Arterial Connectivity Study

along I-595 Corridor

FM#441954-1-12-01

Deficiency Mitigation Measures

Technical Report #1

October 2021

Arterial Connectivity Study along I-595 Corridor
FM# 441954-1-12-01

Deficiency Mitigation Measures for the Arterial Connectivity Study along I-595

Technical Report #1

Prepared for:

100 W. Cypress Creek Road, Suite #650
Fort Lauderdale, FL 33309

and

District Four
3400 W. Commercial Boulevard
Fort Lauderdale, FL 33309

October 2021

THIS PAGE LEFT INTENTIONALLY BLANK

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 Study Overview

The Arterial Connectivity Study along I-595 Corridor is being conducted to identify and define transportation problems and develop effective solutions to fulfill the goal of providing better connectivity for all modes and to provide congestion relief for travel along the north-south study roadways and their access points with I-595 and SR 84. All types of improvement strategies are being considered including land use and policy strategies; geometric modifications to roadways; pedestrian, bicycle, greenway, and transit infrastructure improvements; and technology and traffic signal improvements.

The Arterial Connectivity Study along I-595 Corridor consists of four main tasks as listed below. The Deficiency Mitigation Measures report is part of Task Two and is the fifth of seven deliverables to be completed for the Arterial Connectivity Study along I-595 Corridor.

- Task One – Data Collection, Compilation, Development, and Analysis
- Task Two - Develop Deficiency Mitigation Concepts (MCs) and Mitigation Measures (MMs)
- Task Three - Develop a Master Improvement List and Implementation Packages for Mitigation Measures
- Task Four – Outreach and Meetings

1.2 Study Goal and Objectives

The overall study goal is to provide congestion relief for north-south travel and improve access to and from SR 84 and I-595.

The key objectives for the study are:

- Identify deficiencies,
- Collaborate with stakeholders to develop effective solutions, and
- Implement a plan of mitigation measures.

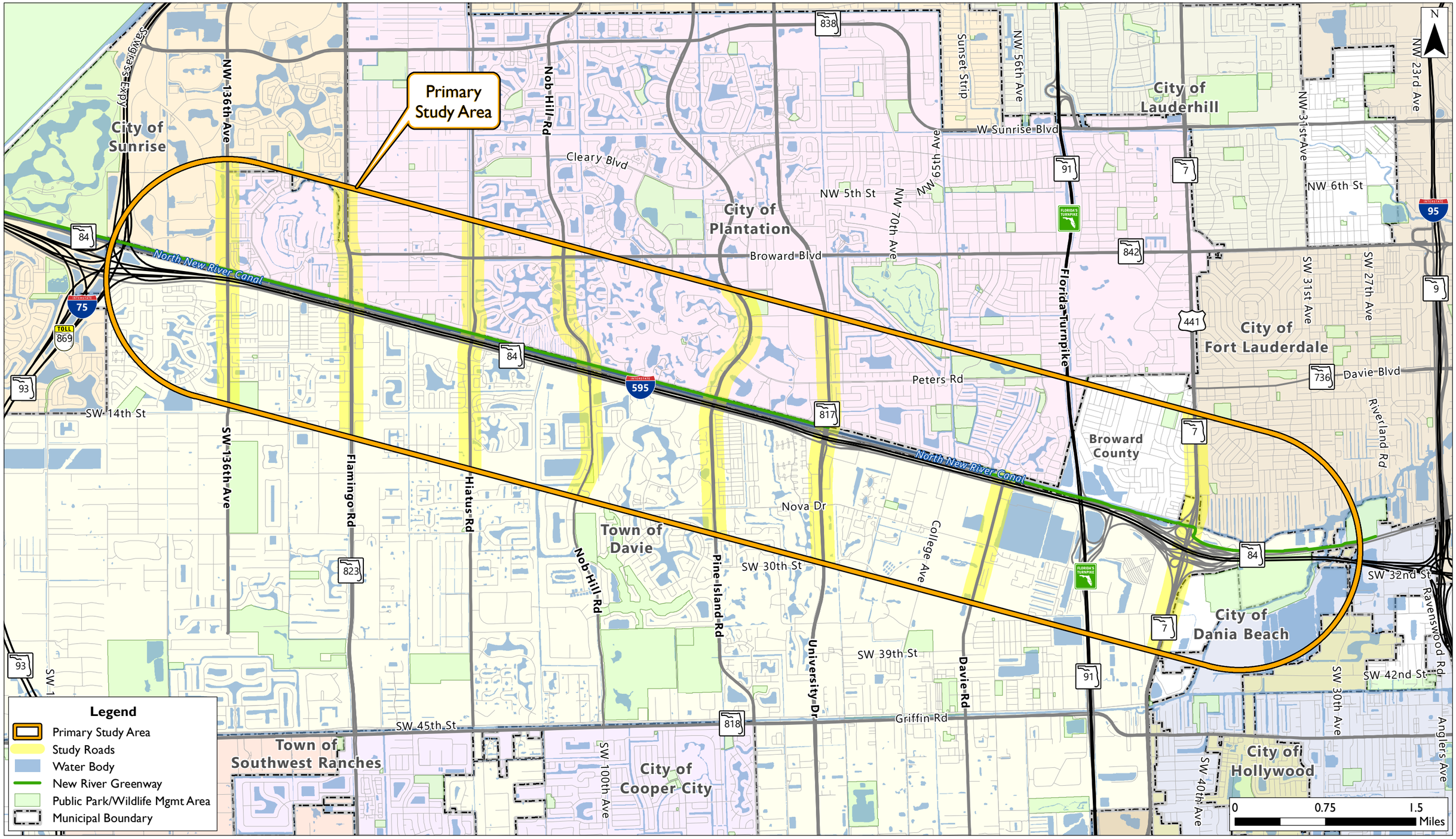
1.3 Purpose of Deficiency Mitigation Measures Report

The Deficiency Mitigation Measures Report (Technical Report #1) documents the development, analysis, and evaluation of mitigation concepts and the resulting recommended mitigation measures. Improvement concepts (also referred to as mitigation measures) were developed and recommended for each north-south arterial corridor that crosses SR 84 and I-595. A summary of the deficiencies identified from the existing conditions and future (2045) conditions analysis is provided herein. In addition, the mitigation concepts, alternatives analysis, recommended improvement concepts / mitigation measures, benefits of the improvement concepts, impacts of the proposed concepts, and estimated construction cost estimates are documented within the report.

1.4 Study Area

The study area is in central Broward County, Florida, along the I-595 and SR 84 corridor between SW 136th Avenue and SR 7/US-441. The study limits include eight north-south arterials that cross I-595 and SR 84 and extend approximately one mile north and one mile south of I-595. The primary study area and study roadways are shown in Figure 1-1. Forty-three intersections have been identified for study within the project limits. Below is a list of the study roadways along with the approximate limits on each road.

1. SW 136th Avenue from north of NW 8th Street to north of SW 14th Street
2. Flamingo Road / SR 823 from south of NW 8th Street to south of SW 15th Place
3. Hiatus Road from north of Broward Boulevard to south of SW 16th Street / S Harmony Lake Circle
4. Nob Hill Road from Broward Boulevard to SW 22nd Court
5. Pine Island Road from SW 3rd Street to south of Nova Drive
6. University Drive / SR 817 from Federated Road to SW 30th Street
7. Davie Road from I-595 / SR 84 to Broward College entrance / SW 35th Street
8. US-441 / SR 7 from SW 16th Street to Powells Road
9. SR 84 eastbound and westbound from I-75 to I-95



Broward MPO Metropolitan Planning Organization | FDOT

Arterial Connectivity Study Along I-595
FM# 441954-1-12-01

Study Area

Figure 1-1

1.5 Workshops and Stakeholder Coordination

After mitigation concept alternatives were analyzed, initial improvement concepts were developed and discussed with FDOT and Broward MPO staff during a workshop in March 2021. The study team received comments and feedback, which was used to refine the initial improvement concepts. Proposed improvement concepts were also coordinated with the Project Advisory Committee (PAC) in April 2021. Following the PAC workshop, the improvement concepts were finalized and the recommended concepts (also known as mitigation measures) subsequently documented in this report.

2. IDENTIFIED DEFICIENCIES

Multiple types of transportation deficiencies were identified from the technical analyses and stakeholder and public input. Crash analysis, crash hotspot information, existing (2019) field reviews, and public input was used to identify safety deficiencies. Roadway capacity deficiencies were identified based on existing (2019) and future (2045) level of service and volume-to-capacity ratio. In addition, intersection operational deficiencies were identified, based on existing (2019) and future (2045) level of service, delay, queues, and public and stakeholder input. Existing (2019) field reviews, level of service analysis, and inventory of missing facilities, and stakeholder and public input was used to identify the bicycle, pedestrian, and greenway deficiencies. Transit facility deficiencies were based on an existing (2019) inventory of bus stop infrastructure at each of the Broward County Transit bus stops and a review of the park-and-ride lot facilities in the study area. Freight movement deficiencies were based on existing (2019) and future (2045) intersection operational analysis and stakeholder and public input. These safety, roadway capacity, intersection operations, and multimodal deficiencies are described below.

2.1 Safety Deficiencies

The north-south study corridor with the highest number of crashes over five years is University Drive. Eastbound SR 84 has the second highest number of crashes within the last five years. In addition, 36 crash hotspot locations were identified along the eight north-south study roadways. Crash hotspots were identified at each the north-south arterial study intersections with eastbound and westbound SR 84. Each of these high crash locations have existing deficiencies that should be addressed. The most common crash type was the rear-end type crash, which is common in highly congested areas.

Improvements are needed to reduce long queues, and to reduce congestion causing vehicles to frequently stop and start while traveling along the north south arterials and along SR 84.

2.2 Roadway Capacity Deficiencies

Existing (2019) and future year (2045) AADTs for each of the north-south arterials were compared to FDOT generalized table LOS D maximum service volume thresholds. Given the existing (2019) Annual Average Daily Traffic (AADT) volumes for each of the north-south arterials as well as SR 84, three roadway segments were identified that currently exceed capacity. These three roadways are listed below.

<u>Roadways with Existing Volume Exceeding Capacity</u>

1. University Drive/SR 817 north and south of SR 84
2. SR 7/US-441 north and south of SR 84
3. Sections of SR 84 eastbound and westbound

In addition to the three roadway segments that have current volumes that exceed capacity, three additional roadways will have volumes that exceed capacity by year 2045. Listed below are all six roadways with AADTs that exceed capacity by 2045.

<u>Roadways with Future (2045) Volume Exceeding Capacity</u>

1. University Drive/SR 817 north and south of SR 84
2. SR 7/US-441 north and south of SR 84
3. Nob Hill Road north of SR 84
4. Pine Island Road north of SR 84
5. Davie Road south of SR 84
6. Sections of SR 84 eastbound and westbound

Segments with volumes that exceed capacity need multiple types of mitigation improvement strategies to fully address the transportation need and over capacity issue.

2.3 Intersection Operational Deficiencies

Each of the 43 study intersections were analyzed to determine existing (2019) and future year (2045) operating conditions. Existing and future delay and LOS during AM and PM peak hours was estimated for each intersection and used to determine the overall intersection LOS during the peak hours. Improvements were evaluated for intersections with an existing or future year peak hour LOS worse than the target LOS D.

Under existing conditions, drivers traveling through 17 of the 43 study intersections experience extensive delay and congestion during peak hours. By 2045, if no improvements or strategies are implemented, the number increases to 31 of 43 study intersections where motorists will experience unacceptable delay and congestion. These 31 intersections were analyzed further to determine recommended improvement strategies.

2.4 Multimodal Deficiencies

Existing bicycle, pedestrian, and greenway deficiencies include missing sidewalks, and missing or inadequate bicycle facilities along each of the arterial study roadways. In addition, continuity and safety should be improved at each of the five existing New River Greenway crossings of the north-south study arterials. There is also an existing gap in the New River Greenway between University Drive and Davie Road that should be addressed to provide continuity for greenway users.

Transit deficiencies to be addressed involve missing infrastructure such as a bench or shelter at existing bus stops where they are needed. No deficiencies were identified at the only existing Park-and-Ride lot within the study area at Davie Road and SR 84.

Freight deficiencies within the study area are related to inefficient access to and from the Florida 595 Truck Stop located in the south-east quadrant of I-595 and Florida's Turnpike. Access to the truck stop is through the SR 7/US-441 and I-595 interchange, and the intersection of SR 7/US-441 and Oakes Road located south of I-595. Existing and future 2045 intersection operational deficiencies were identified at the intersection of SR 7/US-441 and Oakes Road.

3. MITIGATION CONCEPTS

Mitigation concepts, consisting of infrastructure improvements along each of the north-south arterial corridors, and the New River Greenway were developed. These mitigation concepts include improvements along each north-south study arterial that will improve safety, add capacity, improve operations, and address multimodal deficiencies identified in Section 2.

Section 3.1 provides the design criteria used to develop each of the mitigation concepts. A description of the design goals and constraints common to each of the north-south corridor mitigation concepts is also provided in Section 3.1.

Following Section 3.1, the New River Greenway corridor improvements are described in Section 3.2. Mitigation concepts for each of the eight north-south study arterial corridors are described in the subsequent sections following the New River Greenway concepts in Section 3.2.

3.1 Design Criteria and Constraints

Appropriate design criteria were utilized considering the jurisdiction of each roadway, FDOT context classifications for state roads, existing conditions, and current design preferences for pedestrian and bicycle facilities. The proposed improvements throughout the study area were prepared consistent with the design criteria from the following publications:

- FDOT Design Manual (2020), Florida Department of Transportation, Part 1 and 2
- Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways - Florida Greenbook (2016)
- FDOT Traffic Engineering Manual (2019)
- Standard Plans for Road and Bridge Construction, Florida Department of Transportation (2020-2021)
- A Policy of Geometric Design of Highways and Streets – AASHTO Greenbook (2011)
- Manual of Uniform Traffic Control Devices (2009)

Mitigation concepts for each of the north-south arterials and the New River Greenway, were developed considering the following needs and constraints. These are common to each of the north-south arterial corridor mitigation concepts, due to the same general proximity to I-595, the New River Greenway, and the New River Canal.

- Need to minimize impacts to the New River Canal, owned by the South Florida Water Management District, which runs along the north side of SR 84 westbound throughout the study limits.
- Need to avoid negative impacts to I-595 operations.
- Need to provide a minimum 7-foot buffered bicycle lane separated from vehicular traffic along each north-south study arterial.
- Need to provide a minimum 5-foot pedestrian pathway along both sides of each north-south study arterial.
- Need to maintain a potential future transit envelope along the I-595 and SR 84 throughout the study limits.
- Need to avoid identifying improvements that would fall outside existing public rights of way.
- Need to avoid significant impacts to social and economic, cultural, natural, or physical resources.

Design considerations specific to each study corridor are discussed within each of the following corridor mitigation concept sections.

3.2 New River Greenway

The New River Greenway is an existing shared use path within the study area that stretches from Markham Park located west of I-75, to University Drive. There is an existing gap in the New River Greenway shared use path between University Drive and Davie Road. The New River Greenway shared use path begins again near Davie Road and continues east to Anglers Avenue located just west of I-95.

Within the study area there are five existing locations where users of the New River Greenway must cross the north-south study arterials:

1) NW/SW 136th Avenue
2) Flamingo Road
3) Hiatus Road
4) Nob Hill Road
5) Pine Island Road

3.2.1 Design Considerations

At existing crossings, users are expected to travel south of the trail along a bridge over the New River Canal to a signalized intersection with westbound SR 84. At this intersection, they are expected to push the pedestrian signal button to activate the pedestrian crossing phase allowing them to cross the arterial. After crossing they then must travel north along the bridge over the New River Canal to reach the other side of the New River Greenway. This path to cross each arterial is approximately 500 feet and may take several minutes to cross on a walk signal at the intersection.

There are several design issues with the New River Greenway, and opportunities for improvement, which are noted below.

- Safety – Requiring greenway users to cross at the busy signalized intersections of the north-south arterials and westbound SR 84 means that the greenway users are exposed to a large volume of traffic approaching the crossing from the east, north and south. Although they are required to, the large volume of westbound right-turning vehicles do not always yield to pedestrians in the crosswalk.
- Mobility – The existing crossings not only cause undue delay to greenway users, but to motorists as well. When a person activates the pedestrian crossing signal at the SR 84 interchange, this can increase the amount of green time given to the westbound approach and reducing green time for the north-south movements. Also, westbound right-turning traffic must stop to wait for the crosswalk to clear, reducing the amount of time they can turn.
- Connectivity - The greenway does not provide a continuous path. Users must stop to cross each north-south arterial located approximately 1 mile apart. In addition, there is an approximately one-mile gap in the shared use path between University Drive and Davie Road. These connectivity issues can discourage bicyclists and other potential users from choosing to use the greenway for trips.

Improvement concepts were developed to address these issues, keeping in mind the need to minimize impacts to the New River Canal and other adjacent canals, avoid impacts to I-595 mainline and ramps, and minimize impacts to traffic on SR 84 and north-south arterials. The purpose of improving the crossings is to make the New River Greenway more attractive by making it safer and more efficient to cross the north-south arterials, by reducing the crossing time / distance, and minimizing exposure to traffic.

3.2.2 Evaluated Improvements

3.2.2.1 New River Greenway North-South Arterial Crossings

The existing crossings at each of the north-south arterials were evaluated to determine improvements that could enhance safety, connectivity, and reduce delays for crossing pedestrians and bicyclists. In addition, improvements were considered that reduced traffic delays on the arterials.

Short-Term Improvements

A short-term greenway crossing improvement concept was identified, which consists of implementing a pedestrian hybrid beacon (also known as a High Intensity Activated Cross Walk (HAWK) signal) along with crosswalk pavement markings, median modifications, and signage. The Manual on Uniform Traffic Control Devices (MUTCD) provides guidelines that should be

met prior to a HAWK signal being installed. The HAWK signal helps mitigate conditions where pedestrians must cross high-speed or wide-crossings, which is the situation at five existing New River Greenway crossings within the study area. The new traffic signal is activated only when a pedestrian pushes the button to cross. The signal then stops north-south vehicular traffic to allow for pedestrians and bicyclists to cross the roadway in a high intensity crosswalk.

The new traffic signal would be installed on the north-south arterial approximately 250 feet north of where the greenway ends at the roadway. The crosswalk would be located north of the turn lane storage bays where there is a shorter distance to cross the roadway and to provide some storage for vehicles to stop on the roadway in between the SR 84 westbound signalized intersection and new HAWK signal. The new HAWK signal needs to be synchronized with, or on the same controller as, the traffic signal at SR 84. This is to ensure that when activated the HAWK signal stops north-south traffic only during the same time when the SR 84 eastbound and westbound phases have a green signal, and not when north-south traffic has a green signal.

This short-term concept is recommended for five existing arterial crossings within the study area:

- NW 136th Avenue
- Flamingo Road
- Hiatus Road
- Nob Hill Road
- Pine Island Road

Figure 3-1 shows a photograph of an example HAWK signal.

Figure 3-1: Example HAWK Signal Photo

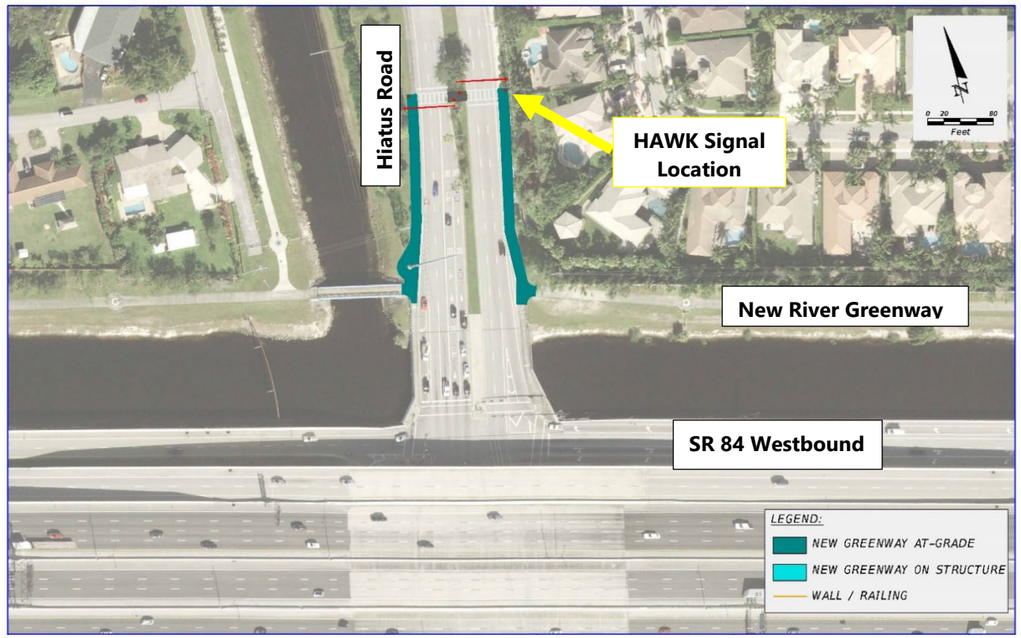
Figure 1. A PHB in Phoenix Arizona provides protection for pedestrians near a high school. Photo Credit: Mike Cynecki

Source: FHWA Pedestrian Hybrid Beacon Guide

A HAWK signal pedestrian crossing improvement is already being designed and constructed by Broward County at two of the New River Greenway crossings within the study area: Hiatus Road and Flamingo Road.

Figure 3-2 shows a conceptual design plan view of the short-term HAWK signal concept at one of the existing New River Greenway crossings (Hiatus Road).

Figure 3-2: HAWK Signal Concept Plan at Hiatus Road



Long-Term Improvements

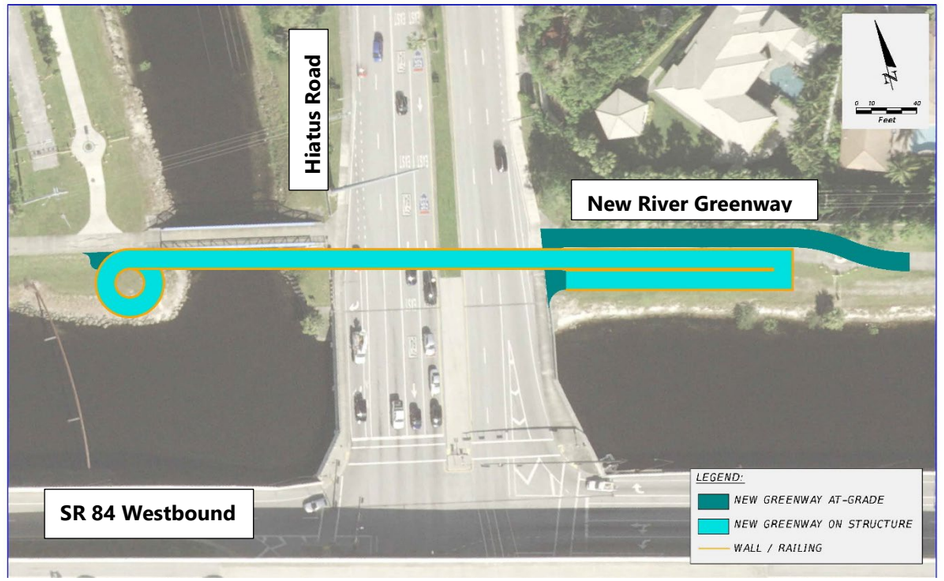
Two long-term improvement concepts were considered for New River Greenway roadway crossings within the study area:

1) An overpass (or above-ground) crossing, and,
2) An underpass (or below-ground) crossing.

The overpass crossing concept consists of a new pedestrian and bicyclist bridge that would be constructed to span over top of the north-south arterial with a ramp on each side to facilitate pedestrians, bicyclists, and wheelchair users. The ramps would link the greenway to the bridge, and a connection would remain between the greenway and the sidewalk along the north-south arterial. In addition, stairs are a feature that should be considered for pedestrians to use the overpass more efficiently without having to travel up or down ramps. The overpass concept presents an opportunity to incorporate artistic design features such as a gateway sign on the bridge to make it an attractive community feature.

Two variations of the overpass crossing concept plan were developed: Option A and Option B. Option A shown in Figure 3-3 shows the overpass bridge crossing directly over the roadway.

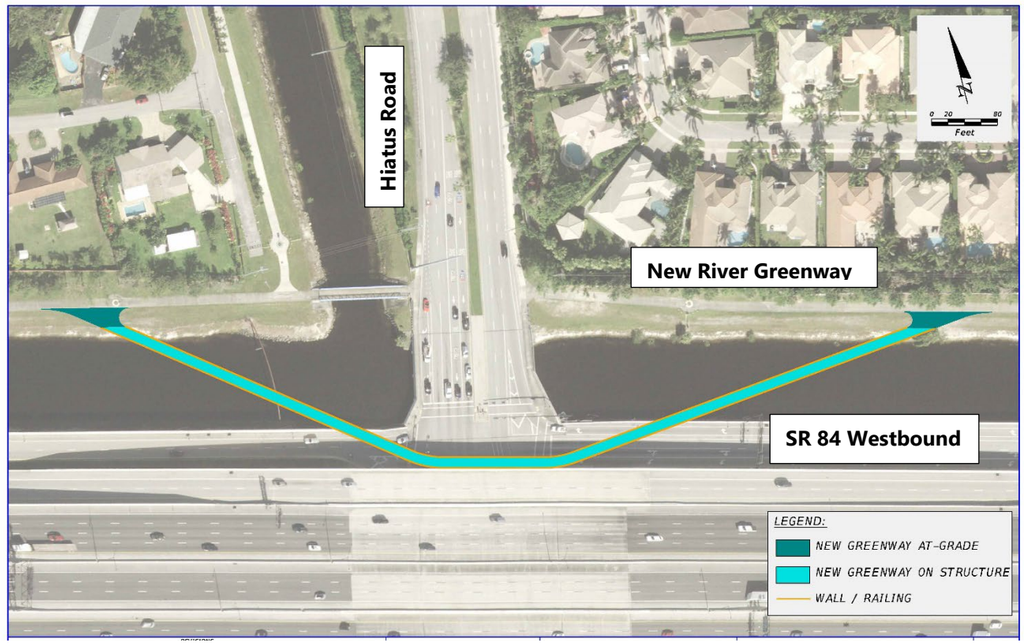
Figure 3-3: New River Greenway Overpass Crossing Concept Plan Option A



There are a wide variety of possible ramp end treatments that can be designed depending on available space, cost, and materials. Two possible types of ramps are shown in the concept plan. One is a circular ramp on the west end while the other is a linear ramp on the east end.

Option B is depicted in Figure 3-4 and shows an overpass with longer ramp bridges on both ends that would span over the New River Canal.

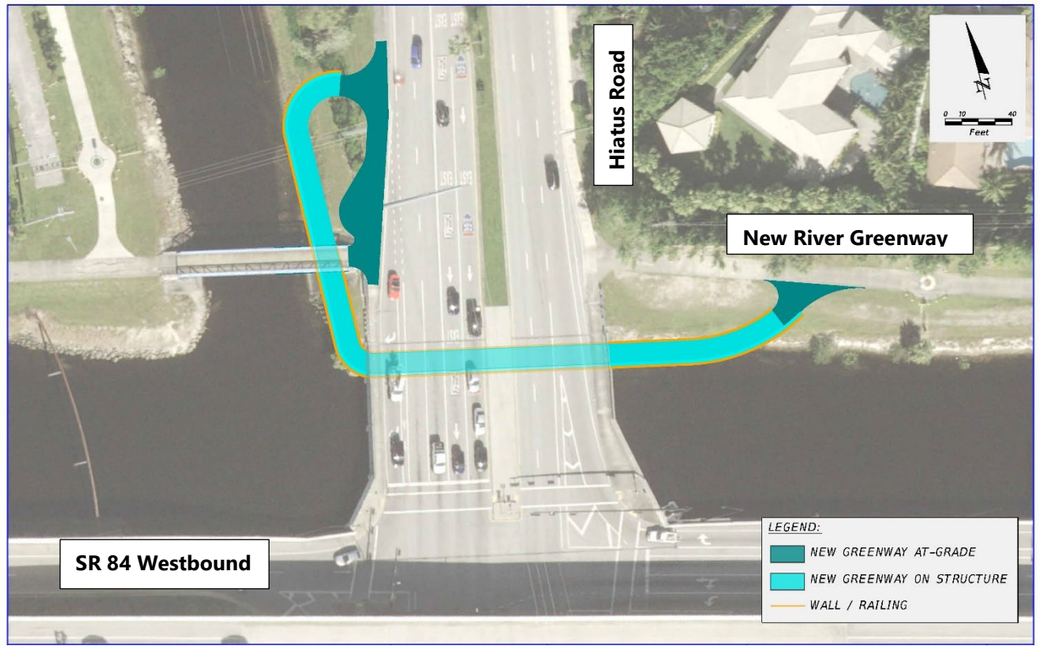
Figure 3-4: New River Greenway Overpass Crossing Concept Plan Option B



The Option B overpass crossing concept connects to a bridge spanning over the north-south arterial alongside the outside edge of the I-595 roadway bridge. The longer bridges over the New River Canal would introduce impacts to the canal, and the proximity of pedestrians to noisy traffic on I-595 in Option B make this option less attractive. Therefore, the shorter overpass crossing, Option A, is recommended.

For the underpass crossing concept, two variations of a concept plan were considered as well. The underpass crossing Option A, shown in Figure 3-5, has a shared use path cross below the north-south roadway along the edge of the north bank of the New River Canal.

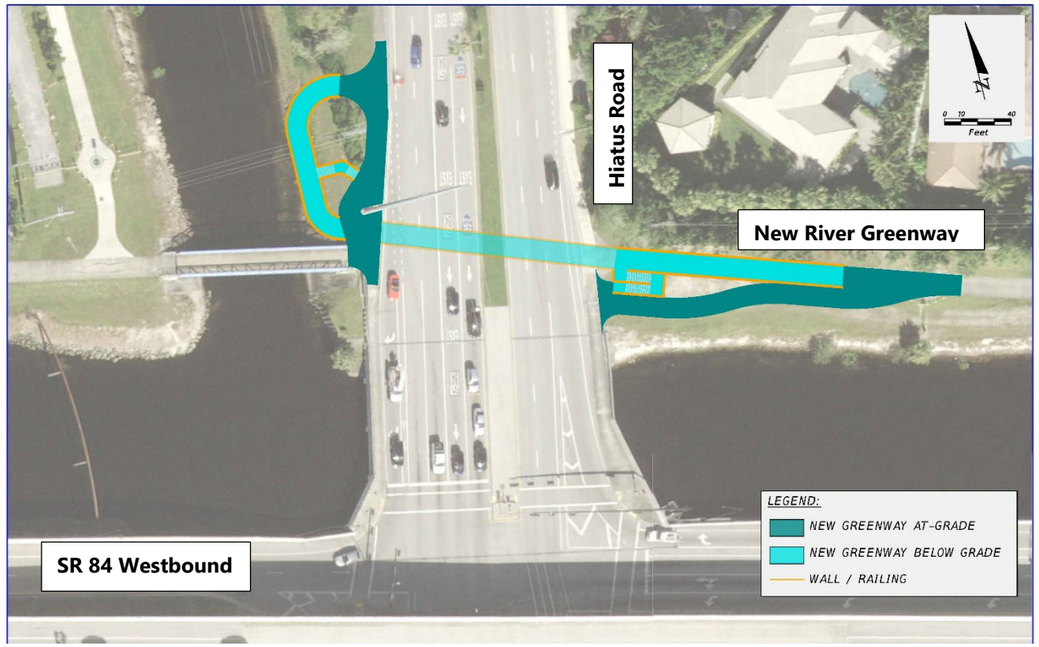
Figure 3-5: New River Greenway Underpass Crossing Concept Plan Option A



This option would depress the pathway below the roadway bridge deck and the path would be partially submerged below the canal water level. The underpass would be open to the air above, with barrier walls on each side for safety to prevent canal water from intruding into the pathway. The Underpass Option A design would be similar to the El Rio Trail underpass below I-95 in Boca Raton, Florida. The El Rio Trail runs alongside the Gulf Stream Canal and passes underneath I-95 just south of Yamato Road.

Figure 3-6 illustrates the option B underpass crossing concept.

Figure 3-6: New River Greenway Underpass Crossing Concept Plan Option B



This crossing would be constructed as an enclosed tunnel underground below the north-south arterial. The design of the tunnel would be a concrete culvert type design. Pedestrian railings and ramps are needed for safety and access on each end, while pumps and drains would drain water out of the tunnel. In addition, the maintaining agency may want to consider lighting for safety, and gates on each end to close access to the tunnel if needed. As with the overpass concept, it is recommended for the underpass crossing to include stairs on each side along with ramps to provide an efficient pedestrian crossing.

Unlike underpass crossing Option A, Option B avoids impacts to the New River Canal. However, to install the Option B underpass below the north-south arterial, would require reconstruction of the roadway over top of the underpass.

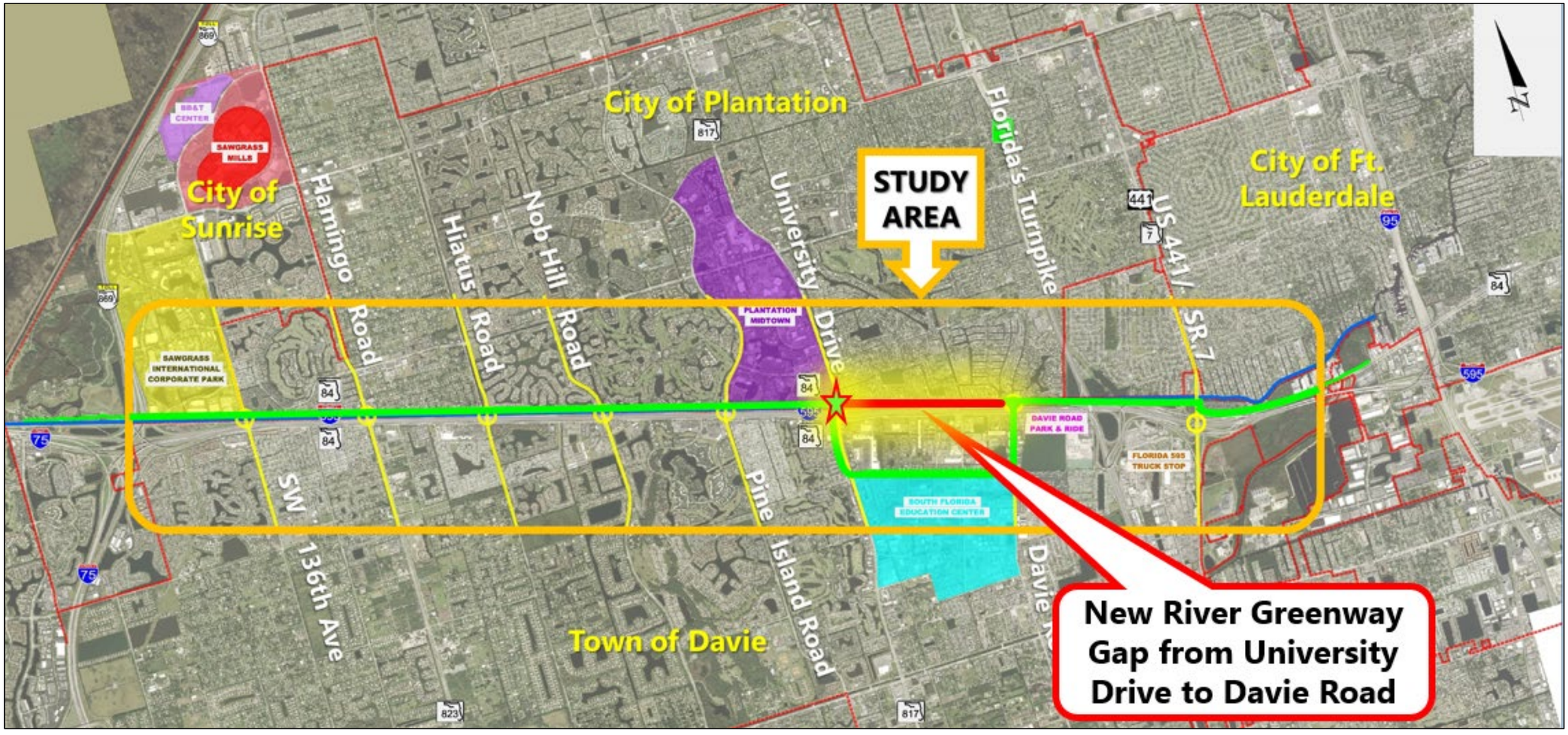
Both underpass crossing options are feasible. Each specific location would need to be analyzed to determine which option is best. The unique physical characteristics of the existing bridge over the New River Canal, and construction methods and maintenance of traffic requirements for each north-south arterial should be considered.

3.2.2.2 New River Greenway Extension

There is a gap in the existing New River Greenway shared use path between University Drive and Davie Road. This is shown in Figure 3-7. To connect each side of the greenway, users are currently required to travel north or south along University Drive or Davie Road, then east or west along Nova Drive, and north-south again along Davie Road or University Drive. That route is approximately 2.65 miles long and directs greenway users to travel along the side of University Drive and Dave Road, both of which are roadways with very high volumes of traffic.

An extension is proposed of the existing New River Greenway shared use path between University Drive and the location where the path terminates just west of Davie Road at Sewell Lock Park. The greenway extension would provide an uninterrupted and direct east-west pathway for greenway users along the New River Canal. This proposed extension would shorten the user's route length between Davie Road and University Drive from 2.65 miles to approximately 1.6 miles. The greenway extension would improve connectivity, safety, and efficiency for greenway users and is expected to attract more people to it. Exhibit A-1 in Appendix A shows the conceptual design plan for the proposed New River Greenway extension between University Drive and Davie Road.

Figure 3-7: Existing New River Greenway Gap between University Drive and Davie Road



The greenway extension would require construction of the following new structures:

1) New River Greenway underpass crossing below University Drive;
2) New River Greenway bridge to cross over the north-south canal situated on the western edge of the Isla del Sol neighborhood; and
3) New River Greenway bridge to cross over the New River Canal, west of Sewell Lock Park. This third structure is only needed if the existing Sewell Lock structure could not be utilized as a pedestrian/bicyclist bridge.

The extension of the New River Greenway shared use path between University Drive and west of Davie Road near Sewell Lock Park is proposed to be constructed within South Florida Water Management District (SFWMD) property along the north side of the New River Canal. This will require close coordination with SFWMD to determine possible impacts to the canal or their operations and maintenance of the canal, and if the greenway extension can be permitted. Also, extending the greenway will require close coordination with property owners of the single-family homes which run along the north side of the New River Canal. The extension of the greenway shared use path would be constructed near the southern edge of their properties.

3.2.3 Recommended Concepts

New River Greenway Extension Recommendation

The New River Greenway extension between University Drive and Davie Road is recommended to be implemented. This recommended improvement consists of constructing a new 12-foot-wide shared use path along the north side of the New River Canal from University Drive to Sewell Lock Park. Sewell Lock Park is located on the north side of westbound SR 84, just west of Davie Road, where the existing greenway pathway currently terminates. For consistency the New River Greenway extension should be designed to match with the existing greenway design as a 12-foot-wide shared use concrete path with signing and amenities provided for users.

Two possible locations were identified for the new greenway path to cross over the New River Canal and connect with the existing terminus of the greenway on the south side of the canal. The first option is to utilize the existing Sewell Lock, which currently spans across the canal, and modify it so it may be used as a pedestrian/bicyclist bridge in addition to its current purpose. The second option is to construct a new pedestrian/bicyclist bridge over the New River Canal just west of the Sewell Lock. The location of the bridge across the New River Canal would need to be determined after assessing the acceptability of using the existing Sewell Lock as a pedestrian/bicyclist bridge. Constructing the New River Greenway extension provides a shorter and faster route to travel between Davie Road and University Drive and can encourage more people to use the greenway to make trips.

The conceptual design plan for the New River Greenway Extension is provided as Exhibit A-1 in Appendix A.

New River Greenway Crossings Recommendations

For the New River Greenway crossings, the short-term HAWK signal concept is recommended to be implemented at five of the existing north-south arterial crossings within the study area. Long-term concept improvements were also evaluated and recommended based on the physical characteristics and feasibility at each of the north-south arterial crossing locations. The following improvements are recommended at each of the crossings.

- NW 136th Avenue
  - Short-term: Implement HAWK signal concept
  - Long-term: An underpass concept assuming study-recommended roadway improvements for NW 136th Avenue will be constructed, since the roadway improvements include an elevated flyover that may conflict with the location of a greenway overpass.

- Flamingo Road
  - Short-term: Implement HAWK signal concept
  - Long-term: An overpass concept assuming it has slightly less impacts and cost than an underpass.
- Hiatus Road
  - Short-term: Implement HAWK signal concept
  - Long-term: An overpass concept assuming it has slightly less impacts and cost than an underpass.
- Nob Hill Road
  - Short-term: Implement HAWK signal concept
  - Long-term: An overpass concept assuming it has slightly less impacts and cost than an underpass.
- Pine Island Road
  - Short-term: Implement HAWK signal concept
  - Long-term: An overpass concept assuming it has slightly less impacts and cost than an underpass.
- University Drive
  - Long-term: An underpass concept due to the existing elevated flyover that conflicts with the location of a greenway overpass. This greenway crossing improvement is only recommended if the New River Greenway extension will be constructed, since there is currently no greenway to connect to east of University Drive.

Underpass Crossings

The underpass crossings are envisioned to be constructed as a concrete culvert installed below the north-south arterial. In accordance with the 2020 Florida Design Manual Chapter 224, the minimum tunnel width for a shared use path is the width of the path plus four feet. To meet Americans with Disabilities Act (ADA) requirements, the maximum cross slope on shared use paths is 2%; the maximum longitudinal grade is 5%; and the maximum ramp slopes are 8.33%. A 12-foot vertical clearance is desirable for underpasses, tunnels, and designated SUN Trail facilities. Various ramp alignments can be considered such as spiral or linear. Stairs should be included for pedestrians as an efficient way to access the underpass. Lighting fixtures and a pump system for stormwater removal will also be needed for this type of crossing. The underpass concept plan is shown as Exhibit A-2 in Appendix A.

Figure 3-8 on the following page shows two photos of an example underpass designed for the Seminole-Wekiva Trail crossing under the intersection of Lake Mary Boulevard and International Parkway in Lake Mary, Florida. The project was open to the public in December 2011. The underpass is similar to the underpass that is recommended for the New River Greenway crossings.

Figure 3-8: Example 1 - Pedestrian/Bicycle Underpass Crossing Lake Mary, Florida

Location: Seminole Wekiva Trail, Lake Mary, Florida

Figure 3-9 shows a photo of a second example pedestrian/bicycle underpass located in Litchfield Park, Arizona. This underpass opened to the public in 2013. According to www.americastransportationawards.org this underpass cost approximately $2.8 million dollars to construct. It is a slightly different type of design than the first example and shows how stairs can be incorporated into the design, as well as aesthetic features.

Figure 3-9: Example 2 - Pedestrian/Bicycle Underpass Crossing

Figure 3-10 shows a third example photo of a pedestrian/bicycle underpass located in Cambridge, Massachusetts. This underpass was reconstructed in 2006 and indicates how unique materials and aesthetic treatments could be incorporated into the design of an underpass.

Figure 3-10: Example 3 - Pedestrian/Bicycle Underpass Crossing

Location: Cambridge, Massachusetts

Overpass Crossings

The overpass crossings are envisioned to be concrete or steel bridge structures installed above the north-south arterial. In accordance with the 2020 Florida Design Manual Chapter 224, as well as ADA requirements, the maximum cross slope on shared use paths is 2%, the maximum longitudinal grade is 5%, and maximum ramp slopes are 8.33%. The minimum vertical clearance for a new pedestrian bridge over roadways is 17.5 feet. Various ramp alignments can be considered such as spiral or linear. Stairs should be included for pedestrians to use as an efficient way to access the underpass. The overpass concept plan is shown as Exhibit A-3 in Appendix A.

Figure 3-11 shows a 3D rendering developed to illustrate the overpass crossing concept at Flamingo Road and SR 84. For purposes of illustrating different ramp options, a spiral ramp is shown on the west side and a linear ramp on the east side.

Figure 3-11: Rendering of New River Greenway Overpass Crossing at Flamingo Road

3.2.4 Concept Benefits

The short-term HAWK signal can provide a safer crossing for greenway users. It allows greenway users to cross at a location with fewer vehicle movements than the busy SR 84 westbound intersection, and it provides better visibility. The long-term improvements (overpass crossing and underpass crossing) provide a more direct, continuous, and safer crossing for greenway users. In addition, the improvements can reduce delay to vehicles on the roadway by reducing the number of pedestrians crossing at the signalized intersections. Table 3-1 summarizes the advantages and disadvantages of each of the New River Greenway concepts.

Table 3-1: New River Greenway Concepts Advantages and Disadvantages

Greenway Concept	Advantages	Disadvantages
HAWK Signal	• Provides a safer crossing than No Build. • Easy to Use - No grade change for greenway users. • Can be implemented as a short-term improvement. • Minimal to no negative environmental impacts.	• Greenway users must stop to activate pedestrian crossing signal. • Traffic must stop on north south arterial for greenway crossing. • Slightly longer distance for pedestrians/bicyclists to cross using HAWK signal as compared to No Build.
Overpass Crossing	• Provides a safer crossing for greenway users than No Build by reducing conflicts between greenway users and vehicles. • Provides a more direct route for greenway users to cross than No Build. • Provides a continuous non-stop route to cross the arterial. • Reduces delay to vehicles on the roadway by reducing number of pedestrians crossing at signalized intersections.	• Need to avoid or minimize impacts to canals and maintenance area for canals. • Greenway users need to travel uphill and downhill on the ramps. • Long bridges and foundations can be challenging to design and construct. • Visual impacts to nearby businesses or homes.
Underpass Crossing	• Provides a safer crossing for greenway users than No Build by reducing conflicts between greenway users and vehicles. • Provides a more direct route for greenway users to cross than No Build. • Provides a continuous non-stop route to cross the arterial. • Reduces delay to vehicles on the roadway by reducing number of pedestrians crossing at signalized intersections.	• Need to avoid or minimize impacts to canals and maintenance area for canals. • Greenway users need to travel uphill and downhill on the ramps. • Constructing a culvert / tunnel requires roadway reconstruction. • Requires regular maintenance, lighting, bulkhead wall, and pump station.
Extension between University Drive and Davie Road	• Provides a more direct route for greenway users to travel between University Drive and Davie Road. • Provides a continuous non-stop route between University Drive and Davie Road. • Provides a safer route for greenway users by reducing the exposure to roadway traffic. • Reduces delay to vehicles on the roadway by reducing number of pedestrians crossing at signalized intersections.	• Need to minimize impacts to canals and maintenance area for canals. • Visual impacts to nearby homes.

3.2.5 Right-of-Way

The short-term HAWK signal does not require any additional public right-of-way to implement. However, the long-term overpass crossing and underpass crossing improvements will require right-of-way or an easement from the South Florida Water Management District. The additional space is needed for bridge supports and ramp end treatments to connect to the existing greenway path.

3.2.6 Structural Impacts

The short-term HAWK Signal will not require any change to existing structures. However, it will require the design and construction of new traffic signal mast arms and pedestrian signals to implement the new HAWK signals for each direction to control the north-south vehicular traffic.

The long-term overpass crossing requires a new pedestrian/bicycle bridge to be constructed over the north-south arterials. In accordance with the 2020 Florida Design Manual (FDM) it is required to have a minimum vertical clearance of 17.5 feet over the roadway and will need to be long enough to span the expanded north-south arterial lanes. Ramp end treatment structures are also needed. A variety of ramp end treatments can be considered and the best fit selected based on existing surrounding conditions and community preference. Ramp end treatments can be different styles such as a spiral or circular ramp, or a linear ramp. It is recommended that stairs are provided for pedestrians as the most efficient way for them to access the overpass to cross the roadway.

The New River Greenway Extension between University Drive and Davie Road will require three structures. The first is an underpass for the greenway to cross below University Drive. The second is a new approximately 150-foot-long pedestrian/bicycle bridge to cross over the canal located along the west edge of the Isla del Sol neighborhood. Lastly, there are two different options to explore to bridge the shared use path across the New River Canal west of Davie Road near Sewell Lock Park:

1) New approximately 160-foot-long pedestrian/bicycle bridge to cross over the New River Canal just west of the Sewell Lock, or
2) Adapt the Sewell Lock to not only serve as a water control structure, but to also serve as a pedestrian and bicycle bridge on top.

3.2.7 Environmental Impacts

The short-term HAWK Signal is not expected to have any significant environmental impacts since the work would be done within existing public right-of-way and would be designed to avoid any critical areas of concern. However, the long-term concept of an overpass crossing requires a new pedestrian/bicycle bridge to be constructed over the north-south arterials. Since this will require work outside existing public right-of-way, a review of potential impacts to environmental resources will need to be conducted.

The underpass crossing is envisioned to be constructed as a concrete culvert below the north-south arterial. While most work will be done within existing public right-of-way, the ramp end treatments for the greenway will likely fall outside of public right-of-way. Therefore, a review of potential impacts to environmental resources will need to be conducted.

The New River Greenway extension between University Drive and Davie Road will require three structures, one of which would span the New River Canal. Also, the shared use path would be constructed outside existing public right-of-way and within the SFWMD right-of-way. A review of potential impacts to environmental resources will need to be conducted.

3.2.8 Other Impacts

No other types of impacts were identified for the short-term HAWK Signal improvements for the New River Greenway crossings.

The long-term New River Greenway crossing improvements consist of overpasses and underpasses. The overpass crossing can have visual impacts to adjacent properties, as it may be seen from adjacent properties, and people using the overpass crossing may have a line of

sight into neighboring properties. Coordination and public outreach to the adjacent communities is recommended at the next phase.

For the underpass crossing, safety of users during dark conditions may be a concern. Therefore, lighting and an emergency telephone may be installed to facilitate safe nighttime use, or gates may be installed to preclude nighttime use. If nighttime use is precluded, then an at-grade crossing must be maintained.

The New River Greenway Extension between University Drive and Davie Road may have visual impacts to adjacent residential properties. Such residences would be able to see the shared use path, and people using the greenway may be able to see into neighboring buildings. Coordination and public outreach to the adjacent communities is recommended at the next phase.

3.2.9 Cost Estimates

Similar projects were used as a guide to estimate the cost of the recommended HAWK signal improvement, the overpass crossing, and the underpass crossing concept. A planning level cost estimate for the New River Greenway Extension was developed using FDOT's Long Range Estimate (LRE) program. The estimated construction costs are summarized in Table 3-2.

According to Broward County's Mobility Advancement Program website (as of July 17, 2021) the County has budgeted between $779,000 and $713,000 for design and construction of a new HAWK signal at each of the five (NW 136th Avenue, Flamingo Road, Hiatus Road, Nob Hill Road, and Pine Island Road) existing New River Greenway crossings. These projects have been programmed to begin within the next five years.

Table 3-2: Construction Cost Estimates for New River Greenway Concepts

Greenway Improvement	Estimated Construction Cost (Year 2021 $)
HAWK Signal	$779,000 - $713,000 per location ** based on Broward County project costs shown on Broward County Surtax Project website as of July 2021*
Overpass Crossing	$2.9 million
Underpass Crossing	$3.3 million
Extension between University Drive and Davie Road	$7.3 million

A planning level cost estimate was developed using cost assumptions available from the FDOT Long Range Estimate (LRE) tool for a New River Greenway overpass crossing at the north-south arterials (Flamingo Road, Hiatus Road, Nob Hill Road, Pine Island Road). To develop an average cost per location, an average length for the overpass bridge was used; one circular pedestrian ramp was assumed for one end; and a linear ramp was assumed for the other end of the overpass. The cost estimate for construction of an overpass at one of the north-south arterials is approximately $2.9 million.

To estimate the cost of constructing a New River Greenway underpass crossing, a planning level cost estimate was developed. It was based upon cost assumptions available from the FDOT Long Range Estimate (LRE) tool. The length of the underpass was predicated on the estimated crossing distance below University Drive. For construction of an underpass at one of the north-south arterials, the cost estimate is approximately $3.3 million.

3.3 NW/SW 136th Avenue Corridor

The NW/SW 136th Avenue corridor was studied from NW 8th Street in City of Sunrise to SW 14th Street in Town of Davie. NW 136th Avenue between NW 8th Street and SR 84 is a six-lane divided Broward County arterial. SW 136th Avenue south of SR 84 is a Town of Davie major collector. South of SR 84 it is a four-lane divided roadway between SR 84 and Cumberland Terrace, and a two-lane undivided roadway from Cumberland Terrace to SW 14th Street. NW/SW 136th Avenue has sidewalk along both sides within the study area, except for a gap where sidewalk is missing on the east side between SR 84 and NW 5th Street. There are no bicycle lanes on NW/SW 136th Avenue within the study limits.

3.3.1 Design Considerations

The development of improvement concepts is multifaceted and must consider a number of deficiencies and design constraints unique to the NW/SW 136th Avenue corridor. The specific safety, operational, and multimodal design considerations are noted below along with the design constraints.

Within the study area four signalized intersections along NW/SW 136th Avenue were studied. The NW/SW 136th Avenue study intersection at SR 84 eastbound currently operates at LOS F and E during the AM and PM peak hours. The SR 84 westbound intersection currently operates at LOS D and E during the AM and PM peak hours. By 2045 without any improvements, both study intersections will operate at LOS F during both AM and PM peak hours.

There are several issues with the NW/SW 136th Avenue corridor, which represent opportunities for improvement. These design considerations are noted below.

- Mobility/Operational
  - Inadequate capacity at the SR 84/I-595 interchange
  - Multiple conflicting high traffic volume turning movements
- Safety
  - High crash rate associated with heavily congested conditions
- Bicycle and Pedestrian
  - Inadequate crossing for the New River Greenway users
  - Missing sidewalk along an arterial segment
  - Missing bicycle lanes along the entire study segment
  - Need to accommodate safe pedestrian and bicycle movements through the SR 84/I-595 interchange
- Transit
  - Upgrade existing bus stops along NW/SW 136th Avenue north of SR 84. No bus service south of SR 84.
- Key Constraints
  - Avoid or minimize impacts to I-595 mainline
  - Avoid or minimize impacts to New River Canal
  - Avoid or minimize impacts to adjacent business and residential properties
  - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to avoid or minimize impacts to I-595 mainline and ramps, the New River Canal and other adjacent canals, and adjacent properties. The purpose of improving the NW/SW 136th Avenue and SR 84 interchange is to improve safety, reduce delay, reduce travel times along NW/SW 136th Avenue, and reduce long queues and congestion. To provide for safe and efficient alternative modes of travel, adding and improving pedestrian and bicycle facilities along NW/SW 136th Avenue was considered.

3.3.2 Evaluated Improvements

NW/SW 136th Avenue corridor improvements include improvements to the SR 84 / I-595 interchange as well as multimodal improvements. Multiple alternatives were evaluated for improving the NW/SW 13th Avenue and SR 84 / I-595 interchange, since capacity and operational issues were very challenging to address at this location. Addressing the capacity and operational and safety issues at the interchange was difficult at this location due to the large conflicting traffic movement volumes, as well as the physical design constraints.

3.3.2.1 NW/SW 136th Avenue at SR 84 / I-595 Interchange Alternatives

At the NW/SW 136th Avenue and SR 84 / I-595 interchange, the following four interchange configurations were evaluated to determine a recommended mitigation concept.

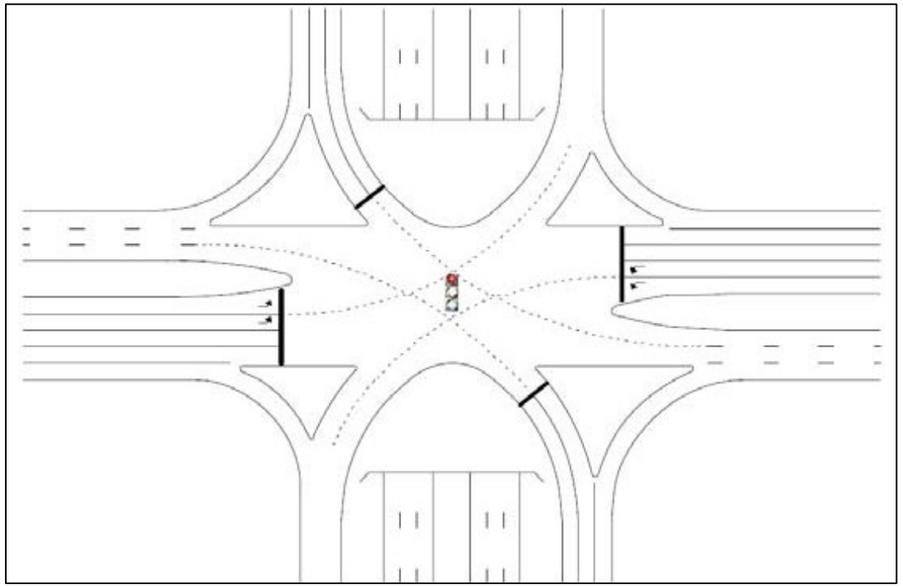
1. Single Point Urban Interchange (SPUI)
2. Diverging Diamond Interchange (DDI)
3. Displaced Left-turn (DLT) with Bypass Lanes
4. Modified Diamond Interchange with Flyover and Bypass Lanes

Single Point Urban Interchange (SPUI)

The SPUI is a compressed diamond interchange that can improve traffic capacity and operations while requiring less right-of-way than a traditional diamond interchange. All left-turn movements traverse through one central signalized point, which in the case of NW/SW 136th Avenue would occur below I-595. Some of the key design characteristics that need to be considered when designing a SPUI are the skew angles of each approach; number of through, left, and right-turn lanes; median widths; and islands. Typically, a SPUI can operate with three or four phase signal phasing, which reduces lost time and allows the intersection to operate more efficiently. However, if frontage roads are present, like SR 84, an additional phase is needed to serve through movements on the frontage road. As a result, such a configuration will not be as efficient. Overall, a SPUI interchange configuration represents a high-capacity alternative.

A typical configuration of a Single Point Urban Interchange (SPUI) is shown in Figure 3-12.

Figure 3-12: Single Point Urban Interchange (SPUI) Configuration



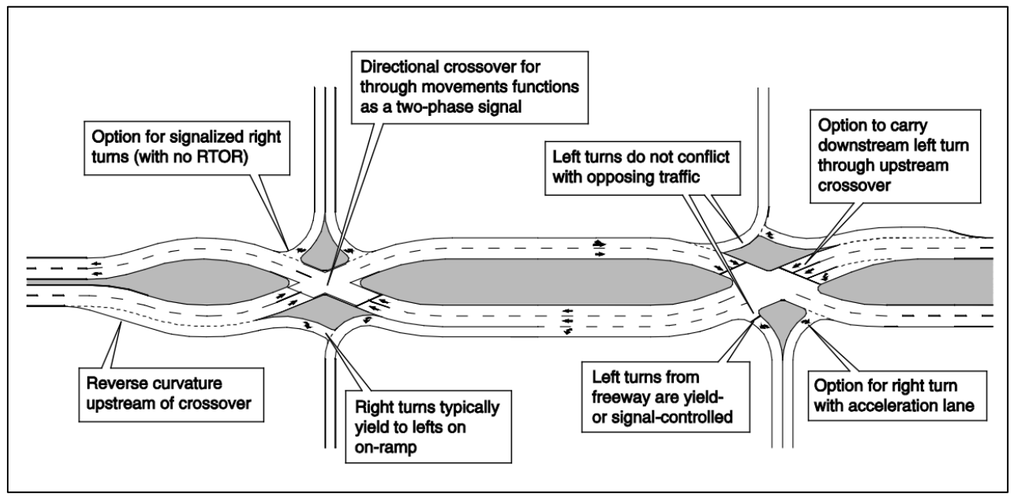
Source: Transportation Research Board

Diverging Diamond Interchange (DDI)

The DDI is an alternative to the conventional diamond interchange. One of the differences between a diamond interchange and a DDI is the directional crossover intersections on either side of the interchange. The crossover intersections are signalized intersections that control the crossing of opposing through movement traffic over to the other side of the road and back again. With through traffic crossed to the left side, this can reduce or eliminate the need for separate traffic signal phases for turning traffic movements. The DDI design can make an interchange more efficient and improve operations and safety by reducing the number of vehicle conflict points. Typically, a DDI designed with the cross street (NW/SW 136th Avenue in this case) as an overpass offers the most design flexibility. However, the NW/SW 136th Avenue interchange is presently constructed with the cross street below the interstate, so a DDI configuration must be designed within the available space below the I-595 bridge.

Figure 3-13 shows a general layout of a Diverging Diamond Interchange (DDI) configuration.

Figure 3-13: Diverging Diamond Interchange (DDI) Configuration



Source: FHWA Diverging Diamond Interchange Informational Guide

Displaced Left-turn (DLT) with Bypass Lanes

A displaced left-turn (DLT) interchange configuration can increase capacity by implementing more efficient two-phase or three-phase signal operations. In addition, it is compatible with high-volume turning movements, and can provide more green time for major movements. It can lower delay and cause fewer stops. At the NW/SW 136th Avenue and SR 84 interchange, a DLT configuration was evaluated for the heaviest left-turn movement, which is the southbound NW/SW 136th Avenue left-turn to I-595 and eastbound SR 84.

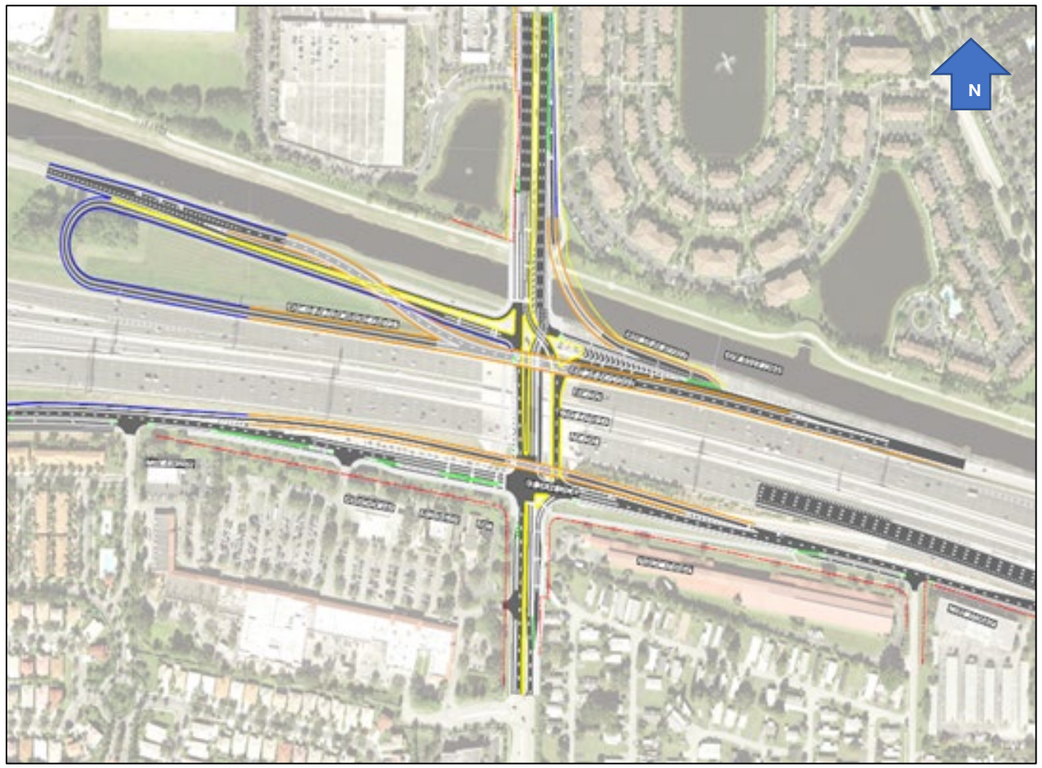
There are typically only two movements at the crossover intersections in a DLT design: the two through movements crossing over each other. However, at the NW/SW 136th Avenue and SR 84 / I-595 interchange, the westbound SR 84 through and left-turn movements would also occur at the crossover intersection unless they were removed. To remove the westbound SR 84 movements from the crossover intersection, the concept included a westbound SR 84 overpass (or bypass) over NW/SW 136th Avenue for westbound through and left-turn movements. This would remove these movements fully from the signalized intersection on NW/SW 136th Avenue.

The westbound SR 84 traffic would bypass the signal using an overpass over NW/SW 136th Avenue. The overpass would also bridge over top of the at-grade westbound SR 84 lanes west of NW/SW 136th Avenue and merge with westbound SR 84 further downstream to continue west. The westbound SR 84 bypass would also bring all left-turning vehicles to a loop ramp which would route them east towards the signalized intersection where they would make a right-turn to go south on NW/SW 136th Avenue. A westbound SR 84 to northbound NW 136th Avenue right-turn bypass lane is also included in the concept which allows most right-turning traffic to bypass the signalized intersection at SR 84 and merge onto northbound NW 136th Avenue without stopping.

The concept also includes a bypass which allows eastbound SR 84 traffic to use an overpass over NW/SW 136th Avenue that subsequently merges into eastbound SR 84. This effectively permits motorists to bypass the at-grade signalized intersection at SR 84 and NW/SW 136th Avenue. The eastbound and westbound SR 84 bypasses remove a significant volume of traffic from the signalized intersections along NW/SW 136th Avenue. This reduces conflicts, delay, and travel time for NW/SW 136th Avenue traffic.

Figure 3-14 shows an image of the Displaced Left-turn (DLT) with Bypass Lanes concept at the interchange. For a more detailed view of the DLT with Bypass Lanes interchange configuration shown in Figure 3-14, please refer to the concept plan provided as Exhibit A-4 in Appendix A.

Figure 3-14: Displaced Left-turn (DLT) with Bypass Lanes Configuration



<u>Modified Diamond Interchange with Flyover and Bypass Lanes</u>

The Modified Diamond Interchange with Flyover and Bypass Lanes concept is similar in design to the Displaced Left-turn (DLT) with Bypass Lanes Configuration. The one difference is that instead of the displaced left-turn movement, a flyover is proposed for the southbound NW/SW 136th Avenue to eastbound I-595 and SR 84 movement. Removing that heavy southbound left-turn traffic from the SR 84 interchange further reduces delays for the remaining traffic movements at the interchange.

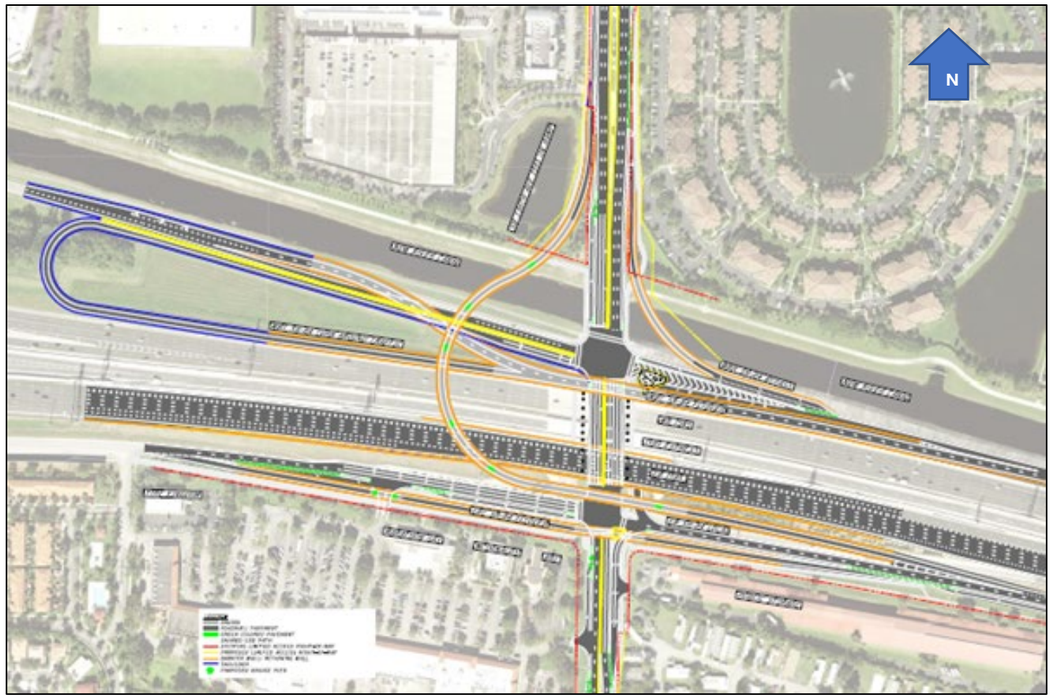
As with the Displaced Left-turn (DLT) with Bypass Lanes concept, the Modified Diamond Interchange with Flyover and Bypass Lanes concept includes a westbound SR 84 bypass for westbound SR 84 through and left-turn movements. The westbound SR 84 traffic would bypass the signal using an overpass over NW/SW 136th Avenue. The overpass would also bridge over top of the at-grade westbound SR 84 lanes west of NW/SW 136th Avenue and merge with westbound SR 84 further downstream to continue west. The westbound SR 84 bypass would also bring all left-turning vehicles to a loop ramp which would route them east towards the signalized intersection where they would make a right-turn to go south on NW/SW 136th Avenue. A westbound SR 84 to northbound NW 136th Avenue right-turn bypass lane is also included in the concept which allows most right-turning traffic to bypass the signalized intersection at SR 84 and merge onto northbound NW 136th Avenue without stopping.

An eastbound SR 84 bypass is also included, which allows eastbound SR 84 through traffic to use an overpass over NW/SW 136th Avenue that subsequently merges into eastbound SR 84. This effectively permits motorists to bypass the at-grade signalized intersection at SR 84 and NW/SW 136th Avenue.

The eastbound and westbound SR 84 bypasses remove a significant volume of traffic from the signalized intersections along NW/SW 136th Avenue, which reduces conflicts, delay, and travel time for NW/SW 136th Avenue traffic.

The Modified Diamond Interchange with Flyover and Bypass Lanes concept is shown in Figure 3-15. For a more detailed view of the Modified Diamond Interchange with Flyover and Bypass Lanes interchange configuration shown in Figure 3-15, please refer to the concept plan provided as Exhibit A-5 in Appendix A.

Figure 3-15: Modified Diamond Interchange with Flyover and Bypass Lanes Configuration



Advantages and Disadvantages of NW/SW 136th Avenue and SR 84 / I-595 Interchange Alternatives

The 2045 AM and PM peak hour traffic volumes documented in Technical Memorandum 3 for the No Build condition were reassigned through the reconfigured interchange intersection configurations for each of the alternatives. The signalized study intersections were then analyzed using Synchro software to determine the estimated delay and LOS for the study intersections for each of the alternative interchange configurations. Next, the physical feasibility of the geometric layout of the roadway for each of the interchange alternatives was evaluated. It was determined whether there would be significant impacts to any of the key constraints listed in Section 3.3.1.

Advantages and disadvantages of each of the four interchange concepts were considered. The SPUI and Modified Diamond interchange concepts can significantly reduce delays and allow the signalized intersections to operate at LOS D or better during 2045 AM and PM peak hours. The DDI and Displaced Left-turn concepts allow the signalized intersections to operate at LOS E or better during the 2045 AM and PM peak hours.

When evaluating the physical feasibility of each of the alternatives, it was determined that the SPUI would require full reconstruction of the I-595 interchange including the existing bridge structures. This was considered an unacceptable alternative since it would significantly impact I-595 traffic flow.

Key design features needed for the DDI are difficult to provide within the available space on either side of the I-595 bridge. In addition, typically a DDI design does not accommodate through movements for the ramps (in this case SR 84). When this was included, it negated benefits of a 2-phase or 3-phase signal timing and did not provide the benefits of a typical DDI design. The other option was to reroute the eastbound and westbound through movements downstream along NW/SW 136th Avenue, where they would need to make a U-turn and travel

back to the SR 84 intersection and make a right-turn. Rerouting these fairly heavy movements Locations along NW/SW 136th Avenue were not available to accommodate the heavy U-turn volumes (over 500 vehicles during the peak hours). The DDI was eliminated due to concerns with the feasibility of the design at this location.

The DLT concept provides significant benefits since the bypass lanes accommodate the majority of heavy movements without requiring traffic to stop. It does impact the New River Canal with the westbound right-turn bypass lane.

The displaced left-turn concept includes three new bridge structures:

1. SR 84 westbound right-turn bypass over the New River Canal
2. SR 84 westbound bypass over NW/SW 136th Avenue
3. SR 84 eastbound bypass over NW/SW 136th Avenue

The displaced left-turn concept is considered next best to the Modified Diamond Interchange with Flyover and Bypass Lanes Configuration. There were no fatal flaws. However, traffic operations did not perform as well as the modified diamond concept.

The Modified Diamond Interchange with Flyover and Bypass Lanes concept allows traffic to operate acceptably through year 2045. Like the displaced left-turn concept, it provides significant benefits since the bypass lanes and flyover accommodate the heavy movements without requiring traffic to stop. However, it does impact the New River Canal with the westbound right-turn bypass lane, and includes four new bridge structures:

1. SR 84 westbound right-turn bypass over the New River Canal
2. SR 84 westbound bypass over NW/SW 136th Avenue
3. SR 84 eastbound bypass over NW/SW 136th Avenue
4. NW/SW 136th Avenue southbound to eastbound I-595/SR 84 flyover (third level)

It also impacts the existing I-595 mainline and requires the I-595 eastbound lanes to be shifted to the south to create space for the flyover bridge structure supports to be placed in between the I-595 express lanes and the eastbound I-595 general purpose lanes.

Table 3-3 summarizes the advantages and disadvantages of each of the four NW/SW 136th Avenue at SR 84 interchange concepts.

Table 3-3: Comparison of Interchange Concept's Advantages and Disadvantages at NW/SW 136th Avenue and I-595

Alternatives	Advantages	Disadvantages
1) Single Point Urban Interchange	• Significantly reduces delay • LOS D in 2045 peak hours	• Not feasible due to design requirements, and impacts to I-595 bridges
2) Diverging Diamond Interchange	• Reduces delay • LOS E in 2045 peak hours	• Not feasible due to design requirements
3) Displaced Left-turn with Bypass Lanes	• Reduces delay • Reduces conflicts • Reduces stops • LOS E in 2045 peak hours	• Right-of-way impact • Canal impact • Reroutes EB to WB U-Turns & NB left-turns to Flamingo Rd. Impacts operations at Flamingo Rd. • Requires 3 new structures
4) Modified Diamond Interchange with Flyover & Bypass Lanes	• Significantly reduces delay • Reduces conflicts • Reduces stops • LOS D in 2045 peak hours	• Right-of-way impact • Canal impact • Driveway impact • Visual impacts (view of flyover) • Impacts I-595 eastbound lanes • Requires 4 new structures

NOTE: All alternatives include the following improvements:

1) *New shared use path to improve pedestrian and bicycle facilities through interchange at SR 84.*
2) *Bicycle lanes along NW/SW 136th Avenue northbound and southbound.*
3) *Sidewalk along NW/SW 136th Avenue northbound and southbound.*
4) *Transit bus stop upgrades for benches or shelters.*

3.3.3 Recommended Concept Improvements

Recommended improvements for the NW/SW 136th Avenue corridor include SR 84 / I-595 interchange improvements as well as multimodal sidewalk, bicycle lane, and bus stop improvements. To address the SR 84 interchange deficiencies, the modified diamond interchange with flyover and bypass lanes alternative is recommended for further analysis, design, and implementation. The Displaced Left-turn with Bypass Lanes alternative is an interchange alternative that may also be further analyzed for comparison in the next phase of analysis and design.

The recommended NW/SW 136th Avenue corridor concept includes new bicycle lanes along NW/SW 136th Avenue within the study limits. It also includes sidewalk where it is currently missing on the east side of NW/SW 136th Avenue between NW 5th Street and SR 84.

The existing bus stops on NW/SW 136th Avenue were reviewed to determine whether any need a bench or a shelter. Seven of the eight bus stops located on NW/SW 136th Avenue between SR 84 and NW 8th Street are lacking benches. A bench is recommended to be provided at all stops. None of the eight stops have a shelter. However, daily activity at existing bus stops was not 10 or more. Therefore, shelters are not necessary for the stops along NW/SW 136th Avenue.

The scope items for the NW/SW 136th Avenue corridor improvements are described below.

<u>NW/SW 136th Avenue Corridor Improvements</u>

The limits of the corridor improvements are from NW 8th Street to SW 14th Street; and along SR 84 eastbound and westbound from approximately 2,800 ft west of NW/SW 136th Avenue to approximately 2,800 ft east of NW/SW 136th Avenue. The corridor improvements include the following components.

- **NW/SW 136th Avenue at SR 84 / I-595 Interchange**
  - Westbound SR 84 to northbound NW/SW 136th Avenue right-turn lane bypass over canal.
  - Southbound NW/SW 136th Avenue to eastbound SR 84 flyover - requires shifting eastbound I-595 mainline general-purpose lanes to the south to fit in columns for flyover.
  - Westbound SR 84 bypass/overpass – includes a new bridge structure and a loop ramp for traffic that needs to go south on NW/SW 136th Avenue.
  - Eastbound SR 84 bypass/overpass.
  - Reconfigure I-595 off- and on-ramps along eastbound SR 84 east of NW 136th Avenue to accommodate the new eastbound SR 84 flyover and bypass lane.
  - Reconfigure westbound SR 84 and NW/SW 136th Avenue signalized intersection as noted below:
    - Northbound: Add a second left-turn lane.
    - Westbound: Reduce to one right-turn lane and one lane for the Texas U-turn.
    - Add new eastbound approach and provide two exclusive eastbound right-turn lanes.
  - Reconfigure eastbound SR 84 and NW/SW 136th Avenue signalized intersection as noted below:
    - Northbound: Add a second right-turn lane.
    - Southbound: Reduce to one left-turn lane.
    - Eastbound: Reduce to one through lane, keep two left-turn lanes, and one right-turn lane.

- **NW/SW 136th Avenue north and south of SR 84**
  - Add buffered bicycle lanes along NW/SW 136th Avenue northbound and southbound for the study limits.
  - Add or widen sidewalk to be a shared use path width for both bicyclists and pedestrians through the interchange area (northbound, southbound, eastbound).
  - Add sidewalk where it does not exist along NW/SW 136th Avenue south of SR 84.

The NW/SW 136th Avenue corridor concept plan with modified diamond interchange with flyover and bypass lanes interchange concept is provided as Exhibit A-5 in Appendix A.

Typical sections showing the existing conditions and proposed conditions for NW/SW 136th Avenue north and south of SR 84 are shown in Figures 3-16 and 3-17.

Figure 3-16: NW/SW 136th Avenue Typical Section North of SR 84

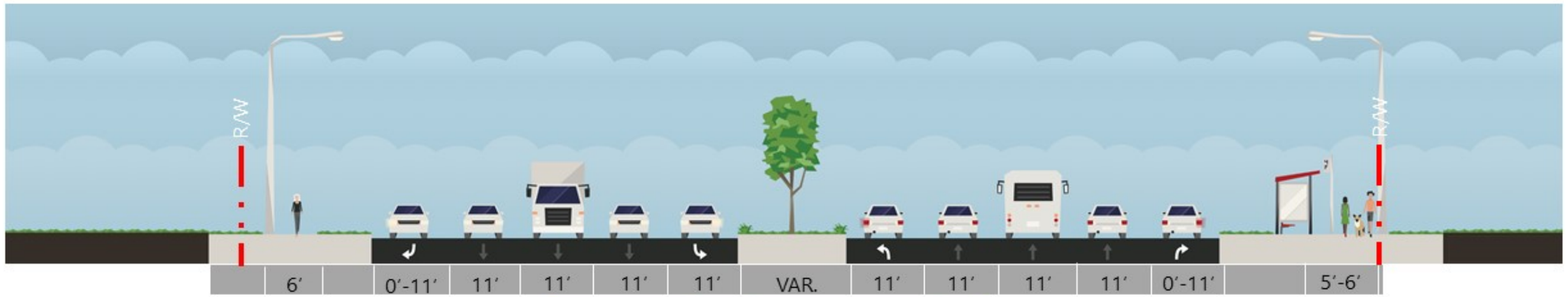
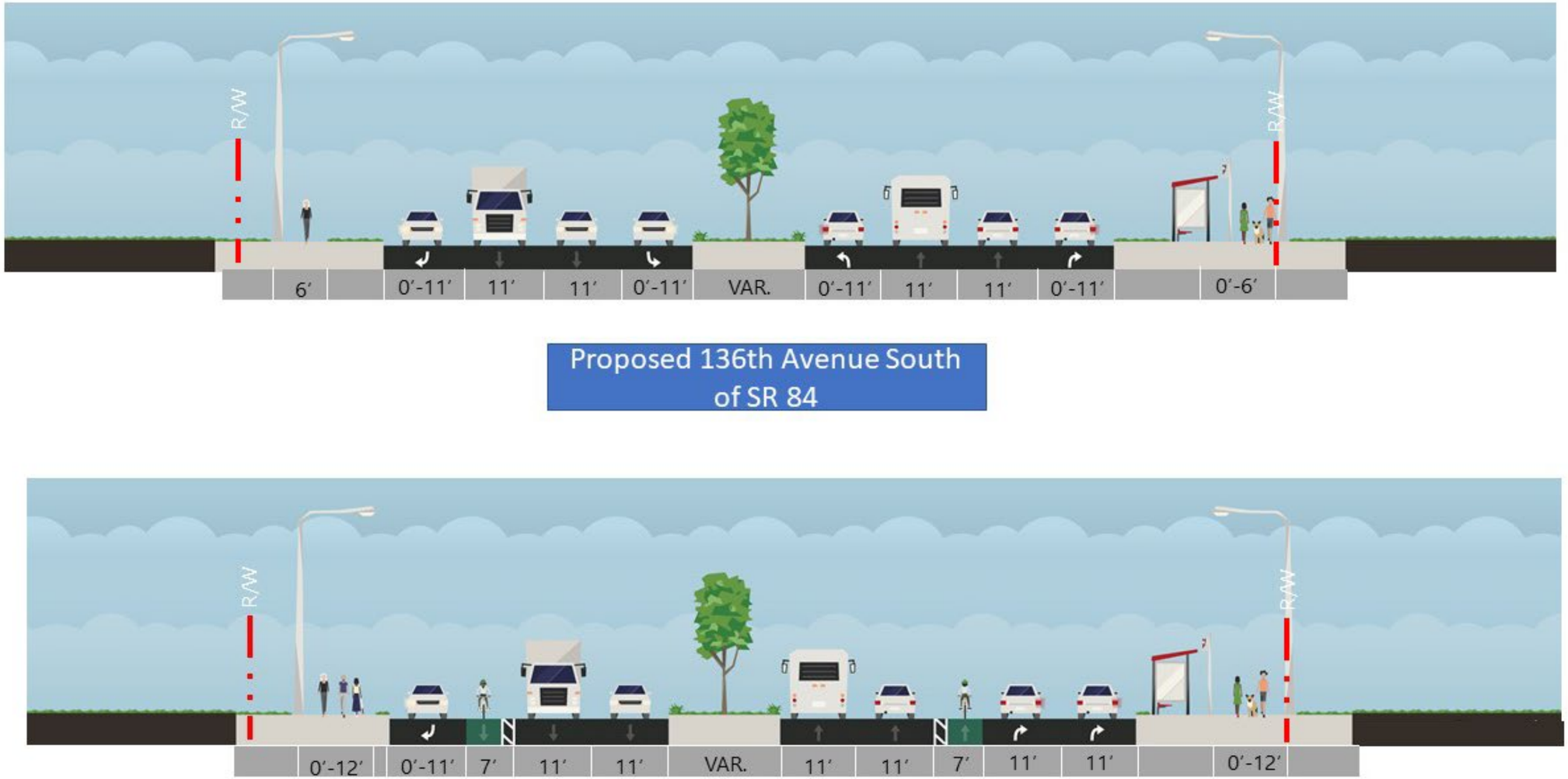


Figure 3-17: NW/SW 136th Avenue Typical Section South of SR 84

Existing 136th Avenue South of SR 84



Proposed 136th Avenue South of SR 84

Figure 3-18 shows a 3D rendering of the recommended NW/SW 136th Avenue improvements at the SR 84 interchange.

Figure 3-18: Rendering of NW/SW 136th Avenue at SR 84 Concept

3.3.4 Concept Benefits

The NW/SW 136th Avenue corridor improvements improve safety, and address congestion at the SR 84 interchange. In addition, the improvements improve safety for vehicles, pedestrians, and bicyclists along the corridor and through the SR 84 interchange. Advantages and disadvantages are summarized in Table 3-4 for the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-4: NW/SW 136th Avenue Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion, does not meet LOS D in 2045 peak hours – operates at LOS F • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Meets LOS D in 2045 peak hours • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for pedestrians & bicyclists	• Right-of-way impact • Canal impact • Driveway impact • Visual impact • I-595 impact • Cost

A summary of the benefits of the proposed NW/SW 136th Avenue corridor improvements is provided in Table 3-5.

Table 3-5: NW/SW 136th Avenue Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS D or better
Delays	90% reduction in total delays
North South Travel Time	50% reduction in travel times along NW/SW 136th Avenue
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	Accommodates bus stops and shelters and potential future enhanced transit service

3.3.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- NW/SW 136th Avenue north of SR 84, along east and west sides from NW 3rd Street to SR 84, potentially impacting a row of parking for the IKEA business on the west side, and Solero Apartments on the east side.
- Westbound SR 84 at NW/SW 136th Avenue, along the north side east and west of NW/SW 136th Avenue, potentially impacting the New River Canal South Florida Water Management District property.
- Eastbound SR 84 at NW/SW 136th Avenue, along the south side, from SW 133rd Avenue to Paradise Way East. This potentially may impact businesses and a residential property.

The concept plan shown as Exhibit A-5 in Appendix A also depicts where right-of-way is potentially needed to accommodate the recommended conceptual improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.3.6 Structural Impacts

The recommended improvements would impact two existing roadway structures. These bridges must be evaluated in the next phase to determine if they can be widened or replaced. The impacted existing structures and potential modifications are listed below.

1) I-595 eastbound bridge over NW/SW 136th Avenue must be modified to allow the eastbound lanes to be shifted south, to make space for a support structure for the proposed southbound to eastbound flyover.
2) NW/SW 136th Avenue bridge over the New River Canal may need to be widened to accommodate the new number of lanes, the bicycle lanes, and sidewalk.

In addition to the existing structures, there are four new roadway structures required as part of the NW/SW 136th Avenue improvements. They are described below.

1) Approximately 350-foot-long roadway bridge for westbound SR 84 traffic destined to northbound NW/SW 136th Avenue, to cross over the New River Canal.
2) Approximately 2,500-foot-long roadway bridge for westbound SR 84 traffic to travel over NW/SW 136th Avenue.
3) Approximately 1,500-foot-long roadway bridge for eastbound SR 84 traffic to travel over NW/SW 136th Avenue.
4) Approximately 2,500-foot-long roadway bridge for a flyover for southbound NW/SW 136th Avenue traffic destined to eastbound SR 84 and I-595, to cross over the New River Canal, SR 84, and I-595.

3.3.7 Environmental Considerations

Impacts to wetlands and other surface waters are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of 136th Avenue and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Due to the potential to impact Florida bonneted bat and wood stork habitat, a PD&E Study would require assessment of and include listed species surveys and United Stated Fish and Wildlife Services (USFWS) consultation. Impacts to floodplains are anticipated and would need to be further evaluated. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features. Environmental considerations are noted below.

Wetlands and Other Surface Waters

- Wetland impacts would occur if submerged aquatic vegetation is present within the North New River Canal (as a result of new ramps). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.
- Impacts to I-595 stormwater ponds (other surface water) would occur.

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees and bridge widening) for the Florida bonneted bat (Endangered species) would occur.
- Impacts to suitable foraging habitat for the wood stork would occur (stormwater ponds).

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family and Multi-Family, Recreational, Institutional) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family (Sunshine Village) and Residential Multi-Family (Solero at Plantation Apartments)
  - Activity Category C: Recreational (New River Greenway Trail)
  - Activity Category D: Institutional (Sunny Seeds Preschool)

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100 year floodplain).

Sociocultural

- Potential for sociocultural impacts as a result of changes to business access (IKEA).

3.3.8 Other Impacts

The southbound NW/SW 136th Avenue to eastbound SR 84/I-595 flyover could have visual impacts to adjacent properties, as it will be a third level structure, and therefore may be seen from adjacent properties. Coordination and public outreach to the adjacent property owners will occur at the next phase.

The flyover will also impact the existing I-595 freeway, and a Maintenance of Traffic (MOT) plan will be necessary to mitigate any impacts to traffic during construction.

3.3.9 Cost Estimate

A planning level construction cost estimate was developed for the NW/SW 136th Avenue corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the NW/SW 136th Avenue and SR 84 / I-595 interchange improvements as well as the recommended multimodal improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $49.0 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate is provided in Appendix B.

3.4 Flamingo Road Corridor

The Flamingo Road corridor was studied from SW 8th Street in Town of Davie to Broward Boulevard in City of Plantation. Flamingo Road between SW 8th Street and SR 84 is a six-lane divided State of Florida principal arterial. North of SR 84 Flamingo Road is a six-lane divided principal arterial under jurisdiction of Broward County and City of Plantation.

Flamingo Road has sidewalk along both sides from SW 6th Court through the SR 84 interchange to the New River Greenway just north of SR 84. However, sidewalk exists on one side only between SW 8th Street and SW 6th Court, from the New River Greenway to south of SW 3rd Street, and from SW 1st Street to Broward Boulevard. There is no sidewalk along Flamingo Road between SW 3rd Street and SW 1st Street. Bicycle lanes exist on Flamingo Road between SW 8th Street and SW 6th Court and are missing between SW 6th Court to Broward Boulevard.

3.4.1 Design Considerations

The development of improvement concepts is multifaceted and must consider several deficiencies and design constraints unique to the Flamingo Road corridor. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Within the study area four signalized intersections along Flamingo Road were studied. Three of the intersections show operational issues under existing or future (2045) conditions. The Flamingo Road study intersections that intersect with eastbound SR 84 and SR 84 westbound are operating at LOS E or F during the existing AM and PM peak hours. By 2045 without any improvements, both study intersections will operate at LOS F during both AM and PM peak hours. Also, the intersection of Flamingo Road and Broward Boulevard operates at LOS D today; however, by 2045 it will operate at LOS E during the AM peak hour.

There were several deficiencies and opportunities for improvement identified along the Flamingo Road corridor. These are noted below.

- Mobility/Operational
    - Inadequate capacity at the SR 84 / I-595 interchange
    - Multiple conflicting high traffic volume turning movements
- Safety
    - High crash rate at the SR 84 / I-595 interchange associated with heavily congested conditions
- Bicycle and Pedestrian
    - Inadequate crossing for the New River Greenway users
    - Missing sidewalk along segments of Flamingo Road
    - Missing bicycle lanes along most of the study segment
    - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange
- Transit
    - Consider upgrades to existing bus stop along Flamingo Road near Broward Boulevard.
- Key Constraints
    - Avoid or minimize impacts to I-595 mainline
    - Avoid or minimize impacts to New River Canal
    - Avoid or minimize impacts to adjacent business and residential properties
    - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to improve operations at the SR 84 / I-595 interchange in the near term, and to improve the Broward Boulevard intersection when operations begin to deteriorate in the long-term. In addition, improvements were considered that could avoid or minimize impacts to adjacent properties. The purpose of improving the Flamingo Road corridor and its study intersections is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety

and connectivity for all modes. Pedestrian, bicycle, and transit facility improvements along Flamingo Road are intended to provide safe and efficient travel for all modes.

3.4.2 Evaluated Improvements

Flamingo Road corridor improvements include improvements to the SR 84 / I-595 interchange, improvements at the intersection with Broward Boulevard, and multimodal improvements along the corridor.

Flamingo Road at SR 84 / I-595 Interchange

At the Flamingo Road and SR 84 / I-595 interchange, the traffic analysis showed that with one major traffic movement removed from the interchange, no additional major modifications are necessary to allow the interchange to operate at an acceptable level of service through 2045. Therefore, a modified diamond interchange configuration with an eastbound SR 84 overpass was evaluated.

The concept includes an eastbound SR 84 bypass which allows eastbound SR 84 traffic to use an overpass bridge over Flamingo Road. The eastbound SR 84 traffic then merges back into eastbound SR 84 downstream, bypassing the signalized intersection. The eastbound SR 84 bypass can remove a significant volume of traffic from the signalized intersection along Flamingo Road, which reduces conflicts, delay, and travel time for not only SR 84 eastbound traffic, but Flamingo Road traffic as well.

The Flamingo Road at SR 84/I-595 interchange concept also includes a proposed modification to the westbound I-595 off-ramp to SR 84. West of Flamingo Road, the westbound I-595 off-ramp would bridge over top of westbound SR 84 and merge into westbound SR 84 on the right side instead of the left side as it does today. This eliminates the existing weaving section where traffic from the I-595 off-ramp destined to westbound SR 84 and NW/SW 136th Avenue must weave across westbound SR 84 traffic, while westbound SR 84 traffic weaves left to access the I-595 westbound on-ramp.

At Flamingo Road and eastbound SR 84, the following additional turn lanes were evaluated and shown to provide significant benefit to operations.

- Eastbound: Add a second exclusive right-turn lane.
- Northbound: Add a second exclusive right-turn lane.

The additional turn lanes evaluated at Flamingo Road and westbound SR 84, and shown to provide significant benefit to operations are listed below.

- Westbound: Add a second exclusive left-turn lane in addition to a shared through/left-turn lane.
- Westbound: Add a second exclusive right-turn lane in addition to a shared through/right-turn lane.
- Southbound: Add a second exclusive right-turn lane.

Flamingo Road at Broward Boulevard Intersection

At Flamingo Road and Broward Boulevard, a second westbound right-turn lane addresses the intersection operations through 2045.

Flamingo Road Multimodal Improvements

Sidewalk is proposed to be added where it is missing along Flamingo Road. In addition, 7-foot-wide bicycle lane facilities, where missing, are proposed to be added as well. To safely accommodate both pedestrian and bicycle traffic through the SR 84/I-595 interchange area, a shared use path is proposed along northbound and southbound Flamingo Road and eastbound SR 84. The shared use path is proposed in this area in lieu of separate sidewalk and bicycle lanes.

Evaluation of Improvements

When evaluating the physical feasibility of the improvements, it was determined that all were feasible. The proposed improvements accommodate all interchange movements, and the

eastbound SR 84 overpass and added turn lanes allow all study intersections to operate at LOS D or better through 2045. In addition, realigning the westbound I-595 off-ramp would reduce conflicts and improve safety for westbound SR 84 traffic.

There were no fatal flaws; however, the improvements do have some impacts. Providing additional turn lanes at the westbound SR 84 intersection will impact the New River Canal and the realigned westbound I-595 off-ramp will also impact the New River Canal. In addition, some right-of-way is needed along Flamingo Road north of SR 84 to Broward Boulevard. Right-of-way is also needed along eastbound SR 84 east and west of Flamingo Road.

The Flamingo Road concept includes one new bridge structure. It is a SR 84 eastbound bypass over Flamingo Road. It also included reconstructing the existing westbound I-595 off-ramp bridge over westbound SR 84.

The Flamingo Road concept allows traffic to operate acceptably through year 2045. The improvements provide significant benefits since the bypass accommodates one of the heavy movements without requiring traffic to stop. However, it does impact the New River Canal, requires some right-of-way, and includes one new bridge structure and reconstruction of an I-595 off-ramp bridge structure.

3.4.3 Recommended Concept Improvements

Recommended improvements for the Flamingo Road corridor include SR 84 / I-595 interchange improvements as well as multimodal sidewalk, bicycle lane, and bus stop improvements. To address the SR 84 interchange operational and safety deficiencies, the modified diamond interchange configuration with eastbound SR 84 bypass and realigned westbound I-595 off-ramp is recommended for further analysis, design, and implementation. Additional turn lanes are also recommended at the Flamingo Road and Broward Boulevard intersection.

To address the bicycle and pedestrian needs, the recommended Flamingo Road corridor concept includes new 7-foot-wide bicycle lanes along Flamingo Road within the study limits. It also includes sidewalk where it is currently missing on segments of Flamingo Road between SW 8th Street and Broward Boulevard. Shared use path is recommended through the SR 84/I-595 interchange along northbound and southbound Flamingo Road, as well as along eastbound SR 84.

To address transit needs, the existing bus stops on Flamingo Road were reviewed to determine whether any needed a bench or a shelter. Three of the four bus stops located on Flamingo Road between SR 84 and NW 8th Street are lacking benches. A bench is recommended to be provided at all four stops. None of the four stops have a shelter. Daily activity at one the bus stops is greater than 10. The stop is for Route 22 and is located on northbound Flamingo Road at Broward Boulevard. A shelter is recommended for the BCT stop #3591 along Flamingo Road.

A list of the Flamingo Road corridor improvements scope items is provided below.

Flamingo Road Corridor Improvements

The limits of the corridor improvements are from SW 8th Street to north of Broward Boulevard; and along SR 84 eastbound and westbound from approximately 2,800 ft west of Flamingo Road to approximately 2,800 ft east of Flamingo Road.

- **Flamingo Road at SR 84 / I-595 Interchange**
  - Eastbound SR 84 bypass/overpass– includes a new bridge structure for traffic to travel over Flamingo Road.
  - Reconstruct I-595 off-ramp bridge structure to cross over westbound SR 84 lanes, so that westbound I-595 off-ramp traffic merges with westbound SR 84 on the right side (north side).
  - Add turn lanes to the eastbound SR 84 and Flamingo Road signalized intersection as noted below.
    - Eastbound: Add a second exclusive right-turn lane.
    - Northbound: Add a second exclusive right-turn lane.

- Add turn lanes to the westbound SR 84 and Flamingo Road signalized intersection as noted below.
    - Westbound: Add a second exclusive left-turn lane in addition to a shared through/left-turn lane
    - Westbound: Add a second exclusive right-turn lane in addition to a shared through/right-turn lane
    - Southbound: Add a second exclusive right-turn lane

- **Flamingo Road north and south of SR 84**
    - Add buffered bicycle lanes along Flamingo Road northbound and southbound throughout the limits.
    - Add or widen sidewalk to be a shared use path width for both bikes and pedestrians through the interchange area (northbound, southbound, eastbound).
    - Add sidewalk where it does not exist along Flamingo Road north and south of SR 84.
    - Construct a shelter at BCT stop #3591 along Flamingo Road.

- **Flamingo Road and Broward Boulevard Intersection**
    - Add a second westbound exclusive right-turn lane.
    - Widen for buffered bicycle lanes along both directions of Flamingo Road north and south of Broward Boulevard, and along both directions of Broward Boulevard east and west of Flamingo Road.
    - Replace sidewalk where impacted along Flamingo Road and Broward Boulevard.

The Flamingo Road corridor concept plan is provided as Exhibit A-6 in Appendix A.

Typical sections for Flamingo Road south of SR 84 are shown in Figures 3-19, and typical sections for Flamingo Road north of SR 84 are shown in Figures 3-20. These figures depict the existing cross section of Flamingo Road followed by a cross section of the proposed improvements on Flamingo Road.

Figure 3-19: Flamingo Road Typical Section South of SR 84

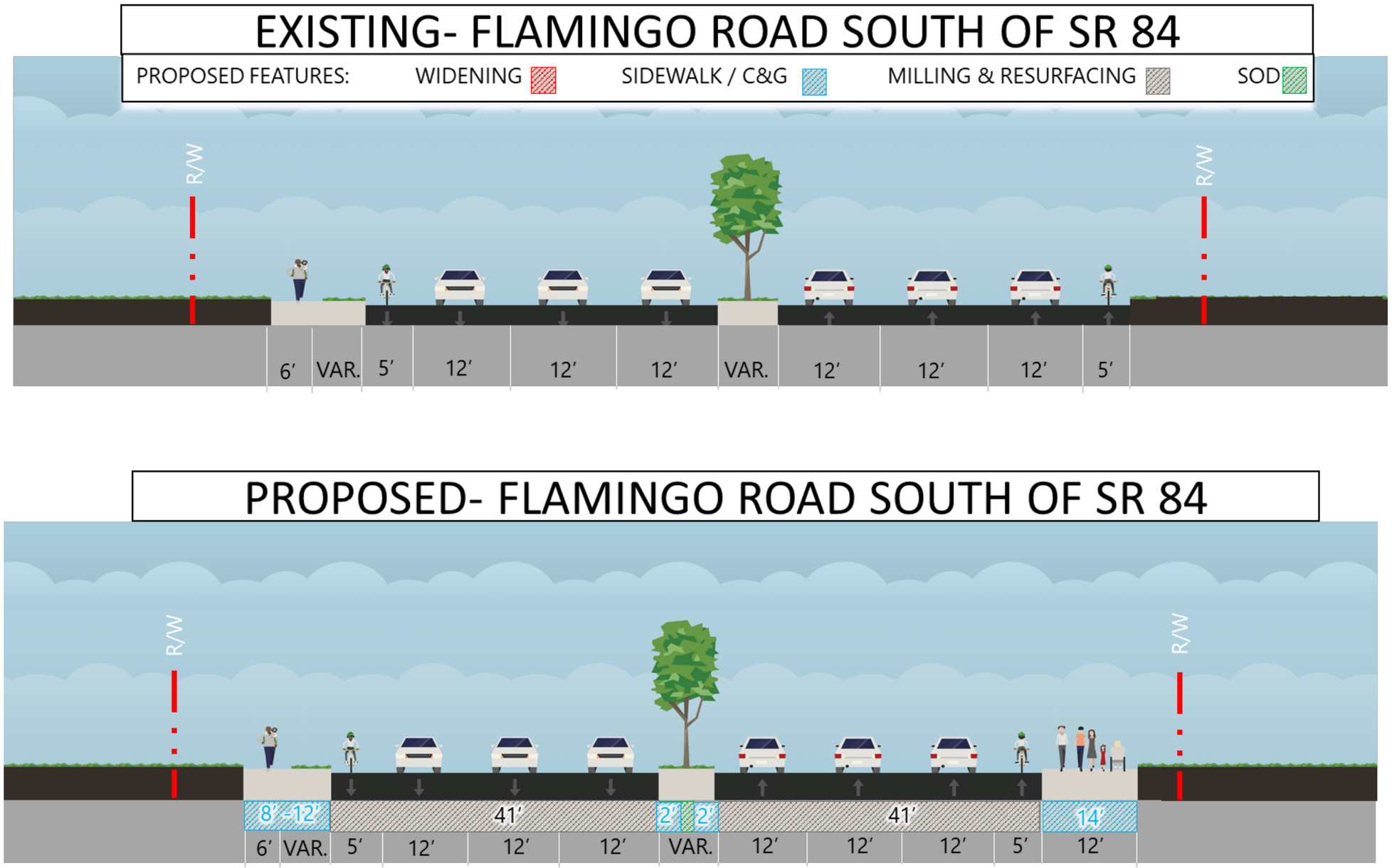
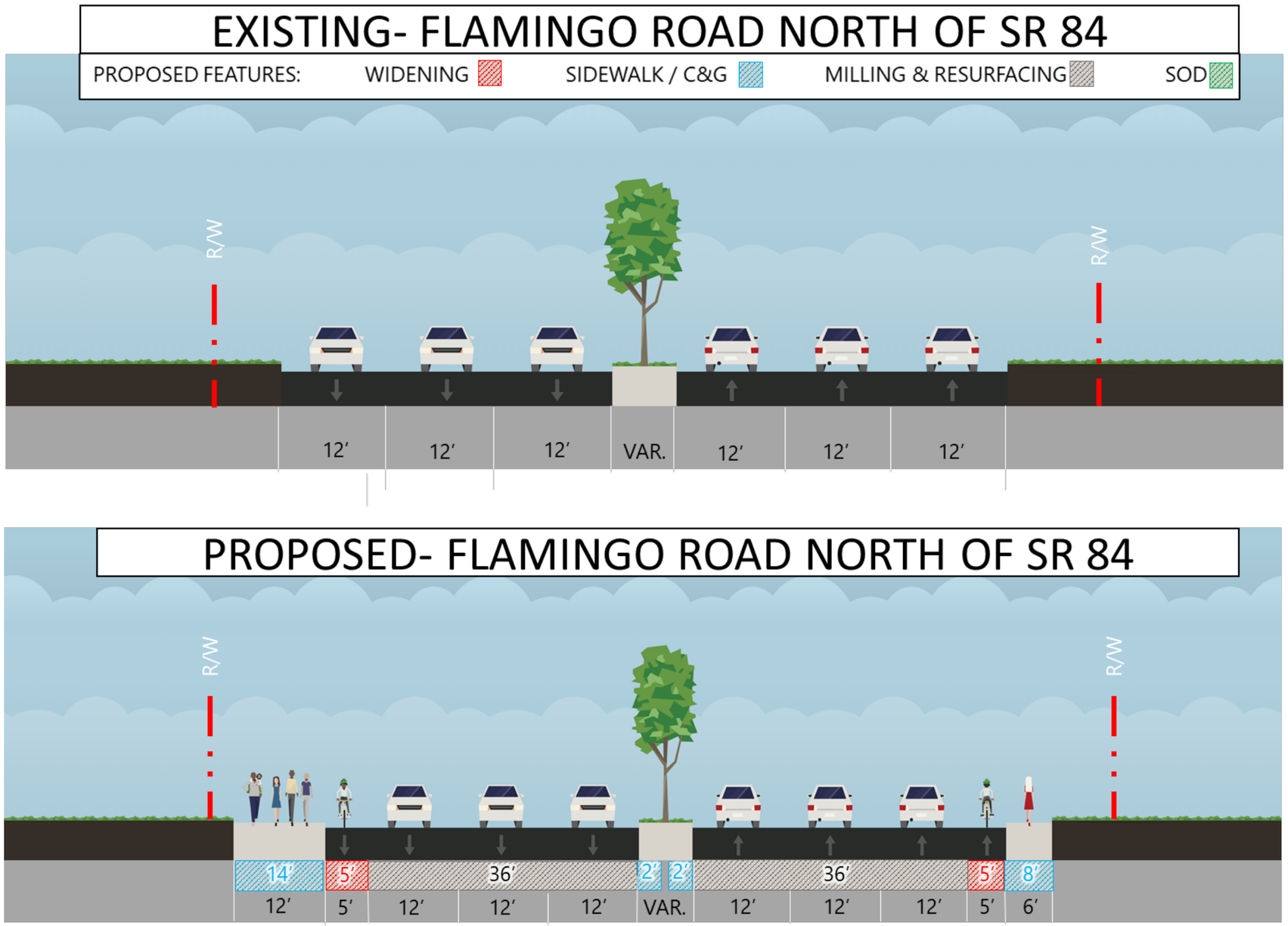


Figure 3-20: Flamingo Road Typical Section North of SR 84



3.4.4 Concept Benefits

The Flamingo Road corridor improvements can provide a more efficient and less congested route for traffic on Flamingo Road. In addition, safety for vehicles, pedestrians, and bicyclists is improved along the corridor and through the SR 84 interchange. Table 3-7 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-7: Flamingo Road Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion, does not meet LOS D in 2045 peak hours – operates at LOS F • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Meets LOS D in 2045 peak hours • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for pedestrians & bicyclists	• Right-of-way impact • Canal impact • Visual impact • I-595 off-ramp impact • Cost

Table 3-8 summarizes the benefits of the proposed Flamingo Road corridor improvements.

Table 3-8: Flamingo Road Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS D or better
Delays	55% reduction in total delays
North South Travel Time	10% reduction in travel times along Flamingo Road
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	Accommodates bus stops and shelters

3.4.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- Westbound SR 84 along the north side east and west of Flamingo Road, potentially impacting the New River Canal South Florida Water Management District property.
- Eastbound SR 84 along the south side, from SW 125th Avenue to Flamingo Road, and from Flamingo Road to SW 121st Avenue.

The concept plan in Appendix A also shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.4.6 Structural Impacts

One existing structure would need to be replaced. It is the westbound I-595 off-ramp bridge over Flamingo Road and westbound SR 84. It will need to be modified to allow the off-ramp lanes to be shifted north so that the off-ramp traffic can merge with westbound SR 84 on the right side and eliminate the existing weaving condition.

In addition to the existing structure replacement, one new structure is required as part of the Flamingo Road improvements: an approximately 1,500-foot-long roadway bridge for eastbound SR 84 traffic to cross over Flamingo Road.

3.4.7 Environmental Issues

Impacts to wetlands and OSWs are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of Flamingo Road and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Additionally, two shoulder mounted noise walls would potentially be impacted by the conceptual design and would need to be considered for partial/full replacement or enhancement in a future traffic noise study. Due to the potential to impact Florida bonneted bat habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. Impacts to floodplains are anticipated and would need to be further evaluated. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features. Environmental considerations are noted below.

Flamingo Road and SR 84 Interchange

Wetlands and Other Surface Waters

- Wetland impacts would occur if submerged aquatic vegetation is present within the North New River Canal (as a result of widening to accommodate dual right and bike lane). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.

Protected Species and Habitat

- Impacts to suitable roosting habitat (Removal and relocation of mature trees and bridge widening) for the Florida bonneted bat (Endangered species) would occur.

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family, Recreational) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family (Plantation Acres and King Manor)
  - Activity Category C: Recreational (New River Greenway Trail)

- Two Shoulder/Structure mounted noise walls would potentially be impacted and would need to be considered for partial/full replacement in a future noise study
  - Northside of westbound SR 84, east of Flamingo Road
  - Northside of westbound I-595, east of Flamingo Road

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100-year floodplain).

Flamingo Road and Broward Boulevard Intersection

- No environmental issues were identified at this location.

3.4.8 Other Impacts

The eastbound SR 84 bypass lane could have visual impacts to adjacent properties, as it will be a second level structure, and therefore may be seen from adjacent properties. Coordination and public outreach to the adjacent property owners will occur at the next phase.

The westbound I-595 off-ramp reconstruction will also impact the existing I-595 freeway, and a Maintenance of Traffic (MOT) plan will be necessary to mitigate any impacts to traffic during construction.

3.4.9 Cost Estimate

A planning level construction cost estimate was developed for the Flamingo Road corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the Flamingo Road and SR 84 / I-595 interchange improvements, Flamingo Road and Broward Boulevard intersection improvements, as well as recommended multimodal improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $35.2 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the Flamingo Road corridor improvements is provided in Appendix B.

3.5 Hiatus Road Corridor

The Hiatus Road corridor was studied from Rexmere Boulevard/Scarborough Drive in Town of Davie to Broward Boulevard in City of Plantation. Hiatus Road between Rexmere Boulevard/Scarborough Drive and SR 84 is a four-lane divided Town of Davie major collector. North of SR 84 Hiatus Road is a six-lane divided minor arterial under jurisdiction of Broward County. Hiatus Road has sidewalk along both sides from Rexmere Boulevard/Scarborough Drive to Broward Boulevard. On-street bicycle lanes are provided on Hiatus Road between SR 84 and Broward Boulevard, but they are not buffered bicycle lanes. Bicycle lanes are not provided between Rexmere Boulevard/Scarborough Drive and SR 84.

3.5.1 Design Considerations

The development of improvement concepts is multifaceted and must consider a number of deficiencies and design constraints unique to the Hiatus Road corridor. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Within the study area three signalized intersections along Hiatus Road were studied. All three of the intersections show operational issues under existing and future (2045) conditions. The Hiatus Road study intersections that intersect with SR 84 eastbound, and SR 84 westbound, are currently operating at LOS E or F, during the AM and PM peak hours. By 2045 without any improvements, both study intersections will operate at LOS F during both AM and PM peak hours. Also, the intersection of Hiatus Road and Broward Boulevard operates at LOS E today; and, by 2045 it will operate at LOS F during the AM and PM peak hours.

There were several deficiencies and opportunities for improvement identified along the Hiatus Road corridor. These are noted below.

- Mobility/Operational
  - Inadequate capacity at the SR 84 / I-595 interchange
  - Multiple conflicting high traffic volume turning movements
- Safety
  - High crash rate at the SR 84 / I-595 interchange associated with heavily congested conditions
- Bicycle and Pedestrian
  - Inadequate crossing at the New River Greenway
  - Missing bicycle lanes south of SR 84
  - Bicycle lanes north of SR 84 are not buffered bicycle lanes
  - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange
- Transit
  - No BCT transit service is provided along Hiatus Road. Consequently, no bus stop deficiencies were identified along Hiatus Road.
- Key Constraints
  - Avoid or minimize impacts to I-595 mainline
  - Avoid or minimize impacts to New River Canal
  - Avoid or minimize impacts to adjacent business and residential properties
  - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to identify improvements that could avoid or minimize impacts to I-595, New River Canal, and adjacent properties. The purpose of improving the Hiatus Road corridor and its study intersections is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety and connectivity for all modes. Pedestrian and bicycle facility improvements along Hiatus Road are intended to provide safe and efficient travel for all modes.

3.5.2 Evaluated Improvements

Hiatus Road corridor improvements include improvements to the SR 84 / I-595 interchange and Broward Boulevard intersection, and multimodal improvements. The 2045 traffic analysis showed that additional lanes for the heavy volume movements at the interchange and at the intersection could allow the intersections to operate at an acceptable Level of Service through 2045. Therefore, the diamond interchange configuration with added lanes was evaluated, and intersection turn lanes were evaluated.

The existing Hiatus Road and SR 84/I-595 interchange includes an eastbound SR 84 bypass lane which allows eastbound I-595 off-ramp traffic to use an overpass over Hiatus Road and merge into eastbound SR 84 downstream, bypassing the signalized intersection. However, the existing eastbound bypass lane does not serve eastbound SR 84 traffic. Therefore, a second lane was evaluated that would allow eastbound SR 84 traffic to also bypass Hiatus Road. A second bypass lane is proposed to extend over Hiatus Road, with the entrance to the second bypass lane located approximately 1,500 feet west of Hiatus Road. This would allow the majority of eastbound SR 84 traffic to bypass Hiatus Road which reduces conflicts, delay, and travel time for not only SR 84 eastbound traffic, but Hiatus Road traffic as well.

Hiatus Road and SR 84 / I-595 Interchange Improvements

At Hiatus Road and eastbound SR 84, the following additional turn lanes were evaluated and shown to provide significant benefit to operations.

- Eastbound: Widen approach from four lanes to six lanes. Provide three exclusive left-turn lanes, one through lane, one shared through/right-turn lane, and one exclusive right-turn lane.

The additional turn lanes evaluated at Hiatus Road and westbound SR 84, and shown to provide significant benefit to operations are listed below.

- Northbound: Add a third exclusive through lane, along with existing one exclusive left-turn lane.
- Westbound: Widen approach from four lanes to five lanes. Provide two exclusive left-turn lanes, one shared through/right-turn lane, and two exclusive right-turn lanes.
- Southbound: Add a second exclusive right-turn lane.

Hiatus Road and Broward Boulevard Intersection Improvements

At Hiatus Road and Broward Boulevard additional turn lanes were evaluated and showed operational benefits. It is important to note that based on Broward County surtax projects listed online in February 2020, widening of Broward Boulevard from four lanes to six lanes was shown as a planned and funded future project to be completed by year 2045. Therefore, a third eastbound and third westbound through lane was assumed at the intersection in the 2045 No Build and Build traffic analysis. Even with the six-lane capacity on Broward Boulevard the intersection will not operate acceptably. Therefore, intersection turn lanes were evaluated to find improvements that would improve operations for Hiatus Road. The additional improvements listed below were evaluated and found to be beneficial to overall intersection operations.

- Northbound: Add a second exclusive left-turn lane.
- Westbound: Add a second exclusive left-turn lane.
- Eastbound: Add a second exclusive right-turn lane.

Hiatus Road Multimodal Improvements

Seven-foot-wide bicycle lane facilities are proposed to be added along Hiatus Road from Rexmere Boulevard to SR 84. It is also proposed to widen the bicycle lanes along Hiatus Road from SR 84 to Broward Boulevard to 7-foot-wide bicycle lane facilities. To safely accommodate both pedestrian and bicycle traffic through the SR 84/I-595 interchange area, a shared use path

is proposed along northbound and southbound Hiatus Road and eastbound SR 84. The shared use path is proposed in this area in lieu of separate sidewalk and bicycle lanes.

Evaluation of Improvements

When evaluating the physical feasibility of the improvements, it was determined that all were feasible. The proposed improvements accommodate all interchange movements, and the eastbound SR 84 overpass and added turn lanes allow the SR 84 interchange study intersections to operate at LOS D or better through 2045. The recommended improvements at Broward Boulevard will allow the intersection to operate at LOS E or better during the 2045 peak hours.

There were no fatal flaws and most of the improvements can fit within existing right-of-way. However, there are some impacts. Providing additional turn lanes at the westbound SR 84 intersection will impact the New River Canal. In addition, some right-of-way is needed along the south side of eastbound SR 84 west of Hiatus Road. Right-of-way is also needed in the southeast corner of the Hiatus Road and SR 84 eastbound intersection.

The Hiatus Road concept would involve modifying two existing structures. These structures would need to be evaluated in the next phase to determine whether or not they can be widened or would need to be replaced. They are noted below.

- Hiatus Road bridge over New River Canal
- Eastbound SR 84 bypass over Hiatus Road

The Hiatus Road concept allows traffic to operate acceptably through year 2045. The improvements provide significant benefits, reducing congestion, improving safety, and improving bicycle lane connectivity. However, it does impact the New River Canal, requires some right-of-way, and includes modifications to two existing bridge structures.

3.5.3 Recommended Concept Improvements

Recommended improvements for the Hiatus Road corridor include SR 84 / I-595 interchange improvements, Broward Boulevard intersection improvements, and bicycle lanes. To address the SR 84 interchange operational and safety deficiencies, the existing diamond interchange configuration with eastbound SR 84 bypass and added turn lanes is recommended for further analysis, design, and implementation. Additional turn lanes are also recommended at the Hiatus Road and Broward Boulevard intersection.

The recommended Hiatus Road corridor concept includes new 7-foot-wide bicycle lanes along Hiatus Road within the study limits. Shared use path is recommended through the SR 84 / I-595 interchange along northbound and southbound Hiatus Road, as well as along eastbound SR 84. Sidewalk is already provided throughout along Hiatus Road, so no additional sidewalk is proposed. BCT transit service does not operate along Hiatus Road, so no bus stop improvements are proposed.

A list of the Hiatus Road corridor improvements scope items is provided below.

Hiatus Road Corridor Improvements

The limits of the corridor improvements are from Rexmere Boulevard/Scarborough Drive to Broward Boulevard; and along SR 84 eastbound and westbound from approximately 2,800 ft west of Hiatus Road to approximately 2,800 ft east of Hiatus Road. The corridor improvements include the following components.

- **Hiatus Road at SR 84 / I-595 Interchange**
  - Eastbound SR 84 bypass/overpass– includes a new one-lane overpass for traffic to travel over Hiatus Road.
  - Add turn lanes to the eastbound SR 84 and Hiatus Road signalized intersection as noted below.

    - Eastbound: Widen approach from four lanes to six lanes. Provide three exclusive left-turn lanes, one through lane, one shared through/right-turn lane, and one exclusive right-turn lane.
  - Add turn lanes to the westbound SR 84 and Hiatus Road signalized intersection as noted below.
    - Northbound: Add a third exclusive through lane, along with existing one exclusive left-turn lane.
    - Westbound: Widen approach from four lanes to five lanes. Provide two exclusive left-turn lanes, one shared through/right-turn lane, and two exclusive right-turn lanes.
    - Southbound: Add a second exclusive right-turn lane.
- **Hiatus Road at Broward Boulevard Intersection**
  - Add turn lanes to the Broward Boulevard and Hiatus Road signalized intersection as noted below.
    - Northbound: Add a second exclusive left-turn lane.
    - Westbound: Add a second exclusive left-turn lane.
    - Eastbound: Add a second exclusive right-turn lane.
- **Hiatus Road north and south of SR 84**
  - Add buffered bicycle lanes along Hiatus Road northbound and southbound throughout the limits.
  - Add or widen the sidewalk to be a shared use path width for both bikes and pedestrians through the interchange area (northbound, southbound, eastbound).

The Hiatus Road corridor concept plan showing the SR 84/I-595 interchange and Broward Boulevard intersection improvements is provided as Exhibit A-7 in Appendix A.

Typical sections for Hiatus Road south of SR 84 are shown in Figures 3-21, and typical sections for Hiatus Road north of SR 84 are shown in Figures 3-22. These figures depict the existing cross section of Hiatus Road followed by a cross section of the proposed improvements on Hiatus Road.

Figure 3-21: Hiatus Road Typical Section South of SR 84

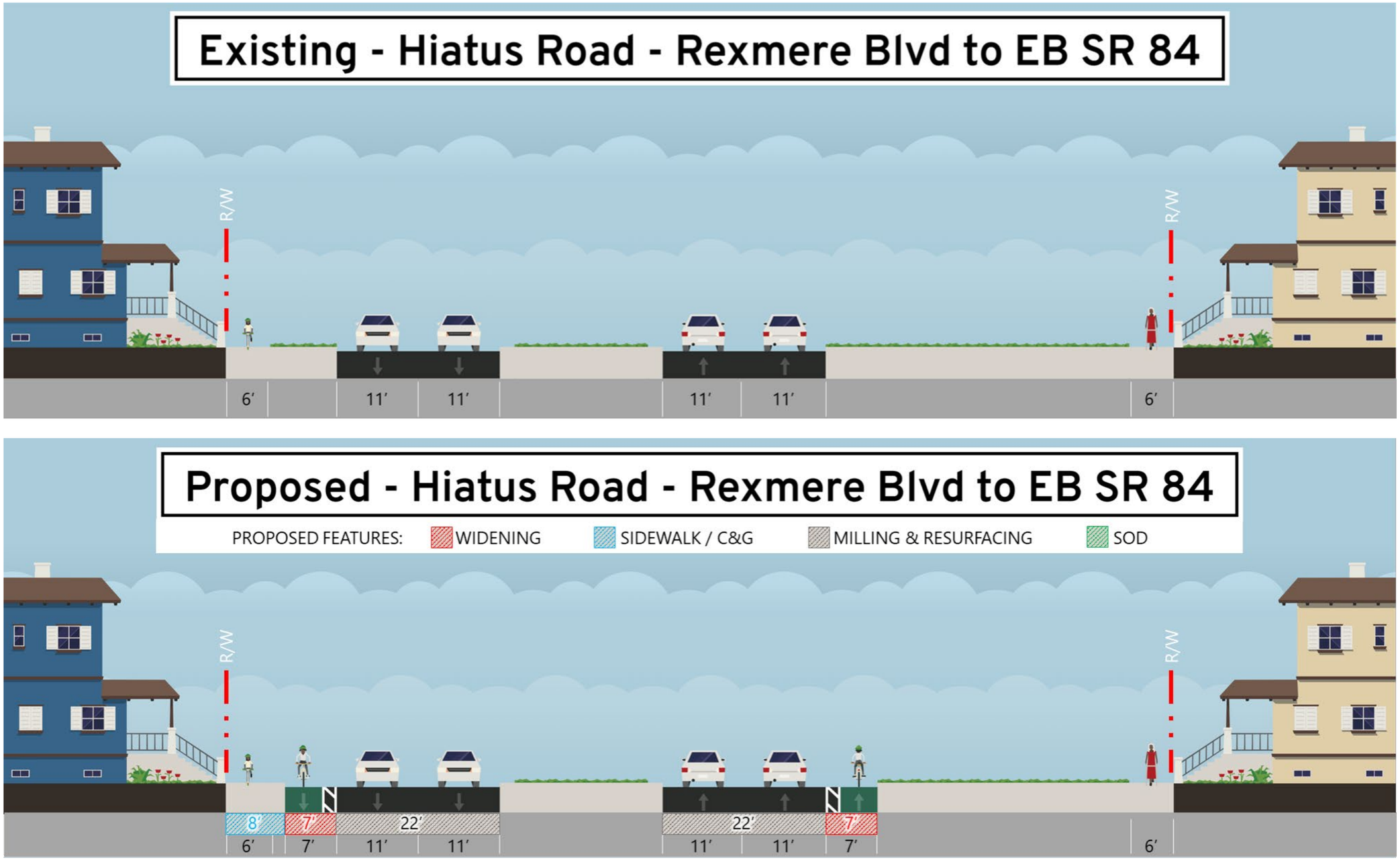
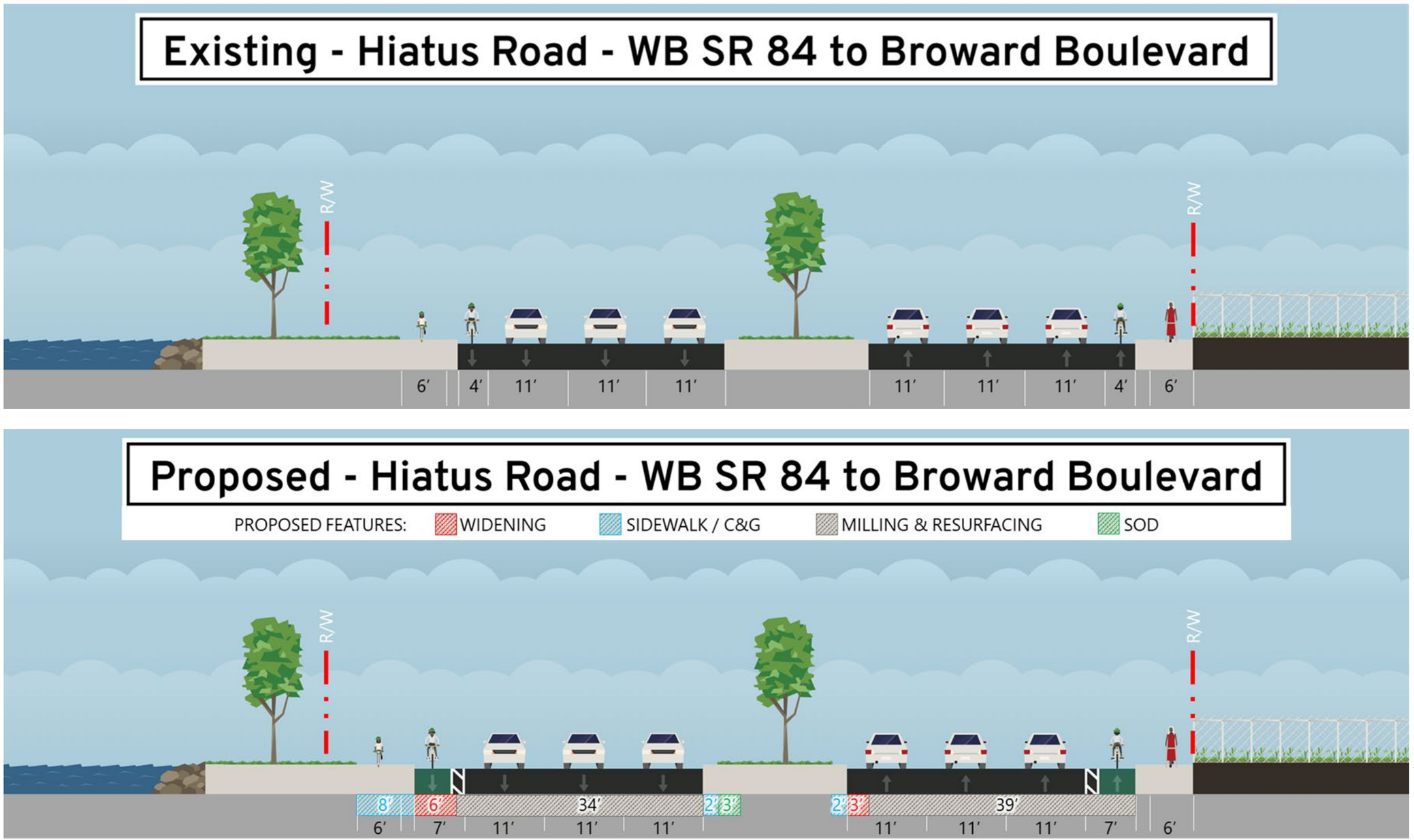


Figure 3-22: Hiatus Road Typical Section North of SR 84



3.5.4 Concept Benefits

The Hiatus Road corridor improvements can provide a more efficient and less congested route for traffic. In addition, safety for vehicles, pedestrians, and bicyclists is improved along the corridor and through the SR 84 interchange. Table 3-10 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-10: Hiatus Road Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion, does not meet LOS D in 2045 peak hours – operates at LOS F • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for bicyclists	• Right-of-way impact • Canal impact • Visual impact • Cost

Table 3-11 summarizes the benefits of the proposed Hiatus Road corridor improvements.

Table 3-11: Hiatus Road Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS E or better in 2045 peak hours
Delays	60% reduction in total delays
North South Travel Time	20% reduction in travel times along Hiatus Road
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	No transit service on Hiatus Road

3.5.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. Additional right-of-way would be needed on eastbound SR 84 along the south side, from east of SW 117th Avenue to Hiatus Road to implement the recommended concept.

The concept plan in Exhibit A-7 Appendix A also shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.5.6 Structural Impacts

Two existing structures would need to be modified or replaced. These are the eastbound SR 84 bypass over Hiatus Road and the southbound Hiatus Road bridge over the New River Canal.

3.5.7 Environmental Issues

Impacts to wetlands and other surface waters are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of Hiatus Road and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Due to the potential to impact Florida bonneted bat and wood stork habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. Impacts to floodplains are anticipated and would need to be further evaluated. The conceptual improvements are not anticipated to impact contamination sites or social and cultural features. Environmental considerations are noted below.

Hiatus Road and SR 84 Interchange

Wetlands and Other Surface Waters

- Wetland impacts would occur if submerged aquatic vegetation is present within the North New River Canal (as a result of widening westbound SR 84 to northbound Hiatus Road and modifications to the north side of the canal to facilitate canal water volume). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees and bridge widening) for the Florida bonneted bat (endangered species) would occur.

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family, Recreational) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family (Hawks Landing, Plantation Acres) and Multi Family (The Palms Apartments)
  - Activity Category C: Recreational (New River Greenway Trail and Hiatus Road/C-42 Canal Trail)
- There are existing noise walls within the project area but none would be impacted by the proposed improvements.

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100-year floodplain).

Hiatus Road and Broward Boulevard Intersection

- Improvements at Hiatus Road and Broward Boulevard would result in noise impacts to adjacent noise sensitive sites (Residential – Single Family and Multi-Family, Recreational, and Institutional) and require consideration of noise abatement measures.

3.5.8 Other Impacts

The eastbound SR 84 bypass lane could have visual impacts to adjacent properties, as it will be a second level structure, and therefore may be seen from adjacent properties. Coordination and public outreach to the adjacent property owners will occur at the next phase.

3.5.9 Cost Estimate

A planning level cost estimate was developed for the Hiatus Road corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the Hiatus Road and SR 84 / I-595 interchange improvements, Hiatus Road and Broward Boulevard intersection improvements, and bicycle lane improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $23.9 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the Hiatus Road corridor improvements is provided in Appendix B.

3.6 Nob Hill Road Corridor

The Nob Hill Road corridor was studied from SW 22nd Court in Town of Davie to Broward Boulevard in City of Plantation. Nob Hill Road between SW 22nd Court and Broward Boulevard is a four-lane divided Broward County minor arterial. Nob Hill Road has sidewalk along both sides throughout the study area. There are buffered bicycle lanes provided in both directions of Nob Hill Road from SR 84 to Broward Boulevard, and a standard on-street bicycle lane is provided in the northbound direction between NW 101st Road and SR 84. Bicycle lanes are not provided south of SW 101st Road to SW 22nd Court.

3.6.1 Design Considerations

Several deficiencies and design constraints unique to the Nob Hill Road corridor must be considered in the development of improvement concepts. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Within the study area six signalized intersections along Nob Hill Road were studied. Three of the six study intersections showed the need for improvement. These are: the intersection of Nob Hill Road at eastbound SR 84, Nob Hill Road at westbound SR 84, and Nob Hill Road at Broward Boulevard. Both SR 84 intersections operate at LOS E or F under existing and future (2045) peak hour conditions. The intersection of Nob Hill Road and Broward Boulevard operates at LOS D during the existing AM peak hour, and LOS E during the PM peak hour. It will operate the same in year 2045.

There were several deficiencies and opportunities for improvement identified along the Nob Hill Road corridor. These are noted below.

- Mobility/Operational
  - Inadequate capacity at the SR 84 / I-595 interchange
  - Multiple conflicting high traffic volume turning movements
- Safety
  - High crash rate at the SR 84 / I-595 interchange associated with heavily congested conditions
- Bicycle and Pedestrian
  - Inadequate crossing at the New River Greenway
  - Missing bicycle lanes south of SW 101st Road
  - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange
- Transit
  - No BCT transit service is provided along Nob Hill Road so no bus stop deficiencies were identified
- Key Constraints
  - Avoid or minimize impacts to I-595 mainline
  - Avoid or minimize impacts to New River Canal
  - Avoid or minimize impacts to adjacent business and residential properties
  - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat

Improvement concepts were developed to address these issues, keeping in mind the need to identify improvements that could avoid or minimize impacts to I-595, New River Canal, and adjacent properties. The purpose of improving the Nob Hill Road corridor and its study intersections is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety and connectivity for all modes. To provide for safe and efficient alternative modes of travel, adding and improving pedestrian and bicycle facilities along Nob Hill Road was considered.

3.6.2 Evaluated Improvements

Improvements to the Nob Hill Road and SR 84 interchange were evaluated, along with intersection improvements at Broward Boulevard and NW 101st Road, and pedestrian and bicycle facilities along Nob Hill Road.

Nob Hill Road and SR 84 / I-595 Interchange

The 2045 traffic analysis showed that removing one of the heavy volume movements from the eastbound SR 84 intersection and adding turn lanes for other heavy volume movements at the SR 84 interchange could improve operations to an acceptable Level of Service D or better through 2045. Therefore, the diamond interchange configuration with an eastbound SR 84 bypass lane over Nob Hill Road and added turn lanes was evaluated.

The concept includes an eastbound SR 84 bypass which allows eastbound SR 84 traffic to use a bridge over Nob Hill Road to bypass the signalized intersection. The eastbound SR 84 bypass can remove a significant volume of traffic from the signalized intersection at Nob Hill Road. This reduces conflicts, delay, and travel time for Nob Hill Road traffic and SR 84 eastbound traffic.

At Nob Hill Road and eastbound SR 84, the following modifications were evaluated and shown to provide significant benefit to operations.

- Eastbound: Modify the four-lane approach to provide a second exclusive right-turn lane, in addition to a shared through/left-turn lane and exclusive left-turn lane.
- Northbound: Add a second exclusive right-turn lane.

The improvements evaluated at Nob Hill Road and westbound SR 84, and shown to provide benefit to operations are listed below.

- Westbound: Widen the approach from four to six lanes. Provide three exclusive right-turn lanes, and one dedicated through lane, in addition to the one exclusive left-turn lane, and one shared through/left-turn lane. Provide three northbound receiving lanes on Nob Hill Road.

Nob Hill Road and Broward Boulevard Intersection

Broward County surtax projects posted on the website as of February 2020 and documented in Technical Memorandum 1, include a project to widen Nob Hill Road from four to six lanes north of SR 84 through the Broward Boulevard intersection. This capacity improvement was assumed to be in place by 2045 and was assumed in the 2045 traffic analysis when testing for improvements. The third northbound and third southbound lane through the intersection will help prevent delay from increasing, and the LOS from degrading. However, since the 2045 PM peak hour would operate at a LOS E, other operational improvements such as turn lanes and signal phasing were tested to determine if any additional improvements should be recommended.

Additional turn lanes and signal operational improvements were evaluated for the Broward Boulevard and Nob Hill Road intersection. It was determined that adding turn lanes cannot improve the overall 2045 PM peak hour intersection LOS from E to D. The intersection already has exclusive right-turn lanes and left-turn lanes on all four approaches. In addition, dual left-turn lanes are already provided for the southbound and westbound approaches, and dual right-turn lanes are provided for the northbound approach. A northbound right-turn overlap phase is already provided and should remain.

Nob Hill Road and NW 101st Road Intersection

At the Nob Hill Road and NW 101st Road intersection, stakeholder outreach identified the potential need for a signal phasing modification. This signalized intersection provides access to the Town of Davie fire rescue station 65 located in the northeast corner. Currently the southbound and northbound left-turn phasing at the signalized intersection is permissive only. According to Town of Davie staff, large fire trucks have difficulty turning left across Nob Hill

Road to enter the fire station. Therefore, there is a need to evaluate left-turn signal warrants to determine whether conditions warrant protected left-turn phasing, or if there is a need for traffic signal preemption for emergency vehicles at this signal.

Nob Hill Road Multimodal Improvements

For bicycle improvements along Nob Hill Road, 7-foot-wide bicycle lanes are proposed to be added along both directions of Nob Hill Road from SW 22nd Court to SR 84. To safely accommodate both pedestrian and bicycle traffic through the SR 84/I-595 interchange area, a shared use path is proposed along northbound and southbound Nob Hill Road and eastbound SR 84. The shared use path is proposed in the interchange area in addition to on-street bicycle lanes along Nob Hill Road.

Evaluation of Improvements

When evaluating the physical feasibility of the improvements, it was determined that all were feasible. The proposed improvements accommodate all interchange movements, and the eastbound SR 84 overpass and added turn lanes allow the SR 84 interchange study intersections to operate at LOS D or better through 2045.

There were no fatal flaws and most of the improvements can fit within existing right-of-way. However, there are some impacts. Providing additional turn lanes at the westbound SR 84 intersection will impact the New River Canal. In addition, some right-of-way is needed along the east and west sides of Nob Hill Road south of SR 84 to fit the additional northbound turn lane and buffered bicycle lanes. Right-of-way is also needed along the south side of eastbound SR 84, east and west of Nob Hill Road.

The Nob Hill Road and SR 84 / I-595 interchange improvements would require modifying one existing structure: the Nob Hill Road bridge over the New River Canal. This structure would need to be evaluated in the next phase to determine whether it can be widened or would need to be replaced. One new structure is needed for the SR 84 eastbound bypass over Nob Hill Road.

The Nob Hill Road corridor improvements provide significant benefits, reducing congestion, improving safety, and improving bicycle lane connectivity. However, the improvements will impact the New River Canal, require some right-of-way, and require modification to one existing bridge structure.

3.6.3 Recommended Concept Improvements

Recommended improvements for the Nob Hill Road corridor include SR 84 / I-595 interchange improvements as well as bicycle lane improvements. To address the SR 84 interchange operational and safety deficiencies, the existing diamond interchange configuration with eastbound SR 84 bypass and added turn lanes is recommended for further analysis, design, and implementation. The recommended Nob Hill Road corridor concept includes new 7-foot-wide bicycle lanes along Nob Hill Road from SR 84 to W 22nd Court. Shared use path is recommended through the SR 84/I-595 interchange along northbound and southbound Nob Hill Road, as well as along eastbound SR 84. Sidewalk is already provided throughout along Nob Hill Road, so no additional sidewalk is proposed. No bus stop improvements are needed since there is no BCT transit service on Nob Hill Road.

A list of the Nob Hill Road corridor improvements scope items follows.

Nob Hill Road Corridor Improvements

The limits of the corridor improvements are from SW 22nd Court to Broward Boulevard; and along SR 84 eastbound and westbound from approximately 2,800 ft west of Nob Hill Road to approximately 2,800 ft east of Nob Hill Road.

- **Nob Hill Road at SR 84 / I-595 Interchange**
  - Eastbound SR 84 bypass/overpass– includes a new one-lane overpass for traffic to travel over Nob Hill Road.
  - Add turn lanes to the eastbound SR 84 and Nob Hill Road signalized intersection as noted below.
    - Eastbound: Provide a second exclusive right-turn lane, in addition to a shared through/left-turn lane and exclusive left-turn lane.
    - Northbound: Add a second exclusive right-turn lane.
  - Add turn lanes to the westbound SR 84 and Nob Hill Road signalized intersection as noted below.
    - Westbound: Provide three exclusive right-turn lanes, and one dedicated through lane, in addition to the one exclusive left-turn lane, and one shared through/left-turn lane. Provide three northbound receiving lanes on Nob Hill Road.
- **Nob Hill Road north and south of SR 84**
  - Add buffered bicycle lanes along Nob Hill Road northbound and southbound from SR 84 to SW 22nd Court.
  - Add or widen the sidewalk to be a shared use path width for both bikes and pedestrians through the interchange area (northbound, southbound, eastbound).

The Nob Hill Road corridor concept plan showing the SR 84 / I-595 interchange improvements is provided as Exhibit A-8 in Appendix A.

Figure 3-23 depicts the existing conditions typical section for Nob Hill Road south of SR 84, as well as the proposed typical section for the recommended corridor improvements.

Figure 3-23: Nob Hill Road Typical Section South of SR 84

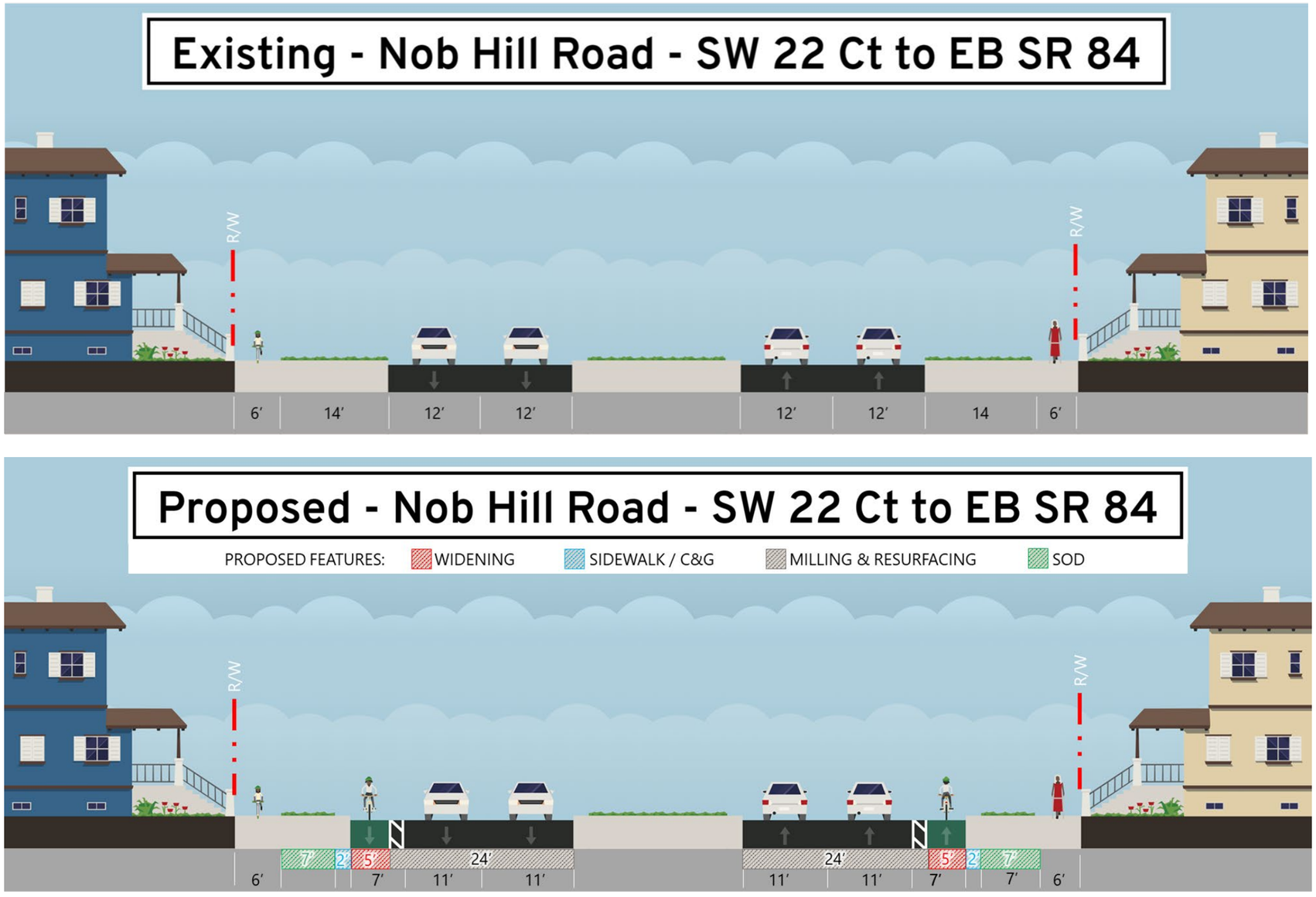
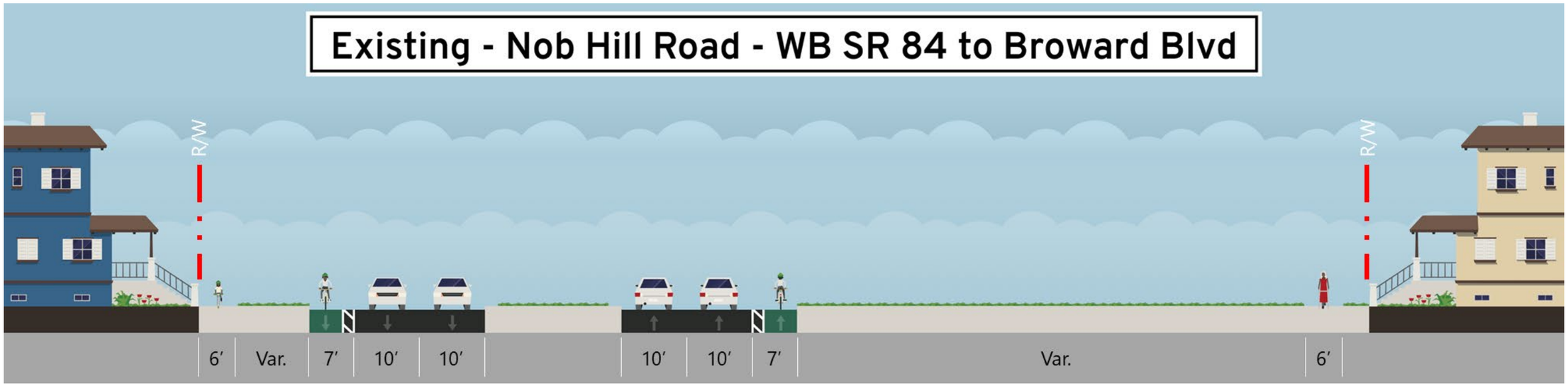


Figure 3-24 depicts the existing conditions typical section for Nob Hill Road north of SR 84. No changes are recommended for this section of Nob Hill Road, since adequate roadway, pedestrian, and bicycle facilities are provided.

Figure 3-24: Nob Hill Road Typical Section North of SR 84



3.6.4 Concept Benefits

The Nob Hill Road corridor improvements can provide a more efficient and less congested route for traffic. In addition, safety for vehicles, pedestrians, and bicyclists is improved along the corridor and through the SR 84 interchange. Table 3-13 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-13: Nob Hill Road Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion, does not meet LOS D in 2045 peak hours – operates at LOS F • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for bicyclists	• Right-of-way impact • Canal impact • Visual impact • Cost

The benefits of the proposed Nob Hill Road corridor improvements are summarized in Table 3-14.

Table 3-14: Nob Hill Road Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS E or better in 2045 peak hours
Delays	35% reduction in total delays
North South Travel Time	20% reduction in travel times along Nob Hill Road
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	No transit service on Nob Hill Road

3.6.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- Northeast corner of Nob Hill Road and westbound SR 84 intersection.
- Eastbound SR 84 along the south side, from west of Nob Hill Road to east of Nob Hill Road.
- Along the east and west sides of Nob Hill Road south of SR 84.

The concept plan in Appendix A also shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.6.6 Structural Impacts

One existing roadway structure would need to be modified or replaced. This is the Nob Hill Road bridge over the New River Canal. One new roadway structure would need to be constructed. This is the eastbound SR 84 overpass (bypass) over Nob Hill Road.

3.6.7 Environmental Issues

Impacts to wetlands and other surface waters are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of Nob Hill Road and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Additionally, one shoulder mounted noise walls would potentially be impacted by the conceptual design and would need to be considered for partial/full replacement or enhancement in a future traffic noise study. Due to the potential to impact Florida bonneted bat habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. Impacts to floodplains are anticipated and would need to be further evaluated. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features. Environmental considerations are noted below.

<u>Wetlands and Other Surface Waters</u>

- Wetland impacts would occur if submerged aquatic vegetation is present within the North New River Canal (as a result of widening westbound SR 84 to northbound Nob Hill Road and modifications to the north side of the canal to facilitate canal water volume). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.

<u>Protected Species and Habitat</u>

- Impacts to suitable roosting habitat (removal and relocation of mature trees and bridge widening) for the Florida bonneted bat (endangered species) would occur.

<u>Highway Traffic Noise</u>

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family, Recreational) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family and Multi Family (Manaranda Village and The Trellises at Jacaranda)
  - Activity Category C: Recreational (New River Greenway Trail, Manaranda Village Pool/Tennis Area, and Jacaranda Golf Courses)
- One shoulder/structure mounted noise wall would be impacted and would need to be considered for partial/full replacement in a future noise study
  - Northside of westbound SR 84, east of Nob Hill Road
- There are existing noise walls within the project area, but these would be impacted by the proposed concept.

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100 year floodplain).

3.6.8 Other Impacts

The eastbound SR 84 bypass lane could have visual impacts to adjacent properties, as it will be a second level structure, and therefore may be seen from adjacent properties. Coordination and public outreach to the adjacent property owners will occur at the next phase.

3.6.9 Cost Estimate

A planning level cost estimate was developed for the Nob Hill Road corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the Nob Hill Road and SR 84 / I-595 interchange improvements as well as the recommended multimodal improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $27.0 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the Nob Hill Road corridor improvements is provided in Appendix B.

3.7 Pine Island Road Corridor

The Pine Island Road corridor was studied from SW 3rd Street in City of Plantation to south of Nova Drive in Town of Davie. Pine Island Road between SW 3rd Street and Nova Drive is a six-lane divided Broward County minor arterial. Sidewalk and on-street bicycle lanes are present along both sides within the study area, except for a bicycle lane gap in the northbound direction between Orange Grove Drive to eastbound SR 84.

3.7.1 Design Considerations

The development of improvement concepts is multifaceted and must consider a number of deficiencies and design constraints unique to the Pine Island Road corridor. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Five signalized intersections along Pine Island Road were studied. The SR 84 eastbound intersection is currently operating at LOS F during the AM peak hour and LOS E during the AM peak hour. The SR 84 westbound intersection is currently operating at LOS F during the AM and PM peak hours. By 2045 without any improvements, both study intersections will operate at LOS F during both AM and PM peak hours, with delay more than doubling. In addition, by 2045, three additional intersections will operate at LOS E or F during peak hours. These include SW 6th Court, Peters Road, and Nova Drive.

Along Pine Island Road there are several issues and opportunities for improvement, which are noted below.

- Mobility/Operational
    - Forecasted 2045 volume exceeds capacity for six lanes on Pine Island Road north of SR 84.
    - Inadequate capacity at the SR 84/I-595 interchange.
    - Multiple conflicting high traffic volume turning movements.
- Safety
    - High crash rate associated with heavily congested conditions.
    - Bicycle and pedestrian crashes near SR 84 / I-595 interchange.
- Bicycle and Pedestrian
    - Inadequate crossing at the New River Greenway.
    - Missing bicycle lane along northbound Pine Island Road between Orange Grove Drive and eastbound SR 84.
    - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange.
- Transit
    - Upgrade existing bus stops where needed along Pine Island Road north of SR 84. No bus service south of SR 84.
- Key Constraints
    - Avoid or minimize impacts to I-595 mainline.
    - Avoid or minimize impacts to New River Canal.
    - Avoid or minimize impacts to adjacent business and residential properties.
    - Avoid impacts to sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to avoid or minimize any impacts to I-595 mainline and ramps, avoid or minimize impacts to the New River Canal and other adjacent canals, and avoid or minimize impacts to adjacent properties. The purpose of improving the Pine Island Road corridor and SR 84 interchange is to improve safety, reduce delay, travel times, queues, and congestion. Adding and improving pedestrian and bicycle facilities along Pine Island Road will provide for safe and efficient alternative modes of travel.

3.7.2 Evaluated Improvements

Pine Island Road corridor improvements include improvements to the SR 84 / I-595 interchange, intersection improvements at SW 6th Court, Peters Road, and Nova Drive, as well as multimodal improvements. Capacity and operational issues were very challenging to address at this location. Therefore, multiple alternatives were evaluated for improving the Pine Island Road and SR 84 / I-595 interchange. There are several high-volume conflicting traffic movements at the interchange, and extremely limited right-of-way for physical improvements.

3.7.2.1 Pine Island Road at SR 84 / I-595 Interchange Alternatives

At the Pine Island Road and SR 84 / I-595 interchange, the following four interchange configurations were evaluated to determine a recommended mitigation concept.

1. Single Point Urban Interchange (SPUI)
2. Diverging Diamond Interchange (DDI)
3. Modified Diamond Interchange with Overpasses and Flyover
4. Modified Diamond Interchange Overpasses

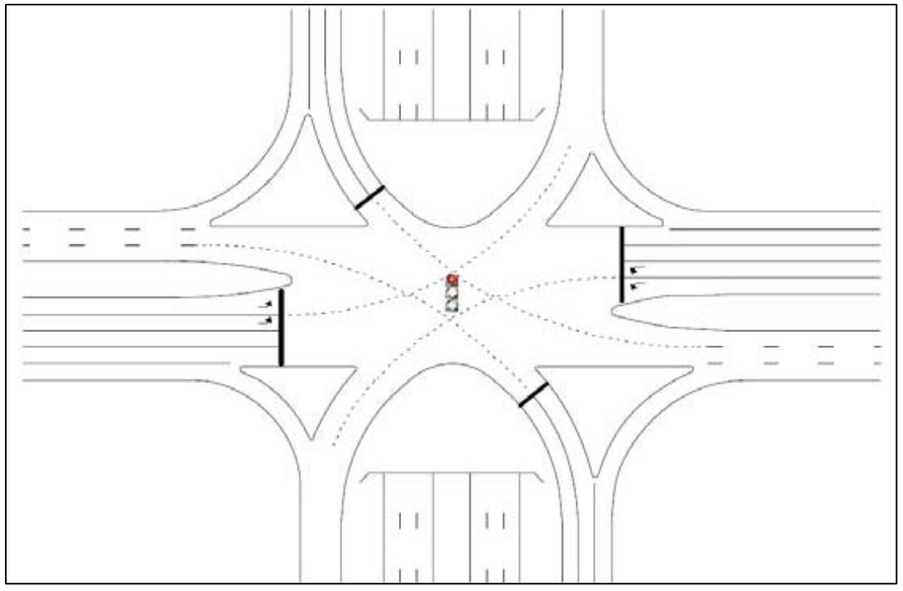
Single Point Urban Interchange (SPUI)

An alternative to the traditional diamond interchange configuration is the Single Point Urban Interchange (SPUI). It is a compressed diamond interchange that can improve traffic capacity and operations while requiring less right-of-way than a traditional diamond interchange. One central signalized intersection controls all left-turn movements. The SPUI signalized intersection can operate with three or four signal phases, and this one signal can reduce lost time when compared to the diamond interchange. This makes the intersection more efficient than dual intersections. The main benefit of the SPUI configuration is increased capacity. However, SR 84 acts as a frontage road requiring a through movement, and this adds an additional phase at the signal, so it will not be as efficient as standard SPUI configurations.

This concept is not recommended to move forward, due to the inability to accommodate the needed geometry for the SPUI under the I-595 overpass. This would require complete reconstruction of the I-595 bridges.

A sketch of a typical configuration for a SPUI is shown in Figure 3-25.

Figure 3-25: Single Point Urban Interchange (SPUI) Configuration



Source: Transportation Research Board

Diverging Diamond Interchange (DDI)

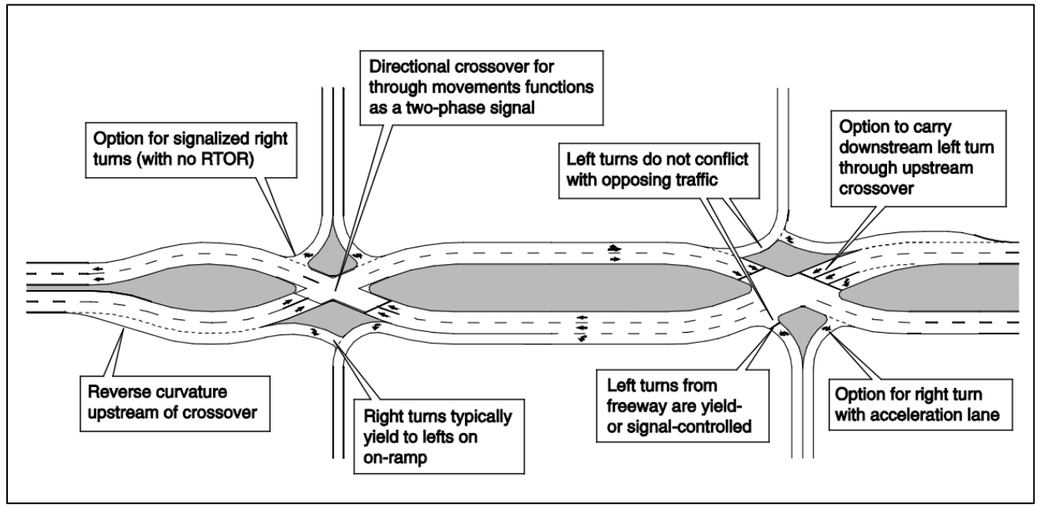
Another alternative to the conventional diamond interchange, is the Diverging Diamond Interchange (DDI). Directional crossover intersections are provided on either side of the interchange. The crossover intersections cross the two through traffic movements to the left side of the roadway. This allows left-turning traffic to make their turn without conflicting with the opposing through movement.

The DDI design can make the interchange operations more efficient and reduce the number of vehicle conflict points. The key design aspects of a DDI re easier to accommodate when the cross street is an overpass over the freeway facility. Pine Island Road passes below the I-595 mainline, so it is difficult to design a DDI within the available space provided underneath the existing I-595 overpass bridge.

This concept is not recommended to move forward, due to the inability to accommodate the needed geometry for the DDI under the I-595 overpass. In addition, the benefits of a DDI would be reduced by the need to accommodate added movements through the crossover intersections (SR 84 eastbound and westbound through movements).

Figure 3-26 shows a general layout of a Diverging Diamond Interchange (DDI) configuration.

Figure 3-26: Diverging Diamond Interchange (DDI) Configuration



Source: FHWA Diverging Diamond Interchange Informational Guide

Modified Diamond Interchange with Overpasses and Flyover

The Modified Diamond Interchange with Overpasses and Flyover concept can improve operations and reduce conflicts, by removing heavy traffic volume movements from the signalized intersections at the interchange. The heavy movements would be accommodated by a flyover or overpass. The Modified Diamond Interchange with Overpasses and Flyover concept includes the following:

- Southbound Pine Island Road to eastbound SR 84 flyover
- Westbound SR 84 to northbound Pine Island Road right-turn bypass lane
- Eastbound SR 84 overpass for eastbound through movement
- Westbound SR 84 overpass for westbound SR 84 through movement
- Additional lanes at the Pine Island Road and SR 84 eastbound and westbound signalized intersections

These grade separated overpasses, bypass lane, and flyover, would remove heavy volume movements fully from the signalized intersections at Pine Island Road. This would allow the northbound and southbound through movements and other more minor movements to have more green time and less delay. The one-lane westbound SR 84 overpass would merge with the two-lane I-595 westbound off-ramp. It would then braid over top of the at-grade westbound SR 84 ramps and connect to westbound SR 84 further downstream to continue west. A westbound SR 84 to northbound Pine Island Road right-turn bypass lane is also included in the concept. This allows westbound SR 84 right-turning traffic to bypass the signalized intersection at SR 84 and merge onto northbound Pine Island Road without stopping.

The Modified Diamond Interchange with Overpasses and Flyover concept is shown in Figure 3-27.

Figure 3-27: Modified Diamond Interchange with Overpasses and Flyover Concept

The concept also includes an eastbound SR 84 overpass which allows eastbound SR 84 traffic to pass over Pine Island Road. The new overpass lane would merge with the existing eastbound I-595 off-ramp, then east of Pine Island Road, the overpass lanes would merge into eastbound SR 84. The southbound Pine Island Road to eastbound SR 84 flyover could remove over 1,000 vehicles during the 2045 AM peak hour. The eastbound and westbound SR 84 bypasses, bypass, and flyover would also remove a significant volume of traffic from the signalized intersections along Pine Island Road, which would reduce conflicts, delay, and travel time for Pine Island Road traffic.

This alternative could reduce delays for vehicles traveling through the interchange so that the SR 84 intersections could operate at LOS D during the 2045 AM peak hour, and LOS D during

the 2045 PM peak hour. However, this alternative would significantly impact numerous businesses located adjacent to the interchange. To accommodate the southbound flyover, the following would be impacted:

- Shopping center located on the west side of Pine Island Road north of SR 84
- I-595 mainline - space between the existing bridges over Pine Island Road is needed for flyover supports to be placed
- Retail stores located along the south side of SR 84 east of Pine Island Road

To accommodate the westbound SR 84 right-turn bypass to northbound Pine Island Road, the following would be impacted:

- New River Greenway
- Office building on the east side of Pine Island Road north of SR 84
- New River Canal Road intersection and access to the mixed-use multi-story building under construction on the east side of Pine Island Road between New River Canal Road and Peters Road

Due to significant impacts to adjacent businesses, impacts to access along Pine Island Road north of SR 84, and impact to the I-595 mainline, this concept was not recommended to move forward.

<u>Modified Diamond Interchange with Overpasses</u>

The Modified Diamond Interchange with Overpasses concept is similar to the previous concept. However, it does not include the southbound to eastbound flyover, or westbound to northbound bypass lane, since these are the design components that significantly impact adjacent businesses. The Modified Diamond Interchange with Overpasses concept includes the following:

- Eastbound SR 84 overpass for eastbound through movement
- Westbound SR 84 overpass for westbound SR 84 through movement
- Additional lanes at the Pine Island Road and SR 84 eastbound and westbound signalized intersections

The modified diamond interchange with overpasses and flyover concept is shown in Figure 3-28. The Build Concept plan showing the Pine Island Road and SR 84 interchange improvements in more detail, is provided as Exhibit A-9 in Appendix A.

Figure 3-28: Modified Diamond Interchange with Overpasses Concept

Both overpasses would remove heavy volume movements fully from the signalized intersections at Pine Island Road. This would reduce delay for the northbound and southbound through movements.

The one-lane westbound SR 84 overpass would merge with the two-lane I-595 westbound off-ramp. West of Pine Island Road, the westbound overpass would cross over top of the at-grade westbound SR 84 ramps and merge with the westbound SR 84 lanes further downstream to continue west. A proposed eastbound SR 84 overpass would allow eastbound SR 84 traffic to cross over Pine Island Road. The new overpass lane would merge with the existing eastbound I-595 off-ramp, then east of Pine Island Road, the overpass lanes would merge into eastbound SR 84.

This concept can significantly improve operations and reduce conflicts, by removing heavy traffic volume movements from the signalized intersections at the interchange. It improves the operations but cannot achieve LOS D or better for peak hour operations in 2045. With the overpasses in place and modifications to the SR 84 and Pine Island Road signalized intersections, the SR 84 eastbound intersection with Pine Island Road will operate at LOS E during the AM and PM 2045 peak hours. The westbound SR 84 signalized intersection with Pine Island Road will operate at LOS E during the 2045 AM peak hour and LOS F during the 2045 PM peak hour.

Advantages and Disadvantages of Pine Island Road and SR 84 / I-595 Interchange Alternatives

For each of the alternatives, the 2045 AM and PM peak hour traffic volumes documented in Technical Memorandum 3 for the No Build condition were reassigned through the reconfigured interchange configurations. The signalized study intersections were then analyzed using Synchro software to determine the estimated delay and LOS for the study intersections for each of the alternative interchange configurations. The physical feasibility of the design features for each of the interchange alternatives was evaluated. It was also determined whether there would be significant impacts to any of the key constraints listed in Section 3.3.1.

Table 3-16 summarizes the advantages and disadvantages of each of the four Pine Island Road at SR 84 interchange concepts.

Table 3-16: Comparison of Interchange Concept's Advantages and Disadvantages at Pine Island Road and SR 84 / I-595

Alternatives	Advantages	Disadvantages
1) Single Point Urban Interchange	• Significantly reduces delay • Achieves LOS D in 2045 peak hours	• Not feasible due to design requirements, and impacts to I-595 bridges
2) Diverging Diamond Interchange	• Reduces delay • Achieves LOS E/F in 2045 peak hours	• Not feasible due to design requirements
3) Modified Diamond Interchange with Overpasses and Flyover	• Significantly reduces delay • Achieves LOS D/E in 2045 peak hours • Reduces conflicts • Reduces stops	• Significant right-of-way impacts • Access impacts to developments • Visual impacts (view of flyovers) • Noise impacts • Canal impact
4) Modified Diamond Interchange with Overpasses	• Reduces delay • Achieves LOS E/F in 2045 peak hours • Reduces conflicts • Reduces stops	• Does not meet LOS D in 2045 peak hours • Right-of-way impact • Canal impact

NOTE: All alternatives include the following improvements:

1) *New shared use path to improve pedestrian and bicycle facilities through interchange at SR 84.*
2) *Bicycle lanes along Pine Island Road.*

3.7.3 Recommended Concept Improvements

Recommended improvements for the Pine Island Road corridor include SR 84 / I-595 interchange improvements, intersection improvements at SW 6th Court, Peters Road, and Nova Drive, as well as multimodal improvements. To address the SR 84 interchange deficiencies, the modified diamond interchange with overpasses alternative is recommended for further analysis, design, and implementation. Standard intersection lane improvements are also proposed for the three additional intersections along Pine Island Road where the LOS will not meet the target LOS D. Turn lanes are proposed at: SW 6th Court, Peters Road, and Nova Drive.

The recommended Pine Island Road corridor concept includes new bicycle lanes where they are missing in the northbound direction between Orange Grove Drive and eastbound SR 84. The existing bus stops on Pine Island Road were reviewed to determine whether any need a bench or a shelter. All four of the bus stops located on Pine Island Road between SR 84 and SW 3rd Street have benches, but not shelters. Daily activity at all four bus stops is greater than 10. Therefore, a shelter is recommended for the four BCT stops (#3572, 3573, 3574, and 3575) along Pine Island Road.

The scope of the Pine Island Road corridor improvements is described below.

Pine Island Road Corridor Improvements

The limits of the corridor improvements are from north of SW 6th Court to south of Nova Drive; and along SR 84 eastbound and westbound from approximately 2,800 ft west of Pine Island Road to approximately 2,800 ft east of Pine Island Road.

- **Pine Island Road and SR 84 / I-595 Interchange**
  - Westbound SR 84 bypass/overpass –new bridge over Pine Island Road
  - Eastbound SR 84 bypass/overpass –new bridge over Pine Island Road
  - Reconstruct westbound SR 84 and Pine Island Road signalized intersection as noted below.
    - Westbound: Widen the approach and provide one exclusive left-turn lane, one shared through/left-turn lane, and three exclusive right-turn lanes.
    - Southbound: Widen the approach and provide two left-turn lanes, three through lanes, an exclusive right-turn lane, and a shared through/right-turn lane.
    - Northbound: Add a third northbound through lane.
  - Reconstruct eastbound SR 84 and Pine Island Road signalized intersection as noted below.
    - Eastbound: Widen the approach and provide two exclusive left-turn lanes, one shared through/left-turn lane, and two exclusive right-turn lanes.
    - Northbound: Widen the approach and provide two left-turn lanes, three through lanes, and two exclusive right-turn lanes.
    - Southbound: Add a third through lane.
- **Pine Island Road north and south of SR 84**
  - Add buffered bicycle lanes along Pine Island Road where missing between Orange Grove Drive and eastbound SR 84.
  - Widen sidewalk to be a shared use path for both bicycles and pedestrians through the interchange area (northbound, southbound, eastbound).
  - Construct bus shelters to serve four BCT bus stops located along Pine Island Road between SR 84 and SW 3rd Street.
- **Pine Island Road and SW 6th Court Signalized Intersection**
  - Add a second westbound left-turn lane.

- **Pine Island Road and Peters Road Signalized Intersection**
  - Add a third westbound left-turn lane.
  - Add a second westbound right-turn lane.
  - Add a second northbound right-turn lane.
- **Pine Island Road and Nova Drive Signalized Intersection**
  - Add an exclusive eastbound right-turn lane.
  - Add an exclusive westbound right-turn lane.

The Pine Island Road corridor concept plan is provided as Exhibit A-9 in Appendix A.

Figure 3-29 depicts the existing conditions typical section for Pine Island Road south of SR 84, as well as the proposed typical section for the recommended corridor improvements.

Figure 3-29: Pine Island Road Typical Section South of SR 84

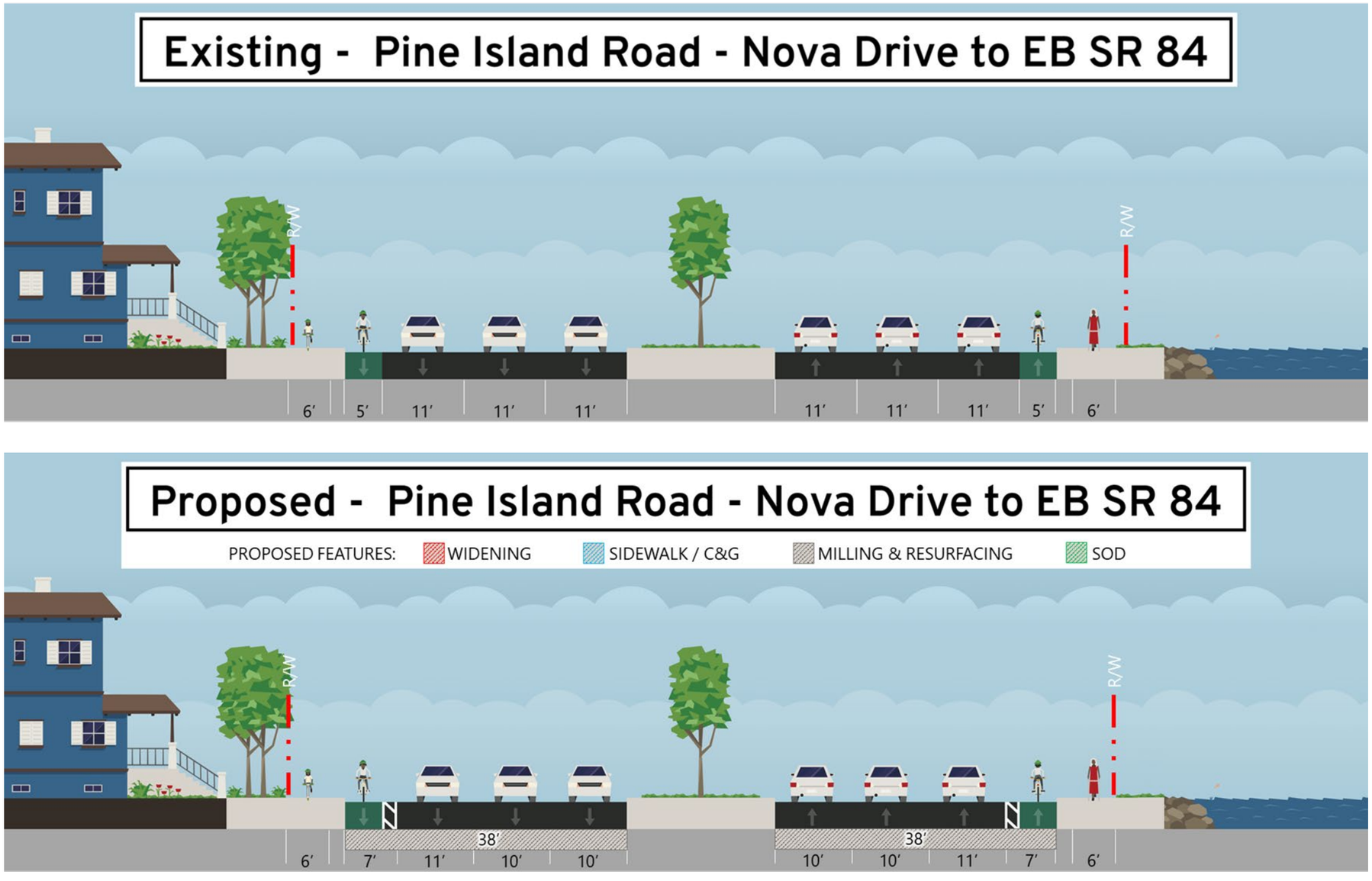
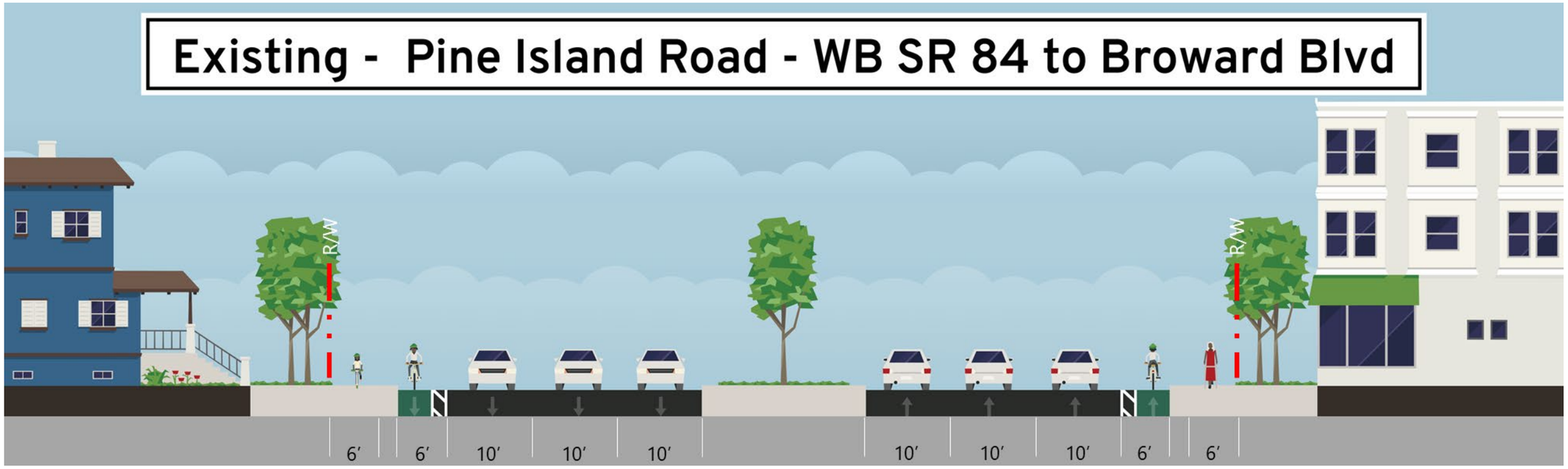


Figure 3-30 depicts the existing conditions typical section for Pine Island Road north of SR 84. No changes are recommended for this section of Pine Island Road. Adequate roadway, pedestrian, and bicycle facilities are provided.

Figure 3-30: Pine Island Road Typical Section North of SR 84



3.7.4 Concept Benefits

The Pine Island Road corridor improvements can provide a more efficient and less congested route for traffic, and can improve safety for motorists, pedestrians, and bicyclists. Table 3-17 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-17: Pine Island Road Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion, does not meet LOS D in 2045 peak hours – operates at LOS F • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for pedestrians & bicyclists	• Some delay & congestion remain in 2045 peak hours • Right-of-way impacts • Canal impact • Cost

Table 3-18 summarizes the benefits of the corridor improvements along Pine Island Road.

Table 3-18: Pine Island Road Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS E or better; except SR 84 westbound (PM)
Delays	55% reduction in total delays
North South Travel Time	25% reduction in travel times along Pine Island Road
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	Accommodates bus stops and shelters and potential future enhanced transit service

3.7.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- Pine Island Road south of SR 84, along east and west sides from Orange Grove Drive to SR 84, potentially impacting a residential mobile home property and a gas station on the east side.
- Pine Island Road north of SR 84, along east and west sides from SR 84 to the driveway north of New River Canal Road.
- Westbound SR 84 east of Pine Island Road, along the north side potentially impacting the New River Canal South Florida Water Management District property.
- Eastbound SR 84 west of Pine Island Road, potentially impacting some of the businesses along the south side.
- At Nova Drive Intersection – Along the west side of Pine Island Road north and south of Nova Drive.
- At Peters Road Intersection – Along the east side of Pine Island Road south of Peters Road.
- At SW 6th Court Intersection – Along the north and south sides of SW 6th Court east of SW 6th Court.

The concept plan Exhibit A-9 in Appendix A also shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.7.6 Structural Impacts

Two existing roadway structures would be impacted. They are described below.

1) The existing eastbound SR 84 overpass roadway bridge to cross over Pine Island Road would need to be widened or replaced to accommodate two lanes – one for the existing I-595 off-ramp and one for the eastbound SR 84 overpass lane.
2) The existing westbound I-595 off-ramp bridge would need to be widened or replaced to accommodate three lanes - two for the existing I-595 off-ramp and one for the westbound SR 84 overpass lane.

3.7.7 Environmental Considerations

Impacts to wetlands and other surface waters are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of Pine Island Road and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Additionally, one shoulder mounted noise wall would potentially be impacted by the conceptual design and would need to be considered for partial/full replacement or enhancement in a future traffic noise study. Due to the potential to impact Florida bonneted bat habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. Impacts to floodplains are anticipated and would need to be further evaluated. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features.

<u>Wetlands and Other Surface Waters</u>

- Wetland impacts would occur if submerged aquatic vegetation is present within the North New River Canal (as a result of new ramps). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100 year floodplain).

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees and bridge widening) for the Florida bonneted bat (endangered species) would occur.

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family and Multi-Family, Recreational, Other Sensitive Land Uses) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family and Multi Family (Examples: Park City Mobile Homes and Turtle Run)
  - Activity Category C: Recreational (New River Greenway Trail and Jacaranda Golf Courses)
  - Activity Category E: Other Sensitive Land Use (Renaissance Fort Lauderdale-Plantation Hotel Pool Area)
- Two shoulder/structure mounted noise walls would potentially be impacted and would need to be considered for partial/full replacement in a future noise study.
  - Northside of westbound SR 84, west of Pine Island Road.

Cultural

- Mobile home in SE corner of SR 84 and Pine Island Road is historic structure but was determined to be ineligible for National Register of Historic Places (NRHP) listing per previous SHPO evaluation.

3.7.8 Other Impacts

No other impacts are anticipated.

3.7.9 Cost Estimate

A planning level cost estimate was developed for the Pine Island Road corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the Pine Island Road and SR 84 / I-595 interchange improvements, intersection improvements at SW 6th Court, Peters Road, and Nova Drive, as well as recommended multimodal improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $74.3 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the Pine Island Road corridor improvements is provided in Appendix B.

3.8 University Drive Corridor

The University Drive corridor was studied from Federated Road in City of Plantation to SW 30th Street in Town of Davie. University Drive between Federated Road and SW 30th Street is a six-lane divided state of Florida principal arterial. University Drive has sidewalk along both sides of the roadway between SW 30th Street and Peters Road. However, there is a gap in sidewalk along the east side between Peters Road and Federated Road. There are 5-foot wide on-street bicycle lanes in both directions of University Drive from SW 30th Street to Kolsky Boulevard, and north of SR 84 to Federated Road. However, there are no bicycle lanes provided from Kolsky Boulevard through the SR 84 interchange.

3.8.1 Design Considerations

The development of improvement concepts is multifaceted and must consider a number of deficiencies and design constraints unique to the University Drive corridor. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Nine signalized intersections along University Drive were studied. Two of the University Drive study intersections are currently operating below LOS D in the AM peak hour. The University Drive at SR 84 westbound intersection and University Drive at Peters Road intersection are operating at LOS E during the AM peak hour. By 2045 without any improvements, eight of the nine study intersections will operate at LOS E or F during the weekday peak hours.

The University Drive corridor has a number of deficiencies and key issues that were considered when developing improvement alternatives. They are listed below.

- Mobility/Operational
  - Inadequate capacity at the SR 84/I-595 interchange.
  - Multiple conflicting high traffic volume turning movements at SR 84 interchange and at study intersections.
  - North-south through volumes on University Drive exceed the capacity of the six-lane roadway.
  - Maintain all movements at interchange and maintain existing flyovers.
  - Consider the closely spaced existing intersections and driveways along the arterial and maintain access to adjacent properties.
- Safety
  - University Drive corridor had the highest number of total crashes (3,028) of all study roadways within the study area over five-year period.
  - High crash rate at associated with heavily congested conditions.
  - University Drive / SR 817 had the highest number of pedestrian related crashes (13) over five-year period.
  - Enhance safety at Peters Road intersection (two fatal crashes and four pedestrian related crashes occurred within five-year period).
  - Enhance safety at Nova Drive intersection (one fatal crash, one pedestrian related crash, and two bicycle related crashes occurred within five-year period).
- Bicycle and Pedestrian
  - Missing sidewalk along an arterial segment.
  - Missing bicycle lanes along an arterial segment.
  - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange.
- Transit
  - Upgrade existing bus stops located within study area along University Drive where needed for the existing Breeze route and local bus routes.
  - Consider needs of potential future enhanced transit service along University Drive corridor.

- Key Constraints
  - Avoid or minimize impacts to I-595 mainline, ramps and flyovers.
  - Avoid or minimize impacts to New River Canal.
  - Avoid or minimize impacts to adjacent business and residential properties.
  - Avoid impacts to sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to avoid or minimize any impacts to I-595 mainline and ramps, avoid or minimize impacts to the New River Canal and other adjacent canals, and avoid or minimize impacts to adjacent properties. The purpose of improving the University Drive corridor and SR 84 interchange is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety and connectivity for all modes. To provide for safe and efficient alternative modes of travel, adding and improving pedestrian, bicycle, and transit facilities along University Drive was considered.

3.8.2 Evaluated Improvements

University Drive corridor improvements include roadway capacity improvements north and south of SR 84, improvements to the SR 84 / I-595 interchange, improvements to the study intersections at Peters Road, Nova Drive, and SW 30th Street, as well as multimodal improvements. Multiple alternatives were evaluated for improving the University Drive and SR 84 / I-595 interchange, and the University Drive and Peters Road intersection. These alternatives are discussed within this section.

For all study intersections that will operate below the LOS target D in the 2045 peak hours, improvements were considered and identified where feasible. When determining the type of alternatives to consider, a three-step process was used. First, minor lane geometry and signal improvements were considered for each failing study intersection along University Drive. Minor improvements considered included changes such as adding a turn lane, reconfiguring lanes to optimize operations, increasing storage bay lengths, and/or modifying signal phasing or timings to improve operations and ultimately try to meet LOS D during both 2045 peak hours. Where minor improvements could not address operational deficiencies, then alternative configuration intersection improvements were considered as well as grade separation for high volume movements.

The FDOT ICE stage 1 process was followed using CAP-X and SPICE tools to evaluate possible alternatives for failing intersections that may require alternative intersection configurations. HCS intersection analysis using Synchro software was then used to determine recommended operational improvements. For locations that required more non-traditional signalized intersection improvements, the most viable alternative intersection configuration improvement concepts from CAP-X were considered as a starting point. Alternative intersection configurations such as displaced left-turns, restricted crossing u-turns, median u-turns, grade separation, and other alternative intersection configurations were considered.

The estimated footprint of alternatives and the potential impacts to adjacent properties was considered when evaluating alternatives. This included considering the need for additional right-of-way to construct improvements within. It also included considered impacts to existing driveways and local roadway access points and how that would impact traffic to and from adjacent properties.

University Drive locations that require improvements are listed below and the evaluated improvements are described in the following sections.

1) University Drive from SW 30th Street to eastbound SR 84
2) University Drive and SR 84 interchange
3) University Drive from westbound SR 84 to north of Federated Road
4) University Drive and SW 30th Street intersection
5) University Drive and Nova Drive intersection
6) University Drive and Peters Road intersection

3.8.2.1 University Drive from 30th Street to Eastbound SR 84

The following roadway modifications were evaluated to determine a recommended mitigation concept.

1) Add a fourth northbound and fourth southbound through lane on University Drive through the four signalized study intersections listed below. The fourth southbound University Drive through lane would begin just south of eastbound SR 84 and extend to south of SW 30th Street. The fourth northbound through lane would begin south of SW 30th Street and extend to where it would drop as the right-turn lane to eastbound SR 84.
    a) SW 30th Street
    b) Nova Drive
    c) SW 23rd Street/2300 Block
    d) Kolsky Boulevard
2) Elevate two northbound and two southbound University Drive through lanes over Nova Drive and over 23rd Street/2300 Block signalized intersections to allow through traffic to bypass the signalized intersections.
3) Provide two northbound and two southbound University Drive through lanes at-grade to allow for local trips to access the signalized intersections of 23rd Street/2300 Block and Nova Drive and adjacent driveways.
4) Provide a one-lane ramp from the elevated northbound through lanes to merge with an at-grade University Drive one-lane ramp, leading to the existing northbound to westbound SR 84/I-595 flyover.

The additional fourth through lane can accommodate more vehicles and reduce delays at each of the intersections. It also provides an opportunity for buses to use the outside at-grade lane to drop off and pick up passengers at various points along the University Drive corridor, and for other vehicles to use the outside lane for slower right-turning traffic.

Elevating two through lanes in each direction allows a large percentage of traffic on University Drive to bypass the signalized intersections at 23rd Street/2300 Block and Nova Drive. This would reduce the number of stops, and vehicular delay at the signalized intersections would be significantly decreased. The signal's extra green time can be redistributed to large volume turning movements at these intersections to improve their operations.

3.8.2.2 University Drive and SR 84 Interchange

The following modifications were evaluated to determine a recommended mitigation concept.

- Modified diamond interchange with the following additional components described below.
    1) Eastbound SR 84 through lane overpass over University Drive - The overpass was found to be feasible and provided significant benefit to the traffic operations at the University Drive signalized intersection.
    2) Eastbound SR 84 to southbound University Drive flyover - A flyover could provide significant traffic relief for the signalized study intersections of SR 84 eastbound and Kolsky Boulevard. However, it would require structural supports to be constructed through the shopping center plaza property in the southwest corner of the interchange. This would affect the design and capacity of the parking lot and the impacts may not be reasonably mitigated. Therefore, it was not recommended for further consideration.
    3) Westbound SR 84 right-turn bypass lane - A right-turn bypass lane that bridges over the New River Canal and allows traffic to merge free-flowing onto northbound University Drive. This can significantly reduce delays and queuing at the westbound SR 84 intersection with University Drive. However, impacts to the New River Canal from the proposed bridge structure would need to be mitigated.

4) Widen existing University Drive southbound to eastbound SR 84/I-595 flyover from one-lane to two-lanes – It is not feasible to widen the existing flyover bridge structure. The existing bridge would need to be replaced at significant cost, and the flyover has not yet reached its useful lifespan. Widening the flyover should be considered at the time when the bridge needs to be replaced.
5) Widen existing University Drive northbound to westbound SR 84 / I-595 flyover from one-lane to two-lanes – It is not feasible to widen the existing flyover bridge structure. The existing bridge would need to be replaced at significant cost, and the flyover has not yet reached its useful lifespan. Widening the flyover should be considered at the time when the bridge needs to be replaced.
6) Bridging the I-595 westbound off-ramp over westbound SR 84 - This allows the heavier I-595 off-ramp traffic to merge on the right side of westbound SR 84. This would improve operations and safety on westbound SR 84. It would better align traffic from the I-595 off-ramp with the downstream right-turn lanes at Pine Island Road without having to weave across westbound SR 84 traffic. The majority of westbound SR 84 traffic is expected to stay in the left lanes since it is destined to the I-595 on ramp west of Pine Island Road.

3.8.2.3 University Drive from Westbound SR 84 to North of Federated Road

A fourth northbound and fourth southbound through lane on University Drive was evaluated and recommended as the mitigation concept for this section of roadway. A fourth northbound and fourth southbound through lane is recommended on University Drive through the following signalized study intersections.

1) Peters Road
2) The Fountains
3) Federated Road

The fourth southbound University Drive through lane would begin north of Federated Road and drop as a right-turn lane at westbound SR 84. The fourth northbound through lane would begin where the westbound SR 84 right-turn bypass lane joins northbound University Drive and extend through Federated Road.

The additional fourth through lane will accommodate more vehicles and reduce delays at each of the intersections. It also provides an opportunity for buses to use the new outside fourth lane to drop off and pick up passengers at various points along the University Drive corridor, and for all vehicles to use the new fourth outside lane for slower right-turning traffic.

3.8.2.4 University Drive and SW 30th Street Intersection

Additional turn lanes that could improve operations and fit mostly within existing right-of-way were evaluated. A westbound second right-turn lane was identified as a feasible improvement. It is recommended to be implemented along with the fourth northbound and southbound through lane as part of the University Drive corridor improvements.

3.8.2.5 University Drive and Nova Drive Intersection

Additional turn lanes that could improve operations and fit mostly within existing right-of-way were evaluated. A westbound second left-turn lane was identified as a feasible improvement. It is recommended to be implemented along with the fourth northbound and southbound through lane as part of the University Drive corridor improvements.

3.8.2.6 University Drive and Peters Road Intersection

The following three intersection alternatives were evaluated to determine a recommended mitigation concept.

1) Displaced Left-Turn (DLT) for the eastbound, westbound, and southbound approaches, and Median U-turn for northbound left-turns
2) Center Left-Turn Overpass
3) Additional Lanes At-Grade

Alternative 1 - Displaced Left-Turn (DLT)

The distinguishing feature of a DLT intersection is the crossover of the left-turn lanes to the other side of the opposing lanes, in advance of the main signalized intersection. The crossover for the left-turns in advance of the main signalized intersection enables the left-turns to move during the same signal phase as the through movement. Removing the left-turn movements from the main intersection reduces signal phases, which in turn leads to higher capacity for the intersection. The DLT configuration can decrease delay due to use of more efficient two-phase or three-phase signal operations. It can be a more efficient design for intersections with high-volume left-turning movements and can provide more green time for major movements. It can lower delay and cause fewer stops.

At the University Drive and Peters Road intersection, a DLT configuration was evaluated for the southbound, eastbound, and westbound left-turn movements. A median U-turn configuration was considered for the northbound left-turn movement. This configuration would require the northbound University Drive left-turn to make a U-turn north of Peters Road followed by a right-turn at Peters Road to complete the left-turn. This alternative also includes the fourth northbound and southbound through lane on University Drive.

The DLT intersection configuration requires a new signalized intersection on each leg of the intersection where the left-turn lanes must cross over to the other side of the opposing through lanes. All the signals should be coordinated and synchronized to allow movements to occur together at the main signal and each of the upstream crossover intersections in sequence.

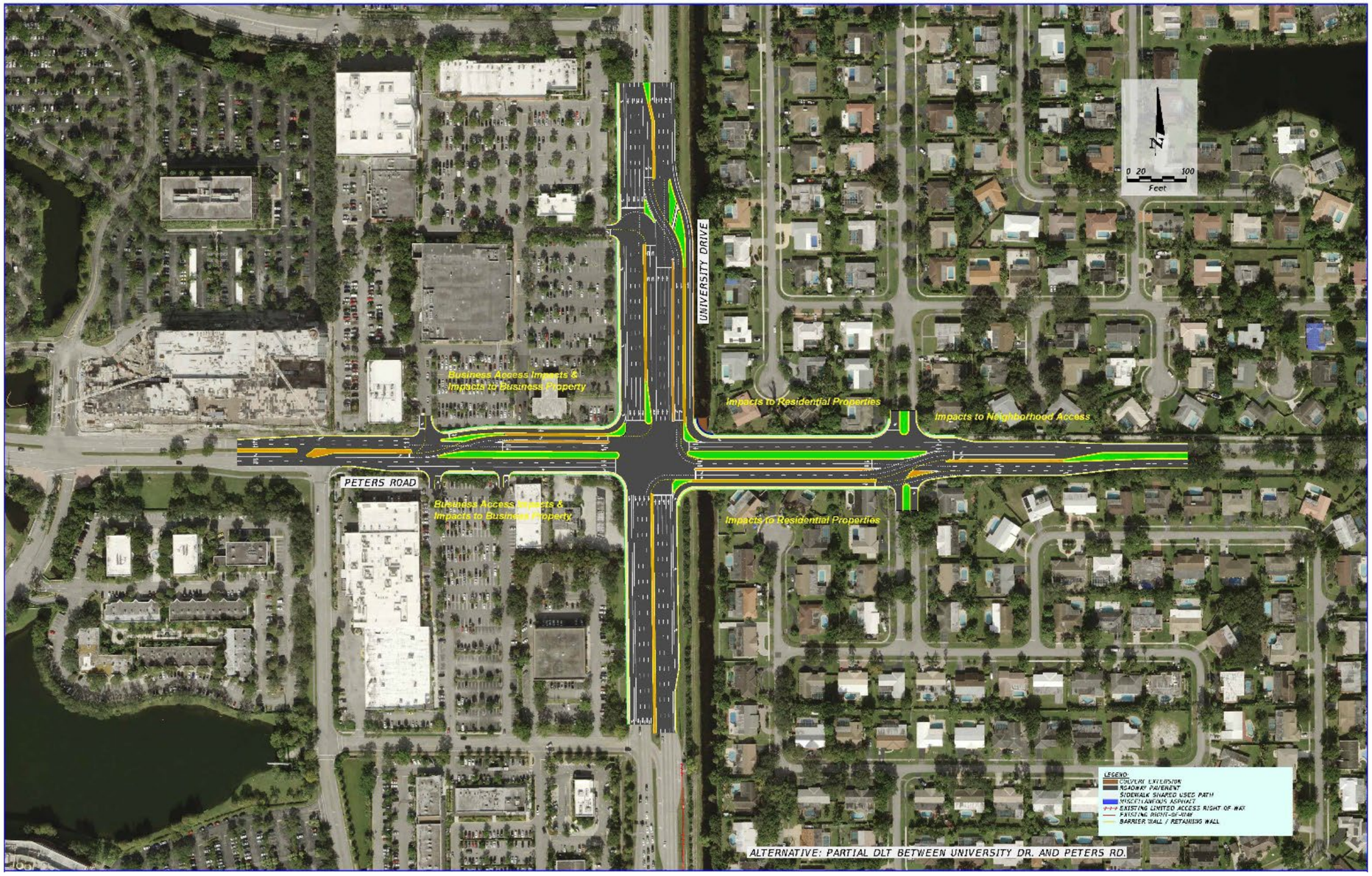
The approaches with the left-turn crossovers cannot accommodate median breaks within approximately 600 to 700 feet of the main intersection. Therefore, driveways in these areas need to be right-in/ right-out only. Since a right-turn lane will be located as the outside lane on the departure sides of the intersection, far side bus stops would need to be relocated farther away from the intersection or an island on the near side of the intersection would need to be created for the bus stop. The DLT intersection would require unique pedestrian crossing design, and most likely a two-stage crossing for pedestrians is needed along with pedestrian refuge islands through the University Drive and Peters Road intersection. This is due to the wide geometric footprint. Also, the right-turn lanes should be signalized for pedestrians to cross.

Also of note, the crossover intersection has the potential for wrong-way movements. In addition, due to the unconventional design, a backup generator for the signals may be needed in case of a power outage to allow vehicles to safely navigate through the complex intersection.

With respect to the median U-turn for the northbound left-turn movement, this helps improve operations at the main signal as it removes the left-turn phase from the main signalized intersection. However, it requires a wide median (typically 60 to 100 feet wide) to allow for large vehicles to make a U-turn downstream. Otherwise, it may not accommodate the turning path needed for large trucks. Also, with a driveway at the same location as the median U-turn signal, a signal phase would need to be provided for the driveway, reducing the amount of green time for the heavy southbound through movement and northbound U-turn movement.

Figure 3-31 shows the conceptual design plan for the Displaced Left-turn (DLT) intersection at University Drive and Peters Road.

Figure 3-31: Displaced Left-turn (DLT) Alternative at University Drive and Peters Road



Alternative 2 - Center Left-Turn Overpass

The center left-turn overpass separates the left-turn movements from all approaches and relocates them to an elevated structure over top of the at-grade intersection. This alternative also includes the fourth northbound and southbound through lane on University Drive. One-lane ramps are provided for the left-turn movements within the median to bring the left-turns to a signal at the top that controls the left-turn movements with a two-phase traffic signal. In this location at the intersection of Peters Road and University Drive, a left-turn lane would still need to be provided on all approaches of the at-grade intersection, to allow access to adjacent properties in all four corners of the intersection. Removing the very heavy left-turn volumes from the main signalized intersection provides significant benefit by reducing delays. However, with a left-turn phase still needed for all directions, it is not possible to eliminate the left-turn signal phases, so it must remain a 4-phase signal operation, which is not as efficient. The signals above and below are expected to be coordinated.

The elevated left-turn ramps would be on a retaining wall structure, and the traffic descending from the elevated ramps must merge back into traffic on all four legs. The retaining wall structures would require the roadway to be widened to fit them in the median on all four approaches. Also, the walls will block the median for approximately 750 feet on each leg of the intersection. This will restrict access from sides streets and driveways within this area to right-in / right-out only.

At this location, it was found that vehicles traveling southbound from the overpass on the median ramp, will merge into southbound University Drive too close to the location where the southbound University Drive flyover lane exit begins. Many of the vehicles that would like to use the left-turn overpass are destined to SR 84 / I-595 from the flyover, but they would not be able to weave across four southbound lanes on University Drive in the short distance to access the flyover. Therefore, most of the westbound left-turns would need to still use the at-grade intersection, which would cause the improvement to be functionally less beneficial than intended.

Figure 3-32 on the next page shows the conceptual design plan for the center left-turn overpass intersection at University Drive and Peters Road.

Alternative 3 - Additional Lanes At-Grade

This option consists of adding turn lanes where needed and primarily within existing right-of-way. It also includes the fourth northbound and southbound through lane on University Drive. The additional turn lanes found to provide operational benefit and to fit primarily within existing right-of-way are listed below.

- Third westbound left-turn lane on Peters Road
- Second northbound right-turn lane on University Drive

These additional turn lanes at-grade were analyzed and are shown to reduce overall delay at the intersection, as well as reduce queue lengths. While these additional lanes at-grade cannot improve traffic operations as much as the DLT or center left-turn overpass alternatives, they have the least impacts to right-of-way and access.

On the next page, Figure 3-33 shows the conceptual design plan for the additional lanes at-grade intersection at University Drive and Peters Road.

Figure 3-32: Center Left-Turn Overpass at University Drive and Peters Road

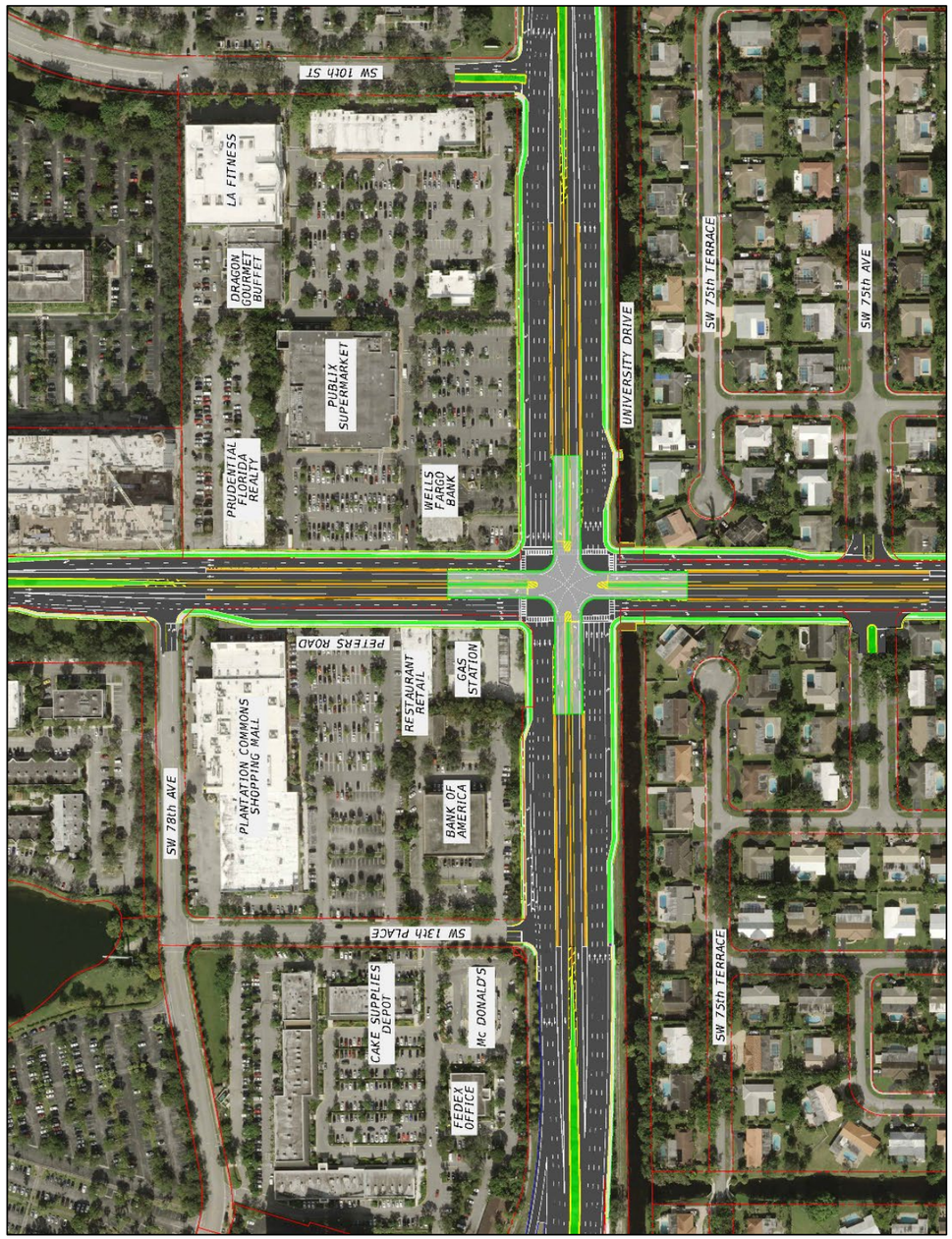
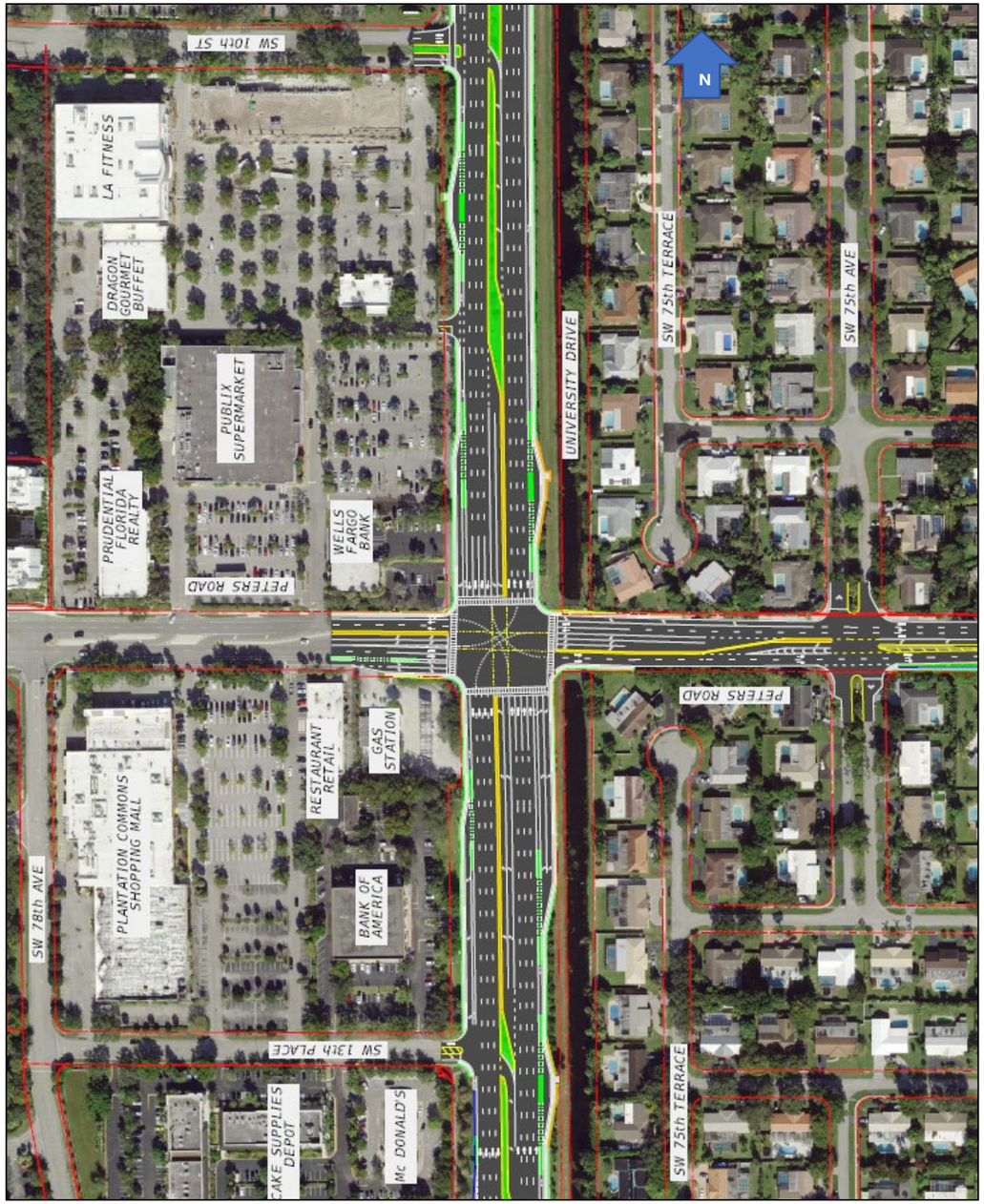


Figure 3-33: Additional Lanes At-Grade at University Drive and Peters Road



Advantages and Disadvantages of University Drive and Peters Road Intersection Alternatives

The 2045 AM and PM peak hour traffic volumes documented in Technical Memorandum 3 for the No Build condition were reassigned through the reconfigured intersection configurations for each of the alternatives. The signalized study intersection was then analyzed using Synchro software to determine the estimated delay and LOS for each of the alternative interchange configurations. The overall intersection LOS and delays for each of the three alternatives are summarized in Table 3-20.

Table 3-20: University Drive and Peters Road Intersection Alternatives LOS Comparison

2045 Build Alternatives	Central / At-Grade Signal		North / Top Signal		East Signal		West Signal	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
No Build [(1)]								
AM	274	F						
PM	211	F						
DLT & Median U-Turn [(1)]								
AM	23	C	15	B	18	B	14	B
PM	15	B	12	B	15	B	15	B
Center Left-turn Overpass								
AM	76	E	36	D				
PM	75	E	24	C				
Add Lanes At-Grade								
AM	164	F						
PM	113	F						

NOTES: (1) Analysis from University Drive Study Report, dated 2020

Next, the physical feasibility of the geometric layout of the intersection alternatives was evaluated. It was determined whether there would be significant impacts to any of the key constraints listed in Section 3.3.1.

The advantages and disadvantages of each of the three intersection concepts were considered. The DLT and Center Left-turn Overpass alternatives can improve operations the most, by reducing delays and allowing the signalized intersection to operate at LOS E or better during 2045 AM and PM peak hours. While the additional lanes at-grade alternative could not improve operations to LOS E or better during the 2045 AM and PM peak hours, it can still significantly reduce delay at the intersection by 40% to 50% in the 2045 peak hours.

When evaluating the physical feasibility of each of the alternatives, it was determined that the footprint of the DLT alternative would significant require right-of-way along Peters Road west of University Drive impacting businesses parking lots. In addition, access into and out of driveways for businesses along the north and south sides of Peters Road west of University Drive would be restricted. Significant right-of-way would also be required along Peters Road east of University Drive which would fully impact at least three single family homes. In addition, the full median opening at SW 75th Avenue and Peter Road east of University Drive would need to be restricted to right-in / right-out only. This would impact access for the large residential communities along the north and south sides of Peters Road. Therefore, this was considered an unacceptable alternative since it would significantly impact many adjacent private properties.

The center left-turn overpass alternative requires one-lane ramps in each direction on all four legs of the intersection. Peters Road and University Drive must be widened for a length of approximately 1,200 feet on all four approaches to the intersection to accommodate the ramps and the at-grade travel lanes through the intersection. Each elevated ramp must be wide enough for one lane of traffic and have shoulders wide enough to allow a vehicle to pass a disabled vehicle on the shoulder. The width for the ramps in the median requires the at-grade lanes to be pushed out on either side of the ramp structures. The available right-of-way is not wide enough to accommodate the widening. As with the DLT alternative, significant right-of-way would be required along Peters Road and University Drive, which would impact the

businesses on both sides of Peters Road and at least three single family homes along Peters Road. As with the DLT alternative, there would be impacts to driveways and access into and out of the business driveways along Peters Road, as well as restricting SW 75th Avenue to right-in / right-out only.

The additional lanes at-grade alternative can provide significant operational benefits and does not require right-of-way, except for a small sliver along Peters Road east of University Drive to accommodate the third westbound left-turn lane. In addition, this alternative does not impact access to any of the adjacent properties.

Table 3-21 summarizes key advantages and disadvantages of each of the three University Drive and Peters Road intersection concepts.

Table 3-21: University Drive and Peters Road Intersection Alternatives Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
1) No Build	• No cost • No impacts • No disruption	• Does not address congestion, operates with long delay and queues at LOS F • Does not improve safety for bicyclists, pedestrians, vehicles • Does not improve connectivity for bicyclists, pedestrians, vehicles
2) Displaced Left-Turn (DLT) Lanes	• Significantly reduces delay and achieve LOS D in peak hours • Lower delay and fewer stops on major street could reduce rear-end crashes	• Required right-of-way larger than conventional intersection • Access impacts to businesses and adjacent side streets (changes ingress/egress patterns to corner developments) • Potential driver confusion & wrong-way movements • More complex for pedestrians & bicyclists to navigate • Due to adjacent driveway at median U-turn signal, and pedestrian crossing phases, estimated delay benefits may not be fully realized
3) Center Left-Turn Overpass	• Significantly reduces delay and improves to LOS E in peak hours • Reduces conflict points, improves safety • Pedestrian and bicyclists cross less traffic and less lanes	• Required right-of-way larger than conventional intersection • Access impacts to businesses and adjacent side streets (changes ingress/egress patterns to corner developments) • Visual impacts (blocked visibility to businesses by structure) • Left-turn lanes must remain through the at-grade signal for access to developments in four corners • Southbound overpass ramp merge point (south of Peters Road) too close to I-595/SR 84 eastbound flyover entrance could cause weaving maneuvers and render overpass for westbound left-turns destined to flyover unusable
4) Add Turn Lanes	• Reduces delay and queues, but remains LOS F in peak hours	• Partly addresses congestion • Minor right-of-way impacts

NOTE: Alternatives 2, 3, and 4 include the following improvements:

1) *New 4th northbound and southbound through lane on University Drive.*
2) *Wider bicycle lanes along University Drive northbound and southbound.*
3) *Sidewalk along University Drive northbound and southbound.*
4) *Transit bus stop upgrades for benches or shelters.*

3.8.3 Recommended Concept Improvements

Recommended improvements for the University Drive corridor include roadway capacity improvements along University Drive north and south of SR 84, improvements at the SR 84 / I-595 interchange, and intersection improvements at Peters Road, Nova Drive, and SW 30th Street. Corridor improvements also include multimodal improvements such as added sidewalk, bicycle lanes, and bus stop improvements. These improvements are recommended for further analysis, design, and implementation to address the safety, capacity, and operational deficiencies. At the University Drive and Peters Road intersection, the additional lanes at-grade intersection alternative is recommended as the best alternative.

The recommended University Drive corridor concept includes wider bicycle lanes along University Drive within the study limits, which is in keeping with FDOT's ongoing bicycle lane design and construction project along University Drive (FM#432066). The recommended improvements also include adding sidewalk where it is currently missing on the east side of University Drive between Peters Road and Federated Road.

The additional fourth through lane recommended along University Drive in each direction may be utilized as a bus and access lane. The recommended additional lane along University Drive can help with implementation of premium transit service along the corridor in the future. Proposed transit improvements include bus stop shelters where needed for the existing stops along University Drive.

Recommended improvements are consistent with recommendations in the Broward MPO's University Drive Mobility Improvements Planning Study, Final Summary Report recommendations, dated March 2015.

Following is a list of the scope items for the recommended University Drive corridor improvements.

University Drive Corridor Improvements

The limits of the corridor improvements are from Federated Road to SW 30th Street, and along SR 84 eastbound and westbound from approx. 2,800 ft west of University Drive to approx. 3,900 ft east of University Drive.

- **University Drive South of SR 84**
  - Widen University Drive from south of SW 30th Street to eastbound SR 84 to add a fourth northbound and southbound through lane.
  - Reconstruct University Drive from approx. 1,700 feet south of Nova Drive (at Autozone driveway) to south of Kolsky Boulevard, to provide two elevated lanes northbound and southbound in the median and two northbound and southbound lanes at-grade.
  - Construct a one lane ramp from the elevated northbound University Drive lanes to the existing flyover to westbound I-595. This includes modifying or replacing the approach to the northbound to westbound I-595 flyover.
  - Add buffered bicycle lanes along University Drive for the limits.
  - Widen sidewalk along northbound University Drive to be a shared use path for bicyclists and pedestrians from Nova Drive to SR 84.
  - Replace bus bays where they currently exist.
- **University Drive and SW 30th Intersection**
  - Widen University Drive to add a fourth northbound and southbound through lane through the intersection.
  - Add a second westbound right-turn lane and an accompanying right-turn overlap phase with signal head.
- **University Drive and Nova Drive Intersection**
  - Widen University Drive to add a fourth northbound and southbound through lane through the intersection, including two elevated lanes in each direction and two at-grade lanes in each direction.
  - Add a second westbound left-turn lane.
- **University Drive and SR 84 / I-595 Interchange**
  - Construct a westbound SR 84 to northbound University Drive right-turn lane bridge over the New River Canal to allow for a free-flow right-turn movement.

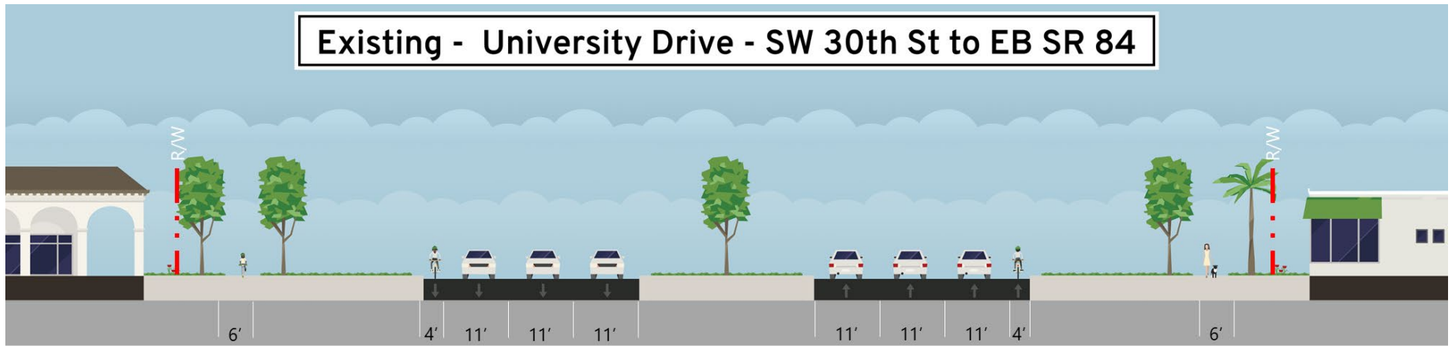
- Reconstruct the westbound I-595 off-ramp bridge over westbound SR 84 to allow ramp traffic to merge with SR 84 on the north side.
- Construct an eastbound SR 84 bypass/overpass bridge over University Drive.
- At the westbound SR 84 and University Drive signalized intersection reconfigure the turn lanes as noted below.
    - Southbound: Provide one exclusive right-turn lane.
    - Westbound to eastbound SR 84 U-turn: Signalize the U-turn movement at eastbound SR 84 and provide two U-turn lanes.
- At the eastbound SR 84 and University Drive signalized intersection, widen the eastbound SR 84 approach to provide three exclusive right-turn lanes, one shared through/left-turn lane, and one exclusive left-turn lane.
- Widen sidewalk to a shared use path width to serve both bicyclists and pedestrians through the interchange area (northbound, southbound, eastbound).

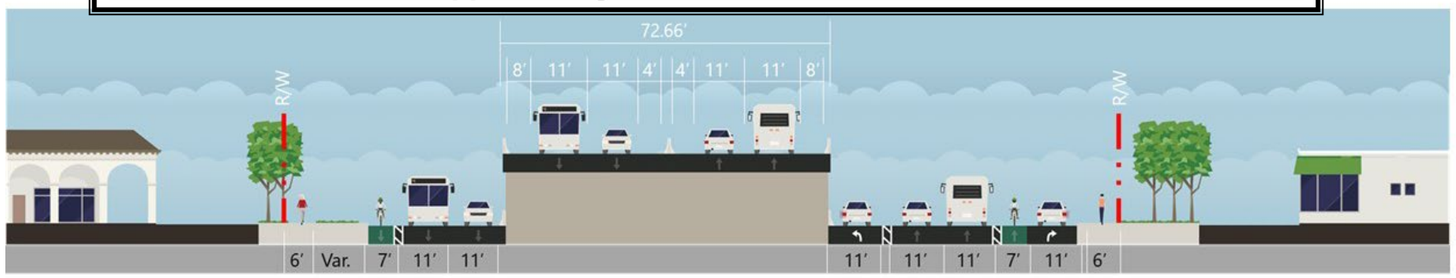
- **University Drive North of SR 84**
    - Widen University Drive from westbound SR 84 to north of Federated Road to add a fourth northbound and southbound through lane.
    - Replace buffered bicycle lanes along University Drive northbound and southbound for the limits.
    - Add sidewalk where it does not exist along University Drive between Peters Road and Federated Road.
    - Replace bus bays where they currently exist.
- **University Drive and Peters Road Intersection (Add Lanes At-Grade Concept)**
    - Widen University Drive to add a fourth northbound and southbound through lane through the intersection.
    - Add a second northbound right-turn lane & overlap phase with signal head.
    - Add a third westbound left-turn lane on Peters Road.
    - Add an overlap phase with signal head for the eastbound right-turn lanes.
    - Include sidewalk and bicycle lanes on all approaches where it exists currently.
    - Replace bus bays where they currently exist.
- **University Drive Bus Stop Improvements**
    - Provide bus shelters for five BCT bus stops (#5637, 0277, 3783, 3495, 4194) along University Drive within the study limits where daily activity is greater than 10.

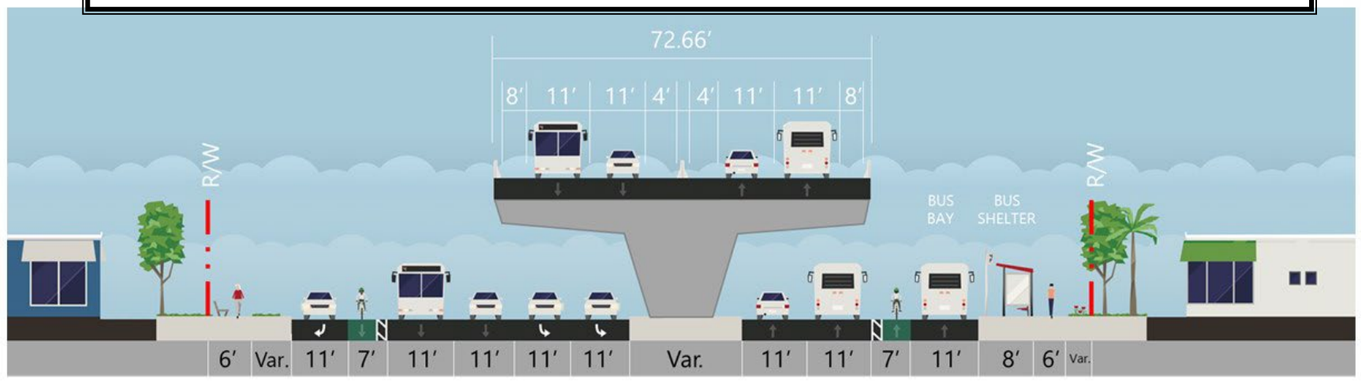
The University Drive corridor concept plan is provided as Exhibit A-10 in Appendix A.

The existing conditions typical section for University Drive south of SR 84 is depicted in Figure 3-34. Shown below the existing typical section, are two views of the proposed typical section for the recommended corridor improvements.

Figure 3-34: University Drive Typical Sections South of SR 84







In Figure 3-35, the existing conditions typical section for University Drive north of SR 84 is shown, along with the proposed typical section for the recommended corridor improvements.

Figure 3-35: University Drive Typical Section North of SR 84

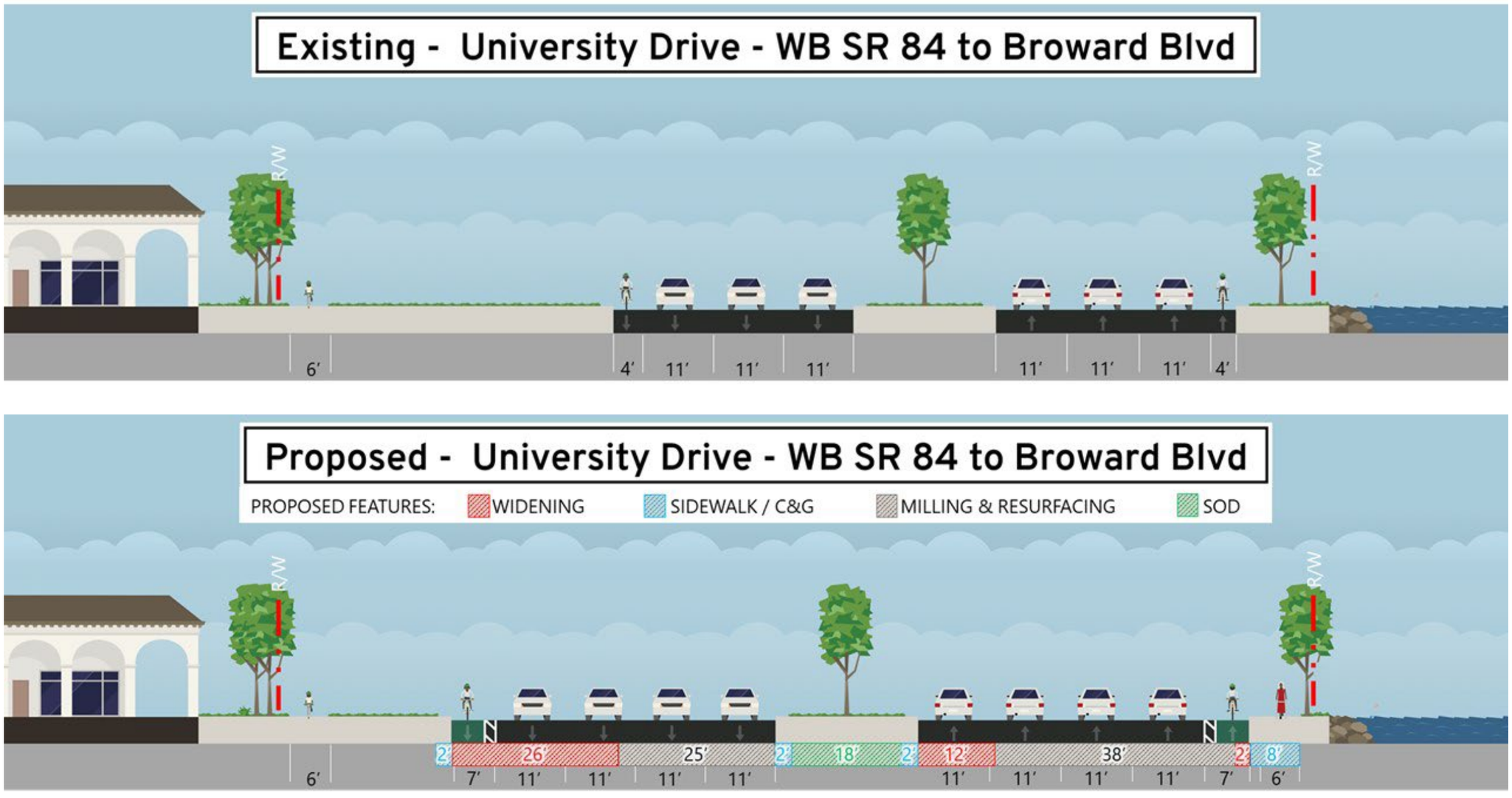


Figure 3-36 shows a 3D rendering developed to illustrate the recommended University Drive improvements at the SR 84 interchange.

Figure 3-36: Rendering of University Drive at SR 84 / I-595 Interchange Improvements

A 3D rendering of the University Drive corridor improvements south of SR 84 is shown in Figure 3-37.

Figure 3-37: Rendering of University Drive Improvements South of SR 84

3.8.4 Concept Benefits

The University Drive corridor improvements can provide a more efficient and less congested route for traffic, while enhancing safety and connectivity for pedestrians and bicyclists. It also improves safety for vehicles, pedestrians, and bicyclists along the corridor and through the SR 84 interchange. Table 3-22 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-22: University Drive Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Significantly reduces delay & congestion • Reduces conflicts at intersections • Improves safety for pedestrians, bicyclists, vehicles • Enhances connectivity for pedestrians, bicyclists, vehicles	• Right-of-way impact • Minor access impacts (restricts movements at 2 driveways south of Nova Drive) • Potential for noise impact • Visual impact (view of overpasses) • Canal impact • Cost

A summary of key benefits of the University Drive improvements is provided in Table 3-23.

Table 3-23: University Drive Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS E or better; except Kolsky Blvd (PM) and Peters Rd (AM & PM)
Delays	50% reduction in total delays
North South Travel Time	40% reduction in travel times along University Drive
Bicycle & pedestrian needs	Enhances safety and connectivity
Transit needs	Accommodates bus stops and shelters and potential future enhanced transit service

3.8.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. From south to north, the locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- University Drive southbound along the west side south of SW 30th Street to SW 33rd Street for the fourth lane and bicycle lanes.
- At University Drive and SW 30th Street, westbound along the north side of SW 30th Street east of University Drive, for the second westbound right-turn lane and sidewalk.
- At University Drive and Nova Drive in the southwest corner.
- University Drive southbound along the west side from south of Nova Drive to eastbound SR 84 for the fourth lane and bicycle lanes.
- Westbound SR 84 east and west of University Drive impacts the New River Canal SFWMD property.
- At University Drive and Peters Road, a minor corner clip in all four corners.
- Along east side of University Drive south of Federated Road for replacing the bus bay and sidewalk.

The concept plan in Appendix A also shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.8.6 Structural Impacts

One existing roadway structure would be impacted and would need to be modified or replaced. The northbound University Drive roadway bridge over Kolsky Boulevard must be modified or replaced to accommodate two lanes (one lane from at-grade northbound University Drive, one lane from elevated northbound University Drive) to merge together prior to connecting to the flyover leading to westbound I-595.

In addition to the existing structure, there are four new roadway structures needed as part of the University Drive improvements. They are described below.

1) Approximately 2,600-foot-long roadway bridge for northbound and southbound University Drive traffic to cross over Nova Drive and SW 23rd Street/2300 Block intersections.
2) Approximately 1,400-foot-long roadway bridge for eastbound SR 84 traffic to cross over University Drive.
3) Approximately 1,000-foot-long roadway bridge for westbound SR 84 to northbound University Drive traffic to cross over the New River Canal.
4) Approximately 2,000-foot-long roadway bridge for westbound I-595 off-ramp to cross over westbound SR 84.

3.8.7 Environmental Issues

Impacts to wetlands and other surface waters are expected to be minimal. Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of University Drive and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Additionally, one shoulder mounted noise walls would potentially be impacted by the conceptual design and would need to be considered for partial/full replacement or enhancement in a future traffic noise study. Due to the potential to Florida bonneted bat and wood stork habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. Impacts to floodplains are anticipated and would need to be further evaluated. A Sociocultural Effects Evaluation will be required to assess the potential access impacts to business and neighborhoods. The conceptual improvements are not anticipated to impact contaminated sites.

The environmental considerations are noted below.

Wetlands and Other Surface Waters

- Wetland impacts would occur if submerged aquatic vegetation is present within the canals (including North New River Canal as a result of new ramp from WB SR 84 to NB University Drive and from widening University Drive over the canal). If no submerged aquatic vegetation exists, widening would result in other surface water impacts.
- Impacts to University Drive Stormwater ponds (other surface water) would occur.

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees) for the Florida bonneted bat (endangered species) would occur.
- Impacts to suitable foraging habitat for the wood stork would occur (stormwater ponds and grassy edges of canals).

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family, Recreational, Institutional, and Other Sensitive Land Uses) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family and Multi Family
  - Activity Category C: Recreational (New River Greenway Trail and outdoor pool/tennis areas associated with residential areas)
  - Activity Category D: Institutional (Fred Hunters Funeral Home)
  - Activity Category E: Other Sensitive Land Use (outdoor seating at Whole Foods, Starbucks, Burger King, Longhorn, Publix, and multiple locations within the Promenade West Shopping Center)
- One shoulder/structure mounted noise wall would be impacted and would need to be considered for partial/full replacement in a future noise study. It is located along the northside of westbound SR 84, east of University Drive.
- There are existing noise walls within the project area, but these would be impacted by the proposed concept.

Floodplains

- Widening into the North New River (sheet pile wall) would result in impacts to Type AE floodplain (100 year floodplain).

Sociocultural

- Potential for sociocultural impacts because of changes to business and neighborhood access and impacts to residential properties.

3.8.8 Other Impacts

The proposed new roadway structures could have visual impacts to adjacent properties. The new structures along University Drive at Nova Drive and SW 23rd Street, eastbound SR 84 over University Drive, westbound SR 84 over the New River Canal, and westbound I-595 off-ramp over westbound SR 84, could be seen from adjacent properties. Coordination and public outreach to adjacent property owners would need to occur.

The widening of University Drive between south of SW 30th Street and SR 84 will need to use right-of-way along the west side of University Drive where the SW 79th Avenue frontage road exists. The two-way two-lane SW 79th Avenue frontage road runs parallel to University Drive between SW 30th Street and Nova Drive and provides access to/from all of the businesses, allowing access to/from University Drive to be consolidated to three driveways. With the widening of University Drive and removal of the frontage road, it is anticipated that six individual driveways may need to be provided along the west side of University Drive. Adding more access points along the corridor can have a detrimental impact on safety. Therefore, it is

recommended that an Access Management Plan be prepared for the University Drive corridor, to identify opportunities to consolidate driveways.

3.8.9 Cost Estimate

A planning level cost estimate was developed for the University Drive corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include widening of University Drive to four lanes in each direction, and two of the four lanes in each direction would be elevated between Kolsky Boulevard and SW 30th Street. The corridor improvements also include intersection improvements at SW 30th Street, Nova Drive, and Peters Road; improvements at the SR 84 / I-595 interchange; as well as the recommended multimodal improvements along the corridor.

The estimated construction cost for the corridor improvements is approximately $121.1 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the University Drive corridor improvements is provided in Appendix B.

3.9 Davie Road Corridor

The Davie Road corridor was studied from Nova Drive to SR 84 in the Town of Davie. This section of Davie Road is a Broward County six-lane divided minor arterial. South of Nova Drive it is a four-lane divided roadway south of Nova Drive. Davie Road has sidewalk along both sides within the study area, .and bicycle lanes from Nova Drive to Reese Road. There are no bicycle lanes on Davie Road between Reese Road and SR 84.

3.9.1 Design Considerations

Several deficiencies and design constraints unique to the Davie Road corridor were considered in the development of improvement concepts. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Within the study area four signalized intersections along Davie Road were studied. One of the Davie Road study intersections (SR 84 eastbound) is currently operating at LOS F during AM and PM peak hours. By 2045 without any improvements, three of the four study intersections will operate at LOS F during both AM and PM peak hours.

There are several deficiencies along the Davie Road corridor and opportunities for improvement, which are noted below.

- Mobility/Operational
  - Inadequate capacity at the SR 84 / I-595 interchange and Nova Drive intersection
  - Multiple conflicting high traffic volume turning movements at the study intersections.
- Safety
  - High crash rate at SR 84 interchange and at Nova Drive associated with heavily congested conditions.
- Bicycle and Pedestrian
  - Missing bicycle lanes between SR 84 and Reese Road, and desire for buffered bicycle lanes.
  - Need to accommodate safe pedestrian and bicycle movements through the SR 84 / I-595 interchange.
- Transit
  - Upgrade existing bus stops where needed and where possible along Davie Road.
  - Maintain access to and from the existing Davie Park-and-Ride lot in the southwest corner of the Davie Road and SR 84 / I-595 interchange.
- Key Constraints
  - Avoid impact to Forest Lawn funeral home and memorial gardens/cemetery in southwest corner of SR 84 interchange.
  - Avoid impact to the historic Broward Memorial Lock / Sewell Lock Park on north side of westbound SR 84 west of Davie Road.
  - Avoid or minimize impacts to I-595 mainline.
  - Avoid or minimize impacts to New River Canal.
  - Avoid or minimize impacts to Park-and-Ride lot and adjacent business and residential properties.
  - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

Improvement concepts were developed to address these issues, keeping in mind the need to avoid the cemetery, avoid or minimize any impacts to I-595 mainline and ramps, avoid or minimize impacts to the New River Canal, and avoid or minimize impacts to other adjacent properties. The purpose of improving the Davie Road corridor and its interchange with SR 84 is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety

and connectivity for all modes. Pedestrian, bicycle, and transit facility improvements along Davie Road are intended to provide for safe and efficient alternative modes of travel.

3.9.2 Evaluated Improvements

Improvements to the Davie Road and SR 84 / I-595 interchange, Davie Road and Nova Drive intersection, and pedestrian, bicycle, and transit facilities were evaluated. Multiple alternatives were evaluated for improving the Davie Road and SR 84 / I-595 interchange. Capacity and operational issues were very challenging to address at this location due to limited right-of-way and multiple properties located adjacent to the interchange that could not be impacted. Improvements evaluated at the locations along the corridor are described below.

3.9.2.1 Davie Road and Nova Drive Intersection

Additional lanes were evaluated to improve operations from LOS F to a LOS D in both peak hours. Adding lanes would be the least impactful way to improve the intersection. Adding the following turn lanes would allow the intersection to operate at LOS D or better during both the 2045 AM and PM peak hours.

- Begin a third northbound through lane south of the intersection and extend it through the intersection to join with the existing three lanes north of Nova Drive.
- Add a second northbound left-turn lane.
- Add a second southbound left-turn lane.
- Add a second southbound right-turn lane and right-turn overlap phase and signal head.
- Add a second eastbound left-turn lane.

These recommended additional lane improvements would require widening Davie Road outside of available right-of-way. Widening to the west would have some impacts to property along that side of Davie Road, but existing access to/from all properties could be maintained. These improvements significantly reduce delay and would allow the intersection to operate at a LOS D during both peak hours.

3.9.2.2 Davie Road and SR 84 / I-595 Interchange

At the Davie Road and SR 84 / I-595 interchange, the following two alternatives were evaluated to determine a recommended mitigation concept.

1. Diverging Diamond Interchange (DDI) with Overpass
2. Diamond Interchange with Lane Modifications and Overpass

<u>Diverging Diamond Interchange (DDI) with Overpass</u>

The DDI is an alternative to the conventional diamond interchange. It includes a directional crossover signalized intersection on either end of the interchange. The crossover intersections control the through movements as they cross to the left side of the road. These crossover intersections eliminate the need for left-turning vehicles to turn at the signals. The DDI design can improve operations and reduce the number of vehicle conflict points.

The Davie Road and SR 84 / I-595 interchange only provides access to and from the south, so there is no north approach. For a DDI configuration at Davie Road and SR 84, the westbound SR 84 left-turn movement would be located east of the northbound left-turn movement under the I-595 bridge. Crossing these two movements over at the signalized intersection with eastbound SR 84 would remove the conflict point for the two movements at the westbound SR 84 signalized intersection.

This interchange alternative includes an eastbound SR 84 overpass lane as well. The other improvements included with the alternative consist of converting the eastbound SR 84 right-turn movement to a free flow right-turn movement and converting the northbound right-turn movement to a free flow movement. This alternative can significantly reduce delay and travel time for Davie Road traffic as well as SR 84 traffic.

There are many constraints at this location that must be considered. One constraint at this interchange is the location of Sewell Lock Park which is located approximately 900 feet west of the signalized intersection of westbound SR 84 and Davie Road. There is approximately 50 feet

of width between the wall for I-595 and the edge of the park property. This can only accommodate a total of three westbound SR 84 through lanes at this point. So, there can only be a maximum of four through lanes departing the intersection of Davie Road and westbound SR 84, which must merge down to three lanes before the park. Another key constraint is the westbound SR 84 traffic and ensuring that queues will not spill back to the I-595 mainline along the westbound I-595 off-ramp.

When evaluating the DDI alternative, it was found that the proposed eastbound SR 84 overpass lane would need to begin at least 1,500 feet west of Davie Road. This means that one, possibly two driveways, along the south side of SR 84 would be precluded from entering the overpass lane and would need the ability for their exiting traffic to go east through the signalized intersection of Davie Road and eastbound SR 84. This meant that at least one through lane needs to remain at the signalized intersection. This conclusion makes the DDI more challenging to design and it reduces the benefit of the DDI design, because a through signal phase must be accommodated at the crossover signalized intersection.

Figure 3-38 shows the layout of a Diverging Diamond Interchange (DDI) configuration at Davie Road and SR 84.

Figure 3-38: Diverging Diamond Interchange (DDI) Configuration at Davie Road and SR 84

Diamond Interchange with Lane Modifications and Overpass

A second alternative, the diamond interchange with lane modifications and overpass, was evaluated as well. This concept includes modifying the westbound SR 84 approach lane configuration to better balance lane capacity with the projected 2045 peak hour volumes. It also includes modifying the eastbound SR 84 and northbound Davie Road approaches to optimize the lane assignments to better match the highest volume movements. The alternative also includes a proposed eastbound SR 84 overpass lane. The overpass would remove a majority of eastbound through traffic from the signalized intersection at Davie Road, allowing more green time to be allocated to the north-south movements on Davie Road.

Other modifications include converting the eastbound SR 84 right-turn movement to a free flow right-turn movement and converting the northbound right-turn movement to a free flow movement. To provide the three needed northbound left-turn lanes, the westbound SR 84 turbo lane must be removed. This will eliminate the potential for a short merge down to three lanes just before Sewell Lock Park. Various lane configurations were tested for the westbound SR 84 approach. The optimal lane configuration was determined, with the goal of keeping queue lengths from backing up to the I-595 mainline. Three dedicated through lanes are proposed along with two dedicated left-turn lanes.

This alternative can reduce delay and travel time for Davie Road traffic as well as eastbound SR 84 traffic.

The diamond interchange with lane modifications and overpass alternative is shown in Figure 3-39.

Figure 3-39: Diamond Interchange with Lane Modifications and Overpass Alternative at Davie Road and SR 84

Advantages and Disadvantages of Davie Road and SR 84 / I-595 Interchange Alternatives

The advantages and disadvantages of the two interchange alternatives were considered. The DDI alternative and Diamond Interchange with Lane Modifications and Overpass alternative can both significantly reduce delays. The Diamond Interchange with Lane Modifications and Overpass alternative can also reduce delays enough to allow the signalized intersections to operate at LOS D or better during the 2045 AM and PM peak hours.

When evaluating the physical feasibility of each of the alternatives, it was determined that the DDI design would be challenging in this location, because a through lane must also be accommodated at the crossover signalized intersection. Also, the crossover signal would need to remain three phases to allow for the eastbound through movement. This reduced the benefit of the DDI and was estimated to operate at LOS E in the 2045 AM peak hour and LOS C in the 2045 PM peak hour. The short distance between Davie Road and Sewell Lock Park, creates a short merge distance for the westbound turbo lane traffic to merge into the free-flow northbound left-turn lane traffic.

The Diamond Interchange with Lane Modifications and Overpass alternative allows traffic to operate acceptably through year 2045. Like the DDI alternative, it provides significant benefits since the overpass lane removes a significant volume of traffic form the signalized intersection allowing more green time for Davie Road traffic.

Both alternatives avoid impacting the New River Canal, and both keep westbound SR 84 queues at a reasonable length, so they do not back up into the I-595 mainline. Both alternatives have one new proposed bridge structure for the eastbound SR 84 overpass. Also, both alternatives include the eastbound right-turn and northbound right-turn free flow movements. To allow pedestrians and bicyclists to cross these free flow movements, a pedestrian signal is recommended at each location to stop traffic from turning when a pedestrian or bicyclist activates the signal.

Table 3-25 summarizes the advantages and disadvantages of both Davie Road and SR 84 interchange concepts.

Due to challenges with the DDI design, and because traffic operations did not perform as well as the modified diamond concept, the Diamond Interchange with Lane Modifications and Overpass alternative is recommended over the DDI alternative.

Table 3-25: Davie Road and SR 84 / I-595 Interchange Concepts Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
1) Diverging Diamond Interchange	• Increases capacity for Davie Road at SR 84 • Improves LOS and reduces delay • Avoids impacting Sewell Lock Park • Avoids impacting cemetery	• Indirect path for pedestrians to cross traffic. • Challenging design for an eastbound through lane through the crossover signal • Short distance for westbound turbo lane to merge into three free-flow northbound left-turn lanes. • Does not achieve LOS D in 2045 peak hours. A signal phase must be provided for EB through movement • Possibility of wrong way movements • Pedestrian crossings at free flow lanes require ped push button activated signals
2) Diamond Interchange with Lane Modifications and Overpass	• Increases capacity for Davie Road at SR 84 • Improves LOS and reduces delay, meets LOS D in 2045 peak hours. • Avoids impacting Sewell Lock Park • Avoids impacting cemetery	• Eliminates westbound SR 84 turbo lane • Pedestrian crossings at free flow lanes require ped push button activated signals

NOTE: Both alternatives include the following improvements:

1) *Shared use path provided through interchange at SR 84.*
2) *Eastbound SR 84 overpass.*

3.9.3 Recommended Concept Improvements

Recommended improvements for the Davie Road corridor include SR 84 / I-595 interchange improvements, Nova Drive intersection improvements, and multimodal sidewalk and bus stop improvements. To address the SR 84 interchange deficiencies, the Diamond Interchange with Lane Modifications and Overpass alternative is recommended for further analysis, design, and implementation. Due to right-of-way constraints and the cemetery located along the west side of Davie Road, corridor improvements would maintain existing bicycle lanes along Davie Road where they currently exist. In lieu of providing on-street bicycle lanes where they are currently missing between Reese Road and SR 84, a shared use path is proposed along the east side of Davie Road. Sidewalk would be maintained along both sides of Davie Road.

To address transit needs, the existing bus stops on Davie Road were reviewed to determine whether any need a bench or a shelter. Eight of the nine existing bus stops located on Davie Road between SR 84 and south of Nova Drive have benches, but not shelters. One stop has no bench or shelter. A bench is recommended for BCT bus stop #0156. Daily activity at six of the bus stops is greater than 10. Therefore, shelters are recommended where feasible for the six BCT stops (#0281, 3382, 0157, 4617, 3378, and 3383) along Davie Road.

The scope of the recommended Davie Road corridor improvements is described below.

<u>Davie Road Corridor Improvements</u>

The limits of the corridor improvements are from south of Nova Drive to SR 84; and along SR 84 eastbound and westbound from approximately 2,800 ft west of Davie Road to approximately 2,800 ft east of Davie Road.

➢ **Davie Road and SR 84 / I-595 Interchange Improvements**

- Add new eastbound SR 84 overpass – includes a new bridge structure for traffic to travel over Davie Road.
- Reconfigure the westbound SR 84 and Davie Road signalized intersection as noted below.
  - Westbound: Widen approach from four lanes to five lanes and eliminate the one free flowing through lane (turbo lane). Replace with three westbound through lanes and two exclusive left-turn lanes controlled by the signal.
  - Northbound: Add a third northbound left-turn lane.
- Reconfigure the eastbound SR 84 and Davie Road signalized intersection as noted below.
  - Eastbound: Reconfigure approach to one exclusive left-turn lane, one through lane, one exclusive free-flow right-turn lane.
  - Northbound: Add a third northbound through lane. Design the one exclusive right-turn lane as a free-flow right-turn lane.
  - Southbound: Remove the one existing southbound left-turn lane to use the space for the third northbound left-turn lane.

➢ **Davie Road and Nova Drive Intersection Improvements**

- Add a third northbound through lane.
- Add a second northbound left-turn lane.
- Add a second southbound left-turn lane.
- Add a second southbound right-turn lane.
- Add a second eastbound left-turn lane.
- Replace existing bicycle lanes along Davie Road where they currently exist.

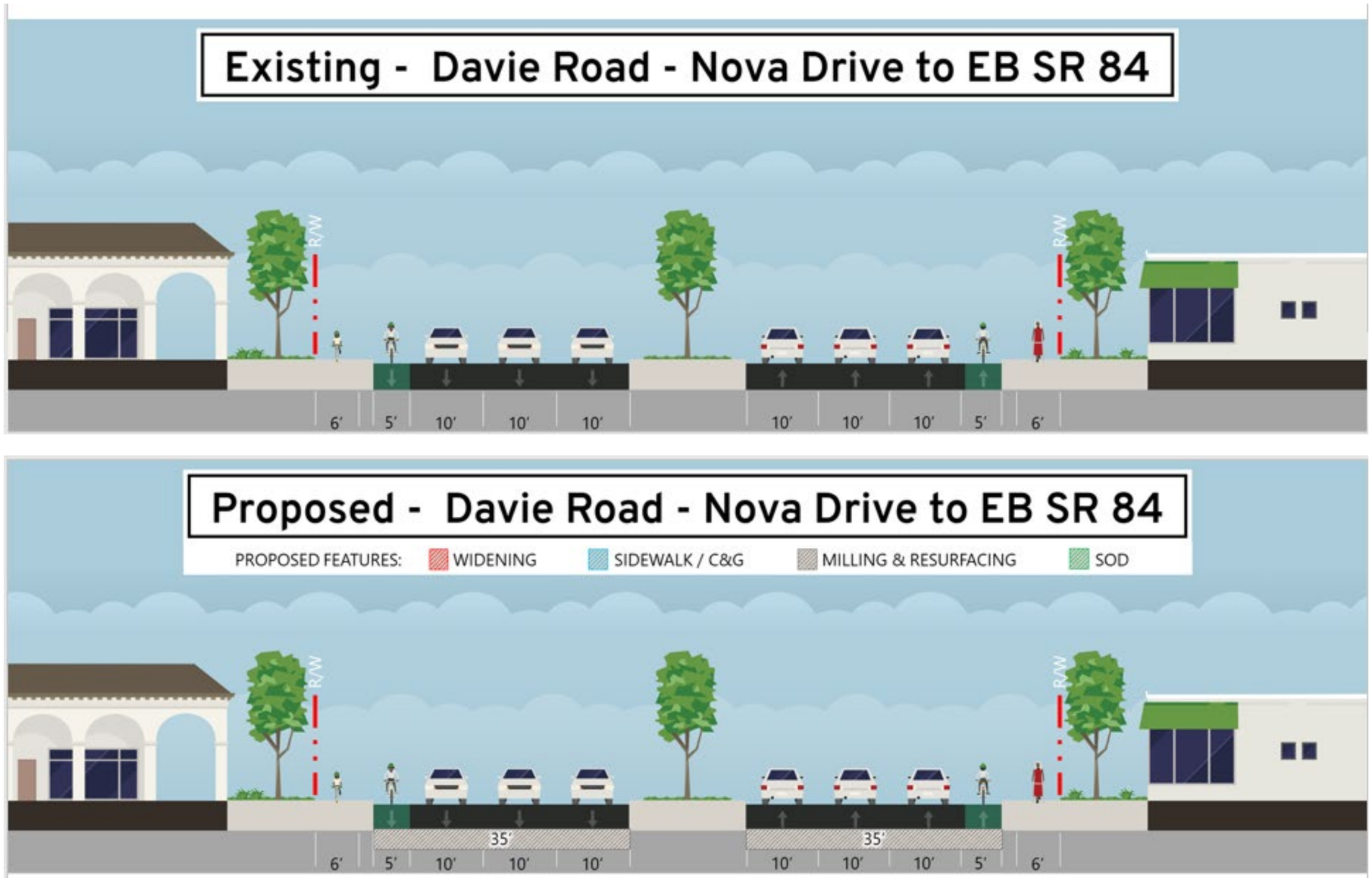
➢ **Davie Road Multimodal Improvements**

- Replace existing bicycle lanes along Davie Road where they currently exist.
- Widen sidewalk to be a shared use path width for both bikes and pedestrians through the interchange area (northbound, southbound, eastbound).
- Provide shelters for six BCT bus stops along Davie Road between SR 84 and south of Nova Drive.

The Davie Road corridor concept plan with Diamond Interchange with Lane Modifications and Overpass alternative is provided as Exhibit A-11 in Appendix A.

A typical section showing the existing conditions and proposed conditions for Davie Road south of SR 84 is shown in Figure 3-40.

Figure 3-40: Davie Road Typical Section South of SR 84



3.9.4 Concept Benefits

The Davie Road corridor improvements can provide a more efficient and less congested route for traffic on Davie Road, as well on SR 84. It also improves safety for vehicles by reducing the number of stops (congestion) which can reduce the likelihood of rear end crashes. Table 3-26 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-26: Davie Road Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
No Build	• No cost • No impacts • No disruption	• Long delays & congestion • Operates at LOS F in 2045 peak hours • Does not improve safety for bicyclists, pedestrians, or vehicles • Does not improve connectivity for pedestrians, bicyclists, or vehicles
Build	• 2045 Traffic Operations – Reduces delay, congestion, backups, travel times • Meets LOS D in 2045 peak hours • Improves safety for vehicles	• Right-of-way impact • Cost

Table 3-27 summarizes the benefits of the recommended Davie Road improvements.

Table 3-27: Davie Road Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS D or better
Delays	85% reduction in total delays
North South Travel Time	65% reduction in travel times along Davie Road
Bicycle & pedestrian needs	Maintains existing facilities
Transit needs	Accommodates bus stops and shelters

3.9.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

- Davie Road along the east side between SR 84 and Reese Road.
- Davie Road along the east and west sides from north of Nova Drive to south of Nova Drive.

The concept plan in Exhibit A-11 in Appendix A shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.9.6 Structural Impacts

No existing roadway structures would be impacted by the recommended improvements. One new structure is required as part of the Davie Road and SR 84 improvements. The proposed roadway structure is an approximately 1,700-foot-long roadway bridge for eastbound SR 84 traffic to cross over Davie Road.

3.9.7 Environmental Considerations

Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of Davie Road and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Due to the potential to impact Florida bonneted bat habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features. Environmental considerations are noted below.

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees) for the Florida bonneted bat (endangered species) would occur.

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family and Multi-Family, Recreational, and Institutional) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise.
  - Activity Category B: Residential Single Family and Multi Family (The Avenue Apartments)
  - Activity Category C: Recreational (New River Greenway Trail and outdoor areas at Forest Lawn Memorial Gardens Cemetery)
  - Activity Category D: Institutional (Forest Lawn Memorial Gardens Cemetery)
  - There are existing noise walls within the project area, but these would be impacted by the proposed concept.

Sociocultural

- Potential for sociocultural impacts if right-of-way impacts occur to the Forest Lawn Memorial Gardens Cemetery. (Note this is not currently proposed.) If impacted this would need to be evaluated for historic impacts (50 years old in 2021), sociocultural impacts (focal point) assessed as a Section 4(f) Resource if recreational areas (gardens and pathways) are open to the public, and public controversy would be anticipated.

3.9.8 Other Impacts

The eastbound SR 84 overpass is expected to be visually the same as the existing I-595 overpass; therefore, visual impacts are not anticipated to adjacent properties, but coordination with adjacent property owners would occur at the next phase. No changes to access are anticipated due to the recommended improvements.

3.9.9 Cost Estimate

A planning level cost estimate was developed for the Davie Road corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the Davie Road and SR 84 / I-595 interchange improvements, and Davie Road and Nova Drive intersection improvements, along with the recommended multimodal improvements.

The estimated construction cost for the corridor improvements is approximately $25.7 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements.

The LRE cost estimate for the Davie Road corridor improvements is provided in Appendix B.

3.10 SR 7 / US-441 Corridor

The SR 7 / US-441 corridor was studied from Oakes Road to Riverland Road. SR 7/US-441 south of SR 84 is the boundary between Town of Davie along the west side and Broward County unincorporated on the east side. North of SR 84, SR 7/US-441 is the boundary between unincorporated Broward County on the west side and City of Fort Lauderdale on the east side.

SR 7/US-441 is a six-lane divided principal arterial. SR 7/US-441 has no sidewalk from Oakes Road to south of Riverland Road. Bicycle lanes are generally not provided between Oakes Road and Riverland Road, except for keyhole bike lane markings southbound at the Oakes Road intersection and northbound at the Riverland Road intersection.

3.10.1 Design Considerations

Several deficiencies and design constraints unique to the SR 7/US-441 corridor must be considered in the development of improvement concepts. The specific safety, operational, and multimodal issues are noted below along with the design constraints.

Within the study area two signalized intersections along SR 7/US-441 were studied; these are the Oakes Road intersection and Riverland Road intersection. One of the SR 7/US-441 study intersections (Riverland Road) is currently operating at LOS F during the AM peak hour, and at LOS E during the PM peak hours. By 2045 without any improvements, both study intersections will operate at LOS E or F during both AM and PM peak hours.

There are several deficiencies along the SR 7/US-441 corridor, and opportunities for improvement. They are noted below.

- Mobility/Operational
  - Inadequate capacity along SR 7/US-441.
  - High traffic volume turning movements at the study intersections conflict with high volume northbound and southbound through movements.
  - Inadequate capacity at the Oakes Road intersection.
  - Existing FDOT design project will add turn lane improvement at Oakes Road intersection.
  - Inadequate capacity at the Riverland Road intersection.
  - Existing FDOT design project will add turn lane improvement at Riverland Road intersection.
- Freight
  - Inefficient truck access to and from the 595 Truck Stop via the intersection of Oakes Road and SR 7/US-441. Long delays and queues for trucks (and all vehicles) characterize peak hour operations on Oakes Road.
- Safety
  - Of the eight north-south study arterials SR 7/US-441 has the most fatal crashes within the recent five-year period.
  - Of the eight north-south study arterials SR 7/US-441 has the second highest number of pedestrian and bicycle crashes in the recent five-year period.
  - High crash rate at Oakes Road and at Riverland Road intersections.
- Bicycle and Pedestrian
  - Missing bicycle lanes and sidewalk between Oakes Road and Riverland Road intersections.
  - Existing FDOT design project will add bicycle and pedestrian facilities along SR 7 from Oakes Road to Riverland Road.
  - School crossing at Riverland Road.
- Transit
  - Upgrade existing bus stops where needed and where possible along SR 7/US-441.
  - Maintain ability for potential future premium transit service along SR 7/US-441.

- Key Constraints
    - Avoid or minimize impact to I-595 mainline and SR 84/I-595/SR 7 free flow on and off-ramps. Ramps are near both study intersections.
    - Avoid impacts to other sociocultural resources, archaeological and historical resources, section 4(f) resources, and protected species and habitat.

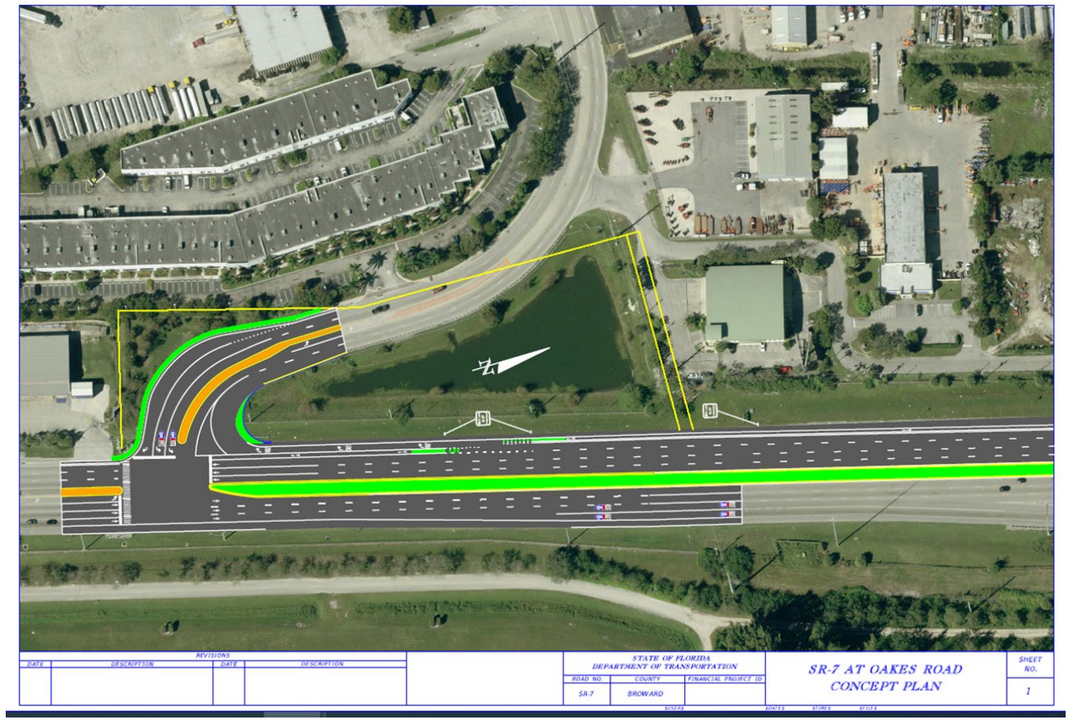
Improvement concepts were developed to address these issues, keeping in mind the need to improve truck access at Oakes Road, consider pedestrians and school crossings at Riverland Road, avoid or minimize any impacts to I-595/SR 84 mainline and ramps, and avoid or minimize impacts to adjacent properties. The purpose of improving the SR 7/US-441 corridor and its study intersections is to reduce delay, reduce travel times, reduce long queues and congestion, and improve safety and connectivity for all modes. In addition, pedestrian, bicycle, and transit facility improvements along SR 7/US-441 are intended to provide for safe and efficient alternative modes of travel.

3.10.2 Evaluated Improvements

3.10.2.1 SR 7/US-441 and Oakes Road Intersection

FDOT has an existing design project that is making minor improvements to the Oakes Road intersection. The project includes adding a second eastbound left-turn lane from Oakes Road to northbound SR 7/US-441 and increasing the turning radius for trucks to make a right-turn onto Oakes Road from southbound SR 7. This improvement project will reduce delay for traffic on Oakes Road and reduce the queue length on Oakes Road waiting to turn onto SR 7/US-441. Figure 3-41 shows an excerpt from the FDOT Concept Plan for the SR 7 at Oakes Road intersection improvements.

Figure 3-41: SR 7 at Oakes Road Concept Plan –Short-Term Improvements



As part of the Arterial Connectivity Study (ACS) along I-595 Corridor, this intersection was evaluated to identify any additional improvements that would allow the intersection to operate at a LOS D through 2045, for the long-term, once the lifespan of the short-term improvements is reached. Geometric modifications were evaluated to improve operations from LOS E/F to a LOS D in both peak hours in 2045. The main concern at Oakes Road is that large heavy vehicles, that turn slower, are not able to turn onto SR 7/US-441 efficiently. Part of the issue is related to the curving geometry on Oakes Road, and the difficulty that larger vehicles have in navigating the "S" curve to turn onto SR 7. The goal is to reduce the delay and queueing on the Oakes Road eastbound approach. Therefore, a "quadrant" intersection design was considered.

This would address two of the issues with the existing intersection. First, vehicles on Oakes Road turning left onto SR 7 could use a new Oakes Road extension that would intersect with SR 7/US-441 at a 90-degree angle, creating a new signalized intersection north of the existing Oakes Road signalized intersection. The northern Oakes Road intersection would process southbound right-turn movements and eastbound left-turn movements. These movements would be made more efficiently at the northern signalized intersection. The heavy truck movements going to and from the north on SR 7 to the I-595 / SR 84 interchange ramps, would no longer navigate around a "S" curve, which would allow the trucks to make the turns faster.

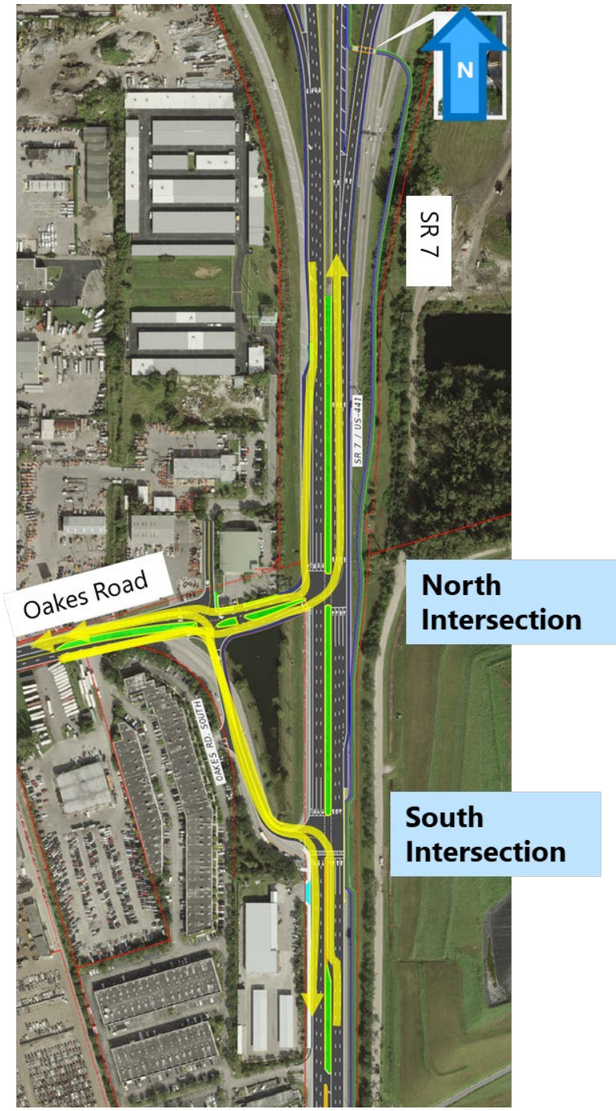
Creating the new northern Oakes Road T-intersection" approximately 800 feet north of the southern Oakes Road intersection, would require the existing eastbound I-595/SR 84 to southbound SR 7 off-ramp to be reconstructed so that it intersects with SR 7 at a point approximately 800 feet north of where it currently intersects. This would provide the space needed between the off-ramp merge and the downstream new signalized Oakes Road North intersection.

The southern Oakes Road intersection would remain and would be modified to process only the northbound left-turn movement and the eastbound right-turn movement. By separating the turning movements into two intersections, and coordinating and synchronizing both signals, each intersection can operate as a more efficient two-phase signal and process the vehicles to and from Oakes Road more efficiently.

The new Oakes Road North roadway would intersect Oakes Road South and form a new unsignalized T intersection. While the new Oakes Road north can be constructed within existing public right-of-way, the new Oakes Road north roadway would pass through an existing retention pond. The pond would need to be redesigned and reconstructed. In addition, new Oakes Road North would impact the access to the existing Town of Davie Fire Station. This would need to be reconfigured and may become the north leg of the unsignalized T-intersection of Oakes Rod North and Oakes Road South.

Figure 3-42 shows a diagram of the proposed long-term improvements for the SR 7 at Oakes Road intersection. Exhibit A-12 in Appendix A provides the conceptual design plan for the proposed long-term improvements for the SR 7 at Oakes Road intersection.

Figure 3-42: SR 7 at Oakes Road – Long-Term Improvements

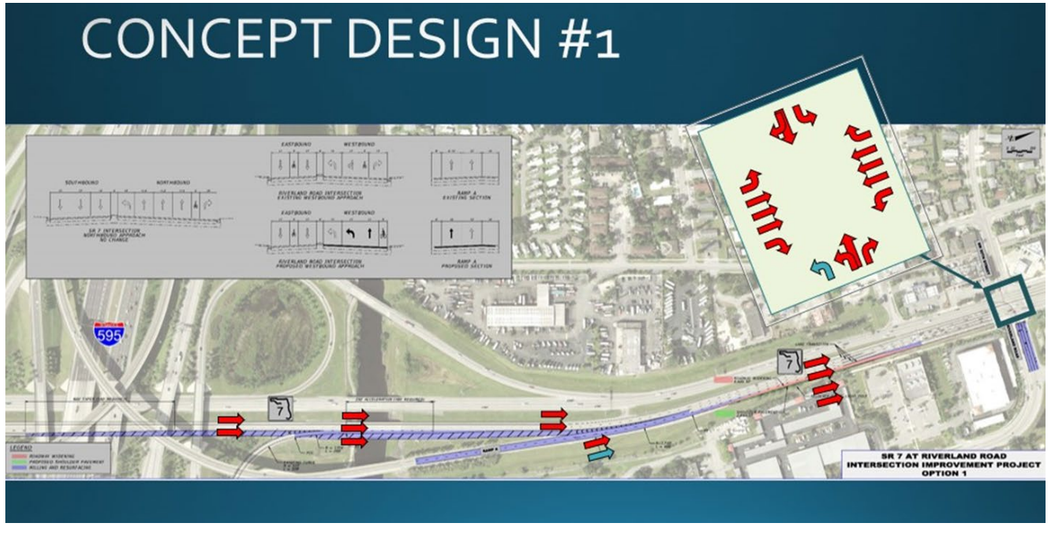


3.10.2.2 SR 7/US-441 and Riverland Road Intersection

FDOT also has an existing design project that is making minor improvements along northbound SR 7, between the westbound I-595/SR 84 to northbound SR 7 off-ramp and the Riverland Road intersection. The project will extend a second lane from the eastbound I-595/SR 84 to northbound SR 7 flyover, creating four northbound lanes up to Riverland Road. It also involves reducing the number of SR 7 northbound lanes from three to two lanes prior to the eastbound flyover merging with SR 7. This short-term improvement project will reduce the long queue length that occurs on the eastbound flyover as the traffic merges down to one lane and then merges into SR 7 northbound. In addition, a second westbound left-turn lane on Riverland Road is included in this project to help reduce delays for that high volume movement.

Figure 3-43 shows a diagram of the FDOT Concept Plan for the SR 7 and Riverland Road intersection improvements.

Figure 3-43: SR 7 at Riverland Road Concept Plan –Short-Term Improvements



As part of the Arterial Connectivity Study (ACS) along I-595 Corridor, this intersection was evaluated to identify any additional improvements needed to allow it to operate acceptably through 2045. The short-term improvements currently under design do not require right-of-way and can provide congestion relief for the foreseeable future. However, once traffic volumes reach projected volumes for year 2045, additional improvements were found to be needed to ensure the intersection of SR 7 and Riverland Road would operate at a LOS D through 2045.

Geometric modifications were evaluated to improve operations from LOS F/E to a LOS D in both peak hours in 2045. Adding lanes would be the least impactful way to improve the intersection. Adding the following turn lanes would allow the intersection to operate at LOS D or better during both the 2045 AM and PM peak hours.

- Keep a fourth northbound through lane south of the intersection and extend it through the intersection to join with the existing three lanes north of SW 17th Street.
- Begin a fourth southbound through lane south of the intersection and extend it through the intersection to the southbound SR 7 to westbound I-595/SR 84 off-ramp.
- Add a second northbound left-turn lane.
- Add a second southbound left-turn lane.
- Add an exclusive eastbound right-turn lane.
- Restripe/reconfigure the three lane westbound approach to have two exclusive left-turn lanes and a shared through/right-turn lane.

These recommended modifications would significantly reduce delay and queueing at the intersection. They would allow the intersection to operate at a LOS D during both peak hours through year 2045. Bicycle lanes would be included through the intersection on the north and south approaches and would connect to planned bicycle lanes or shared use path that is under design along SR 7 south of the intersection. The additional lanes would require right-of-way along both sides of SR 7 from south of Riverland Road to north of Riverland Road where the

fourth lanes would end/begin. Right-of-way is also required on the south side of SW 20th Street for the eastbound right-turn lane.

Exhibit A-12 in Appendix A provides the conceptual design plan for the proposed long-term improvements for the SR 7 at Riverland Road intersection.

3.10.2.3 SR 7/US-441 between Oakes Road and Riverland Road

FDOT is currently also designing a transit corridor improvements project on SR 7 between Oakes Road and Riverland Road that will add a shared use path for pedestrians and bicyclists along the east side of SR 7 between the two intersections. This project (FM#445673-1) has construction funded in fiscal year 2025 and will address the pedestrian and bicycle deficiencies along SR 7 in the study area.

3.10.3 Recommended Concept Improvements

The recommended SR 7/US-441 corridor concept improvements consist of intersection improvements at Oakes Road and at Riverland Road. It is assumed that the three current design improvements along SR 7 / US-441 will be completed within the next five to 10 years. To address the long-term SR 7 / US-441 deficiencies, the intersection improvements at SR 7 and Oakes Road and SR 7 at Riverland Road are recommended for further analysis, design, and implementation.

The bicycle and pedestrian improvements currently being designed on SR 7 between Oakes Road and Riverland Road will add a shared use path along the east side of SR 7. These improvements will address the pedestrian and bicycle deficiencies along SR 7 in the study area. The existing bus stops on SR 7 were reviewed to determine whether any need a bench or a shelter. Four of the ten bus stops located on SR 7 from south of Oakes Road to north of Riverland Road do not have benches. A bench is recommended for all four of these bus stops (BCT stops #3877, 1294, 1386, 1295). Only two of the ten bus stops have a shelter. Daily activity at seven of the bus stops is greater than 10. Therefore, a shelter is recommended for the seven BCT stops (#1384, 3877, 3487, 1294, 1385, 1386, and 1383) along SR 7 within the study area.

The scope of the recommended SR 7 corridor improvements is described below.

<u>SR 7/US-441 Corridor Improvements</u>

- **SR 7/US-441 and Oakes Road Intersection Improvements**

  The long-term improvements will create a new Oakes Road North signalized intersection at SR 7, separate the Oakes Road intersection turning movements into two signalized intersections with SR 7 (Oakes Road North, and Oakes Road South), and create a new unsignalized intersection of Oakes Road South at Oakes Road North.

  - New Oakes Road North at SR 7 signalized intersection to consist of:
    - Eastbound: Two exclusive left-turn lanes.
    - Northbound: Four northbound through lanes. The outer two lanes must be signed and marked as I-595 / SR 84 on-ramp lanes.
    - Southbound: One exclusive right-turn lane and three through lanes.
  - Oakes Road South at SR 7 signalized intersection to consist of:
    - Eastbound: One exclusive right-turn lane.
    - Northbound: One exclusive left-turn lane and three through lanes.
    - Southbound: Three through lanes.
  - New Oakes Road South at Oakes Road North unsignalized intersection to consist of:
    - Two-way stop control on the minor north and south approaches.
    - Eastbound: One shared through/right-turn lane, and one shared through/left-turn lane.
    - Northbound: One shared left-turn/ through / right-turn lane.
    - Westbound: One shared through/right-turn lane, and one shared through/left-turn lane.
    - Southbound: One shared left-turn/ through / right-turn lane.

- Reconstruct Oakes Road, extending it directly east to intersect SR 7 from the current east-west alignment, and reconstructing the S-curve section of Oakes Road South to intersect at approximately 90 degrees at Oakes Road North.
- Reconstruct three existing driveways along the north side of Oakes Road, including the Town of Davie fire station driveway.
- Realign the Turnpike off ramp to southbound SR 7 to create separation between the off ramp merge point with SR 7 and the new Oakes Road North intersection. This distance would help vehicles coming from the Turnpike ramp merge into southbound SR 7 and get into the correct lane to either turn right at Oakes Road North or continue south on SR 7.
- Realign the northbound SR 7 on ramp, to Turnpike and eastbound I-595, to create separation and a longer distance between the intersection and the ramp diverge point. This distance would help vehicles turning from North Oakes Road get into the correct lane to either enter Florida's Turnpike/I-595 or continue north on SR 7.
- Replace any impacted shared use path along SR 7.
- Replace existing bicycle lane keyholes at the intersection approaches.
- Provide a bus bench at the one bus stop location without a bench south of Oakes Road, and provide shelters at the other three bus stops located at Oakes Road and south of Oakes Road.

➢ **SR 7/US-441 and Riverland Road Intersection Improvements**

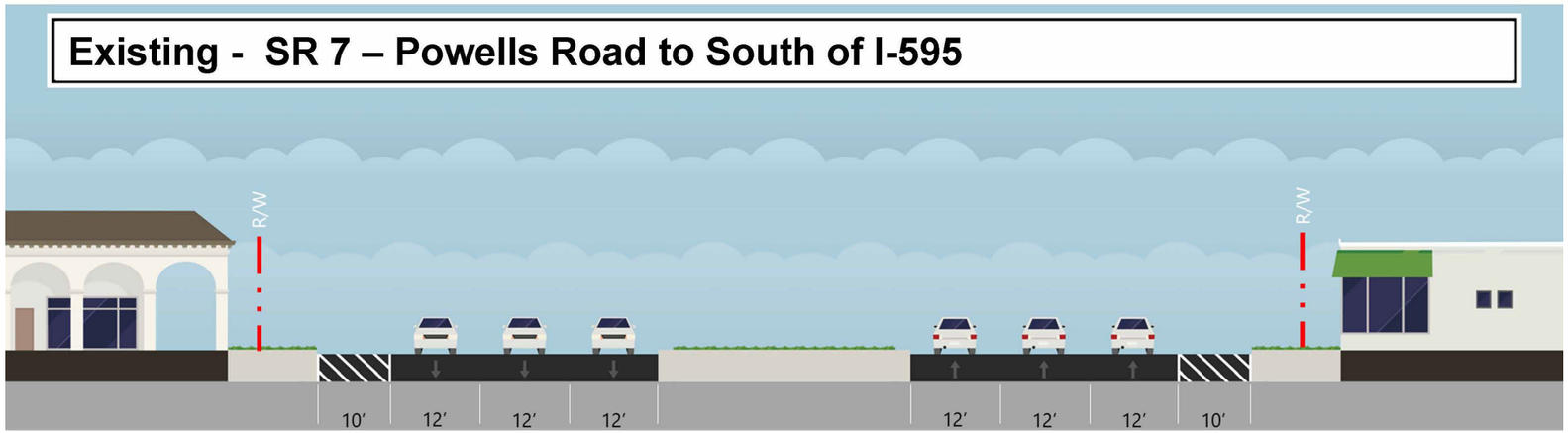
The improvements include the following modifications at the intersection.

- Add a second northbound left-turn lane.
- Add second southbound left-turn lane.
- Add an exclusive eastbound right-turn lane on SW 20th Street.
- Restripe the westbound Riverland Road approach as two exclusive left-turn lanes and one shared through/right-turn lane.
- Add/replace sidewalk along SR 7 and along Riverland Road in all four corners.
- Provide high emphasis crosswalks all four legs of intersection since the intersection is a designated school crossing with many pedestrians.
- Add a fourth lane northbound and southbound along SR 7 from the Turnpike/SR 84/I-595 ramps south of Riverland Road through the intersection to approximately 1,600 feet north of Riverland Road.
- The Turnpike/SR 84 off-ramp to northbound SR 7 will remain two-lanes and where it merges with northbound SR 7 this ramp will add two lanes to the three northbound SR 7 through lanes. At the intersection one of the five northbound lanes will end as the right-turn lane at Riverland Road.
- The fourth southbound through lane will extend through the intersection and end as it becomes one of two lanes that make up the Turnpike/westbound SR 84/I-595 on-ramp.
- Replace any impacted shared use path along SR 7.
- Replace existing bicycle lane keyholes at the intersection approaches.
- Provide a bus bench at the three bus stop locations without a bench north of Riverland Road, and provide shelters at the four bus stops that do not have shelters north of Riverland Road.

The SR 7 corridor concept plan with proposed intersection improvements shown is provided as Exhibit A-12 in Appendix A.

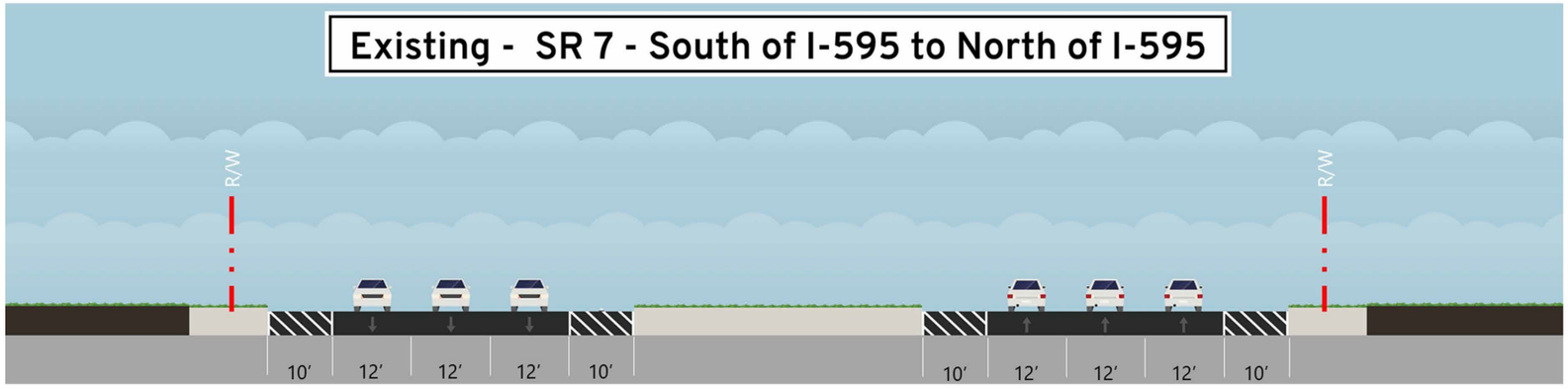
The existing typical section for SR 7 south of the SR 84/I-595 interchange area is shown in Figure 3-44. Modifications are not proposed to the SR 7 typical section. Therefore, a proposed typical section was not developed.

Figure 3-44: SR 7 Existing Typical Section, Powells Road to South of I-595



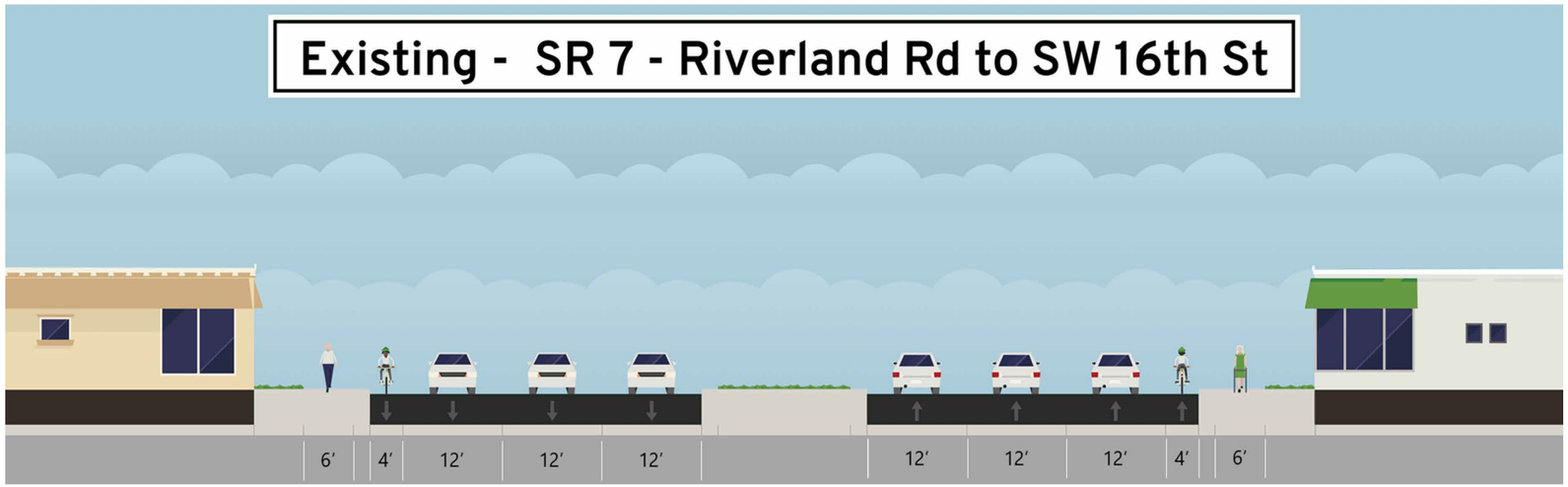
The existing typical section for SR 7 within the SR 84/I-595 interchange area (north of Oakes Road to south of Riverland Road) is shown in Figure 3-45. Modifications are not proposed to this SR 7 typical section either. Therefore, a proposed typical section was not developed.

Figure 3-45: SR 7 Existing Typical Section, South of I-595 to North of I-595



A typical section showing the SR 7 existing conditions north of Riverland Road is shown in Figure 3-46. A proposed typical section was not developed since modifications are not proposed to the SR 7 typical section.

Figure 3-46: SR 7 Existing Typical Section, Riverland Road to SW 16th Street



3.10.4 Concept Benefits

The SR 7 corridor improvements can provide a more efficient and less congested route for traffic on SR 7 through the SR 84 / I-595 interchange area. It also improves access for freight trucks traveling to and from the 595 Truck Stop located in the southeast quadrant of SR 84 and Florida's Turnpike. The proposed improvements also improve safety, as the changes would result in less stops for vehicles traveling through the study intersections. Table 3-29 summarizes the advantages and disadvantages of the recommended "Build" improvements in comparison to the No Build conditions, without any improvements.

Table 3-29: SR 7 / US-441 Corridor Improvements Advantages and Disadvantages

Alternatives	Advantages	Disadvantages
Existing Design Project Improvements	• No additional cost • Reduces delay & some queueing until 2040 • No right-of-way impacts • Improves safety & connectivity for bicyclists, pedestrians, vehicles	• Does not meet LOS D in 2045 peak hours • Only partially addresses truck turning movements to/from Oakes Road
Build	• Further reduces delay, congestion, backups, travel times • Meets LOS D in 2045 peak hours • Further improves safety for vehicles • Further addresses truck turning movements to/from Oakes Road	• Right-of-way impacts • Pond impact • Access impacts • Interchange ramp impacts • Additional cost

Table 3-30 summarizes the benefits of the recommended SR 7 improvements.

Table 3-30: SR 7 / US-441 Corridor Improvements Benefits

MOEs / Performance Measures	Build Corridor Concept (2045 Condition)
Level of Service	All intersections operate at LOS D or better
Delays	35% reduction in total delays
North South Travel Time	30% reduction in travel times along SR 7
Bicycle & pedestrian needs	Maintains planned facilities currently under design
Transit needs	Accommodates bus stops and shelters

3.10.5 Right-of-Way

To implement the recommended improvements, additional right-of-way would be required. The locations listed below describe where additional right-of-way would be needed to implement the recommended concept.

1) Oakes Road south side between SW 46th Avenue and SR 7.
2) SR 7 both sides south of Riverland Road to SW 17th Street.
3) SW 20th Street south side between SW 41st Avenue to SR 7

The concept plan in Appendix A shows where right-of-way is potentially needed to fit the improvements. The identified areas are preliminary in nature and only intended to provide a general idea of where right-of-way potentially may be needed and to what extent. This is informational only and used only for determining the next phase of analysis and design needed to implement the recommended improvements.

3.10.6 Structural Impacts

No existing roadway structures would be impacted by the recommended improvements, and no new roadway structures are required as part of the recommended SR 7 / US-441 improvements.

3.10.7 Environmental Considerations

Noise impacts will need to be assessed due to the presence of noise sensitive sites in the vicinity of SR 7 / US-441 and noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. Due to the potential to impact Florida bonneted bat and wood stork habitat, a PD&E Study would require assessment of and include listed species surveys and USFWS consultation. The conceptual improvements are not anticipated to impact contaminated sites or social and cultural features. Environmental considerations are noted below.

SR 7 at Oakes Road Intersection

Wetlands and Other Surface Waters

- Impacts to SR 7 stormwater ponds (other surface waters) would occur.

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees) for the Florida bonneted bat (endangered species) would occur.
- Impacts to suitable foraging habitat for the wood stork would occur (stormwater ponds).

SR 7 at Riverland Road Intersection

Highway Traffic Noise

- Noise impacts will need to be assessed due to the presence of noise sensitive sites (Residential – Single Family) noise abatement measures will need to be evaluated at sites impacted by design year traffic noise. (Activity Category B: Residential Single Family)

Protected Species and Habitat

- Impacts to suitable roosting habitat (removal and relocation of mature trees) for the Florida bonneted bat (endangered species) would occur.

Environmental Justice Considerations

- Homes west of SR 7 are 90-95% low income and persons of color.

3.10.8 Other Impacts

The realignment and extension of Oakes Road between SW 46th Avenue and SR 7 is expected to require changes to existing access (driveways and the northern leg of Oakes Road) for adjacent properties along the north side of Oakes Road. Coordination with adjacent property owners, including the Town of Davie fire station would need to occur at the next phase.

In addition, the realignment and extension of Oakes Road between SW 46th Avenue and SR 7 would impact the existing drainage pond located along the west side of SR 7/US-441 at Oakes Road. The pond would need to be redesigned and reconstructed in this area. It is anticipated that the pond could be reconstructed within existing right-of-way.

3.10.9 Cost Estimate

A planning level cost estimate was developed for the SR 7 corridor improvements using FDOT's Long Range Estimate (LRE) program. The corridor improvements include the SR 7 / US-441 at Oakes Road and SR 7 / US-441 at Riverland Road long-term improvements. The estimated construction cost for the corridor improvements is approximately $19.1 million. This construction cost estimate does not include the cost of acquiring additional right-of-way needed to construct the conceptual improvements. The LRE cost estimate for the Flamingo Road corridor improvements is provided in Appendix B.

3.11 SR 84 Corridor

The recommended Build concept for the SR 84 study corridor is provided as Exhibit A-13 in Appendix A. The SR 84 Build concept incorporates the improvements identified for each of the north-south study arterial intersections with SR 84. The SR 84 Build concept also illustrates the locations of entry and exit ramps along SR 84. Most I-595 entry and exit ramps remain unchanged in the Build concept. However, a few I-595 ramp entry and exit points along SR 84 are recommended to be modified to better accommodate 2045 traffic volumes and proposed SR 84 overpass ramp connections. The major roadway capacity improvements included in the SR 84 Build concept are listed below.

- An eastbound SR 84 overpass (aka bypass) is recommended at the following north-south arterials:
  - NW/SW 136th Avenue
  - Flamingo Road
  - Hiatus Road
  - Nob Hill Road
  - Pine Island Road
  - University Drive
  - Davie Road
- A westbound SR 84 overpass (aka bypass) is recommended at the following north-south arterials:
  - Pine Island Road
  - Hiatus Road (existing overpass to remain)
  - NW/SW 136th Avenue

An overpass was proposed where the traffic volume estimated to use the overpass was found to be significant, and where it would improve operations at the north-south signalized intersection. Ramp connections along eastbound SR 84 and westbound SR 84 are designed to operate acceptably, and existing weaving sections along eastbound SR 84 are not impacted by the SR 84 overpasses. The minimum number of lanes needed for SR 84 between interchanges was determined based on the 2045 volumes. A minimum of two-lanes is needed along eastbound SR 84 throughout the study area. Two-lanes are also needed for the majority of westbound SR 84 throughout the study area.

Microsimulation traffic analysis of eastbound and westbound SR 84 is recommended as part of the next phase of the interchange projects. A microsimulation analysis tool such as CORSIM or VISSIM, is most appropriate to model the unique traffic flow along eastbound and westbound SR 84, which cannot be fully characterized as interrupted flow or uninterrupted flow. This type of traffic analysis should be conducted to analyze the complex traffic interactions at the ramp junction points and weaving sections between ramps along SR 84. Analysis results can be used to refine recommended lane geometry along SR 84 and to document the safety, operations, and engineering feasibility of the SR 84 build concept. The microsimulation analysis is recommended to be documented as part of an Interchange Access Request document, which will be necessary to approve SR 84 / I-595 ramp modifications.

3.11.1 Concept Benefits

The proposed eastbound SR 84 and westbound SR 84 overpasses not only improve operations and safety along eastbound and westbound SR 84, but they improve safety and operations at the north-south arterials as well. SR 84 traffic using an overpass will remove traffic at the arterial cross street signalized intersection. This reduces traffic exposure and conflicts at the intersection which will enhance safety for pedestrians, bicyclists, and motorists. It also reduces the overall number of traffic stops, delay and travel time for motorists traveling on SR 84. In addition, each overpass reduces the volume of traffic that must travel through the signalized intersection with the north-south arterial. This reduces the traffic volume and queue length on SR 84 at the intersection, requiring less green time to accommodate the east and west approaches, and allowing more green time to be allocated to the north-south arterial. With more green time provided for north-south arterial traffic

movements, this reduces the number of stops, delay, and travel time for north-south arterial movements through the interchange as well.

Reducing the number of stops and queue lengths along SR 84 will also improve safety. With less traffic stopping on SR 84 and reduced queue lengths along SR 84, this can reduce the risk of potential rear-end crashes that can occur during congested traffic conditions. Reducing queue lengths can also reduce the risk of dangerous lane change maneuvers that can also occur during congested conditions.

Estimated costs and impacts for the recommended SR 84 corridor improvements are documented within each previous north-south arterial corridor section.

4. BUILD TRAFFIC ANALYSIS

Traffic analysis was conducted to assist with evaluating alternatives for each of the north-south arterials and study intersections. The traffic analysis for evaluating alternatives involved the FDOT Intersection Control Evaluation (ICE) Stage 1 analysis process.

Future Year (2045) Build traffic analysis was then conducted for each of the study intersections and arterials, to quantify the benefits of each of the mitigation concepts. Delay, LOS, queues, and travel times are reported for each of the mitigation concepts.

4.1 Alternatives Analysis

The FDOT Intersection Control Evaluation (ICE) Stage 1 analysis process was used to complete an initial assessment of potential improvement concepts for failing interchanges and intersections. The failing study intersections and interchanges that required major modifications were assessed using the ICE Stage 1 process.

The ICE process quantitatively evaluates several intersection control scenarios (alternatives) and ranks these alternatives based on their operational and safety performance. The FDOT CAP-X tool was used to obtain generalized capacity information as part of the initial ICE stage, along with rankings based on volume-to-capacity and multimodal rankings. The FDOT SPICE tool was used to quantify safety benefits for each potential alternative. The SPICE tool compares life cycle and benefit costs of alternatives.

Year 2019 was designated as existing year and year 2045 as the design year for the ICE process. Year 2045 forecasted volumes were used in the CAP-X analysis for the comparison of potential build alternatives against 2045 No Build conditions. For the SPICE tool analysis, year 2019 represents the opening year and year 2045 represents the design year. In the ICE Stage 1 forms the alternative rankings from both CAP-X and SPICE are summarized, and the top ranked alternatives are recommended. The ICE Stage 1 forms and the CAP-X and SPICE tool results for each of the intersections and interchanges are provided in Appendix C.

Table 4-1 lists the failing study intersections that were assessed using the ICE Stage 1 analysis process and provides a summary of the initial alternatives that came from the ICE process and were recommended for further analysis.

Table 4-1 Stage 1 ICE Analysis Results

Location	Top Ranked Alternatives
1. 136th Avenue at SR 84	1. Traditional Diamond with Flyover, WBR bypass lane and Bypass (EB & WB) 2. Displaced Left-turn (DLT) Interchange 3. Traditional Diamond with Bypass (EB & WB)
2. Flamingo Road at SR 84	1. Traditional Diamond with Bypass (EB Only) 2. Traditional Diamond 3. Diverging Diamond Interchange (DDI)
3. Flamingo Road at Broward Boulevard	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Displaced Left-turn (DLT)
4. Hiatus Road at SR 84	1. Traditional Diamond with Bypass (EB Only) 2. Traditional Diamond 3. Diverging Diamond Interchange (DDI)
5. Hiatus Rd at Broward Boulevard	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Displaced Left-turn (DLT)
6. Nob Hill Road at SR 84	1. Traditional Diamond with Bypass (EB Only) 2. Traditional Diamond 3. Displaced Left-turn (DLT) Interchange
7. Nob Hill Road at Broward Boulevard	1. Signalized Control 2. Displaced Left-turn (DLT)
8. Pine Island Road at Nova Drive	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Displaced Left-turn (DLT)
9. Pine Island Road at SR 84	1. Traditional Diamond with Bypass (EB & WB) 2. Traditional Diamond 3. Traditional Diamond with Flyover
10. Pine Island Rd at Peters Road	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Partial Displaced Left-turn (DLT)
11. Pine Island Road at SW 6th Court	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Displaced Left-turn (DLT)
12. University Drive at Peters Road	1. Signalized Control (Added Lanes) 2. Signalized Control with Overpass Left 3. Displaced Left-turn (DLT)
13. University Drive at SR 84	1. Traditional Diamond with Bypass (EB & WBR bypass lane) 2. Traditional Diamond 3. Diverging Diamond Interchange (DDI)
14. Davie Road at SR 84	1. Traditional Diamond with Bypass (EB Only) 2. Traditional Diamond 3. Displaced Left-turn (DLT) Interchange
15. Davie Road at Nova Drive	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Displaced Left-turn (DLT)
16. SR 7 at Oakes Road	1. Signalized Control (Added Lanes) 2. Quadrant Roadway 3. Signalized Control
17. SR 7 at Riverland Road	1. Signalized Control (Added Lanes) 2. Signalized Control 3. Partial Displaced Left-turn (DLT)

4.2 Level of Service Targets and Performance Measures

As with the existing conditions and No Build 2045 traffic analysis, the results of the 2045 Build conditions traffic analysis were compared to the FDOT's Level of Service (LOS) targets, as set forth in the FDOT Policy Topic No. 000-525-006c. A LOS D is the target for the operational analyses of the study roadways since all are located within the urbanized area. For purposes of this study, improvements were evaluated whenever a roadway segment or overall intersection was estimated to operate below the LOS D target.

To assess performance the following performance measures are reported herein and used to evaluate traffic operations and quantify benefits of the recommended Build concepts.

Study Roadway Segments

- LOS
- Volume to Capacity (V/C) ratio
- Travel time

Study Intersections

- LOS
- Control delay
- 95th percentile queue lengths

4.3 Year 2045 Traffic Volumes for Recommended Build Concepts

The 2045 No Build AM and PM weekday peak hour traffic volumes documented in the No Build 2045 Traffic Analysis Technical Memorandum 3 were used as the starting point for the 2045 Build concepts traffic analysis. The 2045 volumes were reassigned where necessary based on the alternative(s). For example, where a flyover or overpass concept was part of an alternative, the 2045 No Build volume was reassigned to that new flyover based on the percentage of traffic estimated to utilize the proposed flyover. The percentage of traffic estimated to utilize a new flyover was based on the origin of where that traffic came from and the flyover destination downstream (i.e. what side streets and developments the new flyover would provide access to and what it would not).

The 2045 AM and PM peak hour traffic volumes used for the traffic analysis of the Build concepts are summarized in the detailed intersection summary tables provided in Appendix E.

4.3.1 Origin-Destination Traffic Data

Traffic origin-destination percentages were obtained from StreetLight data. The origin- destination data was obtained for the months of September 2019 through November 2019, and the analysis focused on the weekday AM peak period (6:00 AM – 10:00 AM) and weekday PM peak period (3:00 PM – 7:00 PM). For each origin-destination pair, "gates" were placed at key locations along the study roadways within the platforms user interface and designated as an origin gate or destination gate. Using StreetLight's Modular Analysis, vehicles were identified that passed through the origin gate and out at the destination gate, thus providing origin-destination sample volumes for specified peak periods. Sample volumes were then summarized as a percentage for each O-D pair.

For the study interchanges along SR-84, origin gates were placed on the northbound, southbound, eastbound, and westbound approaches. Destination gates were placed on eastbound and westbound SR 84 as well as entrance ramps to I-595. Thus, the distribution of vehicles originating from each of the approaches and destined to SR 84 or I-595 was determined.

In Appendix D, summary tables of the origin-destination percentages used for the analysis of the Build concepts is provided. A volume split by movement table illustrates how the No Build volumes were distributed from the existing intersections to the proposed facilities in the Build concepts. Additionally, an interchange origin-destination distribution table comprehensively summarizes how the origin volume from each arterial is distributed to SR 84 and I-595. Lastly, a University Drive analysis of traffic anticipated to use the proposed elevated lanes is shown.

4.4 Recommended Build Concepts Year 2045 Traffic Analysis

As with the existing conditions traffic analysis and 2045 No Build traffic analysis completed for the study, the Highway Capacity Manual (HCM) 2000 methodology within the Synchro software (version 10) was used to calculate delay and Level of Service (LOS) for the signalized and unsignalized study intersections. In addition, for the Build concepts, the 95th percentile queue lengths as estimated using the Synchro methodology were considered to help conceptually design the intersection improvements. Synchro estimated average travel times along each north-south study corridor were used to estimate percent difference in peak hour travel time for northbound and southbound traffic in the the recommended Build conditions compared with the 2045 No Build conditions.

Consistent with the 2045 No Build analyses, a Peak Hour Factor (PHF) of 0.95 was used for the Build (2045) AM peak hour (7:30 am to 8:30 am) and PM peak hour (5:00 pm to 6:00 pm) analyses. Also consistent with the 2045 No Build analysis, for intersection approaches with a volume of more than 5 pedestrians and bicyclists in the peak hour, the signal timings for the Walk and Flash Don't Walk times, along with the volume of pedestrian and bicycle traffic, were incorporated into the intersection analysis. Signal timings (e.g. cycle lengths, phasing, and splits) used for the 2045 Build signalized intersection analysis were based on the existing signal timings obtained from Broward County Traffic Engineering. However, at study intersections where major modifications are recommended or where traffic signal optimization and synchronization is recommended, the existing cycle lengths, green times, phasing, and offsets were optimized.

Build 2045 intersection conditions were analyzed assuming the lane geometry presented in the Build Corridor Concept Plans presented for each north-south study corridor in Section 3 of this report. In addition, planned background improvements documented in Technical Memorandum 1 and Technical Memorandum 3 were assumed to be constructed and in place by year 2045.

The 2045 Build conditions traffic analysis results for the study intersections along each of the north south study arterials are summarized and discussed in the following sections. The HCM2000 intersection LOS and delay reports for each study intersection for the 2045 AM and PM peak hours are provided in Appendix E. The Synchro queue reports and Synchro arterial travel time reports are also provided in Appendix E. In addition, Tables E-1 through E-13 in Appendix E provide a summary of the LOS and delay for each movement, approach and overall intersection, along with estimated queue lengths for each movement.

4.4.1 NW/SW 136th Avenue Corridor Concept Traffic Analysis

The recommended Build concept for the NW/SW 136th Avenue study corridor is shown in Exhibit A-5 in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 westbound overpass for left-turn movements and through movements
- SR 84 westbound to NW/SW 136th Avenue northbound right-turn bypass lane
- SR 84 eastbound overpass for through movements
- NW/SW 136th Avenue southbound flyover to SR 84 eastbound and I-595 eastbound
- Modified intersection turn lanes at:
    - NW/SW 136th Avenue at SR 84 eastbound
    - NW/SW 136th Avenue at SR 84 westbound

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along NW/SW 136th Avenue and the adjacent study intersections is summarized in Table 4-2.

Table 4-2: NW/SW 136th Avenue Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
NW/SW 136th Avenue	1	Shenandoah Parkway / SW 5th Street	Signal	C	B
	2	SR 84 Eastbound	Signal	D	D
	3	SR 84 Westbound	Signal	D	C
	4	NW 2nd Street	Signal	A	B
SR 84 Westbound	5	Commodore Drive	Stop Control	F	F
	6	SW 125th Avenue	Stop Control	C	D

The 2045 Build traffic operations at each study intersection is described below.

1. **NW/SW 136th Avenue at Shenandoah Parkway / SW 5th Street** – Under No Build conditions this intersection is expected to operate at an acceptable LOS C during the AM peak hour and LOS B during the PM peak hour, therefore, improvements were not necessary for this intersection. The delay is maintained below 30 seconds per vehicle during AM and PM peak periods.
2. **NW/SW 136th Avenue at SR 84 eastbound** – The intersection will operate at an acceptable LOS D in both the AM and PM peak hour. The delay is reduced from over 300 seconds per vehicle to less than 55 seconds of delay per vehicle. The SR 84 eastbound overpass will remove the majority of eastbound through traffic from the signalized intersection, and the southbound to eastbound flyover removes most of the southbound left-turning traffic from the signalized intersection. Removing a significant volume of traffic from the signalized intersection, allows the remaining traffic traveling through the intersection to do so with much less delay.
3. **NW/SW 136th Avenue at SR 84 westbound** – The westbound movements (left, through, and right-turn) all experience long delays during both peak hours in the No Build, which causes the intersection to operate at an overall LOS F in the AM and PM peak hours. With the Build improvements in place the intersection operates at a LOS D. The westbound overpass and right-turn bypass allows all through traffic to continue without stopping, and most westbound right-turn traffic to continue without stopping. The westbound left-turning traffic travels past the intersection into a loop ramp, and then makes a right-turn to go south onto NW/SW 136th Avenue.
4. **NW/SW 136th Avenue at NW 2nd Street** – Under No Build conditions this intersection is expected to operate at an acceptable LOS A during the AM peak hour and LOS B during the PM peak hour, therefore, improvements were not necessary for this intersection. The delay is maintained below 20 seconds per vehicle during the AM and PM peak periods.
5. **SR 84 westbound at Commodore Drive** – This unsignalized intersection will operate the same as under the No Build condition since no changes are proposed. Delay will be experienced by southbound drivers that are turning right onto westbound SR 84.
6. **SR 84 westbound at SW 125th Avenue** – Under No Build conditions, this unsignalized intersection is expected to operate at an acceptable LOS C during the AM peak hour and LOS D during the PM peak hour, therefore, improvements were not necessary for this intersection. The delay is maintained below 30 seconds per vehicle during AM and PM peak periods.

The estimated average 2045 AM and PM peak hour travel times along NW/SW 136th Avenue are reported in Table 6-3. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-3.

Table 4-3: NW/SW 136th Avenue 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
NW/SW 136th Avenue from Shenandoah Parkway / SW 5th Street to NW 2nd Street	NB	147	147	283	238	-48%	-38%
	SB	167	183	280	520	-40%	-65%

The recommended Build concept provides for a travel time reduction of 38% to 48% for northbound traffic during the 2045 peak hours, and a 40% to 65% reduction for southbound traffic.

4.4.2 Flamingo Road Corridor Concept Traffic Analysis

The recommended Build concept for the Flamingo Road study corridor is shown in Appendix A, and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 eastbound overpass for through movements
- Overpass for the I-595 westbound off-ramp to cross over SR 84 westbound lanes and merge into SR 84 westbound on the north side
- Modified intersection turn lanes at:
  - Flamingo Road at SR 84 eastbound
  - Flamingo Road at SR 84 westbound
  - Flamingo Road at Broward Boulevard

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along Flamingo Road is summarized in Table 4-4.

Table 4-4: Flamingo Road Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Flamingo Road / SR 823	7	SW 8th Street	Signal	B	A
	8	SR 84 Eastbound	Signal	D	D
	9	SR 84 Westbound	Signal	D	D
	10	Broward Boulevard	Signal	D	D

The 2045 Build traffic operations at each study intersection is described below.

7. **Flamingo Road at SW 8th Street –** Under 2045 No Build conditions, this intersection would operate at an overall LOS B during both the AM and PM peak hours. Therefore, improvements were not necessary for this intersection. With the Build improvements in place along Flamingo Road, the intersection will continue to operate at an acceptable overall LOS B during the 2045 AM peak hour, and LOS A during the 2045 PM peak hour.
8. **Flamingo Road at SR 84 eastbound** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. With the Build improvements in place, the eastbound through movement traffic will be able to utilize a new overpass to avoid any delay at the signalized intersection. With most of the traffic using the overpass, and with intersection turn lane improvements, this will allow the intersection to operate at an acceptable LOS D in both the 2045 AM and PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 180 seconds per vehicle to approximately 44 seconds of delay; a 75% decrease in delay. Delay during the 2045 PM peak

hour is reduced from 80 seconds per vehicle to approximately 47 seconds of delay; a 41% decrease in delay.

9. **Flamingo Road at SR 84 westbound** – The westbound movements (left, through, and right-turn) and southbound movements (through and right-turn) all experience long delays during both 2045 peak hours under the No Build conditions, which causes the intersection to operate at an overall LOS F in the AM and PM peak hours. With additional southbound and westbound turn lanes provided, the Build concept will allow the intersection to operate at an acceptable LOS D in the 2045 AM and PM peak hours.

10. **Flamingo Road at Broward Boulevard -** This intersection operates at LOS E in 2045 AM peak hour and a LOS D in the 2045 PM peak hour as shown from the 2045 No Build traffic analysis. A second westbound right-turn lane is recommended on Broward Boulevard to provide additional capacity for the heavy right-turn volume (619 vehicles in AM, 418 vehicles in PM). With this Build improvement in place, the overall intersection will operate at an overall LOS D in both 2045 peak hours.

The estimated average 2045 AM and PM peak hour travel times along Flamingo Road are reported in Table 6-5 below. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 6-5.

Table 4-5: Flamingo Road 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
Flamingo Road from SW 8th Street to Broward Boulevard	NB	204	190	258	171	-21%	11%
	SB	198	203	231	238	-14%	-15%

The recommended Build concept provides for a travel time reduction of 21% for northbound traffic during the AM 2045 peak hour, a slight increase for the northbound direction in the PM peak hour, and a 14% to 15% reduction for southbound traffic.

4.4.3 Hiatus Road Corridor Concept Traffic Analysis

The recommended Build concept for the Hiatus Road study corridor is shown in Appendix X and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 eastbound overpass for through movements
- Modified intersection turn lanes at:
  - Hiatus Road at SR 84 eastbound
  - Hiatus Road at SR 84 westbound
  - Hiatus Road at Broward Boulevard

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along Hiatus Road is summarized in Table 4-6.

Table 4-6: Hiatus Road Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Hiatus Road	11	SR 84 Eastbound	Signal	D	D
	12	SR 84 Westbound	Signal	C	D
	13	Broward Boulevard	Signal	E	E

The 2045 Build traffic operations at each study intersection is described below.

11. **Hiatus Road at SR 84 eastbound** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. With the Build improvements in place, the traffic destined to SR 84 eastbound will be able to utilize a new overpass to avoid any delay at the signalized intersection. With only the eastbound traffic destined to I-595 remaining at the signal for the eastbound through movement, and a third eastbound left-turn lane, this will allow the intersection to operate at an acceptable LOS D during both the 2045 AM and PM peak hours. The reduced volume on the eastbound approach allows additional time to be allotted to the northbound and southbound approaches resulting in reduced delay.

12. **Hiatus Road at SR 84 westbound** – The westbound movements (right and left) and southbound movements (through and right) experience long delays during both AM and PM 2045 peak hours under the No Build conditions, causing the intersection to operate at an overall LOS F during the AM and PM peak hours. With two additional westbound right-turn lanes provided and a second southbound right-turn lane, the Build concept will allow the intersection to operate at an acceptable LOS C during the AM peak hour and LOS D during the PM peak hour.

13. **Hiatus Road at Broward Boulevard** – This intersection operates at LOS F during the 2045 AM and PM peak hours as shown from the 2045 No Build traffic analysis. A second left-turn lane is recommended for the northbound and westbound approach, and a second right-turn lane is recommended for the eastbound approach. With build improvements in place, LOS E operations are expected for 2045 AM and PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 95 seconds per vehicle to approximately 58 seconds per vehicle; a 39% decrease in delay. Delay during the 2045 PM peak hour is reduced from 89 seconds per vehicle to approximately 61 seconds of delay; a 31% decrease in delay.

The estimated average 2045 AM and PM peak hour travel times along HIatus Road are reported in Table 4-7. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-7.

Table 4-7: Hiatus Road 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
Hiatus Road from south of SR 84 eastbound to Broward Boulevard	NB	200	205	209	210	-5%	-2%
	SB	176	194	279	266	-37%	-27%

The recommended Build concept provides for a travel time reduction of 2% to 5% for northbound traffic during the 2045 peak hours, and a 27% to 37% reduction for southbound traffic.

4.4.4 Nob Hill Road Corridor Concept Traffic Analysis

The recommended Build concept for the Nob Hill Road study corridor is shown in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 eastbound overpass for through movements
- Modified intersection turn lanes at:
  - Nob Hill Road at SR 84 eastbound
  - Nob Hill Road at SR 84 westbound

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along Nob Hill Road is summarized in Table 4-8.

Table 4-8: Nob Hill Road Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Nob Hill Road	14	SW 13th Street	Signal	C	A
	15	SW 101 Road	Signal	B	B
	16	SR 84 Eastbound	Signal	D	C
	17	SR 84 Westbound	Signal	D	D
	18	Hawks View Boulevard	Signal	B	B
	19	Broward Boulevard	Signal	D	E

The 2045 Build traffic operations at each study intersection is described below.

14. **Nob Hill Road at SW 13th Street** – Under No Build conditions this intersection is expected to operate at an acceptable LOS C during the AM peak hour and LOS A during the PM peak hour, therefore, improvements were not necessary for this intersection. The delay is maintained below 25 seconds per vehicle during AM and PM peak periods.

15. **Nob Hill Road at SW 101 Road** – The intersection is expected to operate at an acceptable LOS B during the AM and PM peak hours under No Build conditions, Therefore, improvements were not necessary for this intersection. The delay is maintained below 20 seconds per vehicle during AM and PM peak periods.

16. **Nob Hill Road at SR 84 eastbound** – The northbound movements (through and right) and eastbound movements (left, through and right) all experience long delays during both AM and PM peak hours under the No Build conditions, causing the intersection to operate at an overall LOS F during the AM and PM peak hours. In addition to the EB overpass for eastbound through movements, a second northbound right-turn lane and an eastbound right-turn lane in the build concept will allow the intersection to operate at LOS D during the AM peak hour and LOS C during the PM peak hour.

17. **Nob Hill Road at SR 84 westbound** – The southbound movements (through and right) and westbound movements (left, through and right) all experience long delays during both AM and PM peak hours under the No Build conditions, causing the intersection to operate at an overall LOS F during the AM and PM peak hours. A third westbound right-turn lane and exclusive westbound through lane along with signal cycle length and re-timing recommendations will allow the intersection to operate at LOS D during both AM and PM peak hours.

18. **Nob Hill Road at Hawks View Boulevard** – Under No Build conditions this intersection is expected to operate at an acceptable LOS B during the AM and PM peak hours, therefore, improvements were not necessary for this intersection. The delay is maintained below 15 seconds per vehicle during AM and PM peak periods.

19. **Nob Hill Road at Broward Boulevard** – The intersection is expected to operate at an acceptable LOS D during the AM peak hour and at LOS E during the PM peak hours under No Build conditions. Concept evaluations found that in order to significantly improve LOS E during the PM peak hour, excessive geometric modifications would be required. Given that PM peak hour operations of LOS E are near the threshold to LOS D, signal operation recommendations maintain the intersection at LOS D during the AM peak hour and LOS E during the PM peak hour.

The estimated average 2045 AM and PM peak hour travel times along Nob Hill Road are reported in Table 4-9. The 2045 Build conditions travel times were compared with the 2045 No Build

conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-9.

Table 4-9: Nob Hill Road 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
Nob Hill Road from SW 13th Street to Broward Boulevard	NB	294	286	311	310	-6%	-8%
	SB	284	308	460	379	-38%	-19%

The recommended Build concept provides for a travel time reduction of 6% to 8% for northbound traffic during the 2045 peak hours, and a 19% to 38% reduction for southbound traffic.

4.4.5 Pine Island Road Corridor Concept Traffic Analysis

The recommended Build concept for the Pine Island Road study corridor is shown in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 westbound overpass for through movements
- SR 84 eastbound overpass for through movements
- Modified intersection turn lanes at:
  - Pine Island Road at SW 24th Street / Nova Drive
  - Pine Island Road at SR 84 eastbound
  - Pine Island Road at SR 84 westbound
  - Pine Island Road at Peters Road
  - Pine Island Road at SW 6th Court

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along Pine Island Road is summarized in Table 4-10.

Table 4-10: Pine Island Road Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Pine Island Road	20	SW 24th Street / Nova Drive	Signal	E	D
	21	Orange Grove Road	Signal	C	B
	22	SR 84 Eastbound	Signal	E	E
	23	SR 84 Westbound	Signal	E	F
	24	New River Canal Road	Signal	A	C
	25	Peters Road	Signal	C	E
	26	SW 6th Court	Signal	D	E

The 2045 Build traffic operations at each study intersection is described below.

20. **Pine Island Road at SW 24th Street/Nova Drive** – Under 2045 No Build conditions, this intersection would operate at LOS E during both AM and PM peak hours. The Build concept recommends an exclusive right-turn lane for both the eastbound and westbound approaches improving the intersection to LOS E during the AM peak hour and LOS D during the PM peak hour. During the 2045 AM peak hour, the overall average delay is reduced from 77 seconds per vehicle to 55 seconds per vehicle; a 28% decrease in delay. Delay during the 2045 PM

peak hour is reduced from 70 seconds per vehicle to approximately 49 seconds of delay; a 30% decrease in delay.

21. **Pine Island Road at Orange Grove Road** – Under No Build conditions this intersection is expected to operate at an acceptable level of service during both AM and PM peak periods. Therefore, improvements were not necessary for this intersection. The delay is maintained below 25 seconds per vehicle during AM and PM peak periods.

22. **Pine Island Road at SR 84 eastbound** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. Recommendations include an eastbound overpass for through movements, a second northbound right-turn lane, a third eastbound right-turn lane and a southbound through lane. With Build improvements, the intersection will operate at a LOS E during both the AM and PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 248 seconds per vehicle to approximately 57 seconds of delay; a 77% decrease in delay. Delay during the 2045 PM peak hour is reduced from 172 seconds per vehicle to approximately 66 seconds of delay; a 61% decrease in delay.

23. **Pine Island Road at SR 84 westbound** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. Recommendations include a westbound overpass for through movements destined to westbound SR 84 while traffic destined to I-595 must use the signal. Additionally, a northbound through lane, a third westbound right-turn lane and a southbound shared through-right-turn lane is recommended. The intersection will operate at a LOS E during the AM peak hour and remain at LOS F during the PM peak hour. The overall average delay during the AM peak hour at the intersection is reduced from 248 seconds per vehicle to approximately 72 seconds of delay; a 70% decrease in delay. Delay during the 2045 PM peak hour is reduced from over 300 seconds per vehicle to approximately 107 seconds of delay; a 73% decrease in delay.

24. **Pine Island Road New River Canal Road** – Under No Build conditions this intersection is expected to operate at an acceptable level of service during both AM and PM peak periods. Therefore, improvements were not necessary for this intersection. The delay is maintained below 30 seconds per vehicle during AM and PM peak periods.

25. **Pine Island Road at Peters Road** – Without improvements, this intersection will operate at LOS D during the 2045 AM peak period and LOS F during the 2045 PM peak period. Recommendations include a second northbound exclusive right-turn lane, a third westbound left-turn lane and a second westbound right-turn lane. The build concept operates under LOS C conditions during the AM peak period and LOS E during the PM peak period.

26. **Pine Island Road at SW 6th Court** – Under 2045 No Build conditions, this intersection would operate at LOS E during the AM peak period and LOS F during the PM peak period. A second left-turn lane on the westbound approach is recommended and improves the intersection to LOS D during the AM peak hour and LOS E during the PM peak hour. During the 2045 AM peak hour, the overall average delay is reduced from 68 seconds per vehicle to 42 seconds per vehicle; a 38% decrease in delay. Delay during the 2045 PM peak hour is reduced from 121 seconds per vehicle to approximately 61 seconds of delay; a 50% decrease in delay.

The estimated average 2045 AM and PM peak hour travel times along Pine Island Road are reported in Table 4-11. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-11.

Table 4-11: Pine Island Road 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
Pine Island Road from SW 24th Street/Nova Drive to SW 6th Court	NB	397	504	822	1334	-22%	-41%
	SB	410	480	1302	1257	-45%	-43%

The recommended Build concept provides for a travel time reduction of 22% to 41% for northbound traffic during the 2045 peak hours, and a 43% to 45% reduction for southbound traffic.

4.4.6 University Drive Corridor Concept Traffic Analysis

The recommended Build concept for the University Drive study corridor is shown in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 eastbound overpass for through movements
- SR 84 westbound to University Drive northbound right-turn bypass lane
- Elevated northbound and southbound through lanes from south of Kolsky Blvd to north of SW 30th Street
- Modified lane geometry at the following intersections:
  - University Drive at SW 30th Street
  - University Drive at Nova Drive
  - University Drive at SW 23rd Street
  - University Drive at Kolsky Boulevard
  - University Drive at SR 84 eastbound
  - University Drive at SR 84 westbound
  - University Drive at Peters Road
  - University Drive at The Fountains
  - University Drive at Federated Road

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along University Drive is summarized in Table 4-12.

Table 4-12: University Drive Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Peters Rd	27	SW 80th Terrace	Signal	B	D
SR 84 Eastbound	28	SW 81st Avenue	Stop Control	F	F
University Drive / SR 817	29	SW 30th Street	Signal	E	E
	30	Nova Drive	Signal	D	E
	31	SW 23rd Street	Signal	C	D
	32	Kolsky Boulevard	Signal	C	F
	33	SR 84 Eastbound	Signal	E	E
	34	SR 84 Westbound	Signal	C	D
	35	Peters Road	Signal	F	F
	36	The Fountains	Signal	B	B
	37	Federated Road	Signal	C	E

The 2045 Build traffic operations at each study intersection is described below.

27. **Peters Rd at SW 80th Terrace** – Under No Build conditions, this unsignalized intersection is expected to operate at an acceptable LOS B during the AM peak hour and LOS D during the PM peak hour, therefore, improvements were not necessary for this intersection. The delay is maintained below, 45 seconds per vehicle during the AM and PM peak periods.

28. **SR 84 eastbound at SW 81st Avenue** – This unsignalized intersection will operate the same as under the No Build condition since no changes are proposed. Delay will be experienced by northbound drivers that are turning right onto eastbound SR 84.

29. **University Drive at SW 30th Street** – Under 2045 No Build conditions, this intersection would operate at an overall LOS F during both the AM and PM peak hours. Improvements include a fourth northbound and southbound through lane as well as a second right-turn lane on the westbound approach. With these improvements, this will allow the intersection to operate at a LOS E during both the 2045 AM and PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 130 seconds per vehicle to approximately 63 seconds per vehicle; a 52% decrease in delay. Delay during the 2045 PM peak hour is reduced from 174 seconds per vehicle to approximately 60 seconds of delay; a 65% decrease in delay.

30. **University Drive at Nova Drive** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. With the Build improvements in place, a portion of the southbound and northbound through traffic will be able to utilize the elevated lanes over the intersection. A second westbound left-turn lane is also recommended. With these improvements, this will allow the intersection to operate at a LOS D during the 2045 AM peak hour and LOS E during the 2045 PM peak hour. The overall average delay during the AM peak hour at the intersection is reduced from 148 seconds per vehicle to approximately 55 seconds per vehicle; a 62% decrease in delay. Delay during the 2045 PM peak hour is reduced from 124 seconds per vehicle to approximately 56 seconds of delay; a 55% decrease in delay.

31. **University Drive at SW 23rd Street** – This intersection operates at LOS E in 2045 AM peak hour and a LOS F in the 2045 PM peak hour as shown from the 2045 No Build traffic analysis. With the Build improvements in place, a portion of the southbound and northbound through traffic will be able to utilize the elevated lanes over the intersection. With these improvements, this will allow the intersection to operate at a LOS C during the 2045 AM peak hour and LOS D during the 2045 PM peak hours.

32. **University Drive at Kolsky Boulevard** – Under 2045 No Build conditions, this intersection would operate at an overall LOS D during the AM peak hour and LOS F during the PM peak hour. Improvements include additional northbound and southbound through lanes as well as an exclusive northbound right-turn lane. With these improvements, this will allow the intersection to operate at a LOS C during both the 2045 AM peak hour and will remain at LOS F during the PM peak hour. The overall average delay during the AM peak hour at the intersection is reduced from 37 seconds per vehicle to approximately 23 seconds per vehicle; a 38% decrease in delay. Delay during the 2045 PM peak hour is reduced from 179 seconds per vehicle to approximately 118 seconds of delay; a 34% decrease in delay.

33. **University Drive at SR 84 eastbound** – Without improvements, this intersection will operate at LOS E during both 2045 AM and PM peak hours. With the Build improvements in place, the eastbound through movement traffic will be able to utilize a new overpass to avoid any delay at the signalized intersection and a third eastbound right-turn lane is recommended. With these improvements, this will allow the intersection to continue to operate at a LOS E during the 2045 AM and 2045 PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 75 seconds per vehicle to approximately 62 seconds per vehicle; a 17% decrease in delay. Delay during the 2045 PM peak hour is reduced from 69 seconds per vehicle to approximately 56 seconds of delay; a 18% decrease in delay.

34. **University Drive at SR 84 westbound** – This intersection operates at LOS F in 2045 AM peak hour and a LOS E in the 2045 PM peak hour as shown from the 2045 No Build traffic analysis. With the Build improvements in place, a portion of the westbound to northbound traffic will be able to utilize the right-turn bypass lane to avoid delay at the intersection. With these improvements, this will allow the intersection to operate at a LOS C during the 2045 AM peak hour and LOS D during the 2045 PM peak hours.

35. **University Drive at Peters Road** – Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. Build improvements consist of additional northbound and southbound through lanes, a second northbound right-turn lane and a third westbound left-turn lane. With these improvements, the intersection will continue to operate at LOS F during both 2045 AM and PM peak hours. The overall average delay during the AM peak hour at the intersection is reduced from 274 seconds per vehicle to approximately 164 seconds per vehicle; a 40% decrease in delay. Delay during the 2045 PM peak hour is reduced from 210 seconds per vehicle to approximately 113 seconds of delay; a 46% decrease in delay.

36. **University Drive at The Fountains** – Under No Build conditions this intersection is expected to operate at an acceptable LOS C during the AM and PM peak hours. The intersection will benefit from additional northbound and southbound through lanes improving the intersection to LOS B under Build conditions. The delay is maintained below 20 seconds per vehicle during AM and PM peak periods.

37. **University Drive at Federated Road** – The intersection is expected to operate at LOS E during the AM peak hour and LOS F during the PM peak hour under No Build conditions. The intersection will benefit from additional northbound and southbound through lanes. With these improvements, this will allow the intersection to operate at a LOS C during the 2045 AM peak hour and LOS E during the PM peak hour. The overall average delay during the AM peak hour at the intersection is reduced from 76 seconds per vehicle to approximately 32 seconds per vehicle; a 58% decrease in delay. Delay during the 2045 PM peak hour is reduced from 93 seconds per vehicle to approximately 63 seconds of delay; a 32% decrease in delay.

The estimated average 2045 AM and PM peak hour travel times along University Drive are reported in Table 4-13 below. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-13.

Table 4-13: University Drive 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
University Drive from SW 30th Street to Federated Road	NB	640	787	822	1334	-22%	-41%
	SB	720	713	1302	1257	-45%	-43%

The recommended Build concept provides for a travel time reduction of 22% to 41% for northbound traffic during the 2045 peak hours, and a 43% to 45% reduction for southbound traffic.

4.4.7 Davie Road Corridor Concept Traffic Analysis

The recommended Build concept for the Davie Road study corridor is shown in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- SR 84 eastbound overpass for through movements
- Modified intersection turn lanes at:
  - Davie Road at SR 84 eastbound
  - Davie Road at SR 84 westbound
  - Davie Road at Nova Drive

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along Davie Road is summarized in Table 4-14.

Table 4-14: Davie Road Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
Davie Road	38	Nova Drive	Signal	D	D
	39	Reese Road	Signal	D	D
	40	SR 84 Eastbound	Signal	C	C
	41	SR 84 Westbound	Signal	D	D

The 2045 Build traffic operations at each study intersection is described below.

38. **Davie Road at Nova Drive –** This intersection operates at LOS F during the 2045 AM and PM peak hours as shown from the 2045 No Build traffic analysis. A second left-turn lane is recommended for the eastbound, northbound, and southbound approaches. An exclusive right-turn lane is recommended for the eastbound approach and a second right-turn lane is recommended for the southbound approach. Lastly, an additional northbound through lane is recommended. With Build improvements in place, the overall intersection will operate at an overall LOS D in both the 2045 AM and PM peak hours.

39. **Davie Road at Reese Road –** Under No Build conditions this intersection is expected to operate at an acceptable level of service during both AM and PM peak periods. Therefore, improvements were not necessary for this intersection. The delay is maintained below 45 seconds per vehicle during AM and PM peak periods.

40. **Davie Road at SR 84 eastbound –** Without improvements, this intersection will operate at LOS F during both 2045 AM and PM peak hours. With the Build improvements in place, the eastbound through movement traffic will be able to utilize a new overpass to avoid any delay at the signalized intersection. On the northbound approach an additional northbound through lane is recommended along with a channelized free-flow right-turn lane. In the southbound direction, left-turn movements will not be permitted, which helps reduce delay. With these improvements, this will allow the intersection to operate at an acceptable LOS C in both the 2045 AM and PM peak hours.

41. **Davie Road at SR 84 westbound –** Under 2045 No Build conditions, this intersection would operate at an overall LOS F during both the AM and PM peak hours. Recommendations include a third northbound left-turn lane and a second westbound left-turn lane as well as modification of the existing continuous westbound through lane (“turbo lane”) to a standard westbound through lane adhering to signal control. With these improvements, this will allow the intersection to operate at an acceptable LOS D during both the 2045 AM and PM peak hours.

The estimated average 2045 AM and PM peak hour travel times along Davie Road are reported in Table 4-15. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-15.

Table 4-15: Davie Road 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
Davie Road from Nova Drive to SR 84 westbound	NB	315	306	1136	1057	-72%	-71%
	SB	144	126	160	196	-10%	-36%

The recommended Build concept provides for a travel time reduction of 71% to 72% for northbound traffic during the 2045 peak hours, and a 10% to 36% reduction for southbound traffic.

4.4.8 SR 7 / US-441 Corridor Concept Traffic Analysis

The recommended Build concept for the SR 7/US-441 study corridor is shown in Appendix A and includes several major roadway infrastructure capacity improvements. The major roadway capacity improvements which have a positive impact on the traffic operations are noted below.

- Modified geometry and number of lanes at the following intersections:
  - SR 7/US-441 at Oakes Road
  - SR 7/US-441 at SW 20th Street / Riverland Road

The 2045 AM and PM peak hour overall intersection Level of Service (LOS) for each study intersection along SR 7/US-441 is summarized in Table 4-16.

Table 4-16: SR 7 / US-441 Build Concept 2045 Intersection LOS

Cross Road	Intersection Ref. No.	Intersection With:	Control Type	2045 Build LOS	
				AM	PM
SR 7 / US-441	42	Oakes Road (S)	Signal	A	A
	44	Oakes Road (N) (New)	Signa (New)	B	C
	43	SW 20th Street / Riverland Road	Signal	D	D

The 2045 Build traffic operations at each study intersection is described below.

42. **SR 7 / US-441 at Oakes Road (S) –** Under 2045 No Build conditions, this intersection would operate at an overall LOS E during both the AM peak hour and PM peak hour. Recommendations include converting the existing intersection to a quadrant intersection with an additional signal installed just north of Oakes Road. The southern Oakes Road and SR 7 signalized intersection would exclusively serve eastbound right-turning vehicles and northbound left-turn vehicles. With these improvements, this will allow the Oakes Road North signalized intersection to operate at LOS A during the 2045 AM and PM peak hour.

43. **SR 7 / US-441 at SW 20th Street / Riverland Road** – Without improvements, this intersection will operate at LOS F during the 2045 AM peak period and LOS E during the 2045 PM peak period. Recommendations are to add a fourth northbound and southbound through lane as well as a second left-turn lane for the northbound and southbound approaches. An exclusive eastbound right-turn lane is also recommended as well as reconfiguring the westbound approach to include two exclusive left-turn lanes and a shared through/right-turn lane. The Build concept would operate at LOS D during both the 2045 AM peak and PM peak hours.

44. **SR 7 / US-441 at Oakes Road (N) –** This new northern signalized intersection would be created as part of the conversion of the intersection to a quadrant intersection. The new northern Oakes Road and SR 7 signalized intersection would exclusively serve eastbound left-turning vehicles and southbound right-turn vehicles. This configuration will allow the Oakes Road North signalized intersection to operate at LOS B during the AM peak hour and LOS C during the PM peak hour for the 2045 analysis year.

The estimated average 2045 AM and PM peak hour travel times along SR 7 / US-441 are reported in Table 4-17. The 2045 Build conditions travel times were compared with the 2045 No Build conditions travel times. The percent difference in 2045 peak hour travel times for northbound and southbound traffic is shown in Table 4-17.

Table 4-17: SR 7 / US-441 2045 Estimated Travel Times

Study Corridor	Travel Direction	2045 Build Travel Time		2045 No Build Travel Time		% Difference Build vs. No Build	
		AM	PM	AM	PM	AM	PM
SR 7 / US-441 from Oakes Road to Riverland Road	NB	220	225	306	420	-28%	-46%
	SB	234	224	298	308	-22%	-27%

The recommended Build concept provides for a travel time reduction of 28% to 46% for northbound traffic during the 2045 peak hours, and a 22% to 27% reduction for southbound traffic.

5. INTELLIGENT TRANSPORTATION SYSTEMS (ITS) AND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS (TSM&O) STRATEGIES ANALYSIS

5.1 Analysis Methodology

The Transportation System Management and Operations (TSM&O) strategies that were evaluated are intended to enhance the efficiency of the current transportation network by implementing strategies that could be applied to address capacity and operational issues identified for the study corridors. The goal of TSM&O strategies is to preserve existing capacity, enhance safety, and improve reliability of the transportation network by establishing systems, services and programs that optimize utilization of the existing infrastructure and show improvements in the transportation network performance.

To properly assess the opportunity of a specific TSM&O strategy being applied to a corridor the FDOT District 4 TSM&O Master Plan and Broward County Mobility Advancement Program established by the transportation surtax were referenced. See Table 4-1 for a summary of the plans and existing documents that were reviewed when considering each arterial study corridor. The project priority score is based on prioritization criteria identified in the FDOT District 4 TSM&O Master Plan. It is based on a maximum score of 9 which indicates projects with the greatest need and highest priority.

The TSM&O strategies were evaluated considering how well they could address mobility, safety, and multimodal performance. Where scores were available from the FDOT District 4 TSM&O Master Plan, they are noted in Table 5-1.

Table 5-1: TSM&O Strategies Planning Reference

Arterial Roadway	FDOT D4 TSM&O Master Plan					Broward County Surtax	
	On Strategic Network?	Prioritization Criteria and/or Score*			Project Priority Score	Included on Surtax Plan?	Proposed Strategy
		Mobility	Safety	Transit			
SR 84	Yes	Yes	Yes	No	6	Yes	- Video Detection Predictive Maintenance - Fiber Optic Network
SR 7/ US-441	Yes	Yes	Yes	Yes	7	Yes	- Video Detection Predictive Maintenance - Rapid Bus Route
Davie Road	Yes	2.4	2.2	1.6	6.2	Yes	- Intersection Improvement - Video Detection Predictive Maintenance
SR 817/ University Drive	Yes	Yes	Yes	Yes	8	Yes	- Adaptive Signal Control - Video Detection Predictive Maintenance - Rapid Bus Route
Pine Island Road	Yes, Partial	2.0	2.0	3.0	8	Yes	- Intersection Improvement - Video Detection Predictive Maintenance
Nob Hill Road	No	No	No	No	N/A	Yes	- Intersection Improvement - Video Detection Predictive Maintenance
Hiatus Road	No	No	No	No	N/A	Yes	- Intersection Improvement - Video Detection Predictive Maintenance
SR 823/ Flamingo Road	Yes	Yes	Yes	No	4	Yes	- Intersection Improvement - Video Detection Predictive Maintenance - Fiber Optic Network
SW 136 Avenue	Yes, Partial	1.0	2.0	3.0	5	Yes	- Intersection Improvement - Video Detection Predictive Maintenance

*Yes/No or score if available. Scores available based on project prioritization (Max = 9), if prioritized in the master plan.

Strategies related to improving mobility were further categorized into three sub-categories.

1) Capacity improvements,
2) Dynamic applications, and
3) Automated Vehicle (AV) and Connected Vehicle (CV) type strategies.

Table 4-2 summarizes the recommended strategy related to each corridor. Nob Hill Road and Hiatus Road were not considered for proposing TSM&O strategies due to the roadways not being on the FDOT strategic network.

The TSM&O strategies shown in Table 4-2 were considered based on their implementation timeframes. Strategies considered short-term improvements have readily available technology and systems that are currently in use within FDOT District 4 and/or Broward County. Mid-term strategies would require one or more of the following before they could be implemented:

- A demonstration project to take place to provide proof of concept,
- Other devices or systems to be in place to support the strategy, or
- Other restrictions related to operations and maintenance agreements would need to be resolved amongst project stakeholders.

Lastly, strategies were identified as long-term based on the current availability of necessary technology, and/or the need for a phased approach due to existing systems and devices already deployed, and the need for stakeholder commitment, support, and resources.

It is important to note that all proposed strategies are contingent on commitments by stakeholders to fund operations and maintenance of the systems and devices.

Following Table 5-2, each of the mitigation strategies are discussed in more detail. Proposed TSM&O mitigation strategies are based on context specific information related to each corridor or intersection. They are recommended for corridors based on the existing facility characteristics, communication access, and operational constraints. Strategies labeled as existing corridors are based on current systems/devices deployed or current standard operating procedures used to manage that corridor. Refer to Table 4-2 for information related to the existing and proposed strategies, or existing strategies that can be upgraded or replaced. Prerequisite strategies identify any strategy that is required to be in place in order to support the proposed strategy.

The goal of these strategies is to implement or support the expansion of the actively managed transportation network within proximity to the I-595 corridor and arterials that provide connectivity to the corridor. By engaging operational stakeholders that manage the transportation infrastructure within the project limits these strategies will support a holistic approach to traffic management that can adapt in real-time to events, congestion, and other operational influences.

Table 5-2: Proposed TSM&O Strategies

Arterial Roadway	Active Arterial Management	Adaptive Signal Control	Advanced Intersection Detection	Event Management	Integrated Corridor Management (ICM)	Advanced Traffic Management System	Dynamic Lane Use Control	Dynamic Routing	Autonomous Fixed Route Transit	Connected Vehicles	Signal Phase and Timing (SPaT)	Emergency Vehicle Preemption	Bicycle Alert System	Queue Warning System	Road Rangers/ Incident Management	Work Zone Management	Wrong Way Driving Countermeasures	Adaptive and Intelligent Streetlights	Bus Rapid Transit	Queue Jump	Transit Signal Priority	Transit Traveler Information
	Capacity						Dynamic		AV/CV				Safety					Multimodal				
	Mobility																					
SR 84	X		X	X	X	U	X	X		X	X	U		X	E	X	X	X	X			
SR 7/US-441	E	X	X	E		U		X		X	X	U	X		X	X		X	X	X	X	X
Davie Road	X		X	X		U		X	X	X	X	U	X			X		X		X	X	X
SR 817/ University Drive	E	X	X	E		U		X	X	X	X	U	X		X	X		X	X	X	X	X
Pine Island Road	X		X			U		X	X	X	X	U	X		X	X		X		X	X	
Nob Hill Road																						
Hiatus Road																						
SR 823/ Flamingo Road			X			U				X	X	U	X			X		X				
SW 136 Avenue	X	X	X	X		U		X	X	X	X	U	X		X	X		X		X	X	

X = Proposed Strategy; E = Existing Strategy; U = Upgrade and/or Replace Existing Strategy/ Infrastructure
Proposed strategy implementation timeline: **Long-Term**; **Mid-Term**, Short-Term

5.2 Mobility TSM&O Mitigation Strategies - Capacity

5.2.1 Active Arterial Management (AAM)

The 2017 TSM&O Strategic Plan, produced by FDOT Central Office, notes that AAM applies freeway management practices to major urban arterials. AAM enables the use of sensors and advanced traffic signal control on major arterials that are used to collect traffic flow and travel time data, while Traffic Management Center (TMC) operations provide the ability to adjust signal timings to mitigate the real-time traffic conditions.

AAM is defined by FHWA as the active prioritization of objectives and collection of data to efficiently manage traffic signal infrastructure and control devices. This maximizes safety and throughput while minimizing delays. Traffic signal maintenance is preventative and responsive activities intended to preserve traffic signal infrastructure and control devices necessary for the safe and efficient utilization of arterial, collector and local roadways.

Currently, FDOT District 4 operates an 80-mile AAM network within Broward County which includes University Drive and SR 7/US-441. Additionally, SR 84 can be monitored using existing infrastructure along I-595. However, a dedicated infrastructure deployment to support AAM along SR 84 is recommended.

Recommended Corridors

- SR 84
- Davie Road
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- SR 7/ US-441
- SR 817/ University Drive

Prerequisite Strategies

- Advanced Traffic Management System
  - Fiber Optic Communications
  - CCTV Cameras
  - Bluetooth Readers
  - Microwave Vehicle Detection Systems (MVDS)
  - Dynamic Message Signs (DMS)
  - Traffic Signal Controller Upgrade

5.2.2 Adaptive Signal Control

Adaptive Signal Control reacts to fluctuations in traffic patterns by utilizing sensors for traffic data, and specially developed algorithms that then take the traffic data and generate signal timing adjustments that are customized to the prevailing conditions. Traffic signal timings adapt continuously to the real-time traffic conditions and fluctuations in traffic flows, optimizing the control of traffic along corridors. These systems can account for changes in traffic speeds due to congestion, severe weather or event specific situations.

Recommended Corridors

- SR 7/ US-441
- SR 817/ University Drive
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
  - Fiber Optic Communications
  - Traffic Signal Controller Upgrade

5.2.3 Advanced Intersection Detection

Advanced intersection detection incorporates advance detection beyond the standard video vehicle detection currently in place. Additional detection may include a camera or loop that is placed further away from the intersection to provide early detection of approaching vehicles.

In coordination with adaptive signal control and Automated Traffic Signal Performance Measures (ATSPMs), this advance detector loop can be used to reduce wait times for approaching traffic and more accurately determine the number of vehicles queuing at the intersection. Alternatively, Advanced Intersection Detection may include replacing the existing standard vehicle video vehicle detection with microwave, thermal, magnetometer or similar technology.

Recommended Corridors

- SR 84
- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SR 823/ Flamingo Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
  - Fiber Optic Communications
  - Traffic Signal Controller Upgrade

5.2.4 Event Management

Special or planned events that generate a significant increase in traffic that impacts the transportation system can be better managed through use of a coordinated approach involving TSM&O strategies to manage the traffic in and out of the event. It is important to coordinate with event managers and prepare a plan with an understanding of the event time periods, occurrences, expected magnitude of traffic, and opportunities to modify the surrounding transportation network temporarily to manage the traffic.

Traffic conditions can be monitored during planned events, and modifications to signal timings can be implemented and adjusted in real-time to better match the actual conditions. The TSM&O strategies that could help facilitate this, are implementation of adaptive signal control and Automated Traffic Signal Performance Measures (ATSPMs). Detectors and cameras can be installed at signalized intersections surrounding the special event areas. With strategies in place, the signal timing adjustments can help shorten delays and the duration of transportation congestion in the area. It can also improve safety for people using all modes during an event.

The recommended corridors for this strategy were selected based on their proximity to major activity centers (South Florida Education Center, BB&T Center) and their ability to serve as a main or alternate route in response to events.

Recommended Corridors

- SR 84
- Davie Road
- SW 136 Avenue

Existing Corridors

- SR 7/ US-441
- SR 817/ University Drive

Prerequisite Strategies

- Active Arterial Management
- Advanced Traffic Management System
  - Fiber Optic Communications
  - Traffic Signal Controller Upgrade

5.2.5 Integrated Corridor Management (ICM)

An ICM transportation system is the ultimate objective when it comes to operating and maintaining a complex multi-modal traffic network. ICM involves an integrated approach to transportation along a specific designated corridor or set of corridors. Multiple agencies and modes are coordinated using compatible strategies and data sharing. Through an ICM approach, transportation agencies manage the corridor as a multimodal system and make operational decisions for the benefit of the entire corridor and local network. Multiple roadway types within the corridor, as well as transit and other types of transportation facilities, are managed to optimize transportation service delivery and align agency strategies. This strategy provides the ability to treat transportation as a single system, increase the operational efficiency of the whole transportation network, and maximize the effect of transportation investments. This would support statewide TSM&O initiatives as well, where the use of technology is used to manage existing infrastructure, improving the transportation system with minimal investment and greater benefits to costs.

Recommended Corridors

- Network surrounding SR 84, including adjacent north-south arterials, and parallel east-west arterials

Existing Corridors

- N/A

Prerequisite Strategies

- Active Arterial Management
- Advanced Traffic Management System
- Event Management
- Road Rangers and Traffic Incident Management
- Work Zone Management
- Multimodal TSM&O Strategies

5.2.6 Advanced Traffic Management System (ATMS)

ATMS seeks to reduce traffic congestion in urban environments by improving the efficiency of existing infrastructure. Generally, Signal ATMS is operated out of the area's Traffic Management Center (TMC) and requires ITS infrastructure such as CCTVs, fiber optic cable, and traffic signal controllers. ATMS allows traffic engineers to fine-tune signal timing, react to traffic incidents more efficiently, and maneuver cameras to better determine traffic issues. All of these components can help improve safety and the flow of traffic.

Currently, Broward County Traffic Engineering Department operates their entire traffic signal system through an ATMS platform (ATMS.now). Upgrading or replacing this system, or its components, would include providing real-time video feeds from the traffic signal detection equipment; integrating data collection devices; or upgrading traffic signal controllers to catalog high-resolution data that will provide insight for traffic signal operations and maintenance.

Systems and devices that directly support or enhance this strategy include:

- Fiber Optic Communications
- CCTV Cameras
- Bluetooth Readers
- Microwave Vehicle Detection Systems (MVDS)
- Dynamic Message Signs (DMS)
- Traffic Signal Controller Improvements

Recommended Corridors: Upgrade or Replacement

- SR 84
- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SR 823/ Flamingo Road
- SW 136 Avenue

Existing Corridors

- All Corridors

Prerequisite Strategies

- N/A

5.3 Mobility TSM&O Mitigation Strategies – Dynamic Applications

5.3.1 Dynamic Lane Use Control

Dynamic Lane Use Control makes use of overhead variable message signs that are lane specific. During an event or incident, certain lanes can be opened or closed depending on the location of an event or incident. Approaching traffic can also be slowed down in increments well in advance of an incident or directed to change lanes due to lane closures or temporary traffic pattern changes. This strategy maximizes available capacity and efficiently manages the travel demand. This application would ultimately inform travelers of an irregular occurrence in a timely manner to eliminate secondary crashes.

Recommended Corridors

- SR 84

Existing Corridors

- N/A

Prerequisite Strategies

- Active Arterial Management
- Advanced Traffic Management System
- Event Management

5.3.2 Dynamic Routing

Dynamic Routing makes use of roadside variable message signs to direct traffic around an incident on the mainline of freeways and arterials. It can also redirect motorists to less congested facilities. Traffic sensors along the highway or arterial can be used to detect prevailing traffic conditions on the mainline and on the diversion route. Dynamic routing can also be achieved using in-vehicle information systems where individual drivers can be given different re-routing instructions. The private sector would provide the in-vehicle equipment and the information content to be delivered to the driver. This may include the use of FL-511, Google maps, and WAZE.

Recommended Corridors

- SR 84
- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Active Arterial Management
- Advanced Traffic Management System
- Event Management

5.4 Mobility TSM&O Mitigation Strategies – Automated and Connected Vehicles (AV/CV)

5.4.1 Autonomous Fixed Route Transit

Autonomous Fixed Route Transit is a relatively new technology. There are several pilots around the United States. Although, the primary feature of this strategy is an automated, driver-less transit vehicle operating along a fixed route. There are several challenges involved in the development and establishment of an automated transit service, including: fare collection, security and authority onboard the large upfront costs associated with developing the necessary digital and physical infrastructure, and the limitations of the current technology.

Recommended Corridors

- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Active Arterial Management
- Advanced Traffic Management System
- Event Management

5.4.2 Connected Vehicles

A Connected Vehicle (CV) is a vehicle that uses any number of different communication technologies to communicate with the driver, other vehicles (Vehicle-to-Vehicle [V2V]), roadside infrastructure (Vehicle-to-Infrastructure [V2I]), and other devices (Vehicle-to-Everything [V2X]). Connected Vehicles produce, distribute, and receive large quantities of data in order to provide the driver more information to use while operating a motor vehicle. V2V communications occur between vehicles, meaning the public investments required to support such communications are minimal. However, V2I communications will require considerable investments from public agencies to provide the infrastructure necessary to support such communications. V2I requires roadside units (RSU) to be able to communicate to the vehicle's on-board unit (OBU).

There are two primary means of providing real-time messaging to support CV uses and goals, Dedicated Short-Range Communications (DSRC) and 5G cellular communications. Further analysis will be required to determine the appropriate means of communications when considering cost, ease of implementation, public support, and end user utilization.

Recommended Corridors

- SR 84
- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SR 823/ Flamingo Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System

5.4.3 Signal Phasing and Timing (SPaT)

Signal Phase and Timing (SPaT) is provided via dedicated short-range communications (DSRC) or cellular communications to appropriately equipped vehicles and/or applications with information relating to the approaching signal's phase and timing to next phase. Deploying this kind of technology will support safer and more efficient movements in connected vehicles.

Recommended Corridors

- SR 84
- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SR 823/ Flamingo Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System

5.5 Safety TSM&O Mitigation Strategies

5.5.1 Bicycle Alert System

Bicycle Alert Systems are innovative ITS solutions that focus on the safety of the bicyclists. Bicycle warning systems can use detectors and electronic signs to identify bicycle traffic to motorists when a cyclist is in at an upcoming intersection or roadway segment. Additional features include GIS/GPS bike route mapping, trail-roadway intersections, and shared lane signing markings. This could be a beneficial safety strategy for notifying motorists of the presence of pedestrians or bicyclists at the SR 84 arterial crossing intersections and New River Greenway crossings.

Recommended Corridors

- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SR 823/ Flamingo Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System

5.5.2 Queue Detection and Warning System

Queue detection and warning systems are used to inform travelers of the presence of downstream stop-and- go traffic based on real-time traffic detection. This system utilizes warning signs, flashing lights, or connected vehicle messaging. Drivers can anticipate an upcoming situation of emergency braking by slowing down ahead of time and avoid erratic behavior, ultimately reducing queuing-related collisions. Dynamic message signs along with flashing lights can inform motorists of queues with significant slowdowns ahead. This strategy might also be combined with the use of a variable speed limit system to reduce severe acceleration and deceleration on the approach to a bottleneck. Speed harmonization and lane control signals that provide incident management capabilities can also be combined with queue warning. The system can be automated or controlled by a traffic management center operator. Work zone management is commonly associated with queue warning systems.

This can be a beneficial strategy employed for motorists along SR 84 where queueing can be an issue at the north-south arterial cross road intersections.

Recommended Corridors

- SR 84

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Advanced Intersection Detection

5.5.3 Road Rangers and Traffic Incident Management

Road Ranger Service Patrol generally consists of trained personnel who use specially equipped vehicles to patrol congested highways searching for and responding to traffic incidents. General services provided by road rangers include pushing vehicles out of travel lanes, providing gasoline, changing flat tires, and providing minor repairs to help motorists safely drive their vehicle from the highway. The FDOT Road Ranger program also allows motorists two local phone calls if necessary. Road Ranger Service Patrol vehicles are equipped with warning lights or a variable message sign alerting traffic to move over.

Incident Management utilizes the detection devices for verification of incidents to result in the clearance and traffic management associated with incidents on freeways, expressways and arterials. This strategy uses any closed-circuit television (CCTV) cameras, traffic sensors, telecommunications and centralized command to operate the TMC. Incident management has a significant effect on the

operational efficiency of roadways. Continued adoption of this strategy will be critical to the management of both recurring and nonrecurring congestion in the region. With the onset of TSM&O initiatives promoting active arterial management and incident management on the arterials, this strategy has adopted/birthed some of the technologies and strategies that support TSM&O.

Incident management strategies have transformed the operations of state roadways over the past few decades. Incident management uses operators stationed at the TMC to identify non-recurring active traffic incidents such as vehicle crashes, disabled vehicles and severe weather using roadside detectors and camera surveillance. Upon detection of an incident, the operators are instructed to follow the developed set of Standard Operating Guidelines (SOG) to notify the appropriate first response agencies (i.e. Fire, Police, etc.). In addition, not only are the emergency first responders notified, but the traveling public is also notified via the ITS traveler information system (i.e. HAR, DMS, FL 511, etc.). The technologies and strategies currently utilized by these programs have improved incident response in FDOT District 4 TSM&O and incident clearance times.

Statewide, the average roadway clearance times on freeways have been cut almost in half since the inception of incident management. Overall, incident management has shown significant savings in terms of reducing unnecessary delay, idling, fuel consumption, automotive gas emissions and secondary crashes. Currently, incident management operations along Florida's freeways are recognized at the highest level throughout the nation.

Recommended Corridors

- SR 7/ US-441
- SR 817/ University Drive
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- SR 84

Prerequisite Strategies

- Advanced Traffic Management System
- Active Arterial Management

5.5.4 Work Zone Management

Work zone management aims to maintain safe and smooth traffic flow through work zones. The safety of construction crews and travelers must be a priority of any Work Zone Management strategy. In work zones, safety can be enhanced through separation and barriers, lighting, speed control, education, enforcement, and more. Once safety is addressed, agencies can optimize construction staging, lane closures, detours, and incident management to reduce delays to the traveling public. Work zone management can deploy temporary devices when permanent devices are not available to monitor the roadway and/or collect data to support AAM.

Recommended Corridors

- All Corridors

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Active Arterial Management

5.5.5 Wrong Way Driving Countermeasures

Wrong Way Driving Countermeasures solutions like illuminated signs on ramps to grab the attention of wrong way drivers prior to entering the mainline. Other countermeasures include using microwave vehicle detection systems to detect wrong way drivers and alert traffic management centers and highway patrol immediately. Wrong way driving is usually linked to intoxicated drivers, roadway design challenges, or lighting or signing concepts. By using this technology, this strategy could be used to protect drivers of major freeways and expressways from wrong way drivers.

This could be beneficial specifically at the SR 84 and NW 136th Avenue interchange and its recommended mitigation concept due to the complex geometry.

Recommended Corridors

- SR 84

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Active Arterial Management

5.6 Multimodal TSM&O Mitigation Strategies

5.6.1 Adaptive and Intelligent Streetlights

Adaptive and Intelligent Streetlight technology automatically adjusts the brightness of streetlights based on need, time of day, etc. This technology also includes sensors that can detect issues within the streetlight and relay that information to the local jurisdiction for maintenance or repair, instead of waiting for customers or mobile teams to identify and report the issue. These intelligent streetlights allow operators remote access to adjust the brightness and runtime of the LED bulbs based on various conditions (inclement weather, longer/shorter days, etc.). Adaptive and Intelligent Streetlight technology can improve brightness when appropriate, reduce maintenance costs, provide longer bulb life, and improve customer satisfaction.

Recommended Corridors

- All Corridors

Existing Corridors

- N/A

Prerequisite Strategies

- N/A

5.6.2 Queue Jump

Queue Jump typically utilizes the right-turn lane and is accompanied by dedicated transit signals to allow only a bus to proceed through the intersection prior to the signal phase starting. This allows the bus to effectively "jump" the queue past the other vehicles waiting for a green light. This would be a transit-specific strategy to support on-time arrivals and reduce route travel time delay.

Recommended Corridors

- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System

5.6.3 Transit Signal Priority

Transit Signal Priority (TSP) was developed to improve schedule adherence for transit agencies. TSP slightly modifies the existing timing plan at an intersection by reallocating available green time from movements with lower demand to allow qualified transit busses to pass through the intersection. TSP may extend or reduce the green time for the approach of the bus using the extra time taken from a conflicting movement. Additional sensors are installed at traffic signals that sense the presence of transit vehicles. These transit vehicles are given priority to pass through the signalized intersection. More advanced systems can also take a count of the number of people on board the transit vehicle and the current schedule status of the transit vehicle before deciding if priority should be granted. Most systems require the installation of an in-vehicle unit on the transit vehicle.

TSP may also impose a negative effect to the collective traffic signal timing when the system reallocates green movement time (seconds) from another phase. This alters the overall signal timing as the system requires multiple traffic signal timing cycles to return to normal operations.

Recommended Corridor

- SR 7/ US-441
- Davie Road
- SR 817/ University Drive
- Pine Island Road
- SW 136 Avenue

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Traffic Signal Preemption

5.6.4 Bus Rapid Transit

Bus Rapid Transit (BRT) has been defined by the FTA as a rapid mode of transportation that can provide the quality of rail transit and the flexibility of buses. This is an integrated system of facilities, equipment, services, and amenities that improves the speed, reliability, and identity of bus transit. It operates as a rubber-tired light rail transit with greater operating flexibility and potentially lower costs.

BRT operates in a variety of configurations including operating within dedicated lanes, a bi-directional lane, contra-flow lanes or a shared lane known as a Business Access Transit (BAT) lane. This may be most applicable to implementing future premium transit along University Drive and SR 7/US-441, as identified in previous planning studies. In the future it may also apply to the 595 express bus route that runs along a portion of I-595 / SR 84.

Recommended Corridors

- SR 817/ University Drive
- SR 7/ US-441
- SR 84

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Active Arterial Management
- Queue Jump and/or Transit Signal Priority

5.6.5 Transit Traveler Information

Similar to traveler information provided by DMS, Transit Traveler Information's goal is to inform the public, specifically the transit schedule and updates. Equipment on board the transit vehicle enables travelers to gain access to information regarding the current transit stop, upcoming transit stops and real-time transit schedule information. The system can also be extended to provide traveler information at bus stops and for pre-trip through the use of kiosks or web-based delivery systems. This strategy also increases the attractiveness of transit use and could influence the modal split in favor of transit within the region. There are a variety of system to support transit traveler information to collect this transit information, including Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC).

Recommended Corridors

- SR 817/ University Drive
- Davie Road
- SR 84

Existing Corridors

- N/A

Prerequisite Strategies

- Advanced Traffic Management System
- Bus Rapid Transit
- Queue Jump and/or Transit Signal Priority

6. TRANSPORTATION RESILIENCY

Changing weather patterns and climate trends are causing Southeast Florida to experience heavier precipitation events and more intense hurricanes. Sea level rise also affects coastal, riverine, and hydrologically connected areas. These stressors/hazards can result in roadway inundation and flooding. The study scope did not include looking at potential vulnerabilities and resiliency improvements. When concepts advance to the next phase of planning and design, potential exposure to stressors/hazards throughout the proposed project's design and service life should be evaluated more fully and adaptation strategies considered to reduce negative impacts to transportation infrastructure and services.

Local governments are familiar with the analysis of vulnerability to sea level rise completed by the Southeast Florida Regional Climate Compact in 2012. Please reference the following website for more information:

(https://southeastfloridaclimatecompact.org//wp-content/uploads/2014/09/vulnerability-assessment.pdf).

The SIS Resiliency Study prepared by FDOT's Systems Implementation Office provides information on a range of hazards for I-595. FDOT District Four has compiled and used data and maps from these and other completed vulnerability assessments focused on transportation infrastructure in the region and continues to compile and use data relevant to planning, designing, constructing, and operating and maintaining transportation infrastructure from additional sources as they become available. The data are largely available in GIS form for use in future project phases.

Several key data sources and tools are listed here as resources for the arterials connecting to I-595.

- The Sea Level Scenario Sketch Planning Tool, developed by the University of Florida GeoPlan Center for FDOT, can be used to help identify vulnerable/at risk transportation infrastructure in or near a study area. The tool evaluates the vulnerability of current and future transportation infrastructure relative to the 100- and 500-year FEMA flood zones and five hurricane storm surge categories as well as potential impacts of sea level rise in seven future years (every decade from 2040 - 2100). It can be accessed at http://sls.geoplan.ufl.edu. Attachment 1 shows the areas proximal to I-595 that may be impacted by storm surge. The NOAA intermediate High scenario for 2040, consistent with the Compact's unified sea level rise projections for short-term projects, does not show potentially vulnerable transportation facilities in the study area.
- Broward County leads the state on assessing water related community impacts and using county data is highly recommended due to the modeling approach used. Several maps are available, such as the 2020 Priority Planning Area Map (PPA) and Future Conditions Broward County 100-year Flood Elevation Map. (Attachments 2 and 3) PPAs along I-595 are identified toward the eastern end of the study area. The Future Conditions Broward County 100-year Flood Elevation Map represents predicted changes in surface flood elevations by integrating the anticipated rise in the groundwater table and the associated loss of regional storage during the 100-year design storm event. For a significant portion of the county, the flood elevation is higher than FEMA flood elevations and maps. For more details, please reference: https://www.broward.org/Climate/Pages/Future-Conditions-100-Year-Flood-Elevation.aspx.

7. SUMMARY OF RECOMMENDED MITIGATION MEASURES

The Arterial Connectivity Study along I-595 Corridor is being conducted to identify and define transportation problems and develop effective solutions to fulfill the goal of providing better connectivity for all modes and to provide congestion relief for travel along the north-south study roadways and their access points with I-595 and SR 84. All types of improvement strategies were considered including geometric modifications to roadways; pedestrian, bicycle, greenway, and transit infrastructure improvements; and technology and traffic signal improvements.

This report documents the work completed to develop, analyze, and evaluate mitigation concepts and the resulting recommended mitigation measures. Improvement concepts (aka mitigation measures) were developed and are recommended for each north-south arterial corridor that crosses SR 84 and I-595. A summary of the deficiencies identified from the existing conditions and future (2045) conditions analysis is provided herein. In addition, the mitigation concepts, alternatives analysis, recommended improvement concepts / mitigation measures, benefits of the improvement concepts, impacts of the proposed concepts, and estimated construction cost estimates are documented within the report.

The improvements and TSM&O strategies documented in this report are recommended for implementation. The short-term infrastructure improvements are recommended to move into design. The long-term infrastructure improvements are recommended to move to the next phase, which is a PD&E Study for most locations.

In the next and final phase of this study, project implementation information will be documented such as project phasing, timing, and funding. Potential funding mechanisms for the recommended improvements in this report will be documented in the *Arterial Connectivity Study along I-595 Corridor Master Improvement List, Technical Report 3*.

7.1 Mitigation Concepts Summary

Mitigation concepts were evaluated for each of the eight north-south study arterials, as well as the New River Greenway, to address safety, mobility, and connectivity issues. Multiple alternatives were evaluated for locations where issues and solutions were complex and there was more than one potential beneficial alternative. In addition, where possible, short-term improvements were identified at locations where the improvements are needed in the near-term and the mitigation concepts could be implemented without requiring right-of-way or a PD&E Study.

Mitigation concepts for the New River Greenway crossings at the north-south arterials include short-term and long-term improvements. Short-term and long-term crossing improvements are proposed at the following north-south arterials:

- NW/SW 136th Avenue – short-term HAWK signal, long-term underpass
- Flamingo Road – short-term HAWK signal, long-term overpass
- Hiatus Road – short-term HAWK signal, long-term overpass
- Nob Hill Road – short-term HAWK signal, long-term overpass
- Pine Island Road – short-term HAWK signal, long-term overpass

In addition to the New River Greenway crossing improvements, an extension of the New River Greenway between University Drive and Davie Road is also proposed. The greenway extension would provide a continuous pathway for greenway users along the New River Canal and shorten the connection between Davie Road and University Drive from 2.65 miles to approximately 1.6 miles. Along with the extension, an underpass is proposed for the crossing at University Drive.

Mitigation concepts for each of the north-south arterials were developed and analyzed. Major features of the mitigation measures for each of the eight north-south arterials are summarized in a list on the following page.

Table 7-1: List of North-South Arterials Mitigation Concept Features

NW/SW 136 Avenue

- Modify interchange at SR 84/I-595
- Greenway crossing underpass
- Bicycle lanes and sidewalks

Flamingo Road

- Modify interchange at SR 84/I-595
- Modify intersection at Broward Blvd.
- Greenway crossing overpass
- Bicycle lanes and sidewalks

Hiatus Road

- Modify interchange at SR 84/I-595
- Modify intersection at Broward Blvd.
- Greenway crossing overpass
- Bicycle lanes and sidewalks

Nob Hill Road

- Modify interchange at SR 84/I-595
- Greenway crossing overpass
- Bicycle lanes and sidewalks

Pine Island Road

- Modify interchange at SR 84/I-595
- Modify intersection at Nova Drive
- Modify intersection at Peters Road
- Modify intersection at SW 6th Court
- Greenway crossing overpass
- Bicycle lanes and sidewalks

University Drive

- Modify interchange at SR 84/I-595
- Add 4th NB & SB through lane capacity
  - Elevated section
  - At-grade sections
- Modify intersection at SW 30th Street
- Modify intersection at Peters Road
- Midtown Bridge reliever route
- Greenway crossing underpass
- Bicycle lanes and sidewalks

Davie Road

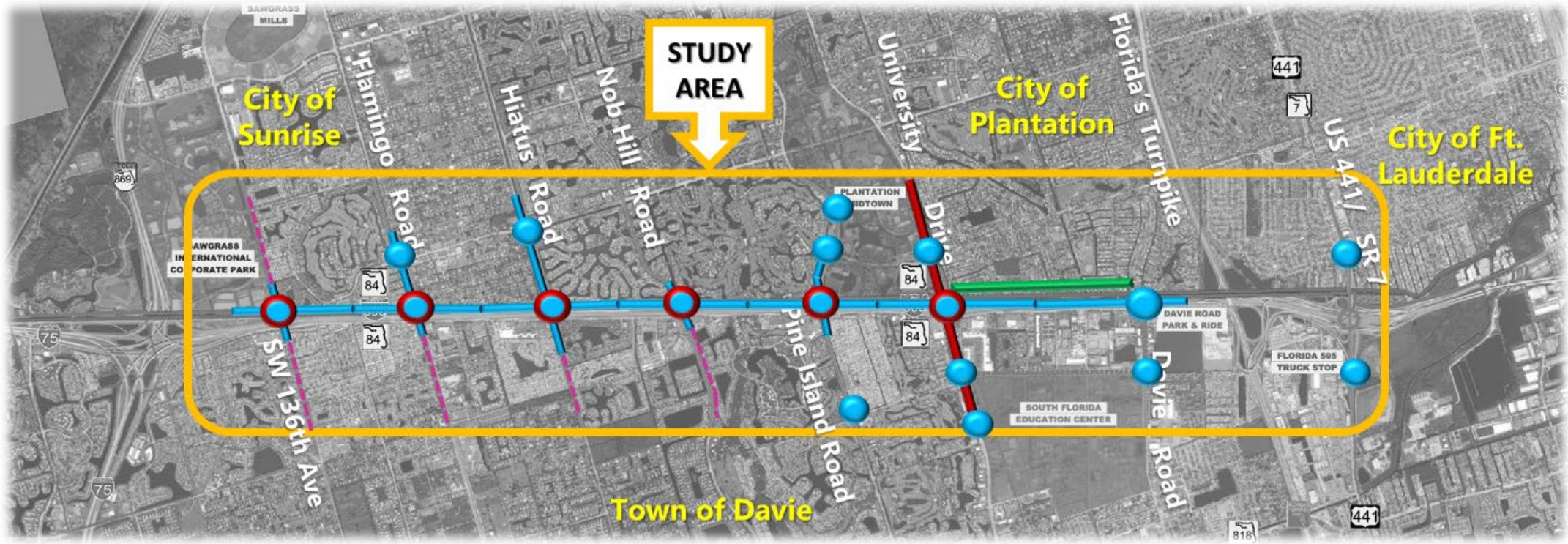
- Modify interchange at SR 84/I-595
- Modify intersection at Nova Drive
- Shared use path through SR 84 interchange

SR 7

- Modify intersection at Oakes Road
- Modify intersection at Riverland Road
- Modify SR 84 / I-595 ramp connections

The locations and types of mitigation concepts along each of the north-south arterials are shown in Figure 7-1.

Figure 7-1: Map of North-South Arterials Mitigation Concepts



7.2 Mitigation Concepts Traffic Analysis Summary

Traffic analysis was conducted to assist with evaluating alternatives for each of the north-south arterials and study intersections. The traffic analysis for evaluating alternatives involved the FDOT Intersection Control Evaluation (ICE) Stage 1 analysis process. This process was used to complete an initial assessment of potential improvement concepts for failing interchanges and intersections. The failing study intersections and interchanges that required major modifications were assessed using the ICE Stage 1 process. Seventeen of the study intersections were analyzed using the CAP-X tool and SPICE tool to evaluate alternatives. The safety, operational, and multimodal rankings for potential alternatives are documented in the Stage 1 ICE forms for each intersection.

Future Year (2045) Build traffic analysis was then conducted for each of the study intersections and arterials, to quantify the benefits of each of the mitigation concepts. Delay, LOS, queues, and travel times are reported for each of the mitigation concepts. The benefits in terms of reduced delay and reduced travel times for each north-south corridor were estimated from the Synchro analysis. A comparison was made of the 2045 Build traffic analysis results, to the 2045 No Build traffic analysis results. Table 7-2 summarizes the 2045 LOS, and delay and travel time benefits, resulting for each north-south corridor.

Table 7-2: Summary of 2045 Build Traffic Analysis Results

MOE / Performance Measures	Level of Service	Delays	North South Travel Time
Build Corridor Concept (2045 Condition)	**All intersections operate at LOS D or better?**	**% reduction in total intersection delay**	**% reduction in total travel time**
NW/SW 136th Avenue	Yes	90%	50%
Flamingo Road	Yes	55%	10%
Hiatus Road	No (E)	60%	20%
Nob Hill Road	No (E)	35%	20%
Pine Island Road	No (E/F)	55%	25%
University Drive	No (E/F)	50%	40%
Davie Road	Yes	85%	65%
SR 7 / US-441	Yes	35%	30%

7.3 Recommended Transportation System Management and Operations (TSM&O) Strategies Summary

In addition to the infrastructure improvements mitigation concepts, Transportation System Management and Operations (TSM&O) strategies were evaluated as well. These intended to enhance the efficiency of the current transportation network by implementing strategies that could be applied to address capacity and operational issues identified for the study corridors. TSM&O strategies were evaluated to address safety and mobility issues, and multimodal opportunities within the study area. Twenty-two different TSM&O strategies were evaluated, and appropriate strategies are proposed for each north-south arterial. The strategies for the corridors are listed below.

Mobility

1. Active Arterial Management
2. Adaptive Signal Control
3. Advanced Intersection Detection
4. Event Management
5. Integrated Corridor Management (ICM)
6. Advanced Traffic Management System
7. Dynamic Lane Use Control
8. Dynamic Routing
9. Autonomous Fixed Route Transit
10. Connected Vehicles
11. Signal Phase and Timing (SPaT)
12. Emergency Vehicle Preemption

Safety

13. Bicycle Alert System
14. Queue Warning System
15. Road Rangers/ Incident Management
16. Work Zone Management
17. Wrong Way Driving Countermeasures

Multimodal

18. Adaptive and Intelligent Streetlights
19. Bus Rapid Transit
20. Queue Jump
21. Transit Signal Priority
22. Transit Traveler Information