FHWA-HEP-18-067

FINAL REPORT

Techniques for Reviewing Noise Analyses and Associated Noise Reports

6.1.2018

U.S. Department of Transportation

Federal Highway Administration

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Cover image source: Resource Systems Group, Inc. (RSG)

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List of Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ACEC	American Council of Engineering Companies
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
DGAC	Dense-graded asphalt concrete
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAQ	Frequently asked questions
FHWA	Federal Highway Administration
FONSI	Finding of no significant impact
IL	Insertion loss
LOS	Level of Service
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
OGAC	Open-graded asphalt concrete
RCNM	Roadway Construction Noise Model
ROD	Record of decision
SHA	State highway agency
TNM	Traffic Noise Model

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16. Abstract

This guide includes information on how to review a noise study report and provides guidance on reviewing the noise section of the environmental document. It discusses other types of noise reports that may need review. The guide also included an associated noise study review checklist in Appendix A to determine if it provides all required information. A reviewer can complete a checklist for each report noting items that are complete and add notes on items that are missing, incorrect, or need attention. Similarly, a reviewer can use this guide and the associated review checklist in Appendix B to determine if the noise section of the environmental document provides the needed information

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1.0 What Every Reviewer Should Know

Each state highway agency (SHA) must develop a noise policy to comply with the requirements of the Federal Highway Administration (FHWA) noise regulation, *Procedures for Abatement of Highway Traffic and Construction Noise*, *23 CFR 772* [1]. SHAs must conduct noise studies for federal highway projects in accordance with the FHWA noise regulation and the SHA noise policy.

SHAs have flexibility in developing their noise policies and documenting the results of noise studies. This guide provides technical guidance and is a tool for SHA practitioners to support and promote comprehensive and efficient reviews of highway traffic noise studies. Some SHAs already provide guidance for noise study analysis and reporting. This guide serves as a supplemental resource but is not intended to replace SHA guidance.

1.1 Legislation, Regulations, and Policies

1.1.1 The National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969 (NEPA) established a national policy on the environment and created the Council on Environmental Quality (CEQ). The purpose of NEPA is to minimize or eliminate damage to the environment caused by actions funded or taken by the federal government. NEPA provides broad authority and responsibility for evaluating and mitigating adverse environmental effects including those resulting from highway traffic noise.

1.1.2 1970 Federal-Aid Highway Act

The Federal Aid Highway Act of 1970 (FAHA 1970) mandated that FHWA develop noise standards for identifying noise impacts and evaluating noise mitigation for federal projects. FAHA 1970 also stipulated that FHWA cannot approve plans and specifications for federal projects unless the project includes adequate noise abatement measures to comply with the standards.

Source: "Three States Claim First Interstate Highway", by Richard F. Weingroff, FHWA, Public Roads, Vol. 60, No. 1, Summer 1996

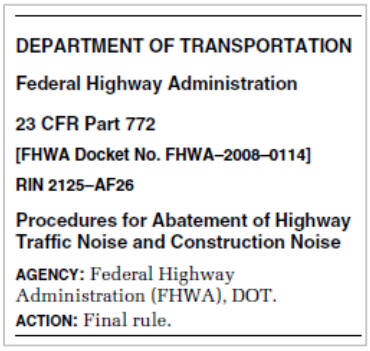
1.1.3 FHWA Noise Regulation (23 CFR 772)

FHWA developed noise regulations or standards in response to the requirements set forth in FAHA 1970. The purposes of the FHWA noise regulation are to:

- Provide procedures for noise studies and noise abatement measures to help protect public health, welfare and livability;
- Supply noise abatement criteria (NAC); and
- Establish requirements for information to be given to local officials for use in the planning and design of highways.

FHWA has updated the regulations as summarized below:

- 1973 - *Policy and Procedure Memorandum (PPM)* 90-2.
- 1976 – *Federal-Aid Highway Procedures Manual, Volume 7, Chapter 7, Section 3* (FHPM 7-7-3).
- 1982 - *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, 23 CFR 772.
- 1997 - *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, 23 CFR 772: Revised eligibility for Type II projects.
- 2005 - *Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 CFR 772:* Revised to require FHWA's Traffic Noise Model (FHWA TNM) for highway traffic noise analyses.
- July 13, 2010 - *Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 CFR 772:* Revised to add definitions and to clarify the applicability of the regulation, certain analysis requirements, and the use of Federal funds for noise abatement measures. [1]



DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

23 CFR Part 772

[FHWA Docket No. FHWA–2008–0114]

RIN 2125–AF26

Procedures for Abatement of Highway Traffic Noise and Construction Noise

AGENCY: Federal Highway Administration (FHWA), DOT.

ACTION: Final rule.

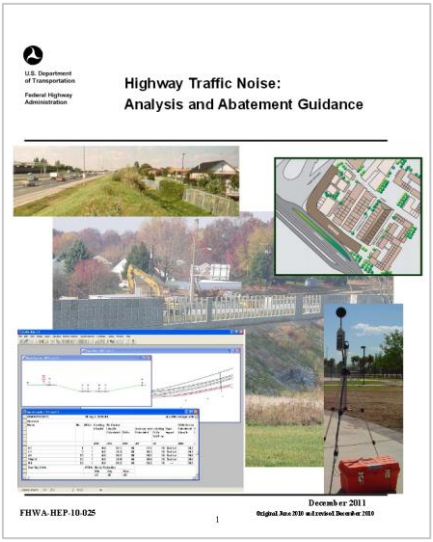
Each update supersedes and replaces the previous one.

1.1.4 State Highway Agency (SHA) Noise Policies

On June 12, 1995, FHWA issued a memorandum requiring states to adopt written statewide noise policies. These written state policies must be approved by FHWA and demonstrate "substantial compliance" with the FHWA noise regulation. SHAs have flexibility in developing their noise policies and documenting the results of noise studies.

1.1.5 FHWA Guidance

FHWA concurrently published the document, *Highway Traffic Noise Analysis and Abatement: Policy and Guidance* (FHWA's guidance), to aid states in developing their policies. FHWA updated this guidance most recently in December 2011 [2] to ensure consistency with the July 13, 2010 FHWA noise regulation.



U.S. Department of Transportation
Federal Highway Administration

Highway Traffic Noise:
Analysis and Abatement Guidance

December 2011

FHWA-HEP-10-025

FHWA has developed answers to many Frequently Asked Questions (FAQs) and developed a series of "Highway Traffic Noise Resources" to assist SHAs in implementing the FHWA noise regulation.

1.2 Noise Study Requirements

The FHWA noise regulation requires noise studies for Type I projects including: roadway widening to provide additional through travel lanes, the construction of a highway on new location, or the physical alteration of an existing highway that significantly changes either the

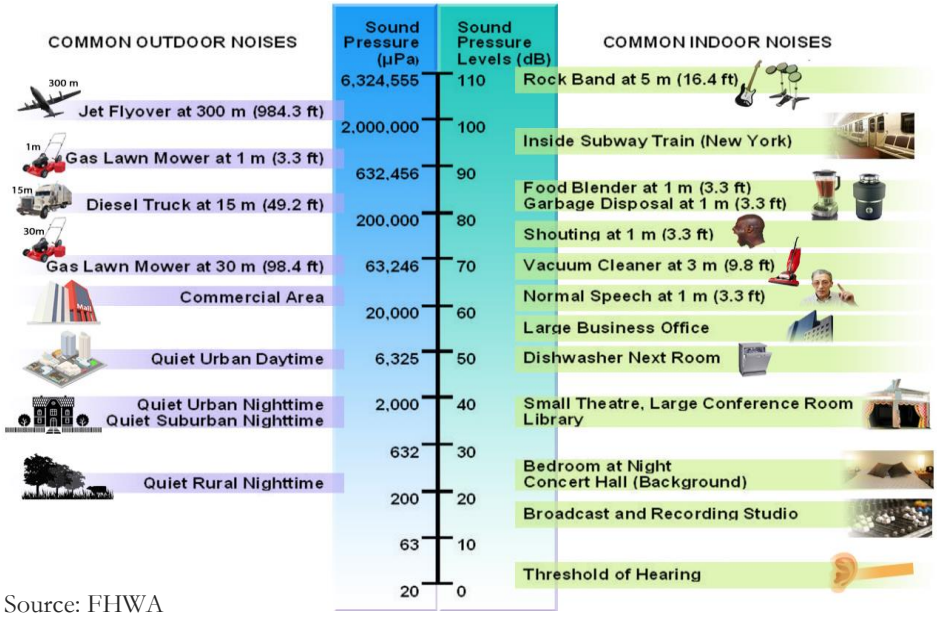
horizontal or vertical alignment or increases capacity. Projects that involve the addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza are also Type I.

The SHA must conduct detailed noise analyses for Type I projects as well as for Type II projects, which involve the construction of noise barriers when there is no associated highway project. Projects that are not Type I or Type II are Type III. Type III projects include projects that typically do not add capacity and are not expected to cause noise impacts including roadway safety, bridge repair, intersection improvement, and bicycle and pedestrian projects. Noise analyses are not required for Type III projects regardless of the level of environmental document.

1.3 Traffic Noise Terminology

Highway traffic noise levels are expressed in terms of the hourly, A-weighted equivalent sound level in decibels (dBA). A sound level represents the level of the rapid air pressure fluctuations caused by sources, such as traffic, that are heard as noise. A decibel is a unit that relates the sound pressure of a noise to the faintest sound the young human ear can hear. The A--weighting refers to the amplification or attenuation of the different frequencies of the sound (subjectively, the pitch) to correspond to the way the human ear "hears" these frequencies. Generally, when the sound level exceeds the mid-60 dBA range, outdoor conversation in normal tones at a distance of three feet (0.9 meters) becomes difficult. A 9-10 dB increase in sound level is typically judged to be twice as loud as the original sound, while a 9-10 dB reduction is half as loud. Doubling the number of sources (i.e., vehicles) increases the hourly equivalent sound level (L_{eq}) by approximately 3 dB, which is usually the smallest change that people can detect without specifically listening for the change. Figure 1-1 shows some common indoor and outdoor sound levels.

Figure 1-1: Common Sound Levels



Source: FHWA

Because most environmental noise fluctuates from moment to moment, it is standard practice to condense data into a single level called the equivalent sound level (L_{eq}). The L_{eq} is a steady sound level that would contain the same amount of sound energy as the actual time-varying sound evaluated over the same time period. The L_{eq} averages the louder and quieter moments, but gives much more weight to the louder moments in the averaging. For traffic noise studies, L_{eq} is typically evaluated over the worst one-hour period and is defined as L_{eq} (1h).

The term insertion loss (IL) is generally used to describe the reduction in L_{eq} (1h) at a location after a noise barrier is constructed. For example, if the L_{eq} (1h) at a residence before a barrier is constructed is 75 dBA and the L_{eq} (1h) after a barrier constructed is 65 dBA, then the insertion loss would be 10 dB.

Noise studies may use the terms "receptor" and "receiver" that are similar but distinct. Receptors represent noise-sensitive locations, such as a backyard or an outdoor seating area at a restaurant. Receivers are discreet TNM modeling points that represent receptors. A TNM receiver can represent a single receptor or a group of receptors, such as using one TNM receiver to represent a group of residences with similar sound levels.

1.4 Criteria for Determining Impacts

Noise impact is determined by comparing predicted future noise levels with the project: (1) to a set of Noise Abatement Criteria (NAC) for a land use activity category, and (2) to existing noise levels.

The FHWA noise regulation states that traffic noise impacts require consideration of abatement when worst-hour noise levels approach or exceed the NAC listed in Table 1-1 or substantially increase existing noise levels. FHWA requires that each SHA define "approach" and "substantial increase." Most SHAs define approach as one dB below the NAC. FHWA permits SHAs to define "substantial increase" between 5 and 15 dB.

The FHWA established the NAC based on interference of speech communication. The NAC are a compromise between noise levels that are desirable and those that are achievable and are not design goals. SHAs should not design noise abatement to reduce noise levels to the NAC.

1.5 Noise Abatement Evaluation

SHAs must evaluate noise abatement for impacted land uses in accordance with the feasibility and reasonableness criteria in the SHA noise policy. SHAs may consider the following abatement measures per the FHWA noise regulation:

1. Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.
2. Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.

Table 1-1: Noise Abatement Criteria [Hourly A-weighted Sound Level, decibels (dBA)]

Activity Category	$L_{Aeq}(h)$	Evaluation Location	Activity Description
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[1]	67	Exterior	Residential.
C[1]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structure, radio stations, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structure, radio studios, recording studios, schools, and television studios.
E[1]	72	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.

Source: FHWA

3. Alteration of horizontal and vertical alignments.
4. Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type I projects only.

[1] Includes undeveloped lands permitted for this activity category. Source: 23 CFR 772, July 2010

5. Noise insulation of Activity Category D land use facilities listed in Table 1-1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

At a minimum, the SHA must evaluate noise barriers for impacted land uses. The SHA must evaluate any abatement measure for feasibility and reasonableness in accordance with the SHA noise policy.

Feasibility means that: (1) the construction of a barrier would not be anticipated to pose any major design, construction, maintenance, or safety problems; and, (2) the noise barrier will provide a noise reduction (or insertion loss) of 5 dB reduction in design year highway traffic noise levels for impacted receptors.

A barrier must also meet three criteria in order to be "reasonable."

1. Noise Reduction Design Goal (i.e., the barrier reduces noise levels at benefited receptors by 7 to 10 dBA);
2. Cost Effectiveness; and
3. Viewpoints of Benefited Residents and Property Owners.

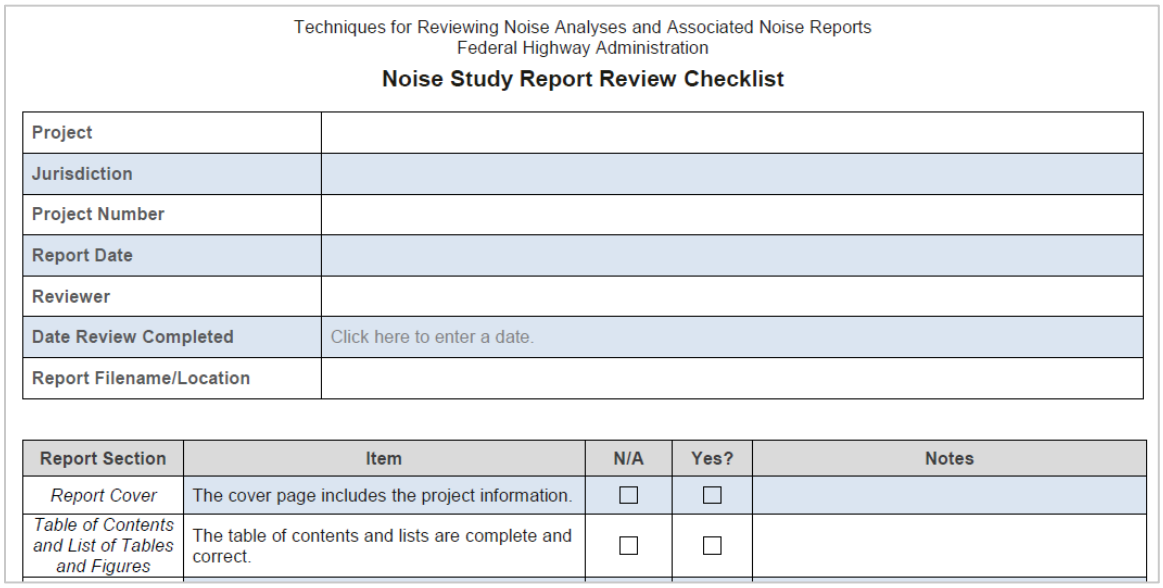
The FHWA noise regulation permits SHAs to consider other reasonableness factors including: date of development, length of time receptors have been exposed to highway traffic noise impacts, exposure to higher absolute highway traffic noise levels, changes between existing and future build conditions, percentage of mixed zoning development, and use of noise compatible planning concepts by the local government.

A *benefited* receptor is most commonly defined as one that receives a 5 dB reduction in noise levels from a noise abatement measure. However, SHAs may define *benefited* as any value between 5 dB and their Noise Reduction Design Goal.

1.6 How to Use this Guide

Section 2.0 of this guide includes information on how to review a noise study report and Section 3.0 provides guidance on reviewing the noise section of the environmental document. Section 4.0 discusses other types of noise reports that may need review. Sections 2.0 and 3.0 are in a statement and response format. The reviewer can move through a submitted noise report using Section 2.0 and the associated noise study review checklist in Appendix A to determine if it provides all required information. A reviewer can complete a checklist for each report noting items that are complete and add notes on items that are missing, incorrect, or need attention. Similarly, a reviewer can use Section 3.0 and the associated review checklist in Appendix B to determine if the noise section of the environmental document provides the needed information.

Figure 1-2: Noise Study Report Review Checklist



Techniques for Reviewing Noise Analyses and Associated Noise Reports
Federal Highway Administration

Noise Study Report Review Checklist

Project	
Jurisdiction	
Project Number	
Report Date	
Reviewer	
Date Review Completed	Click here to enter a date.
Report Filename/Location	

Report Section	Item	N/A	Yes?	Notes
Report Cover	The cover page includes the project information.	☐	☐	
Table of Contents and List of Tables and Figures	The table of contents and lists are complete and correct.	☐	☐	

The blue boxes in the right margin throughout the guide provide additional review tips, many of which reference the FHWA FAQs. The orange boxes in the right margin throughout the guide reference the applicable section of the FHWA noise regulation.

Refer to blue boxes for additional review tips!

Refer to orange boxes for applicable section of the FHWA noise regulation.

The reviewer can also use FHWA's review guide, *Techniques for Reviewing TNM Model Runs and Associated Modeling Reports,* to ensure that the TNM modeling associated with the report is accurate and that the reported results are correct.

FHWA also updated the Noise Measurement Handbook and developed a Noise Measurement Field Guide. SHAs may opt to use these documents to supplement their noise measurement procedures. All referenced FHWA documents are available on FHWA's Noise Program website [3].

2.0 Reviewing Noise Study Reports

Noise studies must identify (1) locations where noise impacts are predicted to occur; 2) noise abatement measures which are feasible and reasonable, and which are likely to be incorporated in the project; and 3) identify noise impacts for which no noise abatement measures are feasible and reasonable.

§772.13(g)(3)

Noise studies include the following steps:

- *Identification of noise-sensitive land uses:* Identification of existing noise-sensitive land uses in the project area.
- *Determination of existing noise levels:* Measurement and/or prediction of existing worst-hour noise levels at noise-sensitive land uses.
- *Determination of future noise levels:* Prediction of design year worst-hour noise levels for the No-Build and Build Alternatives.
- Determination of traffic noise impacts.
- *Noise abatement evaluation:* Evaluation of noise abatement measures for impacted noise-sensitive land uses. The study will only include this step if there are impacts.
- *Discussion of construction noise.* Identification of affected land uses and needed abatement measures.
- *Provision of information for local officials*. Discussion of noise compatible planning concepts, future noise levels on undeveloped lands, and Type II program eligibility.

The noise study report should clearly document each of these steps and any associated analysis procedures. Tables and figures can help convey the study results and make the report more easily understandable to the technical reviewer as well as a lay person.

2.1 Report Cover

Confirm that the cover page includes the project information.

Confirm that the cover page includes the correct project name, identification number, termini, and report date. Additional information might include the names of the SHA and preparer.

A picture of the project plans on the cover is helpful especially during the reevaluation

2.2 Table of Contents and List of Tables and Figures

Check that the table of contents and lists are complete and correct.

Check that the table of contents includes all appropriate headings and subheadings, and that the page references are correct. Confirm that the lists of tables, figures, and appendices are correct.

2.3 Summary

Check that the report includes a summary of the results.

Check that the summary correctly describes the project, the project status, and the purpose of the report. A summary would typically include the main conclusions regarding the number of impacts, the noise abatement evaluation results, and impacts for which abatement is not feasible or reasonable. The results and conclusions should match what is stated in the body of the report.

The summary section can have sufficient detail to be the basis for the noise section of the environmental document.

2.4 Introductory Material and Project Description

Check that the report references the FHWA noise regulation and SHA noise policy.

Check that that report references the current FHWA noise regulation and SHA noise policy as well as any other applicable SHA procedures.

Verify that the report provides the correct project name, limits, description, and length.

Verify that the project name, limits, description, and length match the project design plans, environmental document, and public involvement materials and that a project location map is included.

Ensure that the report identifies the type of project.

§772.5

Ensure that the report explains why the project is Type I, Type II, or Type III in accordance with the FHWA regulation and SHA noise policy. SHAs may elect to conduct noise studies for some Type III projects. The FHWA noise regulation defines Type I projects and FHWA Guidance and FAQs further expand on the definition. For example, FHWA Guidance states that

improvements to existing rest areas and truck weigh stations that involve increased capacity for overnight parking, relocation of parking facilities closer to noise-sensitive land uses would be Type I. FHWA has also determined that construction of a grade separation to replace existing at-grade railroad crossings is a Type I project because it significantly changes the vertical alignment.

Although the function of an auxiliary lane differs depending on the type of facility, an auxiliary lane should classify the project as Type I if the auxiliary lane is 2,500 feet (762 meters) or longer. (FAQ C2)

2.5 Traffic Noise Fundamentals and Terminology

Check that the report explains the fundamentals of traffic noise and the terminology used in the noise study report.

Check that the report explains the fundamentals of highway traffic noise and defines the noise descriptors in a manner that is understandable to the public. At a minimum, the study should define: *decibel*, *hourly A-weighted equivalent sound level* (L_{eq}(1h)), and *insertion loss* (IL). An overview of common sound levels is also helpful. FHWA developed a "Sound Level Descriptors" document (FHWA-HEP-17-053) that defines the various metrics used in noise studies that could be an additional resource.

2.6 Identification of Noise-Sensitive Land Uses

§772.11(c)(2)

Check that the report identifies the lands that contain, or will contain, noise-sensitive land uses.

Check that the noise study summarizes the existing land uses in the project area, including the applicable activity category in Table 1-1. The report should also identify any undeveloped lands for which building permits have been issued and the associated activity category of the permitted use.

It may be helpful to identify separate areas of noise-sensitive land uses to better organize the modeling, analysis, and reporting of results. These separate areas might be called Noise Analysis Areas (NAAs) or Noise Study Areas (NSAs) and may be designated using a naming or numbering system or some other system relevant to the project. Additional reasons to use NAAs or NSAs include: uniquely identifying affected neighborhoods; separating land uses with different NACs; separating areas that are divided by terrain features or long distances; and anticipating that an impacted area(s) will require a noise abatement evaluation.

If used, the report should adequately define and describe the NSAs or NAAs. Figures showing the locations of land uses and NSAs/NAAs can be helpful.

Developed lands may include Activity Category B, C, and E land uses with exterior areas of frequent human use, as well as qualifying Activity Category D (interior) uses. Activity Category F land uses are not noise-sensitive and are not typically included in noise studies.

As stated in Table 1-1, Activity Category A includes *"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."*

Activity Category A land uses are extremely rare. FHWA developed a *"Test for Meeting Activity Category A Designation"* determine if a land use qualifies as Activity Category A (FAQ D2). If a land use meets FHWA's criteria, the SHA should prepare a *"Proposal for Justification for Designating Land Use as Activity Category A"* and submit it to their FHWA Division Office.

Source: Library of Congress

The Tomb of the Unknown Soldier at Arlington National Cemetery is an example of an Activity Category A land use.

Confirm that modeling extends an adequate distance to identify all impacts and benefits.

§772.11(a)

Review the noise level results for the most distant receptors to determine if the modeling extends an adequate distance to identify all impacts and benefits. The report will only identify all impacts if the modeling extends an adequate distance from the road. This "impact distance" can vary considerably from project to project depending on the type of facility (e.g., arterial or freeway), the type of project (e.g., widening or new alignment), the percentage of trucks, vehicle speeds, type of intervening ground, and the presence of terrain or buildings.

Source: Bowlby and Associates

Widening projects generally create impacts based on approaching or exceeding the NAC. Arterial widening projects might only impact land uses within a couple of hundred feet, whereas freeway widening projects could impact land uses farther away.

New alignment projects are more likely to create impacts based on a "substantial increase" over existing noise levels, especially if there is no existing highway noise source. New alignment projects can also create impacts based on approaching or exceeding the NAC if the new road will be close to the adjacent uses.

A preliminary TNM analysis can identify a conservative distance within which impacts would be expected for a project. The analysis then includes all uses within that distance to ensure identification of all impacts.

Barriers often benefit land uses that are not impacted, such as second and third row residences in a neighborhood. The modeling should extend an adequate distance to identify all land uses the are benefited by a barrier. This distance will vary from area to area and will also depend on the SHA noise barrier design process.

If the road is on fill, a barrier at the shoulder will be more effective than if the road was at the same elevation as the land uses and may provide more benefits. If the road is in cut, a barrier at the top of the slope may only benefit the closest land uses because the cut itself provides a significant amount of shielding.

2.6.1 Activity Category B (Residential) Land Uses

Check that the report identifies all potentially impacted and benefited residential properties.

§772.11(c)(2)(ii)

Check that the study includes all potentially impacted and benefited residential properties including single and multi-family residences (duplexes, apartments, condominiums), mobile home communities and facilities that provide long-term residential stays. If there are no exterior areas of frequent human use at a residential property (e.g., at some apartments or nursing homes), then the property is not considered noise-sensitive and is not evaluated for impacts. Outdoor land uses can be individual areas, such as yards, patios or balconies.

Residential hotels and motels that function as apartment dwellings are Activity Category B. (FAQ D6)

Confirm that the report identifies and accounts for common areas of residential neighborhoods.

Confirm that the analysis includes common areas of residential neighborhoods including playgrounds, swimming pools, tennis and basketball courts, and picnic areas. These are exterior areas of frequent human that are typically available for use by all residents and the noise study should address them.

Source: Bowlby and Associates

Confirm that the report identifies and accounts for exterior areas (i.e., balconies) of multi-story residential buildings.

Confirm that the analysis includes upper floor units of multi-story residential buildings in the impact evaluation. The SHA may or may not design noise

There may be situations, specific to local terrain or other shielding objects, where a noise barrier is warranted, reasonable and feasible for higher floors. (FAQ E3)

abatement for upper floor locations, however, the noise abatement evaluation should account for benefited upper floor units.

2.6.2 Activity Category C, D and E Land Uses

Confirm that the report identifies and describes the qualifying exterior areas of Activity Category C land uses.

§772.11(c)(2)(iii)

Confirm that the analysis includes Activity Category C land uses with exterior areas of frequent human use and shows the predicted future noise levels for each. The FHWA noise regulation requires that SHAs adopt standard practices for analyzing Activity Category C, D, and E land uses that are consistent and applied uniformly statewide. FHWA Guidance further states that the SHA should develop a method to evaluate the number of receptors used to represent these locations and introduces the concept of "equivalent number of residences" to equate other land uses to a number of residential receptors. The analysis should also determine an equivalent number of residential receptors for common use areas within Category B residential communities such as playgrounds and swimming pools.

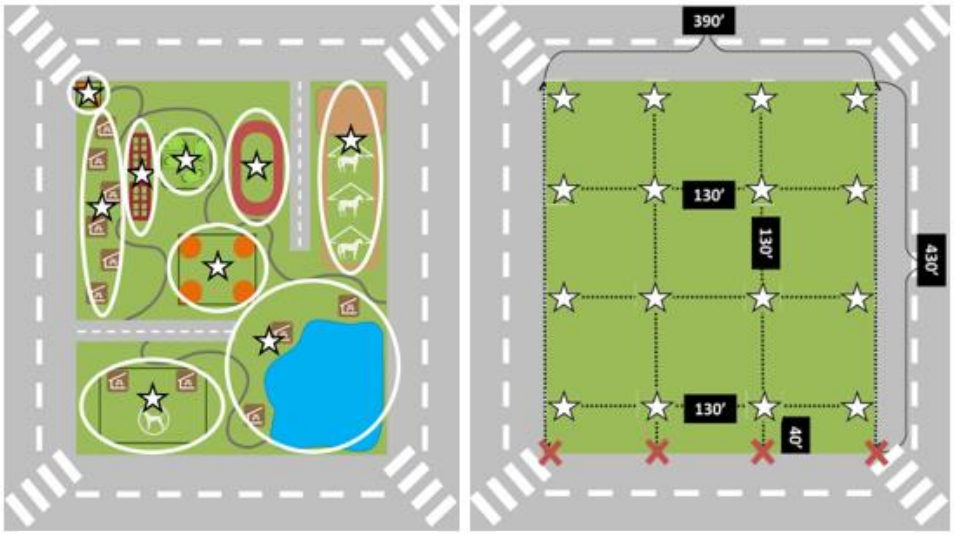
FHWA encourages SHAs to carefully consider the context of the use of campgrounds and similar facilities when identifying the appropriate land use category.

FHWA developed six fact sheets for "Calculating and Placing Non-Residential Receptors (NRRs) including:

- Activity Categories A - E (FHWA-HEP-17-057)
- Methodology: Single Point (FHWA-HEP-17-058)
- Methodology: Frontage (FHWA-HEP-17-054)
- Methodology: Lot Size (FHWA-HEP-17-056)
- Methodology: Grid (FHWA-HEP-17-055)
- Methodology: Usage (FHWA-HEP-17-059)

Examples of the grid and single point methodologies are shown Figure 2-1.

Figure 2-1: Example of single point (left) and grid (right) methodologies



Source: FHWA-HEP-17-058 Source: FHWA-HEP-17-055

Per Table 1, Section 4(f) properties are Activity Category C land uses if they have a qualifying exterior area of frequent human use. If the project impacts an Activity Category C land use, then the noise study should evaluate noise abatement in accordance with the SHA noise policy to satisfy the requirements of the FHWA noise regulation.

If the project will affect Section 4(f) properties, a separate noise evaluation may be needed to ensure that the project will not cause a "constructive use." Section 23 CFR 774.15 of FHWA's regulations governing implementation of Section 4(f) addresses whether noise impacts would constitute a constructive use. In general, a constructive use occurs when *"…the projected noise level increase attributable to the project substantially interferes with the use and enjoyment of a noise-sensitive facility of a property protected by Section 4(f)".* Conversely, 23 CFR 774.15(f) states that a constructive use does not occur when the projected noise levels do not exceed the FHWA NAC or the increase in noise levels is barely perceptible (3 dB or less). (FAQ D4)

As with Section 4(f), the consideration of historic properties under Section 106 of the National Historic Preservation Act of 1966 is a separate requirement, but may be related to the assessment of noise impacts under the FHWA noise regulation. The effect of the project under Section 106 will depend on the characteristics and use of the historic resource. Some properties may be sensitive to any perceptible change in sound level. In such cases, FHWA considers anything above 3 dB to be considered an effect (FAQ D4).

Proposed abatement measures could create a separate impact to a historic property. For example, a noise barrier may create a visual impact.

Confirm that the report identifies and describes the land uses that qualify as Activity Category D.

§772.11(c)(2)(iv)

Source: Google Earth© with annotation

Confirm that the analysis evaluates Activity Category C land uses that do not have an exterior area of frequent human use as Activity Category D land uses, which are evaluated for interior impacts. As an example, if a place of worship has a playground, it would be an Activity Category C land use. If the exterior area is far from or physically shielded from the roadway in a manner that prevents an impact on the exterior area, the land use is Activity Category D (photo at left). Additionally, if there are no exterior areas of frequent human use, then the facility is an Activity Category D land use.

For the purposes of 23 CFR 772, the FHWA defines a "medical facility" as an inpatient medical facility where medical treatment and care occurs. (FAQ D4)

Confirm that the report identifies the qualifying exterior areas of Activity Category E land uses.

§772.11(c)(2)(v)

Confirm that the analysis includes Activity Category E land uses with exterior areas of frequent human use. Frequent human use areas could include balconies, exterior sitting or eating areas, playgrounds, pools or other similar locations where people gather for extended periods. If there are no exterior areas of frequent human use, the facility is not considered noise-sensitive.

Source: FHWA

Parking lots and sidewalks are not frequent human use areas. The activity category for a rest stop depends on its use. (FAQ D11)

2.6.3 Activity Category F Land Uses

Confirm that the report identifies the Activity Category F land uses in the project area.

§772.11(c)(2)(vi)

Confirm that the report identifies Activity Category F land uses even though they are not noise-sensitive and not evaluated for impacts. Activity Category F retail facilities include malls, stores, and shops (FAQ D7).

Motorized activities are noise generators (Activity Category F). (FAQ D4)

2.6.4 Activity Category G Land Uses

Check that the report states whether there are Activity Category G undeveloped lands along the project.

§772.11(c)(2)(vii)

Check that the report discusses whether there are undeveloped Activity Category G lands along the project. Activity Category G includes undeveloped lands without a permit for future development.

Natural areas, preserves, or similar locations with no exterior areas of frequent human use are Activity Category G. (FAQ D9)

Check that the text points the reader to the "Information for Local Officials" section.

Check that the discussion of Activity Category G land uses points the reader to the "Information for Local Officials" section of the noise study report for information on the future effects on undeveloped lands.

Check that the report identifies permitted noise-sensitive land uses.

§772.11(c)(2)(vii)(A)

Check that the noise study identifies lands for which development is "permitted" at the date of public knowledge for the project. The date of public knowledge is the date that FHWA approves a project's final environmental document (i.e., CE's FONSI, or ROD).

The municipal planning or codes department may provide online permit data.

If there is an approved environmental document for the project and the noise study is being updated as part of the NEPA reevaluation process, then the noise study should include land uses permitted or constructed after the date of public knowledge in the impact assessment. However, these uses are not eligible for noise abatement per the FHWA noise regulation.

Development permitted between the time of the noise study and the approval of the CE, FONSI, or ROD should be considered for impacts and abatement.

2.7 Determination of Existing Noise Levels

§772.11(a)

The FHWA noise regulation defines "existing noise levels" as "the worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area." The worst noise hour is generally the loudest hour and may not the same as that for the future condition with the project.

Existing noise levels are determined by using one of the following methods:

- Perform measurements at representative receptors during the "worst noise hour;"
- Predict noise levels using TNM; or
- Use a combination of measurements and prediction with a validated model. Measurements should occur during free flow traffic conditions and do not need to occur during the "worst noise hour." (FAQ E1)

Source: Bowlby and Associates

The study should use field measurements to determine existing noise levels for projects on a new alignment. Field measurements should also be used to validate the noise model prior to predicting the existing levels for a widening project.

2.7.1 Measurement of Existing Noise Levels

§772.11(a)(1)

Check that the report identifies the applicable noise measurement procedure (i.e., FHWA Noise Measurement Handbook or SHA noise policy).

Measurement sites should be clear of obstructions and the microphone should be located at least 10 feet (3.1 meters) from any reflective surfaces.

Check that the noise study documents and discusses the noise measurement procedure in adequate detail to meet any SHA requirements. This could include detailed information about the measurement equipment.

SHAs may use FHWA's updated Noise Measurement Handbook and associated Noise Measurement Field Guide to supplement their noise measurement procedures.

Confirm that measurement locations are consistent with the SHA's noise policy and procedures (if applicable).

Confirm that the measurement locations meet any criteria in the SHA noise policy or procedures. Measurement locations generally include exterior areas of frequent human use at Activity Category B, C, and E land uses. The measurement locations should be listed, described by address if possible, and shown on figures with a legend, scale, and north arrow.

Confirm that measurements were conducted under appropriate weather and traffic conditions.

Review the report text and measurement data sheets to confirm that winds were calm, pavement was dry, and traffic was free-flowing during all measurement periods.

Confirm that non-representative noise events were removed from the reported noise levels.

Review the report text and measurement data sheets to confirm that the measurements exclude non-representative noises such as barking dogs, human activity, and (Heating Ventilating and Air Conditioning), and unusual vehicle sounds. The measurements should also identify noise from other significant noise sources including rail, aircraft, and industrial/manufacturing operations. These events may be included in the reported ambient existing noise levels but should be removed for validation as discussed in the following section.

Recording one-minute equivalent noise levels during each measurement facilitates the removal of non-representative noise events.

Confirm that the reported existing measured noise levels represent the "worst noise hour."

Confirm that the reported existing measured noise levels represent the "worst noise hour." For projects that increase the capacity of an existing facility, the worst noise hour normally occurs when the highest traffic volume travels at the highest possible speed. Measurements conducted during times other than the worst noise hour can be adjusted using data from a nearby long-term measurement location if the SHA permits it.

Identifying the worst noise hour for new alignment projects in areas where there are no significant existing highway traffic noise sources can be challenging. Noise levels at locations that are far from significant traffic noise sources can vary significantly throughout the day due to other noise sources, environmental changes, including shifts in wind speed and direction, and changes in the vertical temperature profile.

Quiet daytime noise levels in rural areas with no significant noise sources might be in the 30 to 40 dBA range, while quiet daytime noise levels in suburban areas might be in the 40 to 50 dBA range. Verify that the noise report includes a discussion of the process used to determine the worst noise hour levels.

Confirm that the report discusses of the measured noise levels.

Confirm that the report includes a summary discussion of the noise measurement results.

Check that the report includes the data sheets for all measurement locations and periods.

Check that the report includes noise measurement data sheets in an appendix. Noise measurement data sheets should include a site sketch with appropriate distance measurements. Other important data includes:

- Begin and end times
- Microphone height
- The roadway elevation relative to the measurement location (i.e. above road, below road, at-grade)
- An indication whether the road is on a grade or at-grade
- Pavement type
- Type of intervening ground
- Any surfaces or areas that could affect noise levels such as ponds, lakes, and parking areas
- Existing structures including residences, garages, barns, commercial and industrial buildings, noise barriers, and fences
- Significant terrain features such as berms, hills, and drainage ditches
- Locations and density of areas of trees and/or vegetation
- A description of any non-traffic noise sources including aircraft and/or train operations, commercial and industrial activities, etc.
- Calibration results
- Wind speed and direction
- Temperature

Photographs of each measurement location can be very helpful.

Determination of Existing Noise Levels - Measurement Summary Sheet

Project Name	
Site/Address	
Observer Name	

General Meteorological Conditions

Temperature(s)	
Wind Speed(s)	
Wind Direction(s)	

SLM/Analyzer Information

SLM Model		SLM Serial #	
Mic. Height		Mic. Serial #	
Mic. Extension?		Data File Name/Number	

Calibration Information

	Pre-Measurement	Post-Measurement
Calibration Time		
Calibration Level		

Site Sketch
(plan/profile view, distances, roadways, buildings, reflecting surfaces, ground type as appropriate) (Indicate North)

Source: FHWA Noise Measurement Field Guide

2.7.2 Prediction of Existing Noise Levels for Projects on Existing Alignments

§772.11(a)(2)

Confirm that analysis used an approved version of the FHWA TNM.

§772.9(a)

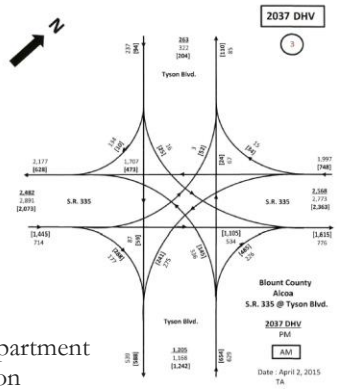
Confirm that the noise analysis used an approved version of FHWA TNM, and that the report documents the version number. Older versions may be

acceptable during transition periods to newer versions of TNM. Consult with your SHA and FHWA Division Office during these times, or to determine whether a model has been found consistent with TNM.

Ensure that the report discusses the existing traffic volumes, truck percentages, and speeds used to predict existing noise levels and documents the source(s) of that data.

Ensure that the report discusses the existing volumes and speeds used to predict existing noise levels and documents the source of that data. The report should also discuss the percentage(s) of trucks on the study roadways as truck volumes significantly affect noise levels.

TNM Vehicle Type	Total Vehicles	Percent of Fleet
Autos	15,304	97.5%
MTs/Buses	196	1.2%
HTs	127	0.8%
Motorcycles	68	0.4%
Total	15,695	100.0%



Source: Tennessee Department of Transportation

Ensure that the report demonstrates that the combination of modeled traffic volumes and speeds represents the existing worst noise hour in accordance with the procedures in the SHA noise policy.

§772.9(d)

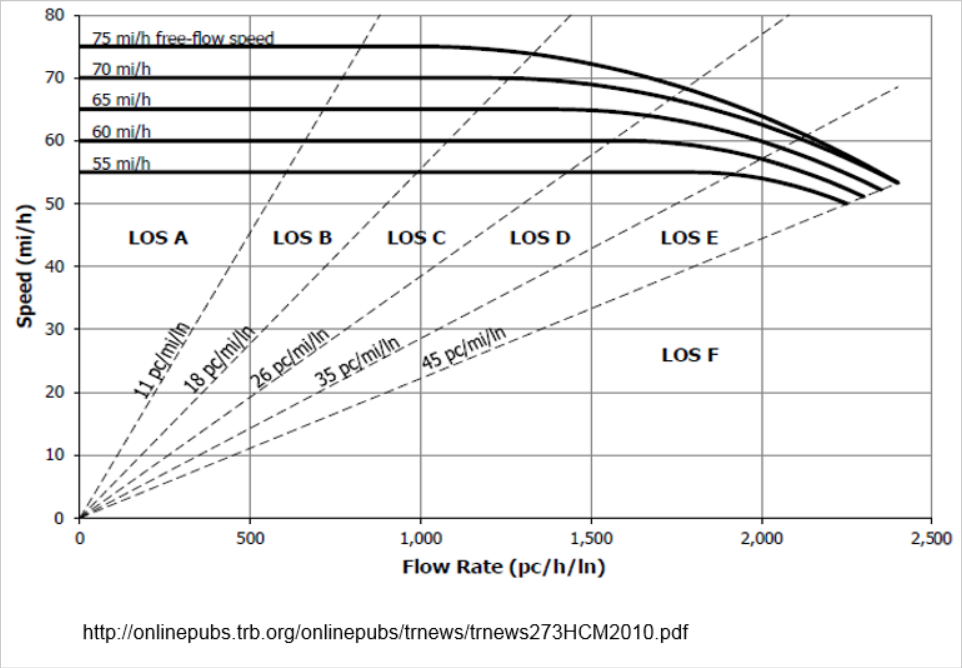
Ensure that the report documents that the combination of modeled traffic volumes and speeds represents the "worst noise hour" as required by the FHWA noise regulation. A complete review of the traffic data may require access to the TNM files.

Some SHAs use Level of Service (LOS) C or LOS D volumes while others use design hourly volumes to predict worst hour noise levels. Level of Service (LOS) is a roadway planning and design concept used to determine the number of needed travel lanes, using the letter A to represent free flow and F to represent a breakdown in vehicular flow as shown in the figure to the right.

In the *Highway Capacity Manual,* LOS for freeway segments is determined from the density of vehicles, computed in terms of passenger car equivalents per mile per lane (pc/mi/ln). As the flow rate of the vehicles (passenger cars per hour per lane, or pc/h/ln) increases, the density increases and eventually the speed decreases from the free flow speed.

If the traffic projections include both the morning and afternoon peak hours, the analysis should use the condition that generates the highest noise levels. If there are land uses on both sides of the road, the morning might be the worst noise hour for one side, while the afternoon might be the worst noise hour for the other side.

Figure 2-2: Relationship between flow rate and vehicle density on speed (from Highway Capacity Manual)



Per FHWA Guidance, SHAs have flexibility to consider the effects of seasonal traffic or limiting the consideration to the typical worst noise hour experienced within the project area.

Check if the analysis accounts for the effects of background noise.

Check if the analysis accounts for the effects of background noise. If so, confirm that the report discusses the process.

Background noise is often masked by highway traffic noise near major roads. In these situations, the noise analysis may not need to consider the effects of background noise. However, background noise could be important in areas where there are no significant highway noise sources, such as on new alignment projects. In these cases, the background noise level should be added to the predicted noise level from the highway(s) to obtain the existing noise level. Background noise may also include other significant noise sources such as rail, aircraft, and industrial/manufacturing operations.

Verify that the report shows and discusses the predicted existing noise levels for the noise-sensitive land uses.

Verify that the report includes a discussion of the predicted existing noise levels at the noise-sensitive land uses as well as a summary table(s) in the body of the report or in an appendix. It is helpful if the report identifies the primary noise sources at each of the measurement locations.

Verify that the reported noise levels match the levels in the TNM runs.

Verify consistency between the TNM results and the reported levels. This would require comparing the TNM results with the noise levels in the summary tables of the report. The reviewer can reference FHWA's *Techniques for Reviewing TNM Model Runs and Associated Modeling Reports* for guidance.

Check that existing noise levels are reported in accordance with the SHA noise policy.

Check that noise levels are reported per the SHA noise policy. SHAs may: 1) report noise levels to the tenth of a dB as predicted by TNM, 2) round noise levels, or 3) truncate. If the SHA has no policy, report the noise levels as they appear in TNM to the tenth of a dB.

Verify that the report shows the predicted existing interior noise levels for Activity Category D land uses.

Verify that the report shows predicted existing interior noise levels for any Activity Category D land use. FHWA Guidance includes a procedure for determining the interior noise levels for Activity Category D land uses by evaluating the type of building construction. Table 2-1 provides the appropriate noise level reduction for combinations of building types and window conditions. The predicted exterior noise level is reduced by the appropriate amount to arrive at the predicted interior noise level, which is compared to the NAC for Activity Category D land uses.

Table 2-1: Building Noise Reduction Factors

Building Type	Window Condition	Reduction
All	Open	10 dB
Light Frame	Ordinary Sash (closed)	20 dB
Light Frame	Storm Windows	25 dB
Masonry	Single Glazed	25 dB
Masonry	Double Glazed	35 dB
* Consider the windows open unless there is firm knowledge that the windows are in fact kept closed almost every day of the year.		

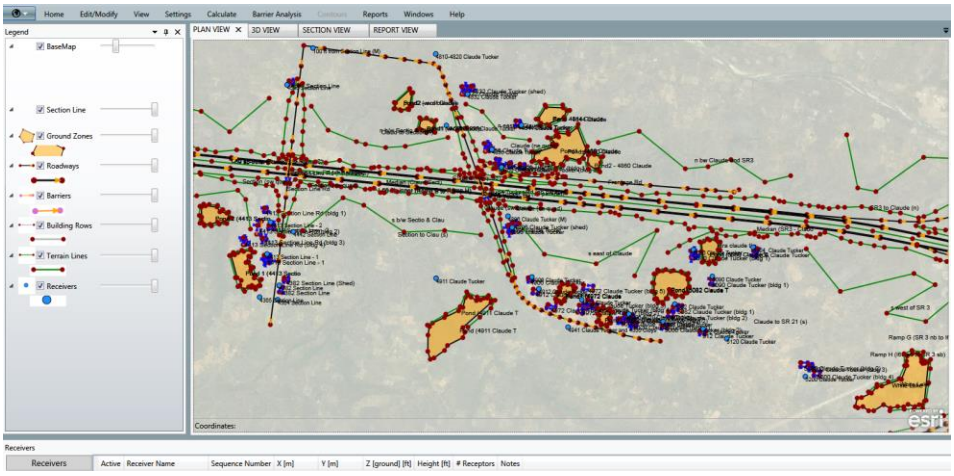
Source: FHWA "Highway Traffic Noise Analysis and Abatement: Policy and Guidance."

In some cases, the SHA may opt to develop noise reduction factors by conducting additional field measurements or more detailed acoustical analysis.

Check that the report includes TNM plan views in an appendix.

Check that the report includes TNM plan views of the existing modeling in an appendix (Figure 2-3). Additionally, the applicable TNM project files should accompany the report.

Figure 2-3: Screenshot of TNM 3.0 Plan View



Source: FHWA

2.8 Validation

Confirm that the analysis includes model validation.

§772.11(d)(2)

Confirm that the analysis includes model validation. The FHWA noise regulation requires validation of existing TNM models. For validation, the analyst develops a TNM model of existing conditions and inputs the traffic and speed data for a particular measurement period. The model is run and the predicted noise level(s) is compared to the measurement level. If the predicted levels are within 3 dB(A) of the measured levels, the model is typically considered successfully validated and can be used to predict future levels. Successful validation requires clean measurements under the required weather condition *and* detailed and accurate noise modeling.

The SHA's policies or procedures should explain how field measurements should be conducted: location, number of measurements, number of repetitions, and acceptable difference between measured and predicted levels.

As discussed above, the measurements should be conducted under acceptable conditions (i.e., minimal wind and temperature effects). It is imperative that the measured noise level include only noise from the roadways in the TNM model.

The level of model detail and accuracy for the validation process should be the same for the existing and future condition models. If not, there can be little confidence that the predicted noise levels are accurate.

Verify that measured levels include only highway-generated noise.

Verify that the validation measurements exclude all non-highway noise events, particularly noise from significant sources such as rail, aircraft, and industrial/manufacturing operations. Atypical highway noise events (i.e., engine compression braking, horns) should be removed as well as any loud and atypical vehicle events on local roads (i.e., garbage truck pass-by). Non-highway and atypical highway noise events are typically removed from the measurement data during post-processing.

Ensure that the report documents the traffic volumes, truck percentages, and speeds for each measurement period.

Ensure that the report documents the vehicle types, volumes and speeds for each measurement period. At a minimum, the report should include tables summarizing the counted volumes of automobiles, medium trucks and heavy trucks as well as the average speeds for each vehicle type. The data may be provided for each travel lane. Traffic volumes for measurement periods less than one hour must be increased to represent a full hour. For example, traffic

volumes for a 20-minute measurement must be multiplied by 3 to arrive at the hourly volumes for the TNM model.

Confirm correct location of TNM receivers for measurement sites.

Confirm that the TNM receivers are located at the actual measurement locations. Differences of a few feet can affect results, particularly if a site is shielded from the road. The report should contain diagrams (i.e., design plans or aerial imagery) that show the measurement and TNM receiver locations.

Check if modeled pavement type represents the actual pavement.

Check if the modeled pavement type is representative of the actual pavement. While FHWA requires that "average" pavement be modeled for future conditions, the pavement type for validation should represent what actually exists (open-graded asphalt concrete (OGAC), dense-graded asphalt concrete (DGAC), or Portland Cement concrete (PCC)).

Source: Bowlby and Associates

Check that predicted levels are within 3 dB of the measured levels.

Check that the reported differences between the measured and predicted noise levels are within 3 dB. Most SHAs consider models validated if predicted noise levels are within 3 dB of measured levels. If greater differences exist, then the model is not considered validated until additional measurements are conducted or until the analysis identifies the reason for the discrepancy and corrects the model. Invalidated models cannot be used to predict future noise levels

2.9 Determination of Future Noise Levels

Check that the report identifies the design year and discusses the future traffic volumes, truck percentages, and speeds used to predict future noise levels and documents the source(s) of that data.

§772.9(d)

Check that the report discusses the future volumes and speeds used to predict noise levels and documents the source of that data. The report should also discuss the percentage(s) of trucks on the study roadways since truck

volumes significantly affect noise levels and noise barrier effectiveness. A table summarizing the traffic data for the modeled roadways is also helpful.

Confirm that the report demonstrates that the combination of modeled traffic volumes and speeds represents the "worst noise hour" for future conditions in accordance with the procedures in the SHA noise policy.

Confirm that the reported future noise levels represent the "worst noise hour" and that modeled volumes and speeds are consistent with the SHA's procedures.

As discussed in Section 2.7, *Determination of Existing Noise Levels*, the FHWA noise regulation requires that noise levels represent the "worst noise hour." Some SHAs model Levels of Service C or D volumes, while others use projected design hour volumes.

FHWA Guidance states that SHAs may use either the posted speed limit or the operating speed to predict noise levels. SHAs should use the operating speed if it is determined to be consistently higher than the posted speed limit.

Check analysis accounts for existing background noise effects.

Check if the analysis accounts for the effects of background noise. If so, confirm that the report discusses the process. As discussed in Section 2.7, *Determination of Existing Noise Levels*, future noise levels may need to include background noise.

For new alignment projects, future noise levels for the No-Build Alternative should be the same as existing noise levels in areas where there are no significant existing highway noise sources.

Check that the report shows and discusses the predicted noise levels for the noise-sensitive land uses.

Check that the report discusses the predicted future noise levels at the noise-sensitive land uses and include a summary table(s) in the body of the report or in an appendix. It can be helpful to also include figures, such as aerials, with a legend, scale and north arrow showing the modeled receptors and predicted noise levels.

Verify that reported noise levels match the levels in the TNM runs.

Verify consistency between the TNM results and the reported levels. This would require comparing the TNM results with the noise levels in the

summary tables of the report. The reviewer can reference FHWA's *Techniques for Reviewing TNM Model Runs and Associated Modeling Reports* for guidance.

Check that noise levels are reported in accordance with the SHA noise policy.

Check that noise levels are reported per the SHA noise policy. As discussed previously, SHAs may report noise levels to the tenth of a dB as predicted by TNM, round noise levels, or truncate. The study should report the predicted existing noise levels in accordance with the SHA noise policy. If the SHA has no policy, report the noise levels as they appear in TNM to the tenth of a dB.

Check that reported noise level changes match expectations.

Compare the predicted design year noise levels for the Build Alternative(s) to the existing worst hour noise levels to assess whether the changes are reasonable based on: the type of project (widening or new alignment), the projected increase in traffic, the path between the source and the receiver, and the characteristics of the intervening terrain.

For example, if traffic increased by 50% but the road was being moved farther away from a land use, there might be little or no change in the noise level. New alignment projects can substantially increase noise levels even at locations far from the road particularly in cases where the road is being constructed in a location with no significant existing noise sources.

If the predicted changes in noise levels due to the project are much higher or lower than the expected changes, then the reviewer might request an additional explanation from the analyst. A review if the TNM model may reveal the reason for the differences.

Table 2-2 and Table 2-3 summarize the characteristics of some typical widening and new alignment projects.

Table 2-2: Highway Project Examples (Widening Projects)

Facility Type	Existing Lanes	Future Lanes	Speed (mph)
Arterial	2	5	45
Arterial	5	7	45
Freeway	4	6	65
Freeway	4	8	65

Table 2-3: Highway Project Examples (New Alignment Projects)

Facility Type	Background Noise Level (dBA)	Future Lanes	Speed (mph)
Arterial	40	2	45
Arterial	50	2	45
Freeway	40	4	65
Freeway	50	4	65

Figure 2-4 through Figure 2-11 show the noise level changes predicted by FHWA TNM 3.0 for each project for distances between 100 feet (30.5 meters) and 800 feet (253.8 meters) from the centerline of the existing road (widening projects) or future road (new alignment projects). The changes are for at-grade conditions with intervening lawn. The analysis used LOS C volumes to account for traffic growth between the existing and design years and 8% trucks for arterials (4% heavy trucks and 4% medium trucks) and 15% trucks for freeways (12% heavy trucks and 3% medium trucks). Traffic was distributed uniformly across the travel lanes.

As shown in Figure 2-4, the predicted noise level increase associated with widening an arterial from two to five lanes ranges from approximately 3 to 4 dB.

Figure 2-4: Noise Increases for Arterial Widening (2 to 5 Lanes)

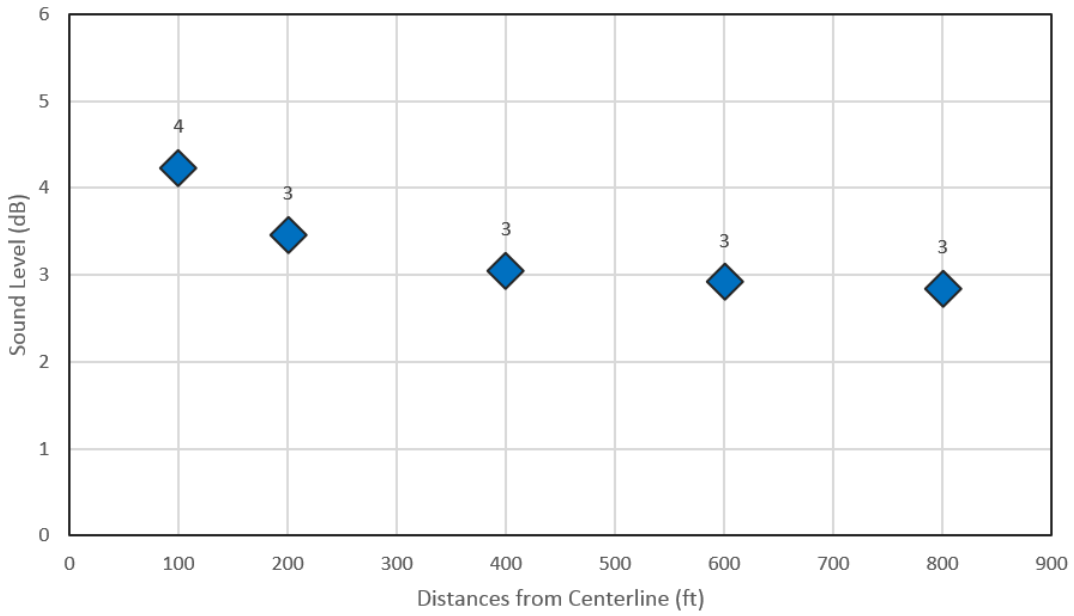
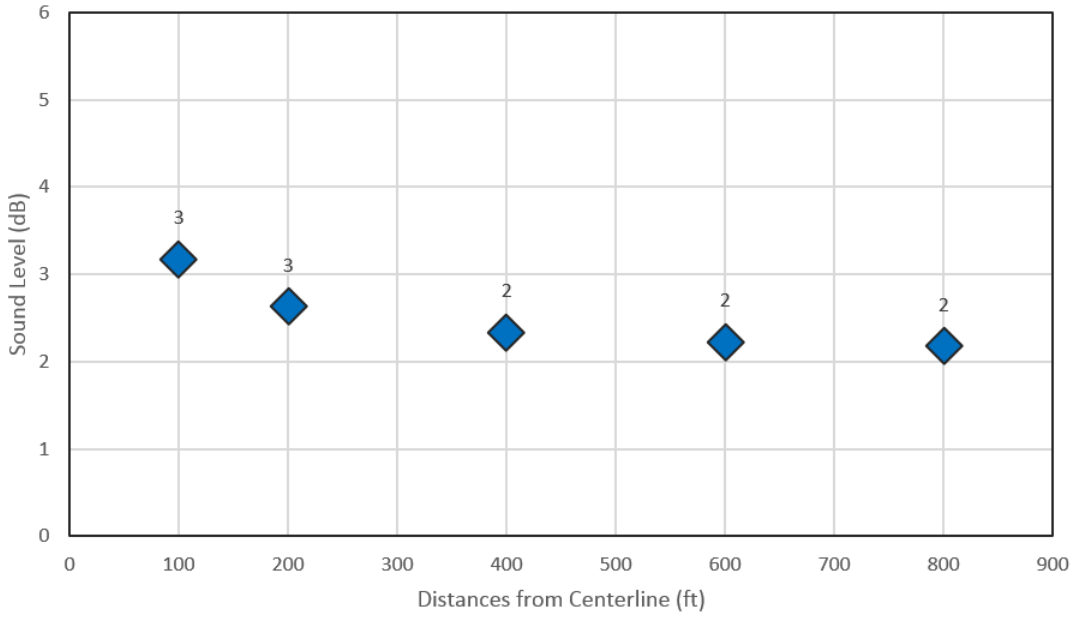


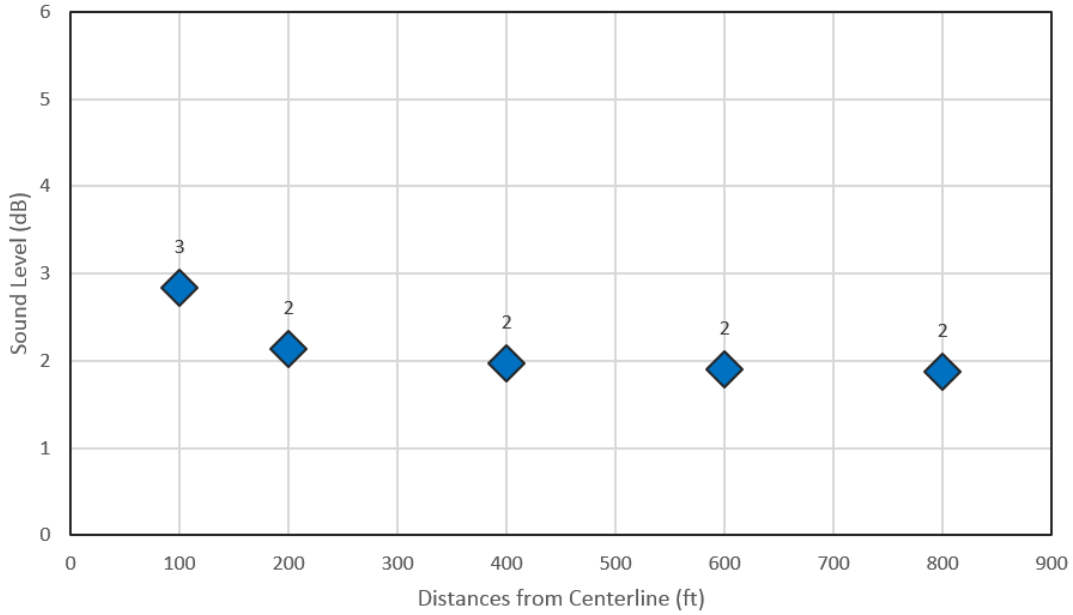
Figure 2-5 shows a slightly lower predicted noise level increase of approximately 2 to 3 dB when widening an arterial from five to seven lanes.

Figure 2-5: Noise Increases for Arterial Widening (5 to 7 Lanes)



Similarly, widening a freeway from four to six lanes yields predicted increase of 2 to 3 dB as shown in Figure 2-6.

Figure 2-6: Noise Increases for Freeway Widening (4 to 6 Lanes)



Widening a freeway from four to eight lanes increases noise levels by 3 to 5 dB as shown in Figure 2-7.

Figure 2-7: Noise Increases for Freeway Widening (4 to 8 Lanes)

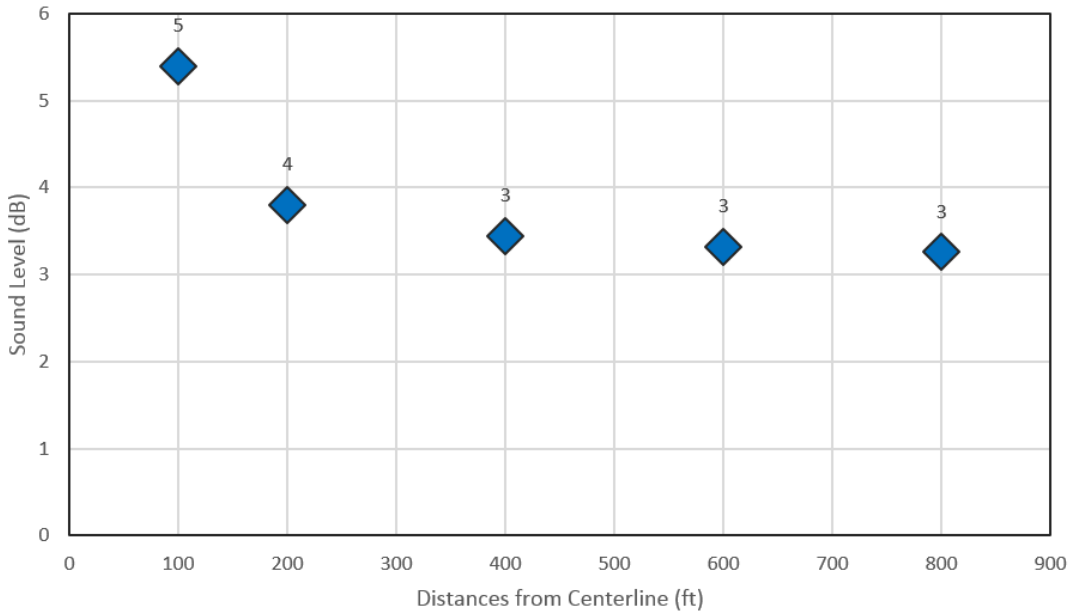


Figure 2-8 and Figure 2-9 show the predicted noise level increases for a 2-lane arterial on new alignment assuming background noise levels of 40 and 50 dBA, respectively. The predicted noise level increases are 21 dB at 100 feet (30.5 meters) from the centerline and 5 dB at 800 feet (243.8 meters) when the existing noise level is 40 dBA.

Figure 2-8: Noise Increases for New Two-Lane Arterial with Background Noise Level of 40 dBA

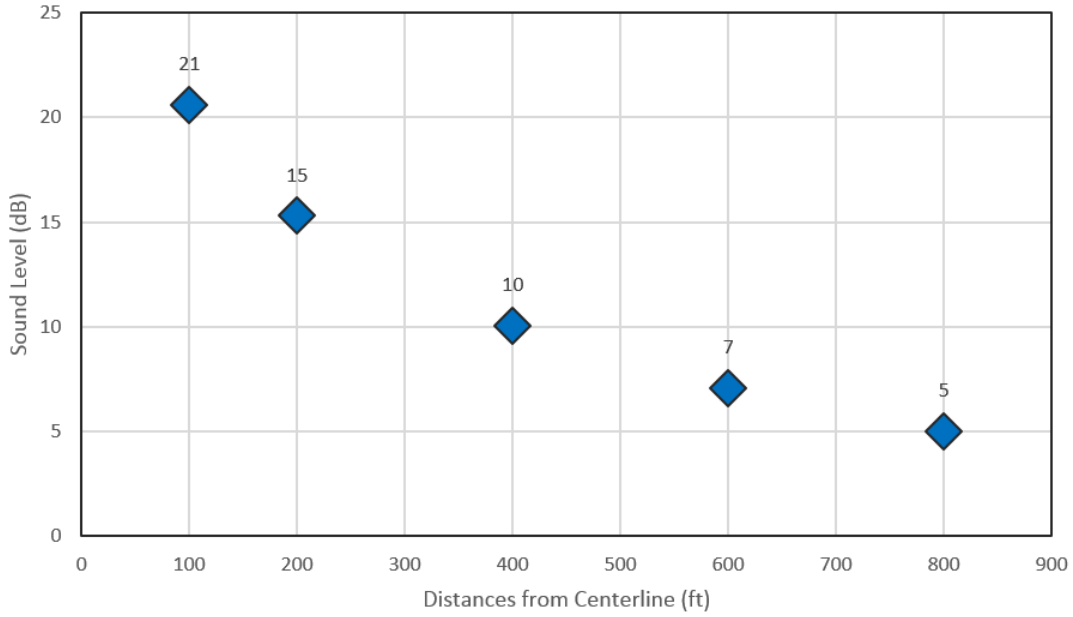


Figure 2-9 shows smaller increases of 0 to 11 dB when the existing noise level is 50 dBA.

Figure 2-9: Noise Increases for New Two-Lane Arterial with Background Noise Level of 50 dBA

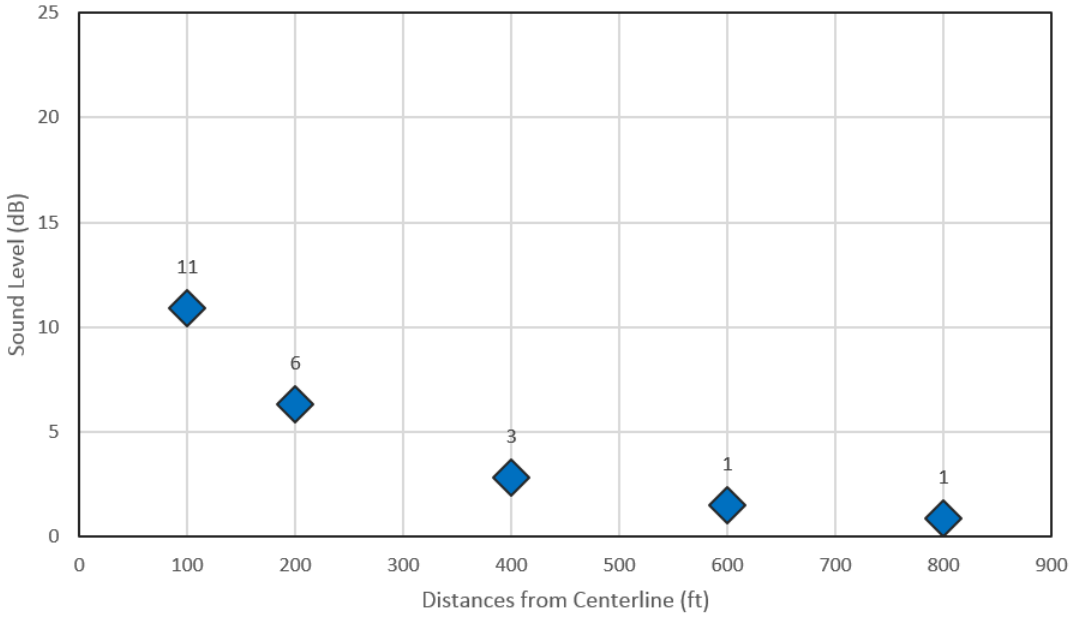


Figure 2-10 and Figure 2-11 show the predicted noise level increases for a 4-lane freeway on new alignment assuming background noise levels of 40 and 50 dBA, respectively. The predicted noise level increases are 34 dB at 100 feet (30.5 meters) from the centerline and 16 dB at 800 feet (243.8 meters) when the existing noise level is 40 dBA as shown in Figure 2-10.

Figure 2-10: Noise Increases for New Four-Lane Freeway with Background Noise Level of 40 dBA

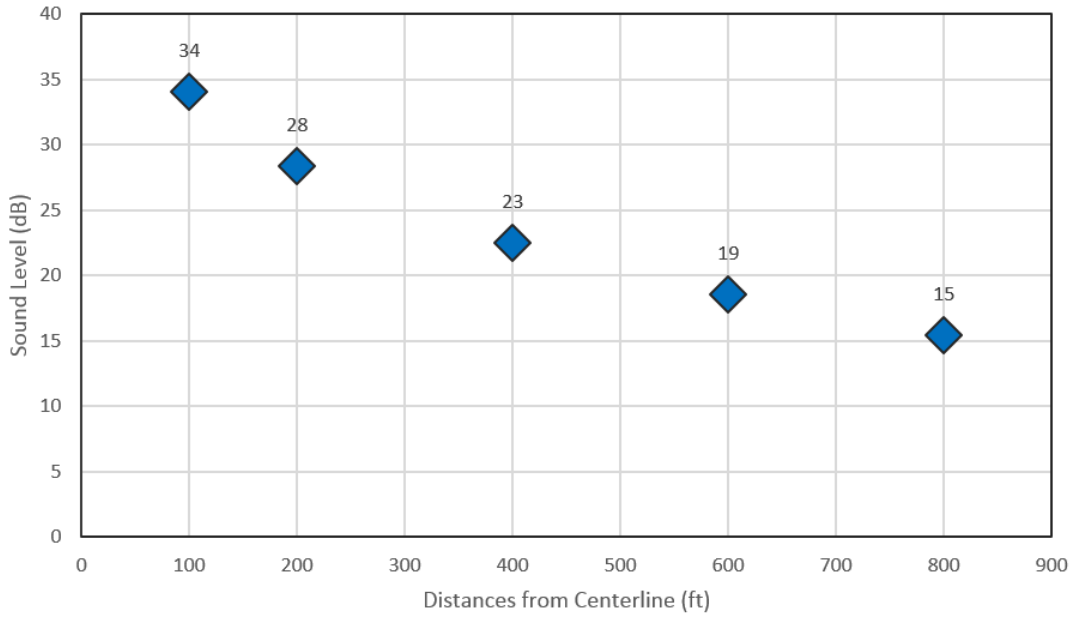
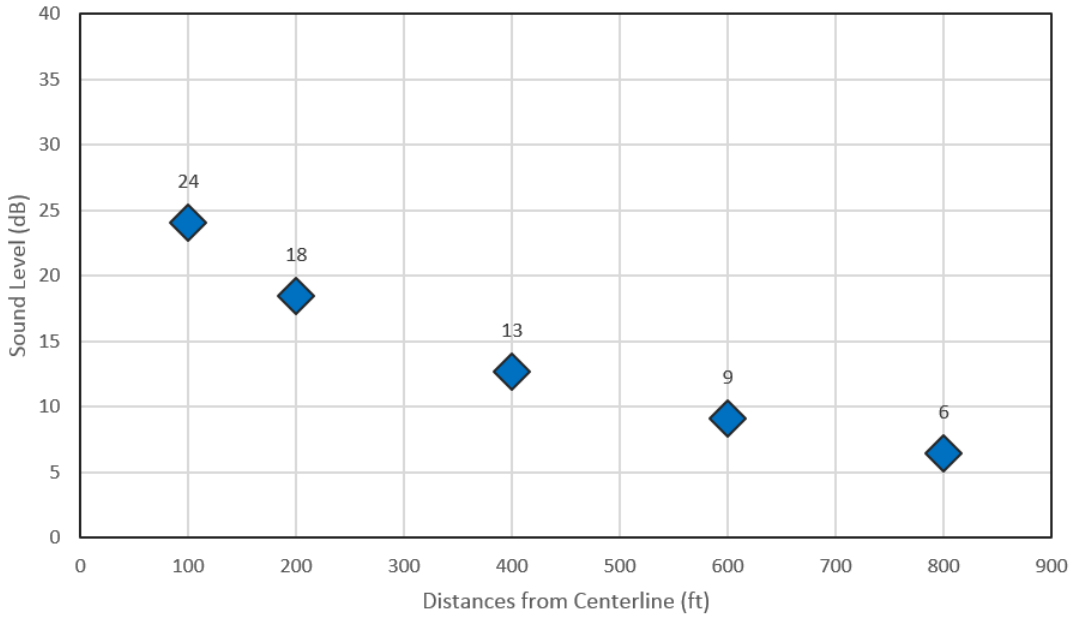


Figure 2-11 shows smaller increases of 6 to 24 dB when the existing noise level is 50 dBA.

Figure 2-11: Noise Increases for New Four-Lane Freeway with Background Noise Level of 50 dBA



Verify that the report includes TNM plan views in an appendix.

Verify that the report includes TNM plan views in an appendix.

2.10 Noise Impact Evaluation

Confirm that the report explains the regulatory definition of a noise impact.

§772.11

Confirm that the report clearly discusses the two types of impacts that can occur. Per the FHWA regulation, impacts occur if predicted future noise levels approach or exceed the NAC or if the project causes a substantial increase in existing noise levels. The report should also replicate the Noise Abatement Criteria table from the FHWA noise regulation in its entirety.

Confirm that the report defines "approach."

§772.11(e)

Confirm that the report states the value that the SHA uses for "approach." It may also include this value as part of a modified Noise Abatement Criteria table (Table 2-4).

Table 2-4: Extract from Noise Abatement Criteria Table

TABLE 1 TO PART 772 - NOISE ABATEMENT CRITERIA

[Hourly A-Weighted Sound Level_decibels (dB(A))]

Activity category	Activity Leq(h)	Criteria L10(h)	Evaluation location	Activity description
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	70	Exterior	Residential.

Confirm that the report defines "substantial increase."

§772.11(f)

Confirm that the report states the SHA's value for "substantial increase." If the SHA uses a sliding scale, a table and/or a discussion of those values should be included.

Verify that the report identifies the number and locations of noise impacts for each Build Alternative.

Verify that the report identifies the number of impacted Activity Category B residences and their locations. The report should also identify all impacted Activity Category C, D, and E receptors including the specific land use types and locations. Showing impacted receptors on an aerial with an appropriate legend can be helpful.

Noise impacts are associated with the Build Alternative(s) only. The report should not identify noise impacts for existing conditions nor for the No-Build Alternative though levels for all three scenarios should be reported.

Verify that analysis accounts for impacts to upper floor units in multi-family buildings.

Verify that the analysis includes upper floor units of multi-family buildings such as apartments and condominiums. The reported impacts should include these locations.

Source: Bowlby and Associates

Confirm that analysis identifies impacts to common areas of residential neighborhoods.

Source: Bowlby and Associates

Confirm that the report identifies impacts to common areas within residential neighborhoods, such as pools and/or playgrounds, separately from the impacts to the residences.

If the SHA allows multiple land uses to be represented by a single receiver in the TNM modeling, then a check of that grouping may be needed to ensure that all impacts are identified.

Verify that the report identifies impacts as NAC or "substantial increase."

Verify that the report identifies each noise-sensitive land use as: *not impacted*, *impacted based on the NAC*, *impacted based on substantial increase in noise levels*, or *impacted based on both the NAC and a substantial increase in noise levels*. This information may be in the body of the report, in a table or figure, or within an appendix.

Confirm that the report identifies the total number of impacts.

Confirm that the report identifies the total number of impacted noise-sensitive land uses and their associated activity categories.

Check that the predicted impacts are consistent with what would be expected.

Check that the reported impacts are consistent with what is expected. Widening projects do not typically create impacts due to a substantial increase in sound levels. Conversely, noise-sensitive land uses within a couple of hundred feet of interstates are generally impacted unless there is intervening shielding.

2.11 Noise Abatement Evaluation

Confirm that analysis evaluates noise abatement measures for all impacted land uses.

§772.13(a)

Confirm that the analysis evaluated noise abatement for all impacted land uses for the Build Alternative(s). At a minimum, the SHA must consider noise abatement in the form of a noise barrier, since barriers are generally the best available abatement measure to reduce noise levels for impacted land uses.

Source: Bowlby and Associates

If there are existing barriers on a Type I project, follow FHWA's guidance document "*Consideration of Existing Noise Barrier in a Type I Noise Analysis*" *(FHWA-HEP-12-051)*

Check that analysis evaluates other abatement measures per the SHA noise policy.

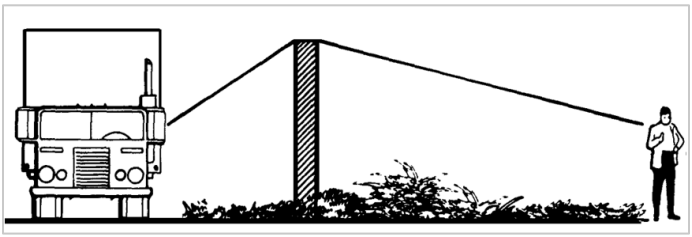
§772.15(c)

Check if the analysis evaluated other abatement strategies per the SHA noise policy. SHAs may consider other types of abatement measures per the FHWA noise regulation including: (1) traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicles types, time-use restrictions for certain vehicle types, and exclusive lane designations); (2) alteration of horizontal and vertical alignments; (3) acquisition of property rights (either in fee or lesser interest) for construction of noise barriers; and (4) noise insulation of Activity Category D land uses.

Noise insulation measures might include: installation of new windows; sealing windows, cracks, and other openings; and installing air-conditioning. However, post-installation maintenance and operational costs are not eligible for Federal funding.

Verify that the report identifies the most acoustically effective barrier locations.

Verify that the report identifies the most acoustically effective location for each noise barrier. Noise barriers are generally most effective when they are close to the road (i.e., at the highway shoulder) or close to the receptor (i.e., at/near the right-of-way). Siting a proposed barrier at the most acoustically effective location for the affected receptors is critical to accurately assess whether a barrier meets the feasibility and reasonableness criteria in the SHA noise policy.

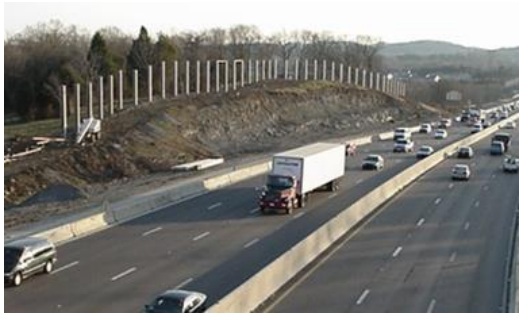


Source: FHWA, "Highway Noise Analysis," FHWA Demonstration Project No. 45, 1978.

If the road is on a fill and the receptors are depressed below the road, the most effective location will be close to road. Barriers located down the slopes will need to be higher to provide the desired noise reduction, which may compromise the ability to achieve the SHA's Noise Reduction Design Goal and cost effectiveness criteria.

Source: Bowlby and Associates

If the road is in cut and the receptors are elevated above the road, the most effective barrier location will generally be near the right-of-way, since a barrier near the road may not break the line-of-sight to elevated receptors. Barriers located down the slope from the right-of-way will need to be higher to provide the desired noise reduction, which may compromise the ability to achieve the SHA's Noise Reduction Design Goal and cost effectiveness criteria.



Source: Bowlby and Associates

Additionally, in areas where a road transitions from cut to fill, the barrier may need to transition from a location near the right-of-way to a location near the road. The analysis may need to evaluate more than one location to ensure that the conclusions regarding barrier feasibility and reasonableness are correct.

There may be non-acoustical reasons for siting a barrier at other locations. These could include drainage, clear zone requirements, and the desire to accommodate future widening of the road.

The report should identify and discuss the most effective barrier location as well as any other evaluated locations.

Check that analysis evaluated interior abatement measures in accordance with the SHA noise policy for impacted Activity Category D land uses for which noise barriers were not feasible or reasonable.

Check that the evaluation of any interior abatement measures is consistent with the SHA noise policy. SHAs must evaluate interior abatement measures for impacted Activity Category D land uses if exterior abatement measures are not feasible or reasonable. This evaluation should be closely coordinated with the SHA before any recommendations are included in the noise study report.

2.11.1 Noise Barrier Design

Verify that the report discusses the process used to design noise barriers or berms.

Verify that the noise barrier design process is consistent with the SHA noise policy. The report should document the noise barrier design process and demonstrate that the process is consistent with the SHA noise policy. The process can involve evaluating varying heights and lengths to find the barrier that achieves the greatest noise reduction at the greatest number of impacted receptors while meeting the SHA's reasonableness criteria.

The SHA's design process is different from achieving the Noise Reduction Design Goal, which is a minimum threshold for reasonableness. For example, the Noise Reduction Design Goal may be 7 dB at one impacted receptor. A SHA should not design abatement to protect only one impacted receptor if multiple receptors are impacted. A barrier should not be designed merely to meet the Noise Reduction Design Goal.

Earth berms require significant right-of-way that is typically not available. If the noise study report includes earth berms as a potential abatement measure, the report should include a detailed discussion of the locations and dimensions that might be possible based on the current project plans.

Source: Ohio Department of Transportation

A 15-foot high berm constructed at a 2:1 slope with a 5-foot top would be 65 feet wide. Additionally, berms are generally not feasible if the road is in cut or on-fill. Maintenance and operational costs are not eligible for Federal-air funding.

Coordination with the project management and design team may be needed before recommendations are included in the report.

Check that the report notes any barrier design limitations in the SHA noise policy.

Check that the report identifies any engineering or environmental limitations included in the SHA noise policy such as general barrier height constraints due to wind loads, icing during winter, or weight restrictions. There may also be limitations on absorptive materials close to ground level where they may be affected by deicing salts in northern climates.

Source: Bowlby and Associates

Tall barriers on bridges may not be possible or may require significant design modifications. Coordination with the design engineers is recommended when barriers on bridges are evaluated. Maintenance and operational costs are not eligible for Federal-aid funding.

Check that noise barrier evaluation accounts for the effects of background noise.

Check if the noise barrier evaluation accounts for the effects of background noise. If so, confirm that the report discusses the process. The feasibility and reasonableness evaluations should consider all noise sources in the project area. As discussed previously, background noise can increase noise levels and affect noise impact conclusions.

Background noise may also affect the noise barrier design process since the TNM-predicted noise barrier reduction will only be realized when the background noise remains substantially lower than the highway noise with the barrier present. Background noise may also reduce the number of benefited residences and affect the feasibility and reasonableness conclusions.

If transit sources are significant, the project might require an analysis using the Federal Transit Administration Report Number FTA-VA-90-1003-06, "Transit Noise and Vibration Impact Assessment."

Check that the report provides the predicted no-barrier and with barrier noise levels and insertion losses for each modeled receiver for each evaluated noise barrier.

Check that the report includes tables that show the predicted no-barrier and with barrier noise levels and insertion losses for each modeled receiver for each evaluated noise barrier. These tables may be included in the body of the report or an appendix. It is helpful if the tables indicate which receivers are benefited and the total number of benefited residences or equivalent residences.

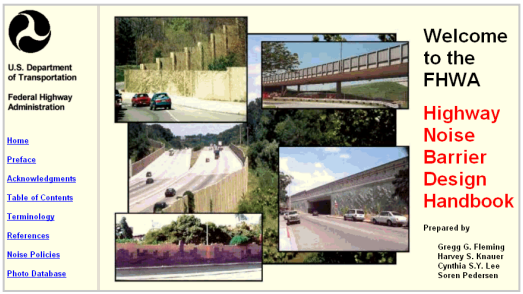
2.11.2 Feasibility

Confirm that the report includes a preliminary qualitative assessment of engineering factors that could affect the barrier.

§772.13(d)(1)

§772.13(d)(1)(ii)

Confirm that the report includes a preliminary qualitative assessment of any engineering factors that could affect the barrier. These factors include: safety (sight distance and clear zone), barrier height, topography, drainage, utilities, maintenance, any special requirements for barriers on bridges, and access to adjacent properties. The extent to which these issues can be assessed will depend on the project development process. FHWA's *Noise Barrier Design Handbook* is a resource for evaluating potential noise barrier construction issues.



Noise study reports done as part of the NEPA process should generally not identify barriers as "not feasible" based on engineering factors as these issues can often be addressed during the design process.

Noise barriers may be feasible along non-access controlled roads, such as arterials, particularly in locations where future access has been precluded by the development itself (i.e. reverse frontage residences). The analysis should evaluate noise barriers at these locations.

Verify that the report provides the acoustic feasibility results for each evaluated noise barrier.

§772.13(d)(1)(i)

Verify that the report summarizes the acoustic feasibility results. Noise barriers must provide a minimum 5 dB reduction in future noise levels for the number or percent of impacted receptors defined in the SHA noise policy to be feasible. The report should document the feasibility results for each barrier. Do not assess reasonableness if noise abatement is not feasible.

Blocking the line of sight between the road and an adjacent land use usually provides a 5 dB noise reduction.

2.11.3 Reasonableness

Verify that the report outlines the steps of the reasonableness evaluation.

§772.13(d)(2)

Verify that the report lists and discusses the three required steps of the reasonableness evaluation:

1. Noise Reduction Design Goal
2. Cost Effectiveness
3. Viewpoints of Benefited Residents and Property Owners

All three criteria must be met per the FHWA noise regulation for a barrier to be considered reasonable.

If a noise barrier does not meet the Noise Reduction Design Goal then it is not reasonable and a cost effectiveness evaluation should not be conducted. Similarly, if a noise barrier does not meet the cost effectiveness criteria then it is not reasonable and there is no need to obtain the viewpoints of the benefited property owners and residents.

The FHWA noise regulation permits SHAs to consider other reasonableness factors including: date of development, length of time that receptors have been exposed to highway traffic noise impacts, exposure to higher absolute highway traffic noise levels, changes between existing and future build conditions, percentage of mixed zoning development, and use of noise compatible planning concepts by the local government. These factors must be applied uniformly to all projects.

Confirm that the report defines "benefited" per the SHA noise policy.

§772.13(e)

Confirm that the report states how much noise reduction a barrier must provide for a receptor to be benefited. The value must be greater than 5 dB, but less than the SHA's Noise Reduction Design Goal.

Confirm that analysis accounts for benefits at upper-floor units in multi-family buildings.

Confirm that the reasonableness evaluation includes benefited upper floor units in the cost effectiveness evaluation.

Check that the report discusses the SHA procedure for calculating equivalent receptors for non-residential land uses.

§772.11(c)(2)(iii)

Check that the report includes a discussion of the procedure for calculating receptors for non-residential land uses. The FHWA noise regulation requires that each SHA develop a procedure for determining an equivalent number of receptors for non-residential uses. The report should discuss this procedure as it was applied to each non-residential land use. Documenting the source of the data can help during subsequent project reevaluations.

Confirm that the report shows the calculations of the equivalent number of receptors for non-residential land uses.

Confirm that the report documents all assumptions and shows any mathematical calculations in the body of the report or in an appendix.

2.11.3.1. Noise Reduction Design Goal

Verify that the report states the Noise Reduction Design Goal.

§772.13(d)(2)(iii)

Verify that report includes the Noise Reduction Design Goal from the SHA noise policy. Some SHAs use "first-row" benefited receptors in lieu of "benefited receptors," which is an important distinction that can affect results.

Check that the report shows the Noise Reduction Design Goal results for each evaluated noise barrier.

Check that the report documents the Noise Reduction Design Goal calculations in the text or in a table. The reviewer may want to check for consistency between the reported number of benefited receptors receiving the Noise Reduction Design Goal value with the associated barrier design in the TNM model.

As shown in Table 4, a 5 dB reduction is relatively simple to obtain and is readily perceptible. A 10 dB reduction is more difficult to obtain but is used as a design goal by many SHAs because it means the sound would be half as loud as without the barrier. A 15 dB reduction is difficult to achieve because it requires removing 97% of the sound energy and often requires very tall barriers. Finally, a 20 dB reduction is nearly impossible because it requires removing 99% of the sound energy.

Table 2-5: Noise Barrier Design and Insertion Loss

Insertion Loss	Degree of Difficulty	Reduction in Sound Energy	Relative Reduction in Loudness
5 dB	Simple	68%	Readily perceptible
10 dB	Attainable	90%	Half as loud
15 dB	Very difficult	97%	One-third as loud
20 dB	Nearly impossible	99%	One-fourth as loud

Source: FHWA "Noise Barrier Design Handbook."

2.11.3.2. Cost Effectiveness

Verify that the report states the cost effectiveness criteria in the SHA noise policy.

§772.13(d)(2)(ii)

Verify that the report states the cost effectiveness criteria in the SHA noise policy. Most SHAs use a cost per benefited receptor as the cost effectiveness criteria. Other SHAs use a barrier area (square-foot) per benefited receptor instead of cost. Some SHAs also use different systems of cost effectiveness for residential land uses (Activity Category B) and non-residential land uses (Activity Categories C, D, and E).

Check that reported values match the barrier design in the associated TNM model.

Check the reported barrier dimensions with the barrier design in the TNM model. This would require comparing the TNM results with the noise levels in the summary tables of the report. The reviewer can reference FHWA's *Techniques for Reviewing TNM Model Runs and Associated Modeling Reports* for guidance.

Confirm that analysis used the correct barrier unit cost per the SHA noise policy.

Confirm that the analysis used the correct barrier unit cost. SHAs periodically update barrier costs, which can affect results. The noise analysis should use the most recent costs provided by the SHA. Costs are not considered by SHAs that use that use barrier area per benefited residence for cost effectiveness.

Confirm that the report identifies the number of benefited receptors for each barrier.

Confirm that the report identifies the total number of benefited residences for each evaluated noise barrier including the number of "equivalent residences" for non-residential land uses. The reviewer may want to check for consistency between the reported number of benefited receptors with the associated barrier design in the TNM model.

Verify that the report shows the cost effectiveness results for each evaluated noise barrier.

Verify that the report documents the cost effectiveness calculations for each evaluated noise barrier in the text or in a table and that the calculations are correct. If the cost per benefited residence or area per benefited residence exceeds the allowable threshold, the reviewer may request that the analyst review the barrier design. Shorter barrier segment lengths and lower barrier height-perturbations may reduce the cost or area enough to make the barrier reasonable. Additionally, increasing the heights of important barrier segments may increase the ILs of receivers that are close to being benefited to above the benefited threshold thus reducing the cost per benefited residence or area per benefited residence.

Check that the report discusses the SHA noise policy regarding cost-averaging analysis (if applicable).

§772.13(k)

Check that the report adequately discusses the SHA policy on cost-averaging. The FHWA noise regulation allows states to average the cost effectiveness values for barriers if: 1) they share a "common noise environment," 2) no barrier exceeds two times the allowable cost effectiveness, 3) the collective cost effectiveness does not exceed the threshold, and 4) the SHA noise policy specifically allows it. The study should apply cost-averaging per the SHA noise policy.

Check that the report shows the cost-averaging calculations and the results are correct (if applicable).

§772.13(d)(2)(i)

Check that the report clearly shows all cost-averaging calculations and verify that the calculations are correct. Table 2-6 shows a cost averaging example.

Table 2-6: Example of Cost Averaging

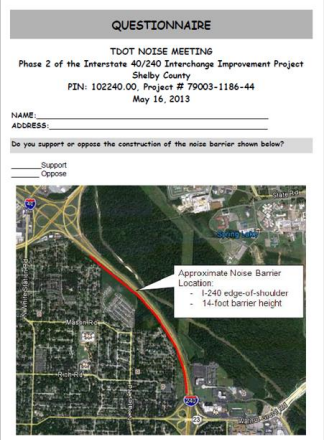
Barrier	Cost	Benefited Residences	Calculated Cost Per Benefited Residence	Allowable Cost Per Benefited Residence	Reasonable?
A	$1,500,000	50	$30,000	$40,000	Yes
B	$1,500,000	30	$50,000	$40,000	No
A and B	$3,000,000	80	$37,500	$40,000	Yes

2.11.3.3. Viewpoints of Benefited Property Owners and Residents

Check that the report documents the SHA process for soliciting the viewpoints of benefited property owners and residents.

Check that the report discusses the SHA policy for soliciting the viewpoints of benefited property owners and residents. The FHWA noise regulation requires that each SHA have a defined process for soliciting the viewpoints of the benefited property owners and residents.

There may be more than one noise study during the life of a project and obtaining public viewpoints may not occur until design is well under way. The report should include any results available at the time a noise study report is finalized.


QUESTIONNAIRE

TDOT NOISE MEETING
Phase 2 of the Interstate 40/240 Interchange Improvement Project
Shelby County
PIN: 102240.00, Project # 79003-1186-44
May 16, 2013

NAME:_____
ADDRESS:_____

Do you support or oppose the construction of the noise barrier shown below?

_____Support
_____Oppose

Approximate Noise Barrier Location:
- I-240 edge-of-shoulder
- 14-foot barrier height

Source: Tennessee Department of Transportation

The solicitation of viewpoints should occur following approval of the final noise abatement design. The statement of likelihood should include a disclosure that the solicitation of viewpoints will occur during the completion of the project's final design and the public involvement processes. (FAQ G8)

§772.13(g)(3)

2.11.4 Statement of Likelihood

Verify that the report includes a statement of likelihood.

Verify that the report includes a statement of likelihood. The FHWA noise regulation requires that all noise study reports and associated environmental documents include a statement of likelihood.

The statement of likelihood must include 1) a description of the barriers that are preliminarily feasible and reasonable, including the preliminary location and physical description of the likely noise abatement measures, and 2) a statement that final decisions regarding noise abatement design and

construction will be made based on the project's final design and completion of the public involvement process.

The barrier descriptions should include barrier lengths, heights, areas and costs. The preliminary noise barrier locations should also be shown on figures in the report or an appendix. SHAs may also include preliminary design tables showing barrier stationing, offsets, and base and top elevations.

2.11.5 Absorptive Noise Barrier Treatments

Check that analysis evaluated the need for absorptive treatments in accordance with the SHA noise policy.

§772.13(c)(2)

Check if the analysis evaluated absorptive treatments and, if so, confirm that process was consistent with the SHA noise policy.

Source: Bowlby and Associates

Noise reflections between parallel reflective noise barriers on both sides of the highway can degrade the predicted effectiveness of the noise barriers. The amount of degradation is highly dependent on geometrics and degradations can vary significantly from location to location behind the same noise barrier. The analysis can use TNM to evaluate absorptive treatments for parallel barriers.

Table 2-7 summarizes FHWA's recommendations regarding absorptive treatments for parallel barriers. As indicated, a distance between the barriers of at least ten times the average height should minimize reflections although it is desirable to confirm the degradations through modeling.

Table 2-7: Noise Barrier Design and Insertion Loss

Width to Height Ratio	Maximum Change in IL	Recommendation
Less than 10:1	3 or greater	Action required to minimize degradation.
10:1 to 20:1	0 to 3	At most, degradation barely perceptible; no action required in most
Greater than 20:1	No measurable degradation	No action required.

Source: FHWA "Noise Barrier Design Handbook."

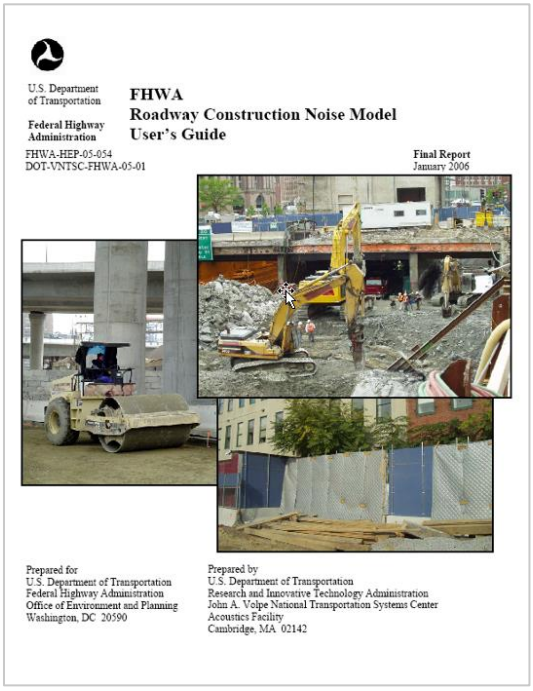
Noise reflections off a single noise barrier can increase noise levels on the opposite side of the highway, typically by less than 3 dB.

SHAs that opt to use absorptive treatments to minimize noise reflections must have a standard practice that is consistent and applied uniformly statewide. The report should discuss this practice and how it was applied to the project. The SHA may opt to wait until later in the design process to evaluate noise reflections. In this case, the report should identify the need to perform this analysis and how this relates to any currently proposed abatement.

2.12 Construction Noise

Confirm that the report includes a discussion of construction noise. *§772.19*

Confirm that the report includes a section on construction noise. Many SHAs include standard language in the report that references the SHA's accepted engineering practices that minimize noise exposure. Most projects will not require modeling or a quantitative construction noise analysis.



If a detailed construction noise evaluation is needed, the FHWA Roadway Construction Noise Model (RCNM) is available.

Noise study reports should only include construction noise mitigation strategies after discussion with the SHA project team. If the noise study report states that these strategies "should" or "shall" be implemented, then they could become environmental commitments. Commitments are legally binding promises and should be carefully considered to ensure they are achievable, prior to being made.

If the report identifies necessary special abatement techniques, they should be included in the final design plans in the form of notes, special provisions, or design features. Specific abatement is typically only evaluated for unique properties (e.g., scientific research labs, museums, or historic areas) or for projects where the SHA plans nighttime construction activities.

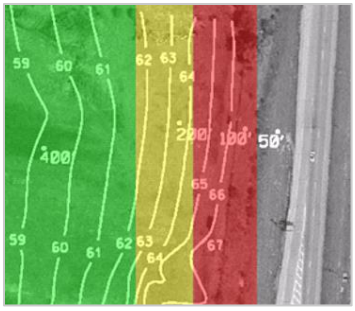
2.13 Information for Local Officials

Confirm that noise study report includes information for local officials.

§772.17

Confirm that the report includes the following information:

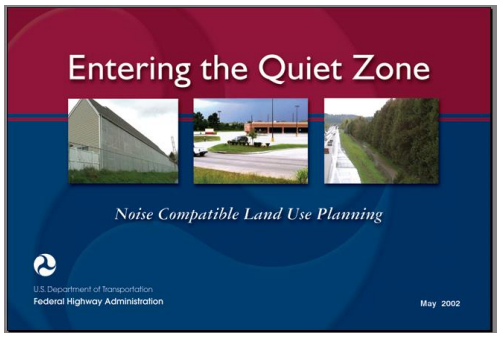
1. Information on noise compatible planning concepts,
2. The best estimation of the design year noise levels on the undeveloped lands along the project at various distances from the edge of the nearest travel lane of the highway improvement (typically in the form of noise contour information – see image on right), and
3. Information on Type II project eligibility.



Source: *Consideration of Land Use Planning in the ODOT Noise Abatement Process, I-675, Greene County, Ohio*, Ohio DOT, November 2004

The reports can reference two FHWA documents on noise compatible land use planning:

- *The Audible Landscape: A Manual for Highway Noise and Land Use*, FHWA, November 1974. [4]
- *Entering the Quiet Zone: Noise Compatibility Land Use Planning*, FHWA, May 2002. [5]



The FHWA noise regulation also requires that SHAs provide the information to local officials. Ensure that the process for providing this information is followed.

2.14 Indirect and Cumulative Effects (for EAs and EISs)

Confirm that the report includes a discussion of indirect and cumulative effects.

Confirm that the report includes a discussion on indirect and cumulative effects for EAs and EISs

The design year traffic projections used for the noise analysis usually includes at least 20 years of traffic growth including the effects of planned and programmed projects. As a result, the reported noise impacts include this growth and represent both direct and cumulative noise impacts.

New alignment projects, in particular, can cause a redistribution of traffic and might affect development patterns in the project area leading to higher traffic volumes and indirect noise effects beyond the project limits. However, the resulting noise level increases are usually small.

2.15 References

Check that the report includes a list of references.

Check that the report includes a list of references and that the list is complete.

2.16 Appendices

Check that the report includes the relevant appendices per the SHA noise policy.

Check that the appendices include the information desired by the SHA. Appendices that may be helpful include:

- Cover of Project Plans and Typical Cross-Sections
- Noise Measurement Data Sheets and Photographs
- Traffic Projections
- TNM Plan Views
- Design Year Noise Levels and Impacts, Build Alternative(s)
- Noise Barrier Feasibility and Reasonableness Results
- Locations of Likely Noise Abatement Measures

3.0 Reviewing the Noise Section of the NEPA Document

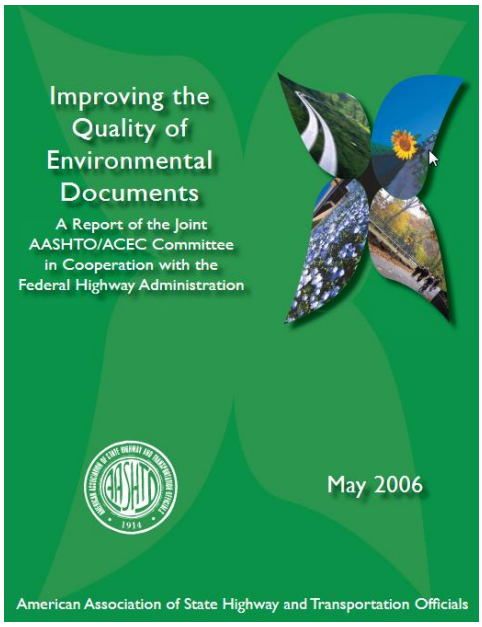
The noise section of the environmental document must summarize the noise study results and conclusions as listed in the FHWA Nosie regulation.

There is a major difference between NEPA and 23 CFR 772 requirements for determining traffic noise impacts. NEPA requires comparison of a proposed alternative with a baseline (the No-Build or no action alternative) in the design year to determine whether traffic noise impacts will occur. The proposed project itself must create the traffic noise impact. However, the FHWA noise regulation utilizes the opportunity provided by a proposed project to consider mitigating current as well as future noise problems. Therefore, under the FHWA noise regulation, if the predicted noise level approaches or exceeds the NAC, there is a traffic noise impact regardless of whether or not the proposed project is the cause. Even if noise levels decrease in the future from 72 dBA to 69 dBA at a Category B site, there is still a traffic noise impact, and noise abatement must be considered. (FAQ A5)

It is FHWA's view that the noise analysis performed to satisfy the requirements of 23 CFR 772 generally satisfies the requirements under NEPA. However, some Type III projects may require additional analysis of traffic noise impacts on wildlife or historic properties, or for unusual circumstances where the project will increase noise levels, but does not include activities classified as a Type I project.

NEPA also requires analysis of the No-Build Alternative, which is not a requirement of 23 CFR 772. Some SHAs require analysis of the future No-Build Alternative to satisfy the NEPA requirement. SHAs may also find analysis of the future No-Build Alternative useful to compare noise levels with and without the project because there are circumstances where project construction reduces future noise levels such as when a road is moved away from sensitive receptors. (FAQ A6)

The FHWA emphasizes the need to develop quality NEPA documents and encourages a "reader friendly" document approach. The FHWA cooperated with the American Association of State Highway and Transportation Officials (AASHTO) and the American Council of Engineering Companies (ACEC) on the report, *Improving the Quality of Environmental Documents*. [6]



Source: AASHTO

The report presents three core principles for developing quality environmental documents. Principle 2 is to keep the document as brief as possible, using clear, concise writing; an easy-to use format; effective graphics and visual elements; and discussion of issues and impacts in proportion to their significance.

The environmental document must summarize the findings of the noise study. Per the FHWA noise regulation, the environmental document must include:

1. The locations where noise impacts are predicted to occur;
2. The Statement of Likelihood, which includes a description of the location and features of noise abatement measures which are feasible and reasonable, with a disclaimer that indicates that final recommendations on the construction of any of these abatement measure(s) is determined during the completion of the project's final design and the public involvement processes; and
3. Land uses with noise impacts for which no noise abatement measures are feasible and reasonable and where noise impacts are an unavoidable consequence of the project.

These items should also be present in the noise study report and the reviewer should verify that the information is consistent and all applicable commitments are properly described in both documents.

3.1 Categorical Exclusion (CE)

Confirm that CE references the FHWA noise regulation and SHA noise policy.

Confirm that the section references the current FHWA noise regulation and SHA noise policy as well as any applicable SHA procedures.

Verify that CE references the noise study report in an appendix/attachment.

Verify that the section references the noise study report.

Check that CE identifies the type of project.

Check that the section identified whether the project is Type I, Type II, or Type III.

Confirm that CE identifies all impacted noise-sensitive land uses.

Confirm that the section identifies the number of impacts for each Activity Category.

Check that CE identifies impacts as NAC or "substantial increase."

Check that the section identifies whether the impacts are NAC, substantial increase, or both.

Verify that CE summarizes the conclusions of the noise abatement evaluation.

Verify that the section summarizes the feasibility and reasonableness results for all evaluated abatement measures. A table summarizing the noise barrier evaluation results may be appropriate.

The section should also summarize any public involvement activities conducted as a part of the noise analysis process.

Check that CE identifies impacted land uses for which abatement is not feasible or reasonable.

Check that the section identifies any impacts that will not be mitigated.

Verify that CE includes a statement of likelihood.

Verify that the CE includes a statement of likelihood per the FHWA noise regulation.

Confirm that CE includes a discussion of information for local officials or a reference to the applicable section of the noise study report.

Confirm that the section includes information for local officials.

3.2 Environmental Assessment (EA) and Environmental Impact Statement (EIS)

EAs and EISs expand upon the information provided in CEs. The *Improving the Quality of Environmental Documents* report recommends a new EIS blueprint as indicated in Table 3-1.

Table 3-1: EIS Sections

Traditional Approach	New Blueprint
Purpose and Need	Purpose and Need
Alternatives	Alternatives Considered
Affected Environment	Environmental Resources, Impacts and Mitigation
Environmental Consequences	Public Comment and Agency Coordination
Section 4(f)	Section 4(f) Chapter
Comments, Coordination & Public Involvement	Comparison and Selection of Alternatives

Source: *Improving the Quality of Environmental Documents*, FHWA.

Noise has traditionally been addressed in the Affected Environment and Environmental Consequences sections, which have been combined into the "Environmental Resources, Impacts and Mitigation" section under the new blueprint. The structure of an EIS may vary from project to project, so chapter titles may not match the sections listed. In these cases, the document preparer will integrate the provided noise information into the document. The noise section should address environmental resources, impacts, and mitigation. Table 3-2 summarizes the section of the noise study report that coincide with each item. Although not shown in Table 3-2, the following various EA Chapters/Sections also apply to the Noise Study report sections: *Affected Environment and*

Environmental Consequences, *Affected Environment and Environmental Impacts*, and *Environmental Consequences*.

Table 3-2: Noise Study Report and EA/EIS Sections

Noise Study Report Section	Traditional Approach for EIS Chapter/Section	New FHWA Blueprint for EIS Chapter/Section
Introductory Material and Project Description	Affected Environment	Environmental Resources
Traffic Noise Fundamentals/Terminology	Affected Environment	Environmental Resources
Identification of Noise-Sensitive Land Uses	Affected Environment	Environmental Resources
Determination of Existing Noise Levels	Affected Environment	Environmental Resources
Determination of Future Noise Levels	Environmental Consequences	Environmental Resources
Determination of Traffic Noise Impacts	Environmental Consequences	Impacts
Construction Noise	Environmental Consequences	Impacts
Noise Abatement Evaluation	Environmental Consequences	Mitigation
Information for Local Officials	Environmental Consequences	Mitigation

3.2.1 Introductory Material and Project Description

Confirm that EA or EIS references the FHWA noise regulation and SHA noise policy.

Confirm that the section references the current FHWA noise regulation and SHA noise policy as well as any applicable SHA procedures.

Verify that EA or EIS references the noise study report in an appendix/attachment.

Verify that the section references the noise study report.

Check that EA or EIS identifies the project as Type I.

Check that the section discusses why the project is Type I.

3.2.1 Traffic Noise Fundamentals/Terminology

Check that EA or EIS explains the fundamentals of traffic noise and terminology.

Check that the section explains fundamentals of highway traffic noise and defines the noise descriptors used for the noise analyses including: *decibel*, *hourly A-weighted equivalent sound level* (L_{eq}(1h)), and *insertion loss* (IL). An overview of common sound levels is also helpful.

3.2.2 Identification of Noise-Sensitive Land Uses

Verify that EA or EIS describes the noise-sensitive land uses in the project area.

Verify that the section summarizes the land uses near each Build Alternative including the activity category.

3.2.3 Determination of Existing Noise Levels

Verify that EA or EIS describes the existing noise environment.

Verify that the section summarizes the existing noise levels at noise-sensitive land uses near each Build Alternative.

3.2.4 Determination of Future Noise Levels

Verify that EA or EIS describes the future noise levels with the project.

Verify that the section summarizes the future noise levels at the noise-sensitive land uses near each Build Alternative.

3.2.5 Determination of Traffic Noise Impacts

Check that EA or EIS discusses the impact criteria in the SHA noise policy.

Check that the section replicates the NAC table from the FHWA noise regulation and states the values that the SHA's values for "approach" and "substantial increase."

Confirm that EA or EIS identifies all impacted land uses and their associated activity categories for each Build Alternative.

Confirm that the section identifies the number of impacted land uses and the associated activity category.

3.2.6 Construction Noise

Verify that EA or EIS includes a discussion of construction noise.

Verify that the section includes a discussion of construction noise.

3.2.7 Noise Abatement Evaluation

Confirm that EA or EIS summarizes the conclusions of the noise abatement evaluation.

Confirm that the section summarizes the feasibility and reasonableness results for all evaluated abatement measures for all Build Alternatives. A table summarizing the noise barrier evaluation results may be appropriate. The section should also summarize any public involvement activities conducted as a part of the noise analysis process.

Confirm that EA or EIS identifies impacted land uses for which abatement is not feasible or reasonable.

Confirm that the section identifies any impacts that will not be mitigated.

Verify that EA or EIS includes a statement of likelihood.

Verify that the EA or EIS includes a statement of likelihood per the FHWA noise regulation.

Confirm that EA or EIS includes a discussion of information for local officials.

Confirm that the section provides the following per the FHWA noise regulation:

1. Information on noise compatible planning concepts,
2. The best estimation of the design year noise levels on the undeveloped lands along the project at various distances from the edge of the nearest travel lane of the highway improvement, and
3. Information on Type II project eligibility.

Verify that EA or EIS includes a discussion of indirect and cumulative effects.

Verify that the section discusses whether the project is expected to have any indirect or cumulative noise effects. If the design year traffic projections used for the analysis include increases in through traffic as well as planned development and projects in the area, the predicted noise impacts could represent both direct and cumulative noise impacts.

Some projects will cause a redistribution of traffic on the surrounding roadway network and might affect development and land use patterns in the project area. These situations could result in higher traffic volumes and noise levels at locations beyond the project limits.

4.0 Reviewing Other Noise Reports

Other types of noise reports and materials that may require review include noise screening reports, public involvement materials, noise reevaluations, and noise barrier design documents. This section provides some general information and guidance for the review of these materials but is not intended to replace any SHA review processes or procedures.

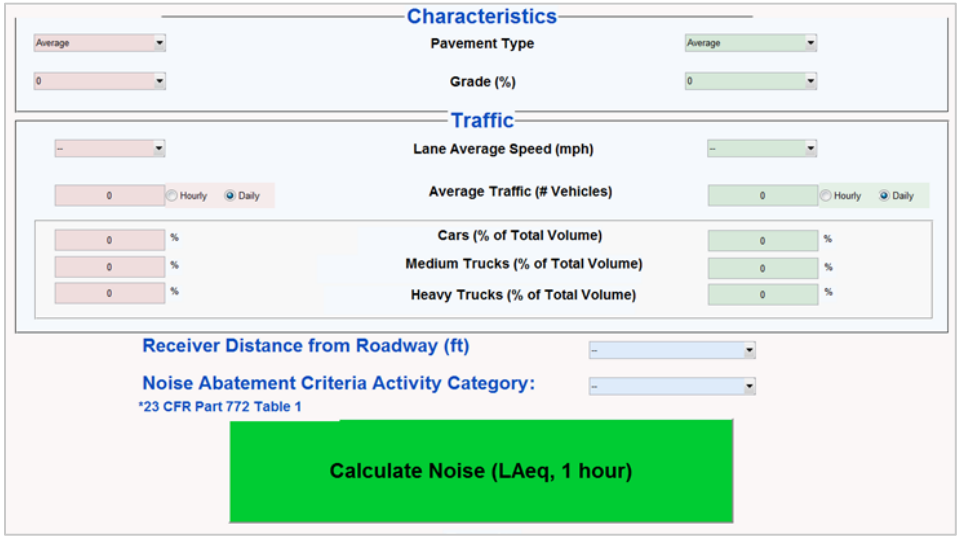
4.1 Noise Screening Reports

Some Type I projects have very low potential to create noise impacts and could benefit from screening. Examples include widening of a low volume road through an agricultural area or where the sensitive land uses are at distances beyond where impacts would be expected. A noise screening analysis assesses the potential for noise impacts in order to determine if a detailed noise study should be undertaken.

FHWA developed a Fact Sheet (FHWA-HEP-17-061) to assist SHAs in considering and implementing various strategies to meet the goal of expediting project delivery. The Fact Sheet includes guidance on establishing noise screening procedures. Some SHAs include a noise screening process in their noise policies.

If the screening analysis indicates that the project will not create noise impacts, the NEPA document would include the results with a statement that the project conforms to 23 CFR 772 and no impacts were predicted. The document would also include sections addressing construction noise and information for local officials. FHWA developed a Low Volume Road Noise Calculation Tool to assist in screening projects for impacts for low volume road projects (Figure 4-1).

Figure 4-1: Screenshot of FHWA Low Volume Road Noise Calculation Tool



Review of a noise screening analysis might involve ensuring that the modeled traffic volumes and speeds are correct. A review of the project area and plans should confirm that there are no potentially impacted noise-sensitive land uses.

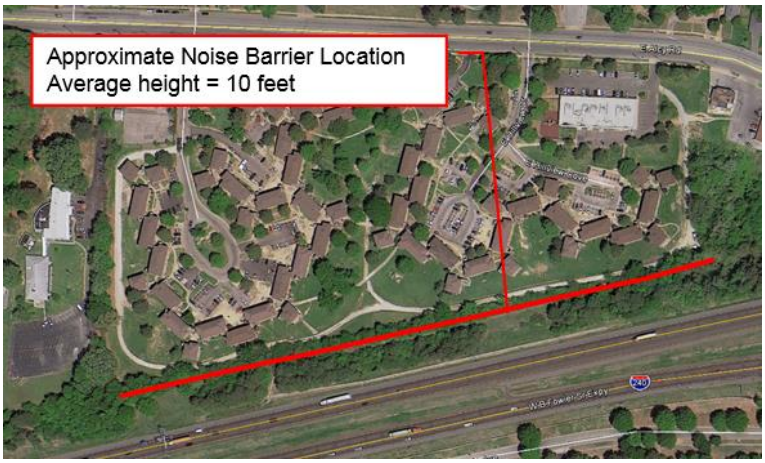
4.2 Public Meeting Materials

The noise-related aspects of a public involvement program are aimed at presenting project-related information to the public and obtaining public viewpoints and input. An effective public involvement program provides a mechanism to keep the stakeholders informed throughout the project development process, to obtain valuable data related to the project, and to become aware of any project-related issues in a timely manner.

It is important to consider diverse viewpoints because different stakeholders may have very different views about noise and noise abatement. For example, residents may feel very strongly that noise barriers are needed, but businesses may be opposed because they want to be visible to motorists. Similarly, an historic preservation group may consider noise barriers as an intrusion on an historic area.

A wide variety of techniques and materials are available for informing the public of the noise-related aspects of a project and receiving public input. Common techniques include:

- Meetings, hearings, and workshops
- Newsletters and handouts
- Websites and phone hotlines
- Public displays



Source: Google Earth© with annotation

The review of public involvement materials should confirm that all content is consistent with the most recent noise analysis. It is important that these materials be written and presented in a manner that is understandable to the public. The SHA must also respond to any public comments. A review to ensure consistency and accuracy of responses is desirable.

Finally, the SHA may use formal surveys to solicit the viewpoints of benefited property owners and residents. The reviewer should confirm that the information provided on the surveys is accurate and that the accounting of the survey results is conducted in accordance with the SHA noise policy

4.3 Noise Re-evaluations

The FHWA/FTA NEPA regulations in 23 CFR 771.129 require SHAs to consult FHWA to determine if NEPA documents and decisions remain valid, in a process known as a "re-evaluation." Re-evaluations are common at the right-of-way, final design, and construction stages of a project but can occur at other times. FHWA's document *"23 CFR 772 Final Rule and NEPA Reevaluations"* provides guidance on the re-evaluation process.

When a re-evaluation occurs, the SHA in consultation with FHWA, must review the NEPA document, including the noise study, and determine if 1) the NEPA decision and documentation remain valid, or 2) that additional analysis is required.

Changes that could require additional analysis or a compete noise study update include revisions to laws and regulations and changes in the design, scope, location and affected environment.

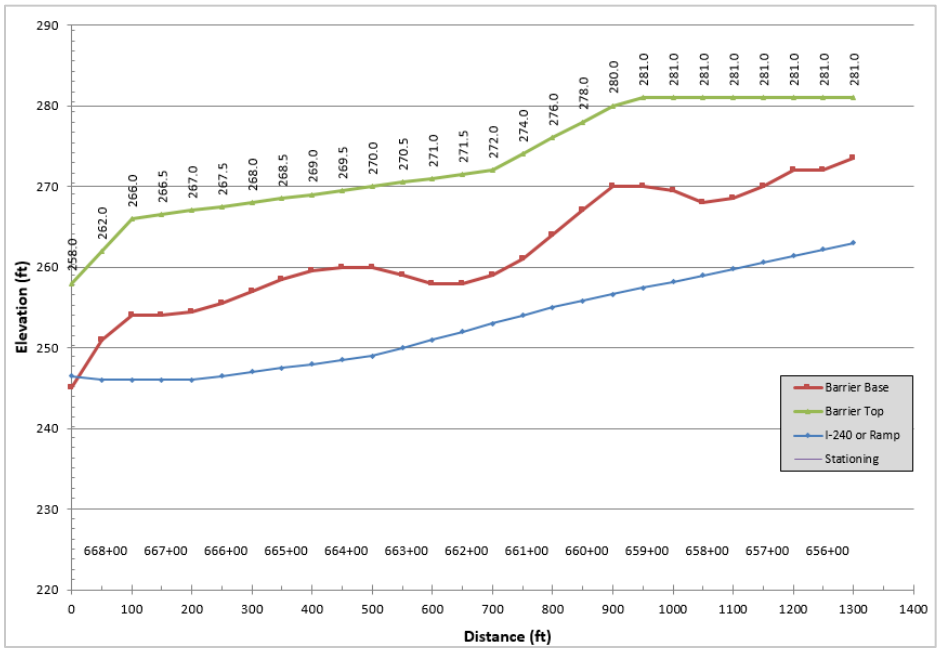
The reviewer may need to coordinate with the designer to identify and understand the changes between the project plans used for the noise study and the project plans at the time of the re-evaluation. Some design changes may be significant, such as shifting the alignment or changing interchange ramp configurations, while others may have little or no noise effects. Design changes can increase or decrease the number of impacts and trigger an update to the noise abatement evaluation, including redesigning the abatement measure and reassessing feasibility and reasonableness. The feasibility and reasonableness conclusions could also change.

If the re-evaluation process concludes that the original noise study remains valid, the reviewer should ensure that the summary states and provides the reasons why the changes to the project plans would not affect the noise analysis and conclusions. If the changes require an updated noise study, the reviewer would follow the noise study review process outlined in Section 2.0. The updated noise study should reference any previous noise studies for the project and summarize the previous conclusions. The analysis should also include land uses permitted or constructed after the date of public knowledge. However, these uses are not eligible for noise abatement per the FHWA noise regulation.

4.4 Noise Abatement Design Documents

The design process for feasible and reasonable noise abatement measures will continue after FHWA approval of the NEPA document until the project is let for construction. The changes to the project plans described above may necessitate redesigning abatement measures and providing updated design information to the project design team. This information might include plan sheets and cross-sections showing the proposed barrier(s), a detailed design table with barrier points tied to the project stationing and showing barrier base and top elevations, heights, and offsets as well as a graphic showing the top profile (Figure 4-2). The reviewer may need to check this information for accuracy using the project plans, TNM runs and any available information on the benefited land uses.

Figure 4-2: Example, showing elevations of the roadway, barrier base, and barrier top by station



Source: Bowlby and Associates

4.5 Type III Project Documentation

A SHA may opt to conduct a noise study for a Type III project to document the predicted noise effects even though a detailed noise study is not required by the FHWA noise regulation. These projects might include long turn lanes or shifting of interchanges ramps that the public perceives might increase sound levels. They might also include large Type III projects such as bridge replacements for which an EA or EIS is prepared and for which significant public involvement will occur. In these cases, the SHA should review the study in the same manner as for a Type I project. However, the report should clearly state that the project is Type III and that FHWA does not participate in funding abatement measures for Type III projects.

Noise Study Report Review Checklist

5.0 Appendix A: Noise Study Report Review Checklist

Project	
Jurisdiction	
Project Number	
Report Date	
Reviewer	
Date Review Completed	Click here to enter a date.
Report Filename/Location	

Report Section	*Item*	*N/A*	*Yes*	*Notes*
Report Cover (2.1)	The cover page includes the project information.	☐	☐	
Table of Contents and List of Tables and Figures (2.2)	The table of contents and lists are complete and correct.	☐	☐	
Summary (2.3)	The report includes a summary of the results.	☐	☐	
Introductory Material and Project Description (2.4)	The report references the FHWA noise regulation and SHA noise policy.	☐	☐	
	The report provides the correct project name, limits, description and length.	☐	☐	
	The report identifies the type of project (I, II or III).	☐	☐	
Traffic Noise Fundamentals/ Terminology (2.5)	The report explains the fundamentals of traffic noise and the terminology used in the noise study report.	☐	☐	
Identification of Noise-Sensitive	The report identifies the lands that contain, or will contain, noise-sensitive land uses.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
Land Uses (2.6)	The modeling extends an adequate distance to identify all impacts and benefits.	☐	☐	
	Activity Category B (Residential) Land Uses			
	The report identifies all potentially impacted and benefited residential properties.	☐	☐	
	The report identifies and accounts for common areas of residential neighborhoods.	☐	☐	
	The report identifies and accounts for exterior areas (i.e., balconies) of multi-story residential buildings.	☐	☐	
	Category C, D and E Land Uses			
	The report identifies and describes the qualifying exterior areas of Activity Category C land uses.	☐	☐	
	The report identifies and describes the land uses that qualify as Activity Category D.	☐	☐	
	The report identifies the qualifying exterior areas of Activity Category E land uses.	☐	☐	
	Category F Land Uses			
	The report identifies the Activity Category F land uses in the project area.	☐	☐	
	Category G Land Uses			
	The report states whether or not there are Activity Category G undeveloped lands along the project.	☐	☐	
	The text points the reader to the “Information for Local Officials” section.	☐	☐	
	Permitted Land Uses			
	The report identifies permitted noise-sensitive land uses.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
Determination of Existing Noise Levels (2.7)	**Measurement of Existing Noise Levels**			
	The report identifies the applicable noise measurement procedure (i.e., FHWA Noise Measurement Handbook or SHA noise policy).	☐	☐	
	The measurement locations are consistent with the SHAs noise policy and procedures (if applicable).	☐	☐	
	Measurements were conducted under appropriate weather and traffic conditions.	☐	☐	
	Non-representative noise events were removed from the reported noise levels.	☐	☐	
	The reported existing measured noise levels represent the “worst noise hour.”	☐	☐	
	The report discusses the measured noise levels.	☐	☐	
	The report includes the data sheets for all measurement locations and periods.	☐	☐	
	Prediction of Existing Noise Levels for Project on Existing Alignments			
	The analysis used an approved version of the FHWA TNM.	☐	☐	
	The report discusses the existing traffic volumes, truck percentages, and speeds used to predict existing noise levels and documents the source(s) of that data.	☐	☐	
	The report demonstrates that the combination of modeled traffic volumes and speeds represents the existing worst noise hour in accordance with the procedures in the SHA noise policy.	☐	☐	
	The analysis accounts for the effects of background noise.	☐	☐	
	The report shows and discusses the predicted existing noise levels for the noise-sensitive land uses.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
	The reported noise levels match the levels in the TNM runs.	☐	☐	
	Existing noise levels are reported in accordance with the SHA noise policy.	☐	☐	
	The report shows the predicted existing interior noise levels for Activity Category D land uses.	☐	☐	
	The report includes TNM plan views in an appendix.	☐	☐	
Validation (2.8)	The analysis includes model validation.	☐	☐	
	The measured levels include only highway-generated noise.	☐	☐	
	The report documents the traffic volumes, truck percentages, and speeds for each measurement period.	☐	☐	
	The TNM receivers for the measurement sites are at the correct locations.	☐	☐	
	The modeled pavement type represents the actual pavement.	☐	☐	
	The predicted levels are within 3 dB of the measured levels.	☐	☐	
Determination of Future Noise Levels (2.9)	The report identifies the design year and discusses the future traffic volumes, truck percentages, and speeds used to predict future noise levels and documents the source(s) of that data.	☐	☐	
	The report demonstrates that the combination of modeled traffic volumes and speeds represents the “worst noise hour” for future conditions in accordance with the procedures in the SHA noise policy.	☐	☐	
	The analysis accounts for the effects of existing background noise.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
	The report shows and discusses the predicted noise levels for the noise-sensitive land uses.	☐	☐	
	The reported noise levels match the levels in the TNM runs.	☐	☐	
	Noise levels are reported in accordance with the SHA noise policy.	☐	☐	
	The reported noise level changes are consistent with what would be expected.	☐	☐	
	The report includes TNM plan views in an appendix.	☐	☐	
Noise Impact Evaluation (2.10)	The report explains the regulatory definition of a noise impact.	☐	☐	
	The report defines “approach.”	☐	☐	
	The report defines “substantial increase.”	☐	☐	
	The report identifies the number and locations of noise impacts for each Build Alternative.	☐	☐	
	The analysis accounts for impacts to upper floor units in multi-family buildings.	☐	☐	
	The analysis identifies impacts to common areas of residential neighborhoods.	☐	☐	
	The report identifies impacts as NAC or “substantial increase.”	☐	☐	
	The report identifies the total number of impacts.	☐	☐	
	The predicted impacts are consistent with what would be expected.	☐	☐	
Noise Abatement Evaluation (2.11)	The analysis evaluates noise abatement measures for all impacted land uses.	☐	☐	
	The analysis evaluates other abatement measures per the SHA noise policy.	☐	☐	
	The report identifies the most acoustically effective barrier locations.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
	The analysis evaluated interior abatement measures in accordance with the SHA noise policy for impacted Activity Category D land uses for which noise barriers were not feasible or reasonable.	☐	☐	
	Noise Barrier Design (2.11.1)			
	The report discusses the process used to design noise barriers or berms.	☐	☐	
	The report notes any barrier design limitations in the SHA noise policy.	☐	☐	
	The noise barrier evaluation accounts for the effects of background noise.	☐	☐	
	The report provides the predicted no-barrier and with barrier noise levels and insertion losses for each modeled receiver for each evaluated noise barrier.	☐	☐	
	Feasibility (2.11.2)			
	The report includes a preliminary qualitative assessment of engineering factors that could affect the barrier.	☐	☐	
	The report provides the acoustic feasibility results for each evaluated noise barrier.	☐	☐	
	Reasonableness (2.11.3)			
	The report outlines the steps of the reasonableness evaluation.	☐	☐	
	The report defines “benefited” per the SHA noise policy.	☐	☐	
	The analysis accounts for benefits at upper floor units in multi-family buildings.	☐	☐	
	The report discusses the SHA procedure for calculating equivalent receptors for non-residential land uses.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
	The report shows the calculations of the equivalent number of receptors for non-residential land uses.	☐	☐	
	Noise Reduction Design Goal (2.11.3)			
	The report states the Noise Reduction Design Goal.	☐	☐	
	The report shows the Noise Reduction Design Goal results for each evaluated noise barrier.	☐	☐	
	Cost-Effectiveness (2.11.3)			
	The report states the cost-effectiveness criteria in the SHA noise policy.	☐	☐	
	The reported values match the barrier design in the associated TNM model.	☐	☐	
	The analysis used the correct barrier unit cost per the SHA noise policy.	☐	☐	
	The report identifies the number of benefited receptors for each barrier.	☐	☐	
	The report shows the cost-effectiveness results for each evaluated noise barrier.	☐	☐	
	The report discusses the SHA noise policy regarding cost-averaging analysis (if applicable).	☐	☐	
	The report shows the cost-averaging calculations and the results are correct (if applicable).	☐	☐	
	Viewpoints of Benefited Property Owners and Residents (2.11.3)			
	The report documents the SHA process for soliciting the viewpoints of benefited property owners and residents.	☐	☐	

Noise Study Report Review Checklist

Report Section	*Item*	*N/A*	*Yes*	*Notes*
Statement of Likelihood (2.11.4)	The report includes a statement of likelihood.	☐	☐	
Absorptive Noise Barrier Treatments (2.11.5)	The analysis evaluated the need for absorptive treatments in accordance with the SHA noise policy.	☐	☐	
Construction Noise (2.12)	The report includes a discussion of construction noise.	☐	☐	
Information for Local Officials (2.13)	The noise study report includes information for local officials.	☐	☐	
Indirect and Cumulative Effects (for EAs and EISs) (2.14)	The report includes a discussion of indirect and cumulative effects.	☐	☐	
References (2.15)	The report includes a list of references.			
Appendices (2.16)	The report includes the relevant appendices per the SHA noise policy.	☐	☐	

NEPA Document Noise Section Review Checklist

6.0 Appendix B: NEPA Document Noise Section Review Checklist

Project	
Jurisdiction	
Project Number	
Report Date	
Reviewer	
Date Review Completed	Click here to enter a date.
Report Filename/Location	

NEPA Document Section	*Item*	*N/A*	*Yes?*	*Notes*
Categorical Exclusion (CE) (3.1)				
Noise	The CE references the FHWA noise regulation and SHA noise policy.	☐	☐	
	The CE references the noise study report in an appendix/attachment.	☐	☐	
	The CE identifies the type of project (Type I, Type II or Type III).	☐	☐	
	The CE identifies all impacted noise-sensitive land uses.	☐	☐	
	The CE identifies impacts as NAC or "substantial increase."	☐	☐	
	The CE summarizes the conclusions of the noise abatement evaluation.	☐	☐	
	The CE identifies impacted land uses for which abatement is not feasible or reasonable.	☐	☐	
	The CE includes a statement of likelihood.	☐	☐	

NEPA Document Noise Section Review Checklist

NEPA Document Section	Item	N/A	Yes?	Notes
	The CE includes a discussion of information for local officials or a reference to the applicable section of the noise study report.	☐	☐	
Environmental Assessment (EA) and Environmental Impact Statement (EIS) (3.2)				
Introductory Material and Project Description (3.2.1)	The EA or EIS references the FHWA noise regulation and SHA noise policy.	☐	☐	
	The EA or EIS references the noise study report in an appendix/attachment.	☐	☐	
	The EA or EIS identifies the project as Type I.	☐	☐	
Traffic Noise Fundamentals/ Terminology (3.2.1)	The EA or EIS explains the fundamentals of traffic noise and terminology.	☐	☐	
Identification of Noise-Sensitive Land Uses (3.2.2)	The EA or EIS describes the noise-sensitive land uses in the project area.	☐	☐	
Determination of Existing Noise Levels (3.2.3)	The EA or EIS describes the existing noise environment.	☐	☐	
Determination of Future Noise Levels (3.2.4)	The EA or EIS describes the future noise levels with the project.	☐	☐	
Determination of Traffic Noise Impacts (3.2.5)	The EA or EIS discusses the impact criteria in the SHA noise policy.	☐	☐	
	The EA or EIS identifies all impacted land uses and their associated activity categories for each Build Alternative.	☐	☐	
Construction Noise (3.2.6)	The EA or EIS includes a discussion of construction noise.	☐	☐	
Noise Abatement Evaluation (3.2.7)	The EA or EIS summarizes the conclusions of the noise abatement evaluation.	☐	☐	
	The EA or EIS identifies impacted land uses for which abatement is not feasible or reasonable.	☐	☐	

NEPA Document Noise Section Review Checklist

NEPA Document Section	*Item*	*N/A*	*Yes?*	*Notes*
	The EA or EIS includes a statement of likelihood.	☐	☐	
	The EA or EIS includes a discussion of information for local officials.	☐	☐	
	The EA or EIS includes a discussion of indirect and cumulative effects.	☐	☐	

7.0 References

[1] Procedures for Abatement of Highway Traffic and Construction Noise, 23 CFR 772, Federal Highway Administration, July 2010.

[2] Highway Traffic Noise: Analysis and Abatement Guidance, Federal Highway Administration, December 2011.

[3] FHWA Highway Traffic Noise, https://www.fhwa.dot.gov/Environment/noise/

[4] The Audible Landscape: A Manual for Highway Noise and Land Use, FHWA, November 1974.

[5] Entering the Quiet Zone: Noise Compatibility Land Use Planning, FHWA, May 2002.

[6] Improving the Quality of Environmental Documents, A Report of the Joint AASHTO/ACEC Committee in Cooperation with the Federal Highway Administration, AASHTO, ACEC and FHWA, May 2006.