S.R. 200 PD&E Study Reevaluation

From U.S. 41 to N. of the Marion County Line
Citrus County, Florida
WPI Segment No. 257188 1
FAP No. FL62-020R

FINAL NOISE STUDY TECHNICAL MEMORANDUM

Florida Department of Transportation

District 7, Tampa, Florida

June 2002

S.R. 200 PD&E Study Reevaluation

From U.S. 41 to North of the Marion County Line
Citrus County, Florida
WPI Segment No. 257188 1
FAP No. FL62-020R

FINAL NOISE STUDY TECHNICAL APPENDICES

Prepared by:

PBS&J

Tampa, Florida

In association with:

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Tampa, Florida

Prepared for:

Florida Department of Transportation

District 7, Tampa, Florida

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NOISE STUDY TECHNICAL MEMORANDUM

S.R. 200 PD&E STUDY
FROM U.S. 41 TO THE MARION COUNTY LINE
CITRUS COUNTY

Work Program Item Segment No: 257188 1
Federal Aid Project No: FL62-020R

Prepared for:

Florida Department of Transportation
District Seven
11201 North McKinley Drive
Tampa, Florida 33612-6456

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FROM U.S. 41 TO THE MARION COUNTY LINE
CITRUS COUNTY

Work Program Item Segment No: 257188 1
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Prepared for:

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June 2002

EXECUTIVE SUMMARY

The Florida Department of Transportation (FDOT) is conducting a Project Development and Environment (PD&E) Study reevaluation for proposed improvements to a 6.7-mile segment of S.R. 200 that extends from U.S. 41 (S.R. 45) in Citrus County to just north of the Marion County Line. The proposed improvements consist of widening the existing two-lane undivided rural roadway to a four-lane divided roadway.

The purpose of this study is to predict and evaluate the effect of the proposed project on traffic noise levels. Specifically, this study will evaluate traffic noise levels at noise sensitive sites and consider noise abatement measures where needed. The study was prepared in accordance with Title 23 CFR, Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise using methodology established by the FDOT in the PD&E Manual, Part 2, Chapter 17 (January 2001).

For the Build Alternative year 2025 traffic conditions, 53 residences are predicted to experience noise levels that approach or exceed the Noise Abatement Criteria (NAC). Noise abatement measures were evaluated for affected noise sensitive sites. Abatement measures considered include traffic system management, alignment modifications, property acquisition, land use controls and noise barriers. An evaluation of traffic system management techniques, alignment modifications and property acquisition indicated that these abatement measures were not feasible or reasonable. Land use controls can be used by local planning officials to minimize development or redevelopment of noise sensitive land uses in proximity to S.R. 200. A copy of the final Noise Study Technical Memorandum will be furnished to local officials to assist them in the development of compatible land uses for future development.

A noise barrier evaluation was also performed. Within the project limits, S.R. 200 is characterized by numerous access drives and intersecting side streets. At some locations, the need to accommodate access to S.R. 200 precluded the construction of a noise barrier while at most other locations access requirements for driveways and intersecting streets

severely limited the length of a noise barrier. Consequently, noise barriers could not provide a minimum 5 dBA reduction at many locations. At some locations, a 5 dBA reduction could be achieved, but the number of benefited residences was small because of the numerous gaps in the barriers to accommodate access to S.R. 200. Because of the small number of benefited residences, noise barriers were not cost reasonable at locations where a 5 dBA reduction could be achieved. Therefore, noise barriers were determined to not be a feasible and cost reasonable abatement measure for the 53 residences with predicted noise levels that approach or exceed the NAC.

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1.0 INTRODUCTION

In accordance with 23 CFR Part 771.129, the Florida Department of Transportation (FDOT) is conducting a Project Development and Environment (PD&E) Study reevaluation for proposed improvements to a 6.7-mile (mi) segment of S.R. 200 that extends from U.S. 41 (S.R. 45) in Citrus County to just north of the Marion County Line. Figure 1 illustrates the location and limits of the study.

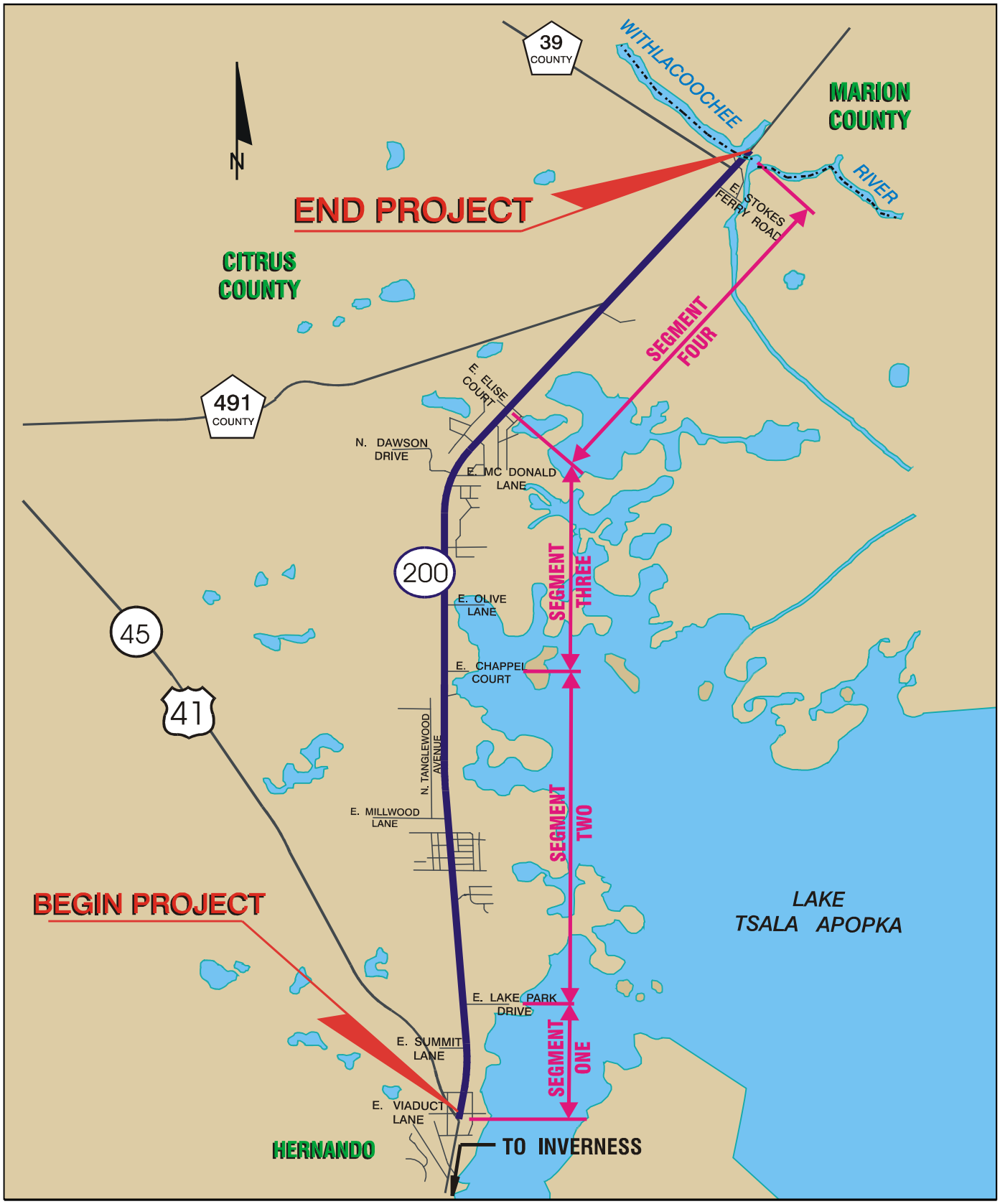
This reevaluation will use current data to re-assess the effects of implementing the recommendations of the original PD&E Study and where possible will modify these recommendations to further minimize these effects. The Design Year for the various analyses, evaluations and assessments performed in this study is 2025.

1.1 Purpose

The objective of the PD&E Study reevaluation is to evaluate proposed design changes to the original PD&E Study and document their effect. This reevaluation study will help the Federal Highway Administration (FHWA) reach a decision on the type, design and location of the necessary improvements along S.R. 200 to accommodate the future traffic demand in a safe and efficient manner. The purpose of the Noise Study Technical Memorandum is to document the effect of the proposed project on traffic noise levels. Specifically, this study will predict and evaluate traffic noise levels at noise sensitive sites and consider noise abatement measures where needed. The study was prepared in accordance with Title 23 CFR, Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise[1] using methodology established by the FDOT in the PD&E Manual[2], Part 2, Chapter 17 (January 2001).

1.2 Project Description

Within the limits of the reevaluation study area, S.R. 200 is a two-lane undivided rural facility centered within 100 feet (ft) of right-of-way (ROW). The existing cross section,



S.R. 200
PD&E Study Reevaluation

PROJECT LOCATION MAP

FIGURE 1

S.R. 200 PD&E Study Reevaluation
From U.S. 41 to N. of Marion County Line
Citrus County
WPI Seg. No. 257188 1; FAP No. FL62-020R

in general, provides two 11-foot (ft) wide travel lanes and 4-ft wide paved shoulders and open drainage ditches on each side. Adjacent land use is predominately rural and open space. The project includes two bridge structures; a double box culvert over a creek approximately 4.7 mi from the beginning of the project and a bridge over the Withlacoochee River, just south of the northern project terminus, which is currently rated as "Functionally Obsolete."

Beyond the northern project terminus to C.R. 484 (the remaining segment from the original S.R. 200 PD&E Study), S.R. 200 is currently in the Final Design phase to be widened to a four-lane rural facility.

For PD&E Studies, projects are typically divided into segments based on the existing land use, intersection/interchange locations, and projected traffic volumes for the design year. This project was divided into four segments as follows:

Segment 1 – Southern Project Terminus to East Lake Park Drive
Segment 2 – East Lake Park Drive to North of East Chappell Court
Segment 3 – North of East Chappell Court to North of East Elise Court
Segment 4 – North of East Elise Court to Northern Project Terminus

The Preferred Alternative is summarized below:

- **Segment 1** – The Preferred Alternative is a 4-lane urban typical section with 12-ft lanes, 4-ft bicycle lanes, 5-ft sidewalks and 22-ft median contained within a 100-ft ROW. The alignment is centered within the existing ROW. Additional ROW will be limited to ponds.

- **Segment 2 –** The Preferred Alternative is a 4-lane suburban typical section with 12-ft lanes, 8-ft (5-ft paved) outside shoulders and 22-ft median contained within a proposed 180-ft ROW. The alignment is shifted west and maintains the eastern existing ROW limit.

- **Segment 3** – The Preferred Alternative is a 4-lane suburban typical section with 12-ft lanes, 8-ft (5-ft paved) outside shoulders and 22-ft median contained within a proposed 180-ft ROW. The alignment is shifted west and maintains the eastern existing ROW limit.

- **Segment 4** – The Preferred Alternative is a 4-lane rural typical section with 12-ft lanes, 10-ft (5-ft paved) outside shoulders and 40-ft median contained within a proposed 200-ft ROW. The alignment continues the widening to the west before shifting to the east side, just beyond the S.R. 200 / C.R. 491 intersection. North of C.R. 491, the alignment continues with widening to the east, crossing the Withlacoochee River and terminating at the northern project terminus.

2.0 METHODOLOGY

Predicted noise levels were produced using the FHWA Traffic Noise Model (TNM), version 1.0b. All measured and predicted noise levels are expressed in decibels (dB) using an "A"-scale (dBA) weighting. This scale most closely approximates the response characteristics of the human ear. All noise levels are reported as an hourly equivalent noise level (L_{Aeq1h}). The L_{Aeq1h} is defined as the equivalent steady-state sound level that, in a given hourly period, contains the same acoustic energy as the time-varying sound for the same hourly period.

To simulate "worst-case" conditions, level of service (LOS) "C" or demand traffic volumes, whichever is less, was modeled. Traffic data developed for this project is provided in the Traffic Technical Memorandum[3], prepared separately. The existing and year 2025 No-Build traffic data are summarized in Table 1, and the traffic data for the year 2025 Build condition is summarized in Table 2. A comparison of LOS "C" to demand traffic volumes is provided in the Noise Study Technical Appendices (March, 2002) prepared separately. For the existing conditions (year 2000), the daily volumes were reduced to hourly directional volumes using an hourly (K) factor of 8.21 percent for

Segments 1, 2 and 3 and 8.29 percent for Segment 4; with a peak directional (D) factor of 53.00 percent for Segments 1, 2 and 3 and 67.00 percent for Segment 4. For year 2025 No-Build and Build conditions, the daily volumes were reduced to hourly directional volumes using an hourly (K) factor of 9.95 percent and a peak directional (D) factor of 53.49 percent. The hourly traffic volumes were divided between cars, medium trucks and heavy trucks. As documented on the traffic data sheets (see the Noise Technical Appendices, prepared separately), medium and heavy truck volumes varied by segment of S.R. 200 and by year. For existing conditions (year 2000), the volume of medium trucks varied from 1.6 to 2.5 percent while heavy trucks varied from 2.6 to 3.0 percent. For year 2025 No-Build and Build conditions, the volume of medium trucks varied from 1.15 to 1.36 percent while heavy trucks varied from 1.64 to 1.85 percent. Based on the posted speed limit, a vehicle speed of 45 miles per hour (mph) in Segment 1 and 55 mph in the remaining segments were used for the existing conditions (year 2000) and the year 2025 No-Build and Build conditions.

Table 1
Annual Average Daily Traffic Volumes for Existing and Year 2025 No-Build Conditions

Segment of S.R. 200	Year 2000 Existing Traffic Volumes (daily)	Posted Speed (mph)	Year 2025 No-Build Design Year Traffic Volumes (daily)	Posted Speed (mph)
U.S. 41 to East Lake Park Drive	9200 [1]	45	9200 [1]	45
East Lake Park Drive to East Chappell Court	10600 [1]	55	10600 [1]	55
East Chappell Court to East Elise Court	10600 [1]	55	10600 [1]	55
East Elise Court to North of the Marion County Line	10600 [1]	55	10600 [1]	55

[1] Demand volumes exceeded LOS C conditions. Reported volumes represent LOS C.

Table 2
Traffic Volumes for the Year 2025 Build Condition

Segment of S.R. 200	Year 2025 Build Design Year Traffic Volumes (daily)	Posted Speed (mph)
U.S. 41 to East Lake Park Drive	27000 [1]	45
East Lake Park Drive to East Chappell Court	27000 [1]	55
East Chappell Court to East Elise Court	25000 [1]	55
East Elise Court to North of the Marion County Line	27000 [1]	55

[1] Demand volumes at or greater than LOS "C" conditions. Reported volumes are demand traffic.

3.0 TRAFFIC NOISE ANALYSIS

3.1 Noise Sensitive Sites

Noise sensitive sites are any property (owner-occupied, rented or leased) where frequent exterior human use occurs and where a lowered noise level would be of benefit. The FHWA has established noise levels at which noise abatement must be considered for various types of noise sensitive sites. These noise levels are referred to as the Noise Abatement Criteria (NAC). As shown in Table 3, the NAC vary according to the activity category. Noise abatement measures are considered when predicted traffic noise levels for design year Build conditions approach or exceed the NAC. The FDOT defines the approach criteria as within 1 dBA of the FHWA criteria for an activity category.

Table 3
FHWA NAC

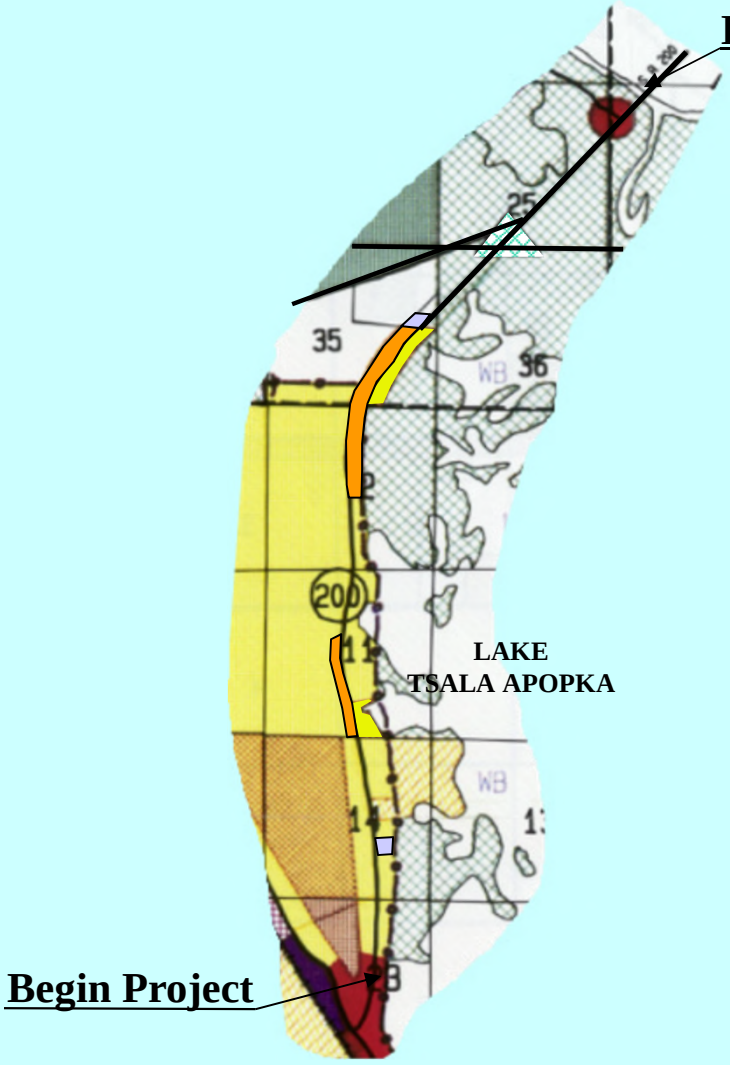
Activity Category	Leq(h)	Description of Land Use Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

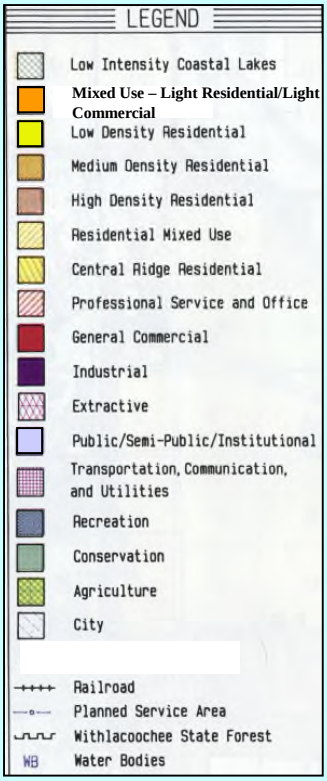
Source: 23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise[1], Federal Highway Administration, 2001.

The existing land use along the project is primarily rural and open land. At the southern terminus of the project, in the vicinity of the Town of Hernando, land use is mostly light commercial. In the vicinity of Apache Shores, where S.R. 200 has been widened, land use transitions to low density residential and commercial. The existing land use is shown in Figure 2. The future land use as identified in the Citrus County Comprehensive Plan indicates that uses will be similar to existing land uses. The future land use is shown in Figure 3. The proposed improvements to S.R. 200 would utilize the existing corridor and land use is not anticipated to change as a result of the improvements.

Noise sensitive land uses along S.R. 200 include residential areas which are in Activity Category B of the NAC. One church, the Riverside Christian Fellowship Church, is also located adjacent to S.R. 200. No outdoor areas of frequent human use were noted at the church; therefore, the church was evaluated under Activity Category E of the NAC.

Source: Citrus County Comprehensive Plan

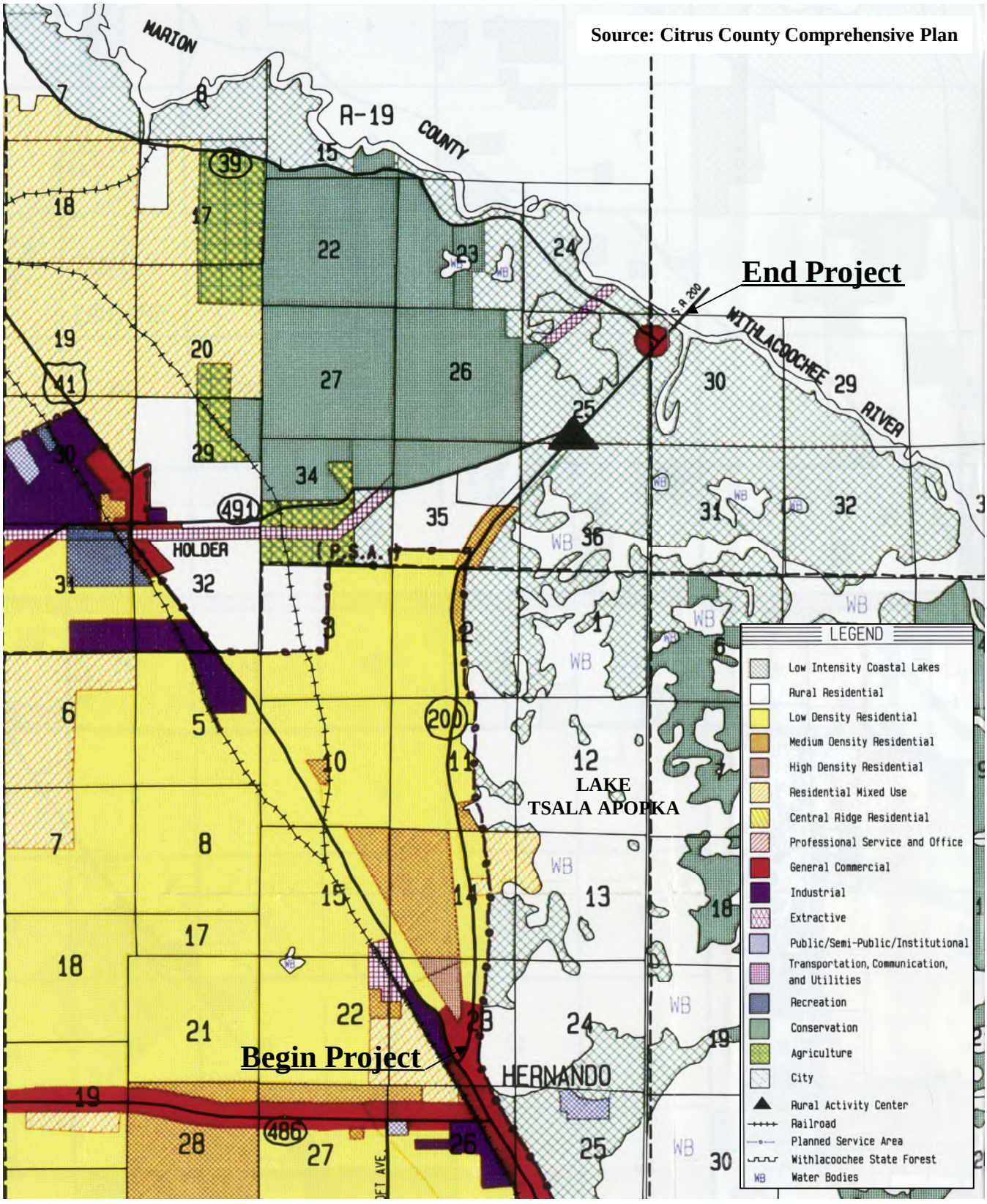




S.R. 200
PD&E STUDY REEVALUATION

GENERALIZED EXISTING LAND USE MAP
FIGURE 2

S.R. 200 PD&E Study Reevaluation
From U.S. 41 to N. of Marion County Line
Citrus County
WPI Seg. No. 257188 1; FAP No. FL62-020R



S.R. 200
PD&E STUDY REEVALUATION

GENERALIZED FUTURE (2020) LAND USE MAP

FIGURE 3

S.R. 200 PD&E Study Reevaluation
From U.S. 41 to N. of Marion County Line
Citrus County
WPI Seg. No. 257188 1; FAP No. FL62-020R

Receiver points representing the noise sensitive sites were located in accordance with the PD&E Manual[2], Part 2, Chapter 17 (January 2001), as follows:

- Residential and church receiver sites were placed at the edge of the building closest to the major traffic noise source.
- Where more than one noise sensitive site was clustered together, single sites were analyzed as representative of the group.
- Ground floor receiver sites were assumed to be 5 ft above the ground elevation.

Noise sensitive land uses listed from south to north are described below. The location of a receiver either east or west of S.R. 200 is denoted by an "E" or "W" in the receiver identification. All referenced street names and receiver locations can be found on the aerials in the Appendix of this report.

East of S.R. 200

- Single-family residences located south of East Luise Lane, represented by Receivers 1E and 2E;
- Single-family residences located between East Luise Lane and North Ventura Village Circle, represented by Receivers 3E through 12E;
- Ventura Village Apartments located between North Ventura Circle and East Wood Knoll Lane, represented by Receivers 13E through 18E;
- Single-family residential neighborhood located at East Arbor Lakes Drive, represented by Receivers 19E and 20E;
- Single-family residential neighborhood located from East Campfire Court to East Buffalo Lane, represented by Receivers 21E through 26E;
- Single-family residential neighborhood located between East Buffalo Lane and North Apache Trail, represented by Receivers 27E through 31E;
- Single-family residential neighborhood located between North Apache Trail and East Flying Arrow Path, represented by Receivers 32E through 38E;

- Single-family residences located between East Flying Arrow Path and East Chappell Court, represented by Receivers 39E through 42E and 44E;
- Single-family residences located between East Chappell Court and East Delight Street, represented by Receivers 43E and 45E through 51E;
- Single-family residential neighborhood located between East McDonald Lane and East Camelot Point, represented by Receivers 52E through 59E;
- Single-family residence located just south of East Posseit Drive, represented by Receiver 60E;
- Riverside Christian Fellowship Church located north of East Posseit Drive, represented by Receiver 61E;
- Single-family residence located south of Stokes Ferry Road, represented by Receiver 62E; and
- Single-family residences located on North Oak River Way, represented by Receivers 63E and 64E.

West of S.R. 200

- Single-family residences located between East Viaduct Lane and V.F.W. Lane, represented by Receivers 1W and 2W;
- Single-family residence located at East Summit Lane, represented by Receiver 3W;
- Single-family residential neighborhood located from south of North Froly Point to East Buffalo Lane, represented by Receivers 4W through 22W;
- Single-family residences located between East Millwood Lane and North Tiger Eye Drive, represented by Receivers 23W through 25W;
- Single-family residences located between East Chappell Court and East Olive Lane, represented by Receivers 26W through 31W;
- Single-family residences located between East Orchid Street and East Hilltop Loop, represented by Receivers 32W through 38W; and
- Single-family residences from East Hilltop Loop to north of East Elise Court, represented by Receivers 39W through 48W.

3.2 Measured Noise Levels

To validate the computer noise model, field measurements were taken within the project area following procedures documented in FHWA's Measurement of Highway-Related Noise[4]. On May 22, 2001, field measurements were obtained using a Metrosonics 308 dBA noise monitor. Each monitoring event lasted 10 minutes. The noise monitor was calibrated using a Metrosonics sound level calibrator. Traffic speeds were recorded with a MPH, Model K-15 hand-held radar gun.

Site selection for the field measurements was based on the location of noise sensitive sites and access to monitoring sites where a representative sampling of free-flow traffic could be obtained. Monitoring site locations are provided in Table 4. Traffic volumes by vehicle classification and vehicle speeds were recorded at each monitoring site. The recorded speeds indicated that the speed limit of 45 mph is a good representation of the average travel speed. The field monitoring results and the results predicted by TNM are shown in Table 4. For additional information, see the Noise Study Technical Appendices (March, 2002) prepared separately.

Table 4
Validation

Location	Date Time	Field Measurement (dBA)	Model Prediction (dBA)	Difference
East of S.R. 200 – Station # 19.5	5/22/01 1:25 PM	66.1	64.6	1.5
	5/22/01 1:37 PM	66.7	66.0	0.7
	5/22/01 1:48 PM	64.1	64.6	0.5
Arbor Lakes Subdivision East of S.R. 200 – Station #92.5	5/22/01 2:25 PM	67.3	68.7	1.4
	5/22/01 2:36 PM	67.5	68.7	1.2
	5/22/01 2:47 PM	68.0	69.0	1.0

With a difference of 1.5 dBA or less between the measured and predicted noise levels, the model results are well within the FDOT's accepted accuracy level of 3 dBA.

3.3 Predicted Noise Levels

The distance to the 66 dBA noise contour for the year 2025 Build Alternative was estimated using the TNM computer model and previously discussed traffic volumes and speed data. The 66 dBA contour delineates the distance from the proposed centerline of S.R. 200 where an approach of the NAC for Activity Category B is anticipated to occur for the year 2025 Build condition. The contour does not consider any shielding of noise provided by structures or topographic features between the receiver and S.R. 200. Additionally, the noise contours do not account for traffic noise from roadways other than S.R. 200 (i.e., intersecting streets). The distances between the proposed S.R. 200 centerline and the 66 dBA contour are provided in Table 5.

Table 5
66 dBA Noise Contour for the Year 2025 Build Condition

Segment of S.R. 200	Distance to 66 dBA[1]
U.S. 41 to East Lake Park Drive	116 ft
East Lake Park Drive to East Chappell Court	152 ft
East Chappell Court to East Elise Court	152 ft
East Elise Court to North of the Marion County Line	147 ft

[1] Distance is measured from the proposed centerline of S.R. 200.

3.4 Noise Analysis

Based on the noise contour data, a review of land use data, proximity of noise sensitive sites to S.R. 200 and field verification of noise sensitive locations, a total of 112 receivers representing 175 noise sensitive sites were evaluated. East of S.R. 200, 64 receivers representing 98 noise sensitive sites were modeled. West of S.R. 200, 48 receivers

representing 77 noise sensitive sites were modeled. The noise sensitive sites represented by the receivers were discussed in Section 3.1 – Noise Sensitive Sites. Predicted noise levels are summarized in Table 6 with the receivers listed beginning at the south end of the project and proceeding north.

Table 6
Predicted Existing and Future Noise Levels

Receiver Identification	Noise Sensitive Sites Represented	Year 2000 Existing	Year 2025 No-Build	Year 2025 Build	Difference between Build and Existing	Build Approaches/ Exceeds NAC?
Residences located south of East Luise Lane						
R1E	4 residences	60.1	60.5	61.3	1.2	No
R2E	1 residence	57.4	57.7	59.3	1.9	No
Residences located between East Luise Lane and North Ventura Village Circle						
R3E	2 residences	53.6	53.8	60.6	7.0	No
R4E	1 residence	57.1	57.3	62.5	5.4	No
R5E	1 residence	55.7	55.9	60.9	5.2	No
R6E	1 residence	54.5	54.6	59.9	5.4	No
R7E	1 residence	52.9	53.0	60.1	7.2	No
R8E	1 residence	54.3	54.5	60.6	6.3	No
R9E	2 residences	56.5	56.8	62.1	5.6	No
R10E	1 residence	60.7	61.1	67.5	6.8	Yes
R11E	1 residence	58.0	58.3	64.3	6.3	No
R12E	1 residence	56.0	56.2	61.8	5.8	No
Ventura Village Apartments located between North Ventura Circle and East Wood Knoll Lane						
R13E	2 residences	58.1	58.5	65.6	7.5	No
R14E	4 residences	55.1	55.4	62.9	7.8	No
R15E	2 residences	57.3	57.7	64.7	7.4	No
R16E	4 residences	56.2	56.6	64.0	7.8	No
R17E	2 residences	54.4	54.7	62.0	7.6	No
R18E	2 residences	54.0	54.3	61.8	7.8	No
Neighborhood located at East Arbor Lakes Drive						
R19E	1 residence	53.0	53.1	62.4	9.4	No
R20E	1 residence	55.8	56.1	60.2	4.4	No
Neighborhood located from East Campfire Court to East Buffalo Lane						
R21E	1 residence	59.9	60.2	64.3	4.4	No
R22E	4 residences	56.7	56.9	62.5	5.8	No
R23E	1 residence	62.6	63.0	65.6	3.0	No

Table 6 (Cont'd.)
Predicted Existing and Future Noise Levels

Receiver Identification	Noise Sensitive Sites Represented	Year 2000 Existing	Year 2025 No-Build	Year 2025 Build	Difference between Build and Existing	Build Approaches/ Exceeds NAC?
R24E	1 residence	61.1	61.5	64.5	3.4	No
R25E	3 residences	60.2	60.5	62.4	2.2	No
R26E	1 residence	60.4	60.7	62.9	2.5	No
Neighborhood located between East Buffalo Lane and North Apache Trail						
R27E	2 residences	69.1	69.5	72.5	3.4	Yes
R28E	2 residences	65.6	66.0	68.4	2.8	Yes
R29E	1 residence	64.2	64.6	68.3	4.1	Yes
R30E	1 residence	69.0	69.4	72.2	3.2	Yes
R31E	2 residences	63.7	64.1	67.0	3.3	Yes
Neighborhood located between North Apache Trail and East Flying Arrow Path						
R32E	1 residence	64.9	65.3	67.9	3.0	Yes
R33E	1 residence	62.9	63.3	66.3	3.4	Yes
R34E	2 residences	65.6	66.0	68.0	2.4	Yes
R35E	2 residences	64.8	65.2	67.2	2.4	Yes
R36E	2 residences	63.0	63.4	65.7	2.7	No
R37E	2 residences	67.6	68.0	70.5	2.9	Yes
R38E	1 residence	65.4	65.8	69.0	3.6	Yes
Residences located between East Flying Arrow Path and East Chappell Court						
R39E	1 residence	57.5	57.7	62.5	5.0	No
R40E	1 residence	67.0	67.5	71.3	4.3	Yes
R41E	1 residence	65.6	66.0	67.4	1.8	Yes
R42E	2 residences	62.7	63.0	65.9	3.2	No
R44E	1 residence	59.7	60.1	62.1	2.4	No
Residences located between East Chappell Court and East Delight Street						
R43E	3 residences	66.9	67.3	70.4	3.5	Yes
R45E	2 residences	57.7	57.9	62.5	4.8	No
R46E	1 residence	60.2	60.5	65.1	4.9	No
R47E	2 residences	67.4	67.9	71.9	4.5	Yes
R48E	2 residences	65.6	66.0	70.4	4.8	Yes
R49E	1 residence	56.2	56.4	62.9	6.7	No
R50E	1 residence	64.7	65.1	69.3	4.6	Yes
R51E	1 residence	56.2	56.3	62.0	5.8	No
Neighborhood located between East McDonald Lane and East Camelot Point						
R52E	1 residence	68.2	68.6	72.1	3.9	Yes
R53E	1 residence	62.5	62.7	66.4	3.9	Yes
R54E	1 residence	61.7	62.0	65.2	3.5	No
R55E	1 residence	62.7	63.0	66.8	4.1	Yes
R56E	1 residence	64.3	64.6	68.7	4.4	Yes
R57E	2 residences	58.8	59.0	64.5	5.7	No

Table 6 (Cont'd.)
Predicted Existing and Future Noise Levels

Receiver Identification	Noise Sensitive Sites Represented	Year 2000 Existing	Year 2025 No-Build	Year 2025 Build	Difference between Build and Existing	Build Approaches/ Exceeds NAC?
R58E	1 residence	57.2	57.3	62.7	5.5	No
R59E	1 residence	64.9	65.3	69.5	4.6	Yes
Residence located just south of East Posseit Drive						
R60E	1 residence	59.5	59.2	63.4	3.9	No
Riverside Christian Fellowship Church						
R61E	Church (interior noise level)	37.7[2]	37.1[2]	41.3[2]	3.6	No
Residence located south of Stokes Ferry Road						
R62E	1 residence	52.4	51.8	58.7	6.3	No
Residences located on North Oak River Way						
R63E	1 residence	58.0	58.5	61.8	3.8	No
R64E	1 residence	54.4	54.3	59.1	4.7	No
Residences located between East Viaduct Lane and V.F.W. Lane						
R1W	2 residences	61.3	61.6	68.9	7.6	Yes
R2W	1 residence	60.6	60.9	68.2	7.6	Yes
Residence located at East Summit Lane						
R3W	1 residence	55.1	55.3	61.1	6.0	No
Neighborhood located from south of North Froly Point to East Buffalo Lane						
R4W	3 residences	63.6	64.0	69.4	5.8	Yes (2 of the 3 residences will be relocated)
R5W	4 residences	67.9	68.4	N/A[1]	N/A[1]	No
R6W	1 residence	69.3	69.8	N/A[1]	N/A[1]	No
R7W	3 residences	60.1	60.5	65.2	5.1	No
R8W	1 residence	59.9	60.2	64.3	4.4	No
R9W	1 residence	63.2	63.5	N/A[1]	N/A[1]	No
R10W	2 residences	67.6	68.1	N/A[1]	N/A[1]	No
R11W	2 residences	67.7	68.2	N/A[1]	N/A[1]	No
R12W	2 residences	66.1	66.5	N/A[1]	N/A[1]	No
R13W	1 residence	69.6	70.1	N/A[1]	N/A[1]	No
R14W	2 residences	67.9	68.4	N/A[1]	N/A[1]	No
R15W	1 residence	60.1	60.4	66.6	6.5	Yes
R16W	1 residence	60.2	60.5	66.3	6.1	Yes
R17W	3 residences	59.9	60.3	63.7	3.8	No
R18W	2 residences	62.7	63.1	66.4	3.7	Yes
R19W	2 residences	62.2	62.6	66.9	4.7	Yes
R20W	1 residence	63.0	63.4	68.7	5.7	Yes
R21W	3 residences	63.3	63.7	67.9	4.6	Yes

Table 6 (Cont'd.)
Predicted Existing and Future Noise Levels

Receiver Identification	Noise Sensitive Sites Represented	Year 2000 Existing	Year 2025 No-Build	Year 2025 Build	Difference between Build and Existing	Build Approaches/ Exceeds NAC?
R22W	1 residence	62.1	62.4	66.7	4.6	Yes
Residences located between East Millwood Lane and North Tiger Eye Drive						
R23W	1 residence	65.4	65.8	N/A[1]	N/A[1]	No
R24W	1 residence	65.5	65.9	N/A[1]	N/A[1]	No
R25W	2 residences	67.9	68.4	N/A[1]	N/A[1]	No
Residences located between East Chappell Court and East Olive Lane						
R26W	2 residences	59.8	59.9	67.3	7.5	Yes
R27W	1 residence	64.2	64.5	N/A[1]	N/A[1]	No
R28W	2 residences	59.7	59.9	N/A[1]	N/A[1]	No
R29W	2 residences	64.3	64.6	N/A[1]	N/A[1]	No
R30W	1 residence	66.0	66.5	N/A[1]	N/A[1]	No
R31W	1 residence	63.4	63.8	N/A[1]	N/A[1]	No
Residences located between East Orchid Street and East Hilltop Loop						
R32W	2 residences	63.2	63.5	N/A[1]	N/A[1]	No
R33W	1 residence	59.8	60.0	N/A[1]	N/A[1]	No
R34W	1 residence	62.7	63.0	N/A[1]	N/A[1]	No
R35W	1 residence	59.8	60.0	66.8	7.0	Yes
R36W	1 residence	62.7	63.0	N/A[1]	N/A[1]	No
R37W	1 residence	64.4	64.7	N/A[1]	N/A[1]	No
R38W	1 residence	61.3	61.6	69.6	8.3	Yes
Residences located between East Hilltop Loop and north of East Elise Court						
R39W	1 residence	61.3	61.6	N/A[1]	N/A[1]	No
R40W	1 residence	58.2	58.4	65.3	7.1	No
R41W	1 residence	56.2	56.3	63.2	7.0	No
R42W	1 residence	62.9	63.2	N/A[1]	N/A[1]	No
R43W	2 residences	62.6	62.9	N/A[1]	N/A[1]	No
R44W	1 residence	56.6	56.7	63.3	6.7	No
R45W	1 residence	62.8	63.1	N/A[1]	N/A[1]	No
R46W	1 residence	60.1	60.3	67.4	7.3	Yes
R47W	1 residence	56.8	56.9	62.9	6.1	No
R48W	2 residences	58.7	58.9	65.5	6.8	No

[1] N/A - Not applicable, residence relocated

[2] Represents an interior noise level. Reduced predicted noise level by 20 dBA to account for noise reduction provided by the building. The reduction factor is consistent with FHWA guidance.

For the 2025 Build Alternative, 37 receivers representing 53 residences are predicted to experience noise levels which approach or exceed the NAC. The residences are generally located on properties adjacent to S.R. 200 and include the following:

- Receiver 10E representing 1 residence located east of S.R. 200 between East Luise Lane and North Ventura Village Circle;
- Receivers 27E through 31E representing 8 residences in the neighborhood located east of S.R. 200 between East Buffalo Lane and North Apache Trail;
- Receivers 32E through 35E, 37E and 38E representing 9 residences in the neighborhood located east of S.R. 200 between North Apache Trail and East Flying Arrow Path;
- Receivers 40E and 41E representing 2 residences located east of S.R. 200 between East Flying Arrow Path and East Chappell Court;
- Receivers 43E, 47E, 48E, and 50E representing 8 residences located east of S.R. 200 between East Chappell Court to East Delight Street;
- Receivers 52E, 53E, 55E, 56E, and 59E representing 5 residences in the neighborhood located east of S.R. 200 between East McDonald Lane and East Camelot Point;
- Receivers 1W and 2W representing 3 residences located west of S.R. 200 between East Viaduct Lane and V.F.W. Lane;
- Receivers 4W, 15W, 16W, and 18W through 22W representing 12 residences in the neighborhood located west of S.R. 200 from south of North Froly Point to East Buffalo Lane;
- Receiver 26W representing 2 residences located west of S.R. 200 between East Chappell Court and East Olive Lane;
- Receivers 35W and 38W representing 2 residences located west of S.R. 200 between East Orchid Street and East Hilltop Loop; and
- Receiver 46W representing 1 residence located west of S.R. 200 between East Hilltop Loop and north of Elise Court.

In addition to approaching or exceeding the NAC, noise sensitive sites are considered affected if the Build Alternative is predicted to cause a substantial increase in the noise level. The FDOT defines the term "substantial increase" as 15 or more dBA above the existing noise level as a direct result of the transportation improvement project. Comparing the existing to the design year Build condition, the range of increase for the predicted noise levels is from 1.8 to 8.3 dBA. Therefore, no noise sensitive sites are predicted to experience a "substantial increase." Higher traffic volumes and the closer proximity of travel lanes to residences cause most of the increases. Reduced noise shielding from the relocation of front row residences causes some of the predicted increases in specific areas.

3.5 Noise Abatement Techniques

As stipulated by 23 CFR Part 772, the FHWA requires that noise abatement measures be considered if the noise level at a sensitive site approaches or exceeds the NAC. Therefore, abatement was evaluated for the 53 residences affected by traffic noise. Abatement measures considered include traffic system management techniques, alignment modifications, property acquisition, land use controls and noise barriers.

3.5.1 Traffic System Management Techniques

Traffic system management techniques that limit motor vehicle speeds and reduce traffic volumes can be used to abate traffic noise. However, these measures conflict with the purpose of providing a facility that can accommodate forecasted traffic volumes. For example, a substantial speed reduction on S.R. 200 would lower traffic noise levels. However, the capacity of the roadway to service traffic would also be reduced. As a major north-south route in Citrus County, reducing traffic volumes or prohibiting truck traffic is not a viable alternative. Therefore, traffic system management techniques are not considered feasible abatement measures.

3.5.2 Alignment Modifications

Alignment modification involves orientating and/or siting the roadway at sufficient distances from the noise sensitive areas so as to minimize traffic noise. Since this project involves lane additions to the existing roadway, the existing alignment dictates the proposed horizontal and vertical alignment with project costs and detrimental effects on land use minimized by making use of the existing corridor. An alignment modification that could provide a substantial noise reduction is, therefore, not a feasible or reasonable abatement measure.

3.5.3 Property Acquisition

The FDOT has established a criterion of $30,000 per benefited residence when evaluating the cost reasonableness of an abatement measure. The administrative and property costs to acquire affected residences would exceed the cost criteria.

3.5.4 Land Use Controls

Land use controls can be used to minimize noise sensitive sites that may be affected by traffic noise. Local planning officials can use the noise contours previously provided in Table 5 as a guide to minimize development or redevelopment of noise sensitive land uses in proximity to S.R. 200.

3.5.5 Noise Barriers

Noise barriers reduce noise levels by blocking the sound path between a roadway and noise sensitive sites. To effectively reduce traffic noise, a noise barrier must be relatively long, continuous (with no intermittent openings) and of sufficient height. On roadways with minimal access control, such as S.R. 200, the ability of a noise barrier to reduce noise levels can be limited by the need to accommodate access drives and side streets.

In order for a noise barrier to be considered feasible and economically reasonable, the following minimum conditions should be met:

- A noise barrier must provide a minimum insertion loss (noise reduction) of at least 5 dBA with a design goal of 10 dBA, or more.
- The cost of the noise barrier should not exceed $30,000 per benefited noise sensitive site. This is the upper cost limit established by FDOT. A benefited noise sensitive site is defined as a site that would experience at least a 5 dBA reduction as a result of providing a noise barrier. The current unit cost used to evaluate cost reasonableness is $25 per square foot, which covers barrier materials and labor.

After consideration of the amount of noise reduction and cost reasonableness, other factors such as community desires, adjacent land uses and land use stability, antiquity, predicted noise level increases, safety considerations, drainage issues, utility conflicts, maintenance requirements and construction issues are also considered when evaluating the feasibility and reasonableness of providing noise barriers.

In order to analyze the effectiveness of noise barriers, the TNM model was used. Noise barrier evaluation areas were established by reviewing the proximity of affected residences to each other and grouping the sites. A noise barrier was then modeled to reduce noise levels for the group of residences.

Within the project limits, S.R. 200 is characterized by numerous access drives and intersecting side streets. At any specific location, the length of a noise barrier is very limited to accommodate the access to S.R. 200. The numerous access drives and intersecting side streets also divide the affected noise sensitive sites into numerous small groups typically composed of only one or two sites. The groupings of affected noise sensitive sites were reviewed to identify representative areas where a noise barrier had the greatest possibility of being both feasible and cost reasonable. These areas were selected based on the following criteria:

- Area where spacing between access drives allows for longer noise barriers (the longer the potential barrier length, the greater the potential noise reduction),
- Area with a higher density of affected residences (the higher the density of residences the lower the cost per benefited residence),
- Area where the affected residences are closer to the potential noise barrier (the decreased distance between the residence and barrier allows for a lower barrier height which will decrease the cost per benefited residence), and
- Area where the affected residences are further away from an access drive or intersecting street (the further away from the edge of the barrier the better the noise reduction).

The premise behind this approach is that if noise barriers are not feasible and cost reasonable under the best conditions, then noise barriers will not be feasible and cost reasonable at other locations. If determined to be feasible and cost reasonable for an area, then subsequent areas would be selected for noise barrier evaluation. At a minimum, at least one representative area was selected within Segments 1, 2 and 3. There were no affected noise sensitive sites in Segment 4. The noise barriers that were evaluated are discussed below. If the evaluation involved modeling, then the modeled noise barrier location is shown on the aerials provided in the Appendix.

Segment 1

Within Segment 1 there are four affected residences grouped into two areas. A noise barrier evaluation was performed for each area.

Residences west of S.R. 200 between East Viaduct Lane and V.F.W. Lane (Receivers 1W and 2W)

Three residences are predicted to experience noise levels that approach or exceed the NAC. With only 10 ft between the travel lane of S.R. 200 and the ROW line, line-of-sight requirements for East Viaduct Lane preclude the construction of a noise barrier for

these three residences. Because of this safety issue, a noise barrier is not a feasible measure to abate noise at this location.

Single residence east of S.R. 200 north of V.F.W. Lane (Receiver 10E)

One residence is predicted to experience noise levels that approach or exceed the NAC. With only 10 ft between the travel lane of S.R. 200 and the ROW line, line-of-sight requirements for an access road to the north preclude the construction of a noise barrier for this residence. Because of this safety issue, a noise barrier is not a feasible measure to abate noise at this location.

Segment 2

Within Segment 2 there are 34 affected residences. Representative noise barrier evaluations were performed at three locations.

Residences west of S.R. 200 between North Froly Point and East Buffalo Lane (Receivers 15W, 16W, and 18W through 22W; Barriers 2, 3 and 4)

This area was selected for analysis because the residential driveways connect to a frontage road rather than S.R. 200. This allowed for longer barriers. Additionally, the residential development is relatively dense with affected residences located on as many as five contiguous lots.

At this location, 11 residences are predicted to experience noise levels that approach or exceed the NAC. A noise barrier had to be divided into three parts (identified as Barriers 2, 3 and 4 on the aerials in the Appendix of this report) to accommodate the East Wagon Trail and East Pony Express Lane connections to S.R. 200. Depending on the barrier height, these three noise barriers segments could provide at least a 5 dBA reduction at up to nine of the 11 affected residences. Two residences could not be benefited because of their close proximity to intersecting streets that limited the noise barrier length.

The results of the evaluation at varying barrier heights are provided in Table 7. The lengths of the barriers were optimized for the various heights to minimize cost while still maintaining a reduction of at least 5 dBA at the affected residences. The lowest cost per benefited residence that could be achieved was $33,457 at a height of 10 ft and total barrier length of 938 ft. At the 10-ft height only seven residences could be benefited. The cost is above the reasonableness criteria of $30,000 per benefited residence. Therefore, noise barriers were determined to not be a cost reasonable abatement measure at this location.

Table 7
Noise Barrier Analysis for Barriers 2, 3 and 4
(Receivers 15W, 16W, and 18W through 22W)

Barrier Height (ft)	Residences With Insertion Loss of (dBA)						Number of Benefited Residences			Total Estimated Cost	Cost Per Benefited Residence
	5-5.9 dBA IL	6-6.9 dBA IL	7-7.9 dBA IL	8-8.9 dBA IL	9-9.9 dBA IL	10+ dBA IL	Affected	Other *	Total		
8	6						6	0	6	$208,900	$34,817
10	7						7	0	7	$234,200	$33,457
12	5	3					8	0	8	$296,300	$37,038
14	7	2					9	0	9	$329,300	$36,589
16	8	1					9	0	9	$355,700	$39,522
18	8	1					9	0	9	$400,200	$44,467
20	6	3					9	0	9	$444,600	$49,400
22	6	2	1				9	0	9	$489,000	$54,333

* Other = Residences with traffic noise levels predicted to be less than 66 dBA but benefited by the noise barrier.

Residences east of S.R. 200 between East Buffalo Lane and North Apache Trail (Receivers 27E, 28E, 29E, 30E, and 31E; Barriers 7, 8 and 9)

This area was selected because some of the affected residences are in very close proximity to the ROW line. Because of the small distance between the residences and the potential barrier location, this area allowed the greatest potential for a feasible noise barrier with a short length and short height.

At this location, eight residences are predicted to experience noise levels that approach or exceed the NAC. A noise barrier had to be divided into three parts (identified as Barriers 7, 8 and 9 on the aerials in the Appendix of this report) to accommodate the East Deer Run Lane and East Bear Lane connections to S.R. 200. Depending on the barrier height, these three noise barrier segments could provide at least a 5 dBA reduction at up to three of the eight affected residences. Five residences could not be benefited because they are set further back from the potential noise barrier location and are in close proximity to an intersecting street that limited the noise barrier length.

The results of the evaluation at varying barrier heights are provided in Table 8. The lengths of the barriers were optimized for the various heights to minimize cost while still maintaining a reduction of at least 5 dBA at the affected residences. The lowest cost per benefited residence that could be achieved was $32,500 at a height of 10 ft and total barrier length of 130 ft. At the 10-ft height only one residence could be benefited. The cost is above the reasonableness criteria of $30,000 per benefited residence. Therefore, noise barriers were determined to not be a cost reasonable abatement measure at this location.

Table 8
Noise Barrier Analysis for Barriers 7, 8 and 9
(Receivers 27E through 31E)

Barrier Height (ft)	Residences With Insertion Loss of (dBA)						Number of Benefited Residences			Total Estimated Cost	Cost Per Benefited Residence
	5-5.9 dBA IL	6-6.9 dBA IL	7-7.9 dBA IL	8-8.9 dBA IL	9-9.9 dBA IL	10+ dBA IL	Affected	Other *	Total		
8		1					1	0	1	$34,700	$34,700
10		1					1	0	1	$32,500	$32,500
12			1				1	0	1	$39,000	$39,000
14		2					2	0	2	$102,200	$51,100
16	1	1		1			3	0	3	$151,500	$50,500
18	1	1			1		3	0	3	$170,500	$56,833
20	1	1			1		3	0	3	$189,400	$63,133
22	1	1	1				3	0	3	$184,600	$61,533

* Other = Residences with traffic noise levels predicted to be less than 66 dBA but benefited by the noise barrier.

Residences east of S.R. 200 between North Longbow Lane and East Flying Arrow Path (Receivers 37E and 38E; Barrier 10)

This area was selected for the analysis because intersecting streets allowed for consideration of a relatively long barrier length. One of the affected residences would be located near the center of a noise barrier at a relatively common setback distance from the barrier. A noise barrier evaluation at this location is representative of an analysis for relatively isolated residences.

At this location, three residences are predicted to experience noise levels that approach or exceed the NAC. A noise barrier (identified as Barrier 10 in the Appendix of this report) would benefit only one of the three affected residences. Two residences could not be benefited because of their close proximity to an intersecting street that limited the noise barrier length.

The results of the noise barrier evaluation are provided in Table 9. The lengths of the barriers were optimized for the various heights to minimize cost while still maintaining a reduction of at least 5 dBA at an affected residence. The lowest cost per benefited residence that could be achieved was $88,100 for a barrier 252 ft long and 14 ft high. The cost is above the reasonableness criteria of $30,000 per benefited residence. Therefore, a noise barrier was determined to not be a cost reasonable abatement measure at this location.

Table 9
Noise Barrier Analysis for Barrier 10
(Receivers 37E and 38E)

Barrier Height (ft)	Residences With Insertion Loss of (dBA)						Number of Benefited Residences			Total Estimated Cost	Cost Per Benefited Residence
	5-5.9 dBA IL	6-6.9 dBA IL	7-7.9 dBA IL	8-8.9 dBA IL	9-9.9 dBA IL	10+ dBA IL	Affected	Other *	Total		
8							0	0	0	N/A[1]	N/A[1]
10							0	0	0	N/A[1]	N/A[1]
12							0	0	0	N/A[1]	N/A[1]
14				1			1	0	1	$88,100	$88,100
16				1			1	0	1	$100,700	$100,700
18				1			1	0	1	$113,200	$113,200
20				1			1	0	1	$100,700	$100,700
22				1			1	0	1	$110,700	$110,700

* Other = Residences with traffic noise levels predicted to be less than 66 dBA but benefited by the noise barrier.
[1] N/A – Not applicable, residence did not receive at least a 5 dBA reduction

Segment 3

Within Segment 3 there are 15 affected residences. Residences currently adjacent to the west side of S.R. 200 would be acquired as part of the ROW acquisition for the proposed improvements. The remaining affected residences both east and west of S.R. 200 are all

located in close proximity to access drives or intersecting streets. A noise barrier evaluation was performed at one representative location.

Residence west of S.R. 200 at East Hilltop Loop (Receiver 38W; Barrier 5)

This residence was selected for analysis because, of the remaining affected residences both east and west of S.R. 200, it is in closest proximity to the S.R. 200 ROW line. Because of the small distance between the residence and the potential barrier location, this area allowed the greatest potential for a noise barrier to be feasible.

At this location, one residence is predicted to experience noise levels that approach or exceed the NAC. The length of a noise barrier at this location is limited by East Hilltop Loop which intersects S.R. 200 to the north and the need to maintain access rights to a parcel of property to the south. At the maximum barrier height of 22 ft, an insertion loss of 5 dBA could not be achieved because of the limitations on barrier length. Therefore, noise barriers were determined to not be a feasible abatement measure at this location.

3.6 Conclusions

For the Build Alternative year 2025 traffic conditions, 53 residences are predicted to experience noise levels that approach or exceed the NAC. Noise abatement measures were evaluated for these sites. An evaluation of traffic system management techniques, alignment modifications and property acquisition indicated that these abatement measures were not feasible or reasonable. Land use controls can be used by local planning officials to minimize development or redevelopment of noise sensitive land uses in proximity to S.R. 200. A copy of the final Noise Study Technical Memorandum will be furnished to local officials to assist them in the development of compatible land uses for future development.

A noise barrier evaluation was also performed. Within the project limits, S.R. 200 is characterized by numerous access drives and intersecting side streets. At some locations,

the need to accommodate access to S.R. 200 precluded the construction of a noise barrier while at most other locations access requirements for driveways and intersecting streets severely limited the length of a noise barrier. Consequently, noise barriers could not provide a minimum 5 dBA reduction at many locations. At some locations, a 5 dBA reduction could be achieved, but the number of benefited residences was small because of the numerous gaps in the barriers to accommodate access to S.R. 200. Because of the small number of benefited residences, noise barriers were not cost reasonable at locations where a 5 dBA reduction could be achieved. Based on the noise barrier evaluation at representative areas, noise barriers were determined to not be a feasible and cost reasonable abatement measure for the 53 residences with predicted noise levels that approach or exceed the NAC.

Based on the noise analysis performed to date, there appears to be no apparent solutions available to mitigate for traffic noise at the 53 affected noise sensitive sites.

4.0 CONSTRUCTION NOISE AND VIBRATION

During the construction phase of the proposed project, short-term noise may be generated by stationary and mobile construction equipment. The construction noise will be temporary at any location and will be controlled by adherence to the most recent edition of the FDOT Standard Specifications for Road and Bridge Construction[5].

Using FDOT's listing of vibration sensitive sites, residences were identified as potentially sensitive to vibration caused during construction. If during final design, it is determined that provisions to control vibration are necessary, the project's construction provisions can be modified as needed.

5.0 PUBLIC COORDINATION

Local officials can promote compatibility between land development and highways. A copy of this report will be provided to local agencies responsible for controlling

land use. The 66 dBA noise contour data previously provided in Table 5 delineates the area where exterior uses at residences, motels, schools, churches and recreational facilities would be considered incompatible. Local officials can use the noise contour data to establish compatible development of currently undeveloped parcels or compatible redevelopment in areas where land use may change.

6.0 REFERENCES

1. Title 23 CFR, Part 772, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise; April 2001.

2. Florida Department of Transportation Project Development and Environment (PD&E) Manual, Volume 2, Chapter 17; Tallahassee Florida; January 2001.

3. Florida Department of Transportation District Seven Traffic Technical Memorandum; Tampa, Florida; October 2000.

4. Federal Highway Administration Measurement of Highway-Related Noise; Springfield, VA; May 1996.

5. Florida Department of Transportation Standard Specifications for Road and Bridge Construction; Tallahassee, Florida; 2000.

S.R. 200 PD&E Study Reevaluation

From U.S. 41 to N. of the Marion County Line
Citrus County, Florida
WPI Segment No. 257188 1
FAP No. FL62-020R

FINAL NOISE STUDY TECHNICAL APPENDICES

Florida Department of Transportation

District 7, Tampa, Florida

June 2002

APPENDIX

Aerials