MnDOT Noise Policy

for

Type I Federal-aid Projects

as per 23 CFR 772

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This document contains the Minnesota Department of Transportation Noise Policy which describes the implementation of the requirements set forth by the Federal Highway Administration Title 23 Code of Federal Regulations Part 772: Procedures for Abatement of Highway Traffic Noise and Construction Noise. This Noise Policy also describes the implementation of the requirements set forth by Minnesota Statute 116.07 Subd.2a: Exemptions from standards, and Minnesota Rule 7030: Noise Pollution Control. This policy was developed by the Minnesota Department of Transportation and reviewed and concurred with by the Federal Highway Administration.

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Charlie Zelle, Commissioner Date
Minnesota Department of Transportation

_____ _____

David Scott, Acting Division Administrator Date
Minnesota Division
Federal Highway Administration

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1.0 DEFINITIONS

The following definitions are set forth for the MnDOT Highway Noise Policy.

Term	***Definition***
Benefited Receptor	The receptor of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dBA.
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.
Design Year	The future year used to estimate the probable traffic volume for which a highway is designed, typically 20 years from date of project opening.
Existing Noise Level	The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.
Feasibility	The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.
Future Noise Level	The worst hourly traffic noise level predicted for the design-year using an approved noise prediction model.
Impacted Receptor	A receptor that has a traffic noise impact (see definition for traffic noise impacts).
L10	The sound level that is exceeded 10 percent of the time (the 90th percentile) for the period under consideration. L10(h) is the hourly value of L10.
L50	The sound level that is exceeded 50 percent of the time (the 50th percentile) for the period under consideration. L50(h) is the hourly value of L50.
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, with Leq(h) being the hourly value of Leq.
Multifamily 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 benefited receptors.
Noise Abatement Criteria (FHWA)	The Noise Abatement Criteria (NAC) represent the upper limit of FHWA acceptable highway traffic noise for different types of land uses and human activities, when approached or exceeded noise abatement would need to be considered.
Noise Area Classification (State)	The Noise Area Classification as identified in Section 4, Table 2, are groupings of land use activities established in the State Noise Rules.
Noise Barrier	A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including standalone noise walls, noise berms (earth or other material), and combination berm/wall systems.

Term	***Definition***
Noise Level (A-weighted)	The sound pressure level obtained through use of A-weighting characteristics. The unit of measure is the decibel (dB), commonly referred to as dBA when A-weighting is used.
Noise Reduction Design Goal	The desired dBA noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. The noise reduction design goal is 7 dBA (must be achieved at a minimum of one receptor for each proposed barrier to achieve reasonableness).
Noise Sensitive Area	A geographic area containing a collection of noise sensitive receptors that might be protected behind a single noise barrier, such as a continuous neighborhood of homes abutting one side of the highway between two interchanges.
Owner	An individual or entity that is named on the deed of a benefited receptor as an owner, or listed as the owner on tax rolls.
Owner/Resident	An individual or entity that is named on the deed of a benefited receptor as an owner, and resides in that same benefitted receptor.
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.
Reasonableness	The combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.
Receptor	An outdoor place where frequent human use occurs and a lowered noise level may be of benefit. Also, a discrete location of a noise sensitive area(s), for any of the land uses listed in Table 1 (Section 4.1).
Residence	The official location of a household or dwelling unit. Either a single family residence or each dwelling unit in a multifamily dwelling.
Resident	An individual or entity that resides in or utilizes a benefited receptor via contract (i.e. a legal renter of a benefited residence). This includes a legal renter when a commercial establishment has been determined to be a benefited receptor.
Statement of Likelihood	A statement addressing the likelihood of noise abatement 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	One of two types of highway traffic noise impacts. For a Type I project, an increase in noise levels of at least 5 dBA in the design year over the existing noise level.
Traffic Noise Impacts	Design year build condition noise levels that approach or exceed the FHWA NAC listed in Table 1 (Section 4.1), or exceed State Noise Standards listed in Table 2 (Section 4.1) for the design year build condition; or design year build condition noise levels that create a substantial noise increase over existing noise levels.

Term	***Definition***
Type I Projects	A proposed Federal or Federal-aid highway project for the construction of a highway meeting one or more of the following conditions. (1) The construction of a highway on new location; or, (2) The physical alteration of an existing highway where there is either: (i) 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, (ii) 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 (not including the addition or removal of vegetation) between the highway traffic noise source and the receptor; or, (3) Bridge replacement projects that satisfy item (2), above. (4) The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, contraflow lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or, (5) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane. (6) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or, (7) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or, (8) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza. (9) If a project is determined to be a Type I project as defined above, 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; often referred to as retrofit projects. Eligibility requires the development of a priority ranking system to allow for consistent and uniform application of a Type II Program State-wide. See link for FHWA Highway Traffic Noise: Analysis and Abatement Guidance in Appendix H.
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 a noise analysis.

2.0 INTRODUCTION

This document contains the Minnesota Department of Transportation (MnDOT) policy on highway traffic noise and construction noise. This policy describes MnDOT's implementation of the requirements of the Federal Highway Administration (FHWA) Noise Standard at 23 Code of Federal Regulations (CFR) Part 772 (see Appendix A). This policy was developed by MnDOT and Local Public Agencies (LPAs) and reviewed and approved by FHWA. Additional guidance and clarification related to this policy can also be found in MnDOT's Highway Project Development Process manual (HPDP).

During the rapid expansion of the Interstate Highway System and other roadways in the 20th century, communities began to recognize that highway traffic noise and construction noise had become important environmental impacts. In the 1970 Federal-aid Highway Act, Congress required FHWA to develop a noise standard for new Federal-aid highway projects. While providing national criteria and requirements for all highway agencies, the FHWA Noise Standard gives highway agencies flexibility that reflects state-specific attitudes and objectives in approaching the problem of highway traffic and construction noise. This document contains the MnDOT's policy on how highway traffic noise impacts are defined, how noise abatement is evaluated, and how noise abatement decisions are made.

In addition to defining traffic noise impacts, the FHWA Noise Standard requires that noise abatement measures be considered when traffic noise impacts are identified for Type I Federal projects. Noise abatement measures that are found to be feasible and reasonable must be constructed for such projects. Feasible and reasonable noise abatement measures are eligible for Federal-aid participation at the same ratio or percentage as other eligible project costs.

This noise policy, as detailed in this document is in complete compliance with the FHWA Noise Standard as specified in 23 CFR 772 with two important clarifications. First, in addition to the Noise Abatement Criteria presented in the FHWA Noise Standard, this policy recognizes the Minnesota State Noise Standards, which are expressed in terms of L10 and L50 for daytime and nighttime periods, as it applies to traffic and construction noise. Second, the MnDOT approved noise prediction model at the time of this policy update is MINNOISEV3 rather than FHWA TNM 2.5 under an agreement with FHWA (due to the inability of TNM 2.5 to predict Minnesota State required noise metrics). See section 3.1 for more detail regarding approved noise prediction models.

The Federal Regulations on the Procedures for Abatement of Highway Traffic Noise and Construction Noise were effective July 13, 2011.

2.1 Purpose

This policy describes the MnDOT program to implement 23 CFR 772. Where FHWA has given the highway agencies flexibility in implementing the standard, this policy describes MnDOT's approach to implementation.

2.2 Noise Standards

This policy outlines the MnDOT program to implement the FHWA Noise Standard found at 23 CFR 772. These standards include traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials.

MnDOT must address both the FHWA Noise Standards and the Minnesota State Noise Standards (Minn. R. 7030). Minnesota State Noise Standards are regarded as absolute limits which carry the weight of law; however, Minnesota Statute 116.07 Subd. 2a. lists certain exemptions from the state noise standards, including the following:

> "*No standards adopted by any state agency for limiting levels of noise in terms of sound pressure level which may occur in the outdoor environment shall apply to (1) segments of trunk highways constructed with federal interstate substitution money, provided that all reasonably available noise mitigation measures are employed to abate noise, (2) an existing or newly constructed segment of a highway, provided that all reasonably available noise mitigation measures, as approved by the commissioners of the department of transportation and pollution control agency, are employed to abate noise and (3) except for the cities of Minneapolis and St. Paul, an existing or newly constructed segment of a road, street, or highway under the jurisdiction of a road authority of a town, statutory or home rule charter city, or county, except for roadways for which full control of access has been acquired.*"

Determinations on whether these exemptions from State Noise Standards apply to a roadway should be discussed with the Minnesota Pollution Control Agency, since "full control of access" is not defined in the Statute.

It is also required to adhere to applicable State (Minn Rule 7030) and Federal (23 CFR 772) noise standards as the basis for proposed noise barrier design requirements.

FHWA requires that states give numerical meaning to the phrase "approach the criterion." MnDOT defines a level as "approaching" the criterion level when it is **1 dBA**, or less, below the criterion level of the applicable Federal NAC.

2.3 Applicability

This policy applies uniformly and consistently to all Type I Federal highway projects in the State of Minnesota; that is, any projects that receive Federal-aid funds or are otherwise subject to FHWA approval. This includes Federal projects that are administered by LPAs as well as MnDOT.

If there are any questions about whether a project is subject to this policy or the FHWA Noise Standard, contact MnDOT noise staff (LPAs should contact the State Aid Federal Aid Project Development Engineer). Due to the long lead time to complete a traffic noise analysis, it should be determined as early as possible in the project development if a traffic noise analysis is necessary.

In addition to Federal-aid projects, this policy shall also apply to projects under MnDOT's authority that do not have Federal funds or require a Federal approval action.

For state funded only projects, no noise analysis is required unless the project crosses mandatory Environmental Quality Board thresholds or the project requires an FHWA undertaking. For

multi-state or border projects each State/Province is responsible for analyzing noise impacts in its own jurisdiction under its own policy.

MnDOT Metro District has developed and maintains a Highway Noise Abatement Program. This program is entirely state funded without Federal-aid funds, so no FHWA review or approval is required. MnDOT does not have a Type II program at this time. If a Type II program is developed in the future, it shall meet the requirements of 23 CFR 772.7 and 772.15. Any FHWA Type II participation must be applied uniformly and consistently statewide.

2.4 Federal Participation

Federal funds may be used for noise abatement measures when traffic noise impacts have been identified and abatement measures have been determined to be feasible and reasonable.

The following noise abatement measures may be considered for incorporation into a project to reduce traffic noise impacts. The costs of such measures may be included as Federal-aid participating project costs. The Federal cost share will be the same as that for the roadway on which the project is located.

1) Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Neither landscaping nor privacy fencing are viable noise abatement measures.
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.
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.
5) Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

3.0 TRAFFIC NOISE PREDICTION

Future noise levels must be predicted for all build alternatives. Noise levels for the existing condition must also be determined, either from use of noise prediction tools or noise measurement.

3.1 Approved Traffic Noise Prediction Tools

The noise model to be used for noise studies is STAMINA 2.0 based, MINNOISE. The latest version of MINNOISE at the time of this Noise Policy's implementation is MINNOISEV31. All noise predictions shall use the latest released version of MINNOISE available at the time of a project's environmental process. The MINNOISEV31 model can be downloaded at the following location:

http://www.dot.state.mn.us/environment/noise/models.html

MnDOT also makes available a noise barrier design aid program named MINNOPT, which is an OPTIMA based program. The latest version of MINNOPT at the time of this Noise Policy's implementation is MINNOPTV31. This program allows for the evaluation of seven noise barrier heights, as well as the ground line evaluation, for a total of eight heights. To stay updated as to model version names and capabilities, refer to the website link below. The MINNOPTV31 model can be downloaded at the following location:

http://www.dot.state.mn.us/environment/noise/models.html

The STAMINA 2.0/OPTIMA User Manual contains an errata sheet that discusses the changes that have been incorporated into MINNOISE and MINNOPT. For MINNOISEV31 and MINNOPTV31 example input/output files and/or user assistance contact MnDOT. The User Manual can be downloaded at:

http://www.dot.state.mn.us/environment/noise/models.html

Section 23 CFR 772.9(a) now states that "Any analysis required by this subpart must use the FHWA Traffic Noise Model (TNM)… or any other model determined by the FHWA to be consistent with the methodology in FHWA TNM." However, based upon an agreement between FHWA and MnDOT (in emails between FHWA and MnDOT on 9/28/07 and 10/9/07), MnDOT will be allowed to continue to use the MINNOISE model for noise analyses until either TNM has been modified to predict L10 and L50 noise level metrics, or MnDOT has demonstrated to FHWA that MINNOISE is consistent with the methodologies in TNM.

3.2 Noise Prediction of Alternatives

Future noise levels must be predicted and noise impacts assessed for all reasonable build alternatives under consideration in the environmental document (does not include alternatives rejected for detailed analysis because they are not reasonable or do not meet the project's purpose and need). However, evaluation of noise abatement and the solicitation of viewpoints of benefited receptors only need to be conducted for the preferred alternative.

3.3 Use of Pavement Type

Prediction of future noise levels used for noise impact assessments must be analyzed using a noise level prediction methodology based on an "average" pavement type (meaning that the

reference energy mean emission levels used in the prediction model must represent an average of pavement types, which generally includes both concrete and asphalt based pavements).

3.4 Use of Noise Contours

Noise contour lines (either those produced by an approved traffic noise prediction program, or those produced by a graphics computer program from a group of noise level point predictions) can only be used for project alternative screening or for land use planning purposes, NOT for determining highway traffic noise impacts.

3.5 Worst Traffic Noise Impact

In predicting noise levels and assessing noise impacts, traffic characteristics that would yield the worst noise hour for the design year must be used. Care must be taken not to model traffic volumes that would result in traffic congestion affecting the worst hour noise levels. Additional information and guidance on determining the traffic conditions for the worst noise hours are provided in Appendix D.

Seasonal traffic variations will be considered for modeling worst case traffic noise levels in areas where they are expected to be substantially higher during a particular season according to traffic volume projections. This may be true in some areas where traffic is substantially higher in summer months than in winter months due to seasonal use of recreational areas. However, any such temporary variation in traffic should only be taken into consideration for predicting traffic noise levels if traffic volumes are expected to be elevated for an entire season (such as summer), rather than just a few peak weekends (such as 4th of July weekend).

3.6 Modeling Conventions and Preferences

In sparsely populated areas where residences are significantly far apart to receive differentiating sound levels, individual receptors should be modeled. However, in dense, heavily developed residential areas experiencing a similar noise environment, it is permissible to group multiple receptor units into one representative modeling location. The FHWA recommends that lanes be modeled individually to place each noise source in its proper distance from the receptors. However if it is impracticable to break out the traffic data, multiple lanes with similar speeds and vehicle classes can be grouped into one single roadway represented by the centerline of the lanes. Realistic and reasonable roadway and receiver elevation data must be incorporated into noise models – No “flat earth” models.

3.7 Determining Noise Analysis Limits Beyond Project Termini

It is often difficult to determine the working limits of a noise analysis beyond the project termini. The analyst shall NEVER assume that the noise impacts are limited to the physical limits of the construction of a project. The analysis must include all areas that are affected by the project.

The analyst should verify their approach to noise modeling with MnDOT and/or FHWA Environmental Staff prior to starting the noise analysis.

The first step in determining the affected area is the analyst should extend the modeling limits at a minimum 500’ or to a “logical” termini point greater than 500’ from the end of physical

construction. This "logical" termini point for the noise analysis might be a roadway crossing or change in land use that is beyond 500 feet from the end of physical construction. At this point, the analyst should determine if the project's impacts extend beyond this point. If these impacts do exist, the analyst should extend the modeling further away from the project terminus (to 1000'), to a point where the future build condition noise levels do not create a substantial noise increase (5 dBA) over future no-build levels or cause receptors to approach or exceed the applicable Federal NAC and/or State Standards **as a result of the project (future no-build vs. future build)**. If noise modeling indicates impacts beyond 1000' from the project terminus, contact MnDOT noise staff for further guidance.

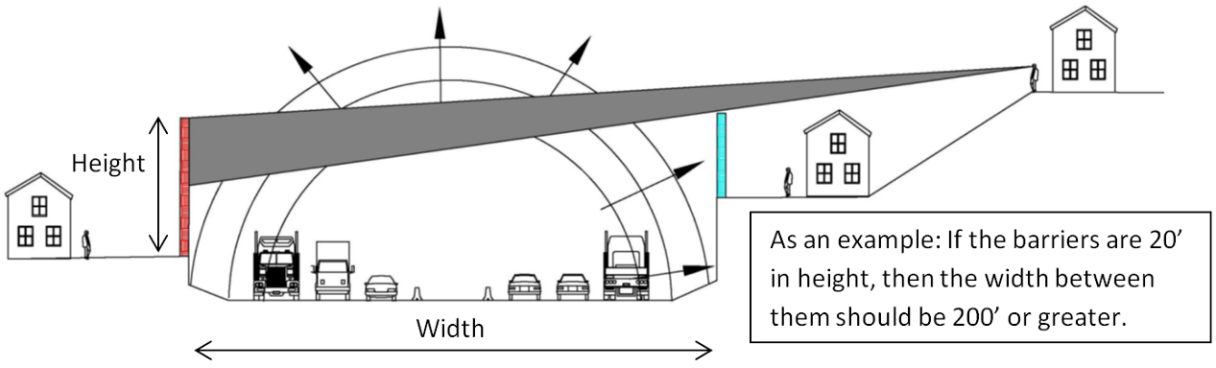
The mapped receptors and associated narrative should clearly indicate that the analysis has gone far enough to demonstrate that receptors are neither experiencing a 5 dBA (or greater) increase nor are they approaching/exceeding applicable NAC for the future build vs. future no-build year conditions as a result of the project.

Once the limits of the noise analysis have been determined, continue the analysis to determine impacts (existing condition vs. future build) and mitigation using MnDOT Noise Policy.

3.8 Procedure to Address Reflected Noise from Parallel Barriers

In certain configurations, noise reflecting off of noise barriers or structures can degrade the noise barriers' performance or cause noise increases in areas opposite the barriers. To avoid this effect, MnDOT's standard practice is that noise barriers be provided with an acoustically absorptive surface with a minimum noise reduction coefficient (NRC) of 0.80 if it's shown through analysis that noise levels increase from the reflection by 3 dBA (L_{10}) or greater under either of the following conditions:

- The ratio (W/H) of the width (W) between facing parallel barriers or retaining walls to the average height (H) of the barriers or walls is equal to or less than 10. See figure below.
- Receptors have a direct line of sight from a noise sensitive area of frequent human use to a barrier or retaining wall on the opposite side of the highway. (see figure below)



The cost of implementing an absorptive surface that is triggered by either of the conditions described above shall not be included in the cost of the abatement in terms of cost-effectiveness (i.e. reasonableness).

Noise modeling guidance for reflections using MINNOISE (STAMINA)

If either of the conditions above is met, the noise analyst shall take a small sample of the receptors on the opposite side of the roadway and rerun the model using "R" on the new noise barrier. If noise level increases above 2.5 dBA (L_{10}) are found using the "R" barrier option, then the analyst shall model the roadways as an "image roadway". This "image roadway" shall be mirrored around the new barrier using the same traffic volumes/classes and speeds as the actual roadway. When modeling the image roadway, the analyst shall remove the barrier that the image roadway was mirroring about. If increases from reflections are equal to or greater than 3 dBA (L_{10}) then an acoustical absorptive material must be installed. To model the effect of the treatment, the analyst shall reduce the image source roadway traffic volumes equally across the vehicle mix categories by the NRC value (e.g., if the NRC value of the treatment is 0.85 then the image source traffic volumes shall be reduced by 85%).

4.0 ANALYSIS OF TRAFFIC NOISE IMPACTS

A noise impact analysis shall be completed for all Type I projects (as determined by the Type I definition in Section 1 of this document).

4.1 Noise Impact Criteria and Assessment

Noise impacts are required to be assessed under any of the three following conditions:

FHWA Required Impact Criteria:

1) Predicted for the worst hour L10 noise levels for future build alternatives which approach (within 1 dBA) or exceed the FHWA Noise Abatement Criteria (NAC) as stated in Table 1, or
2) Predicted worst hour L10 noise levels for future build alternatives which exceed existing noise levels by 5 dBA or more, or

Minnesota State Required Impact Criteria (when applicable per MN Stat.116.07)

3) Predicted for the worst hours (daytime and nighttime) L10 and L50 noise levels for future build alternatives which exceed Minnesota State Noise Standard noise level limits as indicated by Table 2. See Section 2.2 for guidance regarding applicability of the Minnesota State Noise Standards.

The noise impact analysis must consider the following:

1) Consider all existing land use activities within the project area which may be affected by noise from the project, including all developed and undeveloped lands as applicable.
2) In determining noise impacts, primary consideration should be given to outdoor areas, except in the case of Category D if there is no exterior land use.
3) Impact assessment must consider all future build alternatives.
4) Although both L10 and L50 noise metrics must be considered under the Minnesota State Noise Standards for determining noise **impacts**, only the L10 metric must be evaluated for the **abatement** analysis for both daytime and nighttime conditions. Only L10 and a single worst hour (worst noise hour) is required for both **impact** and **abatement** analysis when the Federal NAC apply.
5) The scope of the noise analysis for a project shall also provide any data necessary to facilitate study of noise-related impacts to Section 4(f) resources per 23 CFR 774.15(e) and 23 CFR 771.15(f).

Noise studies shall identify all potentially impacted receptor locations in table and graphic format. The graphic format (i.e. figure) shall identify the locations of each representative receptor with a unique ID designation. For each identified representative receptor, the table shall include the following:

- A unique ID designation
- The FHWA (Table 1) and State (Table 2) if applicable
- Land use activity category

- Street address
- Number of units represented by the designated receptor
- Existing noise levels.

For Tier 1 Environmental Impact Statements, or other studies that will examine broad corridors, the appropriate scope and methodology of the noise analysis should be discussed with FHWA and other participating agencies early in the project planning process.

If any segment or component of an alternative meets the definition of a Type I project, then the entire project is considered to be Type I and is subject to the noise analysis requirements.

Note: To assess potential traffic noise impacts due to a substantial noise increase (5 dBA or greater), it is required to determine existing noise levels at potentially impacted receptor locations. Existing noise levels within the project area may be determined either by validated noise modeling (typical for receptor locations near existing highway alignments), as discussed in Section 3; or noise measurements (typically for receptor locations near new alignments), as discussed in Appendix C; or a combination of both as appropriate for the specific project.

Table 1 FHWA Noise Abatement Criteria

Activity Category	***Activity Criteria(1,2) L10(h), dBA***	***Evaluation Location***	***Activity Description***
A	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B(3)	70	Exterior	Residential
C(3)	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E(3)	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

Notes
(1) L10(h) shall be used for impact assessment.
(2) The L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
(3) Includes undeveloped lands permitted for this activity category.

Activity Categories

The noise analysis must include analysis for each Activity Category present in the study area. The following information further explains the FHWA NAC land use activity categories that apply to the noise abatement criteria given in Table 1.

Activity Category A (lands on which serenity and quiet are of extraordinary significance and serve an important public need). This is a very infrequently identified activity category. Proposals and justifications for designating land as Category A will be submitted through the FHWA Minnesota Division Office and FHWA Headquarters for approval. Activity Category A land uses are analyzed at this stricter standard even if the land use is identified within an activity category with a higher FHWA NAC.

Activity Category B (exterior areas of single-family and multi-family homes). This category general includes exterior impact criteria for all types of permanent residential dwelling units, including detached homes, multi-unit residential structures, apartments, condominiums, townhomes, mobile homes (but no transient lodgings, such as hotels and motels). When analyzing areas with multi-family dwelling units, the analyst must identify all dwelling units predicted to experience highway traffic noise impacts. This may include units above the ground level. Consider abatement for all identified highway traffic noise impacts and implement abatement that is feasible and reasonable. Multi-family dwelling units often have associated common areas for recreational or other use. The number of receptors used to represent these locations should considering the use, potential use and capacity limits of the activity area. These common areas are typically available for use by residents of the entire multi-family facility rather than limited to those units near the highway. The number of receptors for common areas should include all users or potential users of the impacted common area(s).

Activity Category C (exterior areas of non-residential lands such as schools, parks, cemeteries, etc.). Exterior impact criteria for this category will generally apply for identified exterior areas of frequent human use where noise abatement would provide a significant benefit. The equivalent number of residences needs to be based on the context and intensity of each non-residential land use within the project area. Examples for determining the number of receptors are provided in Appendix B. Consultation with MnDOT noise staff may be required for special cases.

Activity Category D (interiors of select Category C facilities; see Table 1, page 10). Only consider the interior levels at these land uses after fully completing an analysis of any outdoor activity areas or determining that exterior abatement measures are not feasible or reasonable. Due to the unique variations of scenarios and the rare occurrence of Activity Category D designations, placement of receptors will be done on a case by case basis in consultation with MnDOT noise staff, (see Appendix B). Table 6 in the FHWA Highway Traffic Noise Analysis and Abatement Guidance document may be used to estimate interior noise levels as a function of building type (see reference in Appendix H).

Activity Category E (exteriors of developed lands that are less sensitive to highway noise). Since permanent residential units (B) and hotels and motels (E) fall under different categories with different impact levels, it should be determined that properties identified as “hotels” do not actually function as apartment buildings. The number of receptors shall be determined in the same fashion that we would determine receptors for exterior analysis for Activity Category B. Due to the unique variations of scenarios for Activity Category E, placement of receptors will be done on a case by case basis in consultation with MnDOT noise staff, (see Appendix B).

Activity Category F (land uses that are not sensitive to highway traffic noise). No highway noise analysis is required under FHWA NAC Table 1 for land uses in this activity category, but some of these areas may still require noise analysis under the State Industrial/NAC-3 category in Table 2 (including industrial areas and transportation terminals).

Activity Category G (undeveloped land). Land that is permitted for development (that is, a building permit has been issued on or before the date of public knowledge) shall be analyzed under the Activity Category for that type of development. For land that is not permitted for development by the date of public knowledge, the noise analysis shall determine future noise levels and the results shall be documented in the project environmental documentation and in the

noise analysis report. At a minimum, the analysis should report the distance measured from the proposed edge of the traveled way to the FHWA NAC for all exterior land use categories. Any noise abatement for undeveloped Category G lands shall not be eligible for Federal-aid participation.

Table 2 Minnesota State Noise Standard

Land Use	***NAC: Noise Area Classification***	***Exterior Hourly Noise Level Limit, dBA***			
		Daytime 7:00 am to 10:00 pm		***Nighttime 10:00 pm to 7:00 am***	
		L10	***L50***	***L10***	***L50***
Residential	NAC-1	65	60	55	50
Commercial	NAC-2	70	65	70	65
Industrial	NAC-3	80	75	80	75

Notes,
1. NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping and picnicking land uses
2. NAC-2 includes retail and restaurants, transportation terminals, professional offices, parks, recreational and amusement land uses.
3. NAC-3 includes industrial, manufacturing, transportation facilities (except terminals), and utilities land uses
4. From Minnesota Pollution Control Agency, Minn. Rules sec. 7030.0040

4.2 Required Noise Measurements

Field measurements are required for all Type I projects. Noise measurements must be conducted at appropriate representative locations that emphasize exterior areas of frequent human use. Measurements must be conducted only under appropriate environmental conditions (temperature between 32 and 110 degrees F, relative humidity between 5 and 90%, winds less than 12 mph, no precipitation, dry roads, etc.), and must be thoroughly and accurately documented.

In general, field noise measurements must be conducted using ANSI Type 1 or Type 2 rated sound level meters (as per ANSI S1.4-1983) and procedures should be consistent with those identified in Chapter 4 of the FHWA Measurement of Highway Related Noise manual. (See Appendix H for a link to this reference).

Where an existing highway is the dominant noise source, representative field measurement levels should be compared to the modeled existing levels to determine whether or not the model is correctly validated. In areas where an existing highway is not present, such as rural areas where a new alignment is proposed, existing noise levels may be determined by field measurements.

For noise model validation measured highway traffic noise levels are compared to modeled noise levels for existing conditions (geometry, traffic volume, mix, speed). These levels must have a discrepancy of less than 3.0 dBA in order for the model to be considered validated. The validated noise model can then be modified to predict worst hour noise level for existing and future build alternatives. If the model fails to validate within acceptable limits, the model should be reassessed for input accuracy, or field measurements may have to be repeated, or both.

Additional guidance on the selection of measurement/analysis locations and noise measurement procedures are included in Appendices B and C, respectively.

5.0 ANALYSIS OF NOISE ABATEMENT MEASURES

5.1 Consideration of Noise Abatement Measures

Once traffic noise impacts are identified, noise abatement shall be considered and evaluated for feasibility and reasonableness. The noise analysis shall analyze and present appropriate noise abatement measures to abate identified impacts by giving weight to the benefits and costs of abatement and the overall social, economic, and environmental effects by using feasible and reasonable noise abatement measures for decision-making.

In abating traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs.

If a noise impact is identified, the noise analysis shall consider, at a minimum, noise abatement in the form of a noise barrier. However, any of the abatement measures listed below shall be considered if a noise barrier is determined not feasible or not reasonable:

1) 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. (This option may not be practical for most state interstate highways.)
2) Alteration of horizontal and vertical alignments (usually considered in the evaluation and comparison of noise impacts of various project build alternatives).
3) 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.
4) Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding or non-Federal-aid funding.

The use of quieter pavements is not an acceptable noise abatement measure for Federal-aid projects. 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 by a noticeable amount.

5.2 Feasibility

The following factors will be considered for noise abatement feasibility:

5.2.1 Acoustic Feasibility

1) Each noise abatement measure must achieve a noise reduction of at least **5 dBA** at impacted receptors in order for them to be considered benefited.
2) It is not required that every impacted receptor receive the minimum benefit in order for the noise abatement to be considered acoustically feasible, but at least one impacted receptor per proposed barrier must receive the minimum reduction of 5 dBA to achieve acoustic feasibility.

5.2.2 Engineering Feasibility

1) The noise analysis should address whether it is possible to design and construct proposed noise abatement.

   Constructability factors may include the following:

   a. **Safety:** Barriers must not present a crash hazard, intrude into crash zones, cause restrictions of critical sight lines at intersections or access ramps, or provide an unacceptable or unavoidable barrier to emergency access.

   b. **Barrier Height:** Local zoning requirements, such as height limits on fencing and walls are not acceptable limitations on the configuration or design of noise abatement. However, engineering limitation such as static loads and wind loads must be taken into consideration in determining a practical barrier height that can be achieved at a reasonable cost. MnDOT has established a maximum noise barrier height of 20 feet above the finished ground line at the barrier.

   c. **Topography**: In some cases the only available area for a barrier foundation may cause the barrier to become acoustically ineffective, such as when the roadway is in a canyon or topographically depressed area where noise barriers within the ROW would not effectively block the line of site between the roadway and homes situated at an elevation above the roadway. In other cases, substantial engineering required to support a barrier on the ROW, such as significant retaining walls or slope stabilization, could negatively affect the barrier cost, thereby reducing the barrier's cost reasonableness.

   d. **Drainage**: Barriers should not cause conditions that would seriously restrict adequate drainage or run-off that could cause flooding of travel lanes, ROW or adjacent property, or where the cost to circumvent these conditions would be excessive.

   e. **Utilities**: Barriers should not cause a condition that could interrupt the operation, use or maintenance of critical overhead or underground utilities or signage, or where the cost to circumvent these conditions would be excessive.

   f. **Maintenance**: Noise barrier designs should not be permitted to create a hindrance to required maintenance of the roadway (such as restricting snow removal or general repair activities), the adjacent ROW (restricting required access for landscaping), or the barrier itself (graffiti removal, collision damage, repainting, etc.).

2) The noise analysis may reference the MnDOT Road Design Manual, the MnDOT Standard Plans, or the FHWA Noise Barrier Design Handbook for site design requirements and other engineering feasibility issues. (See Appendix H.)

5.3 Reasonableness

There are three reasonableness factors or "tests" that must be met for a noise abatement measure to be considered reasonable.

1) Noise Reduction Design Goal
2) Cost Effectiveness
3) Viewpoint of Benefited Residents and Owners

5.3.1 Noise Reduction Design Goals

This policy establishes a noise reduction design goal of at least **7 dBA**. This design goal must be achieved at a minimum of one benefited receptor for each proposed noise abatement measure to be considered reasonable. This goal provides that even though the minimum noise reduction required for receptors to be considered as benefited is 5 dBA (see 5.2.1 Acoustic Feasibility), a minimum 7 dBA reduction must be achieved for at least one benefited receptor. For Federal-aid projects in areas where Minnesota State Standards do not apply, it is expected that preliminary noise abatement designs should attempt to achieve the 7 dBA design goal for as many benefited receptors as possible without exceeding the cost effectiveness requirements. For Federal Aid projects in areas where Minnesota State Noise Standards apply, it is also expected that preliminary noise abatement designs should attempt to maximize noise reduction for as many benefited receptors as possible while remaining within the limits placed on barrier height (20 ft.) and cost effectiveness ($43,500 per benefited residence).

5.3.2 Cost Effectiveness

1) A cost effectiveness threshold of **$43,500** per individual benefited receptor has been established, based on an estimated construction cost $20/sq. ft. for noise walls. The cost effectiveness threshold and basis for construction cost estimate will be tracked and the cost effectiveness number will be updated every five years, with the next update in 2020. The $20/sq. ft. cost was based on historical data over 5 years (2005-2010) for both Type I and MnDOT Metro District's Highway Noise Abatement Program projects using a concrete post/wooden plank type wall (MnDOT's standard wall design). This cost included the following "typical" construction items needed only to construct a noise barrier: mobilization, clearing, grubbing, removal of chain link fence, granular or concrete backfill, concrete posts, wood planks, traffic control (including portable concrete barrier), temporary fence, silt fence and turf reestablishment (seed/sod, fertilizer, erosion control).
2) For multi-family dwelling units (without upper floor balconies), habitable ground floor units facing the project roadway, with or without exterior use areas would be counted as benefited receptors for cost reasonableness calculations providing they receive a 5 dBA or greater noise reduction (see Section 5.2.1 Acoustic Feasibility).
3) The additional costs of some items such as guard rail, rub rail, utility relocation, construction on structure, and special anchoring or support systems are examples of items that if specifically necessary for the construction of a noise barrier, shall be added to the baseline unit costs cited above for the purpose of cost estimation.

4) Purchased Right-of-way which is absolutely necessary for the construction of a noise barrier shall be counted toward the cost effectiveness threshold after clearly exhausting all options for constructing a reasonable and feasible noise barrier within existing right-of-way. FHWA continues to support noise compatible land use planning. This planning approach may include types of land use, as well as, defining sufficiently wide corridors for roadways to minimize the likelihood of having to acquire additional right-of-way for construction of noise abatement.
5) The project proposer is responsible for all noise abatement costs associated with a Federal-aid project. Funding for costs necessary to construct any noise abatement measure that is considered reasonable and feasible must not be required from a local unit of government or otherwise transferred to residents.
6) If additional design elements or enhancement features, such as aesthetic treatments, alternative barrier alignments and landscaping, are requested by someone other than the project proposer (i.e., a local unit of government or property owner) the funding for these costs may become the responsibility of the requestor.
    a. Such requests must be submitted in writing and agreed upon by the project proposer.
    b. These costs must not be counted toward the cost effectiveness threshold.
    c. A local unit of government may receive funds for property owner requested additional design elements or enhancement features through a voluntary special assessment from the property owner.
    d. This does not apply when Federal law requirements (i.e. Sec 106 vs 23 CFR 772) have to be balanced for a specific barrier solely to avoid or minimize a section 106 adverse effect.
7) If a barrier is found to be reasonable and feasible, as described above, the barrier will be proposed.

5.3.3 Viewpoints of Benefited Residents and Owners

Although the noise analysis must be completed for all reasonable build alternatives under consideration, the solicitation of votes from the benefited receptors shall only be conducted on the preferred alternative. Viewpoints of the property owners and residents of all benefited receptors shall be solicited and considered in reaching a decision on the abatement measures to be provided. Several methods of public interaction are available to solicit viewpoints of benefited receptors including, but not limited to, the following:

- Local public meetings (local home, town hall, local church, etc.)
- Direct mail (letters, flyers, door hangers, fact sheet, return mail ballots)
- Project websites
- Telephone (call in lines or direct call campaign)

MnDOT requires at least one direct mailing and one public meeting but other public outreach may also be employed based on specific project needs. The outreach strategy will be determined by the sponsoring project manager, with MnDOT or FHWA approval. A public meeting is

required for any Type I project where noise abatement is proposed. A minimum 30 calendar-day response time is required for each mailing and 15 calendar-day notice for the public meeting. The second mailing, if required, will not take place prior to the completion of the 30 calendar-day requirement for the first mailing. See Appendix F for Guidance on Public Involvement Related to Noise Studies.

The solicitation of viewpoints must include information about the project and provide information regarding proposed noise abatement considerations associated with the project. The input of a benefited receptor must be documented in a manner that ties the input to the benefited receptor's street address (such as on a ballot or sign-in/response sheet). The desires of the benefited property owners and residents regarding the construction of proposed noise abatement will be expressed in a vote that will be weighted as follows:

1) For benefited properties abutting the highway right-of-way of the proposed project, the property owner will receive 4 points for each benefited receptor unit (occupied and unoccupied) and residents will receive 2 points for each benefited receptor unit. An owner/resident of an abutting benefited receptor would receive a total of 6 points. An abutting property is considered to be a property that is adjacent to the proposed noise barrier. Properties that are separated from the project roadway by a transportation facility carrying vehicular traffic or active rail lines (does not include private roadway (i.e., alley) or trails) are considered non-abutting properties. For further guidance on abutting properties, see MnDOT's noise website: http://www.dot.state.mn.us/environment/noise
2) For benefited properties not abutting the highway right-of-way, the property owner will receive 2 points for each benefited receptor unit (occupied and unoccupied) and the residents will receive 1 point for each benefited receptor unit. An owner/resident of a non-abutting benefited receptor would receive 3 points.
3) Due to the myriad of Association structures and the unique characteristics each one possesses, benefitted receptors that are part of an Association with a common land ownership and property units served by an Association with a common land ownership will be weighed on a case-by-case basis in consultation with MnDOT noise staff and FHWA. See Appendix G for an example of how votes are counted for an Association that has common land ownership.
4) Manufactured home parks will be weighed the same as the property owner and residents noted in #1 and #2.
5) In the case of multi-family residential buildings, such as apartment buildings, only those individual units that are considered to be benefited receptors (receptors receiving a 5 dBA reduction, regardless of upper/lower floor location) have a vote according to the same point system explained above. Non-benefiting units do not receive points.
6) Due to the unique variations of scenarios, the number and placement of non-residential receptor units for designated Activity Categories C and E shall be reviewed by appropriate MnDOT noise staff. See Appendix B for guidance on assigning receptor units for non-residential land uses such as parks, recreation areas, active sports areas, picnic areas, playgrounds, campgrounds, etc.

7) Any single benefited receptor unit (such as a house, apartment or condo, but not individual residents) will only be able to vote "yes" or "no"; no split votes. (Owner, owner/resident, or resident votes must individually be either all yes or all no points. Votes may not be split (i.e., an owner receives 4 points, he may not vote 3 "no" and 1 "yes"; all 4 points must be either "yes" or "no").
8) Non-benefiting receptors do not receive points.

If 50% or greater of all possible voting points from benefited receptors for a barrier are received on the first solicitation (typically by mail and/or ballot received at a public meeting), then a simple majority of voting points cast will be used to determine if the proposed barrier will be constructed or not. If less than 50% of all possible points for a barrier are received on the first solicitation, a second solicitation (typically by mail) will be sent to benefited receptors who did not respond to the first solicitation. If after the second solicitation 25% or greater of all possible points for a barrier are received, a simple majority of voting points cast will be used to determine whether the barrier will be constructed or not. However, if fewer than 25% of total possible points for a noise barrier are received after the second solicitation, then the barrier will not be constructed. In the case of a tie (equal number of points for and against a barrier) the barrier will be constructed.

It is understood that the above cases do not cover every possible condition or property type. Therefore, for the property types that do not fit the cases above, the balloting procedure may need to be considered on a case by case basis. This must be done with review and approval of MnDOT's Office of Environmental Stewardship or State Aid Division (for Local Agency Projects) and the FHWA Minnesota Division office, as appropriate.

See Appendix G for a simple example of the above method for evaluating benefited receptor viewpoints and a sample letter for soliciting owner/resident viewpoints.

Additionally, some consideration for abatement design alternatives may be considered to accommodate reasonable requests of potentially benefited receptors in mixed-use developments to opt-out given a reasonable compelling argument, as long as that receptor's exclusion allows the abatement element to continue to provide benefit to other receptors. For example, if a noise sensitive area includes mostly noise impacted single family homes and a single front-row commercial property, and that commercial property owner argues that a noise barrier would negatively and significantly impact his business, then a design alternative could be considered that would preserve the view from the highway to his business as long as it did not interfere with adequate noise reduction for other impacted and benefited receptors.

5.4 Noise Abatement Reporting

1) Prior to CE approval or issuance of a FONSI or ROD for a Type I project, the NEPA documentation must identify the :
   a. locations where noise impacts will occur,
   b. locations where noise abatement measures are feasible and reasonable,
   c. noise impacts for which no abatement appears to be feasible and reasonable;

2) The NEPA document for any Type I project must also include a statement of likelihood to include the preliminary locations of feasible and reasonable abatement and a statement that the final recommendation will be made after the final design and public involvement processes are complete. (See section 7.2 of this policy for a detailed discussion for the required statement of likelihood.)

3) For design-build projects, the preliminary technical noise study shall document all considered and proposed noise abatement measures for inclusion in the NEPA document. Final design of design-build noise abatement measures shall be based on the preliminary noise abatement design developed in the technical noise analysis and shall confirm that all of the final noise barrier heights, lengths, locations, cost-effectiveness indexes, and acoustical effectiveness ratings are not diminished or neglected with respect to the noise mitigation anticipated and possibly provided for in the preliminary design noise analysis. Noise abatement measures shall be considered, developed, and constructed in accordance with this standard and in conformance with the provisions of 40 CFR 1506.5(c) for environmental impact statements, and provisions of 23 CFR 636.109 for design build projects.

5.5 Analyzing Existing Noise Barriers on Type I Projects

Some Type I projects may be proposed in areas that already have existing noise barriers in place, and these may require special consideration.

If the proposed project would result in the removal of an existing barrier (barrier must be removed in full or in part to accommodate the proposed modifications to the transportation facility), that area with the displaced barrier shall be modeled and analyzed just as any other area with noise impacts and subjected to the same barrier reasonableness and feasibility evaluation as any other new barrier location as outlined in this policy document. However, if the new barrier (up to 20 feet high) is determined to not be reasonable or feasible, then the existing barrier shall be replaced with a barrier that maintains or increases the acoustical effectiveness of the original barrier.

If the proposed project would not displace an existing barrier, it should be determined if the existing barrier is already at the 20-foot maximum height. If so, that barrier would remain and would be reported in the environmental document. If not, higher barriers (including 20 feet) should be evaluated for reasonableness and feasibility (including solicitation of viewpoints of benefited receptors), and if determined to be reasonable and feasible, shall be proposed with the project. If a new 20 foot high barrier is determined to be not reasonable and feasible, the existing noise barrier would remain.

The analyst should include appropriate removal costs of the existing barrier when determining cost effectiveness of the new noise barrier.

6.0 CONSTRUCTION NOISE

For all projects subject to this policy, a qualitative assessment of construction noise must be prepared according to the following guidelines:

1) Identify land uses or activities that may be affected by noise from construction of the project. Areas that are potentially affected by construction noise may be similar to those for operational traffic noise except areas near bridges and interchanges where more pile-driving activity may affect properties at a further distance.
2) Identify or propose measures that are needed to minimize or eliminate adverse construction noise impacts to the community. See MnDOT's noise website for an example construction noise write-up: http://www.dot.state.mn.us/environment/noise
3) Incorporate the needed abatement measures in the plans and specifications.

7.0 DOCUMENTATION OF NOISE STUDY ANALYSIS

7.1 Noise Study Analysis

All highway noise analysis studies must be documented in the noise section of the environmental document. The environmental document noise section must clearly and concisely document the steps and results of the analysis and demonstrate that required policy was appropriately addressed and that suitable noise abatement measures are identified. The actual content and organization of the noise analysis section may vary depending on the characteristics, history and complexity of the project. However, every noise study report should include, at a minimum, the following sections:

- Introduction and Project Description
- Analysis Methodology and Policies
- Existing Conditions and Noise Environment
- Future Condition and Predicted Noise Environment
- Traffic Noise Impacts
- Consideration of Noise Abatement
- Construction Noise
- Conclusions and Recommendations
- Appropriate Appendices

An annotated example outline for noise study documentation is provided in Appendix E. Local Agencies are encouraged to use this content and formatting guidance to facilitate review and approval of noise analysis and decisions.

Note: receptor street addresses shall not be included in documents that go out for required public review, posting prior to the date of public knowledge, or at public meetings.

7.2 Statement of Likelihood

Every NEPA document for a Federal-aid project determined to be Type I for purposes of noise analysis shall include a statement of likelihood.

The statement of likelihood shall:

- Provide a summary of the preliminary location and physical description of noise abatement measures determined reasonable and feasible in the preliminary analysis.
- Clearly indicate that final recommendations on the construction of abatement measure(s) are determined during the completion of the project's final design.
- Outline the process for documentation and review of proposed withdrawal of noise abatement measure(s) that are determined to be reasonable and feasible in the NEPA process but not in the final design, (including, but not limited to, approach to contacting

benefited receptors that may lose noise abatement, the benefited receptors opportunity to respond to the proposed change, public involvement and coordination with stakeholder agencies).

- Clearly discuss the site conditions that may affect an existing reasonable and feasible determination.

Withdrawal of a noise abatement measure determined to be reasonable and feasible during the NEPA process will be reviewed by the same agencies that had signature authority on the NEPA document. Documentation will be prepared that:

- Outlines the site conditions assumed when the noise abatement measure was determined to be reasonable and feasible during the NEPA process.
- Outlines the additional site information (changes from initial assumptions) and design changes (if any) that were implemented during the final design process.
- Verifies that the notification and input process outlined in the NEPA document occurred.
- Documents the response(s) of the impacted benefited receptors to loss or modification of noise abatement.

Notification of the affected benefited receptor(s), coordination with appropriate stakeholders, and approval of the request to eliminate or substantially modify a noise abatement measure(s) must be obtained prior to completion of the final design process (re-solicitation of benefited receptors may be required). Benefited receptors that may lose a noise abatement measure are expected to be provided a reasonable time (30 calendar-days) for comprehension and response to the project change. Notification of a benefited receptor must clearly and concisely outline why a noise abatement measure may no longer be reasonable and feasible.

For an example Statement of Likelihood, see FHWA Highway Traffic Noise: Analysis and Abatement Guidance, July, 2010, revised January 2011 in Appendix H.

8.0 INFORMATION FOR LOCAL OFFICIALS

For Type I projects where there are undeveloped lands, local officials will be provided with estimates of future design year noise levels and provided information on noise compatible land use planning concepts. Information on Federal-aid non-eligibility of noise abatement for lands permitted for development after the date of public knowledge will be conveyed to local officials. The project proposer will communicate this information by means of the environmental documentation process (EIS, EA, or Environmental Assessment worksheet), public hearings, public information meetings and direct contact, as dictated by the project scope and requirements.

Appendix A. FHWA Noise Standard - 23 CFR 772

PART 772--PROCEDURES FOR ABATEMENT OF HIGHWAY TRAFFIC NOISE AND CONSTRUCTION NOISE

Authority: 23 U.S.C. 109(h) and (i); 42 U.S.C. 4331, 4332; sec.

339(b), Pub. L. 104-59, 109 Stat. 568, 605; 49 CFR 1.48(b).

Sec. 772.1 Purpose.

To provide procedures for noise studies and noise abatement measures to help protect the public's health, welfare and livability, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to title 23 U.S.C.

Sec. 772.3 Noise standards.

The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in this regulation constitute the noise standards mandated by 23 U.S.C. 109(1). All highway projects which are developed in conformance with this regulation shall be deemed to be in accordance with the FHWA noise standards.

Sec. 772.5 Definitions.

Benefited Receptor. The recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dB(A), but not to exceed the highway agency's reasonableness design goal.

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.

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 part 771.

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

Existing Noise Levels. The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.

Feasibility. The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.

Impacted Receptor. The recipient that has a traffic noise impact.

L10. The sound level that is exceeded 10 percent of the time (the 90th percentile) for the period under consideration, with L10(h) being the hourly value of L10.

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, with Leq(h) being the hourly value of Leq.

Multifamily 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 benefited receptors.

Noise Barrier. A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including stand alone noise walls, noise berms (earth or other material), and combination berm/wall systems.

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 noise reduction design goal shall be at least 7 dB(A), but not more than 10 dB(A).

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.

Reasonableness. The combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

Receptor. A discrete or representative location of a noise sensitive area(s), for any of the land uses listed in Table 1.

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. One of two types of highway traffic noise impacts. For a Type I project, an increase in noise levels of 5 to 15 dB(A) in the design year over the existing noise level.

Traffic Noise Impacts. Design year build condition noise levels that approach or exceed the FHWA NAC listed in Table 1 for the future build condition; or design year build condition noise levels that create a substantial noise increase over existing noise levels.

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:

> (i) 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,
>
> (ii) 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, High-Occupancy Toll (HOT) 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 or toll plaza.

(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. 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).

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 a noise analysis.

Sec. 772.7 Applicability.

(a) This regulation applies to all Federal or Federal-aid Highway Projects authorized under title 23, United States Code. Therefore, this regulation applies to any highway project or multimodal project that:

(1) Requires FHWA approval regardless of funding sources, or

(2) Is funded with Federal-aid highway funds.

(b) In order to obtain FHWA approval, the highway agency shall develop noise policies in conformance with this regulation and shall apply these policies uniformly and consistently statewide.

(c) This regulation applies to all Type I projects unless the regulation specifically indicates that a section only applies to Type II or Type III projects.

(d) The development and implementation of Type II projects are not mandatory requirements of section 109(i) of title 23, United States Code.

(e) If a highway agency chooses to participate in a Type II program, the highway agency shall develop a priority system, based on a variety of factors, to rank the projects in the program. This priority system shall be submitted to and approved by FHWA before the highway agency is allowed to use Federal-aid funds for a project in the program. The highway agency shall re-analyze the priority system on a regular interval, not to exceed 5 years.

(f) For a Type III project, a highway agency is not required to complete a noise analysis or consider abatement measures.

Sec. 772.9 Traffic noise prediction.

(a) Any analysis required by this subpart must use the FHWA Traffic Noise Model (TNM), which is described in ``FHWA Traffic Noise Model'' Report No. FHWA-PD-96-010, including Revision No. 1, dated April 14, 2004, or any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM. These publications are incorporated by reference in accordance with section 552(a) of title 5, U.S.C. and part 51 of title 1, CFR, and are on file at the National Archives and Record Administration (NARA). For information on the availability of this material at NARA, call (202) 741-6030 or go to http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. These documents are available for copying and inspection at the Federal Highway Administration, 1200 New Jersey Avenue, SE., Washington, DC 20590, as provided in part 7 of title 49, CFR. These documents are also available on the FHWA's Traffic Noise Model Web site at the following URL: http://www.fhwa.dot.gov/environment/noise/index.htm.

(b) Average pavement type shall be used in the FHWA TNM for future noise level prediction unless a highway agency substantiates the use of a different pavement type for approval by the FHWA.

(c) Noise contour lines may be used for project alternative screening or for land use planning to comply with Sec. 772.17 of this part, but shall not be used for determining highway traffic noise impacts.

(d) In predicting noise levels and assessing noise impacts, traffic characteristics that would yield the worst traffic noise impact for the design year shall be used.

Sec. 772.11 Analysis of traffic noise impacts.

(a) The highway agency shall determine and analyze expected traffic noise impacts.

(1) For projects on new alignments, determine traffic noise impacts

by field measurements.

(2) For projects on existing alignments, predict existing and design year traffic noise impacts.

(b) In determining traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs.

(c) A traffic noise analysis shall be completed for:

(1) Each alternative under detailed study;

(2) Each Activity Category of the NAC listed in Table 1 that is present in the study area;

(i) Activity Category A. This activity category includes the exterior impact criteria for 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 for the area to continue to serve its intended purpose. Highway agencies shall submit justifications to the FHWA on a case-by-case basis for approval of an Activity Category A designation.

(ii) Activity Category B. This activity category includes the exterior impact criteria for single-family and multifamily residences.

(iii) Activity Category C. This activity category includes the exterior impact criteria for a variety of land use facilities. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(iv) Activity Category D. This activity category includes the interior impact criteria for certain land use facilities listed in Activity Category C that may have interior uses. A highway agency shall conduct an indoor analysis after a determination is made that exterior abatement measures will not be feasible and reasonable. An indoor analysis shall only be done after exhausting all outdoor analysis options. In situations where no exterior activities are to be affected by the 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, the highway agency shall use Activity Category D as the basis of determining noise impacts. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(v) Activity Category E. This activity category includes the exterior impact criteria for developed lands that are less sensitive to highway noise. Each highway

agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(vi) Activity Category F. This activity category includes developed lands that are not sensitive to highway traffic noise. There is no impact criteria for the land use facilities in this activity category and no analysis of noise impacts is required.

(vii) Activity Category G. This activity includes undeveloped lands.

(A) A highway agency shall 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.

(B) If undeveloped land is determined to be permitted, then the highway agency shall assign the land to the appropriate Activity Category and analyze it in the same manner as developed lands in that Activity Category.

(C) If undeveloped land is not permitted for development by the date of public knowledge, the highway agency shall 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.

(d) The analysis of traffic noise impacts shall include:

(1) Identification of existing activities, developed lands, and undeveloped lands, which may be affected by noise from the highway;

(2) For projects on new or existing alignments, validate predicted noise level through comparison between measured and predicted levels;

(3) Measurement of noise levels. Use an ANSI Type I or Type II integrating sound level meter;

(4) Identification of project limits to determine all traffic noise impacts for the design year for the build alternative. For Type II projects, traffic noise impacts shall be determined from current year conditions;

(e) Highway agencies shall establish an approach level to be used when determining a traffic noise impact. The approach level shall be at least 1 dB(A) less than the Noise Abatement Criteria for Activity Categories A to E listed in Table 1 to part 772;

(f) Highway agencies shall define substantial noise increase between 5 dB(A) to 15 dB(A) over existing noise levels. The substantial noise increase criterion is independent of the absolute noise level.

(g) A highway agency proposing to use Federal-aid highway funds for a Type II project shall perform a noise analysis in accordance with Sec. 772.11 of this part in order to provide information needed to make the determination required by Sec. 772.13(a) of this part.

Sec. 772.13 Analysis of noise abatement.

(a) When traffic noise impacts are identified, noise abatement shall be considered and evaluated for feasibility and reasonableness. The highway agency shall determine and analyze alternative noise abatement measures to abate identified impacts by giving weight to the benefits and costs of abatement and the overall social, economic, and environmental effects by using feasible and reasonable noise abatement measures for decision-making.

(b) In abating traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs.

(c) If a noise impact is identified, a highway agency shall consider abatement measures. The abatement measures listed in Sec. 772.15(c) of this part are eligible for Federal funding.

(1) At a minimum, the highway agency shall consider noise abatement in the form of a noise barrier.

(2) If a highway agency chooses to use absorptive treatments as a functional enhancement, the highway agency shall adopt a standard practice for using absorptive treatment that is consistent and uniformly applied statewide.

(d) Examination and evaluation of feasible and reasonable noise abatement measures for reducing the traffic noise impacts. Each highway agency, with FHWA approval, shall develop feasibility and reasonableness factors.

(1) Feasibility:

(i) Achievement of at least a 5 dB(A) highway traffic noise reduction at impacted receptors. The highway agency shall define, and receive FHWA approval for, the number of receptors that must achieve this reduction for the noise abatement measure to be acoustically feasible and explain the basis for this determination; and

(ii) Determination that it is possible to design and construct the noise abatement measure. Factors to consider are safety, barrier height, topography, drainage, utilities, and maintenance of the abatement measure, maintenance access to adjacent properties, and access to adjacent properties (i.e. arterial widening projects).

(2) Reasonableness:

(i) Consideration of the viewpoints of the property owners and residents of the benefited receptors. The highway agency shall solicit the viewpoints of all of the benefited receptors and obtain enough responses to document a decision on either desiring or not desiring the noise abatement measure. The highway agency shall define, and receive FHWA approval for, the number of receptors that are needed to constitute a decision and explain the basis for this determination.

(ii) Cost effectiveness of the highway traffic noise abatement measures. Each highway agency shall determine, and receive FHWA approval for, the allowable cost of abatement by determining a baseline cost reasonableness value. This determination may include the actual construction cost of noise abatement, cost

per square foot of abatement, the maximum square footage of abatement/benefited receptor and either the cost/benefited receptor or cost/benefited receptor/dB(A) reduction. The highway agency shall re-analyze the allowable cost for abatement on a regular interval, not to exceed 5 years. A highway agency has the option of justifying, for FHWA approval, different cost allowances for a particular geographic area(s) within the State, however, the highway agency must use the same cost reasonableness/construction cost ratio statewide.

(iii) Noise reduction design goals for highway traffic noise abatement measures. When noise abatement measure(s) are being considered, a highway agency shall achieve a noise reduction design goal. The highway agency shall define, and receive FHWA approval for, the design goal of at least 7 dB(A) but not more than 10 dB(A), and shall define the number of benefited receptors that must achieve this design goal and explain the basis for this determination.

(iv) The reasonableness factors listed in Sec. 772.13(d)(5)(i), (ii) and (iii), must collectively be achieved in order for a noise abatement measure to be deemed reasonable. Failure to achieve Sec. 772.13(d)(5)(i), (ii) or (iii), will result in the noise abatement measure being deemed not reasonable.

(v) In addition to the required reasonableness factors listed in Sec. 772.13(d)(5)(i), (ii), and (iii), a highway agency has the option to also include the following reasonableness factors: 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. No single optional reasonableness factor can be used to determine reasonableness.

(e) Assessment of Benefited Receptors. Each highway agency shall define the threshold for the noise reduction which determines a benefited receptor as at or above the 5 dB(A), but not to exceed the highway agency's reasonableness design goal.

(f) Abatement Measure Reporting: Each highway agency shall maintain an inventory of all constructed noise abatement measures. 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); project type (Type I, Type II, and optional project types such as State funded, county funded, tollway/turnpike funded, other, unknown). The FHWA will collect this information, in accordance with OMB's Information Collection requirements.

(g) Before adoption of a CE, FONSI, or ROD, the highway agency shall identify:

(1) Noise abatement measures which are feasible and reasonable, and which are likely to be incorporated in the project; and

(2) Noise impacts for which no noise abatement measures are feasible and reasonable.

(3) Documentation of highway traffic noise abatement: The environmental document shall 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. For environmental clearance, this analysis shall 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 shall 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 shall 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 an abatement measure(s) is determined during the completion of the project's final design and the public involvement processes.

(h) The FHWA will not approve project plans and specifications unless feasible and reasonable noise abatement measures are incorporated into the plans and specifications to reduce the noise impact on existing activities, developed lands, or undeveloped lands for which development is permitted.

(i) For design-build projects, the preliminary technical noise study shall document all considered and proposed noise abatement measures for inclusion in the NEPA document. Final design of design-build noise abatement measures shall be based on the preliminary noise abatement design developed in the technical noise analysis. Noise abatement measures shall be considered, developed, and constructed in accordance with this standard and in conformance with the provisions of 40 CFR 1506.5(c) and 23 CFR 636.109.

(j) Third party funding is not allowed on a Federal or Federal-aid Type I or Type II project if the noise abatement measure would require the additional funding from the third party to be considered feasible and/or reasonable. Third party funding is acceptable on a Federal or Federal-aid highway Type I or Type II project to make functional enhancements, such as absorptive treatment and access doors or aesthetic enhancements, to a noise abatement measure already determined feasible and reasonable.

(k) On a Type I or Type II projects, a highway agency has the option to cost average noise abatement among benefited receptors within common noise environments if no single common noise environment exceeds two times the highway agency's cost reasonableness criteria and collectively all common noise environments being averaged do not exceed the highway agency's cost reasonableness criteria.

Sec. 772.15 Federal participation.

(a) Type I and Type II projects. Federal funds may be used for noise abatement measures when:

(1) Traffic noise impacts have been identified; and

(2) Abatement measures have been determined to be feasible and reasonable pursuant to Sec. 772.13(d) of this chapter.

(b) For Type II projects.

(1) No funds made available out of the Highway Trust Fund may be used to construct Type II noise barriers, as defined by this regulation, if such noise barriers were not part of a project approved by the FHWA before the November 28, 1995.

(2) Federal funds are available for Type II noise barriers along lands that were developed or were under substantial construction before approval of the acquisition of the rights-of-ways for, or construction of, the existing highway.

(3) FHWA will not approve noise abatement measures for locations where such measures were previously determined not to be feasible and reasonable for a Type I project.

(c) Noise Abatement Measures. The following noise abatement measures may be considered for incorporation into a Type I or Type II project to reduce traffic noise impacts. The costs of such 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.

(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.

(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.

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

Sec. 772.17 Information for local officials.

(a) To minimize future traffic noise impacts on currently undeveloped lands of Type I projects, a highway agency shall inform local officials within whose jurisdiction the highway project is located of:

(1) Noise compatible planning concepts;

(2) The best estimation of the future design year noise levels at various distances from the edge of the nearest travel lane of the highway improvement where the future noise levels meet the highway agency's definition of ``approach'' for undeveloped lands or properties within the project limits. At a minimum, identify the distance to the exterior noise abatement criteria in Table 1;

(3) Non-eligibility for Federal-aid participation for a Type II project as described in Sec. 772.15(b).

(b) If a highway agency chooses to participate in a Type II noise program or to use the date of development as one of the factors in determining the reasonableness of a Type I noise abatement measure, the highway agency shall have a statewide outreach program to inform local officials and the public of the items in Sec. 772.17(a)(1) through (3).

Sec. 772.19 Construction noise.

For all Type I and II projects, a highway agency shall:

(a) Identify land uses or activities that may be affected by noise from construction of the project. The identification is to be performed during the project development studies.

(b) Determine the measures that are needed in the plans and specifications to minimize or eliminate adverse construction noise impacts to the community. This determination shall include a weighing of the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.

(c) Incorporate the needed abatement measures in the plans and specifications.

Table 1 to Part 772--Noise Abatement Criteria
[Hourly A-Weighted Sound Level--decibels (dB(A)) (1)]

Activity Category	Activity Criteria(2)		Evaluation Location	Activity Description
	Leq(h)	L10(h)		
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B(3)	67	70	Exterior	Residential
C(3)	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools , television studios, trails, and trail crossings
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E(3)	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	--	Undeveloped lands that are not permitted

(1) Either Leq(h) or L10(h) (but not both) may be used on a project.
(2) The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
(3) Includes undeveloped lands permitted for this activity category.

Appendix B. Guidance on Selection and Use of Noise Analysis Locations

This appendix includes guidance and discussion on the following topics:

- The terminology used in establishing noise analysis locations,
- Selecting appropriate noise analysis locations within the project area (where or where not on the property, areas of frequent human use, second story units, etc.), and
- Assigning noise analysis locations for special land uses.

Noise Analysis Location Terminology

The following terms are more fully defined below for use in this appendix and noise policy with regard to noise analysis locations.

Noise Receptor (or receptor): A location that represents an individual, potentially noise sensitive land use, such as an individual home or apartment. Receptors may also include areas in open spaces (such as parks, campgrounds recreation areas, playgrounds, school yards, trails) or near the exterior areas of non-residential structures (such as school buildings, churches, hotels, libraries, etc.). In practice the term "receptor" may sometimes be used to describe the individual land use itself (e.g. 123 Main Street) or, in context, a specific location associated with such a property (e.g. the rear yard of 123 Main Street approximately 20 feet from the rear façade). Receptors are often used to represent noise measurement and prediction locations, as well as for the purpose of determining cost effectiveness (i.e., cost per benefited receptor) and solicitation of resident/owner viewpoints. When determining the number of benefited receptors for cost effectiveness and the solicitation of resident/owner viewpoints, the context and intensity of the land use must be taken into consideration. (See "Assigning Receptors for Exterior Special Land Uses" in this appendix.)

Noise Measurement Locations: A noise measurement location is a location where noise measurements were conducted as part of the project. Noise measurements are usually conducted at a noise receptor location (as described above) but not all receptors will include noise measurements.

Noise Prediction Locations: A noise prediction location is typically a receptor location that includes a noise prediction only but did not include a noise measurement. For most studies it is expected that only a few of the receptor locations would also be noise measurement locations, with the rest being noise prediction locations only. A single noise prediction location may be used to represent several noise receptor locations where it is expected that noise levels would be similar.

Noise Sensitive Areas: A noise sensitive area (or NSA) is usually defined as a group of noise receptors that are geographically situated in a single, continuous geographic area, without large gaps and which might reasonably be protected by a single noise barrier. A typical NSA might encompass a residential area with a few dozen homes within a few hundred feet of the highway that extend between two interchanges. It is also common that an NSA will have a fairly consistent land use (such as single family homes), but some NSAs may have mixed use areas. In this sense an NSA may consist of a single isolated noise sensitive structure, or a mile long stretch

of closely spaced, uninterrupted homes alongside the project highway. The use of NSAs in a noise analysis is not required, but is encouraged in order to make the noise analysis process more organized and easier to follow by laypersons and decision makers.

Assigning Noise Receptor Locations

As discussed above, a noise receptor represents an individual land use such as a single family home, individual apartment unit or a human use area in a park, playground, school, or recreation area, and may also coincide with a noise measurement location, a noise prediction location, or both. For the purpose of conducting measurements and predictions, the receptor location is also a specific location in three-dimensional space where a noise measurement or prediction will take place and some care should be exercised in selecting the precise location.

For residential land uses appropriate choices for receptor locations may include a patio or other exterior areas of frequent human use on the side of a residential structure facing the project, but care should be taken not to select a location that is too far from the receptor structure itself. If no such area of frequent human use is evident, an exterior position approximately 20 feet from the facade of the structure closest to the project should be used. For multi-story, multifamily residential buildings it may be required to assign receptor locations to exterior use areas such as upper story balconies if these balconies represent the sole, private exterior use for a specific unit. A measurement position at the ROW line at the back of the property is typically a poor choice since these locations rarely represent an area of frequent human use and noise abatement elements designed to provide sufficient noise reduction at this position will usually offer insufficient protection at areas nearer to the structure. Positions at the front curb or sidewalk of the receptor property are inappropriate since they generally do not represent an area of frequent use and are highly influenced by local street traffic passing within a few feet of the position.

The distance from the project highway within which to identify receptor locations is also an important consideration. FHWA guidance advises against establishing a firm screening distance within which noise impacts should be identified, however, it is also observed here that beyond some reasonable distance noise impacts become less likely to occur and increasingly difficult to reliably predict or mitigate. For example, under normal meteorological conditions it is unusual to see highway traffic noise levels exceeding noise abatement criteria levels beyond about 500 feet, and it is generally accepted that traffic noise models can reasonably predict traffic noise levels within this distance. However, beyond 500 feet absolute noise level impacts become less likely and the effectiveness of both traffic noise prediction models and typical noise abatement measures become less reliable. In some rural areas with low existing ambient noise levels relative noise impacts (from a substantial noise increase) may still exist beyond 500 feet. Caution should be exercised in analyzing noise levels at locations greater than 500 feet from the roadway due to practical limitations in noise prediction methodology.

Assigning Noise Receptors for Activity Category C

Assigning the number and locations of receptors for Activity Category C, (such as parks, recreation areas, active sports areas, picnic areas, playgrounds, campgrounds, etc.) generally requires some special attention. A basic strategy for assigning receptor units is offered below for simple cases, and as a starting point for more complex cases.

For exterior areas under Activity Category C, assign one receptor location for each 100 feet of frontage which includes an improved area of frequent human use that would benefit from a reduced noise level within 500 feet of the project roadway, except trails, which should be assigned no more than one receptor per 200 feet of trail. Do not assign receptors for areas that do not have improved areas as described above, beyond 500 feet from the roadway, and do not include more than one receptor location per 100 feet of frontage.

For current guidance on motorized versus non-motorized trails see FHWA guidance at: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm

For example, consider a large suburban park that extends approximately 4000 feet along the project roadway: at the easternmost 1000 foot portion of the park there is a picnic pavilion, a playground, a fountain with benches, tennis courts, a basketball court a softball field, all within 500 feet of the highway. The next 3000 feet includes a parking area and less formally developed areas with no specific areas of frequent human use. In this example one receptor could be located within each of the ten 100 foot sections of frontage with improvements, at a setback distance consistent with the improvements in that section, for a total of ten receptor units, and no additional units in the parking area or less developed area to the west, and no more than one receptor per each 100 foot frontage section. The ten identified receptor units would be used as measurement or prediction locations to determine existing and future noise levels, and used in the calculation to determine cost effectiveness of proposed noise abatement as well as the solicitation of votes from the benefited receptors.

The placement of receptor locations for the wide variety of land uses that might fall into this category, and the highly variable ways that these land uses are used by the public defies a simple description. Therefore, the number and placement of receptor units shall be handled on a case by case basis and reviewed by appropriate MnDOT staff.

For Cemeteries specifically, one (1) receptor should be counted for each area of a formalized memorial gathering facility. Individual grave sites and access ways are not considered individually sensitive receptors or centers of human activity; however, each section of the cemetery as defined through consultation with the operator, which may have informal gathering areas, should be assigned a receptor because they are considered to meet the intent of ‘centers of human activity’. If there are no formalized or operator defined informal gathering areas, a generalized receptor(s) shall be placed within the property that best represents the worst expected traffic noise condition, based on professional judgment of the noise specialist.

Assigning Noise Receptors for Activity Categories D

For institutional or commercial structures included in Activity Category D, the receptor location shall be located at an exterior area representing the façade of the building facing the project. This receptor will be used as part of the process to estimate an interior sound level. Contact MnDOT noise staff for guidance on estimating interior noise levels.

Assigning Noise Receptors for Activity Categories E

For institutional or commercial structures included in Activity Category E, the receptor location shall be located at the exterior area of frequent human use if one exists (such as an outdoor break area, eating area, or casual seating area). If no such area exists, an exterior area representing the façade of the building facing the project shall be selected.

Appendix C. Guidance and Procedures for Field Noise Measurements

Noise measurements are required for all noise studies. Consultants and agency staff conducting field noise measurement programs for noise studies are encouraged to have sound professional experience and decision making skills in addressing the various routine and non-routine issues that present themselves in all field noise measurement work. To assist in this effort this appendix provides general guidance on the following topics:

- Purpose for conducting traffic noise measurements (model validation, document existing noise levels)
- Basic procedures for conducting noise measurements (equipment type, set-up, field calibration, measurement parameters, intervals, documentation)
- Common mistakes or poor measurement conditions to avoid
- Reporting noise measurement data
- Technical references to be followed

Purpose for Conducting Noise Measurement for Traffic Noise Studies

There are two primary purposes for conducting noise measurements for traffic noise studies, and which are generally covered in this appendix:

- Validation of noise model runs
- Establish existing noise levels at areas that cannot be properly modeled

The model validation task consists of comparing measured noise levels to modeled noise levels for similar traffic conditions, and *validate* that the measured and predicted levels are within suitable agreement (typically within +/- 3dBA). Model validation measurements are typically conducted in areas near existing roadways where the traffic noise is the dominant noise source.

Existing noise level measurements are conducted to empirically determine the existing noise environment in areas where traffic is not the dominant noise source, such as for a proposed new roadway alignment (and where traffic noise prediction models cannot accurately predict existing conditions).

There are other, less routine noise measurement tasks, such as long term noise measurements to empirically demonstrate loudest noise hour, and specialized noise measurement procedures to document noise barrier performance, determine exterior to interior acoustical transmission loss of a structure, or generate reference levels for noise prediction models and pavement noise studies, but these are not covered in this section. Please see the FHWA's Measurement of Highway-Related Noise (link in Appendix H) for more information on these measurement types, or other suitable standards and references if they are required.

Basic Procedures for Conducting Noise Measurements

Field noise measurements must be taken consistent with the guidelines contained in FHWA's manual 'Measurement of Highway Related Noise', Minnesota Statute 7030.0060 'Measurement Methodology' and this appendix, as described below.

Equipment

Equipment required to conduct suitable and defensible traffic noise measurements generally include the following:

- Integrating sound level meters (SLM) with microphones classified as Type 1 (preferred) or Type 2 (ANSI S1.4-1983), fitted with an appropriate environmental windscreen,
- Field calibrator,
- Instrument tripod,
- Environmental weather meter (small hand-held versions are suitable),
- GPS transponder (optional, but highly recommended), and
- Digital camera (optional, but highly recommended).

All SLM and field calibrators must be documented to be within their one-year laboratory calibration period at the time of the measurements. For this task it would be suitable to include an equipment list with equipment model and serial numbers and last laboratory calibration date for each piece of key equipment (typically SLMs and field calibrators), and proof of calibration available and offered upon request. The use of compact "dosimeter" type sound level meters is discouraged, since these units are generally designed for indoor use and often lack appropriate measurement metrics, noise floor, dynamic range, and appropriate wind screens for outdoor environmental measurements.

Instrument Calibration

As stated above, all SLMs and field calibrators must be documented as being within their one year factory or laboratory calibration period. All laboratory calibrations should be traceable to the National Institute of Standards and Technology (NIST) in Washington, DC. In addition, a field calibration check is required before and after each field measurement session.

Measurement Locations and Set up

Traffic noise measurements are typically conducted at representative locations within the project area. If possible, locations along the alignment should be chosen that represent potentially impacted noise sensitive receptors and that have a noise environment similar to other areas along that section of the alignment. Selecting the precise number and locations of representative locations requires some level of professional experience and judgment. In general, it is expected that at least one measurement location should be conducted for each noise sensitive area (collection of receptor sites or residences that might be expected to be protected behind a single noise barrier) and that the measurement location should be representative of an exterior area of frequent human use. Appropriate choices for measurement positions may include an exterior patio or other areas of frequent human use on the side of a residential structure facing the project, but care should be taken

not to select a location that is too far from the receptor structure itself. If no such area of frequent human use is evident, a position approximately 20 feet from the facade of the structure closest to the project should be used. A measurement position at the ROW line at the back of the property is typically a poor choice since abatement elements designed to provide sufficient noise reduction at this position will usually offer insufficient protection at areas nearer to the structure. Measurement positions at the front curb or sidewalk of the receptor property are inappropriate since they generally do not represent an area of frequent use and are highly influenced by local street traffic passing within a few feet of the microphone.

Once the precise measurement site and position are selected, the SLM should be set up on a tripod with the microphone set to a height of approximately 5 feet above the ground. The SLM should be set to "A-weighting" and "Fast" response, and fitted with an appropriate foam wind screen in good condition (typically 3.5 inch diameter). Before beginning measurements the SLM should undergo a field calibration check, with the results documented in a field data sheet.

Measurement Times and Durations

At least two sets of readings (if practical) should be conducted at each selected location during a period representative of the worst hourly traffic noise condition. While it may not always be practical, it is recommended that one set of readings be taken during the morning hours and a second set taken during the afternoon hours. At each measurement location, a 30 minute measurement should be conducted, although a shorter 15 minute measurement time period may be appropriate for busy highways with a constant flow of traffic.

Documentation

All field noise measurements must be accompanied by an appropriate and legible field data sheet. In order for noise measurements to be in compliance with recognized standards the field data sheet should include the following items:

- Name, location and land use of field measurement site (such as a residential address, or name of commercial or institutional locations), including measurement site ID name/number if applicable,
- Date and time of the measurement,
- Name and affiliation (agency or company) of the person conducting the measurement,
- SLM settings (weighting network, response setting),
- Results of pre- and post-measurement field calibration check,
- Meteorological conditions (temperature, wind speed, %RH, precipitation, cloud cover), including an observation of roadway conditions (confirm dry roadways),
- Terrain conditions (hilly/flat, hard/soft/mixed, presence of ice or snow, etc.),
- A measurement site sketch (indicating SLM position, nearby buildings and structures, relevant terrain features, distance from SLM to permanent landmarks, direction and approximate distance to dominant sound sources including roadways, etc.). A general rule of thumb is that the site sketch should be detailed enough that someone else following the notes should be able to replicate the measurement position within a few feet.

- Notes on dominant and observed noise sources during the measurement. Also a listing with approximate times of significant transient events that could influence the noise measurement (such as passing emergency vehicles, dogs barking nearby, operator noise, audible aircraft over-flights, etc.).
- Notes on the actual measured sound levels. Although the L10 metric is used for impact assessment, other metrics including Leq, L50, L90, Lmax and Lmin for the time measurement period should also be recorded, if available.
- Classified traffic counts (autos/medium trucks/heavy trucks). It may be difficult to collect traffic data for the entire measurement period, but it is recommended to collect an approximate classified traffic count for at least a limited, representative portion of the measurement, perhaps 5 minutes, for comparison to traffic volume assumptions used for the analysis.
- GPS coordinates of the SLM position (optional, but highly recommended).
- A list of photos taken of the measurement set-up. It is recommended that two photos be taken at each measurement site, one showing the SLM mounted on its tripod with the receptor location in the background, and another of the SLM with the dominant noise source (typically the subject roadway) in the background (optional, but highly recommended).

A sample data sheet is provided in this appendix.

Interaction with Residents and Property Owners

Interacting with residents and property owners is an important part of the field measurement process. In any such interaction with residents or property owners, the noise measurement staff must exercise a high level of respect and professionalism. Since measurements need to be conducted at an area of frequent human use or near the structure it is typically required that the measurements be conducted on private property. Permission to conduct measurements on private property must be obtained from the resident or owner. One exception to this requirement is when the desired measurement position is freely accessible to the public, such as a common use area at a large apartment complex or commercial area, but even here, permission to access the property should be sought if possible. Any area specifically signed as “Private Property” or “Do Not Enter” should not be accessed without specific permission from the owner or resident. To assist in obtaining owner or resident permission to access private property it is often useful to have proper documentation including proper personal documentation, a business card, associated project documents, and if possible, a letter on agency letterhead referencing the project and respectfully requesting voluntary cooperation in allowing the measurements to be conducted on their property.

In addition to obtaining proper permission to conduct measurements on private property, it is also important that the noise measurement staff not overstep their project role in their communications with owners and residents. Some residents may have questions related to the project such as various project alternatives or timing. Field measurement staff should not attempt to answer these questions (unless they are specifically authorized to do so), but rather, should direct such inquires to the overall project manager, or the project’s public interaction or public relations staff.

Common Mistakes and Poor Measurement Conditions to Avoid

Avoid conducting noise measurements under any of the following conditions:

- Any type of active precipitation (rain, snow, sleet, etc.).
- In the presence of significant snow or ice cover between noise source (roadway) and measurement location.
- During periods when roadway pavement is wet (such as from recent precipitation or snow melt).
- With wind speeds greater than 12 mph.
- On extremely hot or cold days (typically greater than 100 degrees or below 20 degrees F.)
- When relative humidity is greater than 90% or less that 5%.
- In the presence of atypical or temporary noise sources, including those caused by, or due to the presence of the operator (such as dogs barking at the operator, conversation with the operator, etc.) but also including other temporary sources such as nearby lawn maintenance/landscaping activity, nearby construction activity, children playing, etc.
- In the immediate vicinity of highly localized noise sources, such as a window air conditioner or pool pump/filter equipment, keeping in mind that these types of noise sources may cycle on and off.
- In the immediate presence of large acoustically reflective surfaces (should be at least 20 feet from building walls) or near/behind large temporary shielding objects (such as behind a large van or truck) blocking line-of-sight to the primary noise source.

In addition, for noise measurements to be used for noise model run validation it is especially important to reduce the influence of non-highway noise sources, since these are not taken into consideration by the noise model. However, for cases where noise measurements are being conducted for new highway alignments and traffic noise is not the dominant existing noise source, other non-highway noise sources are more likely to control the existing acoustical environment and should be included in the measurement.

And, of course, it is important for the noise measurement staff members to avoid contaminating the measurements by talking near the measurement equipment while it is operating, or allowing others to do so, or by coughing or sneezing, or by standing directly in front of the meter during measurements. Frequently during a measurement a homeowner or interested passer-by may wish to ask some questions. In this case, silently direct the interested person away from the meter to a more distant location away from the SLM where you can have a quiet conversation without influencing measured noise levels. In general, it is good practice to stand several feet away from, or to the side of, the SLM during the measurement period.

Reporting Measurement Data

The field noise measurement data sheets, if completed properly, provide ample detail regarding the noise measurement effort. It is recommended that copies of the data sheets be included in an appendix along with indexed photos of the measurement positions, and that a table summarizing the pertinent measurement data be included in the noise analysis. The table should include for each

measurement the site ID, brief site description, measurement time and duration, and measured noise levels (L10, L50 and Leq preferred). See the table below as one example of a simple noise measurement summary table:

Example Noise Measurement Summary Table

Site ID	***Location Description***	***Measurement Time***		***Measured Level, dBA****			
		Start	***End***	***L10***	***L50***	***L90***	***Leq***
ML1	Single family home, 123 Elm (rear yard)	8:00 AM	8:30 AM	65.0	62.0	60.0	63.0
		3:00 PM	3:30 PM	67.0	64.0	62	65.0
ML2	Four unit apartment, 234 Spruce (common rear yard)	8:45 AM	9:15 AM	66.0	63.0	61.0	64.0
		3:45 PM	4:15 PM	65.0	62.0	60.0	63.0
ML3	Public Park, 75 Main (picnic area)	9:30 AM	10:10 AM	61.0	58.0	56.0	59.0
		4:15 PM	4:45 PM	60.0	57.0	55.0	58.0

*Level should be reported to the nearest one-tenth decibel

Noise Model Validation

The field noise measurements can be used to compare the modeled noise levels for existing conditions to measured levels. If the difference between the modeled predictions and the existing measured levels exceeds 3 dBA, the modeling site input parameters must be checked for consistency with actual site conditions and modified as appropriate prior to the prediction of the design year noise levels. If there is still a difference of more than 3 dBA between measured and modeled noise levels an appropriate adjustment factor should be applied or the measured noise level must be used to represent the existing noise level (use of adjustment factors should be reviewed with MnDOT noise staff).

Technical References

Provide a list of technical reference including Volpe document, MN regulations, ANSI standard.

- ANSI S1.4-1983
- FHWA Measurement of Highway Related Noise
- Minnesota Statute 7030.0060 ‘Measurement Methodology

Appendix D. Guidance on Determining Worst Noise Hour

The following page is an excerpt from a Federal Highway Administration document entitled "Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA", March 2010 (Section 2.6.1).

The results of travel demand forecasts are used as inputs to noise analyses routinely conducted as part of the NEPA process. The procedures used to identify and estimate noise impacts are found in 23 CFR Part 772, the FHWA regulations for the evaluation and mitigation of traffic noise in the planning and design of Federal funded highway projects. This regulation establishes:

1. Methodologies for conducting a traffic noise analysis, and

2. Guidelines and requirements for the consideration of noise abatement measures.

In preparing traffic projections for NEPA documents, it is important to understand certain requirements of the FHWA regulations with respect to traffic volume estimation and modeling:

- *Noise levels are established for the existing condition and a no-build and build scenario in the design year. The "design year" is "[t]he future year used to estimate the probable traffic volume for which a highway is designed" and is usually consistent with the design year established for other impact analyses in the EIS process.*
- *Noise impacts are measured during the one-hour period where the worst-case noise levels are expected to occur. This may or may not be the peak hour of traffic. That is, higher traffic volumes can lead to higher congestion and lower operating speeds. Since higher speeds lead to higher noise emissions from motor vehicles, the worst-case noise levels may occur in hours with lower volumes and higher speeds. In addition, vehicle mix may also change hourly. On many highways, the percentage of heavy trucks is reduced during peak hour. Since heavy trucks have greater sound emissions than passenger cars, vehicle mix is an important component in determining the peak hour of noise impact. It may be necessary to conduct screening runs on several hours to determine which combination of traffic volume, speed, and vehicle mix yields the greatest impact. It may be the case that the peak hour of noise impact changes as the result of the proposed project. For example, the introduction of a multimodal facility like a freight terminal could introduce a large volume of heavy trucks during off-peak hours. In this case, a different analysis hour could be evaluated for the no-build and build alternative scenarios.*

If the hour to be modeled is not included as a direct output of the travel demand forecasting model, then adjustments can be considered based on factors developed for similar types of roads. For example, if a transportation model is used to develop annual average daily traffic (AADT), then adjustment factors based on automatic traffic recorders (ATRs) could be used to estimate time-of-day hourly volumes and vehicle mix. The methodology for adjustments of model volumes used in the noise analysis should be consistent with that used in other sections of the EIS, and should be documented.

Example traffic breakdown sheet

HOURLY TRAFFIC BREAKDOWNS

Location: **TH 100, No. of TH 55 (Vehicle Classification Site #7726)**

Beg. Hour	Hourly % of ADT	Hourly Direct. Distrib.		% of Hourly ADT that are Trucks (HCADT)	Truck Splits	
		SB	NB		Single Units	Semi's
0:00	.063 %	33 %	67 %	2.13 %	50 %	50 %
1:00	.49 %	28 %	72 %	7.55 %	25 %	75 %
2:00	.32 %	40 %	60 %	9.72 %	29 %	71 %
3:00	.36 %	54 %	46 %	9.64 %	25 %	75 %
4:00	.68 %	71 %	29 %	6.00 %	25 %	75 %
5:00	2.37 %	77 %	23 %	3.94 %	44 %	56 %
6:00	6.44 %	71 %	29 %	1.78 %	57 %	43 %
7:00	8.78 %	65 %	35 %	1.65 %	63 %	37 %
8:00	6.93 %	66 %	34 %	2.30 %	59 %	41 %
9:00	4.90 %	57 %	43 %	4.25 %	65 %	35 %
10:00	4.15 %	53 %	47 %	5.02 %	72 %	28 %
11:00	4.58 %	50 %	50 %	3.85 %	73 %	27 %
12:00	4.48 %	49 %	51 %	2.96 %	77 %	23 %
13:00	5.32 %	49 %	51 %	3.68 %	71 %	29 %
14:00	6.05 %	48 %	52 %	2.59 %	59 %	41 %
15:00	7.42 %	42 %	58 %	1.99 %	62 %	38 %
16:00	7.71 %	42 %	58 %	2.45 %	49 %	51 %
17:00	7.90 %	42 %	58 %	1.79 %	61 %	39 %
18:00	6.21 %	45 %	55 %	2.13 %	60 %	40 %
19:00	4.11 %	42 %	58 %	2.16 %	69 %	31 %
20:00	3.57 %	43 %	57 %	1.94 %	75 %	25 %
21:00	3.26 %	45 %	55 %	2.21 %	67 %	33 %
22:00	2.13 %	42 %	58 %	2.70 %	45 %	55 %
23:00	1.23 %	33 %	67 %	5.38 %	25 %	75 %

Note:

ADT = Average Daily Traffic
HCADT = Heavy Commercial Average Daily Traffic

Example Write-up for Loudest Traffic Noise Hour

Traffic Noise Analysis

Worst Hourly Traffic Noise Analysis

In general, higher traffic volumes, vehicle speeds, and numbers of heavy trucks increases the loudness of highway traffic noise. The worst hourly traffic noise impact typically occurs when traffic is flowing more freely and when heavy truck volumes are the greatest. For determining the worst-case traffic noise hour, traffic noise levels for three time periods were modeled at six representative receptor locations along the project corridor under existing conditions, taking into account the appropriate vehicle mix (i.e., cars, medium trucks, heavy trucks), seasonal traffic variations where appropriate, and directional split in traffic volume (i.e., northbound versus southbound).

The daytime L_{10} and L_{50} levels for each of the three modeled time periods are summarized in Table 1 below, along with the daytime monitored noise levels at each of the six representative receptor locations. Based on this analysis, it was determined that the time period from 9:00 AM to 10:00 AM represents the worst-case traffic noise hour.

TABLE "X"
WORST HOURLY TRAFFIC NOISE SUMMARY

Receptor ID	Monitored Level (dBA)		Modeled Level (dBA) by Time Period					
			9:00-10:00 AM		3:00-4:00 PM		PM Peak Hour	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
35	63.0	60.0	64.9	**62.5**	64.1	**61.8**	62.2	**60.1**
46	63.0	**60.5**	63.3	**61.5**	62.6	**60.9**	61.0	59.9
52	**70.3**	**68.0**	**69.6**	**67.0**	**68.8**	**66.4**	**67.2**	**65.1**
57	57.5	55.3	59.9	58.1	59.1	57.4	57.1	55.6
66	60.0	56.0	63.9	**61.7**	63.7	**61.4**	61.9	59.8
78	**70.5**	**68.0**	**72.1**	**69.0**	**71.2**	**68.3**	**69.9**	**67.0**

Bold numbers are above State daytime standards for residential land uses.
Underline numbers approach or exceed Federal noise abatement criteria B (NAC B)

Appendix E. Guidance on Traffic Noise Analysis Documentation

This appendix provides an example expanded outline for a typically acceptable noise analysis documentation. Normally, a noise analysis can be summarized and documented in the required environmental document, provided that the following main sections are all adequately addressed and approved by MnDOT and FHWA.

1.) Introduction
   a. General Project Description
   b. Background information on noise explaining fundamental concepts and noise metrics
   c. Review of Federal and State noise policies on Traffic Noise

2.) Analysis Methodology
   a. Affected Environment

      Include a brief description of the Project and define its limits. This includes walking through the methodology located at

      http://www.dot.state.mn.us/environment/noise/training.html

      to determine noise analysis limits at project termini.

   b. Noise Monitoring

      Describe monitored locations and noise measurement methodology, such as when the monitoring took place, what equipment was used (include serial numbers), and give a summary of the minimum and maximum range of monitored levels.

   c. Document methodology and data to support selection of worse case noise hour (see Appendix B).

3.) Predicted Noise Levels and Noise Impacts
   a. Noise Receptors

      Provide a general description of the identified noise receptors, such as how many total receptors were modeled, if they are solely residential receptors or not, where the greatest concentration of receptors is located, and provide a figure of the monitored and modeled receptors.

   b. Noise Model Results

      Provide a summary of noise modeling assumptions and inputs (including traffic volume and mix, speeds, etc.), and a description of both existing and future modeled noise levels. Give the range of levels, state whether or not they exceed the Minnesota State Noise Standards (unless the roadways under analysis are determined to be exempt from Minnesota State Noise standards and rules) or approach or exceed FHWA NAC guidelines for noise impacts, or both, and provide any details on existing noise barriers or other mitigation that may be affecting the noise levels. For both future no build and future build noise levels,

state the range of increase over existing noise levels. Provide tables for both the daytime and nighttime periods when Minnesota State Noise Standards apply. Provide tables for only the worst noise hour when only the FHWA criteria apply. Tables should provide the following information:

- Receptor ID or name
- Monitored/Measured Noise Levels in L10 and L50 when MN State Noise Standards apply or just L10 when only Federal Standards apply.
- Modeled Existing Noise Levels in L10 and L50 when MN State Noise Standards apply or just L10 when only Federal Standards apply.
- Modeled Future No-Build Levels in L10 and L50 when MN State Noise Standards apply or just L10 when only Federal Standards apply.
- Difference between Modeled Existing and Future No-build.
- Modeled Future Build Noise Levels in L10 and L50 when MN State Noise Standards apply or just L10 when only Federal Standards apply.
- Difference between Modeled Existing and Future Build (used for FHWA impact criterion only)

Indicate which receptors exceed MN State Noise Standards for both daytime and nighttime periods or FHWA NAC (such as with Bold Font). An Example Noise Results Table is provided below.

Example Modeled Noise Results Table

Table 3. I-90 Lane Additions, Noise Model Results: Daytime Levels

Receptor ID	***Monitored 2010***		***Modeled Existing 2010***		***Modeled No Build 2030***		***Difference between Existing 2010 and No build 2030***		***Modeled Build 2030***		***Difference between Existing 2010 and Build 2030***	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
NSA B: I-90 WB Main to Elm												
B-1 (R)			62.0	**61.0**	63.0	**62.0**	1.0	1.0	64.0	**63.0**	2.0	2.0
B-2 (R)	62.0	61.0	63.0	**61.0**	64.0	**62.0**	1.0	1.0	65.0	**63.0**	2.0	2.0
B-3 (R)			***69.0***	**67.0**	***70.0***	**68.0**	1.0	1.0	***71.0***	**69.0**	2.0	2.0

Bold Numbers are above State Standards,
Italized numbers approach or exceed FHWA NAC.
(R) designates residential

4.) Consideration of Noise Abatement

a. Include a description of acceptable noise abatement measures.

b. Noise Barrier Evaluation

i. Include a description of reasonableness and feasibility requirements, as well as any cost-effectiveness information (cost per square foot, cost per benefited receptor, the definition of a benefited receptor, etc.). Be explicit, what, if any, costs were included beyond the standard $20/SF on a wall-

by-wall basis. Only include costs incurred directly due to the construction of the noise barrier itself, i.e., right-of-way, guardrail, etc. Provide a figure with all modeled noise barriers. Provide a table for each proposed noise abatement element indicating which receptors were benefited with the minimum noise reduction of 5 dBA and which met the noise abatement design goal of 7 dBA. Provide a table showing the cost-effectiveness results.

ii. Provide a detailed description of each Noise Sensitive Area that will be affected by an individual barrier, including information such as the length and height of the barrier, the total number of receptors in the area (include identifying information, i.e. the name of the receptor), the number of benefited receptors, cost information, and the noise reduction range. If a barrier is not recommended in the area, describe the reasoning behind it. If there are multiple alignment or height options for a barrier within an area, describe those individually.

c. Noise Barrier Cost-Effectiveness

Describe the Cost-Effectiveness for each barrier and whether or not any of the modeled barriers meet the criteria. State whether the barriers are not recommended or recommended after this analysis.

d. Other Noise Mitigation Techniques (if applicable)
State whether or not each applicable mitigation technique is feasible and reasonable for the Project and provide reasoning for this decision.

5.) Construction Noise

a. Identification of land uses affected by project construction noise.
b. Identify typical construction equipment and processes to be used in the construction of the project.
c. Identify or propose measures that are needed to minimize or eliminate adverse construction noise impacts.

6.) Conclusions and Recommendations

Provide a general description of overall results and state whether or not any noise mitigation has been recommended. Results of public participation efforts and formal voting results are required for final environmental documents.

Project information to be retained in project files includes the following:

- Field measurement data sheets, photographs of the monitored locations, and any other pertinent information related to the noise monitoring for the project.
- Modeled data, such as traffic data and barrier design information (if applicable).
- Print-outs of any applicable modeling data, such as barrier information, receptor information (including location and results), and traffic information.

Appendix F. Guidance on Public Involvement Related to Noise Studies

Public involvement is an important part of highway improvement projects. With the emphasis on considering viewpoints of benefited receptors (owners and residents), the need for effective public interaction is critical.

This appendix includes discussion on the following topics:

- The purpose of the public involvement process for highway noise studies
- Common public involvement tools and techniques
- The desired timing and outcome of the public participation process

Purpose

The purpose of the public involvement process for highway noise studies is twofold:

1) Inform the public about the various elements of the project, including potential noise impacts and noise abatement options, and
2) Collect input from the public regarding their input and desire for reasonable and feasible noise abatement options.

Some of the important information that the public interaction process can provide and collect includes the following:

- The elements of the proposed project (new alignments, new lane additions, new interchanges, traffic control devices, landscaping, safety enhancements, reduction in traffic congestion, etc.)
- Predicted existing and future noise levels and assessed noise impacts associated with proposed improvements.
- Proposed noise abatement for the project, including visual depictions of noise walls and barriers (including any proposed aesthetic enhancements), and expected acoustical performance at specific noise receptor locations.
- Communicate the requirement to take into account viewpoints of residents and property owners of benefited receptors before making a final decision on implementing noise abatement elements, and ultimately, collecting that viewpoint or opinion.

In relaying expected existing and future noise levels as well as expected noise reduction provided by proposed noise abatement, it is critical to realize that understanding noise levels and changes in noise levels is far from intuitive, and most lay-persons can be easily confused by the use of decibels and different measurement metrics. It is recommended that special care be taken to adequately relay this information to owners and residents that are asked to express a viewpoint or opinion on proposed noise abatement in a way that they can comprehend.

Public Interaction Tools and Techniques

A variety of public interaction methods and tools are available for presenting information to, and collecting opinions from, the interested public. Depending on the particular aspects of the project (including project size, number and demographics of the potentially impacted public, and level of project controversy) some combination of public involvement techniques may be used to best achieve the goals of the project. Project proposers should be aware of any language barriers and provide effective methods of communicating, for example, interpreters, bilingual materials alternate formats, etc. Some of the more frequently employed tools and techniques are described below:

Public Meetings

Public meetings are one of the primary and most frequently used tools for public interaction and can be useful for both providing project information to the public as well as soliciting opinions and viewpoints.

Public meetings can be presented in a variety of formats, including the following:

1) Seminar Format: Where a speaker presents information to an audience of stakeholders or area residents with a question and answer session afterwards. An advantage of this format is that all visitors receive the same information and questions asked and answered provided during the QA session are open for all to hear. A disadvantage of this method is some visitors to the presentation will be too intimated to ask critical questions, relative to more direct contact with project personnel.
2) Open House Format: Displays, literature and project personnel are available in different stations in an open room where visitors can move from station to station to learn about different aspects of the project, speak directly with project personnel and fill out a comment card expressing their opinion or requesting additional information. An advantage is that this format provides visitors with more hands-on access to displays and staff allowing for interactive presentation of project information and allows them to visit on their own schedule and absorb information at their own pace, and ask questions; but the lack of a formal presentation requires visitors to visit all stations/displays to get all the relevant information to make informed decisions.
3) Seminar / Open House Combination: A hybrid between the seminar and open house concepts where visitors can sit in on a prepared presentation and then have direct access to project personnel and additional displays and information. This approach may take more time and planning than either a seminar or open house meeting alone but can offer the advantages of both.

Regardless of the type of public meeting format to be used, it will need to be properly promoted, and possibly presented more than once at different locations and times to ensure that all interested parties can participate.

Appropriate locations for public meetings are public meeting venues in or near the project areas. These may include the following:

- A local agency project office
- A local church or school, or community center
- Town hall meeting room, or training room
- A local hotel meeting room

Public meetings are best held in the early evening hours, after work, and when families with children can attend. For some larger projects it may be appropriate to hold more than one meeting on different nights, to give local residents and property owners a choice of when they can attend.

Direct Mail and Door Hangers

Direct mailing or door hangers can be an effective method to deliver project information to stakeholders and interested parties. Mailers to area residents and property owners can also announce public meetings or solicit opinions on project abatement measures. However, when using direct mail methods special attention shall be paid to making the materials appear official, using official agency mailing envelopes and stationary so that they will not be mistakenly discarded as unsolicited junk mail.

Telephone Surveys and Information Lines

Telephone surveys can sometimes be used to alert area residents and property owners to important upcoming public meetings or as reminders to respond to direct mail surveys, but telephone surveys are usually not an effective choice as the primary method for informing residents and property owners about project details. Telephone call-in numbers can sometimes be set up as an option for property owners and residents to call in to ask project related questions or to officially express their opinion on noise abatement elements in response to a public meeting or receiving an informational mailing.

Internet Web Pages

A well designed project webpage can be a highly effective method of disseminating project information, announcing public meetings or allowing residents and property owners to state their opinions regarding noise abatement elements. However, this method should always be offered in addition to more traditional interactive methods since all interested parties may not have convenient access to on-line resources.

Door to Door Canvassing

Door to door interaction can sometimes be used to communicate project information, or collect feedback from area residents when other methods have failed to solicit participation, or in some cases, where the number of potentially impacted receptors is very small and a public meeting may not be appropriate.

Media Announcements

Media announcements in local newspapers and radio and television stations might be used to promote public meetings for larger projects, however, this is usually not a good method for relaying detailed project information.

Public Interaction Timing

Various aspects of the public participation process, including soliciting the viewpoints and opinions of the benefited property owners/residents, may take place at various times during the life of the project. However, for the purpose of informing property owners and residents about noise impacted properties and proposed noise abatement, the public interaction should be conducted sometime after the preliminary noise analysis has been conducted, and before the final design process has begun, (in effect, during the NEPA process). The NEPA documentation will need to state if noise abatement will be provided. For projects with multiple build alternatives, the proposed noise abatement and associated costs may help determine which alternative will be selected.

A key outcome of the public interaction process is to collect and document the viewpoints and opinions of the owners and residents of benefited receptor units regarding proposed noise abatement measures, as specified in Section 5.3 and Appendix G of the MnDOT Noise Policy document.

Appendix G. Guidance for Evaluating Viewpoints of Benefited Receptors

Although the noise analysis must be completed for all reasonable build alternatives under consideration, the solicitation of votes from the benefited receptors shall only be conducted on the preferred alternative.

This appendix includes a sample letter that can be used for soliciting viewpoints from benefited receptors and an illustrated example of viewpoint vote counting. The input of a benefited receptor must be documented in a manner that ties the input to the benefited receptor's street address (such as on a ballot or sign-in/response sheet). The ballots and response sheets are to be retained as part of the project file.

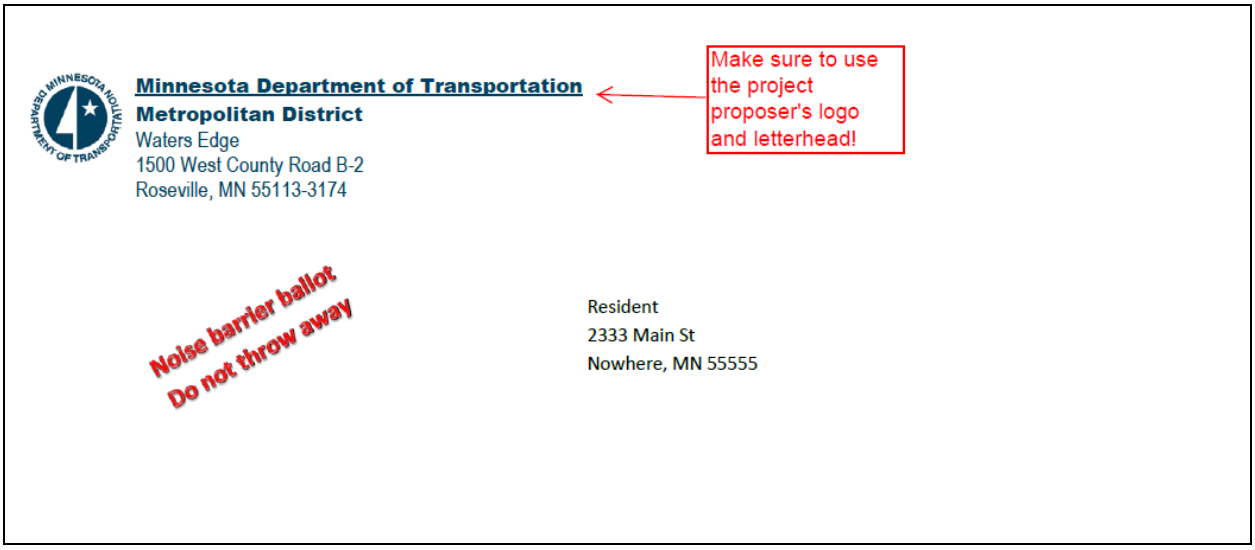
Voting points are assigned and voting results evaluated as described in Section 5.3.3

Sample Letter Soliciting Owner/Resident Viewpoint.

This section includes a recommended sample envelop format, solicitation letter template and blank ballot for use in soliciting viewpoints of benefited receptors.

Sample Outreach Letter Envelop Format

Please update with appropriate logo and return address for your project!



Example Blank Ballot

Project Name:

Owner _____ Resident _____ Owner/Resident_____

Name _____

Address _____

City State _____

Please mark with an "X" one of boxes below:

By submitting this ballot, the voter acknowledges that this vote represents the owner's selection or the consensus selection of the owners or all of the residents.

Yes, I want the noise barrier ☐

No, I do not want the noise barrier ☐

Solicitation Letter Template, Page 1

<Project> Proposed Noise Barriers

Why you are receiving this information

The Minnesota Department of Transportation (MnDOT) recently conducted a noise study along <location> and determined a noise barrier constructed at <location> would reduce the traffic noise level at your property, unit or business by at least 5 decibels.

Vote on the proposed noise barrier

Property owners and residents who will experience a 5-decibel reduction in noise as a result of a noise barrier can vote for or against the proposed noise barrier at <location>. The property owners and the residents who are eligible to vote are shown to the left in <color>.

Your vote can make a difference

Cast your vote on the noise barrier that affects you (highlighted in color – to the left) by completing the enclosed voting ballot and mailing it back by <date>.

How voting works

You can vote for or against the noise barrier that affects your property, unit or business. MnDOT uses a weighted voting system to ensure residents and property owners are given appropriate influence on the outcome of the noise barrier. How much you influence the outcome of the noise barrier is based on how much your property/unit is affected by the noise barrier and whether or not you own the property/unit.

Proximity to Noise Barrier	Points Awarded		
	Resident	Owner	Both
Property/unit is immediately adjacent to the noise barrier	2	4	6
Property/unit is not immediately adjacent to the noise barrier	1	2	3

Only the units in apartments/multi-family residential buildings that receive a 5 decibel reduction of noise get to vote. Businesses, churches and schools receive a vote equal to that of a property owner. The table above is an example of the voting system. Please see MnDOT's Noise Policy for additional information about the voting process.

If 50 percent or more of all possible voting points from eligible voters are received after the first request for votes, the majority of points (based upon the votes received) determine the outcome of the noise barrier. If less than 50 percent of the possible voting points for a barrier are received after the first request, a second ballot will be mailed to the eligible voters who did not respond.

If 25 percent or more of all possible points for a barrier are received after the second request for votes, then the outcome is determined by the majority of votes received. If less than 25 percent of total possible points for a noise barrier are received after the second request for votes, then the barrier will NOT be constructed. If there is a tie, where there are equal numbers of points for and against a noise barrier, the noise barrier WILL be constructed.

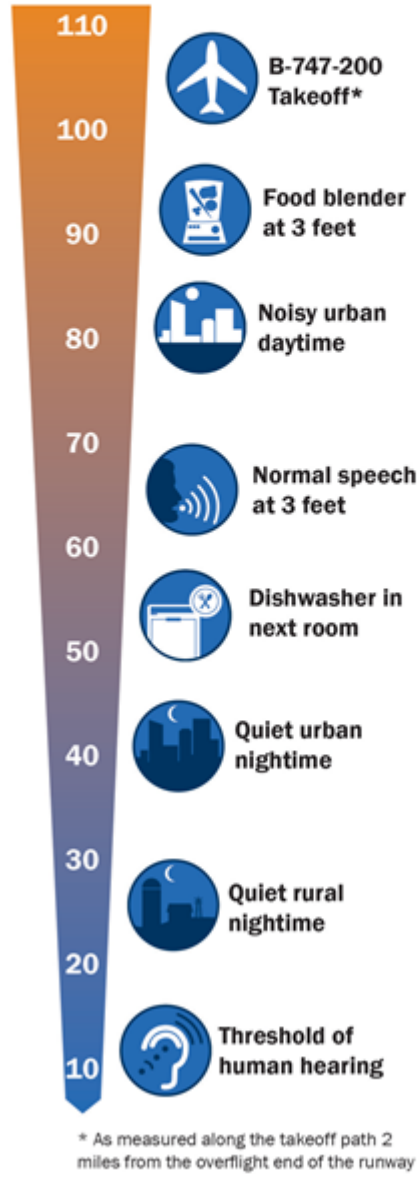
Upcoming public meeting

When: <Date><Time>

Where: <Location>
<Address>

Solicitation Letter Template, Page 2

Frequently-Asked Questions



Why are noise barriers being proposed as part of the <Project Name>?

MnDOT conducted a noise study along <Location> to determine if noise barriers would reduce the level of noise in the community adjacent to the project. Currently, traffic noise along <Location> exceeds the state's noise standards and a noise barrier would reduce the noise levels at certain locations in the community by at least 5 decibels. MnDOT is required to comply with the noise limit requirements set by the State of Minnesota (MN Rules Chp 7030) and the Federal Highway Administration (23 C.F.R. 772).

Studies have shown that changes in noise levels of less than 3 decibels are not typically noticeable by the average human ear. An increase of 5 decibels is generally noticeable by anyone, and a 10-decibel increase is usually "twice as loud."

Why does MnDOT conduct noise studies?

MnDOT assesses existing noise levels and predicts future noise levels and noise impacts of proposed construction projects. If noise impacts are identified, MnDOT is required to consider noise mitigation measures, such as installing noise barriers. All traffic noise studies and analyses must follow the requirements established by federal law, Federal Highway Administration Noise Abatement Criteria, Minnesota Pollution Control Agency State Noise Standards, and MnDOT's Noise Policy and noise analysis guidelines.

How does MnDOT determine if a noise barrier is needed?

Constructing a noise barrier must be feasible and reasonable. Feasibility and reasonableness are determined by cost, amount of noise reduction, safety and site considerations. Noise mitigation is not automatically provided where noise impacts have been identified. Decisions about noise mitigation are made on an individual case.

When will the noise barrier be installed?

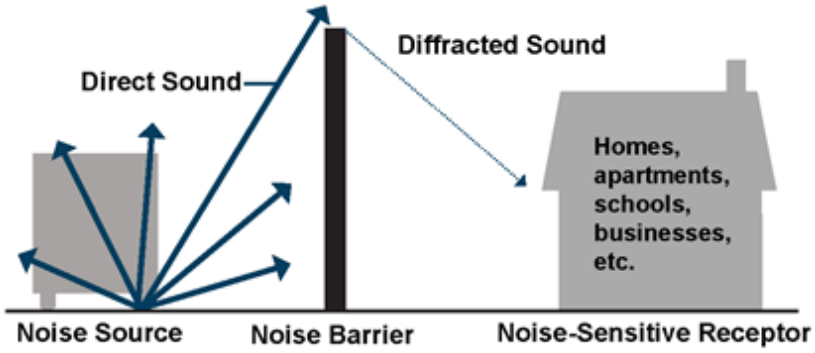
The noise barrier would be installed as part of the overall construction project, which is anticipated to begin <Construction Date>.

Solicitation Letter Template, Page 3

Frequently-Asked Questions

How do noise barriers reduce noise?

Noise barriers do not eliminate all noise. Noise barriers reduce noise by blocking the direct path of sound waves to a home or business. **To be considered effective, a noise barrier must reduce noise levels by at least 5 decibels.**



Can noise levels increase as sound waves pass over a noise barrier?

No, noise levels do not increase as sound waves pass over a barrier. Noise levels are reduced the further the sound waves travel.

Could trees be planted to block traffic noise?

There is not enough space to plant the amount of and size of trees needed to reduce traffic noise. To effectively reduce traffic noise there needs to be room for at least 100 feet of dense evergreen trees that are 15 feet tall or more. Additionally, if trees are used to reduce traffic noise, they need to be maintained. MnDOT lacks the necessary resources to maintain trees or other vegetation.

How is the location of the noise barrier determined?

MnDOT studied various location options to determine the height, length and location which provides the greatest level of noise reduction.

Do noise barriers affect property values?

There have not been any studies that link property values to the presence of noise barriers.

Where can I find more information about the project?

Visit MnDOT's project website at **<project website address>**

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Computer Generated Visualizations

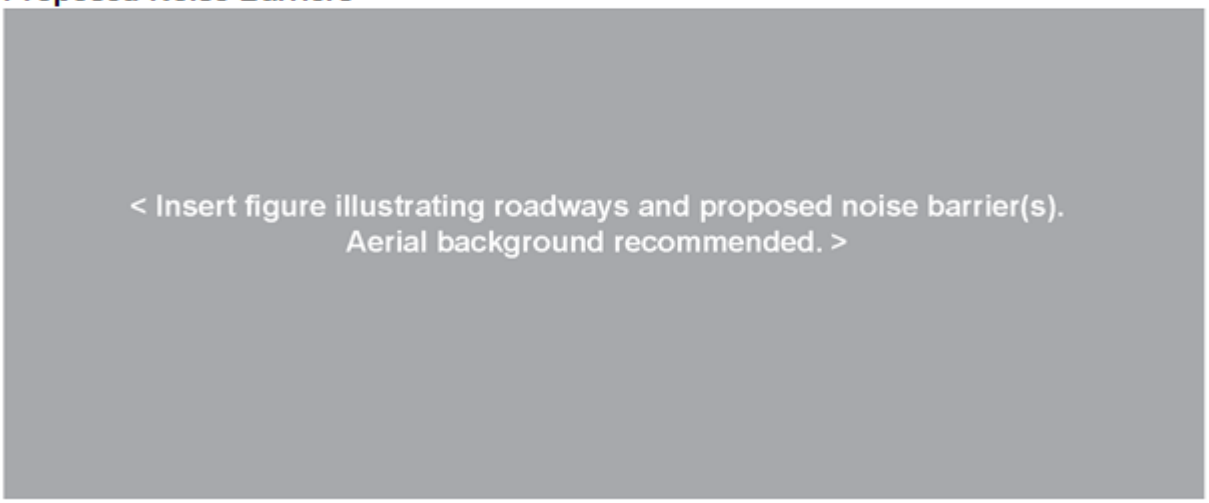
What will the noise barriers look like?

The noise barriers will be <xx feet tall>, built with wood planks and concrete posts. The visuals below are based on the information available <time of pictures> and should not be interpreted as an exact design of this project.

View from <Location>

View from <Location>

Proposed Noise Barriers

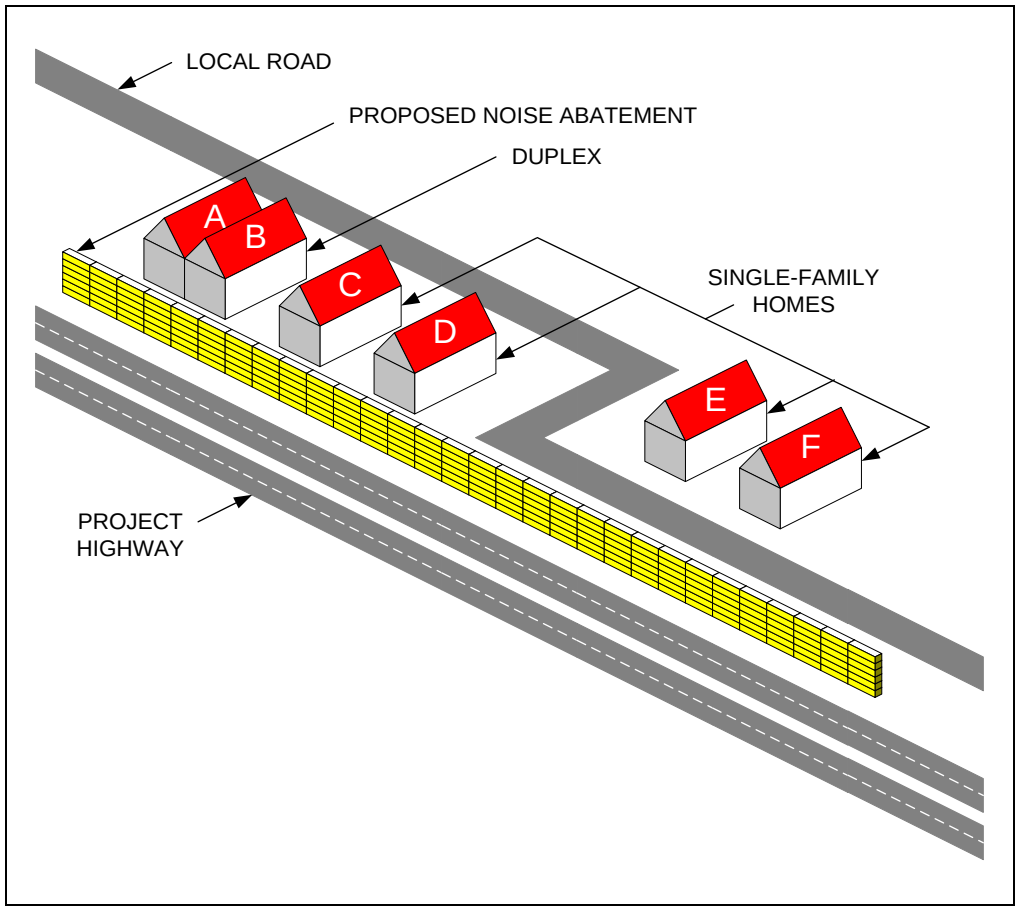


Example of Resident/Owner Viewpoint Point Counting

This section includes a simple theoretical example for the implementation of the benefited receptor viewpoint assessment method presented in Section 5.3.3. In the example below, there are six benefited receptors in the NSA with the proposed noise abatement, a noise barrier. Note the following characteristics of the receptors in the NSA relative to this example:

- Receptors A, B, C, and D are on the Highway side of the local road, making them abutting properties of the project highway. Receptors E and F are on the opposite side of the local road, and therefore are non-abutting properties.
- Receptors A and B are two residential units within the same duplex and therefore count as two separate benefited receptors, the resident in unit B owns both units, and rents out Unit A.
- Receptors C and E are single-family owner occupied units (owner plus resident).
- Receptors D and F are rental units.
- All benefited receptor owners and residents voted except for the Receptor D resident.

The theoretical voted viewpoints for the owners and residents for this example are shown in the table below, with some owners and residents voting for and some against the proposed noise abatement and one resident not voting. The resulting voting points are tallied and calculated as a percentage of all received voting points (assuming up to two separate solicitations, as needed to achieve minimum required voting points received). If the required percentage of voting points are received (25% or greater of total possible points for a barrier after two solicitations) and the percentage of those voting points in favor of the barrier is equal to or greater than 50% of the total voting points cast, the barrier would be advanced to the final design stage.



Sample Noise Sensitive Area (NSA) for Viewpoint counting example

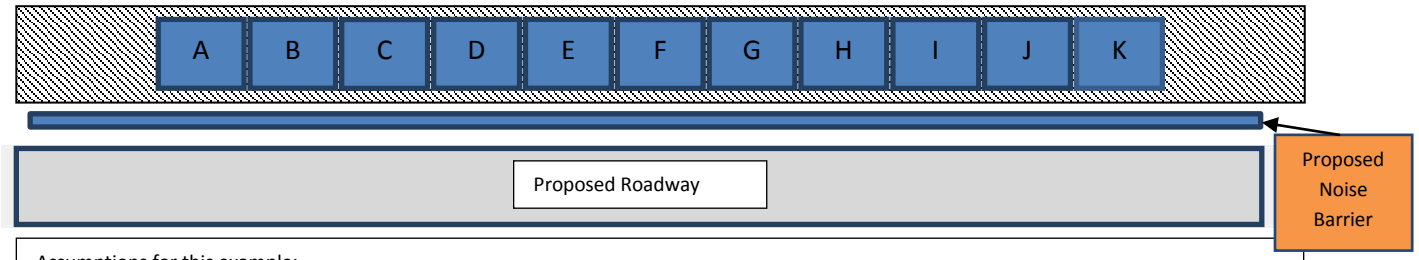
Vote Tally Table for Benefited Viewpoint Counting Example

Benefited Receptor ID	*Owner or Resident*	*Barrier Abutter?*	*In favor of Abatement?*	*Points Available*	*Points for*	*Points against*
A	Owner	Yes	Yes	4	4	
A	Resident	Yes	No	2		2
B	Owner/Res.	Yes	Yes	6	6	
C	Owner/Res.	Yes	Yes	6	6	
D	Owner	Yes	No	4		4
D	Resident	Yes	Yes	2*		
E	Owner/Res.	No	No	3		3
F	Owner	No	No	2		2
F	Resident	No	Yes	1	1	
Total				**30**	**17**	**11**
Percentage	**(93% of total possible points received)**				**61%**	**39%**

* Unit D was vacant at the time of the vote, so 30 points possible, 28 received.

2015 MnDOT Noise Policy

Voting of Benefitted Receptors When There is Common Land Ownership by a Townhome Association



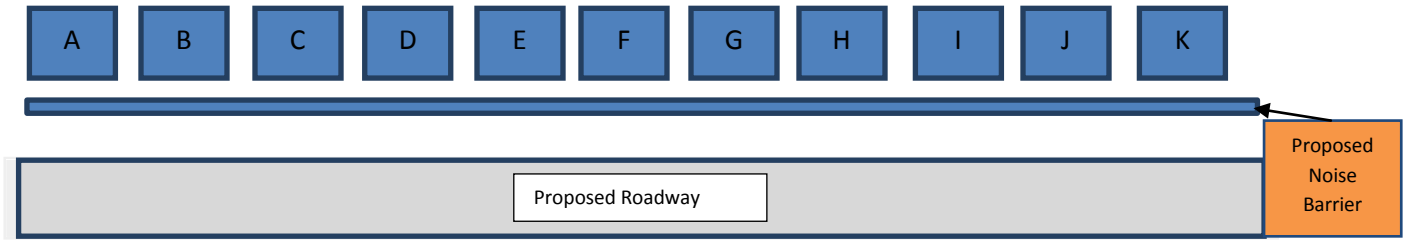
Assumptions for this example:

1. Type I project with only one row of homes that are benefitted receptors.
2. Hatched area represents land that is commonly owned by a townhome association.
3. All of the homes are part of a townhome association in which there is common land ownership by the townhome association. In this example, the townhome association owns the land around and/or underneath the homes but does not own the homes. Each home is owned by an individual.
4. Prior to public input results, the proposed noise barrier is otherwise reasonable and feasible.
5. All 11 homes (A through K) are owner/resident; i.e. the individual that lives in the home is also the owner. This means 6 points per benefited receptor under the noise policy. For each unit where the property is owned by the Association, 4 points per benefited receptor will be given.
6. This is a convenient example to illustrate a point…do not get caught up in realities like looking at options to split this into two barriers or a project proposer demonstrating diligence in getting a response.

Voting Scenarios

Home	Voting Scenario I	Voting Scenario II	Voting Scenario III	Voting Scenario IV	Voting Scenario V	Voting Scenario VI
A	Yea	Yea	NR	NR	NR	Yea
B	Yea	Yea	NR	NR	NR	Nay
C	Nay	No response (NR)	NR	Yea	Nay	Nay
D	Nay	Nay	Nay	Nay	Nay	NR
E	Yea	Yea	Yea	Yea	Nay	Nay
F	Yea	Nay	Nay	Yea	Yea	NR
G	Yea	Nay	Nay	NR	NR	Nay
H	Yea	Nay	Nay	NR	NR	Nay
I	Nay	NR	NR	NR	NR	Yea
J	Yea	Yea	Yea	NR	NR	Nay
K	Yea	Yea	Yea	NR	NR	Yea
Association (11 Units)	11 Yeas @ 4 each	11 Yeas @ 4 each	11 Nays @ 4 each	11 Yeas@4 each	11 Nays@4 each	11 Yeas@4 each
Owner/Resident Total	8 Yeas@6each 3 Nays@6each	5 Yeas @6each 4 Nays@6each 2 NR	3 Yeas@6each 4 Nays@6each 4 NR	3 Yeas@6each 1 Nay@6each 7 NR	1 Yea@6each 3 Nays@6each 7 NR	3 Yeas@6each 6 Nays@6each 2 NR
Association, Total	44 Yeas	44 Yeas	44 Nays	44 Yeas	44 Na	44 Yeas
Total Possible Points (TPP)	110	110	110	110	110	110
Total Points received	110	98	86	68	68	98
>25% of TPP received?	Yes	Yes	Yes	Yes	Yes	Yes
Points for Yeas	92	74	18	62	6	62
Points for Nays	18	24	68	6	62	36
50% of received Points	55	49	43	34	34	49
Does the barrier get built?	Yes	Yes	No	Yes	No	Yes

2015 MnDOT Noise Policy



Assumptions for this example:

1. Type I project with only one row of homes that are benefitted receptors.
2. Prior to public input results, the proposed noise barrier is otherwise reasonable and feasible.
3. All 11 homes (A through K) are owner/resident; i.e. the individual that lives in the home is also the owner. This means 6 points per benefitted receiver under the proposed policy.
4. This is a convenient example to illustrate a point…do not get caught up in realities like looking at options to split this into two barriers or a project proposer demonstrating diligence in getting a response.

Voting Scenarios

Home	Voting Scenario I	Voting Scenario II	Voting Scenario III	Voting Scenario IV	Voting Scenario V	Voting Scenario VI
A	Yea	Yea	NR	NR	NR	Yea
B	Yea	Yea	NR	NR	NR	Nay
C	Nay	No response (NR)	NR	Yea	Nay	Nay
D	Nay	Nay	Nay	Nay	Nay	NR
E	Yea	Yea	Yea	Yea	Nay	Nay
F	Yea	Nay	Nay	Yea	Yea	NR
G	Yea	Nay	Nay	NR	NR	Nay
H	Yea	Nay	Nay	NR	NR	Nay
I	Nay	NR	NR	NR	NR	Yea
J	Yea	Yea	Yea	NR	NR	Nay
K	Yea	Yea	Yea	NR	NR	Yea
Totals	8 Yeas, 3 Nays	5 Yeas, 4 Nays, 2 NR	3 Yeas, 4 Nays, 4 NR	3 Yeas, 1 Nay, 7 NR	1 Yea, 3 Nays, 7 NR	3 Yeas, 6 Nay, 2 NR
Total Possible Points (TPP)	66	66	66	66	66	66
Total points received	66	54	42	24	24	54
>25% TPP received?	Yes	Yes	Yes	Yes	Yes	Yes
Points for Yeas	48	30	18	18	6	18
Points for Nays	18	24	24	6	18	36
50% of received Points	33	27	21	12	12	27
Does barrier get built?	Yes	Yes	No	Yes	No	No

Appendix H. References and Links to Additional Policy, Guidance and Standards

This Appendix includes a brief synopsis and on-line links to a number of useful resources related to Highway Noise Analysis including the following:

- Minnesota State Noise Regulations and Noise Analysis resources
- FHWA Traffic Noise Guidance Document
- FHWA/Volpe Highway Noise Measurement Manual
- FHWA Noise Barrier Design Handbook
- FHWA Construction Noise Handbook
- FHWA Highway Traffic Noise resource website

Minnesota State Noise Regulations

https://www.revisor.mn.gov/statutes/?id=116.07

https://www.revisor.mn.gov/statutes/?id=161.125

This link accesses the relevant Minnesota State Statutes (including Statute 116.07 which discusses applicable projects, and 161.125 which discusses sound abatement requirements).

MnDOT Noise Analysis Resources

http://www.dot.state.mn.us/environment/noise

This website provides access to the updated MnDOT Noise Policy and various guidance documents related to highway noise analysis.

FHWA Traffic Noise Guidance Document

http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/guidancedoc.pdf

This document serves as a companion document to the 2010 update for the FHWA Noise Standard 23 CFR 772 providing additional explanations, examples, and guidance. It generally follows along the same sectioning format as the Standard with more detailed explanations of policy issues and technical approaches. In many cases the technical information in this document goes into much greater detail than the official code.

FHWA/Volpe Measurement of Highway-Related Noise

http://www.fhwa.dot.gov/environment/noise/measurement/measure.cfm

This document, developed by the USDOT Volpe Transportation Systems Center Acoustics Facility, provides significant detail for procedures and practices in the measurement of highway related noise. In addition to providing procedures for noise measurements suitable for noise model validation and documenting existing environmental noise levels at typical receptor locations, this document also includes techniques and procedures for measurement of tire/pavement noise, building transmission loss, noise barrier performance, noise model emission levels, and construction equipment.

FHWA Noise Barrier Design Handbook

http://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/design/index.cfm

This document contains a wide range of information with regard to the design, construction and maintenance of highway noise barriers. These include design considerations such as acoustical performance, safety, aesthetics, materials, drainage, barriers on structures, and maintenance.

FHWA Construction Noise Handbook

http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/

This handbook provides information and guidance on a range of topics related to highway construction noise prediction and abatement.

FHWA Noise and Environmental website

http://www.fhwa.dot.gov/environment/noise/

This website serves as a repository for a variety of information for FHWA policy and guidance for highway environmental issues, including noise. The site includes updated links to many of the above references and others, as well as a discussion bulletin board in which individual participants can ask questions or engage in related technical and policy discussions.