DESIGN NOISE STUDY REPORT

Orange Avenue Widening
from Orange / Osceola County Line to Florida's Turnpike

Orange County, Florida

CIP Number: 2929

Prepared For:
ORANGE COUNTY

March 2026

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1.0 INTRODUCTION

Orange County is conducting a Reevaluation of the approved Roadway Conceptual Analysis (RCA) for Orange Avenue from the Orange / Osceola County line to Florida's Turnpike, which is located in southern Orange County (Figure 1), a distance of 0.61 miles in length. Existing Orange Avenue is a two-lane, minor arterial roadway located in a suburban area of southern Orange County Commission District Four. The roadway alignment is straight then curves before crossing Florida's Turnpike, and the corridor is surrounded by a mix of housing developments, wetlands, and vacant property.

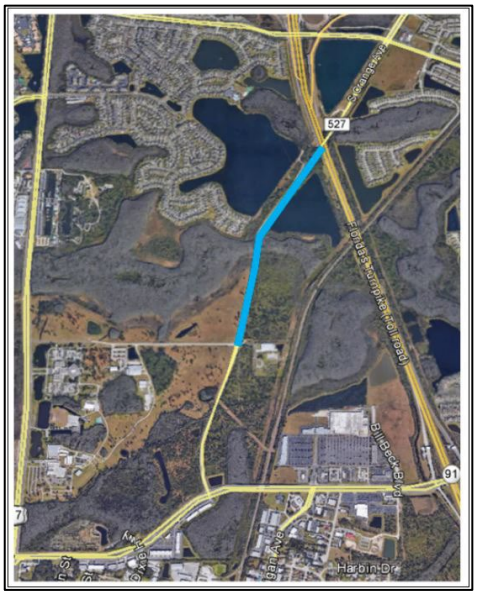

Figure 1: Project Location Map

The Roadway Conceptual Analysis (RCA) was approved on March 24, 2020 to document the development and implementation of potential improvements to widen Orange Avenue from the Orange/Osceola County Line to Florida's Turnpike. The study evaluated the widening of Orange Avenue from two to four lanes. The proposed typical section consists of four 11 ft travel lanes with two in each direction. In addition, a 7 ft buffered bike lane and 6 ft sidewalks are provided in each direction. The recommended geometry was a centered widening with an alignment modification. Additional improvements included drainage, cross drains, signing and pavement markings and signalization.

This Noise Study Report documents the methodology, analysis, and findings of the traffic noise evaluation conducted for the proposed improvements. The results will inform decisions regarding potential noise abatement measures and ensure compliance with applicable federal and state noise regulations.

2.0 METHODOLOGY

The traffic noise study was performed in accordance with *Code of Federal Regulations, Title 23, Part 772 (23 CFR 772) Procedures for Abatement of Highway Traffic Noise and Construction Noise*[1] using methodology established by the Florida Department of Transportation (FDOT) in the *Project Development and Environment Manual*, *Part 2, Chapter 18 (FDOT, July 31, 2024)*[2] and FDOT's *Traffic Noise Modeling and Analysis Practitioners Handbook*[3]. Predicted noise levels were produced using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM), version 2.5.

2.1 Noise Metrics

Noise levels developed for this analysis are expressed in decibels (dB) using an "A"-scale [dB(A)] weighting. This scale most closely approximates the response characteristics of the human ear. All noise levels are reported as hourly equivalent noise levels [Leq(h)]. The Leq is defined as "the equivalent

steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq"[1]. Use of the dB(A) and Leq(h) metrics to evaluate traffic noise is consistent with 23 CFR 772[1].

2.2 Traffic Data

Traffic noise is heavily dependent on both traffic speed and traffic volume with the amount of noise generated by traffic increasing as the vehicle speed and number of vehicles increases. The traffic conditions that result in the highest noise levels for roadways are the hourly traffic volumes that represent Level of Service (LOS) C traffic conditions because they represent maximum service volumes under stable flow conditions.

Traffic volumes and vehicle mix (e.g., cars, medium trucks, heavy trucks, motorcycles, and buses) were predicted for the design year (2045) under the Build condition. For Orange Avenue roadway segments, LOS C hourly traffic volumes were compared to predicted design year demand hourly volumes and the lower of the two was used in the model, consistent with Section 18.2.1.5 of the FDOT PD&E Manual. For ramps, hourly traffic demand volumes were utilized. Traffic volumes and speeds used in the analysis are provided in Appendix A.

2.3 Noise Abatement Criteria and Considerations

Noise-sensitive sites are any property where frequent exterior and/or interior human use occurs and where a lowered noise level would provide a benefit. FHWA has established noise levels at which noise abatement must be considered for various types of noise-sensitive sites. These levels, which are used by the FTE for the purpose of evaluating traffic noise, are referred to as the Noise Abatement Criteria (NAC). As shown in Table 2-1, the NAC vary by activity category. Noise abatement measures are considered when predicted traffic noise levels approach or exceed the NAC. FDOT defines "approach" as within one dB(A) of the applicable FHWA criterion. For comparison purposes, typical noise levels for common indoor and outdoor activities are provided in Figure 2.

Noise abatement measures must also be considered when a substantial increase in traffic noise will occur as a direct result of the transportation project. The FDOT PD&E Manual[2] defines a substantial increase as 15 or more dB(A) above existing conditions. A substantial increase typically occurs in areas where traffic noise is a minor component of the existing noise environment but would become a major component after the project is constructed (e.g., new alignment project). The proposed concept design for this project follows the existing alignment of Orange Avenue and the results from the RCA noise analysis indicated that a substantial increase in traffic noise will not occur.

Table 2-1 – FHWA Noise Abatement Criteria

NOISE ABATEMENT CRITERIA (NAC) [Hourly A-Weighted Sound Level-decibels (dB(A))]				
Activity Category	Activity Leq(h)[1]		Evaluation location	Description of activity category
	FHWA	FDOT		
A	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[2]	67	66	Exterior	Residential
C[2]	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[2]	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)

[1] The Leq(h) Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.

[2] Includes undeveloped lands permitted for this activity category.

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.

Figure 2 – Typical Noise Levels

Common Outdoor Activities	Noise Level dB(A)	Common Indoor Activities
	---110---	Rock Band
Jet Fly-Over 1000 ft.		
	---100---	
Gas Lawn Mower at 3 ft.		
	---90---	
Diesel Truck at 50 ft., at 50 mph		Food Blender at 3 ft.
	---80---	Garbage Disposal at 3 ft.
Noise Urban Area (Daytime)		
Gas Lawn Mower at 100 ft.	---70---	Vacuum Cleaner at 10 ft.
Commercial Area		Normal Speech at 3 ft.
Heavy Traffic at 300 ft.	---60---	
		Large Business Office
Quiet Urban Daytime	---50---	Dishwasher Next Room
Quiet Urban Nighttime	---40---	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime		
	---30---	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	---20---	
	---10---	
Lowest Threshold of Human Hearing	---0---	Lowest Threshold of Human Hearing

Source: California Dept. of Transportation; Technical Noise Supplement; Oct 1998; Page 18.

3.0 TRAFFIC NOISE ANALYSIS AND ABATEMENT ASSESSMENT

3.1 Model Verification

To verify the accuracy of the TNM 2.5 noise model, field measurements were taken within the project limits following procedures documented in FHWA's Noise Measurement Field Guide[4] (FHWA, June 2018). Noise monitoring was performed on March 10, 2026, using a Larson Davis LxT noise monitor. All monitoring events were 10 minutes in duration, which is consistent with methodology documented in the FDOT PD&E Manual[2]. The noise monitor was calibrated using a CAL200 calibrator before and after each event. Typical vehicle speeds were established by sampling with a Bushnell handheld radar gun. Vehicles generally traveled within 5 miles per hour (mph) of the 45-mph posted speed limit on Orange Avenue. Traffic volumes by vehicle classification were recorded for each monitoring event and then extrapolated to one-hour equivalent volumes for input within the TNM.

Due to the size and limited access to safe monitoring locations, one location was used to validate the ability of the TNM to accurately predict traffic noise for this project. The location of the validation site is shown on the project aerials in Appendix C as receptor point VAL-001. Measurements were taken for three validation events at the validation site. The validation receptor point is located north of Mary Louis Lane on southbound side of Orange Avenue at approximately Station 110+00.

The results of the monitoring events are summarized in Table 3-1. As shown in Table 3-1, the variance between the measured and predicted noise levels were 3.0 dB or less for all validation events. Therefore, the noise model is predicting traffic related noise for this project within the level of accuracy specified in the FDOT PD&E Manual[2].

Table 3-1 – TNM Validation Results Summary

Location	Validation Event	TNM Predicted (dB(A))	Field Measured (dB(A))	Variance (dB(A))
VAL-001[1] (Location 1)	VS-01-R1	71.5	73.7	2.7
	VS-01-R2	72.0	74.3	2.3
	VS-01-R3	71.1	72.3	1.2

[1] Measurements Taken 3/10/2026.

3.2 Noise-sensitive Sites and Impact Analysis

The analysis evaluated noise-sensitive sites within the project limits, including residential properties and Special Land Use (SLU) areas. Receptors representing these sites were digitized in the noise model in accordance with the FDOT *PD&E Manual*[2]. Receptor placement followed these criteria:

- **Residential receptors:** Located in areas of frequent exterior use (e.g., patio or lanai) or at the corner of the residential building closest to the primary traffic noise source.

- **Special Land Use (SLU) receptors:** Placed in areas with frequent outdoor human use. For large SLU areas, such as parks or schoolyards, receptors were arranged in a grid pattern to capture spatial variability in outdoor use.
- **Representative receptor:** Used to model clusters of residences with similar characteristics, where a single receptor represents multiple sites.
- **Ground floor receptors:** Positioned at a height of 5 feet above ground elevation.

Receptor locations are illustrated on the project aerials in Appendix C.

3.2.1 Receptor Naming System

Each receptor is identified by a unique alphanumeric code that reflects its NAC classification and location:

1. **First Letter:** "B" for residential receptors.
2. **Next Two Letters:** indicate the roadway side (e.g., "SB" for southbound).
3. **Next Two-Digit Number:** Represents the Common Noise Environment (CNE) identifier.
4. **Final Three-Digit Number:** Separated by a dash, this denotes the specific receptor (e.g., BSB01-002 is the 2nd residential receptor in the 1st CNE on the southbound side).

Predicted noise levels are included in Appendix B, while receptor locations are illustrated on the project aerials in Appendix C.

3.3 Noise Abatement Analysis

To evaluate noise abatement measures, the analysis grouped receptors into Common Noise Environments (CNEs). Noise barriers were considered to mitigate traffic noise by obstructing the sound path between the roadway and noise-sensitive sites. Effective barriers are sufficiently long, continuous (without gaps), and of adequate height.

A noise barrier must meet both feasibility and reasonableness criteria to be considered for construction:

Feasibility Criteria:

- Must provide at least a 5 dB(A) reduction in traffic noise to at least two impacted receptors.

Must consider design, construction, safety, access, ROW constraints, maintenance, drainage, and utility factors.

Reasonableness Criteria:

- Must meet FDOT's Noise Reduction Design Goal (NRDG), reducing noise at least 7 dB(A) for at least one benefited receptor.
- Must satisfy FDOT's cost threshold of $64,000 per benefited receptor (defined as a receptor receiving at least a 5 dB(A) reduction). The current unit cost used to evaluate cost reasonableness is $40 per square foot, covering materials and labor.
- Must incorporate community feedback from affected property owners and residents.

Within the project limits, noise barrier locations were assessed based on the following criteria:

- Non-shoulder noise barriers located outside the clear recovery zone but within the ROW were initially considered at heights ranging from 8 to 22 feet in 2-foot increments.
- If a non-shoulder noise barrier could not provide feasible and reasonable abatement for an impacted receptor, a shoulder noise barrier was evaluated.
    - When placed on a structure (e.g., bridge, retaining wall), a shoulder noise barrier was limited to a maximum height of 8 feet.
    - When located on an embankment or ground-mounted, the maximum height was 14 feet.

Noise barriers were evaluated to identify the maximum number of impacted receptors eligible for at least a 5 dB(A) reduction in traffic-related noise. Site-specific constraints, such as overhead utilities, may limit barrier effectiveness, preventing some impacted receptors from achieving the full reduction.

In certain locations, noise barriers may also benefit receptors that are not predicted to approach or exceed the NAC. Since abatement is not required for these receptors, barrier lengths or heights are not increased solely to enhance their benefit. However, if a non-impacted receptor receives noise reduction due to proximity to an impacted receptor, it is included in the cost-reasonableness analysis based on cost per benefited receptor. This evaluation approach is consistent with FHWA noise abatement policy and guidance, including criteria for feasibility, reasonableness, and cost-effectiveness.

3.4 Common Noise Environments on Southbound Side of Orange Avenue

3.4.1 Cumberland Meadows (CNE SB01)

Cumberland Meadows is located on the southbound side of Orange Avenue, between Mary Louis Lane and Florida's Turnpike. This area is shown on sheet 1 of the project aerials located in Appendix C. The noise model for this area includes six NAC B receptors representing 20 residences. Noise levels are not predicted to approach or exceed the applicable Noise Abatement Criteria (NAC) under the Build condition for the design year (2045). Predicted noise levels range from 45.9 to 60.0 dB(A) and are not expected to approach or exceed the NAC for the Build Condition in Design Year (2045). Predicted noise levels are shown in Appendix B.

4.0 CONCLUSIONS

Within the project limits, noise levels were predicted at six NAC B receptors representing 20 residences. Noise levels are not predicted to approach or exceed the NAC under the 2045 Build condition at any residence, and therefore noise abatement was not considered for this project.

5.0 CONSTRUCTION NOISE AND VIBRATION

During the construction phase of the proposed project, short-term noise may be generated by stationery 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 FDOT's Standard Specifications for Road and Bridge Construction[4].

Using the listing of sensitive sites found in FDOT's Project Development and Environment Manual, residents were identified as the only land use potentially sensitive to vibration that could occur during construction. If during final design it is determined that measures to control vibration are necessary, the project's construction provisions can be modified as needed.

6.0 PUBLIC INVOLVEMENT

Stakeholder and general public input play a key role in guiding the development of the Study recommendations. As such, a community meeting will be held prior to determining the final roadway alignment. The meetings will be publicly posted, and an informational newsletter will be distributed to property owners in the vicinity of the road at least two weeks prior to the meeting date. A public hearing will also be held in May 2026 with the Orange County Board of County Commissioners where public comments will be received.

7.0 REFERENCES

1. **Federal Highway Administration**. *Procedures for Abatement of Highway Traffic Noise and Construction Noise.* Title 23, Code of Federal Regulations, Part 772 (23 CFR Part 772). Washington, D.C.: FHWA, July 13, 2010.
2. **Florida Department of Transportation**. *Project Development and Environment (PD&E) Manual – Part 2, Chapter 18.* Tallahassee, FL: FDOT, Jul. 31, 2024.
3. **Florida Department of Transportation**. *Traffic Noise Modeling and Analysis Practitioners Handbook.* Tallahassee, FL: FDOT, July 2025.
4. **Federal Highway Administration**. *Noise Measurement Handbook.* Washington, D.C.: FHWA, Jun. 2018.
5. **Florida Department of Transportation.** *Methodology to Evaluate Highway Traffic Noise at Special Land Uses.* Tallahassee, FL: FDOT, July 2025.
6. **Florida Department of Transportation**. *Standard Specifications for Road and Bridge Construction.* Tallahassee, FL: FDOT, Jul. 2023.

Appendix A

Traffic Data

Highway Traffic Noise: Traffic Data

Project/Data Information

Project Name	Orange Avenue Design
Project Number	2929
Condition	Existing
Year	2017
Source	Orange Avenue RCA DTTM (December 2019)
Preparer [Traffic Engineer]	brian Ribaric
Prepared Date	3/6/2026
Notes	

	Roadway Details					Traffic Details										Raw Traffic Data Selection & Off-Peak Calculation		
Traffic Segment Number	**Roadway Name**	**From**	**To**	**Roadway Type**	**Number of Lanes** *In 1 direction	**LOS C Peak Hour Peak Direction (PHPD)**	**Demand Hourly Volumes (DHV) Peak Hour Peak Direction (PHPD)**	**% Autos**	**% Medium Trucks**	**% Heavy Trucks**	**% Buses**	**% Motorcycles**	**Standard K-factor**	**D-factor**	**Posted Speed (mph)**	**LOS C vs. DHV Comparison**	**Peak Direction Volume*** *Used on both sides for LOS C	**Off-Peak Direction Volume*** *DHV only
1	Orange Ave	Mary Louise Dr	Florida's Turnpike	Other	1	970	991	96.0%	2.0%	1.6%	0.3%	0.1%	9.00%	55.00%	45	LOS C	970	N/A

Highway Traffic Noise: Traffic Data

Project/Data Information

Project Name	Orange Avenue Design
Project Number	2929
Condition	No-Build
Year	2045
Source	Orange Avenue RCA DTTM (December 2019)
Preparer [Traffic Engineer]	brian Ribaric
Prepared Date	3/6/2026
Notes	

	Roadway Details					Traffic Details										Raw Traffic Data Selection & Off-Peak Calculation		
Traffic Segment Number	**Roadway Name**	**From**	**To**	**Roadway Type**	**Number of Lanes** *In 1 direction	**LOS C Peak Hour Peak Direction (PHPD)**	**Demand Hourly Volumes (DHV) Peak Hour Peak Direction (PHPD)**	**% Autos**	**% Medium Trucks**	**% Heavy Trucks**	**% Buses**	**% Motorcycles**	**Standard K-factor**	**D-factor**	**Posted Speed (mph)**	**LOS C vs. DHV Comparison**	**Peak Direction Volume*** *Used on both sides for LOS C	**Off-Peak Direction Volume*** *DHV only
1	Orange Ave	Mary Louise Dr	Florida's Turnpike	Other	1	970	1,747	96.0%	2.0%	1.6%	0.3%	0.1%	9.00%	55.00%	45	LOS C	970	N/A

Highway Traffic Noise: Traffic Data

Project/Data Information

Project Name	Orange Avenue Design
Project Number	2929
Condition	Build
Year	2045
Source	Orange Avenue RCA DTTM (December 2019)
Preparer [Traffic Engineer]	brian Ribaric
Prepared Date	3/6/2026
Notes	

	Roadway Details					Traffic Details										Raw Traffic Data Selection & Off-Peak Calculation		
Traffic Segment Number	**Roadway Name**	**From**	**To**	**Roadway Type**	**Number of Lanes** *In 1 direction	**LOS C Peak Hour Peak Direction (PHPD)**	**Demand Hourly Volumes (DHV) Peak Hour Peak Direction (PHPD)**	**% Autos**	**% Medium Trucks**	**% Heavy Trucks**	**% Buses**	**% Motorcycles**	**Standard K-factor**	**D-factor**	**Posted Speed (mph)**	**LOS C vs. DHV Comparison**	**Peak Direction Volume*** *Used on both sides for LOS C	**Off-Peak Direction Volume*** *DHV only
1	Orange Ave	Mary Louise Dr	Florida's Turnpike	Other	2	1,700	2,025	96.0%	2.0%	1.6%	0.3%	0.1%	9.00%	55.00%	45	LOS C	1700	N/A

Appendix B – Residential Properties

Predicted Noise Levels

Predicted Noise Levels

Common Noise Environment (CNE)	Rec. Point	No. of Units	NAC	NAC Criteria (dBA)	FDOT Criteria (dBA)	2017 Existing LAeq1h (dBA)	2045 No-Build LAeq1h (dBA)	2045 Build LAeq1h (dBA)	Increase	NAC Approach or Exceeded	Subst. Increase (>15dB(A))	Description
XX.X	Impacted Receptor											
NB01	BNB01-001	2	B	67	66	52.6	52.6	57.4	4.8	No	No	Cumberland Meadows
NB01	BNB01-002	5	B	67	66	48.6	48.6	54.0	5.4	No	No	Cumberland Meadows
NB01	BNB01-003	3	B	67	66	55.3	55.3	60.0	4.7	No	No	Cumberland Meadows
NB01	BNB01-004	4	B	67	66	41.3	41.3	45.9	4.6	No	No	Cumberland Meadows
NB01	BNB01-005	3	B	67	66	48.7	48.7	54.5	5.8	No	No	Cumberland Meadows
NB01	BNB01-006	3	B	67	66	46.3	46.3	52.1	5.8	No	No	Cumberland Meadows

Appendix C

Project Aerials

Not Impacted

Validation Site

County Boundary

NOISE SPECIALIST	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			NOISE STUDY REPORT PROJECT AERIALS	Sheet No.
Jeff Jones, GISP. Ardurra 3452 Lake Lynda Dr, Orlando, Florida 32817 P 407.971.8850	ROAD NAME	COUNTY	CIP PROJECT NUMBER	Orange Avenue from Orange/Osceola County Line to Florida's Turnpike	1
	Orange Avenue	ORANGE	2929		

- Not Impacted
- Validation Site
- County Boundary

NOISE SPECIALIST	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			NOISE STUDY REPORT PROJECT AERIALS	Sheet No.
Jeff Jones, GISP. Ardurra 3452 Lake Lynda Dr, Orlando, Florida 32817 P 407.971.8850	ROAD NAME	COUNTY	CIP PROJECT NUMBER	Orange Avenue from Orange/Osceola County Line to Florida's Turnpike	2
	Orange Avenue	ORANGE	2929		