Oklahoma Department of Transportation
Consultant Scope of Services - Traffic Noise Studies

(Revised 01/02/2026)

All traffic noise studies completed for the Oklahoma Department of Transportation (ODOT) must meet the Federal Highway Administration (FHWA) regulations, 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise,* and the most current version of the ODOT Highway Traffic Noise Abatement Policy Manual. . **Appendix A** includes the current ODOT Highway Traffic Noise Abatement Policy Manual. A complete analysis shall be a "stand-alone" study describing the project area and land use, sound terminology/theory, methodology, traffic data, representative receivers, determining existing and future predicted noise levels, identifying impacted receivers, and identifying those receivers who can benefit from feasible and reasonable noise abatement. The analysis must use the FHWA Traffic Noise Model version 2.5 (TNM 2.5). Although FHWA guidance resources and the ODOT Highway Traffic Noise Abatement Policy Manual provide details on the noise analysis requirements, the following offers for basic analysis steps, report format, report review/approval procedures, and personal qualifications needed in completing a noise study:

Analysis Steps

(1) Describe the proposed project and any associated project or environmental analysis history in sufficient detail.

(2) Identify existing activities, developed lands, and undeveloped lands for which development is planned, designed, and programmed that may be affected by noise from the highway being considered for reconstruction or construction.

(3) Field measurements are required for model validation using an FHWA-approved Type II or better sound level meter. Measurements must be consistent with the methodology presented in *Measurement of Highway Related Noise FHWA-PD-96-046* (http://www.fhwa.dot.gov/environment/noise/) and the ODOT Highway Traffic Noise Abatement Policy Manual. The consultant will be responsible for providing their sound level meter.

(4) After model validation has been completed, computer modeling of existing noise levels will need to be conducted for the existing highway facility within the project footprint utilizing TNM 2.5. For two-lane roadways, each traffic lane, including the outside paved shoulder, shall be modeled in each direction of travel. In some cases (i.e., highly congested facilities where trucks avoid peak automobile travel periods), both a peak traffic period and non-peak period field measurements may be required to verify the worst-hour noise levels. For studies with no highway traffic noise sources (e.g., highway on a new location), ambient field readings representing existing sound levels will be required using an FHWA-approved Type II or better sound level meter. Depending on circumstances, such field measurements will require durations ranging from 15 minutes to a maximum of 1 hour, preferably during peak AM or PM periods.

(5) Prediction of traffic noise levels of representative receivers in the future condition shall be determined using TNM 2.5. All traffic noise impacts are identified based on the ODOT Highway Traffic Noise Abatement Policy Manual. This requires quantifying noise levels. A brief explanation of the basis for no traffic noise impacts should be documented if no impacts exist. For two-lane roadways, each traffic lane, including the outside paved shoulder, shall be modeled

for each direction of travel.

(6) If impacts exist, determine if any feasible and reasonable measures will lessen the impacts per the ODOT Highway Traffic Noise Abatement Policy Manual. Abatement benefits and costs should be quantified to the extent possible. The final NEPA document should indicate which abatement measures are "likely" to be incorporated into the project and identify impacts for which no prudent solution is reasonably available. All engineering considerations regarding noise barrier location must be thoroughly investigated, especially in identifying potential safety, utility, or drainage conflicts. For some noise studies, it may be required to evaluate two or more alternative noise barrier locations inside the existing or proposed right-of-way that can be considered during the final project design phase.

Report Format

Sample noise report(s) can be provided to the consultant, but the following are the essential contents for a Traffic Noise Assessment report:

Section:	Include Discussion Of:
1. Executive Summary	Concise project description, noise impacts, abatement considerations, mitigation commitments
2. Introduction	This section should include a detailed project description
3. Fundamentals of Noise & Sound Theory	**Appendix B** provides ODOT's standard text
4. Analysis Methodology	Modeling analysis procedure, model version and inputs, FHWA NAC, and ODOT Highway Traffic Noise Abatement Policy Manual criteria.
5. Traffic Data	Existing and future design year traffic data were used in the analysis.
6. Model Validation	Sound meter validation/calibration process and results. Include the actual date of field inspection and measurements taken.
7. Existing Condition & Noise Analysis Results	Land uses roadway classification/information; receptors are used in measurement and modeling. Present modeled receptors' existing noise levels for each appropriate FHWA NAC activity area to determine worst-case existing noise conditions.
8. Future Noise Analysis Results	Modeled noise level results of the future Build. In addition, modeled noise levels of the future no-build condition may be required based on the project involved consisting of using the future traffic data of the existing roadway being considered for improvement.
9. Traffic Noise Impacts	Identification of impacted and non-impacted receptors in the future condition, comparisons between Build vs. existing levels, and, if required, the No-build vs. existing levels.
10. Consideration of Abatement	The report shall evaluate noise mitigation for impacted receivers identified in the Build condition that may benefit from feasible and reasonable noise abatement measures per the ODOT Highway Traffic Noise Abatement Policy Manual. Only noise abatement measures that are feasible and reasonable will be recommended, including barrier type with estimated location(s), height(s), extent, and associated benefit-cost analysis. In addition, an explanation should be included explaining why for those impacted receivers for which mitigation is not feasible or reasonable.
11. Construction Noise	**Appendix B** provides ODOT's standard language only if it has been determined that construction noise associated with the proposed project does not appear severe or if no public concerns are received due to early public involvement.
12. Coordination with Local Officials	**Appendix B** provides ODOT's standard text and table examples.
13. Appendix	Include general project location map(s) and aerial photo or plan sheets depicting the project footprint that identifies the modeled receptors, field measurement site locations, any existing and proposed noise barriers, and the 66 dB(A) and 71

	dB(A) noise impact zone contours. In addition, the aerial photo or plan sheets need to include a north arrow, scale, and labeling of adjacent or intersecting roadways and other necessary landmarks.

Review and Approval Procedures

The following are the noise study review and approval procedures:

(1) Initial consultation between the ODOT Noise Specialist and the Consultant Project Manager and Consultant Noise Specialist shall be conducted before the noise study, also called the "kick-off" meeting. The ODOT Noise Specialist's contact information is as follows:

Evan Mace
Noise Specialist
Oklahoma Department of Transportation,
Environmental Programs Division
200 N.E. 21st Street, Rm. 3D-2
Oklahoma City, Oklahoma 73105
Mobile: (405) 416-0831
Email: EMace@odot.org

(2) After completing the field task and noise analysis, the Consultant Noise Specialist shall provide deliverables in phases to the ODOT Noise Specialist via Outlook, Zip File for Microsoft Windows 10, or other agreed upon method. The ODOT Noise Specialist will review, approve and file each Phase described as follows:

Phase I Submittal – Field Data

- ODOT Consultant Review Request Form.
- Adobe Acrobat Pro (PDF) copy of the field record sheets with traffic counts
- TNM 2.5 files (i.e., "objects.dat" and "objects.idx" files) for each successful run of the model validation site.
- Sound Level Meter (SLM) files of each recorded reading (Excel format is acceptable).
- Certificate of calibration for all sound level meters and associated calibration units used for the noise readings.

Phase II Submittal – TNM files

- TNM 2.5 files (i.e., "objects.dat" and "objects.idx" files) for Existing, Future, and Future No-Build (if required) and barrier analysis (if needed).
- Traffic data spreadsheet(s) and a copy of the traffic data source, either the plan title sheet or a traffic study report.
- Graphics to be included in the report in PDF format (Project Location Map and Receiver/Model Validation Site Map).
- .kmz file showing the receiver and model validation locations.

Phase III – Report & TNM Final Run Printouts

- Traffic Noise Assessment Report (Microsoft Word and PDF format).
- PDF printouts of the final TNM 2.5 run of all successful Model Validations, Existing,

Future, Future No-Build (if required), and Barrier Analysis (if needed). The PDF page order is as follows: sound level results, plan view (with labeled receivers), roadway input, traffic input, receiver input, barrier input (if required, existing, and proposed), and all other data inputs included in the respective TNM run.

NOTE: The above Phases are considered the standard deliverable process. However, modifications may be necessary case-by-case, depending on the circumstances. For example, if a need arises to provide analysis results at a public meeting, delaying the field task would be allowed so the noise modeling could be advanced.

(3) For each Phase Submittal, the ODOT Noise Specialist will correspond directly with the Consultant Noise Specialist. The Consultant Project Manager and the ODOT Environmental Project Manager shall be copied on any correspondence with the Consultant Noise Specialist to inform them of any major issues. Once the draft report and support documentation have been reviewed, the ODOT Noise Specialist will return via email attachment, the draft report directly to the Consultant Noise Specialist with comments and suggested edits/revisions and, if necessary, request any omitted data not included in the item (2) above to be provided or, in some cases, additional data or information may be requested. Suppose the Consultant Noise Specialist has questions or concerns about the report review comments/edits. In that case, the Consultant Noise Specialist must contact the ODOT Noise Specialist and the assigned Noise Specialist directly with specific inquiries before sending the final report. Once the comments/edits have been addressed, and if required, requested additional data have been provided, then the Consultant Noise Specialist shall compile the final noise report with graphics in PDF format, sign/date by the preparer, and send it to the last review of the ODOT Noise Specialist.

(4) The ODOT Noise Specialist will issue a written approval memorandum to the Consultant Project Manager and be included on the first page of the final noise report. The ODOT Noise Specialist will distribute the approved final noise report to the Consultant Project Manager, Consultant Noise Specialist, ODOT Environmental Project Manager, and others deemed necessary.

Qualifications

All individuals performing or responsible for preparing noise studies and performing computer noise modeling shall, at a minimum, have completed the FHWA TNM 2.5 Training Course. In addition, these same individuals should have appropriate training for using either a Type I or Type II sound level meter and be knowledgeable in conducting field measurements.

Appendix A

ODOT Highway Traffic Noise Abatement Policy Manual

Oklahoma Department of Transportation

Highway Traffic Noise Abatement Policy Manual
Version 1

ODOT Environmental Programs Division

December 1, 2025

In accordance with ODOT Policy Directive C-201-3

Table of Contents

PURPOSE

This manual outlines the processes and recommendations for evaluating and assessing highway traffic noise impacts for federal or federally funded Type I highway projects, in compliance with the National Environmental Policy Act (NEPA) of 1969.

The guidance provided for noise impact evaluations, noise abatement methods, criteria, coordination steps, and reporting requirements is based Title 23 of the Code of Federal Regulations, Part 772, the Federal Highway Administration's (FHWA) Procedures for Abatement of Highway Traffic Noise and Construction Noise. All transportation improvement projects prepared under the Oklahoma Department of Transportation (ODOT) guidelines must follow FHWA regulations and recommendations. FHWA rules and guidance require that noise mitigation be considered whenever noise impacts are identified.

DEFINITIONS

Benefitted Receptors - All receptors, impacted and non-impacted, which, by placement of the noise abatement measure, receive a minimum noise level reduction at or above 5 dB(A).

Categorical Exclusion (CE) - Categorical exclusion means a category of actions which do not individually or cumulatively have a significant effect on the human environment and for which neither an environmental assessment nor an environmental impact statement is required.

Common Noise Environment - A group of receptors within the same Activity Category in Table 1 that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections, cross-roads and may be modeled using representative receivers.

Date of Public Knowledge - The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR 771. After this date, local governments are responsible for noise compatible land use planning, and ODOT is not responsible for noise impacts occurring after this date.

Design Year - The future year is used to estimate the probable traffic volume for which a highway is designed.

Environmental Assessment (EA) - A concise public document that serves to briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI), to aid an agency's compliance with the National Environmental Policy Act when no environmental impact statement is necessary, and to facilitate preparation of an EIS when one is necessary.

Environmental Impact Statement (EIS) - A full disclosure document that details the process through which a transportation project was developed, includes consideration of a range of reasonable alternatives, analyzes the potential impacts resulting from these alternatives, and demonstrates compliance with other applicable environmental laws and executive orders. An EIS is required for major actions that significantly affect the quality of the human environment.

Existing Noise Levels - The highest noise level over an hour that is resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.

Finding of No Significant Impact (FONSI) - When applicable, the conclusive determination after completion of the Environmental Assessment process that a highway project will not create any significant environmental impacts.

Leq - The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period.

Leq(h) - The equivalent sound level for a one-hour period of time.

Multi-Family Dwelling - A residential structure containing more than one residence. Each residence in a multifamily dwelling shall be counted as one receptor when determining impacted and benefitted receptors.

NEPA - National Environmental Policy Act of 1969, which establishes the basic national policy for protection of the environment during the development of federal actions. It provides an interdisciplinary framework to ensure that decision-makers adequately take the human and natural environmental factors into account.

Noise - Any unwanted sound.

Noise Abatement - Type of attenuation, such as an earthen berm or solid-mass wall, used to reduce traffic noise levels.

Noise Abatement Criteria (NAC) - FHWA has determined noise levels for various activities or land uses which represent the upper limit of acceptable traffic noise level conditions, which are found in 23 CFR 772. These regulations do not require meeting the abatement criteria in every instance; rather, they require highway agencies to make every reasonable and feasible effort to provide noise mitigation when the criteria are approached or exceeded.

Noise Contour - A linear representation of equal noise levels similar to elevation contour lines on a topographic map.

Noise Reduction Design Goal - The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. The ODOT noise reduction design goal is 7 dB(A) and must be achieved for at least 75 percent of the benefitted receptors identified within the first row of receptors for the abatement measure to meet ODOT reasonableness criteria.

Permitted - A definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.

Property Owner - An individual or group of individuals that holds a title, deed, or other legal documentation of ownership of a property or a residence.

Receiver - A discrete or representative location representing receptors that are included in the computer model used for noise analysis.

Receptor -A discrete or representative location of a noise sensitive area(s) for any of the land uses listed in Noise Abatement Criteria Activity Categories (Table 1).

Record of Decision (ROD) - The final step in the EIS process whereby the Federal Government issues final approval of the environmental documentation.

Residence - A dwelling unit, either a single-family residence or each dwelling unit in a multifamily dwelling.

Statement of Likelihood - A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time the environmental document is being approved.

Substantial Construction - The granting of a building permit, prior to right-of-way acquisition or construction approval for the highway.

Substantial Noise Increase - Along with the NAC defined above, one of two criteria to determine noise impacts created by a proposed highway project. A receptor is considered impacted if the predicted future hourly equivalent traffic noise level exceeds the existing ambient noise level by 15 dB or more.

Traffic Noise Impact

1. Impacts which occur when the future predicted exterior Leq(h) traffic noise levels approach by one (1) decibel, meet or exceed any of the Federal Highway Administration (FHWA) Noise Abatement Criteria (see Table 1); or,

2. Impacts which occur when there is a substantial noise increase as defined in this section.

Type I Project - A federal aid project that meets one or more of the following criteria, see 23 CFR 772 for the full definition of at Type I project:

1. The construction of a highway on new location; or,

2. The physical alteration of an existing highway where there is either:

    a. Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,

    b. Substantial Vertical Alteration. A project that removes shielding, therefore, exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or

3. The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, bus lane, or truck climbing lane; or,

4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,

5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,

6. Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,

7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot.

8. If a project is determined to be a Type I project under this definition, then the entire project area as defined in the environmental document is a Type I project.

Type II Project - A Federal or Federal-aid highway project for noise abatement on an existing highway without meeting the criteria listed in the Type 1 definition. For a Type II project to be eligible for Federal-aid funding, the highway agency must develop and implement a Type II program in accordance with section 772.7(e). ODOT does not have a Type II program.

Type III Project - A Federal or Federal-aid highway project that does not meet the classifications of a Type I or Type II project. Type III projects do not require noise analysis.

IMPLEMENTATION (SPECIFIC)

A. Analysis of Traffic Noise Impacts

The ODOT will determine and analyze expected traffic impacts and document the results in a traffic noise analysis for highway projects in accordance with the following methodology:

1. Identify Noise Sensitive Receivers

   Identify existing activities, developed lands, and those areas for which development of this type is permitted with local authorities (i.e., an approved building permit) which may be affected by noise. Classify the activities according to the Noise Abatement Criteria (NAC) in Table 1 (Next Page) for each alternative under detailed study; and for each Activity Category that is present in the study area.

TABLE 1 Federal Highway Administration Noise Abatement Criteria (NAC) [Hourly A-Weighted Sound Level, decibels dB(A)]		
Activity Category	**Activity Criteria[1] Leq(h)[2]**	**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[3]	67 (Exterior)	Residential
C[3]	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 structures, radio studios, recording studios, recreational 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 or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[3]	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

[1] The Leq(h) Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.
[2] The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq.
[3] Includes undeveloped lands permitted for this activity category.

Select receptor locations to represent each activity area or discrete location to be evaluated for noise. For all Activity Categories, primary consideration shall be given to exterior areas where frequent human use occurs in the determination of traffic noise impacts. The following are specific requirements for each Activity Category.

Activity Category A

ODOT will submit in writing justification to the FHWA on a case-by-case basis for approval of an Activity Category A designation.

Activity Category B

The receptor location will be placed between the right-of-way line and the building, near an area of frequent human use, like patios, pools, and sitting areas, if applicable. These locations will be no nearer than 10 feet from the represented structure. For multifamily dwellings, all dwelling units will be analyzed for traffic noise impacts, including units above the ground level; however, only

impacted units will be considered for noise abatement. For common areas shared by residents, the owner or association representing the users/residents will be solicited for information regarding the average number of daily, time of day of peak usage, average number of hours per visit. This will be used to identify the number of potential impacts for the area and to determine impacts and evaluate potential abatement for that specific location, if applicable.

Activity Category C

Includes the exterior impact criteria for a variety of land use facilities and may include public or private facilities. Structures (e.g., hospitals, libraries, medical facilities) with an exterior area of frequent human use shall have one receptor location placed at each area. For cemeteries, parks, trails and other expansive Category C activities, the number of equivalent receptors will be determined using the Frontage Methodology as approved by FHWA. This will be determined as follows:

1) Determination of the Non-Residential Receptor (NRR) value.

    a. A standard frontage-length section of 100 feet shall be used to determine the NRR value.

    b. NRR Value = Frontage of the facility along the roadway (feet) / 100 feet

    c. Fractions shall be rounded to the nearest whole number.

2) Placement of receptor points will vary depending on usage. Example: A trail along a roadway will have receptor points placed 100 feet apart along the trail path, whereas a park will have receptor points located every 100 feet parallel to the roadway set back the distance to the closest area of frequent human use (e.g., picnic tables, pavilions).

3) NRR points are equally spaced in the center of each frontage line section.

    Example #1: A park with a playground has 650 feet of frontage along the studied roadway.

    NRR = 650 feet / 100 feet = 6.5 (rounded up to 7)

    The park will contain 7 receptor points spaced evenly in the center of each 100-foot section, parallel to the roadway, setback at a distance from the roadway to the playground.

    Example #2: A library has an outdoor picnic table area and a basketball court on the property. One receptor point will be placed at each of these exterior areas of frequent human use.

Activity Category D

ODOT will conduct an indoor analysis after a determination is made that exterior abatement measures will not be feasible and reasonable and shall only be done after exhausting all outdoor analysis options. In situations where no exterior activities are to be affected by traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities, ODOT will use Activity D as the basis of determining noise impacts. One receiver location shall be placed in the center of each structure. Interior noise levels will be predicted in accordance with **D. 6. Traffic Noise Prediction.**

Activity Category E
Receptor locations will be placed at outside use areas. Information from property owners or lessee(s) will identify how many receptors to assign to these areas, time of day and seasonal variation in use will be considered as part of the noise analysis and feasible and reasonableness evaluation if noise impacts are identified. Interest in noise mitigation measures will be established with the property owner(s) prior to initiating noise mitigation analysis.

Activity Category F
There are no impact criteria for the land use facilities in this activity category and no analysis of noise impacts is required.

Activity Category G
As part of the noise study, ODOT will determine if undeveloped land is permitted for development. The milestone and its associated date for acknowledging when undeveloped land is considered permitted shall be the date of issuance of a building permit by the local jurisdiction or by the appropriate governing entity. If undeveloped land is determined to be permitted, then ODOT will assign the land to the appropriate Activity Category and analyze it in the same manner as developed lands in that Activity Category. If undeveloped land is not permitted for development by the date of public knowledge, ODOT will determine noise levels in accordance with 772.17(a) and document the results in the project's environmental clearance documents and noise analysis documents. Federal participation in noise abatement measures will not be considered for lands that are not permitted by the date of public knowledge.

2. Determination of Existing and Future Noise Levels.

    a. For projects on new alignment, determine existing noise levels by field measurements, in accordance with **C. Field Measurement Requirements.**

    b. For projects on existing alignments, predict the existing noise levels and predict the design year traffic noise levels of the future condition in accordance with **D. Traffic Noise Prediction**.

    c. Using the current approved FHWA noise model, the future noise levels must be predicted for all build alternatives under consideration in the NEPA document (all reasonable alternatives, but not alternatives rejected for detailed analysis because they are not reasonable.

3. Noise Impact Determination
   Traffic noise impacts occur by meeting either of the following two conditions:

    a. The predicted traffic noise levels for the Design Year approach (reach one decibel less than) meet or exceed the FHWA NAC contained in 23 CFR 772 and in Table 1, or;

    b. The predicted traffic noise levels for the Design Year substantially exceed existing noise levels by 15 dB(A) or more.

B. Analysis of Noise Abatement Measures

When traffic noise impacts are identified, noise abatement must be evaluated to determine if it is feasible and reasonable. Noise barriers are the most commonly used form of noise abatement and are the only form of noise abatement required for consideration on Federal-aid projects in accordance with 772.13(c)(1). A noise barrier consists of a physical obstruction that is constructed between the highway noise source and the noise sensitive receiver(s) that lowers the noise level, including free standing noise walls, berms (earth or other material), and combination berm/wall systems. If noise barriers are determined to not be feasible or reasonable, other noise abatement measures include traffic management measures such as traffic control devices and modified speed limits, alteration of horizontal and vertical alignments, acquisition of buffer zones of unimproved property, and noise insulation of only Activity Category D facilities will be considered. The Department will not consider insulation of residences as noise mitigation.

In accordance with FHWA policy, planting of vegetation or landscaping is not an acceptable Federal-aid noise abatement measure because only dense stands of evergreen vegetation at least 100 feet deep will reduce noise levels. Use of quieter pavements is not an acceptable Federal-aid noise abatement measure for Federal projects unless part of an FHWA-approved Quiet Pavement Pilot Program.

All of the following will guide consideration in order for noise abatement to be justified, eligible for federal aid, and incorporated into project design, as applicable.

1. Noise Abatement Feasibility Criteria

   Noise abatement must be feasible. Feasibility refers to the combination of acoustic and engineering factors considered in the evaluation of a noise abatement measure. The engineering considerations include whether it is possible to build an abatement measure given site constraints (drainage, safety, utilities) and acoustic considerations include whether the abatement measure provides an acceptable reduction in noise levels. The following are engineering and acoustic considerations that determine the feasibility of a noise barrier.

   a. Noise abatement measures will achieve at least a five dB(A) highway traffic noise reduction for at least 50% of all impacted receptors to be considered feasible.

   b. Consideration of other noise sources in the area, if identified during existing noise surveys. For example, ambient noise levels from industrial sources that exceed future noise levels predicted from the project would make abatement measure ineffective, unless the barriers also provided incidental shielding for the receptors. If the reduction cannot be achieved, then abatement is not feasible.

   c. Determination that it is possible to design and construct the noise abatement measure. This determination will consider adverse impacts created by or upon the safety, property access, drainage, topography, utilities, and maintenance requirements.

   d. American Association of State Highway and Transportation Officials (AASHTO) adopted publications, including the Green Book, governs design requirements for highways and streets regarding engineering feasibility concerns like safety for location of noise barriers.

2. Noise Abatement Reasonableness Criteria

   Mitigation measures must be reasonable. The following are criteria that must be evaluated to determine reasonableness:

   a. The property owners' and residents' desire for mitigation. Only benefitted receptors viewpoints shall receive consideration. Details on how the Department will receive the viewpoints of the benefited property owners and residents are provided in **E. Public Involvement.**

   b. Cost Effectiveness: A square footage per benefitted receptor criteria for determining cost effectiveness will be utilized. This shall be calculated by taking the total area of a proposed noise wall in square feet divided by the number of benefitted receptors (defined below) determined for the noise wall. For a noise barrier to meet the cost effectiveness criteria, barrier cost effectiveness shall not exceed 1,200 square feet per benefitted receptor.

      1) A benefitted receptor is any receptor that achieves at least a five (5) dB(A) reduction. This calculation is made on a per barrier basis, and includes the total number of benefitted receptors, not just modeled receivers.

      2) Cost effectiveness will be reanalyzed at a regular interval not to exceed five (5) years from the effective date of this policy manual. This cost effectiveness criteria will be applied statewide.

   c. Noise Reduction Design Goal: The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. The ODOT noise reduction design goal is 7 dB(A) and must be achieved for at least 75 percent of the benefitted receptors identified within the first row of receptors for the abatement measure to meet ODOT reasonableness criteria.

These three criteria will be used to evaluate the reasonableness of noise abatement.

The additional factors that may be considered to increase the cost effectiveness criteria listed above are as follows: if the overall magnitude of the future noise level without mitigation exceeds 75 dBA for any receptor in a noise abatement area; if the date of permitted construction of the residential area pre-dates the date of initial highway construction, and if local officials have implemented measures to control incompatible growth and development adjacent to highways, then an additional 400 square feet per benefitted receptor will be allowed in the Reasonableness Criteria, for a total of 1,600 square feet per benefitted receptor.

Additionally, FHWA policy states third party funding cannot be used to make a noise barrier cost effective. Third party funding can only be used to pay for additional features such as landscaping, aesthetic treatments, etc. for noise barriers that meet cost effectiveness criteria.

C. Field Measurement Requirements

The primary purpose of field measurements is to measure existing ambient noise levels and ascertain other pertinent information in the vicinity of the project. Existing ambient noise measurements are obtained to quantify the existing acoustic environment and to provide a basis

for assessing potential impacts due to predicted project traffic noise level increases, and to validate the noise modeling results.

1. Field measurements shall be made using sound meters of sufficient accuracy to yield valid data for the particular project. Sound meters shall have suitable specifications consistent with American National Standards Institute (ANSI) S1.4-1983, Type II or better. All devices must have been calibrated within the past twelve calendar months or in accordance with the manufacturer's recommendation.

2. Field measurements of existing highway traffic noise are made to represent an hourly equivalent sound level, Leq(h). For existing highways, a minimum measurement of 15-minute time periods to represent the Leq(h). Measurements along low-volume highways (less than 1200 vehicles per day) or along new alignments may require longer measurement periods (e.g., 30-60 minutes) to attain desirable statistical accuracy. In some cases (e.g., highly congested facilities where trucks avoid peak automobile travel periods), both a peak traffic period and a non-peak period noise measurement may be required to verify the worst hour noise levels. If information is not available to identify the noisiest hour of the day or if there is public controversy at a specific location, 24-hour measurements may be necessary.

3. Field documentation shall include traffic conditions, climatic conditions, land uses and other non-highway sources of noise at the time of measurement. In addition, make, model, serial number and certificate of calibration for all sound meters and associated calibration units used for field noise readings will be recorded with all results.

D. Traffic Noise Prediction

1. All traffic noise analyses shall use the most current version of the FHWA Traffic Noise Model (TNM®) or any other model determined by the FHWA to be consistent with the methodology of the TNM® model, pursuant to 23 CFR 772.9.

2. The Average Pavement Type setting shall be used in the FHWA TNM® for future noise level prediction. However, should there be a need for substantiating the use of a different pavement type the ODOT shall obtain approval by the FHWA. It is noted that specific pavement types in FHWA TNM® are allowed to predict the existing condition.

3. Noise contour lines (future condition) may be used for project alternative screening or for land use planning to comply with 23 CFR 772.17 but shall not be used for determining highway traffic noise impacts. The future 66 dB(A) noise contours lines can either be determined by using a Noise Contour function of the noise model or by modeling discrete receiver points and extrapolating between them. When using a Noise Contour function, adequate grid spacing is required to provide sufficient resolution and when using discrete receivers, the receivers need to be close enough together to enable relatively accurate extrapolation between receiver points. For projects that have a substantial amount of undeveloped land adjacent to the highway project, the traffic noise analysis should include predicted noise impact contours at approximate distances from the highway centerline or center of near lane.

   As a minimum, these distances should equate to the predicted 66 dBA and 71 dBA noise levels.

4. In predicting noise levels and assessing noise impacts, traffic characteristics that would yield the worst hourly traffic noise impact for the design year shall be used for all Activity Categories. For urban highway projects this generally requires analysis of Level of Service C or D.

5. The basic input parameters and general modeling considerations are as follows:

   a. Grouping of receivers is permitted as long as the representative receiver is the same distance and elevation from the roadway being evaluated for the group and come from a common noise environment. However, under all circumstances the two end receivers of a group must be evaluated as individual receivers.

   b. The actual width of roadway pavements should be modeled, including travel lanes and shoulders.

6. Predicting Interior Noise Levels

   For Activity Category D, interior locations are only used where there are no outside activities (e.g., in places of worship, hospitals, libraries, theaters, etc.) or where the exterior areas have characteristics that prevent highway traffic noise impacts on exterior activities (e.g., located far from the highway or already shielded from highway traffic noise). In the absence of calculations or field measurements, compute interior noise level predictions by subtracting noise reduction factors from the predicted exterior levels for the building in question, using the information in Table 3.

TABLE 3
INTERIOR NOISE REDUCTION FACTORS

Building Type	Window Condition*	Noise Reduction
All	Open	10 dB
Light frame	Ordinary sash (closed)	20 dB
	Storm windows	25 dB
Masonry	Single glazed	25 dB
	Double glazed	35 dB

* Windows shall be considered open unless there is firm knowledge that the windows are in fact kept closed almost every day of the year.

7. Model Validation

   All noise studies will require validation to verify the accuracy of noise models used to predict existing or future noise levels. Validation of the model requires a series of noise measurements along a project, taking a minimum of three noise measurements per site along with simultaneous traffic counts. In certain situations, consider two sets of measurements at each location at different times and different days to account for variations in traffic. Model the sites using traffic volumes and speeds collected during the measurement. If the measured and predicted highway traffic noise levels are within +/- 3 dB for all the measurements at all

the sites, then the model is considered valid and can be used to predict existing highway traffic noise levels along the entire project. If the model is not within +/-3 dB for all the measurements at all the sites, then the model is not considered valid until additional measurements are made or until the analyst identifies the reason for the discrepancy and makes a correction within the model.

E. Public Involvement

Communication with the community regarding noise impacts and possible noise abatement shall occur at the start of the noise study process and continue throughout the development of the project. ODOT will communicate with citizens to present information on the nature of highway traffic noise and discuss the effects of noise abatement measures in attenuating traffic noise and the types of noise abatement measures that may be considered. All noise sensitive areas and any known noise abatement measures will be presented and discussed at public hearings and/or public meetings. The concerns of the community shall be a major consideration in reaching a decision on the abatement measures to be provided.

The viewpoints of the property owners and residents of the benefitted receptors of proposed noise abatement measures shall be actively solicited and considered. The primary method for notices will be by US mail. Flyers or personal contact may be used in the event that mailings are unsuccessful in engaging property owners and /or residents in the public involvement process. ODOT will hold meetings with the benefitted property owners and residents and present a brief program on highway traffic noise to explain and demonstrate the characteristics of highway traffic noise, the effects of noise barriers in attenuating traffic noise, and the types of barriers that may be considered. As available, specific details of noise barriers being studied will be presented in addition to a discussion of alternatives to barrier construction. After completion of barrier design, ODOT will meet again with the property owners and benefitted residents to present final details and to solicit the residents' final views and opinions. The decision on whether the noise abatement measure is desired or not desired will be based on the preference provided by 51 percent or more of the benefitted property owners and residents that respond to the solicitation. One owner ballot and one resident ballot shall be solicited for each benefitted receptor. Points per ballot shall be distributed in the following weighted manner:

- 3 points/ballot for benefitted front row property owners
- 1 point/ballot for all other benefitted property owners
- 1 point/ballot vote for all residents

For Category C impacted properties, the property owner/official of jurisdiction only will be balloted regarding desire for abatement.

Consideration of the noise abatement measure will continue unless a simple majority of all distributed points are returned that indicates the balloted voters do not want the abatement measure. The final determination on the noise abatement will be shared with the property owners and residents by letter.

F. Information Required for NEPA

Prior to a Categorical Exclusion (CE) approval or request of a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) for a highway project requiring a noise study, ODOT will identify:

1. The environmental document will include the proposed highway traffic noise abatement and will identify locations where noise impacts are predicted to occur, where noise abatement is feasible and reasonable, and locations with impacts that have no feasible or reasonable noise abatement alternative.

2. For environmental clearance, the analysis will be completed to the extent that design information on the alterative(s) under study in the environmental document is available at the time the environmental clearance document is completed.

   A Statement of Likelihood will be included in the environmental document since feasibility and reasonableness determinations may change due to changes in project design after approval of the environmental document. The statement of likelihood will include the preliminary location and physical description of noise abatement measures determined feasible and reasonable in the preliminary analysis. The statement of likelihood shall also indicate that final recommendations on the construction of abatement measure(s) are determined during the completion of the project's final design and the public involvement processes.

G. Information for Local Government Officials

For highway projects where there are undeveloped lands, ODOT will make the results of the noise analyses and any proposed mitigation measures available to local government officials within whose jurisdiction the highway project is located. This will include expected noise levels as found in the NEPA document or in separate documentation. This information is provided to assist local officials to protect future land development from becoming incompatible with anticipated highway noise levels. ODOT is not responsible for mitigation of noise impacts that occur in developments permitted after the Date of Public Knowledge.

H. Construction Noise

In general, construction noise related to highway projects is not a major issue. Sources of noise include heavy machinery like backhoes and scrapers, cranes, pile drivers, and trucks transporting materials. Typically, construction noise is addressed in a project's noise analysis report and in the project environmental document. Most projects will not require modeling or any form of analysis associated with construction-related noise. In many cases, construction noise may be adequately addressed through a narrative discussion. Typically, construction noise can be minimized by implementing time-of-day restrictions for construction operations adjacent to noise sensitive areas. For projects that require compliance with local ordinances, more detailed analysis techniques should be included in the noise analysis report.

I. Federal Participation

The costs of noise abatement measures may be included in federal aid participating project costs with the federal share being the same as that for the system on which the project is located when:

- Traffic noise impacts have been identified; and
- Abatement measures have been determined to be feasible and reasonable pursuant to 23 CFR 772 and this policy manual.

J. Abatement Measures Reporting

The ODOT will maintain an inventory of all constructed noise barriers. The inventory shall include the following parameters: type of abatement; cost (overall cost, unit cost per/sq. ft.); average height; length; area; location (State, county, city, route); year of construction; average insertion loss/noise reduction as reported by the model in the noise analysis; NAC category(s) protected; material(s) used (precast concrete, berm, block, cast in place concrete, brick, metal, wood, fiberglass, combination, plastic (transparent, opaque, other); features (absorptive, reflective, surface texture); foundation (ground mounted, on structure); and project funding source.

K. Duties and Responsibilities

1. Director-Project Delivery

    a. Environmental Programs Division will implement and oversee the requirements of this policy manual.

    b. The appropriate design division will incorporate noise mitigation measures recommended by Environmental Programs Division in project plans. The Environmental Programs Division Engineer/Manager and Noise Mitigation Specialist must be notified in writing of any modification prior to completion of final construction plans. Such modification may require additional barrier analysis.

    c. Noise abatement measures not covered in the manual of “Standard Specifications for Highway Construction” will be discussed at the Plan-in-Hand meeting and detailed in the Plan-in-Hand report**.**

    d. Pay items will be established for noise abatement measures not covered in the manual of "Standard Specifications for Highway Construction”.

2. Director-Operations

    a. Noise abatement measures not covered in the manual of "Standard Specifications for Highway Construction" will be discussed at the pre-work conference and documented in the report of the meeting.

    b. Any field modifications to noise abatement measures must be approved by the Environmental Division. Such modification may require additional barrier analysis.

L. Review of Policy Manual

This policy manual shall be reviewed by the ODOT at least every five years, specifically, the Cost Effectiveness criteria.

Appendix B

ODOT's Standard Noise Report Sections

FUNDAMENTALS OF NOISE AND SOUND THEORY

Noise, defined as unwanted or excessive sound, is an undesirable by-product of our modern way of life. From these known effects of noise, criteria have been established to help protect public health and safety and prevent the disruption of certain human activities. These criteria are based on such known impacts of noise on people as speech interference, sleep interference, physiological responses, hearing loss, and annoyance. Highway traffic noise is a major contributor to overall transportation noise and is considered a line source of energy from which the energy levels dissipate vertically and laterally from the roadway. The rate at which the sound energy degrades depends on several factors, including distance, buildings, solid fences/walls, topography, ground surfaces, and atmospheric conditions. Traffic noise is not constant. It varies as each vehicle passes a point. The time-varying characteristics of environmental noise are analyzed statistically to determine the duration and intensity of noise exposure. In an urban environment, noise is made up of two distinct parts. One is ambient or background noise. Wind noise and distant traffic noise make up the project's acoustic environment. These sounds are not readily recognized but combine to produce a nonirritating ambient sound level. This background sound level varies throughout the day, lowest at night and highest during the day. The other component of urban noise is intermittent and louder than the background noise. Transportation noise and local industrial noise are examples of this type of noise. It is for these reasons that environmental noise is analyzed statistically.

Highway traffic sounds are generated primarily from a vehicle's tires, engine, and exhaust. It is commonly measured in decibels (dB) and is a logarithmic unit instead of the more common linear units such as temperature. The sound pressure level from two equal sources is 3 dB greater than the sound pressure level of just one source. For example, two trucks producing 90 dB each combine to create 93 dB, not 180 dB. In other words, doubling the noise source by only 3 dB increases the sound pressure level. Studies have shown that this increase is barely perceptible by the human ear. Research indicates that a 10 dB increase is perceived as twice as loud. One dB(A) is the slightest change in sound that an average person can detect. Usually, an observer cannot perceive an increase in noise of three to four dB if the increase occurs over several years.

This analysis will discuss the noise levels as L_{EQ} (h), defined as the steady-state sound level containing the same acoustic energy as the time-varying sound level during the same period. L_{EQ} (h) is the hourly value of L_{EQ} and is based on the more commonly known decibel (dB) and the "A-weighted" decibel unit or dB(A). Sound comprises different frequencies, each perceived differently by the human ear. Since human hearing is not sensitive to low and very high frequencies, the dB(A) scale approximates the human ear's response by compensating for high and low-end frequency insensitivity and rendering noise level readings more meaningful. The dB(A) unit measures perceptible sound energy and factors out the fringe frequencies. This analysis will express all traffic noise levels in dB(A) L_{EQ} (h).

CONSTRUCTION NOISE

Construction noise related to highway projects is not a major issue. Noise sources include heavy machinery like backhoes and scrapers, cranes, pile drivers, and trucks transporting materials. Construction noise can be minimized by implementing time-of-day restrictions for construction operations adjacent to noise-sensitive areas. ODOT is concerned with any unique noise-sensitive land uses or activities that may be affected by construction noise from the proposed project. Any special measures that are feasible and reasonable will be added to the project plans and specifications. No particular noise-sensitive land uses, or activities that may be affected by construction noise are close to the project.

STATEMENT TO LOCAL OFFICIALS

Traffic noise approaching and exceeding the sound levels specified in the ODOT Noise Policy resulting from the proposed facility has been identified. Considering noise-compatible land use planning, using the TNM model, the approximate distance from the centerline of the proposed roadway was used to determine the 66 dB(A) and 71 dB(A) future contour lines and summarized in Table X and shown in Figure 2. The distances vary due to variations in the topography of the receivers to the roadway. Development within these respective zones on either side of the proposed reconstructed roadway facility should be compatible with elevated traffic noise levels. Due to anticipated future noise levels, all residential and NAC Activity Category C land uses are discouraged within the 66 dB(A) impact zone.

TABLE X
Noise Contour Impact Zones*

Roadway Section	66 dB(A)	71dB(A)**
SH-XX	XXX'	XX'

*Distance from the centerline of the existing roadway.

**NOTE: Only include the 71 dB(A) contour in the above table and aerial maps if it is determined to fall outside the project right-of-way.