**METHODOLOGY TO EVALUATE**

**HIGHWAY TRAFFIC NOISE**

**AT SPECIAL LAND USES**

Florida Department of Transportation

Office of Environmental Management



**December 2023**

Table of Contents

[1. Introduction 1](#_Toc153378572)

[1.1. Methodology Developed in 2009 1](#_Toc153378573)

[1.1.1. Limitations of 2009 Methodology 3](#_Toc153378574)

[1.1.1.1. Update to Federal Regulations 3](#_Toc153378575)

[1.1.1.2. Non-Residential Evaluation Separation 5](#_Toc153378576)

[1.1.1.3. Time Consuming 5](#_Toc153378577)

[1.1.1.4. Noise Reduction Design Goal Application 5](#_Toc153378578)

[1.1.1.5. Template 5](#_Toc153378579)

[1.2. Limitations Addressed 5](#_Toc153378580)

[2. Development of Methodology 7](#_Toc153378581)

[2.1. SLU Methodology by State 7](#_Toc153378582)

[3. Methodology to Evaluate Special Land Uses 11](#_Toc153378583)

[3.1. Step 1: Identify Impacts 14](#_Toc153378584)

[3.1.1. Receptor Placement 14](#_Toc153378585)

[3.1.2. Grid Spacing and Extent 16](#_Toc153378586)

[3.1.3. Grid Receptor Naming Convention 17](#_Toc153378587)

[3.2. Step 2: Optional Preliminary Screening 17](#_Toc153378588)

[3.2.1. Step 2a: Isolation Screening 17](#_Toc153378589)

[3.2.2. Step 2b: Usage Screening 18](#_Toc153378590)

[3.2.3. Step 2c and 2d: Viewpoint Screening (Design or Design-Build Phase only) 18](#_Toc153378591)

[3.3. Step 3: TNM Barrier Evaluation and Optimization 19](#_Toc153378592)

[3.3.1. Initial Noise Barrier Length and Height 19](#_Toc153378593)

[3.3.2. Noise Barrier Optimization - Feasibility and Reasonableness (Part 1) 20](#_Toc153378594)

[3.4. Step 4: Determine Cost Reasonableness – Reasonableness (Part 2) 21](#_Toc153378595)

[3.4.1. SLU Worksheet 22](#_Toc153378596)

[3.4.1.1. Noise Barrier Details 26](#_Toc153378597)

[3.4.1.2. Adjacent Benefited Residences 26](#_Toc153378598)

[3.4.1.3. Residential Person-Hours Per Year 26](#_Toc153378599)

[3.4.1.4. SLU Equivalent Residence 26](#_Toc153378600)

[3.4.1.5. Feasibility Factors 28](#_Toc153378601)

[3.4.1.6. Reasonableness Factors 28](#_Toc153378602)

[3.5. Step 5: Engineering Review (After PD&E Phase) - Feasibility (Part 2) 29](#_Toc153378603)

[3.6. Step 6: Public Involvement - Reasonableness (Part 3) 29](#_Toc153378604)

[3.6.1. PD&E Study Public involvement 30](#_Toc153378605)

[3.6.2. Design Phase Public Involvement 30](#_Toc153378606)

[3.7. Step 7: Documentation 31](#_Toc153378607)

[4. Conclusions 35](#_Toc153378608)

[References 36](#_Toc153378609)

[Appendix A A-1](#_Toc153378610)

List of Figures

[Figure 1 Special Land Use Evaluation Methodology: Process Overview 12](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378611)

[Figure 2 Special Land Use Methodology Flowchart 13](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378612)

[Figure 3 Step 1: Identify Impacts 14](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378613)

[Figure 4 Grid Spacing Example 16](#_Toc153378614)

[Figure 5 Step 2: Preliminary Screening 18](#_Toc153378615)

[Figure 6 Step 3: Barrier Evaluation/Optimization 19](#_Toc153378616)

[Figure 7 Step 4: Determine Cost Reasonableness 21](#_Toc153378617)

[Figure 8 SLU Worksheet: Noise Barrier Master Table 24](#_Toc153378618)

[Figure 9 SLU Worksheet: SLU Tabs 25](#_Toc153378619)

[Figure 10 Step 5: Engineering Review 29](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378620)

List of Tables

[Table 1 Special Land Use Worksheet: Reasonableness Determination 3](#_Toc153378621)

[Table 2 Federal Highway Administration Noise Abatement Criteria 4](#_Toc153378622)

[Table 3 Summary Matrix of SLU Methodology by State 8](#_Toc153378623)

[Table 4 Receptor Placement for SLUs 15](#_Toc153378624)

[Table 5 Recommended Receptor Spacing 16](#_Toc153378625)

[Table 6 Viewpoint Weighting Factors 31](#_Toc153378626)

[Table 7 Noise Barrier Evaluation for [INSERT SLU NAMES] (EXAMPLE) 33](#_Toc153378627)

[Table 8 Reasonable and Feasible Noise Barriers (EXAMPLE) 34](#_Toc153378628)

List of Equations

[Equation 1 2009 SLU Threshold Calculation 2](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378629)

[Equation 2 Preliminary Screening Equation 19](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378630)

[Equation 3 ER Equation 27](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378631)

[Equation 4 BER Equation 27](file:///T%3A%5CCEMO%20Engineering%20Support%20Contract%5CTWOs%5CTWO-35%20-%20SLU%5C04%20GUIDANCE%20DOCUMENT%20%26%20WORKSHEET%5C19%20QA%20Documents%5CSLU%20Guidance%20Document%20-%20SLUs_12.13.23.docx#_Toc153378632)

**ACRONYMS**

BER Benefited Equivalent Residence

CNE Common Noise Environment

dB(A) Decibel

EAFHU Exterior Area of Frequent Human Use

ER Equivalent Residence

FDOT Florida Department of Transportation

FHWA Federal Highway Administration

NAC Noise Abatement Criteria

NRDG Noise Reduction Design Goal

NSR Noise Study Report

NSRA Noise Study Report Addendum

OEM Office of Environmental Management

PD&E Project Development and Environment

SLU Special Land Use

TNM Traffic Noise Model

# Introduction

The Florida Department of Transportation (FDOT) is responsible for providing policy and guidance on noise analysis for considering and evaluating potential environmental impacts on transportation projects, in accordance with Part 2, Chapter 18 of the Project Development and Environment (PD&E) Manual (*Highway Traffic Noise)*, and other local, state, and federal rules and regulations.

The FDOT’s guidance on how to assess special land uses (SLUs) (i.e., non-residential noise sensitive sites) in Florida for highway traffic noise, *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations*, was developed in 2009. Since its development, changes in federal regulations have occurred and shortcomings have been identified. Additionally, potential improvements to the methodology have been suggested by highway traffic noise specialists around the state. Therefore, an update to the methodology used to assess highway traffic noise for SLUs has been completed.

The purpose of this document is to provide an overview of the shortcomings and improvement opportunities of the 2009 FDOT SLU Methodology, provide an outline of other states’ methodologies to evaluate SLUs, and to update the methodology FDOT uses to evaluate SLUs.

## Methodology Developed in 2009

Florida’s 2009 SLU Methodology was developed in several “phases”. The first phase that was implemented was a survey which assessed the then-current state policies concerning SLUs. A survey was mailed to representatives from each state Department of Transportation (DOT) to inquire whether any formal state policies concerning SLUs existed. Follow-up telephone calls were made to non-responding state DOTs. Where additional insight was needed for specific problems, additional surveys were mailed to other groups and individuals. The results of the survey indicated that no states had a formal policy for SLUs and the majority of states had difficulty in determining reasonableness of noise abatement for SLUs. Many states responded that they evaluated SLUs on a case-by-case basis.

Furthermore, the survey asked the state DOTs to rank what they thought were the most important factors when determining feasibility and reasonableness. The majority of state DOTs responded that cost was the most important factor, followed by approaching/exceeding the Noise Abatement Criteria (NAC).

The survey also asked state DOTs to suggest a methodology to determine reasonableness at SLUs. Using the survey responses as a basis, a complex SLU Reasonable/Feasible Matrix was developed to determine if noise abatement was reasonable/feasible at a SLU. Upon review, concerns with complexity were identified. As a result, a simplified *Reasonability Matrix* and a separate *Feasibility Flowchart* were developed. The feasibility flowchart assessed if, for sites developed before the Date of Public Knowledge, 1) the SLU is used during peak traffic conditions, 2) the NAC is approached or exceeded or if there is a substantial increase, 3) a 5 decibel (dB[A]) insertion loss can be achieved from abatement, and 4) the property owners desire abatement, then the barrier is considered feasible and the analyst should proceed to the Reasonableness Matrix.

To assess reasonableness, a SLU “abatement cost factor” was identified and a *Reasonableness Matrix* was developed. The SLU “abatement cost factor” was developed by extrapolating the residential “abatement cost factor” and included the following steps:

1. Use the current FDOT accepted barrier cost per residence ($42,000/benefited receptor).
2. Assume residences are used 24 hours/day.
3. Determine the average frontage of a residence (100 ft; 30.5m).
4. Determine the average height of a noise barrier statewide (14 ft; 4.3m).
5. Use the average frontage of a residence and barrier height to determine the area of a hypothetical barrier per residence frontage.
6. Determine the state average number of people per dwelling unit.
7. Use these data to determine a criteria barrier cost per hour of usage and area of barrier.

The above factors were translated into a methodology for evaluating SLUs that accounts for the threshold of $42,000 per benefitted receptor and translated it to apply to a non-residential receptor based on person-hours-of-use in the following equation:

Equation 1 2009 SLU Threshold Calculation

$$\frac{\$42k}{residence}x\frac{residence}{2.46 persons}x\frac{usage}{24 hours }x \left(14ft. x 100 ft.\right)= \$995,935/person hour/ft2$$

The cost of abatement is considered reasonable if the calculated “abatement cost factor” is below the “criteria abatement cost factor” of the above equation ($995,935/person-hour/ft2). To assist in this determination, a Reasonableness Worksheet was developed, shown in **Table 1**. The user enters in various details (highlighted in yellow) and the worksheet automatically calculates if the barrier is considered reasonable for a particular SLU.

Table 1
Special Land Use Worksheet: Reasonableness Determination

|  |  |  |
| --- | --- | --- |
| Item | Criteria | Input/Result |
| 1 | Enter length of proposed noise barrier (ft.) |  |
| 2 | Enter height of proposed noise barrier (ft.) |  |
| 3 | Multiply item 1 by item 2 |  |
| 4 | Enter the average amount of time that a person stays at the site per visit (hours) |  |
| 5 | Enter the average number of people that use this site per day that will receive at least a 5 dB(A) benefit from abatement at the site |  |
| 6 | Multiply item 4 by item 5 |  |
| 7 | Divide item 3 by item 6 |  |
| 8 | Multiply item 7 by $42,000 |  |
| 9 | Does item 8 exceed the "abatement cost factor" of: English Units = $995,935/person-hour/ft2 or SI Units = $92,647/person-hour/m2 |  |
| 10 | If item 9 is no, abatement is reasonable |  |
| 11 | If item 9 is yes, abatement is not reasonable |  |

Developed by Environmental Science Associates, Inc. 2009

Note: Yellow highlighted rows are filled in by the user. Grey rows are auto-calculated within the spreadsheet.

### Limitations of 2009 Methodology

#### Update to Federal Regulations

As previously mentioned, Florida’s 2009 guidance on how to assess SLUs for highway traffic noise was developed in 2009. Since its development, changes to Title 23, Code of Federal Regulations, Part 772 (23 CFR 772*), Procedures for Abatement of Highway Traffic Noise and Construction Noise* have occurred. Specifically, the NAC changed in 2010 such that land uses and their respective dB(A) thresholds were recategorized and additional exterior land use criteria and types were added (see **Table 2**).[[1]](#footnote-1),[[2]](#footnote-2),[[3]](#footnote-3),[[4]](#footnote-4) As the current methodology is written, it references the previous Activity Categories for each land use type.

Table 2
Federal Highway Administration Noise Abatement Criteria

| **Activity****Category** | **Activity Leq(h)a** | **Evaluation Location** | **Description of Activity Category** |
| --- | --- | --- | --- |
| **Pre-2010** | **2010** | **Pre-2010** | **2010** | **Pre-2010** | **2010** |
| A | 57 | Exterior | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 67 | Exterior | Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals | Residential. |
| C | 72 | 67 | Exterior | Developed lands, properties or activities not included in Categories A or B above. | 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**, recreation areas, **Section 4(f) sites**, schools, **television studios**, **trails**, and trail crossings. |
| D | N/A | 52 | N/A | Interior | Undeveloped lands. | 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 | 52 | 72 | Interior | Exterior | *Residences, motels, hotels,* public meeting rooms, schools, churches, libraries. Hospitals, and auditoriums.  | Hotels, motels, **offices**, **restaurants/bars**, and other developed lands, properties or activities not included in A – D or F.  |
| F | N/A | ------ | N/A | ------ | N/A | 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. |

a Federal Highway Administration criteria.

Note: Bolded land uses represent newly added land use. Italicized represent removed land uses (respective to evaluation location).
Source: 23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise, Federal Highway Administration, 2010; US Environmental Protection Agency, Office of Noise Abatement and Control, Highway Noise Impact, May 1977.

#### Non-Residential Evaluation Separation

Using the 2009 methodology, the evaluation of noise barriers for impacted special land uses (i.e., non-residential) is different than for impacted residential receptors. Noise barriers for SLUs are evaluated following procedures documented in *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Use Locations* (FDOT 2009). Because methodologies for evaluating SLUs and residences are independent and include separate metrics (e.g., SLUs incorporate usage factors), there is no uniform way of evaluating abatement for adjacent impacted SLU and residences together. For example, if several impacted residences are adjacent to an impacted SLU (such as a school or a park), separate noise abatement must be evaluated for residential properties and for the SLU and neither of the two may be eligible for noise abatement on its own merit. Typically, these scenarios are addressed on a case-by-case basis and coordination with the FDOT is necessary. Identifying usage of a SLU is an important aspect of identifying if noise abatement for a SLU is cost reasonable.

#### Time Consuming

Using the 2009 methodology, once impacts are identified at a SLU, a grid of receptors is typically developed to identify the area of the SLU that is benefitted. The evaluation of noise abatement can take a considerable amount of work, especially if the SLU area is large. Over the years, it has been found that SLU are often ineligible for noise abatement in the form of a noise barrier due to the difficulty in meeting SLU usage criteria.

#### Noise Reduction Design Goal Application

Of importance, the 2009 guidance does not explicitly state how to apply the required Noise Reduction Design Goal (NRDG) of a 7 dB(A) reduction to SLUs. For example, a noise analyst is left to determine whether the NRDG should apply to the original receptors evaluated to identify impacts, or if it should be applied to a receptor from the grid of receptors that was evaluated to determine insertion loss.

#### Template

The 2009 guidance document does not provide an example of a SLU noise barrier table which could be included in a Noise Study Report (NSR) or Noise Study Report Addendum (NSRA). As a result, NSRs and NSRAs can inconsistently present various information about the noise barrier evaluation .

## Limitations Addressed

This updated methodology accounts for regulation changes to 23 CFR Part 772. Revised activity categories and land use types have been referenced in the guidance document to eliminate confusion.

Additionally, this updated methodology can evaluate adjacent impacted residential and SLUs together to determine if noise abatement is reasonable and feasible. An “Equivalent Receptor” methodology where a SLU is equated to a number of “residential receptors” was identified as the preferred method, as it allows for a reasonable analysis to be made for impacted SLUs in conjunction with impacted residences.

This updated methodology also allows for a “Preliminary Usage Screening” which reduces the level of effort for evaluating noise abatement for low-usage SLUs that would not qualify for noise abatement or SLUs that do not desire a barrier. A matrix has been developed which identifies the lowest number of person-hours required for a certain height and length of barrier to be found cost reasonable. If the SLU is known to have person-hours usage below a certain threshold based upon an estimated noise barrier length and height, the SLU is automatically disqualified for further analysis based on reasonable assumption. Additionally, during Design and Design-Build phase projects, the viewpoints of SLU property owners may be solicited before the analysis begins in order to decrease the amount of time spent on the analysis. If an SLU property owner does not desire a noise barrier, the analysis can be terminated.

This updated methodology also includes explicit guidance on how to apply the NRDG. Step-by-step instructions on how to evaluate single-receptor and multiple-receptor SLU evaluations, and how to meet regulatory requirements for reasonableness are described.

In an effort to encourage consistency, this updated methodology document also contains an example template of a SLU noise barrier evaluation table that could be provided in an NSR/NSRA. This table is provided as example guidance, giving authority to the FDOT District(s) to discern what to provide in an NSR/NSRA on a case-by-case basis, if needed.

In summary, the changes to the methodology presented in *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations* (FDOT, 2009) include:

* Accounting for the change in the NAC in 23 CFR 772.
* The development of an “equivalent residential receptor” based on the SLU usage which allows for the combined evaluation of noise abatement of both impacted residences and SLUs together (if they are adjacent).[[5]](#footnote-5)
* A preliminary screening has been developed which reduces the level of effort for evaluating noise abatement for low-usage SLUs that would not qualify for noise abatement.
* Explicit guidance on how to apply the NRDG has been provided.
* For consistency, the guidance document provides an example of a SLU noise barrier evaluation table that could be provided in an NSR/NSRA.

# Development of Methodology

## SLU Methodology by State

23 CFR 772identifies how highway traffic noise should be evaluated. However, the regulations give authority to each state to define certain thresholds and methodologies. Specifically, 23 CFR 772 does not specify how to evaluate noise abatement for SLUs. As a result, each state has a different way of evaluating SLUs. See **Appendix A** for links to each state’s noise policy.

In an effort to categorize how each state evaluates SLUs, a matrix was compiled (**Table 3**) which documents various aspects of a SLU methodology. Only a few states have a stand-alone SLU guidance document, with most states only having a brief description of a general methodology in a larger guidance document. Many states, not including Florida, utilize an “equivalent receptor” type methodology. In this type of 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.

As shown in **Table 3**, various factors may be considered for calculating how an SLU is evaluated. Similar to Florida, many states consider person-usage of a SLU, which can be important for identifying cost reasonableness. Many states, not including Florida, also consider a linear frontage or area of the SLU to equate to an equivalent receptor. In this fashion, the size, frontage, and/or person-usage of a SLU can determine the weight of a SLU receptor. Thus, the impacted SLU can be evaluated in conjunction with nearby impacted residential receptors, and the composite number of “equivalent receptors” can thus be used to determine reasonableness of a single noise wall serving the combined residential and non-residential land uses.

Some states have a simple methodology, where a single worst-case receptor is identified for a SLU and is equated to a single residence. Although this methodology allows for the combined analysis of an impacted SLU and impacted residences, the methodology makes it nearly impossible for noise abatement to be found reasonable and feasible for a SLU unless there also are adjacent impacted residences.

It should be noted that some states do not have explicit guidance on how to evaluate SLUs. This has led to inconsistencies in application within those states.

Table 3
Summary Matrix of SLU Methodology by State

| **State** | **Stand-alone SLU Guidance Document Developed1** | **SLU Methodology Specified** | **Simple Single Receptor Methodology2** | **Multiple Receptor Methodology3** | **Equivalent Receptor 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 |  |  |  |  |  |  |  |  |  |
| 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).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **Stand-alone SLU Guidance Document Developed1** | **SLU Methodology Specified** | **Simple Single Receptor Methodology2** | **Multiple Receptor Methodology3** | **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.

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).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **Stand-alone SLU Guidance Document Developed1** | **SLU Methodology Specified** | **Simple Single Receptor Methodology2** | **Multiple Receptor Methodology3** | **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).

# Methodology to Evaluate Special Land Uses

This methodology replaces *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations* (FDOT, 2009) and updates FDOT’s process used to identify traffic noise levels, impacts, and evaluate noise abatement for SLUs. SLUs are non-residential noise sensitive sites that are listed in FHWA’s NAC Activity Categories A, C, D, and E. The methodology to evaluate SLUs is comprised of seven steps, as shown in **Figure 1** and **Figure 2**.

.

Figure Special Land Use Evaluation Methodology: Process Overview



Figure 2 Special Land Use Methodology Flowchart

## **Step 1: Identify Impacts**

In order to initiate an evaluation of noise abatement from highway traffic noise for SLUs, the future build predicted noise levels must be identified. For PD&E phase noise studies, the existing noise levels must also be identified. These tasks should be done following procedures listed in 23 CFR 772 and the latest version of the FDOT PD&E Manual, Chapter 18 (*Highway Traffic Noise*). This process is represented in **Figure 3**.

Figure 3 Step 1: Identify Impacts

If impacts are identified at an SLU, the noise analyst should coordinate with the FDOT District Noise Specialist and notify them of the impacted SLU and intent to evaluate noise abatement.

### Receptor Placement

Receptors should be placed at areas of frequent human use as described in Part 2, Chapter 18 of the PD&E Manual (*Highway Traffic Noise)*, the FDOT’s *Traffic Noise Modeling and Analysis Practitioner’s Handbook* (December 2018), and 23 CFR Part 772. Receptors should not be placed at areas which are not considered frequently used.

For NAC A, C, and E, receptors should be placed at exterior areas of frequent human use (EAFHU). There are three types of receptor placement for EAFHU areas at SLUs. They are presented in **Table 4.** Note that an SLU may have more than one receptor placement type if multiple types of SLU usages are present at the SLU (e.g., a park with a playground and a trail).

Receptor placement at some SLUs may require a discussion with the District during the Methodology Meeting that should be conducted at the beginning of the noise evaluation. For example, a park may have multiple areas of EAFHU which is separate by an area of non-frequent human use (i.e., a pond or forested area). All areas of EAFHU at the SLU should be evaluated. Areas of non-frequent human use should not be included in the evaluation.

Table 4 Receptor Placement for SLUs

|  |  |  |
| --- | --- | --- |
| **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 3.3**). This category includes NAC D (interior) use.  | Marker with solid fill |
| 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 greens. Sports fields/arenas should have receptors placed at bleachers/stands and active playing fields.  |  |
| Linear use (trail) | 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. | Route (Two Pins With A Path) with solid fill |

For NAC D, receptor(s) should be placed at an interior point that would be a site of frequent human use (such as a stage, seating area, etc.; following the FDOT *Traffic Noise Modeling and Analysis Practitioner’s Handbook* [2018]) or at the corner of the façade of the building closest to the facility. Typically, only one receptor is sufficient for modeling interior NAC D land uses. However, it may be deemed necessary to evaluate more than one receptor at an interior location based on professional judgement.

Medical facilities such as hospitals or other facilities where an over-night stay may be needed should be evaluated as a NAC C if an EAFHU is present. If no EAFHU is present, the facility should be evaluated as a NAC D. However, medical facilities such as dentist offices and other facilities where an over-night stay would not be required should not be evaluated.

Due to the various types of special use locations, any questions regarding the application of this methodology to project specific conditions should be directed to the FDOT District Noise Specialist. Documentation of decisions and rationale should be provided in the NSR/NSRA.

### Grid Spacing and Extent

For dispersed passive use, a grid format shall be utilized.A Noise Analyst should create a grid of receptors which covers both the entire area of impact and the entire area provided a benefit at the SLU. Spacing and number of the grid of receptors will vary based on the acreage of the SLU being evaluated. **Table 5** provides the recommended spacing of receptors in a grid format. Note that only the area being evaluated for impacts should be considered for the acreage in **Table 5** (i.e., the entire property does not have to be gridded).If impacts are identified, this grid will also be utilized in the barrier optimization process (see **Section 3.3.2**). If the receptor spacing in **Table 5** is not utilized, the density of receptors should be specified in the NSR/NSRA and a balance between number and density should be identified such that the grid is detailed enough to support an accurate barrier optimization process.

Table 5 Recommended Receptor Spacing

|  |  |
| --- | --- |
| **SLU Area Being Evaluated** | **Receptor Spacing** |
| Area 0 to 0.5 Acres | Every 25 ft. |
| Area Greater than 0.5 to 5 Acres | Every 50 ft.  |
| Area Greater than 5 Acres | Every 75 ft. |
| Trail (linear area) | Every 100 ft. |

Of note, changing the extent of an EAFHU at an SLU should not change the ER of the benefited area at an SLU, as shown in **Figure 4**. As shown, increasing the number of receptors (Example C), or the area evaluated (Example B), does not change the ER value of the area which is provided a benefit.



Figure Grid Spacing Example

### Grid Receptor Naming Convention

Receptors which represent a single SLU property should be identified by the same numerical ID and follow with a “-“ and a second numerical identifier (e.g., 15-1, 15-2, 15-3, 15-4, 15-5, etc.)[[6]](#footnote-6). This nomenclature is distinct from receptors representing multi-story residences, which use an alphabetical identifier after the numerical identifier.[[7]](#footnote-7) To avoid difficulty in overlapping labels for receptors in maps, a Noise Analyst may choose to identify the Common Noise Environment (CNE) number of a special land use by drawing a polygon around the property and identifying the CNE number one time on a map. A CNE is a group of receptors within the same NAC activity category that are exposed to similar noise sources and levels, traffic volumes, traffic mix, speed and topographic features.

## Step 2: Optional Preliminary Screening

If desired, an optional preliminary screening may be applied to isolated SLUs which either do not meet usage requirements, do not meet cost criteria, or for SLUs who do not desire a noise barrier (Design phase only) in an effort to decrease evaluation time. This may be decided on a case-by-case basis and in coordination with the FDOT District Noise Specialist. If the SLU does not go through a preliminary screening analysis as described below, the SLU must follow the in-depth analysis in Steps 3 through 7 described in **Sections 3.3** through **Section 3.7**.

### Step 2a: Isolation Screening

This process is only to be applied to isolated impacted SLUs. An isolated and impacted SLU is an impacted SLU which is located far enough away from other impacted SLUs and/or impacted residences such that a single noise barrier would not be a practical form of abatement for all impacted properties. If a single noise barrier would be unable to serve as an abatement measure for two or more impacted SLUs/residences, the SLU is considered isolated. Coordination with the FDOT District Noise Specialist and/or TNM modeling may be needed to determine if an SLU is considered isolated (e.g., If noise barrier panels can be eliminated in between the noise sensitive sites without a loss of benefits, the noise sensitive sites could be considered too far apart to be combined for a single noise barrier evaluation). Additionally, the **FDOT SLU Worksheet**[[8]](#footnote-8) (see **Section 3.4.1**) provides a **Preliminary Screening Tab** that can be utilized for performing preliminary screening.

The following sections provide options for preliminary screening. This process is represented in **Figure 5**.

Figure 5 Step 2: Preliminary Screening

### Step 2b: Usage Screening

An isolated impacted SLU must have enough person-hour usage to equate to at least two residences to be found feasible. To identify the number of person-hours-per-year that a single-family home in Florida has available for use, the average number of people per residence in Florida (2.57 people per residence[[9]](#footnote-9)) was multiplied by the hours available for use per year (24 hours/day x 365 days/year= 8,760 hours) for a total of 22,513 person-hours available for use at each residence per year. Using these assumptions, two residences have a total of 45,026 person-hours available for use each year. Therefore, an isolated SLU must have at least 45,026 person-hours of use per year in the benefited area for a noise barrier to be found a feasible form of noise abatement. Because this is a preliminary screening and the benefited area of an SLU has not yet been identified, if the entire SLU has less than 45,026 person-hours per year, it is reasonable to assume that the benefited area of the SLU has less than 45,026 person-hours per year, and therefore the SLU is not eligible for a noise barrier. As an example, an SLU would need to be utilized by approximately 124 people for 1 hour per day for 365 days in a year to meet the required 45,026 person-hours. The **Preliminary Screening** Tab in the **FDOT SLU Worksheet** aids in this screening process.

### Step 2c and 2d: Viewpoint Screening (Design or Design-Build Phase only)

During a Design or Design-Build phase project, the SLU property owner(s) should be contacted to inquire their viewpoint for or against a noise barrier, if it is determined that a reasonable and feasible noise barrier can be built and after coordination with the FDOT District Noise Specialist has occurred.[[10]](#footnote-10) If the SLU property owner is contacted and they desire a noise barrier, usage information should be collected as well (see **Section 3.4**).

If the SLU is determined to potentially have the minimum number of users according to the Preliminary Screening Table found in **Table 6**, the noise analyst should coordinate with the FDOT District Noise Specialist and notify them of the impacted SLU and intent to evaluate noise abatement.

If the SLU is determined to not meet the minimum number of person-hours of use per day, the noise analyst should coordinate with the FDOT District Noise Specialist and inform them that the SLU was impacted but failed to pass the preliminary screening analysis. Step 3 (**Section 3.3**) through Step 5 (**Section 3.5**) should not be completed for SLUs which did not pass the preliminary screening test based upon reasonable assumptions. In addition, the results and assumptions of the preliminary screening analysis should be provided in the NSR/NSRA to document why the SLU was not eligible for noise abatement.

Alternatively, if the operational hours of the SLU are known, the following formula (**Equation 2**) can be used to identify the minimum required person-hours in the benefited area of an SLU for a noise barrier to be considered cost reasonable:

Equation 2 Preliminary Screening Equation

$$\left(\left[\left\{\left〈\left⌊a × b × \$30\right⌋÷ \$42,000\right〉×22,513\right\} ÷c\right] ÷d \right)÷e$$

Where:
*a = Noise Barrier height*

*b = Noise Barrier length*

*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*

$$\left(\left[\left\{\left〈\left⌊a × b × \$30\right⌋÷ \$42,000\right〉×23,214\right\} ÷c\right] ÷d \right)÷e$$

Where:
*a = Noise Barrier height*

*b = Noise Barrier length*

*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*

## Step 3: TNM Barrier Evaluation and Optimization

If the Preliminary Screening results indicate that a full analysis is warranted (or if the Preliminary Screening process was not applied), the following steps are required to identify the optimal noise barrier length and height for the impacted SLU. This process is represented in **Figure 6**.

Figure 6 Step 3: Barrier Evaluation/Optimization

### Initial Noise Barrier Length and Height

Following guidance from FDOT’s *Traffic Noise Modeling & Analysis Practitioner’s Handbook* (2018),

*A noise barrier is to be input into the Traffic Noise Model (TNM) at a length that is considerably greater than what one might anticipate would be needed to maximize noise reduction so that traffic noise flanking the ends of the noise barrier is considered in the analysis. In this document, this is referred to as the “unadjusted noise barrier length”. A good starting point is to have the barrier extend beyond the end/last receptor at least approximately four times the perpendicular distance between the receptor and the noise barrier. The unadjusted barrier length can also be influenced by other features, such as intersecting cross streets and driveways. In these cases, land use or geographic features may dictate the unadjusted barrier length.*

*When modeling noise barriers as abatement features, the unadjusted barrier length is subdivided, typically into 20-foot to 100-foot increments (with the 20-foot segments at the ends and the 100-foot segments in the middle of a barrier), so that small portions of the noise barrier at either end can be raised or lowered as needed during the optimization process.*

*During PD&E and unless there are significant increases/decreases in ground elevation, noise barriers are typically modeled at constant heights from 8 feet in two-foot increments to the maximum height of 22 feet. If, at these heights, the cost of a noise barrier is close to, but exceeds the cost reasonableness criteria, the incremental height of the barrier is reduced by one foot.*

### Noise Barrier Optimization - Feasibility and Reasonableness (Part 1)

Following guidance is from FDOT’s *Traffic Noise Modeling & Analysis Practitioner’s Handbook* (2018),

*The noise barrier optimization should maximize the noise level reduction while maintaining a cost per benefited receptor at or below the reasonable limit. It is important to note that analysts should not “stop” optimizing a barrier once the noise reduction design goal is achieved or a benefit is provided to impacted receptors (i.e., do not just design the barrier to meet the minimum noise reduction criteria).*

*The height for the 20-foot to 100-foot segments at either end of the noise barrier should be lowered to zero feet while evaluating the amount of noise reduction achieved to maintain the same number of impacted and benefited receptors as the unadjusted barrier length for that particular height, while also achieving the noise reduction design goal. In other words, at each evaluated barrier height, the length of the barrier should be optimized such that only those impacted receptors benefiting from the barrier are considered. The objective of this process is to achieve noise reduction requirements while also minimizing excess barrier length and thus reducing the overall cost (and the cost per benefited receptor) of the noise barrier. Although benefiting the maximum amount of impacted receptors is preferable, receptors that require excessive amounts of barrier length to be benefited may be dropped from consideration if the result is a cost reasonable noise barrier for other impacted receptors that are benefited. In the design phase analysis, the barrier length and height that maximizes the number of impacted receptors that can be benefited at a cost below the reasonable limit should be identified. For this barrier configuration, the barrier length that will maximize the number of receptors that are provided the noise reduction design goal (7 dB(A)) while maintaining cost reasonableness should also be determined. This assists the District Noise Specialist in determining a recommended barrier configuration that maximizes noise reduction while still considering cost.*

*A final recommendation for a noise barrier should be for a barrier that 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 impacted receptor) and the cost of the barrier is at or below the cost reasonable limit.*

The District’s Noise Specialist should be consulted to confirm the optimal barrier height and associated length identified.

## Step 4: Determine Cost Reasonableness – Reasonableness (Part 2)

Once it is determined that a noise barrier can provide a benefit to the SLU, the Noise Analyst should coordinate with the FDOT District Noise Specialist and receive approval to contact the SLU property owner. Upon contact with the SLU property owner, the Noise Analyst should be clear that an evaluation of noise is being performed, and that the determination if a noise barrier is merited has not yet been determined. The SLU property owner should provide the operating hours/days/weeks of the facility as well as person-hour usage information for the area evaluated (i.e., the area of the SLU that was represented by receptors).

If the SLU property owner is unable to be contacted or if usage information is not available, noise analysts should utilize the **FDOT SLU** **Worksheet** to identify the minimum usage required. This worksheet enables the noise analyst to “back calculate” the number of required person-hours of use per day in the benefited area of an SLU for a noise barrier to be considered cost reasonable. This process is represented in **Figure 7**.

Figure 7 Step 4: Determine Cost Reasonableness

If usage data is not available, the Noise Analyst should coordinate with the District Noise Specialist to identify reasonable hourly usage data. All usage assumptions should be documented in the project file and the NSR/NSRA.

All usage information should be reviewed and approved by the FDOT District Noise Specialist. If unreasonable data is provided by the SLU, discussion with the FDOT District Noise Specialist is required to identify reasonable use data before proceeding with the noise barrier analysis. One possible solution to this issue could be to count the number of parking spaces at the facility, assume an appropriate number of occupants per vehicle, and discuss with the District Noise Specialist to identify reasonable hourly usage data**.** Otherwise, an alternative method of identifying usage data should be identified, in coordination with the FDOT District Noise Specialist. All usage assumptions should be documented in the project file and in the NSR/NSRA.

### SLU Worksheet

The **FDOT SLU Worksheet[[11]](#footnote-11)** can be utilized to assist with the assessment of whether a noise barrier is a reasonable and feasible form of abatement for an area which has one or more SLUs[[12]](#footnote-12). The **SLU Worksheet** can also be used to “back-into” or “back-calculate” whether a barrier would be cost reasonable and estimate the required usage. A separate **SLU Worksheet** should be filled out for each noise barrier/noise barrier system. The **SLU Worksheet** should only contain SLUs which the barrier/barrier system is being evaluated for. If multiple barriers/barrier systems are evaluated in a project, multiple **SLU Worksheets** should be utilized. The **SLU Worksheet** has three main components: the **Preliminary Screening** (discussed in **Section 3.2**), the **Noise Barrier Master Table** (shown in **Figure 8**) and the **SLU Tabs** (shown in **Figure 9;** ex. SLU #1, SLU #2, etc.). The **Noise Barrier Master Table** identifies the noise barrier details and summarizes important metrics for determining if a noise barrier/noise barrier system is reasonable and/or feasible which are based upon data in the **SLU Tabs**. The **SLU Tabs** identify usage data of each SLU that the noise barrier/noise barrier system is being evaluated for. All SLUs which receive a benefit from the noise barrier/noise barrier system should have a corresponding **SLU Tab** filled out. However, if the noise barrier is reasonable and feasible for an adjacent residential area, and the SLU would receive a benefit from the barrier, usage of the SLU is not required for determining cost reasonableness (although still required during Design Phase when community input is solicited), as the residential area already qualifies for a noise barrier. The Noise Analyst should fill out all applicable data and insert the completed **Noise Barrier Master Table** into the report.

The **FDOT SLU Worksheet** can be completed by taking the following Steps:

1. **STEP 1 -** Click on the **Noise Barrier Master Table** tab. Fill out the yellow highlighted cells: Project name, FPID, 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/or XY coordinates) and the number of residences provided a benefit (if any), and the Average and Maximum reduction received at any receptor evaluated for the noise barrier (including residences and SLUs).
2. **STEP 2 -** For each SLU evaluated, fill out the yellow highlighted cells in an **SLU Tab**. 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.
3. **STEP 3 -** If an SLU's usage is unknown, **Columns AF** and **AG** of the **Noise Barrier Master Table** can be used as a “Back-in” calculation to identify the minimum usage required for the noise barrier to be cost reasonable. These columns identify the additional Benefited Equivalent Residences (BER) (or residences) and the additional person-hours per day that are required for a noise barrier to be cost reasonable, respectively.
4. **STEP 4 -** Once all SLUs being evaluated have an **SLU tab** with all relevant information filled out, the **Noise Barrier Master Table** summarizes data from each of the **SLU Tabs** and will auto-populate. The Noise Barrier Master Table can be copied into the report.



Figure 8 SLU Worksheet: Noise Barrier Master Table



Figure 9 SLU Worksheet: SLU Tabs

#### Noise Barrier Details

For each noise barrier height evaluated, the location (ROW, shoulder, or structure), height and length of the noise barrier should be filled in **Columns D, E and F** of the **Noise Barrier Master Table**. If a noise barrier system (i.e., more than a single noise barrier; e.g., an overlapping right-of-way and shoulder or structure noise barrier which accommodates an overpass) is evaluated, the location of each segment and associated length should be identified (ex., 1,000 ft. ROW, 500 ft. shoulder, and 400 ft. structure). The resulting auto-calculation, shown in **Column G** of the **Noise Barrier Master Table,** is the cost of the proposed noise barrier using the current FDOT cost estimate of $30 per square foot. This cost-per-square-foot can be adjusted in **cell G9.** The noise barrier’s approximate stationing extent (or XY coordinates) should also be filled in **Column H** of the **Noise Barrier Master Table**.

#### Adjacent Benefited Residences

Although a noise barrier is optimized and designed for impacted residences and SLUs, the SLU Worksheet (and therefore cost reasonableness calculation) should include all residences and SLUs which would receive a benefit from the noise barrier. This methodology allows the combined evaluation of both Activity Category B as well as A, C, D, and E together for a single noise barrier system that would potentially provide a benefit to all land use types evaluated. Impacted and benefited residences should be noted in **Column I** of the **Noise Barrier Master Table**. Benefited residences should be noted in **Column J** of the **Noise Barrier Master Table**. These metrics aid in evaluating feasibility factors (see **Section 3.4.1.5**).

Additionally, if a residential area qualifies for a noise barrier on its own merit and the inclusion of an SLU next to a residential neighborhood would result in the noise barrier not being cost reasonable or feasible, the SLU should not be included with the residential noise barrier analysis, and the analysis, in coordination with the FDOT District Noise Specialist, should proceed with further evaluating the noise barrier for the residential area.

#### Residential Person-Hours Per Year

**Step A1** of the **SLU Tab** outlines usage assumptions about the average single-family residence in Florida. To identify the number of person-hours-per-year that a single-family home in Florida has available for use, the average number of people per residence in Florida (2.57 people per residence[[13]](#footnote-13)) was multiplied by the hours available for use per year (24 hours/day x 365 days/year= 8,760 hours) for a total of 22,513 person-hours available for use at each residence.

#### SLU Equivalent Residence

**Step A2** of the **SLU Tab** identifies the person-hour usage at the SLU. The Noise Analyst should fill out usage data in Steps A2a through A2d (**Column I, rows 11-14** of the **SLU Tab**). The spreadsheet will auto-calculate the Person-Hours per year that are available for use at the SLU, as well as the Equivalent Residences (ER; i.e., number of residences that the area evaluated at the SLU can be equated to, based upon hourly usage).

**Step A3** of the **SLU Tab** is an auto-calculation to equate an SLU area to an ER. The ER facilitates a collective cost reasonableness evaluation which incorporates the usage from both residences as well as SLUs by equating to a common denominator.The ER can be identified by dividing the SLU person-hours per year available for use by the residential person-hours per year available for use. To calculate the ER, refer to the formula in **Equation 3**.

$$\left[\left(a × b × c × d\right)÷e \right] = ER$$

Where:
*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 = Residential Person-Hours per year available for use (22,513 person-hours)*

Equation 3 ER Equation

**Step A4** of the **SLU Tab** requires the Noise Analyst to input the number of receptors evaluated at the SLU (**Column I, row 19** of the **SLU Tab**). This includes single, gridded, and linear placed receptors. The spreadsheet will auto-calculate how many residences each receptor is worth to facilitate the calculation of the SLU’s BER.

In the **Barrier Evaluation** section of the SLU Tab, the number of benefited receptors (**Column F, rows 25-48** of the **SLU Tab**)and the number of impacted and benefited receptors (**Column G, rows 25-48** of the **SLU Tab**) should be filled out by the Noise Analyst. These metrics enable the calculation of the percentage of receptors that are benefited in order to identify the BER and the impacted BER. The spreadsheet will auto-calculate the BER and Impacted BER. To calculate the BER, refer to the formula in  **Equation 4**.

Equation 4 BER Equation

$$\left[\left(a × b × c × d\right)÷e \right] × \left(f÷g\right) = BER$$

Where:
*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 = Residential Person-Hours per year available for use (22,513 person-hours)*

*f = Number of benefited receptors evaluated at the SLU*

*g = Total number of receptors evaluated at the SLU*

$$\left[\left(a × b × c × d\right)÷e \right] = ER$$

Where:
*a = Average number of users per day in the area of the SLU evaluated*

*b = Approximate daily hourly usage by each person in the area of the SLU evaluated*

*c = Number of days per week the SLU is operational*

*d = Number of weeks per year the SLU is operational*

*e = Residential Person-Hours per year available for use*

#### Feasibility Factors

The Noise Analyst should identify the total number of benefited residences (**Column I** of the **Noise Barrier Master Table**) and the number of impacted benefited residences (**Column J** of the **Noise Barrier Master Table**). **Column Y** of the **Noise Barrier Master Table** adds the total number of impacted benefited residences and impacted BERs. A noise barrier must provide a benefit to at least two (2) residences[[14]](#footnote-14) and/or BERs. If a noise barrier does not provide a benefit to at least two residences and/or BERs, the noise barrier is not considered a feasible form of noise abatement.

#### Reasonableness Factors

##### Noise Reduction Design Goal

The Noise Analyst should identify the maximum reduction that any receptor (residential or SLU) receives from the noise barrier (**Column AB** of the **Noise Barrier Master Table**), which identifies whether the NRDG has been met by the noise barrier. If this value is at, or over 7 dB(A), the NRDG has been met. If the maximum reduction is below 7 dB(A), the NRDG has not been met by the noise barrier, and the impacted noise sensitive sites do not qualify for a noise barrier.

##### Cost Reasonableness

**Column AC** of the **Noise Barrier Master Table** of the SLU Worksheetis an auto-calculation of the cost per BER. This step divides the cost of the proposed noise barrier by the total number of SLU BERs and benefited residences. The worksheet then determines if the cost per benefited residence (and/or BER) is less than the current FDOT threshold of $42,000. Note that this criteria can be adjusted in cell **AD9** of the **Noise Barrier Master Table**. If the cost per benefited residence (and/or BER) is less than $42,000 (or the specified FDOT approved criteria), the proposed noise barrier is considered cost reasonable, and the **SLU Tab** should be provided in the NSR/NSRA.

If the cost per benefited residence (and/or BER) is greater than $42,000 (or specified FDOT approved criteria), the proposed noise barrier is considered not cost reasonable, the analysis is complete, and the **SLU Tab** should be provided in the NSR/NSRA.

##### SLU Weighted Residential Vote Value

After a noise barrier is determined to be cost reasonable, the benefited SLU and residential property owners will be solicited for their desire for or against a noise barrier (see **Section 3.6**). The number of residential votes that an SLU is equivalent to is the Benefited Equivalent Residence (BER) rounded up (e.g., a BER of 2.3 should be rounded up to 3 residences). This is auto-calculated in **Step A5** (**column I**) of each **SLU Tab**.

## Step 5: Engineering Review (After PD&E Phase) - Feasibility (Part 2)

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

During the Design phase (or Design-Build), once an optimal barrier height and length have been chosen, a thorough engineering feasibility review of the barrier should be conducted and approval of the engineering feasibility review shall be received by the FDOT, consistent with Part 2, Chapter 18 of the PD&E Manual (*Highway Traffic Noise)* and 23 CFR Part 772 and the FDOT Design Manual to ensure the recommended barrier can be constructed as planned, or if further refinements are necessary before proceeding with the noise barrier specific public involvement. This process is represented in **Figure 10**.

Figure 10 Step 5: Engineering Review

## Step 6: Public Involvement - Reasonableness (Part 3)

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

1. Public Information Meetings
2. Public Hearings
3. Identifying the number of users at an SLU by coordinating with the SLU owner
4. Determining the SLU’s support for/opposition to a noise barrier.

All engineering conflicts must be resolved before an SLU property owner is solicited for their desire for/opposition to a noise barrier.

Following guidance from FDOT’s *Traffic Noise Modeling & Analysis Practitioner’s Handbook* (December 2018),

*Public involvement is an important aspect of any transportation improvement project. Any public involvement activities that take place as part of the project should be documented in the NSR or NSR Addendum. At a minimum, the NSR shall describe the nature of the events that took place (workshop or hearing, date, location, time, etc.) and note whether any traffic noise related issues were raised by the public that were related to the project in question. If written comments are received regarding noise or vibration issues, they should be included as an appendix to the NSR or NSR Addendum.*

*As discussed in the following section, the details of noise barrier specific public involvement with individual communities should be documented, including an appendix containing copies of materials sent to property owners when gathering a community consensus regarding potential noise abatement options.*

### PD&E Study Public involvement

Following guidance from FDOT’s *Traffic Noise Modeling & Analysis Practitioner’s Handbook* (December 2018),

*Public involvement during a PD&E study typically contains two major events; a public workshop (sometimes also referred to as an “alternatives public workshop”), and a public hearing for the project. At the public workshop, the noise analyst should discuss noise sensitive sites within the project corridor. The discussion should include description of the analysis procedures and the potential for traffic noise impacts utilizing generalized noise contours.*

*At the public hearing for the project, the noise analyst should be prepared to discuss site specific results of the noise study, including the location of impacted receptors and the potential for further noise abatement consideration during the design phase, if applicable. A draft NSR should be available at the public hearing.*

### Design Phase Public Involvement

Following guidance from FDOT’s *Traffic Noise Modeling & Analysis Practitioner’s Handbook (December 2018)*,

*Prior to initiating noise barrier related public involvement during the design phase, the optimal barrier length and height should be established and any engineering/ constructability issues should be identified and resolved.*

*Noise barrier specific public involvement includes informational meetings and written surveys to affected property owners and tenants. Additionally, door-to-door and telephone solicitations are necessary if insufficient responses are received from a written survey. As stipulated in the PD&E Manual, it is the FDOT’s desire to obtain a response for or against a noise barrier from the majority of the benefitted property owners and tenants that respond to the survey.*

*The following provides examples of the type of written correspondence prepared by the FDOT and provided to property owners and tenants in connection with a noise barrier survey:*

* *Notification Letter: The notification letter alerts the property owner(s)/tenants of the FDOT’s intent and also informs them that further information is forthcoming. This letter is mailed using regular (non-certified) mail services. The letters are mailed to the address of the property of interest and to the property owner’s address, if different than the property of interest. Property ownership information can be obtained from the property appraiser’s office/website for the county in which the project is located. If a noise barrier specific informational meeting is being held; date, time, and location details are also provided in this letter.*
* *Noise Barrier Survey Package: This package should include a certified letter from the FDOT describing the roadway improvement project and the noise barrier(s) of interest, an exhibit illustrating the proposed location of a barrier(s), information regarding the advantages and disadvantages of noise barriers, color and texture options (if applicable), and a noise barrier survey form. The address of the property being surveyed and the registered property owner’s name(s) should be shown on this form. It is recommended that each survey be individually numbered for easier tracking once they are returned.*

*Copies of all design-phase traffic noise related public involvement materials should be provided as an Appendix in the NSR Addendum to properly document survey efforts.*

It is important to note that the viewpoints of the property owner will be considered as having the greatest weight in the decision as to whether FDOT will provide noise abatement. While the viewpoint of the non-owner resident will be considered, their viewpoint will carry less weight, consistent with the formula shown in **Table 7**.

Table 6 Viewpoint Weighting Factors

|  |  |  |
| --- | --- | --- |
| **Property Type** | **Owner Occupies 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).

Consistent with Part 2, Chapter 18 of the PD&E Manual (Highway Traffic Noise), in the event that some benefited SLU property owners and residents’ desire noise abatement and others do not, further assessment may be necessary in order to determine what impact, if any, this will have on the feasibility and reasonableness as well as the social impacts. Consultation with FDOT’s Office of Environmental Management (OEM) may be needed. Documentation of noise abatement measures developed during the final design should include letters, public hearing transcripts, and survey results. indicating that the benefited property owners or residents were afforded an opportunity to provide input.

## Step 7: Documentation

In addition to the guidance provided in Part 2, Chapter 18 of the PD&E Manual (*Highway Traffic Noise)*, the noise barrier types, lengths and heights evaluated, and the evaluation results must be documented in the NSR/NSRA. 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 and provided in the NSR/NSRA. An example table is provided in **Table 8**.

Additionally, all impacted SLUs which pass the preliminary screening (**Section 3.2**) must have the **SLU Tab** from the **SLU Worksheet** completed and provided in the NSR/NSRA.

Table 7 Noise Barrier Evaluation for [INSERT SLU NAMES] (EXAMPLE)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Barrier Scenario** | **Barrier Location** | **Barrier Height** | **Barrier Length1** | **Barrier total cost2** | **Approximate Barrier XY Extent (Stationing)** | **Residences** | **Special Land Uses** | **Total Impacted and Benefited Residences and Equivalent Residences3** | **Total Benefited Residences and Equivalent Residences** | **Average Reduction [(dB(A)]** | **Maximum Reduction [(dB(A)]4** | **Cost per Benefited Residence/****Equivalent Residence** | **Cost Reasonable?** |
| **Impacted and Benefited** | **Benefited**  | **Impacted and Benefited Equivalent Residences** | **Benefited Equivalent Residences** |
| 1 | Shoulder | 8 | 2,500 | $648,000 |  | 19 | 15 | 1 | 1 | 16 | 20 | 7.5 | 9 | $32,400 | Yes |
| Structure | 8 | 200 |
| 2 | Shoulder | 10 | 2,400 | $768,000 |  | 20 | 15 | 1 | 1 | 16 | 21 | 8.0 | 10 | $36,571 | Yes |
| Structure | 8 | 200 |
| 3 | Shoulder | 12 | 2,200 | $840,000 |  | 21 | 15 | 1 | 1 | 16 | 22 | 8.5 | 11 | $38,182 | Yes |
| Structure | 8 | 200 |
| 4 | Shoulder | 14 | 2,200 | $972,000 |  | 22 | 15 | 1 | 1 | 16 | 23 | 9.0 | 12 | $42,261 | No |
| Structure | 8 | 200 |

1Barrier length refers to the total length at the ROW, Shoulder, or on Structure. Length indicated does not include the length of any required taper in height at a shoulder noise barrier termination.

2Assumes $30 per square foot.

3If total Impacted BER is less than 2, the noise barrier is not considered feasible.

4Maximum 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.

Table 8 Reasonable and Feasible Noise Barriers (EXAMPLE)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Barrier ID** | **Common Noise Environments** | **Barrier Location** | **Barrier Height** | **Barrier Length1** | **Barrier total cost2** | **Approximate Barrier XY Extent (Stationing)** | **Residences** | **SLUs** | **Total Impacted and Benefited Residences and Equivalent Residences3** | **Total Benefited Residences and Equivalent Residences** | **Cost per Benefited Residence/****Equivalent Residence** | **Cost Reasonable?** |
| **Impacted & Benefited Residences** | **Benefited Residences** | **Impacted & Benefited SLUs (ER)** | **Benefited SLUs (ER)** |
| 1 | ABC Neighborhood, ABC Daycare | ROW | 22 | 2,102 | $1,551,480 |  | 36 | 36 | 1 | 1 | 37 | 37 | $36,940 | Yes |
| Shoulder | 8 | 684 |
| 2 | XYZ Neighborhood, XYZ School | Shoulder | 14 | 1,573 | $708,660 |  | 20 | 25 | 1 | 1 | 26 | 26 | $35,433 | Yes |
| Structure | 8 | 200 |
| 3 | DEF Park, DEF Neighborhood | ROW | 22 | 3,475 | $2,293,500 |  | 120 | 130 | 1 | 1 | 121 | 131 | $17,508 | Yes |
| Totals | ------ | ------ | ------ | ------ |  | ------ |  |  |  |  |  |  | ------ | ------ |

1Barrier length refers to the total length at the ROW, Shoulder, or on Structure. Length indicated does not include the length of any required taper in height at a shoulder noise barrier termination.

2Assumes $30 per square foot.

3If total Impacted BER is less than 2, the noise barrier is not considered feasible.

# Conclusions

The FDOT’s guidance on how to assess SLUs in Florida for highway traffic noise, *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations*, was developed in 2009. Since its development, changes in federal regulations have occurred and shortcomings have been identified. Additionally, potential improvements to the methodology have been suggested by highway traffic noise specialists around the state. Therefore, this methodology document provides updated guidance on how to assess traffic noise for SLUs and replaces *A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Land Use Locations* (FDOT, 2009). An Equivalent Receptor methodology has been provided which allows for the combined evaluation of both residential and non-residential noise sensitive land uses. The methodology follows the current 23 CFR Part 772 regulation and the Part 2, Chapter 18 of the PD&E Manual (*Highway Traffic Noise)*.

In circumstances not outlined by this guidance document, Noise Analysts should coordinate with the District Noise Analyst and the FDOT OEM.

# References

23 CFR Part 772, *"Procedures for Abatement of Highway Traffic Noise and Construction Noise"*, Federal Register, Vol. 75, No. 133, Tuesday, July 13, 2010; pages 39834‐39839.

FDOT, “A Method to Determine Reasonableness and Feasibility of Noise Abatement at Special Use Locations”, July 2009. 64 pages.

FDOT, *"Highway Traffic Noise"*, Part 2, Chapter 18. Project Development and Environment Manual, FDOT, Tallahassee, July 1, 2020.

FDOT, “FDOT Traffic Noise Modeling & Analysis Practitioners Handbook”, December 31, 2018. <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/environment/pubs/final-practitioners-handbook---december-2018-version.pdf?sfvrsn=95bb91d6_2>

Federal Highway Administration, Report FHWA‐HEP‐10‐025, *“Highway Traffic Noise: Analysis and Abatement Guidance”*, December 2011; 75 pages.

# Appendix A

Links to State Noise Policies

| State | Resource Type | Link |
| --- | --- | --- |
| Alabama | ALDOT Special Programs, Projects and Policy Webpage | <https://www.dot.state.al.us/dsweb/divPed/EnvironmentalCoordination/SpecialProgramsProjects.html> |
| ALDOT Highway Traffic Noise Analysis and Abatement Policy and Guidance Document | <https://www.dot.state.al.us/dsweb/divPed/EnvironmentalCoordination/pdf/ALDOTNoisePolicy.pdf> |
| Alaska | AKDOT Statewide Environmental Office Webpage | <http://dot.alaska.gov/stwddes/desenviron/resources/noise.shtml> |
| AKDOT&PF Noise Policy Document | <http://dot.alaska.gov/stwddes/desenviron/assets/pdf/resources/aknoisepolicy_18.pdf>  |
| Arizona | ADOT Noise Webpage | <https://azdot.gov/business/environmental-planning/noise> |
| ADOT Noise Abatement Requirements Document | <https://azdot.gov/sites/default/files/2019/06/noise-abatement-requirements-may2017.pdf>  |
| Arkansas | ARDOT Policy on Highway Traffic Noise Abatement Document | <https://www.arkansashighways.com/environmental/ARDOT%20Noise%20Policy%202018.pdf> |
| California | Caltrans Noise and Vibration Webpage | <https://dot.ca.gov/programs/environmental-analysis/noise-vibration> |
| Caltrans Traffic Noise Analysis Protocol Document | <https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/traffic-noise-protocol-april-2020-a11y.pdf>  |
| Colorado | CODOT Noise Program Webpage | <https://www.codot.gov/programs/environmental/noise>  |
| CODOT Noise Analysis and Abatement Guidelines Document | <https://www.codot.gov/programs/environmental/noise/assets/cdot-naag-9-21-20.pdf>  |
| Connecticut | CTDOT Water & Noise Compliance Webpage | <https://portal.ct.gov/DOT/PP_Envir/Water_Natural_Resources/WaterNoiseCompliance> |
| CTDOT Highway Traffic Noise Abatement Policy Document | <https://portal.ct.gov/-/media/DOT/documents/dpolicy/WaterNoiseCompliance/GeneralInformation/May2017CTNoisePolicypdf.pdf>  |
| Delaware | DELDOT Highway Noise Abatement Webpage | <https://deldot.gov/Programs/highway_noise/index.shtml> |
| DELDOT Noise Policy Document | <https://deldot.gov/Publications/manuals/policies/pdfs/d03_transportation_noise.pdf?cache=1604938461964>  |
| Florida | FDOT PD&E Manual Part 2, Chapter 18, Highway Traffic Noise Document | <https://www.fdot.gov/docs/default-source/environment/pubs/pdeman/current/Pt2Ch18_061417-current.pdf> |
| Georgia | GDOT Air and Noise Webpage | <https://www.dot.ga.gov/PS/EnvironmentalProcedures/AirandNoise> |
| GDOT Noise – Assessing Impacts Document | <http://www.dot.ga.gov/PartnerSmart/EnvironmentalProcedures/Noise/Noise%20-%20Assessing%20Impacts.pdf>  |
| GDOT Noise Wall Public Outreach Document | <http://www.dot.ga.gov/PartnerSmart/EnvironmentalProcedures/Noise/Noise%20-%20Noise%20Wall%20Public%20Outreach.pdf>  |
| Hawaii | HIDOT Highways Noise Policy and Abatement Guidelines Document | <https://hidot.hawaii.gov/highways/files/2016/06/hwy_l-2016-Noise-Policy-and-Approval-Letter.pdf> |
| Idaho | Idaho Transportation Department, Section 1300 - Traffic Noise Document | <https://apps.itd.idaho.gov/Apps/env/manual/1300.pdf> |
| Illinois | IDOT Environment Webpage | <http://www.idot.illinois.gov/transportation-system/environment/index> |
| IDOT Highway Traffic Noise Assessment Manual Document | [http://www.idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Guides-&-Handbooks/Highways/Design-and-Environment/Environment/Highway%20Traffic%20Noise%20Assessment%20Manual%202017.pdf](http://www.idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Guides-%26-Handbooks/Highways/Design-and-Environment/Environment/Highway%20Traffic%20Noise%20Assessment%20Manual%202017.pdf)  |
| Indiana | INDOT Environmental Policy Webpage | <https://www.in.gov/indot/2523.htm> |
| INDOT Traffic Noise Analysis Procedure Document | <https://www.in.gov/indot/files/2017%20INDOT%20Noise%20Policy.pdf>  |
| Iowa | Iowa DOT Noise Webpage | [https://iowadot.gov/ole/Noise-Air-Vibration/Noise#:~:text=The%20Iowa%20DOT%20does%20noise,could%20have%20a%20noise%20impact.&text=If%20we%20think%20there%20might,come%20up%20with%20possible%20solutions](https://iowadot.gov/ole/Noise-Air-Vibration/Noise#:~:text=The%20Iowa%20DOT%20does%20noise,could%20have%20a%20noise%20impact.&text=If%20we%20think%20there%20might,come%20up%20with%20possible%20solutions.) |
| Iowa DOT Office of Location and Environment Manual Document | <https://iowadot.gov/ole/manual/Iowa_DOT_OLE_Manual_090821.pdf>  |
| Kansas | KSDOT Highway Traffic Noise Program Document | <https://www.ksdot.org/PDF_Files/KDOTHighwayTrafficNoiseProgram.pdf> |
| Kentucky | KYTC Noise Webpage | <https://transportation.ky.gov/EnvironmentalAnalysis/Pages/Noise.aspx> |
| Updated KYTC Noise Policy Document | <https://transportation.ky.gov/EnvironmentalAnalysis/Environmental%20Resources/2020%20KYTC%20Noise%20Analysis%20and%20Abatement%20Policy.pdf>  |
| Louisiana | LADOTD Noise Policy Webpage | <http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Environmental/Noise%20Policy/Forms/AllItems.aspx> |
| LADOTD Highway Traffic Noise Policy Document | <http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Environmental/Noise%20Policy/LDOTD%20Noise%20Policy%204_26_2011.pdf>  |
| Maine | MDOT Highway Traffic Noise Policy Document | <https://www.maine.gov/mdot/publications/docs/reports/TrafficNoisePolicy.pdf> |
| Maryland | MDDOT Highway Traffic Noise Analysis Webpage | <https://roads.maryland.gov/mdotsha/pages/index.aspx?PageId=828> |
| MDDOT Highway Noise Abatement Planning and Engineering Guidelines Document | <https://roads.maryland.gov/OHD2/SHA_Noise_Policy.pdf>  |
| Massachusetts | MassDOT Highway Noise Abatement Webpage | <https://www.mass.gov/massdot-highway-noise-abatement> |
| Michigan | MDOT Highway Noise Analysis and Abatement Handbook Document | <https://www.michigan.gov/documents/mdot/MDOT_HighwayNoiseAnalysis_and_AbatementHandbook_358156_7.pdf> |
| Minnesota | MnDOT Noise Analysis Webpage | <https://www.dot.state.mn.us/environment/noise/index.html> |
| MnDOT Noise Requirements for MnDOT and other Type I Federal-aid Projects Document | <https://www.dot.state.mn.us/environment/noise/pdf/2017-noise-requirements.pdf>  |
| Mississippi | MSDOT Port Bienville Railroad Draft EIS Appendix D: Noise Vibration Report Document | <https://mdot.ms.gov/documents/Environmental/Projects/Port%20Bienville%20Railroad%20Environmental%20Impact%20Statement/05%20Appendix%20D%20-%20Noise-Vibration%20Report.pdf> |
| Missouri | MODOT Noise Assessment Webpage | <https://www.modot.org/noise-assessment> |
| MODOT Engineering Policy Guide - 127.13 Noise Webpage | <https://epg.modot.org/index.php?title=127.13_Noise>  |
| Montana | MDT Air Noise Webpage | <https://www.mdt.mt.gov/business/contracting/environmental/air_noise.shtml> |
| MDT Traffic Noise Analysis and Abatement Policy Document | <https://www.mdt.mt.gov/business/contracting/docs/MDT-Noise-Policy.pdf>  |
| Nebraska | NDOT Noise & Air Webpage | <https://dot.nebraska.gov/projects/environment/noise-air/> |
| NDOT Noise Analysis Guidance Manual Document | <https://dot.nebraska.gov/media/12080/ndot_noise_manual.pdf>  |
| Nevada | Nevada DOT Documents and Publications Webpage | <https://www.nevadadot.com/doing-business/documents-and-publications> |
| Nevada DOT Traffic and Construction Noise Analysis and Abatement Policy Document | <https://www.nevadadot.com/Home/ShowDocument?id=14255>  |
| New Hampshire | NHDOT Noise Barrier Program Document | <http://www.everettturnpikewidening.com/documents/NHDOT%20Noise%20Barrier%20Programs.pdf> |
| New Jersey | NJDOT Traffic Noise Management Policy and Noise Wall Design Guidelines Document | <https://www.nj.gov/transportation/eng/documents/env/pdf/TrafficNoisePolicy.pdf> |
| New Mexico | NMDOT Procedures for Abatement of Highway Traffic Noise and Construction Noise Document | <https://dot.state.nm.us/content/dam/nmdot/Plans_Specs_Estimates/Design_Directives/2011/IDD-2011-02.pdf> |
| New York | NYDOT Noise Analysis Policy and Procedures Document | <https://www.dot.ny.gov/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/4_4_18Noise.pdf>  |
| North Carolina | NCDOT Regulations & Policies Webpage | <https://www.ncdot.gov/initiatives-policies/environmental/reducing-noise-pollution/Pages/regulations-policies.aspx> |
| NCDOT Traffic Noise Manual Document | <https://connect.ncdot.gov/resources/Environmental/PDEA%20Procedures%20Manual%20Documents/2016%20NCDOT%20Traffic%20Noise%20Manual.pdf>  |
| North Dakota | NDDOT Highway Traffic Noise Information Webpage | [https://www.dot.nd.gov/divisions/environmental/noise.htm#](https://www.dot.nd.gov/divisions/environmental/noise.htm) |
| NDDOT Noise Policy and Guidance Document | [https://www.dot.nd.gov/manuals/design/designmanual/wordfiles\_design/NDDOT%20Noise%20Policy%20and%20Guidance%20(2011).pdf](https://www.dot.nd.gov/manuals/design/designmanual/wordfiles_design/NDDOT%20Noise%20Policy%20and%20Guidance%20%282011%29.pdf)  |
| Ohio | OHDOT Noise Webpage | <http://www.dot.state.oh.us/Divisions/Planning/Environment/NEPA_policy_issues/NOISE/Lists/Noise%20FAQs/default.aspx>  |
| OHDOT’s April 2015 Noise Manual Updates Document | <http://www.dot.state.oh.us/Divisions/Planning/Environment/manuals_guidance/Documents/Noise/Noise%20Manual%202015/Noise%20Manual%202015.pdf>  |
| Oklahoma | ODOT Highway Noise Abatement Document | <https://www.odot.org/env-programs/pdfs/CE%20Scope%20Package%20for%20Local%20Government%20Projects%20Rev.%2012-2-13.pdf> |
| Oregon | ORDOT Environmental Webpage | <https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Environmental.aspx> |
| ORDOT Acoustics Webpage | <https://www.oregon.gov/odot/GeoEnvironmental/Pages/Acoustics.aspx>  |
| ORDOT Noise Manual Document | <https://www.oregon.gov/odot/GeoEnvironmental/Docs_Environmental/Noise-Manual1.pdf>  |
| Pennsylvania | PennDOT Highway Traffic Noise Webpage | <https://www.penndot.gov/ProjectAndPrograms/RoadDesignEnvironment/Environment/environmental-policy/Pages/Noise.aspx> |
| PennDOT Project Level Highway Traffic Noise Handbook Document | <https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%2024.pdf>  |
| Rhode Island |  N/A |
| South Carolina | SCDOT Traffic Noise Abatement Policy Document | <https://www.scdot.org/business/pdf/EnvToolShed/TrafficNoise/SCDOT_Traffic_Noise_Policy_Rev_10Oct2019.pdf> |
| South Dakota | SDDOT Environmental Procedures Manual Document | <https://dot.sd.gov/media/documents/EnvironmentalProceduresManual.pdf> |
| SDDOT Noise Analysis and Abatement Guidance Document | <https://dot.sd.gov/media/documents/FinalNoiseAnalysisandAbatementGuidance071311.pdf>  |
| Tennessee | TDOT Air Quality and Noise Webpage | <https://www.tn.gov/tdot/environmental-home/environmental-technical-studies-office/transportation-environmental-air-noise.html> |
| TDOT Policy on Highway Traffic Noise Abatement Document | <https://www.tn.gov/content/dam/tn/tdot/documents/Signed_and_Approved_TDOT_Policy_on_Highway_Traffic_Noise_Abatement_July_13_2011.pdf>  |
| Texas | TxDOT Traffic Noise Toolkit Webpage | <https://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/traffic-noise.html> |
| TxDOT Traffic Noise Policy Implementation Guidance Document | <https://ftp.txdot.gov/pub/txdot-info/env/toolkit/730-05-gui.pdf> |
| Utah | UDOT Noise Walls Webpage (See Noise Abatement Document Link on webpage)  | <https://www.udot.utah.gov/connect/public/noise-walls/> |
| Vermont | VTrans Noise Webpage | <https://vtrans.vermont.gov/environmental-manual/permitting/other/noise> |
| VTrans Noise Analysis and Abatement Policy Document | <https://vtrans.vermont.gov/sites/aot/files/enviromanual/documents/Noise%20Policy%202011%20Approved.pdf> |
| Virginia | VDOT Noise Barrier Walls Webpage | <http://www.virginiadot.org/projects/pr-noise-walls-about.asp> |
| VDOT Highway Traffic Noise Impact Analysis Guidance Manual Document | <http://www.virginiadot.org/projects/resources/noisewalls/Highway_Traffic_Noise_Impact_Analysis_Guidance_Manual_v8.pdf> |
| Washington | WSDOT Noise Policies and Procedures Webpage | <https://wsdot.wa.gov/environment/technical/disciplines/air-quality-noise-energy/policies> |
| WSDOT Noise Policy Document | <https://wsdot.wa.gov/sites/default/files/2020/03/10/ENV-ANE-NoisePolicy2020.pdf> |
| West Virginia | WVDOT Design Directives Webpage (see Design Directives / Highway Traffic Noise Policy Document (2011)) | [https://transportation.wv.gov/highways/engineering/Pages/Design-Directives.aspx](https://transportation.wv.gov/highways/engineering/DD/2014%20DD%20Manual%20MASTER.pdf)  |
| Wisconsin | WisDOT Sound Quality Webpage | <https://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/environment/sound-quality.aspx> |
| WisDOT Facilities Development Manual - Chapter 23 Noise, Section 35 Noise Abatement Measures Document | [https://wisconsindot.gov/rdwy/fdm/fd-23-35.pdf#fd23-35](https://wisconsindot.gov/rdwy/fdm/fd-23-35.pdf#fd23-35 )  |
| Wyoming | WYDOT Noise Analysis and Abatement Policy Document | <http://www.dot.state.wy.us/files/live/sites/wydot/files/shared/Environmental_Services/Documents/2011%20Noise%20Analysis%20and%20Abatement%20Policy.pdf> |

1. Major changes to the noise regulations were made on July 13, 2010, with an effective date of July 13, 2011. [↑](#footnote-ref-1)
2. Additional exterior and interior land use criteria and types which were added include: amphitheaters, auditorium, campgrounds, cemeteries, day care centers, medical facilities, public meeting rooms, Public/nonprofit institutional structures, radio studios, recording studios, Section 4(f) sites, TV Studios, Trails/trail crossings, offices, and restaurants/bars. Additional interior land use criteria which were added include: day care centers, medical facilities, public/nonprofit institutional structures, radio studios, recording studios, and TV Studios. [↑](#footnote-ref-2)
3. The exterior criteria for hotels and motels changed from 66 dB(A) to 71 dB(A). [↑](#footnote-ref-3)
4. The interior criteria for residences, motels, and hotels was removed. [↑](#footnote-ref-4)
5. Notably, this methodology does not conflict with 23 CFR 772.13(k) which states that FDOT, “has the option to cost average noise abatement among benefited receptors within common noise environments if no single common noise environment exceeds two times the highway agency's cost reasonableness criteria and collectively all common noise environments being averaged do not exceed the highway agency's cost reasonableness criteria.”, as this methodology combines CNEs. [↑](#footnote-ref-5)
6. The receptor’s full ID may contain an identifier which identifies the side of the roadway the receptor is on and the Noise Sensitive area identifier, as described in the *FDOT Traffic Modeling and analysis Practitioner’s Handbook* (2018). [↑](#footnote-ref-6)
7. The FDOT *Traffic Noise Modeling and Analysis Practitioner’s Handbook* (2018) states, “To distinguish receptors located on the first and second floors, additional letters shall be assigned to the receptor ID. In the example above, the ID’s for receptors on the first and second floor would be “3-W-23A” and “3-W-23B”, respectively. Regardless of the specific labeling convention that is used, the NSR/NSRA should describe the convention used.” [↑](#footnote-ref-7)
8. The FDOT SLU Worksheet is downloadable from the FDOT Website. [↑](#footnote-ref-8)
9. The assumption that 2.57 persons utilize the average single-family home in Florida was obtained from the Florida Census data from 2017-2021 (). It should be assumed that each single-family home is available for use 24 hours a day, 7 days a week, 365 days a year. This decision was based upon the fact that working, sleeping, and outdoor activities can be done at all hours of the day. [↑](#footnote-ref-9)
10. Note that during a PD&E phase project, the SLU property owner is not typically contacted. Coordination and approval from the FDOT District Noise Specialist is required to reach out to an SLU property owner during the PD&E phase. [↑](#footnote-ref-10)
11. The FDOT SLU Worksheet is downloadable from the FDOT Website. [↑](#footnote-ref-11)
12. Note that the spreadsheet does not assist with the optimization of the noise barrier in TNM. Optimization must be performed separately. The resulting optimized heights/lengths should be documented in the SLU Worksheet. [↑](#footnote-ref-12)
13. The assumption that 2.57 persons utilize the average single-family home in Florida was obtained from the Florida Census data from 2017-2021 (<https://www.census.gov/quickfacts/fact/table/FL/HSD310220>). It should be assumed that each single-family home is available for use 24 hours a day, 7 days a week, 365 days a year. This decision was based upon the fact that working, sleeping, and outdoor activities can be done at all hours of the day. [↑](#footnote-ref-13)
14. Consistent with the FDOT PD&E Manual, Chapter 18, Section 18.2.3.2.1 [↑](#footnote-ref-14)