Interchange Modification Report (IMR)
I-10 at SR 121 Interchange Interim Improvements

Prepared for:

Florida Department of Transportation
District Two

May 2020

Interchange Modification Report (IMR)

I-10 at SR 121 Interchange

IMR

FPID: 435745-1-22-01

Florida Department of Transportation

Determination of Engineering and Operational Acceptability

Acceptance of this document indicates successful completion of the review and determination of engineering and operational 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.

☒	Requestor	DocuSigned by: 7181B4A758B44FF... David Tyler, PE, AICP District Interchange Review Coordinator, FDOT District 2	5/26/2020 | 4:03 PM EDT Date
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☐	Federal Highway Administration	N/A N/A	N/A Date

SYSTEMS IMPLEMENTATION OFFICE

QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL

Submittal Date: May 2020

FM Number: 435745-1-22-01

Project Title: I-10 at SR 121 Interchange Interim Improvements

District: 2

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

Quality Control (QC) Statement

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

Requestor: DocuSigned by: 718194A7584B44F... [David Tyler, PE, AICP]   Date: 5/26/2020 | 4:03 PM EDT

IRC: DocuSigned by: 718194A7584B44F... [David Tyler, PE, AICP]   Date: 5/26/2020 | 4:03 PM EDT

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing engineering for Arcadis U.S., Inc. and that I have supervised the preparation of and approve the analysis, findings, opinions, conclusions, and technical advice hereby reported for:

PROJECT: I-10 at SR 121 Interchange Interim Improvements
Interchange Modification Report
FPID # 435745-1-22-01
Baker County, Florida

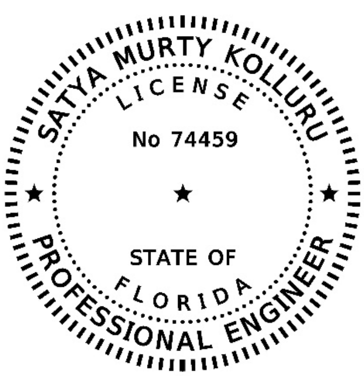
The engineering work represented by this document was performed through the following duly authorized engineering business:

Arcadis U.S., Inc.
1301 Riverplace Blvd., Suite 700
Jacksonville, Florida 32207
Certificate of Authorization No. 7917

This report provides preliminary engineering analyses for the proposed interchange interim improvements along I-10 at SR 121 Interchange. Any engineering analyses, documents, conclusions, or recommendations relied upon from other professional sources or provided by others are referenced accordingly in the following report.

FLORIDA REGISTERED ENGINEER

Satya Murty Kolluru, P.E., P.T.O.E., P.T. P.
P.E. #74459
May 21, 2020



Engineer of Record
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EXECUTIVE SUMMARY

In August 2016, the Federal Highway Administration approved the Interchange Modification Report (IMR) prepared by the Florida Department of Transportation (FDOT) for the improvements at the I-10 interchange with SR 121, which can be found in **Appendix A**. Following the IMR approval, FDOT proposed signalizing the ramp terminal intersection of westbound I-10 with SR 121 as an immediate enhancement to improve existing operational and safety deficiencies of the subject intersection. This concept was documented in the approved September 2019 Interchange Operational Analysis Report (IOAR), which can be found in **Appendix B**. To reduce the construction costs associated with the August 2016 IMR-approved Build Alternative, FDOT proposed interim improvements that will provide significant operational and safety improvements compared with the No-Build Alternative. An overview of the changes with the Interim Build Alternative are as follows:

- Add directional ramp for traffic from westbound I-10 to northbound SR 121
- Improve SR 121 in the northbound direction by widening the road to two lanes south of the SR 121 and George Hodges intersection
- Install a new traffic signal to control the northbound SR 121 and westbound I-10 off-ramp movements

This IMR documents the analysis findings of the Interim Build Alternative proposed at I-10 and SR 121 interchange.

The following deficiencies have been identified under the Existing Year (2020) conditions that are anticipated to improve as part of this project.

- The I-10 and SR 121 interchange is a partial cloverleaf configuration with nonstandard loops in the southeast and northwest quadrants. Under existing conditions, these loop ramps that were built with lower design speeds, hinder normal traffic operations, especially in the westbound I-10 direction. The westbound I-10 off-ramp is currently a three center radii loop ramp that terminates at a stop-controlled intersection with SR 121. This configuration results in interrupted flow and traffic backups, specifically during the AM and PM peak hours.
- Southbound SR 121 commuters encounter poor sight distance due to the vertical curve over I-10. The I-10 westbound ramp terminal intersection is unsignalized. Hesitation to perform the turning movement to head north on SR 121 due to poor sight distance over the vertical curve leads to high delays for motorists exiting the freeway. Drivers of heavy trucks making this movement have been observed making risky decisions. These conditions result in unsafe travel conditions and an increase in queue length that backs into mainline I-10 impeding its operations.
- The study area possesses heavy truck traffic, which accounts for more than 17 percent of peak hour traffic volumes. The grade differentials and curves of the loop ramps paired with the high truck volumes generate speed differentials that deteriorates operating conditions and safety.

The deficiencies found in the Existing Year (2020) analysis are anticipated to worsen with increased traffic volumes by Design Year (2045), even with the westbound I-10 ramp terminal signalization. Without improvements to this interchange, the traffic operations and safety within the study area will continue to deteriorate, the queue lengths and delays will increase, and the number of crashes will rise.

This IMR compares the operational and safety performance of the No-Build Alternative, the No-Build with Signal (IOAR Concept) Alternative, and the Interim Build Alternative.

Future traffic volumes were forecasted utilizing the growth rate established through historical traffic count information from Florida Traffic Online (FTO) and the Northeast Regional Planning Model (NERPM) Activity Based (AB1) Version 2 with the Base and Design Years of 2010 and 2040, respectively. For the purposes of this study, the analysis years included Existing Year (2020), Opening Year (2025), and Design Year (2045). Traffic operational analyses were completed using SYNCHRO version 10 (SYNCHRO) for the study intersections and Highway Capacity Software version 7 (HCS7) for the freeway segments and ramp merge and diverge areas.

Federal Highway Administration (FHWA) Policy Points

The following requirements serve as primary decision criteria used in the approval of interchange modification projects.

1. Proposal does not adversely impact operational 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, 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 (23 CFR 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 must 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 must 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)).

An operational and safety analysis performed for the proposed Interim Build Alternative showed improved traffic operations, approximately 80 percent and over 95 percent reductions in network delay by Design Year (2045) for the AM and PM peak hour, respectively, that decrease excessive delays throughout the study area and thereby improving safety by a 1.3 percent and a 2.9 percent reduction in predictive average crash frequency in the Opening Year (2025) and Design Year (2045), respectively, when compared to the No-Build Alternative as presented in Section 7 and Section 8 of this IMR. No-Build with Signal (IOAR Concept) Alternative is recommended for construction first to improve interchange operations immediately, and its IOAR is approved in September 2019, and can be found in **Appendix B**. The Interim Build Alternative with a westbound to northbound directional ramp is recommended for implementation after this ramp terminal signalization project. The analysis was conducted in accordance with the approved methodology presented to DIRC (January 2020) (**Appendix C**) for this project. This project is located in an urban/transitioning area where the closest interchanges are SR 228, approximately 1.2 miles to the east, and CR 125, approximately 2.4 miles to the west. Additional signage is needed along the SR 121 study area as identified in the conceptual signing plan shown in **Figure 26** for Interim Build Alternative.

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.

The proposed improvements to SR 121 interchange with I-10 will provide full interchange access and caters to all traffic movements from SR 121 to and from I-10. The proposed Interim Build Alternative were designed to meet all current FDOT and FHWA design standards as pertaining to federal-aid projects on the interstate system.

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1 INTRODUCTION

1.1 BACKGROUND

The Interstate 10 (I-10) interchange with State Road (SR) 121 serves as an important access point in Baker County, Florida. The I-10 and SR 121 interchange also provides primary access to commuters for the City of Macclenny to the north and Lake Butler to the south of I-10, as well as a key access point for trucks serving these communities. This section of SR 121 is an important link in Baker County's transportation network and provides major north-south connectivity.

The purpose of this Interchange Modification Report (IMR) is to seek approval from the Florida Department of Transportation (FDOT) Central Office for the proposed interim improvements to the of I-10 with SR 121 in Baker County, Florida. This IMR has been prepared in accordance with FDOT Policy No. 000-525-015, FDOT Procedure No. 525-030-160, and the FDOT Traffic Forecasting Handbook (Procedure No. 525-030-120).

This project is being proposed under the Programmatic agreement between FDOT and Federal Highway Administration (FHWA) and will be reviewed by FDOT, Central Office. The project will be subject to FHWA oversight because the proposed changes evaluated in this report may impact the interstate highway system.

Two roadway improvement projects are planned or programmed within the immediate study area. These projects include the No-Build with Signal (IOAR Concept) Alternative and Interim Build Alternative.

1.2 PURPOSE AND NEED

The purpose of this project is to provide interim capacity relief and improve traffic operations and safety near the SR 121 and I-10 interchange in Baker County.

The I-10 and SR 121 interchange is a partial cloverleaf configuration with loops in the southeast and northwest quadrants. Under existing conditions, these loop ramps hinder normal traffic operations, especially in the westbound I-10 direction. The westbound I-10 off-ramp is currently a three-center radii loop ramp that terminates at a stop-controlled intersection with SR 121. This configuration does not provide efficient operations and results in traffic backups, specifically during the AM and PM peak hours. Additionally, southbound drivers encounter poor sight distance due to the vertical curve over I-10.

In the year 2020, SR 121 carried an Annual Average Daily Traffic (AADT) of 12,100 vehicles to the south and 13,000 vehicles to the north of I-10 on a two-lane facility as shown from counts collected between January 14, 2020 and January 16, 2020. The I-10 mainline within the project study area carried an AADT of 33,100 vehicles to the west of SR 121 and 39,600 vehicles to the east of SR 121 on a four-lane facility from Existing Year (2020) traffic counts.

If no improvements are made, traffic operations and safety within the interchange area will continue to deteriorate as traffic and freight movement to and from the City of Macclenny increases. For this reason, the ultimate build improvements from the approved IMR (August 2016), which can be found in **Appendix A**, were proposed to address operational and safety deficiencies of the study area. For immediate relief, FDOT District Two proposed to install a signal at the ramp terminal intersection of the I-10 westbound off-ramp with SR 121 through a Traffic Operations Push Button Contract as documented in the approved Interchange Operational Analysis Report (September 2019) provided in

Appendix B. With the continued growth in traffic volumes and even with signalization of this ramp terminal intersection, traffic operations will progressively worsen and deteriorates conditions at the I-10 and SR 121 interchange by Design Year (2045) if no geometric roadway improvements are made. Therefore, this report analyzes the improvements proposed with the Interim Build Alternative that includes adding a directional ramp to westbound I-10 to serve northbound traffic along SR 121 which are proposed to address the immediate capacity need at this critical interchange for Baker County, FL.

1.3 PROJECT LOCATION

The I-10 and SR 121 interchange is in Baker County, Florida at mile marker (MM) 335 along I-10. The closest interchange is County Road (CR) 125, approximately 2.36 miles to the west and SR 228, approximately 1.17 miles to the east of SR 121. The study area along SR 121 consists of half a mile-long segment between Woodlawn Road to the south and Willis Hodges Road to the north. The following freeway segments, merge and diverge segments, and intersections were included in the study:

- I-10 – from CR 125 to SR 228
- SR 121 – from Woodlawn Road to Willis Hodges Road
    - SR 121 at Woodlawn Road/I-10 eastbound ramps – Signalized
    - SR 121 at I-10 westbound ramps - Unsignalized
    - SR 121 at George Hodges Road - Unsignalized
    - SR 121 at Willis Hodges Road - Signalized
- CR 125 – Eastbound on-ramp and westbound off-ramp
- SR 228 – Eastbound off-ramp and westbound on-ramp

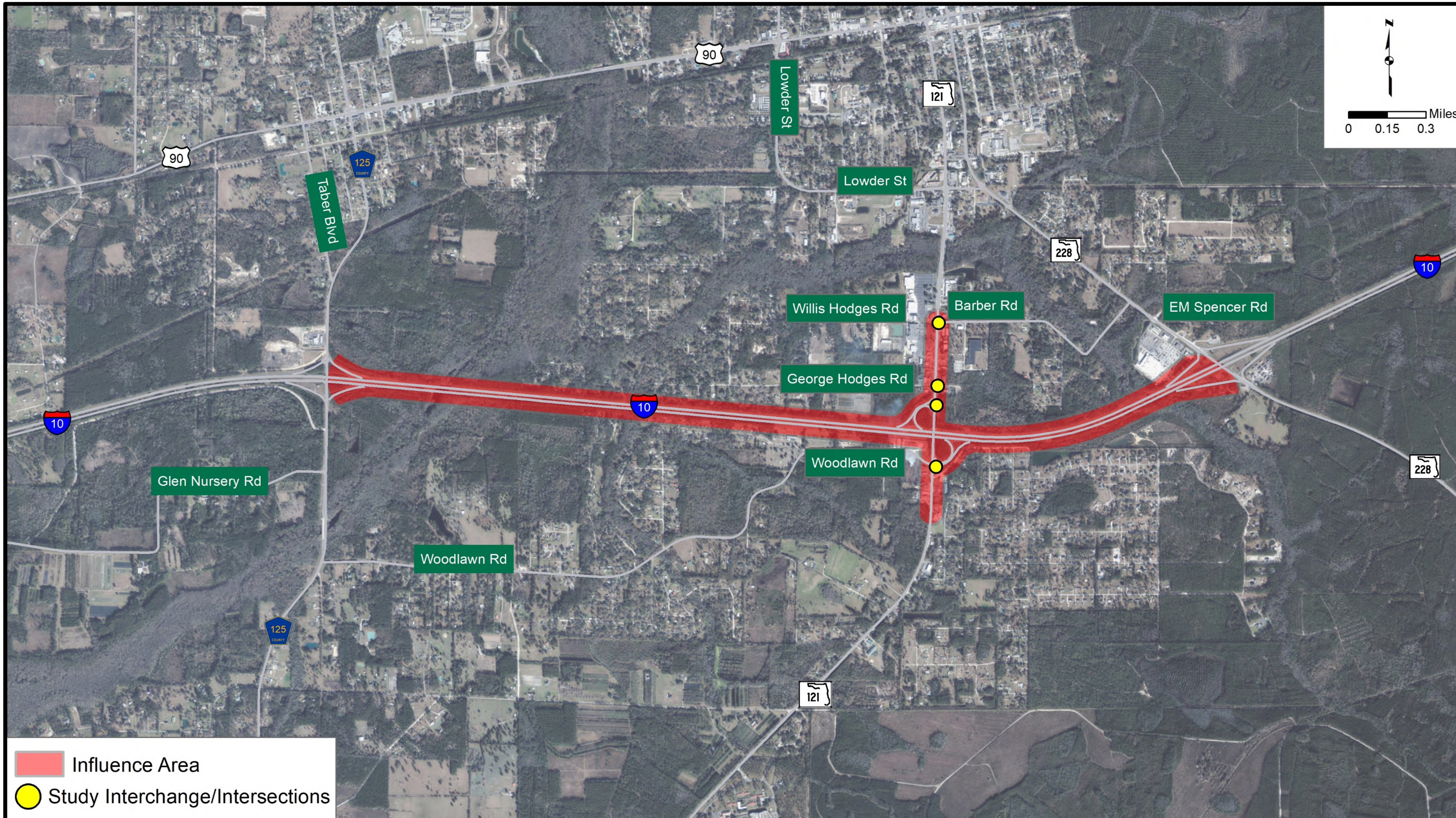
Figure 1 shows the project location and area of influence.

1.4 CHARACTERISTICS OF MAJOR STUDY CORRIDORS

The land use of surroundings adjacent to the study area is predominantly agricultural. However, it also includes some commercial and residential land uses. The functional classification and posted speed limit for major roadways within the influence area are presented in **Table 1**.

Table 1: Functional Classification and Posted Speed Limit of Major Roadways

No.	Roadways	Functional Classification	Posted Speed (mph)
1	I-10	Urban/Rural Interstate	70
2	SR 121	Urban Minor Arterial	45
3	CR 125	Urban Major Collector	45
4	SR 228	Urban Minor Arterial	45



FDOT	SR 121 Interchange Modification Report	**Project Location and Area Influence Map**	Figure 1
			Page 3

2 STUDY METHODOLOGY

2.1 ANALYSIS YEARS

A Methodology Letter of Understanding (MLOU) was prepared to document the methodology for the analysis and evaluation used in this IMR. The MLOU was approved by the FDOT District Two Interchange Review Coordinator (IRC) and FDOT Central Office in January 2020 as a Programmatic Agreement Interchange Access Request. A signed copy of the MLOU is provided in **Appendix C**. The following sections summarize the methodology as set forth in the MLOU.

2.2 ANALYSIS YEARS

The years used for the traffic operational analysis are:

- Existing Year – 2020
- Opening Year – 2025
- Design Year – 2045

2.3 DATA COLLECTION

Existing conditions data that was necessary to understand any recent study area changes was completed for this project. This includes the following data identified in the MLOU. The data collection effort conformed to the Project Traffic Forecasting Handbook (Chapter Two – Traffic Data Sources and Factors) and Procedure 525-030-120.

- Transportation System Data
  - Roadway characteristics data
    - ✓ Roadway geometry
    - ✓ Number of lanes
    - ✓ Posted speed limits
  - Speed and delay data
- Existing and Historical Traffic Data
  - Existing tube counts on ramps and mainline along I-10 (**Appendix D**)
  - Existing turning movement counts at ramp terminal and adjacent intersections (**Appendix E**)
  - Existing queuing at signals
  - Existing traffic volumes from other recent studies
  - Historical traffic volumes (FDOT Annual Count Program)
- Control Data
  - Signal timing data
  - Stop/Yield signs
  - Regulatory/Advisory speed limits
- Land Use Data
  - Land use data were obtained from the Florida Geographic Data Library (FGDL)
- Environmental Data
  - Environmental data were produced using the Efficient Transportation Decision Making (ETDM) tool for identifying land uses and any areas of concerns

- Planned and Programmed Projects
  - The analysis included the following planned and programmed within the area of influence:
    - ✓ I-10 at SR 121 Interchange Improvements – Signalization of ramp terminal intersection

2.4 Traffic Data

The traffic factors used for this study were approved in the January 2020 MLOU (**Appendix C**) and are summarized in **Table 2**. PHF is the peak hour factor showing a measure of traffic demand fluctuation during the peak hours. The T-factor is the percentage of heavy vehicles during a 24-hour period. T_f is the percentage of heavy vehicles during the peak hours. MOCF is the model output conversion factor used to convert traffic volumes generated from Northeast Regional Planning Model (NERPM) to AADT. The K factors are provided for typical section package and design purposes only. These factors were obtained from Florida Traffic Online (FTO) for 2018 count data and were supplemented with existing year 2020 counts.

Table 2: Traffic Factors

Location	Peak Hour Factor (PHF)	T (%)	T_f (%)	MOCF	Standard K (%)	K* (%)
I-10	0.94	35.7	17.9	0.98	**9.0**	**7.5**
SR 121- North of I-10	0.94	22.5	11.3	0.98	**9.0**	**8.3**
SR 121- South of I-10	0.94	12.0	6.0	0.98	**9.0**	**8.3**

Note:
The PHF is updated to 0.94 from the MLOU approved 0.95 value to maintain consistency with the other access approvals completed for the study area which used 0.94 PHF based on count data.
K* is the localized K factor developed from the Year 2020 count information.

Forecasts were made by utilizing growth rates established through historical traffic count information from FTO and from the Northeast Regional Planning Model (NERPM) Activity Based (AB1) Version 2. The use of NERPM AB1 Version 2 was approved by FDOT Central Office for this project. Traffic growth rates applied to the existing year count data to obtain Opening (2025) and Design (2045) years are summarized in **Table 3**.

Table 3: Traffic Growth Rate

Location	Traffic Growth Rate (%)
I-10 Mainline	2.8
I-10 Ramp at CR 125	3.3
I-10 Ramp at SR 121	2.4
I-10 Ramp at SR 228	2.1
SR 121	1.8

2.5 TRAFFIC OPERATIONAL ANALYSIS

Traffic operational analyses were conducted using SYNCHRO version 10 for intersections and Highway Capacity Software version 7 (HCS7) for freeway operations for the No-Build, No-Build with Signal (IOAR concept), and Interim Build Alternatives. This report provides the comparison of operational analysis between the three alternatives.

According to FDOT Policy on Level of Service (LOS) Targets for the State Highway System, the automobile mode LOS target for the study area during peak travel hours is set at LOS “D”.

2.6 ALTERNATIVE ANALYZED

The following scenarios were analyzed for this project:

- No-Build Alternative – Opening Year (2025) and Design Year (2045) – AM and PM peak hours
- No-Build with Signal (IOAR Concept) Alternative - Opening Year (2025) and Design Year (2045) – AM and PM peak hours
- Interim Build Alternative – Opening Year (2025) and Design Year (2045) – AM and PM peak hours

The conceptual layout of the Interim Build Alternative developed for this project is included in **Section 5**.

3 EXISTING CONDITIONS ANALYSIS

This section provides a brief discussion and evaluation of existing conditions within the area of influence for the I-10 at SR 121 Interchange Interim Improvements project. This discussion includes demographics, land use, field observations, transportation system data, existing operating conditions, and existing environmental constrains.

3.1 DEMOGRAPHICS

The influence area is located within Baker County, Florida. I-10 serves as a major corridor throughout the area; the SR 121 and I-10 interchange is considered a major connection to nearby economic opportunities and communities. A 2018 population estimate by the United States Census Bureau shows approximately 27,785 people residing in Baker County. **Table 4** summarizes key demographic data for year 2018 in Baker County. The 2018 census data shows that the median household income is nearly 60 thousand dollars, and nearly 53 percent of labor force is in civilian labor force.

Table 4: Baker County Demographics

2018 Census Data	Baker County Data	Percent
Population	27,785	
Race – Caucasian	22,640	81.5
Black	3,770	13.66
Asian	206	0.7
Other	1,169	4.22
Median Household Income (dollars)	60,293	
Households	8,625	
Family	6,600	76.5
Non-Family	2,025	23.5
Total in Civilian Labor Force	14,801	53.2
Employment Rate		49.3
Total in Armed Forces		

Source: US Census Bureau

3.2 LAND USE

Existing land uses were evaluated from the FGDL. The surrounding areas of the study area are predominantly agricultural. There are also areas of commercial and residential land. **Figure 2** depicts existing land use for the influence area. Commercial land use in the area includes fast food chains, grocery stores, and a distribution center. **Table 5** shows the land uses within the SR 121 study area.

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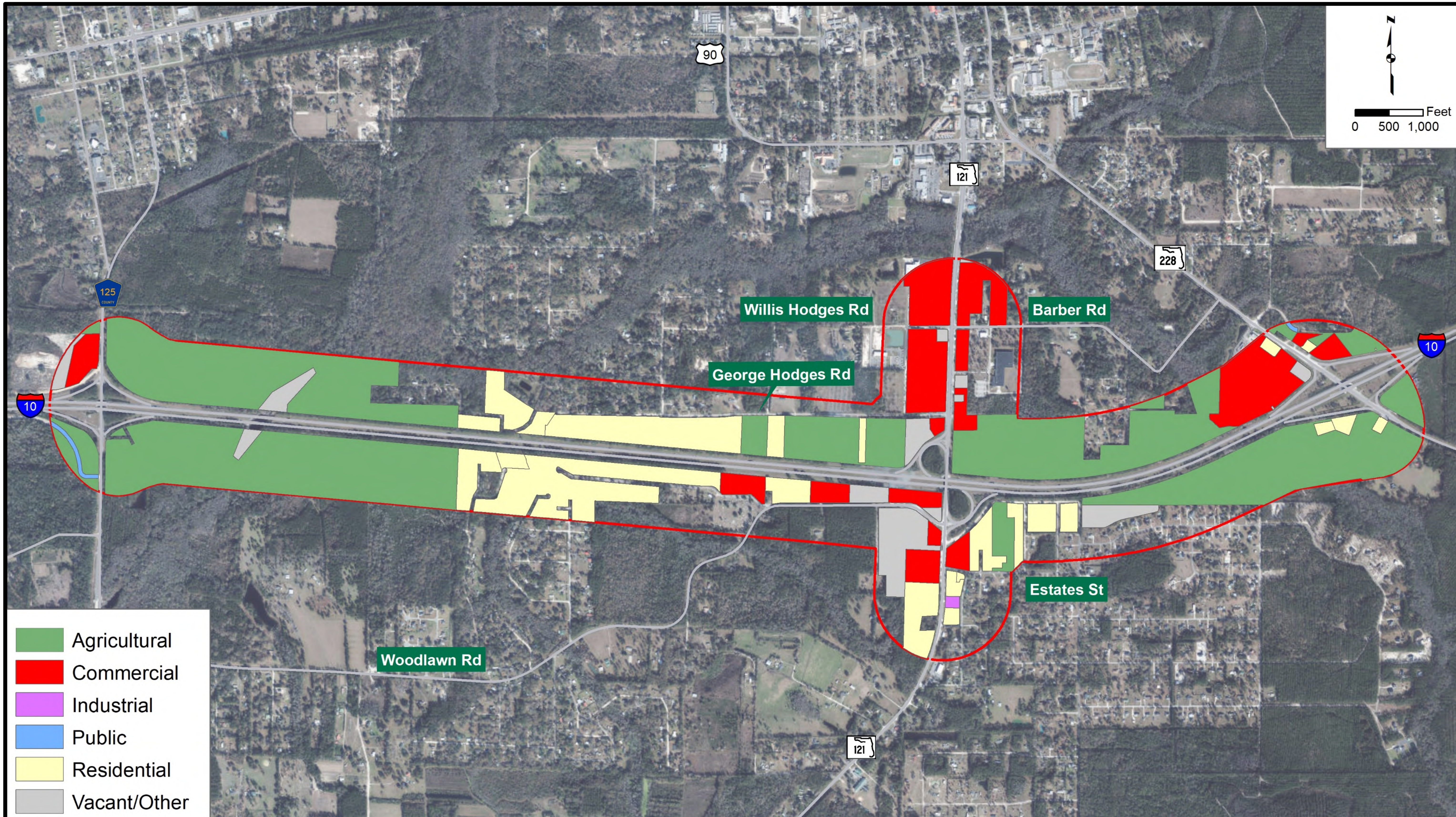

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SR 121 Interchange Modification Report

Existing Land Use

Figure 2

Table 5: Study Area Land Use

Land Use	Number of Parcels
Agricultural	545
Residential	154
Commercial	60
Public	2
Industrial	1
Vacant/Other	15
Total	777

3.3 Road Network

3.3.1 Existing Roadway Network

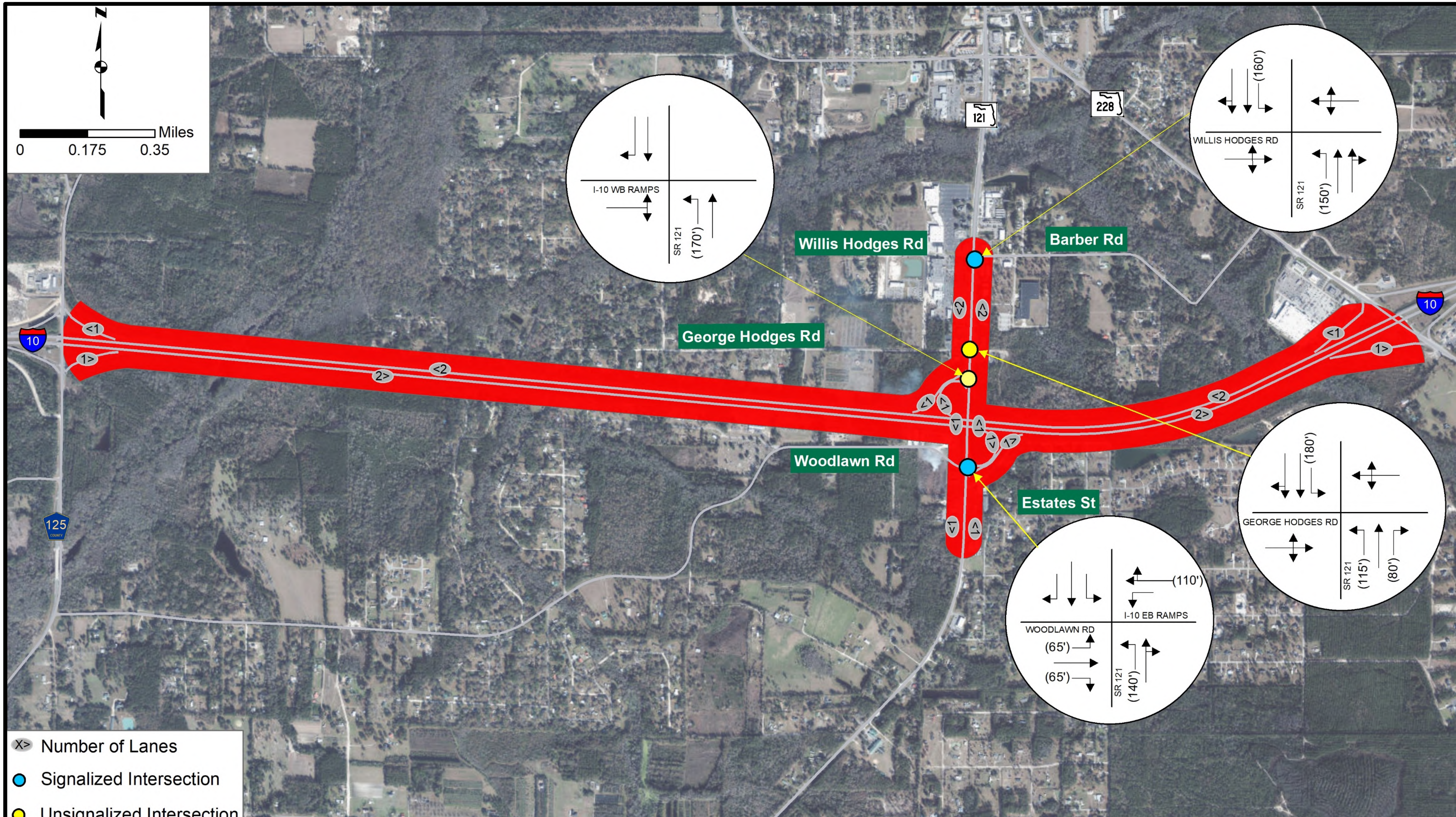
I-10 is a four-lane divided rural freeway extending east-west along the length of the project area. The roadway consists of 12-foot travel lanes with standard shoulders on either side of the travel way. This section of I-10 has approximately 50-foot medians and stormwater is transported through an open drainage system. This study considers a half-mile segment along SR 121 extending from Woodlawn Road to the South to Willis Hodges Road to the North. SR 121 is a two-lane, bidirectional section without a median between Woodlawn Road and George Hodges Road and a four-lane, bidirectional section with a median between George Hodges Road and Willis Hodges Road. SR 121 has sidewalks and bicycle lanes on the northbound and southbound sides from George Hodges Road to Willis Hodges Road. **Figure 3** shows the existing lane configuration identifying the number of lanes and turn storage lengths along SR 121.

3.3.2 Alternative Travel Modes

There are currently no transit routes that serve the existing SR 121 interchange area. Existing SR 121 roadway configuration does not serve the need for bicycles and pedestrians. This project will enhance the bike and pedestrian needs and access to these facilities.

3.3.3 Interchanges and Intersections

The two adjacent interchanges to the study area are I-10 at CR 125 and I-10 at SR 228. The CR 125 and SR 228 interchanges are tight urban diamond configurations, while the SR 121 interchange is considered a two-quadrants cloverleaf configuration. **Table 6** shows the spacing of these interchanges.



SR 121 Interchange Modification Report

Existing Lane Configuration

Figure 3

Table 6: Interchange Spacing

Location	Milepost	Spacing from Study Interchange (miles)
I-10 / CR 125	18.4	2.3
Study Interchange I-10 / SR121	20.7	---
I-10 / SR228	21.9	1.2

SR 121 has four intersections within the study area, two of which are the interchange ramp terminals. The off-ramps from I-10 to SR 121 are loop ramps with substandard radii. The I-10 eastbound ramp terminals share a signalized intersection with Woodlawn Road. The intersection at the I-10 westbound ramp terminal and George Hodges Road is controlled by stop sign.

3.3.4 Consideration for Other Interchange Proposals

There are two interchange proposals currently under consideration within the area of influence. These proposals include:

- IOAR Approved Build with Signal (IOAR Concept) Alternative
- Current IMR Request for the Interim Build Alternative

3.4 Field Observation

Key observations within the study area from the field visits are summarized below.

- Geometric design of the loop ramps that service the eastbound and westbound off-ramps to SR 121 are not of conventional FDOT design standards. These loop ramps were built with lower design speeds and a three-centered compound curve. The transition of different radii along the loop impedes natural driver expectancy, resulting in an interrupted flow. This movement causes rapid braking that affects the density of the roadway resulting in lower capacity and unsafe travel conditions along the loop ramp.
- Southbound SR 121 commuters encounter poor sight distance due to the vertical curve over I-10. The I-10 westbound ramp terminal intersection is unsignalized. Hesitation to perform the turning movement to head north on SR 121 due to poor sight distance over the vertical curve leads to high delays for motorists exiting the freeway. Drivers of heavy trucks making this movement have been observed making risky decisions. These conditions result in unsafe travel conditions and an increase in queue length.
- The study area possesses a high volume of heavy truck traffic, which accounts for more than 17 percent of peak hour traffic volumes. In determining capacity and operating conditions, these trucks are counted as more than 1.5 of a passenger car due to their size and difficulties with accelerating and decelerating. The grade differentials and curves of the loop ramps paired with the high truck volumes generate speed differentials that deteriorate operating conditions and safety.

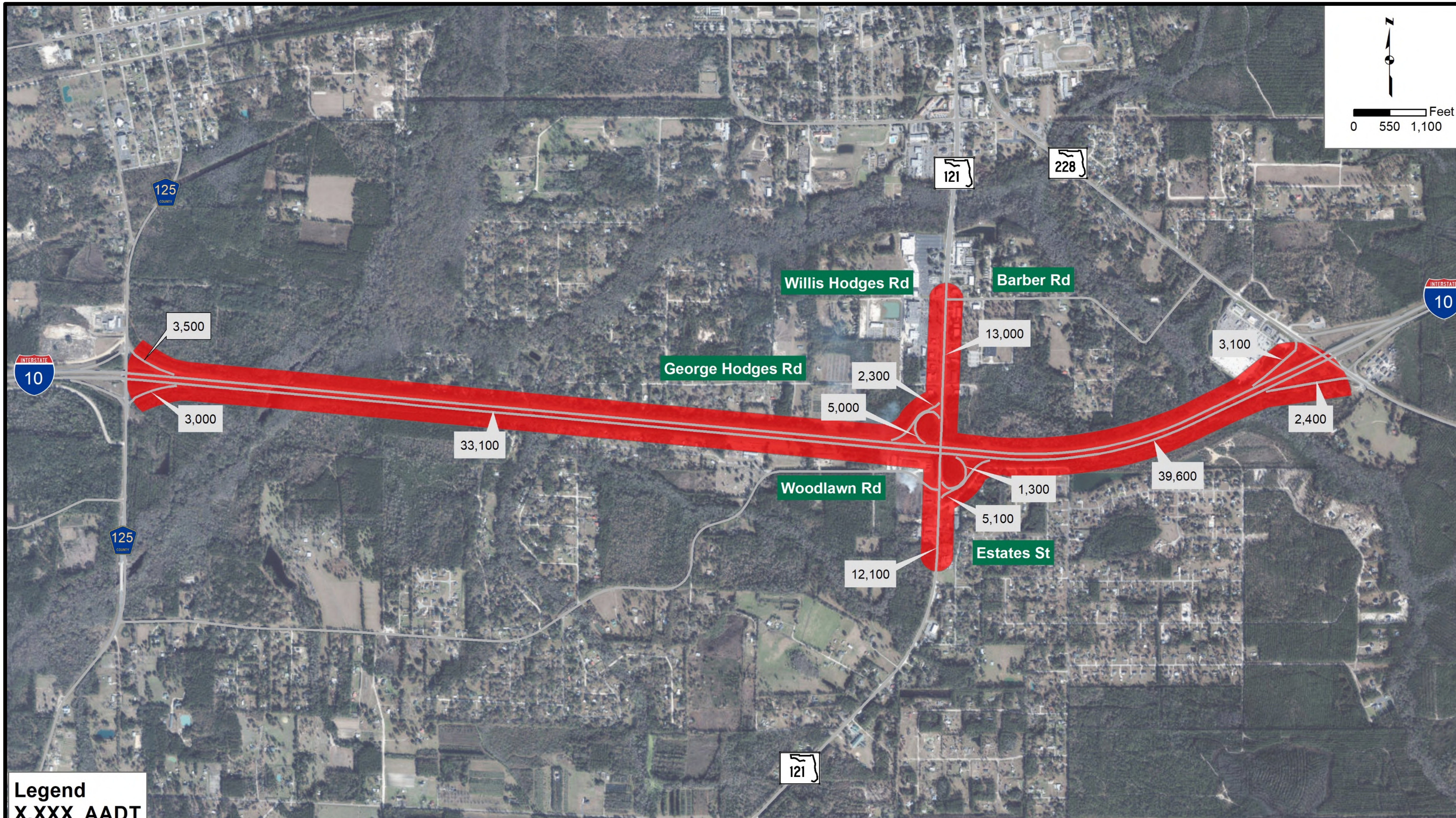
Existing conditions (2020) lane configuration is provided in **Figure 3**. Additionally, the site visit confirmed that the signal timings were set on FREE. Video recordings of intersection timings were utilized to estimate cycle length and phasings for existing conditions operational analysis.

3.5 EXISTING TRAFFIC DATA

Existing daily vehicles and turning movement counts were collected within the study area. Daily vehicle counts were conducted on typical weekdays for up to 48 hours; peak hour turning movement counts were conducted during regular weekdays from 6:00 AM to 10:00 AM and from 3:00 PM to 7:00 PM for the AM and PM peak hours, respectively. The counts were collected between January 14, 2020 and January 16, 2020. Turning movement and tube counts were collected according to the guidelines in the Project Traffic Forecasting Handbook. Traffic counts were adjusted with appropriate seasonal and axle correction factors when applicable. The peak hour for the study area was identified to be 6:45 AM to 7:45 AM during the AM peak and 4:15 PM to 5:15 PM during the PM peak.

In addition, the data collection effort included an evaluation of existing peak hour queuing near the ramp terminal intersections. Ramp terminal queue data was collected near the study area intersections during the AM and PM peak hours on February 4, 2020.

Existing Year (2020) AADT information is provided in **Figure 4** and peak hour volumes are provided in **Figure 5.** Raw count data is provided in **Appendix D**.



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Existing Year (2020)
Annual Average Daily Traffic

Figure 4

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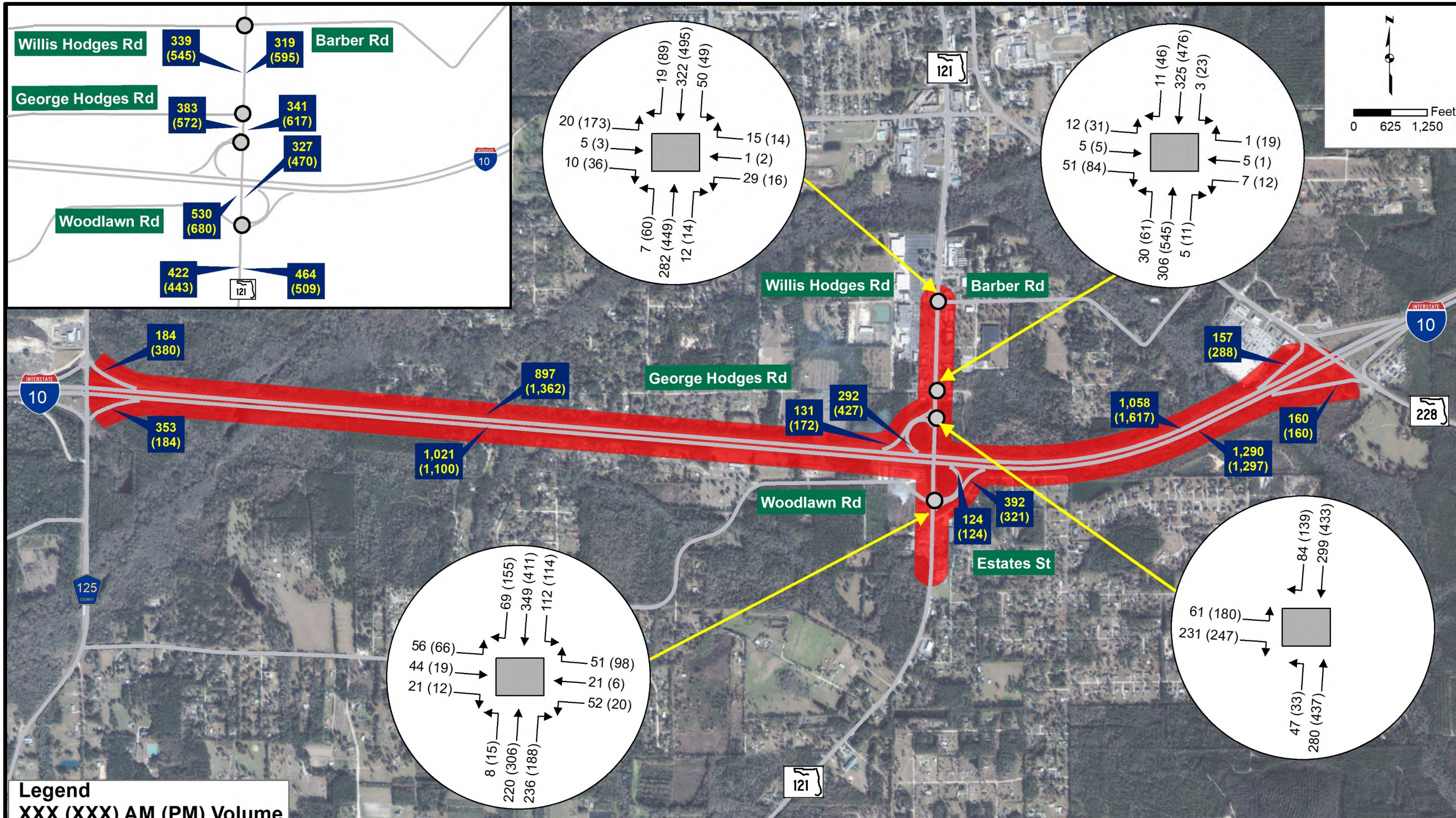


SR 121 Interchange Modification Report

Existing Year (2020) Peak Hour Volumes

Figure 5

3.6 Existing Operational Analysis

Traffic operational analyses were conducted for the intersections within the study area using SYNCHRO 10.0. HCS7 software was used to conduct operational analyses for the mainline freeway segments and ramp merge and diverge locations. Signal timings for the existing conditions were provided by FDOT and were verified in the field.

3.6.1 Arterial Performance

The intersections within the study area were analyzed using SYNCHRO version 10.0. The results are summarized in the **Table 7**.

The intersections within the study area operate at or better than LOS D in the AM peak hour; however, failing LOS (LOS E or F) occurs along the side street approaches near the unsignalized intersections within the study area during the PM peak hour. Extreme delays of more than two minutes (147.8 seconds) are experienced at the unsignalized intersection of SR 121 and the I-10 westbound ramp terminal in the PM peak hour. Conditions will only worsen with the increase in traffic volumes as this area continues to grow in the future.

Table 8 reports the 95th percentile queue lengths observed for the study area intersections. The 95th percentile queues were evaluated for the intersections within the study area. In practice, the 95th percentile queue will rarely be exceeded. The greatest queue length of about 471 feet is observed when vehicles are exiting I-10 westbound onto SR 121. This would be expected because the intersection is unsignalized and motorists must wait for gaps to turn onto SR 121. With the increase in traffic volume, queue lengths will increase in the future with the existing configuration.

Table 7: Existing Year (2020) – Intersection Analysis

Intersection	Type	Eastbound						Westbound						Northbound						Southbound					
		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
AM Peak Hour																									
Woodlawn Rd/ I-10 Eastbound Ramps	S	38.0	D	45.9	D	0.3	A	40.7	D	26.4	C	-	-	7.1	A	25.1	C	-	-	6.2	A	16.2	B	0.2	A
		21.0/C																							
I-10 Westbound Ramps(1)	U	17.7	C	-	-	-	-	-	-	-	-	-	-	8.1	A	0.0	A	-	-	-	-	0.0	A	0.0	A
		5.5/A																							
George Hodges Rd (1)	U	12.5	B	12.5	B	12.5	B	16.5	C	16.5	C	16.5	C	8.3	A	0.0	A	0.0	A	8.1	A	0.0	A	0.0	A
		1.7/A																							
Willis Hodges Rd	S	35.2	D	35.2	D	35.2	D	36.6	D	36.6	D	36.6	D	3.0	A	17.5	B	-	-	2.8	A	17.9	B	-	-
		18.5/B																							
PM Peak Hour																									
Intersection	Type	Eastbound						Westbound						Northbound						Southbound					
		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
Woodlawn Rd/ I-10 Eastbound Ramps	S	45.1	D	41.2	D	0.2	A	35.5	D	19.5	B	-	-	5.3	A	26.3	C	-	-	6.0	A	24.1	C	3.5	A
		21.8/C																							
I-10 Westbound Ramps(1)	U	147.8	F	-	-	-	-	-	-	-	-	-	-	8.5	A	0.0	A	-	-	-	-	0.0	A	0.0	A
		43.1/E																							
George Hodges Rd (1)	U	30.0	D	30.0	D	30.0	D	24.0	C	24.0	C	24.0	C	8.9	A	0.0	A	0.0	A	9.0	A	0.0	A	0.0	A
		4.0/A																							
Willis Hodges Rd	S	45.5	D	45.5	D	45.5	D	16.2	B	16.2	B	16.2	B	8.7	A	20.0	C	-	-	9.1	A	24.3	C	-	-
		24.7/C																							

Notes:
(1) SYNCHRO 10 has limitation to produce results for the subject intersection from HCM 6 and HCM 2010 report. Therefore, HCM 2000 is used to compute results for the subject intersection.
(2) Delay – Average Delay/Vehicle (seconds/vehicle)
(3) S = Signalized; U = Unsignalized

Table 8: Existing Year (2020) – Intersection 95th Percentile Queues

	Intersection	Time Period	Peak Hour Queues (feet)												Remarks
			Eastbound			Westbound			Northbound			Southbound			
			L	T	R	L	T	R	L	T	R	L	T	R	
1	SR 121 and Woodlawn Rd/I-10 Eastbound Ramp Terminals	AM	65	62	0	61	56		7	326		47	205	0	Signalized Intersection
		PM	76	34	0	31	54		10	367		45	297	37	
		Actual Storage Length (ft)	65	1,050	65	900	110		140	590		160	1,140	45	
2	SR 121 and I-10 Westbound Ramp Terminals	AM	77			-	-	-	3	0	-	-	0	0	Unsignalized Intersection
		PM	471			-	-	-	3	0	-	-	0	0	
		Actual Storage Length (ft)	910			-	-	-	170	1,140	-	-	320	170	
3	SR 121 and George Hodges Rd	AM	11			3			2	0	0	0	0		Unsignalized Intersection
		PM	61			13			5	0	0	2	0		
		Actual Storage Length (ft)	600			300			115	320	80	180	1,190		
4	SR 121 and Willis Hodges Rd	AM	43			50			4	87		15	101		Signalized Intersection
		PM	172			28			35	142		30	193		
		Actual Storage Length (ft)	580			500			150	1,190		160	2,650		

Notes:

(1) The # footnote indicates that the volume for the 95th percentile cycle exceeds capacity. This traffic was simulated for two complete cycles to account for the effects of spillover between cycles. If the reported v/c <1for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queues shown with the # footnote are acceptable for the design of storage bay (Trafficware 2012).

(2) The m footnote indicates that the volume for the 95th percentile queue is metered by an upstream signal (Trafficware 2012).

(3) The Storage length values were calculated from aerials or design drawings.

(4) L = left turn, T = through, R = right turn.

(5) Movement with queues exceeding available storage.

3.6.2 Freeway Performance

Operational analyses were conducted for the mainline freeway segments and ramp merge and diverge locations using HCS7 software. These results are shown in **Table 9** and **Table 10**. No weaving sections were identified in the study area, therefore, a weaving section analysis was not performed. Overall, existing operating conditions along I-10 are LOS A for the AM peak hour and LOS B for the PM peak hour. Merge and diverge locations at exit and entry ramps to I-10 experience LOS A/B conditions. The highest density of 17.6 passenger cars per mile per lane (pc/mi/ln) is observed at the exit ramp from I-10 to CR 125. The demand for access to I-10 to and from SR 121 within the influence area is projected to increase by the Opening Year (2025) and Design Year (2045), which will result in increased densities along these segments.

Table 9: Existing Year (2020) – Freeway Segment Analysis Summary

ID	Roadway	From	To	AM Peak				PM Peak			
				Freeway Volumes	Avg. Speed (mph)	Density (pc/mi/in)	LOS	Freeway Volumes	Avg. Speed (mph)	Density (pc/mi/in)	LOS
EASTBOUND											
5	I-10	CR 125	SR 121	1,280	66.8	9.6	A	1,380	66.8	10.3	A
9		SR 121	SR 228	1,618	66.8	12.1	B	1,631	66.8	12.2	B
WESTBOUND											
5	I-10	SR 228	SR 121	1,330	69.6	9.5	A	2,032	69.6	14.5	B
9		SR 121	CR 125	1,129	70.0	8.1	A	1,706	70.0	12.2	B

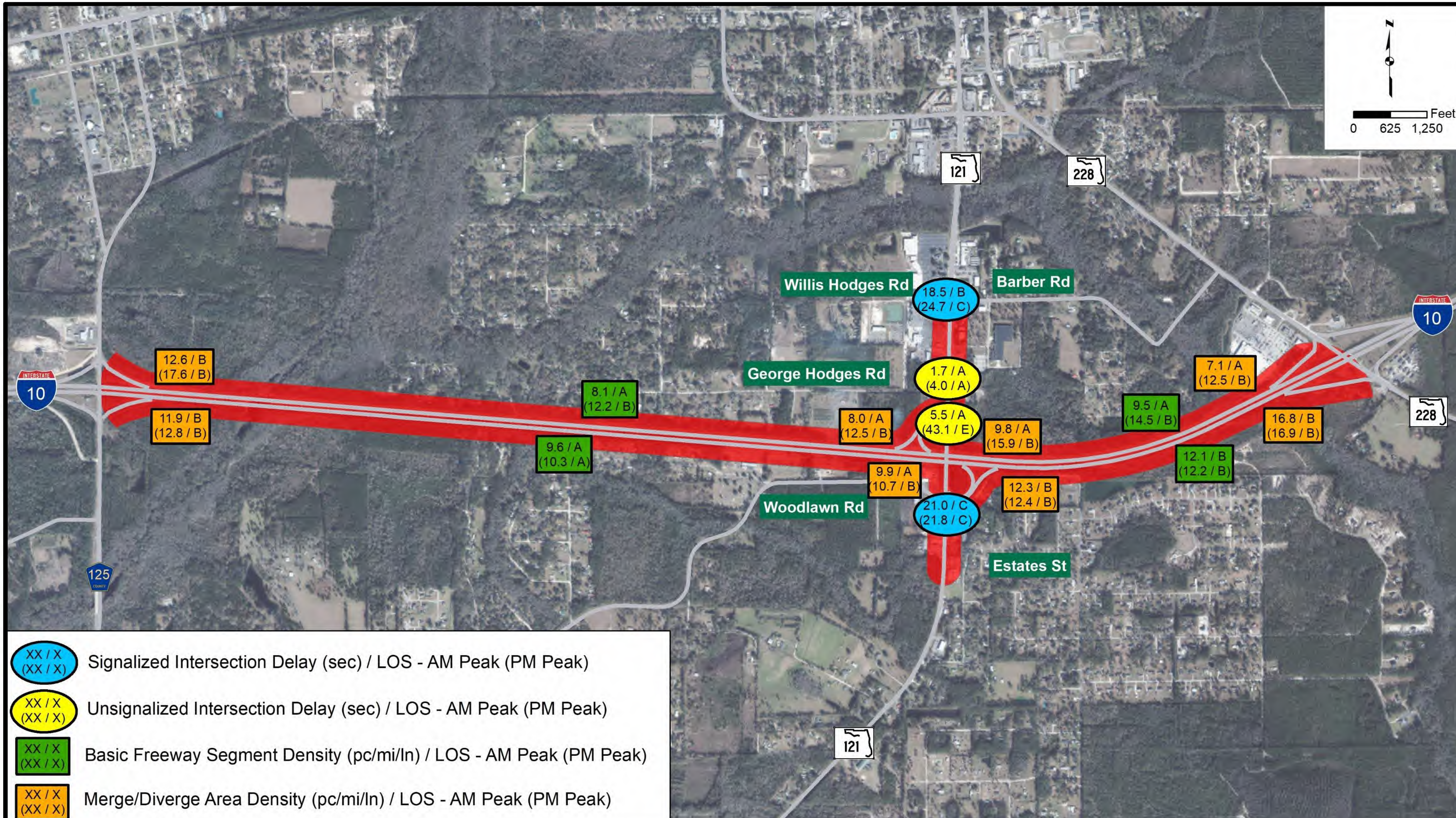
Notes:
mph = miles per hour, pc/mi./ln = passenger car per mile per lane.

The Existing Year (2020) delay, densities, and LOS are provided in **Figure 6**. The SYNCHRO and HCS7 reports are provided in **Appendix F**.

Table 10: Existing Year (2020) – On/Off Ramp Analysis Summary

ID	Roadway	Location	Type	AM Peak Analysis					PM Peak Analysis				
				Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS	Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS
EASTBOUND													
4	I-10	On Ramp from CR 125	Merge	1,280	439	0	11.9	B	1,380	226	0	12.8	B
6		Off Ramp to SR 121	Diverge	1,280	151	489	9.9	A	1,380	151	401	10.7	B
8		On Ramp from SR 121	Merge	1,618	489	151	12.3	B	1,630	151	401	12.4	B
10		Off Ramp to SR 228	Diverge	1,618	201	0	16.8	B	1,631	201	0	16.9	B
WESTBOUND													
4	I-10	On Ramp from SR 228	Merge	1,330	201	0	7.1	A	2,033	364	0	12.5	B
6		Off Ramp to SR 121	Diverge	1,330	364	163	9.8	A	2,032	539	213	15.9	B
8		On Ramp from SR 121	Merge	1,129	163	364	8.0	A	1,706	213	539	12.5	B
10		Off Ramp to CR 125	Diverge	1,129	226	0	12.6	B	1,706	477	0	17.6	B

Notes:
pc/mi./ln = passenger car per mile per lane



FDOT	SR 121 Interchange Modification Report	**Existing Year (2020) Delay or Density / LOS**	Figure 6

3.7 HISTORICAL CRASH DATA

A crash data analysis was performed to identify possible safety deficiencies within the study area. Crash data was obtained from FDOT's Crash Analysis Reporting System (CARS) along I-10 from CR 125 to CR 228 (milepost 18.376 – 21.880) and along SR 121 from south of the I-10 eastbound on-ramp to north of George Hodges Road (milepost 9.019-9.426) for five calendar years (2012 through 2016). A summary of the crash data analysis is provided in the following section of the report. Historical crash data (2012-2016) and crash analysis calculations are provided in **Appendix G**.

During the five-year analysis period, a total of 154 crashes occurred collectively on I-10 and SR 121 within the study area limits. Specifically, 102 crashes occurred along I-10 and 52 occurred on SR 121. A total of 66 injury crashes and 3 fatal crashes occurred within the study area reflecting 43 percent and 2 percent of the total crashes, respectively. The fatal crashes occurred in 2012, 2013, and 2016 on I-10.

The computed crash rate for the entire study segment of I-10 was approximately 108 crashes per 100 Million Vehicle Miles Traveled (MVMT). The crash rate was higher than the state average of 79 crashes per MVMT. The crash rate for SR 121 was determined to be 1,133 crashes per MVMT, which is significantly higher than the state average crash rate (261 crashes per MVMT). Additionally, the computed crash rate for the I-10 ramp terminal intersections was determined to be approximately 1.5 crashes per Million Entering Vehicles (MEV), which is slightly higher than the statewide average crash rate (0.6 crashes per MEV).

Rear end crashes were the predominant crash type occurring on I-10. Of the total 102 crashes, 41 crashes (40 percent) occurred in dark conditions and 32 crashes (31 percent) occurred under wet pavement conditions. Eastbound I-10 had a total of 50 crashes that occurred in the five-year period. The predominant crash type was sideswipe crashes, representing 24 percent of crashes. There were 25 injury crashes (50 percent) and 2 fatal crashes (4 percent). One of the fatal crashes was a head-on collision and the other was an off-road collision. Westbound I-10 had a total of 52 crashes that occurred during the study period. The predominant crash type was rear end crashes, representing 35 percent of the total. There were 19 injury crashes (37 percent) in the westbound I-10 segment of the study area. **Figure 7** and **Figure 8** illustrate the historical crash summary for I-10.

SR 121 had a total of 52 crashes resulting in 22 (42 percent) injury crashes and 30 (58 percent) property damage only crashes. The predominant crash type was rear end crashes (40 percent) followed by off-road crashes (21 percent). Dark conditions were reported for 7 crashes (13 percent) while 9 crashes (17 percent) occurred on wet pavement conditions. **Figure 9** illustrates the historical crash summary for SR 121.

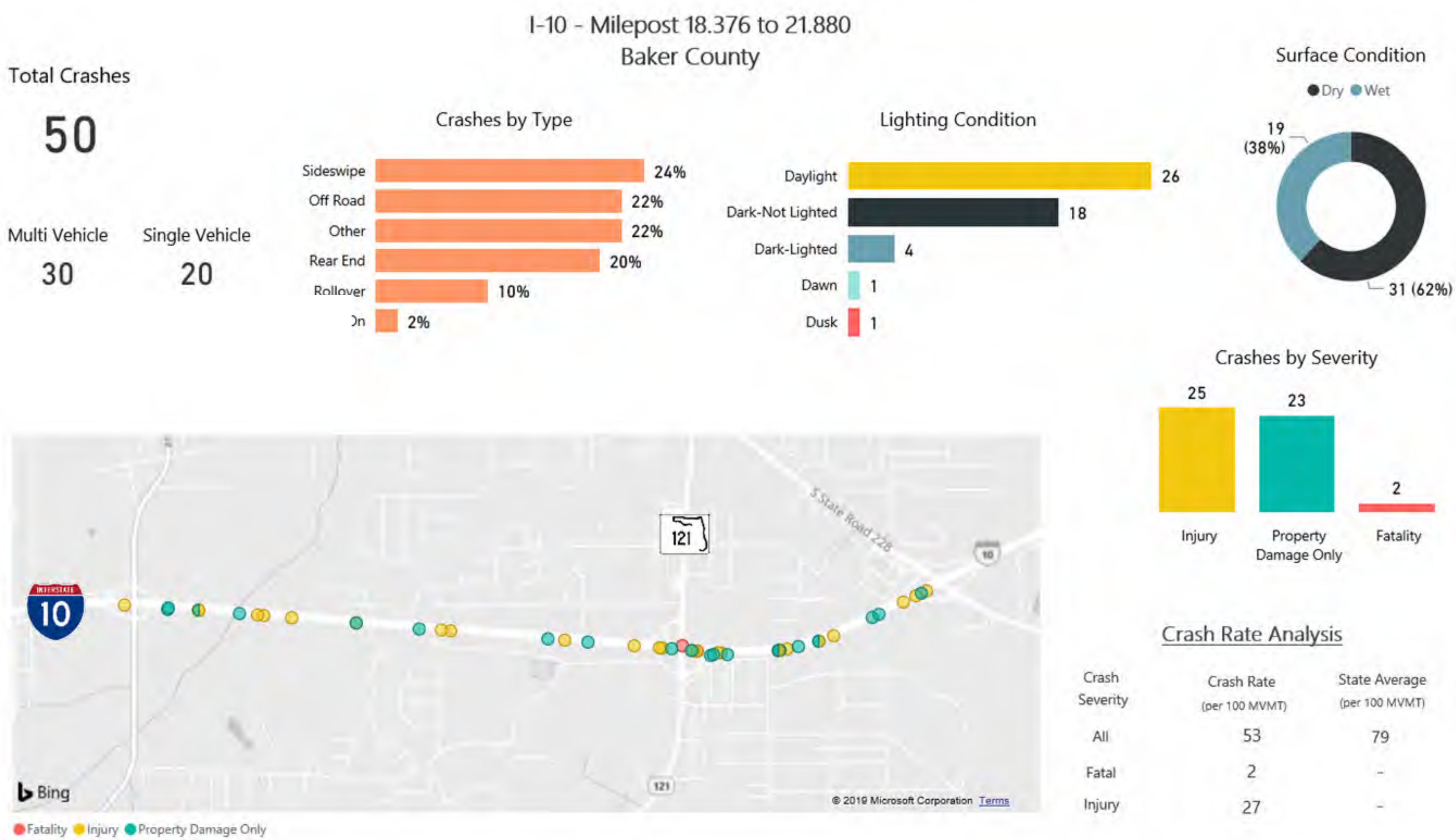


Figure 7: Historical Crashes Summary – I-10 Eastbound

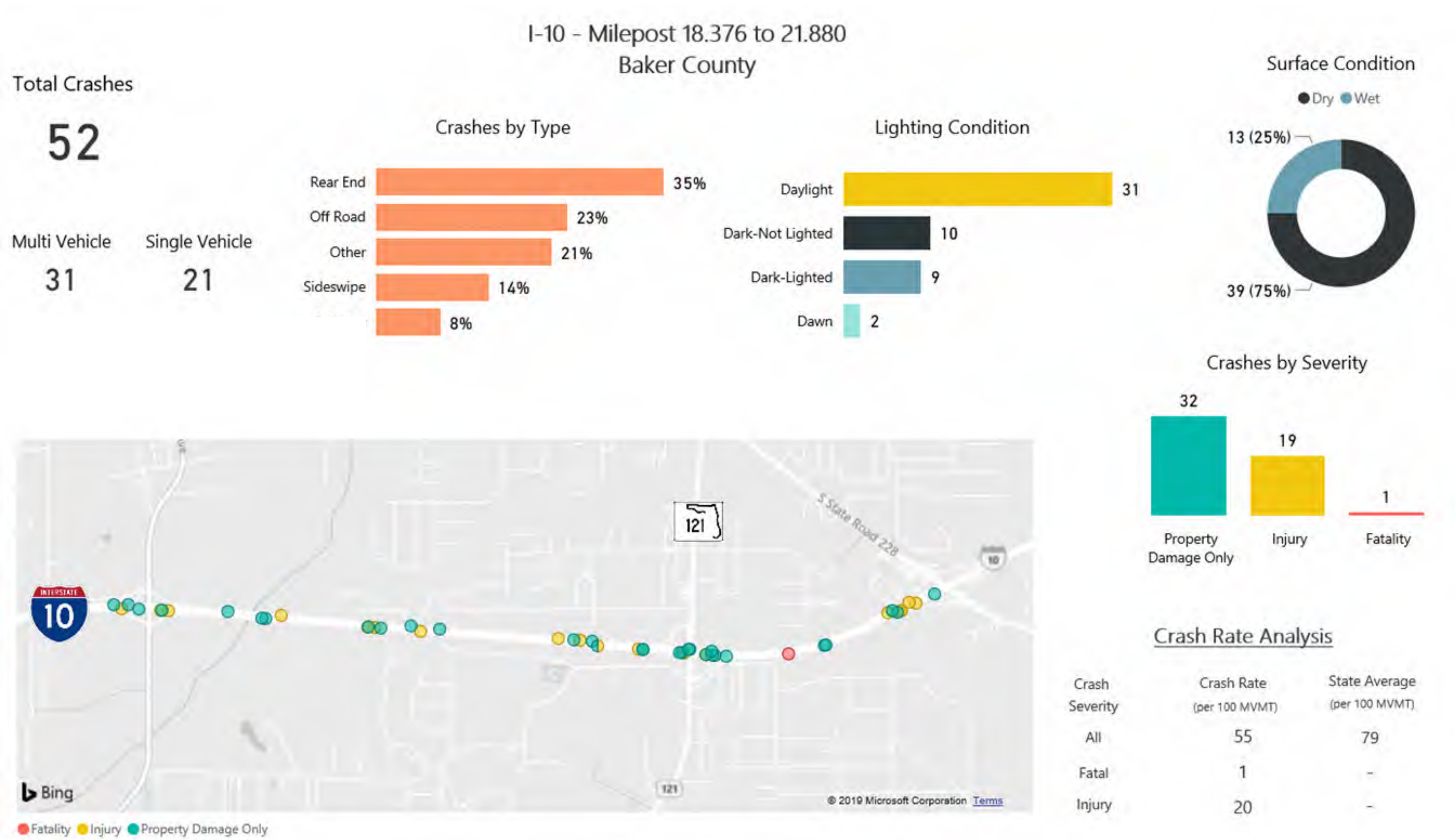


Figure 8: Historical Crashes Summary – I-10 Westbound

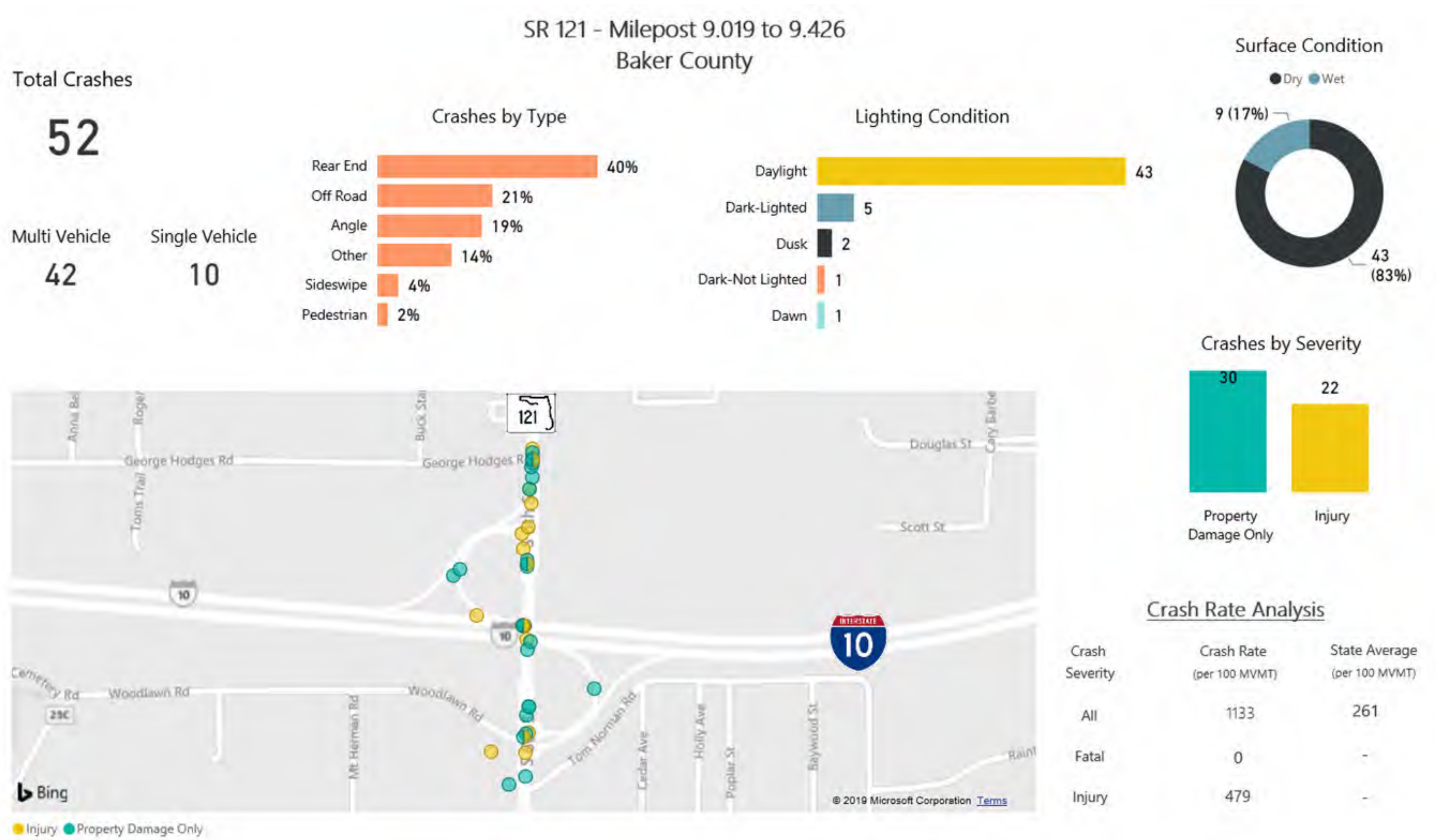


Figure 9: Historical Crashes Summary – SR 121

4 NEEDS

4.1 AREA NEEDS

4.1.1 System Linkage

As a major east-west intercity and regional route, I-10 serves as an integral part of North Florida's transportation network. I-10 extends from I-95 in Jacksonville, Florida through Tallahassee, Florida and eventually to the west coast of the United States. SR 121 connects commuters between Macclenny, Florida and surrounding cities to and from Jacksonville, Florida and is an important arterial.

4.1.2 Transportation Demand

An increase in demand on I-10 and SR 121 in anticipated. Baker County's population is estimated to increase about 15.9 percent from 28,300 in 2020 to 32,800 in 2045 (Bureau of Economic and Business Research (BEBR), 2019). As a result, additional traffic demand on major arterials within the study area will need to be addressed. **Table 11** summarizes the anticipated growth within the study area.

Table 11: Forecasted Growth in Traffic Volume (AADT)

Segment	Existing Year (2020)	Opening Year (2025)	Design Year (2045)	Percent Increase (Existing to 2045)
I-10, West of SR 121	33,100	37,700	65,900	99
I-10, East of SR 121	39,600	43,900	75,900	92
SR 121, North of I-10	13,000	13,100	19,300	48
SR 121, South of I-10	12,100	12,700	14,200	17

The study area has a high volume of heavy trucks. The corridor will experience 11.3 and 6.0 percent heavy vehicles during the peak hour along SR 121 north and south of I-10, respectively and 17.9 percent along I-10. The truck volume will increase proportionally to the vehicular traffic and will results in further deteriorated conditions.

4.1.3 Social Demands or Economic Developments

The I-10/SR 121 interchange is a major access point to economic development and a community focus for the residents of Macclenny, Florida. Light industrial and warehousing land use in the area is expected to increase due to the proximity of a Walmart Distribution Center, nearly four miles from the SR 121 interchange. Operations at the SR 121 interchange will further deteriorate with the increase in truck traffic that will commute to and from this facility.

4.2 PROJECT CORRIDOR NEEDS

4.2.1 Capacity

The existing LOS at the ramp terminal intersections within the study area were evaluated using SYNCHRO version 10 and is summarized in **Table 12**.

Table 12: Existing (2020) LOS for Ramp Terminal Intersections at SR 121

Segment	AM	PM	LOS Target
I-10 Eastbound Ramp(1)	C	C	D
I-10 Westbound Ramp(2)	A	E	D

Notes:
(1) Signalized intersection analysis
(2) Unsignalized intersection analysis

The following factors contribute to existing congestion at the interchange:

- The geometric design of the loop ramps that service the eastbound and westbound offramps to SR 121 are not of current conventional FDOT design standards. These loop ramps were built with lower design speeds and a three-centered compound curve. The transition of different radii along the loop impedes natural driver expectancy, resulting in an interrupted flow. This movement causes rapid braking that affects the density of the roadway resulting in lower capacity and unsafe travel conditions along the loop ramp.
- Southbound SR 121 commuters encounter poor sight distance due to the vertical curve over I-10. The I-10 westbound ramp terminal intersection is unsignalized. Hesitation to perform the turning movement to head north on SR 121 due to poor sight distance over the vertical curve leads to high delays for motorists exiting the freeway. Drivers of heavy trucks making this movement have been observed making risky decisions. These conditions result in unsafe travel conditions and an increase in queue length.
- The study area possesses a high volume of heavy truck traffic, which accounts for more than 11 percent of peak hour traffic volumes. In determining capacity and operating conditions, these trucks are counted as more than 1.5 of passenger car due to their size and difficulties with accelerating and decelerating. The grade differentials and curves of the loop ramps paired with the high truck volumes generate speed differentials that deteriorate operating conditions and safety.

4.2.2 Safety

Existing crash data was reviewed for the most recent 5 years (2012 – 2016) from FDOT Safety Office. Crash data was evaluated for the corridors, ramps, and each intersection within the study area and is summarized in Section 3.7.

Angle and sideswipe collisions made up approximately 23 percent of crashes along SR 121. This may be attributed to poor turning decisions and lack of sight distance at vital intersections along the corridor. In addition, rear-end collisions were prevalent within the influence area along I-10. This may be attributed to sudden braking from motorists entering the non-standard three-centered compound curves when exiting to SR 121. The existing geometric deficiencies may be contributing to these crashes and need improvements to reduce the occurrence and severity of crashes.

5 ALTERNATIVES

The No-Build and Build Alternatives that are evaluated for this IMR are described in the following sections.

5.1 No-Build Alternative

The No-Build Alternative considers existing geometric (as shown in **Figure 3**) and operational conditions with future traffic volumes. Signal timings at the ramp terminal and adjacent intersections were optimized to obtain optimal operational performance with these existing geometric conditions. This alternative serves as the baseline for comparative analysis with the Interim Build Alternatives.

The No-Build Alternative provides benefits related to economic and construction impacts. However, Section 4 describes the necessity of infrastructure improvements due to traffic operations and safety for the existing interchange that will not be addressed with this alternative. The long-term benefits amassed from serving existing and future traffic demands will not be realized with the No-Build Alternative.

5.2 Build Alternatives

The No-Build Alternative with a signal at the westbound I-10 ramp terminal intersection (IOAR Concept) and an Interim Build Alternative were considered to alleviate operational and safety deficiencies of the study area and the details for these alternatives are discussed below.

5.2.1 No-Build with Signal (IOAR Concept) Alternative

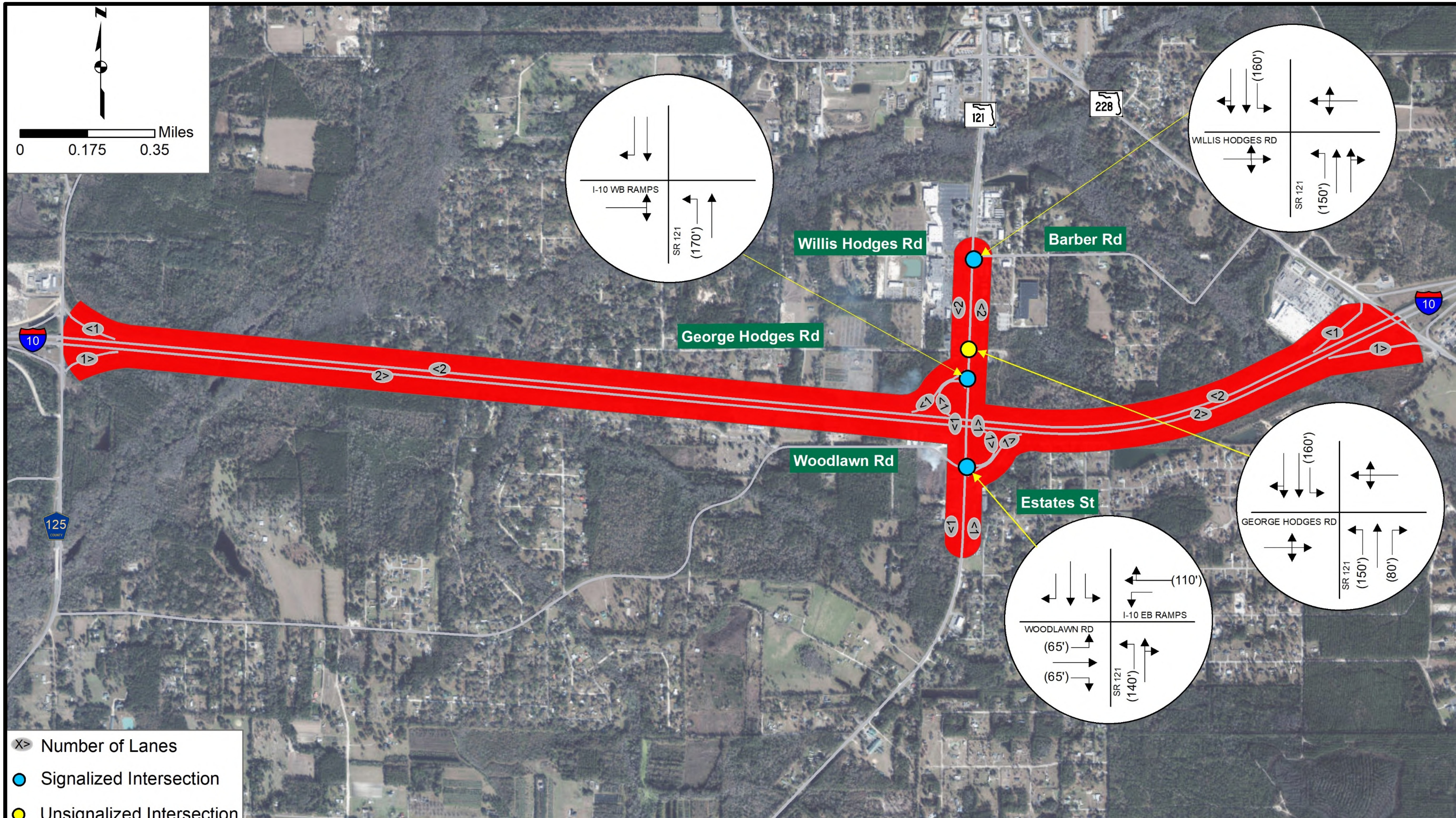
This alternative utilizes the existing geometry and proposes to install a new traffic signal at the intersection of SR 121 and westbound I-10 ramp terminal. **Figure 10** provides the lane configuration and **Figure 11** shows the proposed design plan for this alternative.

5.2.2 Interim Build Alternative

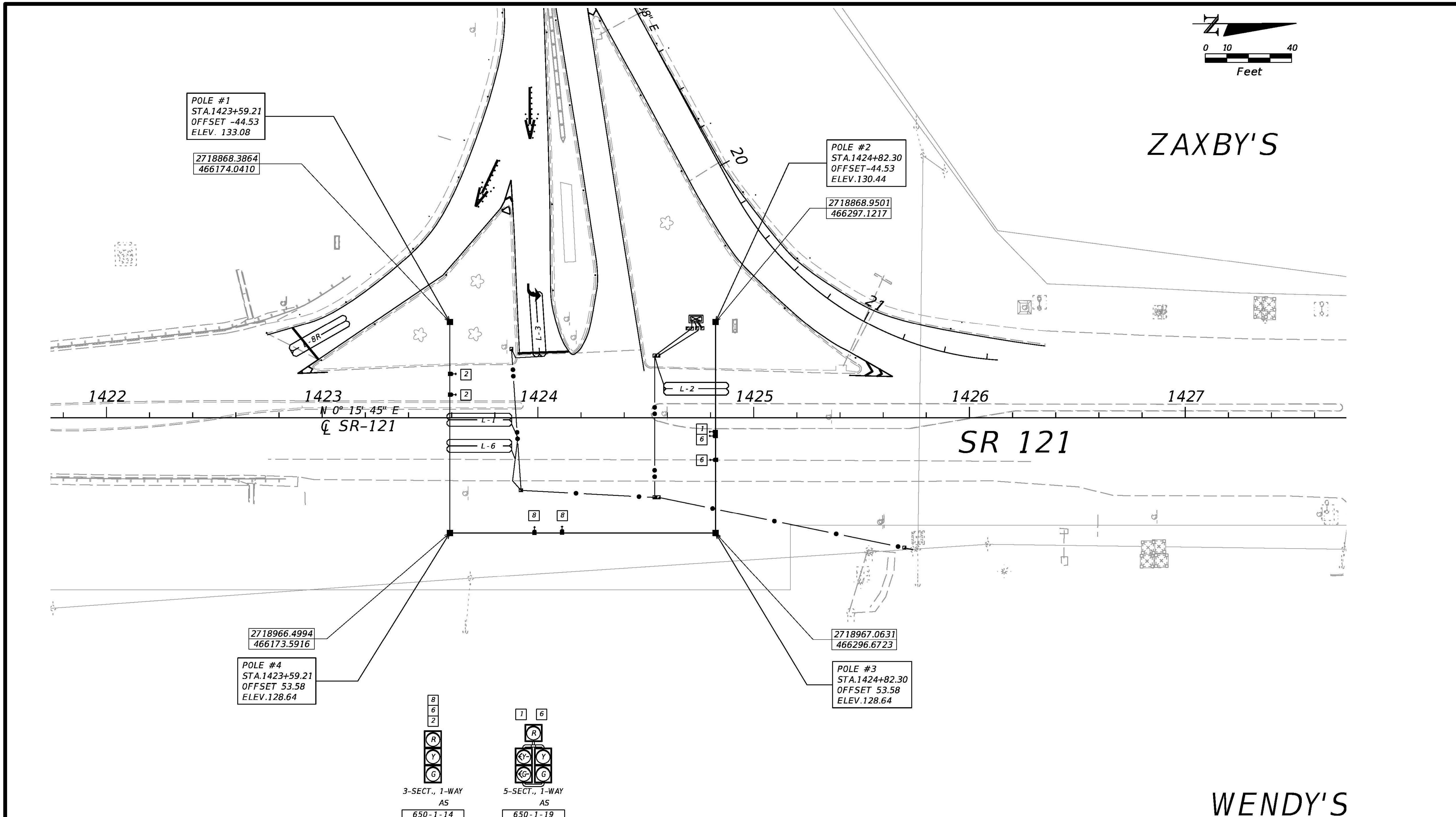
The improvements with the Interim Build Alternative consist of geometric and operational improvements. This alternative has following improvements:

- Add directional ramp for traffic from westbound I-10 off-ramp to northbound SR 121
- Improve SR 121 in the northbound direction
- Install a new traffic signal to control the northbound SR 121 and westbound I-10 off-ramp movements

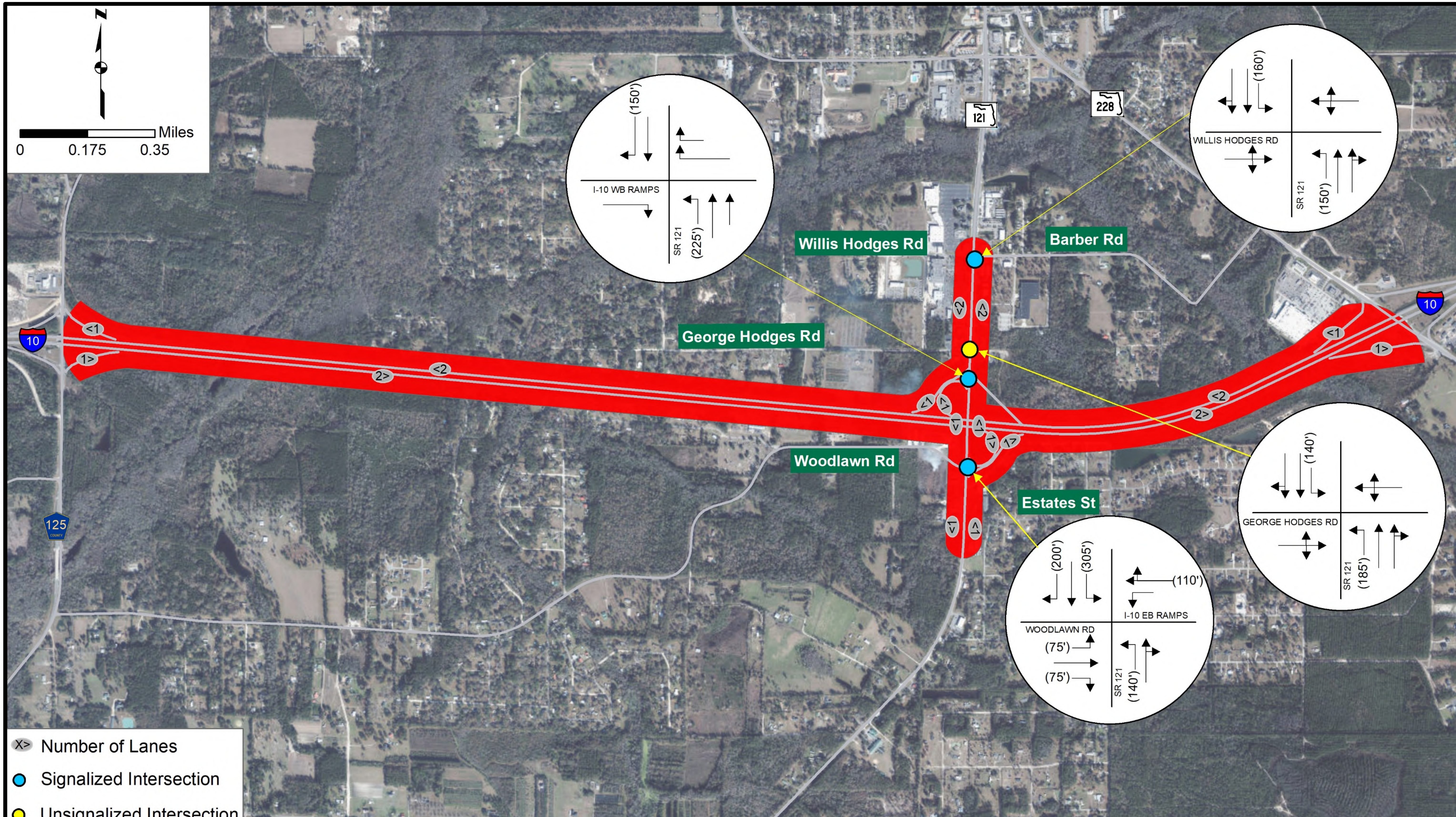
The lane configuration and conceptual layout of this alternative is presented in **Figure 12** and **Figure 13**, respectively.



FDOT	SR 121 Interchange Modification Report	**No-Build with Signal (IOAR Concept) Alternative Lane Configuration**	Figure 10
			Page 28



FDOT	SR 121 Interchange Modification Report	**No-Build with Signal (IOAR Concept) Alternative Conceptual Layout**	Figure 11 Page 29



FDOT

SR 121 Interchange Modification Report

Interim Build Alternative Lane Configuration

Figure 12

FDOT	SR 121 Interchange Modification Report	**Interim Build Alternative Conceptual Layout**	Figure 13
			Page 31

6 FUTURE TRAFFIC FORECAST

The methodology utilized for the development of design traffic volumes for this project followed the procedures summarized below:

Existing Year (2020) traffic counts were compiled from traffic counts conducted within the study area, and the data was adjusted by applying applicable seasonal and axle correction factors as summarized in **Section 3**. Existing traffic data was balanced for the mainline first by holding one location on the mainline constant and adding or subtracting ramp volumes. Next, arterials were balanced with ramp volumes. Raw count information is provided in **Appendix D**.

The NERPM AB1 Version 2 was selected to perform the travel demand forecasting for this project. This model is based on FSUTMS and is recognized by the NFTPO, FDOT District 2, FDOT Systems Implementation Office (SIO) and FHWA as the calibrated and validated model for the region. The use of this model is consistent with other on-going planned and programmed projects in northeast Florida. It has a Base Year of 2010 with a Horizon Year of 2040.

Upon the completion of updating the NERPM AB future year conditions with the proposed roadway improvements for this project, the Base Year (2010) and Horizon Year (2040) models were run. Peak Season Weekday Average Daily Traffic (PSWADT) were extracted from the models and the MLOU-approved MOCF was applied to obtain Base Year (2010) and Horizon Year (2040) AADT for the study area. The "Factoring Procedure – Difference Methods" per NCHRP report 765 was applied to determine the difference in AADT between the Base Year (2010) model volumes and the FTO 2010 count volumes. Interpolation between the 2010 FTO AADT and NERPM AB 2040 AADT established 2020 model volume AADT data; this data was compared to the field collected Existing Year (2020) count data. The difference between the Existing Year (2020) count volume and model-estimated 2020 volume was then applied to the Horizon Year (2040) AADTs to establish recommended 2040 AADT volumes. **Table 13** summarizes the AADT evaluation.

Table 13: Study Area AADT Evaluation Summary

Location	FTO 2010 AADT	NERPM AB 2010 AADT	NERPM AB 2040 AADT	Existing Year (2020) AADT	Existing Year (2020) – Interpolated 2020 Delta	Final 2040 AADT
I-10, between CR 125 Ramps	22,200	28,200	50,780	26,600	27,150	36,100
WB I-10 Off-Ramp to CR 125	2,000	4,480	6,730	3,500	1,390	4,200
EB I-10 On-Ramp from CR 125	1,800	3,630	5,690	3,000	1,490	3,800
I-10, between CR 125 and SR 121	26,000	36,310	63,200	33,100	30,530	44,100
WB I-10 On-Ramp from SR 121	2,000	1,290	2,930	2,300	2,790	3,600
WB I-10 Off-Ramp to SR 121	3,600	2,600	3,800	5,000	4,347	6,900
EB I-10 Off Ramp to SR 121	1,500	1,120	2,290	1,300	2,020	1,900
EB I-10 On-Ramp from SR 121	3,600	3,310	4,400	5,100	4,060	6,300
I-10, between SR 121 and SR 228	29,700	39,780	66,180	39,600	34,160	51,800
WB I-10 On-Ramp from SR 228	1,900	1,630	2,040	3,100	2,110	4,000
EB I-10 Off-Ramp to SR 228	1,700	1,650	2,190	2,400	1,900	3,100
I-10, between SR 228 Ramps	26,100	36,500	62,210	34,100	30,190	44,700

Notes: WB – westbound; EB – eastbound

Model predicted growth rates were computed between Existing Year (2020) count data and the established 2040 AADT volumes for the area of influence. These growth rates were compared with historic growth rates determined from FTO count sites and were verified for reasonableness with population and employment data for the region. Finally, a recommended growth rate was established for the project as summarized in **Table 14**.

Table 14: Study Area Growth Rate Summary

Location	Raw Historic Growth Rate	Adjusted Historical Growth Rate	NERPM AB Growth Rate (2010-2040)	Count to Model Growth Rate (2020-2040)	Recommended Growth Rate
I-10, between CR 125 Ramps	2.7%	2.8%	1.7%	1.5%	2.8%
WB I-10 Off-Ramp to CR 125	3.5%	3.3%	-8.2%	0.9%	3.3%
EB I-10 On-Ramp from CR 125	1.1%	3.3%	-2.5%	-2.5%	3.3%
I-10, between CR 125 and SR 121	2.7%	2.8%	1.4%	1.4%	2.8%
WB I-10 On-Ramp from SR 121	0.5%	2.4%	2.6%	2.3%	2.4%
WB I-10 Off-Ramp to SR 121	2.3%	2.4%	1.6%	1.6%	2.4%
EB I-10 Off Ramp to SR 121	-2.0%	2.4%	2.4%	1.9%	2.4%
EB I-10 On-Ramp from SR 121	2.3%	2.4%	1.1%	1.1%	2.4%
I-10, between SR 121 and SR 228	2.9%	2.8%	1.2%	1.4%	2.8%
WB I-10 On-Ramp from SR 228	2.2%	2.1%	1.0%	1.3%	2.1%
EB I-10 Off-Ramp to SR 228	2.1%	2.1%	1.0%	1.3%	2.1%
I-10, between SR 228 Ramps	2.9%	2.8%	1.3%	1.4%	2.8%

The Base Year (2010) and Horizon Year (2040) NERPM AB1 Version 2 roadway networks with PSWADT are provided in **Appendix H** of this report. FTO, BEBR, and census data used to determine growth rate reasonableness are provided in **Appendix I**.

Opening Year (2025) and Design Year (2045) traffic volumes were developed by applying the recommended growth rates to Existing Year (2020) TMCs. Next, future volumes were adjusted for reciprocity. Mainline design hour volumes were balanced by holding one location along I-10 constant and adding or subtracting ramp volumes. Intersection turns were adjusted to balance with ramp volumes and finally, volumes along arterials were balanced. Since no major capacity improvements were proposed with the Interim Build Alternative, latent demand is not considered for build improvements. Therefore, the Opening Year (2025) and Design Year (2045) peak hour volumes were considered to be the same for both no-build and build conditions.

The Standard K was applied to the final design hour volumes to obtain Opening Year (2025) and Design Year (2045) AADT forecasts. The forecasted AADTs were then checked for reasonableness with several sources including:

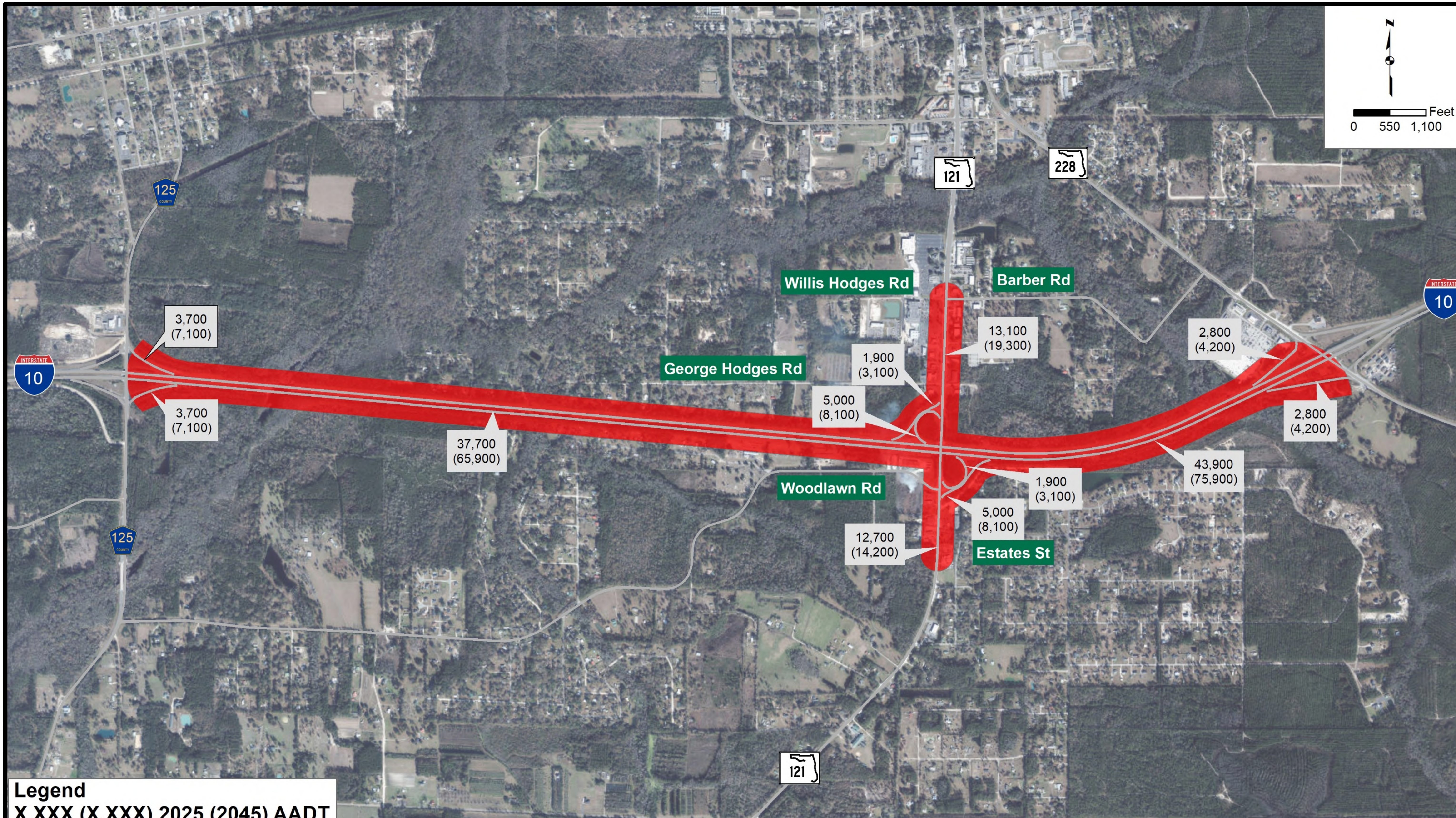
- NERPM AB-generated AADTs
- FTO Year 2018 AADT extrapolated to Opening Year (2025) and Design Year (2045) with recommended growth rate
- Existing Year (2020) count data extrapolated to Opening Year (2025) and Design Year (2045) with recommended growth rate

The I-10 mainline, SR 121, the westbound I-10 to SR 121 off-ramp, and the eastbound I-10 on-ramp from SR 121 (reciprocal ramp movements) AADT were determined to be unreasonable when calculated with the Standard K. Localized K-factors, as identified in **Table 2**, at these locations were evaluated and determined to capture the true future AADT of the study area.

Figure 14 and **Figure 15** provide the AADT information for Opening Year (2025) and Design (2045) for the No-Build Alternative, No-Build with Signal (IOAR Concept) Alternative, and Interim Build Alternative.

Figure 16 and **Figure 17** illustrate the Opening Year (2025) and Design Year (2045) peak hour DDHVs for the No-Build Alternative and No-Build with Signal (IOAR Concept) Alternative.

Figure 18 and **Figure 19** illustrate the Opening Year (2025) and Design Year (2045) DDHVs for the Interim Build Alternative. The Interim Build Alternative traffic volumes were developed by reallocating the I-10 westbound to SR 121 northbound volume to the new directional ramp proposed under this alternative.

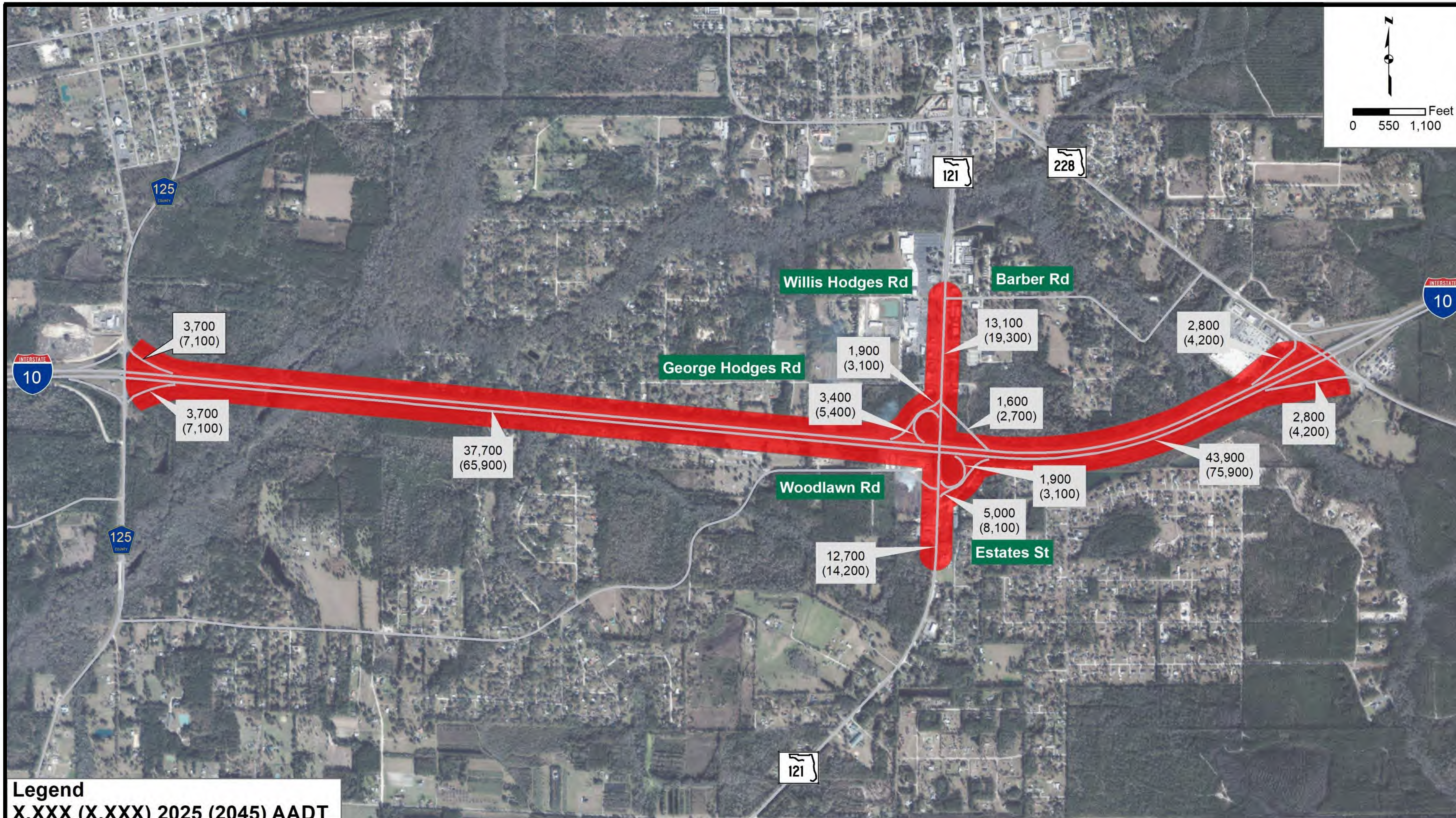


FDOT

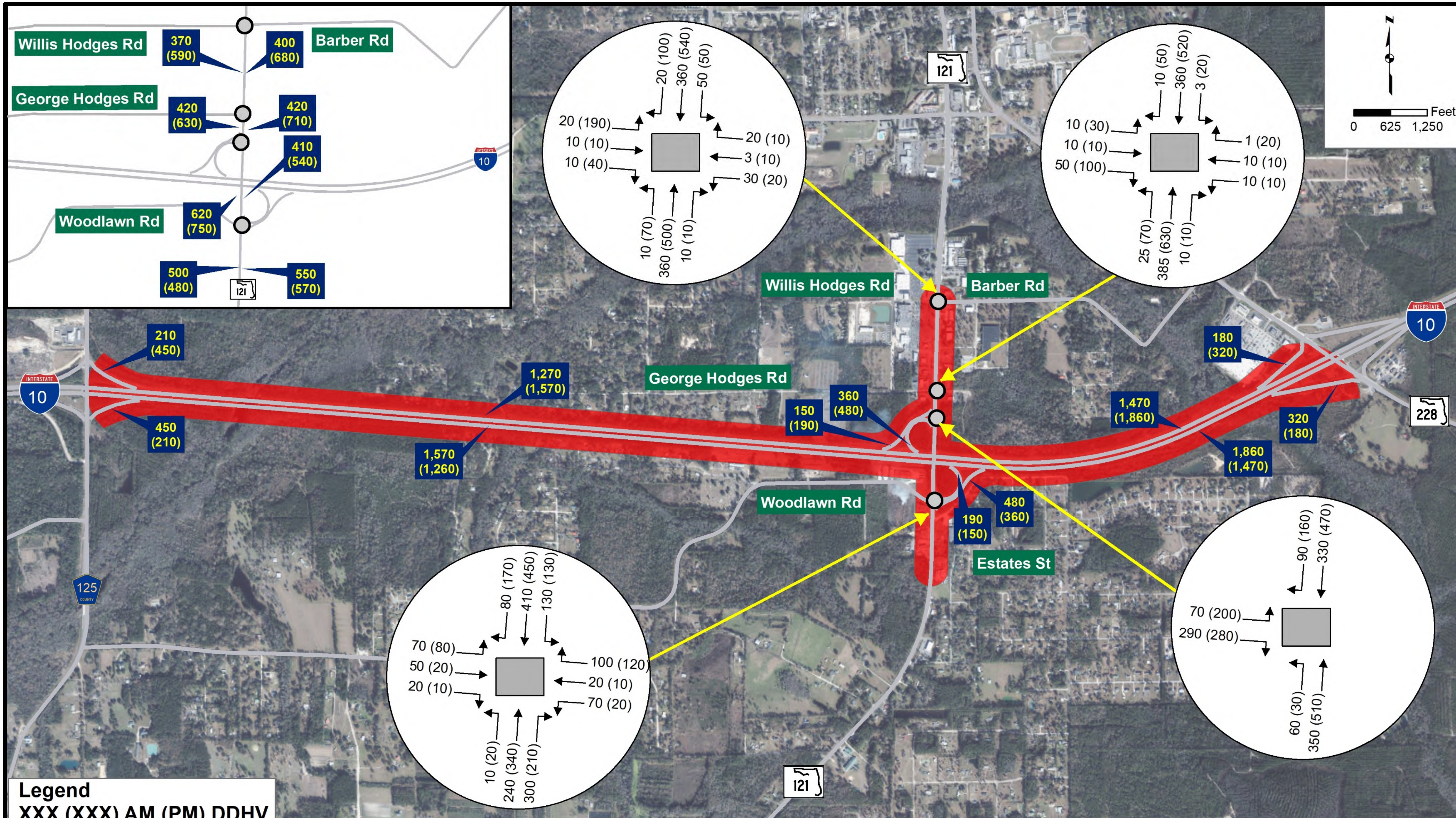
SR 121 Interchange Modification Report

No-Build and No-Build with Signal (IOAR Concept) Alternatives Opening Year (2025) & Design Year (2045) Annual Average Daily Traffic

Figure 14



FDOT	SR 121 Interchange Modification Report	**Interim Build Alternative Opening Year (2025) & Design Year (2045) Annual Average Daily Traffic**	Figure 15
			Page 36

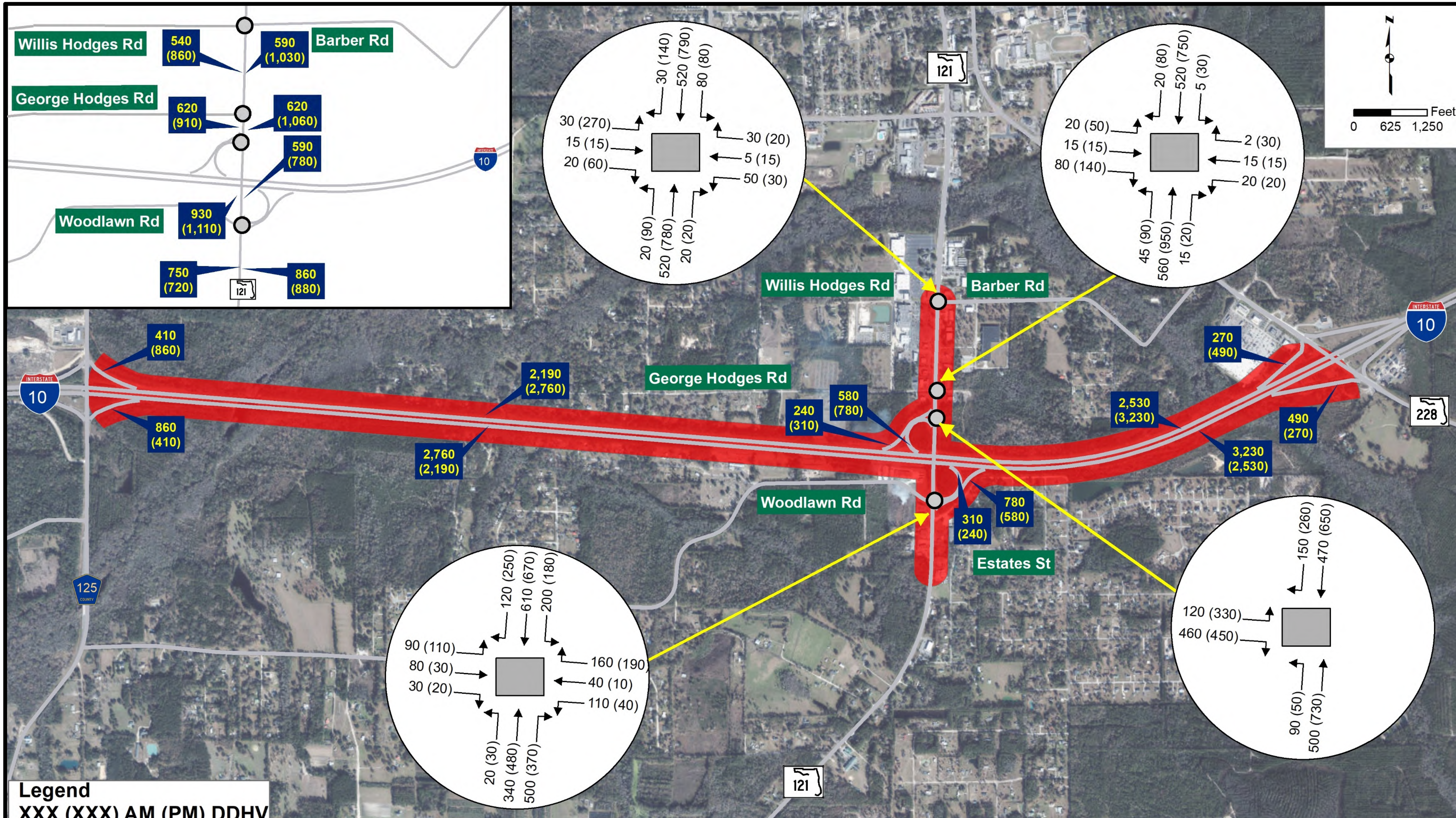


FDOT

SR 121 Interchange Modification Report

No-Build and No-Build with Signal (IOAR Concept) Alternatives DDHV Opening Year (2025)

Figure 16

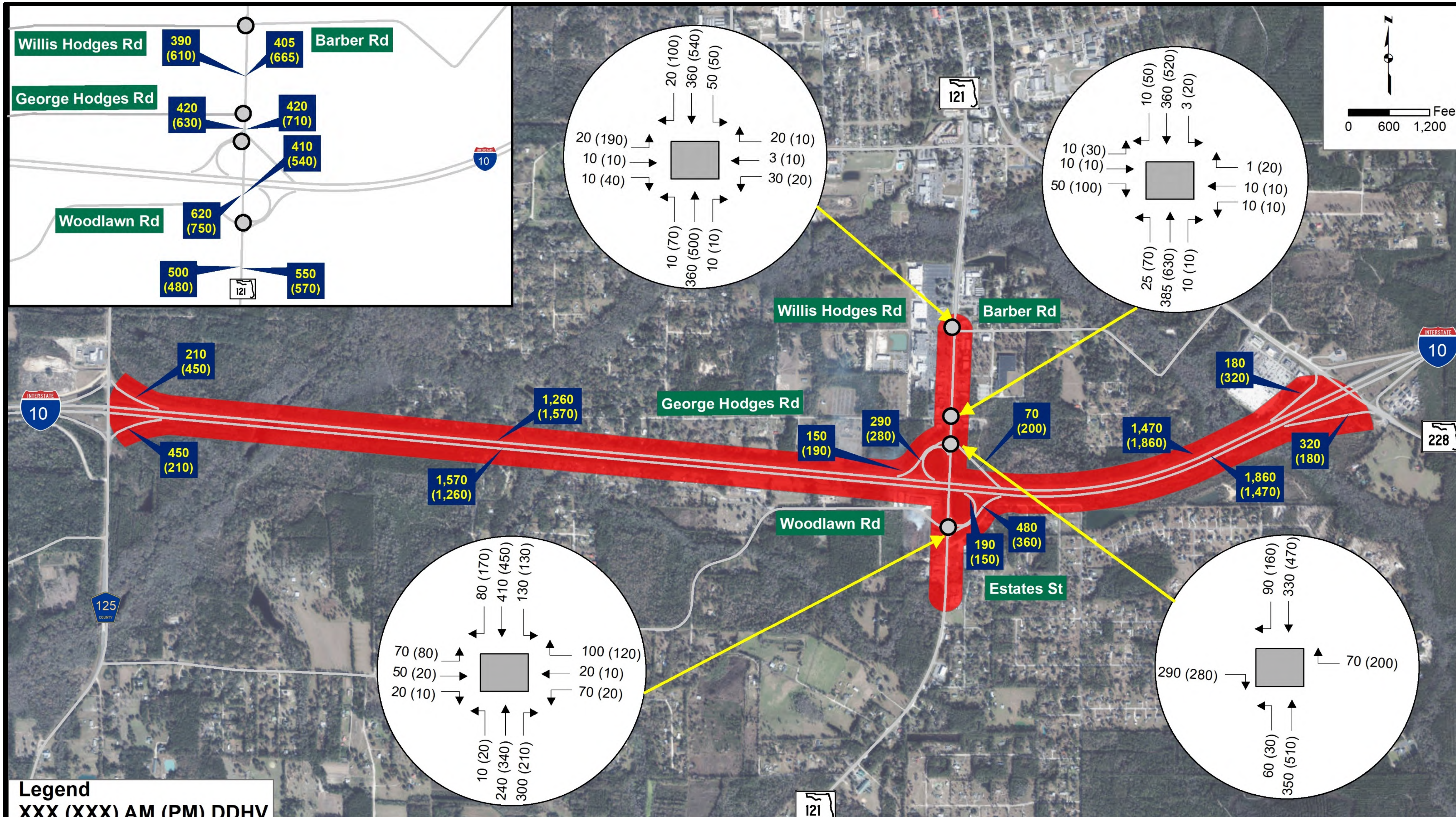


FDOT

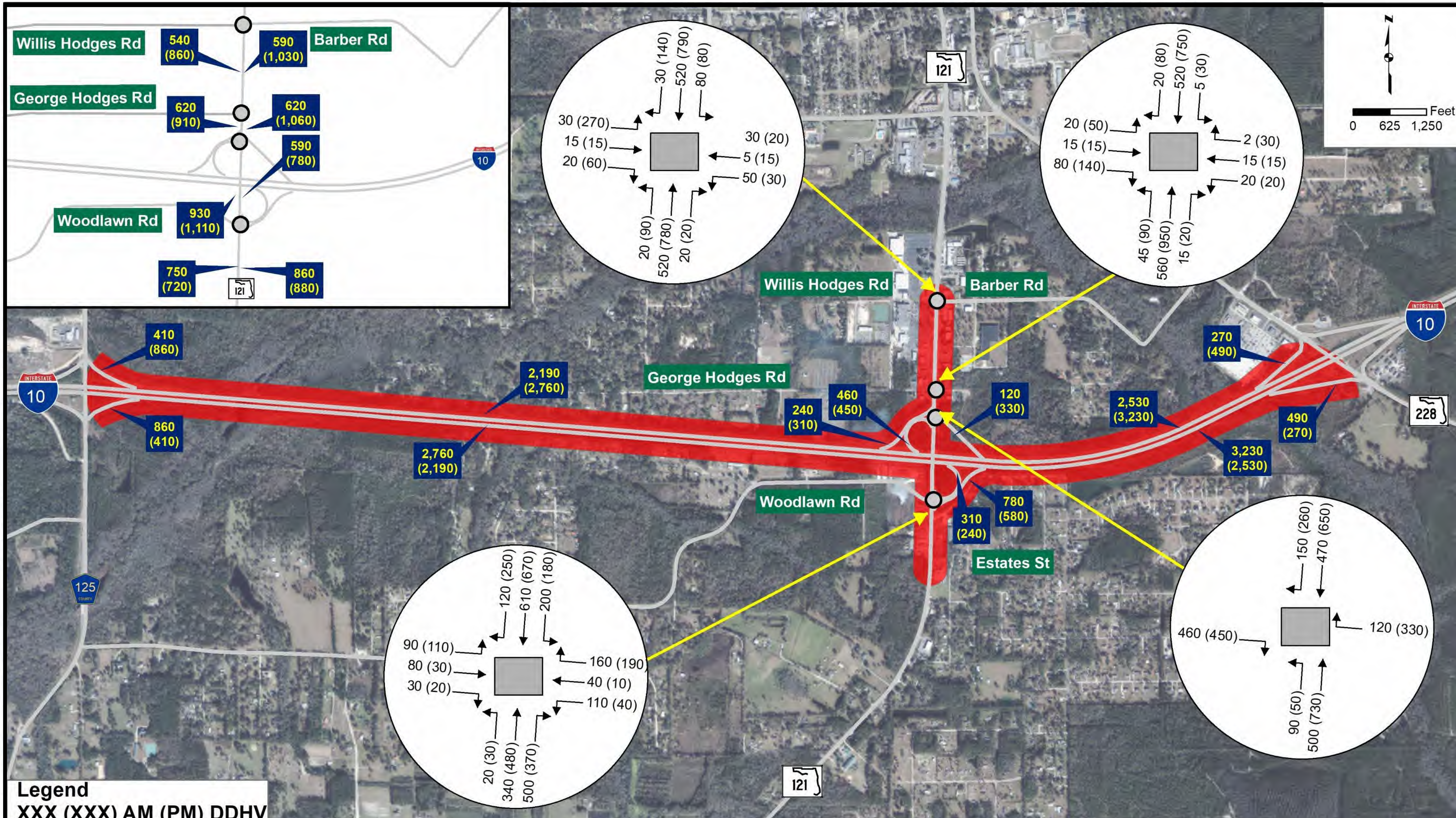
SR 121 Interchange Modification Report

No-Build and No-Build with Signal (IOAR Concept) Alternatives DDHV Design Year (2045)

Figure 17



FDOT	SR 121 Interchange Modification Report	**Interim Build Alternative DDHV Opening Year (2025)**	Figure 18 Page 39



FDOT	SR 121 Interchange Modification Report	**Interim Build Alternative DDHV Design Year (2045)**	Figure 19
			Page 40

7 ALTERNATIVE OPERATIONAL PERFORMANCE

7.1 Conformance with Transportation Plan

This project is consistent with the latest adopted transportation plans available including the following:

- North Florida TPO Year 2045 LRTP
- North Florida TPO TIP
- North Florida TPO Cost Feasible Plan
- FDOT Five-Year Work Program
- City of Jacksonville Plans

This project is Programmed as an Interim Operational Improvement Project in the FDOT Work Program.

7.2 Compliance with Policies and Engineering Standards

7.2.1 Roadway Design Criteria

The SR 121 interchange improvements incorporate several project elements with various design requirements. The design standards are outlined by the FDOT Design Manual (2019 FDM), the Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (2016 Florida Greenbook), and A Policy on Geometric Design of Highways and Streets 6th Edition (AASHTO 2011).

7.2.2 Stormwater Design Criteria

The stormwater design will be governed by the Saint Johns River Water Management District (SJRWMD) and FDOT. Water quality and quantity criteria will be governed by SJRWMD. For existing roadways being widened under current permitting rules, only the new impervious area requires treatment. For roadways being reconstructed, all impervious areas will require treatment. For FDOT roadway projects, the design of stormwater management systems must comply with the requirements of the Drainage Manual (FDOT 2020) to address water quality, quantity, and rate requirements. Stormwater evaluations for this project will be conducted as part of the design phase.

7.2.3 Design Exceptions and Variation

At the time of preparation of this IMR, there are no known design exceptions or variations to any FDOT or FHWA policies, rules, or standards. If an exception or variation should arise during the design phase, it will be processed in accordance with FHWA and FDOT standards, respectively.

7.3 Operational Analysis

The operational analysis for this IMR was conducted in accordance with the approved methodology presented to DIRC (January 2020) provided in **Appendix C**. Study intersections, freeway segments, and elements including ramp merge and diverge locations were evaluated in accordance with methodologies outlined in HCM, FDOT, and FHWA requirements for Opening and Design Year (2025 and 2045) traffic conditions for the No-Build and Build Alternatives.

SYNCHRO version 10 was used to analyze the study intersections using average delay and LOS values and HCS7 was used to determine the density and LOS for freeway elements.

7.4 NO-BUILD ALTERNATIVE

The no-build network is considered the same as existing network to evaluate operational performance of the study area. Operational analyses were conducted for the study intersections and I-10 mainline freeway segments, and ramp junctions for both Opening Year (2025) and Design Year (2045) under no-build conditions. This alternative serves as the baseline for comparative analysis with Build Alternatives.

7.4.1 Intersection Analysis Summary

Intersections were evaluated using SYNCHRO version 10. The No-Build Alternative reflects existing roadway geometric conditions; however, signal timings were optimized to facilitate better operations with higher future traffic volumes. **Table 15** summarizes the Opening Year (2025) and Design Year (2045) No-Build intersection delay and LOS. The unsignalized intersections have movements that operate at LOS F during the PM peak hour by Design Year (2045). The delay at Willis Hodges Road increases from 24.7 seconds in year 2020 to 45.1 seconds in year 2045 in the PM peak hour, which accounts approximately 83 percent increase. Delays near the unsignalized intersections within the study area in the Design Year (2045) are extremely high during the PM peak hour as the volumes exceed the available capacity for unsignalized intersections. The stop-controlled approaches at the unsignalized intersections, specifically westbound I-10 ramp terminal intersection, experience long queues that backup into the mainline impeding I-10 operations.

Table 16 summarizes the Opening Year (2025) and Design Year (2045) No-Build Alternative 95th percentile queue lengths. The 95th percentile queues for a majority of the approaches exceed capacity, specifically the eastbound approach near the I-10 and SR 121 westbound ramp terminal intersection and the northbound and southbound approaches near the I-10 and SR 121 eastbound ramp terminal.

Table 15: No-Build Alternative – Intersection Analysis

Intersection	Type	Year	Eastbound						Westbound						Northbound						Southbound					
			Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
AM Peak Hour																										
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	46.4	D	48.1	D	0.3	A	43.6	D	21.2	C	-	-	6.9	A	27.2	C	-	-	6.6	A	15.9	B	0.2	A
			22.2/C																							
		2045	90.1	F	67.2	E	0.7	A	66.7	E	50.6	D	-	-	6.8	A	47.1	D	-	-	33.4	C	15.7	B	1.8	A
			37.9/D																							
I-10 Westbound Ramps(1)	U	2025	25.9	D	-	-	-	-	-	-	-	-	-	-	8.3	A	0.0	A	-	-	-	-	0.0	A	0.0	A
			8.3/A																							
		2045	320.5	F	-	-	-	-	-	-	-	-	-	-	8.9	A	0.0	A	-	-	-	-	0.0	A	0.0	A
			104.3/F																							
George Hodges Rd (1)	U	2025	14.1	B	14.1	B	14.1	B	19.5	C	19.5	C	19.5	C	8.4	A	0.0	A	0.0	A	8.4	A	0.0	A	0.0	A
			1.9/A																							
		2045	25.3	D	25.3	D	25.3	D	37.2	E	37.2	E	37.2	E	8.9	A	0.0	A	0.0	A	9.0	A	0.0	A	0.0	A
			3.6/A																							
Willis Hodges Rd	S	2025	45.2	D	45.2	D	45.2	D	45.3	D	45.3	D	45.3	D	2.9	A	21.1	C	-	-	2.6	A	19.0	B	-	-
			21.5/C																							
		2045	45.6	D	45.6	D	45.6	D	57.4	E	57.4	E	57.4	E	3.9	A	20.8	C	-	-	3.7	A	18.9	B	-	-
			22.5/C																							
PM Peak Hour																										
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	41.7	D	35.6	D	0.1	A	29.8	C	18.1	B	-	-	7.3	A	41.4	D	-	-	8.3	A	15.0	B	1.2	A
			24.0/C																							
		2045	126.3	F	46.6	D	0.3	A	39.8	D	23.9	C	-	-	6.9	A	77.6	E	-	-	25.8	C	20.3	C	5.6	A
			45.1/D																							
I-10 Westbound Ramps(1)	U	2025	279.0	F	-	-	-	-	-	-	-	-	-	-	8.6	A	0.0	A	-	-	-	-	0.0	A	0.0	A
			81.4/F																							
		2045	***	F	-	-	-	-	-	-	-	-	-	-	9.4	A	0.0	A	-	-	-	-	0.0	A	0.0	A
			3,158.2/F																							
George Hodges Rd (1)	U	2025	48.4	E	48.4	E	48.4	E	34.6	D	34.6	D	34.6	D	9.0	A	0.0	A	0.0	A	9.3	A	0.0	A	0.0	A
			6.1/A																							
		2045	***	F	***	F	***	F	311.0	F	311.0	F	311.0	F	9.3	A	0.0	A	0.0	A	11.1	B	0.0	A	0.0	A
			945.3/F																							
Willis Hodges Rd	S	2025	45.4	D	45.4	D	45.4	D	18.6	B	18.6	B	18.6	B	5.6	A	17.4	B	-	-	10.3	A	27.5	C	-	-
			25.2/C																							
		2045	66.9	E	66.9	E	66.9	E	23.9	C	23.9	C	23.9	C	17.9	B	35.7	D	-	-	18.7	B	46.0	D	-	-
			42.9/D																							

Notes:
(1) SYNCHRO 10 has limitation to produce results for the subject intersection from HCM 6 and HCM 2010 report. Therefore, HCM 2000 is used to compute results for the subject intersection.
(2) *** - Delay is significant and error is reported.
(3) Delay – Average Delay/Vehicle (seconds/vehicle)
(4) S = Signalized; U = Unsignalized

Table 16: No-Build Alternative – Intersection 95th Percentile Queues

	Intersection	Time Period	Year	Peak Hour Queues (feet)												Remarks
				Eastbound			Westbound			Northbound			Southbound			
				L	T	R	L	T	R	L	T	R	L	T	R	
1	SR 121 and Woodlawn Rd/I-10 Eastbound Ramp Terminals	AM	2020	65	62	0	61	56	-	7	326		47	205	0	Signalized Intersection
			2025	77	68	0	77	66	-	8	399		53	237	0	
			2045	#155	124	0	147	#191	-	12	#967		#198	396	23	
		PM	2020	76	34	0	31	54	-	10	367		45	297	37	
			2025	78	32	0	28	58	-	13	#490		m44	328	m5	
			2045	#175	50	0	45	90	-	17	#936		#160	468	76	
		Actual Storage Length (ft)		65	1,050	65	900	110		140	590		160	1,140	45	
2	SR 121 and I-10 Westbound Ramp Terminals	AM	2020	77			-	-	-	3	0	-	-	0	0	Unsignalized Intersection
			2025	140			-	-	-	4	0	-	-	0	0	
			2045	905			-	-	-	8	0	-	-	0	0	
		PM	2020	471			-	-	-	3	0	-	-	0	0	
			2025	716			-	-	-	2	0	-	-	0	0	
			2045	*			-	-	-	5	0	-	-	0	0	
		Actual Storage Length (ft)		910			-	-	-	170	1,140	-	-	320	170	
3	SR 121 and George Hodges Rd	AM	2020	11			3			2	0	0	0	0		Unsignalized Intersection
			2025	14			7			2	0	0	0	0		
			2045	48			25			4	0	0	0	0		
		PM	2020	61			13			5	0	0	2	0		
			2025	104			25			6	0	0	2	0		
			2045	*			148			9	0	0	4	0		
		Actual Storage Length (ft)		600			300			115	320	80	180	1,190		
4	SR 121 and Willis Hodges Rd	AM	2020	43			50			4	87		15	101		Signalized Intersection
			2025	57			63			5	129		15	124		
			2045	81			115			10	188		29	182		
		PM	2020	172			28			35	142		30	193		
			2025	191			35			m23	m147		33	223		
			2045	421			65			m55	m361		74	534		
		Actual Storage Length (ft)		580			500			500	1,190		160	2,650		

Notes:
1) The # footnote indicates that the volume for the 95th percentile cycle exceeds capacity. This traffic was simulated for two complete cycles to account for the effects of spillover between cycles. If the reported v/c <1for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queues shown with the # footnote are acceptable for the design of storage bay (Trafficware 2012).
2) The m footnote indicates that the volume for the 95th percentile queue is metered by an upstream signal (Trafficware 2012).
3) N/A – The SYNCHRO methods cannot compute a delay or queue because volume greatly exceeds capacity.
4) The storage length values were calculated from aerials or design drawings.
5) L = left, T = through, R = right.
6) Movement with queues exceeding available storage.

7.4.2 Freeway Segments Analysis Summary

The four-lane section of I-10 within the influence area was analyzed for the Existing, Opening, and Design Years (2020, 2025, and 2045, respectively). The mainline segment between CR 125 and SR 121 generally operates at LOS A, LOS B, and LOS C for years 2020, 2025, and 2045, respectively. However, this freeway segment between CR 125 and SR 121 in the eastbound direction during AM peak hour operate with LOS D for Design Year (2045). The mainline segment between SR 121 and SR 228 generally operates at LOS B for years 2020 and 2025 and LOS C for year 2045. However, this freeway segment between SR 121 and SR 228 in the eastbound direction during AM peak hour and westbound direction during PM peak hour operate with LOS D for Design Year (2045). The criterion for an urban/transitioning area is LOS D or better. The LOS along I-10 within the study area meets this LOS criteria. **Table 17** summarizes the analysis of the mainline freeway segments.

Table 17: No-Build Alternative – Basic Freeway Segments Analysis

ID	Roadway	From	To	Year	AM Peak				PM Peak			
					Freeway Volume	Avg. Speed (mph)	Density (pc/mi/in)	LOS	Freeway Volume	Avg. Speed (mph)	Density (pc/mi/in)	LOS
EASTBOUND												
5	I-10	CR 125	SR 121	2020	1,280	66.8	9.6	A	1,380	66.8	10.3	A
				2025	1,970	66.8	14.7	B	1,581	66.8	11.8	B
				2045	3,462	64.7	26.8	D	2,747	66.8	20.6	C
9		SR 121	SR 228	2020	1,618	66.8	12.1	B	1,631	66.8	12.2	B
				2025	2,333	66.7	17.5	B	1,844	66.7	13.8	B
				2045	4,052	60.4	33.5	D	3,174	65.9	24.1	C
WESTBOUND												
5	I-10	SR 228	SR 121	2020	1,330	69.6	9.5	A	2,032	69.6	14.5	B
				2025	1,844	69.6	13.2	B	2,333	69.6	16.7	B
				2045	3,174	68.3	23.2	C	4,052	62.1	32.6	D
9		SR 121	CR 125	2020	1,129	70.0	8.1	A	1,706	70.0	12.2	B
				2025	1,581	70.0	11.3	B	1,970	70.0	14.1	B
				2045	2,747	69.6	19.7	C	3,462	66.7	26.0	C

Notes:
mph = miles per hour, pc/mi./ln = passenger car per mile per lane

7.4.3 Ramp Merge/Diverge Analysis Summary

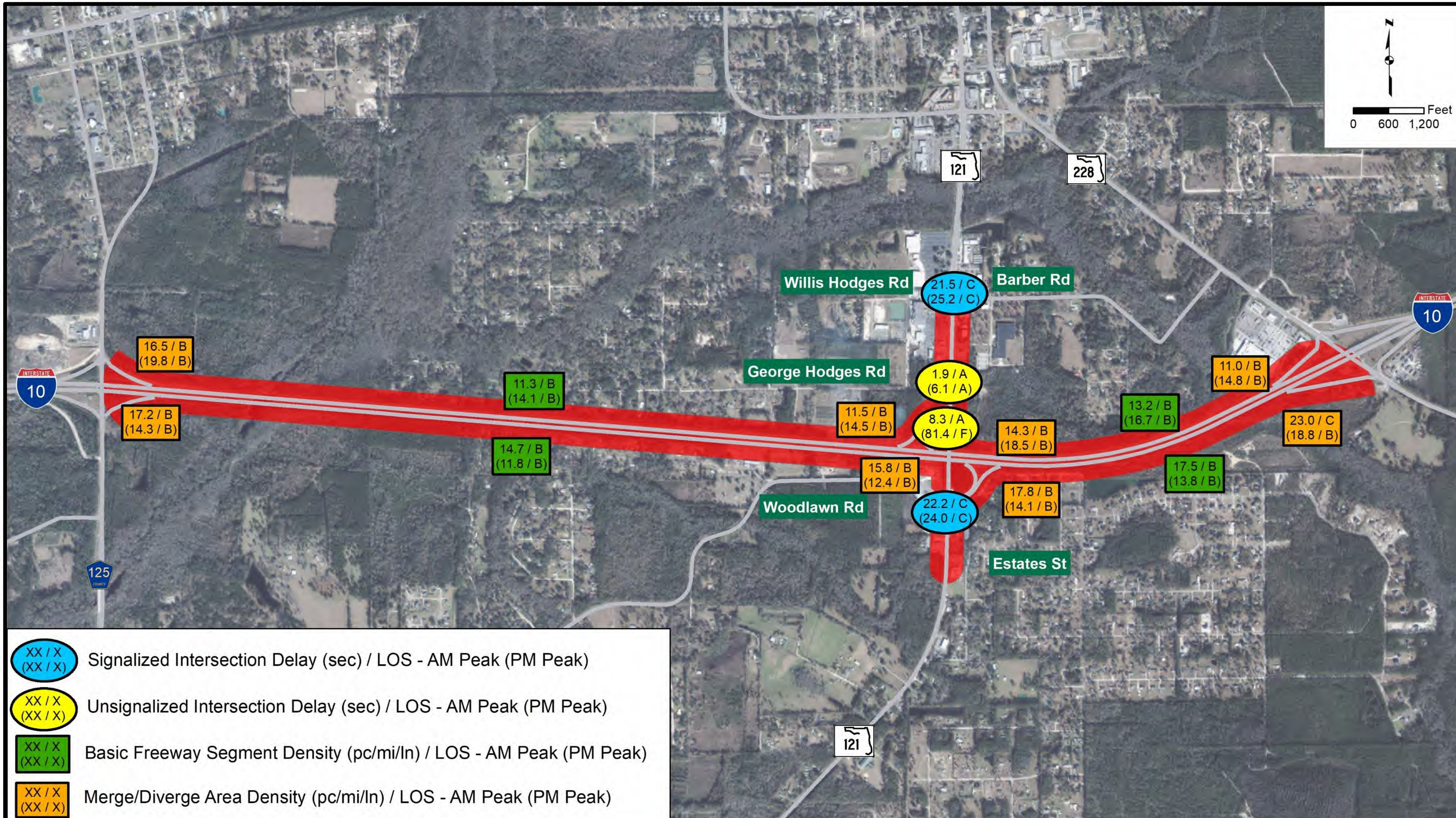
The eastbound and westbound ramp merge and diverge locations along I-10 within the study area were analyzed for the Existing, Opening, and Design Years (2020, 2025, and 2045, respectively). All of the eastbound and westbound ramp merge and diverge locations are working at LOS D or better in the Year 2045 AM and PM peak hours, except I-10 eastbound off-ramp to SR 228 which operates at LOS E in the AM peak hour. Eastbound ramps including CR 125 on-ramp, SR 121 on-ramp and off-ramp operate with LOS D during AM Peak hour. SR 228 off-ramp in eastbound as well as the on-ramp from SR 228, SR 121 off-ramp and CR 125 off-ramp in westbound operate with LOS D during PM peak hour. The ramp merge and diverge analysis results are summarized in **Table 18**.

The Opening Year (2025) operational analysis results for the No-Build Alternative are shown on **Figure 20**. The Design Year (2045) operational analysis results for the No-Build Alternative are shown on **Figure 21**. The SYNCHRO and HCS7 reports are provided in **Appendix F**.

Table 18: No-Build Alternative – Ramp Merge/Diverge Locations Analysis

ID	Roadway	Location	Type	Year	AM Peak Analysis					PM Peak Analysis				
					Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS	Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS
EASTBOUND														
4	I-10	On Ramp from CR 125	Merge	2020	1,280	439	0	11.9	B	1,380	226	0	12.8	B
				2025	1,970	565	0	17.2	B	1,580	263	0	14.3	B
				2045	3,463	1,079	0	28.6	D	2,747	514	0	23.3	C
6		Off Ramp to SR 121	Diverge	2020	1,280	151	489	9.9	A	1,380	151	401	10.7	B
				2025	1,970	238	602	15.8	B	1,581	188	452	12.4	B
				2045	3,462	389	979	28.6	D	2,747	301	728	22.5	C
8		On Ramp from SR 121	Merge	2020	1,618	489	151	12.3	B	1,630	401	151	12.4	B
				2025	2,333	602	238	17.8	B	1,845	452	188	14.1	B
				2045	4,053	979	389	31.1	D	3,174	728	301	24.3	C
10		Off Ramp to SR 228	Diverge	2020	1,618	201	0	16.8	B	1,631	201	0	16.9	B
				2025	2,333	401	0	23.0	C	1,844	226	0	18.8	B
				2045	4,052	615	0	37.7	E	3,174	339	0	30.2	D
WESTBOUND														
4	I-10	On Ramp from SR 228	Merge	2020	1,330	201	0	7.1	A	2,033	364	0	12.5	B
				2025	1,844	226	0	11.0	B	2,333	401	0	14.8	B
				2045	3,174	339	0	21.4	C	4,052	615	0	28.1	D
6		Off Ramp to SR 121	Diverge	2020	1,330	364	163	9.8	A	2,032	539	213	15.9	B
				2025	1,844	452	188	14.3	B	2,333	602	238	18.5	B
				2045	3,174	728	301	25.7	C	4,052	979	389	33.2	D
8		On Ramp from SR 121	Merge	2020	1,129	163	364	8.0	A	1,706	213	539	12.5	B
				2025	1,581	188	452	11.5	B	1,969	238	602	14.5	B
				2045	2,747	301	728	20.6	C	3,463	389	979	26.1	C
10		Off Ramp to SR 125	Diverge	2020	1,129	226	0	12.6	B	1,706	477	0	17.6	B
				2025	1,581	263	0	16.5	B	1,970	565	0	19.8	B
				2045	2,747	514	0	26.5	C	3,462	1,079	0	32.7	D

Notes: pc/mi./ln = passenger car per mile per lane.

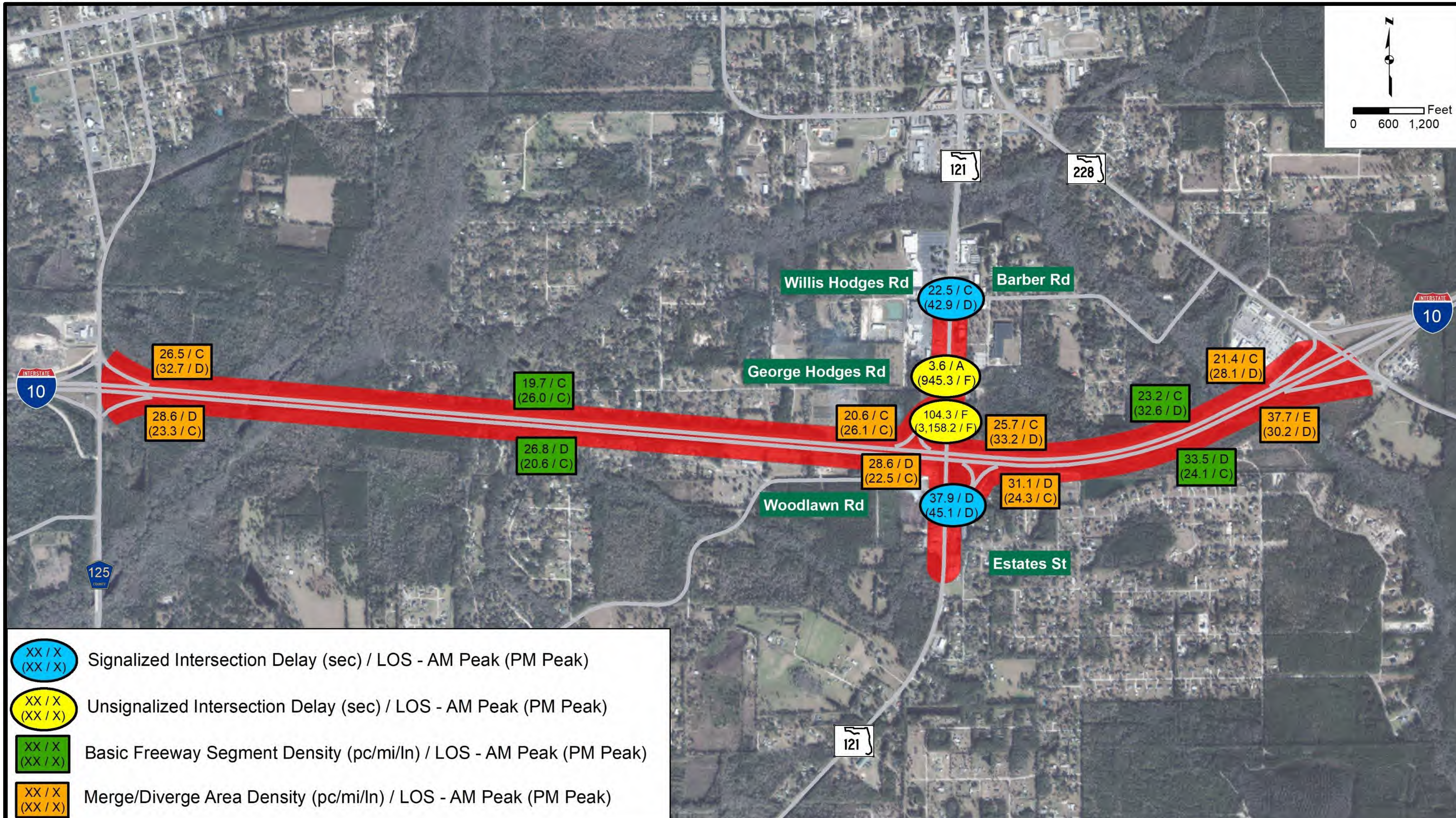


FDOT

SR 121 Interchange Modification Report

No-Build Alternative
Opening Year (2025)
Delay or Density / LOS

Figure 20



FDOT	SR 121 Interchange Modification Report	**No-Build Alternative Design Year (2045) Delay or Density / LOS**	Figure 21
			Page 48

7.5 BUILD ALTERNATIVE

Interim Build Alternative were evaluated for this project to improve traffic operations and safety within the project study area. The operational analysis was conducted for the study area intersections, I-10 mainline freeway segments, and ramp junctions for the Interim Build Alternative in the Opening Year (2025) and Design Year (2045). The Interim Build Alternative operational analysis reports for Opening Year (2025) and Design Year (2045) are included in **Appendix F**.

7.5.1 Intersection Analysis Summary

SYNCHRO version 10 was used to evaluate the intersections for Interim Build Alternative. The signal timing for the Interim Build Alternative signalized intersections were optimized for better operations with higher future traffic volumes.

The No-Build with Signal (IOAR Concept) Alternative and Interim Build Alternative intersection delay and LOS for Opening Year (2025) and Design Year (2045) are summarized in **Table 19** and **Table 20**, respectively. The Interim Build Alternative performs better than the No-Build Alternative and the IOAR Concept. Intersections expected to fail in the No-Build Alternative provide improved traffic operations under the build conditions. For the Interim Build Alternative, all of the intersections operate with LOS D or better for the overall intersection. Although some movements operate below the LOS target with the build conditions, none of these movements at the ramp terminal intersections are anticipated to operate worse than No-Build conditions. Additionally, there are some movements that show less delay in Design Year (2045) than in Opening Year (2025). This can be attributed to signal timings which were optimized for future traffic conditions. The Interim Build Alternative improves the I-10 westbound ramp terminal intersection from approximately 5.3 minutes in the AM peak hour and 53 minutes in the PM peak hour with the No-Build Alternative to about a minute by Design Year (2045). Overall, the Interim Build Alternative increase the operation efficiency of the intersections within the study area.

Table 21 summarizes the Opening Year (2025) and Design Year (2045) 95th percentile queue lengths for Interim Build Alternative and No-Build with Signal (IOAR Concept). The operational improvements reduce the backup and queue does not exceed the available storage through the Design Year (2045) for most of the study intersections. Intersections that were backing up into adjacent intersections in the No-Build Alternative show improved queue lengths with Build Alternative. Overall, the queue length improves with the Interim Build Alternative.

Table 19: No-Build with Signal (IOAR Concept) – Intersection Analysis

Intersection	Type	Year	Eastbound						Westbound						Northbound						Southbound					
			Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
AM Peak Hour																										
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	34.9	C	38.4	D	0.2	A	31.9	C	18.9	B	-	-	7.9	A	26.3	C	-	-	10.7	B	13.9	B	0.2	A
			20.2/C																							
		2045	81.2	F	70.4	E	0.8	A	60.5	E	51.5	D	-	-	6.5	A	38.7	D	-	-	30.3	C	15.7	B	1.8	A
			34.1/C																							
I-10 Westbound Ramps	S	2025	42.3	D	-	-	13.8	B	-	-	-	-	-	-	2.8	A	3.4	A	-	-	-	-	22.5	C	8.1	A
			13.8/B																							
		2045	28.7	C	-	-	38.4	D	-	-	-	-	-	-	7.5	A	9.9	A	-	-	-	-	19.0	B	4.5	A
			20.3/C																							
George Hodges Rd(1)	U	2025	14.1	B	14.1	B	14.1	B	19.4	C	19.4	C	19.4	C	8.4	A	0.0	A	0.0	A	8.4	A	0.0	A	0.0	A
			1.9/A																							
		2045	31.4	D	31.4	D	31.4	D	44.2	E	44.2	E	44.2	E	9.1	A	0.0	A	0.0	A	9.1	A	0.0	A	0.0	A
			4.3/A																							
Willis Hodges Rd	S	2025	34.9	C	34.9	C	34.9	C	37.0	D	37.0	D	37.0	D	3.4	A	9.1	A	-	-	3.5	A	7.7	A	-	-
			11.1/B																							
		2045	32.4	C	32.4	C	32.4	C	38.3	D	38.3	D	38.3	D	3.9	A	9.1	A	-	-	4.7	A	8.5	A	-	-
			11.7/B																							
PM Peak Hour																										
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	34.7	C	32.0	C	0.1	A	26.0	C	17.8	B	-	-	8.0	A	34.9	C	-	-	12.4	B	15.7	B	1.9	A
			21.9/C																							
		2045	72.9	E	57.4	E	0.4	A	56.7	E	26.8	C	-	-	8.3	A	46.5	D	-	-	27.3	C	13.3	B	5.3	A
			30.4/C																							
I-10 Westbound Ramps	S	2025	35.4	D	-	-	7.7	A	-	-	-	-	-	-	5.0	A	7.3	A	-	-	-	-	5.0	A	0.4	A
			9.4/A																							
		2045	71.1	E	-	-	32.7	C	-	-	-	-	-	-	7.0	A	10.0	B	-	-	-	-	9.5	A	0.6	A
			21.1/C																							
George Hodges Rd(1)	U	2025	83.0	F	83.0	F	83.0	F	42.5	E	42.5	E	42.5	E	9.3	A	0.0	A	0.0	A	9.5	A	0.0	A	0.0	A
			9.6/A																							
		2045	421.6	F	421.6	F	421.6	F	84.2	F	84.2	F	84.2	F	9.7	A	0.0	A	0.0	A	12.2	B	0.0	A	0.0	A
			42.5/E																							
Willis Hodges Rd	S	2025	38.1	D	38.1	D	38.1	D	14.9	B	14.9	B	14.9	B	9.4	A	12.9	B	-	-	10.3	B	18.2	B	-	-
			18.8/B																							
		2045	62.1	E	62.1	E	62.1	E	21.9	C	21.9	C	21.9	C	26.8	C	28.1	C	-	-	22.7	C	32.2	C	-	-
			34.4/C																							

Notes:
(1) SYNCHRO 10 has limitation to produce results for the subject intersection from HCM 6 and HCM 2010 report. Therefore, HCM 2000 is used to compute results for the subject intersection.
(2) Delay – Average Delay/Vehicle (seconds/vehicle)
(3) S = Signalized; U = Unsignalized

Table 20: Interim Build Alternative – Intersection Analysis

Intersection	Type	Year	Eastbound						Westbound						Northbound						Southbound					
			Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
AM Peak Hour																										
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	34.9	C	38.4	D	0.2	A	31.9	C	18.9	B	-	-	8.4	A	26.3	C	-	-	6.5	A	9.2	A	0.2	A
			18.5/B																							
		2045	75.6	E	55.8	E	0.8	A	57.8	E	32.8	C	-	-	6.2	A	30.8	C	-	-	53.8	D	18.4	B	1.5	A
			31.5/C																							
I-10 Westbound Ramps	S	2025	-	-	-	-	3.4	A	-	-	-	-	0.1	A	2.3	A	2.5	A	-	-	-	-	15.2	B	3.1	A
			6.1/A																							
		2045	-	-	-	-	22.6	C	-	-	-	-	0.3	A	7.5	A	5.8	A	-	-	-	-	8.6	A	0.7	A
			10.1/B																							
George Hodges Rd(1)	U	2025	13.1	B	13.1	B	13.1	B	19.5	C	19.5	C	19.5	C	8.4	A	0.0	A	0.0	A	8.4	A	0.0	A	0.0	A
			1.8/A																							
		2045	20.4	C	20.4	C	20.4	C	38.1	E	38.1	E	38.1	E	9.1	A	0.0	A	0.0	A	8.9	A	0.0	A	0.0	A
			3.2/A																							
Willis Hodges Rd	S	2025	26.9	C	26.9	C	26.9	C	26.1	C	26.1	C	26.1	C	3.7	A	6.6	A	-	-	3.8	A	6.6	A	-	-
			8.5/A																							
		2045	27.4	C	27.4	C	27.4	C	30.3	C	30.3	C	30.3	C	1.9	A	4.5	A	-	-	5.0	A	8.2	A	-	-
			8.8/A																							
PM Peak Hour																										
Intersection	Type	Year	Eastbound						Westbound						Northbound						Southbound					
			Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Woodlawn Rd/ I-10 Eastbound Ramps	S	2025	33.4	C	30.7	C	0.1	A	24.9	C	16.0	B	-	-	8.7	A	33.5	C	-	-	12.9	B	15.6	B	2.1	A
			21.2/C																							
		2045	61.8	E	58.5	E	0.3	A	49.9	D	34.7	C	-	-	7.1	A	40.1	D	-	-	34.3	C	14.4	B	4.0	A
			28.8/C																							
I-10 Westbound Ramps	S	2025	-	-	-	-	6.1	A	-	-	-	-	0.7	A	2.1	A	2.1	A	-	-	-	-	2.6	A	0.3	A
			2.6/A																							
		2045	-	-	-	-	45.2	D	-	-	-	-	2.6	A	9.6	A	9.3	A	-	-	-	-	8.9	A	0.8	A
			14.0/B																							
George Hodges Rd(1)	U	2025	31.0	D	31.0	D	31.0	D	35.5	E	35.5	E	35.5	E	9.3	A	0.0	A	0.0	A	9.3	A	0.0	A	0.0	A
			4.5/A																							
		2045	122.8	F	122.8	F	122.8	F	86.2	F	86.2	F	86.2	F	9.9	A	0.0	A	0.0	A	10.8	B	0.0	A	0.0	A
			14.4/B																							
Willis Hodges Rd	S	2025	35.7	D	35.7	D	35.7	D	14.2	B	14.2	B	14.2	B	10.9	B	15.1	B	-	-	10.6	B	17.0	B	-	-
			18.7/B																							
		2045	50.3	D	50.3	D	50.3	D	13.2	B	13.2	B	13.2	B	19.5	B	19.3	B	-	-	21.7	C	29.3	C	-	-
			27.9/C																							

Notes:
(1) SYNCHRO 10 has limitation to produce results for the subject intersection from HCM 6 and HCM 2010 report. Therefore, HCM 2000 is used to compute results for the subject intersection.
(2) Delay – Average Delay/Vehicle (seconds/vehicles)
(3) S = Signalized; U = Unsignalized

Table 21: Interim Improvements Build Alternative and No-Build with Signal (IOAR Concept) Alternative – Intersection 95th Percentile Queues

Intersection	Time Period	Year	Build Alternative	Peak Hour Queues (feet)												Remarks
				Eastbound			Westbound			Northbound			Southbound			
				L	T	R	L	T	R	L	T	R	L	T	R	
SR 121 and Woodlawn Rd/ I-10 Eastbound Ramp Terminals	AM	2020	Existing Conditions	65	62	0	61	56	-	7	326		47	205	0	Signalized Intersection
		2025	Interim Improvements Concept	64	58	0	64	59	-	8	#424		30	121	0	
			No-Build with Signal (IOAR Concept)	64	58	0	64	59	-	8	#424		49	219	0	
		2045	Interim Improvements Concept	#112	106	0	#129	123	-	13	#788		#195	401	18	
			No-Build with Signal (IOAR Concept)	#150	124	0	147	#191	-	12	#933		#183	396	23	
	PM	2020	Existing Conditions	76	34	0	31	54	-	10	367		45	297	37	
		2025	Interim Improvements Concept	68	29	0	25	53	-	13	#492	-	54	266	25	
			No-Build with Signal (IOAR Concept)	71	31	0	26	56	-	11	#464	-	47	248	23	
		2045	Interim Improvements Concept	154	62	0	55	#144	-	18	#1,012	-	#158	444	m59	
			No-Build with Signal (IOAR Concept)	151	59	0	67	93	-	19	#1,106	-	m118	428	m102	
	Build Storage Length (ft)			75	1,050	75	900	110		140	590	-	305	1,140	200	
SR 121 and I-10 Westbound Ramp Terminal	AM	2020	Existing Conditions		77		-	-	-	3	0	-	-	0	0	Signalized Intersection
		2025	Interim Improvements Concept	-	-	0	-	-	0	m10	m30	-	-	173	23	
			No-Build with Signal (IOAR Concept)	76	-	72	-	-	-	19	96	-	-	260	46	
		2045	Interim Improvements Concept	-	-	152	-	-	0	40	90	-	-	285	2	
			No-Build with Signal (IOAR Concept)	101	-	#304	-	-	-	40	236	-	-	249	35	
	PM	2020	Existing Conditions		476		-	-	-	2	0	-	-	0	0	
		2025	Interim Improvements Concept	-	-	19	-	-	0	8	41	-	-	34	0	
			No-Build with Signal (IOAR Concept)	141	-	55	-	-	-	13	180	-	-	58	m0	
		2045	Interim Improvements Concept	-	-	322	-	-	11	m23	m208	-	-	m418	m21	
			No-Build with Signal (IOAR Concept)	409	-	323	-	-	-	m13	m366	-	-	122	0	
	Build Storage Length (ft)			450	-	450	-	-	1,200	225	1,140	-	-	320	150	
SR 121 and George Hodges Rd	AM	2020	Existing Conditions		11			3		2	0	0	0	0		Unsignalized Intersection
		2025	Interim Improvements Concept		13			7		2	0		0	0		
			No-Build with Signal (IOAR Concept)		14			7		2	0		0	0		
		2045	Interim Improvements Concept		38			25		4	0		0	0		
			No-Build with Signal (IOAR Concept)		60			29		4	0		0	0		
	PM	2020	Existing Conditions		61			13		5	0	0	2	0		
		2025	Interim Improvements Concept		71			26		7	0		2	0		
			No-Build with Signal (IOAR Concept)		147			31		7	0		2	0		
		2045	Interim Improvements Concept		241			76		10	0		4	0		
			No-Build with Signal (IOAR Concept)		412			80		9	0		5	0		
	Interim Improvements Build Storage Length (ft)				600			300		185	320		140	1,190		
	Existing/No-Build with Signal (IOAR) Storage Length (ft)				580			500		150	1,190		160	2,650		

Intersection	Time Period	Year	Build Alternative	Peak Hour Queues (feet)												Remarks
				Eastbound			Westbound			Northbound			Southbound			
				L	T	R	L	T	R	L	T	R	L	T	R	
SR 121 and Willis Hodges Rd	AM	2020	Existing Conditions		43			50		4	87		15	101		Signalized Intersection
		2025	Interim Improvements Concept		39			44		5	66		16	66		
			No-Build with Signal (IOAR Concept)		47			60		m6	94		16	77		
		2045	Interim Improvements Concept		54			64		2	21		26	108		
			No-Build with Signal (IOAR Concept)		62			86		m6	124		28	120		
	PM	2020	Existing Conditions		172			28		35	142		30	193		
		2025	Interim Improvements Concept		153			28		38	142		29	177		
			No-Build with Signal (IOAR Concept)		162			30		m29	103		27	177		
		2045	Interim Improvements Concept		#291			40		44	193		55	#319		
			No-Build with Signal (IOAR Concept)		397			60		m65	413		71	495		
	Build Storage Length (ft)				580			500		150	1,190		160	2,650		

Notes:
1) The # footnote indicates that the volume for the 95th percentile cycle exceeds capacity. This traffic was simulated for two complete cycles to account for the effects of spillover between cycles. If the reported v/c <1for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queues shown with the # footnote are acceptable for the design of storage bay (Trafficware 2012).
2) The m footnote indicates that the volume for the 95th percentile queue is metered by an upstream signal (Trafficware 2012).
3) The storage length values were calculated from aerials or design drawings.
4) L = left, T = through, R = right.
5) Movement with queues exceeding available storage.

7.5.2 Freeway Segments Analysis Summary

The four-lane section of I-10 within the study area was retained and analyzed for the Existing, Opening, and Design Years (2020, 2025, and 2045, respectively). All mainline segments operate at LOS D or better for years 2020, 2025, and 2045. **Table 22** summarizes the analysis of the mainline freeway segments.

The No-Build with Signal (IOAR Concept) Alternative do not propose any improvements to the freeway; therefore, the HCS7 analysis results do not vary from the No-Build Alternative.

Table 22: Interim Build Alternative – Basic Freeway Segments Analysis

ID	Roadway	From	To	Year	AM Peak				PM Peak			
					Freeway Volume	Avg. Speed (mph)	Density (pc/mi/in)	LOS	Freeway Volumes	Avg. Speed (mph)	Density (pc/mi/in)	LOS
EASTBOUND												
5	I-10	CR 125	SR 121	2020	1,280	66.8	9.6	A	1,380	66.8	10.3	A
				2025	1,970	66.8	14.7	B	1,581	66.8	11.8	B
				2045	3,462	64.7	26.8	D	2,747	66.8	20.6	C
9		SR 121	SR 228	2020	1,618	66.8	12.1	B	1,631	66.8	12.2	B
				2025	2,333	66.7	17.5	B	1,844	66.7	13.8	B
				2045	4,052	60.4	33.5	D	3,174	65.9	24.1	C
WESTBOUND												
5	I-10	SR 228	SR 121	2020	1,330	69.6	9.5	A	2,032	69.6	14.5	B
				2025	1844	68.6	13.2	B	2333	68.5	16.7	B
				2045	3174	68.2	23.2	C	4052	62.1	32.6	D
10		SR 121	CR 125	2020	1,129	70.0	8.1	A	1,706	70.0	12.2	B
				2025	1581	70.0	11.3	B	1970	70.0	14.1	B
				2045	2747	69.6	19.7	C	3462	66.7	26.0	C

Notes:
mph = miles per hour, pc/mi./ln = passenger car per mile per lane

7.5.3 Ramp Merge/Diverge Analysis Summary

The No-Build with Signal (IOAR Concept) Alternative geometry does not differ from No-build conditions, therefore, all the ramp merge and diverge operations will be same as No-Build Alternative as provided in section 7.4.3 previously. For Interim Build Alternative, the eastbound and westbound ramp merge and diverge locations along I-10 within the study area were analyzed for Existing, Opening, and Design Years (2020, 2025, and 2045, respectively). All ramp merge and diverge areas in the eastbound direction showed operations similar to the No-build conditions and operate at LOS D or better through the Design Year (2045) during the AM and PM peak hours within the SR 121 interchange area, except I-10 eastbound off-ramp to SR 228 which operates at LOS E in the AM peak hour. Although, all ramp merge and diverge areas in the westbound direction showed operations similar to the No-Build conditions, off-ramp to SR 121 resulted in lower density of about five and eleven percent less in the Design Year (2045) AM and PM peak hours, respectively, compared to the same segment in the No-Build conditions. The results of the ramp merge and diverge analysis for the Interim Build Alternative are summarized in **Table 23**.

The No-Build with Signal (IOAR Concept) Alternative operational analysis results for Opening Year (2025) and Design Year (2045) are shown on **Figure 22** and **Figure 23**, respectively and the Interim Build Alternative operational analysis results for Opening Year (2025) and Design Year (2045) are shown on **Figure 24** and **Figure 25**, respectively.

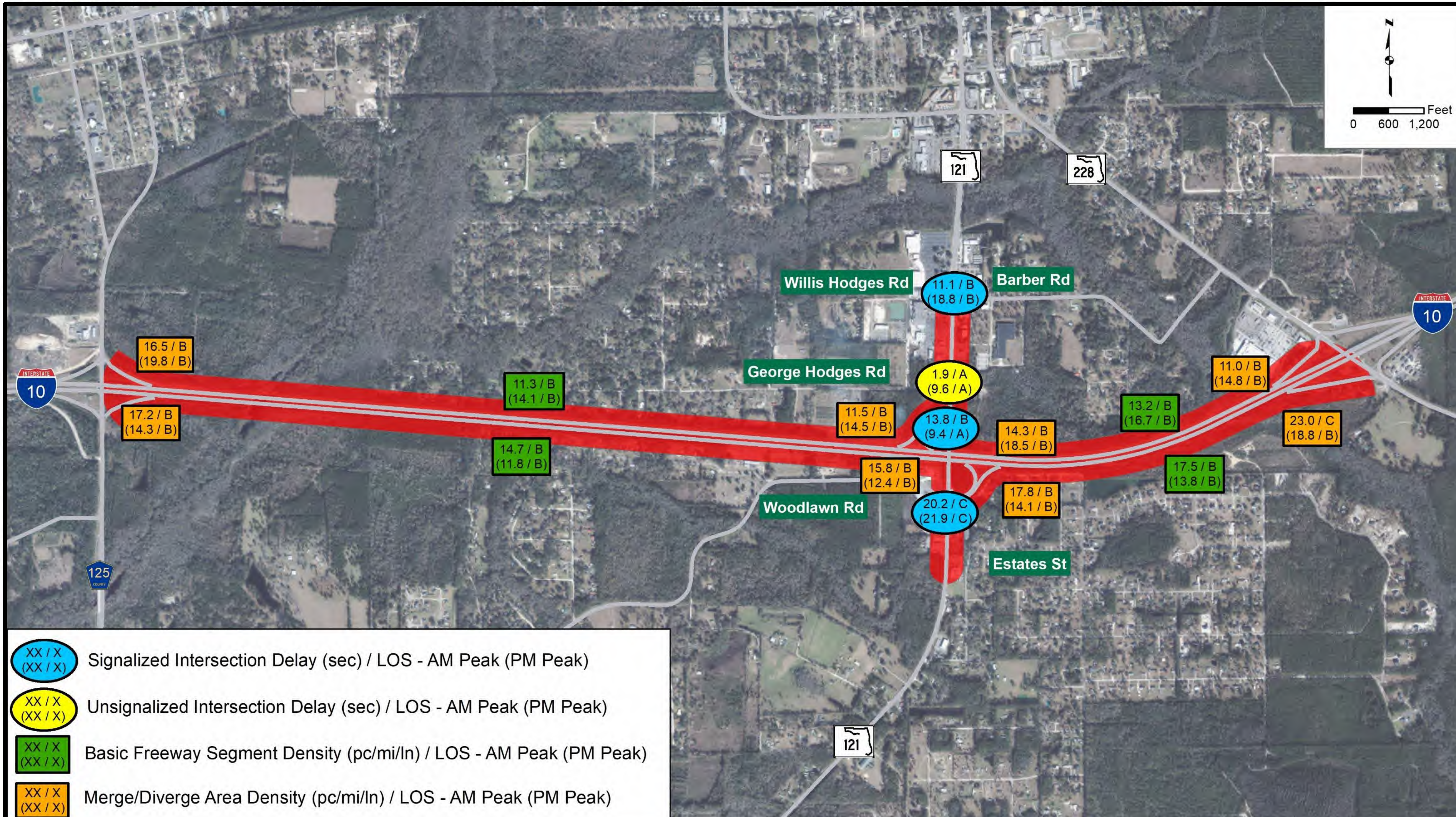
Table 23: Interim Build Alternative – Ramp Merge/Diverge Locations Analysis

ID	Roadway	Location	Type	Year	AM Peak Analysis					PM Peak Analysis				
					Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS	Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS
EASTBOUND														
4	I-10	On Ramp from SR 125	Merge	2020	1,280	439	0	11.9	B	1,380	226	0	12.8	B
				2025	1,970	565	0	17.2	B	1,580	263	0	14.3	B
				2045	3,463	1,079	0	28.6	D	2,747	514	0	23.3	C
6		Off Ramp to SR 121	Diverge	2020	1,280	151	489	9.9	A	1,380	151	401	10.7	B
				2025	1,970	238	602	15.8	B	1,581	188	452	12.4	B
				2045	3,462	389	979	28.6	D	2,747	301	728	22.5	C
8		On Ramp from SR 121	Merge	2020	1,618	489	151	12.3	B	1,630	401	151	12.4	B
				2025	2,333	602	238	17.8	B	1,845	452	188	14.1	B
				2045	4,053	979	389	31.1	D	3,174	728	301	24.3	C
10		Off Ramp to SR 228	Diverge	2020	1,618	201	0	16.8	B	1,631	201	0	16.9	B
				2025	2,333	401	0	23.0	C	1,844	226	0	18.8	B
				2045	4,052	615	0	37.7	E	3,174	339	0	30.2	D

Notes:
pc/mi./ln = passenger car per mile per lane.

ID	Roadway	Location	Type	Year	AM Peak Analysis					PM Peak Analysis				
					Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS	Freeway Volume	Ramp Volume	Adjacent Ramp Volume	Density (pc/mi/in)	LOS
WESTBOUND														
4	I-10	On Ramp from SR 228	Merge	2020	1,330	201	0	7.1	A	2,033	364	0	12.5	B
				2025	1,844	226	0	11.0	B	2,333	401	0	14.8	B
				2045	3,174	339	0	21.4	C	4,052	615	0	28.1	D
6		Off Ramp to SR 121 North	Diverge	2020	1,330	364	163	9.8	A	2,032	539	213	15.9	B
				2025	1,844	88	364	12.9	B	2,333	251	351	17.1	B
				2045	3,174	151	577	24.3	C	4,052	414	565	31.9	D
7		Off Ramp to SR 121 South	Diverge	2020	1,330	364	163	9.8	A	2,032	539	213	15.9	B
				2025	1,756	364	188	13.5	B	2,082	351	238	16.3	B
				2045	3,023	577	301	24.4	C	3,638	565	389	29.7	D
9		On Ramp from SR 121	Merge	2020	1,129	163	364	8.0	A	1,706	213	539	12.5	B
				2025	1,581	188	364	11.5	B	1,969	238	351	14.5	B
				2045	2,747	301	577	20.6	C	3,463	389	565	26.1	C
11		Off Ramp to SR 125	Diverge	2020	1,129	226	0	12.6	B	1,706	477	0	17.6	B
				2025	1,581	263	0	16.5	B	1,970	565	0	19.8	B
				2045	2,747	514	0	26.5	C	3,462	1079	0	32.7	D

Notes:
pc/mi./In = passenger car per mile per lane.

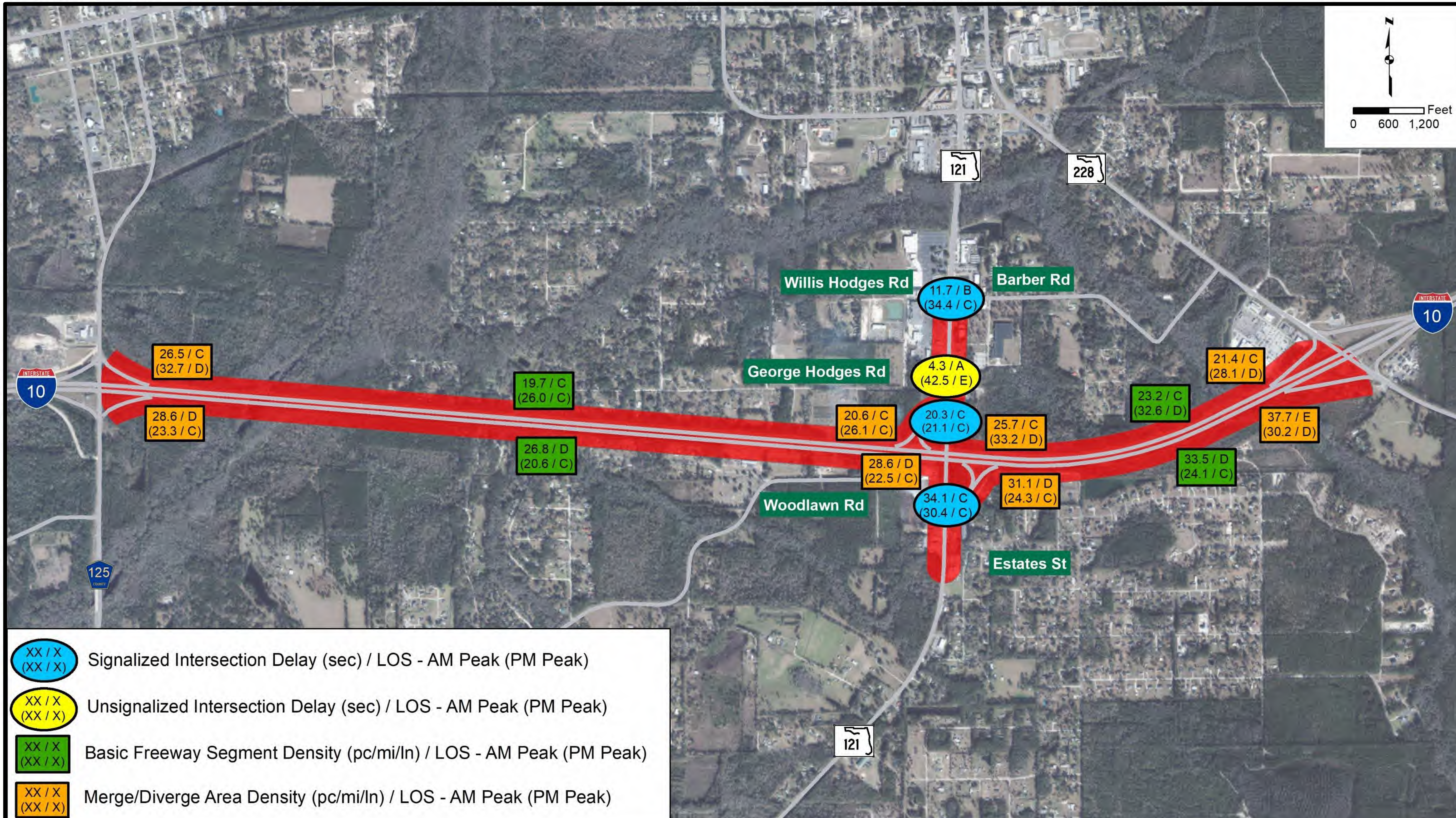


FDOT

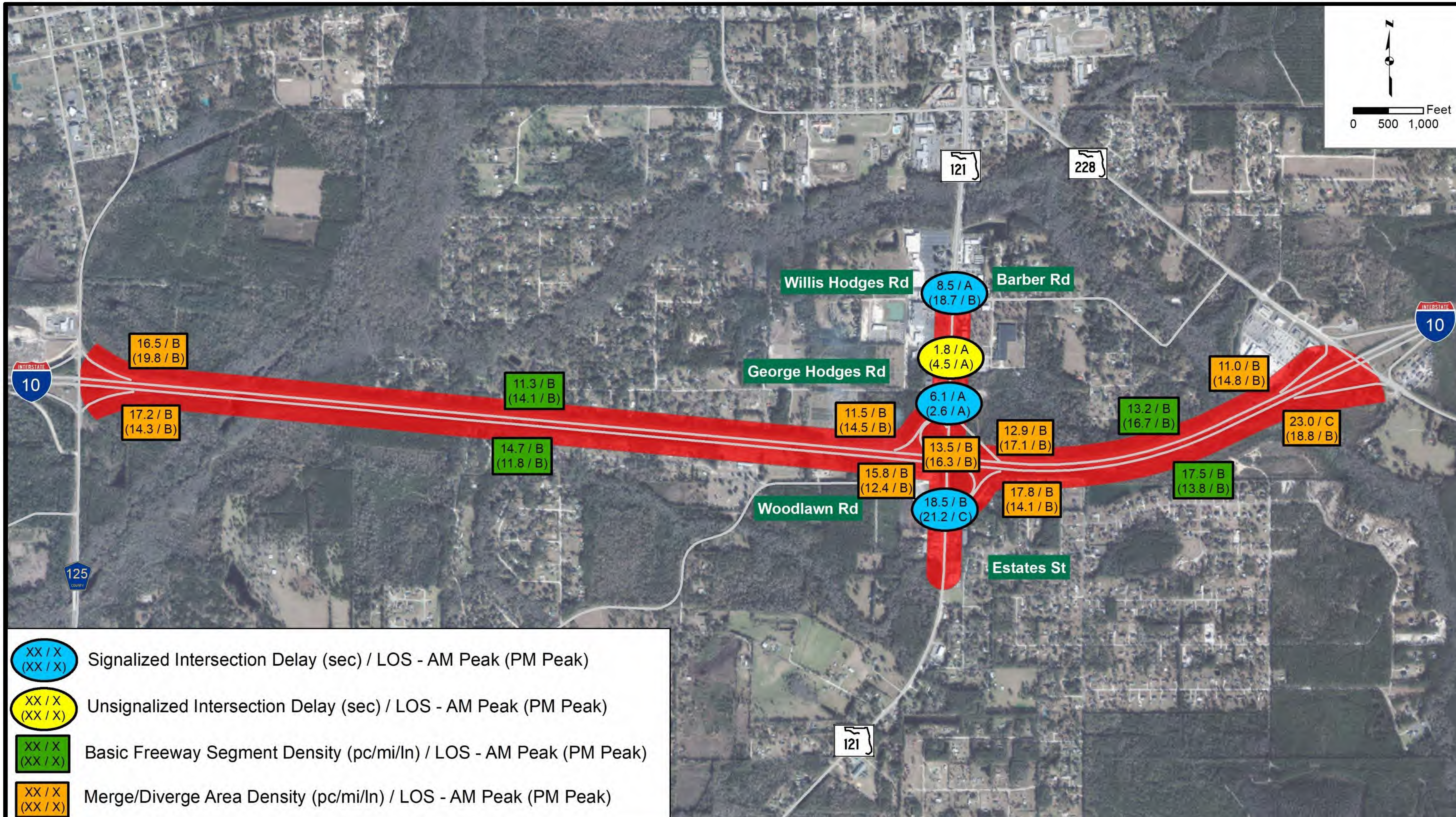
SR 121 Interchange Modification Report

No-Build with Signal (IOAR Concept) Alternative
Opening Year (2025)
Delay or Density / LOS

Figure 22



FDOT	SR 121 Interchange Modification Report	**No-Build with Signal (IOAR Concept) Alternative Design Year (2045) Delay or Density / LOS**	Figure 23
			Page 58



FDOT	SR 121 Interchange Modification Report	**Interim Build Alternative Opening Year (2025) Delay or Density / LOS**	Figure 24
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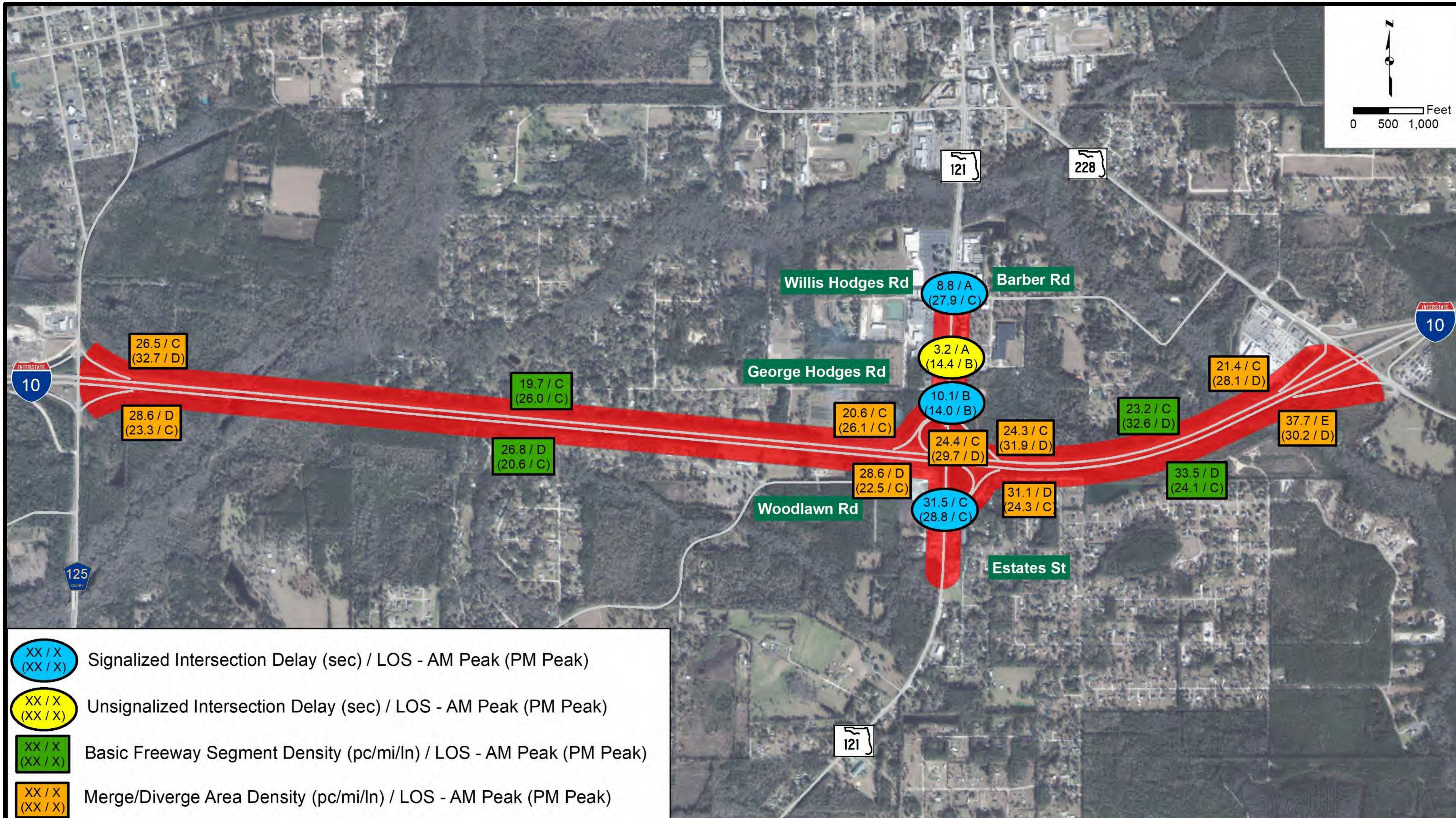


FDOT

SR 121 Interchange Modification Report

Interim Build Alternative
Design Year (2045)
Delay or Density / LOS

Figure 25

7.5.4 Overall Traffic Operations Network Performance

Traffic operational network performance of the three alternatives evaluated in this report is summarized in **Table 24.** Significant vehicle delay reductions at the study area intersections is shown in the operational analysis results when comparing the proposed Interim Build Alternative with the No-Build Alternative. The existing failing condition at the westbound ramp terminal intersection operates with the LOS D or better through the Design Year (2045) with the improvements proposed in Interim Build Alternative. The Interim Build Alternative offers over 95 percent reductions in network delay by Design Year (2045) for the PM peak hour and approximately 80 percent reduction in the network delay during the AM peak hour.

Table 24: Traffic Operational Network Performance Summary

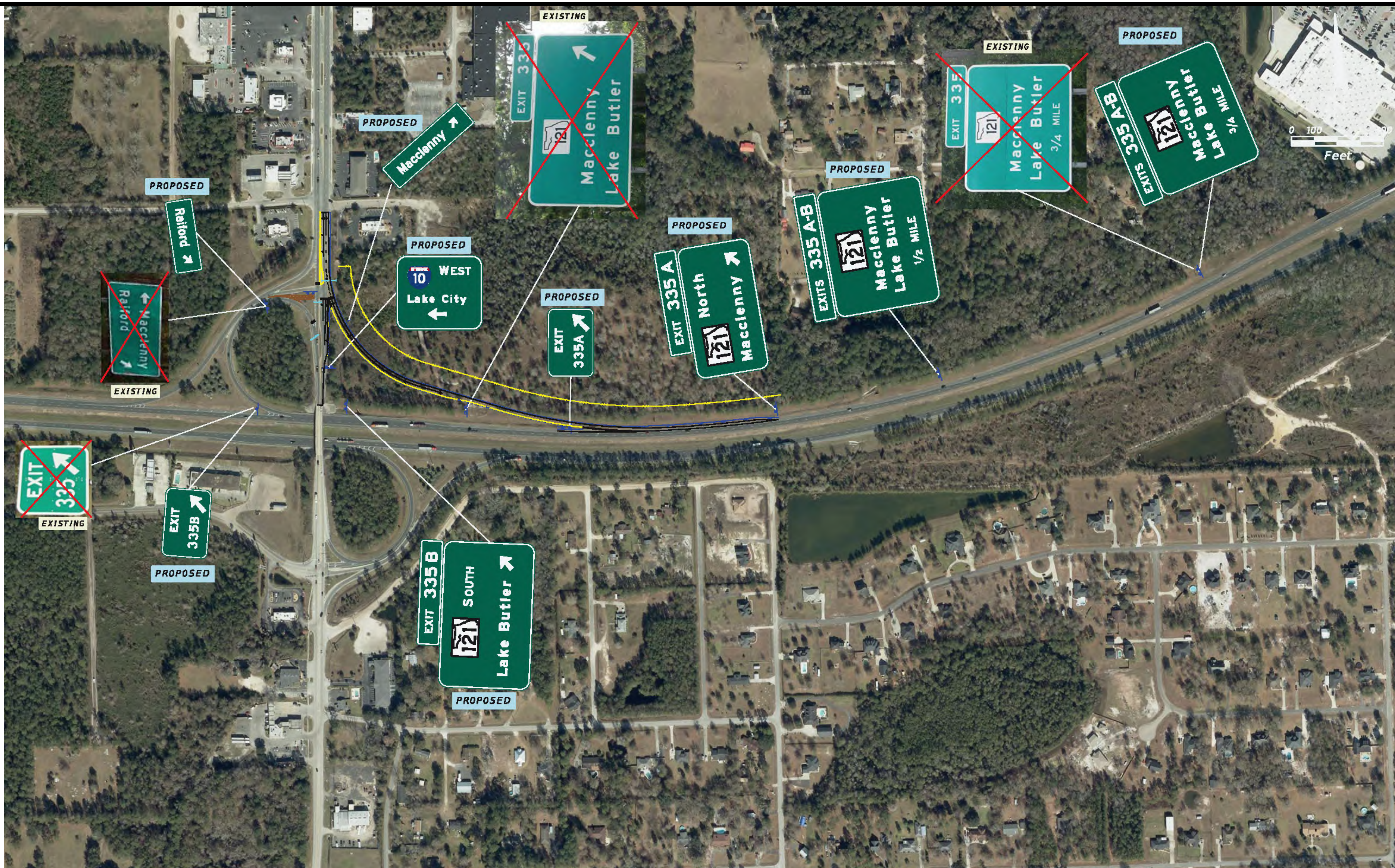
		Opening Year (2025)			Design Year (2045)		
		No-Build	**No-Build with Signal**	**Interim Build Alternative**	**No-Build**	**No-Build with Signal**	**Interim Build Alternative**
AM Peak Hour	Total Network Delay	89.1	64.5	52.6	417.7	110.3	88.5
	Percent Reduction	-	27.6%	41.0%	-	73.6%	78.8%
PM Peak Hour	Total Network Delay	380.7	133.1	78.0	4164.80	507.5	193.5
	Percent Reduction	-	65.0%	79.5%	-	87.8%	95.4%

Notes:
Total Network Delay, reported in seconds/vehicle, is a summation of the overall intersection delay for the four intersections within the study area.

The Interim Build Alternative shows better operational performance than both the No-Build Alternative and No-Build with Signal (IOAR Concept) Alternative. Therefore, Interim Build Alternative is preferred over the No-Build with Signal (IOAR Concept) Alternative.

7.5.5 Concept Signing Plan

The impacts of Interim Build Alternative to existing guide signing were evaluated in detail. The improvements require removal and addition of few guide signs. A conceptual signing plan was prepared for Interim Build Alternative and is shown on **Figure 26**.



SR 121 Interchange Modification Report	**Conceptual Signing Plan Interim Build Alternative**	Figure 26 / Page 62

8 PREDICTIVE SAFETY ANALYSIS

8.1 BUILD ALTERNATIVES SAFETY EVALUATIONS

Predictive safety analysis was performed as per Chapter 18 of the AASHTO Highway Safety Manual (HSM) Supplement utilizing the Enhanced Interchange Safety Analysis Tool (ISATe) to obtain an estimate of the predicted average crash frequency during the Opening Year (2025) and the Design Year (2045) associated with three alternatives: the No Build Alternative, No-Build with Signal (IOAR Concept) and the Interim Build Alternative. The No Build Alternative uses the existing roadway geometry. No-Build with Signal (IOAR Concept) Alternative proposes to install a traffic signal at the north ramp terminal intersection at the interchange of I-10 and SR 121. This intersection is a one-way stop-controlled intersection under existing conditions. The Interim Build Alternative contains all the proposed roadway geometry modifications as described in **Section 5** to the ramp terminal intersections and the George Hodge Road intersection.

Since the Interim Build Alternative requires significant changes in the geometric design such as introducing a new diagonal ramp at the interchange of I-10 and SR 121, therefore, the Predictive Method for Freeways using the Empirical-Bayes Method was not applied for all alternatives in order to have consistent results in accordance with the following language found in Appendix A, Section A.2.1, Page A-16 of the Highway Safety Manual (HSM), 1st edition.

"The EB Method should be applied for the analyses involving the following future project types: Projects in which the roadway cross section is modified but the basic number of through lanes remains the same"

A summary of the predicted average crash frequency obtained by HSM analysis is presented in **Table 25**. **Appendix J** presents the input data used to perform the predictive safety analysis and the output summary for all the alternatives evaluated.

Table 25: Predicted Average Crash Frequency (Crashes/Year)

Analysis Year	Location	Alternative	Predicted Crash Frequency by Severity					Total	Percent Change
			K	A	B	C	PDO		
2025	I-10 Mainline and Ramps	No-Build	0.290	0.765	3.875	5.584	20.524	31.038	
		No-Build with Signal	0.290	0.765	3.875	5.584	20.524	31.038	0.0%
		Interim Build Improvements	0.288	0.758	3.846	5.535	20.494	30.920	-0.4%
	SR 121	No-Build	0.042	0.400	1.514	3.041	8.636	13.633	
		No-Build with Signal	0.040	0.423	1.683	3.896	10.189	16.231	19.1%
		Interim Build Improvements	0.038	0.397	1.504	2.961	8.258	13.158	-3.5%
	Total	No-Build	0.332	1.165	5.389	8.625	29.160	44.671	
		No-Build with Signal	0.330	1.188	5.558	9.480	30.713	47.269	5.8%
		Interim Build Improvements	0.326	1.155	5.349	8.496	28.752	44.078	-1.3%
2045	I-10 Mainline and Ramps	No-Build	0.448	1.211	6.106	12.683	41.136	61.584	
		No-Build with Signal	0.448	1.211	6.106	12.683	41.136	61.584	0.0%
		Interim Build Improvements	0.445	1.201	6.064	12.595	41.086	61.391	-0.3%
	SR 121	No-Build	0.078	0.629	2.417	5.371	14.707	23.201	
		No-Build with Signal	0.067	0.625	2.422	5.561	16.494	25.169	8.5%
		Interim Build Improvements	0.065	0.592	2.196	4.348	13.702	20.903	-9.9%
	Total	No-Build	0.526	1.840	8.523	18.054	55.843	84.785	
		No-Build with Signal	0.515	1.837	8.528	18.244	57.630	86.754	2.3%
		Interim Build Improvements	0.509	1.794	8.260	16.943	54.788	82.294	-2.9%

The analysis indicates that the total predicted average crash frequency along the I-10 mainline and ramps is around 31.0 crashes per year in the Opening Year (2025) and 61.6 crashes per year in the Design Year (2045) for the No-Build Alternative. The same number of predicted average crash frequency for I-10 mainline and ramps was obtained for the No-Build with Signal Alternative. The Interim Build Alternative reduces the predicted average frequency to about 30.9 crashes per year and 61.4 crashes per year in the Opening Year (2025) and Design Year (2045) respectively. This is about a **0.4 percent reduction** and a **0.3 percent reduction** in the Opening Year (2025) and Design Year (2045) respectively.

For SR 121 including the ramp terminal intersections the total predicted average crash frequency is around 13.6 crashes per year in the Opening Year (2025) and 23.2 crashes per year in the Design Year (2045) for the No-Build Alternative. The No-Build with Signal Alternative increases the predicted average frequency to about 16.2 crashes per year and 25.2 crashes per year in the Opening Year (2025) and Design Year (2045) respectively. This is about a 19.1 percent increase and an 8.5 percent increase in the Opening Year (2025) and Design Year (2045) respectively. The Interim Build Alternative reduces the predicted average frequency to about 13.2 crashes per year and 20.9 crashes per year in the Opening Year (2025) and Design Year (2045) respectively. This is about a **3.5 percent reduction** and a **9.9 percent reduction** in the Opening Year (2025) and Design Year (2045) respectively.

For the entire facility evaluated, the total predicted average crash frequency is around 44.7 crashes per year in the Opening Year (2025) and 84.8 crashes per year in the Design Year (2045) for the No-Build Alternative. The No-Build with Signal Alternative increases the predicted average frequency to about 47.3 crashes per year and 86.6 crashes per year in the Opening Year (2025) and Design Year (2045) respectively. This is about a 5.8 percent and a 2.3 percent increase in the Opening Year (2025) and Design Year (2045) respectively. The Interim Build Alternative reduces the predicted average frequency to about 44.1 crashes per year and 82.3 crashes per year in the Opening Year (2025) and Design Year (2045) respectively. This is about a **1.3 percent reduction** and a **2.9 percent reduction** in the Opening Year (2025) and Design Year (2045) respectively.

The Interim Build Alternative shows safety improvement along the entire facility within the study area when compared to both No-Build Alternative, and No-Build with Signal (IOAR Concept) Alternative. A detailed segment by segment comparison between the three analyzed alternatives are presented in **Appendix J**.

8.2 SAFETY BENEFITS

The Interim Build Alternative shows a reduction in the predicted average crash frequency when compared to both No-Build Alternative, and No-Build with Signal (IOAR Concept) Alternative. To compare the benefits of potential crash reduction resulting from the Interim Build Alternative when compared to the No-Build Alternative, and No-Build with Signal (IOAR Concept) Alternative, a benefit-cost analysis was performed.

The first step of the benefit-cost analysis was to convert the predicted average crash frequencies at different severity levels to monetary values by using the FDOT KABCO crash costs from Table 122.6.2 of the 2020 Florida Design Manual. **Table 26** provides a summary of the predicted crash costs of the two alternatives.

Table 26: Summary of Predicted Crash Costs

Analysis Year	Description	Crash Severity					Total	Annual Benefit
		K	A	B	C	PDO		
2045	No Build	$5,608,024	$1,605,995	$1,483,155	$1,917,583	$429,988	$11,044,745	
	No Build with Signal (IOAR Concept)	$5,490,746	$1,603,377	$1,484,025	$1,937,764	$443,748	$10,959,659	$85,086
	Interim Improvements Build	$5,426,776	$1,565,845	$1,437,388	$1,799,580	$421,865	$10,651,454	$393,291

Source: FDOT KABCO Crash Costs, Table 122.6.2, 2020 FDOT FDM

The annual crash costs predicted for the Interim Build Alternative are lower than the No-Build Alternative by approximately $610,439 in the Design Year (2045). This is approximately a 5.5 percent reduction in the crash costs in the Design Year (2045). In addition, the annual crash costs predicted for the No-Build with Signal (IOAR Concept) Alternative are lower than the No-Build Alternative by approximately $83,024 in the Design Year (2045). This is approximately a 0.8 percent reduction in the crash costs in the Design Year (2045), respectively.

The annual cost of the Interim Build Alternative and the No-Build with Signal (IOAR Concept) Alternative were calculated utilizing the FDOT Benefit-Cost spreadsheet and are summarized in **Table 27**.

Table 27: Summary of Annual Cost

Alternative	Annual Cost
No-Build with Signal (IOAR Concept) Alternative	$17,958.40
Interim Build Alternative	$493,452.61

The Benefit-Cost Ratio (BCR) was then computed using the annual benefit calculated in **Table 27** above and the annualized cost of the alternative to determine if the expenditure of funds is justified. **Table 28** summarizes the Benefit-Cost Ratio.

Table 28: Benefit-Cost Ratio

	No-Build with Signal (IOAR Concept) Alternative	Interim Build Alternative
Potential Benefit	$83,024.00	$393,291
Annualized Costs	$17,958.40	$493,452.61
Benefit-Cost Ratio	**4.6**	**0.8**

The Interim Build Alternative has a BCR of 0.8 while the No-Build with Signal (IOAR Concept) Alternative has a BCR of 4.6. The Interim Build Alternative has less BCR compared to the No-Build with Signal (IOAR Concept) Alternative. However, the benefits amassed from safety and operations together show significant improvement for the study area for the Interim Build Alternative over both the No Build Alternative and the No Build with Signal (IOAR Concept) Alternative, as summarized in section 7.5.4.

9 PROJECT FUNDING

Project funding for Build Alternatives is summarized in **Table 29**. Long Range Estimates (LRE) for the proposed improvements with Interim Build Alternative are provided in **Appendix K**. Cost estimation for No-Build with Signal (IOAR Concept) Alternative was provided by FDOT based on a push button design project completed by FDOT in-house.

Table 29: Project Funding

	No-Build with Signal (IOAR Concept) Alternative	Interim Build Alternative
PD&E (From Professional Services Unit (PSU) Executed Contract Value)		
Amount:	$0.00	$500,000.00
Preliminary Engineering (10% of Construction Cost or From Work Program)		
Amount:	$20,000.00	$598,829.00
Right-of-Way (From Work Program)		
Amount:	$0.00	$1,934,074.00
Construction (From LRE or Push Button Construction Cost)		
Amount:	$200,000.00	$3,278,228.68
Construction Engineering Inspection (12% of Construction Cost)		
Amount:	$24,000.00	$393,387.44
Total:	**$244,000.00**	**$6,704,519.12**

10 SUMMARY

The current westbound I-10 off-ramp to SR 121 is a stop-controlled intersection. Commuters traveling along SR 121 encounter poor sight distance due to the vertical curve on bridge over I-10. The westbound I-10 exiting traffic heading northbound on SR 121 hesitate to make the turning movement due to the lack of sight distance causing higher delay and possible unsafe maneuver. Additionally, the geometry of the loop ramp serving the westbound off-ramp traffic to SR 121 is designed with lower design speed, and high volume of heavy trucks in the study area further deteriorates the operation and safety. With the growth of traffic in the future, the traffic operation and safety will continue to deteriorate. In order to improve the operation and safety at this interchange, the ultimate build improvements from the approved IMR (August 2016) which is found in **Appendix A** were proposed. However, FDOT District Two wants to install a signal at the ramp terminal intersection of I-10 westbound off-ramp with SR 121 through a Traffic Operations push button contract that was approved as an IOAR in September 2019, which can be found in **Appendix B**. With the continued growth in traffic volumes, even with signalization of this intersection, if no geometric improvements are made within the interchange area, traffic operations will get progressively worse, increasing the number of crashes, and deteriorating the access to/from SR 121 to I-10 for users. An Interim Build Alternative that can be funded for construction in the near future is analyzed in this report. This Interim Build Alternative include adding a directional ramp to westbound I-10 to serve traffic heading northbound along SR 121 and installing a new traffic signal to control the northbound SR 121 and westbound I-10 off-ramp movements.

The operational analyses show significant vehicle delay reductions at the study area intersections when comparing the proposed Interim Build Alternative with the No-Build Alternative. The existing failing condition at the westbound ramp terminal intersection operates with the LOS D or better through the Design Year (2045) with the improvements proposed in Interim Build Alternative. A summary of the network performance for traffic operations is provided in **Table 24**. The Interim Build Alternative offers over 95 percent reductions in network delay by Design Year (2045) for the PM peak hour and approximately 80 percent reduction in the network delay during the AM peak hour.

In addition to the operational benefit, entire facility predictive safety analysis indicates a 1.3 percent reduction and a 2.9 percent reduction in predictive average crash frequency in the Opening Year (2025) and Design Year (2045) with the Interim Build Alternative compared to the No-Build Alternative. The traffic signal installed at the westbound ramp intersection will eliminate the safety concern due to poor sight distance over the I-10 bridge and improve the excessive queuing, specifically in the future years.

Therefore, Interim Build Alternative proposed in this IMR enhances operating conditions and provide traffic operational and safety benefits within the study area. No-Build with Signal (IOAR Concept) Alternative is recommended for construction first to improve interchange operations immediately as approved with in the IOAR. Interim Build Alternative is still recommended but may be constructed prior to improvements proposed with the ultimate improvements from the approved IMR (August 2016) are constructed.

11 FEDERAL HIGHWAY ADMINISTRATION (FHWA) POLICY POINTS

The following FHWA policy points serve as primary decision criteria used in the approval of this Interchange Modification Report (IMR).

1. Proposal does not adversely impact operational 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, 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 (23 CFR 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 must 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 must 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)).

An operational and safety analysis performed for the proposed Interim Build Alternative showed improved traffic operations, approximately 80 percent and over 95 percent reductions in network delay by Design Year (2045) for the AM and PM peak hour, respectively, that decrease excessive delays throughout the study area and thereby improving safety by a 1.3 percent and a 2.9 percent reduction in predictive average crash frequency in the Opening Year (2025) and Design Year (2045), respectively, when compared to the No-Build Alternative as presented in Section 7 and Section 8 of this IMR. No-Build with Signal (IOAR Concept) Alternative is recommended for construction first to improve interchange operations immediately, and its IOAR is approved in September 2019, and can be found in **Appendix B**. The Interim Build Alternative with a westbound to northbound directional ramp is recommended for implementation after this ramp terminal signalization project. The analysis was conducted in accordance with the approved methodology presented to DIRC (January 2020) (**Appendix C**) for this project. This project is located in an urban/transitioning area where the closest interchanges are SR 228, approximately 1.2 miles to the east, and CR 125, approximately 2.4 miles to the west. Additional signage is needed along the SR 121 study area as identified in the conceptual signing plan shown in **Figure 26** for Interim Build Alternative.

3. 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.*

The proposed improvements to SR 121 interchange with I-10 will provide full interchange access and caters to all traffic movements from SR 121 to and from I-10. The proposed Interim Build Alternative were designed to meet all current FDOT and FHWA design standards as pertaining to federal-aid projects on the interstate system.