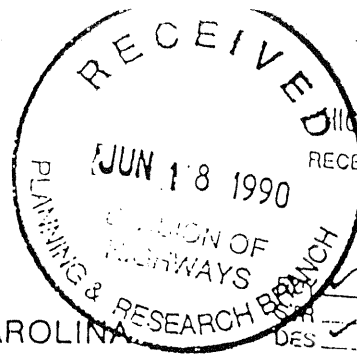


APPENDIX J

LEGACY NCDOT TRAFFIC NOISE POLICIES

1990 Noise Abatement Guidelines

File



Jack Ward

HIGHWAY DESIGN BRANCH
RECEIVED FILE _____
JUN 14 1990

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH 27611-5201

- ☐ Take Appropriate Action
- ☐ Prepare Reply Using Your Signature
- ☐ Prepare Reply For My Signature
- ☐ Prepare Reply For Soc.'s Signature
- ☐ Prepare Reply For Highway's Signature
- ☐ For Your Information
- ☐ Suspense

JAMES G. MARTIN
GOVERNOR

May 30, 1990

THOMAS J. HARRELSON
SECRETARY

GEORGE E. WELLS, P.E.
STATE HIGHWAY ADMINISTRATOR

cc: *WARD*
GALLANT

MEMORANDUM TO: Mr. William G. Marley, Jr., P. E.
Deputy State Highway Administrator

THROUGH: Mr. J. T. Peacock, P. E. *J. T. Peacock*
Chief Engineer - Preconstruction

FROM: Mr. L. J. Ward, P. E. *L. J. Ward*
Manager, Planning & Research Branch

SUBJECT: → Noise Abatement Guidelines

DESIGN SERVICES UNIT					
T. L. P. NO. _____					
RECEIVED JUN 20 1990					
FAC. _____					
PC	EC	SD	PVE	OE	SF
RNDL	PR	PVI	COM	PEN	SEE ME

During the past six months staff members from the North Carolina Department of Transportation and the Federal Highway Administration have met to develop Noise Abatement Guidelines to be used for all major highway projects. Attached you will find a copy of these guidelines which have been discussed in detail and agreed to by committee members from the NCDOT and FHWA. Mr. Tom Fetzer, Deputy Assistant Secretary, participated in the final committee meeting on April 3, 1990, where final changes were incorporated into these proposed guidelines.

As you are aware, highway traffic noise has been a concern that our staff has had to address for some time. However, we have never worked from an official set of guidelines. With the increasing amount of noise work being carried out by our in-house staff and consultants from private engineering firms, it is imperative that our agency develop a common set of guidelines and policy for noise abatement. Other States have formulated similar guidelines and policy.

Mr. Bob Pearson, Consultant Coordinator in Design Services, was instrumental in leading the committee in the formulation of these guidelines. Staff members from the Planning & Research Branch and the Federal Highway Administration also participated in this assignment.

I am pleased to present these guidelines for your review. If you concur in the Committee's decision that these guidelines should be adopted as NCDOT policy, please sign below and return.

APPROVED: *William G. Marley, Jr.*

6-13-90
Date

VCB/rm
cc: Mr. J. T. Peacock, Jr., P. E.

1000 1000

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT GUIDELINES

The North Carolina Department of Transportation will employ the following guidelines to determine the need, feasibility, and reasonableness of noise abatement measures on all major highway projects.

I. Noise Abatement must be considered when either of the following two conditions exist.

A) The predicted design year noise levels approach or exceed those values shown for the appropriate activity category of the FHWA noise abatement criteria table in Title 23 Code of Federal Regulations (CFR), Part 772, U. S. Department of Transportation, Federal Highway Administration (FHWA). Approach values will be 1 dBA less than shown in the table.

B) The predicted design year noise levels substantially exceed existing noise levels as defined below:

Existing (Leq(h))

Increase

≤ 50 dBA

≥ 15 dBA

> 50 dBA

≥ 10 dBA

- C) Noise abatement will not be considered for heavy maintenance, rehabilitation projects and existing conditions.

II. After a determination has been made to consider abatement under IA & IB above, several factors should be examined to determine both the feasibility and reasonableness of constructing a noise abatement device.

A) Feasibility: Feasibility deals primarily with engineering considerations. The following items should be considered in order to determine feasibility:

1. Can a barrier be built given the topography of the location?
2. Can a minimum 6 dBA noise reduction be achieved given certain access, drainage, safety, or maintenance requirements?
3. Are other noise sources present in the area?
4. The insertion loss provided by the wall will be a minimum of 6 dBA, but preferably 8 dBA or more.

B) Reasonableness: Reasonableness is a more subjective criterion. It should show that common sense and good judgement were used in arriving at a decision.

A determination of reasonableness should include items such as follows:

1. The abatement measure must be cost effective. Cost effectiveness is defined as \$25,000 per effectively protected (4 dBA or more reduction) residence.
2. The exposed height of wall does not exceed a maximum of 25 feet.
3. It will not be reasonable to provide abatement unless the receptor is located a distance of four times height of wall or more from the proposed wall.
4. The change in noise levels between design year traffic levels and existing noise levels must exceed 3 dBA (A barely perceptible change).
5. There is documented support of the benefited residents (4 dBA or more reduction) for placement of abatement measures.
6. Unless special conditions exist, it is not considered reasonable to provide noise abatement for impacted businesses or isolated receptors. Businesses generally prefer visibility from the transportation facility. Based on past project experience, it is considered unreasonable to

provide abatement for isolated residences, due to the cost of abatement versus the benefits provided.

7. Unless special conditions exist and effective abatement can be provided, it is not considered reasonable to provide noise abatement on non-controlled or partial access controlled facilities.
8. The noise barrier will be located beyond the clear recovery zone or be incorporated into safety devices.
9. Unless special conditions exist, it is not considered reasonable to construct walls on the shoulder because of safety, drainage problems, trash accumulation, etc.
10. In areas of impacted receptors where abatement measures have been considered, a vegetative barrier may be considered for aesthetic screening even though an acoustical barrier is not justified.

The above listing is not intended to be all encompassing. Rather, it is intended to indicate some of the factors that should be considered in determining the reasonableness of proposed noise abatement measures.

10000 10000

If a local jurisdiction insists on the provision of a noise abatement measure deemed not reasonable by NC DOT, a noise barrier may be installed, provided the locality is willing to assume 100% of the cost of the abatement measure including but not limited to preliminary engineering, construction, maintenance, and that NC DOT's material, design and construction specifications are met.

1996 NCDOT Traffic Noise Abatement Policy

NCDOT TRAFFIC NOISE ABATEMENT POLICY

(Effective Through September 1, 2004)

The North Carolina Department of Transportation (NCDOT) Traffic Noise Abatement Policy provides for the evaluation of sound barriers or other mitigation measures (e.g., landscaping) for communities and facilities adversely impacted by noise from state and federal highways. NCDOT uses this policy to determine the need for noise abatement and the feasibility and reasonableness of abatement measures.

NCDOT noise abatement policy applies only to "Type I" projects for state, federal or federal-aid highway projects. NCDOT does not participate in "Type II" projects (retrofitting of existing roads, heavy maintenance projects, guardrail projects, rehabilitation projects and existing facilities).

Type I Projects

Sound barriers may be considered for new construction or reconstruction of highways. New construction is building a highway on a new location. Reconstruction involves physically altering an existing highway. The most common examples of reconstruction are: increasing the number of through-traffic lanes or substantially changing its vertical grade or horizontal alignment. Consideration of noise abatement as part of construction or reconstruction projects is mandatory whenever traffic noise impacts are predicted.

PREVENTING NOISE IMPACTS - Information for the Public and Local Officials

To prevent future noise impacts on currently undeveloped lands, the following system will be used:

Public information. During the development stage of a proposed highway project, area residents and local officials will be kept informed about the project. Meetings (both formal and informal) will be held to provide information as well as to gather comments, opinions and concerns from the public and local officials.

Public documents. Environmental documents prepared for the project will contain a list of areas that may be impacted by noise as well as proposals for sound barriers and/or other abatement measures.

Design Public Hearing. Proposed noise abatement measures will be presented and discussed at the Design Public Hearing. The walls shown on the design public hearing map will be based on preliminary design and a detailed noise analysis. NCDOT design staff will fine tune the designs during the right of way plan preparation process. The location of the barrier should remain essentially the same as shown in the design public hearing map.

Final determination. Noise abatement measures deemed reasonable and feasible by NCDOT staff will be shown on the design public hearing map. The opinions of first row property owners will be requested so that a final determination on abatement measures may be made.

Date of Public Knowledge. The "Date of Public Knowledge" of the location and potential noise impacts of a proposed highway project will be either a) the approval date of final environmental document, e.g., CE, FONSI or ROD or b) the Design Public Hearing, whichever occurs later.

1. After this date, the federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed highway project.
2. The criteria (e.g., trigger date) for determining when undeveloped land is "planned, designed and programmed" for development will be the approval of a building permit for an individual lot or site.
3. It is the responsibility of local governments and private landowners to ensure that noise-compatible designs are used for development permitted after the Date of Public Knowledge.

NCDOT will provide all traffic noise analyses to local government officials within whose jurisdiction a highway project is proposed. Specifically, environmental documents and design noise reports will contain noise tables identifying areas that may be impacted by traffic noise as well as other appropriate design information. Local officials should coordinate distribution of this information to residents, property owners and developers within the affected areas. Following this procedure will encourage planners, building officials, developers and others within affected communities to plan, design and construct noise-compatible development.

SOUND AND NOISE - Definitions and Measurements.

Sound is created when an object moves, causing vibrations or waves in air molecules. When vibrations reach our ears we hear sounds. Noise is defined as unwanted or excessive sounds. It is an undesirable by-product of our modern way of life.

Sound levels are measured in units called decibels (dB). Adjustment for the high and low pitched sounds an average person can hear is called "A-weighted levels" or dBA. Highway traffic noise is assessed using dBA measurements. Noise is further described by its average level over time. In noise abatement studies an "hourly equivalent sound level," or Leq(h), is the constant, average sound level that contains the same amount of sound energy over the time period as does the varying levels of actual traffic noise.

NOISE IMPACT DETERMINATION AND ABATEMENT.

Noise levels for which abatement must be considered and may be provided are defined by land use or activity category in Figure 1. Noise impacts are projected for the "design year," or the traffic levels anticipated 20 years after highway construction begins. Because these traffic levels

are estimates, noise impacts approaching these criteria are also considered. NCDOT uses an "approach value" of 1 dBA less than those shown in Figure 1.

Traffic noise abatement for NCDOT highway projects must be considered when either of the following two conditions exist:

1. The predicted design year noise levels approach or exceed those measurements shown for the appropriate activity category as shown in Figure 1.
- OR
2. The predicted design year noise levels substantially exceed existing noise levels as defined below:

<u>Existing Leq(h)</u>	<u>Increase</u>
50 or less dBA	15 or more dBA
Greater than 50 dBA	10 or more dBA

Figure 1. Noise Abatement Criteria Hourly A- Weighted Sound Level in Decibels(dBA)		
Activity Category	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)	Residences, churches, school, libraries, hospitals, motels, hotels, parks, picnic and recreation areas, active sports areas and playgrounds
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B
D	Not Applicable	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums

Depending on the existing noise levels, NCDOT uses both a 10 dBA and 15 dBA increase to define "substantially exceeding." This sliding scale allows a greater increase at a lower existing noise level before a "substantial" increase is defined. As sound barriers generally reduce volumes by 5 to 8 dBA, their use is usually not as effective in less noisy areas. A 10 dBA increase is judged by most people as a doubling of the loudness of sounds.

Noise abatement will generally not be considered for heavy maintenance, rehabilitation projects and existing conditions.

SOUND BARRIERS - Feasible and Reasonable.

After it has been determined to consider noise abatement as outlined above, several factors must be examined to determine if construction of sound barriers is feasible and reasonable. These factors include benefits to those impacted by noise, the cost of abatement, and overall social, economic and environmental effects of sound barrier construction.

Feasibility.

Feasibility deals primarily with design and engineering considerations. The following issues should be considered in order to determine feasibility:

1. Can a sound barrier be built given the topography of the location?
2. Can noise reduction ("insertion loss") provided by the wall be a minimum of 5 dBA, but preferably 8 dBA or more, for "design receptors" (first row receptors or properties immediately adjacent to the proposed barrier)?
3. Can this noise reduction level be achieved given site-specific access, drainage, safety or maintenance requirements?
4. Are other noise sources present in the area?
5. Unless special conditions exist and effective abatement can be provided, it is not considered feasible to provide noise abatement on non-controlled or partial access control highways.

Reasonableness.

Reasonableness is a more subjective measure. This consideration should show that good judgement and common sense were used in making a decision. A finding of reasonableness should include the following:

1. Sound barrier cost - The abatement measure should be cost effective. Cost effective is defined as \$25,000 (construction costs at \$15/s.f.) per each receptor effectively benefitted by a 5 dBA or greater noise reduction.
2. Barrier height - The height above ground level facing the receptor should not exceed a maximum of 7.5 meters, or approximately 25 feet.
3. Barrier scale - It generally will not be considered reasonable to construct a barrier unless the receptor is located a horizontal distance at least four times the wall height from the proposed barrier. Sound barriers can have an overwhelming visual impact on receptors located closer to the wall.

4. Difference between existing and future noise levels - It generally is not considered reasonable to provide abatement if the difference between existing and design year noise levels is 3 dBA or less, as this is considered a barely perceptible change.
5. Opinions of impacted residents - Support for the proposed sound barrier by design receptors ("first row" residents) must be documented. Noise barriers will not be constructed without support from 51% or more of the first row residents within a given area. The opinions of design receptors will be requested at formal and informal meetings and/or by mail depending upon the scope of the project.
6. Commercial areas - Unless special conditions exist, it generally is not considered reasonable to provide abatement for impacted businesses. Businesses usually prefer visibility from the highway rather than noise abatement.
7. Isolated receptors - Unless special conditions exist, it generally is not considered reasonable to provide noise abatement for isolated receptors. The cost of abatement versus the noise reduction benefits is usually excessive.
8. Clear recovery zone - A noise barrier will be located behind the vehicle clear recovery zone or incorporated into a safety device such as a Jersey barrier.

The factors listed above are not intended to be all encompassing. Rather, these are to illustrate some of the factors that should be considered in determining the feasibility and reasonableness of proposed abatement measures.

EARTH BERMES

Consideration should be given to providing earth berms for noise abatement purposes on projects that have earth waste and where sufficient right-of-way exists to construct the berm.

VEGETATIVE BARRIERS.

NCDOT 's Roadside Environmental Unit will review areas where abatement measures have been considered and not found to be reasonable, to determine if a vegetative barrier should be constructed as part of the project.

Vegetation that has sufficient height, depth and density of plant materials that it blocks views of the highway can also decrease traffic noise. Studies have shown that a 200 feet (61 meters) depth of dense vegetation can reduce noise levels by 10 dBA. It is often impractical to plant this quantity of vegetation to achieve such reductions. However, it does demonstrate the potential utility of retaining a vegetative buffer area between developed areas and highways.

NOISE BARRIER CONSTRUCTION, MATERIALS AND AESTHETICS.

The type of materials used in construction of sound barriers and other abatement measures should be an engineering decision based on economics, effectiveness and, to a limited degree, visual impacts. Visual impact considerations will ensure that the proposed barrier meets a basic

aesthetic level as well as a basic durability level so that excessive deterioration or corrosion will not occur.

The steel pile and concrete panel wall is NCDOT's standard noise wall.

Traditional highway construction resources pay for required noise abatement measures. Should a local government request that materials be used that are more costly than those proposed by NCDOT, the requesting entity must assume 100% of the additional cost.

If a local government insists on the provision of a noise abatement measure deemed not reasonable by NCDOT, a noise barrier may be installed provided the local government assumes 100% of the costs. These costs include, but are not limited to, preliminary engineering, construction and maintenance. In addition, local governments must ensure that NCDOT's material, design and construction specifications are met.

2004 NCDOT Traffic Noise Abatement Policy

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

TRAFFIC NOISE ABATEMENT POLICY

The North Carolina Department of Transportation (NCDOT) Traffic Noise Abatement Policy provides for the evaluation of noise barriers or other mitigation measures (e.g., landscaping) for communities and facilities adversely impacted by traffic noise on proposed state and federal highway projects. NCDOT uses this policy to determine the need for noise abatement and the feasibility and reasonableness of abatement measures. Requests for vegetative screening for aesthetic purposes may be considered under the Highway Landscaping Planting Policy.

NCDOT noise abatement policy applies only to "Type I" projects for state, federal or federal-aid highway projects. NCDOT does not participate in "Type II" projects (retrofitting of existing roads, maintenance projects, guardrail projects, rehabilitation projects, existing facilities, and addition of auxiliary lanes). If an auxiliary lane is added between interchanges to improve operational efficiency and it is 1500 feet in length or longer, it should be considered as a Type I project. The addition of ramps at an interchange will also be considered as a Type I project in this policy.

Type I Projects

Sound barriers may be considered for new construction or reconstruction of highways. New construction is building a highway on a new location. Reconstruction involves physically altering an existing highway. The most common examples of reconstruction projects requiring noise analysis are increasing the number of through-traffic lanes or substantially changing its vertical grade or horizontal alignment. Consideration of noise abatement as part of construction or reconstruction projects is mandatory in accordance with Code of Federal Regulations, Title 23, Part 772 whenever traffic noise impacts are predicted.

PREVENTING NOISE IMPACTS

Information for the Public and Local Officials

To prevent future noise impacts on currently undeveloped lands, the following system will be used:

Public information. During the development stage of a proposed highway project, area residents and local officials will be kept informed about the project. Meetings (both formal and informal) will be held to provide information as well as to gather comments, opinions and concerns from the public and local officials.

Public documents. Environmental documents prepared for the project will contain a list of areas that may be impacted by noise as well as proposals for noise walls and/or other noise abatement measures.

Corridor/Design Public Hearing. Proposed noise abatement measures will be presented and discussed at the Design Public Hearing. The noise abatement measures shown on the design public hearing map will be based on preliminary design and a detailed noise analysis. NCDOT design staff will fine-tune the designs during the right of way plan preparation process. The location of the noise abatement measures should remain essentially the same as shown in the design public hearing map.

Final determination. Noise abatement measures deemed reasonable and feasible by NCDOT staff will be shown on the design public hearing map. The opinions of front row property owners will be requested so that a final determination on abatement measures may be made.

Date of Public Knowledge - The "Date of Public Knowledge" of the location and potential noise impacts of a proposed highway project will be the approval date of the final environmental document, e.g., Categorical Exclusion (CE), State or Federal Finding of No Significant Impact (FONSI) or State or Federal Record of Decision (ROD).

1. After this date, the federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed highway project.
2. The criteria (e.g., trigger date) for determining when undeveloped land is "planned, designed and programmed" for development will be the approval of a building permit for an individual lot or site.
3. It is the responsibility of local governments and private landowners to ensure that noise-compatible designs are used for development permitted after the Date of Public Knowledge.

NCDOT will provide all traffic noise analyses to local government officials within whose jurisdiction a highway project is proposed. Specifically, environmental documents and design noise reports will contain noise tables identifying areas that may be impacted by traffic noise as well as other appropriate design information. Local officials should coordinate distribution of this information to residents, property owners and developers within the affected areas. Following this procedure will encourage planners, building officials, developers and others within affected communities to plan, design and construct noise-compatible development.

SOUND AND NOISE

Definitions and Measurements

Sound is created when an object moves, causing vibrations or waves in air molecules. When vibrations reach our ears we hear sounds. Noise is defined as unwanted or excessive sounds. It is an undesirable by-product of our modern way of life.

Sound levels are measured in units called decibels (dB). Adjustment for high and low pitched sounds an average person can hear is called "A-weighted levels" or dBA. Highway traffic noise is assessed using dBA measurements. Noise is further described by its average level over time. In noise abatement studies an "hourly equivalent sound level," or Leq(h), is the constant, average sound level that contains the same amount of sound energy over the time period as does the varying levels of actual traffic noise.

NOISE IMPACT DETERMINATION AND ABATEMENT

Future traffic noise levels are determined by traffic volumes projected for the roadway for the "design year" which is approximately 20 years after highway construction begins. Traffic noise abatement for NCDOT highway projects must be considered when traffic noise impacts are created by either of the following two conditions:

The predicted design year noise levels approach or exceed those measurements shown for the appropriate activity category as shown in Figure 1. NCDOT defines "approach" to be within 1 dBA of the Leq(h) value for the activity categories.

Figure 1. Noise Abatement Criteria Hourly A- Weighted Sound Level in Decibels (dBA)		
Activity Category	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)	Residences, churches, schools, libraries, hospitals, motels, hotels, parks, picnic and recreation areas, active sports areas and playgrounds
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B
D	Not Applicable	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums

OR

The predicted design year noise levels substantially exceed existing noise levels as defined below:

<u>Existing Leq(h)</u>	<u>Increase</u>
50 or less dBA	15 or more dBA
51 dBA	14 or more dBA
52 dBA	13 or more dBA
53 dBA	12 or more dBA
54 dBA	11 or more dBA
55 or more dBA	10 or more dBA

NCDOT uses a 10 dBA to 15 dBA increase of future predicted noise levels above existing noise levels to define “substantial increase” in exterior noise levels. This sliding scale allows a greater increase at a lower existing noise level before a “substantial” increase is defined. As noise walls generally reduce volumes by 5 dBA their use is usually not as effective in less noisy areas. A 10 dBA change in noise levels is judged by most people as a doubling or halving of the loudness of the sounds.

NOISE MITIGATION MEASURES

Feasible and Reasonable

After it has been determined to consider noise abatement as outlined above, several factors must be examined to determine if construction of sound barriers is feasible and reasonable. These factors include benefits to those impacted by noise, the cost of abatement, and overall social, economical and environmental effects of sound barrier construction. Also, Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit."

Feasibility: Feasibility deals primarily with design and engineering considerations. The following issues should be considered in order to determine feasibility:

1. The topography of the location should be considered when determining if a noise wall can be built.
2. A readily noticeable noise reduction “insertion loss” should be achieved by the placement of the noise abatement measure, a minimum of 5 dBA for front row receptors.
3. Site-specific access, drainage, safety and maintenance requirements should be considered when determining noise reduction levels.
4. Other noise sources in the areas should be considered.

5. Noise abatement on non-controlled or partial access control highways usually is not feasible. However, in areas where property owners have agreed to voluntarily relinquish access rights to the highway, noise abatement may be considered.

Reasonableness: Reasonableness is a more subjective measure. This consideration should show that good judgement and common sense were used in making a decision. A finding of reasonableness will include the following:

1. **Noise barrier cost** - The abatement measure will be constructed at a reasonable allowable cost per benefited receptor (cost effective). This cost per benefited receptor will be less than or equal to the value (V) determined by dividing the number (N) of benefited receptors into the total cost (C) of the barrier system. A benefited receptor is one that experiences a 5 dBA or more reduction in noise levels by the construction of the noise wall. The cost of the barrier system will be based on \$15.00 per square foot for the noise mitigation measure plus any other major items necessary for the construction of the measure. These other items could include cost for structure improvements, additional earthwork, additional right-of-way, etc. The reasonable cost effective amount for an impacted area will be \$35,000 per benefited receptor plus an incremental increase of \$500 per dBA average increase (I) in the predicted exterior noise levels of the impacted receptors of the area.

$V = C/N$ which must be equal to or less than $\$35,000 + \$500(I)$.

I = Increase in predicted exterior noise levels

Examples:

Cost of noise mitigation measure = \$350,000

Number of benefited receptors = 12

$V = \$350,000/12 = \$29,166$

Projected noise level (72 dBA) – Existing noise level (69 dBA)=I=3 dBA

Cost effective amount = $\$35,000 + \$500(3) = \$36,500$, therefore, a noise mitigation measure **would be considered**.

Cost of noise mitigation measure = \$400,000

Number of benefited receptors = 8

$V = \$400,000/8 = \$50,000$

Projected noise level (70 dBA) - Existing noise level (65 dBA)=I=5dBA

Cost effective amount = $\$35,000 + \$500(5) = \$37,500$, therefore, a noise mitigation measure **would not be considered**.

2. **Noise Wall height and scale** – A major consideration of the reasonableness of a noise wall is the visual impact on the adjoining lands. Specifically, a high noise wall alongside low, single-family residences could have a severe adverse visual effect. Considering these factors, the height of the noise wall

above the ground should not exceed 25 feet or 7.5 meters. Furthermore, the horizontal distance of the noise wall from residences should be greater than four times the height of the noise wall from the residences.

3. Difference between existing and future noise levels - When real-life noises are heard, most people find it difficult to detect noise level changes of 2-3 dBA. If the differences between the existing and future noise levels are 3 dBA or less, sound mitigation measures are generally considered unreasonable.
4. Opinions of impacted residents - Support for the proposed noise barrier by front row receptors must be documented due to the visual effect of the proposed measures. The Department will solicit the opinions of these receptors and a majority of these receptors must support the construction of the noise abatement measure.
5. Isolated receptors - The cost of abatement measures for isolated receptors versus the noise reduction benefits provided are usually excessive. Therefore, unless special conditions exist, it generally is not considered reasonable to provide noise abatement for isolated receptors.
6. Commercial areas - Businesses usually prefer visibility and accessibility from the highway rather than noise abatement. Therefore, noise abatement for impacted businesses will not be considered unless requested by the business affected.
7. Residential multi-unit complexes – NCDOT will evaluate residential multi-unit complexes under activity category ‘E’ (interior condition) of the Noise Abatement Criteria (NAC) Table. If activity category ‘B’ (exterior condition) of the NAC Table is also determined in areas of the complex, NCDOT will evaluate both categories ‘B’ and ‘E’ conditions of the multi-unit complex. Noise mitigation benefits for qualifying NAC activity category ‘B’ will consider all units of the multi-unit building structure. However, noise mitigation benefits for NAC activity category ‘E’ will consider only first floor units due to noise wall height constraints. Owner occupied units (apartment, townhouse, etc.) will be treated as a separate voting member.
8. Special use areas – Special use areas include, but are not limited to, school, pre-school and daycare facility playgrounds; special exterior areas of churches, hospitals, retirement homes; parks and camps that would be evaluated for NAC activity category ‘B’ (exterior condition). Note: A minimum of 25 students is required to qualify for exterior activity “B” for playgrounds for pre-school and daycare facilities.

To determine cost effectiveness of the noise wall an equivalent number of residents would be determined by using the formula: Equivalent # Residences = # Occupants/(# people / residence) * usage

With:

of occupants = # of students in a school or # of people in a congregation at church, etc.

of people per residence = 3. (Used in Computer Modeling)

Usage = # of hours used per day/ 24 hours per day

School Example:

Equivalent # of Residents = $500 \text{ students} / 3 * (4 \text{ hrs per day} / 24 \text{ hrs per day}) = 28$

The factors listed above are not intended to be all encompassing. Rather, these are to illustrate some of the factors that should be considered in determining the feasibility and reasonableness of proposed abatement measures.

NOISE WALL CONSTRUCTION, MATERIALS AND AESTHETICS

The type of materials used in construction of noise barriers and other abatement measures should be an engineering decision based on economics, effectiveness and, to a limited degree, visual impacts. Visual impact considerations will ensure that the proposed noise wall meets a basic aesthetic level as well as a basic durability level so that excessive deterioration or corrosion will not occur.

The steel pile and concrete panel wall is NCDOT's standard noise wall however, NCDOT will consider Context Sensitive Solutions (CSS) as long as other criteria are met.

Consideration should be given to providing earth berms for noise abatement purposes on projects that have earth waste and where sufficient right-of-way exists to construct the berm.

Traditional highway construction resources pay for required noise abatement measures. Should a local government request that materials be used that are more costly than those proposed by NCDOT, the requesting entity must assume 100% of the additional cost.

If a local government insists on the provision of a noise abatement measure deemed not reasonable by NCDOT, a noise wall may be installed provided the local government assumes 100% of the costs. These costs include, but are not limited to, preliminary engineering, construction and maintenance. In addition, local governments must ensure that NCDOT's material, design and construction specifications are met.

REVIEW OF POLICY

This policy shall be reviewed in a manner determined by the Board of Transportation at least every five years.

2011 NCDOT Traffic Noise Abatement Policy

**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
TRAFFIC NOISE ABATEMENT POLICY**



Effective Date: July 13, 2011

Noise Policy Committee:

Jay Bennett, PE.....Roadway Design Unit
Drew Joyner, PE.....Human Environment Unit
Daniel Keel, PE.....NCDOT Operations
Mike Mills, PE.....NCDOT Division 7
Gregory A. Smith, PE.....Human Environment Unit

Technical Resource Team:


Missy Dickens Pair, PE.....Project Development &
Environmental Analysis Branch
Ed Lewis.....Human Environment Unit
Joe Rauseo.....Human Environment Unit
Tracy Roberts, AICP.....North Carolina Turnpike Authority
Steve Walker.....Human Environment Unit

Sponsors:

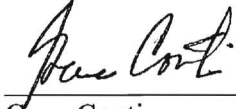
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3/9/2011
Date of Approval


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2/28/2011
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INTRODUCTION

This document contains the North Carolina Department of Transportation (hereinafter NCDOT) policy on highway traffic noise and construction noise and describes the implementation of the requirements of the Federal Highway Administration (hereinafter FHWA) Noise Standard at 23 Code of Federal Regulations (CFR) Part 772 as they relate to federal and state funded highway construction in North Carolina. This policy was developed by the NCDOT and reviewed and approved by the FHWA.

The North Carolina Department of Transportation Traffic Noise Analysis and Abatement Guidance Manual and 23 CFR 772 are intended to be companion documents to this policy.

PURPOSE

This policy describes the NCDOT process that is used in determining traffic noise impacts and abatement measures and the equitable and cost-effective expenditure of public funds for traffic noise abatement. Where the FHWA has given highway agencies flexibility in implementing the 23 CFR 772 standards, this policy describes the NCDOT approach to implementation.

APPLICABILITY

This policy applies to all "Type I" federal, state or federal-aid highway projects in the State of North Carolina, including federal projects that are administered by local public agencies. NCDOT does not participate in nor fund Type II (retrofit) projects along existing state transportation facilities. Noise analyses are not required for Type III projects. Each of these project types are defined below. This policy shall be applied uniformly and consistently to all Type I federal projects throughout the state.

Type I Project

- (a) The construction of a highway on new location; or,
- (b) 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,
- (c) 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,

- (d) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,
- (e) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,
- (f) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,
- (g) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.
- (h) 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.

The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in 23 CFR 772 and this policy constitute the noise standards mandated by 23 U.S.C. 109(1). All highway projects which are developed in conformance with this policy shall be deemed to be in accordance with the FHWA noise standards.

Projects let for construction on or after July 13, 2011 shall be reviewed under the criteria of this policy; however, the original date of public knowledge shall remain unchanged.

DATE OF PUBLIC KNOWLEDGE

The Date of Public Knowledge of the location and potential noise impacts of a proposed highway project is the approval date of the final environmental document, e.g., Categorical Exclusion (CE), State or Federal Finding of No Significant Impact (FONSI) or State or Federal Record of Decision (ROD).

After this date, the federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed highway project. It is the responsibility of local governments and private landowners to ensure that noise-compatible designs are used for development permitted after the Date of Public Knowledge.

This policy applies only to developed land and to undeveloped land for which development is permitted before the project Date of Public Knowledge. The criteria (trigger date) for determining when undeveloped land is permitted for development is the approval date of a building permit for an individual lot or site.

TRAFFIC NOISE PREDICTION

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

Average pavement type shall be used in the FHWA TNM® for future noise level prediction.

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

Traffic characteristics that would yield the loudest hourly equivalent traffic noise levels for the design year shall be used in predicting noise levels and assessing noise impacts.

Traffic noise prediction must adhere to all methodologies detailed in the NCDOT Traffic Noise Analysis and Abatement Guidance Manual.

NOISE IMPACT DETERMINATION

Traffic noise abatement for NCDOT highway projects is warranted and must be considered when traffic noise impacts are created by either of the following two conditions:

- (a) The predicted traffic noise levels for the Design Year approach (reach one decibel less than) or exceed the Noise Abatement Criteria (NAC) contained in 23 CFR 772 and in Table 1, found on page 4 of this policy, OR
- (b) The predicted traffic noise levels for the Design Year substantially exceed existing noise levels as defined in Table 2, found on page 5 of this policy.

A receptor is a discrete or representative location of a noise sensitive area(s) for any of the land uses listed in Table 1. For multifamily dwellings, each residence shall be counted as one receptor when determining impacted and benefited receptors.

Primary consideration shall be given to exterior areas where frequent human use occurs in the determination of traffic noise impacts.

A traffic noise analysis shall be completed for each project alternative under detailed study and for each Activity Category listed in Table 1 that is present in the study area.

Table 1			
Noise Abatement Criteria			
Hourly Equivalent A-Weighted Sound Level (decibels (dB(A)))			
Activity Category	Activity Criteria ¹ Leq(h) ²	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B ³	67	Exterior	Residential
C ³	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare 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 ³	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

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

² The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq.

³ Includes undeveloped lands permitted for this activity category.

Table 2	
Substantial Noise Level Increase	
Hourly Equivalent A-Weighted Sound Level (decibels (dB(A)))	
Existing Noise Level ¹ (Leq(h))	Predicted Design Year Noise Level Increase ² (Leq(h))
50 or less	15 or more
51	14 or more
52	13 or more
53	12 or more
54	11 or more
55 or more	10 or more

¹ Loudest hourly equivalent noise level from the combination of natural and mechanical sources and human activity usually present in a particular area.

² Predicted hourly equivalent Design Year traffic noise level minus existing noise level.

ANALYSIS OF NOISE ABATEMENT MEASURES

When traffic noise impacts are identified and noise abatement is warranted, noise abatement measures shall be considered and evaluated for feasibility and reasonableness. All of the following conditions must be met in order for noise abatement to be justified and incorporated into project design, as applicable. Failure to achieve any single element of feasibility or reasonableness will result in the noise abatement measure being deemed not feasible or not reasonable, whichever applies.

Feasibility

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

- (a) Any receptor that receives a minimum noise level reduction of five dB(A) due to noise abatement measures shall be considered a benefited receptor. Noise reduction of five dB(A) must be achieved for at least one impacted receptor.
- (b) Engineering feasibility of the noise abatement measure(s) shall consider adverse impacts created by or upon property access, drainage, topography, utilities, safety, and maintenance requirements.

Reasonableness

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

- (a) Viewpoints of the property owners and residents of all benefited receptors shall be solicited. One owner ballot and one resident ballot shall be solicited for each benefited receptor. Points per ballot shall be distributed in the following weighted manner:
 - 3 points/ballot for benefited front row property owners
 - 1 point/ballot for all other benefited property owners
 - 1 point/ballot vote for all residents

Consideration of the noise abatement measure will continue unless a simple majority of all distributed points are returned that indicates the balloted voters do not want the abatement measure.

- (b) The maximum allowable base quantity of noise walls and/or earthen berms per benefited receptor shall not exceed 2,500 ft² and 7,000 yd³, respectively. Additionally, an incremental increase of 35 ft² for noise walls and 100 yd³ for earthen berms shall be added to the base quantity per the average increase in dB(A) between existing and predicted exterior noise levels of all impacted receptors within each noise sensitive area, which is defined as a group of receptors that are exposed to similar noise sources. A base dollar value of \$37,500 plus an incremental increase of \$525 (as defined above) shall be used to determine reasonableness of buffer zones and noise insulation.
- (c) A noise reduction design goal of at least 7 dB(A) must be evaluated for all front row receptors. At least one benefited front row receptor must achieve the noise reduction design goal of 7 dB(A) to indicate the noise abatement measure effectively reduces traffic noise.

Other Considerations

Prior to CE approval or issuance of a FONSI or ROD, NCDOT shall identify in environmental documents:

- (a) Noise abatement measures that are feasible and reasonable,
- (b) Noise impacts for which no abatement appears to be feasible and reasonable;
- (c) Locations where noise impacts will occur, where noise abatement is feasible and reasonable, and the locations that have no feasible and reasonable abatement.
- (d) Whether it is “likely” or “unlikely” that noise abatement measures will be installed for each noise sensitive area identified. “Likely” does not mean a firm commitment. The final decision on the installation of the abatement measures shall be made upon

completion of the project design, the public involvement process, concurrence with the NCDOT Policy, and FHWA approval.

Acceptable Noise Abatement Measures

The following noise abatement measures may be considered for incorporation into a project to reduce traffic noise impacts.

- (a) Construction of noise barriers
- (b) Traffic management measures
- (c) Alteration of horizontal and vertical alignments
- (d) Establishment of buffer zones
- (e) Noise insulation of Activity Category D land use facilities listed in Table 1 on Page 4 of this policy.

Third Party Participation

- (a) Third party funding of noise abatement measures cannot be used to make up the difference between the reasonable base quantity allowance and the actual quantity of noise abatement. Third party funding is allowed only by public entities, and can only be used to pay for additional features such as landscaping and aesthetic treatments for noise barriers that meet cost-effectiveness criteria.
- (b) Traditional highway construction resources pay for required noise abatement measures. Should a local government request that materials be used that are more costly than those proposed by NCDOT, the requesting entity must assume 100% of the actual additional construction cost.
- (c) If a local government insists on the provision of a noise abatement measure deemed not reasonable by NCDOT, an abatement measure may be installed provided the local government assumes 100% of the costs and obtains an encroachment permit from NCDOT to perform the work. These costs include, but are not limited to, preliminary engineering, actual construction and maintenance. In addition, local governments must ensure that NCDOT's material, design and construction specifications are met. The local government must also assume 100% of the liability associated with the measure and hold harmless the NCDOT.
- (d) For (b) and (c) above, the settlement agreement shall be signed before third party noise abatement design begins and payment shall be made to NCDOT before project construction begins.

Quantity Averaging

NCDOT will utilize abatement measure quantity averaging among all noise sensitive areas within the same Activity Category in Table 1 that are exposed to a common noise environment, i.e., similar noise sources and levels, traffic volumes, traffic mix, speed and topographic features, if:

- (a) No single common noise environment exceeds two times the base quantity reasonableness criteria (e.g., two times 2,500 square feet, or two times 7,000 cubic yards); and,
- (b) Collectively, all common noise environments being averaged do not exceed the base quantity reasonableness criteria.

PUBLIC INVOLVEMENT

Communication with the community regarding noise impacts and possible noise abatement shall occur at the start of the noise study process and continue throughout the development of the project. NCDOT will communicate with citizens to present information on the nature of highway traffic noise and discuss the effects of noise abatement measures in attenuating traffic noise and the types of noise abatement measures that may be considered. The concerns of the community shall be a major consideration in reaching a decision on the abatement measures to be provided.

COORDINATION WITH LOCAL OFFICIALS

NCDOT will provide all traffic noise analyses to local government officials within whose jurisdiction a highway project is proposed as early in the project planning process as possible to protect future development from becoming incompatible with traffic noise levels. Specifically, environmental documents and design noise reports will contain information identifying areas that may be impacted by traffic noise, predicted noise level contour information, the best estimation of future noise levels for developed and undeveloped lands or properties in the immediate vicinity of the project and other appropriate design information. If requested, NCDOT will assist local officials with coordination and distribution of this information to residents, property owners and developers. NCDOT will provide assistance to local jurisdictions in the development of local noise controls, when requested. NCDOT will advocate the planning, design and construction of noise-compatible development and encourage its practice among planners, building officials, developers and others.

All noise-sensitive areas and any known noise abatement measures will be presented and discussed at the Design Public Hearing and Design Public Meetings.

CONSTRUCTION NOISE

To minimize the impacts of construction noise on the public, NCDOT shall:

- (a) Identify land uses or activities that may be affected by noise from construction of the project.
- (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 consider the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.
- (c) Consider construction techniques and scheduling to reduce construction noise impacts to nearby receptors and incorporate the needed abatement measures in the project plans and specifications.

FEDERAL PARTICIPATION

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

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

REVIEW OF POLICY

This policy shall be reviewed by the NCDOT Board of Transportation at least every five years.