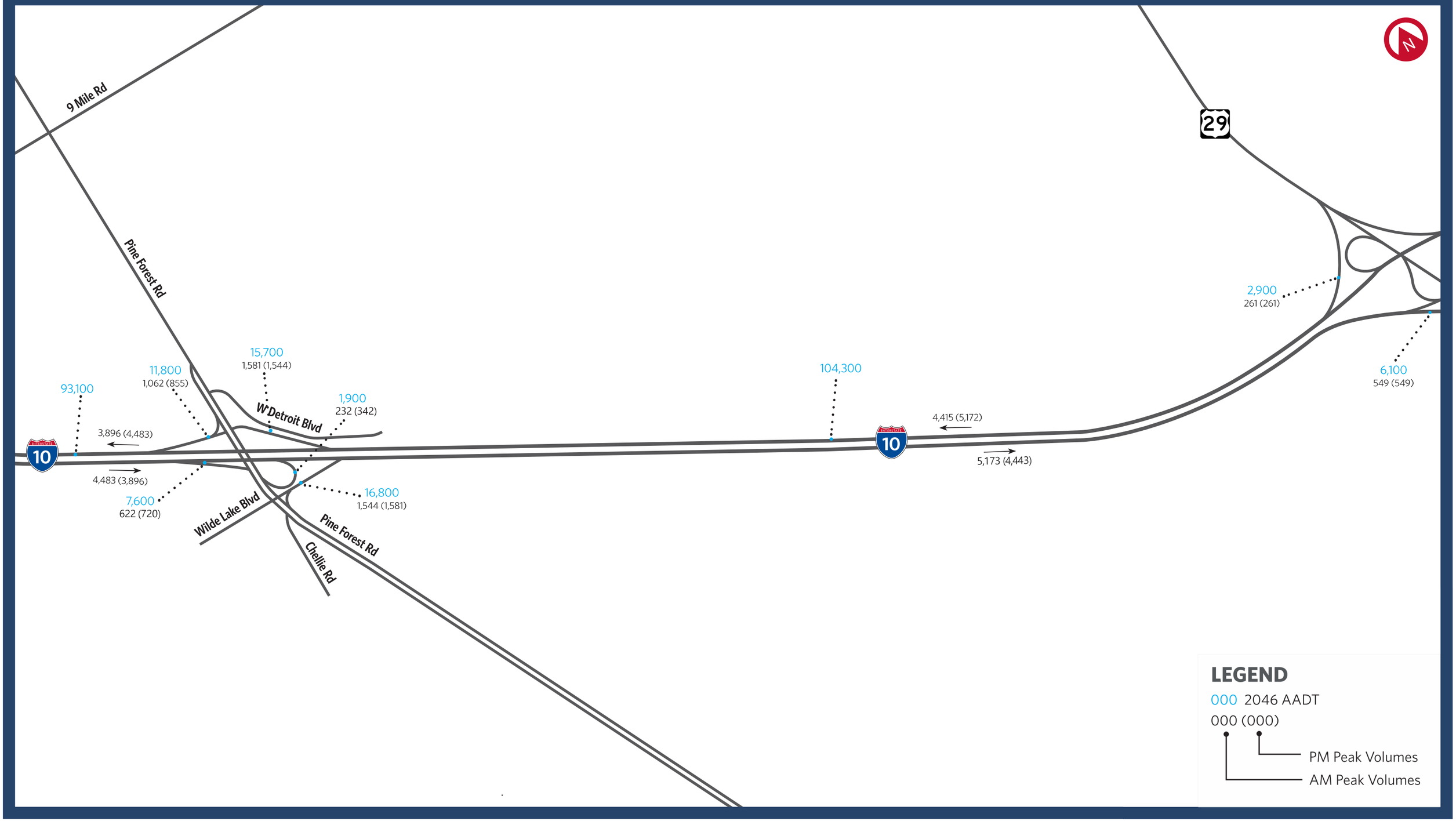



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 4-2:** Design Year (2046) AADT + DDHV

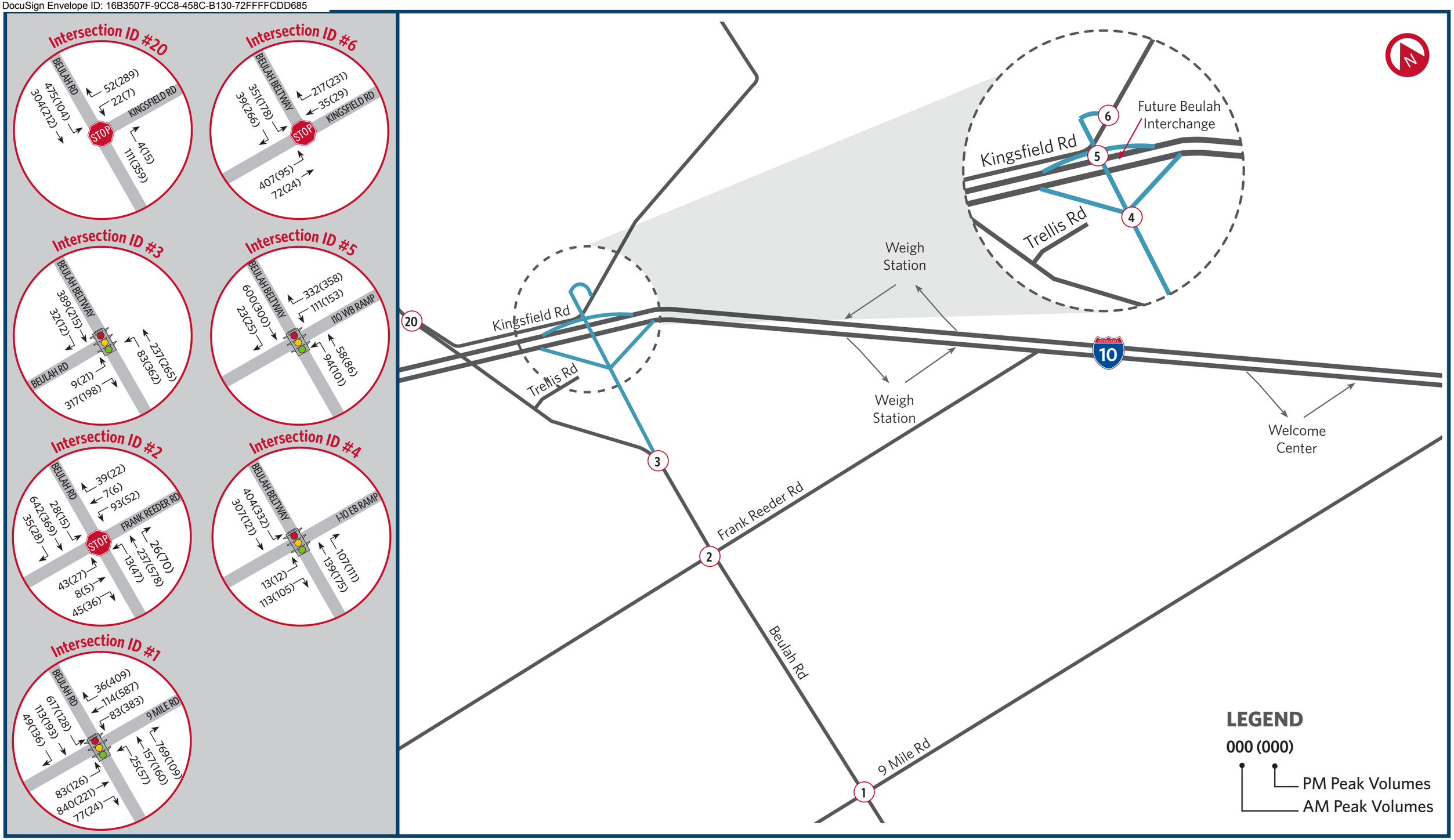

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 4-2:** Design Year (2046) AADT + DDHV



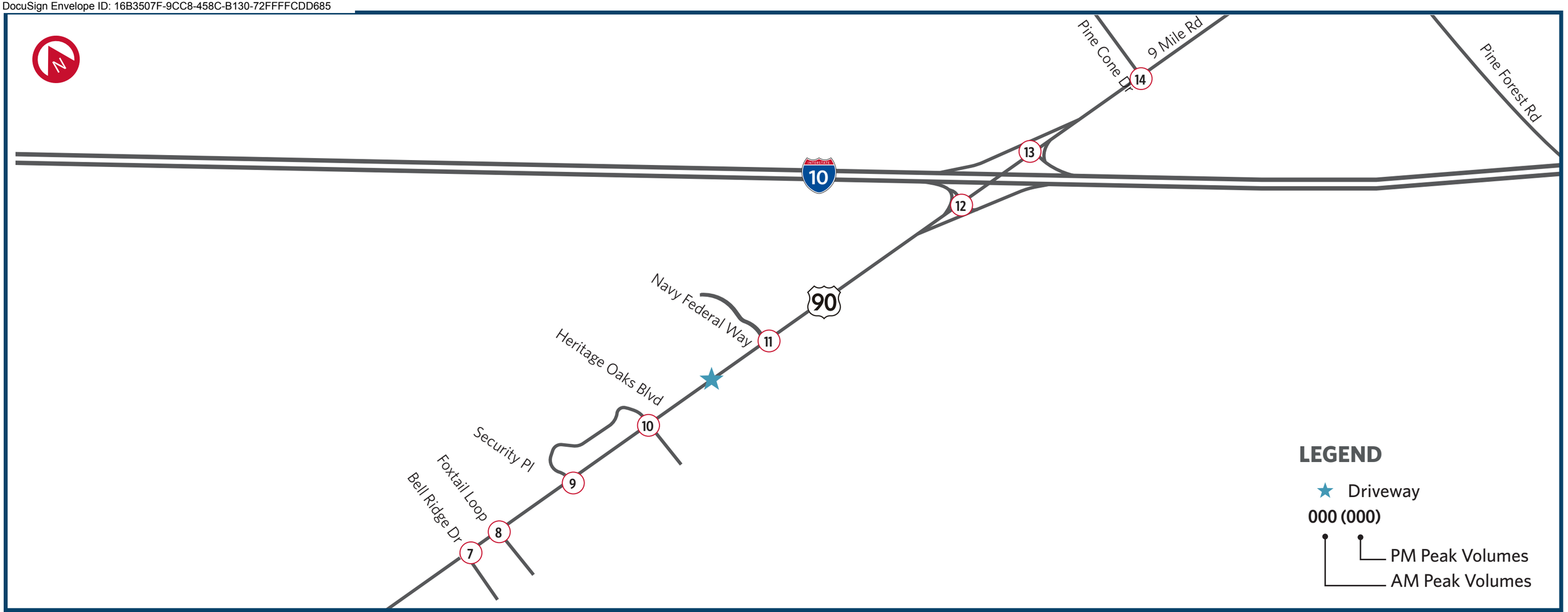

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

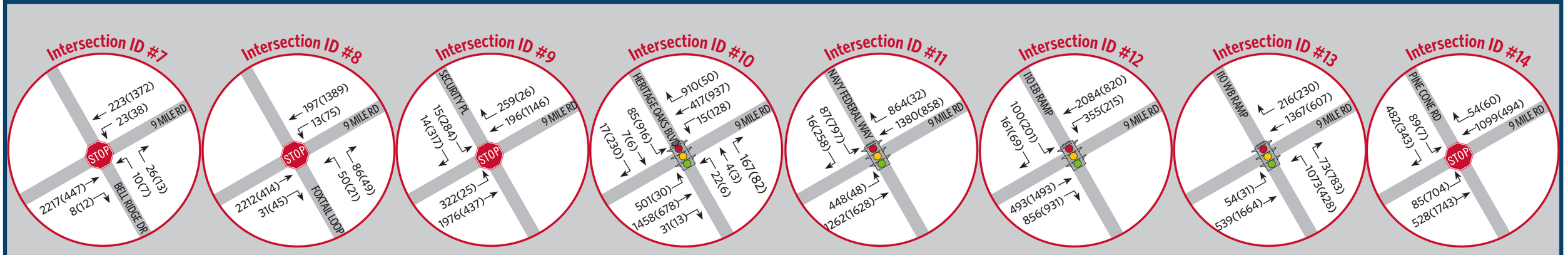
**Figure 4-2:** Design Year (2046) AADT + DDHV




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

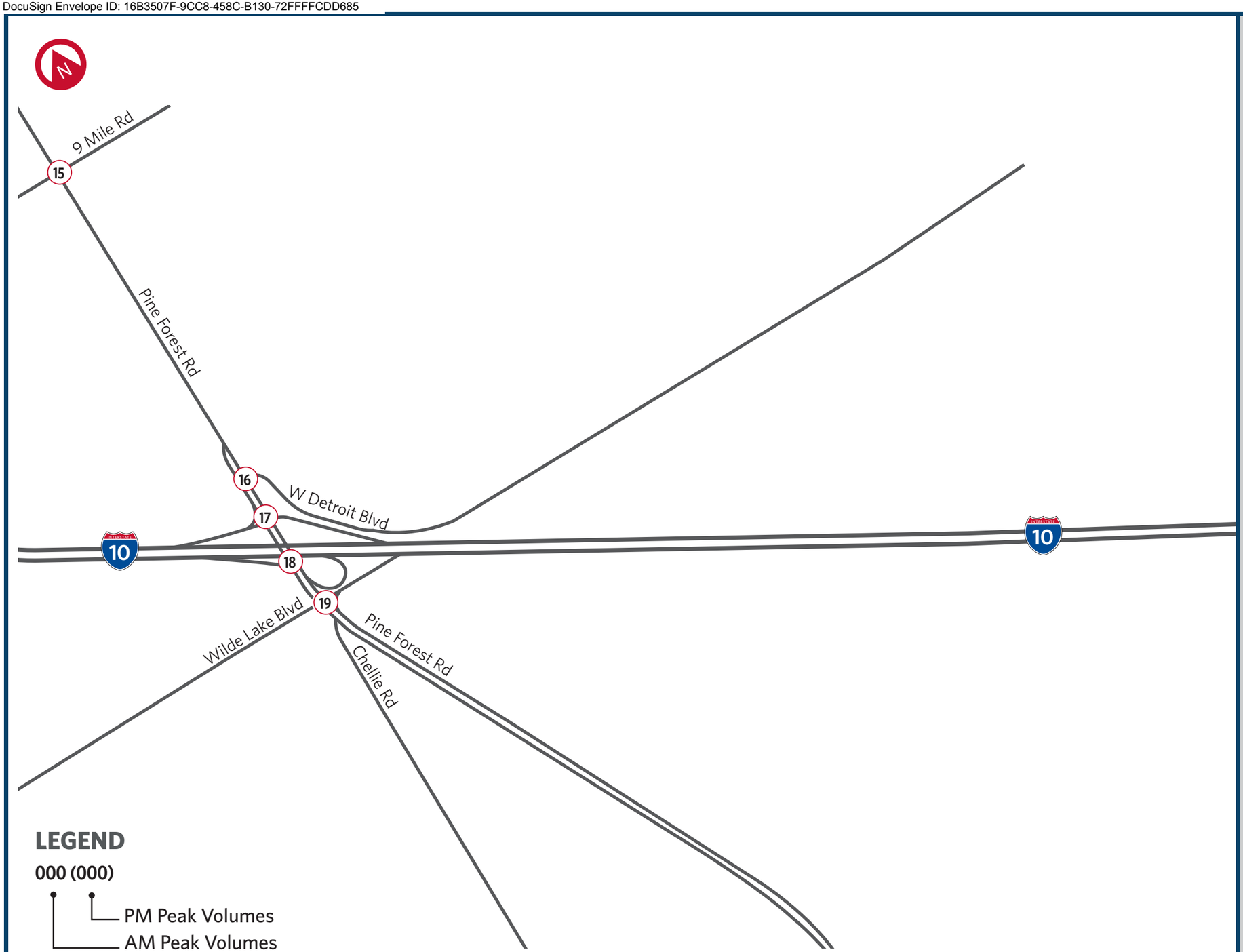
Figure 4-3: Future (2026) Peak Hour Turning Movement Volumes

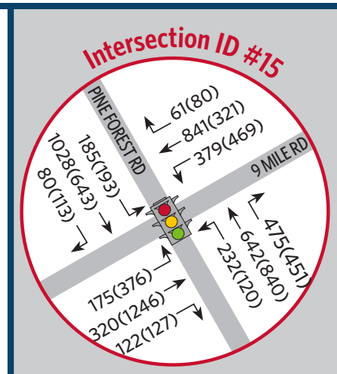


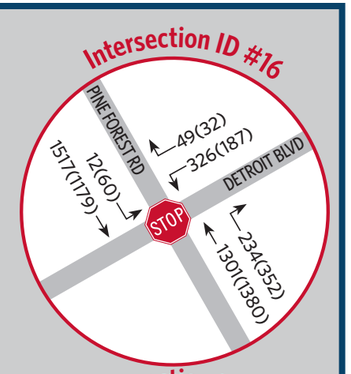



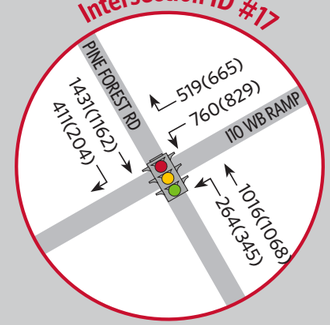

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

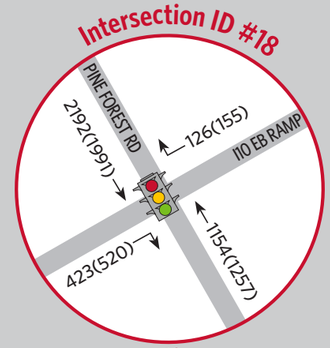
Figure 4-3: Future (2026) Peak Hour Turning Movement Volumes

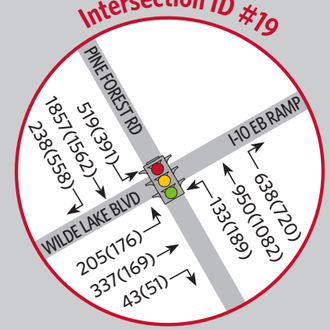


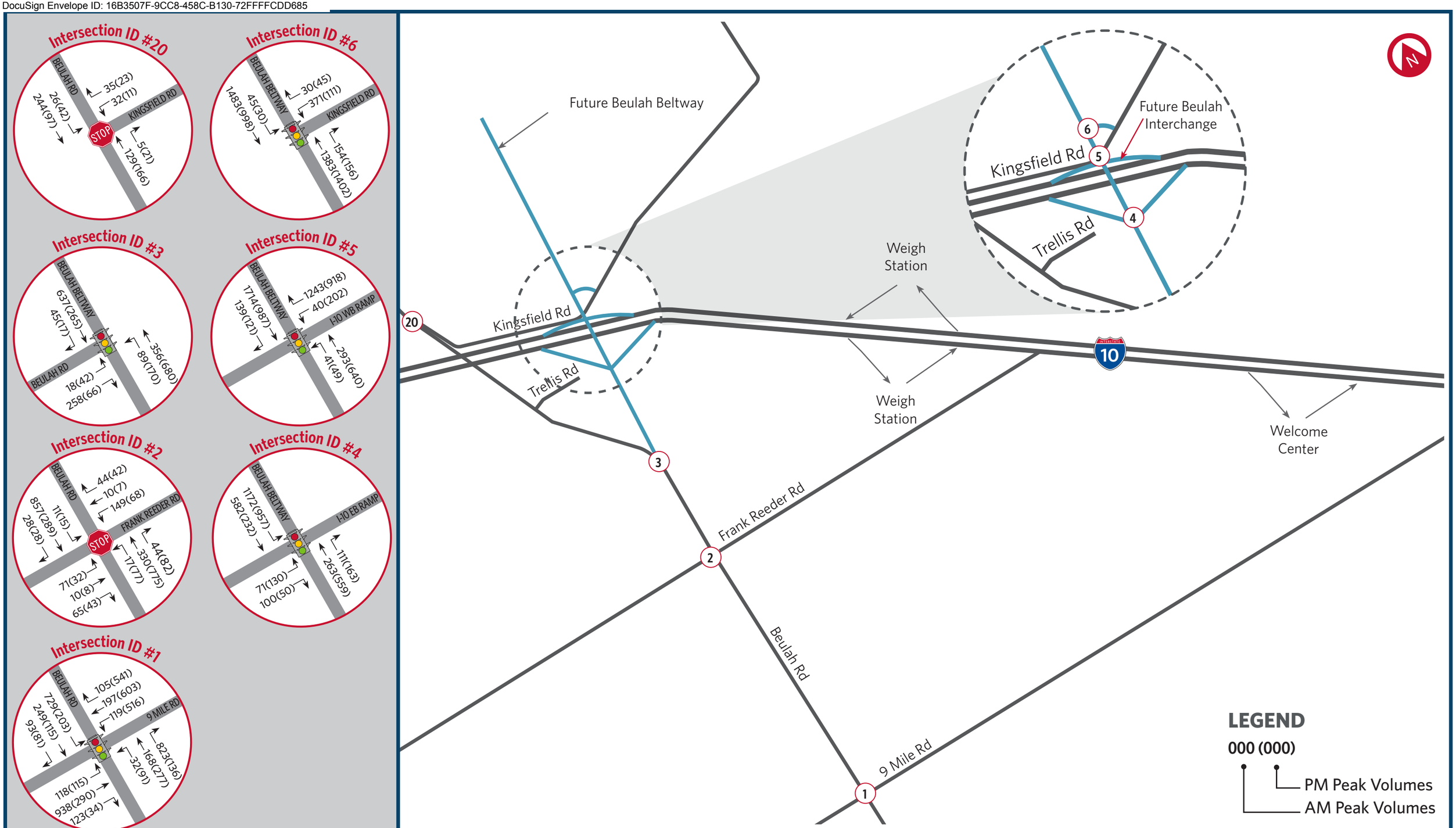



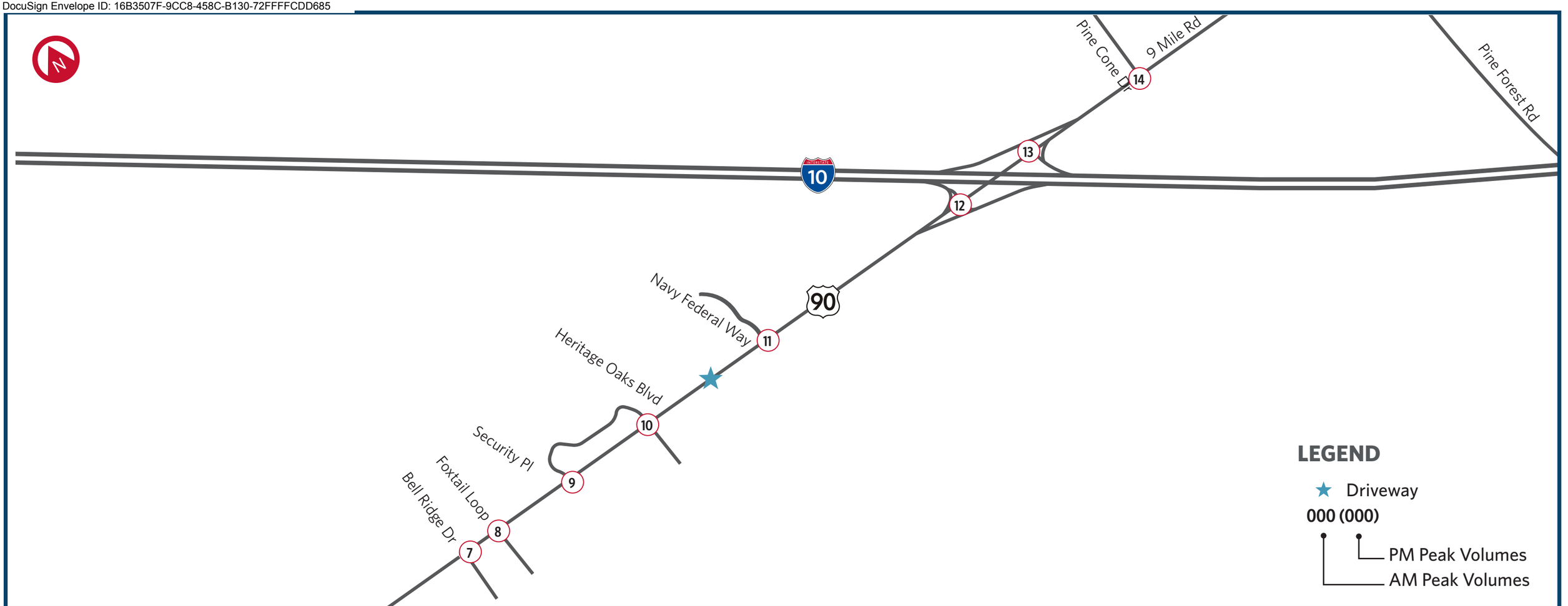

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

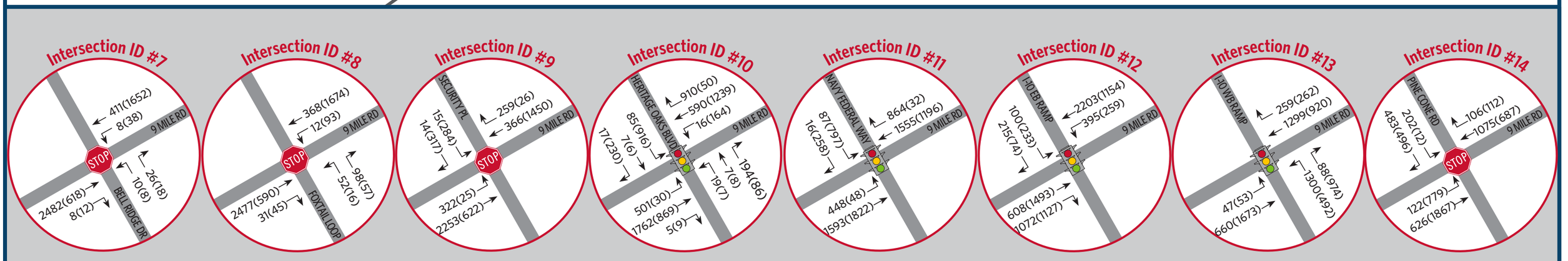
Figure 4-3: Future (2026) Peak Hour Turning Movement Volumes




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

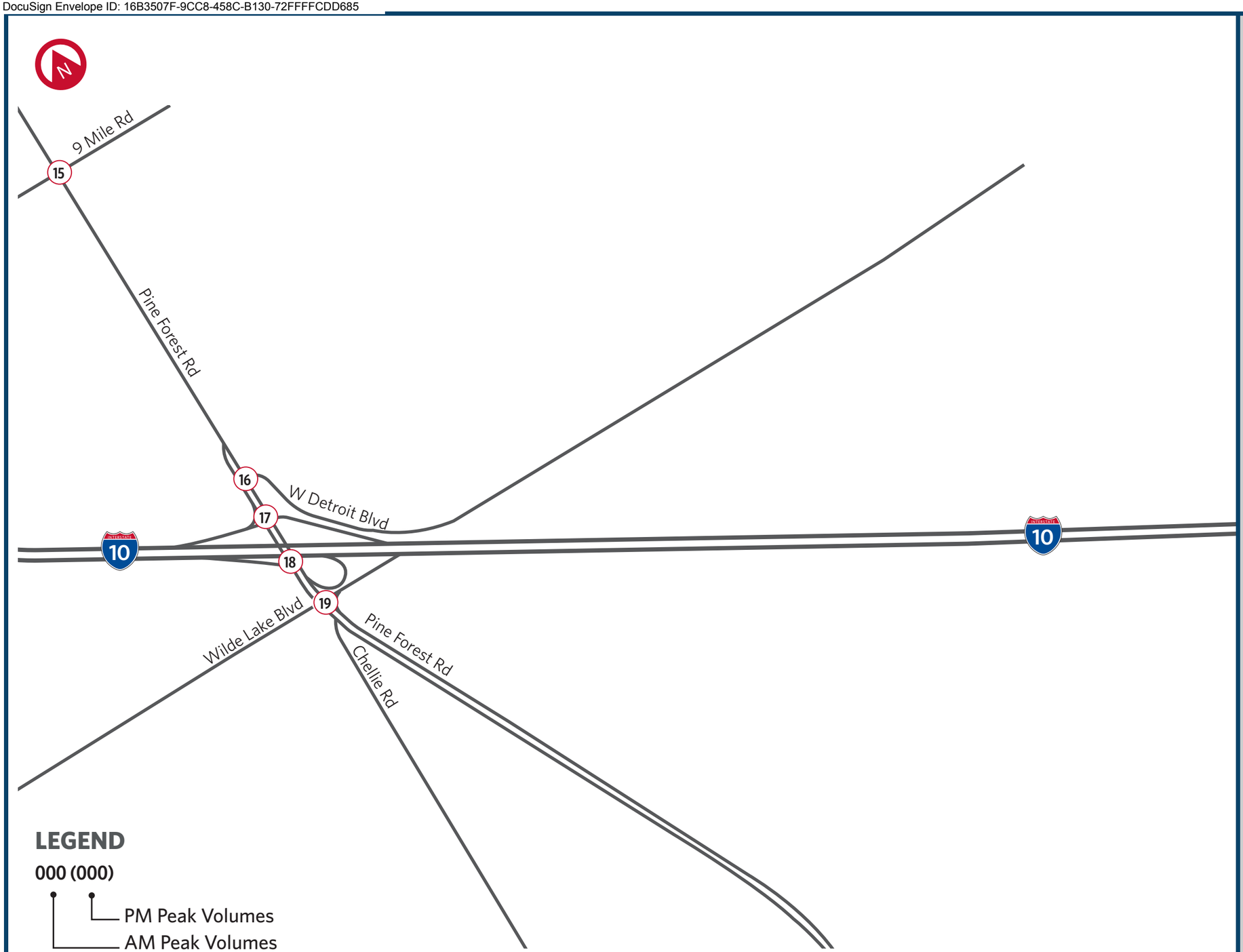
Figure 4-4: Future (2046) Peak Hour Turning Movement Volumes

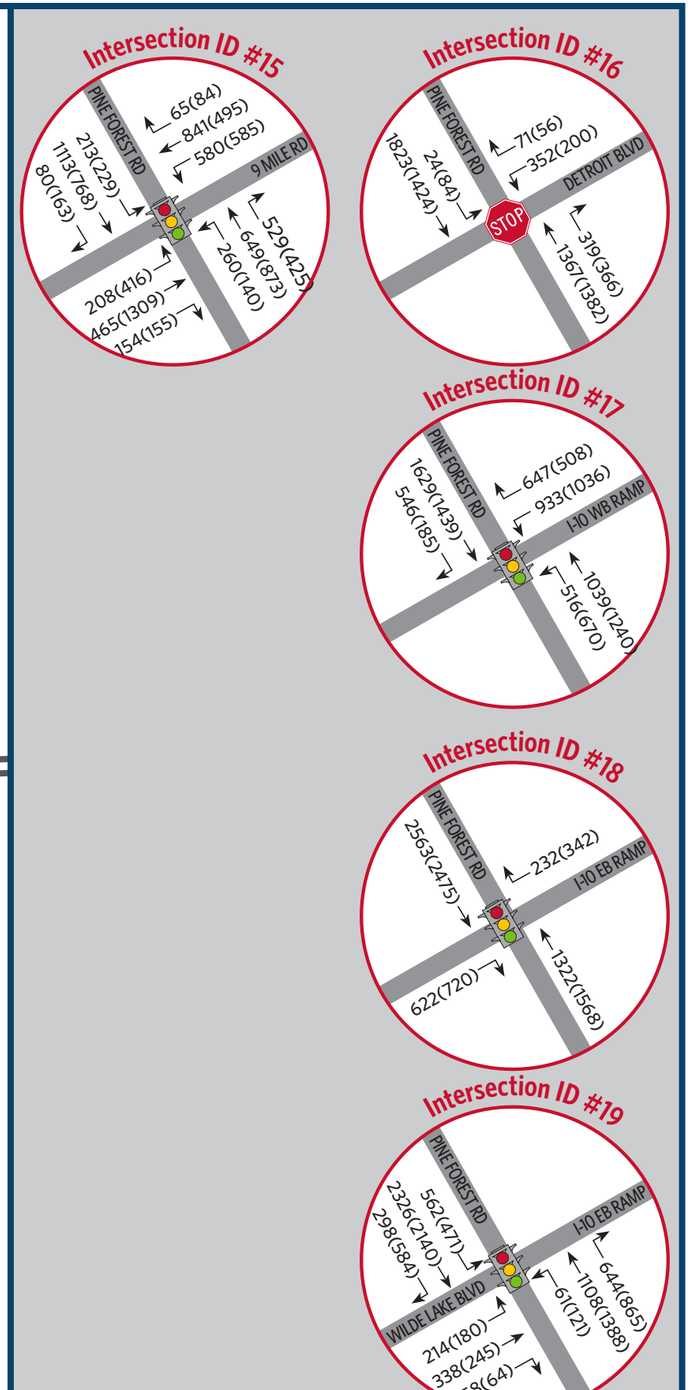



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 4-4: Future (2046) Peak Hour Turning Movement Volumes




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

**Figure 4-4:** Future (2046) Peak Hour Turning Movement Volumes

# 5.0 CONSIDERED ALTERNATIVES

Consistent with the approved MLOU, the following alternatives were considered in this SIMR:

- No-Build Alternative
- Build Alternative

These alternatives are further discussed below.

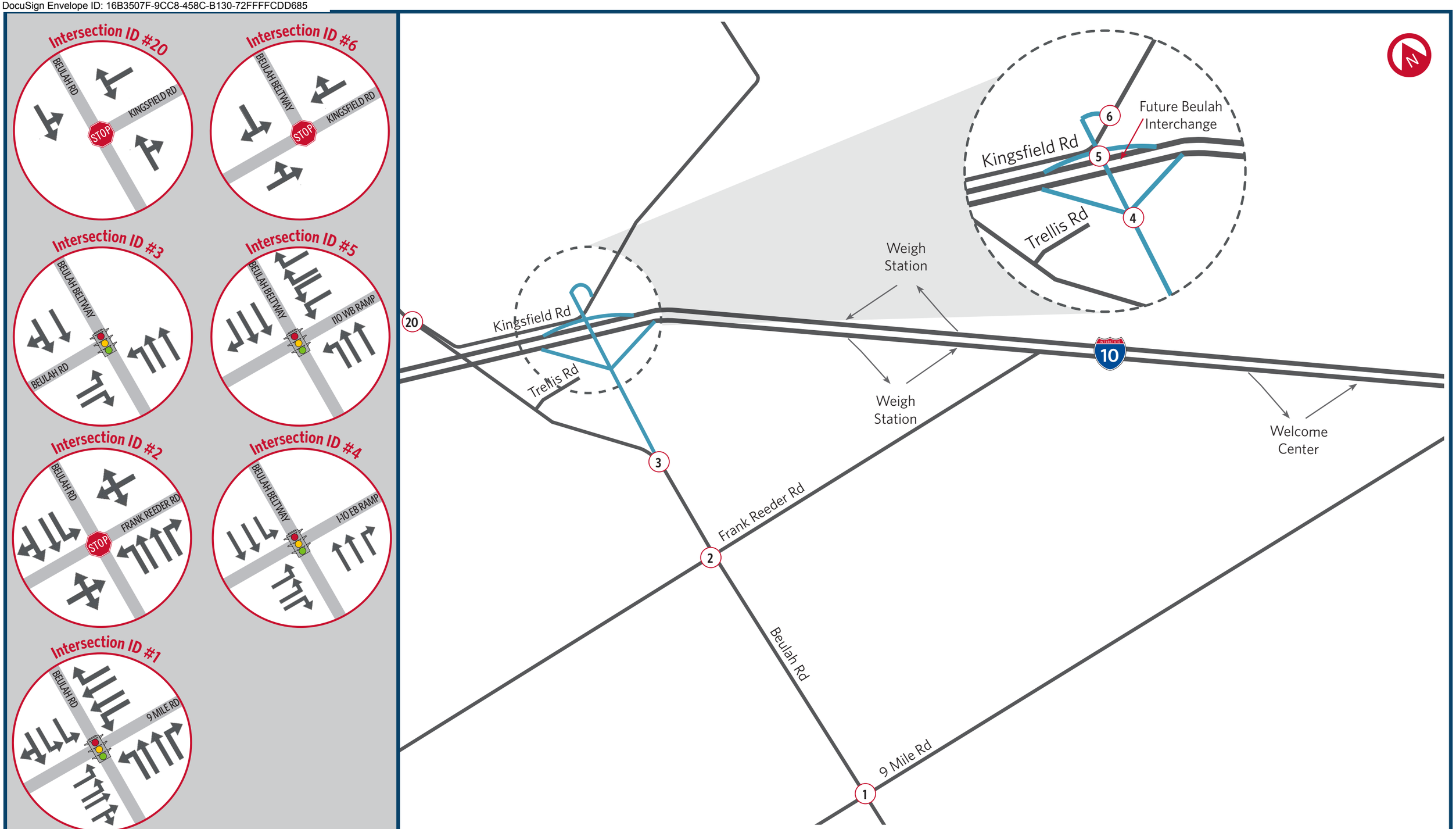
## 5.1 NO-BUILD ALTERNATIVE

The No-Build (no action) alternative maintains the existing four-lane section on the I-10 mainline and has no additional improvements to the existing interchanges at Nine Mile Road and Pine Forest Road.

The No-Build Alternative includes planned and programmed improvements, and the improvements assumed to be in place as discussed in Section 1.3 Planned and Programmed Transportation Projects. These improvements are listed in **Table 5–1** and further discussed in Section 1.3. The no-build lane configurations are depicted in **Figure 5-1**.

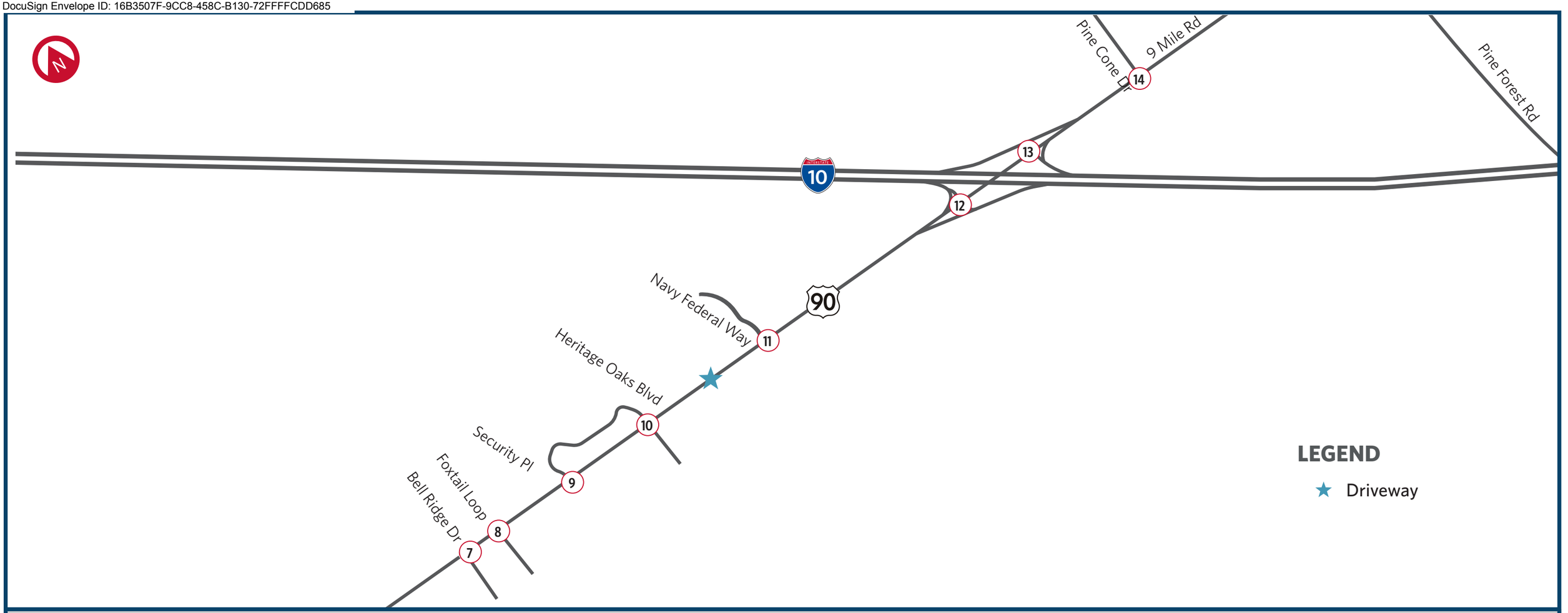
**Table 5-1. Planned and Programmed Improvements**

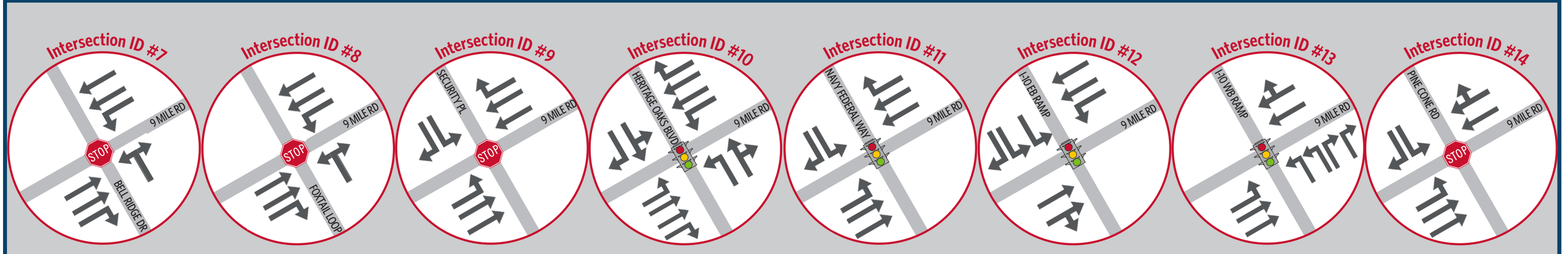
| Roadway | Improvement | Analysis Year/s |
|---|---|---|
| **I-10 at US 29 Interchange** | Ultimate improvements | 2026 and 2046 |
| **Nine Mile Road** | Widen 2 to 4 lanes from Beulah Rd to US 29 and intersection improvements | 2026 and 2046 |
| **Nine Mile Road** | Widen 2 to 4 lanes from Mobile Highway to Beulah Road | 2046 |
| **Nine Mile Road** | Widen 4 to 6 lanes from Beulah Road to east of I-10 and intersection improvements | 2046 |
| **Pine Forest Road** | Widen to 2 to 4 lanes from I-10 to Nine Mile Road | 2046 |
| **US 29** | Widen 4 to 6 lanes from I-10 to Nine Mile Road | 2026 and 2046 |
| **I-10 at Beulah Beltway Interchange** | New interchange | 2026 and 2046 |
| **Beulah Road** | Widen 2 to 4 lanes from Nine Mile Road to Kingsfield Road and intersection improvements | 2026 and 2046 |
| **Beulah Beltway** | New 4-Lane facility from Beulah/I-10 interchange to US 29 | 2046 |




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

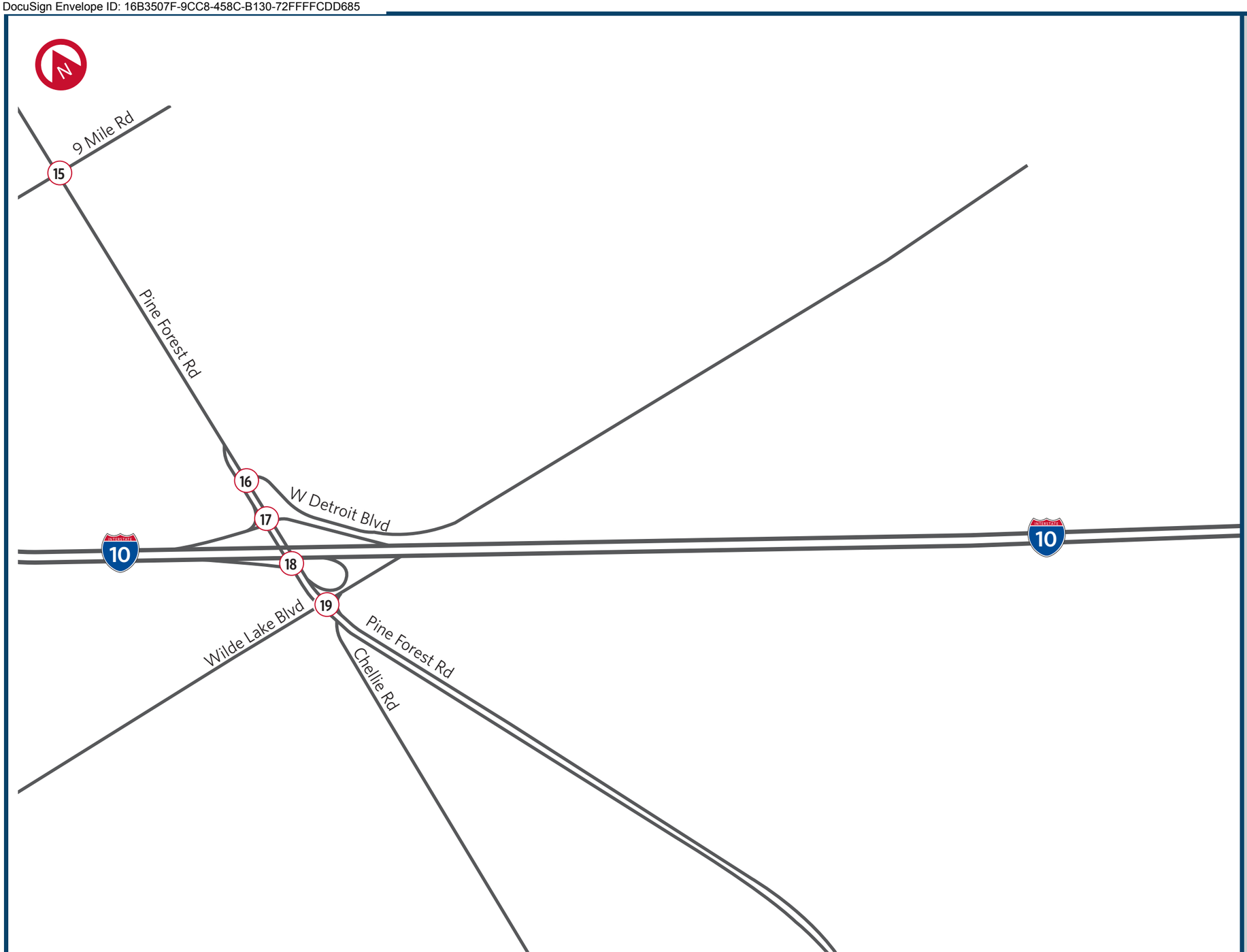
Figure 5-1: Future Year 2026 No-Build Lane Configurations

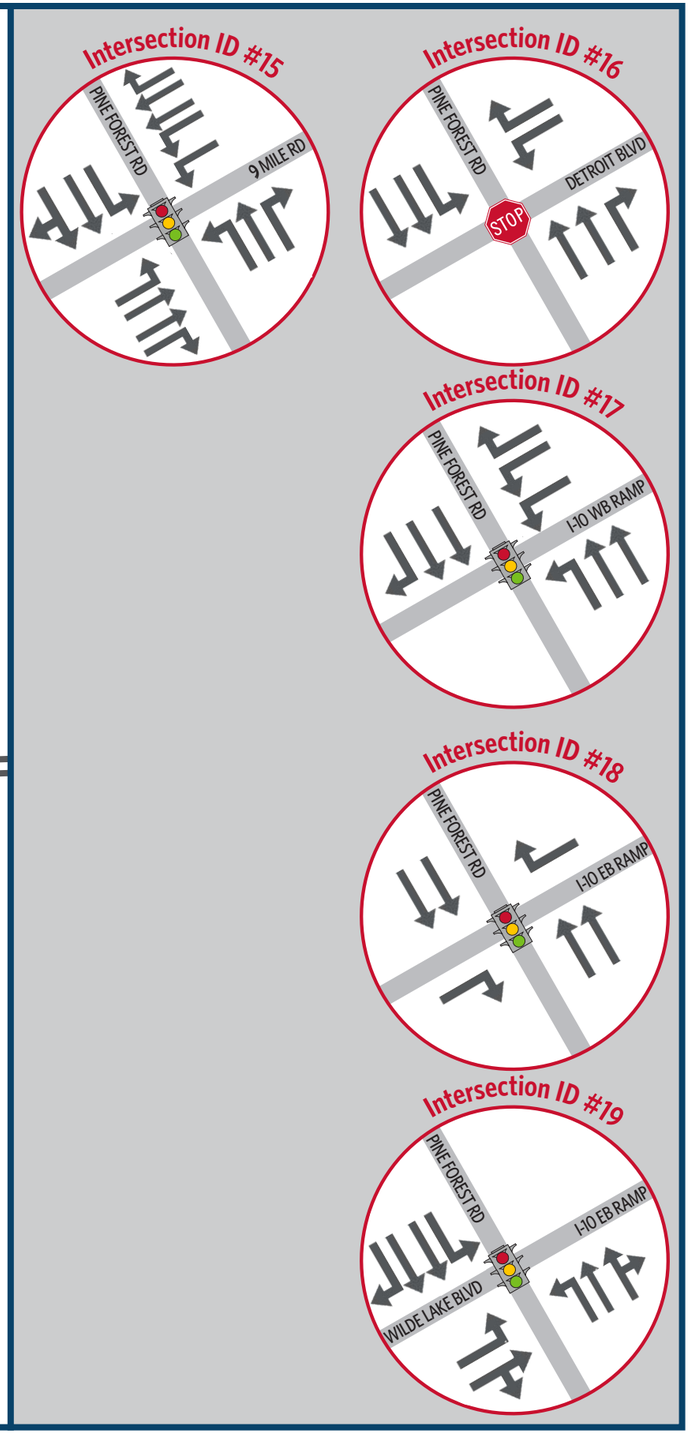



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

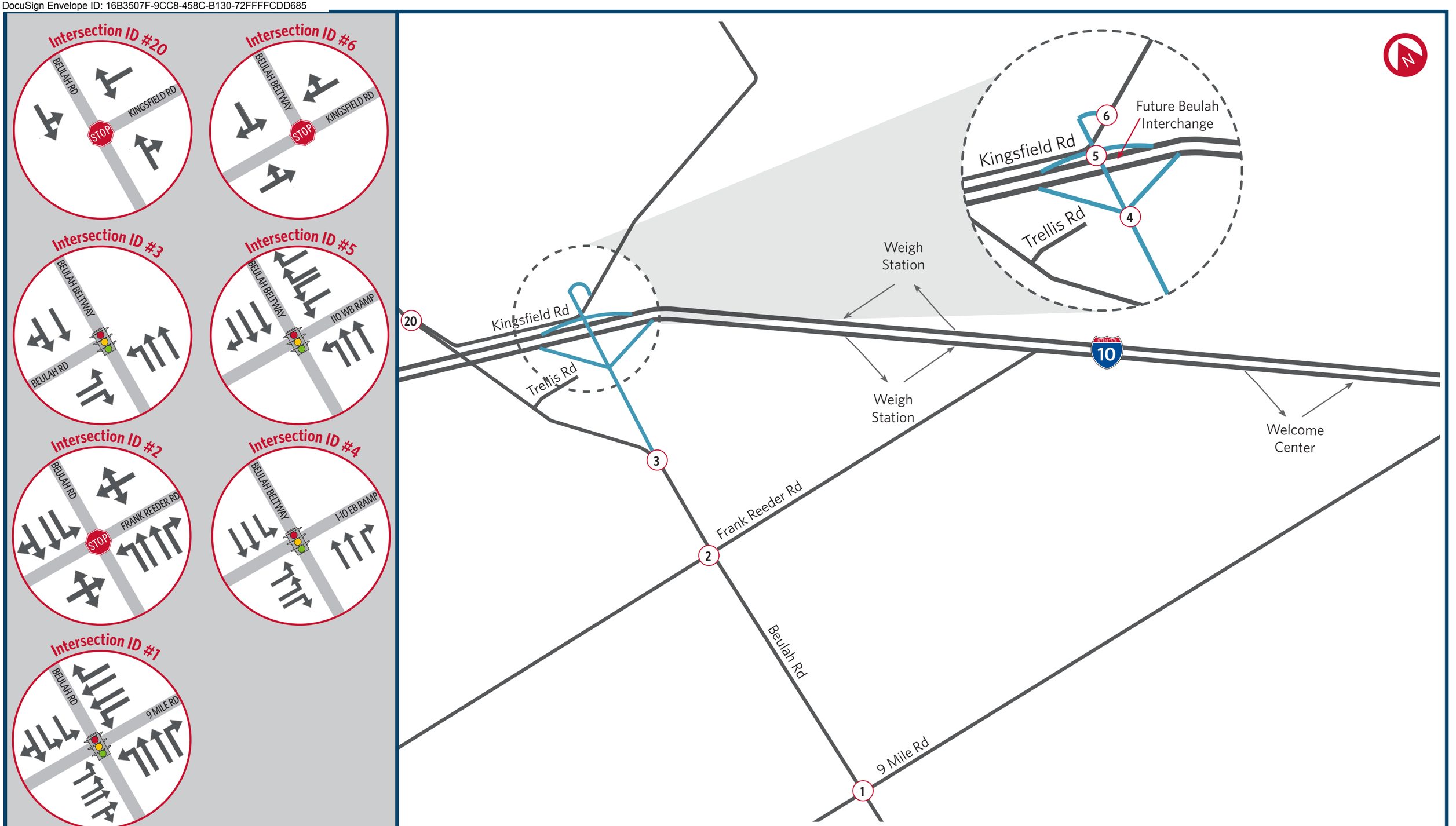
## Figure 5-1: Future Year 2026 No-Build Lane Configurations



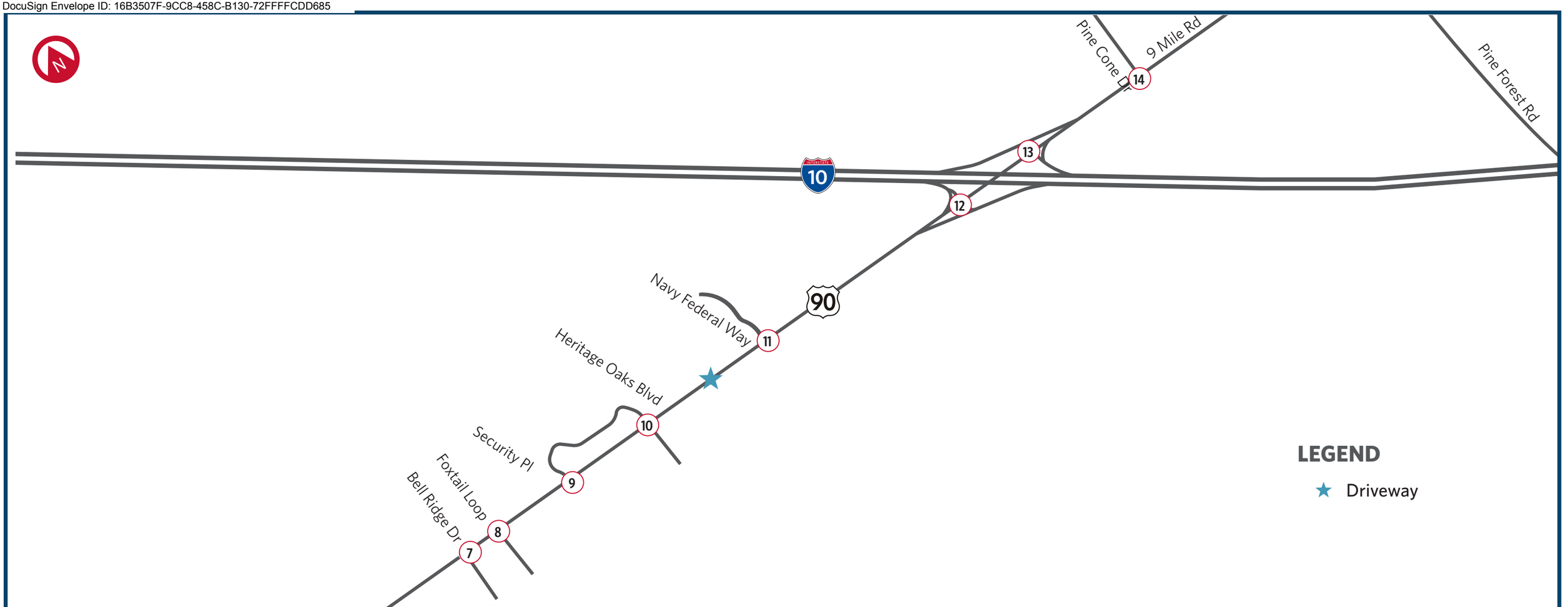

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

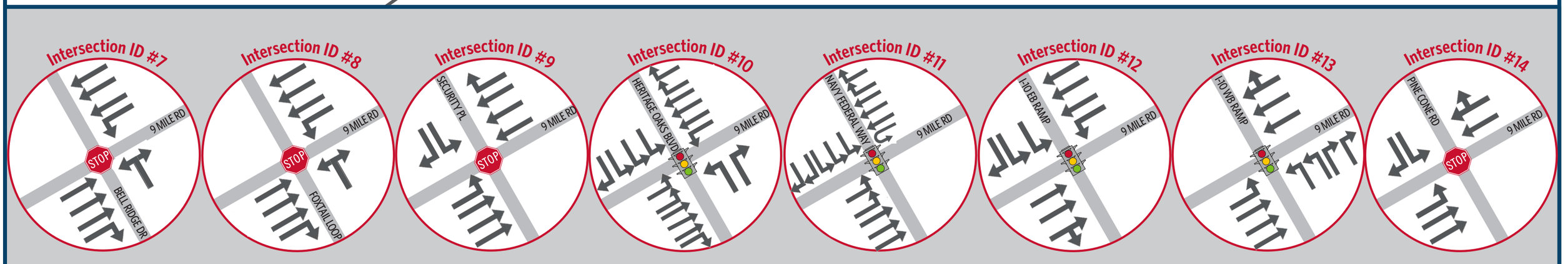
Figure 5-1: Future Year 2026 No-Build Lane Configurations




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

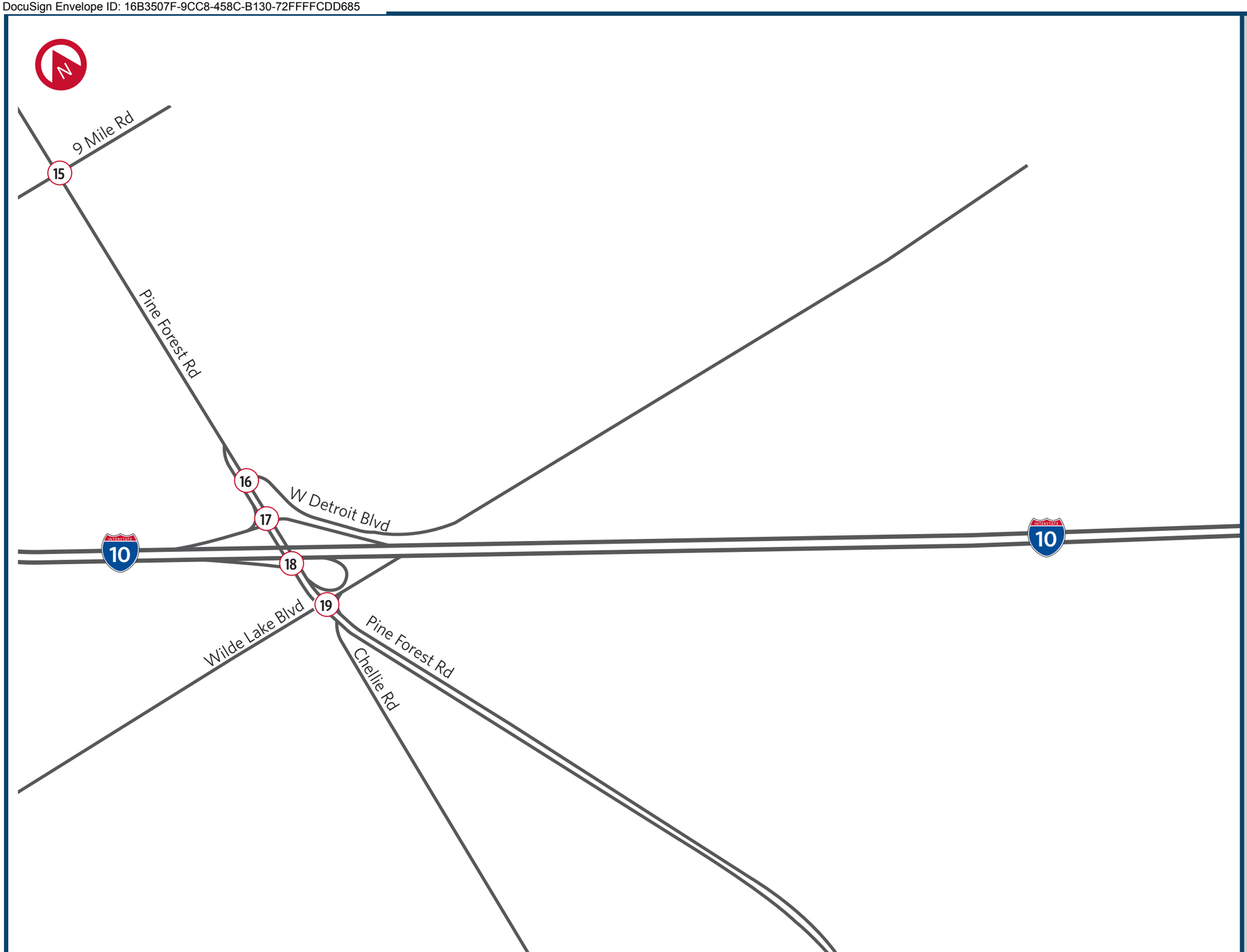
Figure 5-2: Future Year 2046 No-Build Lane Configurations

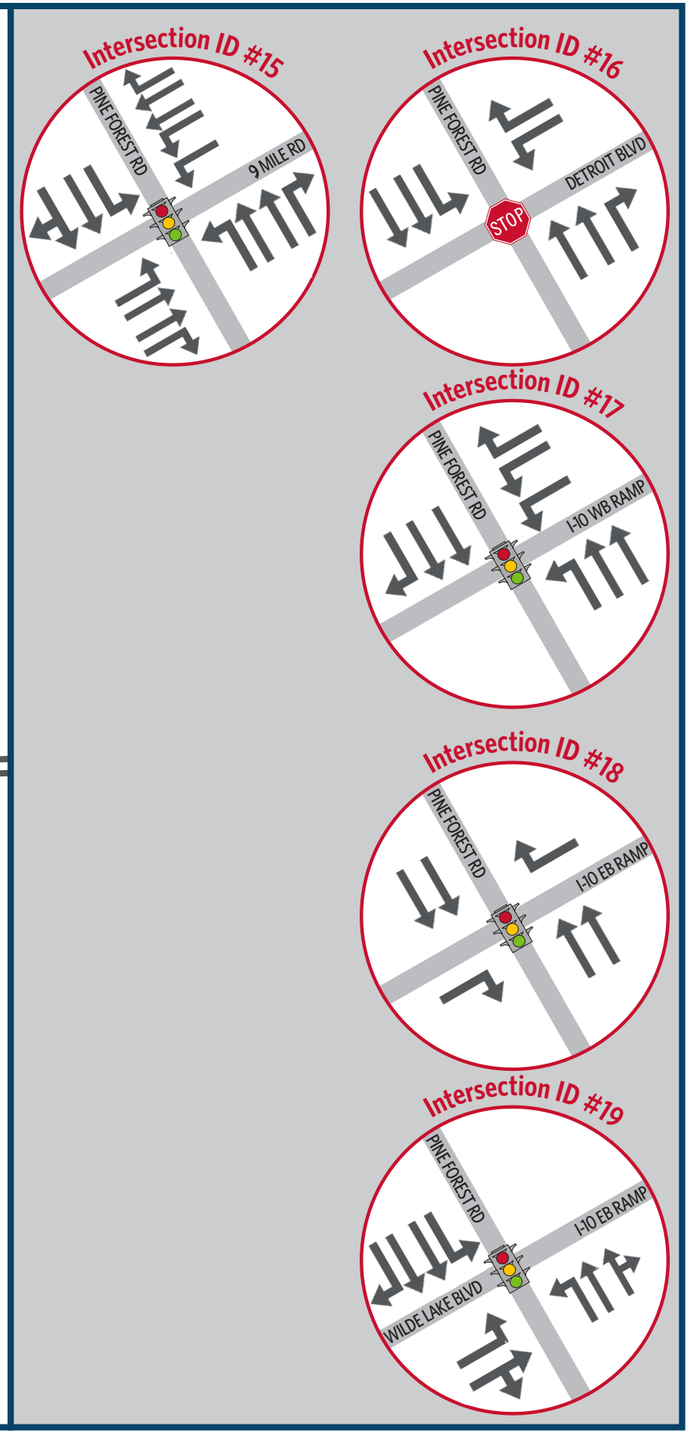



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 5-2: Future Year 2046 No-Build Lane Configurations




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

## Figure 5-2: Future Year 2046 No-Build Lane Configurations

## 5.2 BUILD ALTERNATIVE

In addition to the roadway network changes described for the No-Build alternative, the Build Alternative includes widening on I-10 from four lanes to six lanes, and improvements to the existing interchanges at Nine Mile Road and Pine Forest Road. Based on the project goals, objectives, and in coordination with FDOT, one Build Alternative was developed for the SIMR AOI. Several improvement options were evaluated for the Nine Mile Road corridor, Pine Forest Road corridor, and the I-10 mainline to arrive at a recommended alternative for each. These are further discussed in the Alternatives Analysis Memorandum, provided in **Appendix H**. The following locations were analyzed for operational alternatives:

- The interchange of I-10 at Pine Forest Road
- The interchange of I-10 at Nine Mile Road
- The intersection of Pine Forest Road and Nine Mile Road
- The intersection of Nine Mile Road and Navy Federal Way

Synchro was initially used to screen different interchange and intersection options, primarily using volume to capacity ratios to gauge whether the alternative could accommodate 2046 volumes. Of the considered alternatives presented, only a handful proceeded to sub-area analysis in Vissim due to operational or geometric constraints. A summary of the alternatives is presented in **Table 5–2.** A detailed memo describing the alternatives analysis is provided in **Appendix H**.

**Table 5-2. Summary of Alternatives Considered**

| Location | Alternative Considered | Proceed to Sub-Area Vissim Analysis? | Elimination Reasoning |
|---|---|---|---|
| I-10 at Pine Forest Rd Interchange | Widening of Existing Partial Cloverleaf Interchange | ✗ | Right-of-way constraints |
| | Diamond Interchange | ✓ | - |
| | Single Point Urban Interchange (SPUI) | ✗ | Major realignment; v/c near 1.0 |
| | Restricted Crossing U-Turn (RCUT) with a Displaced Left-Turn | ✗ | Left turns at LOS F |
| | Partial Cloverleaf Interchange with Loop Ramps in the Northwest and Southeast Quadrants | ✗ | Right-of-way constraints |
| | Diverging Diamond Interchange | ✓ | - |
| I-10 at Nine Mile Rd Interchange | Widening of Existing Diamond Interchange | ✓ | - |
| | Single Point Urban Interchange (SPUI) | ✗ | v/c near 1.0 |
| | Diamond Interchange with Displaced Left | ✗ | 9-lane cross section required with no operational benefits |
| | Diverging Diamond Interchange | ✓ | |
| Nine Mile Rd at Pine Forest Rd | Intersection Widening | ✗ | Right-of-way impacts, and operates at LOS E |
| | Continuous Flow Intersection (CFI) | ✓ | - |
| | Median U-Turns on Nine Mile Rd | ✓ | - |
| Nine Mile Rd at Navy Federal Way | Traditional Three-Legged T-Intersection | ✓ | - |
| | T-Intersection with a Median U-Turn | ✓ | - |

## 5.3 SELECTED BUILD ALTERNATIVE

Based on the results of the Vissim analysis, the preliminary conceptual design, and in coordination with FDOT, the following Build Alternative improvements were selected:

- **Interchange of I-10 at Pine Forest Road** (see **Figure 5–1**)
  - A Diverging Diamond Interchange at I-10 and Pine Forest Road.
  - Realign Wilde Lake Boulevard further south.
  - Eliminate left turns from W. Detroit Boulevard and install a northbound Median U-turn north of W. Detroit Boulevard along Pine Forest Road.
- **Interchange of I-10 at Nine Mile Road** (see **Figure 5–2**)
  - A Diverging Diamond Interchange at I-10 and Nine Mile Road.
- **Intersection of Nine Mile Road and Pine Forest Road** (see **Figure 5–3**)
  - Operational improvements at this intersection, e.g., eliminate all left turns at main intersection and install Median U-turns east and west of the intersection along Nine Mile Road.
- **Intersection of Nine Mile Road at Navy Federal Way** (2026 Build Alternative only)
  - A signalized intersection at Navy Federal Way.
  - A six-lane cross-section along Nine Mile Road between Navy Federal Way and the I-10 interchange.

Note that the intersection of Nine Mile Road and Navy Federal Way and the intersection of Nine Mile Road and Pine Forest Road are outside of the scope of this PD&E and will be addressed by separate projects (more information is provided in the 1.3 Planned and Programmed Transportation Projects section). Both intersections were evaluated to determine the feasibility of solutions that would not adversely impact operations at the I-10 and Nine Mile Road, and the I-10 and Pine Forest Road interchanges. These improvements were included for analysis purposes; however, they will be determined by separate projects and are subject to change as those projects progress.

Per the approved MLOU, the recommendations for the Nine Mile Road interchange, Pine Forest Road interchange, and the I-10 mainline were modeled as one combined Build Alternative. This Build Alternative also includes the recommended Beulah Road interchange alternative from the I-10 and Beulah Road IJR. The Build Alternative lane configurations are displayed in **Figure 5-6** and **Figure 5-7**.

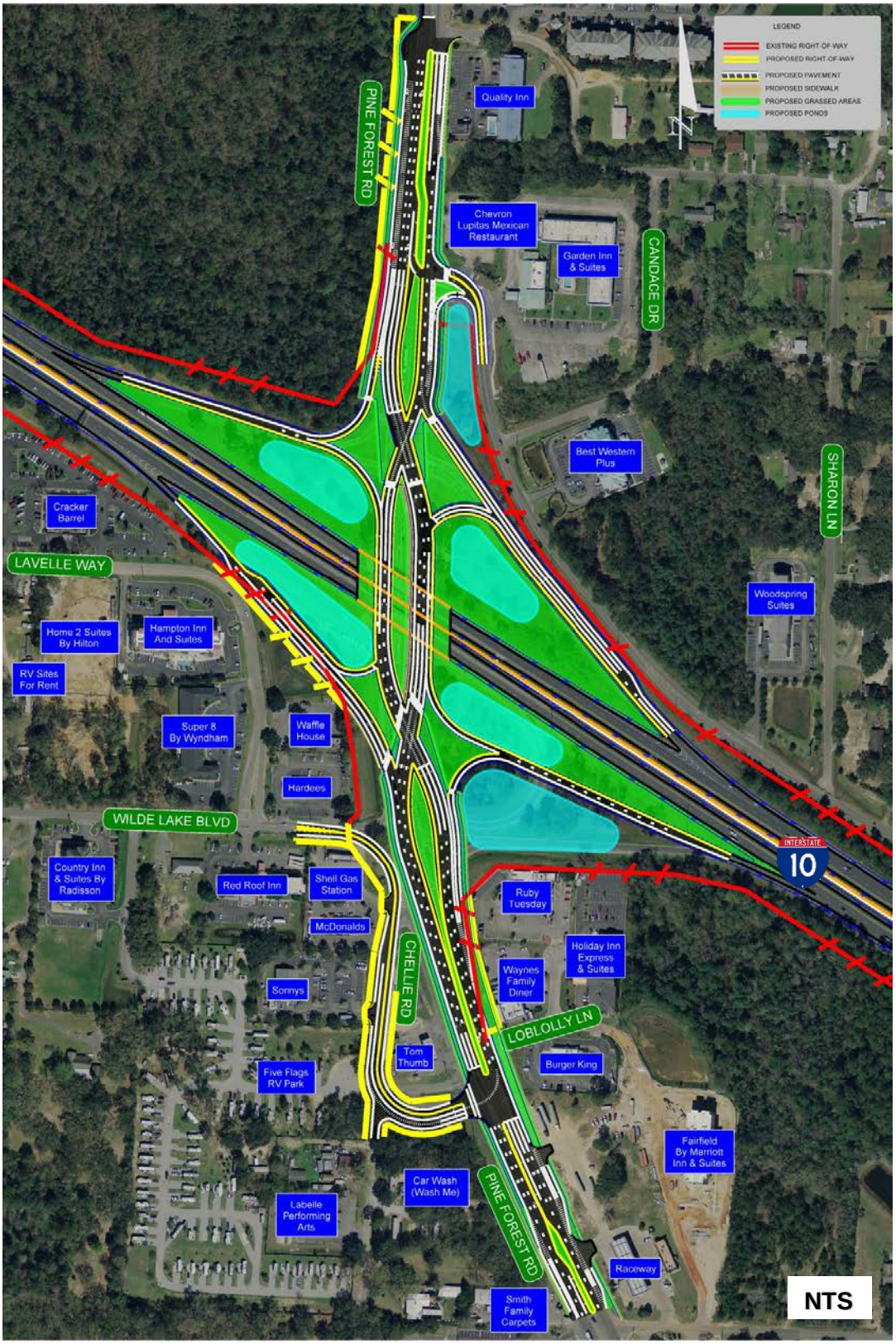



**Figure 5-3. I-10 at Pine Forest Road, Diverging Diamond Interchange**

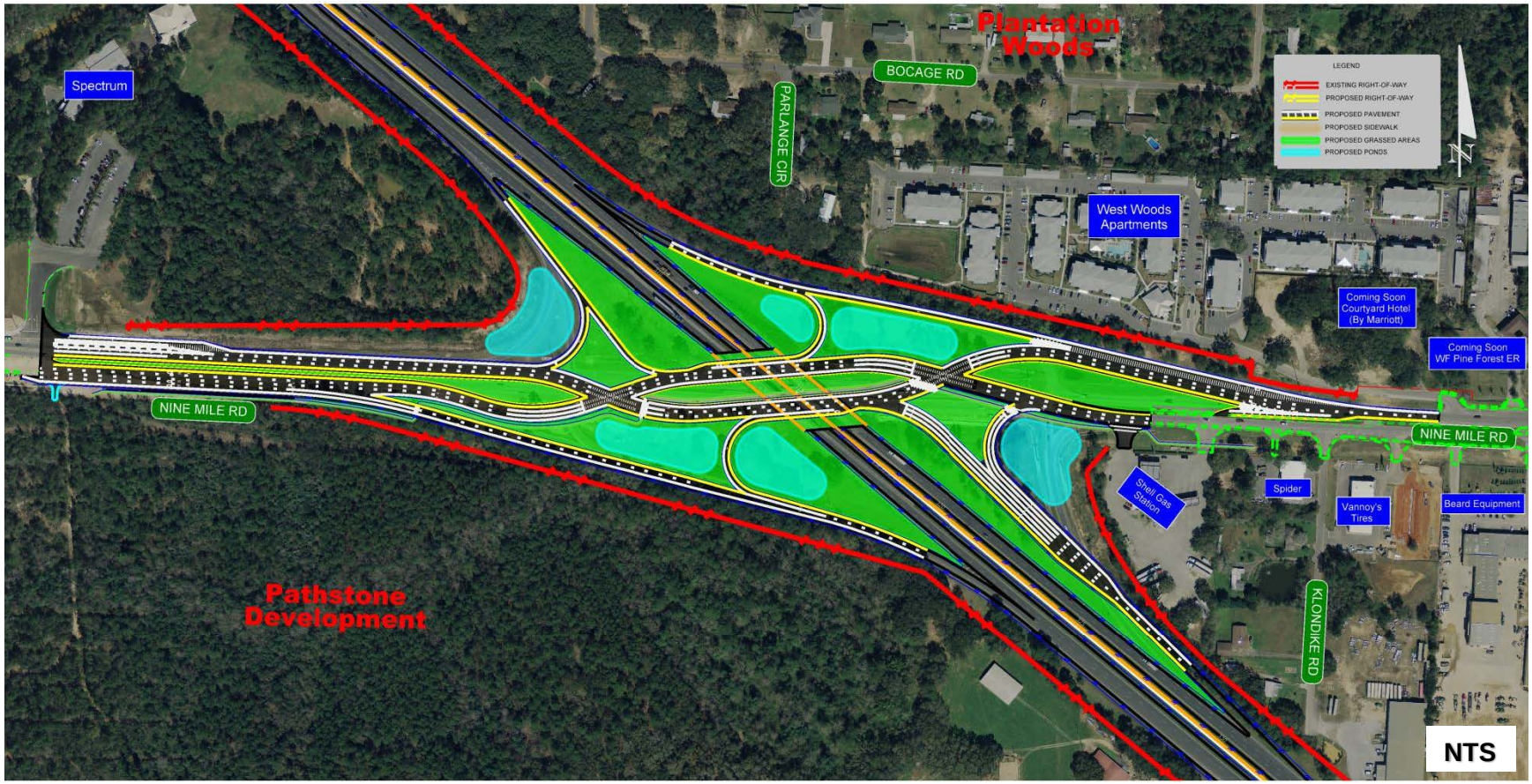



**Figure 5-4. I-10 at Nine Mile Road, Diverging Diamond Interchange**

*Figure note: This is the ultimate interchange configuration. However, the east and west side of the interchange, along Nine Mile Road, is shown connecting to the 4-lane widening of Nine Mile Road. The 6-lane Nine Mile Road was assumed for 2046 modeling.*

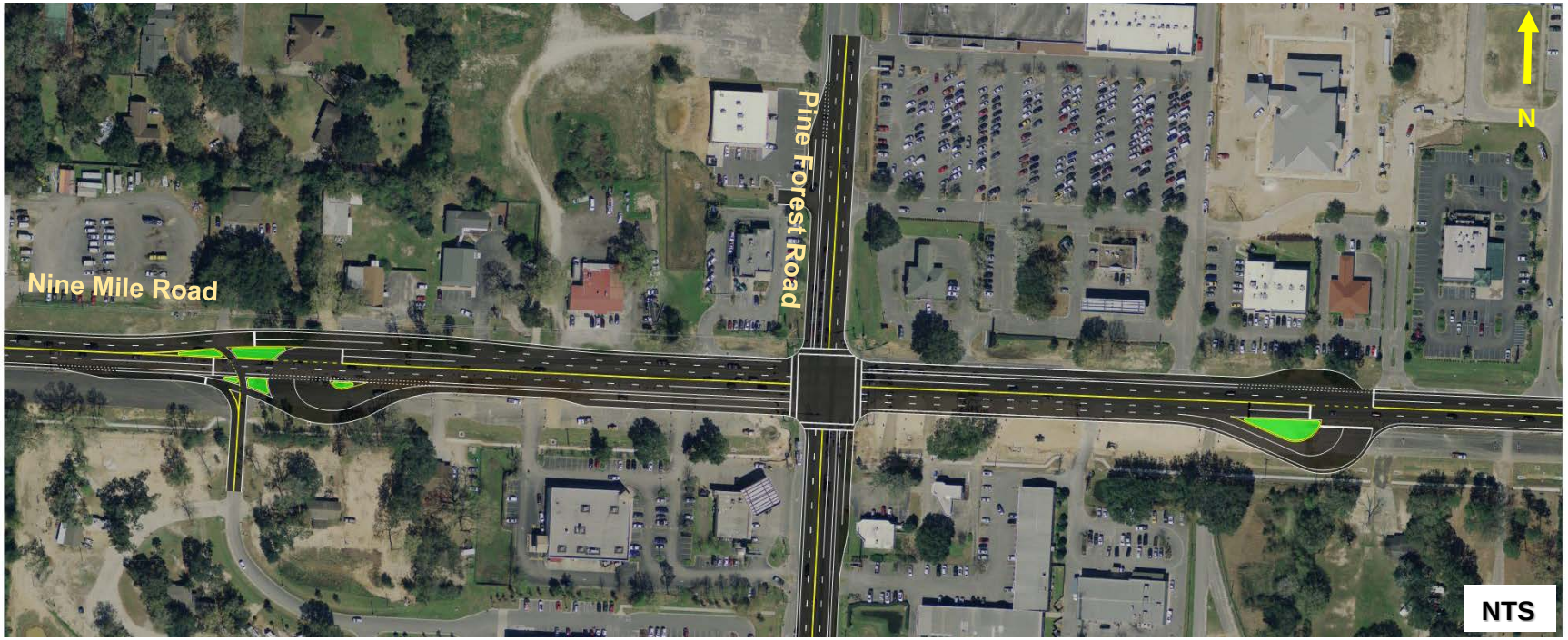
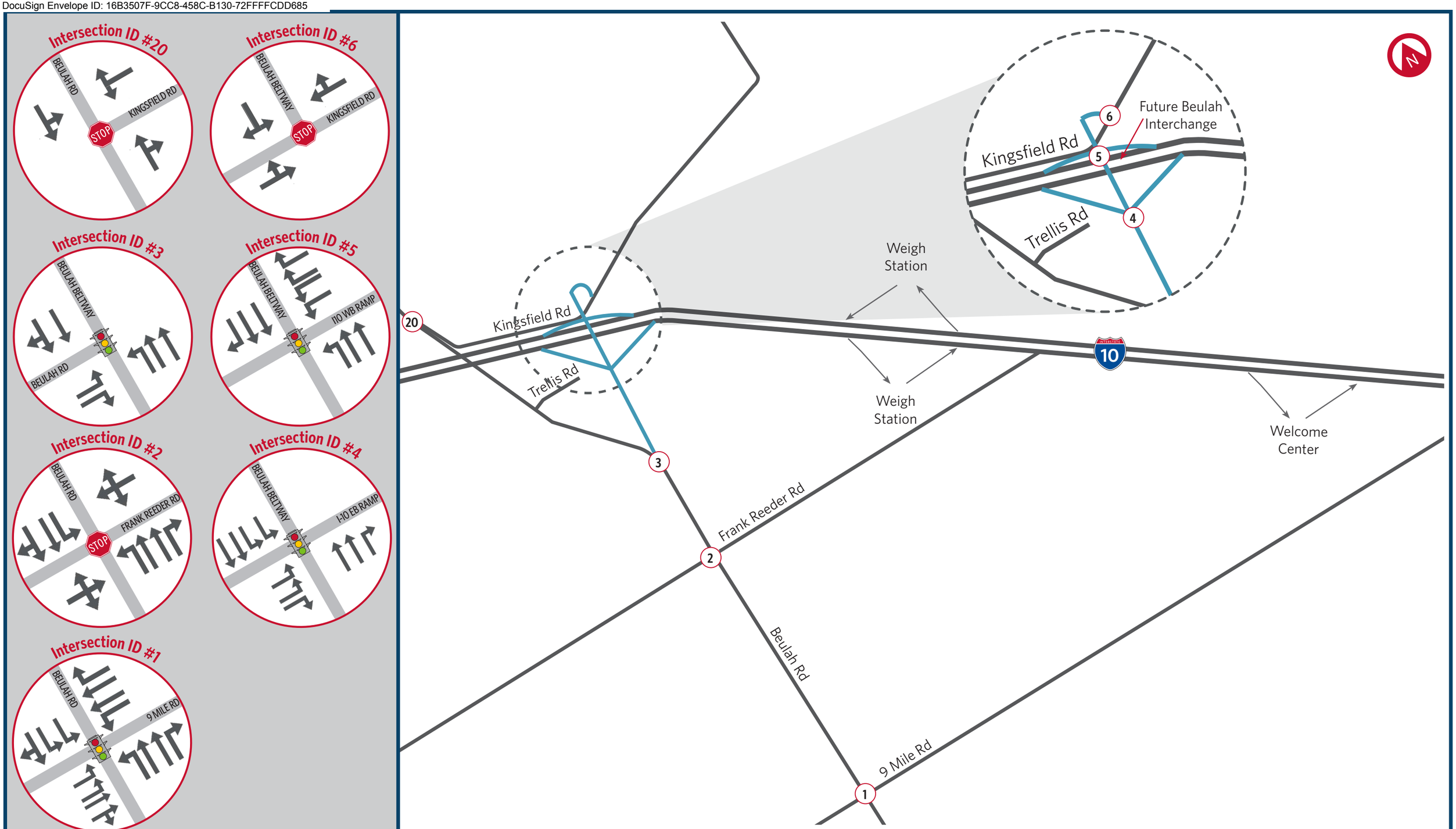
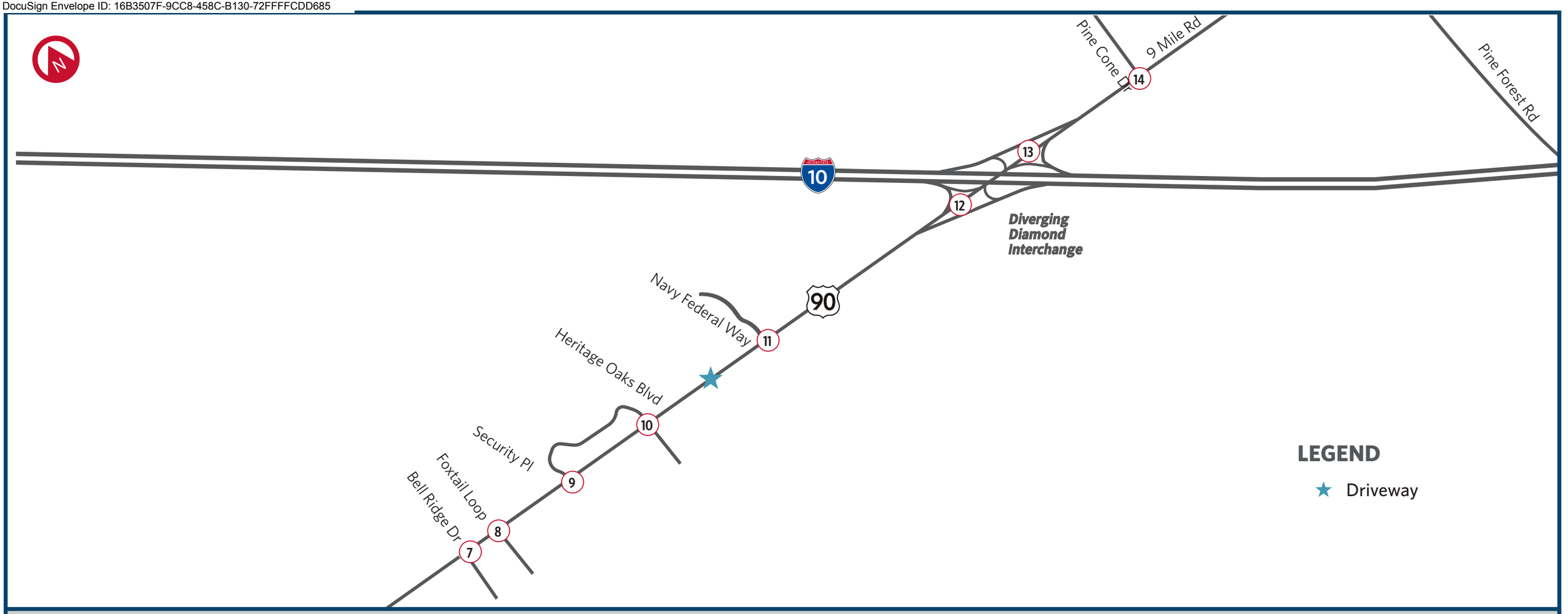


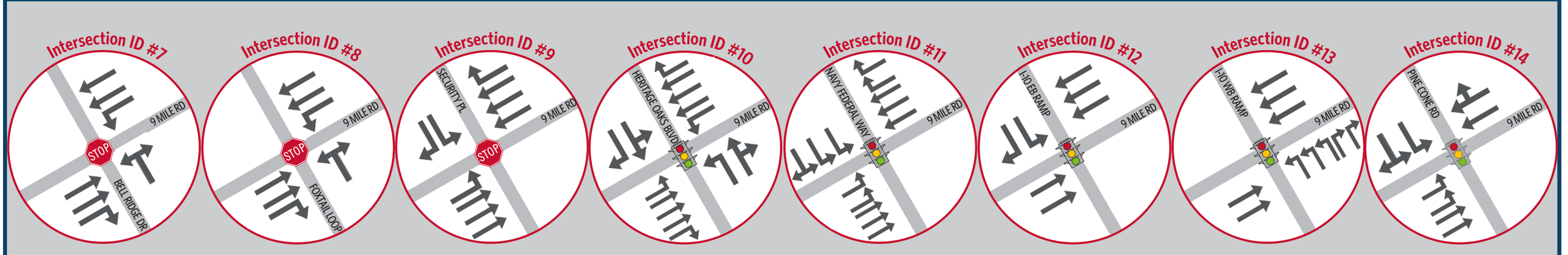

**Figure 5-5. Nine Mile Road at Pine Forest Road, Median U-Turn Intersection**




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

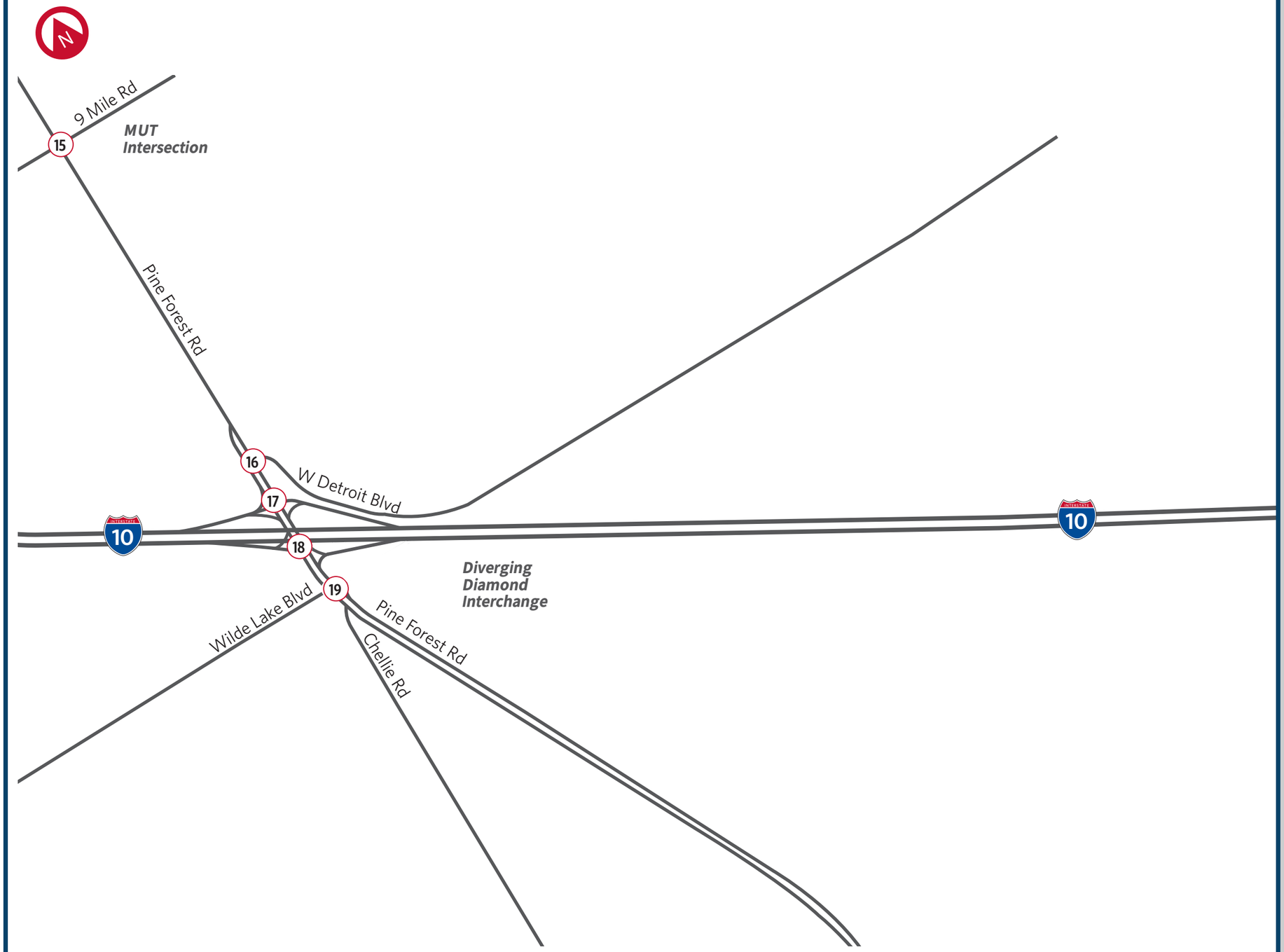
## Figure 5-6: Future Year 2026 Build Lane Configurations

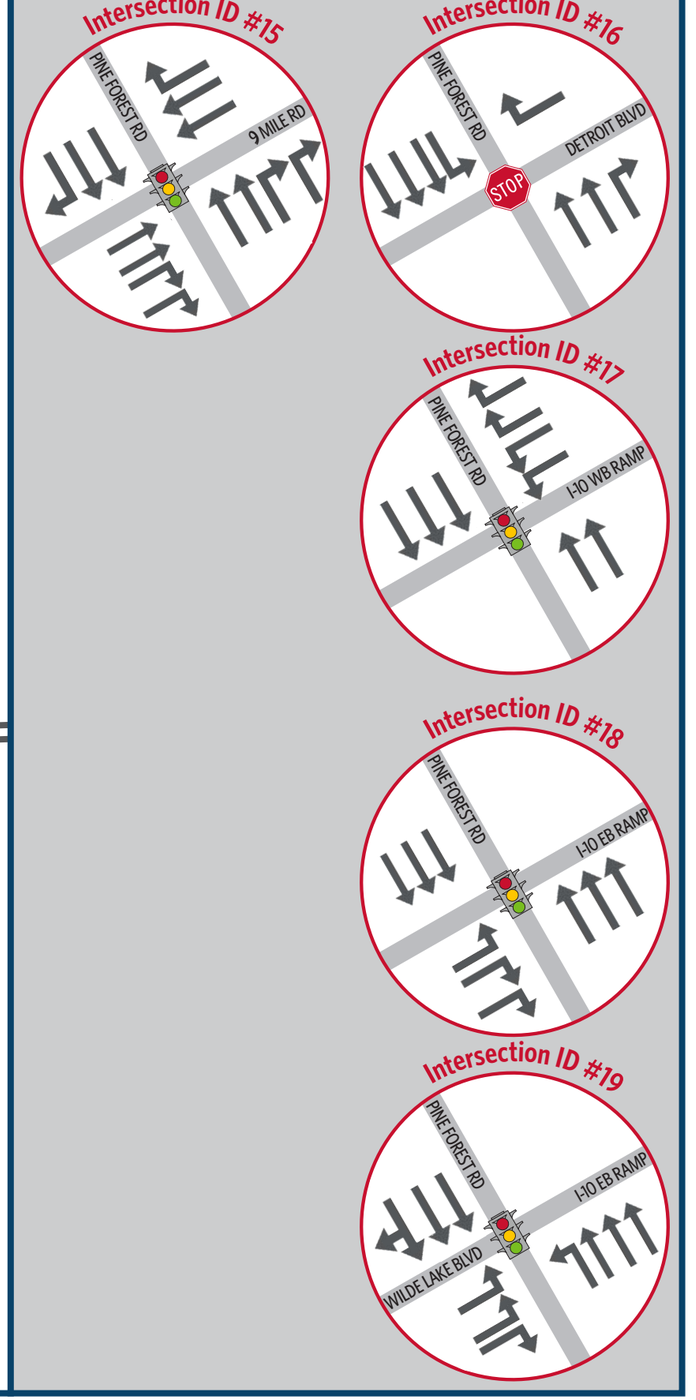



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

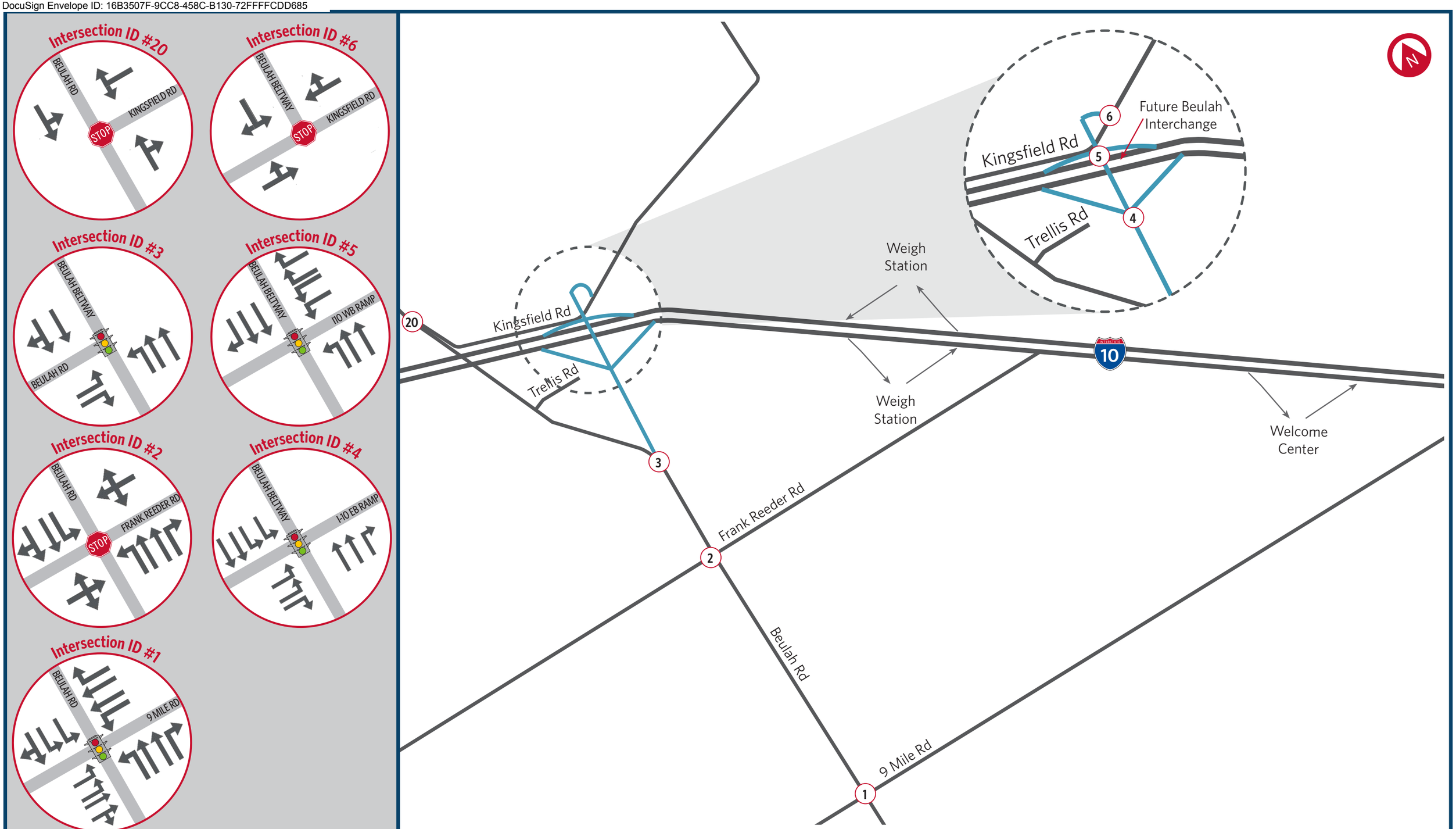
Figure 5-6: Future Year 2026 Build Lane Configurations



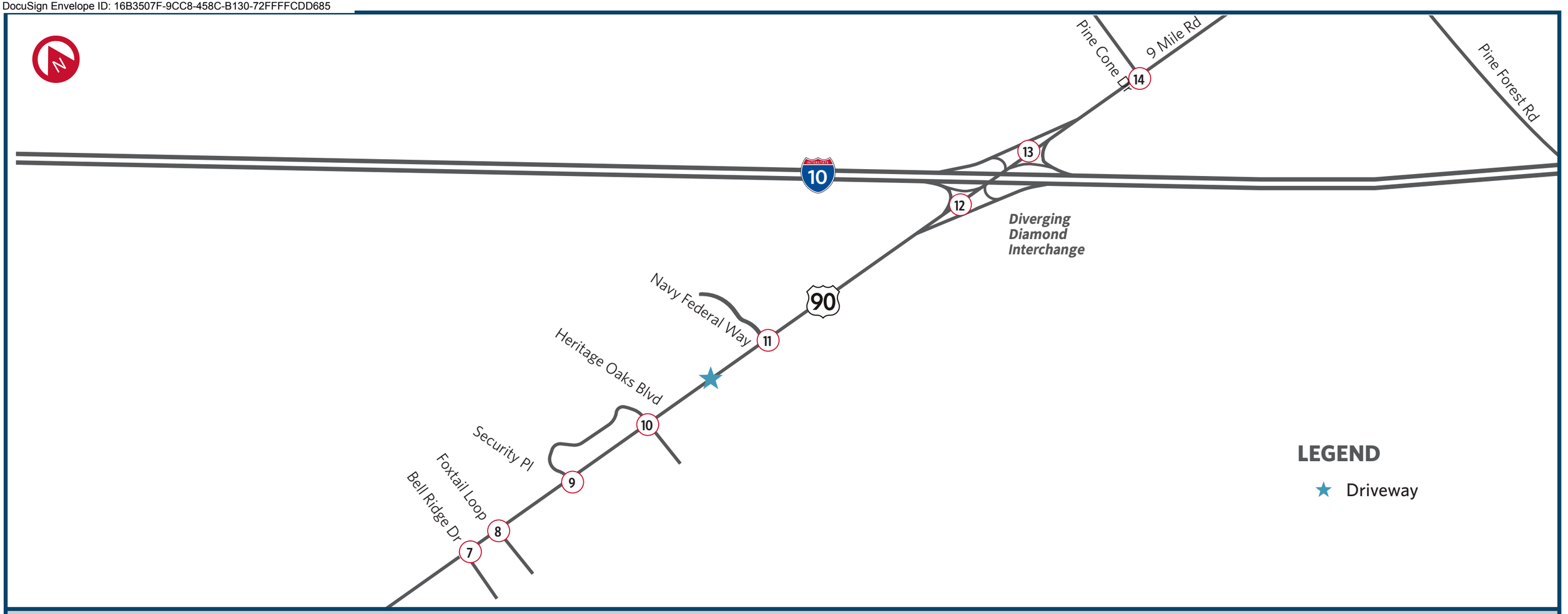

# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

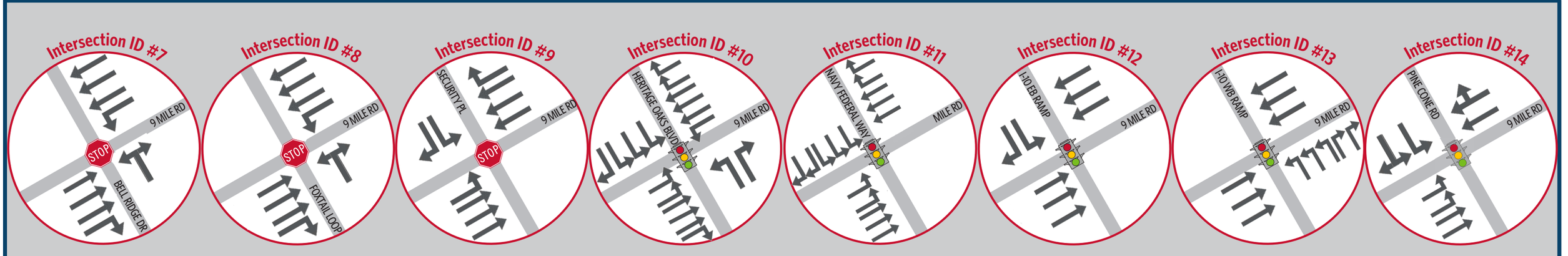
Figure 5-6: Future Year 2026 Build Lane Configurations




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

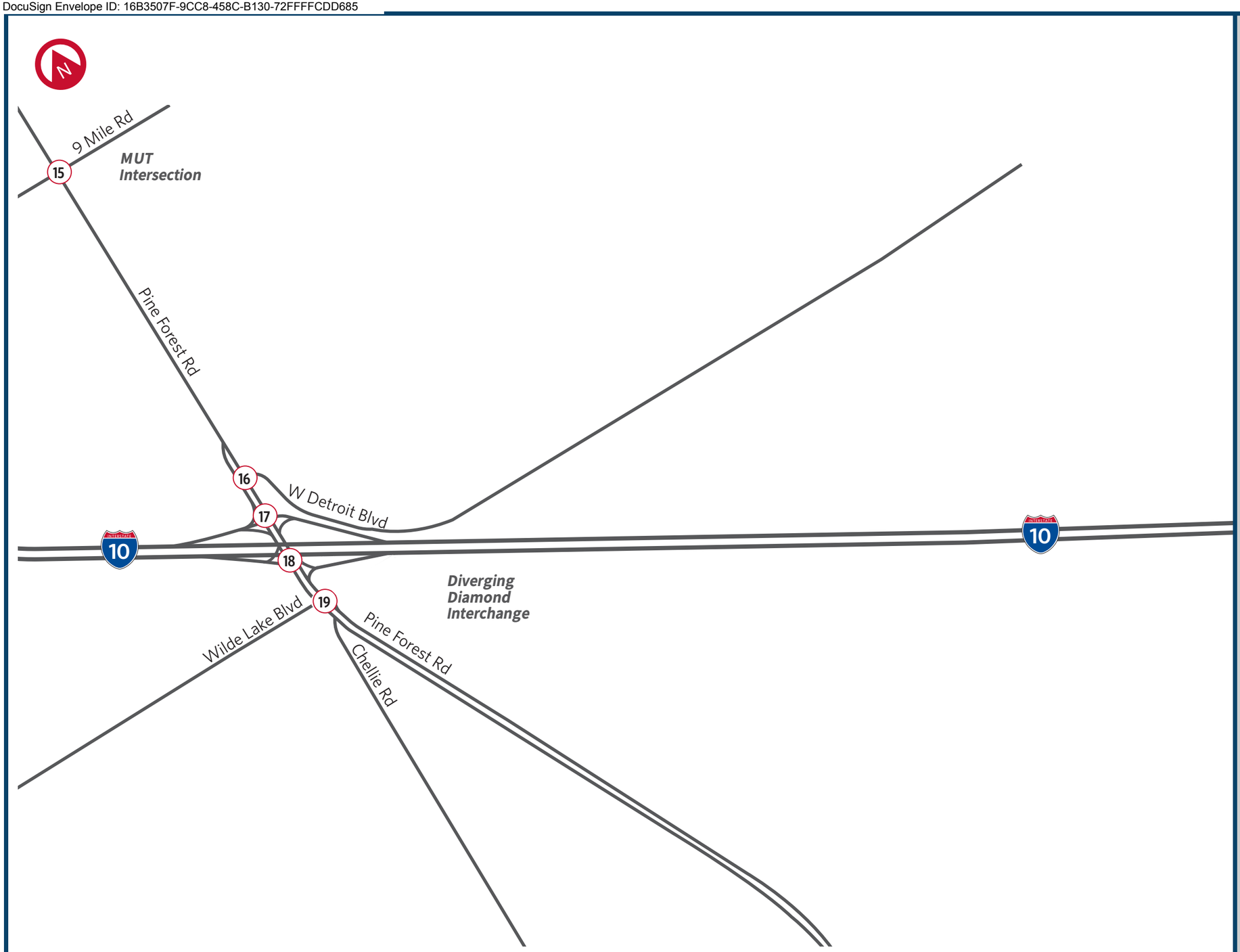
Figure 5-7: Future Year 2046 Build Lane Configurations

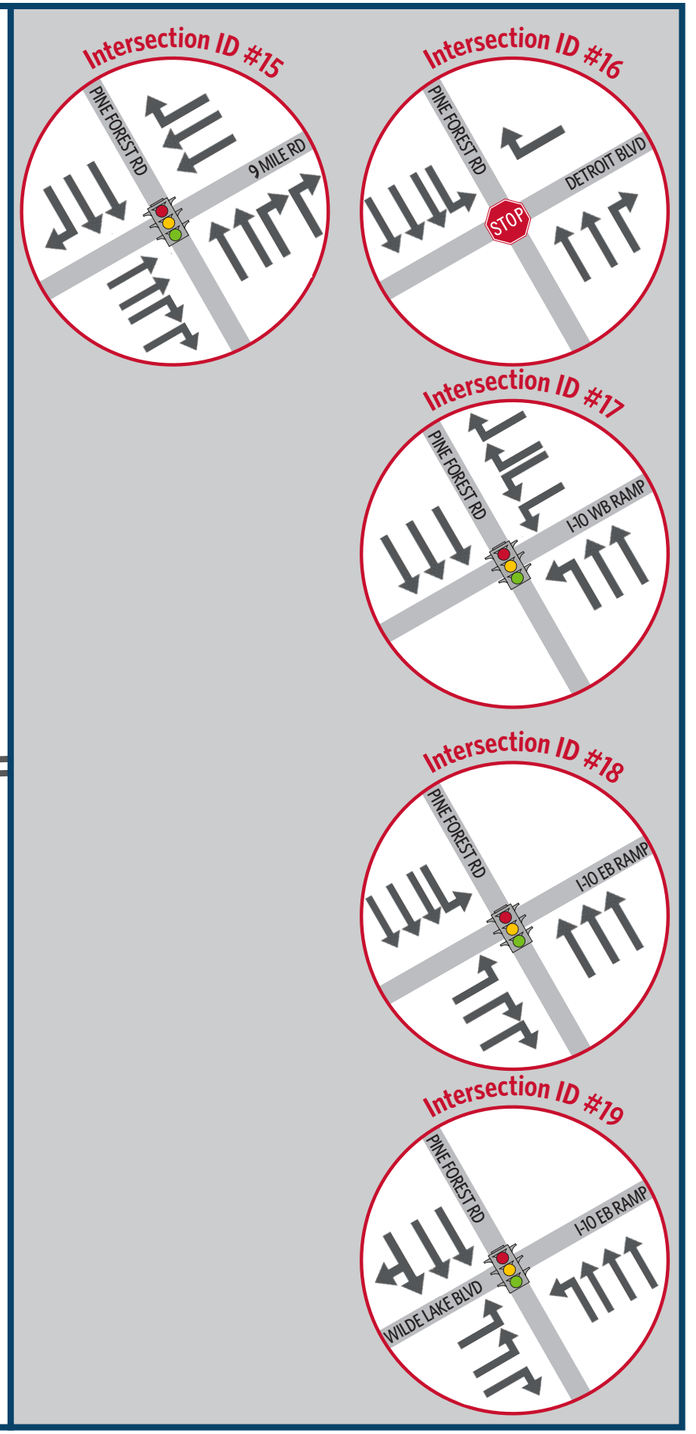



# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 5-7: Future Year 2046 Build Lane Configurations




# I-10 SYSTEMS INTERCHANGE MODIFICATION REPORT (SIMR)

Figure 5-7: Future Year 2046 Build Lane Configurations

# 6.0 FUTURE TRAFFIC OPERATIONAL ANALYSIS

This section documents the future conditions analysis for the project limits and AOI and compares traffic operations of the No-Build and Recommended Build Alternatives. A Vissim microsimulation analysis was performed to evaluate the effects of the proposed improvements in the study area for the Opening Year 2026 and Design Year 2046. The same future traffic volumes were used for both No-Build and Build Alternatives given that the Build Alternative does not include any new corridors, interchanges, or other improvements that would change travel patterns.

## 6.1 VISSIM MODEL DEVELOPMENT

The calibrated Existing Year 2018 models were used to develop the Opening Year 2026 and Design Year 2046 No-Build and Build models. Calibration parameters from the existing conditions models were carried forward to the future year models. The Vissim vehicle inputs, OD matrix estimation, and vehicle routing followed the same procedure used in the Existing Year analysis described in **Section 3.2.2**.

The No-Build model geometry was identical to the Existing model except for the identified improvements discussed in **Section 5.1**. When coding the Beulah Beltway interchange, the Beulah IJR design files (obtained August 1st, 2019) were used as a starting point, but additional ramp storage was added to avoid ramp back up to I-10. The Build model geometry was developed using the design files from the alternatives analysis conducted as part of this PD&E. Signalized intersections within the study area were optimized for both No-Build and Build alternatives.

## 6.2 NETWORK PERFORMANCE

Network performance is an important evaluation metric as it provides the relative number of vehicles that are being served and the extent of latent demand for the study area. Network-wide results comparing No-Build and Build are provided in **Table 6–1** and **Table 6–2**.

The results indicate that the Build Alternative offers an improvement over the No-Build Alternative for almost every network performance parameter during both the AM and PM peaks. In 2046, the percent improvement becomes even greater than in 2026 due to the gridlock effect experienced in the No-Build condition.

In the 2046 AM peak, the average delay time per vehicle is reduced from 265 seconds to 74 seconds, for a 72% improvement. In the 2046 PM peak, the average delay time per vehicle is reduced from 431 seconds to 69 seconds, for an 84% improvement.

**Table 6-1. Future Year Network Results Summary – AM Peak**

| Parameter | AM Peak Hour | | | | | |
|---|---|---|---|---|---|---|
| | 2026 | | | 2046 | | |
| | No-Build | Build | % Improved | No-Build | Build | % Improved |
| Total Travel Time (hr) | 2,004 | 1,766 | 12% | 3,061 | 2,250 | 26% |
| Total Delay Time (hr) | 729 | 388 | 47% | 1,539 | 452 | 71% |
| Average Delay Time (s/veh) | 151 | 79 | 47% | 265 | 74 | 72% |
| Latent Delay Time (hr) | 29 | 1 | 98% | 255 | 1 | 100% |
| Vehicles Left the Network | 15,077 | 15,770 | 5% | 16,995 | 19,694 | 16% |
| Latent Demand (veh) | 124 | 1 | 99% | 918 | 1 | 100% |
| Vehicle Miles Traveled (mi) | 74,003 | 78,337 | 6% | 88,644 | 104,502 | 18% |

**Table 6-2. Future Year Network Results Summary – PM Peak**

| Parameter | PM Peak Hour | | | | | |
|---|---|---|---|---|---|---|
| | 2026 | | | 2046 | | |
| | No-Build | Build | % Improved | No-Build | Build | % Improved |
| Total Travel Time (hr) | 3,078 | 1,702 | 45% | 3,797 | 2,230 | 41% |
| Total Delay Time (hr) | 2,006 | 323 | 84% | 2,442 | 426 | 83% |
| Average Delay Time (s/veh) | 428 | 65 | 85% | 431 | 69 | 84% |
| Latent Delay Time (hr) | 626 | 5 | 99% | 1,517 | 1 | 100% |
| Vehicles Left the Network | 13,472 | 16,163 | 20% | 16,136 | 20,131 | 25% |
| Latent Demand (veh) | 1,659 | 3 | 100% | 3,111 | 2 | 100% |
| Vehicle Miles Traveled (mi) | 61,696 | 79,032 | 28% | 81,167 | 105,899 | 30% |

## 6.3 I-10 MAINLINE OPERATIONS

The volume and speed results for I-10 were reported using the Vissim link evaluation output. Average volume and average speed profiles typically provide a good representation of traffic flow along the corridor. **Figure 6-1** through **Figure 6-8** depict these results for the 2026 No-Build and Build scenarios.

As shown in the figures, the No-Build results in a drastic speed drop in both the eastbound and westbound directions, primarily due to ramp queuing at the Pine Forest Road interchange. The I-10 demand approaching or exceeding capacity for a four-lane freeway also contributes to the sustained speed reduction. At the Pine Forest Road interchange ramp terminal, queuing is a result of the exit ramps being over capacity and unable to process demand at the signal. With competing demand along the arterials, the signal is unable to clear the exit ramp queues during each cycle and therefore the queue grows worse throughout the peak hour. Further, when the arterials are congested, the exit ramp movements may receive the green signal indication but are unable to move due to blocking by vehicles already on the arterial. These issues in tandem create a spillback effect to the I-10 mainline and ultimately result in speed drops as freeway vehicles must slow or change lanes to avoid ramp back up.

The Build Alternative, with widening along I-10 and interchange improvements, results in speeds at or near free-flow along the entire corridor. Minor speed dips are seen near the off-ramps which is expected due to the effects of merging and diverging. The Build Alternative sees an improvement over No-Build due to the ramp reconfigurations and adjacent intersection improvements. With DDIs at the Nine Mile Road interchange and the Pine Forest Road interchange, the number of signal phases are reduced and the number of approach lanes are increased. Given those two changes, the DDIs can better process the exit ramp demand due to increased capacity. Intersection improvements were also included at Wilde Lake Boulevard, Detroit Boulevard, and Pine Cone Road which help the flow of arterial traffic. Improving arterial traffic flow helps ensure the exit ramp movement is not obstructed by arterial traffic. The combination of Build improvements eliminates the exit ramp queuing that extended back to the I-10 mainline in the No-Build. With six-lane capacity on I-10 and no exit ramp queuing, there is minimal disruption on I-10 and near free-flow speeds are achieved.

To further visualize the traffic operations, link-level density is summarized in **Table 6-3** and **Table 6-4**.

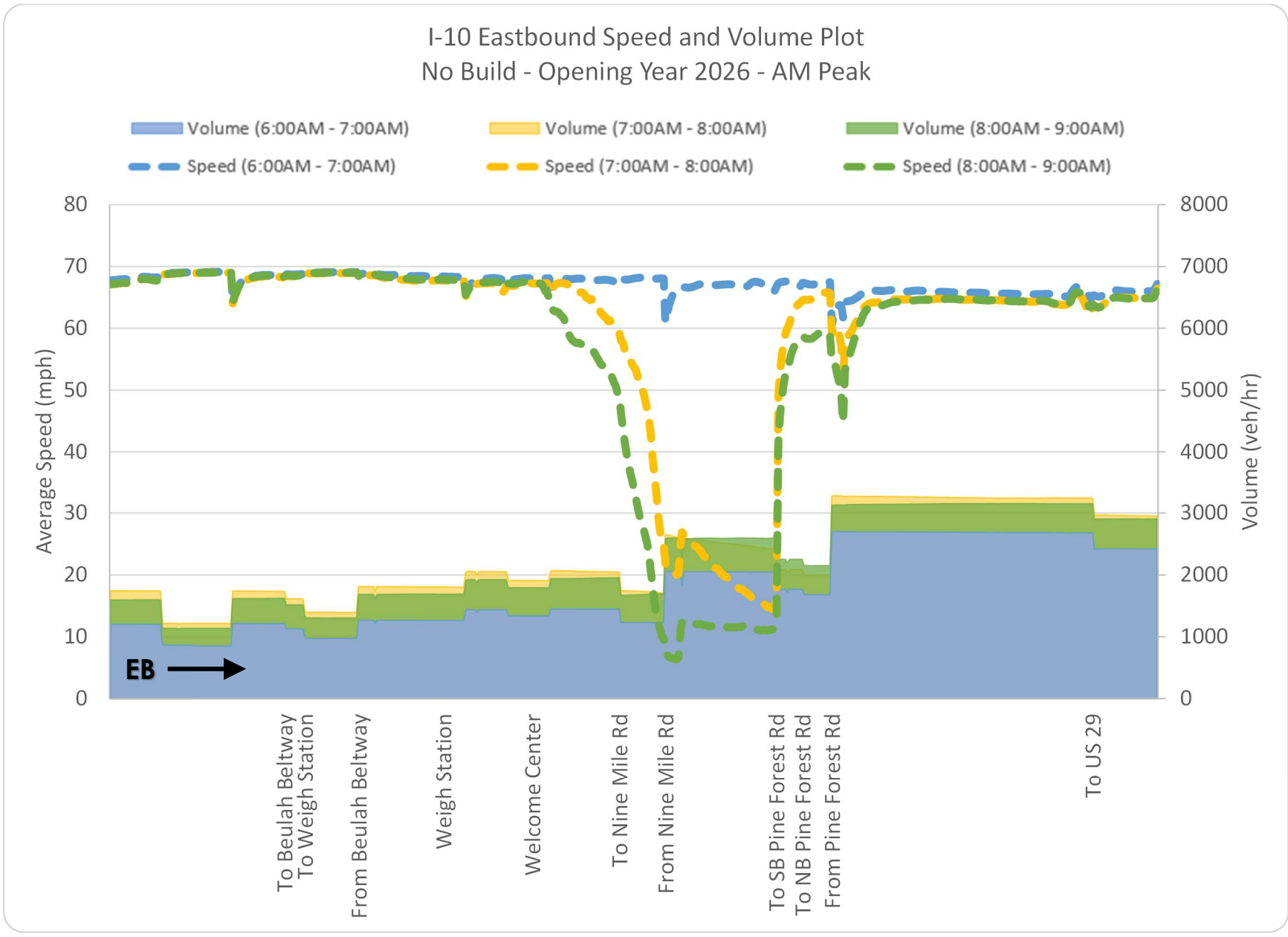



**Figure 6–1. I-10 Eastbound Speed and Volume Plot – No-Build Opening Year 2026 AM Peak**

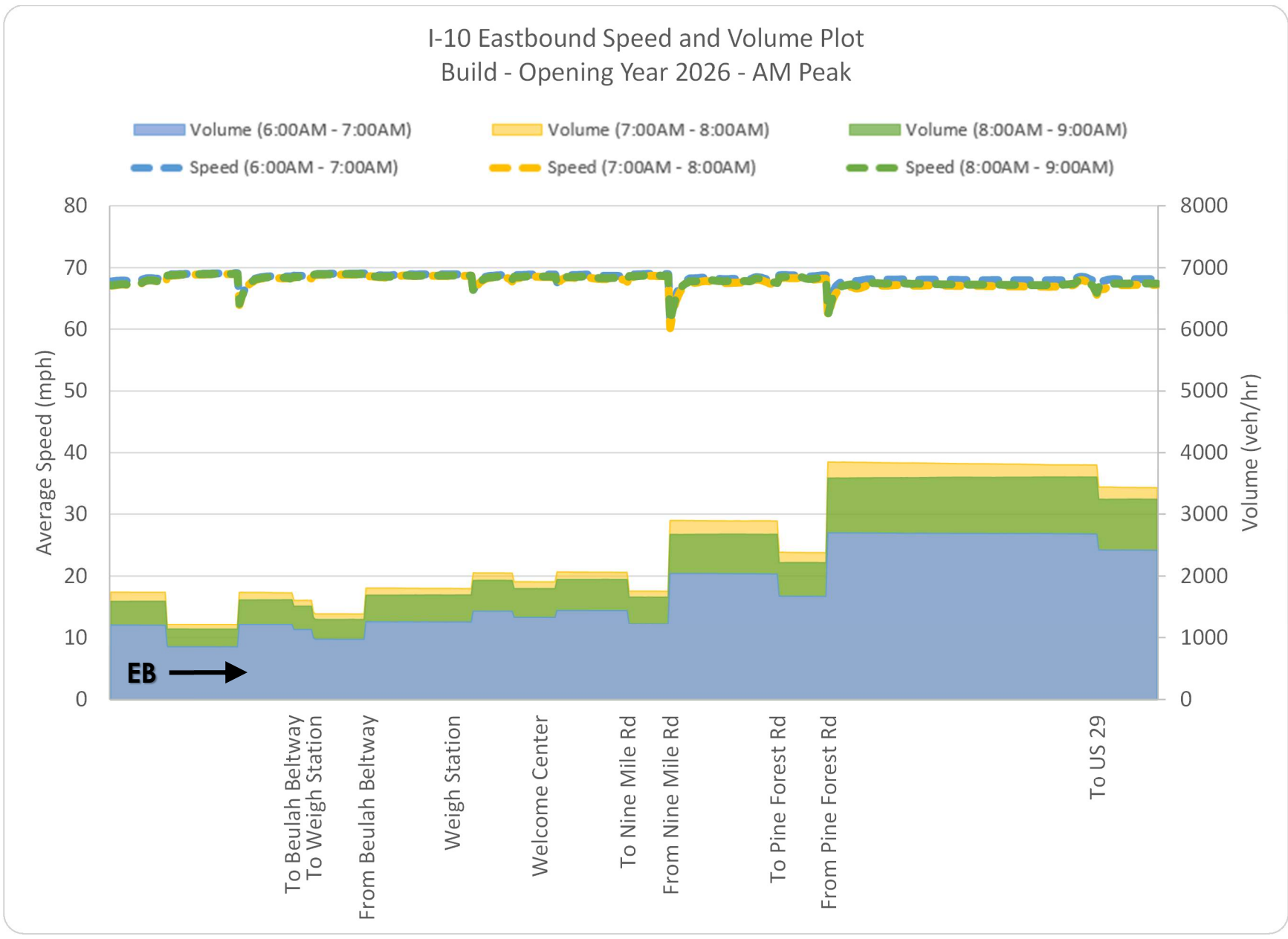



**Figure 6–2. I-10 Eastbound Speed and Volume Plot – Build Opening Year 2026 AM Peak**

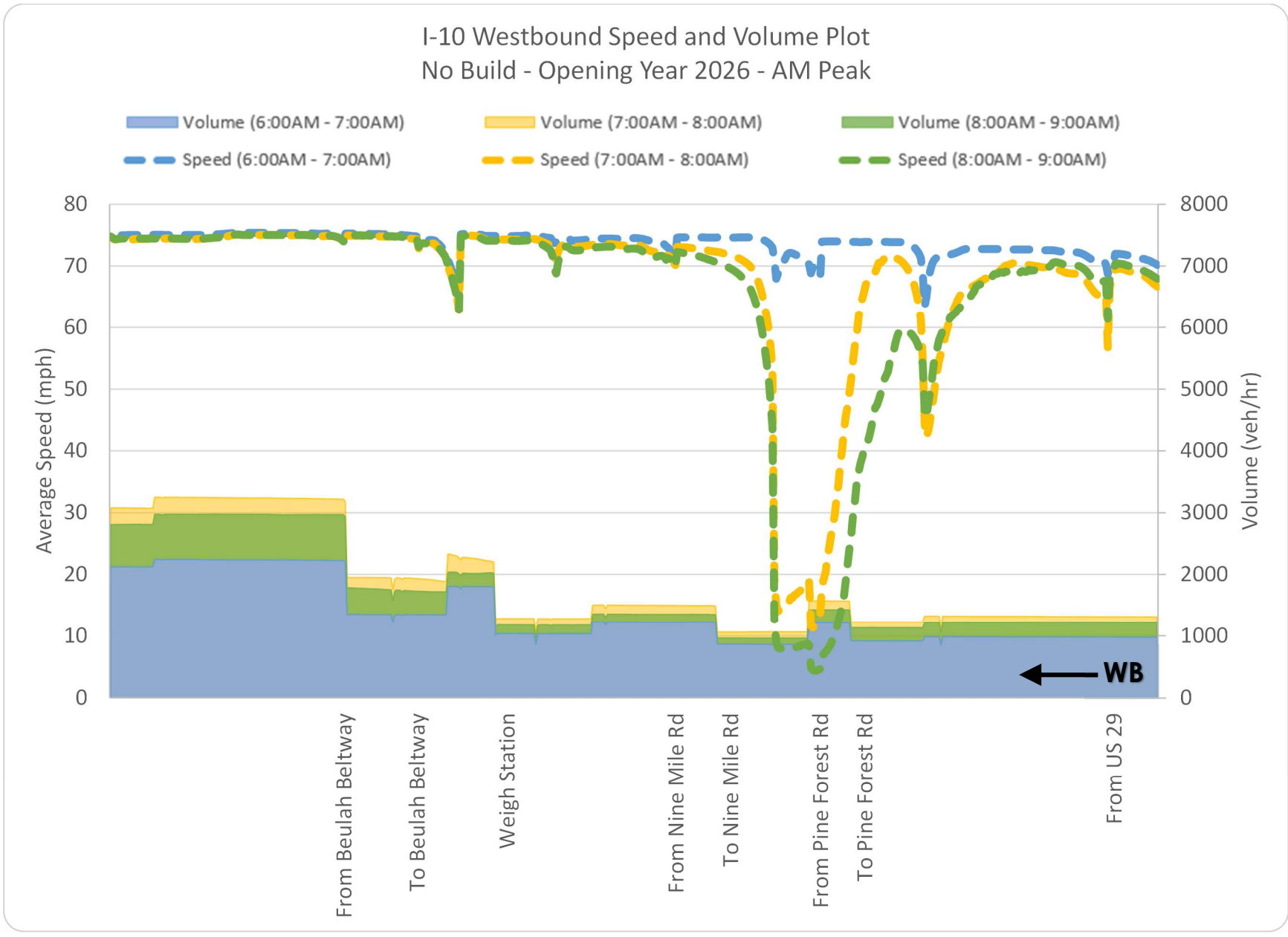



**Figure 6–3. I-10 Westbound Speed and Volume Plot – No-Build Opening Year 2026 AM Peak**

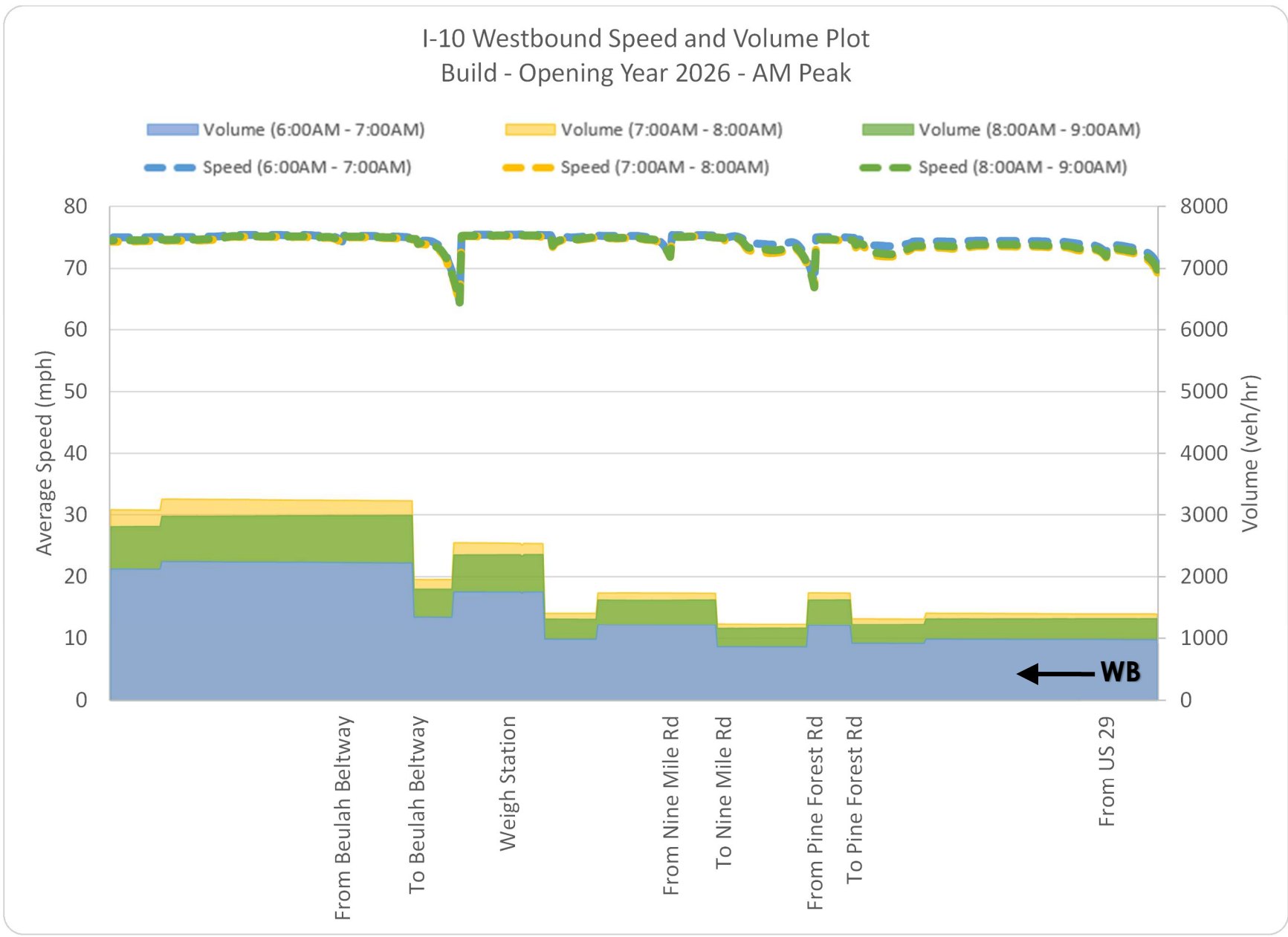



**Figure 6–4. I-10 Westbound Speed and Volume Plot – Build Opening Year 2026 AM Peak**

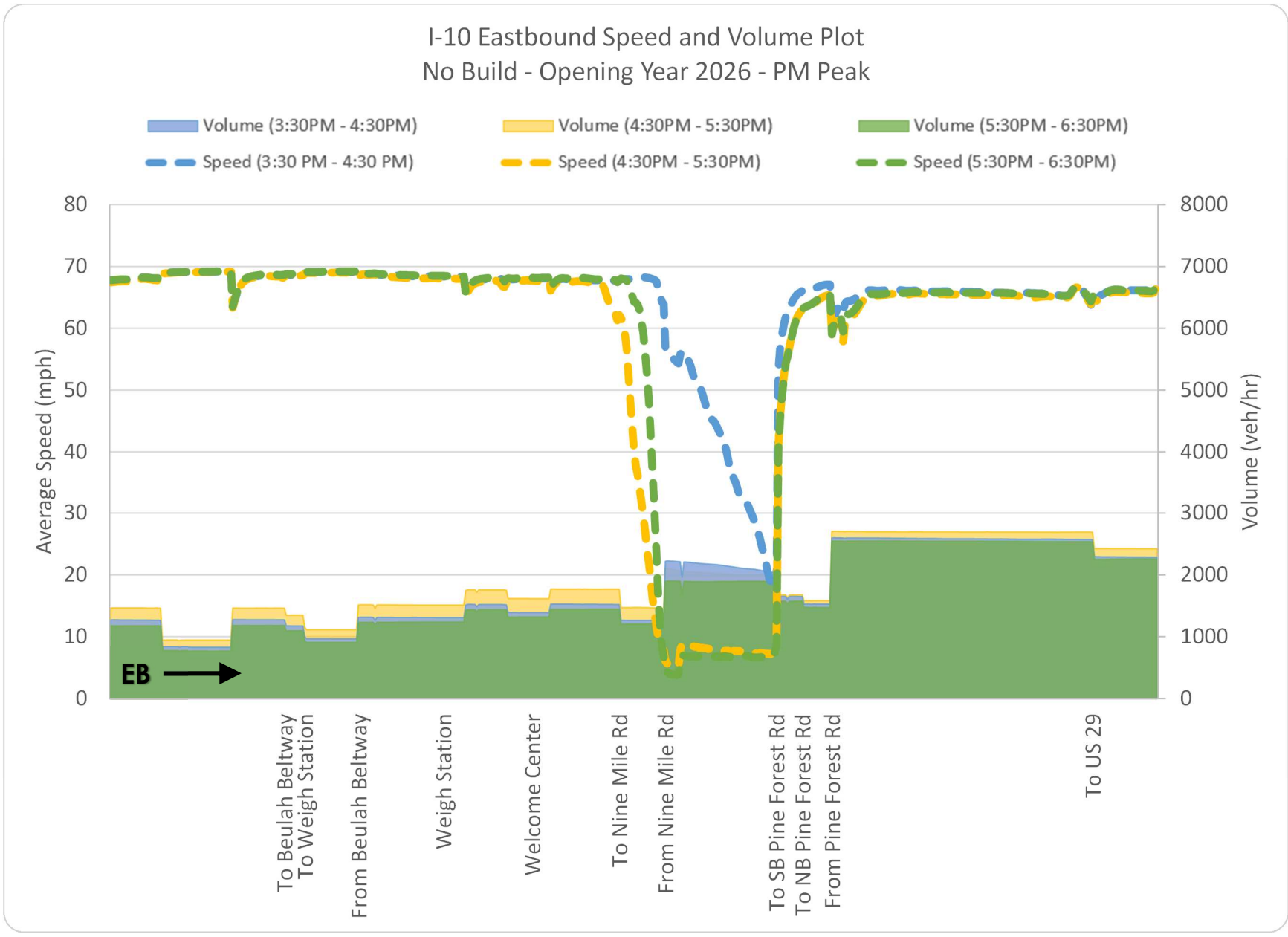



**Figure 6–5. I-10 Eastbound Speed and Volume Plot – No-Build Opening Year 2026 PM Peak**

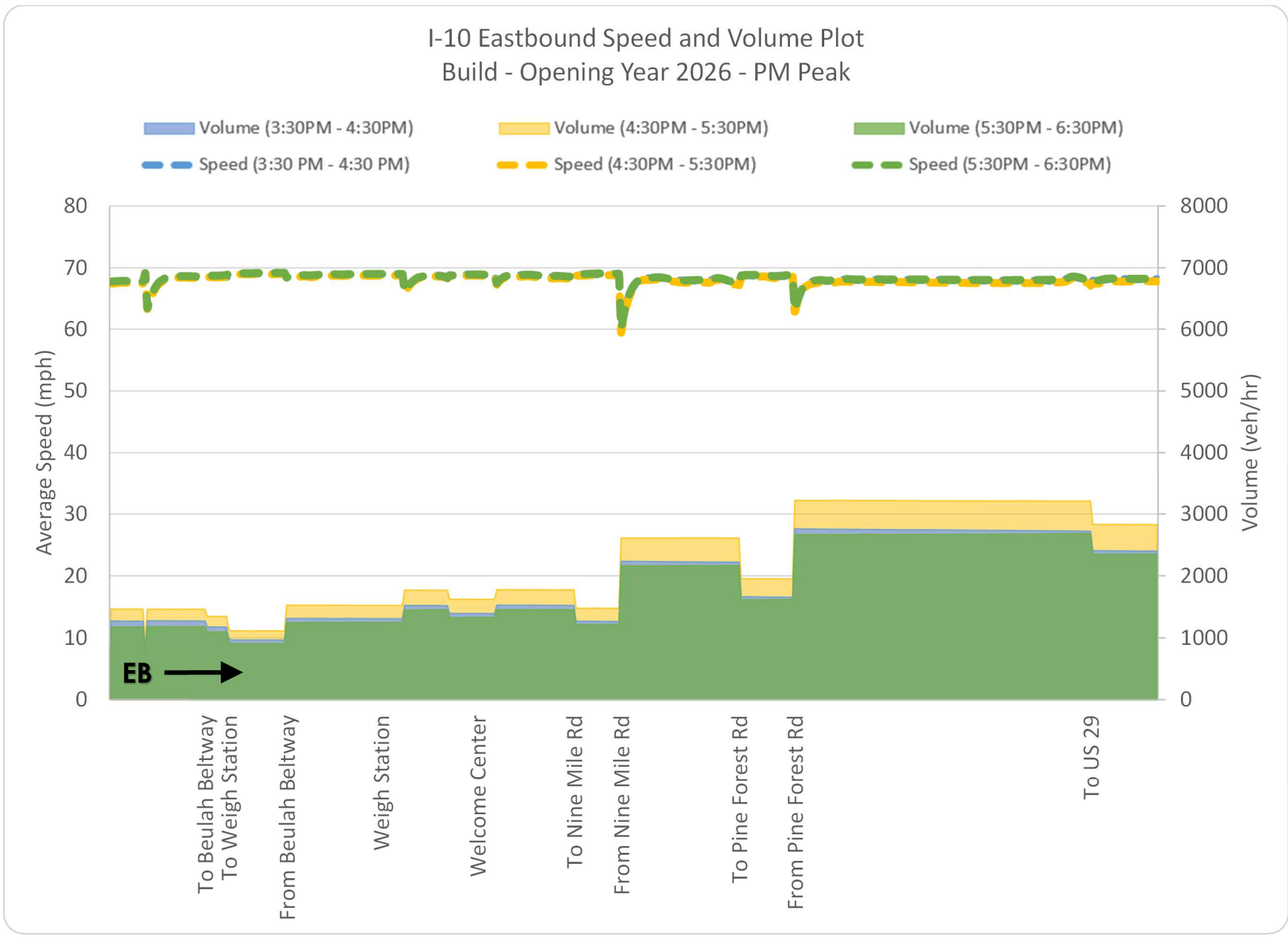



**Figure 6–6. I-10 Eastbound Speed and Volume Plot – Build Opening Year 2026 PM Peak**

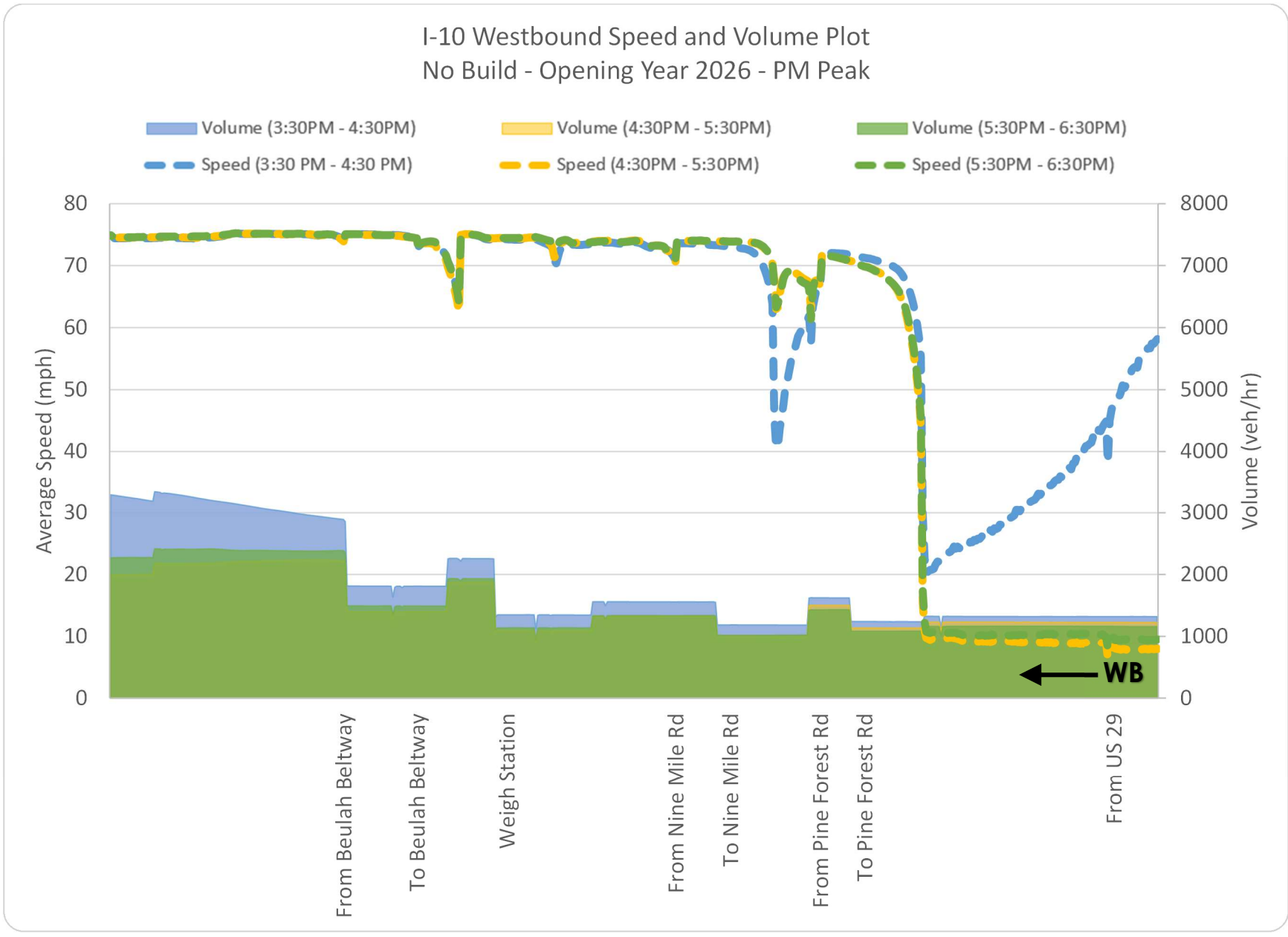



**Figure 6–7. I-10 Westbound Speed and Volume Plot – No-Build Opening Year 2026 PM Peak**

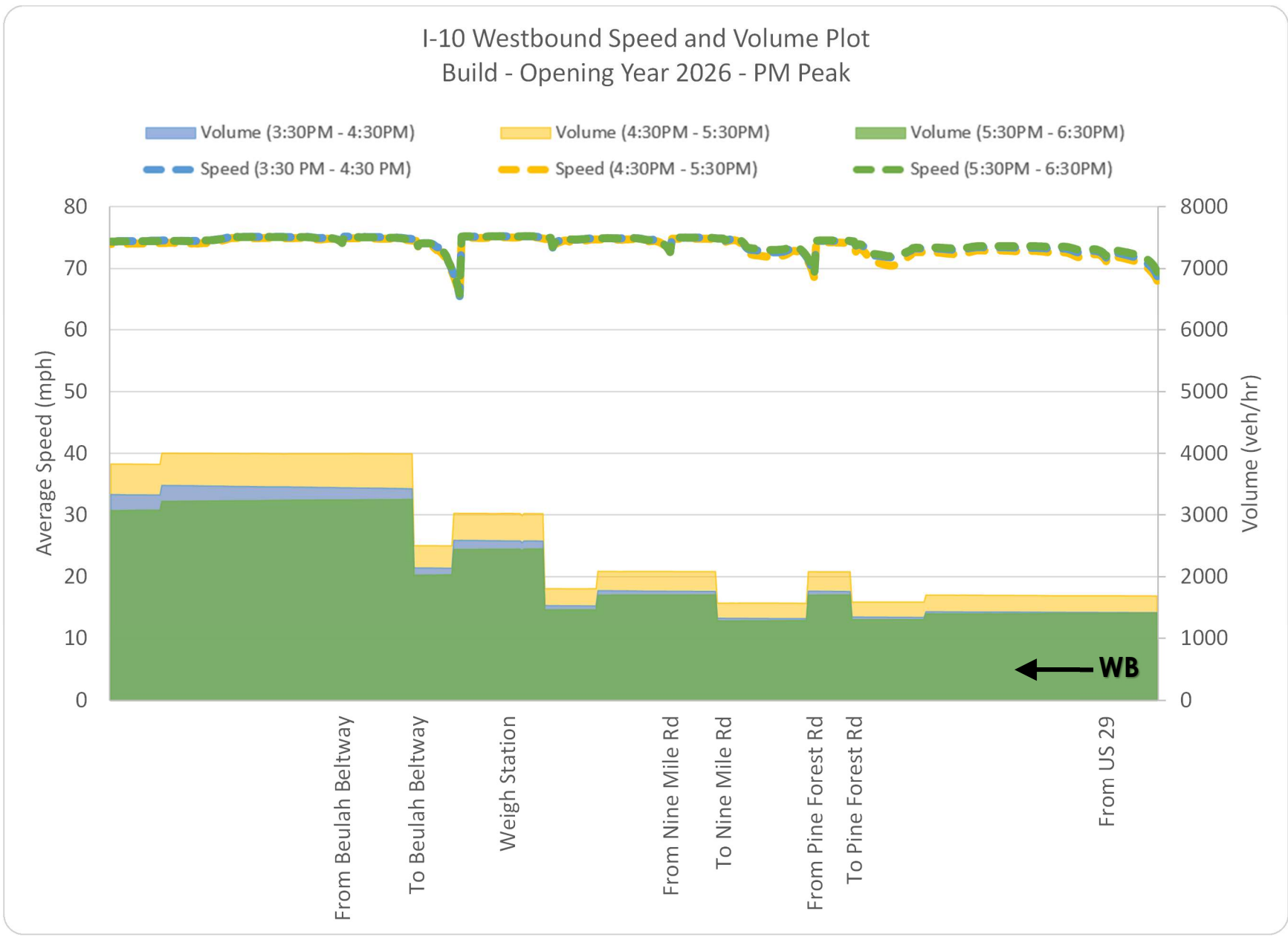



**Figure 6–8. I-10 Westbound Speed and Volume Plot – Build Opening Year 2026 PM Peak**

**Table 6-3. I-10 Eastbound Link Density – Opening Year 2026**

| I-10 Eastbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| **2026 No-Build** | | | | | | | | |
| Beulah Rd On-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 18.5 | 26.6 | 25.0 | 19.2 | 22.3 | 18.2 |
| Weigh Station Merge | 0.00 | 4 | 21.3 | 30.8 | 28.8 | 22.7 | 26.4 | 21.5 |
| Weigh Station On-Ramp to Welcome Center Off-Ramp | 0.25 | 3 | 21.1 | 30.5 | 28.6 | 22.4 | 26.1 | 21.2 |
| Welcome Center Off-Ramp to Welcome Center On-Ramp | 0.50 | 2 | 19.7 | 28.4 | 26.7 | 20.5 | 23.9 | 19.4 |
| Welcome Center Merge | 0.25 | 3 | 21.3 | 30.8 | 28.9 | 22.5 | 26.3 | 21.3 |
| Welcome Center Merge to Nine Mile Rd Off-Ramp | 0.50 | 2 | 21.3 | 30.9 | 29.0 | 22.5 | 26.3 | 21.3 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 18.0 | 26.1 | 24.6 | 18.6 | 22.8 | 20.9 |
| Nine Mile Rd Merge | 0.25 | 3 | 31.3 | 45.4 | 42.8 | 34.1 | 73.7 | 152.1 |
| Nine Mile Rd Merge to Pine Forest Rd Off-Ramp | 1.00 | 2 | 30.5 | 47.3 | 55.0 | 33.7 | 125.1 | 200.7 |
| Pine Forest Rd SB Off-Ramp to Pine Forest Rd NB Off-Ramp | 0.25 | 2 | 26.2 | 38.1 | 36.4 | 26.6 | 34.0 | 34.2 |
| Pine Forest Rd NB Off-Ramp to Pine Forest Rd On-Ramp | 0.25 | 2 | 25.0 | 35.8 | 33.8 | 24.5 | 27.8 | 25.3 |
| Pine Forest Rd Merge | 0.25 | 3 | 42.9 | 69.4 | 60.5 | 42.8 | 47.5 | 43.0 |
| Pine Forest Rd Merge to US 29 Diverge | 2.00 | 2 | 40.9 | 57.9 | 55.6 | 40.7 | 45.0 | 40.6 |
| US 29 Diverge | 0.50 | 4 | 39.3 | 53.9 | 52.3 | 39.0 | 43.1 | 39.0 |
| US 29 Diverge to End of Study Area | 0.50 | 3 | 35.5 | 48.8 | 47.2 | 34.9 | 38.8 | 35.1 |
| **2026 Build** | | | | | | | | |
| Beulah Rd On-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 18.4 | 26.3 | 24.7 | 19.1 | 22.2 | 18.1 |
| Weigh Station Merge | 0.00 | 5 | 21.3 | 30.5 | 28.7 | 22.7 | 26.4 | 21.5 |
| Weigh Station On-Ramp to Welcome Center Off-Ramp | 0.25 | 4 | 20.9 | 30.0 | 28.2 | 22.2 | 25.8 | 21.1 |
| Welcome Center Off-Ramp to Welcome Center On-Ramp | 0.50 | 3 | 19.4 | 27.9 | 26.2 | 20.2 | 23.6 | 19.3 |
| Welcome Center Merge | 0.25 | 4 | 21.1 | 30.3 | 28.4 | 22.3 | 26.0 | 21.2 |
| Welcome Center Merge to Nine Mile Rd Off-Ramp | 0.50 | 3 | 21.0 | 30.3 | 28.5 | 22.2 | 26.0 | 21.2 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 3 | 17.8 | 25.6 | 24.2 | 18.4 | 21.5 | 17.6 |
| Nine Mile Rd Merge | 0.25 | 5 | 31.2 | 46.0 | 42.9 | 34.3 | 40.5 | 32.9 |
| Nine Mile Rd Merge | 0.25 | 4 | 30.1 | 43.9 | 41.1 | 32.7 | 38.6 | 31.6 |
| Nine Mile Rd Merge to Pine Forest Rd Off-Ramp | 0.75 | 3 | 30.1 | 43.9 | 41.1 | 32.7 | 38.7 | 31.7 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 0.25 | 3 | 24.5 | 35.6 | 33.5 | 24.3 | 28.6 | 23.4 |
| Pine Forest Rd Merge | 0.25 | 4 | 40.4 | 59.0 | 55.0 | 41.5 | 48.8 | 40.0 |
| Pine Forest Rd Merge to US 29 Diverge | 2.00 | 3 | 39.6 | 57.7 | 54.3 | 40.3 | 47.6 | 39.2 |
| US 29 Diverge | 0.50 | 4 | 39.5 | 57.3 | 54.3 | 40.1 | 47.5 | 39.3 |
| US 29 Diverge to End of Study Area | 0.50 | 3 | 35.8 | 52.1 | 49.4 | 35.4 | 42.0 | 34.5 |

[1]*Rounded to the nearest 0.25 miles*

**Table 6-4. I-10 Westbound Link Density – Opening Year 2026**

| I-10 Westbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| **2026 No-Build** | | | | | | | | |
| East of US 29 Westbound On-Ramp | 0.75 | 3 | 28.8 | 46.2 | 41.9 | 46.2 | 385.9 | 435.2 |
| US 29 Westbound Merge | 0.25 | 5 | 30.7 | 44.8 | 40.9 | 56.0 | 471.0 | 461.0 |
| US 29 Westbound Merge to Pine Forest Rd Diverge | 1.75 | 2 | 30.9 | 56.5 | 55.2 | 105.0 | 420.2 | 413.9 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 1.00 | 2 | 18.3 | 28.0 | 26.2 | 27.9 | 23.1 | 24.5 |
| Pine Forest Rd Merge | 0.25 | 3 | 25.8 | 37.8 | 35.1 | 33.7 | 28.2 | 29.0 |
| Pine Forest Rd Merge to Nine Mile Rd Diverge | 0.75 | 2 | 24.9 | 37.5 | 35.0 | 33.4 | 27.5 | 29.9 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 14.0 | 20.2 | 19.1 | 19.2 | 15.5 | 16.2 |
| Nine Mile Rd Merge | 0.25 | 3 | 16.8 | 23.3 | 22.5 | 22.0 | 18.5 | 18.4 |
| Nine Mile Rd Merge to Weigh Station Diverge | 1.00 | 2 | 16.4 | 22.9 | 22.1 | 21.7 | 18.2 | 18.1 |
| Weigh Station Diverge | 0.25 | 2 | 16.4 | 22.9 | 22.2 | 21.7 | 18.3 | 18.2 |
| Weigh Station Off-Ramp to Weigh Station On-Ramp | 1.00 | 2 | 11.6 | 16.1 | 15.6 | 16.3 | 13.7 | 13.7 |
| Weigh Station Merge | 0.25 | 5 | 17.8 | 25.3 | 24.0 | 24.2 | 22.9 | 21.0 |
| Weigh Station Merge | 0.25 | 4 | 16.6 | 23.5 | 22.4 | 22.7 | 21.1 | 19.6 |
| Weigh Station Merge to Beulah Rd Off-Ramp | 0.25 | 3 | 16.4 | 23.1 | 22.0 | 22.5 | 20.7 | 19.3 |
| **2026 Build** | | | | | | | | |
| East of US 29 Westbound On-Ramp | 0.75 | 3 | 28.6 | 42.0 | 38.3 | 45.3 | 52.9 | 42.0 |
| US 29 Westbound Merge | 0.25 | 5 | 30.5 | 44.5 | 40.6 | 47.5 | 55.2 | 44.0 |
| US 29 Westbound Merge to Pine Forest Rd Diverge | 1.75 | 3 | 30.1 | 44.1 | 40.5 | 47.0 | 55.0 | 44.0 |
| Pine Forest Rd Diverge | 0.25 | 4 | 29.8 | 43.6 | 40.4 | 46.3 | 54.6 | 44.0 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 0.50 | 3 | 18.0 | 26.3 | 24.1 | 28.8 | 33.8 | 27.3 |
| Pine Forest Rd Merge | 0.25 | 4 | 25.3 | 37.0 | 34.2 | 36.3 | 42.7 | 34.2 |
| Pine Forest Rd Merge to Nine Mile Rd Diverge | 0.50 | 3 | 24.4 | 36.0 | 33.1 | 35.6 | 42.2 | 33.7 |
| Nine Mile Rd Diverge | 0.25 | 4 | 24.0 | 35.0 | 32.4 | 34.8 | 40.9 | 33.1 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 3 | 13.8 | 19.9 | 18.5 | 20.9 | 24.6 | 20.0 |
| Nine Mile Rd Merge | 0.25 | 4 | 16.5 | 23.7 | 22.1 | 24.0 | 28.4 | 23.2 |
| Nine Mile Rd Merge to Weigh Station Off-Ramp | 1.00 | 3 | 16.3 | 23.4 | 22.0 | 23.8 | 28.1 | 23.0 |
| Weigh Station Off-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 11.5 | 16.6 | 15.6 | 17.8 | 21.2 | 17.4 |
| Weigh Station Merge | 0.25 | 5 | 17.8 | 25.8 | 24.0 | 25.7 | 30.4 | 24.8 |
| Weigh Station Merge | 0.25 | 4 | 16.6 | 24.0 | 22.4 | 24.2 | 28.8 | 23.5 |
| Weigh Station Merge to Beulah Rd Off-Ramp | 0.25 | 3 | 16.3 | 23.6 | 22.1 | 23.8 | 28.3 | 23.1 |

[1]*Rounded to the nearest 0.25 miles*

The freeway results for Design Year 2046 are displayed in **Figure 6–9** through **Figure 6–16**. Results show increased shockwave effects of the speed drops seen in the Opening Year 2026 speed plots. The speed drops are due to off-ramp queuing at either the Nine Mile Road or Pine Forest Road interchanges. Additionally, there is merging turbulence in the eastbound and westbound directions generating speed drops upstream of the I-10 merges as vehicles slow to allow traffic to merge.

In the 2046 No-Build AM Peak, the eastbound and westbound speed drop occurs at Pine Forest Road off-ramp and the merge locations. In the PM peak, the speed drops occur at the same locations. This is due to a bottleneck effect created by off-ramp traffic spilling back to the freeway. Once those bottlenecks are cleared with improvements to the interchanges and adjacent intersections, the mainline speeds resume to at or near free flow conditions.

In 2046, the Build Alternative shows that I-10 speeds are consistently near 70 mph or above. Reductions in speed from 60 mph to 70 mph are experienced near the interchanges, which is expected due to the effects of merging and diverging. The Build Alternative also shows an increased volume serviced throughout I-10 when compared to the No-Build. Without any bottlenecks along the corridor, the 2046 traffic demand can be accommodated.

To further visualize the traffic operations, link-level density is summarized in **Table 6-5** and **Table 6-6**.

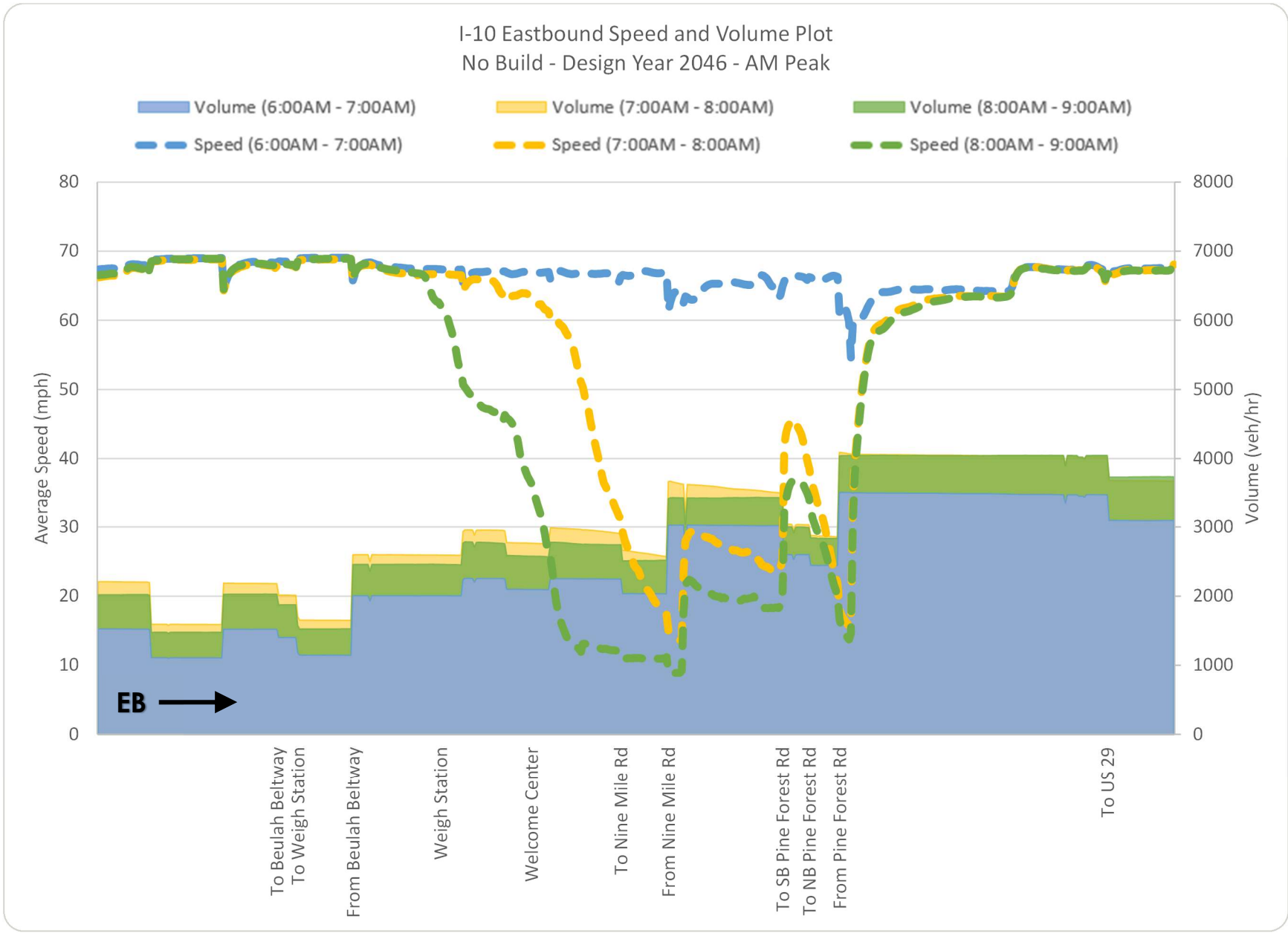



**Figure 6–9. I-10 Eastbound Speed and Volume Plot – No-Build Design Year 2046 AM Peak**

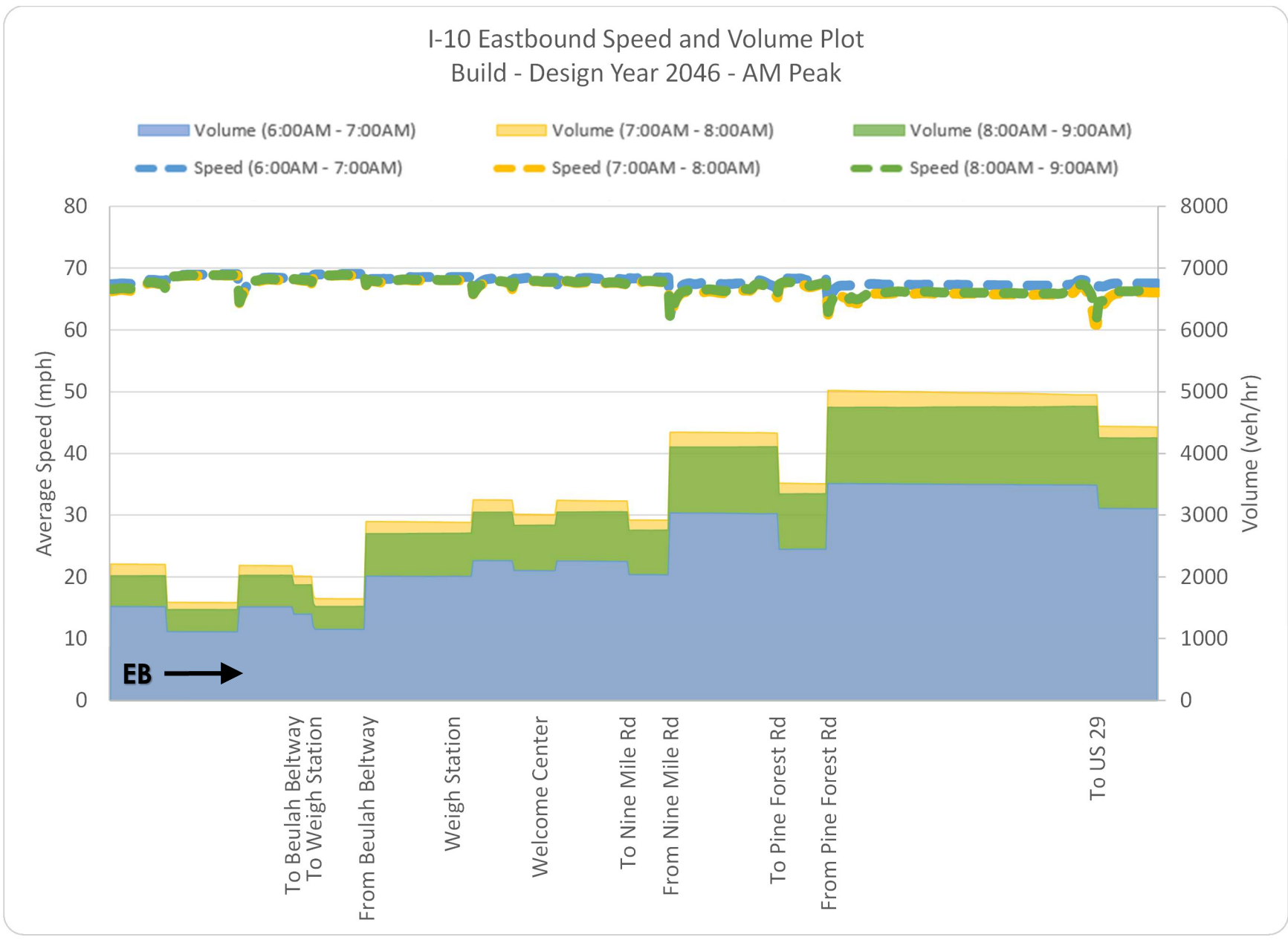



**Figure 6–10. I-10 Eastbound Speed and Volume Plot – Build Design Year 2046 AM Peak**

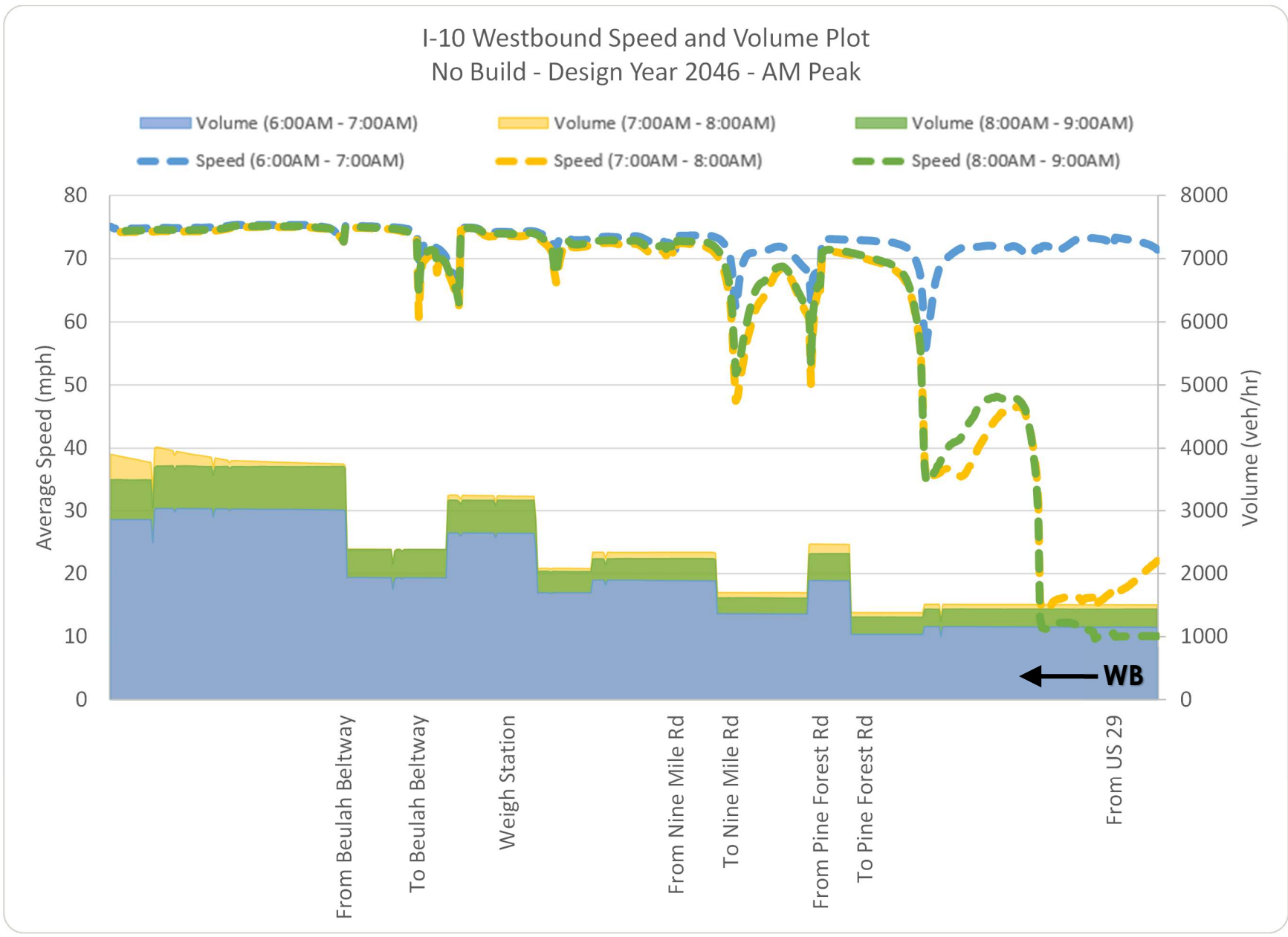



**Figure 6–11. I-10 Westbound Speed and Volume Plot – No-Build Design Year 2046 AM Peak**

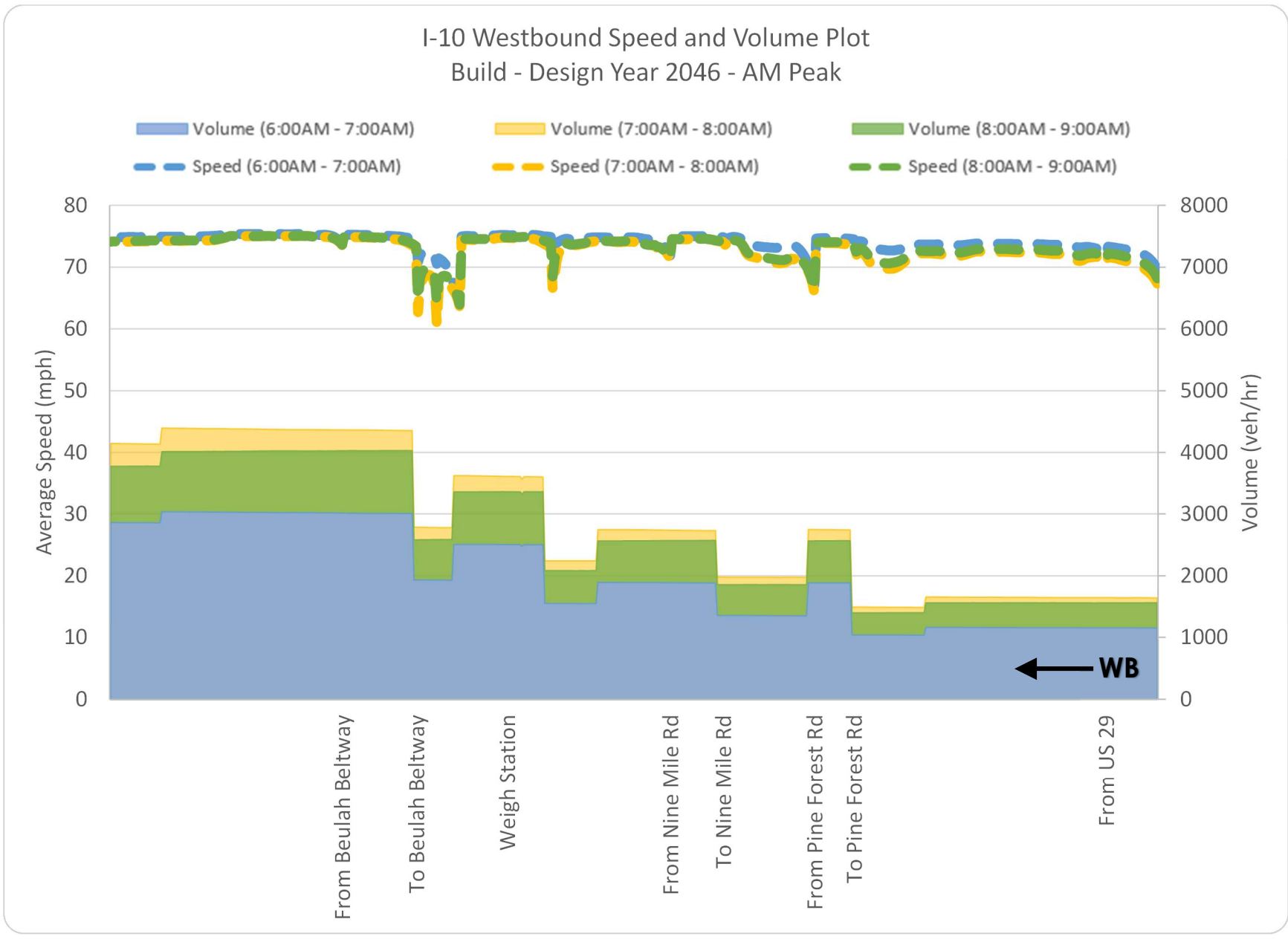



**Figure 6–12. I-10 Westbound Speed and Volume Plot – Build Design Year 2046 AM Peak**

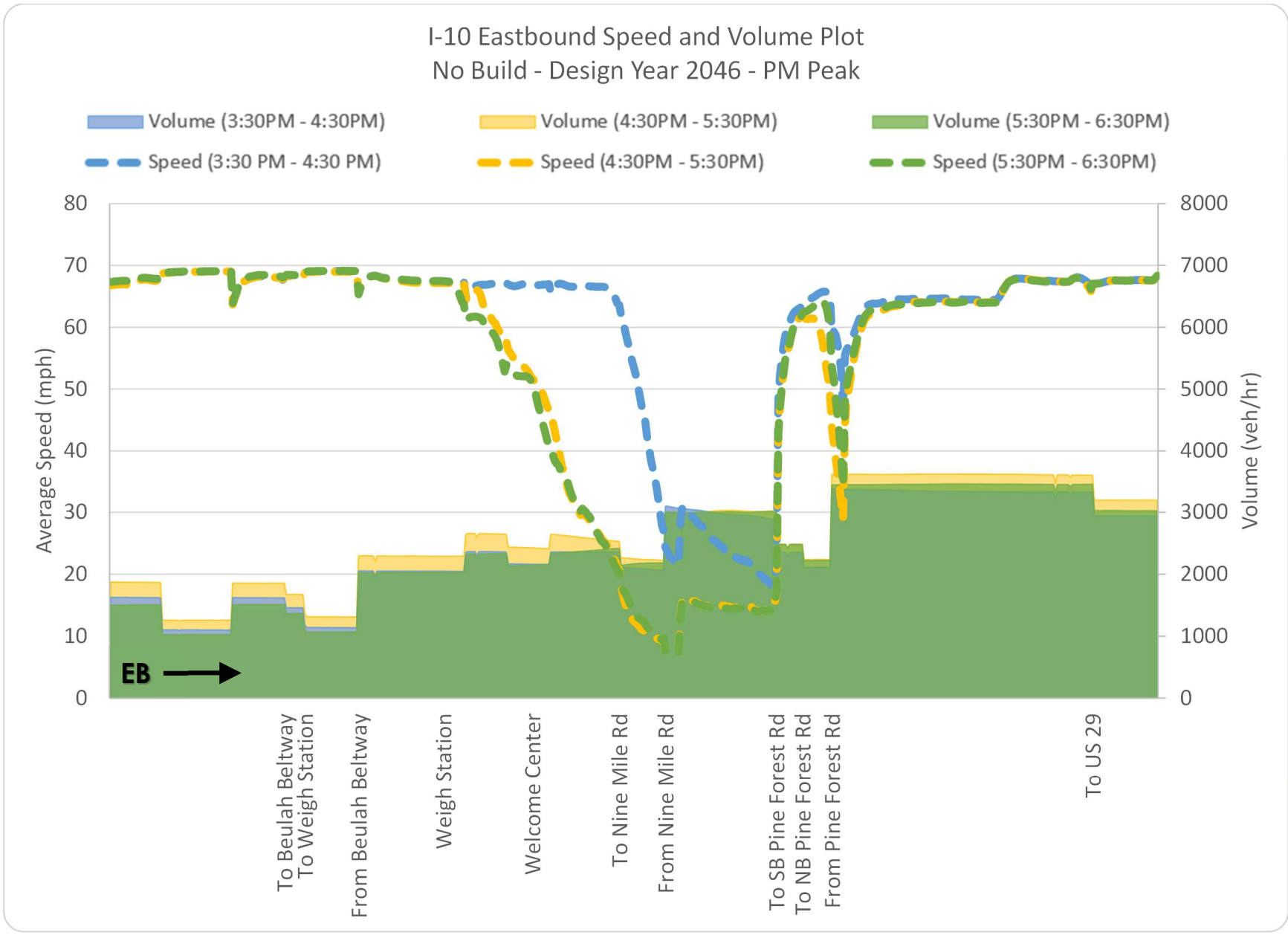



**Figure 6–13. I-10 Eastbound Speed and Volume Plot – No-Build Design Year 2046 PM Peak**

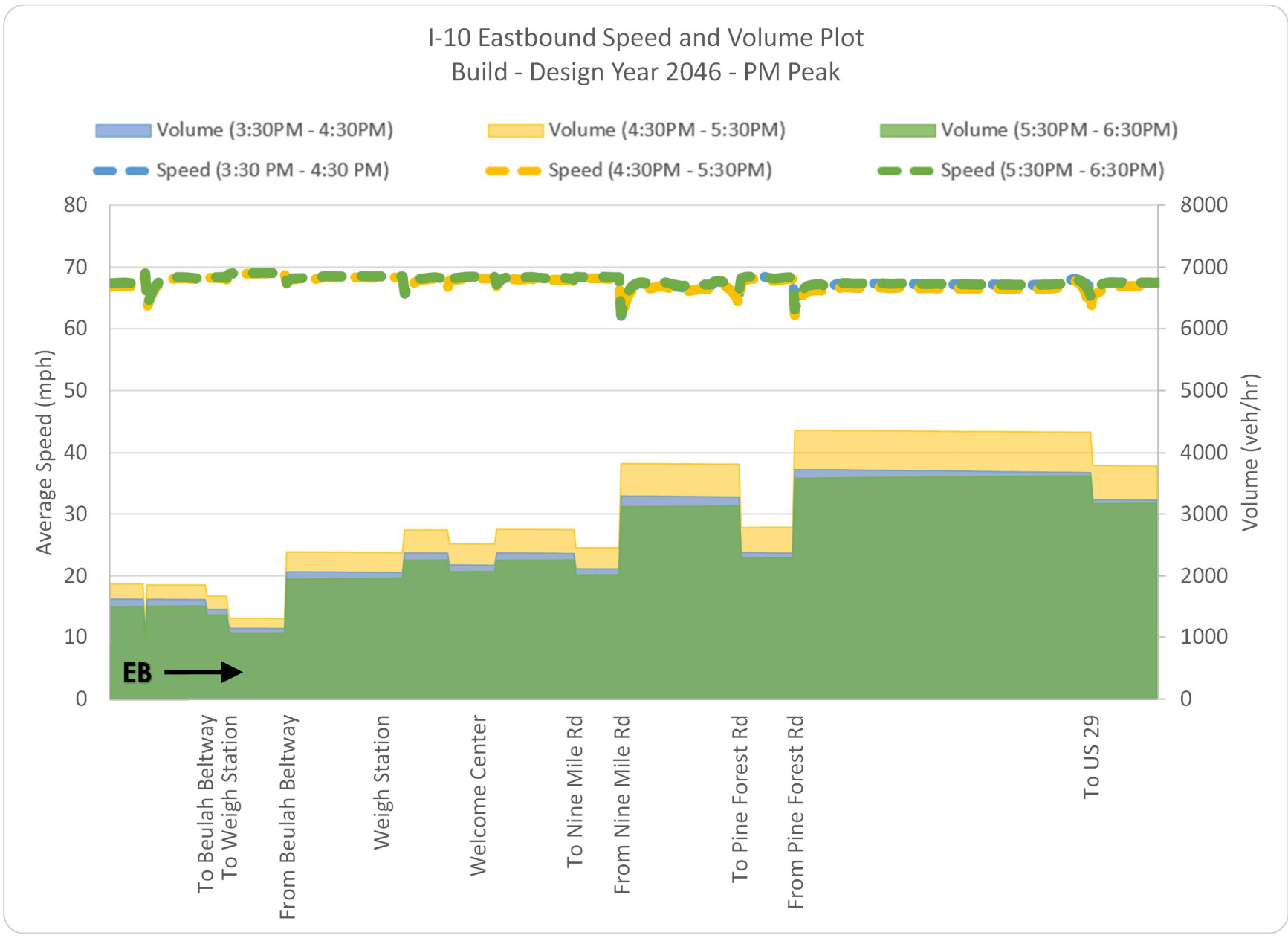



**Figure 6–14. I-10 Eastbound Speed and Volume Plot – Build Design Year 2046 PM Peak**

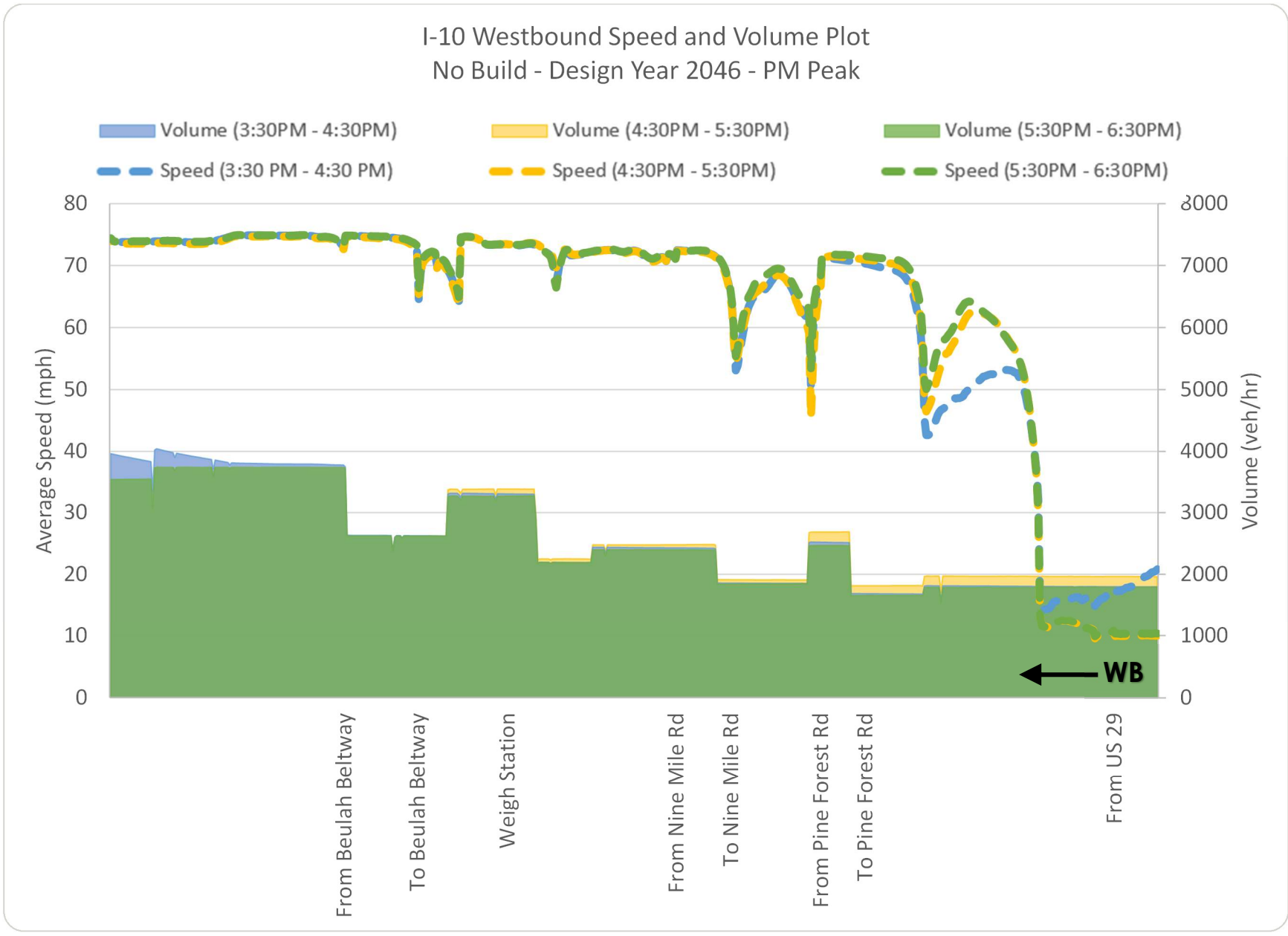



**Figure 6–15. I-10 Westbound Speed and Volume Plot – No-Build Design Year 2046 PM Peak**

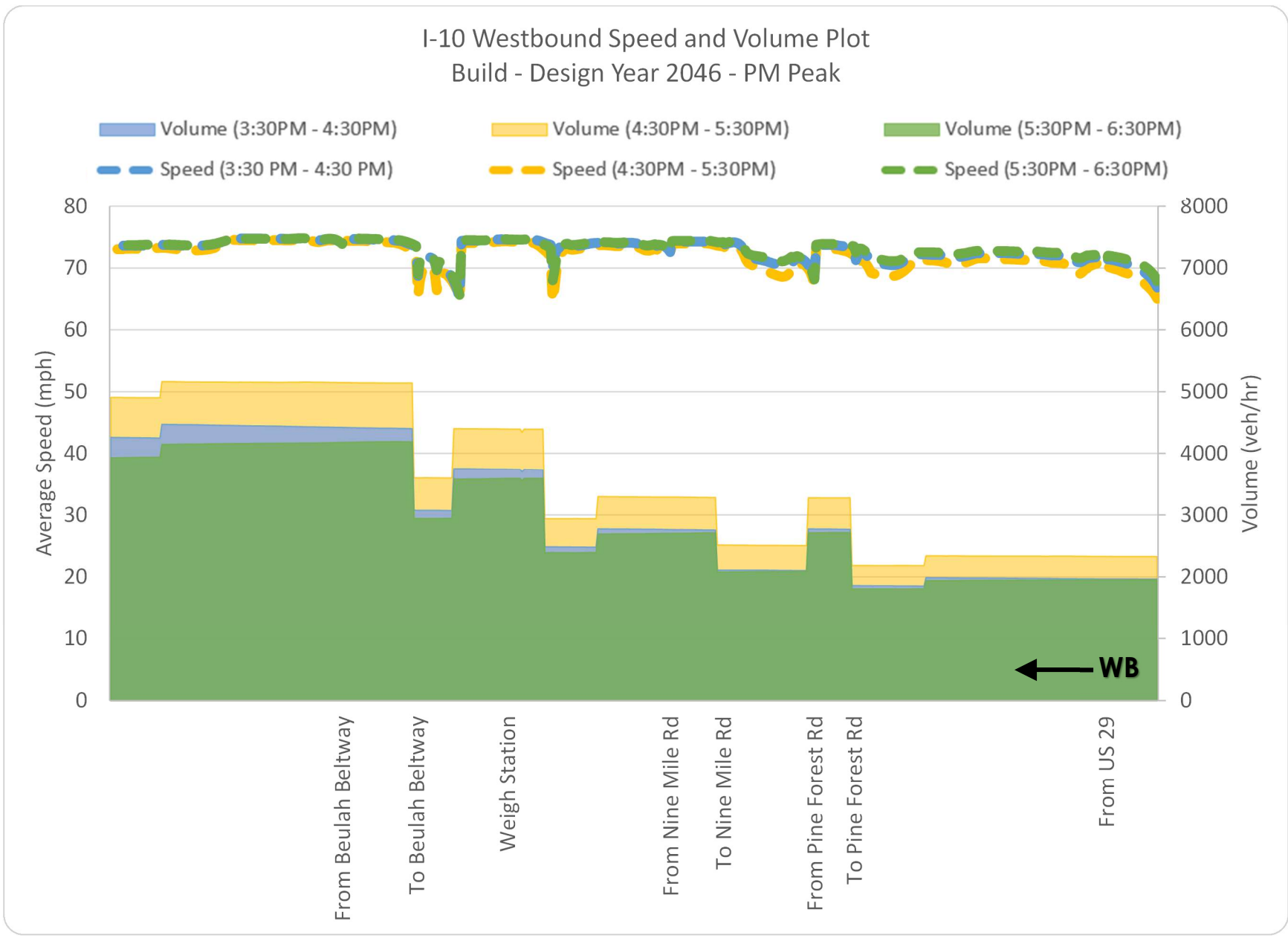



**Figure 6–16. I-10 Westbound Speed and Volume Plot – Build Design Year 2046 PM Peak**

**Table 6-5. I-10 Eastbound Link Density – Design Year 2046**

| I-10 Eastbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| **2046 No-Build** | | | | | | | | |
| Beulah Rd On-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 29.8 | 38.9 | 42.4 | 29.8 | 38.9 | 30.5 |
| Weigh Station Merge | 0.00 | 4 | 33.9 | 45.0 | 70.0 | 33.9 | 45.0 | 43.8 |
| Weigh Station On-Ramp to Welcome Center Off-Ramp | 0.25 | 3 | 33.6 | 45.3 | 86.8 | 33.6 | 45.3 | 57.7 |
| Welcome Center Off-Ramp to Welcome Center On-Ramp | 0.50 | 2 | 31.3 | 44.6 | 110.9 | 31.3 | 44.6 | 75.2 |
| Welcome Center Merge | 0.25 | 3 | 33.7 | 55.1 | 199.9 | 33.7 | 55.1 | 120.5 |
| Welcome Center Merge to Nine Mile Rd Off-Ramp | 0.50 | 2 | 33.7 | 82.6 | 220.9 | 33.7 | 82.6 | 147.2 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 30.4 | 127.3 | 228.5 | 30.4 | 127.3 | 200.2 |
| Nine Mile Rd Merge | 0.25 | 3 | 47.3 | 235.3 | 338.9 | 47.3 | 235.3 | 369.3 |
| Nine Mile Rd Merge to Pine Forest Rd Off-Ramp | 1.00 | 2 | 46.2 | 143.8 | 184.6 | 46.2 | 209.3 | 184.6 |
| Pine Forest Rd SB Off-Ramp to Pine Forest Rd NB Off-Ramp | 0.25 | 2 | 39.2 | 82.5 | 114.9 | 42.5 | 82.5 | 114.9 |
| Pine Forest Rd NB Off-Ramp to Pine Forest Rd On-Ramp | 0.25 | 2 | 37.1 | 116.7 | 145.1 | 37.1 | 116.7 | 145.1 |
| Pine Forest Rd Merge | 0.25 | 3 | 58.2 | 237.4 | 269.2 | 58.2 | 237.4 | 269.2 |
| Pine Forest Rd Merge to US 29 Diverge | 2.00 | 2 | 54.6 | 66.8 | 67.7 | 54.6 | 66.8 | 67.7 |
| US 29 Diverge | 0.50 | 4 | 51.2 | 59.8 | 60.1 | 51.2 | 59.8 | 60.1 |
| US 29 Diverge to End of Study Area | 0.50 | 3 | 45.8 | 54.5 | 55.4 | 45.8 | 54.5 | 44.7 |
| **2046 Build** | | | | | | | | |
| Beulah Rd On-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 29.4 | 42.5 | 39.7 | 30.5 | 35.2 | 28.9 |
| Weigh Station Merge | 0.00 | 5 | 33.7 | 48.6 | 45.5 | 35.8 | 41.4 | 34.0 |
| Weigh Station On-Ramp to Welcome Center Off-Ramp | 0.25 | 4 | 33.1 | 47.9 | 45.0 | 35.2 | 40.7 | 33.5 |
| Welcome Center Off-Ramp to Welcome Center On-Ramp | 0.50 | 3 | 30.7 | 44.4 | 41.8 | 32.1 | 37.2 | 30.6 |
| Welcome Center Merge | 0.25 | 4 | 33.1 | 47.8 | 45.0 | 35.0 | 40.8 | 33.4 |
| Welcome Center Merge to Nine Mile Rd Off-Ramp | 0.50 | 3 | 33.0 | 47.8 | 45.1 | 34.9 | 40.7 | 33.4 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 3 | 29.8 | 43.1 | 40.6 | 31.1 | 36.2 | 29.7 |
| Nine Mile Rd Merge | 0.25 | 5 | 46.0 | 67.0 | 63.2 | 50.2 | 58.8 | 47.5 |
| Nine Mile Rd Merge | 0.25 | 4 | 44.8 | 65.9 | 62.0 | 49.2 | 57.9 | 46.6 |
| Nine Mile Rd Merge to Pine Forest Rd Off-Ramp | 0.75 | 3 | 44.8 | 65.9 | 62.0 | 49.2 | 57.9 | 46.7 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 0.25 | 3 | 35.9 | 52.2 | 49.6 | 35.1 | 41.3 | 33.8 |
| Pine Forest Rd Merge | 0.25 | 4 | 52.7 | 77.5 | 72.9 | 56.5 | 66.9 | 54.2 |
| Pine Forest Rd Merge to US 29 Diverge | 2.00 | 3 | 51.9 | 75.9 | 72.0 | 55.3 | 65.5 | 53.7 |
| US 29 Diverge | 0.50 | 4 | 51.7 | 76.3 | 72.3 | 54.7 | 65.1 | 53.9 |
| US 29 Diverge to End of Study Area | 0.50 | 3 | 46.3 | 69.4 | 65.8 | 48.2 | 57.1 | 47.2 |

[1]*Rounded to the nearest 0.25 miles*

**Table 6-6. I-10 Westbound Link Density – Design Year 2046**

| I-10 Westbound Segment | Dist.[1] (mi) | # of Lanes | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6:00 AM | 7:00 AM | 8:00 AM | 3:30 PM | 4:30 PM | 5:30 PM |
| **2046 No-Build** | | | | | | | | |
| East of US 29 Westbound On-Ramp | 0.75 | 3 | 38.8 | 187.7 | 347.0 | 214.0 | 347.0 | 343.7 |
| US 29 Westbound Merge | 0.25 | 5 | 41.8 | 255.0 | 367.2 | 253.3 | 368.7 | 362.9 |
| US 29 Westbound Merge to Pine Forest Rd Diverge | 1.75 | 2 | 51.6 | 241.8 | 316.0 | 244.2 | 313.3 | 313.8 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 1.00 | 2 | 26.9 | 36.1 | 35.8 | 38.9 | 37.9 | 37.5 |
| Pine Forest Rd Merge | 0.25 | 3 | 39.5 | 53.9 | 51.0 | 54.1 | 58.6 | 52.0 |
| Pine Forest Rd Merge to Nine Mile Rd Diverge | 0.75 | 2 | 37.8 | 55.7 | 51.5 | 52.7 | 53.3 | 50.5 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 2 | 23.5 | 30.9 | 29.5 | 31.8 | 32.6 | 31.6 |
| Nine Mile Rd Merge | 0.25 | 3 | 26.1 | 32.8 | 31.0 | 34.1 | 34.6 | 33.3 |
| Nine Mile Rd Merge to Weigh Station Off-Ramp | 1.00 | 2 | 25.8 | 32.5 | 30.9 | 33.8 | 34.5 | 33.2 |
| Weigh Station Off-Ramp to Weigh Station On-Ramp | 1.00 | 2 | 18.4 | 23.2 | 21.9 | 25.4 | 26.1 | 25.2 |
| Weigh Station Merge | 0.25 | 5 | 28.2 | 37.7 | 35.1 | 37.6 | 40.5 | 36.5 |
| Weigh Station Merge | 0.25 | 4 | 26.6 | 35.8 | 33.3 | 35.8 | 38.4 | 34.8 |
| Weigh Station Merge to Beulah Rd Off-Ramp | 0.25 | 3 | 26.3 | 35.8 | 33.1 | 35.7 | 38.2 | 34.8 |
| **2046 Build** | | | | | | | | |
| East of US 29 Westbound On-Ramp | 0.75 | 3 | 39.1 | 58.9 | 53.2 | 59.0 | 69.5 | 54.6 |
| US 29 Westbound Merge | 0.25 | 5 | 41.6 | 61.6 | 55.8 | 62.1 | 72.6 | 57.4 |
| US 29 Westbound Merge to Pine Forest Rd Diverge | 1.75 | 3 | 41.0 | 60.7 | 55.4 | 61.5 | 72.6 | 57.5 |
| Pine Forest Rd Diverge | 0.25 | 4 | 40.7 | 60.5 | 55.6 | 60.3 | 71.7 | 57.3 |
| Pine Forest Rd Off-Ramp to Pine Forest Rd On-Ramp | 0.50 | 3 | 25.9 | 37.8 | 35.0 | 41.8 | 49.4 | 40.1 |
| Pine Forest Rd Merge | 0.25 | 4 | 35.2 | 51.8 | 47.9 | 53.7 | 64.0 | 51.4 |
| Pine Forest Rd Merge to Nine Mile Rd Diverge | 0.50 | 3 | 34.2 | 50.9 | 47.1 | 53.4 | 64.8 | 51.1 |
| Nine Mile Rd Diverge | 0.25 | 4 | 33.5 | 48.7 | 45.4 | 51.1 | 60.7 | 49.0 |
| Nine Mile Rd Off-Ramp to Nine Mile Rd On-Ramp | 0.50 | 3 | 20.8 | 30.2 | 28.1 | 34.2 | 40.6 | 32.9 |
| Nine Mile Rd Merge | 0.25 | 4 | 25.9 | 37.8 | 35.3 | 37.7 | 45.0 | 36.6 |
| Nine Mile Rd Merge to Weigh Station Off-Ramp | 1.00 | 3 | 25.5 | 38.1 | 35.4 | 37.9 | 46.0 | 37.2 |
| Weigh Station Off-Ramp to Weigh Station On-Ramp | 1.00 | 3 | 18.1 | 26.6 | 25.0 | 28.6 | 34.4 | 28.5 |
| Weigh Station Merge | 0.25 | 5 | 28.2 | 41.7 | 38.7 | 41.0 | 48.8 | 39.9 |
| Weigh Station Merge | 0.25 | 4 | 26.6 | 41.5 | 37.9 | 39.6 | 48.3 | 38.6 |
| Weigh Station Merge to Beulah Rd Off-Ramp | 0.25 | 3 | 26.2 | 40.6 | 37.3 | 38.5 | 46.5 | 37.6 |

[1]*Rounded to the nearest 0.25 miles*

## 6.4 INTERSECTION OPERATIONS

The No-Build and Build intersection results for Opening Year 2026 are compared in **Table 6–3** and **Table 6–4**. Results show that five (5) of the 19 study intersections experience LOS E or worse operations in the No-Build AM Peak scenario, and five (5) of the 19 study intersections LOS E or worse operations in the No-Build PM Peak scenario. Both the Pine Forest Road and Nine Mile Road interchanges are included in the failing intersections. The Build Alternative results in intersection LOS D or better for all ramp terminals and all arterial intersections, except for the Nine Mile Road and Heritage Oaks Boulevard intersection, which operates at LOS E during the AM peak hour in 2026. For the purposes of this analysis, improvements were not assumed on the sidestreet of Heritage Oaks Boulevard for year 2026 (this intersection is being addressed by a separate project, as discussed in **Section 1.3**).

Detailed intersection movement results can be found in **Appendix I**.

Note that in 2026, the No-Build and Build network do include some background network changes that differ from the existing configuration due to the planned and programmed projects for 2026 that were discussed earlier in **Sections 1.3** and **5.0**. For instance, the new Beulah Interchange was assumed to be in place in 2026, as well as widening improvements along Nine Mile Road. Due to these changes, the 2026 No-Build network may operate better than the Existing network, despite an increase in traffic volume.

**Table 6-7. Opening Year 2026 AM Peak Intersection Results Summary**

| Major Rd | Intersection | 2026 AM Peak | | | | | |
|---|---|---|---|---|---|---|---|
| | | No-Build | | | Build | | |
| | | Control Type | Delay[1] (s/veh) | Est. LOS | Control Type | Delay[1] (s/veh) | Est. LOS |
| Beulah Beltway | I-10 WB Ramps | | 21.0 | C | | 10.7 | B |
| | I-10 EB Ramps | | 6.4 | A | | 15.2 | B |
| Beulah Rd | Kingsfield Rd | STOP | 10.7 | B | STOP | 10.3 | B |
| | Beulah Beltway | | 5.5 | A | | 5.9 | A |
| | Frank Reeder Rd | STOP | 12.8 | B | STOP | 13.4 | B |
| Nine Mile Rd | Beulah Rd | | 21.8 | C | | 26.5 | C |
| | Bell Ridge Dr | STOP | 15.9 | C | STOP | 14.6 | B |
| | Foxtail Loop | STOP | 19.8 | C | STOP | 8.2 | A |
| | Security Pl | STOP | 12.9 | B | STOP | 12.4 | B |
| | Heritage Oaks Blvd[2] | | 42.9 | D | | 68.4 | E |
| | Navy Federal Way | | 53.0 | D | | 21.2 | C |
| | I-10 EB Ramps | | 27.2 | C | | 22.4 | C |
| | I-10 WB Ramps | | 96.1 | F | | 23.8 | C |
| | Pine Cone Dr | STOP | 218.1 | F | | 31.8 | C |
| | MUT, W of Pine Forest Rd | - | | - | | 10.2 | B |
| | Pine Forest Rd | | 61.7 | E | | 21.3 | C |
| | MUT, E of Pine Forest Rd | - | | - | | 13.9 | B |
| | MUT, N of Detroit Blvd | - | | - | | 8.9 | A |
| Pine Forest Rd | Detroit Blvd | STOP | 498.2 | F | STOP | 24.0 | C |
| | I-10 WB Ramps | | 62.2 | E | | 25.9 | C |
| | I-10 EB Ramps* | | 46.9 | D | | 17.4 | B |
| | Wilde Lake Blvd* | | 46.1 | D | | 25.6 | C |

*[1]The reported delay for stop controlled intersections is the worst movement delay;*

*[2]With improved traffic flow at the Nine Mile Road ramp terminal, additional traffic is able to flow along Nine Mile Road causing additional delays. Additional improvements are being considered for this intersection under a separate project.*

**The I-10 EB On-Ramp is the East Leg of Wilde Lake Blvd in No-Build*

**Table 6-8. Opening Year 2026 AM Peak Ramp Terminal Movement and Queue Results**

| Major Rd | Intersection and Movement | | 2026 AM Peak | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | No-Build | | | | Build | | | |
| | | | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] |
| Nine Mile Road | West Ramp Terminal | EBT | 33 | C | 316 | - | 20 | C | 274 | - |
| | | EBR | Free | - | - | - | 2 | A | 0 | - |
| | | WBL | 26 | C | 1,109 | - | 8 | A | 605 | - |
| | | WBT | 25 | C | 1,309 | - | 35 | D | 939 | - |
| | | SBL | 42 | D | 114 | 300 | 34 | C | 172 | 675 |
| | | SBR | Free | - | - | 300 | 5 | A | 139 | 675 |
| | East Ramp Terminal | EBL | 39 | D | 122 | - | 1 | A | 57 | - |
| | | EBT | 20 | C | 331 | - | 10 | A | 236 | - |
| | | WBT | 186 | F | 1,994 | - | 38 | D | 594 | - |
| | | WBR | Free | - | - | - | Free | - | - | - |
| | | NBL | 42 | D | 1,082 | 600 | 17 | B | 278 | 750 |
| | | NBR | 70 | C | 83 | 600 | 25 | C | 99 | 650 |
| Pine Forest Road | North Ramp Terminal | WBL | 107 | F | 4,960 | 850 | 21 | C | 342 | 825 |
| | | WBR | 144 | F | 5,010 | 850 | 25 | C | 274 | 975 |
| | | NBL | 27 | C | 552 | - | 2 | A | 356 | - |
| | | NBT | 16 | B | 601 | - | 32 | C | 493 | - |
| | | SBT | 64 | E | 567 | - | 36 | D | 433 | - |
| | | SBR | 6 | A | 209 | - | 2 | A | 0 | - |
| | South Ramp Terminal | EBL | N/A | - | - | - | 24 | C | 158 | 425 |
| | | EBR | 173 | F | 1,451 | 925 | 18 | B | 199 | 725 |
| | | NBT | Free | - | - | - | 28 | C | 379 | - |
| | | NBR | Free | - | - | - | 4 | A | 0 | - |
| | | SBL | N/A | - | - | - | 2 | A | 434 | - |
| | | SBT | 21 | C | 599 | - | 22 | C | 535 | - |

*[1]Approximate storage is measured from the stop bar to the end of the storage bay; does not include deceleration distance*

**Table 6-9. Opening Year 2026 PM Peak Intersection Results Summary**

| Major Rd | Intersection | 2026 PM Peak | | | | | |
|---|---|---|---|---|---|---|---|
| | | No-Build | | | Build | | |
| | | Control Type | Delay[1] (s/veh) | Est. LOS | Control Type | Delay[1] (s/veh) | Est. LOS |
| Beulah Beltway | I-10 WB Ramps | | 11.2 | B | | 11.5 | B |
| | I-10 EB Ramps | | 6.9 | A | | 15.0 | B |
| Beulah Rd | Kingsfield Rd | STOP | 16.0 | C | STOP | 16.0 | C |
| | Beulah Beltway | | 6.7 | A | | 6.7 | A |
| | Frank Reeder Rd | STOP | 12.2 | B | STOP | 11.4 | B |
| Nine Mile Rd | Beulah Rd | | 20.1 | C | | 25.1 | C |
| | Bell Ridge Dr | STOP | 8.7 | A | STOP | 8.4 | A |
| | Foxtail Loop | STOP | 7.9 | A | STOP | 7.5 | A |
| | Security Pl | STOP | 24.0 | C | STOP | 22.0 | C |
| | Heritage Oaks Blvd | | 53.6 | D | | 40.1 | D |
| | Navy Federal Way | | 46.0 | D | | 18.7 | B |
| | I-10 EB Ramps | | 54.0 | D | | 17.7 | B |
| | I-10 WB Ramps | | 34.1 | C | | 20.8 | C |
| | Pine Cone Dr | STOP | 29.1 | C | | 22.7 | C |
| | MUT, W of Pine Forest Rd | - | - | - | | 22.7 | C |
| | Pine Forest Rd | | 222.8 | F | | 14.9 | B |
| | MUT, E of Pine Forest Rd | - | - | - | | 14.6 | B |
| | MUT, N of Detroit Blvd | - | - | - | | 7.2 | A |
| Pine Forest Rd | Detroit Blvd | STOP | 569.4 | F | STOP | 32.1 | D |
| | I-10 WB Ramps | | 152.4 | F | | 21.0 | C |
| | I-10 EB Ramps* | | 82.3 | F | | 14.4 | B |
| | Wilde Lake Blvd* | | 56.9 | E | | 21.5 | C |

*[1]The reported delay for stop controlled intersections is the worst movement delay; *The I-10 EB On-Ramp is the East Leg of Wilde Lake Blvd in No-Build*

**Table 6-10. Opening Year 2026 PM Peak Ramp Terminal Movement and Queue Results**

| Major Rd | Intersection and Movement | | 2026 PM Peak | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | No-Build | | | | Build | | | |
| | | | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage [1] | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage [1] |
| Nine Mile Road | West Ramp Terminal | EBT | 76 | E | 2,731 | - | 16 | B | 477 | - |
| | | EBR | Free | - | - | - | 2 | A | 0 | - |
| | | WBL | 41 | D | 349 | - | 2 | A | 109 | - |
| | | WBT | 11 | B | 318 | - | 34 | C | 307 | - |
| | | SBL | 49 | D | 186 | 300 | 50 | D | 307 | 675 |
| | | SBR | Free | - | - | 300 | 5 | A | 70 | 675 |
| | East Ramp Terminal | EBL | 33 | C | 69 | - | 6 | A | 475 | - |
| | | EBT | 36 | D | 1,178 | - | 16 | B | 699 | - |
| | | WBT | 33 | C | 394 | - | 32 | C | 276 | - |
| | | WBR | Free | - | - | - | Free | - | - | - |
| | | NBL | 29 | C | 218 | 600 | 10 | B | 159 | 750 |
| | | NBR | 34 | C | 374 | 600 | 35 | C | 436 | 650 |
| Pine Forest Road | North Ramp Terminal | WBL | 137 | F | 16,450 | 850 | 22 | C | 401 | 825 |
| | | WBR | 362 | F | 16,501 | 850 | 27 | C | 353 | 975 |
| | | NBL | 81 | F | 1,286 | - | 2 | A | 367 | - |
| | | NBT | 152 | F | 1,285 | - | 20 | B | 505 | - |
| | | SBT | 120 | F | 566 | - | 27 | C | 373 | - |
| | | SBR | 12 | B | 205 | - | 2 | A | 0 | - |
| | South Ramp Terminal | EBL | N/A | - | - | - | 20 | B | 166 | 425 |
| | | EBR | 320 | F | 2,785 | 925 | 16 | B | 237 | 725 |
| | | NBT | Free | - | - | - | 16 | B | 345 | - |
| | | NBR | Free | - | - | - | 4 | A | 0 | - |
| | | SBL | N/A | - | - | - | 2 | A | 321 | - |
| | | SBT | 4 | - | 229 | - | 21 | C | 422 | - |

*[1]Approximate storage is measured from the stop bar to the end of the storage bay; does not include deceleration distance*

The Design Year 2046 results for No-Build and Build are compared in **Table 6–5** and **Table 6–6**. Results show that ten (10) of the 19 study intersections experience a failing level of service in either the No-Build AM or PM Peak scenario, with multiple intersections experiencing severe delays greater than 100 seconds per vehicle. These No-Build results are due to the network gridlock caused at the Pine Forest Road interchange – the eastbound off-ramp cannot process the demand, and therefore backs up the I-10 eastbound and Nine Mile Road eastbound directions. In the Build Alternative, all ramp terminals and arterial intersections operate at LOS D or better with the exception of one intersection in the AM peak hour: Beulah Beltway and I-10 westbound ramps, which operates at LOS E (this interchange is being addressed by a separate project). Both the Nine Mile Road and Pine Forest Road interchanges are able to accommodate the traffic demand, keeping delay for all movements within the LOS D threshold. Detailed intersection movement results can be found in **Appendix I**.

Note that in 2046, the No-Build and Build networks do include some background network changes that differ from the 2026 configurations due to additional projects planned for 2046 that would not be complete by 2026. For instance, the Beulah Beltway is included in 2046 but not in 2026, Nine Mile Road is widened to six (6) lanes from Beulah Road to east of I-10 with intersection improvements at NFCU accesses in 2046 but not in 2026, Nine Mile Road is widened from Mobile Highway to Beulah Road in 2046 but not in 2026, and Pine Forest Road from I-10 to Nine Mile Road is widened in 2046 but not in 2026. Due to these changes, the 2046 network may operate better than the 2026 network despite an increase in traffic volume. The background network changes were discussed earlier in **Sections 1.3** and **5.0**.

**Table 6-11. Design Year 2046 AM Peak Intersection Results Summary**

| Major Rd | Intersection | 2046 AM Peak | | | | | |
|---|---|---|---|---|---|---|---|
| | | No-Build | | | Build | | |
| | | Control Type | Delay[1] (s/veh) | Est. LOS | Control Type | Delay[1] (s/veh) | Est. LOS |
| Beulah Beltway | I-10 WB Ramps | | 165.2 | F | | 61.8 | E |
| | I-10 EB Ramps | | 28.9 | C | | 29.4 | C |
| Beulah Rd | Kingsfield Rd | STOP | 6.9 | A | STOP | 6.9 | A |
| | Beulah Beltway | | 6.1 | A | | 5.7 | A |
| | Frank Reeder Rd | STOP | 12.9 | B | STOP | 13.6 | B |
| Nine Mile Rd | Beulah Rd | | 24.0 | C | | 33.5 | C |
| | Bell Ridge Dr | STOP | 14.3 | B | STOP | 15.3 | C |
| | Foxtail Loop | STOP | 17.1 | C | STOP | 10.1 | B |
| | Security Pl | STOP | 11.3 | B | STOP | 14.9 | B |
| | Heritage Oaks Blvd | | 16.4 | B | | 21.8 | C |
| | Navy Federal Way | | 9.6 | A | | 16.1 | B |
| | I-10 EB Ramps | | 26.1 | C | | 12.9 | B |
| | I-10 WB Ramps | | 39.7 | D | | 26.3 | C |
| | Pine Cone Dr | STOP | 33.8 | D | | 40.5 | D |
| | MUT, W of Pine Forest Rd | - | - | - | | 11.3 | B |
| | Pine Forest Rd | | 94.9 | F | | 22.3 | C |
| | MUT, E of Pine Forest Rd | - | - | - | | 20.7 | C |
| | MUT, N of Detroit Blvd | - | - | - | | 9.7 | A |
| Pine Forest Rd | Detroit Blvd | STOP | 589.3 | F | STOP | 28.5 | D |
| | I-10 WB Ramps | | 59.3 | E | | 25.0 | C |
| | I-10 EB Ramps* | | 67.8 | E | | 16.3 | B |
| | Wilde Lake Blvd* | | 70.4 | E | | 19.3 | B |

*[1]The reported delay for stop controlled intersections is the worst movement delay;*
**The I-10 EB On-Ramp is the East Leg of Wilde Lake Blvd in No-Build*

**Table 6-12. Design Year 2046 AM Peak Ramp Terminal Movement and Queue Results**

| Major Rd | Intersection and Movement | | 2046 AM Peak | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | No-Build | | | | Build | | | |
| | | | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] |
| Nine Mile Road | West Ramp Terminal | EBT | 73 | E | 233 | - | 31 | C | 231 | - |
| | | EBR | Free | - | - | - | 2 | A | 0 | - |
| | | WBL | 33 | C | 814 | - | 15 | B | 365 | - |
| | | WBT | 13 | B | 798 | - | 11 | B | 432 | - |
| | | SBL | 56 | E | 92 | 300 | 6 | A | 79 | 675 |
| | | SBR | Free | - | - | 300 | 38 | D | 304 | 675 |
| | East Ramp Terminal | EBL | 32 | C | 79 | - | 1 | A | 30 | - |
| | | EBT | 22 | C | 242 | - | 44 | D | 235 | - |
| | | WBT | 47 | D | 651 | - | 20 | C | 512 | - |
| | | WBR | Free | - | - | - | Free | - | - | - |
| | | NBL | 41 | D | 92 | 600 | 31 | C | 724 | 750 |
| | | NBR | 32 | C | 173 | 600 | 15 | B | 80 | 650 |
| Pine Forest Road | North Ramp Terminal | WBL | 114 | F | 3,551 | 850 | 26 | C | 466 | 825 |
| | | WBR | 83 | F | 3,608 | 850 | 27 | C | 336 | 975 |
| | | NBL | 51 | D | 806 | - | 3 | A | 337 | - |
| | | NBT | 13 | B | 720 | - | 25 | C | 475 | - |
| | | SBT | 68 | E | 570 | - | 34 | C | 528 | - |
| | | SBR | 7 | A | 208 | - | 3 | A | 0 | - |
| | South Ramp Terminal | EBL | N/A | - | - | - | 19 | B | 219 | 425 |
| | | EBR | 282 | F | 2,867 | 925 | 26 | C | 270 | 725 |
| | | NBT | Free | - | - | - | 36 | D | 528 | - |
| | | NBR | Free | - | - | - | 3 | A | 31 | - |
| | | SBL | N/A | - | - | - | 3 | A | 478 | - |
| | | SBT | 73 | E | 233 | - | 31 | C | 231 | - |

[1]*Approximate storage is measured from the stop bar to the end of the storage bay; does not include deceleration distance*

**Table 6-13. Design Year 2046 PM Peak Intersection Results Summary**

| Major Rd | Intersection | 2046 PM Peak | | | | | |
|---|---|---|---|---|---|---|---|
| | | No-Build | | | Build | | |
| | | Control Type | Delay[1] (s/veh) | Est. LOS | Control Type | Delay[1] (s/veh) | Est. LOS |
| Beulah Beltway | I-10 WB Ramps | | 63.0 | E | | 15.0 | B |
| | I-10 EB Ramps | | 50.5 | D | | 16.5 | B |
| Beulah Rd | Kingsfield Rd | STOP | 6.2 | A | STOP | 6.5 | A |
| | Beulah Beltway | | 5.9 | A | | 5.4 | A |
| | Frank Reeder Rd | STOP | 11.4 | B | STOP | 11.8 | B |
| Nine Mile Rd | Beulah Rd | | 19.6 | B | | 24.9 | C |
| | Bell Ridge Dr | STOP | 16.8 | C | STOP | 8.3 | A |
| | Foxtail Loop | STOP | 23.4 | C | STOP | 5.1 | A |
| | Security Pl | STOP | 148.7 | F | STOP | 23.4 | C |
| | Heritage Oaks Blvd | | 173.9 | F | | 23.7 | C |
| | Navy Federal Way | | 293.6 | F | | 17.1 | B |
| | I-10 EB Ramps | | 118.5 | F | | 18.9 | B |
| | I-10 WB Ramps | | 29.7 | C | | 18.8 | B |
| | Pine Cone Dr | STOP | 36.5 | D | | 27.0 | C |
| | MUT, W of Pine Forest Rd | - | - | - | | 29.7 | C |
| | Pine Forest Rd | | 163.9 | F | | 14.7 | B |
| | MUT, E of Pine Forest Rd | - | - | - | | 16.4 | B |
| | MUT, N of Detroit Blvd | - | - | - | | 7.2 | A |
| Pine Forest Rd | Detroit Blvd | STOP | 489.6 | F | STOP | 33.1 | D |
| | I-10 WB Ramps | | 56.3 | E | | 22.7 | C |
| | I-10 EB Ramps* | | 85.1 | F | | 20.2 | C |
| | Wilde Lake Blvd* | | 53.1 | D | | 17.1 | B |

*[1]The reported delay for stop controlled intersections is the worst movement delay; *The I-10 EB On-Ramp is the East Leg of Wilde Lake Blvd in No-Build*

**Table 6-14. Design Year 2046 PM Peak Ramp Terminal Movement and Queue Results**

| Major Rd | Intersection and Movement | | 2046 AM Peak | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | No-Build | | | | Build | | | |
| | | | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] | Delay (s/veh) | Est. LOS | Max Queue (ft) | Ramp Storage (ft)[1] |
| Nine Mile Road | West Ramp Terminal | EBT | 310 | F | 808 | - | 18 | B | 375 | - |
| | | EBR | Free | - | - | - | 2 | A | 0 | - |
| | | WBL | 29 | C | 420 | - | 15 | B | 322 | - |
| | | WBT | 12 | B | 322 | - | 33 | C | 426 | - |
| | | SBL | 72 | E | 177 | 300 | 34 | C | 276 | 675 |
| | | SBR | Free | - | - | 300 | 7 | A | 67 | 675 |
| | East Ramp Terminal | EBL | 25 | C | 62 | - | 1 | A | 240 | - |
| | | EBT | 26 | C | 550 | - | 14 | B | 491 | - |
| | | WBT | 37 | D | 384 | - | 25 | C | 429 | - |
| | | WBR | Free | - | - | - | Free | - | - | - |
| | | NBL | 27 | C | 479 | 600 | 16 | B | 201 | 750 |
| | | NBR | 28 | C | 530 | 600 | 29 | C | 456 | 650 |
| Pine Forest Road | North Ramp Terminal | WBL | 65 | E | 868 | 850 | 32 | C | 584 | 825 |
| | | WBR | 32 | C | 613 | 850 | 26 | C | 259 | 975 |
| | | NBL | 67 | E | 990 | - | 4 | A | 426 | - |
| | | NBT | 17 | B | 987 | - | 23 | C | 564 | - |
| | | SBT | 101 | F | 559 | - | 29 | C | 473 | - |
| | | SBR | 13 | B | 197 | - | 2 | A | 0 | - |
| | South Ramp Terminal | EBL | N/A | - | - | - | 27 | C | 369 | 425 |
| | | EBR | 312 | F | 3,076 | 925 | 24 | C | 308 | 725 |
| | | NBT | Free | - | - | - | 31 | C | 692 | - |
| | | NBR | Free | - | - | - | 4 | A | 375 | - |
| | | SBL | N/A | - | - | - | 2 | A | 0 | - |
| | | SBT | 16 | B | 558 | - | 24 | C | 535 | - |

*[1]Approximate storage is measured from the stop bar to the end of the storage bay; does not include deceleration distance*

# 7.0 SAFETY ANALYSIS

A summary of the safety analysis results is described in this section and the full safety analysis documentation is provided in **Appendix B**.

## 7.1 HISTORICAL CRASH DATA

Historical crash data was collected for a 5-year period between January 1, 2013 and December 31, 2017 for the following segments:

- Freeway: I-10 from the Beulah Road overpass to US 29
- Interchanges
    - I-10 at Nine Mile Road
    - I-10 at Pine Forest Road

Within the study limits, there were a total of 349 crashes reported during the 5-year period. The crash locations are shown in **Figure 7-2**.

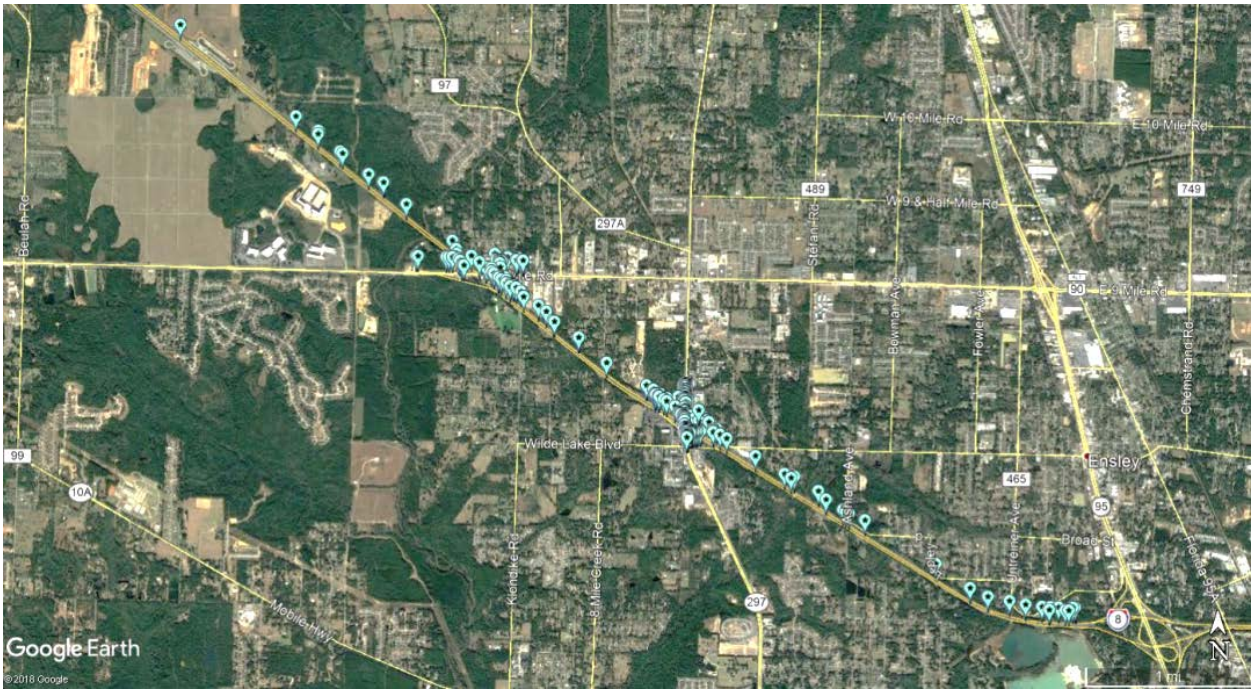



**Figure 7-1. Location of Crashes within Influence Area**

The crash types and severity are shown in **Table 7-1** and **Table 7-2**. Of the two pedestrian related crashes, one occurred on Pine Forest Road and one occurred on I-10 west of SR US 29. Of the four fatal crashes, all occurred on I-10 or on I-10 ramps. The I-10 roadway segment crash rate analysis, which covers I-10 from east of the proposed Beulah Road to west of US 29, is shown in **Table 7-3**.

**Table 7-1. Crashes by Year and Type**

| Type | 2013 | 2014 | 2015 | 2016 | 2017 | Total | Percent of Total |
|---|---|---|---|---|---|---|---|
| Angle | 1 | 4 | 0 | 0 | 4 | 9 | 2.6% |
| Animal | 0 | 1 | 0 | 1 | 0 | 2 | 0.5 % |
| Head On | 0 | 0 | 1 | 0 | 0 | 1 | 0.3% |
| Left Turn | 10 | 4 | 5 | 3 | 9 | 31 | 8.9% |
| Off Road | 18 | 14 | 5 | 4 | 10 | 51 | 14.6% |
| Other | 6 | 12 | 2 | 13 | 6 | 39 | 11.2% |
| Pedestrian | 0 | 1 | 0 | 1 | 0 | 2 | 0.5% |
| Rear End | 32 | 41 | 23 | 32 | 30 | 158 | 45.3% |
| Right Turn | 3 | 0 | 0 | 0 | 0 | 3 | 0.9% |
| Rollover | 5 | 1 | 1 | 4 | 0 | 11 | 3.2% |
| Sideswipe | 6 | 8 | 6 | 7 | 10 | 37 | 10.6% |
| Unknown | 0 | 1 | 0 | 2 | 2 | 5 | 1.4% |
| **Total** | **81** | **87** | **43** | **67** | **71** | **349** | **100.0%** |

**Table 7-2. Crash Severity Table**

| Year | Fatal Crashes | Injured Crashes | Property Damage Only Crashes | Total Crashes |
|---|---|---|---|---|
| **2013** | 1 | 31 | 49 | 81 |
| **2014** | 0 | 28 | 59 | 87 |
| **2015** | 1 | 20 | 22 | 43 |
| **2016** | 0 | 15 | 52 | 67 |
| **2017** | 2 | 21 | 48 | 71 |
| **Totals** | **4** | **115** | **230** | **349** |

**Table 7-3. Statistical Crash Analysis for the I-10 Mainline**

| FDOT District 3 Statistical Crash Analysis | |
|---|---|
| Average Annual Daily Traffic | 44,600 |
| Million Vehicles Per Year (Based on Average Annual Daily Traffic) | 16.279 |
| Length of Segment (Miles) | 6.926 |
| Reported Crashes from January 2013 – December 2017 (5 years) | 132 |
| FDOT Statistical Crash Rate Per Million Vehicle Miles | 0.469 |
| Actual Number of Crashes Per Million Vehicle Miles | 0.234 |

## 7.2 HSM PREDICTIVE METHOD

The Highway Safety Manual Predictive methodology provides techniques to estimate crashes for a given facility, test the effectiveness of alternative designs on estimated crashes and evaluate the economic impact of crashes. The first step is to establish a prediction of annual crashes, based on existing traffic volumes, facility types, geometric conditions and observed crashes. This is followed by an estimate of future crashes with projected traffic volumes for selected alternatives.

The HSM safety analysis was completed using traffic AADT and turning movement projections for I-10 and the ramp terminii. For the analysis, the existing I-10 mainline was separated into 5 segments, and the ramps into 17 segments, with 6 exit ramp terminals. The proposed roadway was similar except there were 16 ramp segments.

The historic crashes utilized in the 2026 Expected Crash determination, using the EB Method, were those described in the historic crash data from the first section of this report. The crash modification factors are the default values in the ISATe spreadsheet – Florida specific calibration factors have not yet been developed. The CMF categories utilized in the model for fatal and injury crashes are summarized below. Further detail on CMFs is in **Appendix B**.

- Freeway Segment CMF Categories
    - Horizontal curvature, Lane width, outside shoulder width, inside shoulder width, median width, median barrier, shoulder rumble strip, outside clearance, outside barrier
- Ramp Segment CMF Categories
    - Horizontal curvature, lane width, right shoulder width, left shoulder width, right side barrier, left side barrier
- Crossroad Ramp Terminal CMF Categories
    - Non-ramp public street leg, segment length, protected left-turn operation, channelized right-turn on crossroad, channelized right-turn on exit ramp, access point frequency, crossroad left-turn lane, crossroad right-turn lane, median width, exit ramp capacity, skew angle

The predicted crashes in 2026 and 2046 No-Build and Build are shown in **Table 7-4**. The analysis results found that the total crashes decreased in the future Build Alternative compared to No-Build Alternative in both 2026 and 2046. The mainline crashes benefit from the additional lanes and show a decrease in crashes for the Build Alternative. This decrease is based on the published crash modification factor of 0.69 (i.e. 31% decrease in crashes) for widening from four to six freeway lanes and reflects a lower density of traffic spread across more lanes and the ability to maneuver more freely. There is an increase in predicted ramp crashes in the Build Alternative due to longer ramps in the diverging diamond design. The crossroad ramp terminal total crashes is predicted to decrease in the Build Alternative compared to the No-Build Alternative. Although the ISATe does not address DDI's, a recent addition to the CMF Clearinghouse shows a significant safety increase when converting a diamond interchange to a DDI. This specific CMF applies to the overall interchange and has a star rating of 4/5 stars (i.e. high reliability) and a value of 0.59 (i.e. 41% decrease in crashes). Thus, a DDI should result in safety improvements at crossroad ramp terminals, and along the crossroads serviced by the ramps.

**Table 7-4. No-Build vs Build Predicted Crashes**

| Facility | 2026 No-Build | 2026 Build |
|---|---|---|
| Freeway Segments | 94.3 | 88.3 |
| Ramp Segments | 8.9 | 10.9 |
| Crossroad Ramp Terminals | 38.6 | 27.2 |
| Totals | 141.7 | 126.4 |

| Facility | 2046 No-Build | 2046 Build |
|---|---|---|
| Freeway Segments | 159.1 | 143.2 |
| Ramp Segments | 10.5 | 13.2 |
| Crossroad Ramp Terminals | 45.6 | 28.7 |
| Totals | 215.2 | 185.1 |

## 7.3 BENEFIT-COST

Considering the predicted crashes for the No-Build and Build conditions allows a determination of the Benefit / Cost ratio for the project, using the following costs:

- Average cost per crash on a rural interstate segment of $327,385 (per the FDM)
- Average cost per crash on an urban interstate segment of $153,130 (per the FDM)
- Annualized capital cost of $2,051,807 (per the FDOT Cost-Per-Mile Model)

The benefit / cost analysis showed a favorable B/C ratio (greater than 1.0) for both future years 2026 and 2046 with the proposed improvements in place. The B/C ratios were determined by comparing the predicted crashes for the No-Build and Build Alternatives, per HSM methodologies. The 2026 annual benefit cost ratio is 1.792, and the 2046 annual benefit cost ratio is 3.525.

More information can be found in **Appendix B.**

# 8.0 RECOMMENDED ALTERNATIVE

Based on the overall analysis for the study area, the Build Alternative is the recommended Alternative. The traffic operational and safety analysis results were considered to select the recommended Build Alternative.

The traffic operational analysis shows that the Design Year 2046 Build Alternative improves the total network delay by 70% in the AM peak hour and by 85% in the PM peak hour when compared to the No-Build. In both Opening Year 2026 and Design Year 2046, the Build Alternative facilitates at or near free-flow speeds along I-10 for both peak hours, as shown in **Figure 6–1** through **Figure 6–16.** Further, the intersection delays are all LOS D or better with the exception of one location in the Design Year 2046 Build Alternative. Overall, the No-Build Alternative is not anticipated to be able to accommodate the future traffic and, therefore, the Build Alternative is recommended.

The safety analysis shows that in 2046, the total number of predicted crashes decreases in the Build Alternative relative to the No-Build Alternative; the freeway segments crashes decrease, the ramp segment crashes increase, and the crossroad ramp terminal crashes decrease. The slight increase in predicted ramp crashes in the Build Alternative is due to the exit ramps increasing in length. Although the current analysis tool does not support DDI analyses, it is noted in **Appendix B** that the CMF Clearinghouse provides a CMF for converting a diamond interchange to a DDI which indicates a significant reduction in crashes. Although it cannot currently be modeled, a diverging diamond interchange should result in safety improvements at crossroad ramp terminals, and along the crossroad serviced by the ramps. A benefit / cost analysis showed a favorable B/C ratio (greater than 1.0) for both future years 2026 and 2046 with the proposed improvements in place. Given this information, the Build Alternative was preferred over the No-Build due to the reduction in crashes along the freeway and the potential reduction in crashes at the crossroad ramp terminals and the crossroads with the DDI configurations.

# 9.0 OTHER CONSIDERATIONS

## 9.1 CONSISTENCY WITH OTHER PLANS/PROJECTS

The FHWA Policy Points (adopted May 22, 2017) for IARs focuses on the SO&E aspects of the project. It is intended that planning and land use consistency be evaluated as part of the socio-cultural effect evaluation during the NEPA process. This SIMR document serves to provide determination of SO&E acceptability per FHWA to advance the project and for inclusion in subsequent NEPA documentation with the PD&E study.

## 9.2 DESIGN EXCEPTIONS AND VARIATIONS

Design variations necessary for the Preferred Alternative, both along I-10 and Pine Forest Road, include the following:

I-10:

- Inside Lane Slope Direction: Variation required as per 2020 FDM Figure 210.2.1 regarding slope direction of the inside travel lane, sloping down provided, sloping up required for 3-lanes in one direction.
- Vertical Alignment: Variation required as per 2020 FDM, Tables 211.9.2 and 211.9.3 regarding K values and minimum vertical alignment length, values less than those provided in these tables are to remain.

Pine Forest Road:

- Design Speed: Variation required as per 2020 FDM Table 201.5.1 regarding design speed of SIS facilities on the State Highway System, 35 mph provided for 700-foot section, 50 mph required.

Further design details are documented in the Preliminary Engineering Report being completed as part of the PD&E.

## 9.3 ENVIRONMENTAL

This SIMR is being developed concurrently with a PD&E study. Details regarding the potential for the proposed project to impact the social, cultural, natural, and physical environmental will be evaluated as part of the PD&E process. This concurrent effort will provide the necessary National Environmental Policy Act documentation to support advancing the project to the next phase of the project development.

Environmental impacts were minimized by selecting to widen the I-10 mainline to the inside, as shown in the Alternatives Analysis Memorandum prepared for the project (**Appendix H**). Potentially impacted resources include two businesses, wetland and other surface waters, and the eastern indigo snake. The businesses will be relocated. Wetland and other surface water impacts were first avoided by widening to the inside; unavoidable impacts will be mitigated. FDOT will implement the U.S. Fish and Wildlife Service Standard Protection Measures for the Eastern Indigo Snake to avoid adverse impacts. Therefore, potential environmental impacts of the project are not fatal impacts. Environmental impacts will be documented in a Type II Categorical Exclusion and supporting technical documents.

## 9.4 FUNDING PLAN

The FL-AL TPO amended the 2040 LRTP Needs and CFP to incorporate this project on April 11, 2018 (FL-AL Resolution 18-04). This project is funded through the PD&E phase as of April 2020. Funding for design, right-of-way, construction, and construction engineering and inspection (CEI) is anticipated in the second five-year SIS CFP.

The Preferred Alternative has an approximate total project cost of $214,201,006 which includes costs for final design, right-of-way acquisition, and construction. The construction cost was estimated using FDOT's Long Range Estimates (LRE) tool and includes the cost to construct roadway, interchanges and ITS. Final design is estimated to be eight percent of the total construction cost. **Table 9-1** provides a summary of the Preferred Alternative cost estimate. Further details and copy of the LRE reports are included in the PER.

**Table 9-1. Preferred Alternative Cost Estimates Summary**

| Cost Item | Cost |
|---|---|
| **Final Design (8%)** | $14,275,630 |
| **Right-of-Way Acquisition** | $21,480,000 |
| **Construction** | $175,445,376 |
| **Total** | $214,201,006 |

## 9.5 PROJECT SCHEDULE

The SIMR is being developed in conjunction with the on-going I-10 PD&E study. The limits of the PD&E study for I-10 are from east of the Alabama State Line to west of SR 95 (US 29). A determination was made by FDOT to keep the official study limits for 437905-1 unchanged but develop design and environmental analysis for the segment from the Weigh Station (MM 3.0) to US 29. Design and analysis of the segment of I-10 from the Alabama State Line to the Weigh Station will be developed within the Beulah Interchange project (433113-1). The I-10 PD&E is scheduled for completion in 2021. As of April 2020, the Alternatives meeting for this project was scheduled for February 2020 and a Public Hearing is scheduled for February 2021.

## 9.6 CONCEPTUAL SIGNING PLAN

Conceptual signing and marking plans in accordance with FHWA guidelines were prepared for the Recommended Build Alternative and are provided in **Appendix J**. The signing plans provided in the SIMR are conceptual in nature and will be subject to final design for construction. The purpose of the provided signing plans is to demonstrate their ability to provide adequate advance signing and directions to drivers entering and/or exiting the study interchanges under the proposed Build Alternative improvements.

## 9.7 ACCESS MANAGEMENT

I-10 is a limited access facility designated at Access Class 1 and currently designated Area Type 3 from the Alabama state line to west of Frank Reeder Road, and Area Type 2 from west of Frank Reeder Road to the remaining project limits to the east. In the vicinity of the two existing interchanges, both of the crossroads at Nine Mile Road and Pine Forest Road are currently designated Access Class 3. No changes are proposed to the Access Management Classes for I-10, Nine Mile Road, or Pine Forest Road as part of this project.

Along the I-10 mainline, no new interchanges are being proposed as a part of this project. A separate IJR is being prepared for the proposed Beulah interchange and access management will be addressed by that project.

On Nine Mile Road, no changes are proposed to the existing access within the study area. More detailed design and analysis for this section of Nine Mile Road is provided as a part of the ongoing projects along Nine Mile Road.

On Pine Forest Road, the following access modifications are proposed as a part of this project:

- Wilde Lake Boulevard is currently a signalized intersection located less than 480 ft from the existing eastbound to southbound I-10 off ramp. The proposed design relocates the Wilde Lake Boulevard connection to a new signalized intersection south of existing Loblolly Lane utilizing portions of the Chellie Road alignment. The new connection will be 950' from the stop bar of the eastbound to southbound I-10 off ramp, but will improve spacing over the existing condition.
- Five existing full median openings will be eliminated or modified by the proposed project, located at a commercial driveway north of Interstate Circle, Loblolly Lane, Chellie Road, existing Wilde Lake, and W. Detroit.
  - The existing commercial driveway opening (north of Interstate Circle) is located 1,120 ft from the stop bar of the eastbound to southbound I-10 off ramp. This opening will be closed and the driveway will become right in/right out.
  - The existing Loblolly Lane opening is located 800 ft from the stop bar of the eastbound to southbound I-10 off ramp. This opening will be closed.
  - The Chellie Road opening is located 400 ft from the stop bar of the eastbound to southbound I-10 off ramp. This opening will be closed.
  - The existing Wilde Lake Boulevard opening is located 175 ft from the stop bar of the eastbound to southbound I-10 off ramp. This opening will be closed as part of the Wilde Lake Boulevard relocation.
  - The existing W. Detroit opening is located 350 ft from the stop bar of the westbound to northbound I-10 off ramp. This location will be converted to a directional median opening. In addition, because the W. Detroit serves a large volume of trucks accessing Empire Truck Sales, a dedicated U-turn with bulb-out has been incorporated into the design to allow trucks to more efficiently access the interchange.

No other access modifications are proposed as a part of this project.

# 10.0 CONCLUSION AND RECOMMENDATIONS

This SIMR documents the proposed widening of I-10 and the proposed improvements to the existing interchanges along I-10 at Nine Mile Road and at Pine Forest Road. The report reviews the traffic forecasting and operational analysis for the Existing Year 2018, the Opening Year 2026, and the Design Year 2046.

Based on the traffic operational results and considering the growing community in the surrounding area, the Build Alternative is the recommended Alternative. The traffic analysis shows that the No-Build network will not be able to accommodate the future traffic demand and will result in gridlock along I-10 and the adjacent arterials including Nine Mile Road and Pine Forest Road.

The Build Alternative, however, provides access throughout the network, specifically through the Nine Mile Road interchange, the Pine Forest Road interchange, and the intersection of Nine Mile Road at Pine Forest Road. Given the unique road network where Nine Mile Road at Pine Forest Road both have interchanges with I-10 approximately 1.5 miles apart, and then intersect with each other about one mile from the interchanges, these areas influence each other and acceptable traffic operations at these locations is critical to maintain traffic flow.

The Build Alternative facilitates at or near free-flow speeds along I-10 for both peak hours, as shown in **Figure 6–1** through **Figure 6–16.** Overall, the Design Year 2046 Build Alternative improves the total network delay by 71% in the AM peak hour and by 83% in the PM peak hour when compared to the No-Build.

The safety analysis predicts that the total crashes will decrease in the future Build Alternative compared to the No-Build Alternative. A benefit / cost analysis showed a favorable B/C ratio (greater than 1.0) for both future years 2026 and 2046 with the proposed improvements in place.

## 10.1 COMPLIANCE WITH FHWA GENERAL REQUIREMENTS

The FHWA Policy on Access to the Interstate System provides the requirements for the justification and documentation necessary to substantiate any proposed changes in access to the Interstate System. The policy is published under the Federal Register, Volume 74, Number 43743, dated May 22, 2017. The responses provided herein for each of the two policy statements demonstrate compliance with these requirements and justification for the proposed SIMR in support of the I-10 from east of the Alabama State Line to west of SR 95 (US 29) PD&E Study in Escambia County, Florida. The following two FHWA Policy Criteria (effective May 22, 2017) are addressed below:

### *Policy*

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

### *Policy Point 1: The proposal does not adversely impact operations or safety of the existing freeway.*

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

**Response:**

*Operational Analysis*

This SIMR consists of existing interchanges at Nine Mile Road and at Pine Forest Road that are planned to be modified. An in-depth traffic operational analysis for the Existing Year (2018), Opening Year (2026) and Design Year (2046) conditions was conducted to study the impacts of the Build Alternative within the AOI. Analyses were conducted for the mainline, and the intersections at the ramp terminals and crossroads.

Several performance measures were used to compare the operations of the existing system under No-Build and Build conditions. Key measures included network travel time, freeway speeds, intersection delays, and queues. Based on the operational analysis conducted for the SIMR, the following high-level operational analysis observations were made and detailed results are provided in Future Traffic Operational Analysis section of this report:

- The operational analysis shows that the Design Year 2046 Build Alternative does not adversely impact the operations of the interstate network or the local streets.
- The Design Year 2046 No-Build Alternative cannot accommodate the future traffic growth and results in sharp speed drops along I-10 in both the eastbound and westbound directions, primarily due to off-ramp queuing at the interchanges locations and the mainline merge locations.
- Intersection LOS E or worse is expected at 10 of the 19 study intersections in the Design Year 2046 No-Build AM or PM peaks.
- The Design Year 2046 Build Alternative is able to accommodate the future traffic and I-10 speeds remain consistently near 70 mph.
- Only one of the study intersections operates at LOS E or worse in the Design Year 2046 Build Alternative, and that location is outside of the scope of this project.
- The proposed Build interchange configurations provide benefit to the network and do not adversely impact operations.

### *Safety Analysis*

A safety analysis was completed for this project and includes an existing conditions safety analysis to review the crash history, and a quantitative safety analysis using the Highway Safety Manual (HSM) predictive method to assess future conditions. The Enhanced Interchange Safety Analysis Tool (ISATe) was used for the HSM predictive analysis to assess future conditions. The future proposed diverging diamond interchanges (DDI) were modeled to the extent possible in ISATe since it does not include an interchange option specifically for DDI's nor does it include crash modification factors (CMF) to predict crashes.

Using this methodology, analysis results found that the total crashes decrease in the future Build Alternative compared to the No-Build Alternative. The mainline crashes decrease in the Build Alternative due to a lower density of traffic spread across more lanes and the ability to maneuver more freely. There is a slight increase in predicted ramp crashes due to the longer ramps that were modeled, consistent with the proposed DDI design.

Although the ISATe does not address DDI's, a recent addition to the CMF Clearinghouse shows a significant safety increase when converting a diamond interchange to a DDI. This specific CMF applies to the overall interchange and has a star rating of 4/5 stars (i.e. high reliability) and a value of 0.59 (i.e. 41% decrease in crashes). Thus, a DDI should result in safety improvements at crossroad ramp terminals, and along the crossroads serviced by the ramps.

A benefit / cost analysis showed a favorable B/C ratio (greater than 1.0) for both future years 2026 and 2046 with the proposed improvements in place. The B/C ratios were determined by comparing the predicted crashes for the No-Build and Build Alternatives, per HSM methodologies. The 2026 annual benefit cost ratio is 1.792, and the 2046 annual benefit cost ratio is 3.525.

### *Conceptual Signing Plan*

Conceptual signing plans were developed and are included in **Appendix J**.

### *Policy Point 2: A full interchange with all traffic movements at a public road is provided.*

*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.*

**Response**:

I-10 is a public facility and all interchanges within the AOI provide full access. The interchange improvements will occur at the I-10 at Nine Mile Road and Pine Forest Road interchanges. Additional improvements are also being proposed at the adjacent intersections to improve traffic flow at the interchanges. All basic movements are currently provided at both interchanges. The proposed improvements at the interchanges will continue to provide full access.