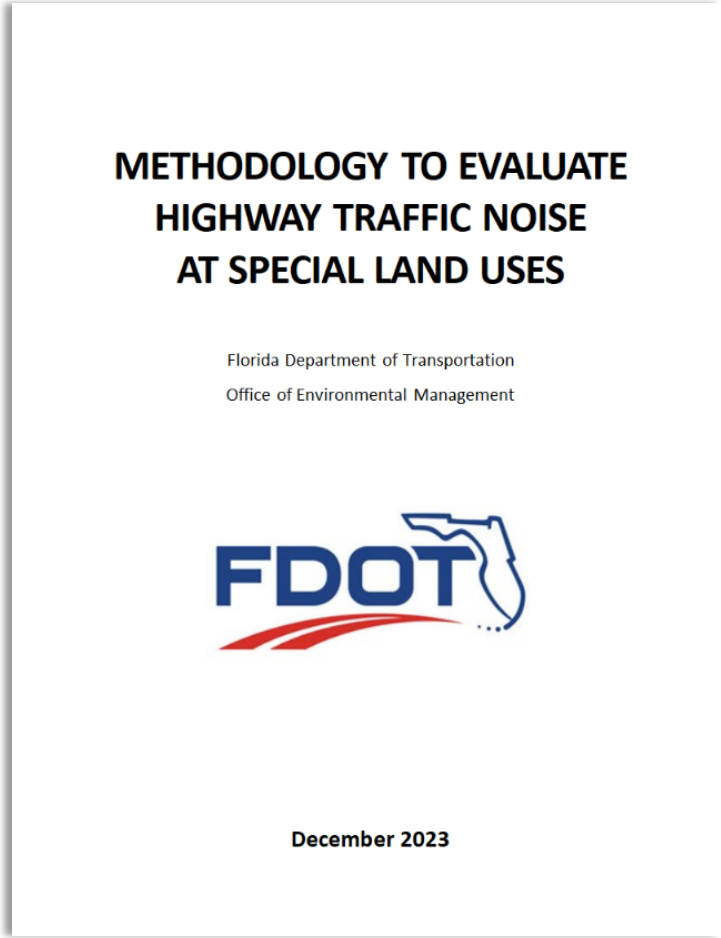
Office of Environmental Management

METHODOLOGY TO EVALUATE HIGHWAY TRAFFIC NOISE AT SPECIAL LAND USES:

A Detailed Look at the New FDOT Methodology

October 30, 2024



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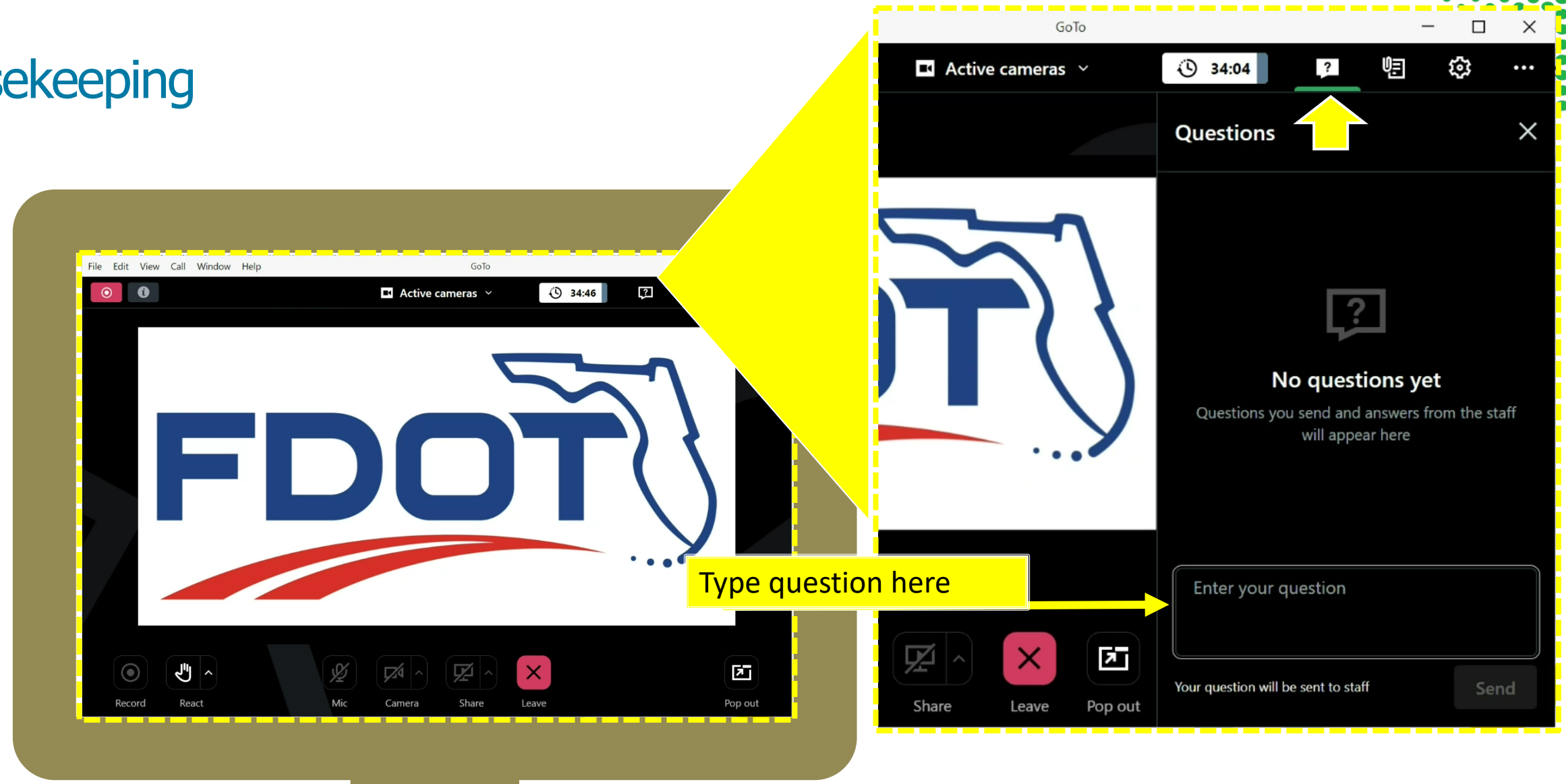

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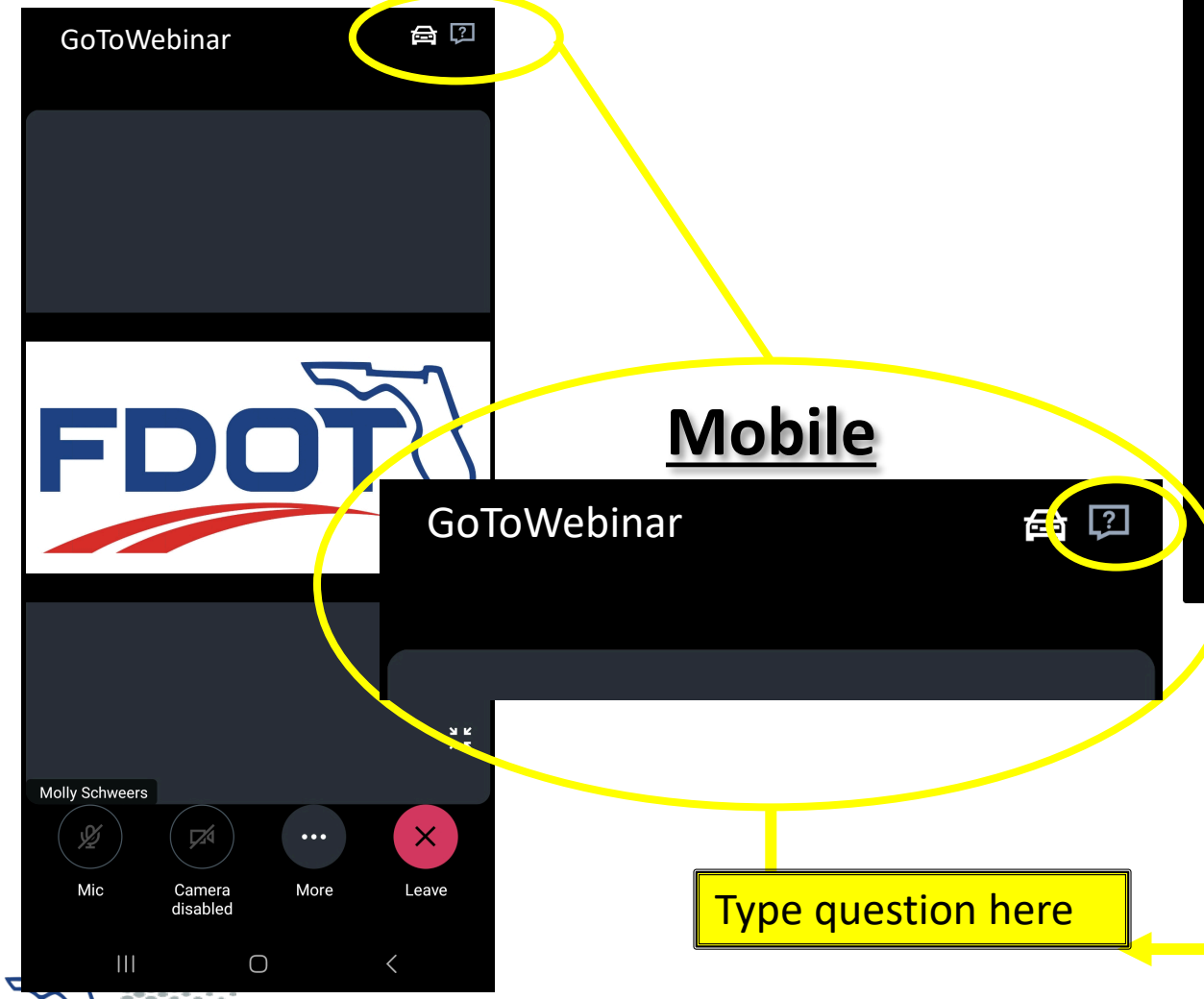

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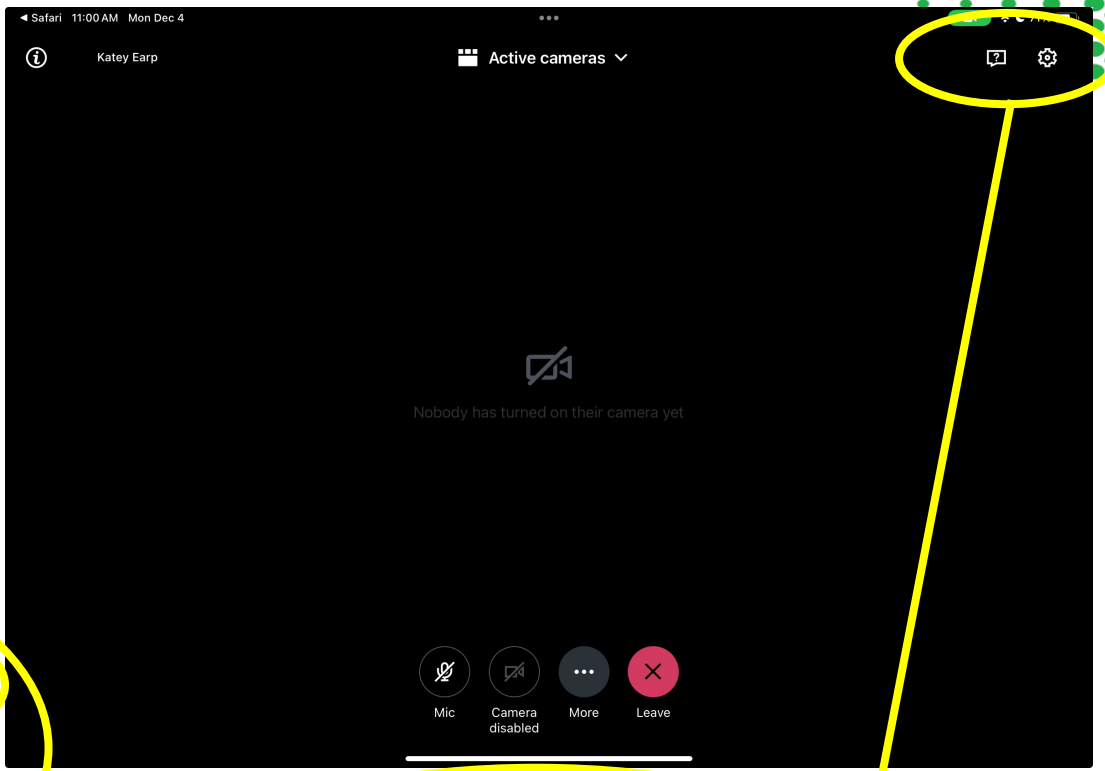

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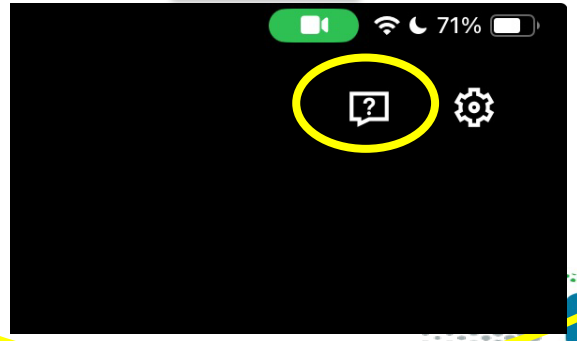

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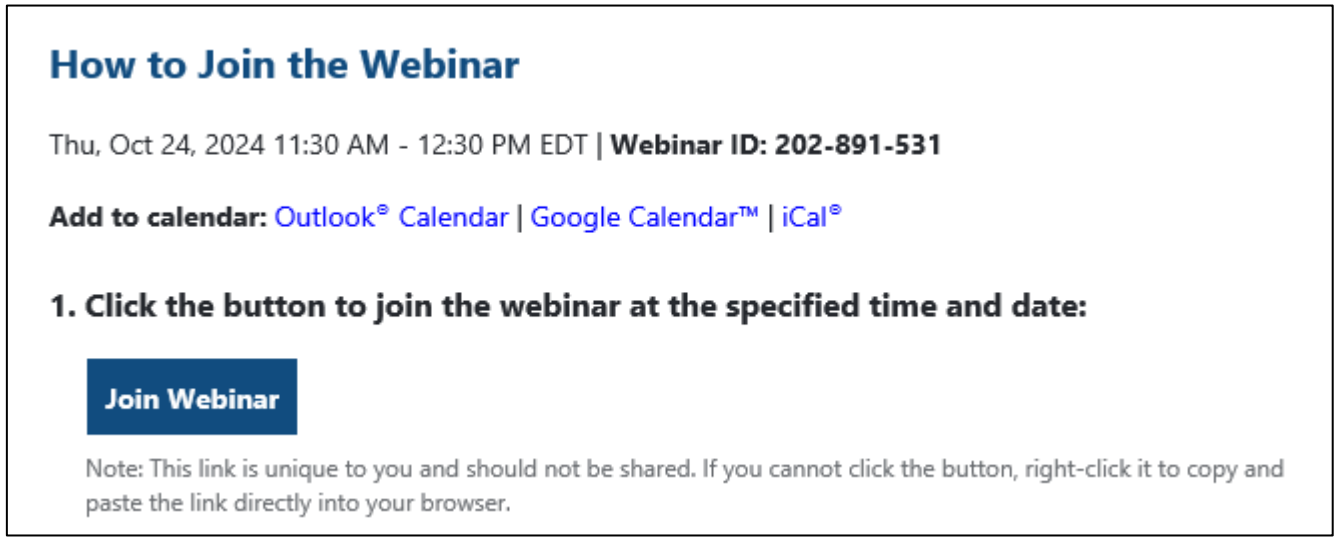

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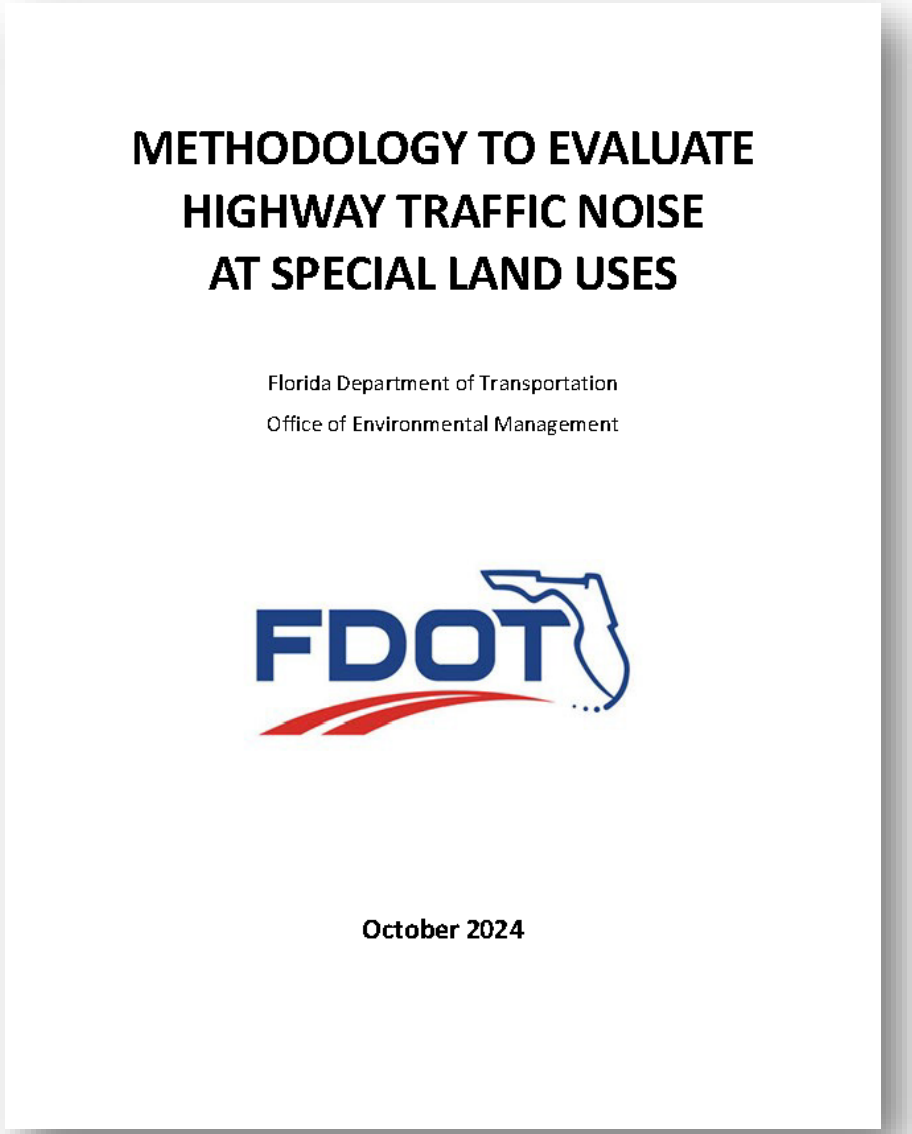
Presentation Outline

- Introduction
- Limitations of 1997/2009 Methodology
- Development of New Methodology
- New Methodology Overview
  - 7-Step Process
    - Identify Impacts
    - Preliminary Screening
    - Optimize Barrier
    - Determine Cost-Effectiveness
    - Engineering Review
    - Public Involvement
    - Documentation
  - Questions

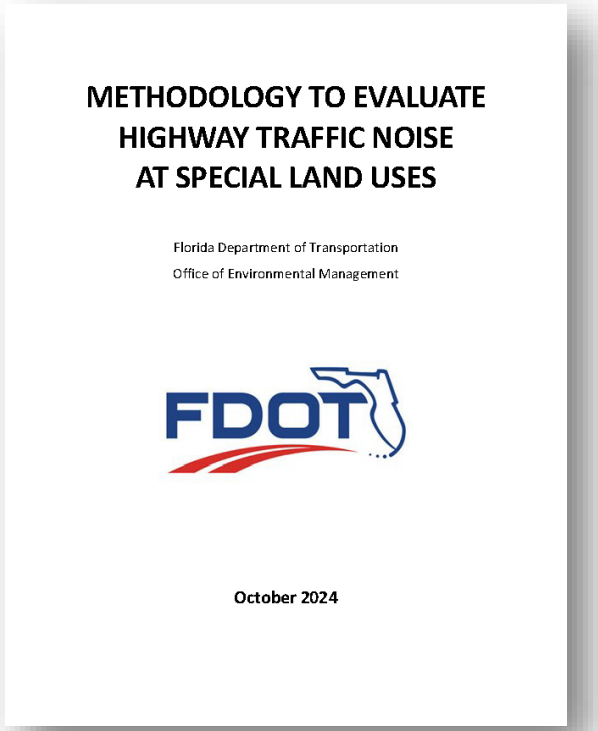


SLU Methodology Document - Table of Contents

Special Land Use (SLU)

SLU Guidance Document and Worksheet can be found at:

https://www.fdot.gov/environment/documents---resources


METHODOLOGY TO EVALUATE
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AT SPECIAL LAND USES

Florida Department of Transportation
Office of Environmental Management

FDOT

October 2024

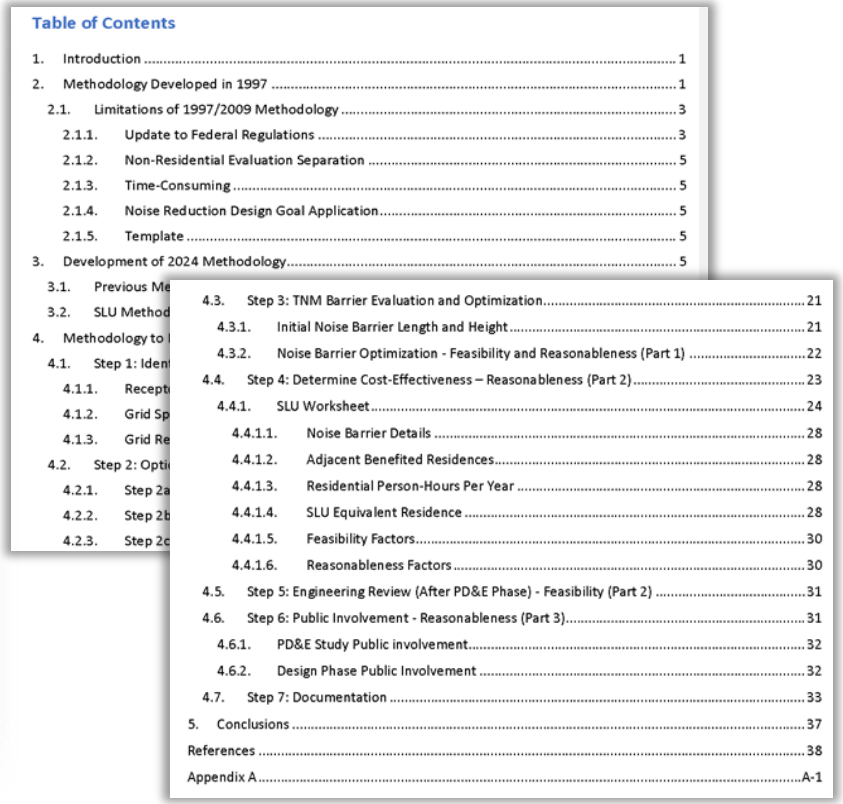
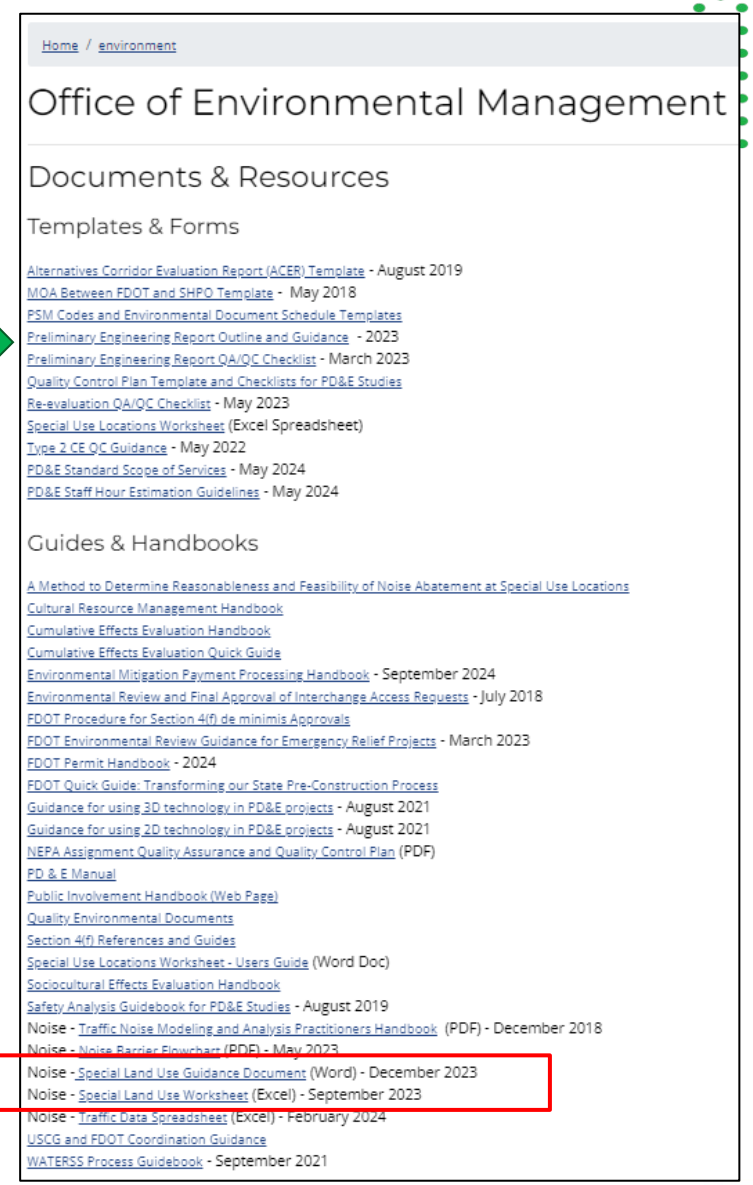


Table of Contents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Documents & Resources

Templates & Forms

Alternatives Corridor Evaluation Report (ACER) Template - August 2019
MOA Between FDOT and SHPO Template - May 2018
PSM Codes and Environmental Document Schedule Templates
Preliminary Engineering Report Outline and Guidance - 2023
Preliminary Engineering Report QA/QC Checklist - March 2023
Quality Control Plan Template and Checklists for PD&E Studies
Re-evaluation QA/QC Checklist - May 2023
Special Use Locations Worksheet (Excel Spreadsheet)
Type 2 CE QC Guidance - May 2022
PD&E Standard Scope of Services - May 2024
PD&E Staff Hour Estimation Guidelines - May 2024

Guides & Handbooks

A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Use Locations
Cultural Resource Management Handbook
Cumulative Effects Evaluation Handbook
Cumulative Effects Evaluation Quick Guide
Environmental Mitigation Payment Processing Handbook - September 2024
Environmental Review and Final Approval of Interchange Access Requests - July 2018
FDOT Procedure for Section 4(f) de minimis Approvals
FDOT Environmental Review Guidance for Emergency Relief Projects - March 2023
FDOT Permit Handbook - 2024
FDOT Quick Guide: Transforming our State Pre-Construction Process
Guidance for using 3D technology in PD&E projects - August 2021
Guidance for using 2D technology in PD&E projects - August 2021
NEPA Assignment Quality Assurance and Quality Control Plan (PDF)
PD & E Manual
Public Involvement Handbook (Web Page)
Quality Environmental Documents
Section 4(f) References and Guides
Special Use Locations Worksheet - Users Guide (Word Doc)
Sociocultural Effects Evaluation Handbook
Safety Analysis Guidebook for PD&E Studies - August 2019
Noise - Traffic Noise Modeling and Analysis Practitioners Handbook (PDF) - December 2018
Noise - Noise Barrier Flowchart (PDF) - May 2023
Noise - Special Land Use Guidance Document (Word) - December 2023
Noise - Special Land Use Worksheet (Excel) - September 2023
Noise - Traffic Data Spreadsheet (Excel) - February 2024
USCG and FDOT Coordination Guidance
WATERSS Process Guidebook - September 2021

IMPORTANT UPDATE: 23 CFR 772

- **FHWA Title 23 Code of Federal Regulations, Part 772 (23 CFR 772)**
  - In the process of being updated
  - Notice of Proposed Rulemaking October 18, 2024
  - Accepting comments through December 17th, 2024
- This methodology will be updated to follow 23 CFR 772 once the final rule has been published

83801

Proposed Rules

Federal Register
Vol. 89, No. 202
Friday, October 18, 2024

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

23 CFR Part 772

[Docket No. FHWA–2019–0036]

RIN 2125–AF78

Procedures for Abatement of Highway Traffic Noise and Construction Noise

AGENCY: Federal Highway Administration (FHWA), U.S. Department of Transportation (DOT).

ACTION: Notice of proposed rulemaking (NPRM); request for comments.

SUMMARY: The FHWA proposes to revise the Federal regulations on the Procedures for Abatement of Highway Traffic Noise and Construction Noise. The proposed rule would clarify certain definitions, the applicability of this rulemaking, certain analysis requirements, and the eligibility of funds made available under the Highways title of the United States Code (U.S.C.) to provide noise abatement measures and to improve the analytical procedures. The FHWA also proposes changes and clarifications of factors used to determine the effectiveness of noise abatement measures. In addition, the proposed rule would include exemptions to Type I projects and allow screening analysis that would focus on the projects most likely to cause a traffic noise impact to improve efficiency. The proposed rule would make several changes that are intended to increase the pool of eligible participants in the noise study and mitigation decision processes to ensure everyone receives due consideration for impacts and the possibility of receiving abatement on a given project.

DATES: Comments must be received on or before December 17, 2024. Late-filed comments will be considered to the extent practicable.

ADDRESSES: To ensure that you do not duplicate your docket submissions, please submit them by only one of the following means:

- *Federal eRulemaking Portal:* Go to *www.regulations.gov* and follow the online instructions for submitting comments.
- *Mail:* Docket Management Facility, U.S. Department of Transportation, 1200 New Jersey Avenue SE, West Building Ground Floor Room W12–140, Washington, DC 20590.
- *Hand Delivery:* West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue SE, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The telephone number is (202) 366–9329.
- *Instructions:* You must include the agency name and docket number or the Regulatory Identification Number (RIN) for the rulemaking at the beginning of your comments. All comments received will be posted without change to *www.regulations.gov*, including any personal information provided.

FOR FURTHER INFORMATION CONTACT: For technical information: Aileen Varela-Margolles, Office of Natural Environment, (305) 978–7780; for legal information: Lev Gabrilovich, Office of the Chief Counsel, (202) 366–3813, Federal Highway Administration, 1200 New Jersey Avenue SE, Washington, DC 20590. Office hours are from 8 a.m. to 4:30 p.m., ET Monday through Friday, except Federal holidays.

SUPPLEMENTARY INFORMATION:

Table of Contents for Supplementary Information

I. Electronic Access and Filing

This document and all comments received may be viewed online through the Federal eRulemaking portal at *www.regulations.gov* using the docket number listed above. Electronic retrieval help and guidelines are available on the website. It is available 24 hours each day, 365 days each year. An electronic copy of this document may also be downloaded by accessing the Office of the Federal Register's website at: *www.federalregister.gov* and the U.S. Government Publishing Office's website at: *www.GovInfo.gov*.

All comments received before the close of business on the comment closing date indicated above will be considered and will be available for examination in the docket at the location specified in the **ADDRESSES** section. Comments received after the comment closing date will be filed in the docket and considered to the extent practicable. In addition to late comments, we will continue to file relevant information in the docket as it becomes available after the comment period closing date, and interested persons should continue to examine the docket for new material. A final rule may be published at any time after the close of the comment period and after DOT has had the opportunity to review the comments submitted.

II. Executive Summary

The FHWA proposes to update the Federal Procedures for Abatement of Highway Traffic Noise and Construction Noise in 23 CFR part 772 (part 772) to clarify the responsibilities under the "applicability" section of this part to various State department of transportation (State DOT) and non-State DOT recipients of apportioned or discretionary funding, provide additional flexibility for State DOTs, improve consistency in the implementation of part 772, increase options for abatement that is best suited to a particular project and community,

LESSON 1
Introduction to Special Land Use Evaluations

Introduction

- This presentation introduces the new methodology for evaluating highway traffic noise at Special Land Uses
- Special Land Uses (SLUs) = non-residential land uses
- Examples:
  - Parks*
  - Schools
  - Places of Worship
  - Medical Facilities
  - Cemeteries
  - Hotels*
  - Restaurants*
- "Impacted" land uses are those that meet/exceed the decibels listed

Table 1 to Part 772—Noise Abatement Criteria

Expand Table

[Hourly A-Weighted Sound Level __ decibels (dB(A))[1]]

Activity category	Activity Leq(h)	Criteria[2] L10(h)	Evaluation location	Activity description
A	57	60	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[3]	67	70	Exterior	Residential.
C[3]	67	70	Exterior	Active sport 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, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	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[3]	72	75	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.

[1] *Either Leq(h) or L10(h) (but not both) may be used on a project.*

[2] *The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.*

[3] *Includes undeveloped lands permitted for this activity category.*

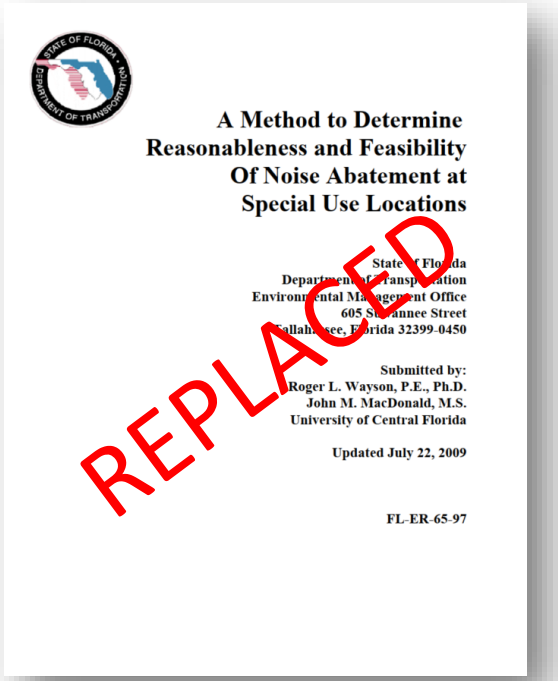
Source: 23 CFR 772

★ *Note: SLUs are non-residential noise sensitive land uses that fall into NAC Activity Categories A, C, D or E.*

* Exterior Only

Introduction

- Up until 2024, SLUs were evaluated using the methodology outlined in the 2009 document, "*A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations*" (originally published in 1997; re-published in 2009)
- This updated methodology replaces the 2009 methodology
- **Why the update?** Changes needed, including:
  - The update to 23 CFR 772 (2010)
    - Noise Abatement Criteria (NAC) changed
  - Separation of the evaluation of residences and non-residential land uses
  - Time-consuming
  - Lack of specific guidance on how to apply the Noise Reduction Design Goal (NRDG)
  - No example tables or table templates
- Updated methodology addresses the above issues



LESSON 2
Development of New Methodology

SLU Methodology by State

- To evaluate Special Land Uses, 23 CFR 772 states that "***Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide***."
- Many states utilize an "equivalent residential value" type methodology
  - An SLU receptor is weighted to reflect its "residential receptor equivalent"
  - This methodology allows for both residential and SLU impacts to be evaluated together
- Some states incorporate a linear frontage or area of the SLU to equate to an equivalent receptor
- Like Florida, many states also incorporate person-usage of a SLU, which is important for identifying cost reasonableness
- Some states have a simple methodology, where a single worst-case receptor is identified for a SLU and is equated to a single residence
- Some states do not have explicit guidance on how to evaluate SLUs

States SLU Methodology Type

State	Specific SLU Guidance Document Developed[1]	SLU Methodology Specified	Simple Single Receptor Methodology[2]	Multiple Receptor Methodology[3]	Equivalent Residential Value Methodology	Grid of Receptors Evaluated	Considers Person-Usage of SLU	Considers Linear Frontage of SLU	Considers Area of SLU
Alabama		X	X						
Alaska		X		X	X				X
Arizona		X		X	X		X		X
Arkansas			X	X					
California			X	X					
Colorado		X		X	X				
Connecticut		X			X		X		
Delaware	No public information available on SLU.								
Florida	X	X		X		X	X		X
Georgia				X	X				
Hawaii		X			X				X
Idaho		X			X			X	
Illinois		X		X	X				
Indiana		X			X		X		
Iowa	No public information available on SLU.								
Kansas	No public information available on SLU.								
Kentucky		X			X		X		
Louisiana				X					
Maine		X			X			X	

[1]"Specific SLU Guidance Document Developed" may include Appendices.

[2]"Simple Single Receptor Methodology" implies that a single receptor is identified for an SLU, and the receptor is worth a single residence.

[3] "Multiple Receptor Methodology" implies that a receptor is placed at each area of "frequent human use" within an SLU (e.g., Receptors at a park are placed at a baseball field, a playground, a basketball court, and a picnic table).

States SLU Methodology Type

State	Specific SLU Guidance Document Developed[1]	SLU Methodology Specified	Simple Single Receptor Methodology[2]	Multiple Receptor Methodology[3]	Equivalent Receptor Methodology	Grid of Receptors Evaluated	Considers Person-Usage of SLU	Considers Linear Frontage of SLU	Considers Area of SLU
Maryland	X	X			X		X	X	
Massachusetts	No public information available on SLU.								
Michigan	X	X			X	X			X
Minnesota		X						X	
Mississippi	No public information available on SLU.								
Missouri					X			X	
Montana		X			X		X		X
Nebraska		X		X	X	X	X	X	X
Nevada		X			X	X	X	X	X
New Hampshire		X			X			X	
New Jersey		X			X			X	
New Mexico		X		X	X			X	X
New York		X		X	X				X
North Carolina					X		X		
North Dakota		X		X	X				X
Ohio		X			X		X		
Oklahoma	X	X		X		X	X		X
Oregon	X	X		X		X	X		X
Pennsylvania	X	X			X	X	X		X
Rhode Island	No public information available on SLU.								

[1]"Specific SLU Guidance Document Developed" may include Appendices.
[2]"Simple Single Receptor Methodology" implies that a single receptor is identified for an SLU, and the receptor is worth a single residence.
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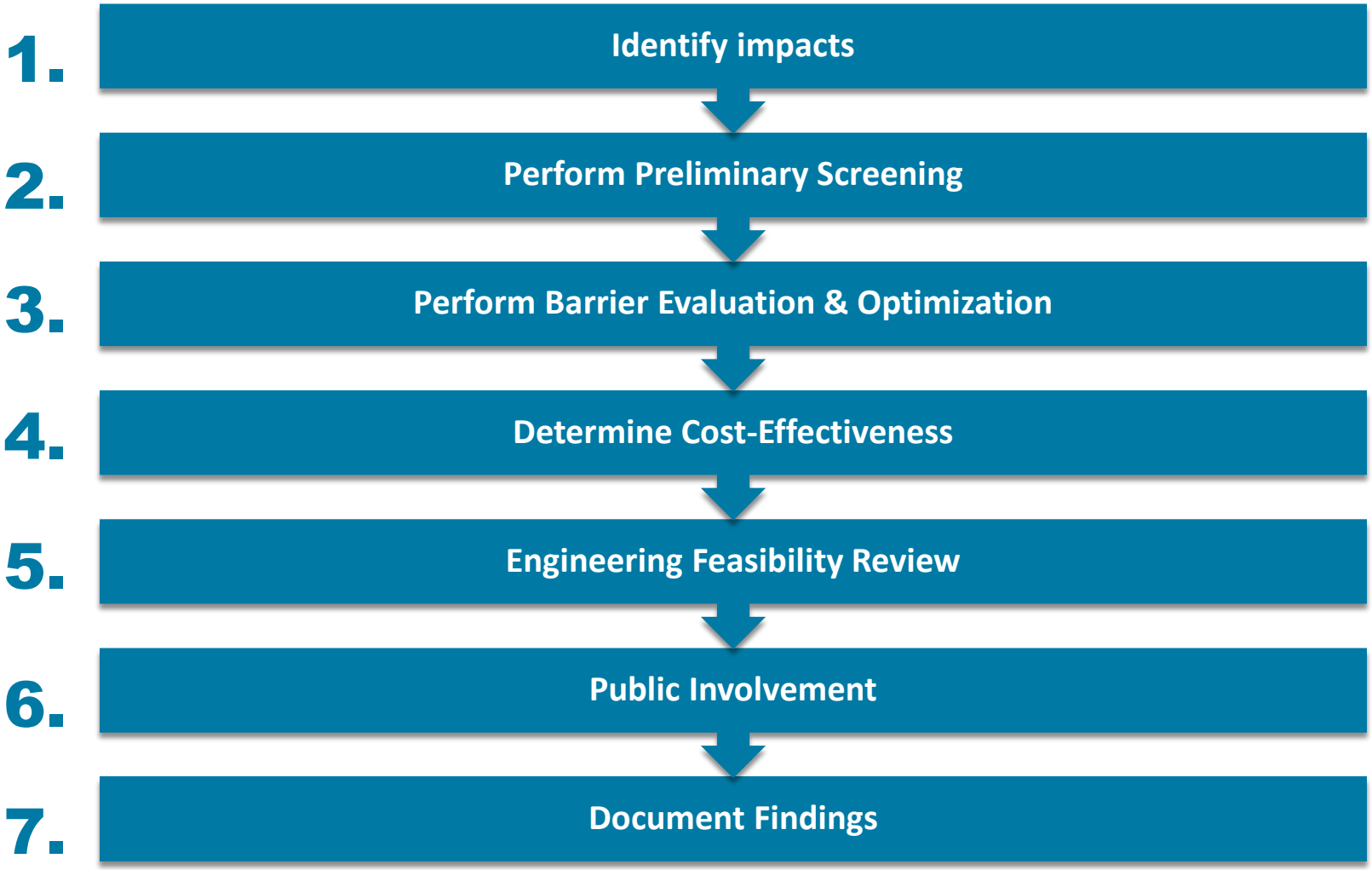
States SLU Methodology Type

State	Specific SLU Guidance Document Developed[1]	SLU Methodology Specified	Simple Single Receptor Methodology[2]	Multiple Receptor Methodology[3]	Equivalent Receptor Methodology	Grid of Receptors Evaluated	Considers Person-Usage of SLU	Considers Linear Frontage of SLU	Considers Area of SLU
South Carolina		X			X	X	X	X	
South Dakota	No public information available on SLU.								
Tennessee					X				X
Texas		X		X	X	X		X	X
Utah								X	
Vermont		X			X			X	
Virginia	X	X		X	X		X	X	
Washington					X	X	X		
West Virginia						X	X		
Wisconsin			X						
Wyoming	No public information available on SLU.								

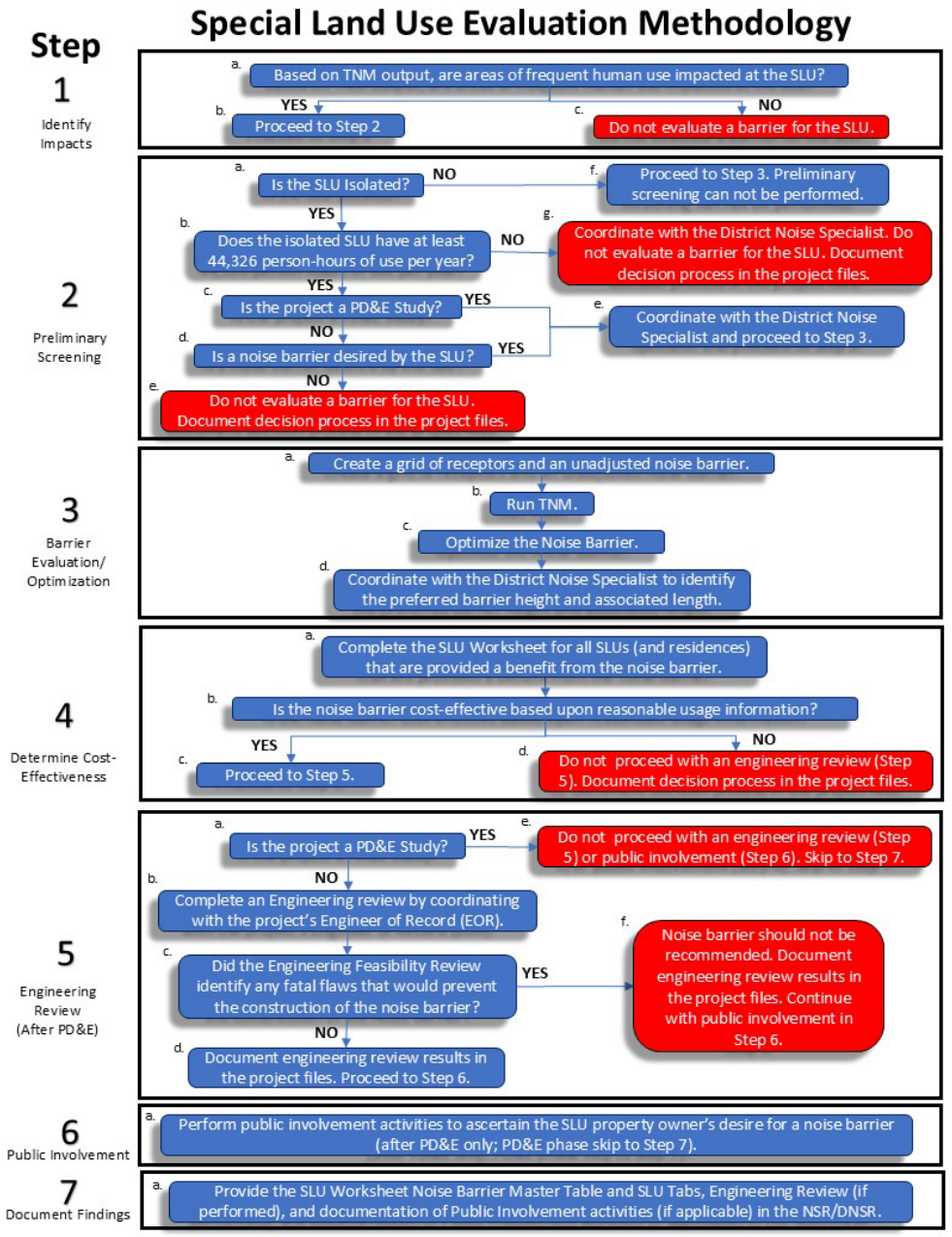
[1]"Specific SLU Guidance Document Developed" may include Appendices.
[2]"Simple Single Receptor Methodology" implies that a single receptor is identified for an SLU, and the receptor is worth a single residence.
[3] "Multiple Receptor Methodology" implies that a receptor is placed at each area of "frequent human use" within an SLU (e.g., Receptors at a park are placed at a baseball field, a playground, a basketball court, and a picnic table).

LESSON 3
Methodology Overview

Methodology Overview

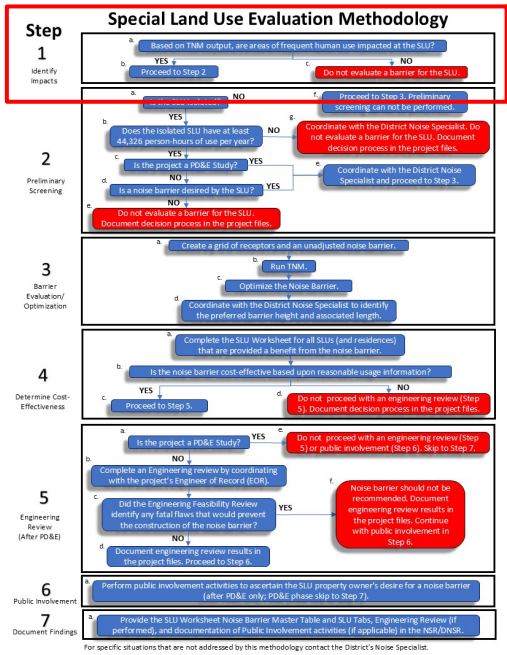


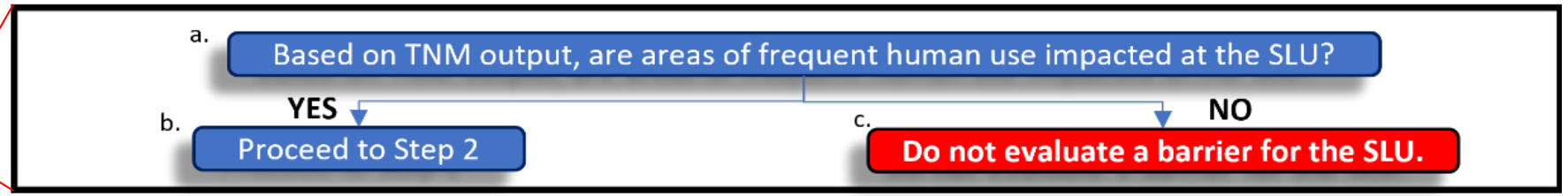
Methodology Flowchart



LESSON 4
Step 1: Identify Impacts

Step 1: Identify Impacts





- Identify predicted noise levels using FHWA's TNM
- Follow procedures listed in 23 CFR 772 and the latest version of the FDOT PD&E Manual, Chapter 18 (*Highway Traffic Noise*)
- Impacts are based upon 23 CFR 772 criteria for each land use type
- If impacts are identified, proceed to Step 2, and inform FDOT District Noise Specialist

*Note: For PD&E phase noise studies, the existing and future no-build noise levels must also be identified

Step 1: Receptor Placement

SLU Usage Type	Receptor Placement Type	Example
Concentrated Activity (e.g., restaurants/bars, basketball court, swimming pools, small playgrounds, etc.)	Receptor(s) shall be placed at the closest location to the highway ROW line (e.g., where impacts are most likely to exist) and where frequent outdoor activity normally occurs. For most concentrated activities, a single receptor is sufficient to identify impacts. However, more than one receptor may be needed to fully assess the area of impact within the area of frequent human use if it is determined to be impacted (e.g., noise barrier optimization and evaluation, see **Section 4.3**). This category includes NAC D (interior) use.	
Dispersed Passive Use (golf course, park, etc.)	Receptors should be placed in a grid fashion where frequent human use occurs. See Section titled *Grid Spacing*. For golf courses, receptors should be placed at tee boxes and putting greens. Sports fields/arenas should have receptors placed at bleachers/stands and active playing fields.	
Linear Use (trails)	Receptors should be placed in a linear fashion along the trail or path. Receptors shall be placed at the intersection of the ROW and the trail/path (if present) and every 50 ft. along the locations of the trail which are closest to the ROW. Receptors may need to extend up to 500 ft. from the ROW in order to determine the extent of impacts and/or benefits. Receptors do not need to be placed on portions of the trail that are within the ROW.	

Step 1: Receptor Placement – Concentrated Activity

SLU Usage Type	Receptor Placement Type	Example
Concentrated Activity (e.g., restaurants/bars, basketball court, swimming pools, small playgrounds, etc.)	Receptor(s) shall be placed at the closest location to the highway ROW line (e.g., where impacts are most likely to exist) and where frequent outdoor activity normally occurs. For most concentrated activities, a single receptor is sufficient to identify impacts. However, more than one receptor may be needed to fully assess the area of impact within the area of frequent human use if it is determined to be impacted (e.g., noise barrier optimization and evaluation, see **Section 4.3**). This category includes NAC D (interior) use.	

- Restaurants/bars, basketball courts, swimming pools, small playgrounds, etc.
- Placed closest to the highway ROW line
- Where frequent outdoor activity normally occurs
- A single receptor is usually sufficient*
- Includes interior areas (NAC D)

**Note: More than one receptor may be needed to evaluate the effectiveness of a noise barrier if the SLU is determined to be impacted*

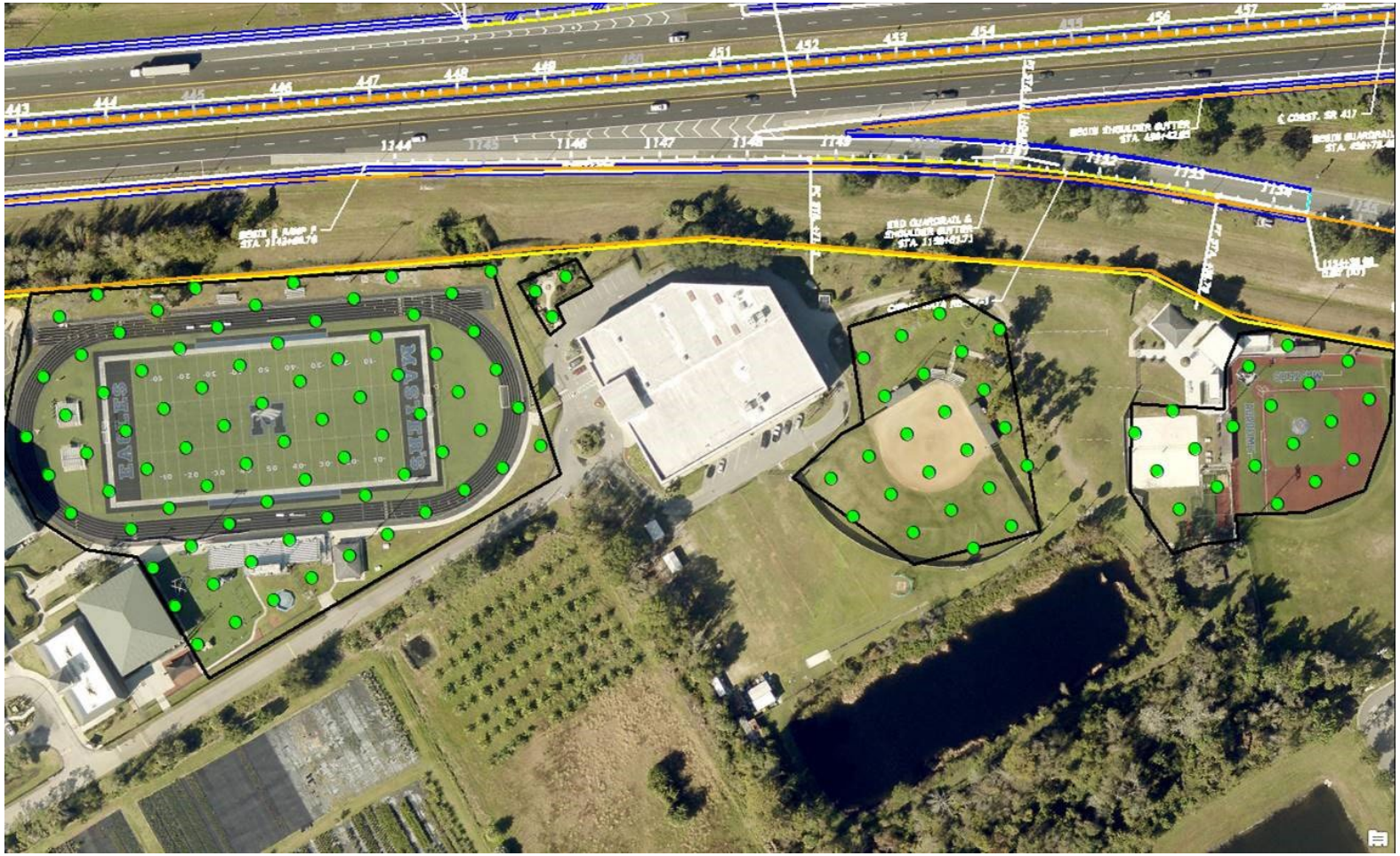
Step 1: Receptor Placement – Dispersed Passive Use

SLU Usage Type	Receptor Placement Type	Example
Dispersed Passive Use (golf course, park, etc.)	Receptors should be placed in a grid fashion where frequent human use occurs. See Section titled *Grid Spacing*. For golf courses, receptors should be placed at tee boxes and putting greens. Sports fields/arenas should have receptors placed at bleachers/stands and active playing fields.	

- Receptors are placed in a ***grid fashion***
  - Golf courses - tee boxes and putting greens
  - Parks
  - Sports arenas – bleachers/stands and active playing fields

**Note: For golf courses, receptors should be placed at tee boxes and putting greens. Sports fields/arenas should have receptors placed at bleachers/stands and active playing fields.*

Step 1: Dispersed Passive Use – Example



This example reflects grid spacing every 50 ft.

Step 1: Receptor Placement – Dispersed Passive Use – Grid Spacing and Extent

- Create a grid of receptors that covers both the area of impact, as well as the suspected area that would be provided a benefit (5 decibel reduction) by a noise barrier at the SLU
- The recommended spacing and number of the grid of receptors vary based on the acreage of the SLU being evaluated
- Note that only the area being evaluated for impacts/benefits should be considered for the acreage in the table (in other words, the entire property or parcel does not have to be gridded)

Acreage of SLU Area Being Evaluated	Receptor Spacing
Area 0 to 0.5 Acre	Every 25 ft.
Area Greater than 0.5 to 5 Acres	Every 50 ft.
Area Greater than 5 Acres	Every 75 ft.
Trail	Every 50 ft.

Step 1: Receptor Placement – Linear Use

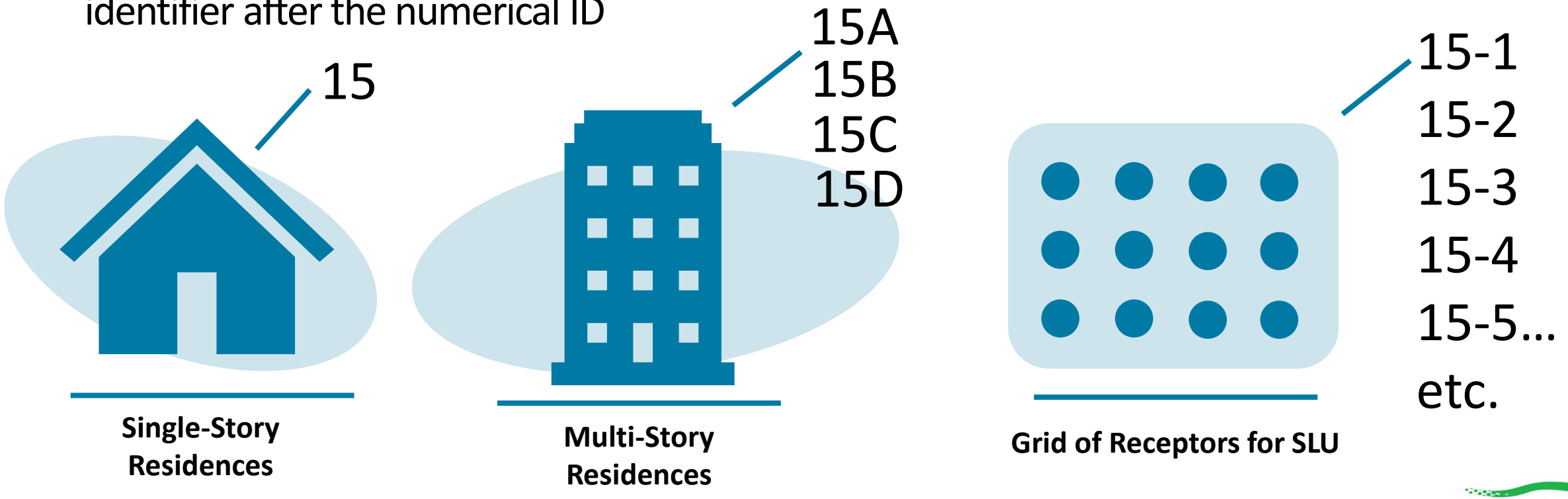
SLU Usage Type	Receptor Placement Type	Example
Linear use (trail)	Receptors should be placed in a linear fashion along the trail. Receptors shall be placed at the intersection of the ROW and the trail (if present) and every 50 ft. along the locations of the trail which are closest to the ROW. Receptors may need to extend up to 500 ft. from the ROW to determine the extent of impacts and/or benefits. Receptors do not need to be placed on portions of the trail that are within the ROW.	

- Trails
- Linear fashion along trail
- Intersection of the ROW & Trail (if present) & every 50 ft. along the trail
- Receptors need to extend 500 ft. from ROW

**Note: Receptors do not need to be placed on portions of the trail that are within the ROW*

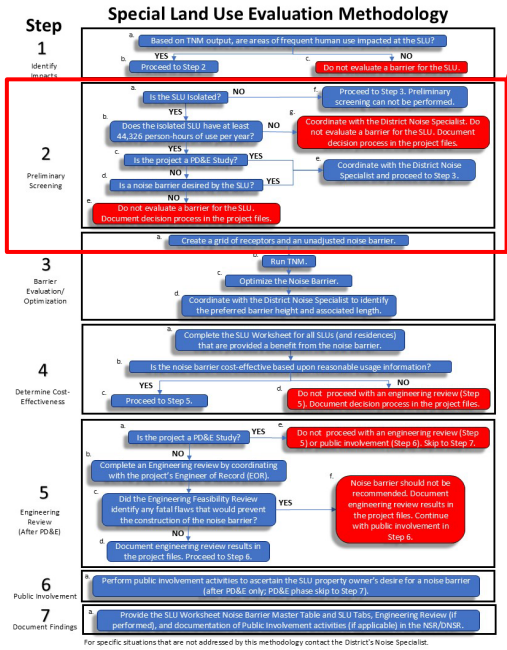
Step 1: Grid Receptor Naming Convention

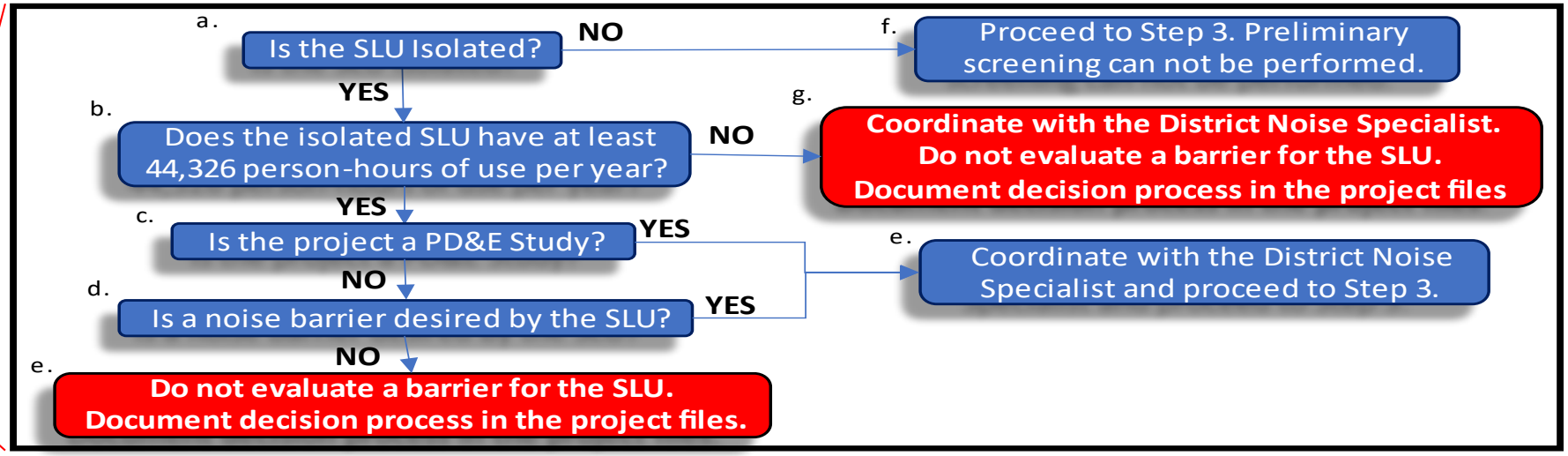
- The SLU should be assigned a numerical ID, followed by a unique numerical ID for each receptor representing the SLU
  - E.g. 15-1, 15-2, 15-3, 15-4, 15-5, etc.
- Different than multi-story residential receptors, which are assigned an alphabetical identifier after the numerical ID



LESSON 5
Step 2: Preliminary Screening

Step 2: Preliminary Screening





- Decreases evaluation time on SLUs:
  - With low usage that do not have the required usage to justify the cost of a noise barrier
  - That do not desire a noise barrier (Design Phase only)
- Screening should be utilized for isolated SLUs only
- If Preliminary Screening is not used, the SLU must follow the in-depth analysis in Steps 3-7

Step 2: Preliminary Screening – Cost-Effectiveness Screening

In summary:

- If a Special Land Use **can achieve** the minimum person-hours for a noise barrier to be considered cost-effective, a detailed noise barrier analysis should be performed using Steps 3-7
- If a Special Land Use is **unable to achieve** the minimum person hours for a noise barrier to be considered cost-effective, it should be documented in the project file and the Noise Study Report
- Coordination with the District Noise Specialist should occur

If an SLU cannot meet the minimum required hours, a noise barrier is not reasonable and should not be fully evaluated.

Step 2: Preliminary Screening – FDOT SLU Worksheet

Usage Screening - To be used for ISOLATED SLUS ONLY

An isolated SLU must have enough person-hour usage to equate to at least 2 residences to satisfy the FDOT requirement that 2 residences must be provided a benefit for a noise barrier to be found feasible.

Average Single-Family Residence in Florida - Person Hours per Year	
Average number of people in a single-family residence in Florida (US CENSUS, 2018-2022 data)	2.53
Hours a single-family residence is available for use (24 hours x 365 days)	8,760
Residential Person-Hours per Year Available for Use	22,163
Isolated SLU Person-Hours per Year	
Average number of users per day at the SLU	
Approximate daily hourly usage by each person at the SLU	
Number of Days per week the SLU is operational	
Number of weeks per year the SLU is operational	
Person-Hours per Year SLU is available for use	-
Equivalent Residence (ER)	-
Isolated SLU Eligible for Noise Barrier Evaluation?	NOT ELIGIBLE

The assumption that 2.53 persons utilize the average single-family home in Florida was obtained from the Florida Census data from 2018-2022 (https://www.census.gov/quickfacts/fact/table/FL/HSD310220).

Instructions | Preliminary Screening | Noise Barrier Master Table | SLU #1 | SLU #2 | SLU #3 | SLU #4 | SLU #5 | SLU #6

*Available on the FDOT Website at: https://www.fdot.gov/environment/documents---resources

Step 2: Preliminary Screening – Cost-Effectiveness Screening

Formula: Minimum required person-hours in the benefited area of an SLU for a noise barrier to be considered cost-effective

$$([\{\langle \lfloor a \times b \times \$40 \rfloor \div \$64{,}000 \rangle \times 22{,}163\} \div c] \div d\ ) \div e$$

Where:

a = Noise Barrier height (ft.)

b = Noise Barrier length (ft.)

c = Number of days per week the SLU is operational

d = Number of weeks per year the SLU is operational

e = Hours per person per day a visitor is present in the benefited area of the SLU

NOTE: The cost per square foot has increased to $40/sq.f.t and the cost per benefit has increased to $64,000/benefited receptor with the publication of the 2024 PD&E Manual Chapter. The SLU Methodology and Worksheet are in the process of being updated to reflect the new criteria.

Step 2: Preliminary Screening – Viewpoint Screening

- Only during the ***Design or Design-Build Phase*** of the project
  - Not to be performed during PD&E Phases, as an engineering review has not occurred
- Inquire the SLU's viewpoint ***for or against*** a noise barrier & evaluation
- If the SLU desires the barrier to be evaluated, obtain usage information

★ *Reach-out occurs AFTER a barrier has been determined to be feasible and reasonable*

QUIZ TIME!

Please visit

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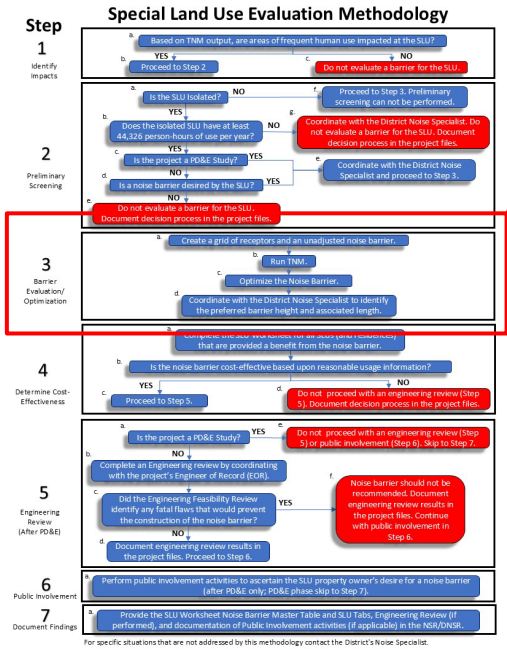
Use code:

3733 2444

LESSON 6
Step 3: TNM Barrier Evaluation and Optimization

Step 3: TNM Barrier Evaluation and Optimization



a. Create a grid of receptors and an unadjusted noise barrier.

b. Run TNM.

c. Optimize the Noise Barrier.

d. Coordinate with the District Noise Specialist to identify the preferred barrier height and associated length.

Step 3: Initial Noise Barrier Length and Height

FDOT's *Traffic Noise Modeling & Analysis Practitioner's Handbook* (2018)

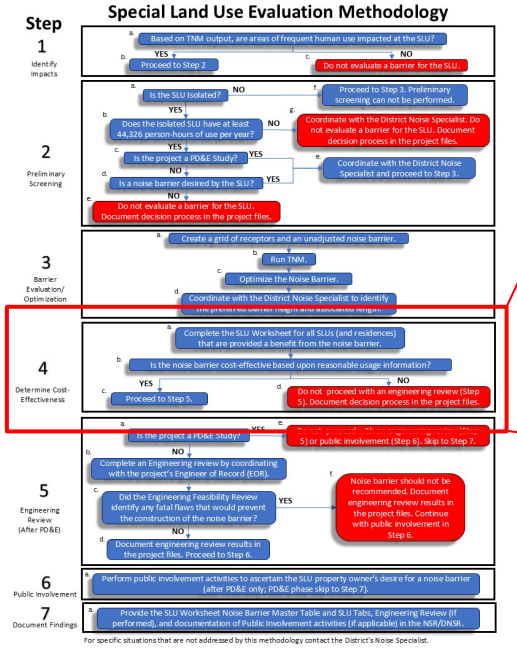
- **The optimization process should follow the process described in FDOT's *Traffic Noise Modeling & Analysis Practitioner's Handbook* (2018)**
- Begin with an Unadjusted Noise Barrier Length
  - Unadjusted barrier should extend beyond the last receptor approximately 4x the perpendicular distance between the receptor and noise barrier
- Barrier should be optimized for the impacted receptors which receive a benefit
- Final Noise Barrier:
  - Achieve noise reduction requirements while also minimizing excess barrier length and thus reducing the overall cost
  - *Benefits the most impacted receptors **(i.e., at least a 5 dB(A) reduction) while achieving the noise reduction design goal of 7 dB(A) for at least one receptor)** and the cost of the barrier is at or below the cost reasonable limit*

Step 3: Initial Noise Barrier Length and Height

- **What does barrier optimization look like for a grid of receptors?**
  - At least one receptor in the grid must meet the NRDG of a 7 dB(A) reduction in noise as a result of the proposed noise barrier
  - To fulfill the feasibility requirement that two impacted receptors must receive a 5 dB(A) reduction, the noise barrier would not be considered feasible if the benefited area of the SLU (represented by a single or multiple receptor) is worth less than 2 residences

LESSON 7
Step 4: Determine Cost-Effectiveness

Step 4: Determine Cost-Effectiveness



a. Complete the SLU Worksheet for all SLUs (and residences) that are provided a benefit from the noise barrier.

b. Is the noise barrier cost-effective based upon reasonable usage information?

YES

c. Proceed to Step 5.

NO

d. Do not proceed with an engineering review (Step 5). Document decision process in the project files.

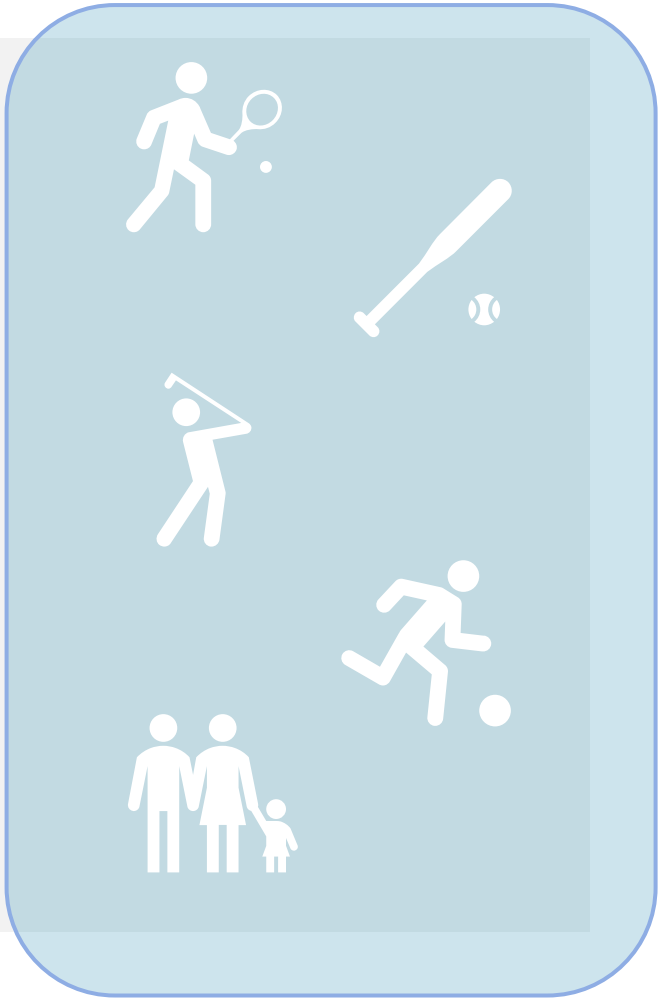
Step 4: Determine Cost-Effectiveness

Note: If unreasonably high usage data is provided by the SLU, the District Noise Specialist should be consulted.

- Obtain usage information from SLU property owner(s)
- Complete the FDOT SLU Worksheet
  - Noise Barrier Master Table
    - Benefited Residences
  - SLU Tabs for each SLU that receives a benefit from the noise barrier
- Determine if the noise barrier is potentially feasible and reasonable

Step 4: Determine Cost-Effectiveness

- All usage information should be reviewed and approved by the FDOT District Noise Specialist before proceeding with the noise barrier analysis
- If the hourly usage per person is not available, the Noise Analyst should coordinate with the District Noise Specialist to identify reasonable hourly usage data
- If unreasonable data is provided by the SLU, discussion with the FDOT District Noise Specialist is required to identify reasonable use data
- All usage data should be documented in the Noise Study Report

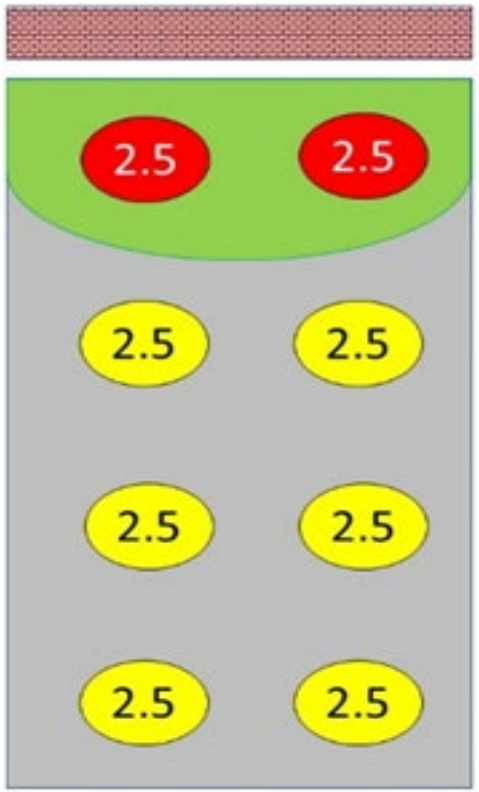


Step 4: Determine Cost-Effectiveness

BENEFITED EQUIVALENT RESIDENCE

The residential weighted value assigned to the benefited area of the SLU based upon person-hours of use (i.e., number of residences that the benefited area of an SLU is equivalent to)

Noise Barrier



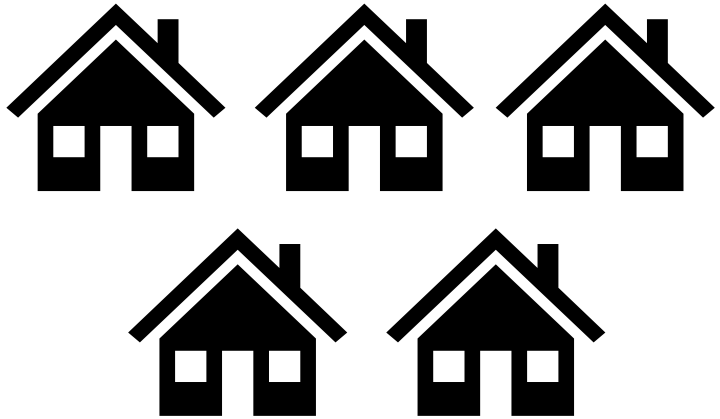
Area Evaluated ER = 20

Benefited Area ER = 5

LEGEND
- Impacted receptor (and ER worth)
- Non-Impacted receptor (and ER worth)
- Benefited area

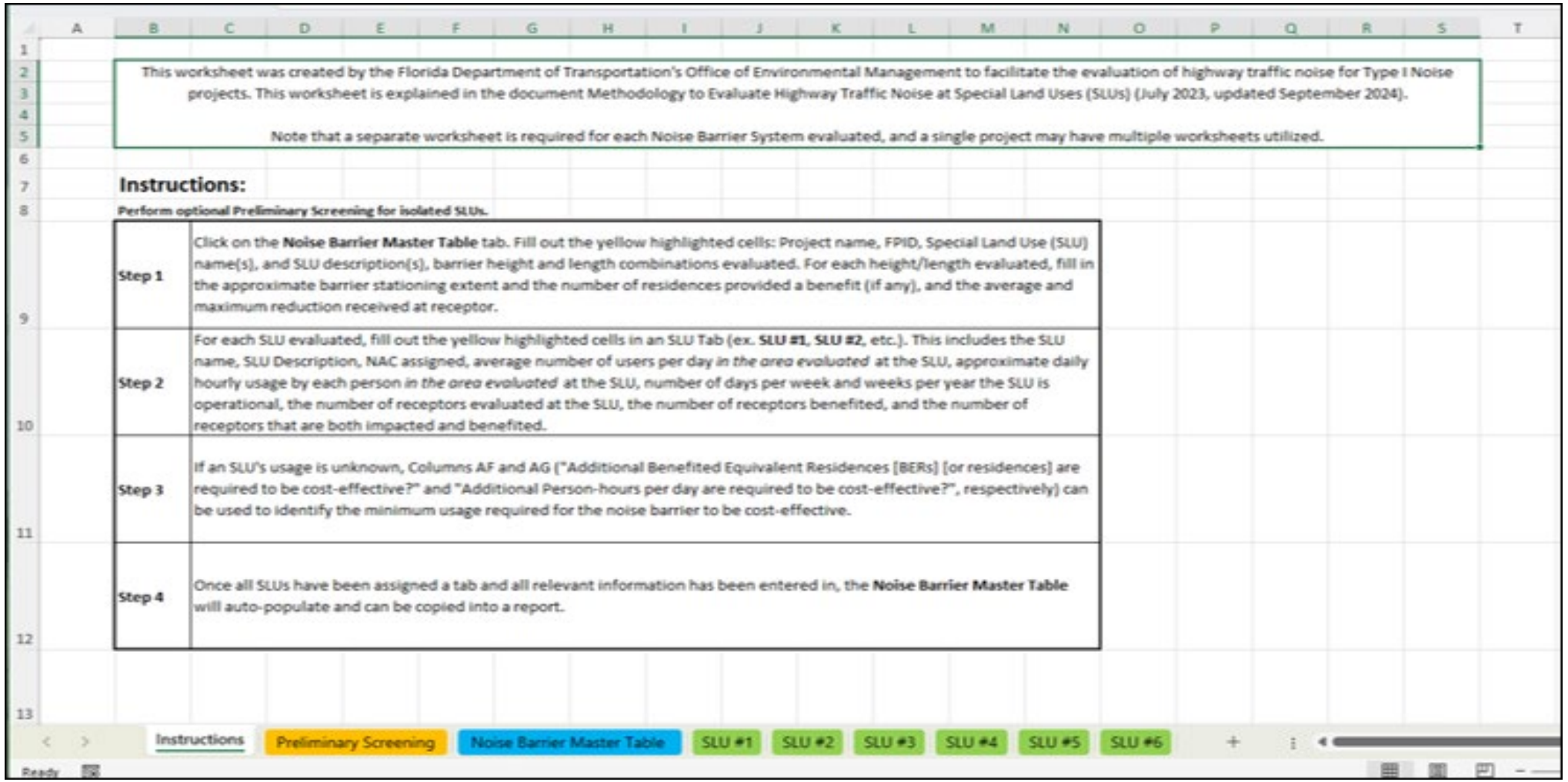
ER = Equivalent Residence

=



BER = 5 residences

Step 4: FDOT SLU Worksheet



This worksheet was created by the Florida Department of Transportation's Office of Environmental Management to facilitate the evaluation of highway traffic noise for Type I Noise projects. This worksheet is explained in the document Methodology to Evaluate Highway Traffic Noise at Special Land Uses (SLUs) (July 2023, updated September 2024).

Note that a separate worksheet is required for each Noise Barrier System evaluated, and a single project may have multiple worksheets utilized.

Instructions:

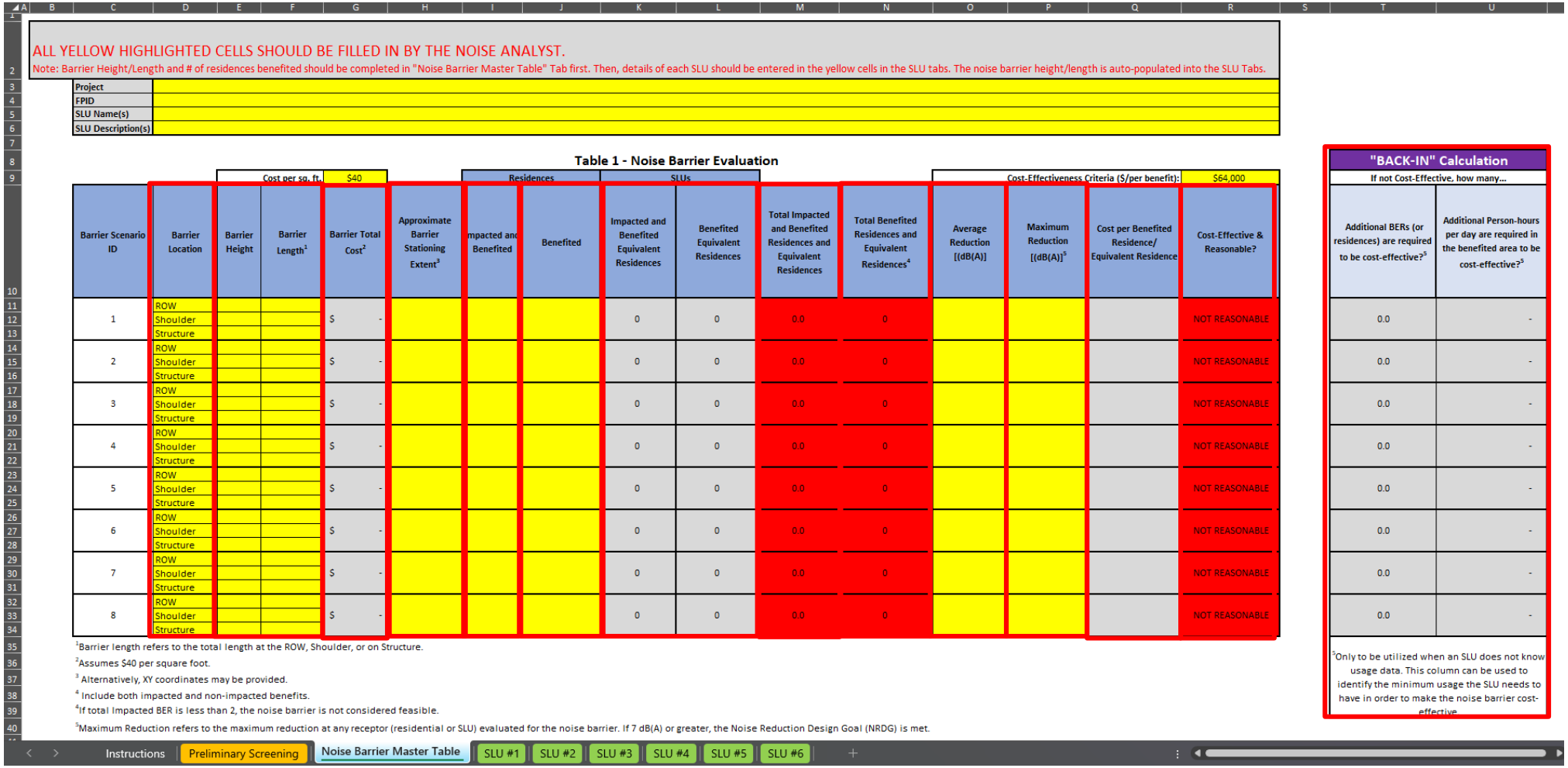
Perform optional Preliminary Screening for isolated SLUs.

Step 1	Click on the **Noise Barrier Master Table** tab. Fill out the yellow highlighted cells: Project name, FPID, Special Land Use (SLU) name(s), and SLU description(s), barrier height and length combinations evaluated. For each height/length evaluated, fill in the approximate barrier stationing extent and the number of residences provided a benefit (if any), and the average and maximum reduction received at receptor.
Step 2	For each SLU evaluated, fill out the yellow highlighted cells in an SLU Tab (ex. **SLU #1**, **SLU #2**, etc.). This includes the SLU name, SLU Description, NAC assigned, average number of users per day *in the area evaluated* at the SLU, approximate daily hourly usage by each person *in the area evaluated* at the SLU, number of days per week and weeks per year the SLU is operational, the number of receptors evaluated at the SLU, the number of receptors benefited, and the number of receptors that are both impacted and benefited.
Step 3	If an SLU's usage is unknown, Columns AF and AG ("Additional Benefited Equivalent Residences [BERs] [or residences] are required to be cost-effective?" and "Additional Person-hours per day are required to be cost-effective?", respectively) can be used to identify the minimum usage required for the noise barrier to be cost-effective.
Step 4	Once all SLUs have been assigned a tab and all relevant information has been entered in, the **Noise Barrier Master Table** will auto-populate and can be copied into a report.

Instructions | Preliminary Screening | Noise Barrier Master Table | SLU #1 | SLU #2 | SLU #3 | SLU #4 | SLU #5 | SLU #6

Ready

Step 4: Noise Barrier Master Table



ALL YELLOW HIGHLIGHTED CELLS SHOULD BE FILLED IN BY THE NOISE ANALYST.

Note: Barrier Height/Length and # of residences benefited should be completed in "Noise Barrier Master Table" Tab first. Then, details of each SLU should be entered in the yellow cells in the SLU tabs. The noise barrier height/length is auto-populated into the SLU Tabs.

Project	
FPID	
SLU Name(s)	
SLU Description(s)	

Table 1 - Noise Barrier Evaluation

Cost per sq. ft. $40 | Residences | SLUs | Cost-Effectiveness Criteria ($/per benefit): $64,000

Barrier Scenario ID	Barrier Location	Barrier Height	Barrier Length[1]	Barrier Total Cost[2]	Approximate Barrier Stationing Extent[3]	Impacted and Benefited	Benefited	Impacted and Benefited Equivalent Residences	Benefited Equivalent Residences	Total Impacted and Benefited Residences and Equivalent Residences	Total Benefited Residences and Equivalent Residences[4]	Average Reduction [(dB(A)]	Maximum Reduction [(dB(A)][5]	Cost per Benefited Residence/ Equivalent Residence	Cost-Effective & Reasonable?
1	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
2	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
3	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
4	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
5	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
6	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
7	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														
8	ROW			$ -				0	0	0.0	0				NOT REASONABLE
	Shoulder														
	Structure														

[1]Barrier length refers to the total length at the ROW, Shoulder, or on Structure.

[2]Assumes $40 per square foot.

[3] Alternatively, XY coordinates may be provided.

[4] Include both impacted and non-impacted benefits.

[4]If total Impacted BER is less than 2, the noise barrier is not considered feasible.

[5]Maximum Reduction refers to the maximum reduction at any receptor (residential or SLU) evaluated for the noise barrier. If 7 dB(A) or greater, the Noise Reduction Design Goal (NRDG) is met.

"BACK-IN" Calculation

If not Cost-Effective, how many...

Additional BERs (or residences) are required to be cost-effective?[5]	Additional Person-hours per day are required in the benefited area to be cost-effective?[5]
0.0	-
0.0	-
0.0	-
0.0	-
0.0	-
0.0	-
0.0	-
0.0	-

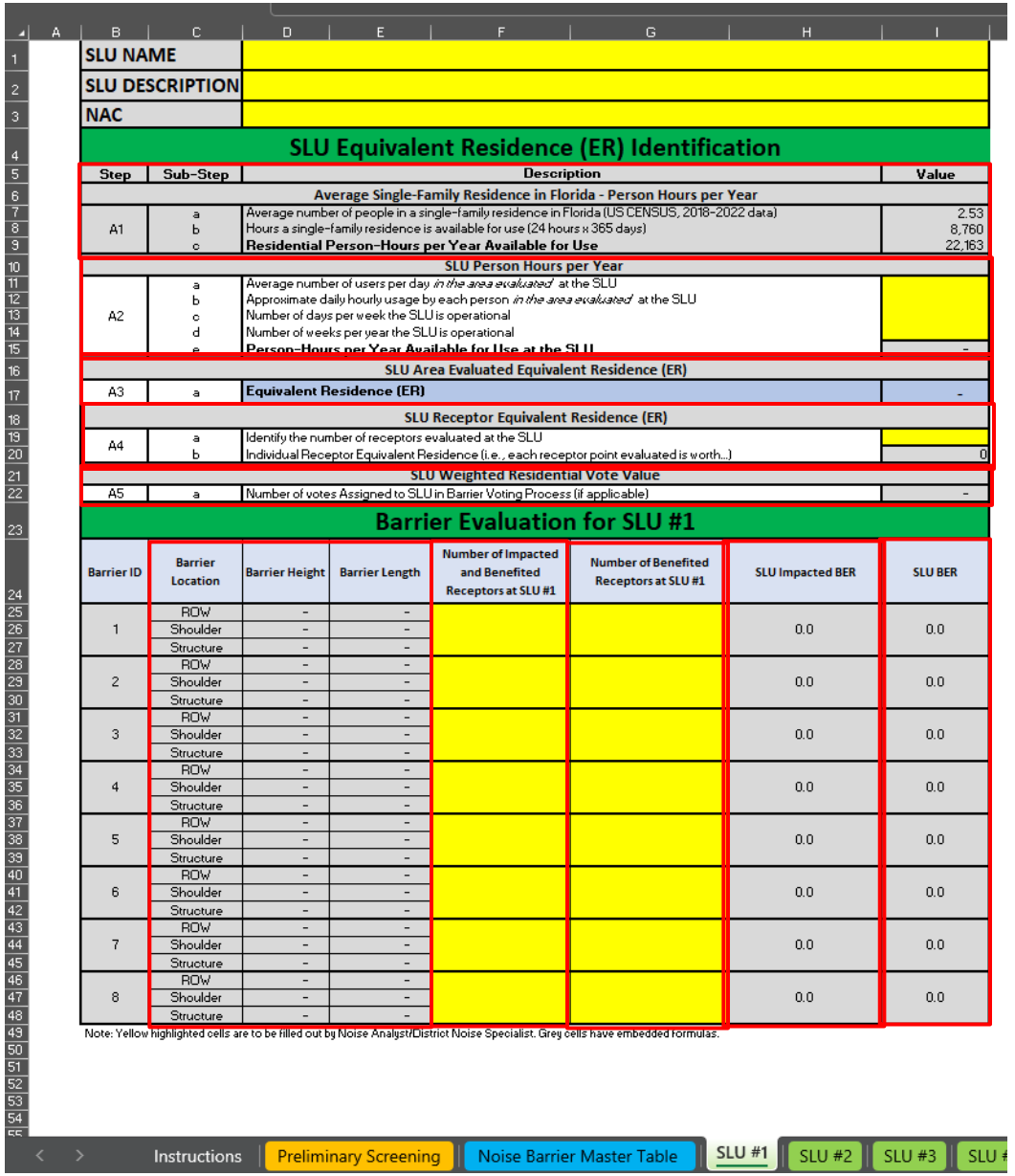
[5]Only to be utilized when an SLU does not know usage data. This column can be used to identify the minimum usage the SLU needs to have in order to make the noise barrier cost-effective

Instructions | Preliminary Screening | Noise Barrier Master Table | SLU #1 | SLU #2 | SLU #3 | SLU #4 | SLU #5 | SLU #6

*Available on the FDOT Website at: https://www.fdot.gov/environment/documents---resources

NOTE: The cost per square foot has increased to $40/sq.f.t and the cost per benefit has increased to $64,000/benefited receptor with the publication of the 2024 PD&E Manual Chapter. The SLU Methodology and Worksheet are in the process of being updated to reflect the new criteria..

Step 4: SLU Tabs



SLU NAME	
SLU DESCRIPTION	
NAC	

SLU Equivalent Residence (ER) Identification

Step	Sub-Step	Description	Value
		Average Single-Family Residence in Florida - Person Hours per Year	
A1	a	Average number of people in a single-family residence in Florida (US CENSUS, 2018-2022 data)	2.53
	b	Hours a single-family residence is available for use (24 hours x 365 days)	8,760
	c	**Residential Person-Hours per Year Available for Use**	22,163
		SLU Person Hours per Year	
A2	a	Average number of users per day *in the area evaluated* at the SLU	
	b	Approximate daily hourly usage by each person *in the area evaluated* at the SLU	
	c	Number of days per week the SLU is operational	
	d	Number of weeks per year the SLU is operational	
	e	**Person-Hours per Year Available for Use at the SLU**	-
		SLU Area Evaluated Equivalent Residence (ER)	
A3	a	**Equivalent Residence (ER)**	-
		SLU Receptor Equivalent Residence (ER)	
A4	a	Identify the number of receptors evaluated at the SLU	
	b	Individual Receptor Equivalent Residence (i.e., each receptor point evaluated is worth...)	0
		SLU Weighted Residential Vote Value	
A5	a	Number of votes Assigned to SLU in Barrier Voting Process (if applicable)	-

Barrier Evaluation for SLU #1

Barrier ID	Barrier Location	Barrier Height	Barrier Length	Number of Impacted and Benefited Receptors at SLU #1	Number of Benefited Receptors at SLU #1	SLU Impacted BER	SLU BER
1	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
2	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
3	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
4	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
5	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
6	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
7	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				
8	ROW	-	-			0.0	0.0
	Shoulder	-	-				
	Structure	-	-				

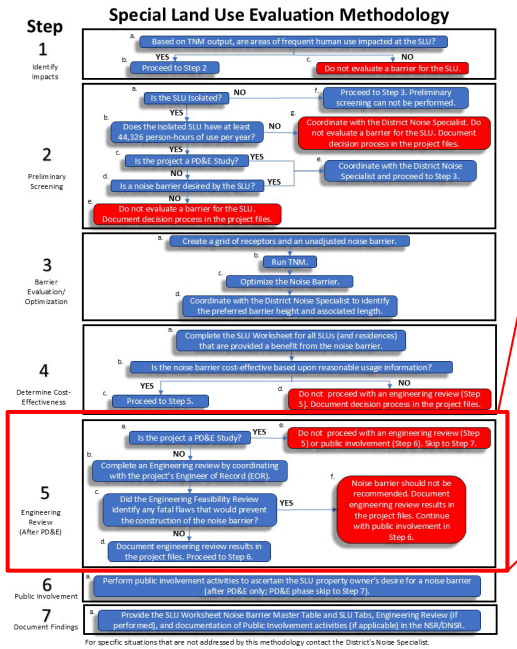
Note: Yellow highlighted cells are to be filled out by Noise Analyst/District Noise Specialist. Grey cells have embedded formulas.

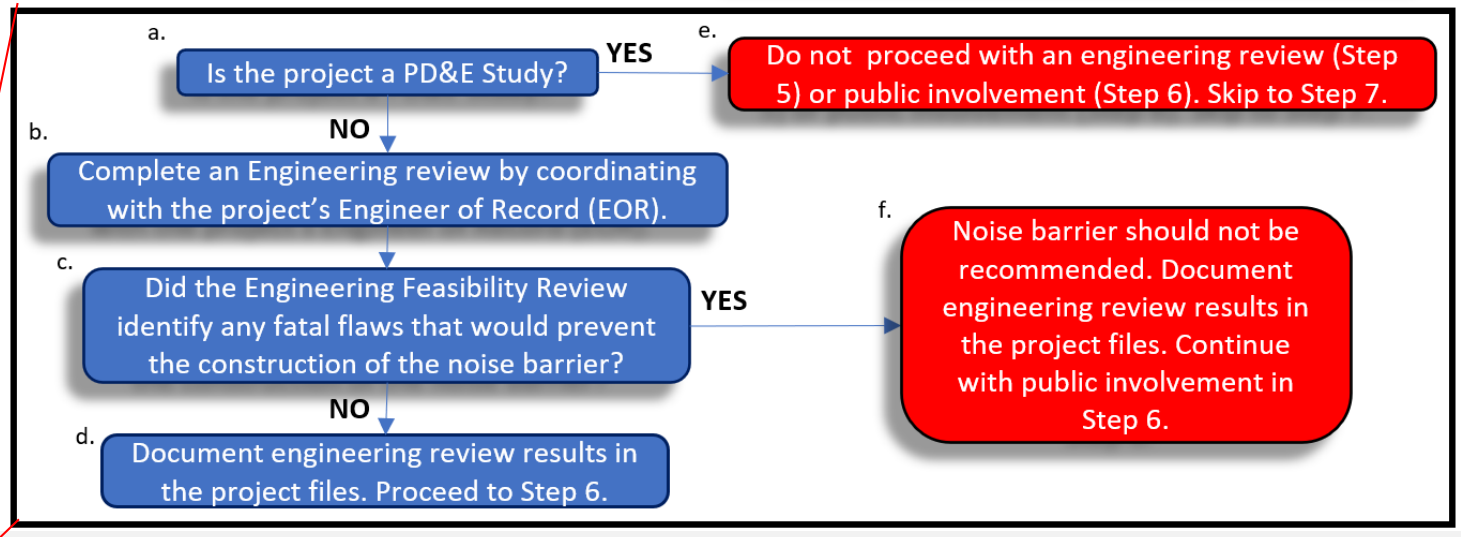
Instructions | Preliminary Screening | Noise Barrier Master Table | SLU #1 | SLU #2 | SLU #3 | SLU #

*Available on the FDOT Website at: https://www.fdot.gov/environment/documents---resources

LESSON 8
Step 5: Engineering Review

Step 5: Engineering Review (After PD&E Phase)





An engineering review is typically not performed in the PD&E phase of a project

- Once an optimal barrier height and length have been chosen, a thorough engineering feasibility review of the barrier should be initiated by the Noise Analyst
- This process ensures the recommended barrier can be constructed as planned, or if further refinements are necessary, completing those before proceeding with the noise barrier

Tip: For any questions consult Part 2, Chapter 18 of the PD&E Manual (Highway Traffic Noise) and 23 CFR Part 772 and the FDOT Design Manual

Step 5: Engineering Review (After PD&E Phase)

- The Noise Analyst should provide a form with the proposed noise barrier details to the Engineer of Record (EOR)
- The EOR should fill out the form and address the following concerns:
  - Design/constructability
  - Drainage
  - Utility
  - Safety
  - Maintenance
  - ROW Acquisition
  - Legal
  - Outdoor advertising
- Additionally, the EOR should make a final determination if the barrier can be constructed.
- The form should be provided in the appendix of the Noise Report

Noise Barrier Engineering Review Form

123456-1 Widen Florida Avenue from Miami Rd. to Western Rd. (MP 1.0 to 4.0)

Hillsborough County, Florida

Noise Barrier #: _____

Date Provided: _____

Date Reviewed: _____

Reviewed By: _____

Topic	Details
Location	ROW
Length	5,000
Height	22
Estimated Cost (@ $30/ sq. ft.)	$3,300,00
Design/Constructability Issues	
Drainage Issues	
Utility Issues	
Safety Issues	
Maintenance Issues	
ROW Acquisition Issues	
Legal Issues	
Outdoor Advertising Issues	
Are any of the above issues severe enough so that a noise barrier cannot be constructed at this location? If so, please explain in detail.	

LESSON 9
Step 6: Public Involvement

Step 6: Public Involvement

Public involvement should occur throughout the lifecycle of a project. Several public involvement tasks related to a noise barrier are performed, including:

- Public Hearings
- Public Information Meetings
- Determining the SLU's support/opposition to a noise barrier*
  *AFTER engineering review has been performed
- Identifying the number of users at an SLU by coordinating with the SLU owner

Public Workshop

- Discuss noise sensitive sites within the project corridor
- Describe analyses procedures
- Describe potential for traffic noise impacts utilizing generalized noise contours

Public Hearing

- Discuss site specific results of the noise study
- Discuss location of impacted receptors
- Describe potential for noise abatement consideration during design phase
- Provide draft of Noise Study Report

Step 6: Design Phase Public Involvement

- Optimal barrier length and height should be established, and any engineering/constructability issues are identified and resolved
- Noise barrier-specific public involvement includes informational meetings and written surveys for property owners and tenants
- Examples of written correspondence:
  - Notification Letter
  - Noise Barrier Survey Package
    - FDOT desires that a majority of the benefited property owners and tenants respond to the survey

★ *Note: If responses to meetings & surveys are insufficient, door-to-door/telephone solicitations may be necessary.*

Step 6: Design Public Involvement – Viewpoint Weighting Factors

Property Type	Owner Occupied Property	Owner Does Not Occupy Property	
		Owner	Renter
Single Family	100%	90%	10%
Multi-Family (duplex, apartments, condominiums)*			
Mobile Home Park*		80%	20%
Offices, Businesses			

* The weighting factor is for each unit (mobile home, apartments, condominiums), not for the entire mobile home park, apartment complex or condominium building.

FDOT, Part 2, Chapter 18 of the PD&E Manual (Highway Traffic Noise) and 23 CFR Part 772, Table 18-1 (2020)

LESSON 10
Step 7: Documentation

Step 7: Documentation

All Noise Study Reports must have:

- Types, Lengths & Heights, & Evaluation Results
- A table documenting the noise barrier types, heights, lengths, locations, cost, and required minimum person-hours for the noise barrier to be considered cost reasonable must be completed
- All impacted SLUs for which a barrier analysis was performed must have the **FDOT SLU Worksheet, SLU Tab** completed and provided in the Noise Study Report
- All impacted SLUs for which a barrier was **not** performed due to the preliminary screening must document the assumptions used

★ Note: In addition to all the documents required, provide the **FDOT SLU Worksheet** in the Appendix for any SLU that is evaluated

Step 7: Documentation

Table 1 Example SLU Noise Barrier Evaluation Table

Barrier Scenario	Barrier Location	Barrier Height	Barrier Length[1]	Barrier Total Cost[2]	Approximate Barrier XY Extent (Stationing)	Residences		Special Land Uses		Total Impacted and Benefited Residences and Equivalent Residences[3]	Total Benefited Residences and Equivalent Residences	Average Reduction [(dB(A)]	Maximum Reduction [(dB(A)][4]	Cost per Benefited Equivalent Residence	Cost-Effective?
						Impacted and Benefited	Benefited	Impacted and Benefited Equivalent Residences	Benefited Equivalent Residences						
1	Shoulder														
	Structure	8													
2	Shoulder														
	Structure	8													
3	Shoulder														
	Structure	8													
4	Shoulder														
	Structure	8													
5	Shoulder														
	Structure	8													
6	Shoulder														
	Structure	8													
7	Shoulder														
	Structure	8													
8	Shoulder														
	Structure	8													

[1]Barrier length refers to the total length at the ROW, Shoulder, or on Structure.
[2]Assumes $40 per square foot.
[3]If total Impacted BER is less than 2, the noise barrier is not considered feasible.
[4]Maximum Reduction refers to the maximum reduction at any receptor (residential or SLU) evaluated for the noise barrier. If 7 dB(A) or greater, the Noise Reduction Design Goal (NRDG) is met.
[5]Only to be utilized when an SLU does not know usage data. This column can be used to identify the minimum usage the SLU needs to have in order to make the noise barrier cost-effective.

NOTE: The cost per square foot has increased to $40/sq.f.t and the cost per benefit has increased to $64,000/benefited receptor with the publication of the 2024 PD&E Manual Chapter. The SLU Methodology and Worksheet are in the process of being updated to reflect the new criteria..

QUIZ TIME!

Please visit

www.menti.com

Use code:

2238 9095

Questions?

Contact

FDOT Office of Environmental Management

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State Environmental Development Engineer

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Tallahassee Central Office Noise Specialist

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Thank you for your participation!