Florida Department of Transportation Interchange Access Request

Type of request  ☒ IJR  ☐ IMR  ☒ IOAR

Type of Process  ☒ Programmatic  ☐ Non-Programmatic

I-95 at SR 524 IOAR

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

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

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

Requestor

Jim Stroz, P.E.
District Traffic Operations Engineer – FDOT District 5

Florida Department of Transportation

Alison Stettner, AICP
District Five Interchange Coordinator

2/27/19
Date

Florida Department of Transportation

Maria Overton, P.E.
Systems Implementation Office – Central Office

03/25/2019
Date

Florida Department of Transportation

Courtney Drummond, P.E.
Chief Engineer

3/28/19
Date
CERTIFICATION

BY

KITTELSON & ASSOCIATES, INC.

Financial Project ID: 405859-1-12-06

Roadway ID: 70070000

I, Adam M. Burghdoff, Florida P.E. Number 73946, have prepared and reviewed the Project Traffic for the above referenced FLORIDA DEPARTMENT OF TRANSPORTATION project. I have specifically followed the “Project Traffic Forecasting Procedure (2012)” as adopted by the Florida Department of Transportation. Based on traffic count information, general data sources, and other pertinent information, the Project Traffic analyses have been prepared using current traffic engineering, transportation planning, and Florida Department of Transportation practices and procedures.

Kittelson & Associates, Inc.
225 E. Robinson Street, Suite 355
Orlando, FL 32801

[Signature]

Date: 26/1/2019
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1. GENERAL PROJECT INFORMATION

1.1. Introduction

The Florida Department of Transportation (FDOT) District Five has prepared an Interchange Operational Analysis Report (IOAR) for proposed signalization of the intersections at the I-95 and SR 524 interchange located in Brevard County, Florida. A Methodology Letter of Understanding (MLOU) was prepared in July 2016 prior to the initiation of this study. The project location is illustrated in Figure 1.

1.2. Purpose and Need

The purpose of this project is to facilitate safety improvements and provide additional vehicle capacity at the I-95 and SR 524 interchange ramp terminals. Operations and safety will be improved by signalizing the left turns at the ramp terminals at the I-95 and SR 524 northbound and southbound ramps. Currently, the left turns are stop controlled; right turns are free-flow. Several developments in the area will be adding increased traffic to this interchange. A Flying J Truck Stop is planned at the SE quadrant of this interchange. A Wal-Mart Distribution Center is planned along SR 524 approximately 0.5 miles east of I-95. These two developments will add additional heavy truck traffic to the interchange, reducing the available capacity.

The goal of this project is to improve safety and operations at this interchange. The objectives are to add operational benefits to the I-95 off ramps to SR 524, better facilitate the movement of freight and goods, and improve safety conditions at the interchange, and the upstream I-95 mainline segments.

The gore areas at the I-95 on-ramps and off-ramps will not be impacted by this improvement. The minor proposed modifications will not impact the number of access points to I-95, existing interchange configuration, or travel patterns. As indicated in the FDOT’s Interchange Access Request User’s Guide (2015), an IOAR is required because the improvements include the following:

- Replacement of an unsignalized free-flow, right-turn lane on an off-ramp with a signalized right-turn or installation of a signal or roundabout to a stop controlled ramp terminal intersection.
- Addition of a lane (or lanes) to an existing on-ramp while maintaining existing lanes at the interstate gore point.
- Any proposal that results in the shortening of an off-ramp.
1.3. Analysis Years
Traffic operations were analyzed for the existing year (2017) and were analyzed for the following future years:

- Opening Year – 2018
- Design Year – 2038

1.4. Area of Influence
The area of influence of the study interchange is illustrated in Figure 2. For the purposes of this IOAR, the following key facilities will be evaluated:

- Freeway
  - I-95 between SR 520 and SR 524
- Ramps
  - On ramp from SR 520 to I-95 northbound
  - Off ramp from I-95 southbound to SR 520
  - Off ramp from I-95 northbound to SR 524
  - On ramp from SR 524 to I-95 northbound
  - Off ramp from I-95 southbound to SR 524
  - On ramp from SR 524 to I-95 southbound
- Arterial
  - SR 524 between Precious Boulevard and the proposed Wal-Mart Distribution Center Access Road (0.42 miles west of Cox Road)
- Intersections
  - SR 524 at Precious Boulevard
  - SR 524 at Friday Road (Western Intersection)
  - SR 524 at Southbound I-95 Ramps
  - SR 524 at Northbound I-95 Ramps
  - SR 524 at Friday Road (Eastern Intersection)
  - SR 524 at Wal-Mart Distribution Center Access Road (Future Conditions Only)

1.5. Level of Service (LOS) Criteria
The Level of Service performance criteria for each roadway classification, including mainline, ramps, ramp terminal intersections and the crossroad beyond the interchange ramp terminal intersections are identified below, consistent with the approved MLOU.

- I-95 Mainline and Ramps – LOS D
- SR 524 – Segment and Intersections – LOS D
2. DATA COLLECTION

2.1. Traffic Data

Forty-eight (48) hour vehicle volume and four-hour manual turning movement counts were collected between January 24 and January 25, 2017 on the study area roadways, intersections, and ramps. The data collection locations are illustrated in Figure 3. Raw tube count and intersection turning movement counts are included in Appendix A.

2.2. Previous Studies

The following summarizes a review of the approved developments adjacent to the study corridor including the Flying J Travel Center and Citizen Kane Developments. The general locations of the developments based upon the approved traffic impact studies (TIS) are shown in Figure 4. The locations depicted in the figure are meant to show relative locations and do not represent actual right-of-way or survey boundaries.

2.2.1. Flying J Travel Center – Cocoa Development

This development is proposed on the south side of the SR 524 at Friday Road (East) intersection as depicted in Figure 4. The development will include gas facilities for both trucks and automobiles, as well as a fast-food restaurant. The TIS evaluated a build-out condition in 2017 for the PM peak hour. The development is expected to generate 1,601 total new automobile trips and 712 new truck trips daily. Of these daily trips, 91 new automobile and 38 new truck trips are projected for the PM peak hour.

Due to the nature of the development, the study assumed truck trips were distributed with 90% of trucks coming to and from the west (I-95) and 10% to and from the east. The study evaluated the study intersection of SR 524 and Friday Road (east) as a signalized intersection. The operational analysis resulted in the addition of an eastbound right-turn lane and a westbound left-turn lane at the study intersection.

2.2.2. Citizen Kane Development and Walmart Distribution Center

The development is proposed on the south side of SR 524 approximately 0.8 miles east of I-95. The general project location is shown in Figure 4 and will include 272 acres of industrial, office, and shopping center land uses. The proposed development is a joint development between Walmart, Inc. and the Canaveral Port Authority. A Walmart distribution center is proposed in the western portion of the site (shown in dark purple on Figure 4), while the eastern portion will be comprised of mixed-use commercial and warehousing.
The TIS evaluated the impacts to the study network assuming build-out during 2018. The 2018 PM peak hour was analyzed as part of the traffic impact analysis (TIA). The proposed development access to SR 524 was evaluated as a full access signalized intersection with exclusive left and right-turn lanes serving traffic exiting the project site as well as an exclusive eastbound right-turn lane and westbound left-turn lane along SR 524. The study projected a total of 405 new trips using a new proposed signalized intersection along SR 524.
FIGURE 3B

I-95 at SR 524 Interchange Operational Analysis | Count Locations

LEGEND

4-HOUR VOLUME COUNT

0 700 1,400
North

Scale in Feet

TOWNSEND RD
ROSEWOOD DR
TUCKER LN
LINCOLN RD
A LN
COX RD
TOWNSEND RD

FIGURE 3B
3. EXISTING CONDITIONS

3.1. Existing Roadway Characteristics

Roadway segment characteristics, including: road names, area type, roadway type, FDOT access classification, number of lanes, and posted speed limit, were reviewed using Straight Line Diagrams (SLDs), field evaluations, aerial photography, and the 2015 Florida Traffic Information (FTI) DVD. Table 1 summarizes existing characteristics for the roadways in the study area.

SR 524 is classified as an urban minor arterial. SR 524 is currently a two-lane divided arterial and has a 45 mile-per-hour (mph) speed limit in the vicinity of the I-95 interchange. However, outside of the interchange area (west of Precious Boulevard and east of E Friday Road), the speed limit increases to 55 mph. West Friday Road has a 25 mph speed limit and Precious Boulevard has a 15 mph speed limit. Curb and gutter, sidewalks, and bike lanes are not provided within the study area. SR 524 has approximately 13-foot paved shoulders with a 12-foot outside lawn shoulder. Both on and off-ramps in both directions for SR 524 have five-foot paved shoulders.

The interchange is configured as a diamond interchange. The existing intersection lane configurations at each of the study intersections are illustrated in Figure 5. The specific lane configurations at each ramp terminal intersection are summarized as follows:

- Single exclusive left-turn lane onto the northbound or southbound I-95 on-ramps with additional left-turn queue storage is provided as an auxiliary through lane through the adjacent ramp terminal intersection.
- The eastbound and westbound right-turn lanes are the channelized, yield controlled bypass lanes.
- Both the northbound and southbound off-ramp approaches consist of a single lane that flares open to add a channelized right-turn lane.
Table 1: Existing Roadway Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>SR 524</th>
<th>I-95</th>
<th>NB I-95 Off-Ramp to SR 524</th>
<th>NB I-95 On-Ramp from SR 524</th>
<th>SB I-95 Off-Ramp to SR 524</th>
<th>SB I-95 On-Ramp from SR 524</th>
<th>NB I-95 On-Ramp from SR 520</th>
<th>SB I-95 Off-Ramp to SR 520</th>
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<tr>
<td>FDOT Roadway ID</td>
<td>70070000</td>
<td>70225000</td>
<td>70225074</td>
<td>70225076</td>
<td>70225075</td>
<td>70225073</td>
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<td>Location (Milepost)</td>
<td>1.266 – 2.496</td>
<td>0.186 – 1.362</td>
<td>0.000 - 0.189</td>
<td>0.000 - 0.201</td>
<td>0.000 - 0.199</td>
<td>0.000 - 0.194</td>
<td>0.000 - 0.223</td>
<td>0.000 – 0.164</td>
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<td>Functional Classification</td>
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<td>Urban Principal Arterial - Interstate</td>
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<td>Ramp</td>
<td>Ramp</td>
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<td>Speed Limit</td>
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<td>Lane Width</td>
<td>12 feet</td>
<td>12 feet</td>
<td>14 feet</td>
<td>14 feet</td>
<td>14 feet</td>
<td>14 feet</td>
<td>14 feet</td>
<td>14 feet</td>
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<tr>
<td>Shoulder Width</td>
<td>Average 13 ft paved shoulder with 12 ft outside lawn shoulder</td>
<td>10 ft outside and 12 ft inside</td>
<td>5 feet</td>
<td>5 feet</td>
<td>5 feet</td>
<td>5 feet</td>
<td>4 feet</td>
<td>4 feet</td>
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<tr>
<td>Median</td>
<td>40-foot raised median vegetation/concrete</td>
<td>26-foot with center barrier</td>
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<td>Curb and Gutter</td>
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<td>Street Lighting</td>
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<td>Present</td>
<td>Present</td>
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<td>Surrounding Land Uses</td>
<td>Low Density Commercial</td>
<td>Residential and commercial</td>
<td>Low Density Commercial</td>
<td>Low Density Commercial</td>
<td>Low Density Commercial</td>
<td>Low Density Commercial</td>
<td>Low Density Commercial</td>
<td>Low Density Commercial</td>
</tr>
</tbody>
</table>
FIGURE 5

I-95 at SR 524 Interchange Operational Analysis | Existing Lane Configurations

LEGEND

UNSIGNALIZED STUDY INTERSECTION
3.2. Existing Traffic Characteristics

The collected turning movement counts and volume counts were adjusted using a seasonal adjustment factor obtained from the 2015 FTI to estimate 2017 average turning movement volumes and Annual Average Daily Traffic (AADTs). An ACF of 0.97 was applied to volume counts along SR 524, which is the ACF reported in 2015 FTI’s Weekly Axle Category Report for SR 524. The Brevard countywide ACF of 0.99 was applied to all volume counts not located on SR 524. Seasonal factors and axle correction factors are included in Appendix B. The 2017 AADTs are summarized in Table 2. The 2017 AADTs within the study area are shown in Figure 6. The seasonally adjusted intersection turning movement volumes used in the existing conditions analysis are illustrated in Figure 7.

Table 2: Existing AADTs

<table>
<thead>
<tr>
<th>Roadway</th>
<th>ADT</th>
<th>Axle Adj. Factor</th>
<th>Seasonal Adj. Factor</th>
<th>2017 AADT</th>
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</thead>
<tbody>
<tr>
<td>SR 524, W of Precious Blvd</td>
<td>5,303</td>
<td>0.97</td>
<td>1.01</td>
<td>5,200</td>
</tr>
<tr>
<td>Precious Blvd, N of SR 524</td>
<td>977</td>
<td>0.99</td>
<td>1.01</td>
<td>980</td>
</tr>
<tr>
<td>SR 524, E of Precious Blvd</td>
<td>6,684</td>
<td>0.97</td>
<td>1.01</td>
<td>6,500</td>
</tr>
<tr>
<td>Friday Rd (West), N of SR 524</td>
<td>1,037</td>
<td>0.99</td>
<td>1.01</td>
<td>1,000</td>
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<tr>
<td>Friday Rd (West), S of SR 524</td>
<td>1,274</td>
<td>0.99</td>
<td>1.01</td>
<td>1,300</td>
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<tr>
<td>SR 524, E of Friday Rd (West)</td>
<td>9,415</td>
<td>0.97</td>
<td>1.01</td>
<td>9,200</td>
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<tr>
<td>I-95 SB Off-Ramp to SR 524</td>
<td>4,748</td>
<td>0.99</td>
<td>1.01</td>
<td>1,900</td>
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<tr>
<td>I-95 SB On-Ramp from SR 524</td>
<td>4,940</td>
<td>0.99</td>
<td>1.01</td>
<td>5,000</td>
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<td>I-95 NB Off-Ramp to SR 524</td>
<td>1,865</td>
<td>0.99</td>
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<td>I-95 NB On-Ramp from SR 524</td>
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<td>0.99</td>
<td>1.01</td>
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<td>SR 524, Between I-95 NB Off-Ramp &amp; Friday Rd (East)</td>
<td>16,201</td>
<td>0.97</td>
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<td>16,000</td>
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<td>Friday Rd (East), N of SR 524</td>
<td>3,205</td>
<td>0.99</td>
<td>1.01</td>
<td>3,200</td>
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<tr>
<td>SR 524, E of Friday Rd (East)</td>
<td>12,214</td>
<td>0.97</td>
<td>1.01</td>
<td>12,000</td>
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<td>I-95 NB On-Ramp from SR 520</td>
<td>5,269</td>
<td>0.99</td>
<td>1.01</td>
<td>5,300</td>
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<td>I-95 SB Off-Ramp to SR 520</td>
<td>1,570</td>
<td>0.99</td>
<td>1.01</td>
<td>4,900</td>
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<tr>
<td>I-95 Between SR 524 and SR 520</td>
<td>51,711</td>
<td>0.89</td>
<td>0.99</td>
<td>45,000</td>
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<td>I-95 north of SR 524</td>
<td>61,835</td>
<td>0.89</td>
<td>1.06</td>
<td>58,000</td>
</tr>
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Note: 48-hour volumes collected 1/24 – 1/25
Figure 6

North Scale in Feet

Legend

Study Intersections

AADT

<table>
<thead>
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<th>STUDY INTERSECTIONS</th>
<th>AADT</th>
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<td>X,xxx</td>
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<td>520</td>
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<td>980</td>
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<td>5,200</td>
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<tr>
<td>9,200</td>
<td>1,900</td>
</tr>
<tr>
<td>16,000</td>
<td>5,000</td>
</tr>
<tr>
<td>4,700</td>
<td>4,900</td>
</tr>
<tr>
<td>4,300</td>
<td>5,300</td>
</tr>
<tr>
<td>4,900</td>
<td>5,500</td>
</tr>
<tr>
<td>5,500</td>
<td>58,000</td>
</tr>
</tbody>
</table>
3.3. Existing Traffic Operations

The following section summarizes the existing (2017) weekday AM and PM peak hour intersection operations. Intersections were analyzed using Highway Capacity Manual (HCM) 2010 methodologies, as implemented in Synchro 9 software. Ramp merge, diverge, and weaving segments were analyzed using HCM 2010 methodologies, as implemented in Highway Capacity Software (HCS) 2010.

3.3.1. Measures of Effectiveness (MOEs)

Existing peak hour level of service, delay, volume-to-capacity (v/c) ratio, and 95th percentile queue for each movement were evaluated for each study intersection. The level of service and density (passenger cars/mile/lane) were evaluated for the ramp merges, diverges, and weaving segments.

3.3.2. Intersection Operations

The following briefly summarizes the existing peak hour intersection operational results. Detailed HCS two-way stop-controlled (TWSC) outputs are included in Appendix C. Detailed peak hour intersection operational results (LOS and delay) are provided in Figure 8.

1. Precious Boulevard Intersection
   - All movements operate under capacity (v/c ratio less than 1.0) during the peak hours.
   - The critical movement (southbound left-turn) experiences less than 13.5 seconds of delay during both peak hours.

2. Friday Road W. Intersection
   - All movements operate under capacity during the peak hours.
   - The southbound left-turn movement is the critical movement at the intersection, experiencing approximately 15.8 seconds (LOS C) and 16.9 seconds (LOS C) of delay during the AM and PM peak hours, respectively.

3. Southbound I-95 Ramps Intersection
   - All movements operate under capacity during the peak hours.
   - The southbound left-turn movement operates with a delay of 37.4 seconds (LOS E) during the AM peak hour and 45.3 seconds (LOS E) during the PM peak hour.
   - No queue spillback onto the interstate is experienced in either peak hour. The 95th percentile queues along the southbound ramp are less than 3 vehicles (approximately 75 feet) during both peak hours.

4. Northbound I-95 Ramps Intersection
   - All movements operate under capacity during both peak hours.
   - The northbound left-turn movement operates with a delay of 15.9 (LOS C) and 23.0 seconds (LOS C) during the existing AM and PM peak hours, respectively.
   - No queue spillback onto the interstate is experienced in either peak hour. The 95th percentile queues along the southbound ramp are less than 3 vehicles (approximately 75 feet) during both peak hours.
5. **Friday Road East Intersection:**
   - All movements operate under capacity during both peak hours.
   - The southbound shared left-turn/right-turn lane experiences approximately 13.9 seconds (LOS B) of delay during the AM peak hour and 18.2 seconds of delay (LOS C) during the PM peak hour.

3.3.3. **Ramp and Mainline Operations**

As described previously in Section 1.4, the I-95/SR 524 interchange ramps, the freeway segment between SR 524 and SR 520, and the northernmost ramps of the I-95/SR 520 interchange were included in the area of influence and were evaluated as part of the peak hour operational analysis. A weaving segment exists in both the northbound and southbound directions between the I-95/SR 524 and I-95/SR 520 interchanges. Therefore, the combination of the ramp merge, basic freeway segment, and ramp diverge analyses are not evaluated individually, but rather as a weaving segment. The SR 524 to northbound I-95 on-ramp and the I-95 southbound to SR 524 off-ramp were evaluated as individual ramp merge and ramp diverge analyses, respectively. The AM and PM peak hour operational results (LOS and density) are summarized in Figure 9. All analysis segments (ramps and weaving segments) operate at LOS B or better during both peak hours. Detailed analysis output reports are included in Appendix C.
FIGURE 9

North Scale in Feet

0 1,200 2,400

RED = AM
BLUE = PM

Legend

Weaving Segment

Density 10.4 (pc/mi/ln) LOS B
Density 8.9 (pc/mi/ln) LOS A
Density 5.6 (pc/mi/ln) LOS A
Density 5.9 (pc/mi/ln) LOS A

Weaving Density 12.9 (pc/mi/ln) LOS B
Weaving Density 11.1 (pc/mi/ln) LOS B
Weaving Density 8.6 (pc/mi/ln) LOS A
Weaving Density 8.8 (pc/mi/ln) LOS A
Weaving Density 8.6 (pc/mi/ln) LOS A

Density 8.6 (pc/mi/ln) LOS A
Density 8.8 (pc/mi/ln) LOS A

LOS A
LOS B

I-95 at SR 524 Interchange Operational Analysis | Existing Peak Hour Limited Access Traffic Operations

FIGURE 9
3.3.4. **Field Review Observations**

A field review was conducted on February 2, 2017 during the AM and PM peak hours. The following summarizes the operational observations made during the AM and PM peak hours:

- **AM Peak Hour**
  - Overall, little to no queueing was observed at stop controlled movements throughout the study corridor.
    - The maximum queues were observed along the northbound approach at Friday Road (West), with five, and the I-95 southbound left turn movement, with four.
  - A few “near miss” crash incidents occurred around the interchange area with left turning vehicles from the I-95 ramps and through vehicles. Some left-turn drivers were impatient and turned in front of through vehicles, forcing the through vehicle to decelerate quickly to avoid a collision.

- **PM Peak Hour**
  - More vehicle queueing was observed during the PM peak hour due to higher traffic volumes.
    - The maximum queue was observed along the I-95 southbound left-turn movement with 6 vehicles. Some vehicles waited over 30 seconds to turn left because of conflicts with through vehicles or westbound left turning vehicles.
  - Similar to the AM peak hour, “near miss” incidents occurred around the interchange area with left turning vehicles from the I-95 ramps and through vehicles.
  - A higher number of trucks were observed during the PM peak hour. A Brevard County waste management facility is located west of the study area, on Adamson Road, thus leading to waste management trucks dropping off final loads before close of business.
3.4. Historical Crash Analysis

Crash records were obtained for SR 524 within the study limits for the most recent five-year period on record (2011 through 2015) from the FDOT Crash Analysis Reporting System (CARS). Raw CARS data are provided in Appendix D. The crash data was reviewed by mileposts utilizing the Department’s straight line diagram (also included in Appendix D). Crash data was then summarized for each of the three unsignalized intersections within the area of influence and the two unsignalized interchange ramp terminals. The following summarizes the crash frequency and severity at each of the study locations:

- SR 524 corridor from Precious Boulevard to West of Cox Road
  - 37 total crashes – 18 injury and 19 property damage only (PDO)
- SR 524 at Precious Boulevard
  - 1 injury crash
- SR 524 at Friday Road (West)
  - 0 crashes
- SR 524 at I-95 Southbound Ramps
  - 9 total crashes – 6 injury and 3 PDO
- SR 524 at I-95 Northbound Ramps
  - 10 total crashes – 3 injury and 7 PDO
- SR 524 at Friday Road (East)
  - 13 total crashes – 6 injury and 7 PDO

The intersections in bold are discussed in more detail within the following subsections.

3.4.1. SR 524 at I-95 Southbound Ramps

Nine (9) crashes were reported at the SR 524 at I-95 southbound ramps over the five-year crash analysis period (2011-2015). Of the nine crashes, six crashes (67 percent) were injury related and three crashes (33 percent) resulted in PDO. No fatal crashes were reported during the crash analysis period at this location. Figure 10 illustrates the yearly crashes by severity at the intersection while Figure 11 displays the crash types by severity. Other crash metrics at this intersection include:

- Left turn crashes were the most common crash type with 2 of the 9 crashes (22 percent);
- Four of the reported crashes (44 percent) occurred during daylight conditions;
- Four of the crashes (44 percent) occurred with drivers under the age of 25; and
- Eighty-eight (88) percent of the crashes (8 crashes) occurred under dry roadway surface conditions.
Figure 10: Crashes by Year and Severity – SR 524 at I-95 Southbound Ramps

Figure 11: Crashes by Type and Severity – SR 524 at I-95 Southbound Ramps
3.4.2. SR 524 at I-95 Northbound Ramps

Ten (10) crashes were reported at the SR 524 at I-95 northbound ramps over the five-year crash analysis period (2011-2015). Of the 10 crashes, three crashes (30 percent) were injury related and seven crashes (70 percent) resulted in PDO. No fatal crashes were reported during the crash analysis period at this location. Figure 12 illustrates the yearly crashes by severity at the intersection while Figure 13 displays the crash types by severity. Other crash metrics at this intersection include:

- Angle and fixed object/run-off road crashes were the highest crash types with each experiencing three crashes;
- A majority of the reported crashes occurred during daylight conditions (8 crashes – 80 percent); and
- All 10 crashes (100 percent) occurred under dry roadway surface conditions.

![Crashes by Year and Severity](image-url)

Figure 12: Crashes by Year and Severity – SR 524 at I-95 Northbound Ramps
3.4.3. **SR 524 at Friday Road (East)**

Thirteen (13) crashes were reported at SR 524 at Friday Road (East) over the five-year crash analysis period (2011-2015). Of the 13 crashes, six crashes (46 percent) were injury related and seven crashes (54 percent) resulted in PDO. No fatal crashes were reported during the crash analysis period at this location. **Figure 14** illustrates the yearly crashes by severity at the intersection while **Figure 15** displays the crash types by severity. Other crash metrics at this intersection include:

- Rear end, angle, and left turn crashes were the three most common crash types, each experiencing two crashes;
- Thirty-one percent of the crashes occurred in non-daylight conditions;
- Ninety-two (92) percent of the crashes (12 crashes) occurred under dry roadway surface conditions; and
- Alcohol was a factor in 15 percent of the crashes (2 crashes), both of which resulted in PDO.
I-95 at SR 524 IOAR

Figure 14: Crashes by Year and Severity – SR 524 at Friday Road (East)

Figure 15: Crashes by Type and Severity – SR 524 at Friday Road (East)
3.5. Future Safety Performance

As described in Section 3.1, the existing I-95 ramp terminal intersections are stop-controlled along the off-ramps. Under this traffic control, eastbound and westbound left-turning vehicles from SR 524 must yield to two lanes of opposing traffic (one through and one auxiliary through lane) prior to traveling to the northbound or southbound I-95 on-ramps. Vehicles making left-turns from the off-ramps onto SR 524 must also yield to two directions of traffic. These conflict types can result in left-turn and angle crashes, which are generally more severe crashes.

Signalization is proposed at both intersections. Signalization will reduce the potential of drivers selecting inadequate gaps in traffic resulting in angle/left-turn crashes. A signal is expected to reduce the potential for injury/fatal crashes when compared to the existing traffic control conditions. Signalization may increase the potential for rear end crashes along SR 524 as through vehicles currently do not stop; however, these types of crashes are generally less severe. Based on the operational analysis to be discussed later in this document, the signalization improvements are not expected to have an adverse impact to the safety of the interstate system within the interchange influence area.
4. TRAVEL DEMAND MODEL ASSUMPTIONS

4.1. Travel Demand Model

The Central Florida Regional Planning Model (CFRPM) version 6.1 is FDOT’s current adopted regional planning model for Brevard County. It reflects transportation improvements identified within the Space Coast Transportation Planning Organization (SCTPO) Long Range Transportation Plan. A subarea of the CFRPM version 6.1, with a base year of 2010 and horizon year of 2040, was validated to FSUTMS standards to aid in forecasting future traffic volumes in the area. The subarea and cutlines are illustrated in Figure 16.

![Figure 16: Subarea and Cutlines](image)
4.2. **Existing Land Use and Roadway Network**

The validation process included a review of socioeconomic (land use) and transportation network data (number of lanes, speeds, facility types, and area types) within the subarea. The model’s transportation network was adjusted, where needed, to reflect 2010 conditions including speeds, number of lanes, facility type, and area type. All modifications from the validation effort are summarized and included within Section 5 of this IOAR.

5. **SUBAREA MODEL DEVELOPMENT**

5.1. **Base Year Subarea Model Development**

Model validation is usually performed when a higher accuracy in volume forecasts is desired. Model validation generally involves the adjustment of the roadway network and land use characteristics to obtain model volume outputs close to existing traffic counts at key locations. Daily volumes were obtained from the CFRPM model; however, these volumes in CFRPM 6.1 represent peak season weekday average daily traffic (PSWADT). The PSWADT were converted to AADT by applying a 0.93 model output conversion factor (MOCF) adjustment. Comparison was then made between the factored model AADT volumes and 2010 AADT counts to verify the subarea model estimation. The validation procedures are detailed as follows:

1. A subarea model was created from the original CFRPM 6.1 model. Cutlines were selected to intersect with the surrounding major roadways and are shown in **Figure 16**. The subarea model boundaries were selected to include the entire study corridor as well as major land uses and roadways within and surrounding the study area.

2. Year 2010 AADT counts were obtained within the subarea model boundary from the FTI and from the SCTPO.

3. Based on the FTI DVD, the 2010 MOCF is 0.93 for Brevard County.

   a. PSWADT was converted to model AADT volumes by applying the 0.93 MOCF.

4. The differences between the 2010 model AADT volumes and the 2010 AADT counts were evaluated and addressed by further modifications to create a proper representation of traffic patterns. Modifications were made to the roadway network and land use characteristics which included centroid connectors, facility types, roadway posted speeds, link penalties, and turning penalties. An iterative approach was taken for these modifications. **Figure 17** through **Figure 21** display the validation changes to the model.
Figure 17: TAZ Centroid Changes

1. Move TAZ 3068 centroid connectors to west
2. Delete TAZ 3044 south centroid connectors, move centroid to east
3. Delete TAZ 3045 south centroid connectors, move centroid to west
4. Move TAZ 3048 to east
5. Delete TAZ 3047 north centroid connectors
6. Move TAZ 3056 centroid connectors to north
7. Delete TAZ 3040 south centroid connectors
8. Delete TAZ 3055 east and south centroid Connectors
1. Split TAZ 3043 to be two TAZs 3043 and 3601, household goes to 3043, employment goes to 3601.
2. Split TAZ 3037 to be two TAZs 3037 and 3602, household goes to 3037, employment goes to 3602.
3. Move all employment from TAZ 3035 to TAZ 3000.
4. Split TAZ 3063 to be two TAZs 3063 and 3603, household goes to 3063, employment goes to 3603.
5. Split TAZ 3062 to be two TAZs 3062 and 3604, household goes to 3062, employment goes to 3604.
6. Split TAZ 3054 to be two TAZs 3054 and 3605, household goes to 3054, employment goes to 3605.
7. Split TAZ 3056 to be three TAZs 3606 and 3607, household goes to 3056, employment goes to 3606, school goes to 3607.
8. Split TAZ 3054 to be two TAZs 3054 and 3608, 50% Household goes to 3054, 50% Household goes to 3608.
1. SR 501 between SR 520 and Michigan Ave facility type change from 23 to 26.

Figure 19: Facility Type Changes
Figure 20: Posted Speed Limit Changes
Figure 21: Link Penalty Changes
5. Traffic Analysis Zone (TAZ) centroid connectors were added, deleted, or moved based on loading patterns determined from the ESRI World Street background base map. Some TAZ nodes or centroid connectors were moved to more accurately reflect the distribution of development. Several TAZs were split into two or more TAZs to better represent locations of population and employment land use developments. The facility types on the major roads were refined based on the roadway characteristics. The posted speed on major roads was increased or decreased within 10 miles per hour (mph) to reflect the realistic relative importance of the roadways chosen by travelers. Existing number of lanes were assessed for all roads in the study area for correctness.

6. Percent root mean square error (RMSE) was calculated and compared with the standards outlined in Figure 3.3 of the 2014 FDOT Project Traffic Forecasting Handbook and Table 2-11 of the FSUTMS-Cube Model Calibration and Validation Standards. Within the study area, 25 traffic count locations were used to calculate the RMSE. Table 3 summarizes the RMSE calculations and FSUTMS-Cube Model Calibration and Validation Standards for the entire subarea from the original CFRPM model.

7. Table 4 summarizes the RMSE calculations and FSUTMS-Cube Model Calibration and Validation Standards for the entire subarea from the validated CFRPM model. The validated CFRPM model has improvements for some groups, and the total RMSE is 16.6 percent from the validated CFRPM subarea model which exceeds FSUTMS preferable standards of 35 percent.

Table 3 summarizes the RMSE values in the original CFRPM 6.1 model. Group 3 (volume range of 10,000 – 14,999) does not meet the acceptable FSUTMS standard. Table 4 summarizes the RMSE values for the validated model. The results show the overall subarea percent RMSE values are better than the acceptable standards for all volume groups. The validated model cutline volume-to-count ratios are within the cutline validation thresholds. For these reasons, the validated CFRPM subarea model meets the FSUTMS standards and is expected to provide a reasonable future traffic projection.

Table 3: Root Mean Square Error (RMSE) Comparison with FDOT Standards from Original Model

<table>
<thead>
<tr>
<th>Group</th>
<th>Volume Range</th>
<th>Number of Observations</th>
<th>% RMSE</th>
<th>FSUTMS Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Less than 5,000</td>
<td>7</td>
<td>30.6%</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>5,000 ~ 9,999</td>
<td>2</td>
<td>35.1%</td>
<td>45%</td>
</tr>
<tr>
<td>3</td>
<td>10,000 ~ 14,999</td>
<td>3</td>
<td>43.3%</td>
<td>35%</td>
</tr>
<tr>
<td>4</td>
<td>15,000 ~ 19,999</td>
<td>2</td>
<td>12.4%</td>
<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>20,000 ~ 29,999</td>
<td>3</td>
<td>26.1%</td>
<td>27%</td>
</tr>
<tr>
<td>6</td>
<td>30,000 ~ 49,999</td>
<td>5</td>
<td>14.1%</td>
<td>25%</td>
</tr>
<tr>
<td>7,8</td>
<td>50,000 ~ 80,000</td>
<td>3</td>
<td>11.0%</td>
<td>19%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25</td>
<td>17.4%</td>
<td>45%</td>
</tr>
</tbody>
</table>
Table 4: Root Mean Square Error (RMSE) Comparison with FDOT Standards from Validated Model

<table>
<thead>
<tr>
<th>Group</th>
<th>Volume Range</th>
<th>Number of Observations</th>
<th>% RMSE</th>
<th>FSUTMS Standards Acceptable</th>
<th>Preferable</th>
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<tr>
<td>1</td>
<td>Less than 5,000</td>
<td>7</td>
<td>23.1%</td>
<td>100%</td>
<td>45%</td>
</tr>
<tr>
<td>2</td>
<td>5,000 ~ 9,999</td>
<td>2</td>
<td>43.6%</td>
<td>45%</td>
<td>35%</td>
</tr>
<tr>
<td>3</td>
<td>10,000 ~ 14,999</td>
<td>3</td>
<td>25.0%</td>
<td>35%</td>
<td>27%</td>
</tr>
<tr>
<td>4</td>
<td>15,000 ~ 19,999</td>
<td>2</td>
<td>23.6%</td>
<td>30%</td>
<td>25%</td>
</tr>
<tr>
<td>5</td>
<td>20,000 ~ 29,999</td>
<td>3</td>
<td>22.1%</td>
<td>27%</td>
<td>15%</td>
</tr>
<tr>
<td>6</td>
<td>30,000 ~ 49,999</td>
<td>5</td>
<td>13.4%</td>
<td>25%</td>
<td>15%</td>
</tr>
<tr>
<td>7,8</td>
<td>50,000 ~ 80,000</td>
<td>3</td>
<td>12.2%</td>
<td>19%</td>
<td>10%</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>16.6%</strong></td>
<td><strong>45%</strong></td>
<td><strong>35%</strong></td>
</tr>
</tbody>
</table>

Table 5 summarizes the subarea cutline volume-to-count ratios. Three cutlines (1-3) had AADTs greater than 70,000; therefore, the validation threshold is plus or minus 10 percent. Cutline number four had an AADT between 35,000 and 70,000 and therefore its validation threshold is plus or minus 15 percent. The cutline volume-to-count ratios are within all validation thresholds at all four cutlines.

Table 5: Subarea Cutline Volume-to-Count Ratios

<table>
<thead>
<tr>
<th>Validation Check</th>
<th>Validation Thresholds¹</th>
<th>Cutline No.</th>
<th>Roadways</th>
<th>Original Model Volume-to-Count Ratio</th>
<th>Validated Model Volume-to-Count Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume-to-Count Ratios at Cutlines 1 through 4</td>
<td>+/- 10% (&gt;70,000 AADT)</td>
<td>1</td>
<td>I-95 Grissom Pkwy US 1</td>
<td>0%</td>
<td>-6%</td>
</tr>
<tr>
<td></td>
<td>+/- 10% (&gt;70,000 AADT)</td>
<td>2</td>
<td>SR 520 SR 528</td>
<td>-7%</td>
<td>-7%</td>
</tr>
<tr>
<td></td>
<td>+/- 10% (&gt;70,000 AADT)</td>
<td>3</td>
<td>I-95 SR 519/Fiske Blvd. US 1</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>+/- 15% (between 35,000 and 70,000 AADT)</td>
<td>4</td>
<td>SR 520 SR 528</td>
<td>2%</td>
<td>-1%</td>
</tr>
<tr>
<td><strong>Average Volume-to-Count Ratio</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>-3%</strong></td>
</tr>
</tbody>
</table>

| SR 524 Study Corridor | 45%-100% (<10,000 VPD)² | 35.7% |

¹ Source: FDOT Project Traffic Forecasting handbook, Table on page 3-66
² Source: FDOT Project Traffic Forecasting handbook, Figure 3.3

A review of the base year (2010) FDOT and TPO counts was completed against the original base year model volumes and the validated base year model volumes. The results of this comparison are summarized in Table 6. The base year model volumes are generally closer to the actual 2010 counts than the original CFRPM 6.1 model volumes.
### Table 6: Subarea Validation Results for Counts

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I-95 &amp; SR 524 Interchange</td>
<td>I-95 Northbound off-Ramp to SR 524</td>
<td>3,500</td>
<td>4,110</td>
<td>4,330</td>
<td>17%</td>
<td>24%</td>
</tr>
<tr>
<td>I-95 &amp; SR 524 Interchange</td>
<td>I-95 Northbound On-Ramp from SR 524</td>
<td>1,300</td>
<td>2,140</td>
<td>1,990</td>
<td>65%</td>
<td>53%</td>
</tr>
<tr>
<td>I-95 &amp; SR 524 Interchange</td>
<td>I-95 Southbound Off-Ramp to SR 524</td>
<td>1,500</td>
<td>2,390</td>
<td>2,080</td>
<td>59%</td>
<td>39%</td>
</tr>
<tr>
<td>I-95 &amp; SR 524 Interchange</td>
<td>I-95 Southbound On-Ramp from SR 524</td>
<td>4,500</td>
<td>4,060</td>
<td>4,220</td>
<td>-10%</td>
<td>-6%</td>
</tr>
<tr>
<td>I-95</td>
<td>N of SR 528</td>
<td>49,000</td>
<td>52,750</td>
<td>48,400</td>
<td>8%</td>
<td>-1%</td>
</tr>
<tr>
<td>I-95</td>
<td>N of SR 524</td>
<td>54,500</td>
<td>50,740</td>
<td>49,770</td>
<td>-7%</td>
<td>-9%</td>
</tr>
<tr>
<td>I-95</td>
<td>N of SR 520</td>
<td>61,400</td>
<td>54,390</td>
<td>54,250</td>
<td>-11%</td>
<td>-12%</td>
</tr>
<tr>
<td>I-95</td>
<td>S of SR 520</td>
<td>63,609</td>
<td>58,780</td>
<td>57,790</td>
<td>-8%</td>
<td>-9%</td>
</tr>
<tr>
<td>I-95 &amp; SR 520 Interchange</td>
<td>I-95 Northbound Off-Ramp to SR 520</td>
<td>8,800</td>
<td>6,860</td>
<td>6,290</td>
<td>-22%</td>
<td>-29%</td>
</tr>
<tr>
<td>I-95 &amp; SR 520 Interchange</td>
<td>I-95 Northbound On-Ramp to SR 520</td>
<td>4,200</td>
<td>4,330</td>
<td>4,290</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>I-95 &amp; SR 520 Interchange</td>
<td>I-95 Southbound Off-Ramp to SR 520</td>
<td>4,000</td>
<td>4,930</td>
<td>4,760</td>
<td>23%</td>
<td>19%</td>
</tr>
<tr>
<td>I-95 &amp; SR 520 Interchange</td>
<td>I-95 Southbound On-Ramp to SR 520</td>
<td>9,300</td>
<td>6,790</td>
<td>6,260</td>
<td>-27%</td>
<td>-33%</td>
</tr>
<tr>
<td>SR 524</td>
<td>E of Adamson Rd</td>
<td>4,600</td>
<td>6,460</td>
<td>5,820</td>
<td>40%</td>
<td>27%</td>
</tr>
<tr>
<td>SR 524</td>
<td>E of Friday Rd</td>
<td>10,400</td>
<td>6,570</td>
<td>7,450</td>
<td>-37%</td>
<td>-28%</td>
</tr>
<tr>
<td>SR 520</td>
<td>W of SR 524</td>
<td>14,600</td>
<td>19,200</td>
<td>15,040</td>
<td>32%</td>
<td>3%</td>
</tr>
<tr>
<td>SR 520</td>
<td>W of I-95</td>
<td>18,800</td>
<td>18,210</td>
<td>15,150</td>
<td>-3%</td>
<td>-19%</td>
</tr>
<tr>
<td>SR 520</td>
<td>E of Cox Rd</td>
<td>19,900</td>
<td>17,580</td>
<td>17,140</td>
<td>-12%</td>
<td>-14%</td>
</tr>
<tr>
<td>SR 520</td>
<td>Hubert Humphrey Causeway</td>
<td>44,135</td>
<td>43,690</td>
<td>43,120</td>
<td>-1%</td>
<td>-2%</td>
</tr>
<tr>
<td>SR 528</td>
<td>Causeway</td>
<td>49,500</td>
<td>43,550</td>
<td>43,900</td>
<td>-12%</td>
<td>-11%</td>
</tr>
<tr>
<td>SR 528</td>
<td>E of I-95</td>
<td>22,700</td>
<td>22,780</td>
<td>23,040</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>SR 528</td>
<td>W of I-95</td>
<td>27,500</td>
<td>23,860</td>
<td>26,790</td>
<td>-13%</td>
<td>-3%</td>
</tr>
<tr>
<td>US 1</td>
<td>N of SR 528</td>
<td>31,000</td>
<td>27,450</td>
<td>27,070</td>
<td>-11%</td>
<td>-13%</td>
</tr>
<tr>
<td>US 1</td>
<td>N of Barton Blvd</td>
<td>33,500</td>
<td>42,160</td>
<td>42,200</td>
<td>26%</td>
<td>26%</td>
</tr>
<tr>
<td>SR 519/Fiske Blvd.</td>
<td>N of Barton Blvd</td>
<td>27,910</td>
<td>19,020</td>
<td>19,810</td>
<td>-32%</td>
<td>-29%</td>
</tr>
<tr>
<td>Grissom Pkwy.</td>
<td>S of Canaveral Groves Blvd</td>
<td>11,060</td>
<td>6,770</td>
<td>8,030</td>
<td>-39%</td>
<td>-27%</td>
</tr>
</tbody>
</table>
5.2. Future Year Subarea Model Development

For the future year model analysis the TAZ structure and roadway network of the 2040 CFRPM 6.1 base model were modified to be consistent with changes of the 2010 base year validated model structure previously described.

5.2.1. Roadway Network Assumptions

The 2040 CFRPM 6.1 model roadway network was used in the model analysis. The changes of the 2010 base year validated model structure previously described were applied to the 2040 CFRPM 6.1 network.

5.2.2. Land Use and Walmart and Flying J Developments

The 2040 CFRPM 6.1 land use data was updated to be consistent with the latest SCTPO socio-economic (SC) data and comments from the City of Cocoa. The TIA reports for Walmart and Flying J were obtained from City of Cocoa. Based on the TIA documents, the approved land use developments for Walmart and Flying J were added to the 2040 CFRPM 6.1 subarea model.
6. FUTURE TRAFFIC DEVELOPMENT

6.1. Recommended Design Traffic Factors

A Methodology Letter of Understanding (MLOU) was prepared in July 2016 prior to the initiation of this study. The MLOU defined design traffic factors based on a review of historical data presented in the 2015 FTI DVD. The defined factors from the MLOU are summarized in Table 7. The MLOU is included in Appendix E.

<table>
<thead>
<tr>
<th>Roadway</th>
<th>K</th>
<th>D</th>
<th>T24</th>
<th>DHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-95</td>
<td>0.09</td>
<td>53.6</td>
<td>16.7</td>
<td>8.4</td>
</tr>
<tr>
<td>SR 524</td>
<td>0.09</td>
<td>55.7</td>
<td>8.7</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Table 7: Recommended K, D, T24, and DHT Values

This study utilized the design traffic factors defined in the MLOU and summarized in Table 7. These traffic factors fall within the recommended ranges identified in the Project Traffic Forecasting Handbook and Procedure (525-030-120).

6.2. Traffic Forecasting

An annual growth rate was selected for each roadway segment based upon comparison of historical volume trends, projected area-wide growth trends from the University of Florida’s Bureau of Economic and Business Research (BEBR), and model growth rates.

6.2.1. Historic Growth Rates

Historic growth rates were evaluated using FDOT standard spreadsheets for linear trend analysis. Evaluations were conducted for seven FDOT count locations within the study area. This spreadsheet was used to summarize the trend analyses from 2000 to 2015. Table 8 shows a summary of the historical data along with the current 2017 AADT for purposes of comparison.

The historical growth rates at each count station location along with their respective R^2 values are also summarized in Table 8. The linear historical growth rates along the four I-95 ramps ranged between -1.33 and +1.88 percent. Historic trends analyses for each count station location are provided in Appendix F. Generally, only growth rates with an R^2 value greater than or equal to 75 percent should be considered when determining growth factors with historical trends.
Table 8: Summary of Historic Growth Rates within the Study Area

<table>
<thead>
<tr>
<th>Year</th>
<th>SR 524, E of Friday Rd</th>
<th>SR 524, W of Precious Blvd</th>
<th>I-95 SB Off Ramp to SR 520</th>
<th>I-95 NB Off Ramp to SR 524</th>
<th>I-95 NB On Ramp from SR 524</th>
<th>I-95 SB Off Ramp from SR 524</th>
<th>I-95 SB On Ramp from SR 524</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FDOT Site 70-0411</td>
<td>FDOT Site 70-0425</td>
<td>FDOT Site 70-2026</td>
<td>FDOT Site 70-2028</td>
<td>FDOT Site 70-2029</td>
<td>FDOT Site 70-2030</td>
<td>FDOT Site 70-2031</td>
</tr>
<tr>
<td>2017</td>
<td>12,000</td>
<td>5,200</td>
<td>4,900</td>
<td>4,700</td>
<td>1,600</td>
<td>1,900</td>
<td>5,000</td>
</tr>
<tr>
<td>2015</td>
<td>10,700</td>
<td>4,800</td>
<td>4,700</td>
<td>4,200</td>
<td>1,400</td>
<td>1,700</td>
<td>4,500</td>
</tr>
<tr>
<td>2014</td>
<td>10,200</td>
<td>4,500</td>
<td>4,400</td>
<td>3,900</td>
<td>1,400</td>
<td>1,600</td>
<td>4,000</td>
</tr>
<tr>
<td>2013</td>
<td>10,100</td>
<td>4,700</td>
<td>4,000</td>
<td>3,300</td>
<td>1,300</td>
<td>1,600</td>
<td>3,800</td>
</tr>
<tr>
<td>2012</td>
<td>9,700</td>
<td>4,500</td>
<td>4,400</td>
<td>3,600</td>
<td>1,400</td>
<td>1,600</td>
<td>4,000</td>
</tr>
<tr>
<td>2011</td>
<td>9,900</td>
<td>4,200</td>
<td>4,000</td>
<td>3,400</td>
<td>1,400</td>
<td>1,600</td>
<td>3,500</td>
</tr>
<tr>
<td>2010</td>
<td>10,400</td>
<td>4,600</td>
<td>4,000</td>
<td>3,500</td>
<td>1,300</td>
<td>1,500</td>
<td>4,500</td>
</tr>
<tr>
<td>2009</td>
<td>10,600</td>
<td>5,600</td>
<td>4,000</td>
<td>3,500</td>
<td>1,300</td>
<td>1,600</td>
<td>3,500</td>
</tr>
<tr>
<td>2008</td>
<td>9,600</td>
<td>6,500</td>
<td>-</td>
<td>3,700</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007</td>
<td>10,700</td>
<td>4,200</td>
<td>4,100</td>
<td>3,200</td>
<td>1,500</td>
<td>1,800</td>
<td>3,400</td>
</tr>
<tr>
<td>2006</td>
<td>11,200</td>
<td>6,500</td>
<td>5,000</td>
<td>3,700</td>
<td>1,600</td>
<td>1,900</td>
<td>3,600</td>
</tr>
<tr>
<td>2005</td>
<td>12,300</td>
<td>6,100</td>
<td>4,900</td>
<td>3,600</td>
<td>1,600</td>
<td>2,100</td>
<td>3,700</td>
</tr>
<tr>
<td>2004</td>
<td>10,900</td>
<td>5,000</td>
<td>4,700</td>
<td>3,400</td>
<td>1,700</td>
<td>2,200</td>
<td>3,600</td>
</tr>
<tr>
<td>2003</td>
<td>10,600</td>
<td>4,800</td>
<td>3,500</td>
<td>4,000</td>
<td>1,700</td>
<td>2,100</td>
<td>3,800</td>
</tr>
<tr>
<td>2002</td>
<td>10,900</td>
<td>4,000</td>
<td>4,000</td>
<td>3,200</td>
<td>1,300</td>
<td>1,700</td>
<td>3,300</td>
</tr>
<tr>
<td>2001</td>
<td>9,400</td>
<td>3,700</td>
<td>3,900</td>
<td>3,200</td>
<td>1,400</td>
<td>1,900</td>
<td>3,300</td>
</tr>
<tr>
<td>2000</td>
<td>8,600</td>
<td>3,400</td>
<td>4,100</td>
<td>2,900</td>
<td>1,300</td>
<td>1,700</td>
<td>3,100</td>
</tr>
<tr>
<td>Annual Linear Growth Rate</td>
<td>0.06%</td>
<td>0.72%</td>
<td>0.49%</td>
<td>1.25%</td>
<td>-0.44%</td>
<td>-1.33%</td>
<td>1.88%</td>
</tr>
<tr>
<td>R²</td>
<td>0.21%</td>
<td>2.99%</td>
<td>3.69%</td>
<td>28.39%</td>
<td>8.31%</td>
<td>34.16%</td>
<td>50.48%</td>
</tr>
</tbody>
</table>

6.2.2. CFRPM v6.1 Growth Rates

The most current version of the CFRPM 6.1 with base year 2010 and forecast year 2040 was utilized to estimate volume growth. A sub-area validation was completed as part of this task work order as previously described in Sections 4 and 5. The model growth rates along the segments within the area of influence are summarized in Table 9. Base year and horizon year model plots are included in Appendix G.

As summarized in Table 9, the average linear model growth rate along SR 524 ranged from 4.91 and 5.67 percent. Some of the minor streets had low model volumes during the base year which resulted in some larger growth rates. Linear growth rates at the four I-95/SR 524 ramps ranged between 3.5 and 4.5 percent. The model indicated a decline in traffic at the I-95/SR 520 ramps. A model growth rate of 1.25 percent to 1.37 percent was estimated along I-95 to the north and south of SR 524.
Table 9: CFRPM v6.1 Model Growth Rates

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>2010 Base Year AADT</th>
<th>2040 Forecast Year AADT</th>
<th>Annual Volume Growth</th>
<th>Annual Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 524, W of Precious Blvd</td>
<td>5,820</td>
<td>15,720</td>
<td>330</td>
<td>5.67%</td>
</tr>
<tr>
<td>Precious Blvd, N of SR 524</td>
<td>110</td>
<td>1,500</td>
<td>46</td>
<td>41.82%</td>
</tr>
<tr>
<td>SR 524, E of Precious Blvd</td>
<td>7,360</td>
<td>19,120</td>
<td>392</td>
<td>5.33%</td>
</tr>
<tr>
<td>Friday Rd (West), N of SR 524</td>
<td>1,040</td>
<td>1,040</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Friday Rd (West), S of SR 524</td>
<td>750</td>
<td>2,480</td>
<td>58</td>
<td>7.73%</td>
</tr>
<tr>
<td>SR 524, E of Friday Rd (West)</td>
<td>3,690</td>
<td>9,120</td>
<td>181</td>
<td>4.91%</td>
</tr>
<tr>
<td>I-95 SB Off-Ramp to SR 524</td>
<td>2,080</td>
<td>4,840</td>
<td>92</td>
<td>4.42%</td>
</tr>
<tr>
<td>I-95 SB On-Ramp from SR 524</td>
<td>4,220</td>
<td>8,650</td>
<td>148</td>
<td>3.51%</td>
</tr>
<tr>
<td>I-95 NB Off-Ramp to SR 524</td>
<td>4,330</td>
<td>8,950</td>
<td>154</td>
<td>3.56%</td>
</tr>
<tr>
<td>I-95 NB On-Ramp from SR 524</td>
<td>1,990</td>
<td>4,530</td>
<td>85</td>
<td>4.27%</td>
</tr>
<tr>
<td>SR 524, Between I-95 NB Off-Ramp &amp; Friday Rd (West)</td>
<td>9,550</td>
<td>22,260</td>
<td>424</td>
<td>4.44%</td>
</tr>
<tr>
<td>Friday Rd (East), N of SR 524</td>
<td>3,160</td>
<td>4,520</td>
<td>45</td>
<td>1.42%</td>
</tr>
<tr>
<td>SR 524, E of Friday Rd (East)</td>
<td>7,450</td>
<td>18,570</td>
<td>371</td>
<td>4.98%</td>
</tr>
<tr>
<td>I-95 NB On-Ramp from SR 520</td>
<td>4,290</td>
<td>3,850</td>
<td>106</td>
<td>-0.35%</td>
</tr>
<tr>
<td>I-95 SB Off-Ramp to SR 520</td>
<td>4,760</td>
<td>3,930</td>
<td>98</td>
<td>-0.59%</td>
</tr>
<tr>
<td>I-95 Between SR 524 and SR 520</td>
<td>54,250</td>
<td>76,600</td>
<td>745</td>
<td>1.37%</td>
</tr>
<tr>
<td>I-95 north of SR 524</td>
<td>49,770</td>
<td>68,360</td>
<td>620</td>
<td>1.25%</td>
</tr>
</tbody>
</table>

6.2.3. BEBR Growth Rates

The University of Florida’s BEBR projections were obtained for Brevard County. The BEBR projections show an estimate for 2015 and projections from 2020 to 2045. The low, medium, and high projections for 2040 are summarized in Table 10. Growth rates range from approximately 0.18 percent to 1.44 percent. BEBR population study data is provided in Appendix H.

It is important to note that the BEBR data accounts for countywide data and does not necessarily reflect expected growth on specific roadways or sub-areas of the county. It is useful in reviewing reasonableness of growth rates obtained from other sources such as travel demand models or historical AADT data. For example, the county is expected to grow and therefore, negative annual growth rates are unreasonable for use in this study.
Table 10: BEBR Population Growth Rates

<table>
<thead>
<tr>
<th>County and Estimation</th>
<th>2015 Estimate</th>
<th>2040 Projection</th>
<th>Annual Growth Rate, Growth/Year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brevard County</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>561,714</td>
<td>586,800</td>
<td>1,003 (0.18%)</td>
</tr>
<tr>
<td>Medium</td>
<td>670,400</td>
<td>4,347</td>
<td>4,347 (0.77%)</td>
</tr>
<tr>
<td>High</td>
<td>763,700</td>
<td>8,079</td>
<td>8,079 (1.44%)</td>
</tr>
</tbody>
</table>

Note: BEBR Volume 49, Bulletin 174, January 2016

6.3. Recommended Growth Rates and Future AADTs

As shown in the historical AADT data, traffic has grown minimally over the last 15 years. The historical growth rates were lower than the CFRPM v6.1 model growth rates and the correlation of the historical growth rate was lower than the $R^2$ threshold of 75 percent. Based on the review of the historic growth rates, population growth rates, and the model growth rates, the model growth per year along each segment was applied to SR 524, each of the I-95 ramps, and along the I-95 mainline segments. There were instances where the model growth per year was not used and the locations are specified as follows:

- Because the model estimated negative growth at the two I-95/SR 520 ramps, a two percent annual linear growth rate was applied as negative growth is unrealistic.
- The northern leg of the Friday Road (West) intersection serves as a driveway into a mobile home development. Google Earth historic images show buildings on nearly all, if not all, the parcels prior to 2010. The land appears to be fully built-out based on 2017 aerial imagery. No traffic growth is assumed between 2010 and 2038.

The applied growth rates, the AADT growth per year, and the forecast AADTs/DDHVs are summarized in Table 11. The 2018 and 2038 AADTs along the segments within the study area of influence are illustrated in Figure 22 and Figure 23, respectively.
## Table 11: Recommended Growth Rates, Forecast AADT, and Forecast DDHV

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>Recommended Growth Rate</th>
<th>Annual Volume Growth</th>
<th>2017 AADT</th>
<th>Future AADT</th>
<th>Future DDHV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2018</td>
<td>2038</td>
<td>2018 2038</td>
</tr>
<tr>
<td>SR 524, W of Precious Blvd</td>
<td>6.35%</td>
<td>330</td>
<td>5,200</td>
<td>5,500 12,000</td>
<td>280 600</td>
</tr>
<tr>
<td>Precious Blvd, N of SR 524</td>
<td>4.69%</td>
<td>46</td>
<td>980</td>
<td>1,000 1,900</td>
<td>60 120</td>
</tr>
<tr>
<td>SR 524, E of Precious Blvd</td>
<td>6.03%</td>
<td>392</td>
<td>6,500</td>
<td>6,900 15,000</td>
<td>350 750</td>
</tr>
<tr>
<td>Friday Rd (West), N of SR 524</td>
<td>0.00%</td>
<td>0</td>
<td>1,000</td>
<td>1,000 60</td>
<td>60 60</td>
</tr>
<tr>
<td>Friday Rd (West), S of SR 524</td>
<td>4.46%</td>
<td>58</td>
<td>1,300</td>
<td>1,400 2,500</td>
<td>80 140</td>
</tr>
<tr>
<td>SR 524, E of Friday Rd (West)</td>
<td>1.97%</td>
<td>181</td>
<td>9,200</td>
<td>9,400 13,000</td>
<td>470 650</td>
</tr>
<tr>
<td>I-95 SB Off-Ramp to SR 524</td>
<td>4.84%</td>
<td>92</td>
<td>1,900</td>
<td>2,000 3,800</td>
<td>180 340</td>
</tr>
<tr>
<td>I-95 SB On-Ramp from SR 524</td>
<td>2.96%</td>
<td>148</td>
<td>5,000</td>
<td>5,100 8,100</td>
<td>460 730</td>
</tr>
<tr>
<td>I-95 NB Off-Ramp to SR 524</td>
<td>3.28%</td>
<td>154</td>
<td>4,700</td>
<td>4,900 7,900</td>
<td>440 710</td>
</tr>
<tr>
<td>I-95 NB On-Ramp from SR 524</td>
<td>5.31%</td>
<td>85</td>
<td>1,600</td>
<td>1,700 3,400</td>
<td>150 310</td>
</tr>
<tr>
<td>SR 524, Between I-95 NB Off-Ramp &amp;</td>
<td>2.65%</td>
<td>424</td>
<td>16,000</td>
<td>16,000 25,000</td>
<td>800 1,300</td>
</tr>
<tr>
<td>Friday Rd (East), N of SR 524</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR 524, E of Friday Rd (East)</td>
<td>1.41%</td>
<td>45</td>
<td>3,200</td>
<td>3,200 4,100</td>
<td>200 250</td>
</tr>
<tr>
<td>I-95 NB On-Ramp from SR 520</td>
<td>3.09%</td>
<td>371</td>
<td>12,000</td>
<td>12,000 20,000</td>
<td>600 1,000</td>
</tr>
<tr>
<td>I-95 SB Off-Ramp to SR 520</td>
<td>2.00%</td>
<td>106</td>
<td>5,300</td>
<td>5,400 7,500</td>
<td>490 680</td>
</tr>
<tr>
<td>I-95 SB Off-Ramp to SR 520</td>
<td>2.00%</td>
<td>98</td>
<td>4,900</td>
<td>5,000 7,000</td>
<td>450 630</td>
</tr>
<tr>
<td>I-95 Between SR 524 and SR 520</td>
<td>1.66%</td>
<td>745</td>
<td>45,000</td>
<td>46,000 61,000</td>
<td>2,200 2,900</td>
</tr>
<tr>
<td>I-95 north of SR 524</td>
<td>1.07%</td>
<td>620</td>
<td>58,000</td>
<td>59,000 71,000</td>
<td>2,800 3,400</td>
</tr>
</tbody>
</table>
6.4. Development of Future Intersection Turning Movement Volumes

The 2038 AADTs (Table 11) were converted to Directional Design Hour Volumes (DDHVs) through the application of the Standard K factor and recommended D factors (Table 7). Software that follows iterative, growth-factoring procedures as described in NCHRP Report 765 was used to convert future segment DDHVs into intersection turning movement volumes for the 2038 Design Year. NCHRP Report 765 is an update to the NCHRP Report 255 (published in 1982), which is a method consistent with the acceptable tools described in FDOT’s Project Traffic Forecasting Handbook (2014).

Based on the existing conditions data, the PM peak hour had higher intersection volumes than the AM peak hour. Thus, the PM characteristics were selected for use in establishing the design hour.

In order to maintain the use of the same K factor for the “AM” peak hour design year turning movement volumes, the future year “AM” turning movement volumes were developed by converting the PM peak hour volumes using a reciprocal movement methodology. For example, northbound right-turn movements in the PM design hour were assumed to be equal to westbound left-turn movements in the AM design hour. This methodology results in an analysis that considers equivalent K factors for the “AM” and “PM” design hours, but considers the opposite D factor directionality.

The “AM” volumes were compared against existing AM turning movement counts to verify reasonableness. Minor manual adjustments were applied to selected movements as necessary to avoid situations where reciprocal volumes were lower than the volume observed during the existing AM peak hour.

The build-out PM peak hour intersection volumes (entering and exiting) associated with the Flying J and Citizen Kane/Walmart Distribution Center (Section 2.2.1 and Section 2.2.2) were added to the forecasted volumes as fourth legs to their respective intersections. These volumes were also converted to AM volumes using the reciprocal movement methodology described previously.

The inputs and raw outputs from the forecasting tool are included in Appendix I. The build-out peak hour volumes associated with the developments along SR 524 are also included in Appendix I. The 2018 and 2038 design hour intersection turning movement volumes are summarized in Figure 24 and Figure 25, respectively.
7. FUTURE (NO-BUILD) OPERATIONAL ANALYSIS

The following summarizes the future No-Build AM and PM peak hour traffic operations for the opening and design years. No geometric or traffic control changes were made to the existing ramp terminal intersections or the intersections west of the interchange. The traffic impact analyses for Flying J and Citizen Kane developments indicated a build-out analysis year of 2017 and 2018, respectively. As such, the developments were assumed to be in place by 2018 and were included as part of this study’s No-Build scenario.

The traffic impact analyses proposed signalizing their respective intersection with SR 524 with some turn lane additions. The turn lane lengths recommended in the studies were also used as a starting point in the No-Build analysis. The proposed lane configurations and traffic control for the future No-Build scenario including the Flying J development at the intersection of SR 524/Friday Road (East) and the proposed access for the Citizen Kane Development are illustrated in Figure 26.

7.1. Opening Year – 2018 No-Build Intersection Operations

The developed turning movement volumes were input into a Synchro network to estimate the no-build traffic operations at the study intersections. Cycle lengths of 120 and 160 seconds were used for the AM and PM peak hours, respectively. Each of the study intersections was analyzed using HCM 2010 methodology, implemented in Synchro 9. Detailed Synchro outputs are included in Appendix J. The Opening Year – 2018 No-Build peak hour intersection operations for the study intersections are summarized as follows and are illustrated in Figure 27:

1. Precious Boulevard Intersection – Unsignalized
   - No operational deficiencies identified in either peak hour. All movements are expected to operate under capacity and with LOS C or better operations during both peak hours.

2. Friday Road (West) Intersection – Unsignalized
   - No operational deficiencies identified in either peak hour. All movements are expected to operate under capacity and with LOS D or better operations during both peak hours (less than 30 seconds of delay).

3. Southbound I-95 Ramps Intersection – Unsignalized
   - The southbound left-turn movement is expected to near capacity during the AM and PM peaks hour with over 80 seconds of delay (LOS F). The 95th percentile queues are expected to extend less than 150 feet along the off-ramp.

4. Northbound I-95 Ramps Intersection – Unsignalized
   - The northbound left-turn movement is expected to operate under capacity during both peak hours with delays less than 27 seconds (LOS D or better). The 95th percentile queues are not expected to extend to the mainline I-95 lanes.
5. **Friday Road (East) Intersection – Signalized**
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS B during both peak hours.

6. **Proposed Access Road Intersection – Signalized**
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

7.2. **Opening Year – 2018 No-Build Ramp and Mainline Operations**

   No changes were made to the number of lanes along the ramps at the gore points along I-95. Therefore, the same ramp merge/diverge and weaving analyses were conducted for the No-Build scenario using 2018 volumes. The 2018 AM and PM peak hour operational results are summarized in Figure 28. All analysis segments (ramps and weaving segments) operate at LOS B or better during both peak hours. Detailed analysis output reports are included in Appendix J.
FIGURE 26

Scale in Feet
0 1,000 2,000 North

LEGEND
- SIGNALIZED STUDY INTERSECTION
- UNSIGNALIZED STUDY INTERSECTION
- LANE CONFIGURATIONS

I-95 at SR 524 Interchange Operational Analysis | Future (No-Build) Lane Configurations/Traffic Control
7.3. Design Year – 2038 No-Build Intersection Operations

The operational issues identified in the 2018 No-Build analysis are expected to persist in 2038. The 2038 No-Build intersection operations are shown in Figure 29 and summarized as follows:

1. Precious Boulevard Intersection – Unsignalized
   - All movements are expected to operate under capacity and with LOS E or better operations during both peak hours.

2. Friday Road (West) Intersection – Unsignalized
   - The northbound left-turn movement is expected to approach capacity (v/c ratio of 0.97) and experience over 112 (LOS F) seconds of delay during the AM peak hour. The southbound left-turn movement is expected to experience a delay over 108 seconds (LOS F) during the AM peak hour and over 82 seconds (LOS F) during the PM peak hour.

3. Southbound I-95 Ramps Intersection – Unsignalized
   - The southbound left-turn movement is expected to be overcapacity during the AM and PM peaks hour with over 500 seconds of delay (LOS F).
   - The 95th percentile queues are expected to extend nearly 750 feet (30 vehicles) along the off-ramp. The off-ramp has approximately 1,300 feet to the gore point along I-95.

4. Northbound I-95 Ramps Intersection – Unsignalized
   - The northbound left-turn movement is expected to operate overcapacity during both peak hours with delays greater than 400 seconds (LOS F).
   - The 95th percentile queues are not expected to extend to the mainline I-95 lanes (approximately 375 feet or 15 vehicles).

5. Friday Road (East) Intersection – Signalized
   - The eastbound through movement is expected to be overcapacity during the AM peak hour (v/c ratio of 1.05) with over 61 seconds of delay per vehicle. The 95th percentile queues are expected to spill back through both ramp terminal intersections.
   - The eastbound left-turn and westbound through movements are expected to be overcapacity during the PM peak hour (v/c ratio of 1.01 and 1.08, respectively.
   - The overall intersection is expected to operate at LOS D during both peak hours.

6. Proposed Access Road Intersection – Signalized
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

7.4. Design Year – 2038 No-Build Ramp and Mainline Operations

The 2018 AM and PM peak hour operational results are summarized in Figure 30. All analysis segments (ramps and weaving segments) operate at LOS B or better during both peak hours. Detailed analysis output reports are included in Appendix J.
Density 15.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 12.5 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
Weaving Density 17.0 (pc/mi/ln) LOS B
Weaving Density 14.5 (pc/mi/ln) LOS B
Density 12.7 (pc/mi/ln) LOS B
Weaving Density 14.8 (pc/mi/ln) LOS B
Density 15.1 (pc/mi/ln) LOS B
Density 15.5 (pc/mi/ln) LOS B
8. FUTURE (BUILD) OPERATIONAL ANALYSIS

A four-lane widening along SR 524 from I-95 to Industry Road has been identified in the SCTPO Long Range Transportation Plan (LRTP): Years 2021-2025; however, no funding has been secured for this project. A corridor planning study is currently ongoing along SR 524 evaluating alternatives, including a four-lane widening. The scope of this IOAR is to evaluate the potential impacts to I-95 with signalization of the existing TWSC ramp terminal intersections. No geometric changes were made to the intersections when comparing the No-Build and Build scenarios. The only changes made to the Build network were the signalization of the southbound and northbound I-95 ramp terminal intersections. The Build lane configurations and traffic control at each of the study intersections are illustrated in Figure 31.

In addition to the signalization of the ramp terminal intersections, minor signal timing improvements (coordination, splits, offsets, and lead-lag phasing) were made in the Build scenarios. Cycle lengths of 120 and 160 seconds were used for the AM and PM peak hours, respectively. The analysis assumed protected only left-turn signal phasing for the left-turn movements from SR 524 to the on-ramps. The following summarizes the future Build AM and PM peak hour traffic operations for the opening and design years.

8.1. Opening Year – 2018 Build Intersection Operations

The developed turning movement volumes were input into a Synchro network to estimate the no-build traffic operations at the study intersections. Each of the study intersections was analyzed using HCM 2010 methodology, implemented in Synchro 9. Detailed Synchro outputs are included in Appendix K. The Opening Year – 2018 Build peak hour intersection operations for the study intersections are summarized as follows and are illustrated in Figure 32:

1. Precious Boulevard Intersection – Unsignalized
   - No operational deficiencies identified in either peak hour. All movements are expected to operate under capacity and with LOS B or better operations during both peak hours.
2. Friday Road (West) Intersection – Unsignalized
   - No operational deficiencies identified in either peak hour. All movements are expected to operate under capacity and with LOS D or better operations during both peak hours (less than 30 seconds of delay).
3. Southbound I-95 Ramps Intersection – Signalized
   - All movements are expected to operate under capacity during both peak hours.
   - The westbound left-turn is approaching capacity (v/c ratio of 0.93) during the AM peak hour with 44.8 seconds of delay. The available queue storage is expected to accommodate the 95th percentile queue.
   - The overall intersection is expected to operate with less than 30 seconds of delay (LOS C) during both peak hours.
4. **Northbound I-95 Ramps Intersection – Signalized**
   - No queue spill back onto I-95 is expected along the off-ramp during either peak hour.
   - All movements are expected to operate under capacity during both peak hours.
   - The overall intersection is expected to operate with less than 21 seconds of delay (LOS C or better) during the AM and PM peak hours.
   - No queue spill back onto I-95 is expected along the off-ramp during either peak hour (95th percentile queues less than 325 feet).

5. **Friday Road (East) Intersection – Signalized**
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS D during both peak hours.

6. **Proposed Access Road Intersection – Signalized**
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

### 8.2. Opening Year – 2018 Build Ramp and Mainline Operations

No changes were made to the number of lanes along the ramps at the gore point along I-95 or the interstate. Therefore, the Build ramp and weaving segment analyses are the same as No-Build. The 2018 AM and PM peak hour operational results are summarized in **Figure 33**. All analysis segments (ramps and weaving segments) operate at LOS B or better during both peak hours. Detailed analysis output reports are included in **Appendix K**.
FIGURE 31

North Scale in Feet

0 1,000 2,000

FIGURE 31

LEGEND

- SIGNALIZED STUDY INTERSECTION
- UNSIGNALIZED STUDY INTERSECTION
- LANE CONFIGURATIONS
FIGURE 32

North Scale in Feet 0 1,000 2,000

FRIDAY RD 95 PRECIOUS BLVD TASHA LNTALBOT BLVD
FRIDAY RD SCENIC DR ADAMSON RD
WOODSMILL BLVD

524 TASHA LN

95 TALBOT BLVD 524

LEGEND

AM DELAY (LEVEL OF SERVICE)
PM DELAY (LEVEL OF SERVICE)
* CRITICAL TURNING MOVEMENT

SIGNALIZED STUDY INTERSECTION
UNSIGNALIZED STUDY INTERSECTION

9.2(A) 10.0(B)
13.8(B)*
13.9(B)*
0.0(A)
8.0(A)
20.2(C)*
28.1(D)*

37.3(D)
17.1(B)
20.9(C)

28.2(C)
26.3(C)

39.0(D)
37.3(D)
16.8(B)
29.3(C)

37.3(D)
29.3(C)

26.3(C)
16.8(B)
29.3(C)

37.3(D)
29.3(C)

26.3(C)
16.8(B)
29.3(C)

37.3(D)
29.3(C)

26.3(C)
16.8(B)
29.3(C)

37.3(D)
29.3(C)

26.3(C)
16.8(B)
29.3(C)

37.3(D)
29.3(C)
Density 9.3 (pc/mi/ln)  
LOS A
Density 11.4 (pc/mi/ln)  
LOS B
Density 9.5 (pc/mi/ln)  
LOS A
Density 11.7 (pc/mi/ln)  
LOS B
Weaving Density 13.7 (pc/mi/ln)  
LOS B
Weaving Density 11.1 (pc/mi/ln)  
LOS B
Weaving Density 10.7 (pc/mi/ln)  
LOS B
Weaving Density 13.6 (pc/mi/ln)  
LOS B

Legend:
RED = AM  
BLUE = PM
8.4. Design Year – 2038 Build Intersection Operations

The 2038 No-Build intersection operations are shown in Figure 34 and summarized as follows:

1. **Precious Boulevard Intersection – Unsignalized**
   - All movements are expected to operate under capacity and with LOS E or better operations during both peak hours.

2. **Friday Road (West) Intersection – Unsignalized**
   - The northbound left-turn movement is expected to approach capacity (v/c ratio of 0.97) and experience over 112 (LOS F) seconds of delay during the AM peak hour. The southbound left-turn movement is expected to experience a delay over 108 seconds (LOS F) during the AM peak hour and over 82 seconds (LOS F) during the PM peak hour.

3. **Southbound I-95 Ramps Intersection – Signalized**
   - All movements are expected to operate under capacity during both peak hours.
   - The westbound left-turn is approaching capacity (v/c ratio of 0.98) during the PM peak hour with 41.4 seconds of delay (LOS D). The 95th percentile queue of approximately 875 feet is expected to spill out of the available queue storage length of approximately 750 feet.
   - The overall intersection is expected to operate with less than 35 seconds of delay (LOS C) during both peak hours.
   - No queue spill back onto I-95 is expected along the off-ramp during either peak hour.

4. **Northbound I-95 Ramps Intersection – Signalized**
   - All movements are expected to operate under capacity during both peak hours.
   - The overall intersection is expected to operate at LOS D or better during both peak hours.
   - No queue spill back onto I-95 is expected along the off-ramp during either peak hour (95th percentile queues less than 325 feet).

5. **Friday Road (East) Intersection – Signalized**
   - The overall intersection is expected to operate at LOS D during both peak hours. The eastbound left-turn and westbound through movements are expected to operate right at capacity (v/c ratio of 1.0) during the 2038 PM peak hour.

6. **Proposed Access Road Intersection – Signalized**
   - All movements are expected to operate under capacity in both AM and PM peak hours. The overall intersection is expected to operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

8.5. Design Year – 2038 Build Ramp and Mainline Operations

The 2038 AM and PM peak hour operational results are summarized in Figure 35. All analysis segments (ramps and weaving segments) operate at LOS B or better during both peak hours. Detailed analysis output reports are included in Appendix K.
**FIGURE 34**

North

Scale in Feet

0 1,000 2,000

**LEGEND**

**AM** DELAY (LEVEL OF SERVICE)

**PM** DELAY (LEVEL OF SERVICE)

* CRITICAL TURNING MOVEMENT

GREEN = SIGNALIZED STUDY INTERSECTION

RED = UNSIGNALIZED STUDY INTERSECTION

**FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)**

I-95 at SR 524 Interchange Operational Analysis | 2038 (Build) Peak Hour Intersection Operations

FIGURE 34
9. FEDERAL HIGHWAY ADMINISTRATION (FHWA) EIGHT POLICY POINTS

The Federal Highway Administration (FHWA) regulates the addition and modification of access points along the interstate system and has eight policy points that must be addressed before a new interchange or modification of access points to the interstate is approved. The following summarizes how the proposed signalization of ramp terminal intersections at the I-95/SR 524 interchange fulfills each requirement.

9.1. Policy Point 1

*The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

The request is consistent with Policy Point 1. The request does not impact the number of access points or the location of the existing access points to I-95. The request is to modify traffic control at the ramp terminal intersections to satisfactorily accommodate the design-year traffic demands and improve safety, consistent with the Policy Point.

9.2. Policy Point 2

*The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

Changes in access to the Interstate are not proposed as part of the interchange improvements. Transportation system management (TSM) improvements such as ramp metering, mass transit, and HOV facilities were not analyzed as the proposed traffic control improvements are expected to satisfy the project need.
9.3. Policy Point 3

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 shall, 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, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that ([Page 43745]) 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)).

The number of lanes along the ramp at the existing gore points as well as the location of the existing gore points will not be modified as part of the interchange improvements. The proposed traffic control modifications will not adversely impact the safety or operations of the mainline and are expected to improve safety and operations at the interchange ramp terminal intersections. The ramp terminal intersections are expected to operate at a LOS D or better during both Design Year (2038) peak hours in the Build condition. Queues along the off-ramps are expected to decrease in the Build condition, reducing risk of queues spilling back onto the interstate system.

9.4. Policy Point 4

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 for managed lanes (e.g., transit, HOVs, HOT 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)).

The existing full access diamond interchange will maintain all traffic movements with proposed interchange improvements. The proposed improvements are expected to improve operations along SR 524 and at the ramp terminal intersections, which is owned and maintained by the FDOT.
9.5. Policy Point 5

The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

The proposed traffic control modification is not included in the FDOT five-year work program or Space Coast TPO (SCTPO) TIP; however, the signalization will be developer-funded as summarized in Table 12.

<table>
<thead>
<tr>
<th>Location</th>
<th>Cost</th>
<th>Schedule</th>
<th>Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-95 SB Ramp Signal</td>
<td>$160,000</td>
<td>Mid-July 2017</td>
<td>Developer</td>
</tr>
<tr>
<td>I-95 NB Ramp Signal</td>
<td>$150,000</td>
<td>June 2018</td>
<td></td>
</tr>
<tr>
<td>Friday Road (East) Signal</td>
<td>$160,000</td>
<td>Mid-July 2017</td>
<td></td>
</tr>
<tr>
<td>Walmart Distribution Center Driveway Signal</td>
<td>$150,000</td>
<td>June 2018</td>
<td></td>
</tr>
</tbody>
</table>

9.6. Policy Point 6

In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).

This IOAR is being completed to identify the operational efficiencies gained by signalizing the ramp terminal intersections. No additional access points are proposed as part of this request. Concurrently, a corridor planning study is being conducted along SR 524. This study will identify whether SR 524 should be widened to four lanes and whether subsequent interchange improvements are warranted to facilitate the widening of SR 524. Future alternatives developed as part of the corridor planning study will be evaluated as part of a subsequent interchange access request to document potential impacts to the interstate system at such time the alternatives are moved forward in a PD&E study, but no additional access points are anticipated as part of the corridor planning study.

9.7. Policy Point 7

When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure
adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).

The proposed improvements to the existing interchange were identified to improve operations along SR 524 and at the interchange ramp terminals. The traffic control enhancements will allow for additional interchange capacity to accommodate projected growth in the area.

9.8. Policy Point 8

The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).

The environmental approval is pending receipt of the interchange expansion/improvement concept. At that time the environmental and right-of-way impacts will be determined. The environmental permitting process will be addressed and documented in the Design Phase of the project. Any adverse effects to archeological or historical resources or endangered species could influence the selection of a preferred alternative as well as the occurrence of contamination in the project area.
10. **CONCLUSIONS AND RECOMMENDATION**

The following bullets summarize up the existing operational, safety, and future operational analysis results, the FHWA policy points, and a recommendation.

- **Existing Traffic Operations**
  - All movements operate under capacity during both the existing AM and PM peak hours.
  - The southbound left-turn movement operates with a delay of 31.5 seconds (LOS D) during the AM peak hour and 36.3 seconds (LOS E) during the peak hour.
  - No queue spillback onto the interstate is experienced in either peak hour at either ramp terminal intersection.
  - The ramp merge, diverge, and weaving segments operate at LOS B or better during both the existing peak hours.

- **Historical Crash Analysis – Five years of historical crash data between 2011 and 2015**
  - There were a total of 9 crashes at the I-95 southbound ramp terminal intersection at 10 crashes at the northbound ramp terminal intersection.
    - Left-turn crashes (2 crashes) and angle crashes (3 crashes) were the most common crash types at the intersections, respectively.

- **Future Safety Performance**
  - A signal is expected to reduce the potential for injury/fatal crashes when compared to the existing traffic control conditions.
  - Signalization may increase the potential for rear end crashes along SR 524 as through vehicles currently do not stop; however, these types of crashes are generally less severe.
  - The signalization improvements are not expected to have an adverse impact to the safety of the interstate system within the interchange influence area.

- **Future No-Build Traffic Operations**
  - The eastbound through movement at the Friday Road (East) intersection is expected to be overcapacity during the 2038 AM peak hour (v/c ratio of 1.05) with over 61 seconds of delay per vehicle. The 95th percentile queues are expected to spill back through both ramp terminal intersections.
  - The eastbound left-turn and westbound through movements at the Friday Road (East) intersection are expected to be overcapacity during the 2038 PM peak hour (v/c ratio of 1.01 and 1.08, respectively.
  - The southbound left-turn movement is expected to be overcapacity during the 2038 AM and PM peaks hour with over 500 seconds of delay (LOS F).
  - The northbound left-turn movement is expected to operate overcapacity during both Design Year (2038) peak hours with delays greater than 400 seconds (LOS F).
  - Queues are not expected to extend to I-95 along either ramp during the 2038 peak hours.
• All analysis freeway segments (ramps and weaving segments) operate at LOS B or better during both Design Year peak hours.

• Future Build Traffic Operations
  o With signalization at both ramp terminal intersections, all movements are expected to operate under capacity during both Design Year peak hours.
  o Both ramp terminal intersections are expected to operate at an overall intersection LOS D or better during both 2038 peak hours.
  o No queue spill back onto I-95 is expected along either ramp in any of the peak hours.
  o The westbound left-turn at the southbound I-95 ramp terminal intersection is expected to approach capacity (v/c ratio of 0.98) during the 2038 PM peak hour with 41.4 seconds of delay (LOS D). The 95th percentile queue of approximately 875 feet is expected to spill out of the available queue storage length of approximately 750 feet.
  o The overall intersection of Friday Road (East) is expected to operate at LOS D during both 2038 peak hours. The eastbound left-turn and westbound through movements are expected to operate right at capacity (v/c ratio of 1.0) during the 2038 PM peak hour. Queue spillback into the interchange is not anticipated.
  o All analysis freeway segments (ramps and weaving segments) operate at LOS B or better during both peak hours.

• FHWA Policy Points
  o The proposed traffic control modification is consistent with FHWA’s Eight Policy Points.
  o The proposed interchange improvements will not impact the number of access points or the location of the existing access points to I-95. Modifications are proposed to the ramp terminal intersections only.
  o Signalization of the ramp terminal intersections is expected to satisfy the purpose and need of this project by improving the safety and operations at both intersections.
  o The proposed modifications are not expected to deteriorate the safety or operations along the Interstate facility. Queues along the off-ramps are expected to decrease in the Build condition, reducing risk of queues spilling back onto the interstate system.

The signalization of the I-95 at SR 524 ramp terminal intersections satisfies the purpose and need outlined in Section 1.2 and satisfies the FHWA Policy Points. It is recommended that the FDOT consider signalization of the ramp terminal intersections.