

**INTERCHANGE OPERATIONAL ANALYSIS REPORT (IOAR) - DRAFT**

INTERSTATE 4 (SR 400) AT BRANCH FORBES ROAD

**HILLSBOROUGH COUNTY, FLORIDA**

FPID #443318-1-52-01

**Prepared for:**

**FLORIDA DEPARTMENT OF TRANSPORTATION**

**DISTRICT 7**

**11201 N McKinley Drive**

**Tampa, Florida 33612**



June 2021

**PROFESSIONAL ENGINEER CERTIFICATION**

I hereby certify that I am a registered professional engineer in the State of Florida and that this study has been prepared in accordance with FDOT and FHWA methodologies and guidelines. I certify that I have prepared/supervised the preparation of this study, traffic analysis, findings, and recommendations for the following project:

**INTERCHANGE OPERATIONAL ANALYSIS REPORT (IOAR)**

INTERSTATE 4 (SR 400) AT BRANCH FORBES ROAD

HILLSBOROUGH COUNTY, FLORIDA

FPID #443318-1-52-01



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Florida BE #63781  
FLORIDA 23, 2021  
PROFESSIONAL ENGINEER

# Interchange Operational Analysis Report (IOAR)





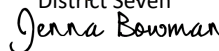

## I-4 at Branch Forbes Road

FPID: 443318-1-52-01

### Florida Department of Transportation

### Determination of Safety, Operational and Engineering Acceptability

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

Requestor	<p>DocuSigned by:                        CADF49BFE536492...</p>	7/6/2021   8:44 AM
	<p>Richard Moss, P.E.                      Florida Department of Transportation, District 7</p>	Date
Interchange Review Coordinator	<p>DocuSigned by:                        9C8266A20D0447F...</p>	7/6/2021   9:15 AM EDT
	<p>Waddah Farah                      District Seven</p>	Date
Systems Management Administrator	<p>DocuSigned by:                        4AD03E6A337F4C1...</p>	7/20/2021   1:44 PM EDT
	<p>Jenna Bowman, PE                      Systems Implementation Office – Central Office</p>	Date
State Chief Engineer	<p>DocuSigned by:                        022E6284200B41A...</p>	7/21/2021   1:31 PM EDT
	<p>Will Watts, P.E.                      Central Office</p>	Date

SYSTEMS IMPLEMENTATION OFFICE

**QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL**

Submittal Date: 6/23/2021

FM Number: 443318-1-52-01

Project Title: I-4 at Branch Forbes Road Interchange Operational Analysis Report (IOAR)

District: Seven

Requestor: Richard Moss, PE

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Document Type:  MLOU  IJR  IMR  IOAR  OTHER \_\_\_\_\_

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)

I-4 at Branch Forbes Road (IOAR)

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  \_\_\_\_\_  
Richard Moss, PE, Director of Transportation  
Development, FDOT D7

Date: 7/6/2021 | 8:44 AM EDT

IRC  \_\_\_\_\_  
Waddah Farah, EI, FDOT D7 DIRC

Date: 7/6/2021 | 9:15 AM EDT



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## EXECUTIVE SUMMARY

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### EXECUTIVE SUMMARY

The purpose of this Interchange Access Request (IAR) is to evaluate current traffic operations, identify operational deficiencies, and recommend operational improvements for the I-4 at Branch Forbes Road interchange.

The need for this project is to improve safety and alleviate existing traffic congestion and excessive vehicle queues at the I-4 at Branch Forbes Road eastbound and westbound off-ramp terminal intersections and the influence area.

The proposed improvements include:

- Installing traffic signals at the I-4 eastbound and westbound ramps terminal intersections.
- Adding a right turn lane at the I-4 eastbound off-ramp; and
- Extending the northbound and southbound left turns lanes on Branch Forbes Road at the ramp terminal intersections.

The proposed improvements at the I-4/Branch Forbes Road ramp terminal intersections will improve the operations of the intersections when compared to the No-Build conditions. The proposed improvements also will improve safety by reducing the off-ramp queues and the impact to the I-4 mainline. Also, the proposed improvements are expected to reduce the intersection total crashes by 39%. The cost estimate for the proposed improvements is \$2,812,893 including design and construction as shown in the FDOT Five-Year Work Program (FY 2021 to FY 2026).

The improvements identified in this IAR meet the Federal Highway Administration (FHWA) two policy points:

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

## EXECUTIVE SUMMARY

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*and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

- The operational and safety analysis demonstrate that the proposed improvements identified in this IOAR will improve the safety and operation of the interchange by significantly reducing the queues for the I-4 eastbound and westbound off-ramps when compared to No-build conditions for Opening Year 2025.
- The total number of crashes at the ramp terminal intersections is expected to be reduced by 39%.
- The proposed improvements will improve the operations of the I-4 westbound and eastbound off-ramps as summarized below when compared to no-build conditions:
  - I-4 WB ramps at Branch Forbes Road:
    - Opening year: The LOS of the WB off-ramp will improve from LOS F to LOS D in both AM and PM peak hours. The vehicle queue will be reduced 55% and 52% during the AM and PM peak hour, respectively.
    - Design Year: The vehicle delay and queues will improve significantly compared to the No-Build conditions. Even though the WB off-ramps are expected to operate at LOS F in Design Year 2045, the No-build conditions don't provide results for the AM peak hour meaning the delay threshold was exceeded.
  - I-4 EB Ramps at Branch Forbes Road:
    - Opening year: The LOS of the EB off-ramp will improve from LOS F to LOS D in both AM and PM peak hours. The vehicle queue will be reduced 66% and 83% during the AM and PM peak hour, respectively.
    - Design Year: The LOS of the EB off-ramp will improve from LOS F to LOS E in AM peak hour and LOS D in the PM peak hour. The vehicle queue will be reduced 91% and 92% during the AM and PM peak hour, respectively.
- The safety and operations of the interchange will also improve significantly for Design Year 2045, but other improvements are needed along Branch Forbes Road to improve the operations for the interchange and the study area. Under No-Build conditions, the operations of the intersection will continue to deteriorate, and the I-4 off-ramp queues are expected to impact the I-4 mainline. FDOT is currently working with Hillsborough County for ultimate improvements at the I-4 at Branch Forbes Road interchange and along Branch Forbes Road from I-4 to US 92. A Project Development

## EXECUTIVE SUMMARY

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and Environment (PD&E) consultant was recently selected to conduct a PD&E study along Branch Forbes Road to identify the ultimate improvements.

- A conceptual signing plan has been prepared for the IOAR.
  
- **FHWA Policy Point 2:** *The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design*
  - Policy Point 2: The existing I-4 interchange at Branch Forbes Road provides access to public roads only. The proposed improvements at the interchange will maintain full access to Branch Forbes Road and accommodate all movements.



## INTRODUCTION

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### 1.0 INTRODUCTION

The Florida Department of Transportation (FDOT) conducted an I-4 Interchange Needs Evaluation Study to evaluate current traffic operations and identify operational deficiencies at the interchanges along I-4 from east of I-75 to the western connection of SR 570 (Polk Parkway). The study's primary goal was to identify problems at the interchanges off-ramps that cause safety and operational issues on the I-4 mainline. Proposed recommendations focused on small-scale, cost-feasible projects that can be funded through current FDOT programs. The I-4 Interchange Needs Evaluation Study was conducted concurrently with the I-4 Project Development and Environment (PD&E) Study from east of 50<sup>th</sup> Street to the Polk Parkway (431746-1). This Interchange Operational Analysis Report (IOAR) focuses on the I-4 at Branch Forbes Road interchange. The I-4 Interchange Needs Evaluation Study is included in **Appendix A**.

I-4 is designated a SIS highway corridor as part of Florida's Strategic Intermodal System (SIS). *"The SIS represents a statewide network of high-priority transportation facilities, including Florida's largest and most significant airports, spaceports, deep-water seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways, highways, military access facilities, intermodal logistic centers, and fixed guideway transit corridors. These facilities represent the state's primary means for moving people and freight between Florida's diverse regions, as well as between Florida and other states and countries".*<sup>1</sup>

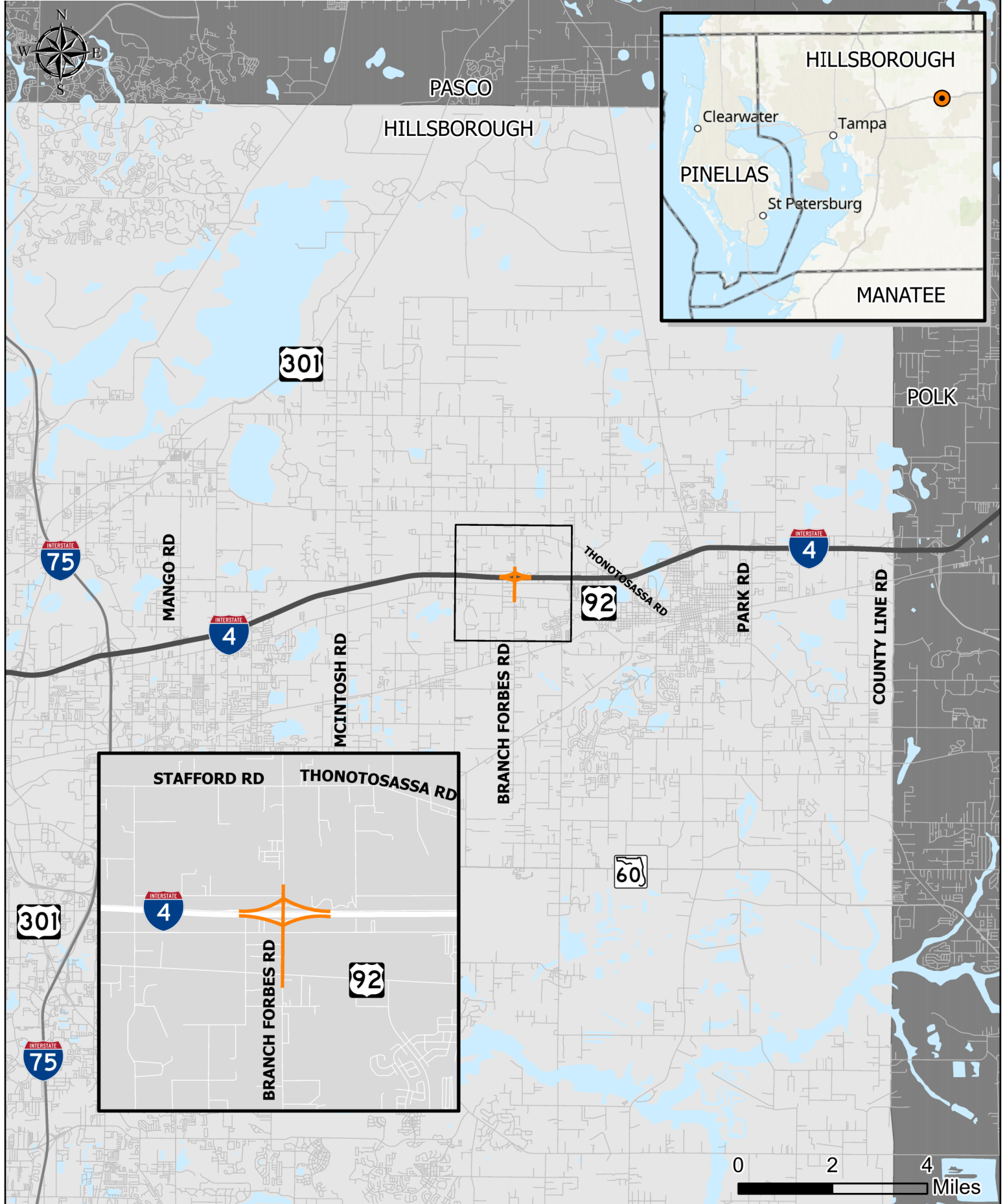
I-4 at Branch Forbes Road is a diamond interchange located approximately three miles east of the I-4 at McIntosh Road interchange and approximately two miles west of the I-4 at Thonotosassa Road interchange. Branch Forbes Road connects US 92 to the south and Thonotosassa Road to the north. **Figure 1-1** shows the location map of the interchange.

#### 1.1 Purpose and Need

The purpose of this IOAR is to document the Safety, Operational and Engineering (SO&E) acceptability of transportation improvements proposed for the I-4 and Branch Forbes Road interchange. The need for this project is to improve safety by alleviating excessive vehicle queue spillback at the I-4 at Branch Forbes Road eastbound and westbound off-ramps and improve the operations of the ramp terminal intersections.

During field observations conducted during the I-4 Interchange Needs Evaluation Study, queues from the off-ramps were observed impacting the I-4 mainline. Also, left turn queues from northbound and southbound left turn movements were observed to block the ramp terminal intersections. Based on the projected queues from the I-4 eastbound off-ramp and future traffic volumes, a need to install traffic signals at the ramp terminal intersections and extend the storage length of the northbound and southbound left turn lanes at the ramp terminal intersections were identified to minimize impacts to I-4 mainline operations and safety.

<sup>1</sup> *Strategic Intermodal System Handbook, Section 1: Strategic System Background, 2020*



## STUDY METHODOLOGY

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### 2.0 STUDY METHODOLOGY

The methodology discussed in this section was used to conduct the I-4 at Branch Forbes Road IOAR. This report follows the guidelines in the *FDOT Interchange Access Request User's Guide* dated January 2018, the current guideline at the time the IOAR process was initiated. The approved Methodology Letter of Understanding (MLOU) is included in **Appendix B**.

- Available 72-hour bi-directional vehicle approach counts and turning movement counts collected were used in this study.
- Field observations conducted at the I-4 at Branch Forbes Road interchange study area during the morning and afternoon peak hours during the I-4 Interchange Needs Evaluation Study are summarized.
- Crash data from FDOT Crash Analysis Reporting System (CAR) and the FDOT State Safety Office GIS (SSOGis) for the most recent five-year period available were used for safety analysis.
- 72-hour counts were converted to Annual Average Daily Traffic (AADT) by applying a seasonal factor (SF) and an axle correction factor (ACF). Design Hour factor (K) and the Directional Distribution (D) factor were applied to the AADTs to obtain the directional design hourly volume (DDHV).
- Evaluation of existing conditions was performed using Synchro 11 and the Highway Capacity Manual (HCM) 6<sup>th</sup> Edition results were reported.
- The years of analysis for this study are:
  - Existing Year – 2020
  - Opening Year – 2025
  - Design Year – 2045
- Year 2025 and 2045 volumes were estimated by applying a growth rate to the existing year AADT since the Tampa Bay Regional Planning Model version 9.1 validation did not reasonably reflect corridor level guidelines for this interchange.
- Future condition traffic analyses were performed for No-Build Conditions and Build Alternative using Synchro 11 and HCM 6<sup>th</sup> Edition results were reported.
- A safety analysis in accordance with the 2018 *FDOT Interchange Access Request User's Guide* was conducted.
- Design for this project is scheduled for Fiscal Year 2022 and Construction for Fiscal Year 2024.

## **STUDY METHODOLOGY**

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- A signing plan was developed for the Build Alternative.
- FHWA Policy Points are discussed.
- Other topics addressed in the IOAR include:
  - Access Management
  - Coordination with other agencies/consistency with area transportation plans,
  - Design exceptions and variances, and
  - Environmental considerations

## EXISTING INTERCHANGE CONDITIONS

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### 3.0 EXISTING INTERCHANGE CONDITIONS

I-4 at Branch Forbes Road is a diamond interchange located approximately three miles east of the I-4 at McIntosh Road interchange and approximately two miles west of the I-4 at Thonotosassa Road interchange. Branch Forbes Road connects US 92 to the south and Thonotosassa Road to the north. The Area of Influence (AOI) along Branch Forbes Road is from south of US 92 (approximately 1,890 feet south of the interchange) to north of Harvey Tew Road (approximately 330 feet north of the interchange) as shown in **Figure 3-1**. Branch Forbes Road is a two-lane undivided County roadway with a posted speed limit of 35 miles per hour (mph) and a functional classification of urban major collector. All the interchange ramps operate under yield traffic conditions except the eastbound to northbound movement and westbound to southbound movement, which operate under stop control conditions.

The businesses located near the interchange include Dinosaur World theme park, Marathon and CITGO gas stations, Circle K convenient store, and Branch Forbes Road Produce store. Several single-family homes are located north and south of the interchange.

The I-4 at Branch Forbes Road interchange has some unique features including:

- Access to Dinosaur World, a theme park with shows and exhibits depicting over 200 life-size dinosaurs.
- Primary access to the annual 11-day Strawberry Festival in Plant City (one of three roads leading to the parking facilities for the event).

**Figure 3-2** shows the existing geometry and traffic control features of the intersections in the AOI of the interchange.

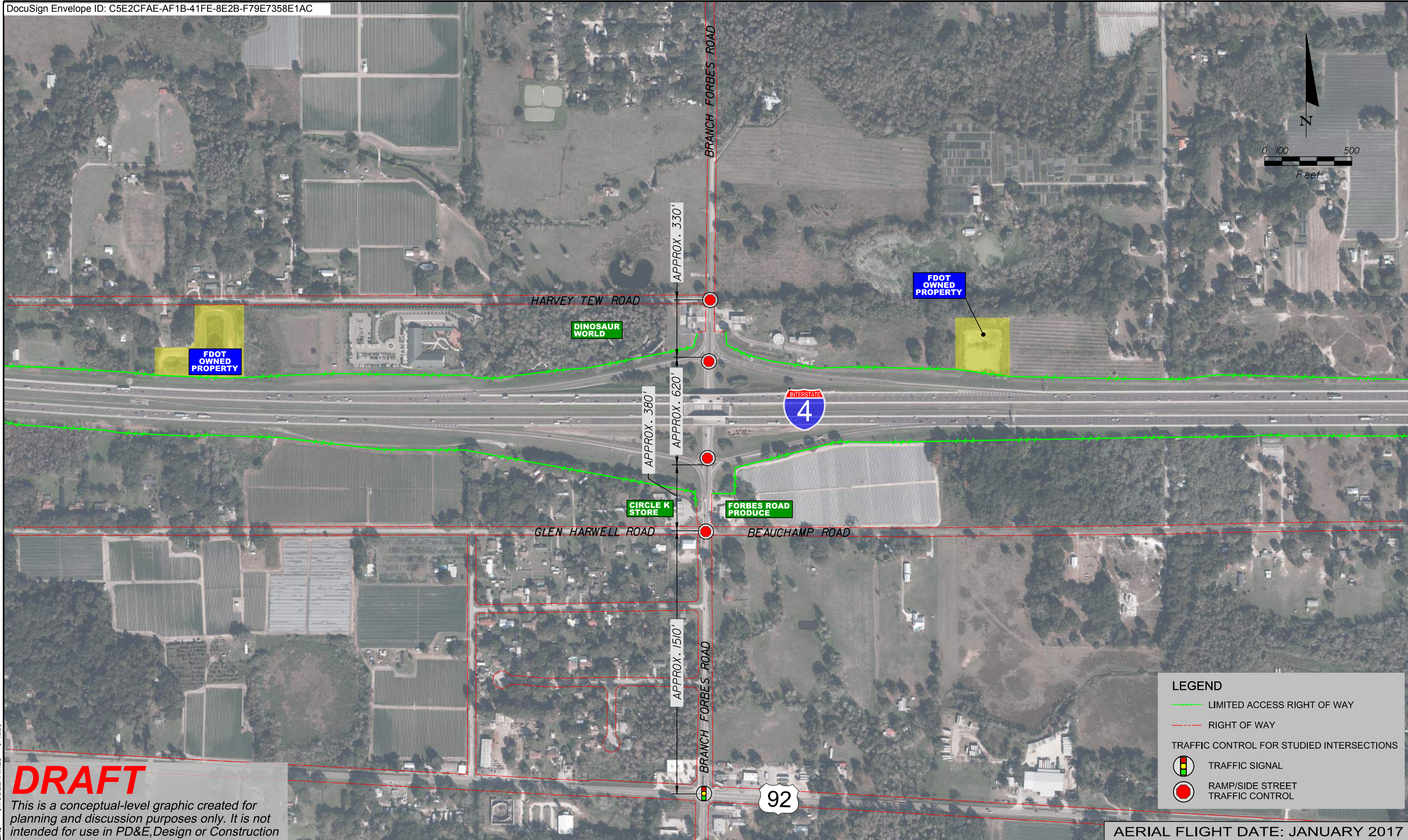
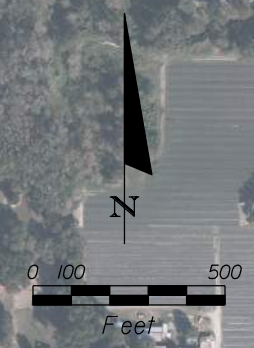
#### 3.1 Field Observations

AM and PM Peak hour field observations were conducted at the I-4 at Branch Forbes Road interchange on Wednesday, March 4, 2015 during the Strawberry Festival. PM peak hour observations were also conducted on Tuesday March 10, 2015, following closure of the annual Strawberry Festival. The field observations are included in **Appendix C**.

Field reviews and observations were performed between July 2018 and September 2018 with the D7 Secretary, Traffic Ops, and FHWA to talk about the improvements and the observations were confirmed.

An additional field observation was conducted on May 18, 2021 during the AM and PM peak hours and the observations are summarized below. The observations are similar to the ones documented in the I-4 Interchange Needs Study taken outside of the Strawberry Festival days.





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**LEGEND**

- LIMITED ACCESS RIGHT OF WAY
- RIGHT OF WAY

TRAFFIC CONTROL FOR STUDIED INTERSECTIONS

- TRAFFIC SIGNAL
- RAMP/SIDE STREET TRAFFIC CONTROL

AERIAL FLIGHT DATE: JANUARY 2017



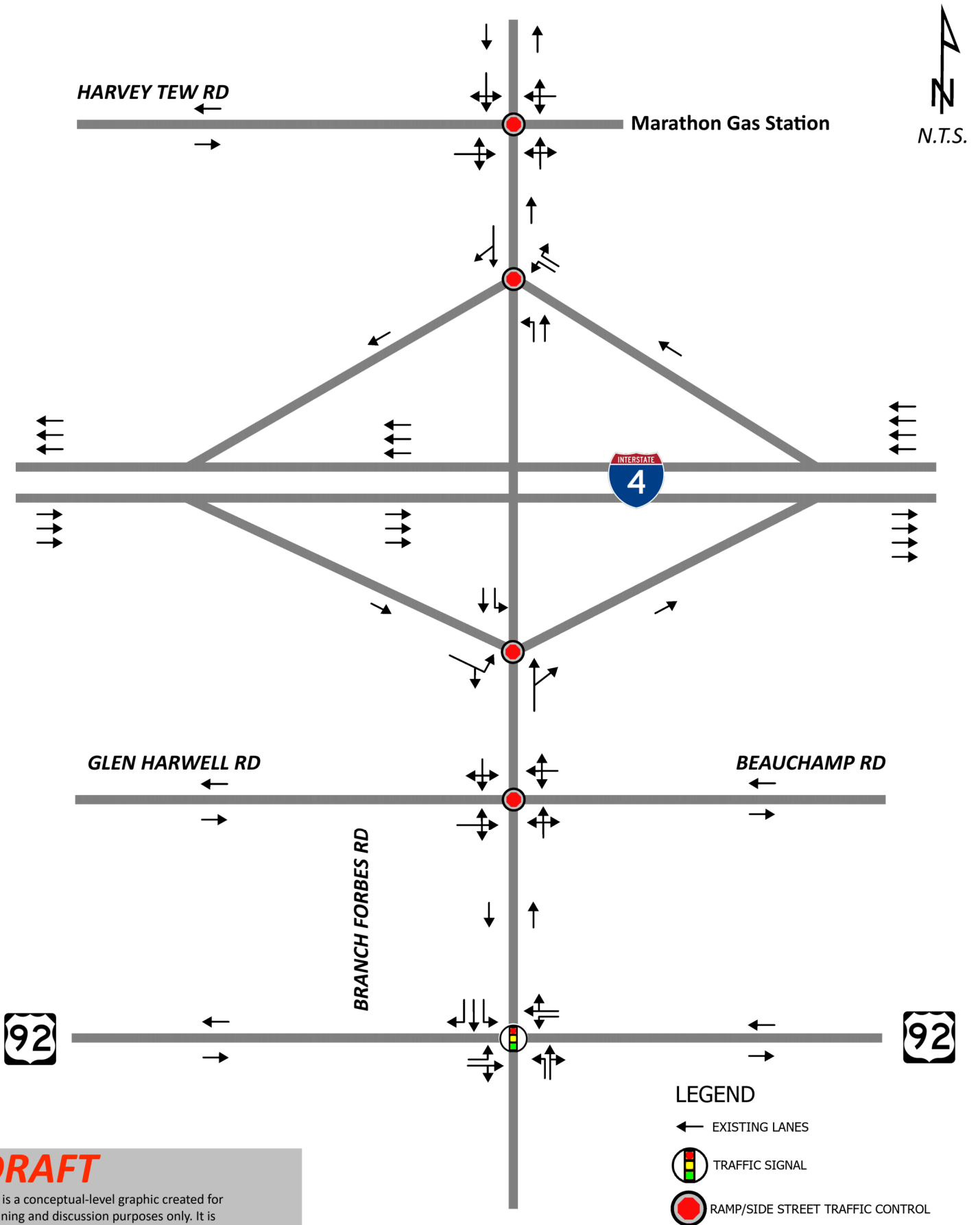
### I-4 at BRANCH FORBES ROAD IOAR

I-4 at BRANCH FORBES ROAD  
AREA OF INFLUENCE

FIGURE 3-1 6

SDATES \$USERS\$ \$MODELNAMES\$ \$FILES\$





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## EXISTING INTERCHANGE CONDITIONS

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### 3.1.1 I-4 Eastbound Ramps

- **AM Peak Hour:**
  - 7:15 am Three vehicles queue on the I-4 eastbound off-ramp to northbound Branch Forbes Road. Queue clears in 35 seconds.
  - 7:18 am: Two vehicles queue on the I-4 eastbound off-ramp to northbound Branch Forbes Road. Queue clears in 23 seconds.
- **PM Peak Hour:**
  - 4:48 pm: Four vehicles queue on the I-4 eastbound off-ramp to northbound Branch Forbes Road. Queues cleared in 55 seconds.
  - 5:00 pm: All movements operate without delay

### 3.1.2 I-4 Westbound Ramps

- **AM Peak Hour:**
  - 7:25 am: Nine vehicles queue on the I-4 westbound off-ramp to southbound Branch Forbes Road. First car took a minute to clear the ramp. Cars were observed to make a right turn at the ramp and then make a quick U-turn to continue southbound on Branch Forbes Road.
  - 7:33 am: Six vehicles queue on the I-4 westbound off-ramp to southbound Branch Forbes Road.
- **PM Peak Hour:**
  - 5:05 pm: Four cars in queue on the I-4 westbound off-ramp to southbound Branch Forbes Road. Queue cleared in 40 seconds.
  - 5:08 pm: Six vehicles in queue on the I-4 westbound off-ramp to southbound Branch Forbes Road. Queue cleared in one minute and 15 seconds.



Westbound Off-ramp queue during the AM peak hour



View of the westbound off-ramp queue during AM peak hour



## EXISTING (2020) TRAFFIC VOLUMES AND OPERATIONAL ANALYSIS

### 4.0 EXISTING (2020) TRAFFIC VOLUMES AND OPERATIONAL ANALYSIS

#### 4.1 Annual Average Daily Traffic Volumes

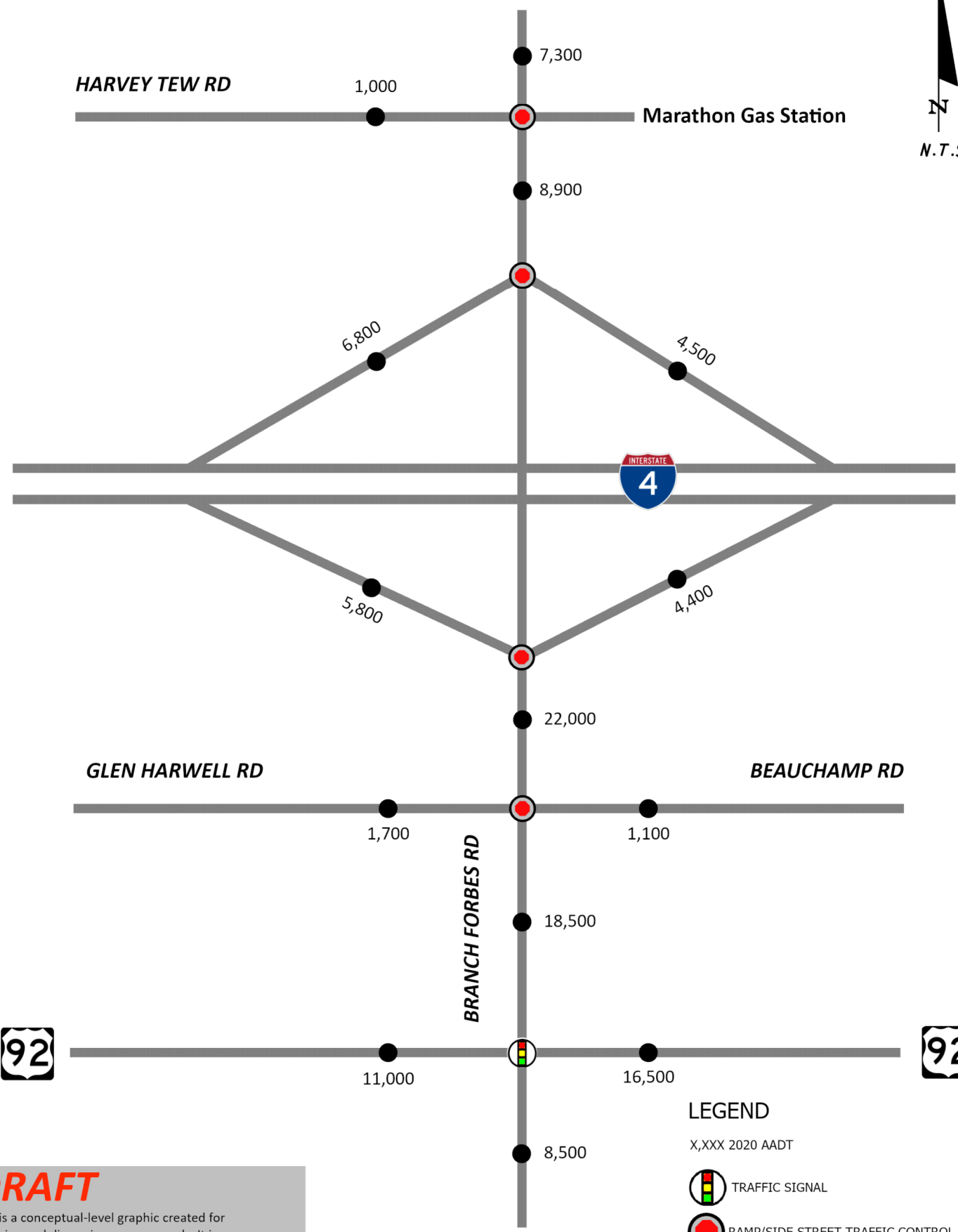
AADTs for the I-4 at Branch Forbes Road interchange Study area were collected from different sources:

- 72-hour bi-directional counts conducted in the study area from March 3, 2020 through March 5, 2020, before the Florida Governor mandated stay-at-home order. Florida Traffic Online (FTO) 2019 AADT data
- Recent studies in the study area

A seasonal factor (SF) of 0.95 and an axle correction factor (ACF) of 0.94 were applied to the 72-hour bi-directional counts to calculate the AADT. For some of the segments, where there was an equipment malfunction, AADTs were taken from recent studies in the AOI and the FTO, and a growth factor was applied. The Existing Year (2020) AADTs are summarized on **Table 4-1** and shown graphically on **Figure 4-1**. The 72-hour counts, data from FTO and recent studies, growth factor, and the AADT calculations are included in **Appendix D**.

**Table 4-1: Existing Year (2020) AADTs**

Location	2020 AADT
I-4 EB Off-ramp	5,800
I-4 EB On-ramp	4,400
I-4 WB Off-ramp	4,500
I-4 WB On-ramp	6,800
Branch Forbes Road north of Harvey Tew Road	7,300
Harvey Tew Road west of Branch Forbes Road	1,000
Branch Forbes Road north of I-4	8,900
Branch Forbes Road south of I-4	22,000
Beauchamp Road east of Branch Forbes Road	1,100
Glen Harwell Road west of Branch Forbes Road	1,700
Branch Forbes Road north of US 92	18,500
Branch Forbes Road south of US 92	8,500
US 92 east of Branch Forbes Road	16,500
US 92 west of Branch Forbes Road	11,000



**LEGEND**

- X,XXX 2020 AADT
- TRAFFIC SIGNAL
- RAMP/SIDE STREET TRAFFIC CONTROL

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## EXISTING (2020) TRAFFIC VOLUMES AND OPERATIONAL ANALYSIS

### 4.2 Traffic Factors

The K and D factors are the percentage of daily traffic volumes occurring during the peak hour and the proportion of traffic traveling in the peak direction, respectively. FDOT adopted a Standard K for roadways to apply between the planning and design phases, making the K factor consistent among all phases of a project. The D factor was obtained from the 72-hour counts and the turning movement counts since Branch Forbes Road is a county road and the most recent five years of historical D factor data could not be obtained from the FTO tool. A K factor of 9.0% and D factor of 56% were used in this study. A D-factor of 65% was used on Branch Forbes Road north of the Harvey Tew Road based on the turning movement counts.

Design Hour Trucks (DHT) is the percentage of truck traffic during the design hour. A DHT of 5.0% was used in the report based on historical truck percentage at the I-4 ramps. The traffic factors are shown in **Table 4-2**.

**Table 4-2: Traffic Factors**

K Factor (%)	D Factor (%)	DHT (%)
9.00	56%	5.00

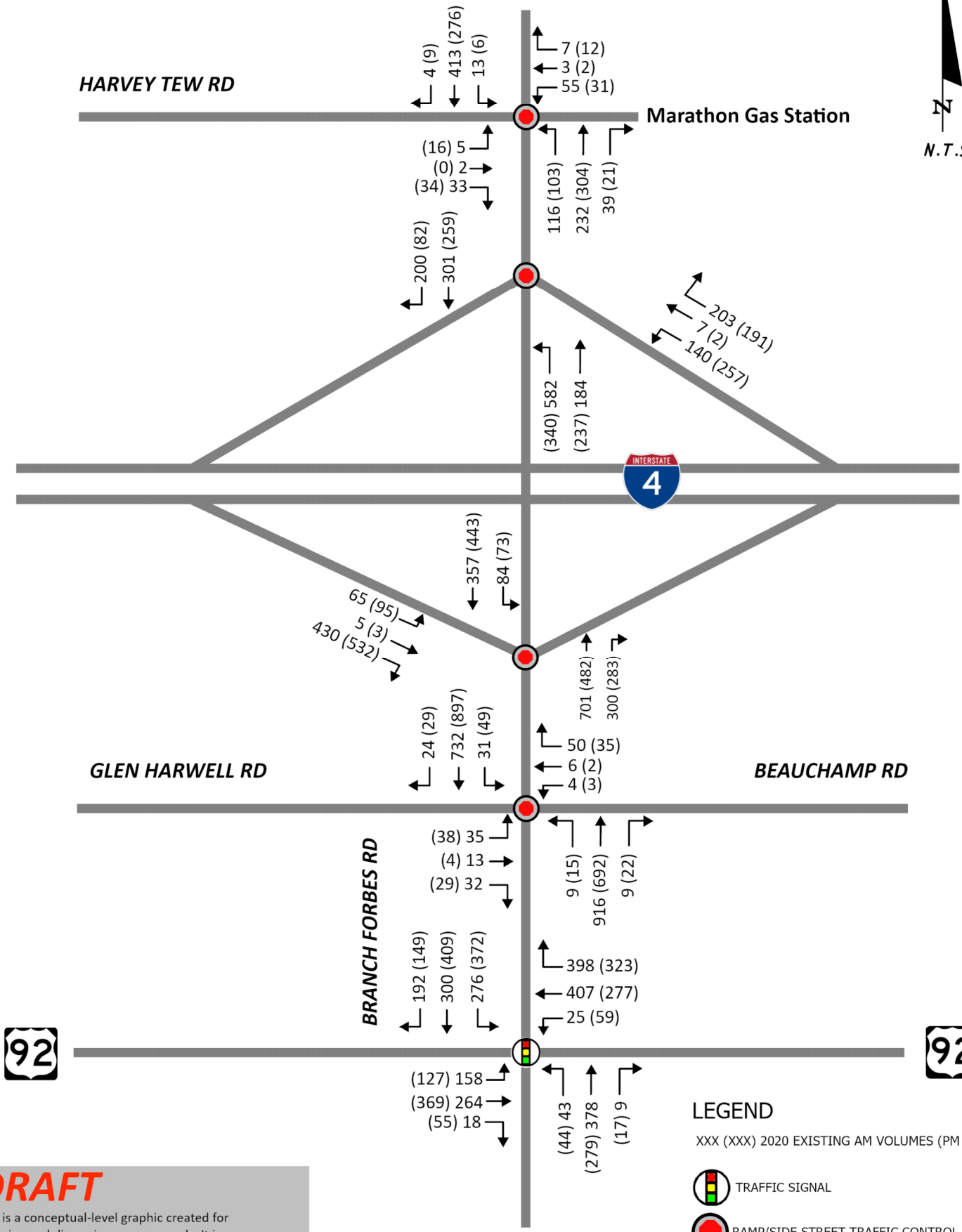
### 4.3 Turning Movement Volumes

The K and D factors were applied to the 2020 AADTs to obtain the DDHVs. The intersection turning volumes were determined by applying turning movement percentages derived from existing turning movement counts (TMCs) to the segment DDHVs. Once the segment DDHVs and intersection turning movements were calculated, the existing design hour traffic volumes were subsequently adjusted and balanced through the system. The TMCs were performed on Thursday, March 5, 2020 from 6:00 am to 9:00 am and from 3:00 pm to 6:00 pm.

The Existing Year 2020 AM and PM peak hours turning movement volumes are shown in **Figure 4-2**. The DDHVs and turning movement volume calculation spreadsheets are included in **Appendix E**.

### 4.4 Existing (2020) Operational Analysis

There are four unsignalized intersections and one signalized intersection along Branch Forbes Road within the AOI. An analysis of the existing signalized intersections was performed using existing signal phasing/timing information obtained from Hillsborough County. The intersections operations were analyzed using Synchro 11 and the Highway Capacity Manual (HCM), 6<sup>th</sup> Edition results are summarized in **Tables 4-3 and 4-4**. A target Level of Service (LOS) of D is established for the study area. The key measures of effectiveness are 95<sup>th</sup> percentile queue and delay for overall intersection and individual movements.



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I-4 at Branch Forbes Road  
IOAR

I-4 at Branch Forbes Road  
Existing Year (2020)  
Turning Movement Volumes

FIGURE  
4-2

Page  
12

## EXISTING (2020) TRAFFIC VOLUMES AND OPERATIONAL ANALYSIS

The peak hour factor (PHF) for the study area intersections ranged from 0.92 to as high as 0.98 with an average of 0.95; therefore, a PHF of 0.95 was used for all analyzed intersections. **Table 4-3** shows the delay and LOS for the existing conditions during the AM and PM peak hours. **Table 4-4** shows the vehicle queue results for the intersection movements.

**Table 4-3: Existing Year (2020) Intersection Delay and LOS Results\***

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Delay (sec)	LOS	Approach LOS	Delay (sec)	LOS	Approach LOS
<b>Intersection: Branch Forbes Road at Harvey Tew Road</b>							
Eastbound	Left/Thru/Right	13.8	B	B	14.2	B	B
Westbound	Left/Thru/Right	31.7	D	D	20.2	C	C
Northbound	Left	8.7	A		8.2	A	
Southbound	Left	7.9	A		8.0	A	
<b>Intersection: Branch Forbes Road at I-4 WB Ramps</b>							
Westbound	Left/Thru	1213.4	F	F	524.5	F	F
	Right	10.7	B		11.2	B	
Northbound	Left	10.8	B		8.9	A	
<b>Intersection: Branch Forbes Road at I-4 EB Ramps</b>							
Eastbound	Left/Thru/Right	19.0	C	C	119.6	F	F
Southbound	Left	9.7	A		8.7	A	
<b>Intersection: Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd</b>							
Eastbound	Left/Thru/Right	291.5	F	F	229.6	F	F
Westbound	Left/Thru/Right	39.1	E	E	26.3	D	D
Northbound	Left	9.5	A		10.3	B	
Southbound	Left	10.4	B		9.5	A	
<b>Intersection: Branch Forbes Road at US 92</b>							
Eastbound	Left	41.3	D	C	32.4	C	C
	Thru/Right	16.7	B		19.2	B	
Westbound	Left	23.2	C	F	26.8	C	F
	Thru/Right	286.0	F		117.0	F	
Northbound	Left	32.5	C	E	35.5	D	D
	Thru/Right	75.2	E		46.0	D	
Southbound	Left	195.9	F	F	203.7	F	F
	Through	25.3	C		28.1	C	
	Right	23.6	C		21.7	C	
<b>Intersection</b>			<b>137.3</b>	<b>F</b>	<b>Intersection</b>	<b>76.6</b>	<b>E</b>

\*Per HCM 6<sup>th</sup> Edition: For Two Way Stop Control (TWSC) intersections only minor movements delay and LOS are reported. HCM 6<sup>th</sup> Edition does not calculate LOS for major street thru movements and approaches or for the whole intersection as a whole.

**Table 4-3** shows the I-4 WB off-ramp operating at LOS F during both peak hours operating with excessive delays and vehicle queues. The PM peak hour results also show the I-4 EB off-ramp operating at LOS F with long delays and vehicle queues. The queues that exceeds the storage for that movement are shown in bold and highlighted in yellow in **Table 4-4**. The Existing Year (2020)

## EXISTING (2020) TRAFFIC VOLUMES AND OPERATIONAL ANALYSIS

Synchro results and the US 92 and Branch Forbes Road signal timing information are included in **Appendix F**.

**Table 4-4: Existing Year (2020) Intersection Vehicle Queues**

Intersection	Movement	Storage (ft)	AM Peak Hour Queues (95 <sup>th</sup> Percentile)		PM Peak Hour Queues (95 <sup>th</sup> Percentile)	
			Veh	Feet**	Veh	Feet**
Branch Forbes Road at Harvey Tew Road	EB Left	1,000	0.3	8	0.4	10
	WB Left	85	1.4	35	0.6	15
	NB Left	330	0.4	10	0.3	8
Branch Forbes Road at I-4 WB Ramps	WB Left	1,850	16.9	423	21.7	543
	WB Right	1,000	1.0	25	1.0	25
	NB Left	80	2.9	73	1.2	30
Branch Forbes Road at I-4 EB Ramps	EB Left	1,700	5.5	138	23.0	575
	SB Left	100	0.3	8	0.2	5
Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd	EB Left	1,000	6.7	168	5.6	140
	WB Left	1,000	1.6	40	0.7	18
	NB Left	1,000	0.0	0	0.1	3
	SB Left	380	0.1	3	0.2	5
Branch Forbes Road at US 92	EB Left	285	5.9	148	4.0	100
	EB Thru/Right	1,300	7.1	178	10.9	273
	WB Left	300	0.7	18	1.9	48
	WB Thru/Right	620	78.3	<b>1,958</b>	36.2	<b>905</b>
	NB Left	150	1.7	42	1.8	45
	NB Thru/Right	1,100	19.7	483	12.4	310
	SB Left	225	22.3	<b>558</b>	26.3	<b>658</b>
	SB Thru	650	9.7	243	13.2	330
SB Right	160	6.3	158	4.6	115	

\*For ramps, the storage was determined as the length of the ramp or as the storage lane length when provided

\*\*Queue in feet estimated by multiplying the number of vehicles times 25 ft.

The storage (ft) length shown in **Table 4-4** were determined as follows:

- For I-4 eastbound off-ramp, the storage length is the length of the ramp from the stop bar to the gore.
- For I-4 westbound off-ramp, the left turn storage is the length of the ramp from the stop bar to the gore and the right turn lane is turn lane storage length.
- For minor streets with an approach length longer than 1,000 ft, a storage length of 1,000 ft was used. 1,000 feet allows for reasonable queuing calculations.

## TRAVEL DEMAND FORECASTING

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### 5.0 TRAVEL DEMAND FORECASTING

The travel demand forecast for this IOAR was developed in accordance with the procedures in the 2019 FDOT Project Traffic Forecasting Handbook. Annual Average Daily Traffic (AADTs) and design hour volumes were computed for each roadway within the area of influence (AOI) following the process described herein.

#### 5.1 Travel Demand Model Validation

The Tampa Bay Regional Planning Model (TBRPM) Version 9.1 (v9.1) is the adopted travel demand model for this study area. The TBRPM v9.1 is a time-of-day based four-step model with Base Year 2015 and Horizon Year (Cost Affordable Year) 2045; other interim year model scenarios are also available but of no relevance for this study.

Prior to utilizing the traffic assignment generated by a travel demand model for forecasting, a validation of the model should be performed to ascertain its ability to reasonably replicate travel demand in the area of influence. The extent and depth of this validation depends on the scope of each project; however, at a minimum, the capability of the Base Year model to replicate available counts should be evaluated, as well as the proper coding of the networks.

For this project, the validation consisted of assessing the reasonableness of the TBRPM v9.1 Base Year 2015 highway assignment output by means of calculating model output-to-count ratios in those links where counts were available. To this end, the 2015 Peak Season Weekday Average Daily Traffic (PSWADT) volumes generated by the model were converted to 2015 AADT by applying the Model Output Conversion Factor (MOCF) obtained from FTO Peak Season Factor Category Report. The model AADTs were then compared to 2015 AADTs volumes obtained from the I-4 Interchange Needs Evaluation Report from east of I-75 to the western connection of SR 570 (Polk Parkway) and FDOT's FTO.

The Cost Affordable Year 2045 model network was reviewed for consistency with planned projects in the study area.

The results of the validation revealed that the 2015 Base Year Model either under-assigned or over-assigned traffic on critical non-interstate links within the AOI, in some cases quite significantly with volume-to-count ratios as low as 0.41 on US 92 west of Branch Forbes Road, 0.47 on Branch Forbes Road north of Harvey Tew Road, and 0.59 on Branch Forbes Road north of I-4. The results of the highway assignment validation are tabulated in **Appendix G**.

Since the travel demand model did not reasonably replicate existing travel behavior on the non-interstate links within the AOI, it was concluded that the application of off-model methods would be more appropriate to estimate the project future year traffic volumes.

## TRAVEL DEMAND FORECASTING

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Off-model methods refer to the analysis conducted to determine the growth rate of the corridor since the travel demand model did not reasonably replicate existing travel behavior and the analysis and methodology is explained in **Section 5.2**.

### 5.2 Project Traffic Forecast

For the off-model forecast methodology, Existing Year 2020 AADTs and AM/PM peak hour volumes were obtained from traffic count data. The 2020 AADTs were computed by applying the appropriate Seasonal Factors (SF) and Axle Correction Factors (ACF) obtained from FDOT's FTO to the field recorded Average Daily Traffic (ADT) counts. The 2020 peak hour intersection turning movement volumes were obtained from field collected turning movement counts (TMCs).

Design Year 2045 AADTs were developed by applying a growth rate to the Existing Year AADTs. Opening Year 2025 AADTs were then determined through interpolation of Existing Year and Design Year AADTs.

Traffic factors were applied to the future year AADTs to obtain Opening and Design Year segment design hour volumes (DHVs) and directional design hour volumes (DDHVs). Lastly, the AM and PM peak hour intersection turning movement volumes for the future horizon years (i.e., 2025 and 2045) were determined by applying turning movement percentages derived from existing TMCs to the segment DDHVs.

Since the project's proposed improvements are not expected to result in any travel pattern changes, one set of future year volumes were developed for each analysis year to evaluate both the No Build and Build scenarios.

#### 5.2.1 Growth Rate Analysis

A robust analysis was undertaken to determine the appropriate growth rate for the corridor. The growth rate analysis included a detailed assessment of historical traffic growth trends, travel demand model highway assignment growth (TBRPM 2015/2045), and socio-economic growth (TBRPM 2015/2045).

Population projections produced by the Bureau of Economic and Business Research (BEBR) were also analyzed; however, the data is representative of countywide trends and does not reflect the localized growth expected in the vicinity of the project interchange; therefore, it was decided that socio-economic data for the AOI from the 2015 and 2045 TBRPM were going to be used for the growth rate analysis. Considering all previously discussed sources of information, a compounded annual growth rate of 2.5% was recommended for the IOAR AOI.

**Table 5-1 and Figure 5-1** show the projected Opening Year (2025) and Design Year (2045) AADTs.



## TRAVEL DEMAND FORECASTING

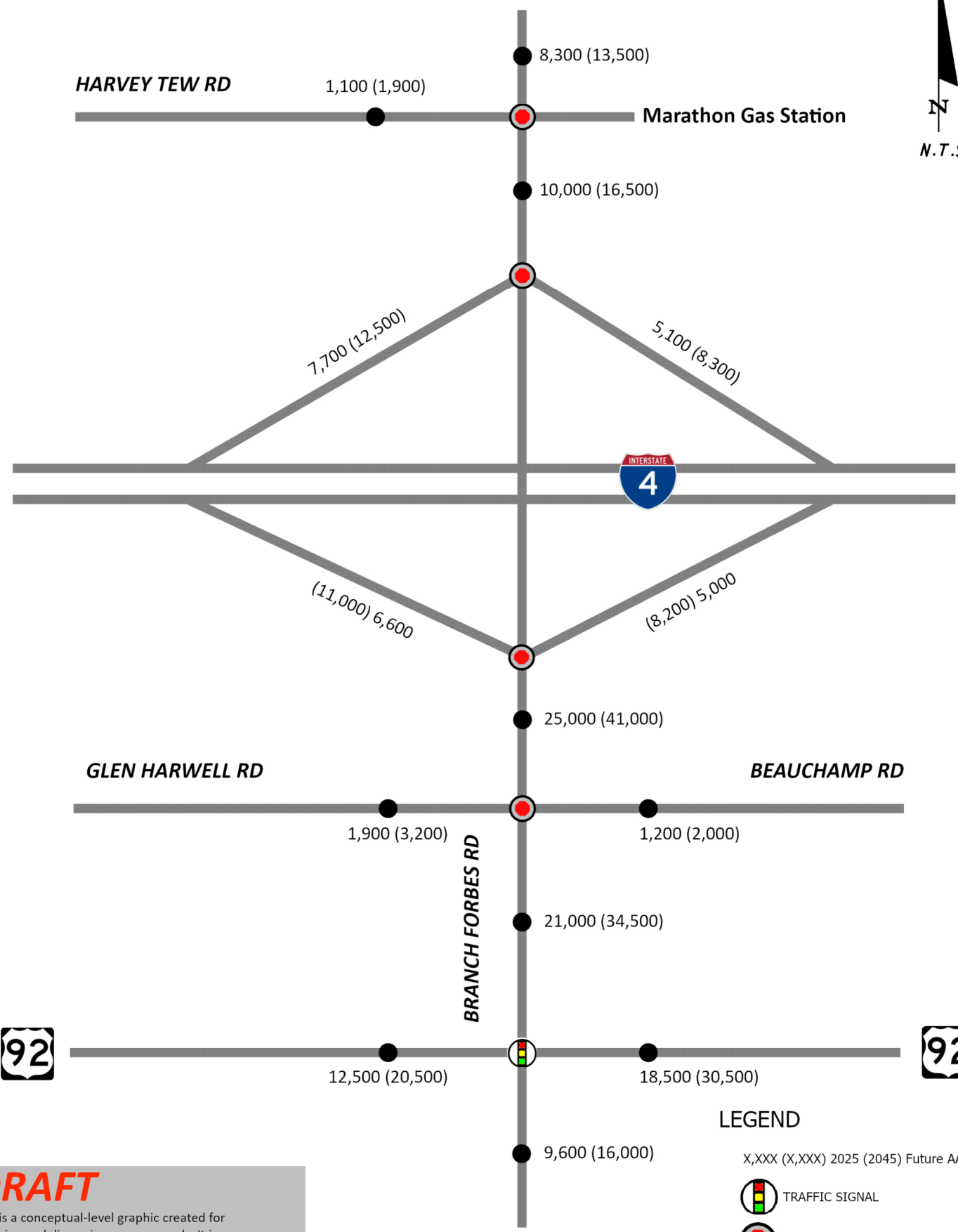
Tables summarizing the historical traffic, travel demand model assignment, and socio-economic growth analyses are provided in **Appendix H** for further reference. **Appendix H** also includes the FDOT Historic Traffic Trends Analysis Tool output reports.

**Table 5-1: Opening Year (2025) and Design Year (2045) AADTs**

Location	Year 2020	Opening Year 2025	Year 2025 Rounded	Design Year 2045	Year 2045 Rounded
I-4 EB Off-ramp	5,800	6,562	6,600	10,753	11,000
I-4 EB On-ramp	4,400	4,978	5,000	8,157	8,200
I-4 WB Off-ramp	4,500	5,091	5,100	8,343	8,300
I-4 WB On-ramp	6,800	7,694	7,700	12,607	12,500
Branch Forbes Road north of Harvey Tew Road	7,300	8,259	8,300	13,534	13,500
Harvey Tew Road west of Branch Forbes Road	1,000	1,131	1,100	1,854	1,900
Branch Forbes Road north of I-4	8,900	10,070	10,000	16,500	16,500
Branch Forbes Road south of I-4	22,000	24,891	25,000	40,787	41,000
Beauchamp Road east of Branch Forbes Road	1,100	1,245	1,200	2,039	2,000
Glen Harwell Road west of Branch Forbes Road	1,700	1,923	1,900	3,152	3,200
Branch Forbes Road north of US 92	18,500	20,931	21,000	34,298	34,500
Branch Forbes Road south of US 92	8,500	9,617	9,600	15,759	16,000
US 92 east of Branch Forbes Road	16,500	18,668	18,500	30,590	30,500
US 92 west of Branch Forbes Road	11,000	12,445	12,500	20,393	20,500

### 5.2.2 Project Traffic Volumes

The DDHVs for the Opening Year (2025) and Design Year (2045) were developed by multiplying the AADT volume by the design traffic factors (Standard K and D factors) described in **Section 4.2**. Peak hour intersection turning movement volumes were obtained from the design hourly volumes using the existing turning movement percentages. **Figures 5-2 and 5-3** show the design hourly volume for the Opening and Design Years, respectively. The DDHVs and turning movement volume calculation spreadsheets are included in **Appendix I**.



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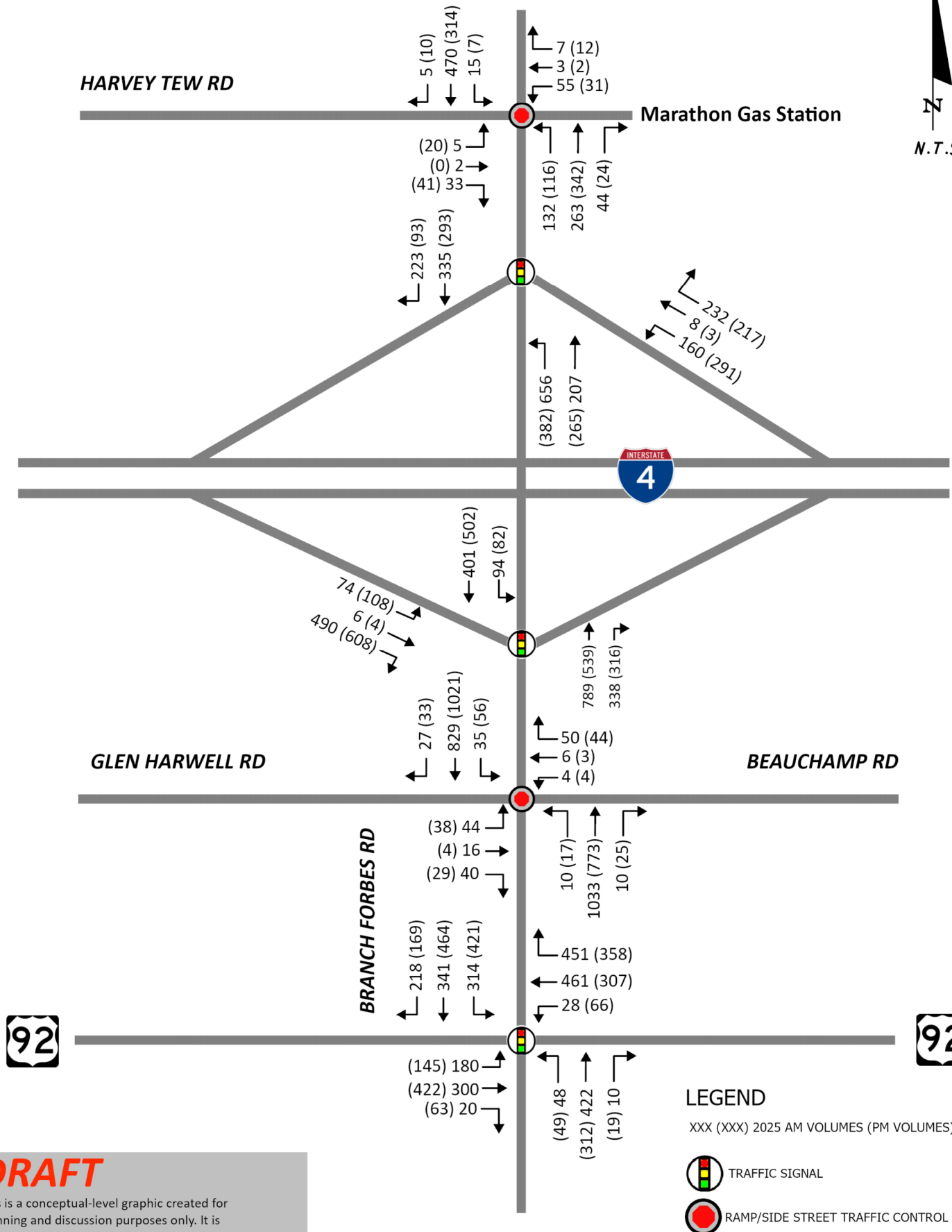


*I-4 at Branch Forbes Road IOAR*

2025 and 2045 Annual Average Daily Traffic (AADT) Volumes

FIGURE 5-1

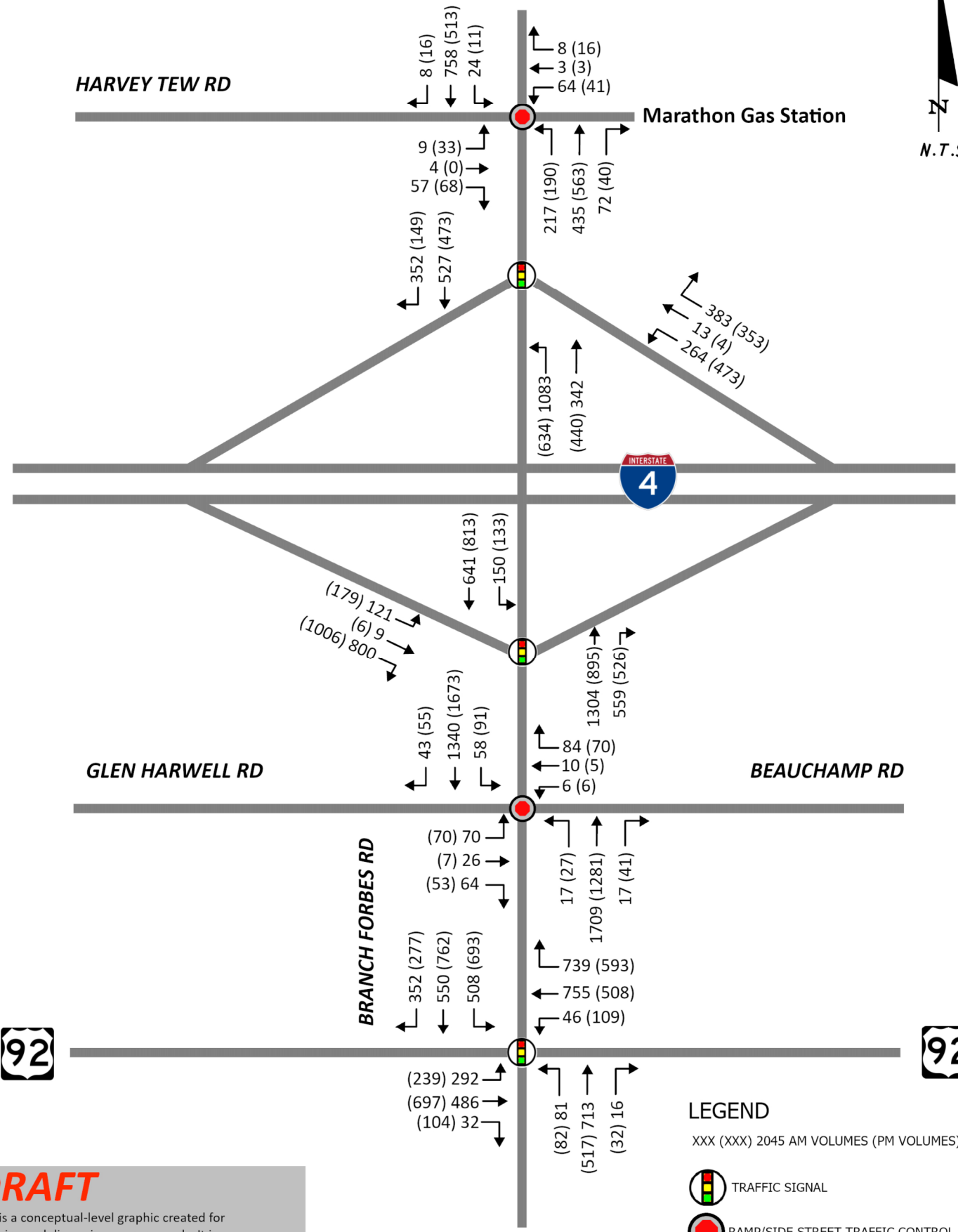
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## ALTERNATIVES CONSIDERED AND ANALYSIS

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### 6.0 ALTERNATIVES CONSIDERED AND ANALYSIS

The I-4 at Branch Forbes Road traffic analysis was conducted for the following scenarios:

- No-Build Conditions
- Build Alternative

The No-Build Conditions and the Build Alternative were evaluated for Opening Year 2025 and Design Year 2045.

#### 6.1 Alternatives Considered

##### 6.1.1 No-Build Alternative

The No-Build Alternative includes existing conditions and any planned or programmed improvements anticipated to be constructed in the AOI. No programmed improvements were identified for the AOI, therefore the No-Build geometry is the same as the existing conditions shown in Figure 3-2.

##### 6.1.2 Build Alternative

The Build Alternative consists of Transportation Systems Management and Operations (TSM&O) strategies plus additional improvements in the AOI based on field observations and projected future traffic volumes. The Build Alternative includes:

- New Traffic Signals and Mast Arms at each of the I-4/Branch Forbes Road ramp terminus
- Add new 840-foot right turn lane to existing I-4 EB off-ramp. Mill and resurface existing ramp.
- Widen Branch Forbes Road to the outside between ramp terminals
- Extend existing northbound and southbound left turn lanes to provide minimum of 260-foot storage capacity at the I-4 ramp terminal intersections.
- Add a southbound left turn lane at the intersection of Branch Forbes Road and Glenn Harwell/Beauchamp Road.

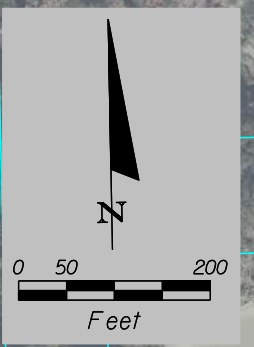
The Build Alternative improvements are shown in **Figure 6-1**. The Build Alternative lane configuration is shown in **Figure 6-2**.

#### 6.2 No-Build Conditions Analysis

##### 6.2.1 Year 2025 No-Build Analysis

**Table 6-1** shows the delay and level of service (LOS) for the No-Build Conditions during the AM and PM peak hours for Opening Year 2025. **Table 6-2** shows the vehicle queue results for the minor movements.





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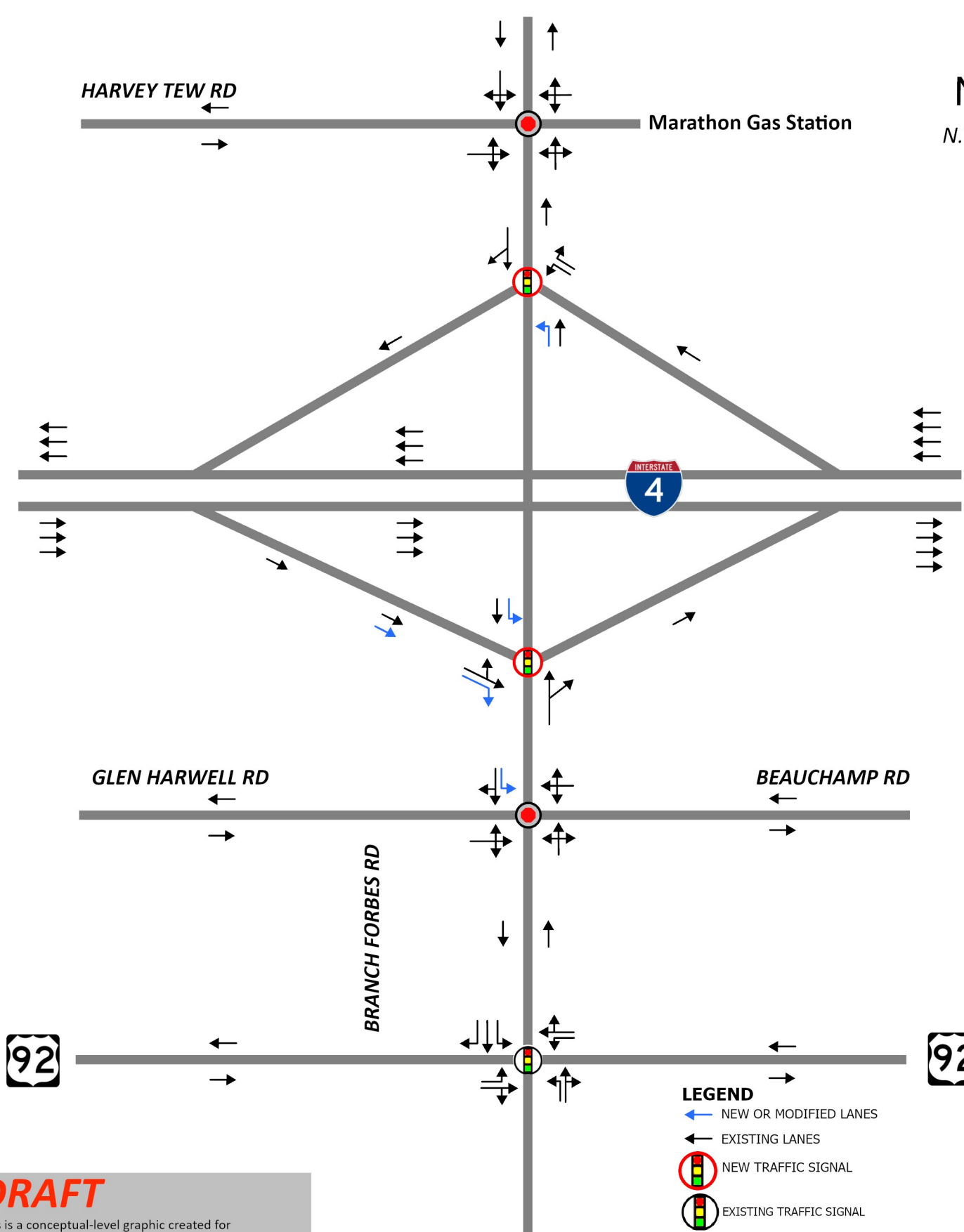


I-4 at BRANCH FORBES ROAD IOAR

I-4 AT BRANCH FORBES ROAD INTERCHANGE BUILD ALTERNATIVE

FIGURE 6-1





- LEGEND**
- NEW OR MODIFIED LANES
  - EXISTING LANES
  - NEW TRAFFIC SIGNAL
  - EXISTING TRAFFIC SIGNAL
  - RAMP/SIDE STREET TRAFFIC CONTROL

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*I-4 at Branch Forbes Road IOAR*

I-4 at Branch Forbes Road Build Alternative Geometry

FIGURE 6-2

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## ALTERNATIVES CONSIDERED AND ANALYSIS

The results show the operations of the I-4 westbound off-ramp are expected to continue to worsen if the intersection keeps its current configuration for both peak hours. The results also show that the operations of the I-4 eastbound off-ramp are also expected to continue to worsen, especially during the PM peak hour.

The AM peak hour shows a queue of 22 vehicles for the westbound left at the I-4 westbound off-ramp and the PM peak hour shows a queue of 30 vehicles. The PM peak hour shows a queue of 45 vehicles for the I-4 eastbound off-ramp. The No-Build Synchro results are included in **Appendix J**.

**Table 6-1: Opening Year (2025) No-Build Intersection Delay and LOS Results\***

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Delay (sec)	LOS	Approach LOS	Delay (sec)	LOS	Approach LOS
<b>Intersection: Branch Forbes Road at Harvey Tew Road</b>							
Eastbound	Left/Thru/Right	15.4	C	C	16.3	C	C
Westbound	Left/Thru/Right	43.3	E	E	24.4	C	C
Northbound	Left	9.0	A		8.3	A	
Southbound	Left	8.0	A		8.1	A	
<b>Intersection: Branch Forbes Road at I-4 WB Ramps</b>							
Westbound	Left/Thru	2563.2	F	F	978.1	F	F
	Right	11.3	B		11.8	B	
Northbound	Left	12.1	B		9.3	A	
<b>Intersection: Branch Forbes Road at I-4 EB Ramps</b>							
Eastbound	Left/Thru/Right	54.0	F	F	342.9	F	F
Southbound	Left	10.2	B		9.0	A	
<b>Intersection: Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd</b>							
Eastbound	Left/Thru/Right	859.9	F	F	604.0	F	F
Westbound	Left/Thru/Right	71.3	F	F	44.6	E	E
Northbound	Left	9.9	A		11.0	B	
Southbound	Left	11.1	B		10.0	A	
<b>Intersection: Branch Forbes Road at US 92</b>							
Eastbound	Left	56.0	E	C	37.3	D	C
	Thru/Right	17.2	B		20.6	C	
Westbound	Left	23.4	C	F	29.8	C	F
	Thru/Right	379.1	F		171.1	F	
Northbound	Left	33.5	C	F	41.3	D	D
	Thru/Right	108.3	F		53.5	D	
Southbound	Left	296.7	F	F	350.9	F	F
	Through	26.7	C		31.5	C	
	Right	24.5	C		22.6	C	
<b>Intersection</b>			<b>185.5</b>	<b>F</b>	<b>Intersection</b>	<b>113.5</b>	<b>F</b>

\*Per HCM 6<sup>th</sup> Edition: For Two Way Stop Control (TWSC) intersections only minor movements delay and LOS are reported. HCM 6<sup>th</sup> Edition does not calculate LOS for major street thru movements and approaches or for the whole intersection as a whole.



## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-2: Opening Year (2025) No-Build Intersection Vehicle Queues**

Intersection	Movement	Storage (ft)*	AM Peak Hour Queues (95 <sup>th</sup> Percentile)		PM Peak Hour Queues (95 <sup>th</sup> Percentile)	
			Veh	Feet**	Veh	Feet**
Branch Forbes Road at Harvey Tew Road	EB Left	1,000	0.4	10	0.6	15
	WB Left	85	1.9	48	0.7	18
	NB Left	330	0.5	13	0.3	8
Branch Forbes Road at I-4 WB Ramps	WB Left	1,850	21.6	540	29.6	740
	WB Right	1,000	1.3	33	1.3	33
	NB Left	80	3.9	98	1.4	35
Branch Forbes Road at I-4 EB Ramps	EB Left	1,700	13.7	343	45.0	1,125
	SB Left	100	0.4	10	0.3	8
Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd	EB Left	1,000	11.3	283	7.8	195
	WB Left	1,000	2.7	68	1.6	40
	NB Left	1,000	0.0	0	0.1	3
	SB Left	380	0.2	5	0.2	5
Branch Forbes Road at US 92	EB Left	285	8.0	200	5.0	125
	EB Thru/Right	1,300	8.2	205	12.8	320
	WB Left	300	0.8	20	2.3	58
	WB Thru/Right	620	101.7	2,543	49.3	1,233
	NB Left	150	2.0	50	2.3	58
	NB Thru/Right	1,100	25.9	648	14.7	368
	SB Left	225	30.7	768	40.0	1,000
	SB Thru	650	11.1	278	15.6	390
SB Right	160	7.4	185	5.4	135	

\*For ramps, the storage was determined as the length of the ramp or as the storage lane length when provided

\*\*Queue in feet estimated by multiplying the number of vehicles times 25 ft.

### 6.2.2 Year 2045 No-Build Analysis

**Table 6-3** shows the delay and level of service (LOS) for the No-Build Conditions for Design Year 2045 during the AM and PM peak hours. **Table 6-4** shows the vehicle queue results for the minor movements.

The results show the operations of both the I-4 westbound off-ramp and I-4 eastbound off-ramp are expected to continue to worsen if the intersection keeps its current configuration for both peak hours. The queues on both ramps are expected to impact the I-4 mainline under No-Build conditions. The No-Build Synchro results are included in **Appendix J**.

## ALTERNATIVES CONSIDERED AND ANALYSIS

The long queues along Branch Forbes Road are expected to affect the operation of the side streets Glen Harwell Road and Beauchamp Road.

**Table 6-3: Design Year (2045) No-Build Intersection Delay and LOS Results\***

Approach	Movement	AM Peak Hour			PM Peak Hour			
		Delay (sec)	LOS	Approach LOS	Delay (sec)	LOS	Approach LOS	
<b>Intersection: Branch Forbes Road at Harvey Tew Road</b>								
Eastbound	Left/Thru/Right	54.3	F	F	76.1	F	F	
Westbound	Left/Thru/Right	891.7	F	F	186.0	F	F	
Northbound	Left	11.2	B		9.5	A		
Southbound	Left	8.6	A		8.9	A		
<b>Intersection: Branch Forbes Road at I-4 WB Ramps</b>								
Westbound	Left/Thru	Err**	**	F	15101.5	F	F	
	Right	17.8	C		20.7	C		
Northbound	Left	92.9	F		14.2	B		
<b>Intersection: Branch Forbes Road at I-4 EB Ramps</b>								
Eastbound	Left/Thru/Right	2392.8	F	F	2714.8	F	F	
Southbound	Left	15.8	C		11.2	B		
<b>Intersection: Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd</b>								
Eastbound	Left/Thru/Right	Err**	**	**	Err**	**	**	
Westbound	Left/Thru/Right	Err**	**	**	Err**	**	**	
Northbound	Left	13.2	B		17.0	C		
Southbound	Left	18.4	C		14.3	B		
<b>Intersection: Branch Forbes Road at US 92</b>								
Eastbound	Left	243.9	F	F	141.9	F	E	
	Thru/Right	21.2	C		54.3	D		
Westbound	Left	30.1	C	F	324.1	F	F	
	Thru/Right	879.7	F		548.0	F		
Northbound	Left	73.0	E	F	217.7	F	F	
	Thru/Right	421.8	F		228.7	F		
Southbound	Left	716.3	F	F	1121.1	F	F	
	Through	39.5	D		116.9	F		
	Right	30.4	C		26.7	C		
<b>Intersection</b>			<b>461.2</b>	<b>F</b>	<b>Intersection</b>		<b>375.5</b>	<b>F</b>

\*Per HCM 6<sup>th</sup> Edition: For Two Way Stop Control (TWSC) intersections only minor movements delay and LOS are reported. HCM 6<sup>th</sup> Edition does not calculate LOS for major street thru movements and approaches or for the whole intersection as a whole

\*\*No results provided, or computations not completed. Delay threshold is exceeded.

## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-4: Design Year (2045) No-Build Intersection Vehicle Queues**

Intersection	Movement	Storage (ft)*	AM Peak Hour Queues (95 <sup>th</sup> Percentile)		AM Peak Hour Queues (95 <sup>th</sup> Percentile)	
			Veh	Feet**	Veh	Feet**
Branch Forbes Road at Harvey Tew Road	EB Left	1,000	2.5	63	4.3	15
	WB Left	85	9.0	<b>225</b>	4.5	<b>113</b>
	NB Left	330	1.2	30	0.7	8
Branch Forbes Road at I-4 WB Ramps	WB Left	1,850	***	***	63.8	1,595
	WB Right	1,000	3.9	98	4.4	110
	NB Left	80	31.1	<b>778</b>	4.7	<b>118</b>
Branch Forbes Road at I-4 EB Ramps	EB Left	1,700	106.1	<b>2,653</b>	137.5	<b>3,438</b>
	SB Left	100	1.4	35	0.7	18
Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd	EB Left	1,000	***	***	***	***
	WB Left	1,000	***	***	***	***
	NB Left	1,000	0.1	3	0.3	8
	SB Left	380	0.7	18	0.7	18
Branch Forbes Road at US 92	EB Left	285	25.3	<b>633</b>	16.0	<b>400</b>
	EB Thru/Right	1,300	13.9	348	32.3	808
	WB Left	300	1.6	40	14.0	<b>350</b>
	WB Thru/Right	620	225.0	<b>5,625</b>	143.2	<b>3,580</b>
	NB Left	150	5.3	133	9.2	<b>230</b>
	NB Thru/Right	1,100	84.6	<b>2,115</b>	47.9	<b>1,198</b>
	SB Left	225	68.1	<b>1,703</b>	102.6	<b>2,565</b>
	SB Thru	650	20.3	508	45.9	<b>1,148</b>
SB Right	160	12.3	<b>308</b>	9.4	<b>235</b>	

\*For ramps, the storage was determined as the length of the ramp or as the storage lane length when provided

\*\*Queue in feet estimated by multiplying the number of vehicles times 25 ft.

\*\*\*No results provided, excessive queue.

## 6.3 Build Analysis

### 6.3.1 Year 2025 Build Analysis

The improvements included in **Figure 6-1** and discussed in Section 6.1.2 are included in the Year 2025 Build Analysis. **Tables 6-5 and 6-6** summarize the intersections operational analysis results for the Year 2025 Build.

## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-5: Opening Year (2025) Build Intersection Delay and LOS Results\***

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Delay (sec)	LOS	Approach LOS	Delay (sec)	LOS	Approach LOS
<b>Intersection: Branch Forbes Road at Harvey Tew Road</b>							
Eastbound	Left/Thru/Right	15.4	C	C	16.3	C	C
Westbound	Left/Thru/Right	43.3	E	E	24.4	C	C
Northbound	Left	9.0	A		8.3	A	
Southbound	Left	8.0	A		8.1	A	
<b>Intersection: Branch Forbes Road at I-4 WB Ramps</b>							
Westbound	Left/Thru	54.6	D	D	46.3	D	D
Northbound	Left	11.6	B	A	29.7	C	B
	Through	0.0	A		4.6	A	
Southbound	Thru/Right	33.0	C	C	28.3	C	C
<b>Intersection</b>			<b>20.3</b>	<b>C</b>	<b>Intersection</b>	<b>27.9</b>	<b>C</b>
<b>Intersection: Branch Forbes Road at I-4 EB Ramps</b>							
Eastbound	Left/Thru	50.7	D	D	36.8	D	D
Northbound	Thru/Right	18.3	B	B	23.9	C	C
Southbound	Left	13.0	B	A	14.5	B	A
	Through	5.5	A		1.1	A	
<b>Intersection</b>			<b>16.1</b>	<b>B</b>	<b>Intersection</b>	<b>15.2</b>	<b>B</b>
<b>Intersection: Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd</b>							
Eastbound	Left/Thru/Right	804.6	F	F	501.3	F	F
Westbound	Left/Thru/Right	65.2	F	F	40.1	E	E
Northbound	Left	9.9	A		11.0	B	
Southbound	Left	11.1	B		10.0	A	
<b>Intersection: Branch Forbes Road at US 92</b>							
Eastbound	Left	56.0	E	C	38.0	D	C
	Thru/Right	18.2	B		22.3	C	
Westbound	Left	23.7	C	F	30.9	C	F
	Thru/Right	379.1	F		162.7	F	
Northbound	Left	33.5	C	F	42.1	D	D
	Thru/Right	108.3	F		54.6	D	
Southbound	Left	296.7	F	F	362.5	F	F
	Through	26.7	C		32.1	C	
	Right	24.5	C		23.0	C	
<b>Intersection</b>			<b>185.6</b>	<b>F</b>	<b>Intersection</b>	<b>113.8</b>	<b>F</b>

\*Per HCM 6<sup>th</sup> Edition: For TSWC intersections only minor movements delay and LOS are reported. HCM 6<sup>th</sup> Edition does not calculate LOS for major street thru movements and approaches or for the whole intersection as a whole.

The results on Tables 6-5 and 6-6 show the Build Alternative will improve the operations of the I-4 westbound and eastbound off-ramps and the overall ramp terminal intersections when compared to the No-Build conditions. The ramp terminal intersections are expected to operate at LOS D or better and the vehicle queues at the off-ramps will be reduced significantly. The 2025 Build Synchro results are included in **Appendix K**.

## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-6: Opening Year (2025) Build Intersection Vehicle Queues**

Intersection	Movement	Storage (ft)*	AM Peak Hour Queues (95 <sup>th</sup> Percentile)		PM Peak Hour Queues (95 <sup>th</sup> Percentile)	
			Veh	Feet**	Veh	Feet**
Branch Forbes Road at Harvey Tew Road	EB Left	1,000	0.4	10	0.6	15
	WB Left	85	1.9	48	0.7	18
	NB Left	330	0.5	13	0.3	8
Branch Forbes Road at I-4 WB Ramps	WB Left	1,700	9.7	243	14.3	358
	WB Right	1,000	0.0	0	0.0	0
	NB Left	260	7.2	180	11.9	298
	NB Thru	620	0	0	2.2	55
	SB Thru/Right	330	13.7	343	11.3	283
Branch Forbes Road at I-4 EB Ramps	EB Left	1,600	4.7	118	5.5	188
	EB Right	840	0.0	0	0.0	0
	NB Thru/Right	380	22.4	560	18.0	450
	SB Left	260	1.5	25	1.8	45
	SB Thru	620	4.4	3	0.6	15
Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd	EB Left	1,000	11.1	278	7.4	185
	WB Left	1,000	2.5	63	1.4	35
	NB Left	1,000	0.0	0	0.1	3
	SB Left	100	0.2	5	0.2	5
Branch Forbes Road at US 92	EB Left	285	8.0	200	5.1	128
	EB Thru/Right	1,300	8.5	213	13.4	335
	WB Left	300	0.9	22	2.5	62
	WB Thru/Right	620	101.7	2,542	48.0	1,200
	NB Left	150	2.0	50	2.3	58
	NB Thru/Right	1,100	25.9	648	14.9	373
	SB Left	225	30.7	768	40.6	1,015
	SB Thru	650	11.1	278	15.9	398
SB Right	160	7.4	185	5.5	139	

\*For ramps, the storage was determined as the length of the ramp or as the storage lane length when provided

\*\*Queue in feet estimated by multiplying the number of vehicles times 25 ft.

### 6.3.2 Year 2045 Build Analysis

Tables 6-7 and 6-8 summarize the intersection operations results for Year 2045 Build analysis.

## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-7: Design Year (2045) Build Intersection Delay and LOS Results\***

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Delay (sec)	LOS	Approach LOS	Delay (sec)	LOS	Approach LOS
<b>Intersection: Branch Forbes Road at Harvey Tew Road</b>							
Eastbound	Left/Thru/Right	54.3	F	F	76.1	F	F
Westbound	Left/Thru/Right	891.7	F	F	186.0	F	F
Northbound	Left	11.2	B		9.5	A	
Southbound	Left	8.6	A		8.9	A	
<b>Intersection: Branch Forbes Road at I-4 WB Ramps</b>							
Westbound	Left/Thru	142.5	F	F	86.1	F	F
Northbound	Left	248.3	F	F	149.1	F	F
	Through	0.0	A		0.1	A	
Southbound	Thru/Right	58.8	E	E	44.7	D	D
<b>Intersection</b>		<b>152.3</b>	<b>F</b>		<b>Intersection</b>	<b>77.5</b>	<b>E</b>
<b>Intersection: Branch Forbes Road at I-4 EB Ramps</b>							
Eastbound	Left/Thru	68.2	E	E	46.1	D	D
Northbound	Thru/Right	80.0	F	F	53.0	D	D
Southbound	Left	203.8	F	D	100.0	F	C
	Through	18.3	B		22.4	C	
<b>Intersection</b>		<b>69.9</b>	<b>E</b>		<b>Intersection</b>	<b>43.2</b>	<b>D</b>
<b>Intersection: Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd</b>							
Eastbound	Left/Thru/Right	Err**	Err**	**	Err**	Err**	**
Westbound	Left/Thru/Right	Err**	Err**	**	Err**	Err**	**
Northbound	Left/Thru/Right	13.2	B		17.0	C	
Southbound	Left/Thru/Right	18.4	C		14.3	B	
<b>Intersection: Branch Forbes Road at US 92</b>							
Eastbound	Left	243.9	F	F	141.9	F	E
	Thru/Right	21.2	C		54.3	D	
Westbound	Left	30.1	C	F	324.1	F	F
	Thru/Right	879.7	F		548.0	F	
Northbound	Left	73.0	E	F	217.7	F	F
	Thru/Right	421.8	F		228.7	F	
Southbound	Left	716.3	F	F	1121.1	F	F
	Through	39.5	D		116.9	F	
	Right	30.4	C		26.7	C	
<b>Intersection</b>		<b>461.2</b>	<b>F</b>		<b>Intersection</b>	<b>375.5</b>	<b>F</b>

\*Per HCM 6<sup>th</sup> Edition: For TSWC intersections only minor movements delay and LOS are reported. HCM 6<sup>th</sup> Edition does not calculate LOS for major street thru movements and approaches or for the whole intersection as a whole.

\*\*No results provided, or computations not completed.

Although both ramps are expected to operate better than the 2045 No-Build Conditions, **Table 6-7** shows that the WB ramp terminal intersection will operate at LOS F with the proposed improvements. Queues at the I-4 eastbound off-ramp are reduced significantly compared to the No-Build conditions, but the ramp will operate at LOS F and E during the AM and PM peak hours,

## ALTERNATIVES CONSIDERED AND ANALYSIS

**Table 6-8: Design Year (2045) Build Intersection Vehicle Queues**

Intersection	Movement	Storage (ft)*	AM Peak Hour Queues (95 <sup>th</sup> Percentile)		PM Peak Hour Queues (95 <sup>th</sup> Percentile)	
			Veh	Feet**	Veh	Feet**
Branch Forbes Road at Harvey Tew Road	EB Left	1,000	2.5	63	4.3	108
	WB Left	85	9.0	<b>225</b>	4.5	<b>113</b>
	NB Left	330	1.2	30	0.7	18
Branch Forbes Road at I-4 WB Ramps	WB Left	1,700	24.3	608	32.3	808
	WB Right	1,000	0.0	0	0.0	0
	NB Left	260	75.6	<b>1,890</b>	35.6	<b>890</b>
	NB Thru	620	4.1	103	0.1	3
	SB Thru/Right	330	30.1	<b>753</b>	24.0	<b>600</b>
Branch Forbes Road at I-4 EB Ramps	EB Left	1,600	9.4	235	10.6	265
	EB Right	840	0.0	0	0.0	0
	NB Thru/Right	380	81.8	<b>2,045</b>	48.7	<b>1,218</b>
	SB Left	260	10.6	<b>265</b>	9.2	230
	SB Thru	620	19.6	490	26.2	<b>655</b>
Branch Forbes Road at Glen Harwell Rd/Beauchamp Rd	EB Left	1,000	***	***	***	***
	WB Left	1,000	***	***	***	***
	NB Left	1,000	0.1	3	0.3	8
	SB Left	100	0.7	18	0.7	18
Branch Forbes Road at US 92	EB Left	285	25.3	<b>633</b>	16.0	<b>400</b>
	EB Thru/Right	1,300	13.9	348	32.3	808
	WB Left	300	1.6	40	14.0	<b>350</b>
	WB Thru/Right	620	225.0	<b>5,625</b>	143.2	<b>3,580</b>
	NB Left	150	5.3	133	9.2	<b>230</b>
	NB Thru/Right	1,100	84.6	<b>2,115</b>	47.9	<b>1,198</b>
	SB Left	225	68.1	<b>1,703</b>	102.6	<b>2,565</b>
	SB Thru	650	20.3	508	45.9	<b>1,148</b>
SB Right	160	12.3	<b>308</b>	9.4	<b>235</b>	

\*For ramps, the storage was determined as the length of the ramp or as the storage lane length when provided

\*\*Queue in feet estimated by multiplying the number of vehicles times 25 ft.

\*\*\*No results provided, excessive queue for the movement

respectively. The southbound queues from the Branch Forbes Road at US 92 intersection will impact the operation of both the ramp termini intersections. Also, the northbound queues from both the I-4 westbound and eastbound ramp termini intersections are expected to impact the US 92 at Branch Forbes Road intersection during the AM peak hour.

## ALTERNATIVES CONSIDERED AND ANALYSIS

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The 2045 Build Synchro results are included in **Appendix K**.

### 6.3.3 Year of Failure Analysis

Additional analysis was conducted to determine the year the ramp terminal intersections will operate at deficient LOS. The Year of Failure Synchro files are included in **Appendix K**.

- By Year 2035, the left turn movement at the I-4 westbound off-ramp and the westbound ramp terminal intersection are expected to operate at LOS E during the AM peak hour.
- By Year 2038, the left turn movement at the I-4 westbound off-ramp is expected to operate at LOS E and the ramp terminal intersection at LOS F during the AM peak hour.
- By Year 2038, even though both ramps termini intersections are expected to operate at LOS D or better during the PM peak hour, the southbound queues from the Branch Forbes Road and US 92 intersection are expected to impact both I-4 eastbound and westbound ramp termini intersections and the ability of the vehicles to turn right or left from the off-ramps to go southbound on Branch Forbes Road.

FDOT is currently working with Hillsborough County for ultimate improvements at the I-4 at Branch Forbes Road interchange and along Branch Forbes Road from I-4 to US 92. A PD&E consultant was recently selected to conduct the PD&E study to identify the ultimate improvements.

## 6.4 Build Alternative Conceptual Signing Plan

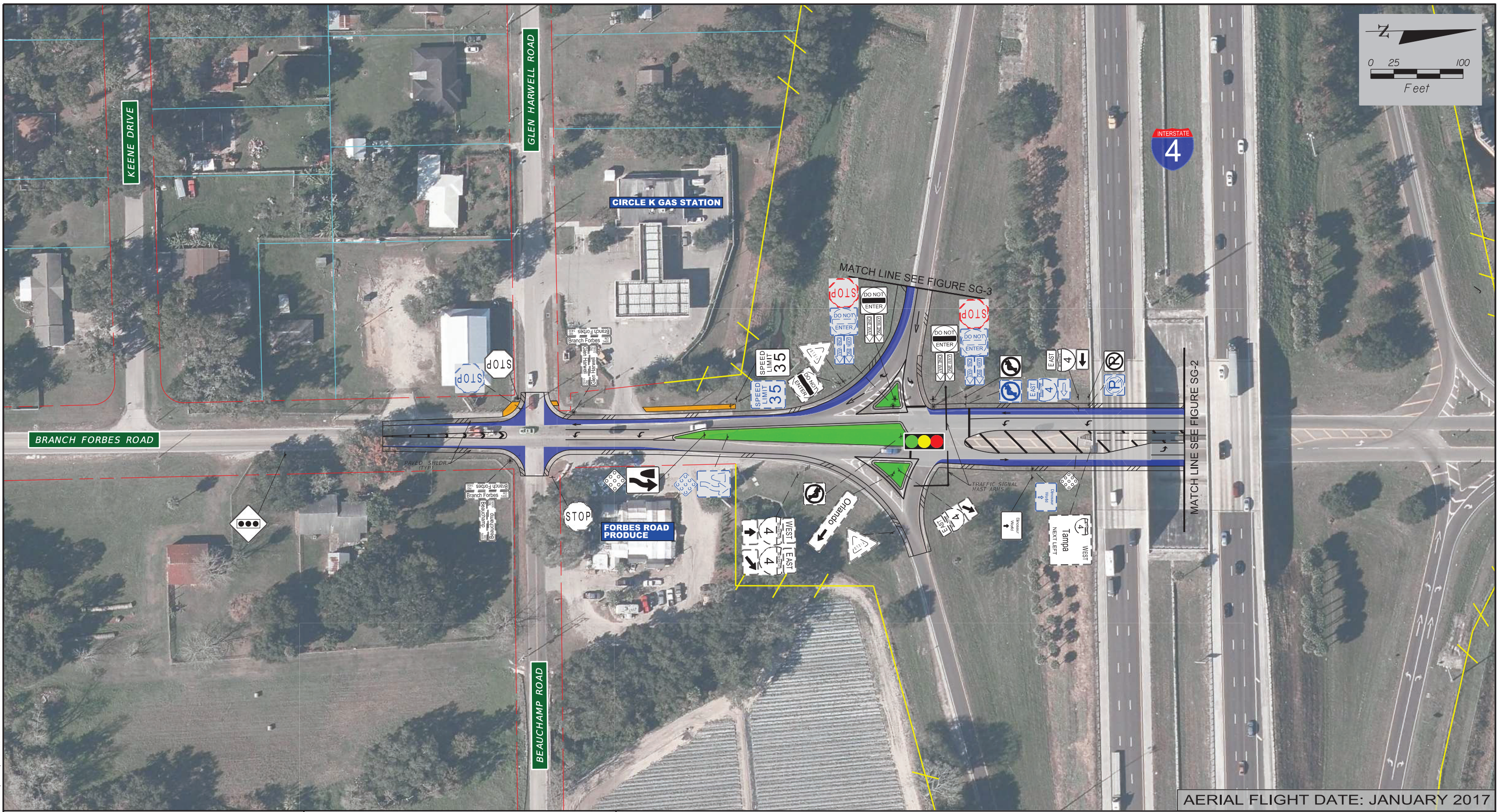
**Figures 6-2 through Figure 6-4** show the proposed signing plan for the build alternative. New signage will be required because of changes in lane configuration and the installation of the traffic signal. Relocation and updates to existing signs are also proposed.

## 6.5 Design Exceptions and Variations

Per *FDOT Design Manual*, the following design variations are anticipated with the proposed improvements:

- **Shoulder Width:** The typical roadway section would have a 10-foot shoulder with 5' paved and 5' unpaved. There are areas on Branch Forbes Road, where due to right-of-way constraints and existing roadway features, the 5' unpaved section of the shoulder may not be able to be fully constructed.
- **Clear Zone:** There are areas on Branch Forbes Road, where due to right-of-way constraints and existing roadway features, the required 14' Clear Zone criteria cannot be able to be met.





AERIAL FLIGHT DATE: JANUARY 2017

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**LEGEND**

- ROAD WIDENING
- CONCRETE SIDEWALK
- SOD - TURF
- EXISTING L/A RIGHT-OF-WAY
- EXISTING R/W
- EXISTING PARCEL LINE (GIS)
- PROPOSED TRAFFIC SIGNAL
- PROPOSED SIGN
- EXISTING SIGN TO REMAIN
- EXISTING SIGN TO BE REMOVED
- EXISTING SIGN TO BE RELOCATED

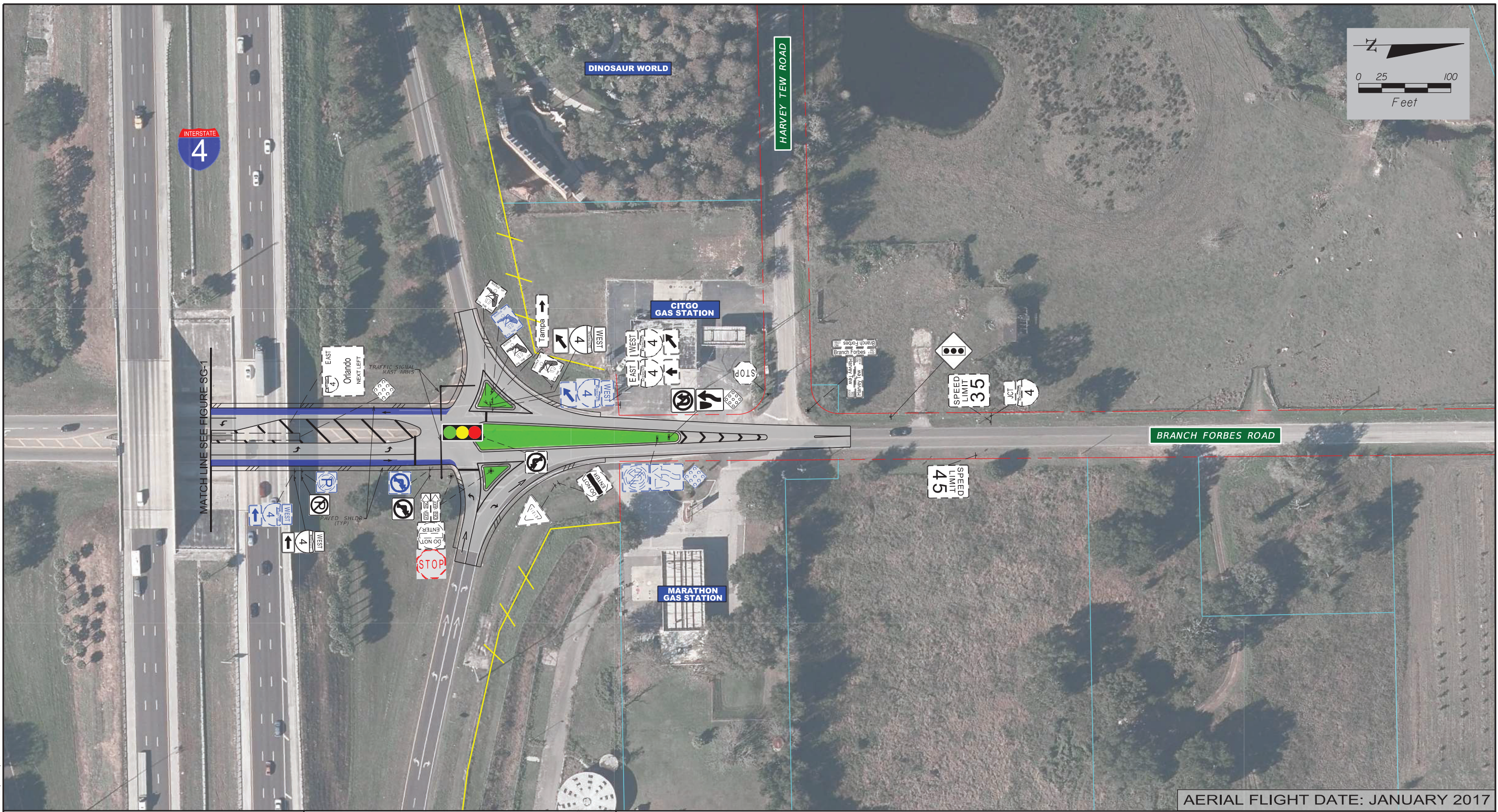


**BRANCH FORBES ROAD INTERCHANGE OPERATIONAL ANALYSIS REPORT (IOAR)**

I-4 AT BRANCH FORBES ROAD INTERCHANGE IMPROVEMENT

PROPOSED SIGNAGE CONCEPT





AERIAL FLIGHT DATE: JANUARY 2017

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**LEGEND**

- ROAD WIDENING
- CONCRETE SIDEWALK
- SOD - TURF
- EXISTING L/A RIGHT-OF-WAY
- EXISTING R/W
- EXISTING PARCEL LINE (GIS)
- PROPOSED TRAFFIC SIGNAL
- PROPOSED SIGN
- EXISTING SIGN TO REMAIN
- EXISTING SIGN TO BE REMOVED
- EXISTING SIGN TO BE RELOCATED

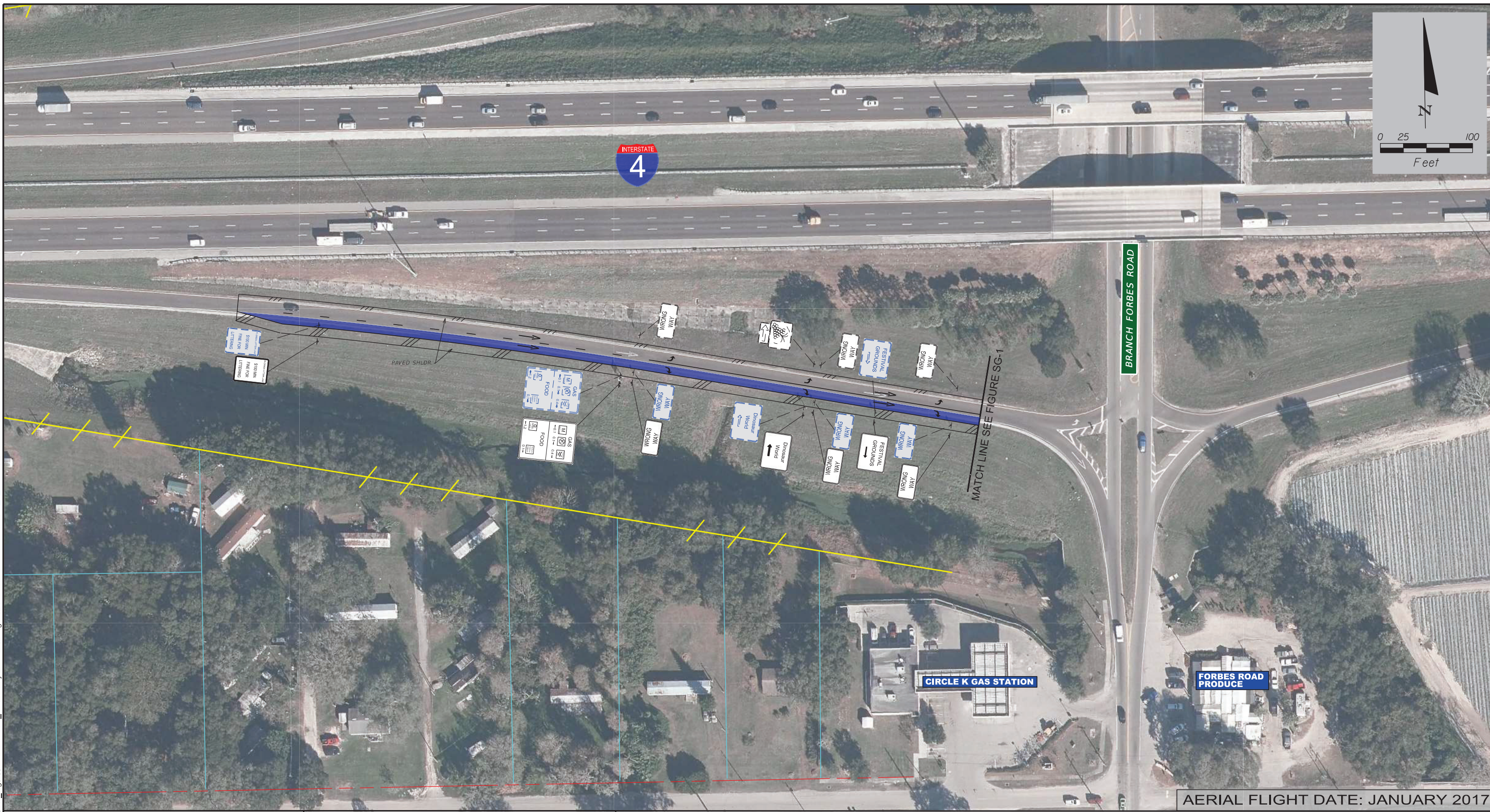


**BRANCH FORBES ROAD INTERCHANGE OPERATIONAL ANALYSIS REPORT (IOAR)**

I-4 AT BRANCH FORBES ROAD INTERCHANGE IMPROVEMENT

PROPOSED SIGNAGE CONCEPT  
 FIGURE 6-4





AERIAL FLIGHT DATE: JANUARY 2017

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**LEGEND**

- ROAD WIDENING
- CONCRETE SIDEWALK
- SOD - TURF
- EXISTING L/A RIGHT-OF-WAY
- EXISTING R/W
- EXISTING PARCEL LINE (GIS)
- PROPOSED TRAFFIC SIGNAL
- PROPOSED SIGN
- EXISTING SIGN TO REMAIN
- EXISTING SIGN TO BE REMOVED
- EXISTING SIGN TO BE RELOCATED



**BRANCH FORBES ROAD INTERCHANGE OPERATIONAL ANALYSIS REPORT (IOAR)**

I-4 AT BRANCH FORBES ROAD INTERCHANGE IMPROVEMENT

PROPOSED SIGNAGE CONCEPT

4/27/2021 USER: RodolfoForbes-SPM\_Fig6-5@DDIESW92007\_12roadway\PLANS\G03.dgn



## SAFETY ANALYSIS

### 7.0 SAFETY ANALYSIS

Crash data for the I-4 ramps was obtained from the FDOT D7 Crash Data Management System, which pulls data from the FDOT Crash Analysis Reporting (CAR) Online, and crash data for Branch Forbes Road was obtained from FDOT State Safety Office GIS (SSOGis). Crash data was provided for the available last five-year period from January 1, 2014 to December 31, 2018.

The I-4 at Branch Forbes Road interchange influence area for which crash data was analyzed includes 1.146 mile of I-4 from MP 24.160 (0.30 mile west of the I-4 eastbound off-ramp) to MP 25.306 (0.30 mile east of the I-4 westbound off-ramp) and each of the ramps. The crash data for Branch Forbes Road includes 1,000 feet south of the US 92 intersection to 1,000 feet north of the Harvey Tew Road intersection. **Table 7-1** provides a summary of the total crashes per year in the study area and the location of the crashes. **Table 7-2** provides a summary of the crash severity along I-4, the ramps, and Branch Forbes Road.

**Table 7-1: Number of Crashes (2014-2018)**

Year	Location			Total
	I-4 mainline	I-4 on/off ramps EB	Branch Forbes Road	
2014	67	9	17	93
2015	70	21	13	104
2016	79	19	12	110
2017	70	16	11	97
2018	76	15	9	100
<b>Total</b>	<b>362</b>	<b>80</b>	<b>62</b>	<b>504</b>

**Table 7-2: Crash Summary (2014-2018)**

Location	Total Number of Crashes	Number of Fatal Crashes	Number of Fatalities	Number of Injury Crashes	Number of Injuries	Number of Property Damage Only (PDO) Crashes
I-4 mainline	362	3	3	132	227	227
I-4 on/off ramps	80	0	0	23	26	57
Branch Forbes Road	62	0	0	25	37	37
<b>Total</b>	<b>504</b>	<b>3</b>	<b>3</b>	<b>180</b>	<b>290</b>	<b>321</b>

## SAFETY ANALYSIS

As shown in **Tables 7-1 and Table 7-2**, 504 crashes occurred in the I-4 at Branch Forbes Road Interchange AOI, of which three were fatal crashes and 180 were injury crashes, resulting in three fatalities and 290 injuries. 321 of crashes resulted in property damaged only (PDO). On average, the crash frequency for the I-4 at Branch Forbes Road interchange AOI is 101 crashes per year.

**Table 7-3** summarizes the types of crashes. The most predominant crash types are rear end with 270 crashes (54%), sideswipe with 63 crashes (12%), hit fixed object with 48 crashes (10%), and angle with 37 crashes (7%).

**Table 7-3: Crash Type Summary**

Type of Crash	Location			Total
	I-4 mainline	I-4 on/off-ramps	Branch Forbes Road	
Rear End	196	57	17	270
Angle	5	4	28	37
Sideswipe	56	3	4	63
Head-on	3	0	3	6
Hit Fixed Object	43	5	0	48
Hit Non-Fixed Object	14	1	0	15
Single Vehicle	31	5	0	36
Bike	0	0	0	0
Run Off Road	4	1	0	5
Pedestrian	1	0	0	1
Right Turn	0	1	0	1
Left Turn	2	3	0	5
Unknown/Other	7	0	10	17
<b>Total</b>	<b>362</b>	<b>80</b>	<b>62</b>	<b>504</b>

**Table 7-4** shows the common cause of crash is operating a motor vehicle in a careless or negligent manner with 253 crashes (50%) followed by failed to yield the right-of-way with 47 crashes (9%).

**Table 7-5** shows 351 of the crashes (70%) occurred at daylight, and **Table 7-6** shows 419 of the crashes (83%) occurred on dry pavement.

## SAFETY ANALYSIS

**Table 7-4: Cause of Crashes**

Type of Crash	Location			Total
	I-4 mainline	I-4 on/off-ramps	Branch Forbes Road	
Failed to Keep in Proper Lane	27	1	1	29
Followed too Closely	20	4	6	30
Failed to Yield Right-of-Way	9	10	28	47
No Contributing Action	40	5	3	48
Other Contributing Actions	20	1	3	24
Improper Turn	0	0	2	2
Operated MV in Careless or Negligent Manner	194	51	8	253
Drove Too Fast for Conditions	11	3	3	17
Ran off Roadway	2	0		2
Over-Correcting/Over-Steering	6	2		8
Unknown	23	3	6	32
Improper Passing	3	0	0	3
Swerved or Avoided: Due to Wind, Slippery Surface, MV, Object, Non-Motorist in Roadway, etc.	6	0	1	7
Operated MV in Erratic, Reckless or Aggressive Manner	1	0	1	2
<b>Total</b>	<b>362</b>	<b>80</b>	<b>62</b>	<b>504</b>

**Table 7-5: Lightning Conditions**

Type of Crash	Location			Total
	I-4 mainline	I-4 on/off-ramps	Branch Forbes Road	
Daylight	244	58	49	351
Dark-Lighted	50	7	2	59
Dusk	17	6	2	25
Dark-Not Lighted	29	4	9	42
Dawn	21	5	0	26
Unknown	1	0	0	1
<b>Total</b>	<b>362</b>	<b>80</b>	<b>62</b>	<b>504</b>

## SAFETY ANALYSIS

**Table 7-6: Pavement Conditions**

Type of Crash	Location			Total
	I-4 mainline	I-4 on/off-ramps	Branch Forbes Road	
Dry	298	67	54	419
Wet	64	13	8	85
<b>Total</b>	<b>362</b>	<b>80</b>	<b>62</b>	<b>504</b>

**Table 7-7** shows the economic loss of the interchange study area using the FDOT KABCO injury classification scale crash costs. The costs were taken from the *2021 FDOT Design Manual Table 122.6.2* and are included in **Appendix L**.

**Table 7-7: 2014-2018 Crash Estimated Economic Loss**

Crash Severity	Crash Cost	Number of Crashes	Economic Loss
Fatal (K)	\$10,670,000	3	\$32,010,000
Severe Injury (A)	\$872,612	16	\$13,961,792
Moderate Injury (B)	\$174,018	44	\$7,656,792
Minor Injury (C)	\$106,215	120	\$12,745,800
Property Damage Only (O)	\$7,700	321	\$2,471,700
<b>Total</b>		<b>504</b>	<b>\$68,846,084</b>

**Table 7-8** shows the intersection crash rate for the intersections in the AOI. The 2020 Annual Average Daily Traffic (AADT) volume taken during the data collection process were used to determine the crashes per million vehicles entering the intersection. The intersection crash rate for the I-4 ramp terminal intersections are less than the statewide average. Even though the number of crashes for the ramp terminal intersections is lower than the statewide average for the same type of facility, projected traffic volumes are expected to worsen the operations of the ramp terminal intersections and projected queues spillback for the off-ramp might impact the safety along I-4 mainline.

## SAFETY ANALYSIS

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**Table 7-8: Average Intersection Crash Rates (2014-2018)**

Branch Forbes Road Intersection	Number of Crashes	Crash Rate (MEV) <sup>1</sup>	Statewide Average Crash Rate
Harvey Tew Road	9	0.573	0.293
I-4 WB Ramp Terminal	35	0.862	1.507
I-4 EB Ramp Terminal	45	0.887	1.507
Glen Harwell Rd/ Beauchamp Rd	21	0.538	0.293
US 92	24	0.438	0.293

<sup>1</sup>Million entering vehicles

The Build Alternative improvements for the I-4 ramps and Branch Forbes Road intersection includes adding a traffic signal at both ramp terminals and adding an exclusive right turn lane on the eastbound off-ramp. A crash modification factor (CMF) of 0.61 was obtained from the CMF Clearinghouse. CMF ID 7848 was used on this report because it includes Florida data. The CMFs represents a reduction of 39% in total crashes at the intersections. Therefore, the improvement is expected to reduce 39% of the 73 applicable crashes (of the total of 80 crashes) that occur at the ramp terminal intersections. CMF are available for exclusive right turn lane, but those CMFs are not applicable to interchanges.

The CMFs information is included in **Appendix M**.



## **CONSISTENCY WITH OTHER PLANS/PROJECTS**

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### **8.0 CONSISTENCY WITH OTHER PLANS/PROJECTS**

The I-4 at Branch Forbes Road IOAR is consistent with the I-4 Project Development and Environment (PD&E) Study from east of 50<sup>th</sup> Street to the Polk Parkway as well as the latest adopted transportation plans.

The I-4 at Branch Forbes Road Interchange improvement is included in the Hillsborough Metropolitan Planning Organization (MPO) Five Year Cost Feasible Transportation Improvement Program (TIP) adopted on June 30, 2020 as shown in **Appendix N**.

## PROJECT FUNDING PLAN AND SCHEDULE

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### 9.0 PROJECT FUNDING PLAN AND SCHEDULE

The project is funded as a Design-Build along with other I-4 interchange improvements. Preliminary Engineering is funded for Fiscal Year (FY) 2021 and 2022 and Construction for FY 2024. The funding for project 443318-1 is shown in **Table 9-1** and included in **Appendix O**.

**Table 9-1: Project Funding for Build Alternative**

Phase	Fiscal Year					
	2021	2022	2023	2024	2025	2026
Preliminary Engineering						
<b>Amount</b>	\$1,000	\$740,422				
Construction						
<b>Amount</b>				\$2,071,471		
<b>Total</b>	\$1,000	<b>\$740,422</b>		<b>\$2,071,471</b>		

Source: FDOT Five-Year Work Program (FY 2021 to FY 2026)

## **ACCESS MANAGEMENT PLAN**

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### **10.0 ACCESS MANAGEMENT PLAN**

The access management plan within the area of influence will not change by the proposed improvements to the I-4 ramp terminal intersections.

## **ENVIRONMENTAL CONSIDERATIONS**

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### **11.0 ENVIRONMENTAL CONSIDERATIONS**

There are no anticipated environmental concerns because all improvements are within the interchange right-of-way.

## RECOMMENDATION

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### 12.0 FHWA POLICY POINTS

The following FHWA policy points were followed during this IOAR.

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

- The operational and safety analysis demonstrate that the proposed improvements identified in this IOAR will improve the safety and operation of the interchange by significantly reducing the queues for the I-4 eastbound and westbound off-ramps when compared to No-build conditions for Opening Year 2025.
- The total number of crashes at the ramp terminal intersections is expected to be reduced by 39%.
- The proposed improvements will improve the operations of the I-4 westbound and eastbound off-ramps as summarized below when compared to no-build conditions:
  - I-4 WB ramps at Branch Forbes Road:
    - Opening year: The LOS of the WB off-ramp will improve from LOS F to LOS D in both AM and PM peak hours. The vehicle queue will be reduced 55% and 52% during the AM and PM peak hour, respectively.
    - Design Year: The vehicle delay and queues will improve significantly compared to the No-Build conditions. Even though the WB off-ramps are expected to operate at LOS F in Design Year 2045, the No-build conditions don't provide results for the AM peak hour, which means the delay threshold was exceeded.

## RECOMMENDATION

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- I-4 EB Ramps at Branch Forbes Road:
  - Opening year: The LOS of the EB off-ramp will improve from LOS F to LOS D in both AM and PM peak hours. The vehicle queue will be reduced 66% and 83% during the AM and PM peak hour, respectively.
  - Design Year: The LOS of the EB off-ramp will improve from LOS F to LOS E in AM peak hour and LOS D in the PM peak hour. The vehicle queue will be reduced 91% and 92% during the AM and PM peak hour, respectively.
- The safety and operations of the interchange will also improve significantly for Design Year 2045, but other improvements are needed along Branch Forbes Road to improve the operations for the interchange and the study area. Under No-Build conditions, the operations of the intersection will continue to deteriorate, and the I-4 off-ramp queues are expected to impact the I-4 mainline. FDOT is currently working with Hillsborough County for ultimate improvements at the I-4 at Branch Forbes Road interchange and along Branch Forbes Road from I-4 to US 92. A Project Development and Environment (PD&E) consultant was recently selected to conduct a PD&E study along Branch Forbes Road to identify the ultimate improvements.
- A conceptual signing plan has been prepared for the IOAR.

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

- The proposed improvements will not alter the existing configuration of the I-4 and Branch Forbes Road interchange. The existing I-4 interchange at Branch Forbes Road provides access to public roads only. The proposed improvements at the interchange will maintain full access to Branch Forbes Road and accommodate all movements.



## RECOMMENDATION

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### 13.0 RECOMMENDATION

The purpose of this IOAR is to evaluate current traffic operations, identify operational deficiencies, and recommend operational improvements for the I-4 at Branch Forbes Road interchange.

The need for this project is to improve safety and alleviate existing traffic congestion and excessive vehicle queues at the I-4 at Branch Forbes Road eastbound and westbound off-ramp terminal intersections and the influence area.

The proposed improvements include:

- Installing traffic signals at the I-4 eastbound and westbound ramps terminal intersections.
- Adding a right turn lane at the I-4 eastbound off-ramp; and
- Extending the northbound and southbound left turns lanes on Branch Forbes Road at the ramp terminal intersections.

The operational and safety analysis demonstrate that the proposed improvements identified in this IOAR will improve the safety and operation of the interchange by significantly reducing the queues for the I-4 eastbound and westbound off-ramps when compared to No-build conditions for Opening Year 2025.

The safety and operations of the interchange will also improve significantly for Design Year 2045, even though the I-4 at Branch Forbes WB ramp terminal intersection is expected to operate at LOS F during the AM peak hour and LOS E during the PM peak hour. Under No-Build conditions, the operations of the intersection will continue to deteriorate, and the I-4 off-ramp queues are expected to impact the I-4 mainline.

Other improvements are needed along Branch Forbes Road to improve the operations for the interchange and the study area. FDOT is currently working with Hillsborough County for ultimate improvements at the I-4 at Branch Forbes Road interchange and along Branch Forbes Road from I-4 to US 92. A Project Development and Environment (PD&E) consultant was recently selected to conduct a PD&E study along Branch Forbes Road to identify the ultimate improvements.