#### **TECHNICAL REPORT COVERSHEET**

#### **Draft Noise Study Report**

Florida Department of Transportation

District Four

SR 9/I-95

Limits of Project: FROM SOUTH OF SR 870/COMMERCIAL BOULEVARD TO NORTH OF CYPRESS CREEK ROAD

Broward County, Florida

Financial Management Number: 435808-1-22-02

ETDM Number: 14222

July 31, 2018

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



## **Executive Summary**

The Florida Department of Transportation (FDOT) is conducting a Project Development and Environment (PD&E) Study for improvements to SR 9/I-95 from south of SR 870/Commercial Boulevard to north of Cypress Creek Road in Broward County, FL (Milepost 14.5 to Milepost 17.0).

The objectives of this Noise Study Report (NSR) are to 1) describe the existing site conditions including noise sensitive land uses within the project study area, 2) document the methodology used to conduct the noise assessment, 3) assess the significance of traffic noise levels on noise sensitive sites for the No Build and Build Alternatives, and 4) evaluate abatement measures for those noise sensitive sites that, under the Build Alternative, approach or exceed the Noise Abatement Criteria (NAC) set forth by the FDOT and Federal Highway Administration (FHWA). Additional objectives include the evaluation of construction noise and vibration impacts and the identification of noise impact "contours" adjacent to the corridor.

The traffic noise analysis was performed following FDOT procedures that comply with Title 23 Code of Federal Regulations (CFR) Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. The evaluation uses methodology established by the FDOT and documented in the PD&E Manual, Part 2, Chapter 18 – Highway Traffic Noise (June 14, 2017). The prediction of existing and future traffic noise levels with and without the roadway improvement was performed using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.5.

Within the project study limits, 521 noise sensitive sites were evaluated, consisting of 507 residences, three recreational areas, one school playground, one outdoor dining area, two churches, two chiropractic clinics, and five hotel pools. Exterior traffic noise levels were predicted for the residential and recreational sites as well as the school playground, outdoor dining area, and hotel pools. Interior traffic noise levels were predicted for the churches and chiropractic clinics.

The results of the analysis indicate that with the proposed Build Alternative, traffic noise levels at the residences are predicted to range from 55.4 to 71.7 dB(A). Traffic noise levels at the non-residential/special-use sites are expected to range from approximately 36.9 to 72.0 dB(A). Design year traffic noise levels are predicted to approach, meet, or exceed the respective FHWA Noise Abatement Criteria (NAC) at 47 residences; at the outdoor dining area, the design year traffic noise level is expected to equal the NAC for Activity Class E sites.

Noise abatement measures were evaluated for the 47 residences and outdoor dining area predicted to be impacted by the proposed project. The results of the evaluation indicate that the construction of a noise barrier appears to be a potentially feasible and cost reasonable method of reducing traffic noise impacts for all 12 impacted receptors located on the east side of I-95 between NW 57th St to North Andrews Avenue.

The likelihood of providing the noise barrier mentioned above as a potential abatement measure varies. The FDOT is committed to the construction of the noise barriers contingent upon the following conditions:

- Final recommendations on the construction of abatement measures is determined during the project's final design and through the public involvement process;
- Detailed noise analyses during the final design process support the need, feasibility and reasonableness of providing abatement;

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- Cost analysis indicates that the cost of the noise barrier(s) will not exceed the cost reasonable criterion;
- Community input supporting types, heights, and locations of the noise barrier(s) is provided to the District Four Office; and,
- Safety and engineering aspects as related to the roadway user and the adjacent property owner have been reviewed and any conflicts or issues resolved.

Noise abatement measures were found to be feasible and cost reasonable for 12 receptors of the 47 receptors analyzed, as described above. Noise barriers were not feasible and cost reasonable for the remaining 35 impacted receptors or the 1 special land use site. This was due to the inability of the evaluated noise barriers to meet the minimum requirements for feasibility and reasonableness because of site specific geometry, conflicts with utilities, or failing to provide a 5.0 dB(A) reduction for at least two impacted receptors.



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## 1 Introduction

The Florida Department of Transportation (FDOT) District Four is conducting a Project Development and Environment (PD&E) Study for improvements to the Commercial Boulevard and Cypress Creek Road interchanges and along I-95 from South of Commercial Boulevard to north of Cypress Creek Road (Mile Posts 14.5 to 17.0), a distance of approximately two and a half miles in Broward County, Florida.

As part of this PD&E Study, a traffic noise study was conducted in accordance with Title 23 CFR 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise (July 13, 2010) and the FDOT PD&E Manual, Part 2, Chapter 18 – Highway Traffic Noise (dated June 14, 2017). The primary objectives of this noise study were to: 1) describe the existing site conditions including noise sensitive land uses within the project study area, 2) document the methodology used to conduct the noise assessment, 3) assess the significance of traffic noise levels on noise sensitive sites for the No Build and Build Alternatives, and 4) evaluate abatement measures for those noise sensitive sites that, under the Build Alternative, approach or exceed the Noise Abatement Criteria (NAC) set forth by the FDOT and Federal Highway Administration (FHWA). Other objectives of this study include consideration of construction noise and vibration impacts and the development of noise level isopleths, which can be used in the future by local municipal and county government agencies to identify compatible land uses. The methods and results of this noise analysis are summarized in this report.

### 1.1 Project Background

I-95 is one of the most important surface transportation facilities along the east coast of Florida. As part of the state's Strategic Intermodal System (SIS), it is a critical asset for moving people and goods within the 12 coastal counties, including Miami-Dade, Broward, and Palm Beach Counties.

FDOT is conducting a comprehensive systematic analysis of the I-95 interchanges in Broward and Palm Beach Counties for the first time since the initial construction of the interstate in the 1970s. Per the I-95 Interchange Master Plan, FDOT has developed preliminary design concepts to address traffic spillback onto I-95, improve traffic operations at the interchanges, reduce congestion which has reached unacceptable levels during peak hours, and to enhance overall safety at each interchange, including those at Cypress Creek Road and Commercial Boulevard. These preliminary design concepts were developed in separate Interchange Concept Development Reports (ICDR) for each interchange completed in February 2016 (Commercial Boulevard) and June 2015 (Cypress Creek Road).

The intent of the I-95 PD&E Study from south of Commercial Boulevard to north of Cypress Creek Road is to study in further detail the preliminary design concepts from the I-95 Interchange Master Plan ICDRs in addition to other alternatives. This PD&E Study will also include a No-Action alternative which assumes no proposed improvement and serves as a baseline for comparison against other alternatives.

## 1.2 Project Description

This project is proposing improvements to the Commercial Boulevard and Cypress Creek Road interchanges and along I-95 from south of Commercial Boulevard to north of Cypress Creek Road,

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a distance of approximately two and a half miles in Broward County, Florida. A project location map is depicted in **Figure 1-1**.

I-95 is the primary north-south interstate facility that links all major cities along the Atlantic Seaboard and is one of the most important transportation systems in southeast Florida. I-95 is one of the two major expressways, Florida's Turnpike being the other, that connect the major employment centers and residential areas within the South Florida tri-county area. I-95 is part of the state's SIS and the National Highway System (NHS). In addition, I-95 is designated as an evacuation route along the east coast of Florida.

I-95, within the project limits, currently has six general purpose lanes (three in each direction) and two High Occupancy Vehicle (HOV) lanes (one in each direction). This segment of I-95 is functionally classified as a Divided Urban Principal Arterial Interstate and has a posted speed limit of 65 miles per hour. The access management classification for this corridor is Class 1.2, Freeway in an existing urbanized area with limited access. There are two full interchanges within the project limits located at Commercial Boulevard and Cypress Creek Road, as well as entry ramps from N. Andrews Avenue and from Cypress Creek Park and Ride Lot to I-95 southbound.

The proposed improvements will be compatible with the proposed I-95 Express Lanes Phase 3 Project, which will introduce two tolled, express lanes in place of the existing HOV lanes from Broward Boulevard in Broward County to Linton Boulevard in Palm Beach County. Phase 3A, which extends from Broward Boulevard to south of SW 10 Street and includes the limits of the proposed interchange improvements, began construction in early 2016.





Figure 1-1 Project Location Map

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### 1.3 Purpose and Need

The primary need for this project is to increase capacity and improve traffic operations on I-95 and at the Cypress Creek Road/I-95 and Commercial Boulevard (SR 870)/I-95 interchanges. The project is also intended to improve safety within the vicinity, including access to I-95 and the arterial intersections. Secondary considerations for the purpose and need of this project include system linkage, modal interrelationships, transportation demand, social demands and economic development, and evacuation.

I-95 within the project limits currently operates at Level of Service (LOS) F. Additionally, Commercial Boulevard operates at LOS E east of I-95 and LOS F west of I-95, while Cypress Creek Road operates at LOS E on both sides of I-95. Without improvements, the driving conditions will continue to deteriorate well below acceptable LOS standards. The I-95 Express Phase 3 improvements will help maintain or slightly improve the I-95 corridor LOS by adding one travel lane in each direction in the form of an Express Lane. The improvements proposed as part of this project will complement the I-95 Express Lanes improvements.

The existing Cypress Creek Park and Ride southbound on-ramp and Commercial Boulevard southbound on-ramp provide less than 500 feet of weave distance before the acceleration lane drops and merges with the general-purpose traffic. This forces commuters to merge with the general-purpose traffic while accelerating which is an unsafe maneuver.

The proposed modifications will improve the safety of the project corridor. The buses travelling onto I-95 from the Cypress Creek Park and Ride will be provided greater distance prior to merging with I-95 southbound traffic. Additionally, the existing substandard vertical clearance of the North Andrews Avenue bridge over I-95 will be resolved with the bridge replacement.

The project is anticipated to improve emergency evacuation capabilities by enhancing connectivity and accessibility to major arterials designated on the state evacuation route. I-95, Commercial Boulevard, and Cypress Creek Road serve as part of the emergency evacuation route network designated by the Florida Division of Emergency Management and by Broward County. Commercial Boulevard and Cypress Creek Road move traffic from the east to I-95. I-95 is critical in facilitating traffic during emergency evacuation periods as it connects to other major arterials and highways of the state evacuation route network (i.e., I-595 and the Florida's Turnpike).

The Cypress Creek Road Interchange Project is included in the Broward County Metropolitan Planning Organization (MPO) Transportation Improvement Program (TIP) for Fiscal Years (FY) 2016-2020, the FDOT Work Program FY 2017-2021, the FDOT State TIP FY 2016-2020, and the FDOT SIS Five Year Plan FY 2016-2020 for PD&E Phase in FY 2016.

The Broward County MPO 2035 Long Range Transportation Plan (LRTP) included improvements to all I-95 interchanges in Broward County under Illustrative Roadway Projects. Illustrative projects are those that cannot be included in the cost feasible plan due to financial constraints but would be included in a future approved TIP.



## 2 Proposed Improvements

A recommended alternative was selected following the June 29, 2017 Alternative Public Workshop based on results from the alternative analysis process, public, local and state officials input, and coordination with FDOT. Alternative 1A-6 was selected as the recommended Build Alternative. This alternative meets the purpose and need of the project. The proposed improvements under this alternative achieve the objectives of the department to improve traffic operations and enhance overall safety within the project study area while minimizing cost and environmental and socioeconomic impacts. A full description of all build alternatives evaluated is included in the Preliminary Engineering Report prepared for this project.

The following are the proposed improvements associated with Alternative 1A-6:

#### **1-95 Mainline Improvements**

- Maintain the proposed I-95 Express Lanes Phase 3 project improvements, which will
  introduce two tolled, express lanes in place of the existing HOV lanes from Broward
  Boulevard in Broward County to Linton Boulevard in Palm Beach County.
- Provide a Collector-Distributor (CD) road system to carry a large volume of the Cypress Creek Road traffic desiring to go southbound onto I-95. The CD road system starts at the Cypress Creek Park & Ride on-ramp and merges with the existing I-95 southbound on-ramp from North Andrews Avenue. The CD road system continues southbound over Commercial Boulevard and merges with the I-95 mainline just north of Powerline Road.
- Reconstruct the North Andrews Bridge over the I-95 mainline.

#### Commercial Boulevard Interchange Improvements

#### I-95 Northbound Off-Ramp:

 Provide two additional eastbound right turn lanes to have a triple right turn movement to Commercial Boulevard east.

#### I-95 Southbound Off-Ramp:

 Provide one additional westbound right turn lane to have a dual right turn movement to Commercial Boulevard west.

#### Commercial Boulevard and Powerline Road Intersection:

- Provide one additional Powerline Road southbound left turn lane by removing one of the three thru lanes to have a triple left turn movement to Commercial Boulevard east.
- Provide one additional Commercial Boulevard westbound thru lane by removing one of the two westbound to southbound left turn lanes to have four thru westbound lanes.
- Provide one additional Commercial Boulevard eastbound thru lane east of Powerline Road.

#### Commercial Boulevard and N. Andrews Avenue Intersection:

• Provide one additional North Andrews Avenue southbound left turn lane to have dual left turn lanes to Commercial Boulevard east.



- Provide one additional Commercial Boulevard eastbound thru lane to have four eastbound thru lanes.
- Reduce existing westbound though lanes from three to two lanes.
- Provide a one lane bridge across North Andrews Avenue to accommodate Commercial Boulevard westbound traffic to the existing I-95 westbound to southbound flyover on-ramp. The proposed one lane bridge merges with the existing I-95 westbound to southbound at-grade ramp which accommodates the North Andrews Avenue southbound and northbound traffic heading to southbound I-95. This reconfigured I-95 westbound to southbound flyover on-ramp will have two lanes at the entrance and will drop to one lane after the third span of the flyover bridge. The first three spans of the flyover bridge will be reconstructed.
- Convert existing two-lane frontage road located at the northeast quadrant of the intersection to a one lane frontage road in the westbound direction. The west end of the proposed one lane frontage road turns northward before approaching North Andrews Avenue and terminates at the intersection of NE 1 Avenue and NE 51 Street.

#### **Cypress Creek Road Interchange Improvements**

#### I-95 Northbound Off-Ramps:

- Replace the existing I-95 northbound to westbound off-ramp loop at the northwest quadrant of the interchange with a bridge parallel to the existing I-95 mainline northbound bridge over Cypress Creek Road. The bridge accommodates the I-95 northbound to Cypress Creek westbound traffic to a stop condition at Cypress Creek Road. This movement will require signalization.
- Widen the northbound to eastbound off-ramp with an additional eastbound right turn lane to have a dual right turn movement to Cypress Creek Road eastbound. This movement will require signalization.

#### I-95 Northbound On-Ramp:

• Remove the Cypress Creek Road westbound free flow right on-ramp onto I-95 northbound. Provide one additional Cypress Creek Road westbound right turn lane to have a dual right turn lane I-95 on-ramp which will drop to one lane before merging with the I-95 mainline.

#### I-95 Southbound On-Ramp from N. Andrews Avenue:

• Reconstruct and widen to provide an additional lane; tie in to the proposed CD road system which starts from the Cypress Creek Park and Ride.

#### Cypress Creek Road and N. Andrews Avenue Intersection:

- Maintain existing number of lanes at the north and south legs of the intersection.
- Remove one Cypress Creek Road eastbound thru lane between NW 6 Way and North Andrews Avenue and provide one additional right turn lane to have dual right turn lanes from Cypress Creek Road eastbound to North Andrews Avenue southbound.

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#### N. Andrews Avenue and N. Andrews Way Intersection:

Maintain existing number of lanes at all legs of the intersection.

#### Cypress Creek Road and NE 7 Avenue Intersection:

• Provide one additional left turn lane to have dual left turn lanes from Cypress Creek Road eastbound to NE 7 Avenue northbound.

## 3 Land Use

The existing land uses within the project area were determined through the interpretation and review of the 2008 South Florida Water Management District (SFWMD) Florida Land Use and Cover Geographical Information Systems (GIS) layer.

The primary land use within the project area is Roads, Highways and Railroads, with sizeable areas of single-family residential land use and commercial services, and smaller areas of retail sales, mobile home and multiple dwelling units, and institutional land uses. Adjacent to the east side of the project corridor, the majority of land uses are residential. The majority of the west side of the study area is comprised of commercial services and other light industrial uses. Smaller areas of wetlands, reservoirs and mixed wetland hardwoods are also present at the north end of the corridor. Existing Land Use is depicted in **Figure 3-1**.



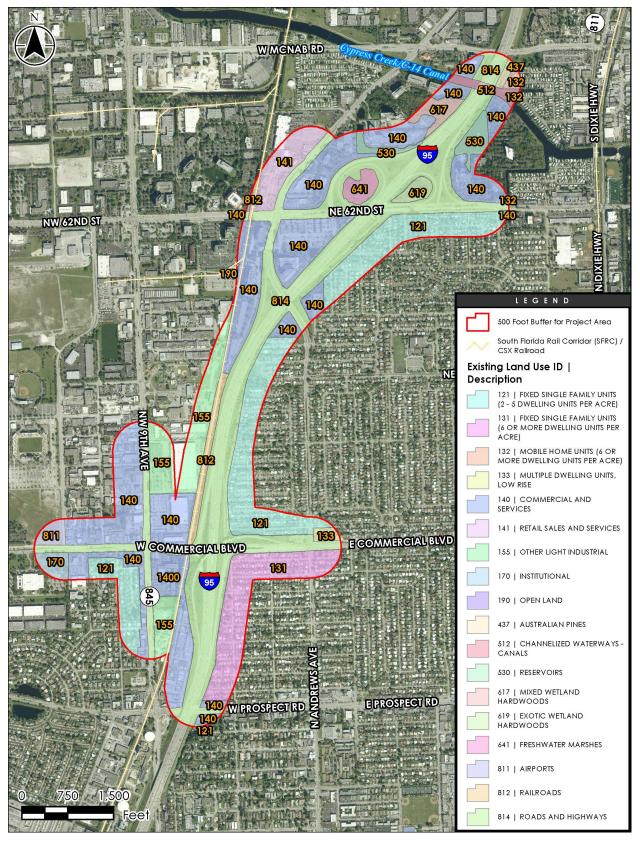


Figure 3-1 Existing Land Use



## **4 Traffic Noise Analysis**

Prior to conducting a detailed noise analysis, a desk-top review of the project was performed to determine if noise levels will likely increase as a result of the proposed improvements, if noise sensitive receptor sites are located within the project area, or if noise impacts are likely to occur. The desk-top review indicated that the proposed improvements associated with the project may cause design year (2040) traffic noise levels to approach or exceed the FHWA NAC at noise sensitive sites within the project limits. Therefore, in accordance with Part 2, Chapter 18 – Highway Traffic Noise of the FDOT PD&E Manual, a more detailed noise analysis was performed. The methods and results of this traffic noise analysis are summarized within this section and involved the following procedures:

- Identification of noise sensitive receptor sites;
- Field measurement of noise levels and noise model validation;
- Prediction of existing and future noise levels;
- Assessment of traffic noise impacts; and,
- Evaluation of the feasibility and reasonableness of noise abatement.

The recommended build alternative (herein referred to as the *Build Alternative*) is Alternative 1A-6.

The FHWA Traffic Noise Model (TNM) Version 2.5 (February 2004) was used to predict traffic noise levels and to analyze the effectiveness of noise barriers. This model estimates the acoustic intensity at a noise sensitive site (the receptor) from a series of roadway segments (the source). Model-predicted noise levels are influenced by several factors, such as vehicle speed and distribution of vehicle types. Noise levels are also affected by characteristics of the source-to-receptor site path, including the effects of intervening barriers, obstructions (houses, trees, etc.), ground surface type (hard or soft) and topography. Elevation data for the existing travel lanes and the limited-access right of way lines were obtained from existing roadway plans where available.

Noise levels presented in this report represent the hourly equivalent sound level [Leq(h)]. The Leq(h) is the steady-state sound level, which contains the same amount of acoustic energy as the actual time-varying sound level over a one-hour period. The Leq(h) is measured in A-weighted decibels [abbreviated as dB(A)], which closely approximate the range of frequencies a human ear can hear.

## 4.1 Noise Sensitive Receptor Sites

The FHWA has established NAC for seven land use activity categories. These criteria determine when an impact occurs and when consideration of noise abatement is required. Maximum noise level thresholds have been established for five of these activity categories. These maximum thresholds, or criteria levels, represent acceptable traffic noise level conditions. The July 2010 NAC levels are presented in **Table 4-1**. Noise abatement measures must be considered when predicted noise levels approach or exceed the NAC levels or when a substantial noise increase occurs. The FDOT defines "approach" as within one dB(A) of the FHWA criteria. A substantial noise increase is defined as when the existing noise level is predicted to be exceeded by 15 dB(A) or more as a result of the transportation improvement project.



## Table 4-1 Noise Abatement Criteria

[Hourly A-Weighted Sound Level-Decibels (dB(A))

Activity Category	Acti Leq( FHWA	•	Evaluation Location	Description of Activity Category
А	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B <sup>2</sup>	67	66	Exterior	Residential
C <sup>2</sup>	67	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E <sup>2</sup>	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	-	-	Undeveloped lands that are not permitted.

(Based on Table 1 of 23 CFR Part 772)

Note: FDOT defines that a substantial noise increase occurs when the existing noise level is predicted to be exceeded by 15 decibels or more as a result of the transportation improvement project. When this occurs, the requirement for abatement consideration will be followed.

The developed lands along the project corridor were evaluated to identify the noise sensitive receptor sites that may be impacted by traffic noise associated with the proposed improvements. Noise sensitive receptor sites represent any property where frequent exterior human use occurs and where a lowered noise level would be of benefit. This includes residential units (FHWA Noise Abatement Activity Category B), other noise sensitive areas including parks, playgrounds, medical facilities, schools, and places of worship (Category C) and certain commercial properties (Category E). Noise sensitive sites also include interior use areas where no exterior activities occur for facilities such as auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, recording studios and schools (Category D).

#### 4.1.1 I-95 - SOUTHERN PROJECT TERMINUS TO SR 870/COMMERCIAL BOULEVARD

Noise sensitive sites along the segment of the I-95 project corridor from the southern project terminus to SR 870/Commercial Boulevard are depicted on **Sheet 1** in **Appendix B**. Noise sensitive sites are found primarily along the east side of this project segment. These noise sensitive sites include approximately 104 nearby residences; most of which are single-family homes, although several 2 to 4-unit multi-family residences are also found nearby. Noise sensitive areas at these residences primarily include yards and patios. Bethany Pentecostal Church (Model Receptor E2),

<sup>&</sup>lt;sup>1</sup> The Leq(h) Activity Criteria values are for impact determination only, and are not a design standard for noise abatement measures.

<sup>&</sup>lt;sup>2</sup> Includes undeveloped lands permitted for this activity category.

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located at 4052 NW 9 Avenue (Powerline Road), is found east of I-95 near the southern project terminus. Also, the City of Oakland Park's North Andrews Garden Volunteer Park (Model Receptor E22) is located east of this segment at 518 NW 48 Court. The noise sensitive area at the church is the sanctuary interior and the noise sensitive area at the park is a walking path. This segment of the project also includes retail stores, office buildings, warehouses, industrial/light industrial enterprises and institutional uses that are not considered noise sensitive (i.e., Activity Category F).

Two noise barriers are located along this segment of I-95. Both are found along the east side of I-95. These noise barriers are as follows:

- 86070-3506 (I-95 C) Shoulder of northbound lanes, NW 41 Street to NW 48 Court (Station 867+60 to 901+60), 3,997 feet long, 8 feet tall.
- 86070-3506 (I-95 D) Eastern limited-access right of way line, NW 48 Street to SR 870/Commercial Boulevard (Station 901+40 to 905+80), 443 feet long, 21feet tall.

#### 4.1.2 I-95 - SR 870/COMMERCIAL BOULEVARD TO N. ANDREWS AVENUE

Noise sensitive sites along the segment of the I-95 project corridor between SR 870/Commercial Boulevard and N. Andrews Avenue are depicted on **Sheet 2** in **Appendix B**. Noise sensitive sites are found only along the east side of this project segment. These noise sensitive sites include approximately 83 residences, all of which are single-family homes. Noise sensitive areas at these residences primarily include yards and patios. The City of Oakland Park's North Andrews Gardens Neighborhood Park (Model Receptors E35 and E36) is located east of the corridor at 300 NW 56 Street. The Iglesia Aposento Alto Church (Model Receptor E37) is located at 301 NW 56 Street, just south of N. Andrews Avenue. Two noise sensitive areas were evaluated at the park, a playground and a pavilion. The noise sensitive area at the church is the sanctuary interior. This segment of the project also includes office buildings, warehouses and industrial/light industrial enterprises that are not considered noise sensitive (i.e., Activity Category F).

One noise barrier is located along the east side of this segment of I-95, as follows:

• 86070-3506 (I-95 3A) – Eastern limited-access right of way line, NW 57 Street to NW 51 Street (Station 910+10 to 944+10), 3,313 feet long, 17 to 20 feet tall.

#### 4.1.3 I-95 – N. ANDREWS AVENUE TO CYPRESS CREEK ROAD

Noise sensitive sites along the segment of the I-95 project corridor between N. Andrews Avenue and Cypress Creek Road are depicted on **Sheets 2 and 3** in **Appendix B**. Noise sensitive sites are found only along the east side of this project segment. These noise sensitive sites include approximately 31 residences; most of which are single-family homes, although several multi-family residences are also found nearby. Noise sensitive areas at these residences primarily include yards and patios. This segment of the project also includes office buildings, warehouses and industrial/light industrial enterprises that are not considered noise sensitive (i.e., Activity Category F).

Two noise barriers are located along this segment of I-95. Both are found along the east side of I-95. These noise barriers are as follows:

 86070-3506 (I-95 3A) – Eastern limited-access right of way line, NE 59 Street to East Cypress Creek Road (I-95 Station 956+90 to I-95 Station 972+87/Cypress Creek Station 233+45), 1,597 feet long, 13 to 19 feet tall.

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In addition, a new noise barrier is under construction at the southern end of the existing noise barrier. This new noise barrier, being built under the I-95 Express project (FM 433180-5-52-01) between Station 954+00 and 957+20, will be 16 feet tall and will extend approximately 317 feet to the south from the existing noise barrier.

#### 4.1.4 I-95 - CYPRESS CREEK ROAD TO NORTHERN PROJECT TERMINUS

There are no residential noise sensitive sites found along this segment of I-95. One non-residential noise sensitive site, the pool at the Westin Hotel (Model Receptor E57) located at 400 Corporate Drive, is found east of this segment and just north of East Cypress Creek Road. This site is shown on **Sheet 3** in **Appendix B**. This segment of the project also includes office buildings, warehouses, industrial/light industrial enterprises and institutional uses that are not considered noise sensitive (i.e., Activity Category F).

#### 4.1.5 SR 870/COMMERCIAL BOULEVARD

Noise sensitive sites along SR 870/Commercial Boulevard within the project limits are depicted on **Sheets 4 and 5** in **Appendix B**. These noise sensitive sites include approximately 195 residences, all of which are single-family homes. Approximately 187 of the residences are found adjacent to the corridor east of I-95 and an additional eight residences are found behind a row of commercial properties south of the corridor west of I-95. Noise sensitive areas at these residences primarily include yards and patios. Non-residential noise sensitive sites include two chiropractic clinics (Model Receptors CN7 and CN10) and a preschool (Model Receptor CN9) found along the north side of this corridor east of I-95. Noise sensitive areas at the chiropractic clinics are the building interiors and the playground at the preschool. This corridor also includes commercial use, office buildings and institutional uses that are not considered noise sensitive (i.e., Activity Category F).

#### 4.1.6 CYPRESS CREEK ROAD

Noise sensitive sites along Cypress Creek Road within the project limits are depicted on **Sheets 3** and 6 in **Appendix B**. The residential noise sensitive sites along this corridor are all found east of I-95 and include 49 single-family homes on the south side of the road and 21 mobile homes to the north. Noise sensitive areas at these residences primarily include yards and patios. Non-residential noise sensitive sites found along this corridor include pools at the Hampton Inn (Model Receptor CCS11) and the Sheraton Suites (Model Receptor CCN5) and an outdoor seating area at the Moonlight Diner (Model Receptor CCN6) near N. Andrews Avenue. This corridor also includes commercial use, office buildings and institutional uses that are not considered noise sensitive (i.e., Activity Category F).

#### 4.1.7 POWERLINE ROAD

Noise sensitive sites along Powerline Road within the project limits are depicted on **Sheet 4** in **Appendix B**. The residential noise sensitive sites along this corridor are all found west of Powerline Road and include 24 single-family homes located behind a row of commercial buildings. Non-residential noise sensitive sites found along this corridor include pools at the Red Roof Inn (Model Receptor PE1) and the Universal Palms Hotel and Conference Center (Model Receptor PE2). This corridor also includes commercial use, office buildings and institutional uses that are not considered noise sensitive (i.e., Activity Category F).



### 4.2 Field Measurement of Noise Levels and Model Validation

Measurements of sample existing noise levels along the project corridor were performed using procedures defined in the FHWA report Measurement of Highway-Related Noise (FHWA-PD-96-046). Field measurements of existing noise levels were conducted on May 30, 2018 at four locations within the project study area. The locations of the field measurement sites are depicted on the figures found in **Appendix B** and described in **Table 4-2**.

	Table 4-2 Field Measurement Data													
Field Receptor	Location	Sample Run	Time/ Date	Measured 10-Minute Traffic Volume (Auto/MT/HT/B/Mcy)	Distance From Roadway (Feet)	Measured Traffic Noise Level [dB(A)]	Modeled Traffic Noise Level [dB(A)]	Difference (Measured - Modeled) [dB(A)]						
	Single-family homes	Α	10:15AM 05-30-17	EB: 161/8/0/0/1 WB: 157/6/0/0/1	85	62.1	62.7	-0.6						
	along the south side of Cypress Creek Road at NE 6 Avenue. Near Cypress Creek Road				190	61.4	58.9	2.5						
FR-1		В	10:30 AM 05-30-17	EB: 172/8/3/1/1 WB: 168/9/2/1/1	85	60.9	63.6	-2.7						
					190 85	62.1 62.8	60.5 63.4	1.6 -0.6						
	Station 246+00.	С	10:45 AM 05-30-17	EB: 180/16/0/0/1 WB: 172/6/4/0/1	190	62.2	60.0	2.2						
					175	58.6	61.0	-2.4						
	Single-family homes along the east side of I-95 at the intersection of NE 59 Court and NE 1 Avenue. Near I-95	Α	11:35AM 05-30-17	NB: 904/50/60/0/2 SB: 875/44/75/1/0	250	58.7	60.8	-2.4						
					175	59.5	61.1	-1.6						
FR-2		В	11:51 AM 05-30-17	NB: 903/60/67/3/1 SB: 865/53/63/3/2	250	59.2	61.2	-2.0						
			10.05014	ND. 051/52/71/2/0	175	60.9	61.2	-0.3						
	Station 958+60.	С	12:05PM 05-30-17	NB: 951/53/71/3/0 SB: 920/61/66/2/2	250	60.6	61.4	-0.8						
			2:20PM	NB: 1040/60/53/1/0	145	59.6	60.8	-1.2						
	Single-family homes along the east side	Α	05-30-17	SB: 980/56/66/3/0	230	58.1	58.6	-0.5						
	of I-95 at the		2:35PM	NB: 1000/63/47/3/1	145	59.2	60.9	-1.7						
FR-3	intersection of NE 55 Street and NE 5	В	05-30-17	SB: 1080/51/57/3/0	230	57.7	58.7	-1.0						
	Avenue. Near I-95	_	2:50PM	NB: 1030/50/47/0/1	145	59.9	60.3	-0.4						
	Station 933+40.	С	05-30-17	SB: 1010/48/68/3/0	230	58.7	58.1	0.6						
	Single-family homes	٨	3:46PM	EB: 192/5/1/1/0	90	63.8	64.2	-0.4						
	along the north side of Commercial	Α	05-30-17	WB: 434/9/1/1/1 Ramp: 160/7/1/0/0	70	64.6	64.3	0.3						
<b>FD</b> 4	Boulevard between		4:00PM	EB: 265/3/2/2/0	90	64.2	64.2	0.0						
FR-4	I-95 and N. Andrews Avenue. Near	В	05-30-17	WB: 397/7/0/0/2 Ramp: 160/3/0/0/1	70	64.6	64.3	0.3						
	Commercial Boulevard Station	С	4:15PM	EB: 278/6/1/0/3 WB: 422/5/2/2/0	90	63.8	64.3	-0.5						
	47+40 and 48+40.		05-30-17	Ramp: 187/4/0/0/0	70	64.6	64.2	0.4						

Notes: MT = Medium Trucks, HT = Heavy Trucks, B = Bus, Mcy = Motorcycles, NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

Three (3) repetitions of ten-minute readings were measured at each site to ensure reasonable results. Where possible, readings were taken at the first and second rows in residential communities. Unusual noises at the monitoring sites were documented to facilitate identification of any atypical noise sources along the alignment. Rion Model NL-21 Type-II integrating sound level meters were used to collect noise level data. Foam wind screens and adjustable tripods were also used. The sound level meters were calibrated to 94 dB at 1000 Hertz using a Rion Model NC-73 acoustical calibrator.

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Traffic data were collected by the project team during each measurement period. Traffic speeds were measured using C.M.I., Inc. - Type JF100 radar speed measuring equipment. Traffic volumes, speed data and noise levels were collected during 12 ten-minute sampling periods. The ambient temperature during the measurement periods was approximately 87 to 92 degrees Fahrenheit, and the wind generally from the east/southeast; and the average wind speed generally remained less than approximately 5 miles per hour (MPH) throughout the measurement periods. The relative humidity was approximately 55 to 60 percent and the cloud cover varied between 10 to 50 percent throughout the measurement periods. All roadway surfaces remained clean and dry during the measurements. The data collected were then used as inputs to the TNM. The dates, times, traffic data and the measured and TNM-predicted noise levels are presented in **Table 4-2**.

#### 4.2.1 FIELD MEASUREMENT SITES

#### 4.2.1.1 Site FR-1

This measurement site is located along the south side of Cypress Creek Road at NE 6 Avenue (See **Sheet 6** in **Appendix B**). This site is representative of noise sensitive single-family homes located south of Cypress Creek Road between I-95 and the eastern project terminus. Traffic noise levels at this site were measured approximately 85 and 190 feet from the near edge of the outside eastbound Cypress Creek Road travel lane in order to be representative of nearby first and second row residences. Noise level readings were taken between 10:15 and 10:55 AM. Existing traffic noise levels were found to range from 60.9 to 62.8 dB(A) at the near location and 61.4 to 62.2 dB(A) at the far location.

#### 4.2.1.2 Site FR-2

This measurement site is located along the east side of I-95, at the intersection of NE 59 Court and NE 1 Avenue (See **Sheet 2** in **Appendix B**). This site is representative of noise sensitive single-family homes located east of the corridor between N. Andrews Avenue and Cypress Creek Road. Traffic noise levels at this site were measured approximately 175 and 250 feet from the near edge of the outside northbound I-95 travel lane in order to be representative of nearby first and second row residences. Noise level readings were taken between 11:35 AM and 12:15 PM. Existing traffic noise levels were found to range from 58.6 to 60.9 dB(A) at the near location and 58.7 to 60.6 dB(A) at the far location.

#### 4.2.1.3 Site FR-3

This measurement site is located along the east side of I-95, at the intersection of NE 55 Street and NE 5 Avenue (See **Sheet 2** in **Appendix B**). This site is representative of noise sensitive single-family homes located east of the corridor between SR 870/Commercial Boulevard and N. Andrews Avenue. Traffic noise levels at this site were measured approximately 145 to 230 feet from the near edge of the outside northbound I-95 travel lane in order to be representative of nearby first and second row residences. Noise level readings were taken between 2:20 PM and 3:00 PM. Existing traffic noise levels were found to range from 59.2 to 59.9 dB(A) at the near location and 57.7 to 58.7 dB(A) at the far location.

#### 4.2.1.4 Site FR-4

This measurement site is located along the north side of SR 870/Commercial Boulevard, east of I-95, adjacent to the westbound SR 870/Commercial Boulevard flyover ramp onto southbound I-95 (See **Sheet 5** in **Appendix B**). This site is representative of noise sensitive single-family homes located north of the SR 870/Commercial Boulevard corridor between I-95 and N. Andrews

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Avenue. Traffic noise levels at this site were measured approximately 70 and 90 feet from the near edge of the flyover in order to be representative of the nearby residences. Noise level readings were taken between 3:46 and 4:25 PM. Existing traffic noise levels were found to range from 63.8 to 64.6 dB(A).

#### 4.2.1.5 Field Measurement Summary

Existing noise levels were measured at four sites along the project corridor during 12 ten-minute long sampling periods. Traffic noise levels were found to range from 57.7 to 60.9 dB(A) at the two sites along I-95 (FR-2 and FR-3) and from 60.9 to 64.6 dB(A) at the two sites along the arterial roadways (FR-1 along Cypress Creek Road and FR-4 along SR 870/Commercial Boulevard). In all cases, traffic noise from either I-95 or the arterial roadways was the predominant source of noise at the nearby noise sensitive sites.

#### 4.2.2 COMPUTER NOISE MODEL VALIDATION

Site conditions and traffic data gathered during the field measurements were used to develop inputs to the FHWA's TNM 2.5 for computer models representative of the existing conditions. Additional geometric information necessary for these models was developed from aerial photographs and/or MicroStation files of the existing conditions in the project study area. The TNM results were then compared to the noise level data collected for each field measurement sample. The results of this analysis are shown in **Table 4-2**. The model inputs for the field conditions are deemed to be within an acceptable level of accuracy if the predicted noise levels are within ±3.0 dB(A) of the measured noise levels. These model inputs are then used as a basis for additional model runs used to predict existing and future noise levels at representative nearby noise sensitive locations. The difference for each of the field measurements falls within the ±3.0 dB(A) verification limit in accordance with Chapter 18 of the FDOT PD&E Manual. Thus, further use of the TNM model on this project is supported.

## 4.3 Noise Model Development

After verification of the prediction methodology, computer models were developed for the existing year (2015) conditions, and the design year (2040) No-Build Alternative and recommended Build Alternative. The TNM models for all alternatives were developed using geometric information from the project master plans. Traffic data used in the TNM models were derived from data provided in the Design Year (2040) and Opening Year (2020) Traffic Volume Development Methodology memo to Cesar Martinez at FDOT District 4 (dated September 7, 2016) and from data contained in the 2012 FDOT Quality/Level of Service Handbook Tables. These data may be found in **Appendix C**. According to Chapter 18 of the PD&E Manual, "Maximum peak-hourly traffic representing Level of Service (LOS) "C", or demand LOS of "A", "B", or "C" will be used (unless analysis shows that other conditions create a "worst-case" level)". In cases where traffic volumes on project roadways were predicted to operate at worse than LOS C, the LOS C project data were used. In overcapacity situations, this represents the highest traffic volume traveling at the highest average speed, which typically generates the highest noise levels at a given site during a normal day.

Representative receptor sites were used in the TNM model inputs to estimate noise levels associated with existing and future conditions within the project study area. These sites were chosen based on noise sensitivity, roadway proximity, anticipated impacts from the proposed project, and homogeneity (i.e., the site is representative of other nearby sites). For single-family

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homes, traffic noise levels were predicted at the edge of the dwelling unit closest to the nearest primary roadway. For other noise sensitive sites that may be impacted, traffic noise levels were predicted where the exterior activity occurs. For the prediction of interior noise levels, receptor sites were placed ten feet inside the building at the edge closest to roadway. Building noise reduction factors identified in *Figure 18-3* of Chapter 18 of the PD&E Manual and window conditions were used to estimate the noise reduction due to the physical structure. All receptor sites were modeled five feet above the local ground elevation. One-hundred thirteen model receptors representative of approximately 507 residential noise sensitive sites and the 14 non-residential noise sensitive sites described in **Section 4.1** of this report were input into the TNM model. These locations are shown in the figures in **Appendix B** and are described in **Table 4-3**.

#### 4.4 Predicted Traffic Noise Levels

The TNM results for the worst-case traffic conditions for the existing (2015) conditions and the Design Year (2040) No Build Alternative and the Build Alternative are summarized in the following sections. Predicted noise levels for individual model receptors are presented in **Table 4-3**.

#### 4.4.1 I-95

Existing traffic noise levels at the residences along I-95 are predicted by TNM to range from 57.3 to 71.3 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 58.4 to 72.5 dB(A) and to be no more than 2.0 dB(A) greater than existing levels at these residences. Design year worst-case traffic noise levels at the residences are predicted to range from 58.4 to 71.7 dB(A) with the recommended Build Alternative. These predicted levels are no more than 2.3 dB(A) greater than the existing levels and 1.1 dB(A) greater than those of the No-Build Alternative. Existing traffic noise levels at the non-residential noise sensitive sites along I-95 are predicted to range from 36.0 to 67.7 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 37.0 to 69.2 dB(A), no more than 1.5 dB(A) greater than existing levels at these sites. Design year worst-case traffic noise levels with the recommended Build Alternative are predicted to range from 36.9 to 69.1 dB(A); no more than 1.4 dB(A) greater than the existing levels and 0.1 dB(A) greater than those of the No-Build Alternative

#### 4.4.2 SR 870/COMMERCIAL BOULEVARD

Existing traffic noise levels at residences along SR 870/Commercial Boulevard are predicted by TNM to range from 54.8 to 68.9 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 55.5 to 69.6 dB(A) and to be no more than 1.1 dB(A) greater than existing levels at these residences. Design year worst-case traffic noise levels at the residences are predicted to range from 55.4 to 68.6 dB(A) with the recommended Build Alternative. These predicted levels are no more than 1.3 dB(A) greater than the existing levels and 0.2 dB(A) greater than those of the No-Build Alternative. Existing traffic noise levels at the non-residential noise sensitive sites along SR 870/Commercial Boulevard are predicted to range from 44.0 to 56.2 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 44.7 to 57.0 dB(A), no more than 0.8 dB(A) greater than existing levels at these sites. Design year worst-case traffic noise levels with the recommended Build Alternative are predicted to range from 42.6 to 55.9 dB(A); up to 1.4 dB(A) lower than the existing levels and up to 2.1 dB(A) lower than those of the No-Build Alternative.



		Modeled		Table 4-3 .ocations and Nois	se Analysis Results					
Representative Model Receptor	Location	Туре	Description (Noise Abatement Activity Category)	FDOT Noise Abatement Approach Criteria [dB(A)]	Location (Station)	Number Of Noise Sensitive Sites	Distance To Nearest Traffic Lane* [Existing/No- Build/Build]		d Traffic Nois Aeq1h, dB(A Design (204	)] 1 Year 40)
		(Feet)		No-Build	Build					
				1-95						
		Southe	ern Project Terminu	s to SR 870/Comme East Side	ercial Boulevard					
E1	NW 40 Street	SFH	В	66	859+00	4	450/420/420	65.9	65.3	65.3
E2	Bethany Pentecostal Church 4052 NW 9 Avenue	Place of Worship	D			SLU	70/50/50	48.1	48.8	48.7
E3	NW 8 Terrace	SFH	В	66	863+40	6	240/225/225	61.2	62.1	62.1
E4	NW 8 Terrace	SFH	В	66	865+80	4	150/135/135	66.4	65.6	65.6
E5	NW 8 Terrace	SFH	В	66	864+20	6	360/345/345	60.7	61.9	61.9
E6	NW 8 Terrace	SFH	В	66	866+20	4	285/270/270	61.1	62.2	62.2
E7	NW 42 Street	SFH/MFH	В	66	872+60	9	120/80/80	62.6	63.4	63.5
E8	NW 42 Street	SFH/MFH	В	66	873+00	9	330/290/290	60.7	62.0	62.1
E9	NW 43 Court	SFH/MFH	В	66	876+00	9	140/105/105	63.1	64.2	63.9
E10	NW 43 Court	SFH/MFH	В	66	876+40	4	295/260/260	60.5	62.3	62.2
E11	NW 45 Street	SFH	В	66	883+60	2	155/105/105	64.3	65.0	64.9
E12	NW 45 Street	SFH	В	66	883+80	2	260/210/210	58.9	60.7	60.8
E13	NW 45 Court	SFH	В	66	887+00	4	120/70/70	63.9	63.7	63.8
E14	NW 45 Court	SFH	В	66	887+40	4	245/195/195	61.6	63.0	63.1
E15	NW 46 Street	SFH	В	66	890+00	3	100/65/65	63.8	64.1	64.2
E16	NW 46 Street	SFH	В	66	890+00	6	195/160/160	61.1	62.5	62.6
E17	NW 47 Street	SFH	В	66	896+20	6	75/75/75	63.7	65.7	65.7
E18	NW 47 Street	SFH	В	66	896+20	7	200/200/200	59.9	61.8	61.9
E19	NW 48 Street	SFH	В	66	901+00	3	70/70/70	63.4	64.1	64.6
E20	NW 48 Street	SFH	В	66	901+60	2	175/175/175	61.6	62.2	62.2
E21	NW 48 Street	SFH	В	66	901+80	4	250/250/250	61.1	61.7	61.7
E22	N. Andrews Garden Volunteer Park NW 48 Court	Park	С	66	903+00	SLU	95/80/80	59.7	60.4	60.5
E23	NW 48 Court	SFH	В	66	904+20	2	130/120/105	60.9	61.4	61.6
E24	NW 48 Court	SFH	В	66	904+40	4	180/175/160	57.9	59.8	60.0
		SR 8	370/Commercial B	oulevard to N. Andr East Side	rews Avenue					
E25	NW 51 Court	SFH	В	66	913+80	5	75/75/75	60.3	60.5	60.5
E26	NW 51 Court	SFH	В	66	914+00	8	160/160/160	61.3	61.7	61.7
E27	NW 52 Court	SFH	В	66	920+60	7	150/150/150	62.5	63.8	63.8
E28	NW 52 Court	SFH	В	66	920+80	8	280/280/280	57.3	58.4	58.5
E29	NW 54 Street	SFH	В	66	926+40	7	200/180/180	62.0	63.1	63.1
E30	NW 54 Street	SFH	В	66	926+60	8	350/330/330	57.8	58.8	58.8
E31	NW 54 Court	SFH	В	66	932+00	5	180/165/165	62.2	63.3	63.2
E32	NW 54 Court	SFH	В	66	932+20	6	310/295/295	57.4	58.4	58.4
E33	NW 55 Street	SFH	В	66	934+60	2	125/110/110	61.8	62.9	62.9



				Table 4-3						
Representative Model Receptor	Location	Type	Description (Noise Abatement Activity Category)	FDOT Noise Abatement Approach Criteria [dB(A)]	oise Analysis Results  Location (Station)	Number Of Noise Sensitive Sites	Distance To Nearest Traffic Lane* [Existing/No-Build/Build]		d Traffic Nois Aeq1h, dB(A Desigr (20 No-Build	.)] n Year
E34	NW 55 Street	SFH	В	66	935+00	3	(Feet) 280/265/265	60.1	61.1	61.0
E35	North Andrews Neighborhood Park 300 NW 56 Street	Park Playground	С	66	936+40	SLU	215/200/200	61.8	62.9	62.8
E36	North Andrews Neighborhood Park 300 NW 56 Street	Park Pavilion	С	66	937+20	SLU	120/105/105	62.9	64.0	64.0
E37	Iglesia Aposento Alto Church 301 NW 56 Street	Place of Worship	D	51	938+20	SLU	285/260/260	36.0	37.0	36.9
E38	NW 56 Court	MFH	В	66	940+80	4	110/95/95	62.8	63.9	63.9
E39	NW 56 Court	MFH	В	66	941+20	8	210/195/195	59.1	60.2	60.2
E40	NW 57 Street	MFH	В	66	943+60	4	70/55/55	68.8	70.7	70.4
E41	NW 57 Street	MFH	В	66	944+60	4	190/175/175	71.3	72.5	71.7
E42	NW 57 Street	MFH	В	66	945+00	4	295/280/280	66.4	67.7	66.1
			N. Andrews Aver	ue to Cypress Cr	eek Road					
				East Side						
E43	NE 1 Avenue	SFH	В	66	957+40	2	100/100/100	60.9	62.4	62.5
E44	NE 1 Avenue	SFH	В	66	956+60	2	200/200/200	63.7	65.6	65.5
E45	NE 1 Avenue	SFH	В	66	959+00	3	140/140/140	61.9	63.3	63.3
E46	NE 1 Avenue	SFH	В	66	958+00	4	230/230/230	62.5	64.1	64.1
E47	NE 59 Court	SFH	В	66	961+40	2	110/105/105	61.1	62.5	62.7
E48	NE 59 Court	SFH	В	66	962+20	2	190/185/185	59.5	60.8	60.8
E49	NE 60 Street	SFH	В	66	962+40	1	100/95/95	60.8	62.5	62.6
E50	NE 60 Street	SFH	В	66	963+00	2	160/155/155	61.2	62.5	62.8
E51	NE 2 Avenue	SFH	В	66	965+60	2	125/110/110	60.8	62.0	63.0
E52	NE 2 Terrace	SFH	В	66	966+80	2	80/65/65	58.5	59.6	60.2
E53	NE 2 Terrace	SFH	В	66	966+60	4	165/180/180	60.7	61.9	63.0
E54	NE 2 Terrace	SFH	В	66	969+20	1	80/65/65	61.0	61.9	63.0
E55	NW 3 Avenue	SFH	В	66	970+00	2	105/85/85	61.5	62.5	63.4
E56	NW 3 Avenue	SFH	В	66	969+40		165/150/150	64.0	64.6	
E36	NW 3 Avenue		_			2	163/130/130	64.0	04.0	65.3
		C	ypress Creek Road	East Side	eci terminus					
E57	Westin Hotel 400 Corporate Drive	Pool	Е	71	987+00	SLU	200/200/200	67.7	69.2	69.1
			SR 870/Co	mmercial Boulev	ard					
			-	tern Project Term						
				South Side						
CS1	NW 49 Street	SFH	В	66	40+80	5	45/45/45	67.0	67.2	67.1
CS2	NW 49 Street	SFH	В	66	44+00	10	185/185/185	60.5	61.0	60.9
CS3	NW 49 Street	SFH	В	66	46+00	10	35/35/35	65.0	65.6	65.1
C\$4	NW 49 Street	SFH	В	66	48+80	10	170/170/165	59.3	59.9	59.8
C\$5	NW 49 Street	SFH	В	50+20	5	40/40/35	65.2	65.8	65.9	
CSS	14 74 7 311 661	эгп	D	66	JUTZU	J	40/40/33	03.2	03.0	03.7



				Table 4-3						
Representative Model Receptor	Location	Modeled Type	Description (Noise Abatement	FDOT Noise Abatement Approach	Location (Station)	Number Of Noise Sensitive	Distance To Nearest Traffic Lane*	Predicted Traffic Noise Le		
кесеріоі			Activity	Criteria		Sites	[Existing/No-	Existing (2015)	Design Yea (2040)	
			Category)	[dB(A)]			Build/Build] (Feet)		No-Build	Build
C\$6	NW 49 Street	SFH	В	66	55+00	4	50/55/55	64.1	64.7	64.5
CS7	NW 49 Street	SFH	В	66	46+60	10	185/185/185	56.3	57.0	57.2
C\$8	NW 49 Street	SFH	В	66	57+20	5	45/45/45	64.7	65.3	65.1
CS9	NW 1 Terrace	SFH	В	66	60+20	2	185/185/190	56.4	57.1	56.7
C\$10	NW 49 Street	SFH	В	66	61+60	6	35/35/35	65.4	66.0	65.4
CS11	NW 49 Street	SFH	В	66	66+00	7	35/35/40	64.2	64.8	64.3
CS12	NW 49 Street	SFH	В	66	66+40	14	170/170/175	55.5	56.3	56.3
C\$13	NW 49 Street	SFH	В	66	69+60	6	30/30/35	65.4	66.0	65.7
CS14	NW 49 Street	SFH	В	66	73+60	3	50/50/50	64.1	64.8	64.7
C\$15	NW 49 Street	SFH	В	66	74+40	6	200/200/200	54.8	55.5	55.4
C\$16	NW 49 Street	SFH	В	66	75+60	5	75/75/75	62.7	63.3	63.1
CS17	NE 5 Terrace	SFH	В	66	77+80	2	170/170/170	63.4	64.3	63.2
				North Side			1 1	I	-1	
CN1	NE 51 Street	SFH	В	66	42+00	5	195/195/195	62.0	62.4	62.4
CN2	NE 51 Street	SFH	В	66	45+00	3	55/55/40	63.8	64.3	62.2
CN3	NE 51 Street	SFH	В	66	46+00	10	245/245/230	60.0	60.5	59.3
CN4	NE 51 Street	SFH	В	66	48+80	6	145/145/100	65.9	66.6	61.8
CN5	NE 51 Street	SFH	В	66	51+00	5	170/140/140	66.8	67.5	65.9
CN6	NE 51 Street	SFH B		66	51+20	4	340/340/310	59.7	60.5	60.3
CN7	Lord's Chiropractic 33 E Commercial Boulevard	Medical	D	51	54+60	SLU	95/65/65	44.2	44.9	43.0
CN8	NE 51 Street	SFH	В	66	60+00	22	185/185/160	56.6	57.4	55.7
CN9	Creative Minds Preschool 191 E Commercial Boulevard	Preschool	С	66	60+40	SLU	90/65/65	56.2	57.0	55.9
CN10	Chiropractic and Wellness 291 E Commercial Boulevard	Medical	D	51	65+40	SLU	75/75/55	44.0	44.7	42.6
CN11	NE 51 Street	SFH	В	66	71+00	21	180/180/175	55.4	56.1	55.8
CN12	421 E Commercial Boulevard	SFH	В	66	73+20	1	75/75/75	68.9	69.6	68.6
,				oject Terminus to I South Side	-95					II.
C\$18	NW 49 Street	SFH	В	66	18+80	5	145/145/135	57.7	58.8	59.0
CS19	NW 49 Street	SFH	В	66	19+20	3	290/290/280	58.1	59.2	59.2
		<u> </u>		ess Creek Road	· · · - ·		,,			
				tern Project Termii	nus					
				South Side						
CC\$1	NE 3 Avenue	SFH	В	66	233+80	2	75/75/75	69.4	69.8	70.9
CC\$2	NE 3 Avenue	SFH	В	66	233+80	4	155/155/155/	65.4	65.8	66.7
CC\$3	NE 3 Terrace	SFH	В	66	236+00	2	70/70/70	69.8	70.5	71.1
CCS4	NE 3 Terrace	SFH	В	66	237+00	4	160/160/160	65.4	66.0	66.9
CC\$5	NE 61 Court	SFH	В	66	242+20	11	95/95/95	67.3	68.5	69.1



		Modeled		Table 4-3 ocations and N	oise Analysis Results					
Representative Model Receptor	Location	Туре	Description (Noise Abatement Activity Category)	FDOT Noise Abatement Approach Criteria [dB(A)]	Location (Station)	Number Of Noise Sensitive Sites	Distance To Nearest Traffic Lane* [Existing/No-Build/Build]		(20	A)] n Year 40)
							(Feet)		No-Build	Build
CC\$6	NE 61 Street	SFH	В	66	242+40	11	165/165/165	63.0	64.2	64.9
CC\$7	NE 61 Court	SFH	В	66	248+40	6	90/90/90	66.4	67.4	68.2
CC\$8	NE 61 Street	SFH	В	66	248+60	5	175/175/175	61.0	62.1	62.8
CCS9	NE 7 Avenue	SFH	В	66	252+00	2	105/105/105	62.6	63.6	64.5
CC\$10	NE 7 Avenue	SFH	В	66	252+20	2	195/195/195	58.7	59.8	60.8
CC\$11	Hampton Inn 720 E Cypress Creek Road	Pool	Е	71	254+80	SLU	220/220/220	49.7	50.8	51.8
				North Side						
CCN1	NE 62 Court	SFH	В	66	253+20	6	105/105/105	63.8	64.9	65.8
CCN2						4	115/115/115	56.8	57.9	59.2
CCN3	NE 62 Court	SFH	В	66	258+20	3	115/115/115	60.5	61.5	61.8
CCN4	NE 62 Court	SFH	В	66	256+20	8	175/175/175	56.9	57.9	59.0
1		1	Western Pro	oject Terminus to	1-95		I	II.		1
				North Side						
CCN5	Sheraton Suites 555 W Cypress Creek Road	Pool	Е	71	206+60	SLU	105/105/105	62.7	63.6	63.4
CCN6	The Moonlite Diner 6201 N. Andrews Avenue	Outdoor Seating	Е	71	212+60	SLU	50/50/50	71.2	72.0	72.0
			Pov	werline Road						
				East Side						
PE1	Red Roof Inn 4800 Powerline Road	Pool	Е	71	109+40	SLU	305/305/305	58.0	58.8	57.7
PE2	Universal Palms 4800 Powerline Road	Pool	Е	71	111+20	SLU	295/295/295	54.1	55.3	55.2
				West Side						
PW1	NE 47 Street	SFH	В	66	103+20	2	115/115/115	57.2	58.2	58.4
PW2	NE 47 Street	SFH	В	66	103+40	4	195/195/195	59.5	60.7	61.3
PW3	NW 9 Terrace	SFH	В	66	105+00	5	245/245/245	57.6	58.9	59.3
PW4	NW 9 Terrace	SFH	В	66	107+40	4	125/125/125	59.8	60.7	59.4
PW5	NW 9 Terrace	SFH	В	66	109+40	5	270/270/270	58.8	59.9	59.8
PW6	NW 9 Terrace	SFH	В	66	110+00	4	130/130/130	60.0	60.9	60.6

Notes:

\* = To existing edge-of-pavement of the nearest travel lane.

Bold numbers indicate Build Alternative noise levels equal or exceeding FDOT Noise Abatement Criteria

SFH = Single-Family Home, MFH = Multi-Family Home (i.e., apartments, condominiums), SLU = Special Land Use site



#### 4.4.3 CYPRESS CREEK ROAD

Existing traffic noise levels at residences along Cypress Creek Road are predicted by TNM to range from 56.8 to 69.8 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 57.9 to 70.5 dB(A) and to be no more than 1.2 dB(A) greater than existing levels at these residences. Design year worst-case traffic noise levels at the residences are predicted to range from 59.0 to 71.1 dB(A) with the recommended Build Alternative. These predicted levels are no more than 2.4 dB(A) greater than the existing levels and 1.3 dB(A) greater than those of the No-Build Alternative. Existing traffic noise levels at the non-residential noise sensitive sites along Cypress Creek Road are predicted to range from 49.7 to 71.2 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 50.8 to 72.0 dB(A), no more than 1.1 dB(A) greater than existing levels at these sites. Design year worst-case traffic noise levels with the recommended Build Alternative are predicted to range from 51.8 to 72.0 dB(A); no more than 2.1 dB(A) greater than the existing levels and 1.0 dB(A) greater than those of the No-Build Alternative.

#### 4.4.4 POWERLINE ROAD

Existing traffic noise levels at residences along Powerline Road are predicted by TNM to range from 57.2 to 60.0 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 58.2 to 60.9 dB(A) and to be no more than 1.3 dB(A) greater than existing levels at these residences. Design year worst-case traffic noise levels at the residences are predicted to range from 58.4 to 61.3 dB(A) with the recommended Build Alternative. These predicted levels are no more than 1.8 dB(A) greater than the existing levels and 0.6 dB(A) greater than those of the No-Build Alternative. Existing traffic noise levels at the non-residential noise sensitive sites along Powerline Road are predicted to range from 54.1 to 58.0 dB(A) during peak periods. Design year worst-case traffic noise levels with the No-Build Alternative are predicted to range from 55.3 to 58.8 dB(A), no more than 1.2 dB(A) greater than existing levels at these sites. Design year worst-case traffic noise levels with the recommended Build Alternative are predicted to range from 55.2 to 57.7 dB(A); no more than 1.1 dB(A) greater than the existing levels and up to 1.1 dB(A) lower than those of the No-Build Alternative.

## 4.5 Noise Impact Analysis

Approximately 507 residences with the potential to be impacted by the proposed improvements were identified along I-95, SR 870/Commercial Boulevard, Cypress Creek Road and Powerline Road within the project study area. These residences include single-family homes and 2 to 4-unit multi-family homes. Also, 14 noise sensitive non-residential/special-use sites were identified in the project study area. These include places of worship, medical offices, parks, hotel pools, a preschool and an outdoor seating area at a restaurant. Under the existing conditions, the primary source of noise at the nearby noise sensitive sites is traffic on the subject roadways (I-95, SR 870/Commercial Boulevard, Cypress Creek Road and/or Powerline Road).

A summary of the improvements planned with this project include;

Construction of a southbound CD road system along the west side of the I-95 corridor.
 The CD road system starts at the Cypress Creek Park & Ride on-ramp and merges with the existing I-95 southbound on-ramp from N. Andrews Avenue. The CD road system



continues southbound over Commercial Boulevard and merges with the I-95 mainline just north of Powerline Road;

- Construction of a one lane bridge across N. Andrews Avenue to accommodate Commercial Boulevard westbound traffic to the existing I-95 westbound to southbound flyover on-ramp. The proposed one lane bridge merges with the existing I-95 westbound to southbound at-grade ramp which accommodates the N. Andrews Avenue southbound and northbound traffic heading to southbound I-95. This reconfigured I-95 westbound to southbound flyover on-ramp will have two lanes at the entrance and will drop to one lane after the third span of the flyover bridge. The first three spans of the flyover bridge will be reconstructed;
- Ramp improvements at the I-95 interchanges at SR 870/Commercial Boulevard and Cypress Creek Road;
- One additional through-lane at various locations along SR 870/Commercial Boulevard and Cypress Creek Road; and,
- Other intersection improvements along the surface street corridors.

During the design year, the primary source of noise in the area is expected to remain traffic on the nearby roadways listed above. Predicted design year traffic noise levels for the Build Alternative were compared to the NAC and to noise levels predicted for the existing conditions, to assess potential noise impacts associated with the proposed project (see **Table 4-3**).

Build Alternative traffic noise levels at the residences are expected to range from approximately 55.4 to 71.7 dB(A) during the project's design year. Build Alternative traffic noise levels at the non-residential/special-use sites are expected to range from approximately 36.9 dB(A) inside the Bethany Pentecostal Church to 72.0 dB(A) at the outdoor seating area at the Moonlight Diner. The worst-case design year traffic noise levels with the Build Alternative are predicted to be no more than 2.4 dB(A) greater than existing levels and 1.3 dB(A) greater than the expected design year No-Build noise levels.

#### 4.5.1 I-95 - SOUTHERN PROJECT TERMINUS TO SR 870/COMMERCIAL BOULEVARD

Build Alternative traffic noise levels are not predicted to approach or exceed the FHWA NAC - 67 dB(A) at any of the residences along the segment of the I-95 project corridor between the southern project terminus and SR 870/Commercial Boulevard. Build Alternative traffic noise levels at the non-residential noise sensitive sites along this project segment are not predicted to approach or exceed the FHWA NAC - 51 dB(A) for the church sanctuary and 67 dB(A) for the park. All of these sites are located adjacent to existing noise barriers.

#### 4.5.2 I-95 - SR 870/COMMERCIAL BOULEVARD TO N. ANDREWS AVENUE

Build Alternative traffic noise levels are predicted to approach or exceed the FHWA NAC - 67 dB(A) at 12 residences along the segment of the I-95 project corridor between SR 870/Commercial Boulevard and N. Andrews Avenue. All of these sites are found at the north end of a 17-foot tall segment of the existing noise barrier. Build Alternative traffic noise levels at the non-residential noise sensitive sites along this project segment are not predicted to approach or exceed the FHWA NAC - 51 dB(A) for the church sanctuary and 67 dB(A) for the park playground or pavilion.



#### 4.5.3 I-95 - N. ANDREWS AVENUE TO CYPRESS CREEK ROAD

Build Alternative traffic noise levels are not predicted to approach or exceed the FHWA NAC - 67 dB(A) at any of the residences along the segment of the I-95 project corridor between N. Andrews Avenue and Cypress Creek Road. All of these sites are located near an existing noise barrier.

#### 4.5.4 I-95 - CYPRESS CREEK ROAD TO NORTHERN PROJECT TERMINUS

Build Alternative traffic noise levels are not predicted to approach or exceed the FHWA NAC - 67 dB(A) at the non-residential noise sensitive site along this project segment, the pool at the Westin Hotel.

#### 4.5.5 SR 870/COMMERCIAL BOULEVARD

Build Alternative traffic noise levels are predicted to approach or exceed the FHWA NAC - 67 dB(A) at 6 residences along SR 870/Commercial Boulevard. All of these sites are found east of I-95, and all but one is located along the south side of the corridor between I-95 and NW 3 Avenue. Build Alternative traffic noise levels at the non-residential noise sensitive sites along this project segment are not predicted to approach or exceed the FHWA NAC - 51 dB(A) for the interiors of the chiropractic offices and 67 dB(A) for the preschool playground.

#### 4.5.6 CYPRESS CREEK ROAD

Build Alternative traffic noise levels are predicted to approach or exceed the FHWA NAC - 67 dB(A) at 29 residences along Cypress Creek Road. All of these sites are found east of I-95, along the south side of the corridor between I-95 and NE 7 Avenue. Build Alternative traffic noise levels at the non-residential noise sensitive sites along this project segment are predicted to approach or exceed the FHWA NAC - 71 dB(A) only at the outdoor seating area for the Moonlight Diner on the northwest corner of the N. Andrews Avenue intersection.

#### 4.5.7 POWERLINE ROAD

Build Alternative traffic noise levels are not predicted to approach or exceed the FHWA NAC - 67 dB(A) at any of the residences along Powerline Road. Build Alternative traffic noise levels at the non-residential noise sensitive sites along this project segment are not predicted to approach or exceed the FHWA NAC - 71 dB(A) for the hotel pools.

#### 4.5.8 NOISE IMPACTS SUMMARY

Build Alternative traffic noise levels are predicted to approach or exceed the FHWA NAC - 67 dB(A) at a total of 47 residences within the limits of the project. For the non-residential noise sensitive sites within the limits of the project, Build Alternative traffic noise levels are predicted to approach or exceed the correlating FHWA NAC at only one such site, the outdoor seating area for the Moonlight Diner where the NAC is 72 dB(A). Therefore, based on the FHWA and FDOT methodologies used to evaluate traffic noise levels in this study, modifications proposed with this project were determined to generate noise impacts at noise sensitive sites within the project study area and consideration of noise abatement is required to mitigate these impacts. An analysis of noise abatement measures considered for the sites that approach or exceed the NAC is presented in **Chapter 5**. Although a number of sites approach or exceed the NAC, the proposed improvements do not result in any substantial noise increases (i.e., greater than 15 dB(A) over existing levels).



## 5 Noise Barrier Analysis

As described in **Section 4.5.8**, predicted design year traffic noise levels with the Build Alternative will approach or exceed the NAC at 47 residences and the outdoor seating area for the Moonlight Diner. The FDOT requires that the reasonableness and feasibility of noise abatement be considered when the NAC is approached or exceeded. Noise abatement was considered for impacted sites in the three areas identified in **Table 5-1** by Common Noise Environment (CNE). A CNE represents a group of impacted receptor sites that would benefit from the same noise barrier or barrier system (i.e., overlapping/continuous barriers) and are exposed to similar noise sources and levels, traffic volumes, traffic mix, speeds and topographic features. Generally, CNEs occur between two secondary noise sources, such as interchanges, intersections and/or cross-roads or where defined by ground features such as canals. Noise abatement was also considered for an isolated impacted residence along SR 870/Commercial Boulevard and for the Moonlight Diner.

	Table 5-1 Locations Evaluated for Noise Barriers													
Common Noise Environnent Identification Number	General Location (Cross Streets)													
	1-95													
195E1	NW 57 Street to N. Andrews Avenue	East Side	Residential (Activity Category B)	12	5.1									
	SR 870/0	Commercial Boul	evard											
CB\$1	Northbound I-95 Off-Ramp to NW 3 Avenue	South Side	Residential (Activity Category B)	5	5.2									
	Су	press Creek Road	d											
CCS1	Northbound I-95 Off-Ramp to NE 7 Avenue	South Side	Residential (Activity Category B)	29	5.3									

The most common and effective noise abatement measure for projects such as this is construction of a noise barrier as close as possible to the impacted sites. Noise barriers reduce noise by blocking the sound path between a roadway and a noise sensitive area. To be effective, noise barriers must be long, continuous, and have sufficient height to block the path between the noise source and the receptor site.

A wide range of factors are used to evaluate the feasibility and reasonableness of noise abatement measures. Feasibility primarily concerns the ability to reduce noise levels by at least 5 dB(A) at the impacted receptor sites using standard construction methods and techniques. Engineering considerations typically assessed during the feasibility analysis include access, drainage, utilities, safety and maintenance.

Current FDOT structural standards require that noise barriers located within the roadway clear recovery zone (e.g., at the edge-of-pavement) meet crash test requirements stipulated by National Cooperative Highway Research Program (NCHRP) 350 Test Level 4 criteria. They must either be constructed of a crash-approved noise barrier design or be protected by a

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supplemental traffic barrier or guardrail meeting Level 4 criteria offset a minimum of five feet from the front face of the noise barrier. Crash-approved noise barrier designs currently permitted by FDOT are limited to a maximum height of 8 feet on structures and 14 feet on fill. Ground-mounted noise barriers not located within the roadway clear recovery zone are limited by FDOT to a maximum height of 22 feet.

Reasonableness implies that common sense and good judgment were applied in a decision related to noise abatement. A reasonableness analysis includes consideration of the cost of abatement, the amount of noise abatement benefit, and the consideration of the viewpoints of the impacted and benefited property owners and residents. The FDOT's current Statewide average noise barrier unit cost is \$30 per square-foot. To be deemed reasonable, a noise barrier must, at a minimum, meet two important FDOT criteria:

- The estimated construction cost cannot exceed the FDOT's reasonable cost criteria of \$42,000 per benefited receptor site; and,
- According to the FDOT's noise reduction reasonableness criteria, the noise barrier must reduce noise levels by at least 7 dB(A) at one or more impacted receptor sites.

As part of the reasonableness cost analysis, various conceptual noise barrier designs were evaluated for each impacted area to determine the most effective location, length and height that will achieve the desired noise level reduction at reasonable cost. In addition, the primary method for determining the cost of noise abatement involves a review of the cost per benefited receptor site for the construction of a noise barrier benefiting a single location or common noise environment (e.g., a subdivision or contiguous impact area).

The locations of the noise barriers that were considered are shown in **Appendix B**. The following discussion provides the details of the feasibility and reasonableness analysis for noise barriers considered for each of the impacted sites.

#### 5.1 CNE 195E1 – I-95 from NW 57 Avenue to N. Andrews Avenue

Twelve (12) multi-family dwelling units (residences) along the east side of I-95 between NW 57 Street and N. Andrews Avenue are expected to experience design year traffic noise levels approaching or exceeding the FHWA NAC [67 dB(A)] with the Build Alternative. These sites are represented by Model Receptors E40 through E42 shown on **Sheet 2** in **Appendix B**. The impacted noise sensitive sites are located at the northern terminus of the existing 3,313-foot long ground-mounted noise barrier along the eastern limited-access right of way line between NW 51 Street and NW 57 Street. The height of this noise barrier is 17 feet near these homes. With the Build Alternative, the design year traffic noise levels at the impacted residences are predicted to range from 70.3 to 71.4 dB(A), an average increase of approximately 1.3 dB(A) above existing levels. No other nearby residences are expected to be impacted by the planned improvements.

The results of the noise barrier analysis for these residences are summarized in **Table 5-2**. The primary planned improvement near the residences is the construction of the southbound CD road system from the Cypress Creek Park & Ride on-ramp to the I-95 mainline just north of Powerline Road. This improvement will move traffic entering southbound I-95 from Cypress Creek Road up to 60 feet further westward. However, the distance to the I-95 mainline lanes is not being affected. N. Andrews Avenue is elevated over I-95 just north of these residences.



## Table 5-2 Noise Barrier Analysis for Common Noise Environment-195E1

Common Noise Environment	Conceptual Noise Barrier Design Number	Noise Barrier Type	Height (feet)	Length (feet)	Begin Station Number	End Station Number	Number of Impacted Receptor Sites	Average (Maximum) Noise Reduction for Impacted Receptor Sites dB(A)	Number of Impacted/ Benefited Receptor Sites	Number of Benefited Receptor Sites/ Not Impacted	Total Number of Benefited Receptor Sites	Average (Maximum) Noise Reduction for all Benefited Receptor Sites dB(A)	Cost (\$30 per square foot)	Average Cost/Site Benefited	Comments
	195E1-CD1	Ground- Mounted	12	250	944+10	946+60	12	6.6 (8.0)	10	0	10	6.6 (8.0)	\$90,000	\$9,000	Not Recommended - Does not benefit all of the impacted sites.
195E1	195E1-CD2	Ground- Mounted	14	230	944+10	946+40	12	7.1 (8.7)	12	0	12	7.1 (8.7)	\$96,600	\$8,050	
I-95 from NW 57 Street to N. Andrews	195E1-CD3	Ground- Mounted	16	230	944+10	946+40	12	7.9 (9.3)	12	0	12	7.9 (9.3)	\$110,400	\$9,200	
Avenue. East Side	195E1-CD4	Ground- Mounted	17	230	944+10	946+40	12	8.2 (9.5)	12	0	12	8.2 (9.5)	\$117,300	\$9,775	Recommended - This design concept matches the existing noise barrier height.
	195E1-CD5	Ground- Mounted	18	230	944+10	946+40	12	8.4 (9.7)	12	0	12	8.4 (9.7)	\$124,200	\$10,350	

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The existing noise barrier was evaluated to determine if it was already reducing noise levels at the impacted sites by the at least 5 dB(A) at the impacted receptor sites in accordance with FDOT's noise reduction feasibility criteria. It was found that the existing noise barrier only reduces the noise level by at least 5 dB(A) at four of the twelve impacted sites. Therefore, modifications to the existing noise barrier are considered necessary. Since the impacted residences are located at the northern terminus of the existing noise barrier, the most effective means of providing additional noise abatement for them would be to construct a new noise barrier segment along the limited-access right of way line extending northward from the existing noise barrier. Increasing the height of the existing noise barrier was not considered since it would require replacing a long segment of the noise barrier with a taller noise barrier. This would be much more expensive, while being less effective since the noise barrier would still end just beyond these homes. Therefore, this option was not considered further. The noise barrier design concept for this site is shown on **Sheet 2** in **Appendix B**.

A 17-foot tall ground-mounted noise barrier located along the eastern limited access right of way line between Stations 944+10 and 946+40 was considered to be the most feasible and effective noise abatement alternative for the impacted residences. This noise barrier design concept will match the height of the existing noise barrier. This concept is referred to as 195E1-CD4 in **Table 5-2**. This 230-foot long noise barrier extension is expected to reduce noise levels at the impacted sites by up to 9.5 dB(A). All twelve impacted residences were predicted to experience a noise level reduction of at least 5.0 dB(A) and thus be benefited by this noise barrier design concept. No other residences will be benefited by this noise barrier extension. The estimated cost of this noise barrier is \$117,300 overall and \$9,775 per benefited site. Therefore, the cost per benefited site of this noise barrier is within the FDOT's noise barrier cost criteria (\$42,000 per benefited site) and it will attain the FDOT's noise reduction reasonableness requirement of 7 dB(A) at one or more sites.

Noise barrier 195E1-CD4 is recommended for further consideration and public input. Of all the noise barrier design concepts assessed, this concept provides reasonable noise abatement performance at a cost within the FDOT noise barrier cost criteria. This noise barrier design also attains the FDOT's noise reduction reasonableness requirement of at least a 7 dB(A) reduction for at least one impacted receptor site. This noise barrier concept will match the height of the existing noise barrier. In addition, this noise barrier concept satisfies the other reasonableness and feasibility factors considered in the evaluation of noise abatement measures including safety, constructability, utilities and drainage. This noise barrier concept does not have any sight distance issues, any substantial conflicts with utilities or drainage facilities signs and it can be constructed using standard construction methods. Although this noise barrier extension will cross in front a portion of the adjacent Public Storage building, this overlap has been minimized. Therefore, this noise barrier is not expected to obstruct any existing, conforming and legally permitted outdoor advertising.

## 5.2 CNE CBS1 – SR 870/Commercial Boulevard from I-95 to NW 3 Avenue

Five (5) single-family homes along the south side of SR 870/Commercial Boulevard between the northbound I-95 off-ramp and NW 3 Avenue are expected to experience design year traffic noise levels approaching or exceeding the FHWA NAC [67 dB(A)] with the Build Alternative. These sites are represented by Model Receptor CS1 shown on **Sheet 5** in **Appendix B**. The design year Build Alternative traffic noise level at the impacted residences is predicted to be 67.1 dB(A), an increase

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of approximately 0.1 dB(A) from existing levels. No other residences along the south side of SR 870/Commercial Boulevard are expected to be impacted by the planned improvements.

The results of the noise barrier analysis for these residences are summarized in **Table 5-3**. The primary planned improvements near the residences are the addition of one new eastbound travel-lane along SR 870/Commercial Boulevard, construction of a new westbound elevated flyover connection to southbound I-95 and turn-lane additions on the northbound off-ramp. The widening for the new eastbound lane will be into the roadway median; therefore, the lanes will not be moved closer to the homes. Elevated nearby roadways include the I-95 mainline over SR 870/Commercial Boulevard just west of these homes, and the new flyover connection along the outside of the westbound lanes from east of N. Andrews Avenue to I-95.

An existing 21-foot-tall, 443-foot-long ground-mounted noise barrier is located along the eastern limited-access right of way line near the end of the northbound off-ramp from I-95. This location is southwest of the impacted residences. Also, an existing approximately 6-foot-tall privacy wall that is to remain was constructed along the south side of this segment of SR 870/Commercial Boulevard by Broward County in 2009 (Broward County Project Number 5237).

The impacted residences are located along SR 870/Commercial Boulevard. Therefore, the most effective means of providing noise abatement for them would be to construct a new noise barrier extending from the existing 21-foot-tall noise barrier at the end of the off-ramp that would continue eastward along SR 870/Commercial Boulevard. Since it will be located within the roadway's clear zone, the noise barrier would be limited to a maximum height of 14 feet along SR 870/Commercial Boulevard. Due to limited available right of way, construction of this noise barrier would require removal of a segment of the existing privacy wall and acquisition of an estimated additional two feet of permanent right of way and a 6-foot-wide construction easement. Also, substantial overhead/underground utilities and drainage facilities are located along the south side of this segment of SR 870/Commercial Boulevard. The noise barrier design concept for this site is shown on **Sheets 2 and 5** in **Appendix B**.

A 14 to 21-foot tall, 490-foot long ground mounted noise barrier located along the limited access right of way line of the off-ramp and along the back of sidewalk of SR 870/Commercial Boulevard between Stations 39+60 to 44+00 was considered to be the most feasible and effective noise abatement alternative for the impacted residences. This noise barrier design concept is referred to as CBS1-CD4 in **Table 5-3**. This concept would reduce noise levels at the impacted sites by up to 7.2 dB(A). All five impacted residences were predicted to experience a noise level reduction of at least 5.0 dB(A) and thus be benefited by this noise barrier concept.

Due to conflicts with underground utilities, additional costs would be incurred in order to relocate underground electric, fiber optic and gas lines in order to construct this noise barrier. The estimated cost to relocate these utilities is \$248,000, which is included in the overall cost estimate. Thus, the estimated cost of this noise barrier is \$482,150 overall and \$96,430 per benefited site. Therefore, the cost per benefited site of this noise barrier exceeds the FDOT's \$42,000 per benefited site noise barrier cost criteria.

Based on the results of this analysis, Noise Barrier CBS1 is not recommended for further consideration and public input since it was not possible to provide reasonable noise abatement performance at a cost within the FDOT's noise barrier cost criteria. Changes to the height or length of the noise barrier did not provide a feasible and/or reasonable noise barrier option.



## Table 5-3 Noise Barrier Analysis for Common Noise Environment-CBS1

Common Noise Environment	Conceptual Noise Barrier Design Number	Noise Barrier Type	Height (feet)	Length (feet)	Begin Station Number	End Station Number	Number of Impacted Receptor Sites	Average (Maximum) Noise Reduction for Impacted Receptor Sites dB(A)	Number of Impacted/ Benefited Receptor Sites	Number of Benefited Receptor Sites/ Not Impacted	Total Number of Benefited Receptor Sites	Average (Maximum) Noise Reduction for all Benefited Receptor Sites dB(A)	Cost (\$30 per square foot)	Average Cost/Site Benefited	Comments	
	CBS1-CD1	Shoulder- Mounted	14	590	39+60	45+00	5	5.4 (6.3)	3	0	3	5.4 (6.3)	\$495,800	\$165,267	No sites predicted to be benefited. Estimated additional cost for relocation of underground utilities is \$248,000. Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).	
CBS1 SR 870/ Commercial Boulevard between the northbound I- 95 off-ramp	CB\$1-CD2	Shoulder- Mounted	11	590	39+60	45+00	5	3.9 (4.7)	0	0	0	3.9 (4.7)	\$442,700	N/A	No sites predicted to be benefited. Estimated additional cost for relocation of underground utilities is \$248,000. Not Recommended – Does not attain FDOT's Noise Level Reduction Criteria.	
and NW 3 Avenue	CBS1-CD3	Ground- Mounted	21	135	39+60	40+45	5	1.3 (2.9)	0	0	0	1.3 (2.9)	\$85,050	N/A	No sites predicted to be benefited.	
Avenue	CBS1-CD3			CRS1-CD4	CBS1-CD4	CBS1-CD4	CRS1-CD4	Ground- Mounted 21 135 39+60 40+45	6.1 (7.2)		0	5	6.1 (7.2)	\$482,150	\$96,430	No sites predicted to be benefited. Estimated additional cost for relocation of underground utilities is \$248,000.
			Shoulder- Mounted	14	355	40+45	44+00	3	0.1 (7.2)	5	U	J	0.1 (7.2)	φ <del>4</del> 02,130	ψ70, <del>4</del> 00	Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).

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### 5.3 CNE CCS1 – Cypress Creek Road from I-95 to NE 7 Avenue

Twenty-nine (29) single-family homes along the south side of Cypress Creek Road between the northbound I-95 off-ramp and NE 7 Avenue are expected to experience design year traffic noise levels approaching or exceeding the FHWA NAC [67 dB(A)] with the Build Alternative. These sites are represented by Model Receptors CCS1 through CCS5 and CCS7 shown on **Sheets 3 and 6** in **Appendix B**. The design year traffic Build Alternative noise levels at the impacted residences are predicted to range from 66.7 to 71.1 dB(A), representing an increase of up to 1.8 dB(A) from existing levels. No other residences along Cypress Creek Road are expected to be impacted by the planned improvements.

An existing 1,597-foot long ground mounted noise barrier is located along the eastern limited access right of way line between NE 59 Street and Cypress Creek Road. The height of the noise barrier is 13 feet at its northern terminus. This location is west of the impacted residences. The results of the noise barrier analysis for these residences are summarized in **Table 5-4**.

The primary improvements near these residences include a new alignment for the northbound I-95 off-ramp to westbound Cypress Creek Road and the addition of a new turn lanes from Cypress Creek Road onto the northbound I-95 on-ramp and NE 7 Avenue. The widening for the new turn lane will be into the roadway median; therefore, the eastbound through-lanes will be moved less than 5 feet closer to the homes. These homes are separated from Cypress Creek Road by NE 61 Court, which primarily carries low volumes of local traffic for the neighborhood. Elevated nearby roadways are the I-95 mainline over Cypress Creek Road.

The impacted residences are located along the south side of NE 61 Court between the I-95 off-ramp and NE 7 Avenue. Therefore, the most effective means of providing noise abatement for these residences would be to construct a new noise barrier extending eastward along Cypress Creek Road from the existing 13-foot tall noise barrier at the end of the off-ramp. Since it will be located within the roadway's clear zone, the new noise barrier would be limited to a maximum height of 14 feet. The noise barrier would be located on an approximately 10-foot wide strip of right of way between the planned sidewalk along the south side of Cypress Creek Road and NE 61 Court. However, substantial overhead/underground utilities and drainage facilities are also located along this strip of right of way. The noise barrier design concept for this site is shown on **Sheets 3 and 6** in **Appendix B**.

A 12-foot tall ground mounted noise barrier located along the eastern limited-access right of way line between Stations 233+45 and 250+15 was considered to be the most feasible and effective noise abatement alternative for these homes. This noise barrier design concept is referred to as CCS1-CD2 in **Table 5-4**. This 1,680-foot long noise barrier would reduce noise levels in this neighborhood by up to 8.6 dB(A). Twenty (20) of the 29 impacted residences were predicted to experience a noise level reduction of at least 5.0 dB(A) and thus be benefited by this noise barrier design concept. It was not possible to benefit the remaining nine impacted sites. One (1) additional residence that is not predicted to be impacted by this project will be benefited incidentally by this noise barrier.



## Table 5-4 Noise Barrier Analysis for Common Noise Environment-CC\$1

	Noise barrier Ariarysis for Common Noise Environment-CC31														
Common Noise Environment	Conceptual Noise Barrier Design Number	Noise Barrier Type	Height (feet)	Length (feet)	Begin Station Number	End Station Number	Number of Impacted Receptor Sites	Average (Maximum) Noise Reduction for Impacted Receptor Sites dB(A)	Number of Impacted/ Benefited Receptor Sites	Number of Benefited Receptor Sites/ Not Impacted	Total Number of Benefited Receptor Sites	Average (Maximum) Noise Reduction for all Benefited Receptor Sites dB(A)	Cost (\$30 per square foot)	Average Cost/Site Benefited	Comments
	CBS1-CD1	Ground- Mounted	10	1,680	233+45	250+15	29	6.2 (7.3)	20	0	20	6.2 (7.3)	\$1,039,000	\$51,950	Estimated additional cost for relocation of underground utilities is \$535,000.  Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).
	CB\$1-CD2	Ground- Mounted	12	1,680	233+45	250+15	29	7.4 (8.6)	20	1	21	7.2 (8.6)	\$1,139,800	\$54,276	Estimated additional cost for relocation of underground utilities is \$535,000.  Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).
CCS1 Cypress Creek Road between the northbound I- 95 off-ramp and NE 7 Avenue	CB\$1-CD3	Ground- Mounted	14	1,680	233+45	250+15	29	8.1 (9.2)	20	1	21	7.9 (9.2)	\$1,240,600	\$59,076	Estimated additional cost for relocation of underground utilities is \$535,000.  Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).
Welled	CBS1-CD4	Ground- Mounted	12	565	233+45	238+00	29	6.5 (6.6)	3	0	3	6.5 (6.6)	\$347,400	\$115,800	Estimated additional cost for relocation of underground utilities is \$144,000.  Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).
	CBS1-CD5	Ground- Mounted	14	565	233+45	238+00	29	6.7 (7.4)	4	0	4	6.7 (7.4)	\$381,300	\$95,325	Estimated additional cost for relocation of underground utilities is \$144,000.  Not Recommended - Cost per benefited site exceeds FDOT's Noise Barrier Reasonable Cost Criterion (\$42,000).

Due to conflicts with underground utilities, additional cost would be incurred to relocate or cross underground water, electric, fiber optic, telephone and gas lines in order to construct this noise barrier. Also, overhead electric lines would be affected. The estimated cost to relocate or cross these utilities is as much as \$535,000 for the longer concepts, which is included in the overall cost estimate. Thus, the estimated cost of this noise barrier is \$1,139,800 overall and \$54,276 per benefited site. Therefore, the cost per benefited site of this noise barrier exceeds the FDOT's \$42,000 per benefited site noise barrier cost criteria.

Based on the results of this analysis, Noise Barrier CC\$1 is not recommended for further consideration and public input since it was not possible to provide reasonable noise abatement performance at a cost within the FDOT's noise barrier cost criteria. Changes to the height or length of the noise barrier did not provide a feasible and/or reasonable noise barrier option.

#### 5.4 CCN6 - Moonlight Diner

The outdoor dining area at the Moonlight Diner on the northwest corner of the Cypress Creek Road/N. Andrews Avenue intersection (represented by model receptor CCN6) is expected to experience a design year noise level with the proposed improvements [72.0 dB(A)] that meets the NAC for Activity Class E sites [72.0 dB(A)]. The predicted Design Year, Build Alternative traffic noise level is expected to only increase by 0.8 dB(A) above the existing levels. Therefore, the traffic noise level at this restaurant is not expected to substantially increase above the existing conditions. The distance between this site and the near lane on Cypress Creek Road will be the same with the Build Alternative and current conditions (50 feet). Due to the numerous openings required to maintain access to the shopping plaza where this restaurant is located, there is not enough uninterrupted right of way to construct an effective continuous noise barrier. In addition, visibility of this restaurant from the roadway is essential to its operation. Therefore, noise abatement is not considered feasible for this site.

### 5.5 CN12 - Isolated Residence on SR 870/Commercial Boulevard

An isolated single-family residence located at 421 E Commercial Boulevard, near the eastern terminus of the frontage road, is expected to experience a design year noise level with the proposed improvements [68.6 dB(A)] that exceeds the NAC for residences [67.0 dB(A)]. This home is represented by model receptor CN12. However, this predicted noise level is expected to be 0.3 dB(A) lower than existing noise levels. Therefore, the traffic noise level at this residence is not expected to substantially increase above the existing conditions. The other nearby properties are non-noise sensitive commercial establishments. The distance between this site and the near lane on SR 870/Commercial Boulevard will be the same with the Build Alternative and the current conditions (75 feet). Since this site is an isolated impacted home, it does not meet the FDOT's noise reduction feasibility criterion requiring that a noise barrier must provide a 5.0 dB(A) reduction for at least two impacted receptors to be considered feasible. Therefore, no noise barrier is proposed for this location.

## 6 Summary and Recommendations

In summary, traffic noise levels were predicted for noise sensitive locations along the project corridor for the existing conditions and the design year (2040) No-Build and recommended Build Alternatives. Build Alternative traffic noise levels at the residences are expected to range from approximately 55.4 to 71.7 dB(A) during the project's design year. Build Alternative traffic noise levels at the non-residential/special-use sites are expected to range from approximately 36.9 dB(A) inside the Bethany Pentecostal Church to 72.0 dB(A) at the outdoor seating area at the Moonlight Diner. The worst-case design year traffic noise levels with the Build Alternative are predicted to be no more than 2.4 dB(A) greater than existing levels and 1.3 dB(A) greater than the expected design year No-Build noise levels.

Design year traffic noise levels with the planned improvements are predicted to approach or exceed the FHWA NAC for residential use [67 dB(A)] at 47 residences. The design year traffic noise level with the planned improvements is predicted to equal the NAC for Activity Class E sites [72.0 dB(A)] at the outdoor dining area at the Moonlight Diner on the northwest corner of the Cypress Creek Road/N. Andrews Avenue intersection. Therefore, based on the FHWA and FDOT methodologies used to evaluate traffic noise levels in this study, modifications proposed with this project were determined to generate noise impacts at noise sensitive sites within the project study area and consideration of noise abatement is required to mitigate these impacts. An analysis of noise abatement measures considered for the sites that approach or exceed the NAC is presented in **Chapter 5**. Although a number of sites approach or exceed the NAC, the proposed improvements do not result in any substantial noise increases (i.e., greater than 15 dB(A) over existing levels).

In accordance with traffic noise study requirements set forth by both the FHWA and FDOT, noise barriers were considered for all noise sensitive receptor sites where design year Build Alternative traffic noise levels were predicted to equal or exceed the NAC. Noise barriers were evaluated at three locations to mitigate noise impacts. **Table 6-1** summarizes the results of the noise barrier analyses and recommendations for each of the three locations where noise barriers were evaluated. The locations where barriers were evaluated or planned are depicted in the figures in **Appendix B**. Noise barriers are recommended for further consideration and public input at one of these locations:

• CNE - 195E1 -East side of I-95 between NW 57 Street and N. Andrews Avenue.

This noise barrier will extend the existing 17 to 20-foot-tall noise barrier and is expected to benefit twelve impacted residences. No other sites will benefit from this noise barrier.

	Table 6-1 Noise Barrier Evaluation Summary and Recommendations														
General	Noise				Limits		Number of Benefited Receptors	Average (Maximum) Noise Reduction for			Meets FDOT's Reasonable Noise Abatement Cost Criteria of	Noise Barrier Recommended for Further Consideration			
Location (Cross Streets)	Barrier Conceptual Design	Number of Impacted Receptors			Begin Station	End Station	(Impacted/ Not Impacted/ Total)	all Benefited Receptors [dB(A)]	Estimated Cost	Estimated Cost/Site Benefited	\$42,000 per Benefited Receptor Site	and Community Input			
I-95 from NW 57 Street to N. Andrews Avenue. East Side	195E1-CD4	12	17	230	944+10	946+40	12/0/12	8.2 (9.5)	\$117,300	\$9,775	Yes	Yes			
SR 870/ Commercial Boulevard between the northbound I-	CBS1-CD4	5	21	135	39+60	40+45	5/0/5	6.1 (7.2)	<b>\$482,150</b>	\$96,430	No	No			
95 off-ramp and NW 3 Avenue			14	355	40+45	44+00									
CC\$1 Cypress Creek Road between the northbound I- 95 off-ramp and Ne 7 Avenue	CC\$1-CD2	29	12	1,680	233+45	250+15	20/1/21	7.2 (8.6)	\$1,139,800	\$54,276	No	No			

#### SR 9/I-95 PD&E STUDY

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The FDOT is committed to the construction of feasible and reasonable noise abatement measures at the noise-impacted locations identified in **Table 6-1** contingent upon the following conditions

- Final recommendations on the construction of abatement measures is determined during the project's final design and through the public involvement process;
- Detailed noise analyses during the final design process support the need, feasibility and reasonableness of providing abatement;
- Cost analysis indicates that the cost of the noise barrier(s) will not exceed the cost reasonable criterion;
- Community input supporting types, heights, and locations of the noise barrier(s) is provided to the District Four Office; and,
- Safety and engineering aspects as related to the roadway user and the adjacent property owner have been reviewed and any conflicts or issues resolved.

It is likely that the noise abatement measure for this location will be constructed if found feasible based on the contingencies listed above. If, during the Final Design phase, any of the contingency conditions listed above cause abatement to no longer be considered reasonable or feasible for a given location(s), such determination(s) will be made prior to requesting approval for construction advertisement. Commitments regarding the exact abatement measure locations, heights, and type (or approved alternatives) will be made during project reevaluation and at a time before the construction advertisement is approved.

The estimated cost to provide noise abatement for the following residential neighborhoods exceeded FDOT's reasonable cost criteria of \$42,000 per benefited site:

- **CBS1** South side of SR 870/Commercial Boulevard from the I-95 Off-Ramp to NW 3 Avenue (\$96,430 per benefited site); and,
- **CC\$1** South side of Cypress Creek Road from the I-95 Off-Ramp to NE 7 Avenue (\$54,276 per benefited site).

Noise abatement was not recommended for the outdoor eating area at the Moonlight Diner due to unavailable right of way, access requirements and visibility.

Also, noise abatement was not recommended for a single impacted residence located at 421 E Commercial Boulevard since it does not meet the FDOT's noise reduction feasibility criterion requiring that a noise barrier must provide a 5.0 dB(A) reduction for at least two impacted receptors to be considered feasible.

Therefore, noise barriers are not recommended for further consideration or construction at these locations. Based on the noise analyses performed to date, there are no apparent solutions available to mitigate the noise impacts at 35 residences and one special land use site. The traffic noise impacts to these noise sensitive sites are considered to be an unavoidable consequence of the project.

From South of SR 870/Commercial Boulevard to North of Cypress Creek Road FM# 435808-1-22-02/ ETDM 14222



## 7 Construction Noise and Vibration

During construction of the project, there is the potential for noise impacts to be substantially greater than those resulting from normal traffic operations due to the heavy equipment typically used to build roadways. In addition, construction activities may result in vibration impacts. Therefore, early identification of potential noise/vibration sensitive sites along the project corridor is important in minimizing noise and vibration impacts. The project area does include residences, hotels, places of worship and medical offices that may be affected by noise and vibration associated with construction activities. These sites are identified in **Table 4-3**. Construction noise and vibration impacts to these sites will be minimized by adherence to the controls listed in the latest edition of the FDOT's *Standard Specifications for Road and Bridge Construction*. According to Section 335.02 of the Florida Statutes, the FDOT is exempt from compliance with local ordinances. However, it is the FDOT's policy is to follow the requirements of local ordinances to the extent that is considered reasonable. Also, the contractor will be instructed to coordinate with the project engineer and the District Noise Specialist should unanticipated noise or vibration issues arise during project construction.



## 8 Coordination with Local Officials

Agency coordination to obtain noise-related information for this project occurred through the ETDM Programming Screening (ETDM #14222) and the Advance Notification process. The ETDM review occurred between April 10, 2015 to May 25, 2015, and the Programming Screen Summary Report was published on February 22, 2016. No comments were received on noise-related issues.

To aid in promoting land use compatibility, a copy of the NSR, which provides information that can be used to protect future land development from becoming incompatible with anticipated traffic noise levels, will be provided to Broward County. In addition, generalized future noise impact contours for properties in the immediate vicinity of the project have been developed for Noise Abatement Activity Categories B/C and E (i.e., residential/other sensitive land uses and sensitive commercial, respectively). These contours represent the approximate distance from the edge of the nearest proposed travel lane of a roadway to the limits of the area predicted to approach [i.e., within 1 dB(A)] or exceed the NAC in the Design Year 2040. These contours do not consider any shielding of noise provided by structures between the receiver and the proposed travel lanes. Contours were generally developed for portions of the project that are located away from significant ground features such as existing noise barriers. Within the project corridor, the distance between the proposed edge of the outside travel lane and the contour at various locations are presented in **Table 8-1**. To minimize the potential for incompatible land use, noise sensitive land uses should be located beyond this distance.

Table 8-1 Design Year (2040) Noise Impact Contour Distances											
Lagation	Distance from Proposed Nearest Travel Lane to Noise Contour Line (Feet)										
Location	51/71 dB(A) – Activity Category D/E	66 dB(A) – Activity Category B/C									
I-95 between SR 870/Commercial Boulevard and N. Andrews Avenue. Station 930+00. West Side.	180	355									
I-95 between Cypress Creek Road and the Northern Project Terminus. Station 990+00. West Side.	230	410									
Cypress Creek Road between the Western Project Terminus and N. Andrews Avenue. Station 218+00. South Side	50	140									



## 9 References

- Florida Department of Transportation, "Project Development and Environment Manual, Part 2, Chapter 18", June 14 2017.
- 23 CFR Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise", Federal Register, Vol. 75, No. 133, Tuesday, July 13, 2010; pages 39834-39839.
- Federal Highway Administration Report FHWA-HEP-10-025, "Highway Traffic Noise: Analysis and Abatement Guidance", June 2010 (revised December, 2010); 76 pages.
- Florida Statute 335.17, "State highway construction; means of noise abatement". 1989; 1 page.
- Florida Department of Transportation Policy, "Noise Abatement". Topic 000-360-005-f; Effective September 20, 2007; 1 page.
- Federal Highway Administration Report Number FHWA-PD-96-046, "Measurement of Highway-Related Noise". Cynthia S.Y. Lee and Gregg Fleming; May, 1996; 206 pages.
- Florida Department of Transportation, "Standard Specifications for Road and Bridge Construction". 2010; 996 pages.
- Federal Highway Administration Report FHWA-HEP-06-015, "FHWA Highway Construction Noise Handbook: Final Report". August 2006; 185 pages.



## Appendix A Concept Plans

Noise Study Report Appendix A

#### COMPONENTS OF CONTRACT PLANS SET

CONCEPT PLANS

SHEET NO.

XX - XX

A DETAILED INDEX APPEARS ON THE KEY SHEET OF EACH COMPONENT

#### INDEX OF ROADWAY PLANS

1	KEY SHEET
2-XX	PROPOSED ALTERNATIVE TYPICAL SECTIONS
XX	CURVE DATA SHEET
XX-XX	PRELIMINARY CONCEPT PLANS
XX-XX	TRAFFIC CONTROL PLANS
X X – X X	PRELIMINARY SIGNING PLANS

SHEET DESCRIPTION

#### GOVERNING STANDARDS AND SPECIFICATIONS:

Florida Department of Transportation, Design Standards and revised Index Drawings as appended herein, and Specifications for Road and Bridge Construction, as amended by Contract Documents.

For Design Standards click on the "Design Standards" link at the following web site: http://www.dot.state.fl.us/rddesign/

For the Standard Specifications for Road and Bridge Construction click on the "Specifications" link at the following web site: http://www.dot.state.fl.us/specificationsoffice/

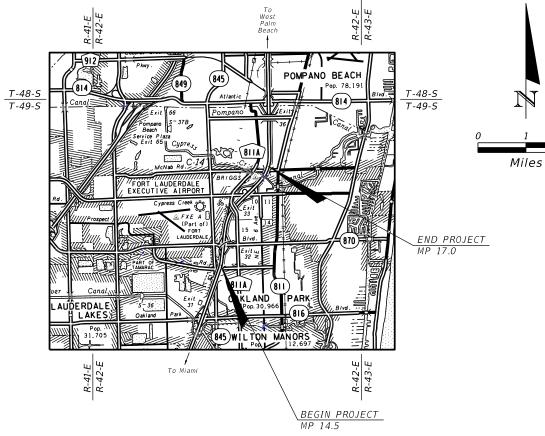
## STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

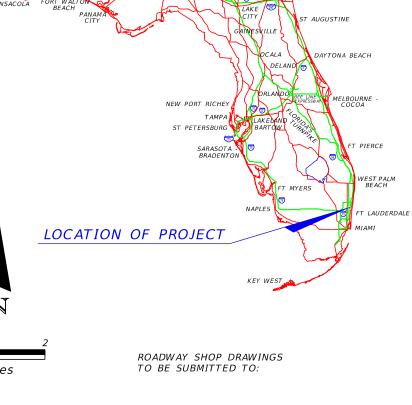
## PRELIMINARY CONCEPT PLANS

#### FINANCIAL PROJECT ID 435808-1

#### BROWARD COUNTY (86070)

FROM SOUTH OF SR 870/COMMERCIAL BOULEVARD TO NORTH OF CYPRESS CREEK ROAD





CONSTRUCTION CONTRACT NO.

PLANS PREPARED BY: STANTEC CONSULTING SERVICES, INC. 901 PONCE DE LEON BLVD., SUITE 900 CORAL GABLES, FLORIDA 33134 MIAMI (305)-445-2900 FLORIDA (800)-448-0227 CERTIFICATION OF AUTHORIZATION NO. 00027013 VENDOR ID NO. 650039493001 CONSULTANT CONTRACT NO. C-8F17

NOTE: THE SCALE OF THESE PLANS MAY HAVE CHANGED DUE TO REPRODUCTION.

#### PROJECT LENGTH IS BASED ON Q OF CONSTRUCTION

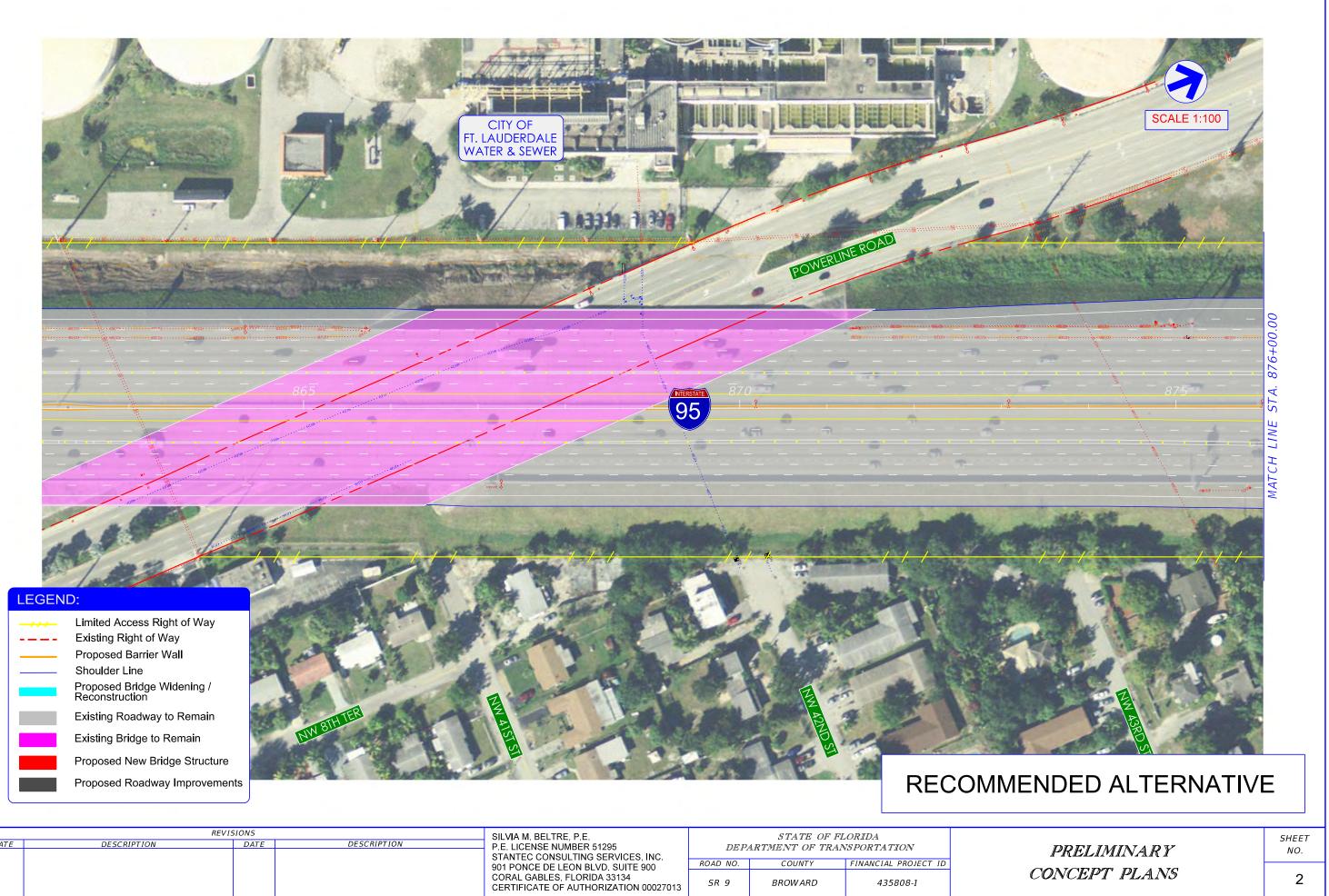
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EXCEPTIONS		
GROSS LENGTH OF PROJECT		

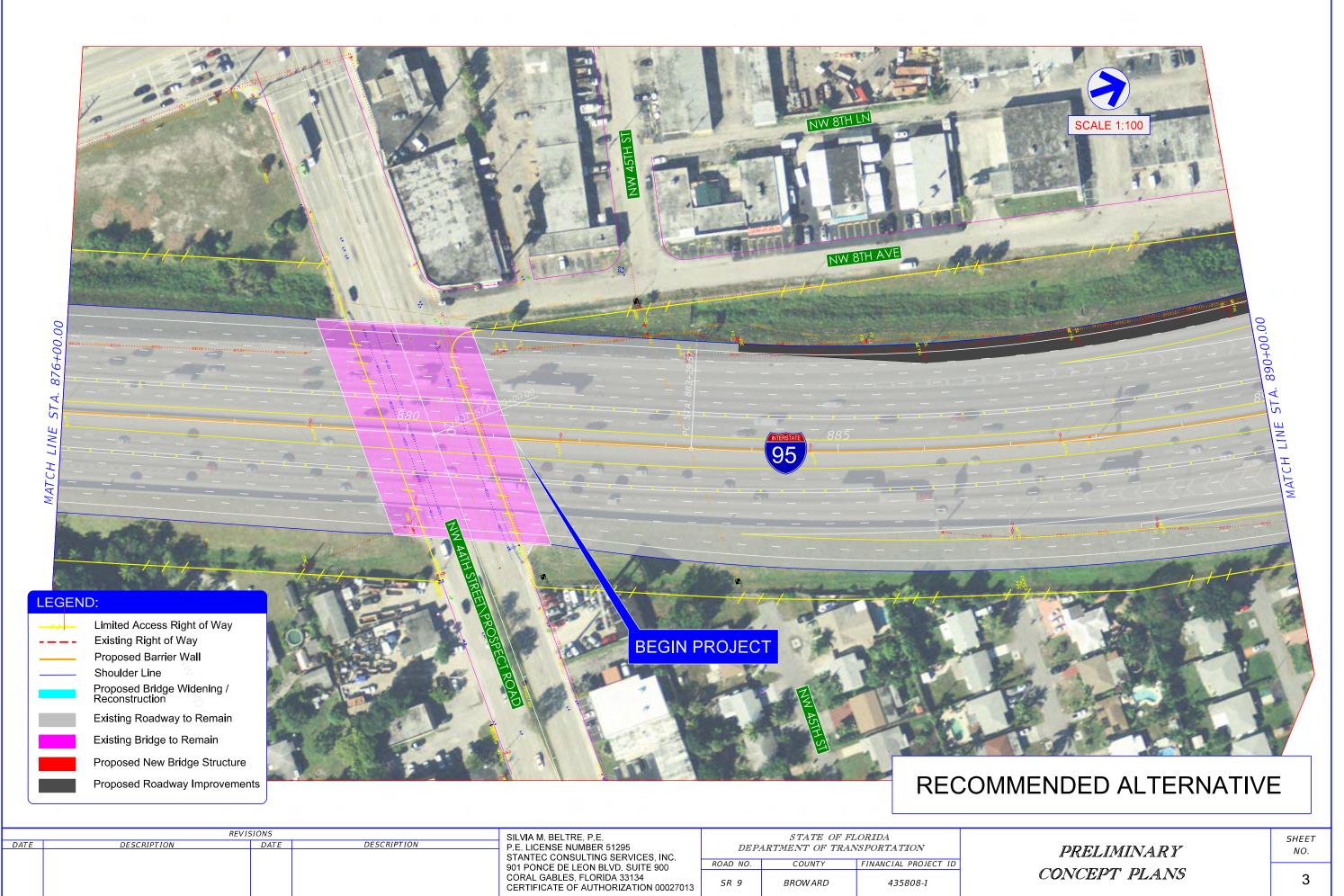
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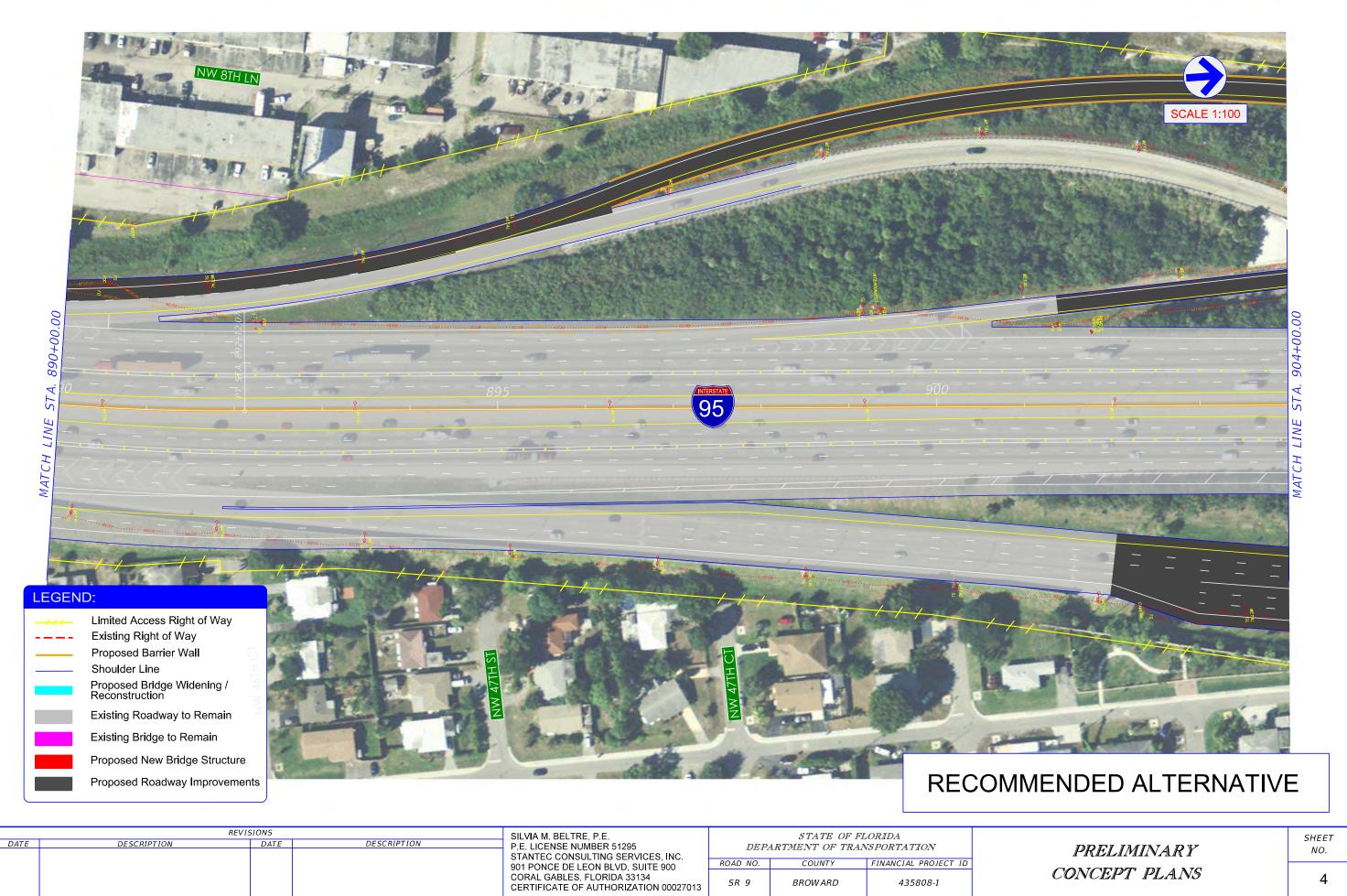
ROADWAY PLANS ENGINEER OF RECORD: SILVIA BELTRE, P.E.

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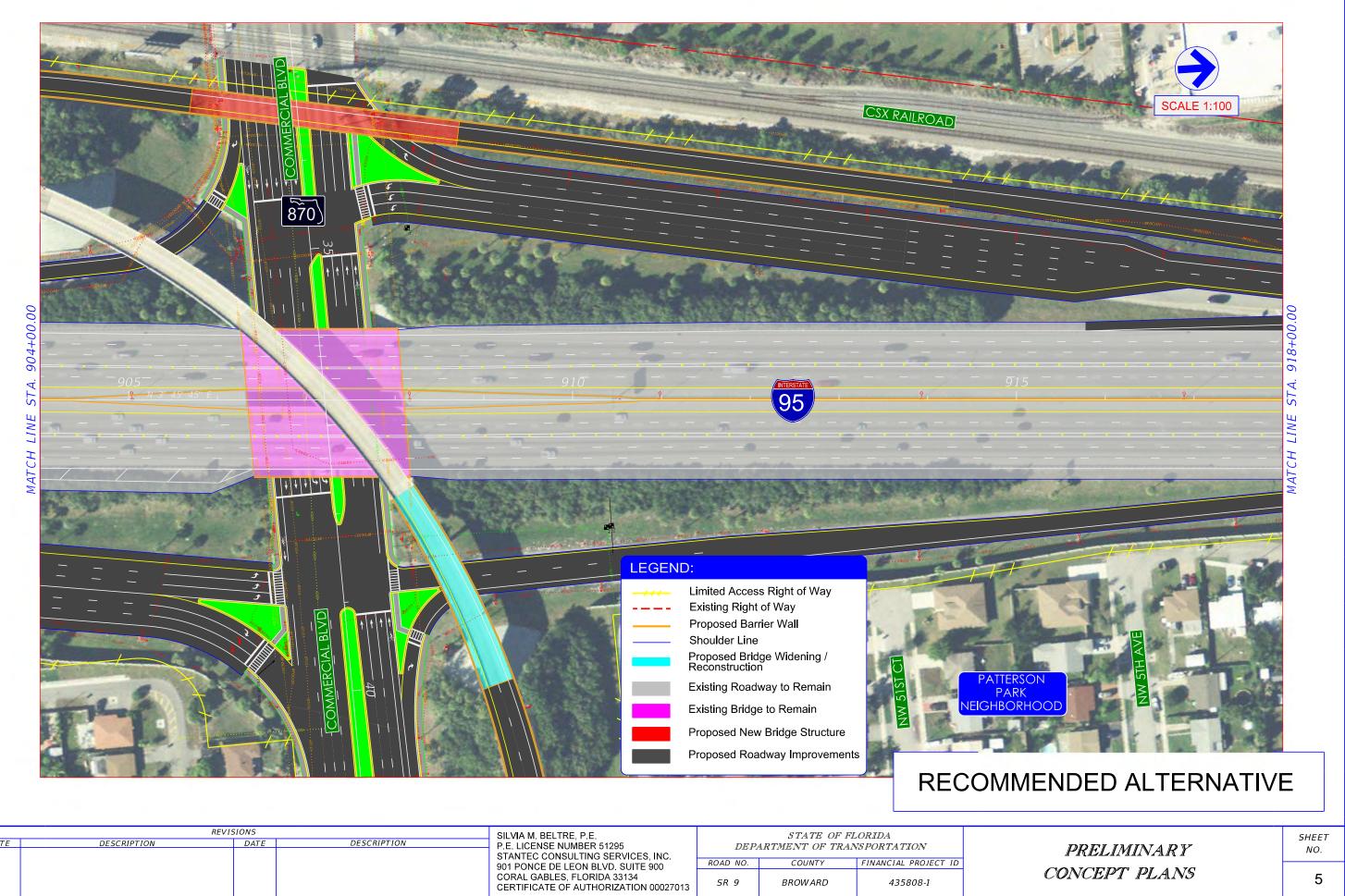




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CONCEPT PLANS



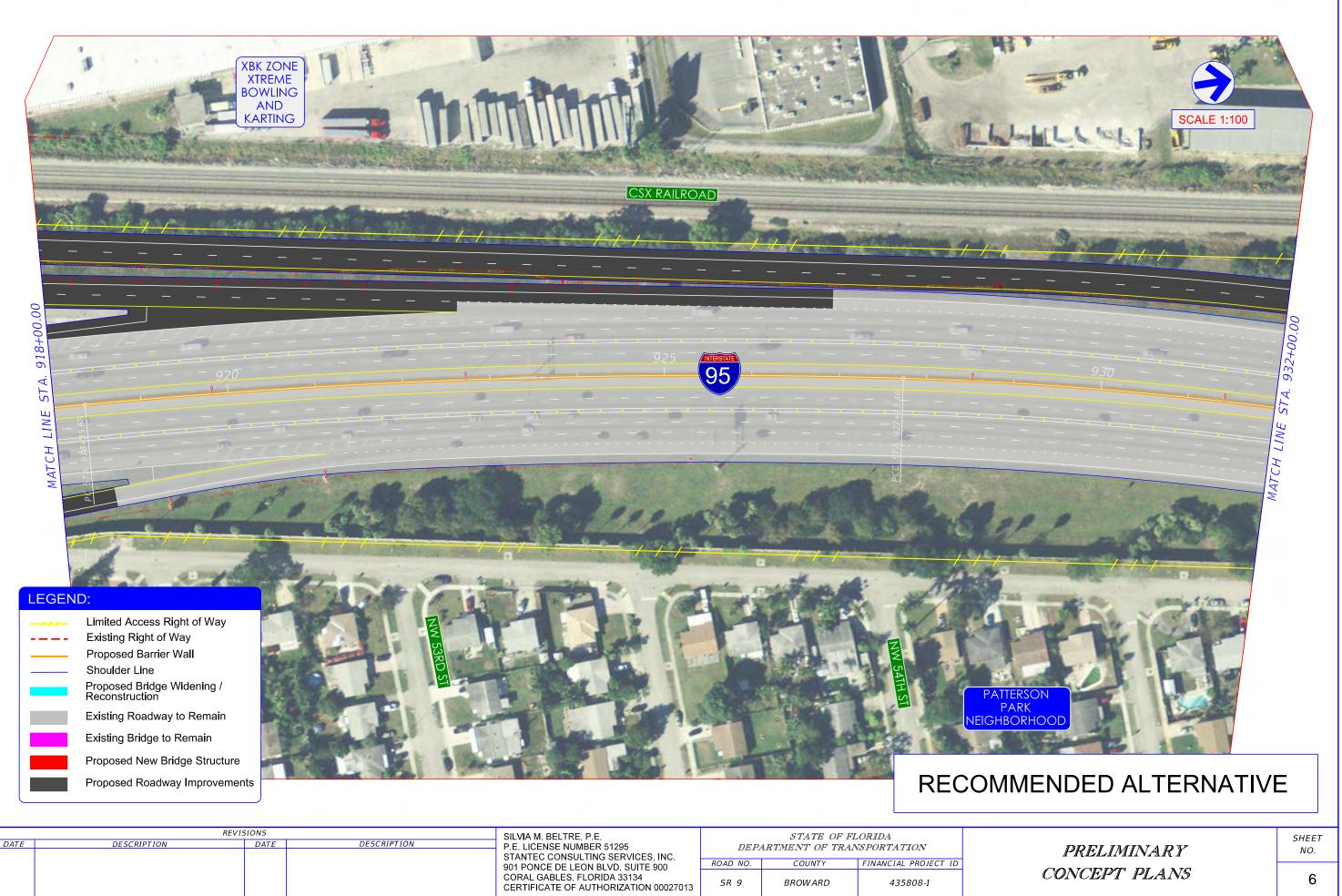
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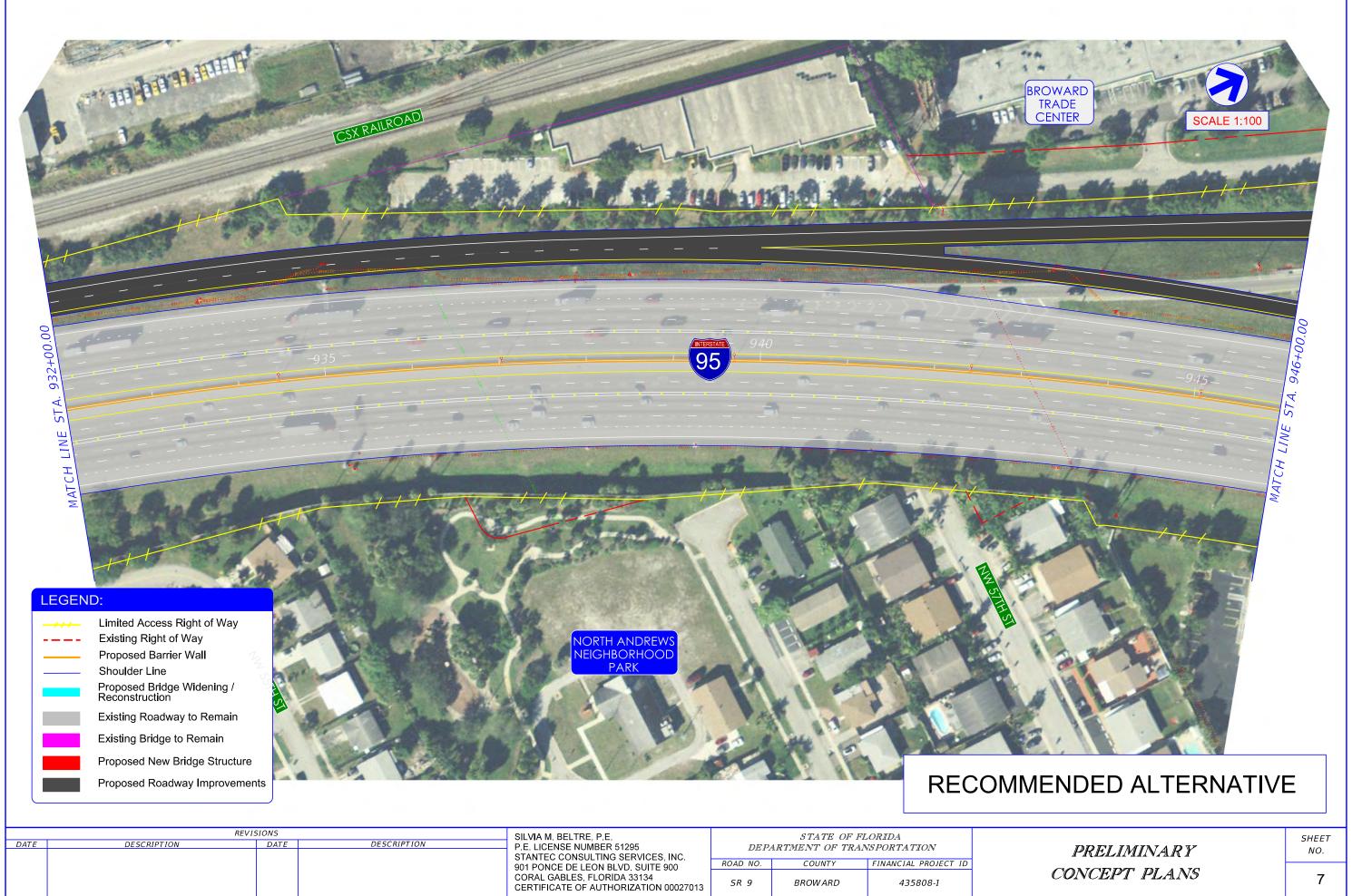
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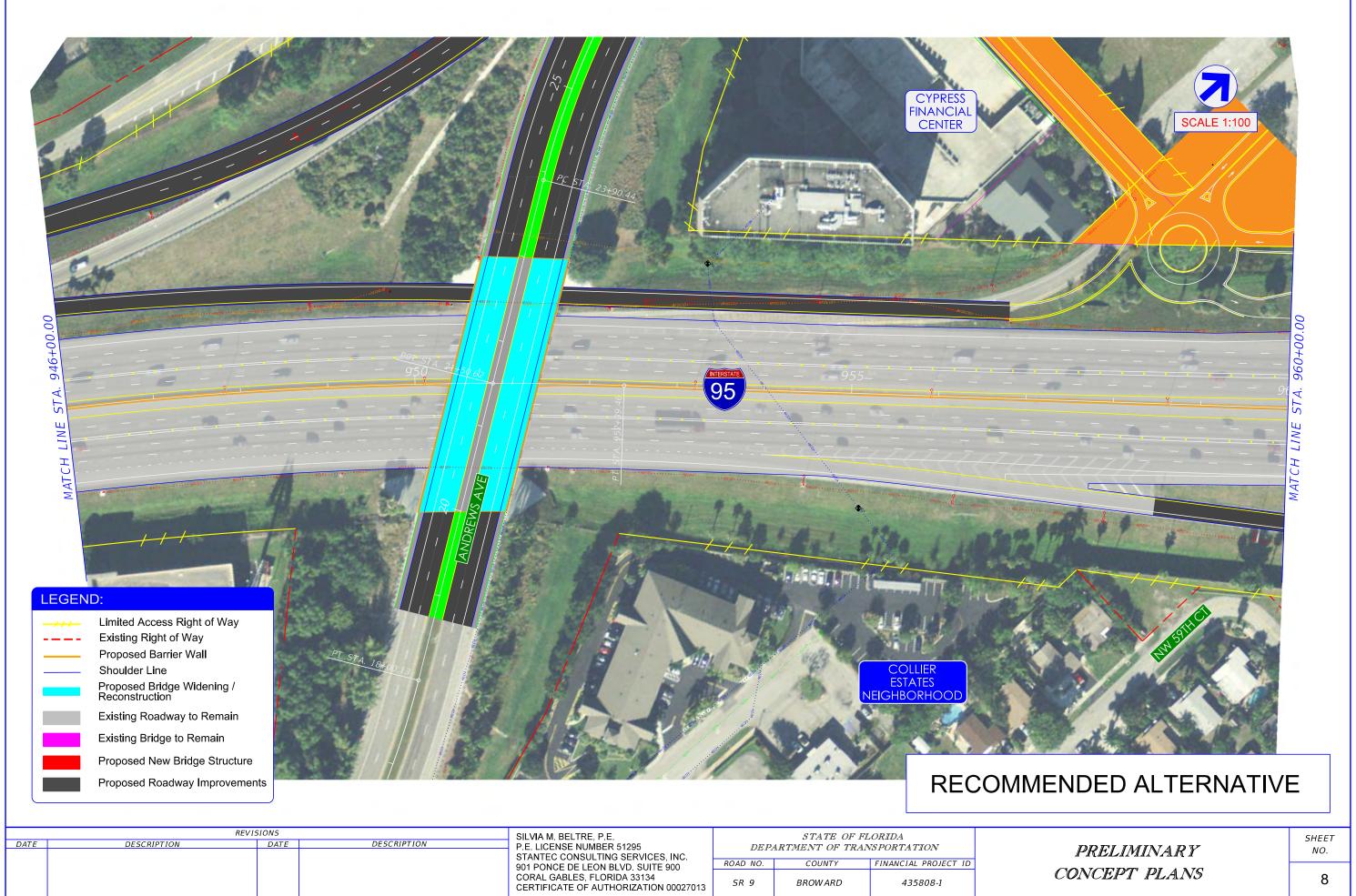
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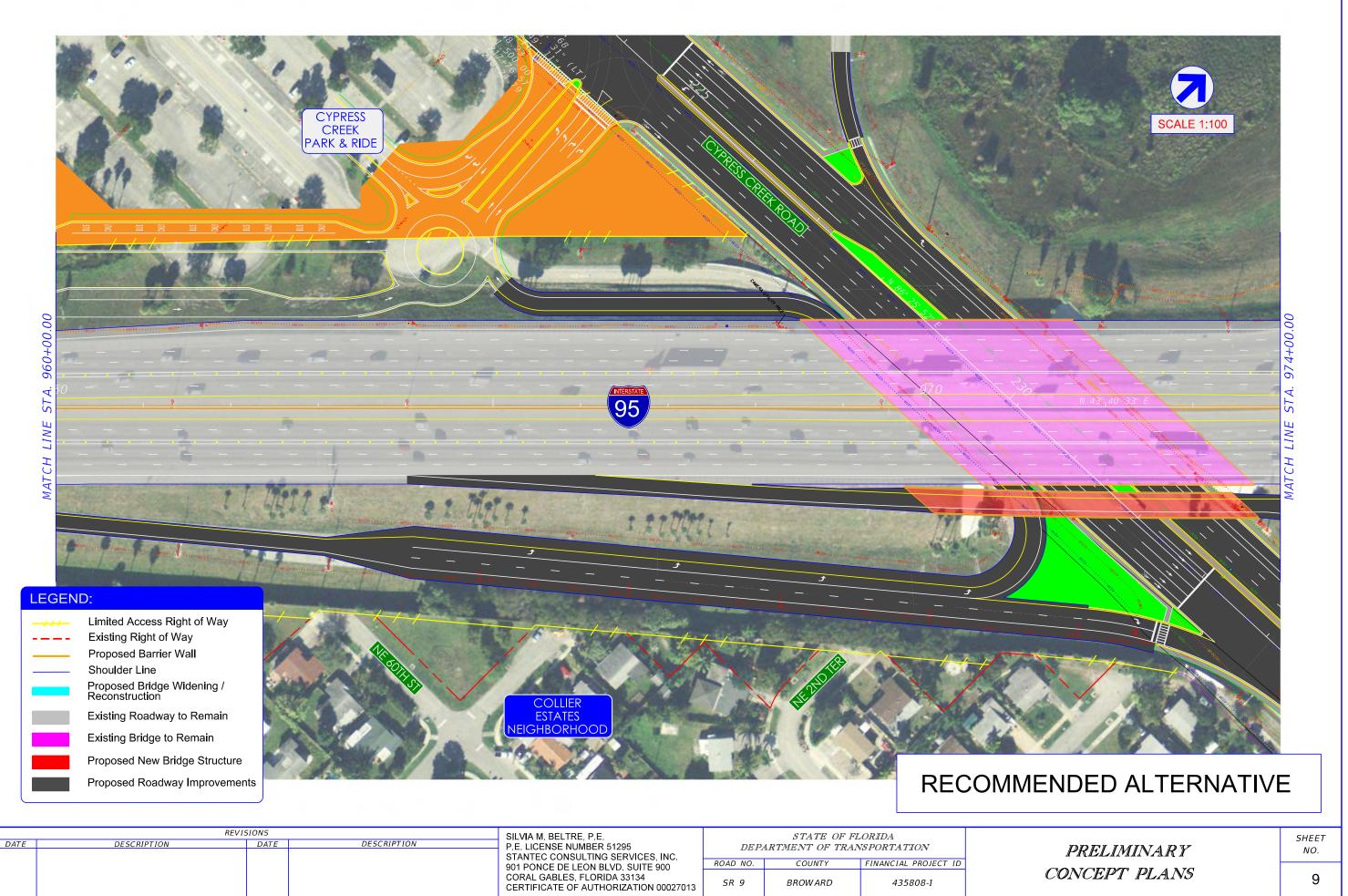
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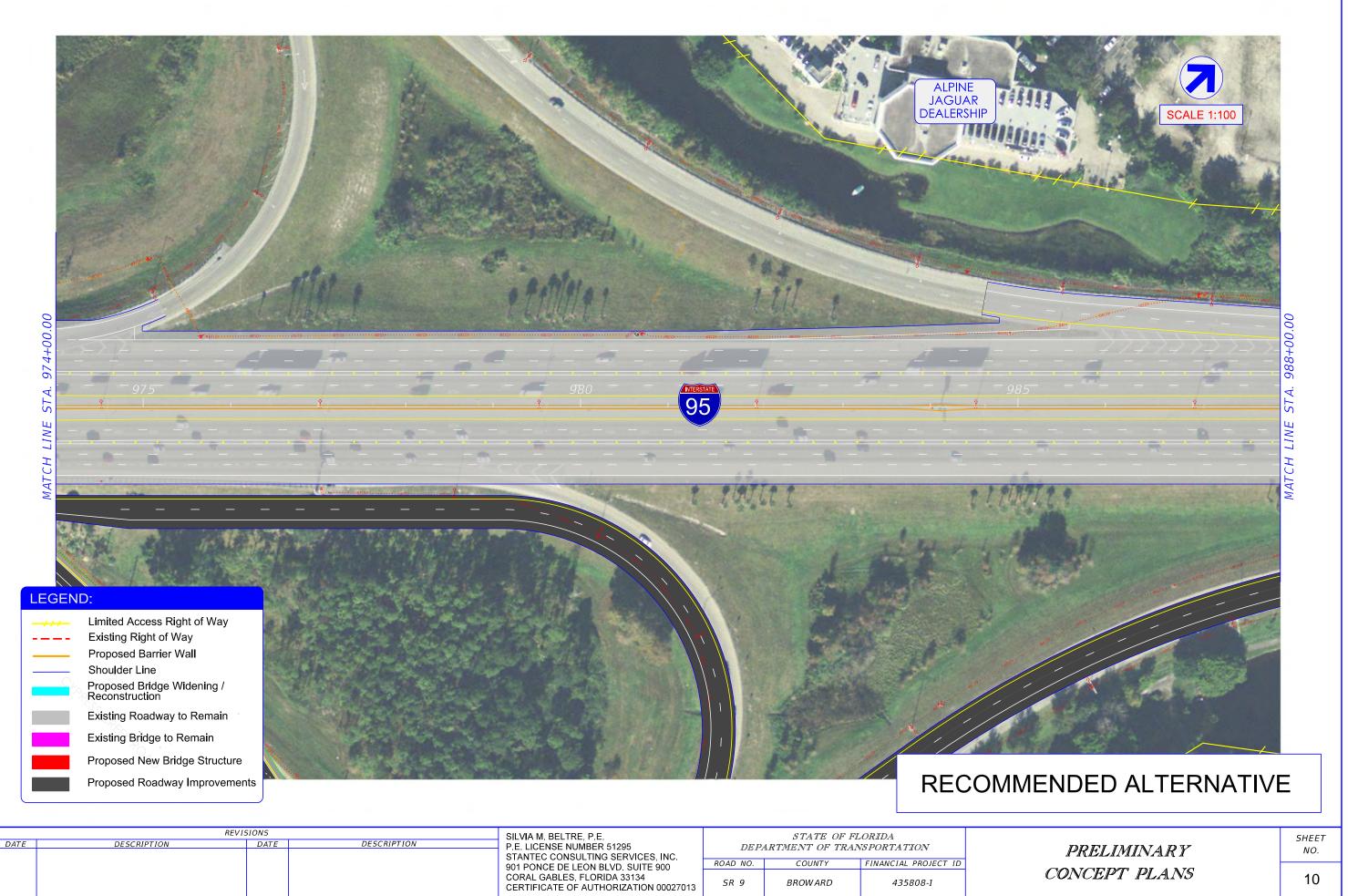
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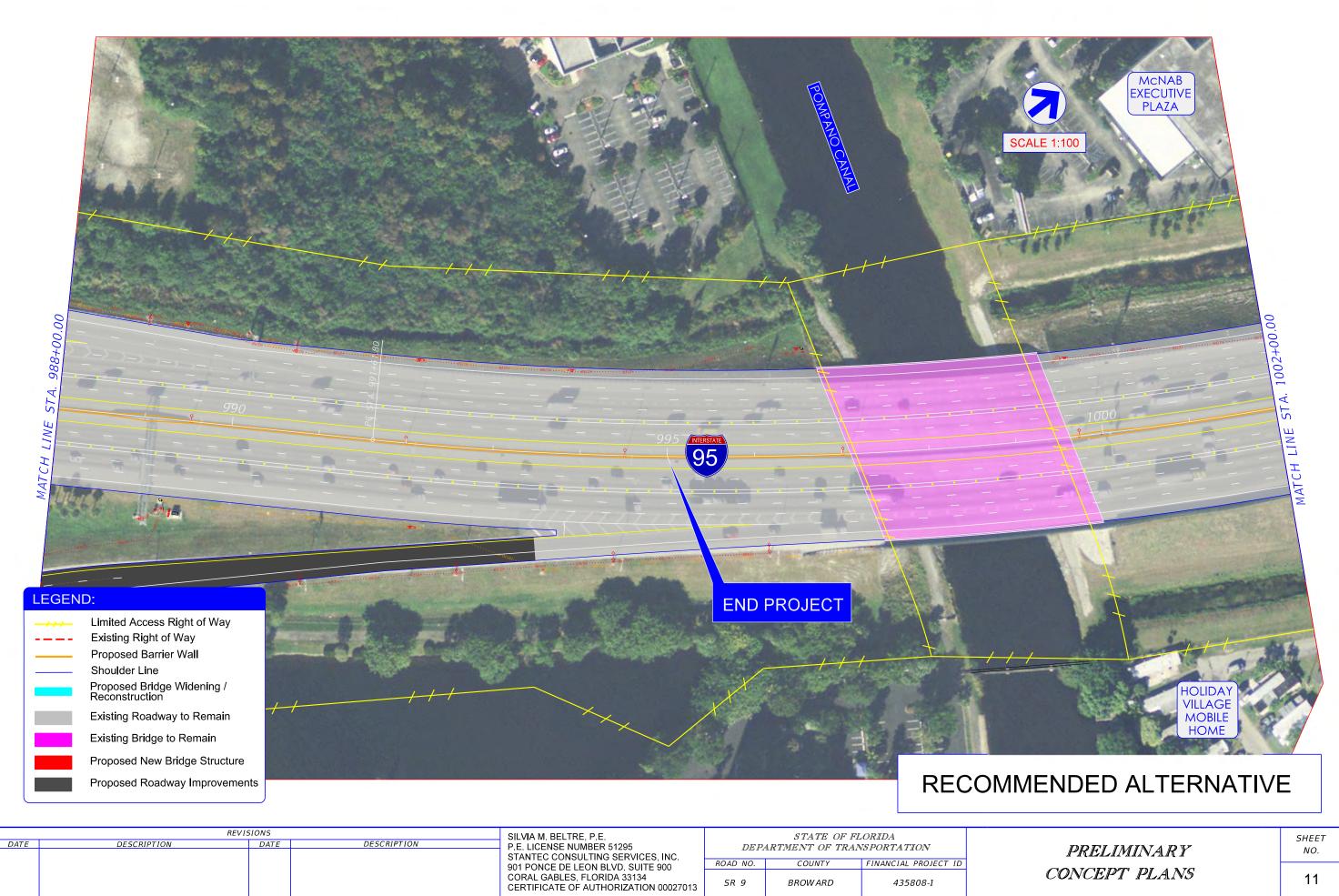


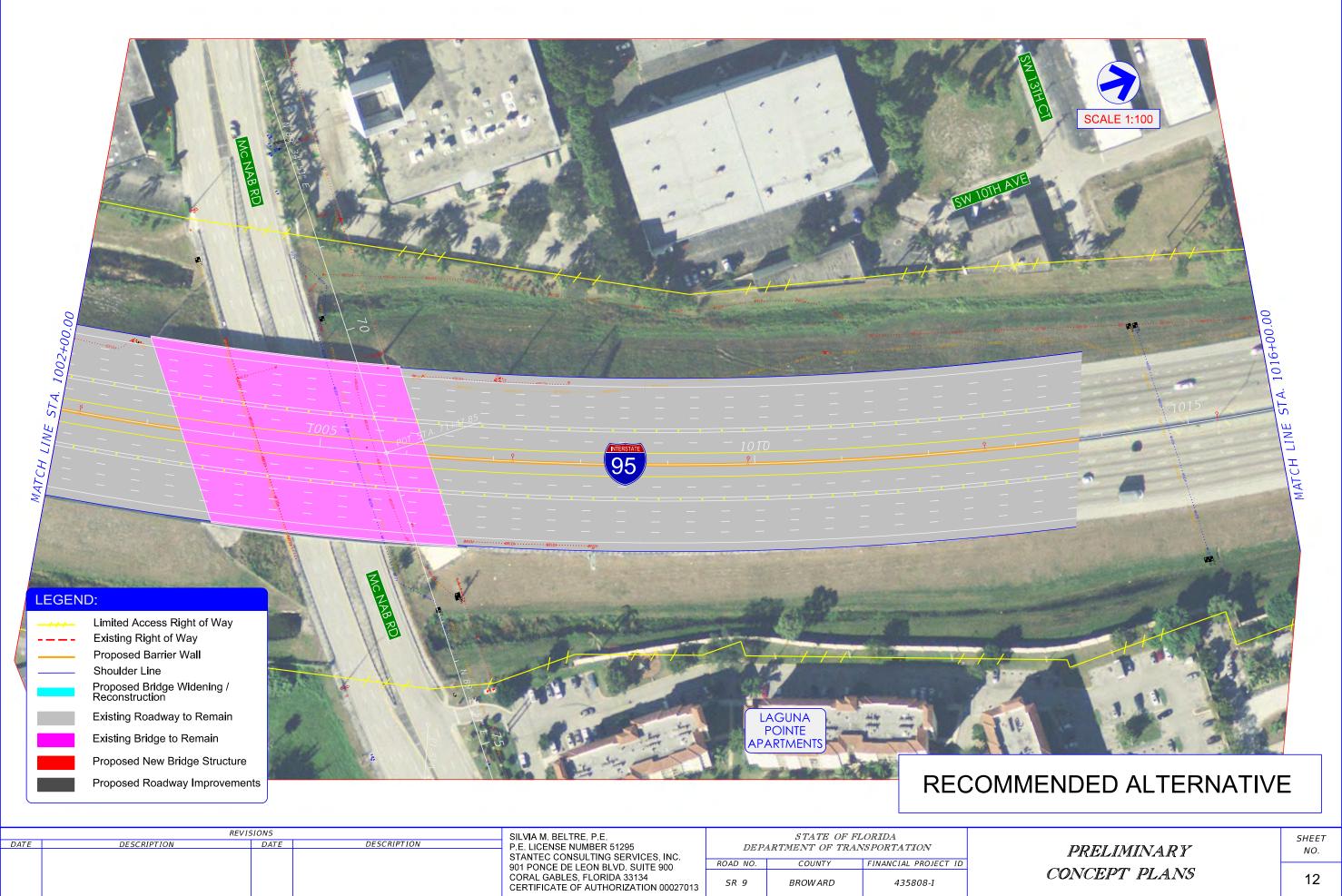


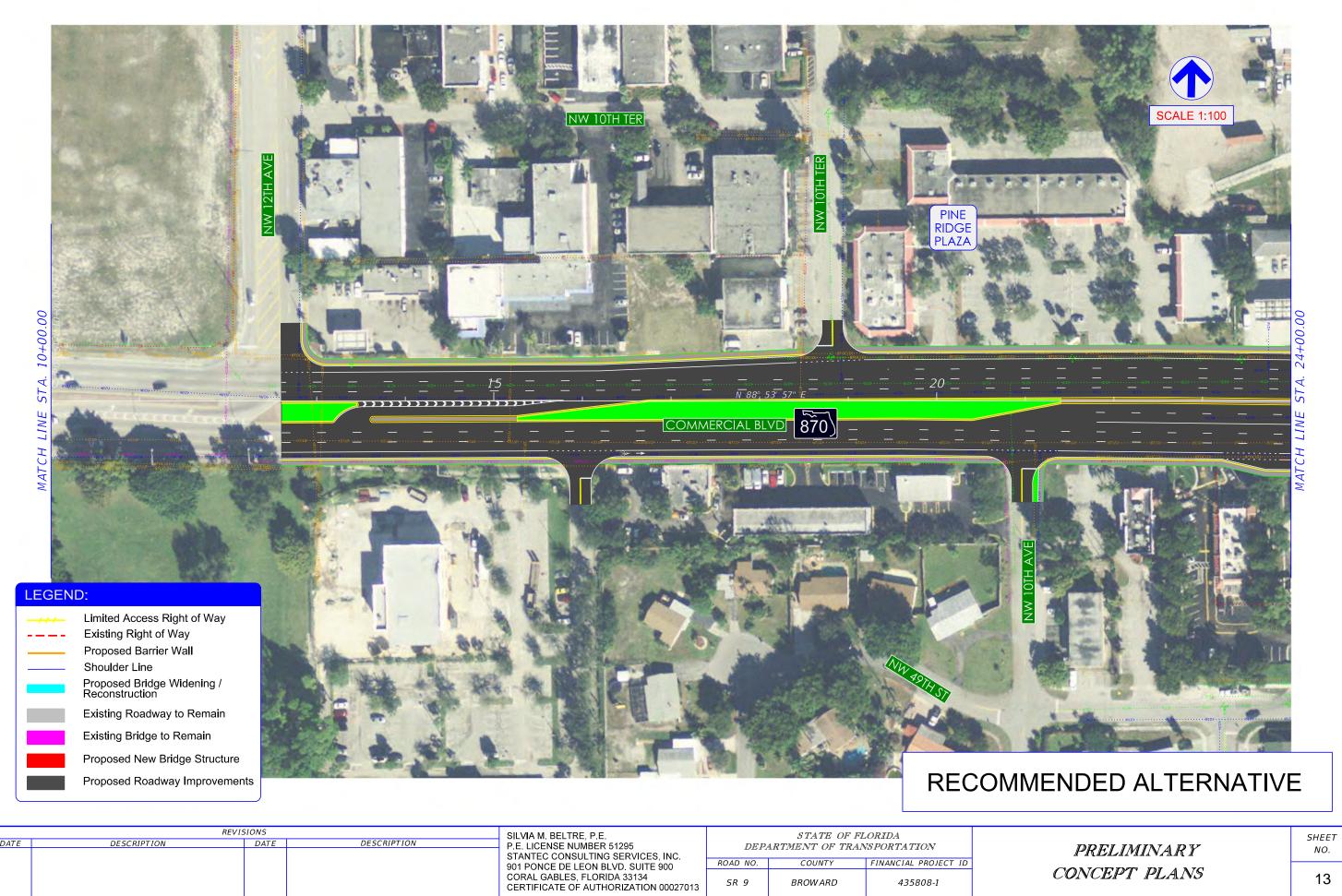












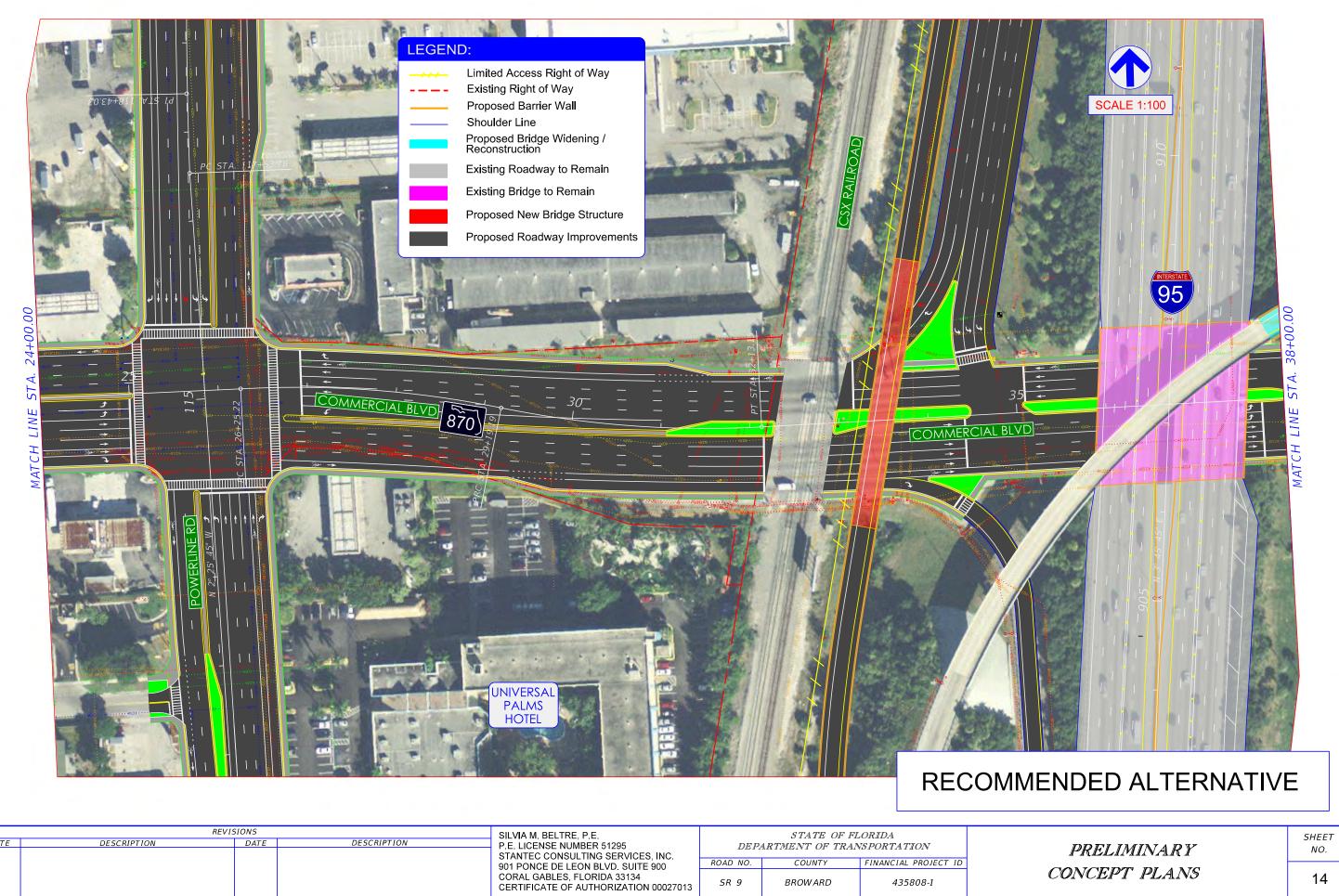
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FINANCIAL PROJECT ID

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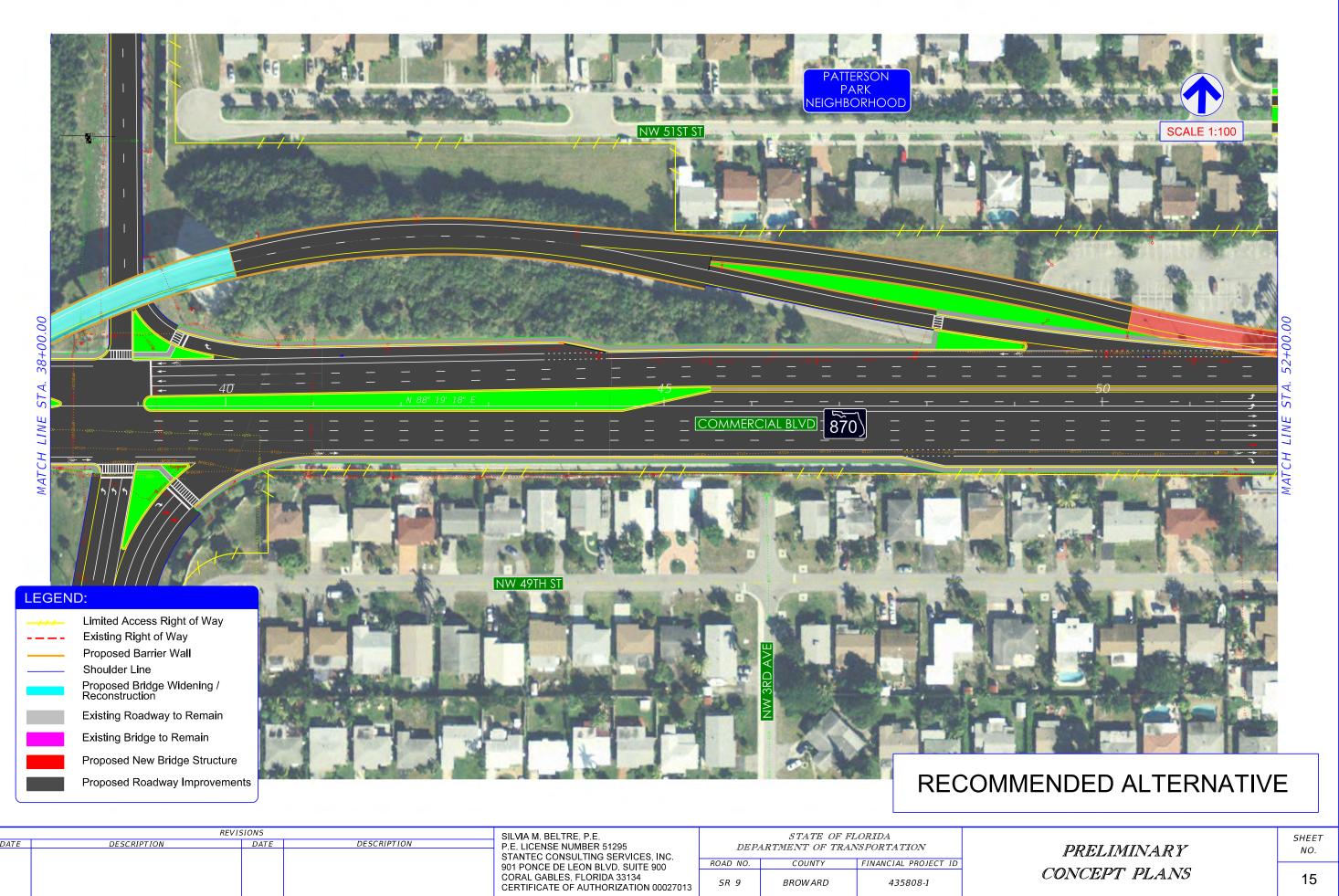
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ROAD NO.

SR 9

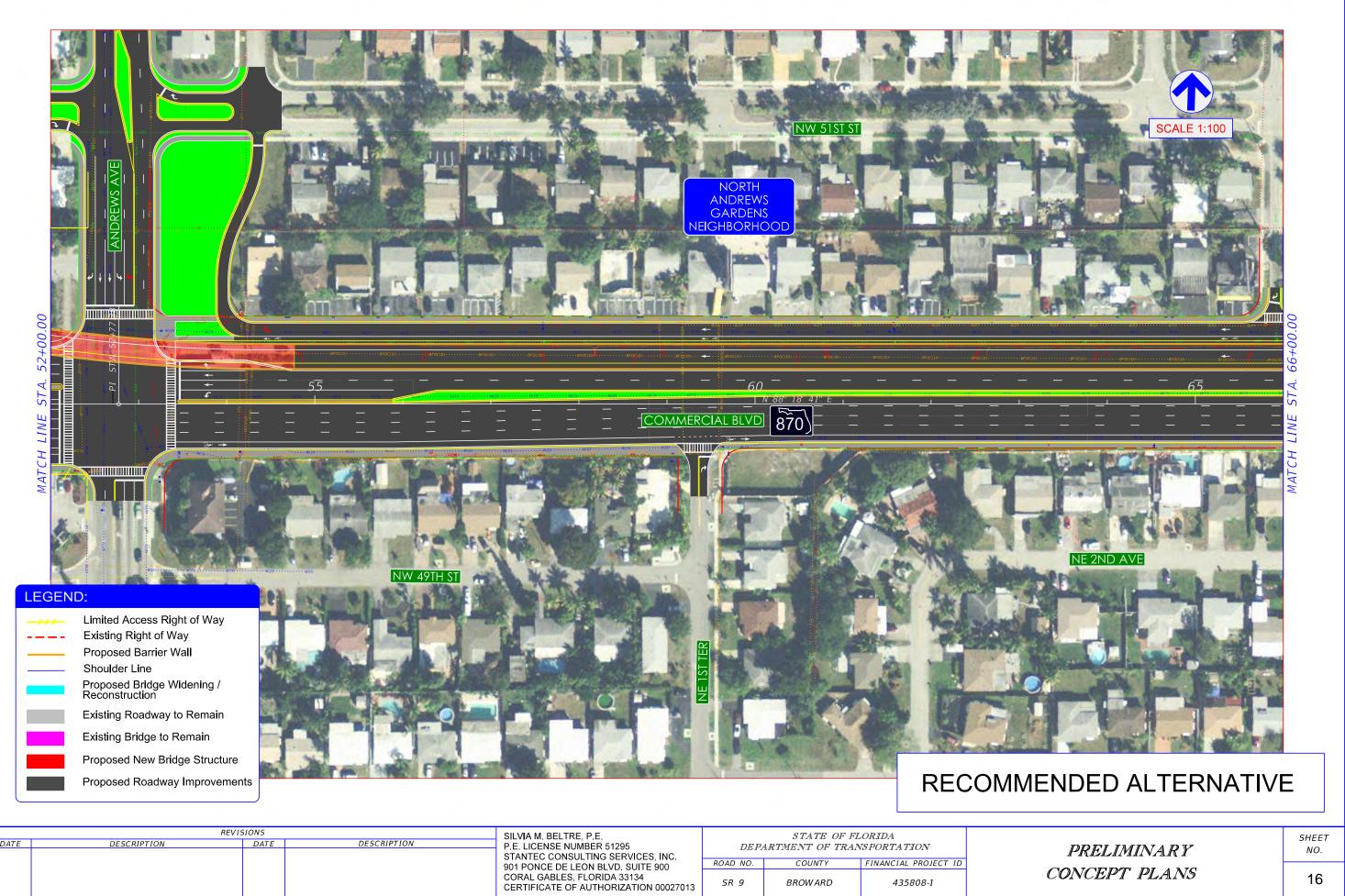
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14



SR 9

CONCEPT PLANS

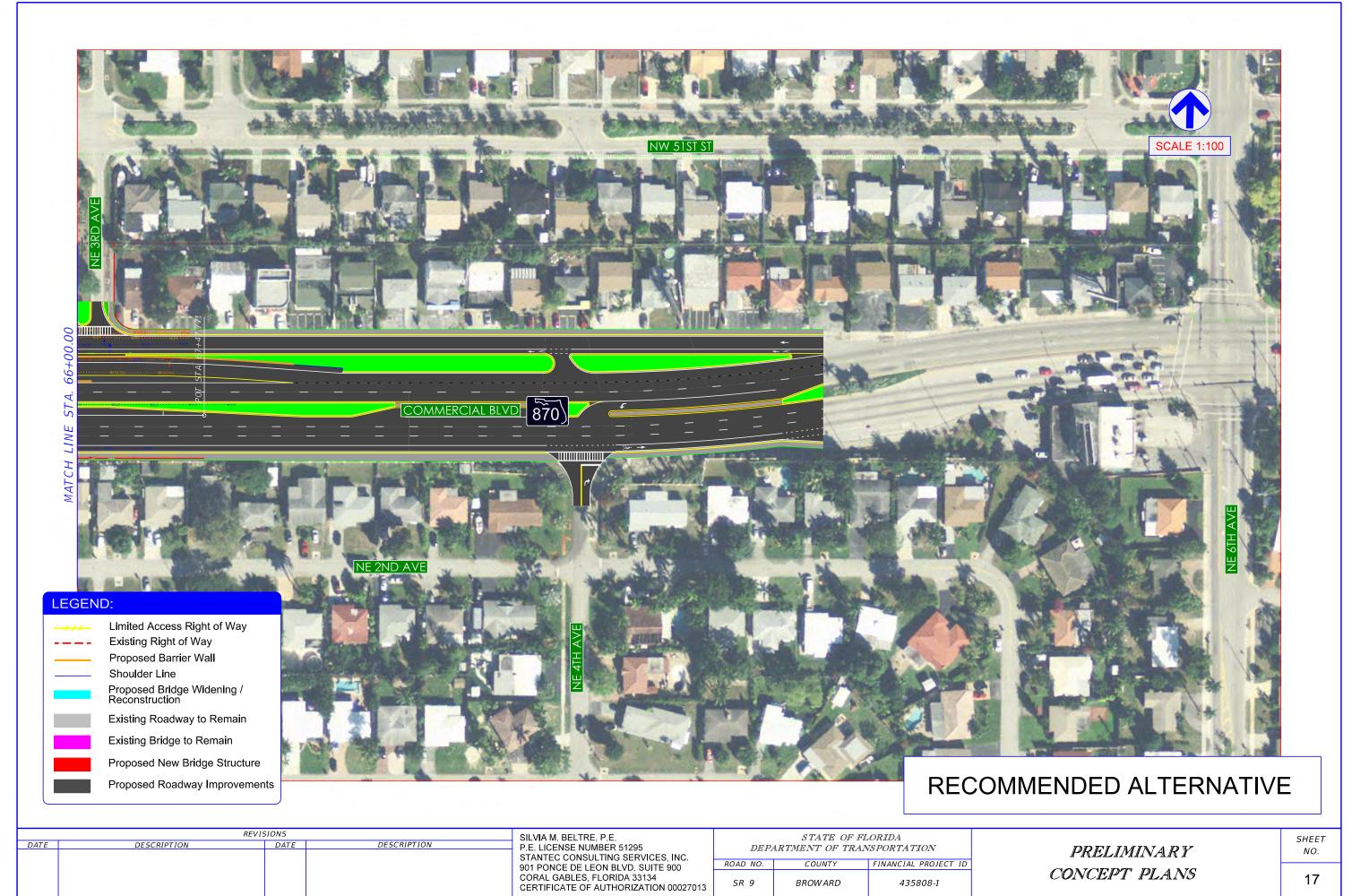


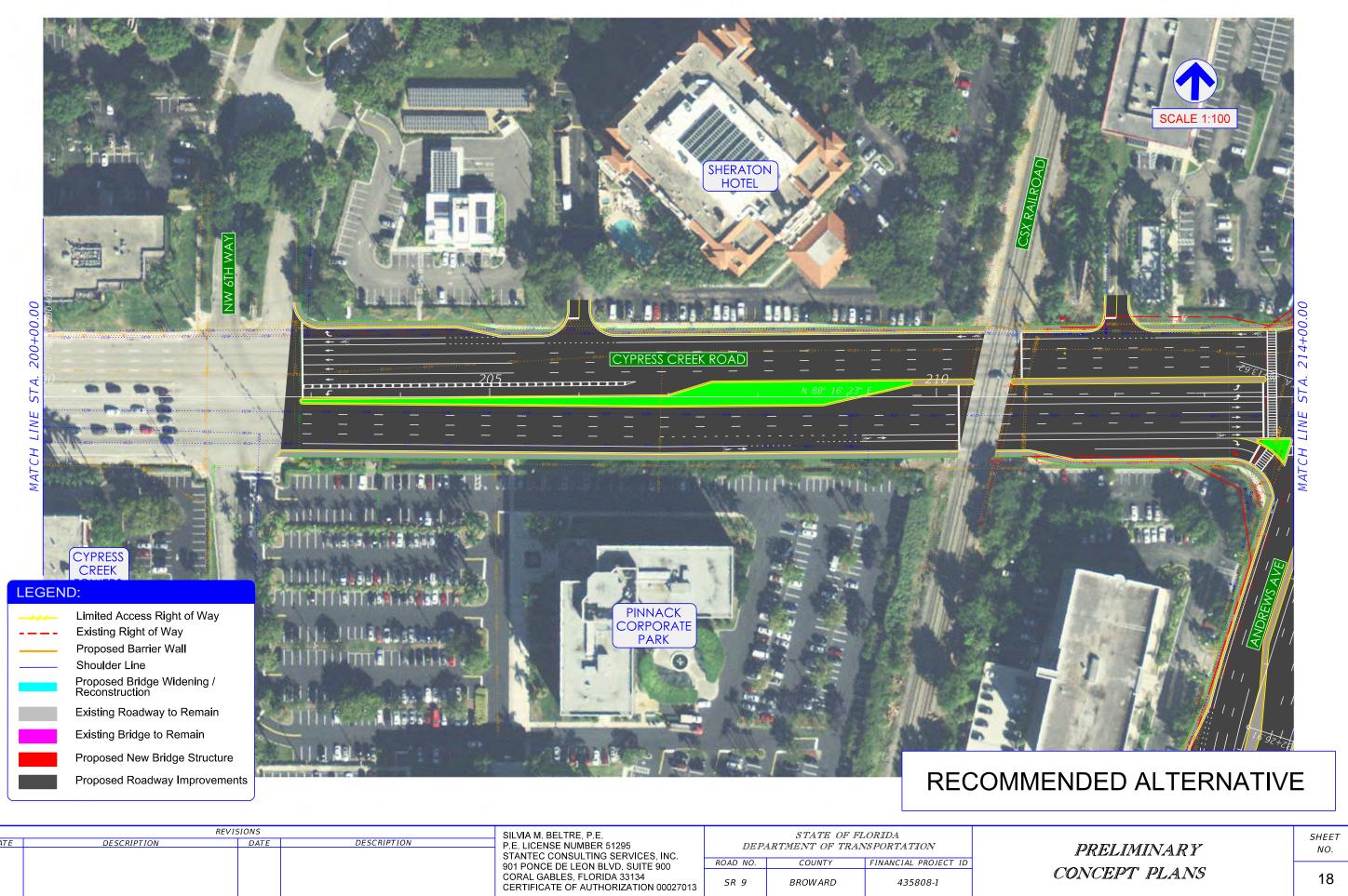
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BROWARD

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FINANCIAL PROJECT ID

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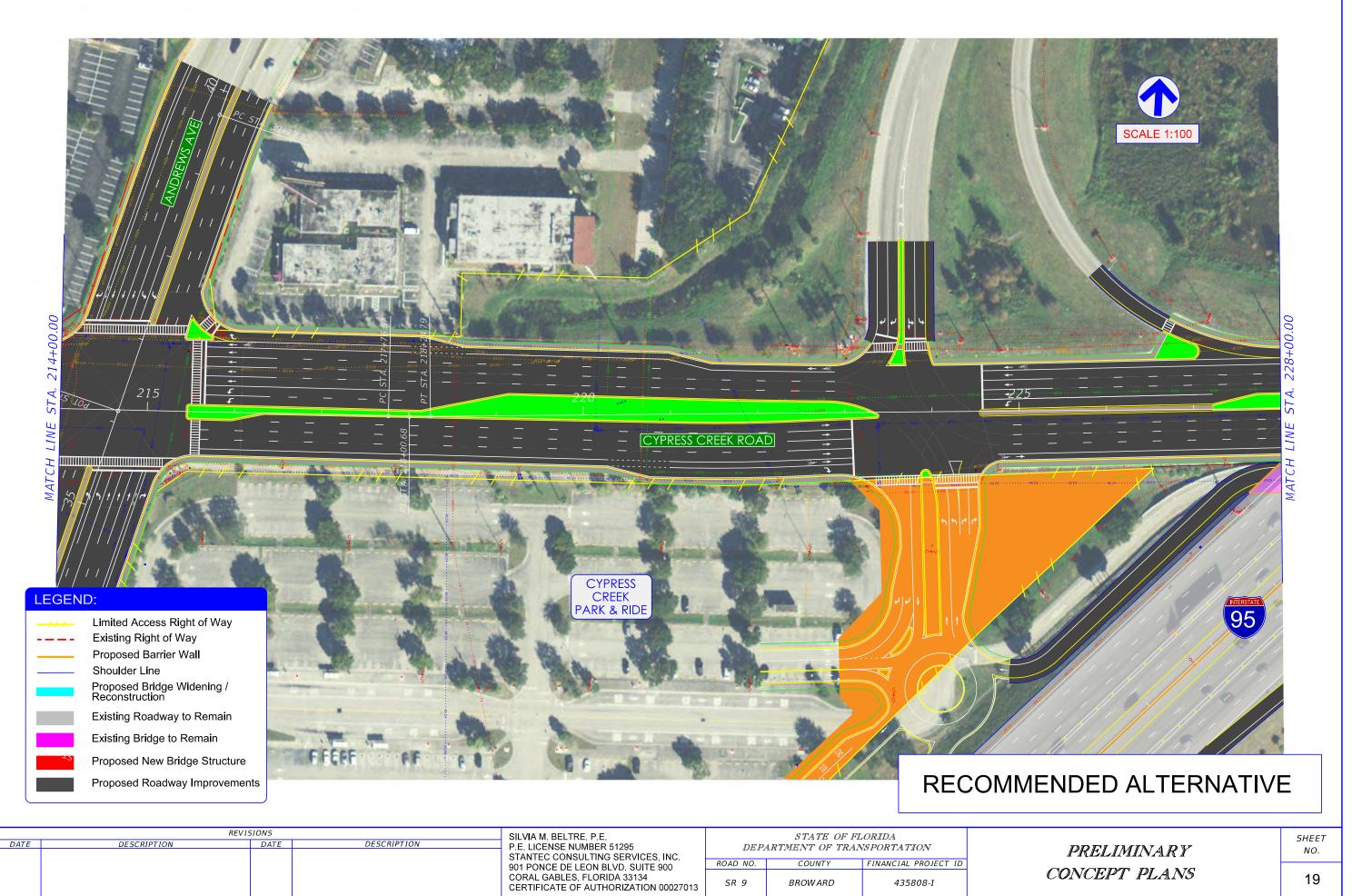
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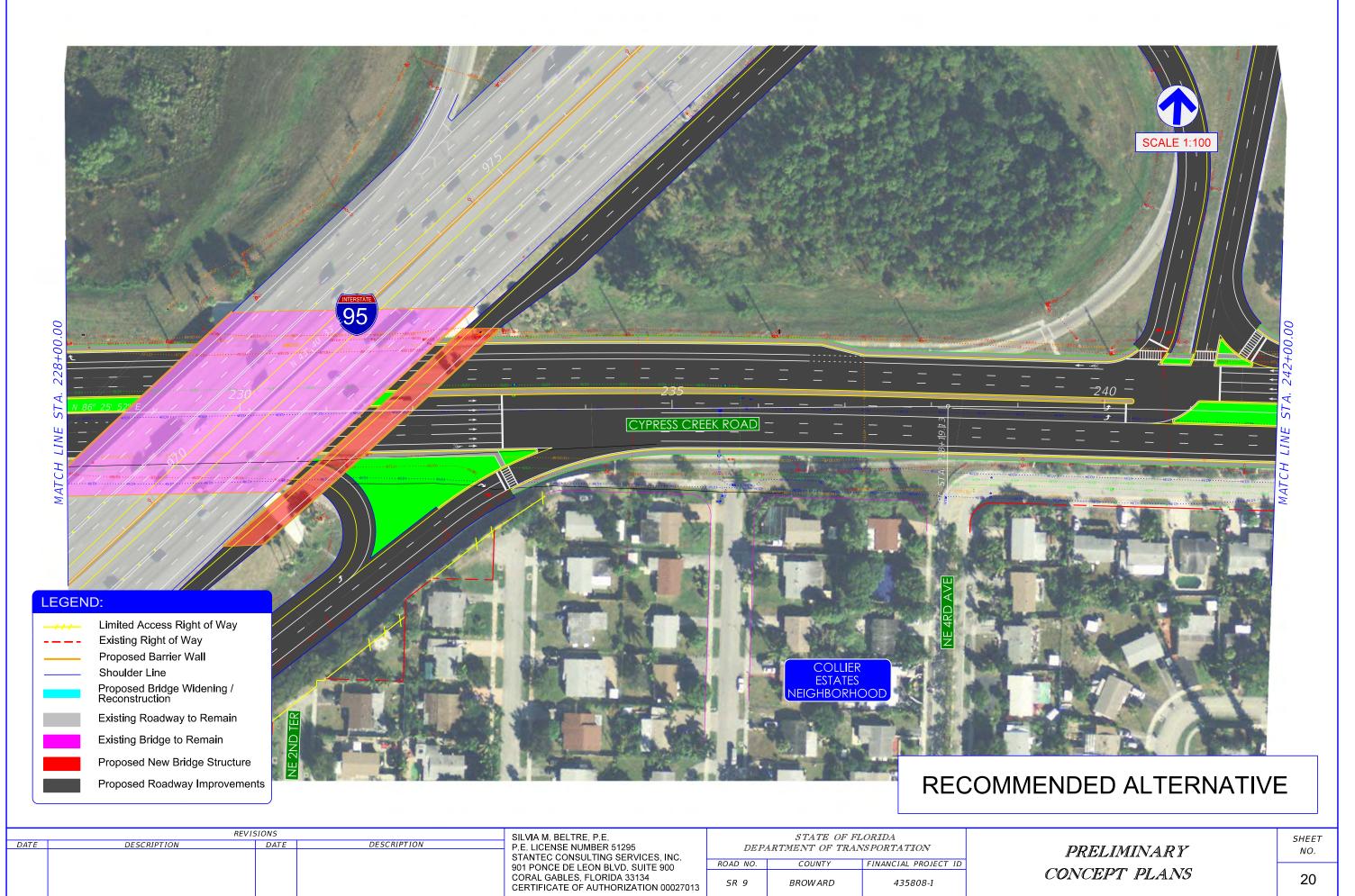
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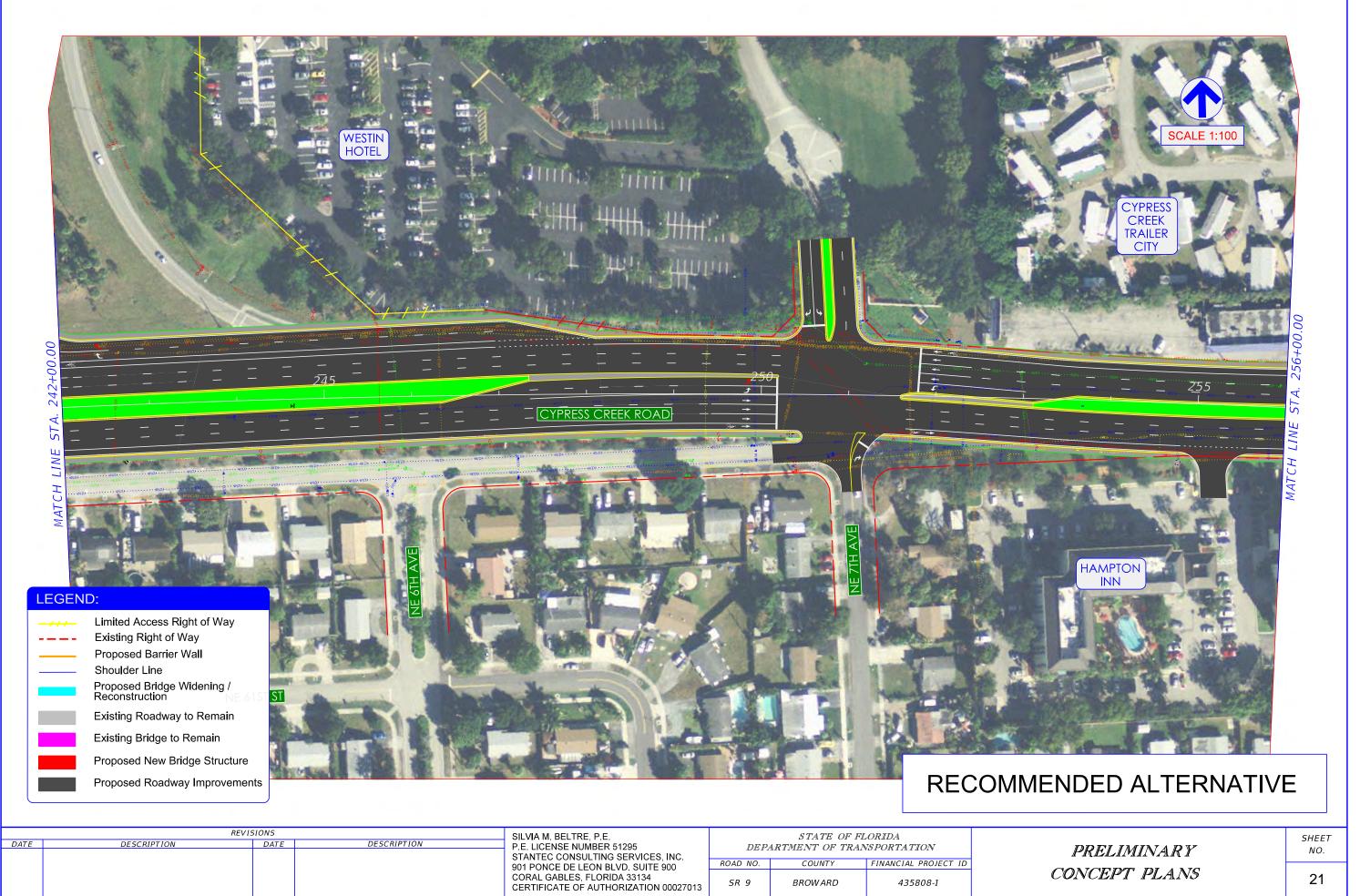
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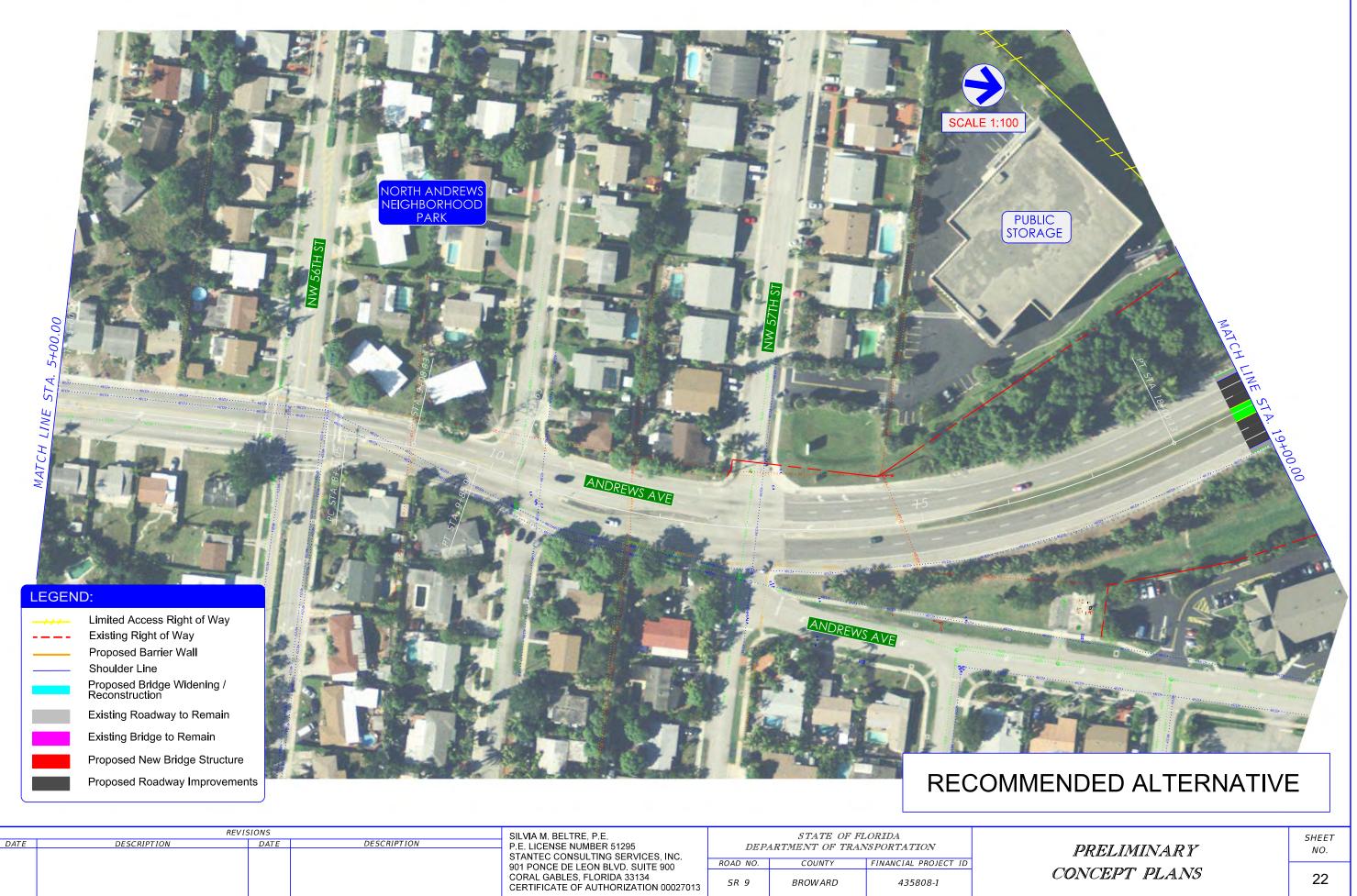


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435808-1



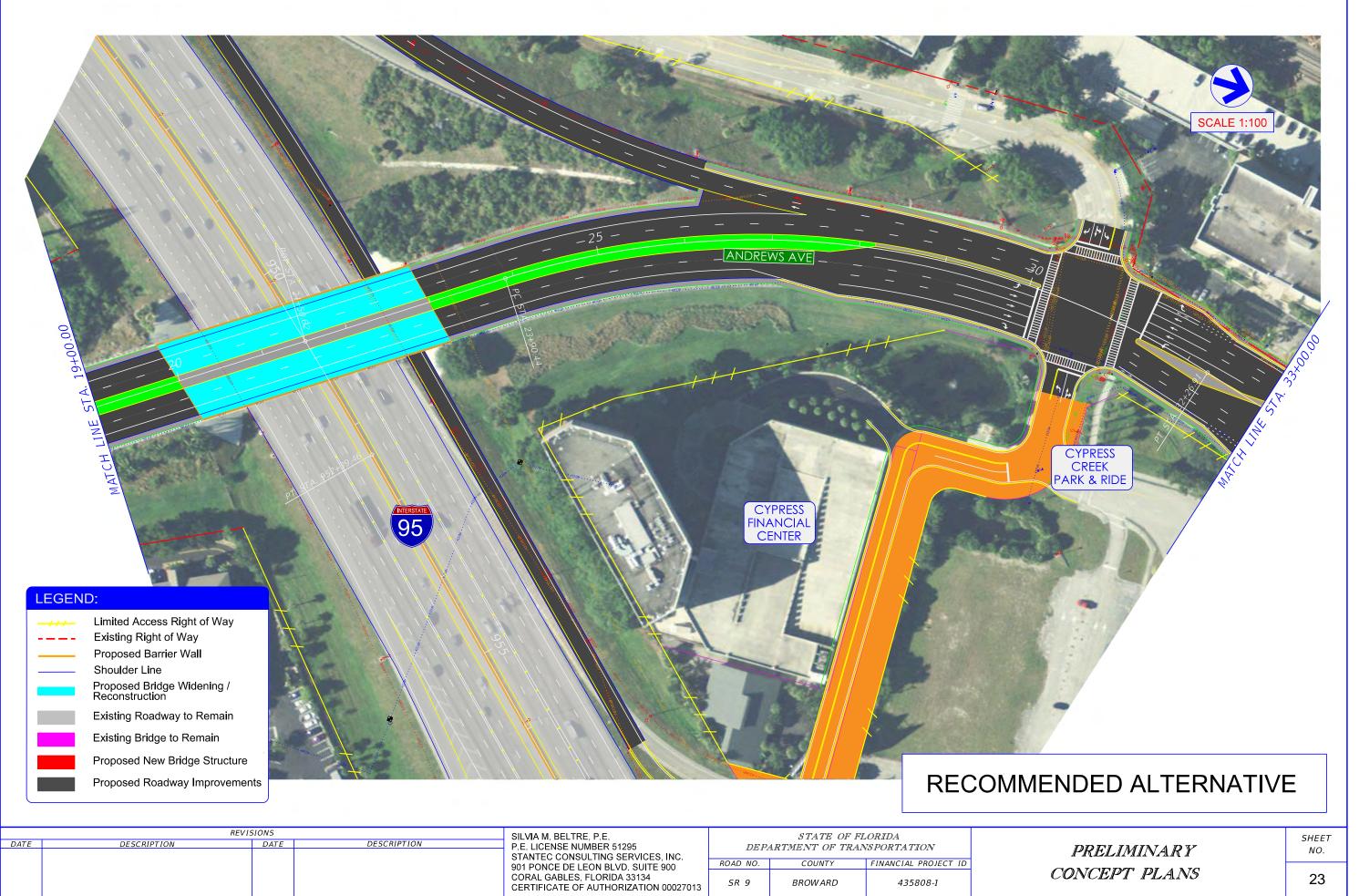
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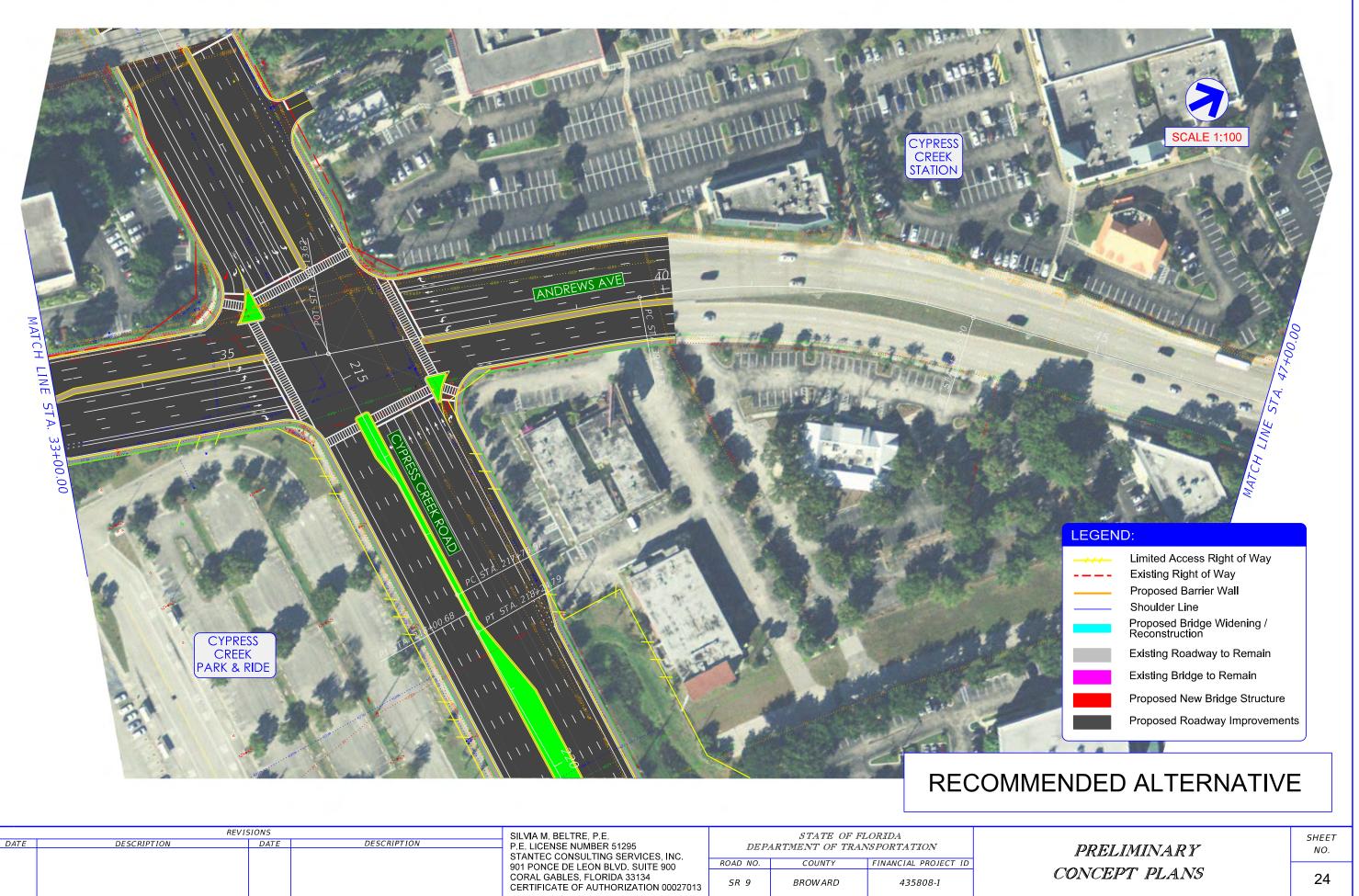
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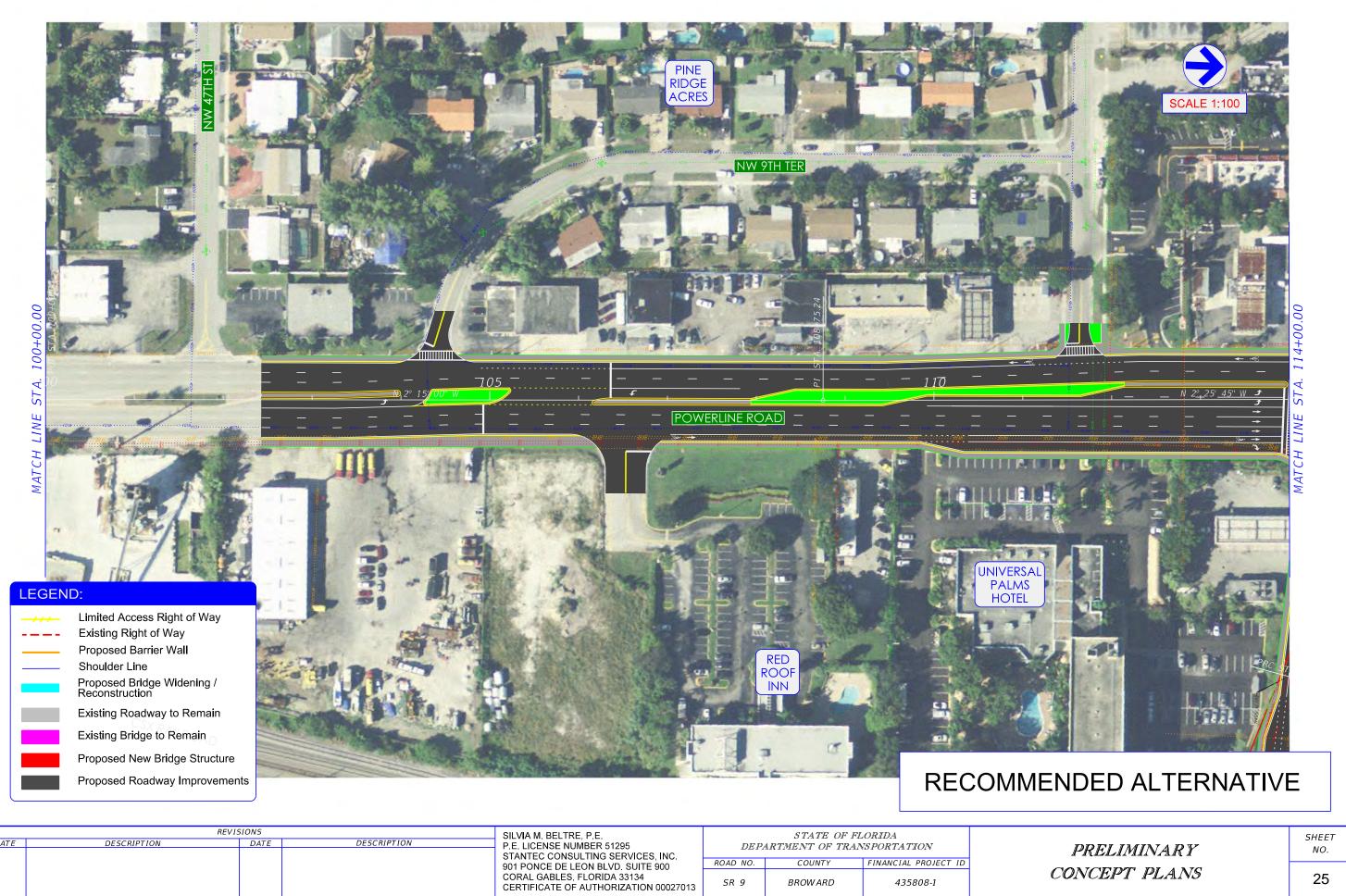
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BROWARD

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COUNTY

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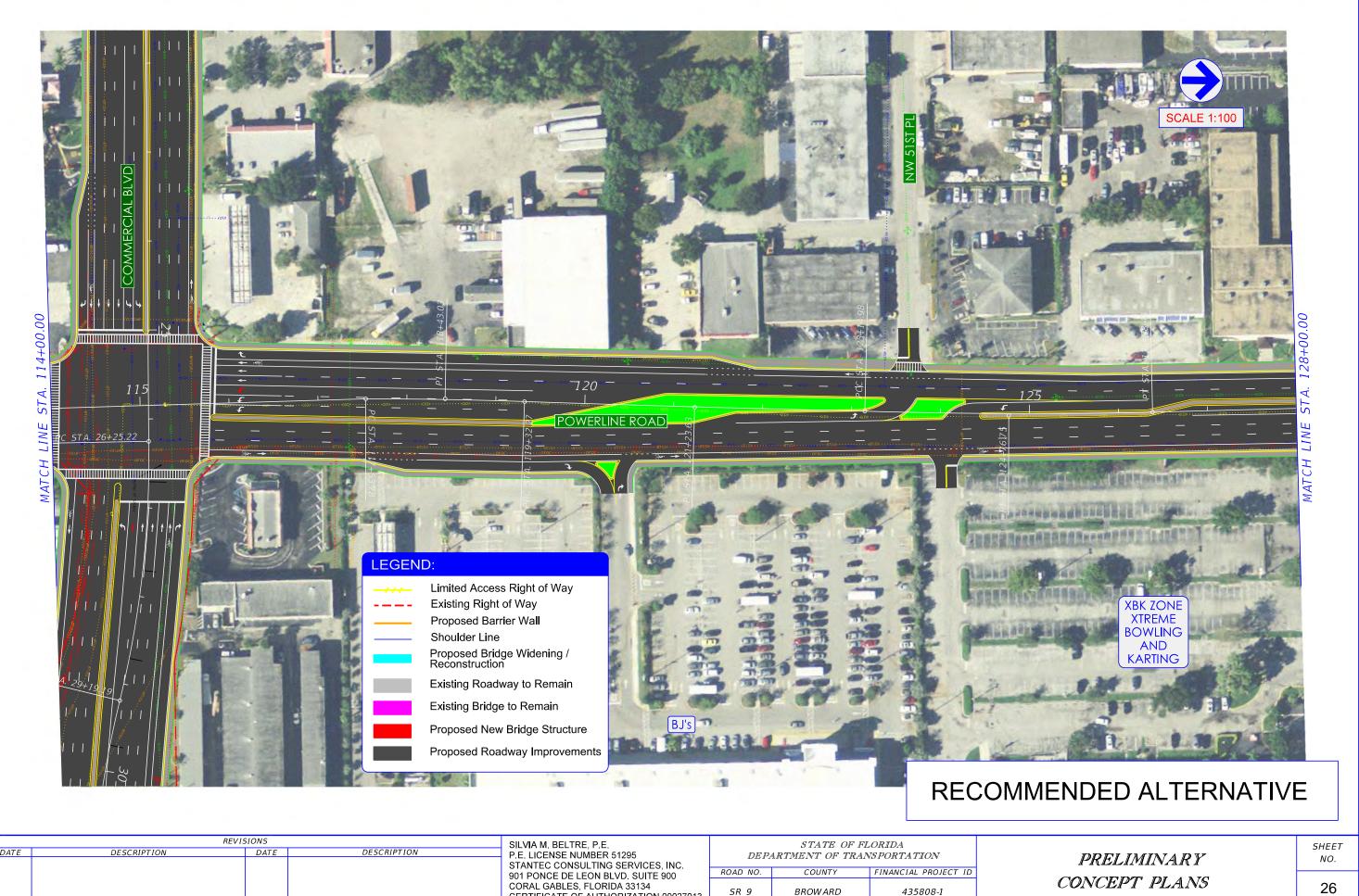
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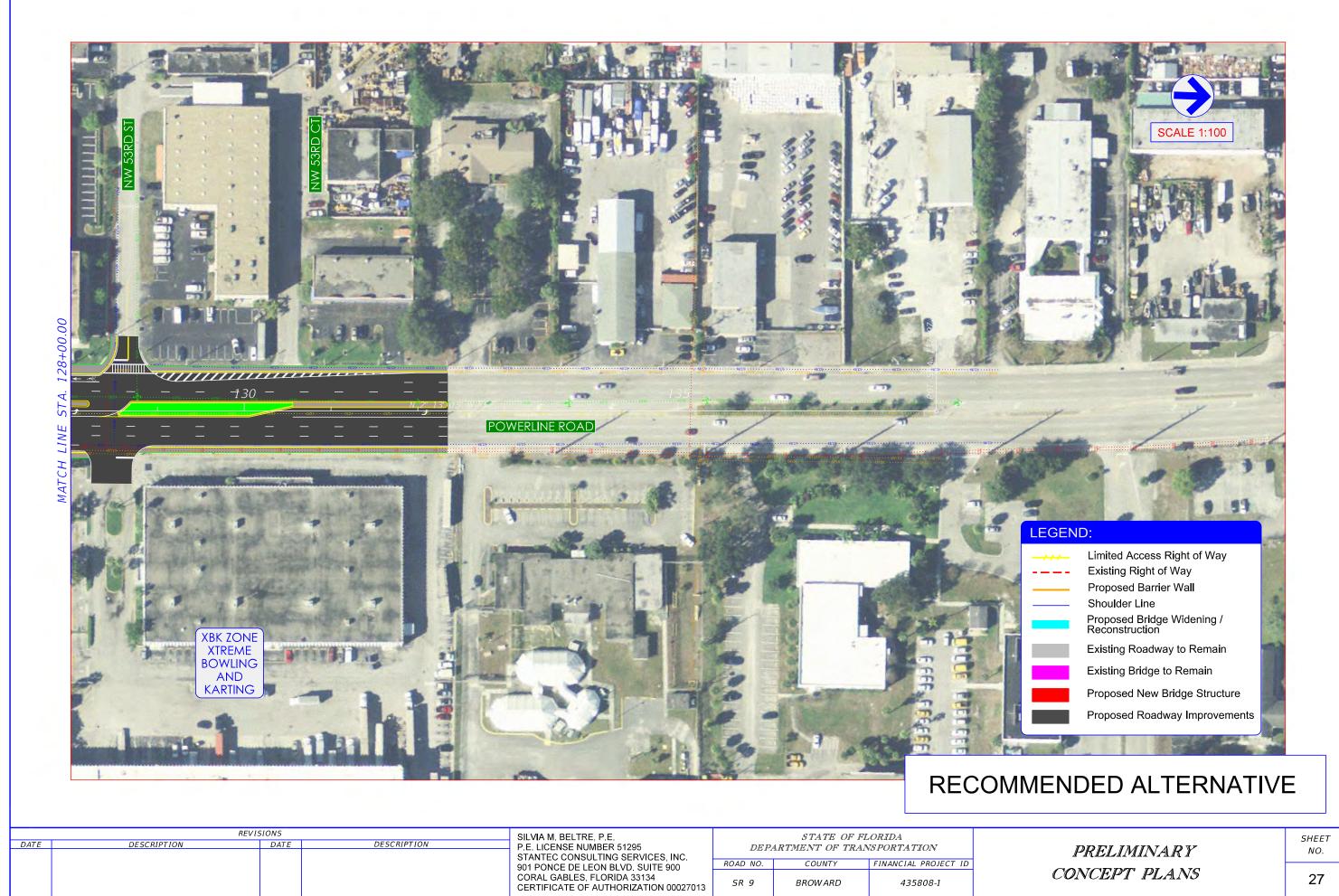
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BROWARD

CONCEPT PLANS

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DESCRIPTION

SR 9 BROWARD 435808-1

COUNTY

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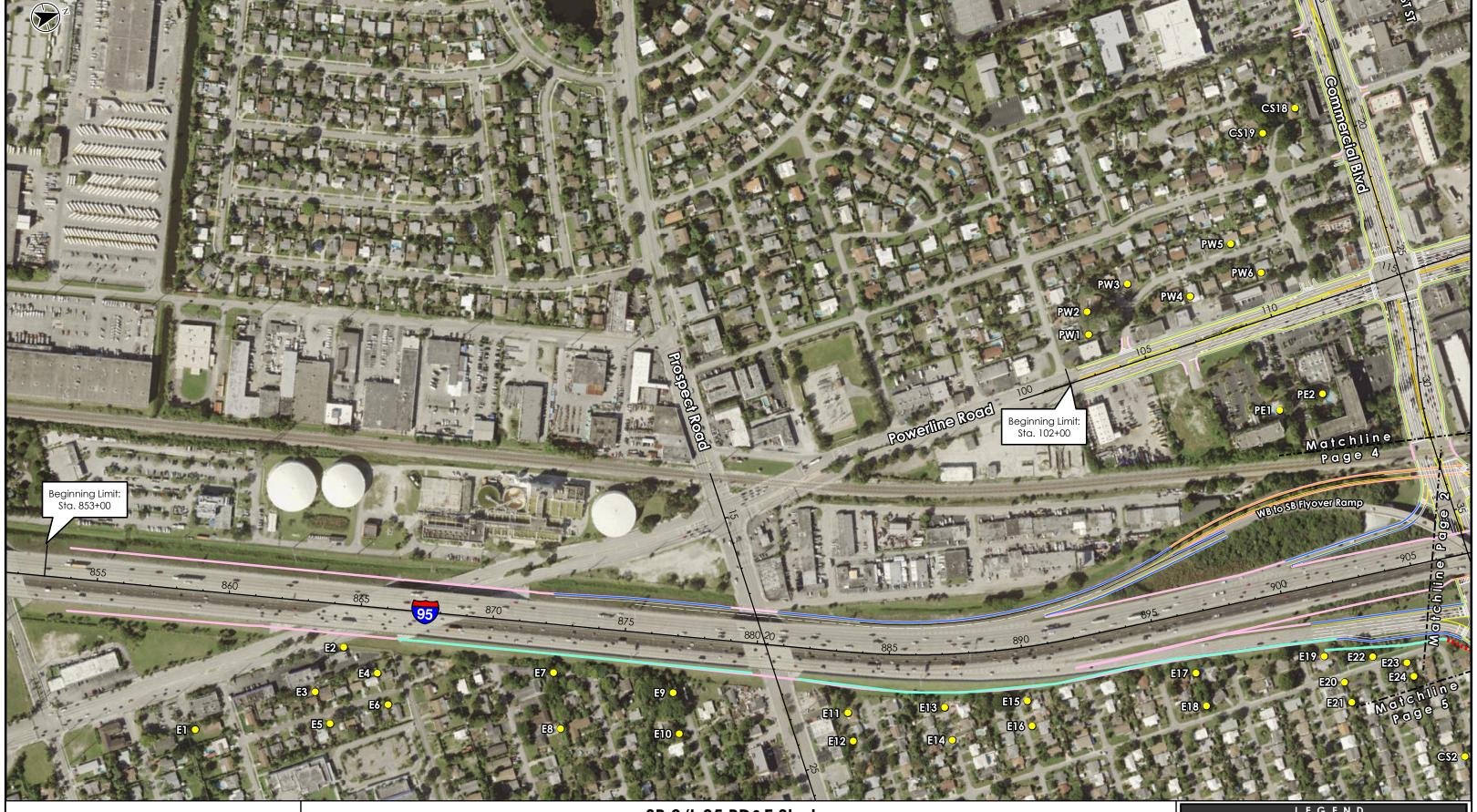
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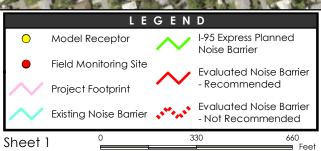
# Appendix B Noise Analysis Maps

Noise Study Report Appendix B





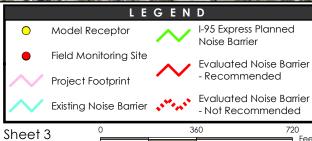
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South of SR 870/Commercial Boulevard to North of Cypress Creek Road
Broward County, Florida
FM #435808-1-22-02





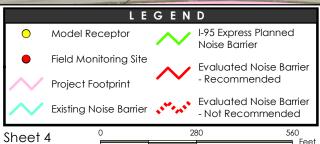


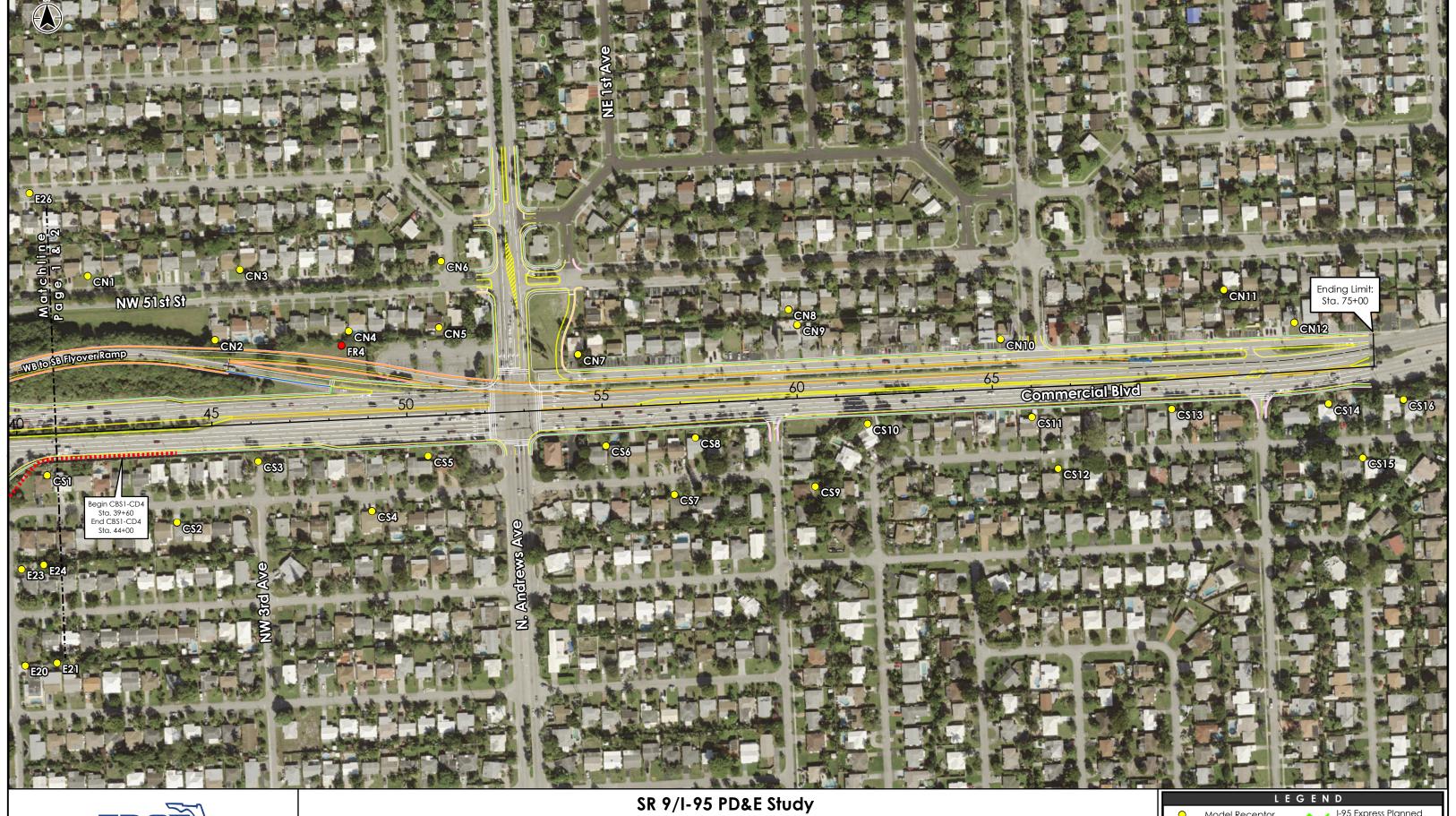
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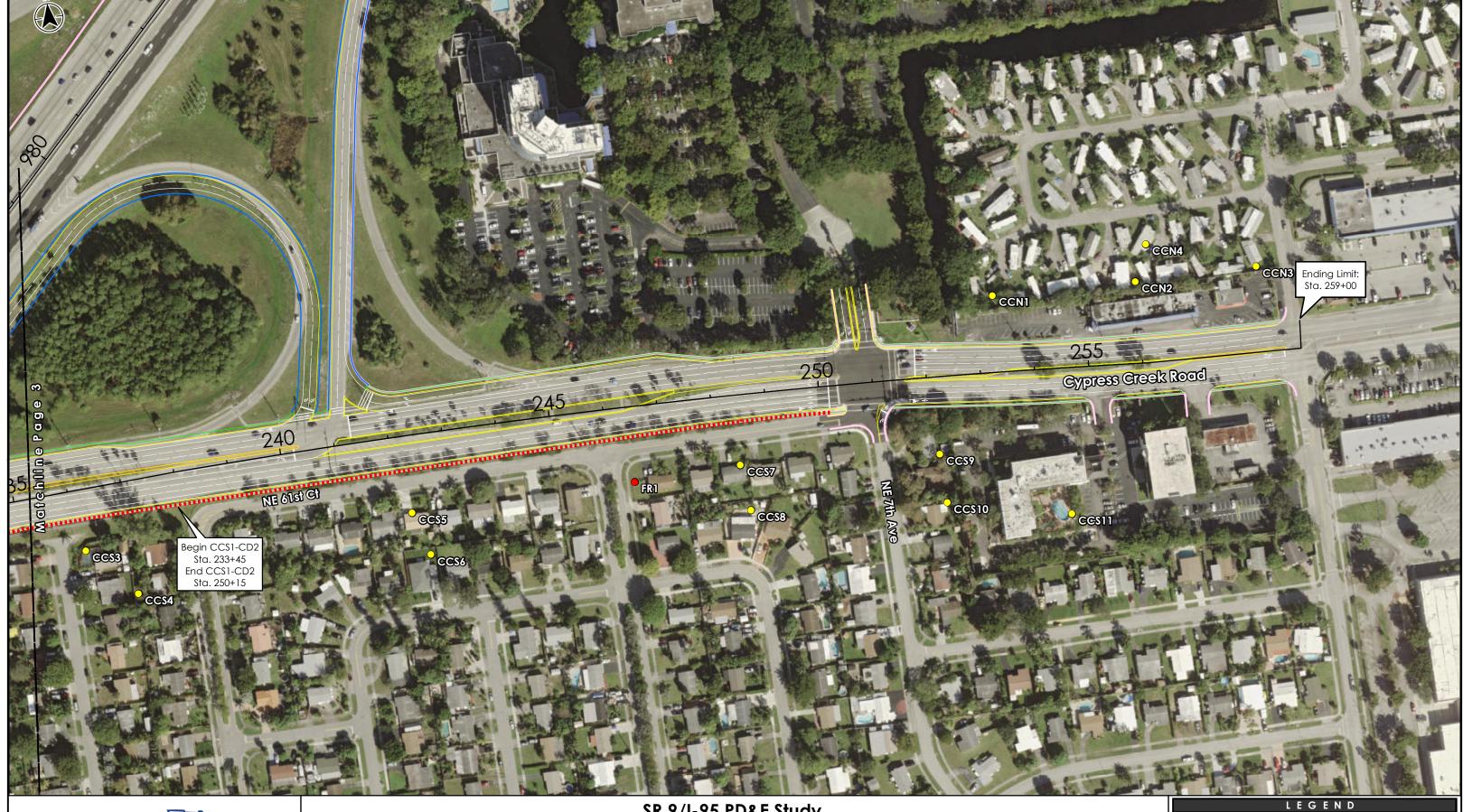






SR 9/I-95 PD&E Study
South of SR 870/Commercial Boulevard to North of Cypress Creek Road
Broward County, Florida
FM #435808-1-22-02







SR 9/I-95 PD&E Study
South of SR 870/Commercial Boulevard to North of Cypress Creek Road
Broward County, Florida
FM #435808-1-22-02





## Appendix C TNM Traffic Data

Noise Study Report Appendix C

				Traffic	Data Used in T	'NM Model <sup>†</sup>								
Roadway			Existing (2015)				D	esign Year (2045) No	o-Build			Design Ye	ar (2045) Build	
Segment	Number of Lanes		Peak-Hour	LOS C	TNM Data	Number of Lanes		Peak-Hour	LOS C	TNM Data	Number of Lanes		LOS C	TNM Data
	*	•			I-95						•	•		
1.45 Northbound Southern Project Terminus to Commercial Blvd Off-Ramp	5	8,600	8695	7080	7,080	7	12,395	12,395	10,400	10,400	7	12,395	10,400	10,400
I-95 Southbound Commercial Blvd On-Ramps to Southern Project Terminus	5	9,245	9970	7080	7,080	7	15,420	13,700	10,400	10,400	7	13,700	10,400	10,400
1-95 Northbound Commercial Bivd Off-Ramp to Commercial Bivd On-Ramp	4	6,645	7045	6080	6,080	5	10,095	10,605	7,900	7,900	5	10,605	7,900	7,900
1-95 Sutthbound Commercial Blvd Off-Ramp to Commercial Blvd On-Ramps	4	7,460	7925	6080	6,080	5	13,235	11,390	7,900	7,900	5	9,675	7,900	7,900
1-95 Northbound Commercial Blvd On-Ramp to EB Cypress Creek Rd Off-Ramp	5	7,475	7955	7080	7,080	6	11,245	11,840	8,900	8,900	6	11,840	8,900	8,900
1-95 Suthbound EB Cypress Creek Rd On-Ramp to Commercial Bivd Off-Ramp	5	8,525	8730	7080	7,080	6	14,595	12,290	8,900	8,900	6	10,575	8,900	8,900
I-95 Northbound EB Cypress Creek Rd Off-Ramp to WB Cypress Creek Rd Off-Ramp	4	6,520	7200	6080	6,080	5	9,990	10,855	7,900	7,900	5	10,855	7,900	7,900
I-95 Sulthbound WB Cypress Creek Rd On-Ramp to EB Cypress Creek Rd On-Ramp	4	7,770	7550	6080	6,080	5	13,580	10,575	7,900	7,900	5	10,575	7,900	7,900
Nr195 Nr195 Nr195bound WB Cypress Creek Rd Off-Ramp to Cypress Creek Rd On-Ramp	4	5,320	6810	6080	6,080	5	8,590	10,180	7,900	7,900	5	10,180	7,900	7,900
1-95 Southbound Cypress Creek Rd Off-Ramp to WB Cypress Creek Rd On-Ramp	4	7,175	6740	6080	6,080	5	12,490	9,855	7,900	7,900	5	9,855	7,900	7,900
1-95 Northbound Cypress Creek Rd On-Ramp to Northern Project Terminus	5	5,785	7625	7080	7,080	6	9,535	11,455	8,900	8,900	6	11,455	8,900	8,900
I-95 Southbound Northern Project Terminus to Cypress Creek Rd Off-Ramp	5	7,800	7410	7080	7,080	6	13,315	10,895	8,900	8,900	6	10,895	8,900	8,900
					Southbound CD I	Road								
Southbound CD Road Southbound SB Andrews Ave Park & Ride On-Ramp to SB Andrews Ave On-Ramp	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	265	N/A	265
Southbound CD Road Southbound SB Andrews Ave On-Ramp to Merge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	1,715	N/A	1,715
Southbound CD Road Southbound Merge to WB Commercial Bivd to SBI-95 On-Ramp	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1,715	N/A	1,715

Traffic Data Used in TNM Model   Roadway Existing (2015) Design Year (2045) No-Build Design Year (2045) Build														
Roadway Segment	Number of Lanes	1	Existing (2015) Peak-Hour	LOS C	TNM Data	Number of Lanes		esign Year (2045) No Peak-Hour		TNM Data	Number of Lanes	Design Ye Peak-Hour	ear (2045) Build LOS C	TNM Data
				S	R 870/Commercia	l Blvd								
Commercial Blvd Eastbound NW 12th Ave to Powerline Rd	3	1,715	1935	3087	1,935	3	2,465	2,325	3,087	2,325	3	2,325	3,087	2,325
Commercial Blvd Westbound Powerline Rd to NW 12th Ave	3	1,805	1760	3087	1,760	3	2,320	2,115	3,087	2,115	3	2,115	3,087	2,115
Commercial Blvd Eastbound Powerline Rd to SB I-95 On-Ramp	3	2,095	2550	3087	2,550	3	2,830	2,980	3,087	2,980	4	2,980	4,169	2,980
Commercial Blvd Westbound SB I-95 Off-Ramp to Powerline Rd	3	2,185	2020	3087	2,020	3	2,825	2,330	3,087	2,330	4	2,330	4,169	2,330
Commercial Blvd Eastbound SB I-95 On-Ramp to NB I-95 Off-Ramp	3	1,915	1935	3087	1,935	3	2,445	2,310	3,087	2,310	3	2,310	3,087	2,310
Commercial Blvd Westbound NB I-95 On-Ramp to SB I-95 Off-Ramp	3	1,645	1590	3087	1,590	3	2,130	1,880	3,087	1,880	3	1,880	3,087	1,880
Commercial Blvd Eastbound NB I-95 Off-Ramp to Andrews Ave	3	2,505	2385	3087	2,385	3	2,895	2,670	3,087	2,670	4	2,670	4,169	2,670
Commercial Blvd Westbound SB I-95 On-Ramp to NB I-95 On-Ramp	3	1,110	1300	3087	1,300	3	1,430	1,685	3,087	1,685	3	1,685	3,087	1,685
Commercial Blvd Westbound Andrews Ave toSB I-95 On-Ramp	3	2,190	2355	3087	2,355	3	2,565	2,875	3,087	2,875	3	1,950	3,087	1,950
Commercial Blvd Eastbound Andrews Ave to NE 3rd Ave	3	2,235	2335	3087	2,335	3	2,605	2,660	3,087	2,660	4	2,660	4,169	2,660
Commercial Blvd Westbound NE 3rd Ave to Andrews Ave	3	1,865	1970	3087	1,970	3	2,155	2,440	3,087	2,440	2	1,495	2,006	1,495
Commercial Bird Eastbound NE 3rd Ave to NE 6th Ave	3	2,185	2320	3087	2,320	3	2,530	2,640	3,087	2,640	3	2,640	3,087	2,640
Commercial Bird Westbound NE 6th Ave to NE 3rd Ave	3	1,830	1965	3087	1,965	3	2,100	2,435	3,087	2,435	3	2,435	3,087	2,435
					Cypress Creek	Rd								
Cypress Creek Rd Estatbound NW 6th Way to Andrews Ave	4	1,650	2,100	3,752	2,100	4	2,340	2,600	3,752	2,600	3	2,600	3,752	2,600
Cypress Creek Rd Westbound Andrews Ave to NW 6th Way	4	2,050	1,425	3,752	1,425	4	2,330	1,825	3,752	1,825	4	1,825	3,752	1,825
Cypress Creek Rd Estbound Andrews Ave to Park & Ride Entrance	4	1,100	1,520	3,752	1,520	4	1,615	2,065	3,752	2,065	4	2,065	3,752	2,065
Cypress Creek Rd Westbound SB I-95 Off-Ramp to Andrews Avenue	4	2,430	1,735	3,752	1,735	4	2,730	2,205	3,752	2,205	4	2,205	3,752	2,205
Cypress Creek Rd Eastbound Park & Ride Entrance to NB I-95 Off-Ramp	3	1,370	1,710	2,778	1,710	3	1,910	2,285	2,778	2,285	3	2,285	2,778	2,285
Cypress Creek Rd Westbound NB I-95 On/Off-Ramps to SB I-95 Off-Ramp	3	2,595	1,950	2,778	1,950	3	3,210	2,375	2,778	2,375	3	2,375	2,778	2,375
Cypress Creek Rd Estbound NB I-95 Off-Ramp to Corporate Dr/NE 7th Ave	3	1,820	1,740	2,778	1,740	3	2,205	2,160	2,778	2,160	3	2,160	2,778	2,160
Cypress Creek Rd Westbound Gorporate Dr/NE 7th Ave to NB I-95 On/Off-Ramps	3	1,490	1,725	2,778	1,725	3	1,950	1,950	2,778	1,950	3	1,950	2,778	1,950
Cypress Creek Rd Eastbound Corporate Dr.NE 7th Ave to NE 9th Ave	3	1,440	1,605	2,778	1,605	3	1,715	2,020	2,778	2,020	3	2,020	2,778	2,020
Cypress Creek Rd Westbound NE 9th Ave to Corporate Dr/NE 7th Ave	3	1,450	1,390	2,778	1,390	3	1,885	1,650	2,778	1,650	3	1,650	2,778	1,650
Cypress Creek Rd Estatbound NE 9th Ave to Eastern Project Terminus	3	1,340	1,500	2,778	1,500	3	1,575	1,915	2,778	1,915	3	1,915	2,778	1,915
Cypress Creek Rd Westbound Eastern Project Terminus to NE 9th Ave	3	1,505	1,435	2,778	1,435	3	1,910	1,705	2,778	1,705	3	1,705	2,778	1,705

				Traffic	Data Used in T	NM Model†									
Roadway	1		Existing (2015)		Data Oseu III I	I WINDOW	-	esign Year (2045) N	o-Ruild		Design Year (2045) Build				
Segment	Number of Lanes		Peak-Hour	LOS C	TNM Data	Number of Lanes		Peak-Hour	LOS C	TNM Data	Number of Lanes		LOS C	TNM Data	
					Ramps										
NB I-95 to Commercial Blvd NB to EBWB OH-Ramp	2	1,955	1,650	N/A	1,650	2	2,300	1,790	N/A	1,790	3	1,790	N/A	1,790	
Commercial Bivd to NB I-95 EB/WB to NB On-Ramp	1	830	910	N/A	910	1	1,150	1,235	N/A	1,235	1	1,235	N/A	1,235	
SB I-95 to Commercial Bivd SB to EBWB Off-Ramp	1	1,065	805	N/A	805	2	1,360	900	N/A	900	2	900	N/A	900	
EB Commercial Blwd to SB I-95 EB to SB On-Ramp	1	705	990	N/A	990	1	1,050	1,120	N/A	1,120	1	1,120	N/A	1,120	
WB Commercial Blvd to SB I-95 WB to SB On-Ramp	1	1,080	1,055	N/A	1,055	1	1,135	1,190	N/A	1,190	1	1,190	N/A	1,190	
NB I-95 to EB Cypress Creek Rd NB to EB Off-Ramp	1	955	755	N/A	755	1	1,255	985	N/A	985	2	985	N/A	985	
NB I-95 to WB Cypress Creek Rd NB to WB Off-Ramp	1	1,200	390	N/A	390	1	1,400	675	N/A	675	2	675	N/A	675	
EBWB Cypress Creek Rd to NB I-95 EBWB to NB On-Ramp	2	465	815	N/A	815	1	945	1,275	N/A	1,275	2	1,275	N/A	1,275	
SB I-95 to EBWB Cypress Creek Rd SB to EBWB Off-Ramp	2	625	670	N/A	670	2	825	1,040	N/A	1,040	2	1,040	N/A	1,040	
WB Cypress Creek Rd to SB 1-95 WB to SB On-Ramp	1	570	575	N/A	575	1	1,060	720	N/A	720	1	720	N/A	720	
Park & Ride to SB I-95 CD Road EB to SB On-Ramp	1	25	235	N/A	235	1	30	265	N/A	265	1	265	N/A	265	
EB Cypress Creek Rd/Andrews to SB I-95 CD Road EB to SB On-Ramp	1	755	1,180	N/A	1,180	1	1,015	1,450	N/A	1,450	2	1,450	N/A	1,450	

Notes:

† = Peak-Hour Demand traffic data taken from the project's approved Traffic Volume Development Methodology Memo.

\* = Level of Service C data taken from the FDOT's Generalized Level of Service Tables

PHD = Peak-Hour Demand

LOS C = Level-of-Service C