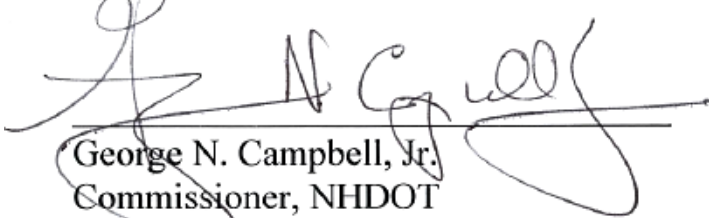


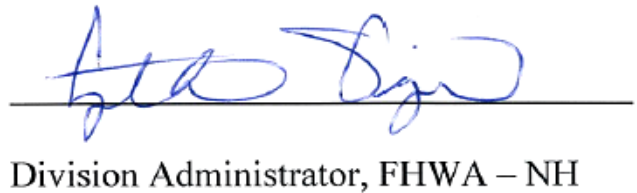


Policy and Procedural Guidelines  
for the  
Assessment and Abatement  
of  
Highway Traffic Noise  
for  
Type I Highway Projects

Approved By

  
George N. Campbell, Jr.  
Commissioner, NHDOT

Date: June 28, 2011

  
Division Administrator, FHWA – NH

Date: July 6, 2011

## Table of Contents

Introduction .....	2
Definitions .....	2
Noise Abatement Guidelines .....	5
Purpose and Scope.....	5
Identification of Receptors .....	5
Traffic Noise Prediction .....	7
Identification of Noise Impacts .....	7
Examination of Potential Mitigation Measures .....	7
The Incorporation of Feasible and Reasonable Noise Mitigation Measures.....	8
Feasibility .....	8
Reasonableness .....	9
1. Cost Effectiveness .....	9
2. Noise Reduction Design Goal .....	10
3. Views of the Benefited Receptors .....	10
Coordination with Local Officials.....	10
Noise Barrier Commitments in Environmental Documents (CE, EA, EIS).....	11
Construction Noise .....	11

## Introduction

This document contains the New Hampshire Department of Transportation's (NHDOT) policy and procedural guidelines for assessing noise impacts and determining the need, feasibility, and reasonableness of noise abatement measures for proposed Type I highway construction and improvement projects. Highway noise impact assessment procedures, noise abatement procedures, coordination requirements, and noise abatement criteria contained herein are based on the Federal Highway Administration's (FHWA) Title 23 Code of Federal Regulations, Part 772. This policy was developed by NHDOT and reviewed and concurred with by the FHWA. NHDOT does not have a Type II noise abatement program.

This policy is applicable to any project receiving Federal or State-aid funds or that is otherwise subject to FHWA or NHDOT approval.

The intent of this policy is to provide guidance for determining noise impacts and identifying appropriate noise abatement.

## Definitions

**Activity Category** – A grouping of similar land uses upon which it can be reasonably assumed noise will have a similar effect.

**Approach** – This term is defined as 1 decibel below the FHWA Noise Abatement Criteria.

**Benefited Receptor** – The recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dB(A).

**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.

**dba** – A weighted decibel unit used to measure noise that best corresponds to the frequency response of the human ear.

**Date of Public Knowledge** – The date of approval of a Categorical Exclusion (CE), Finding of No Significant Impact (FONSI), or Record of Decision (ROD) for a Federally funded highway project, or when design approval is granted for a non-Federal project.

**Design Year** – The future year used to estimate the probable traffic volume for which a highway is designed: a time, ten to twenty years, from the start of construction is usually used.

**Existing Noise Levels** -- The worst-case noise hour under the current conditions, resulting from a combination of natural and mechanical sources and human activity, considered to be 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** – Any receptor which has a worst case noise hour Leq that approaches (within 1 dBA) or exceeds the Noise Abatement Criteria for the corresponding land use category, or whose future build noise level exceeds the existing noise levels by 15 dBA or greater.

**Insertion Loss** – The amount of noise reduction provided by a noise barrier, normally 7-10 dBA.

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

**Leq(h)** – 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 (NAC)** – Noise levels for various activities which represent the absolute levels at which abatement must be considered.

Activity Category	NAC Leq (h)	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential.
C	67 (exterior)	Active sport areas, amphitheatres, 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 (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	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	Undeveloped lands that are not permitted.

**Noise Barrier** – A solid wall, earth berm, or wall/berm combination located between the roadway and a ground-level receiver location, which breaks the line-of-sight between the receiver and the roadway noise sources. All barriers should be designed as low as possible and still attain a noise reduction of 7 dBA to 10 dBA. The practical maximum height of a barrier will be 25 feet. Berm and berm/wall combinations are preferred where space and other environmental constraints permit.

**Noise Reduction Design Goal** – The optimum desired dBA noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. Every effort should be made to attain a 10 dBA (or greater) insertion loss (IL) at first row receptors. In order for an abatement measure to be considered reasonable, it must be able to provide at least a 7 dBA noise reduction for at least 1 benefited receptor.

**Permitted** – A definite commitment to develop land with an approved specific design 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** – The precise location on any property where frequent activity is found to occur.

**Residence** – A dwelling unit. Either a single family household or each unit in a multifamily dwelling.

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

**Traffic Noise Impacts** – Impacts which occur when the predicted traffic noise levels approach (within 1 decibel) or exceed the FHWA Noise Abatement Criteria, or when the predicted future build traffic noise levels exceed the existing noise levels by 15 dBA or more.

**Type I Project** – A proposed highway project which involves:

- (1) The construction of a highway on a 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 one or more through-traffic lane(s). This includes the addition of a through-traffic lane that functions as an 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 proposed project for noise abatement on an existing highway where no highway improvements are programmed.

**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.

**Unit** – A single family household, each household in a multifamily dwelling or an area of frequent human activity such as a church, school or business.

**Worst Case Noise Hour** – A period of sixty (60) minutes throughout a twenty-four (24) hour day that reflects the peak noise hour, usually associated with the peak traffic hour but not in every instance.

## **Noise Abatement Guidelines**

### ***Purpose and Scope***

The NHDOT will perform noise impact assessments for Type I projects during the Preliminary Design Phase of the highway project development process. A noise analysis will be conducted for each reasonable Type I alternative. If any segment or component of an alternative meets the definition of a Type I project, then the entire alternative is considered to be Type I and subsequently requires a noise analysis. The noise impact assessments will determine the noise impact of the proposed highway project on the community and will include the following:

- Identification of receptors
- Traffic noise prediction
- Identification of noise impacts
- Examination of potential mitigation measures
- The incorporation of feasible and reasonable noise mitigation measures
- Coordination with local officials to provide helpful information on compatible land use planning and control

### ***Identification of Receptors***

Noise assessments performed during the Preliminary Design Phase of the highway project will determine noise levels for all receptors in proximity to the project and along other routes which may be affected due to changes in traffic volume, composition, or patterns resulting from the proposed project.

In some cases, lands that are undeveloped during project development may be under consideration for future development. Any such lands which are permitted for development and which may be impacted by noise from the proposed highway project, will be considered potential receptor locations and included in the noise assessment. The Department considers future development to be permitted when a noise sensitive land use such as a residence, school, church, etc., has received a building permit or similar final approval from the local governing body by the date of public knowledge.

Each identified receptor will have one location for use in determining noise impacts and abatement measures. Primary consideration for these receptor locations will be given to exterior, ground level areas where frequent human use occurs. If more than one area of frequent human use is observed, the area with the highest potential for noise impacts will be used. Raised decks will be used only if there is no evidence of any other frequent exterior use.

The following indicates how receptors will be identified for each Activity Category within the study area:

- Activity Category A (lands on which serenity and quiet are of extraordinary significance) – The potential presence of any Activity Category A properties will be identified during the preliminary design project phase. The Department shall submit justifications to the FHWA on a case-by-case basis for approval of an Activity Category A designation. Upon approval of an Activity Category A designation the Department will prepare and submit a noise impact assessment plan to FHWA for approval. For non-federal projects the above noted determinations will be made by the Commissioner of the Department.
- Activity Category B (exterior areas of single-family and multi-family homes) – The number of receptors associated with multifamily dwellings will be determined based on the number of families availing themselves of any exterior activities. If it can be clearly demonstrated that a multi-family dwelling provides exterior activity for residents that occupy the structure, then those dwelling units may be included in the cost effectiveness calculation. One location can be used for multiple receptors as long as each receptor has equal access to that particular location. The number of receptors for such multi-receptor areas will be calculated using the maximum capacity of the activity area divided by the number of dwelling units with access to the area. If the maximum capacity of an area cannot be determined, then the number of dwelling units with access to that particular location will be used.
- Activity Category C (exterior areas of non-residential lands such as schools, parks, cemeteries, etc.) – For each distinct area of exterior frequent human use the number of receptors will be determined as follows:
  1. Determine the typical linear highway frontage of residences in the surrounding area; and
  2. Divide the proposed highway frontage length of the Category C site by the amount determined in step 1 above with any remainder counting as an additional receptor. (Example: If the typical residential frontage in the surrounding area is 150 feet and the proposed frontage of a public park is 200 feet, the park would be counted as two receptor sites.)
- Activity Category D (interiors of Category C facilities) - An indoor analysis shall only be done after exhausting all outdoor analysis options and only for those facilities which have an inherent indoor function which cannot typically be performed outdoors (i.e. recording studio, radio station, etc.). The number of receptors will be calculated for each room within the facility meeting the requirements of Activity Category D. The number of receptors will be determined using the maximum capacity of the room divided by the average number of residents per household within the local municipality.
- Activity Category E (exteriors of developed lands that are less sensitive to highway noise) - The number of receptors associated with multi-unit facilities will be determined based on the number of units availing themselves of any exterior activities. If it can be clearly demonstrated that a multi-unit facility provides exterior activity for users of the structure, then those units may be included in the cost effectiveness calculation. One location can be used for multiple receptors as long as each receptor has equal access to that particular location. The number of receptors for such multi-receptor areas will be calculated using the maximum capacity of the activity area divided by the average number of residents per household within the local municipality. If the maximum capacity of an area cannot be determined, then the number of units with access to that particular location will be used.

- Activity Category F (land uses that are not sensitive to highway traffic noise) – A highway noise analysis is not required for Activity Category F and therefore no receptors will be identified on any properties falling within this category.
- Activity Category G (undeveloped land not permitted for development) – For land that is not permitted for development by the date of public knowledge, the Department shall report the distance – measured from the proposed edge of the traveled way – to the NAC for all exterior land use categories under the future build condition.

## ***Traffic Noise Prediction***

The current FHWA approved Traffic Noise Model (currently TNM 2.5) shall be used to predict noise levels for all reasonable build alternatives. Predictions will normally be made for the worst case noise hour of the day occurring on a regular basis. In areas where seasonal travel results in increased traffic volumes; the weekly worst case noise hour occurring on a regular basis during the peak travel season will also be evaluated. In such cases the situation resulting in the highest noise levels will be used for further traffic noise predictions and abatement measure evaluation.

In order to ensure that all TNM models are properly set up and produce results that reflect actual conditions, all TNM models will be verified using field noise measurements and simultaneous traffic counts. The traffic volumes obtained during the measurement periods will be input into the prepared noise model and the predicted noise levels will be compared to the actual noise measurements obtained in the field. The difference between the modeled noise levels and the field measurements will be no greater than 3 dBA. Variations of 3 dBA or less will be considered adequate for model verification.

Noise contour lines may not be used for determining highway traffic noise impacts but may be used for project alternative screening or for land use planning purposes.

## ***Identification of Noise Impacts***

All noise avoidance techniques will be evaluated, refined, and objectively considered during the preliminary design process. Should avoidance not be possible, then every attempt will be made to minimize noise impacts.

An area is considered impacted by highway traffic noise when the **worst case noise hour**, design year noise level (Leq(h)) either (1) approaches (within 1 dBA) or exceeds the Noise Abatement Criteria for the corresponding land use category, or (2) exceeds the existing worst case hour noise level by 15 dBA or more.

For proposed highways on new alignments where no highway currently exists, existing noise measurements must be taken at appropriate receptor locations

## ***Examination of Potential Mitigation Measures***

When considering mitigation for traffic noise impacts, primary consideration will be given to exterior, ground level areas where frequent human use occurs and where a lower noise level would be of benefit.

The following measures should be considered when noise analyses indicate the need for abatement:



- Traffic management measures,
- Alteration of horizontal and vertical alignments,
- Acquisition of property rights for construction of noise barriers or acquisition of buffer zones,
- Construction of noise barriers or berms, and
- Noise insulation of public use or non-profit institutional structures.

Mitigation measures will be determined on a site by site basis to obtain the most cost effective abatement, consistent with design and community related factors. Abatement is most frequently obtained through the construction of a noise barrier, a berm or a combination of the two.

Due to long term maintenance and acoustic longevity concerns, the use of quieter pavement treatments are not an acceptable noise abatement measure for Federal or State projects. Planting of vegetation or landscaping is also not an acceptable abatement measure because only dense stands of vegetation, at least 100 feet deep, will result in a noticeable reduction in noise levels.

When noise abatement measures are considered every effort should be made to attain a 10 dBA (or greater) insertion loss (IL) at first row benefited receptors. In order for an abatement measure to be considered reasonable, it must be able to provide at least a 7 dBA noise reduction for at least 1 benefited receptor.

It is the Department's policy that the final decision on the implementation of noise abatement measures will be made only after careful and thorough consideration of the feasibility and reasonableness of proposed noise abatement measures, including coordination with the affected property owners.

## ***The Incorporation of Feasible and Reasonable Noise Mitigation Measures***

### **Feasibility**

Feasibility deals with engineering and safety considerations (e.g. can a barrier be built given the existing geometry and topography, can a 5 dBA or greater noise reduction be achieved, etc.). Cross streets, ramps, driveways, and other noise sources will influence the amount of noise reduction that can be achieved. Safety and environmental impacts are important considerations in determining whether a barrier is feasible.

Every effort should be made to attain a 10 dBA (or greater) insertion loss (IL) at first row receptors. The construction of a noise barrier is not feasible if a 5 dBA noise reduction cannot be achieved for at least 1 impacted receptor.

For safety and stability reasons, the structural portions of a barrier should not be in excess of 25 feet in height. A barrier will not typically be considered if any portion of the barrier would need to be taller than 25 feet to obtain the minimum insertion loss of 7 dBA.

Safety factors that should also be considered in the design of the barrier include: maintaining a clear recovery zone, redirection of errant vehicles, adequate sight distance, and fire/emergency vehicle access. The design of the barrier should also consider potential environmental impacts to wetlands, historic properties, park lands, etc.

## **Reasonableness**

Reasonableness implies that common sense and good judgment have been applied in arriving at a decision. The overall noise abatement benefits must outweigh the overall adverse social, economic, and environmental effects and the costs of the abatement measures. In order for an abatement measure to be considered reasonable, each of the following criteria must be met.

### **1. Cost Effectiveness**

Cost effectiveness shall be determined for each feasible abatement alternative under consideration. Cost effectiveness can be determined either through the use of the Department's Cost Effectiveness Index (CEI) or Dimensional Effectiveness Index (DEI).

The CEI is determined by dividing the total cost of the abatement alternative by the number of receptors receiving at least a 5 dBA insertion loss. This calculation generates a cost per receptor ratio which cannot be in excess of \$45,000 per receptor or the alternative is considered to be unreasonable. When determining the CEI for a noise wall, the Department utilizes a cost of \$30 per square foot. When determining the cost of a berm, the Department utilizes a cost of \$5 per cubic yard. These costs are assumed to include all standard expenditures directly associated with the construction of the noise abatement measure (materials, standard drilled shafts, etc.). Items ancillary to the installation of an abatement measure, such as design, drainage and traffic control, or items that are in excess of those expenditures commonly found in the construction of similar measures will not be included in the cost estimate. For example, the additional costs associated with drilled shafts into bedrock would not be included in the cost estimate, as such conditions are not typically found at most proposed barrier locations.

The DEI is determined by dividing the total protective surface area of an abatement alternative by the number of receptors receiving at least a 5 dBA insertion loss. This calculation generates an area per receptor ratio which cannot be in excess of 1,500 square feet per receptor or the alternative is considered to be unreasonable.

The implementation of an abatement alternative is considered cost effective if either the CEI or the DEI indicate that the alternative is reasonable. If both the CEI and DEI indicate that an alternative is unreasonable, then the alternative is considered to be not cost effective.

All receivers in the study zone attaining at least a 5 dBA insertion loss will be counted as "benefited" and included in the cost effectiveness calculation, regardless of whether or not they were identified as impacted.

In order to ensure that all receptors are treated equally, third party funding (public and/or private) cannot be used to subsidize the construction of any abatement measure which would otherwise not meet the Department's CEI.

## 2. Noise Reduction Design Goal

Every effort should be made to attain a 10 dBA (or greater) insertion loss (IL) at first row benefited receptors. In order for an abatement measure to be considered reasonable, it must be able to provide at least a 7 dBA noise reduction for at least 1 benefited receptor.

## 3. Views of the Benefited Receptors

As part of the National Environmental Policy Act (NEPA) public involvement requirements, viewpoints from the entire project community, including benefited receptors, will be solicited for all aspects of the project, including noise impacts and abatement. If no objections to the proposed noise abatement are found at this level of public involvement, then the noise barrier will be deemed reasonable. If objections are identified, a second, more detailed solicitation will occur with the benefited receptors to determine reasonableness.

Support will be determined by obtaining one vote from each of the benefited receptors. Points will then be applied to each vote to make the final reasonableness determination. One owner and one occupancy point will be given for each receptor. (For example; a single family, owner-occupied receptor, will be given two points, one for ownership and one for occupancy. For a single family rental property, one point will be given to the owner and one point will be given to the rental unit. For a multifamily dwelling, one point will be given to each rental unit and one point per rental unit will be given to the owner.)

At least 51% of the total possible points must be in support of an abatement alternative for it to be considered reasonable.

### *Coordination with Local Officials*

The prevention of future impacts is one of the most important aspects of noise control. Local development and highways can co-exist, but local government officials need to know what noise levels to expect from a highway and what type of development will be compatible with it.

To prevent future traffic noise impacts, the Department shall compile noise analysis information and provide it to local planning officials within whose jurisdiction the highway project is located. This information will include the following:

- The best estimation of future noise levels (for various distances from the highway improvement) for both developed and undeveloped lands or properties in the immediate vicinity of the project, and
- Information that may be useful to local communities to protect future land development and land use changes from becoming incompatible with anticipated highway noise levels.

The Federal Highway Administration and the New Hampshire Department of Transportation are responsible for all noise abatement considerations up until the "Date of Public Knowledge" of the project for all existing or permitted development. After this date, the Department is still responsible for analyzing changes in traffic noise impacts, when appropriate, but the Department is no longer responsible for providing noise abatement for new development which occurs adjacent to the proposed highway project. Provision of such noise abatement becomes the responsibility of local communities and private developers.

Based on this information, local governments should use their power to regulate land development in such a way that noise sensitive land uses are either prohibited from being located adjacent to a highway, or developments are planned, designed and constructed in such a way that noise impacts are minimized.

## **Noise Barrier Commitments in Environmental Documents (CE, EA, EIS)**

At the time the environmental documentation is being finalized, noise studies will have determined if the proposed project will result in traffic noise impacts. If no traffic noise impacts are identified, noise abatement will not be required. If traffic noise impacts are identified but there are no apparent solutions available to mitigate these impacts, it will be documented and noise abatement will not be included as part of the project. If traffic noise impacts are identified and it appears that noise abatement can be provided (although it is unlikely that exact layout, material type, right-of-way requirements, etc. will be available at this stage of project development), a statement similar to the following will be included in the environmental document:

"Based on the studies so far completed, the NH Department of Transportation is committed to the construction of feasible and reasonable noise abatement measures at \_\_\_\_\_.

These preliminary indications of likely abatement measures are based upon preliminary design for a barrier cost of \$\_\_\_\_\_ that will reduce the noise level by \_\_\_ dBA for \_\_\_ residents. If it is subsequently found during final design that these conditions have substantially changed, the abatement measure(s) might not be provided. A final decision on the installation of the abatement measure(s) will be made during the final design process following the completion of public involvement."

## **Construction Noise**

Construction noise will be addressed during the NEPA public involvement and environmental documentation project phases. Effective control of highway construction noise will be achieved by design considerations, sequence of operations, source control, site control, time and activity constraints, and community awareness, as practicable.