

PROPOSED NOISE ANALYSIS METHODOLOGY

Project Development and Environment (PD&E) Study
SR A1A Over Sebastian Inlet – Bridge 880005
Bridge Replacement
Indian River County and Brevard County, Florida

Financial Project ID: 445618-1-22-02
Federal Aid Number: D420 075B
ETDM Number: 14433

PREPARED FOR



Florida Department of Transportation
District Four
3400 West Commercial Boulevard
Fort Lauderdale, Florida 33309

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.

FEBRUARY 2021

Table of Contents

1.0	INTRODUCTION	1
2.0	NOISE LEVEL DESCRIPTORS	1
3.0	DATA COLLECTION	1
4.0	TRAFFIC NOISE ANALYSIS	3
4.1	NOISE SENSITIVE SITES	3
4.2	TRAFFIC NOISE MODEL DEVELOPMENT	3
4.3	TRAFFIC NOISE IMPACT ANALYSIS.....	4
4.4	NOISE ABATEMENT ANALYSIS	4
5.0	CONSTRUCTION NOISE AND VIBRATION	6
6.0	NOISE STUDY REPORT	7
7.0	PUBLIC INVOLVEMENT	7

List of Figures

Figure 1	PROJECT LOCATION MAP	2
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List of Tables

Table 1	– Modeled Noise Receptor Locations and Noise Analysis Results (Sample).....	5
Table 2	– Noise Barrier Analysis for Oak Harbor East of I-95 at SW 7th Street (Sample).....	8
Table 3	– Noise Barrier Evaluation Summary and Recommendations (Sample)	9

1.0 INTRODUCTION

This document describes the methodology that will be used to complete the traffic noise impact analysis and prepare a Noise Study Report (NSR) for the Florida Department of Transportation (FDOT) District Four Project Development & Environment (PD&E) Study to evaluate the replacement of the Sebastian Inlet Bridge (No. 880005) crossing the Sebastian Inlet located at the Indian River County and Brevard County boundary. The bridge is known as the James H. Pruitt Memorial Bridge. The project study area is shown on the project location map (see **Figure 1**).

The traffic noise study will be 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* (July 01, 2020). The FDOT’s *Traffic Noise Modeling and Analysis Practitioners Handbook* (January 1, 2016) will be referenced as necessary to conduct the traffic noise analysis.

2.0 NOISE LEVEL DESCRIPTORS

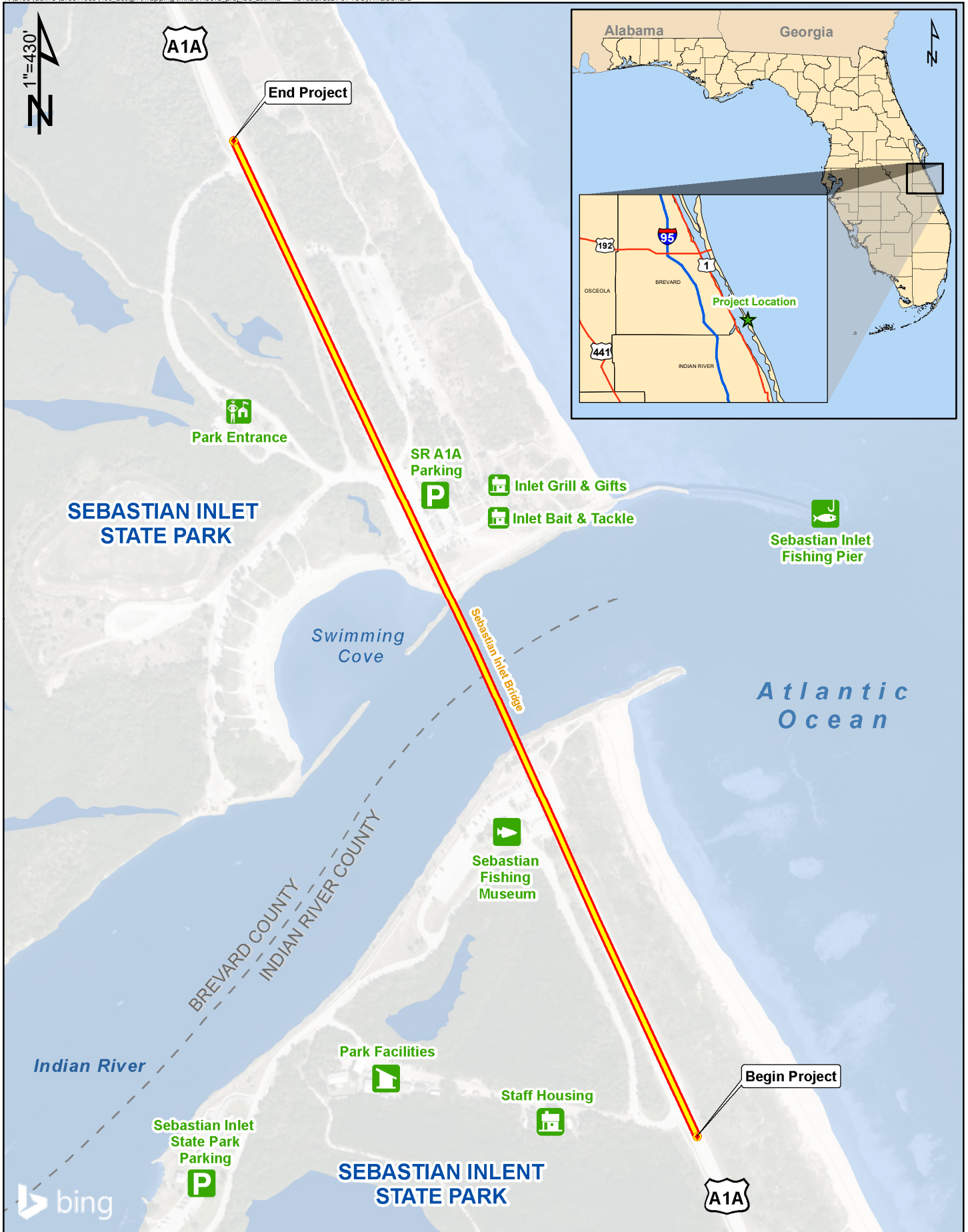
The noise level descriptor that will be used for this project is the hourly equivalent sound level, $Leq(h)$. All noise levels will be presented in A-weighted decibels [dB(A)], which closely approximate the human frequency response. All data will be reported to the nearest 0.1 dB(A).

3.0 DATA COLLECTION

A field evaluation will be performed to determine existing noise levels, types, and quantities of existing potentially noise sensitive sites, prevailing ground cover, terrain, locations of existing noise barriers, and other environmental data pertinent to the noise analysis. Field measured noise level data will also be used to validate model inputs for the current version of Federal Highway Administration’s (FHWA) Traffic Noise Model (TNM) 2.5. Traffic noise measurements will be conducted in accordance with guidelines and criteria contained in Section 18.2.2.2 of the PD&E Manual and the FHWA document “Measurement of Highway-Related Noise”.

Existing traffic noise levels will be measured over a period of one day at two (2) locations representative of noise sensitive land uses along the project corridor. It is anticipated that traffic noise levels will be measured along the east side of SR A1A near the Inlet Grill restaurant north of Sebastian Inlet and along the west side of SR A1A near the Sebastian Fishing Museum south of the inlet. Prior to initiating the field measurements, the proposed monitoring locations will be identified on an aerial map submitted to the District Four Noise Specialist for approval and to confirm that areas with known noise concerns will be addressed.

Measurements will be conducted on a weekday (Monday through Friday) to avoid traffic noise fluctuations that may occur during the weekend. Data collected at these sites will include traffic noise levels, traffic volumes and speeds, physical features of the site, and meteorological data. A minimum of three 10-minute samples of traffic noise, volumes, and speeds will be collected at each measurement site to characterize existing traffic noise and to validate inputs into TNM 2.5. Traffic volumes will be counted



PROJECT LOCATION
 PROJECT DEVELOPMENT AND ENVIRONMENT (PD&E) STUDY
 SR-A1A OVER SEBASTIAN INLET - BRIDGE 880005 - BRIDGE REPLACEMENT
 INDIAN RIVER COUNTY AND BREVARD COUNTY, FLORIDA

**FIGURE
1**

manually during each measurement period. Speed data will be collected using Doppler-radar speed measurement equipment. Meteorological data, including wind speed and direction, temperature, and humidity will be collected during each 10-minute sample period. All measured data will be recorded on data sheets and included in the project files.

Noise level data will be collected at distances from the roadway that will facilitate reliable prediction of noise levels at nearby noise sensitive sites using the TNM model. Where access is available, and where site conditions allow for accurate measurement, traffic noise levels will be measured adjacent to the edge of the noise sensitive site nearest the roadway. Where applicable and practicable, noise level data will be collected at two offset distances from SR A1A to evaluate noise level drop-off with distance from the subject roadway.

4.0 TRAFFIC NOISE ANALYSIS

The purpose of the traffic noise analysis is to determine if traffic noise impacts are expected to occur at existing and future noise sensitive sites along the project corridor and to evaluate noise abatement alternatives for sites determined to be impacted by the proposed project. This analysis will include computer predictions of worst-case (i.e., peak) noise levels for the existing conditions, the design-year No-Build Alternative and the recommended Build Alternative.

4.1 NOISE SENSITIVE SITES

Within the limits of the project, nearby noise sensitive sites include amenities at Sebastian Inlet State Park including beaches, fishing jetties, and outdoor seating areas at the Surfside Grill and the Sebastian Fishing Museum. The remaining land use along the project corridor is unimproved park land.

4.2 TRAFFIC NOISE MODEL DEVELOPMENT

Traffic noise level predictions will be completed using TNM 2.5. Geometric inputs for this project will be developed using MicroStation files and/or aerial imagery. Pavement and ground elevations will be taken from profile-grade data developed for the project and/or from existing cross-section data, where available. Pavement, bridges, super-elevations, ground types (i.e., water bodies), barriers, buildings, etc. will be modeled as appropriate and in accordance with currently accepted methodologies regarding their input into TNM 2.5. Roadway lanes will be modeled individually in accordance with current guidance from the FHWA. Existing noise barriers will be modeled at elevations appropriate for their location according to elevation data provided for this project.

Model input validation will be performed using data collected in the field and information taken from aerial imagery of the existing conditions and available roadway plans. Model inputs will be determined to be valid for a site when the average predicted noise level from at least three sample periods is no more than 3.0 dB(A) above/below the averaged measured noise level during the same three periods. The validation models will be used as a basis to further develop TNM 2.5 model inputs to predict worst-case traffic noise levels for the existing conditions and design year No-Build and all viable Build Alternatives.

The 51.0, 66.0 and 71.0 dB(A) noise level isopleths for the recommended Build Alternative during the design year will be developed for a representative location along the project corridor. Existing land use

conditions and maps will be assessed to identify current noise sensitive sites along the project corridor in accordance with Chapter 18 of the PD&E Manual. Future noise sensitive development along the project corridor will be evaluated based upon information provided by the local planning/permitting agencies for noise sensitive sites having construction permits issued prior to the project's Date of Public Knowledge (DPK).

Model receptors representative of noise sensitive sites along the project corridor will be located in accordance with FHWA and FDOT guidance. Generally, model receptors will be placed at the edge of the noise sensitive site facing the project roadway at an elevation of five feet above the surrounding ground surface. Exceptions to this may occur at multi-story buildings if exterior noise sensitive uses such as outdoor seating areas are identified above the first floor. In such cases, the elevations of model receptors representative of above the ground level will be assumed to increase as necessary in increments of 10 feet. Interior receptors will only be used for sites identified under FHWA's Activity Class D. A sufficient number of model receptors will be used such that variations in the locations/types of noise sensitive sites, roadway geometry, traffic data, etc. are represented.

Maximum peak-hourly traffic representing Level-of-Service (LOS) C will be used unless traffic analysis shows that LOS C will not be reached. If LOS C will not be reached, demand volumes shall be used. If demand volumes are used in place of LOS C volumes, the directional peak traffic should be worst-case for receptors on each side of the roadway. The roadway or ramp's posted speed limit or TNM generated speeds for on-ramps will be used.

4.3 TRAFFIC NOISE IMPACT ANALYSIS

Traffic noise levels will be predicted for the existing peak-hour conditions and design year No-Build and viable Build Alternatives. The predicted noise levels for existing and future conditions at the noise sensitive sites along the project corridor will be presented in the NSR in a table similar to **Table 1**. Noise sensitive sites will be considered impacted when traffic noise levels are predicted to approach to within 1.0 dB(A) or exceed the applicable FHWA Noise Abatement Criteria (NAC) [Example; 67.0 dB(A) for residential Activity Class B sites], or when traffic noise levels are predicted to increase by at least 15 dB(A) from existing noise levels, in accordance with PD&E Manual Chapter 18. Impacts behind existing noise barriers will be evaluated in accordance with FDOT's current methodologies.

4.4 NOISE ABATEMENT ANALYSIS

The reasonableness and feasibility of traffic noise abatement will be considered for all sites found to be impacted as a result of the proposed project. Noise barrier design concepts will be evaluated using TNM 2.5 for the recommended Build Alternative. Proposed noise barriers will be modeled at elevations appropriate for their location according to elevation data provided for this project. Bridges, super-elevations, swales, or other ground features that exist along the roadway that have the potential to influence the effective heights of proposed noise barriers independent of roadway elevation will be modeled as appropriate according to elevation data provided for this project. Where possible, noise barriers will be designed to provide noise level reductions (i.e., insertion losses) of at least 10 dB(A). For the purposes of determining cost reasonableness, a receptor must be predicted to receive an insertion loss of at least 5.0 dB(A) in order to be considered benefitted. In accordance with FDOT criteria, at least

SAMPLE

Table 1 – Modeled Noise Receptor Locations and Noise Analysis Results

Representative Model Receptor	Site and Address	Type	Description (Noise Abatement Activity Category)	FDOT Noise Abatement Approach Criteria [dB(A)]	Location (Side of Road, Station)	Number Of Noise Sensitive Sites	Distance To Nearest Traffic Lane* (Existing/No-Build/Build)	Predicted Traffic Noise Levels [Leq(h), dB(A)]			Notes
								Existing (2010)	Design Year (2035)		
									No Build	Build	
HI	Holiday Inn 1234 SW 128 th Avenue	Hotel Pool	Sensitive Commercial (E)	71	West Side Sta. 15+20	SLU	150/150/145/135	65.6	67.8	67.9	SB Off-ramp from SR 836
RB(a/b/c/d/e)	Rio Blanco Condominiums 4500 West Sunset Place	Residential	Residential (B)	66	East Side Sta. 22+00	3/3/3/3	250/250/200/190	66.6/69.0/69.5/69.9/70.4	66.8/69.2/69.7/70.2/70.8	65.4/69.8/70.5/71.3/71.9	–
BR	Bayside 103.8 Radio 1007 W 107 th Place	Studio	Studio Interior (D)	51	East Side Sta. 25+80	1	105/105/100/95	45.1	47.5	47.7	NB Off-ramp to SR 117
BE	Bayside Elementary Playground 100 SW 102 nd Street	School Playground	School Playground (C)	66	West Side Sta. 30+60	SLU	150/150/140/130	71.0	72.0	72.3	–
CB	Cracker Barrel Restaurant 199 W 57 th Street	Outdoor Seating Area	Sensitive Commercial (E)	71	West Side Sta. 35+00	SLU	180/180/170/155	65.5	67.3	67.8	–
–	–	–	–	–	–	–	–	–	–	–	–

Notes: * = To existing edge-of-pavement of the nearest through-lane on SR 326.
 Bold numbers indicate noise levels above FDOT Noise Abatement Criteria
 SLU = Special Land Use site, Sta. = Station
 †=Indoor receptor site, includes 25 dB(A) building noise reduction factor in accordance with FDOT PD&E Manual Chapter 17

One (1) impacted site must receive an insertion loss of no less than 7.0 dB(A). Also, at least two (2) impacted receptors must be benefited by a proposed noise barrier for the noise barrier to be considered feasible.

Ground mounted barriers will not exceed a height of 22 feet above the ground line and noise barriers on structure or mechanically stabilized earth (MSE) wall will not exceed 8 feet above the height of the structure. Ground mounted noise barriers within the roadway clear recovery zone (i.e., shoulder mounted noise barriers) will be limited to a maximum height of 14 feet. All noise barriers will be evaluated at heights in two-foot increments beginning at 8 feet.

The FDOT's standard unit cost for noise barriers, currently \$30 per square-foot, and a maximum rounded cost of \$42,000 per benefitted receptor will be used. In determining the optimum noise barrier design, we will evaluate the benefit of greater insertion loss versus increased cost, etc. This will be particularly important when considering increased noise barrier height versus benefit to second-row sites.

The reasonableness and feasibility of the noise barriers will be assessed using the considerations presented in Chapter 18 of the PD&E Manual such as utilities, drainage, right-of-way needs, safety, constructability, etc. These considerations will generally be used to refine the rationale behind proposing noise barriers rather than to disqualify noise barriers from consideration. However, issues such as poor effectiveness, cost, diminished safety, community desires, accessibility, etc. may lead to a particular noise barrier being removed from consideration.

Noise abatement will not be considered for commercial or industrial property unless there is an exterior use that is particularly noise sensitive such as an outdoor seating area at a restaurant. Noise barriers will not be considered for recreational uses such as golf courses, isolated picnic tables, outdoor basketball or tennis courts, sports fields, walking trails and similar uses unless the sports field or other use areas are part of a larger facility that has extensive use throughout the day. If this condition occurs, the reasonableness and feasibility of noise abatement for noise sensitive sites within special land uses will be assessed in accordance with FDOT Report No. FL-ER-65-97 titled "*A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Use Locations*".

The cost reasonableness of a noise barrier (or system of noise barriers) benefitting a discreet neighborhood or impacted area will be evaluated independently from noise barriers for other neighborhoods or impacted areas. Information relating to the performance and costs associated with individual noise barrier designs under consideration will be presented in the NSR in a table format similar to **Table 2**. In addition, a table will be presented in the conclusions section of the NSR that will summarize all of the noise barriers that were considered. This table will be similar to **Table 3**.

5.0 CONSTRUCTION NOISE AND VIBRATION

FDOT is exempt from compliance with local ordinances. However, since FDOT policy is to follow the requirement of local ordinances, to the extent that it is reasonable, local ordinances with potential to impact construction activities with regard to noise and vibration will be identified. The results of these efforts will be reported in the NSR for reference during final design and for construction contract development. Any special site uses, such as surgical centers or precision laboratories, sensitive to

construction noise and vibration (where applicable) will be identified in the NSR. If such sites are not found, a general reference to FDOT Standard Specifications for construction to control noise and/or vibration impacts and the inclusion of any local construction noise and/or vibration ordinances shall be sufficient for the NSR.

6.0 NOISE STUDY REPORT

A NSR will be prepared during the PD&E phase of this project in accordance with guidelines set forth in Chapter 18 of the PD&E Manual. The NSR will generally contain an introduction; a characterization of the existing conditions; a description of the proposed action; a summary of existing/future noise sensitive land uses; a description of the noise analysis methodology; the measured and modeled traffic noise levels; a summary of the results; an impact analysis; a description of noise abatement evaluated for impacted sites; a conclusions section; a summary of potential construction noise impacts; and, a description of any noise-related public involvement. Completed tables similar to the samples presented herein will appear in the report. Figures will be prepared depicting where the field measurements occurred, the locations of the model noise receptors, and locations where noise barriers were considered/proposed. The PD&E phase NSR will serve as the support document for the primary environmental report. An abbreviated summary of the NSR will be included in the primary document.

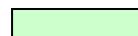
7.0 PUBLIC INVOLVEMENT

Public involvement for noise issues on this project will, if necessary, include attendance at the project's public hearing which occurs near the end of the PD&E phase. Written responses to noise-related questions or comments that are submitted at the public hearing will be prepared.

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Table 2 – Noise Barrier Analysis for Oak Harbor East of I-95 at SW 7th Street

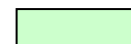
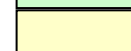
Community Identifier(s)	Noise Barrier Design Concept Number	Barrier Type	Height (feet)	Length (feet)	Begin Station Number	End Station Number	Number of Impacted Receptor Sites	Average (Maximum) Noise Reduction for Impacted Receptor Sites dB(A)	Number of Impacted/Benefited Receptor Sites	Number of Benefited 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
Barrier Alternatives for Common Noise Environment Area I95-E6															
Oak Harbor	CD1-I95-E6	Ground-Mounted	20	3,520	876+00	879+00	22	9.0 (11.5)	21	17	38	8.0 (11.5)	\$2,112,000	\$55,579	Ground-mounted. Exceeds FDOT Cost Guideline.
	CD2-I95-E6	Ground-Mounted	22	3,520	876+00	879+00	22	9.5 (11.9)	21	20	41	8.4 (11.9)	\$2,323,200	\$56,663	Ground-mounted. Exceeds FDOT Cost Guideline.
	CD3-I95-E6	Ground-Mounted	20	1,930	876+00	879+00	22	8.9 (11.5)	21	7	28	8.5 (11.5)	\$1,158,000	\$41,357	Recommended for Further Consideration and Community Input.
	CD4-I95E6	Ground-Mounted	22	1,930	876+00	878+20	22	9.5 (12.0)	21	7	28	9.1 (12.0)	\$1,651,800	\$58,993	Ground-mounted and Shoulder-mounted noise barrier segments. Exceeds FDOT Cost Guideline.
		Shoulder-Mounted	14	900	878+20	879+00									
CD5-I95-E6	Ground-Mounted	22	1,930	876+00	878+20	22	9.6 (12.1)	21	7	28	9.2 (12.1)	\$1,825,800	\$65,207	Ground-mounted, Shoulder-mounted, and Structure-mounted noise barrier segments. Exceeds FDOT Cost Guideline.	
	Shoulder-Mounted	14	900	878+20	878+60										
Structure-Mounted	8	725	878+60	879+00											

 Conceptual noise barrier design that meets FDOT's reasonable cost criteria and noise reduction design goal of at least a 7.0 dB(A) reduction for at least one impacted receptor site

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Table 3 – Noise Barrier Evaluation Summary and Recommendations

General Location (Cross Streets)	Relative Location	Common Noise Environment/ Community Names	Type of Noise Sensitive Site (Noise Abatement Criteria Activity Category)	Recommended Noise Barrier Conceptual Design	Barrier Type	Height (feet)	Length (feet)	Begin Station Number	End Station Number	Number of Impacted Receptors	Average Noise Reduction for Impacted Receptors [dB(A)]	Number of Impacted and Benefited Receptors	Number of Not Impacted but Benefited Receptors	Total Number of Benefited Receptors	Average Noise Reduction for all Benefited Receptors [dB(A)]	Estimated Cost	Estimated Cost/Site Benefited	Optimal Noise Barrier Design Meets FDOT's Reasonable Noise Abatement Cost Criteria of \$42,000 per Benefited Receptor Site	Noise Barrier Recommended for Further Consideration and Community Input
SR 826 - Between NW 103rd Street and NW 114th Street	East of SR 826	SR826-E1/Westland Eden, Meadowgreen, Palm West Gardens, Westland Gardens and Conquistador Park	Residential (Activity Category B)	CD1-SR826-E1	Structure-Mounted	8	2,600	450+00	476+00	152	1.6	0	0	0	N/A	\$624,000	N/A	No	No
	West of SR 826	SR826-W1/West Lake, Westland Village and Unnamed Townhomes	Residential (Activity Category B)	CD1-SR826-W1	Structure-Mounted	8	2,700	449+00	476+00	29	1.3	0	0	0	N/A	\$648,000	N/A	No	No
SR 826 - Between NW 114th Street and NW 122nd Street	East of SR 826	SR826-E2/The Palmetto, Palmetto Gardens North, Villa Luisa, Andes, Palm Springs Lakes South, and Los Arboles	Residential (Activity Category B)	CD1-SR826-E2	Structure-Mounted	8	2,650	476+00	618+00 (NW 122nd St Off-ramp)	106	1.7	0	0	0	N/A	\$636,000	N/A	No	No
I-75 - Between NW 87th Avenue and NW 138th Street	North of I-75	I75-E2/Florinda Estates	Residential (Activity Category B)	CD3-I75-E2	Shoulder-Mounted	14	1,675	77+00	24+00 (NW 138 St Off-ramp)	30	7.1	30	3	33	6.8	\$703,500	\$21,318	Yes	Yes
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 Conceptual noise barrier design that meets FDOT's reasonable cost criteria
 Conceptual noise barrier design that does not meet FDOT's reasonable cost criteria