

## Chapter 32

### Noise Barriers

32.1	General Requirements .....	32-1
32.2	Noise Study Report Addendum.....	32-4
32.3	Noise Abatement Criteria .....	32-5
32.4	Public Involvement .....	32-9
32.5	Final Noise Abatement Commitments.....	32-11
32.6	Structural Design.....	32-12
32.7	Geotechnical Investigation .....	32-13
32.8	Preparation of Control Drawings .....	32-14
32.9	Detail Drawings .....	32-15

#### Tables

Table 32.1	Noise Abatement Criteria .....	32-8
------------	--------------------------------	------

**THIS PAGE LEFT BLANK INTENTIONALLY**

## Chapter 32

### Noise Barriers

#### 32.1 General Requirements

**Chapter 23 of the Code of Federal Regulations Part 772 (23 CFR 772) entitled “Procedures for Abatement of Highway Traffic Noise and Construction Noise”** contains the federal regulations for the assessment of traffic noise impacts and abatement on federal aid projects. **Chapter 335.17 of the Florida Statutes** requires the use of **23 CFR 772** for traffic noise impact assessment on highway projects, regardless of funding. **Policy No. 000-360-005, Noise Abatement** contains the policy for abatement of traffic noise on Department projects. The requirements for assessing the noise impacts and abatement commitments are detailed in **Part 2, Chapter 17 of the Project Development and Environmental Manual (PD&E Manual) (Topic No. 650-000-001)**. The initial evaluation of noise impacts is made during the Project Development and Environmental (PD&E) phase of a project. Any preliminary commitments to provide reasonable and feasible noise abatement measures on a project are included in the Noise Study Report (NSR) and summarized in the environmental document. The environmental documents and any subsequent re-evaluations shall be reviewed to identify all preliminary noise abatement commitments.

Preliminary noise abatement commitments made during the PD&E phase are subject to change due to refinements during final design. Designers must consider final roadway grades and horizontal alignments, land use changes, as well as ground elevation at noise barrier locations. Noise abatement identified as reasonable and feasible during the PD&E phase need to be reassessed against the final roadway features. The typical PD&E phase assumptions are appropriate for reasonableness and feasibility decisions but the final design must utilize location specific data that reflects proposed vertical and horizontal locations of the travel lanes and noise barriers. The noise specialist shall provide the top of wall elevation for both minimum and desirable insertion reductions as described below. The designer shall coordinate with the noise specialist in the District Environmental Management Office to ensure proper analysis and public involvement occurs during final design.

**Modification for Non-Conventional Projects:**

Delete the above paragraph and replace with the following:

See the RFP for noise barrier requirements. On projects that require noise barriers, an Alternative Technical Concept is required for all proposed changes to the horizontal or vertical roadway alignments depicted in the Concept Plans. Any modifications/additions to noise barrier location and height requirements depicted in the RFP shall be assessed by the Department based on the information provided by the design-build firm and are subject to Department approval. Reassessment of the noise study shall be performed by the Department as necessary. The Design-Build Firm shall coordinate with the noise specialist in the District Environmental Management Office to ensure proper public involvement occurs during final design.

If no noise abatement is identified in the environmental document or any subsequent environmental re-evaluations, no further effort is required during final design. However, it may still be necessary to evaluate construction noise and vibration impacts and develop any special provisions to be included in the plans.

**Modification for Non-Conventional Projects:**

Delete the above paragraph and replace with the following:

If noise walls are not specified in the RFP, no further effort is required during final design. However, it may still be necessary to evaluate construction noise and vibration impacts and develop any special provisions to be included in the plans.

Upon review of the environmental documents the designer and the noise specialist should identify the noise receptors considered during the noise impact assessment performed in PD&E. Noise receptors resulting from development completed after the approval date of the environmental documents should not be considered as the Department is not responsible for providing noise abatement at these sites. A detailed design reassessment of the preliminary noise abatement commitments should be conducted for the following:

1. Locations of preliminary noise abatement commitments
2. Receptor sites where roadway geometric refinements are likely to change noise impacts

An addendum to the NSR (NSRA) prepared by the District Environmental Management Office during Final Design will document the final noise abatement commitments.

Modification for Non-Conventional Projects:

Delete the above two paragraphs and replace with the following:

Any NSRA prepared during a Design-Build project shall be prepared by the Department.

See RFP for requirements.

## 32.2 Noise Study Report Addendum

The primary effort related to the reassessment of preliminary noise abatement commitments during design is the preparation of an addendum to the NSR. The reassessment shall be based on the final roadway geometry and the proposed noise abatement design, including noise barrier type, location, dimensions and estimated costs. For consistency, the Final Design reassessment should be conducted using the latest version of the FHWA's Traffic Noise Model (TNM).

Noise abatement measures are considered when noise levels at a receptor(s) approach or exceed the noise abatement criteria or substantially exceed existing noise levels. The noise abatement criteria is listed in **Table 32.1**. Approaching the criteria means within 1 dB(A) of the noise abatement criteria. A predicted increase of 15 dB(A) or more is considered substantial. Noise abatement is considered for Activity Categories 'A', 'B', C, D and E only. Preliminary noise abatement commitments are documented in the original NSR.

Modification for Non-Conventional Projects:

Insert the following sentence at the beginning of **Section 32.2**:

The NSRA shall be prepared by the Department.

## 32.3 Noise Abatement Criteria

The insertion loss is the level of noise reduction as a result of abatement. The desirable insertion loss is 10 dB(A) or more; however, the minimum insertion loss should be 5 dB(A) or more for at least two (2) impacted residential receptors to be considered for abatement to be considered reasonable. Additionally, at least one (1) benefited receptor at each noise barrier location must meet the noise reduction design goal of 7 dB(A) or more to be considered reasonable. If a noise barrier can meet the desired insertion loss for a cost of \$42,000 or less per benefited receptor site, the barrier is considered cost reasonable. The statewide average unit cost (per square foot) and the upper limit of the cost per benefited receptor to be used in determining cost reasonableness is established by the Environmental Management Office. As of the printing of this update the statewide average unit cost of noise barriers to be used in the calculation of the cost/benefited receptor is \$30.00/ft<sup>2</sup>. The PD&E manual should be referenced for the latest unit cost update. Additional costs such as required additional right of way, special drainage features, special bridge support and special foundations associated with the installation of a noise barrier should be added to the unit cost if appropriate. If these special features increase the cost per benefited receptor above \$42,000, the decision whether or not to provide a barrier must be made in consultation with the District Environmental Management Office and FHWA (if appropriate). Any decision to eliminate a noise barrier from consideration based on the additional cost of special features will require clear demonstration that the need for such special features are associated only with the noise barrier and cannot be mitigated by other considerations.

If a minimum of 5 dB(A) insertion loss cannot be achieved at a receptor, that receptor is not benefited; therefore, it cannot be considered in the cost effective calculation to determine the reasonableness of that barrier. The noise specialist should thoroughly investigate the scenarios required to meet the desirable insertion loss of 10 dB(A) at \$42,000 or less per benefited receptor particularly where design changes or the consideration of special features require cost or abatement level reanalysis.

Under normal conditions noise barriers shall not exceed the following heights:

1. For ground mounted noise barriers use a maximum height of 22 feet. Noise barriers within the clear zone require shielding.
2. For noise barriers on bridge and wall structures use a maximum height of 8 feet unless a taller barrier is specifically approved in writing by the State Structures Design Engineer.

Modification for Non-Conventional Projects:

Delete condition #2 above and replace with the following:

2. For noise barriers on bridge and wall structures use a maximum height of 8 feet unless otherwise specified in the RFP.

3. For ground mounted Traffic Railing/Noise Barrier combinations use a maximum height of 14 feet.

Use of barrier heights greater than these shall require a Design Variation and project specific designs. Justification for a variation should include, as a minimum, a description of site conditions requiring the increased height and a comparison to the standard height of both insertion loss and cost per benefited receptor.

The noise specialist should provide analytical results to the Department project manager evaluating barrier heights necessary to achieve minimum, desired and optimum insertion loss. The optimum barrier height is the most cost effective in consideration of noise reduction benefits per unit cost of the barrier. An evaluation matrix is suited to this type of comparative analysis. The evaluation matrix should consider an appropriate range of noise barrier configurations (height, length and roadway offset) that provide the desirable insertion loss (10 dB(A)) per impacted receptor and the minimum insertion loss (5 dB(A)) per impacted receptor and the noise reduction design goal of 7 dB(A). The number of benefited receptors should be identified and the cost per benefited receptor calculated for each configuration evaluated. If a noise barrier configuration can provide the desirable insertion loss (10 dB(A)) at a reasonable cost (less than \$42,000 per benefited receptor), then it should be provided. If this is not achievable, the noise specialist should select a noise barrier configuration that optimizes insertion loss per impacted receptor and cost per benefited receptor. The noise specialist should always provide a recommendation with the evaluation. The noise specialist should also coordinate with the District Structures Design Office to ensure that the noise barrier design meets appropriate structural design standards and that construction is feasible and achievable.

The height of the noise barrier is measured from the ground elevation to the top of the barrier. Tall noise barriers are seldom necessary at the top of roadway embankments or berms since the elevation of the embankment contributes to the effective height of the barrier. In addition, changes in the vertical grade of the top of the barrier should be gradual and abrupt changes in barrier heights should be avoided. Often natural ground elevations at the base of the barrier fluctuate, even in flat terrain. Therefore, the designer,



in conjunction with the noise specialist, should provide plan details that make clear to the contractor the final barrier top elevations, foundation step locations and post spacing.

When an otherwise continuous barrier is broken resulting in a horizontal separation between the barriers, it is often necessary to overlap the barriers to reduce insertion loss degradation. Applications of this occur when the mainline barrier is located at the right of way line, but must be moved to the shoulder point at a bridge location. This may also occur at interchanges when transitioning from the mainline to a ramp. The overlap distance of noise barriers is generally equal to four times the separation; however, an analysis by the noise specialist is necessary to determine the optimum overlap. The need or effectiveness of a noise barrier in the infield area of an interchange should be reviewed as well during final design. The attenuation of ramp traffic may provide adequate insertion loss when considering the intersecting roadway's noise contribution. Maintenance access and clear zone must be considered when selecting barrier termini details.

Other noise abatement techniques that may be considered to supplement or replace noise barrier walls are:

1. Traffic management measures (e.g., traffic control devices and signing for prohibition of certain type vehicles, time use restrictions for certain type vehicles, modified speed limits, and exclusive lane designations);
2. Alteration of horizontal and vertical alignments;
3. Acquisition of property rights for construction of noise barriers by donation, purchase or condemnation;
4. Acquisition of the balance of a noise-sensitive property from which there is a taking, if acquisition is less expensive than other methods;
5. Acquisition of real property to create a buffer zone; and
6. Noise insulation of Activity D land uses.

**Table 32.1 Noise Abatement Criteria**

<b>NOISE ABATEMENT CRITERIA</b> [Hourly A-Weighted Sound Level-decibels (dB(A))]				
Activity Category	Activity Leq(h) <sup>1</sup>		Evaluation location	Description of activity category
	FHWA	FDOT		
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B <sup>2</sup>	67	66	Exterior	Residential
C <sup>2</sup>	67	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E <sup>2</sup>	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	–	–	–	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	–	–	–	Undeveloped lands that are not permitted.

*(Based on Table 1 of 23 CFR Part 772)*

<sup>1</sup> The Leq(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

<sup>2</sup> Includes undeveloped lands permitted for this activity category.

*Note:* FDOT defines that a substantial noise increase occurs when the existing noise level is predicted to be exceeded by 15 decibels or more as a result of the transportation improvement project. When this occurs, the requirement for abatement consideration will be followed.

## 32.4 Public Involvement

The identification and design of noise abatement measures during the project design phase will require additional public involvement efforts and will be especially important in the establishment of noise barrier design features such as barrier texture. Public coordination is often necessary to finalize barrier locations, heights and aesthetic features, especially if there are substantial changes to prior commitments. These changes may be the result of any of the considerations noted in **Section 17-4.6** of the **PD&E Manual**. Coordination with the District Public Involvement or Community Liaison Coordinator in obtaining additional input during the final design of the noise barrier is required.

When a barrier is warranted, a written survey shall be conducted to establish whether a numerical majority of the benefited receptors are in favor of the construction of the barrier. If they are not in favor, the Department may choose not to build it. If agreement cannot be reached by a neighborhood on the use of noise barriers, the decision to provide them or not will rest solely with the Department. This survey will usually be conducted during the design phase although it is possible that a survey could be conducted during the PD&E phase. Survey issues should be coordinated with the District Environmental Management Office.

Noise barriers located on arterial roadways can potentially impact access. The ability to construct an effective noise barrier(s) can depend on an individual property owner's willingness to sign a right of way indenture allowing access to be cut off or modified. For these type projects it is general practice to obtain a written statement from each affected property owner demonstrating support for the noise barrier. If an adjacent property owner(s) declines to sign the indenture the noise specialist shall re-evaluate the effectiveness of noise abatement on the project segment considering alternate noise barrier layouts. If insertion loss criteria cannot be met, the noise specialist shall document in the NSR Addendum that the barrier is not feasible.

**F.S. 479.25** "Outdoor Advertising", allows permitted, conforming, lawfully erected outdoor advertising signs to be increased in height if visibility is blocked due to construction of "noise attenuation" barriers. In addition, the amended statute requires the Department to notify a local government or local jurisdiction before erecting a noise barrier that will block a lawfully permitted sign. The local government or local jurisdiction is then required to notify the Department if increasing the height of an outdoor advertising sign will violate any local ordinance or land development regulation of the local government. When the notice has been received from the local government or local jurisdiction and prior to erection of the noise barrier, the Department shall:

- a.) Inform all the benefited receptors, as part of the written survey, that:
1. Erection of a specific noise barrier may block the visibility of an existing outdoor advertising sign;
  2. The local government or local jurisdiction may restrict or prohibit increasing the height of the existing outdoor advertising sign to make it visible over the barrier;
  3. If a majority of the benefited receptors vote for construction of the noise barrier, the local government or local jurisdiction will be required to:
    - a. Allow an increase in the height of the sign in violation of a local ordinance or land development regulation;
    - b. Allow the sign to be relocated or reconstructed at another location if the sign owner agrees; or
    - c. Pay the fair market value of the sign and its associated interest in the real property.

The statute also requires the Department to hold a public hearing within the boundaries of the affected local government or local jurisdiction to receive input on proposed noise barriers that may conflict with the local ordinances or land development regulations and to suggest or consider alternatives or modifications to the proposed noise barrier to alleviate or minimize the conflict with the local ordinances or land development regulations or minimize any costs associated with relocating, reconstructing, or paying for the affected outdoor advertising sign. Alternatives or modifications to barriers that will reduce the insertion loss below the minimum of 5 dB(A) will not be considered unless the results of the survey indicate that a numerical majority of the benefited receptors do not favor construction of the noise barrier.

The written survey materials shall inform the affected property owners of the location, date, and time of the public hearing. The public hearing may be held concurrently with other public hearings scheduled for the project. A general notice of the public hearing shall also be published in a newspaper in accordance with the notice provisions of **F.S. 335.02(1)** and containing the same information provided in the written survey materials. The notice shall not be placed in that portion of a newspaper in which legal notices or classified advertisements appear. Please refer to **Part 1, Chapter 11 Public Involvement, of the PD&E Manual** for additional details about meeting notification requirements.

The Department shall not construct a noise barrier that screens or blocks the visibility of an outdoor advertising sign until after the public hearing is held and the numerical majority of the benefited receptors has approved the construction of the barrier. If the construction of the noise barrier is approved, the department shall notify the local governments or local jurisdictions. The local governments or local jurisdictions shall then exercise one of the options in paragraph 3 above.

## 32.5 Final Noise Abatement Commitments

During the final design phase, the noise abatement locations, noise barrier types, lengths and heights will be determined. The final noise abatement commitments must be documented in the environmental reevaluation and the noise study report addendum prior to construction advertisement. The required data collection, analysis and documentation detailed in **Part 2, Chapter 17 of the Project Development and Environmental Manual** will be documented in the NSR addendum. It should also contain a description of the methodology for selecting final noise barrier dimensions including any evaluation matrix(s) used.

Modification for Non-Conventional Projects:

Replace the first two sentences of the above paragraph with the following:

Any modifications to noise abatement locations, noise barrier types, lengths and heights must be documented in the environmental reevaluation and the noise study report addendum prepared by the Department prior to beginning noise barrier construction.

A copy of the NSR addendum, a summary of proposed noise barrier and a summary of the public involvement regarding noise abatement that took place during the design effort will be provided to the District Environmental Management Office. The environmental management staff will ensure that the final noise abatement commitments are reflected in the reevaluation of the environmental document and will obtain concurrence from FHWA, if appropriate.

## 32.6 Structural Design

Designers shall specify the Department's Design Standard for Noise Barriers. Use ***Design Standards Index 5200*** for Precast Noise Barriers or ***Design Standards Indexes 5210 thru 5215*** for Traffic Railing/Noise Barrier combinations. See the appropriate ***Design Standards*** and ***Instructions for Design Standards (IDS)*** for more information. See the ***LRFD Section 15*** and ***Structures Manual, Volume 1*** for the Noise Barrier design criteria.

Modification for Non-Conventional Projects:

Delete ***PPM 32.6*** and replace with the following:

### 32.6 Structural Design

Unless otherwise required in the RFP, utilize the Department's ***Design Standard*** for Noise Barriers. Use ***Design Standards Index 5200*** for Precast Noise Barriers or ***Design Standards Indexes 5210 thru 5215*** for Traffic Railing/Noise Barrier combinations. See the appropriate ***Design Standards*** and ***Instructions for Design Standards (IDS)*** for more information. See the ***LRFD Section 15*** and ***Structures Manual, Volume 1*** for the Noise Barrier design criteria.

## 32.7 Geotechnical Investigation

Once the barrier location, alignments, height and minimum thickness are determined, the soil exploration should be undertaken. The geotechnical engineer should follow the Department's *Soils and Foundations Handbook* for exploration.

## 32.8 Preparation of Control Drawings

The initial set of drawings to be prepared by the EOR is referred to as Control Drawings. By preparation of these drawings, the EOR shall provide all control parameters such as alignments, limits, notes, etc., and shall provide all the information which is common to all wall types. See the appropriate ***Design Standards*** and the associated ***IDS*** for more information.



## 32.9 Detail Drawings

The EOR or project manager shall establish the project requirements for noise barriers and include feasible commitments made during the PD&E phase or during the design phase public involvement. Project requirements may include color, textures, graphics, absorptive vs. reflective surface, flush vs. recessed panels, etc. The project requirements shall be listed in the plans.

Modification for Non-Conventional Projects:

Delete **PPM** 32.9 and see RFP for requirements:

**THIS PAGE LEFT BLANK INTENTIONALLY**