

**SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION**

**NOISE ANALYSIS AND ABATEMENT GUIDANCE**

Effective Date: July 13, 2011

Prepared by

South Dakota Department of Transportation  
Office of Project Development  
Environmental Office



\_\_\_\_\_  
SDDOT Secretary



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Date



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FHWA SD Division Administrator



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Date

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## 1. INTRODUCTION

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities, such as sleep, work, speech, or recreation. Noise levels from highway traffic are affected by three factors: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, traffic noise is increased by these three factors. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires.

Public concern about the increase in traffic noise caused by the rapid expansion of the Interstate system and other roadways in the 20<sup>th</sup> century led to federal legislation in 1970 that authorized the use of federal-aid highway funds for measures to abate and control highway traffic noise. The Federal-Aid Highway Act of 1970 mandated that the Federal Highway Administration (FHWA) develop noise standards for the mitigation of highway traffic noise. FHWA prepared standards for the mitigation of highway traffic noise in the planning and design of federally funded projects. These standards comprise Title 23 of the United States Code of Federal Regulations Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR 772)*. On July 13, 2010, the Federal Highway Administration (FHWA) published a final rule which revised 23 CFR 772. The rule requires that State highway agencies prepare state-specific noise policies/guidance and procedures for applying the revised rule in their state.

This document outlines the South Dakota Department of Transportation's (SDDOT) procedures on how highway traffic impacts are defined, how noise abatement is evaluated and how noise abatement decisions are made. It is intended to supplement 23 CFR 772. The document will be reviewed annually and will be updated, as necessary, when FHWA issues new guidance. This document was developed by the SDDOT and was reviewed and approved by FHWA.

## 2. PURPOSE

The purpose of this document is to outline SDDOT's procedures for applying 23 CFR 772 in an equitable and cost-effective manner in South Dakota. Where FHWA has given

flexibility in implementing the standard, this guidance describes the SDDOT's approach to implementation.

### 3. DEFINITIONS

<b>Abatement</b>	Measures used to reduce traffic noise levels. Abatement measures will not be implemented unless determined to be feasible and reasonable.
<b>Approach</b>	1 dB(A) less than the Noise Abatement Criteria (NAC).
<b>Benefited Receptor</b>	The recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dB(A).
<b>Common Noise Environment</b>	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, speed and features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections and cross-roads.
<b>Date of Public Knowledge</b>	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.
<b>dB(A)</b>	A-weighted decibel. Decibels as measured by a sound meter with an "A" weighting filter. Using this filter, the sound level meter is less sensitive to very high and very low frequencies, like the human ear.
<b>Design Year</b>	The future year used to estimate the probable traffic volume for which a highway is designed (usually 20 years). It starts once construction is complete and the highway facility is open to traffic.
<b>Existing Noise Levels</b>	The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.
<b>Feasibility</b>	The combination of engineering and acoustical factors considered in the evaluation of a noise abatement measure.

<b>Impacted Receptor</b>	The recipient that has a traffic noise impact.
<b>L<sub>eq</sub></b>	The equivalent steady-state sound level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same time period.
<b>L<sub>eq(h)</sub></b>	The loudest hourly value of L <sub>eq</sub> .
<b>Multifamily Dwelling</b>	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.
<b>Noise Abatement Criteria (NAC)</b>	FHWA has determined noise levels for various activities or land uses which represent the upper limit of acceptable traffic noise level conditions, which are found in 23 CFR 772. These regulations do not require meeting the abatement criteria in every instance; rather, they require highway agencies make every reasonable and feasible effort to provide noise mitigation when the criteria are approached or exceeded. Compliance with the noise regulations is a prerequisite for using Federal-aid highway funds for construction of Type 1 projects in South Dakota. (See Appendix 1.)
<b>Noise Barrier</b>	A physical obstruction that is constructed between the highway noise source and the noise receptor(s) that lower the noise level, including stand alone noise walls, noise berms (earth or other material), and combination berm/wall systems.
<b>Noise Reduction Design Goal</b>	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 goal shall be at least 7 dB(A).
<b>Permitted</b>	A definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.

<b>Property Owner</b>	An individual or group of individuals that holds a title, deed or other legal documentation of ownership of a property or residence.
<b>Reasonableness</b>	The combination of social, economic and environmental factors considered in the evaluation of noise abatement measures.
<b>Receptor</b>	A discrete or representative location of a noise sensitive area(s) for any of the land uses listed in Table 1.
<b>Residence</b>	A dwelling unit. This includes single family residences and multi-family dwellings, including mobile home parks.
<b>Statement of Likelihood</b>	A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time of the environmental document is being approved.
<b>Substantial Construction</b>	The granting of a building permit prior to right-of-way acquisition or construction approval for the highway.
<b>Substantial Noise Increase</b>	Along with the NAC defined above, one of two types of highway traffic noise impacts created by a proposed Type 1 project. SDDOT defines this as an increase in noise levels of at least 15 dB(A) in the design year over the existing ambient noise level.
<b>Traffic Noise Impacts</b>	Design year build condition noise levels that approach or exceed the NAC listed in Appendix 1 for the future build condition; or design year build condition noise levels that create a substantial noise increase over existing noise levels by 15 dB(A).
<b>Type I Project</b>	<p>(1) The construction of a highway on new location; or</p> <p>(2) The physical alteration of an existing highway where there is either:</p> <ul style="list-style-type: none"> <li>(i) Substantial Horizontal Alteration: A project that halves the distance between the edge of the outermost through-traffic lane and the closest receptor between the existing condition and the future build condition; or,</li> <li>(ii) Substantial Vertical Alteration: A project that removes shielding thereby exposing the line-of-site between the</li> </ul>

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;
- (4) The addition of an auxiliary lane except for when the auxiliary lane is a turn lane;
- (5) The addition of a new interchange or the relocation of interchange lanes, or when ramps are added to a quadrant to complete an existing partial interchange;
- (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 portion of a project is determined to be a Type I project under this definition, then the entire project is defined as 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 II programs are voluntary, and SDDOT has elected not to have a Type II program.

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

#### **4. NOISE STANDARDS**

This document outlines the SDDOT's program to implement the FHWA noise standards found at 23 CFR 772. The standards include traffic noise prediction requirements, noise analyses, noise abatement criteria and requirements for informing local officials.

#### **5. APPLICABILITY**

The SDDOT Traffic Noise Analysis and Abatement Procedures and Guidance applies uniformly and consistently to Type I highway projects in the State of South Dakota that receive federal-aid funds or are otherwise subject to FHWA approval. They include federal projects that are administered by the SDDOT or Local Public Agencies (LPA). SDDOT will use the definition of Type I projects used in this document to determine whether or not a project is Type I. The SDDOT does not participate in nor fund Type II projects along existing highways.

If there are any questions about whether a project is subject to this policy or the FHWA Noise Standard at 23 CFR 772, contact Terry Keller, Environmental Supervisor, Office of Project Development: Phone:(605) 773-3721; Email: [terry.keller@state.sd.us](mailto:terry.keller@state.sd.us) .

#### **6. TRAFFIC NOISE PREDICTION**

Noise analysis on Type I projects in South Dakota must use the latest version of the FHWA Traffic Noise Model (TNM). Noise contour lines may be used for project alternative screening and for land use planning, but shall not be used for determining noise impacts on any project.

#### **7. ANALYSIS OF TRAFFIC NOISE IMPACTS**

The noise analysis process will not be initiated unless the project has been identified as a Type I project. A traffic noise analysis is required for all reasonable build alternatives that have been retained for detailed analysis in the National Environmental Policy Act (NEPA) document. A noise analysis is not required for the "No Build" alternative or for any alternative that was rejected as unreasonable during the alternatives screening process.



Existing noise levels shall be determined by taking field measurements with an ANSI Type I or 2 sound level meter. To avoid noise interference from winds, a wind screen must be attached to the microphone during all readings. Noise measurements should not be taken if the wind velocity is 12 mph or greater. Each noise reading shall be at least 15 minutes long. The time of day, length of measurement periods, location of receptors, traffic counts and weather conditions should be documented for each reading. For additional guidance on noise measurement methodology, refer to the publication *Measurement of Highway Related Noise FHWA-PD-96-046*.

The noise analysis will be performed using forecasted traffic volumes for the Design Year (at least 20 years after the year of construction). Worst hour traffic volumes for the Design Year and the future posted speed limits must be used as TNM inputs. Average pavement shall be used unless SDDOT obtains FHWA approval to use a different pavement type. For additional guidance on using TNM, consult the *TNM User's Guide*.

The noise study area for the build alternatives will be from the beginning project construction point to the ending project construction point. The minimum distance to look for receptors is 300 feet from the edge of pavement. If an impact is identified at 300 feet, the next closest receptor would need to be analyzed until a distance where impacts are no longer identified is reached. If no receptors are located within the 300 foot zone, then the closest receptor(s) should be analyzed. In cases where the roadway is on fill, the analysis area may need to be extended to ensure that all impacts are identified. If any segment of an alternative meets the definition of a Type 1 project, then the entire alternative is considered to be Type 1 and is subject to the noise analysis requirements.

The noise analysis must include an analysis of each Activity Category listed below that is present in the project area. A detailed list of land use types within each Activity Category can be found in Appendix 1: 23 CFR 772 Noise Abatement Criteria.

- Activity Category A: Lands on which serenity and quiet are of extraordinary significance and serve an important public need
- Activity Category B: Exterior areas of single-family and multi-family dwellings
- Activity Category C: Exterior areas of non-residential lands

- Activity Category D: Interior areas of Category C facilities
- Activity Category E: Exterior areas of developed lands that are less sensitive to highway noise
- Activity Category F: Exterior areas of developed lands that are not sensitive to highway traffic noise
- Activity Category G: Undeveloped lands that have been permitted for development on or before the date of public knowledge

See Appendix 2 for guidance on evaluating land uses within the above Activity Categories.

## 8. TRAFFIC NOISE IMPACTS

Highway traffic noise impacts occur when the predicted traffic noise levels for the Design Year approach (reach 1 decibel less than) or exceed the NAC contained in 23 CFR 772 (Appendix 1), or when the predicted traffic noise levels substantially exceed the existing noise levels by 15 dB(A), even though the predicted levels may not exceed the NAC.

## 9. ANALYSIS OF NOISE ABATEMENT MEASURES

When a traffic noise impact is identified on a Type I project, noise abatement measures will be considered and evaluated for feasibility and reasonableness by comparing the costs and effect of the abatement measure against the amount of benefit. All of the following conditions must be met in order for noise abatement to be justified and incorporated into project design. 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**

When a traffic noise impact is identified on a Type 1 project, noise abatement will be considered and evaluated for engineering and acoustical feasibility.

- **Engineering feasibility:**

- **Safety:** An abatement measure would not be deemed feasible if causes an excessive restriction of sight distance, continuous shadow causing icing or snow accumulation of the driving lanes, severe drainage problems associated with the barrier, or flood-prone areas.
  - **Barrier height:** The design of each proposed barrier will be considered on an individual basis when determining barrier height. The designed height of any proposed barrier may be adjusted based on feasibility and reasonableness considerations. Due to safety concerns, SDDOT will generally not construct barriers higher than 20 feet.
  - **Topography:** If the topography is such that an abatement measure can not be built, then it will not be deemed feasible.
  - **Drainage and utilities:** A noise abatement measure is not feasible if access to drainage and utilities are not maintained.
  - **Maintenance of the abatement measure, maintenance access to adjacent properties and access to adjacent properties:** A noise abatement measure is not feasible if access to the abatement measure, side streets, driveway, ramps, etc. is not maintained.
- **Acoustic Feasibility:** A noise abatement measure is considered acoustically feasible when a minimum of 60% of front row receptors directly behind the noise wall (noise wall must extend entirely across receptor's property line) achieve a 5 dB(A) noise reduction.

### **Reasonableness**

Reasonableness is a more subjective criterion than feasibility. It implies that common sense and good judgment were applied in arriving at a decision when noise abatement measures are considered. The following three reasonableness criteria must be collectively achieved for an abatement measure to be considered reasonable:

- **Viewpoints of the Property Owners and Residents of all Benefited Receptors (Activity Category B Land Uses)**

When it is determined that it would be feasible to provide noise abatement for a site, and a preliminary determination has been made that abatement would be reasonable, a public informational meeting will be held as part of the process for a

final determination of whether abatement would be reasonable. Benefited property owners and residents will be given an opportunity to vote on noise abatement by ballot. An information packet and a ballot will be sent by certified mail to all benefited property owners and residents, at least 14 days before the date of noise abatement meeting. The votes will be weighed in the following manner:

- 3 points/ballot for benefited first 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 more than 50% of all distributed points are returned that indicate the balloted voters do not want the abatement measure. If the benefited property owners and residents vote to reject construction of a noise barrier, their area will not be reconsidered for future noise abatement unless another Type I project is proposed for the area.

For Activity Categories A, C, D and E, the views of the property owner or authority having jurisdiction over the property will be considered.

▪ **Cost Effectiveness**

Noise barriers that are determined to be feasible to design and construct must also be evaluated for reasonable cost. SDDOT defines cost effectiveness as dollars per benefited receiver. Based on 2010 construction cost estimates, SDDOT will use \$44/ft<sup>2</sup> for barrier costs. The abatement cost guidance will be reevaluated every five years, or sooner, if updated costs become available. If the cost per benefited receptor is more than \$21,000, the abatement measure will be considered not reasonable.

The cost calculations of the noise abatement measure should include all items directly related to the construction of the noise abatement measure. Examples of cost items that should be included in the estimate include design, right-of-way, drainage modifications, utility relocation, traffic control, retaining walls, landscaping for graffiti abatement and standard aesthetic treatments. To determine whether a cost is attributable to a noise abatement measure, it should be determined whether the cost would be necessary if no noise abatement measure was constructed.

- **Noise Reduction Goal:** A minimum of 40% of benefited receptors must achieve a 7 dB(A) noise reduction in order for noise abatement to be reasonable.

## 10. NOISE ABATEMENT MEASURES

The following noise abatement measures may be considered for incorporation into a project to reduce traffic noise impacts. In accordance to 23 CFR 772(13) (c), these abatement measures are eligible for federal funding.

- Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. When a noise barrier has been determined to be the most effective abatement measure, concrete or composite materials shall be considered. SDDOT will not allow the construction of wood barriers due to long term maintenance issues.

Acoustically absorptive materials will be provided when the following conditions indicate that the use of reflective materials would cause noise increases in areas not protected by the barriers:

- The ratio of the spacing between new parallel barriers and the average height of the barrier is 15:1 or less,
  - Receptors on one side of the highway have a direct line of sight from an area of frequent human use that would benefit from a lowered noise level to a new barrier on the opposite side of the highway.
- Other measures that may be examined for reasonableness include earth berms, buffer zones, traffic management measures, and the alteration of horizontal and vertical alignments.

### **Noise Abatement Measure Reporting**

The SDDOT shall maintain an inventory of all constructed noise abatement measures. The inventory shall include the parameters listed in 23 CFR 772.13(f). A noise barrier inventory report to will be submitted to FHWA triennially.

## 11. NEPA DOCUMENTATION

Prior to CE approval or issuance of a FONSI or ROD for a Type I project, the following information will be included in the NEPA file:

- Noise abatement measures that are feasible or reasonable, and are likely to be incorporated into the project;

- Noise impacts for which no abatement appears to be feasible and reasonable, and;
- Statement of Likelihood (See Appendix 3)

## **12. FEDERAL PARTICIPATION**

Federal funds may be used for noise abatement measures on Type I highway projects in South Dakota, when:

- Traffic noise impacts have been identified; and
- Abatement measures have been determined to be feasible and reasonable pursuant to 23 CFR 772.13(d).

## **13. THIRD PARTY FUNDING**

Third party funding can not be used to make up the difference in cost between the reasonable cost allowance and the actual cost. For noise barriers that meet the cost effective criteria, third party funding can be used to incorporate additional features such as landscaping, aesthetic treatments, increase height, etc.

## **14. INFORMATION FOR LOCAL OFFICIALS**

Local officials will be provided with information on noise compatible planning techniques that can be used to prevent future highway traffic noise impacts. To assist local officials within whose jurisdiction a Type I highway project is located, the SDDOT will provide information on future noise levels for each Activity Category located along the project. This will be accomplished by providing a copy of the noise analysis report to the local official. The local official will also be provided with an estimation of future noise levels for various distances from the highway (noise contours).

## **15. DATE OF PUBLIC KNOWLEDGE**

The "Date of Public Knowledge" of the location and potential noise impacts of a Type I project will be the approval date of the environmental document, i.e. CE, FONSI or ROD. SDDOT will not be responsible for providing highway traffic noise abatement for undeveloped lands permitted after the Date of Public Knowledge.

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 Type I 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.

**16. CONSTRUCTION NOISE**

During construction, contractors will be required to comply with the sound control requirements identified in the SDDOT Standard Specifications for Roads and Bridges, 2004 (Section 7.22). Construction noise abatement will be reviewed on a case-by-case basis. Construction abatement measures will be determined by weighing the duration of the project, benefits achieved, overall adverse social, economic and environmental effects, and cost of abatement measures.

## APPENDIX 1: 23 CFR 772 NOISE ABATEMENT CRITERIA (NAC)

The following table summarizes noise abatement criteria corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

<b>23 CFR 772 Noise Abatement Criteria</b> [Hourly A-Weighted Sound Level_decibels (dB(A)) <sup>1</sup> ]				
Activity Category	Activity Leq(h)	Criteria <sup>2</sup> L10(h)	Evaluation Location	Activity Description
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve as 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 <sup>3</sup>	67	70	Exterior	Residential
C <sup>3</sup>	67	70	Exterior	Active sports 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	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 <sup>3</sup>	72	75	Exterior	Hotels, motels, office, 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

<sup>1</sup> Either Leq(h) or L10(h) [but not both] may be used on a project

<sup>2</sup> The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

<sup>3</sup> Includes undeveloped lands permitted for this activity category.



## **APPENDIX 2: GUIDELINES FOR EVALUATING ACTIVITY CATEGORY LAND USES**

**ACTIVITY CATEGORY A:** The designation of Activity Category A lands will be done on a case-by-case basis in consultation with FHWA. FHWA must approve the Category A land use designation prior to initiating a noise analysis.

One receptor should be assigned to each exterior area of frequent human use present within the same land use. If no exterior area of frequent human use is present, no further noise analysis is required. Documentation of this finding should be placed in the project file.

**ACTIVITY CATEGORY B:** When determining traffic noise impacts for Activity Category B residential land uses, primary consideration will be given to exterior areas of frequent human use. Receptors shall be located at exterior activity areas such as a patio or play area. For multi-family dwellings, receptors should be placed at an exterior common area of frequent human use such as a sitting area, pool, tennis court or other formalized outdoor activity area. If more than one outdoor activity area is present, one receptor shall be assigned to each formal activity area. If no common areas of outdoor activity are present, the receptor should be placed at individual exterior activity areas that face the noise source, such as balconies. If no exterior areas of frequent human use are present, no further noise analysis is required. Documentation of this finding shall be placed in the project file.

**ACTIVITY CATEGORY C:** When determining traffic noise impacts for Activity Category C land uses, primary consideration will be given to exterior areas of frequent human use. The following guidelines should be used when evaluating various Category C land uses:

**Parks & Recreation Areas** – One receptor should be assigned to each outdoor activity area that is located within the park or recreation area boundary. If the park or recreational area has no discernable formal exterior activity area (trail, camping facility, picnic areas, ball fields, etc.) a minimum of one receptor should be sited at least 50 feet from the edge of the pavement.

**Picnic Areas** – One receptor should be counted for each area of clustered tables that are oriented or situated as a single functional area.

**Campgrounds** – One receptor should be counted for each formal campsite or camping cabin capable of human occupation. Informal campsite areas located within formalized campgrounds should be counted as one collective receptor per separated area.

**Sporting Fields** – One receptor should be counted for individual seating areas at each formalized sporting field. Less formalized activity areas such as grassy areas of a park or recreation area, which is commonly utilized for informal sporting activity, should be counted as one receptor per area.

**Golf Courses** – One receptor should be placed at each hole (tee-off areas or fairway-green combination) of the golf course that best represents the worst expected traffic noise condition for that hole. Other formal outdoor activity areas that exist within the golf course, such as practice areas, outdoor restaurants, etc., should be evaluated with a separate receptor.

**Jurisdictionally Controlled Forests & Other Areas Officially Managed for Outdoor Recreational Activity** – Jurisdictionally managed controlled areas are federal lands that have a management plan including defined outdoor activity use. Receptors should be located within the activity managed area boundary for each identified management area that defines outdoor activity areas. If the management area has no discernable activity areas (trails, camping facilities, picnic areas, etc.) as defined within this section, a minimum of one generalized receptor should be placed no closer than 50 feet from the edge of pavement within the management area that best represents the worst expected traffic noise condition, based on professional judgement.

**Trails/Trail Crossings** – One (1) receptor should be counted for each formal trail crossing regardless of the pathway orientation. The receptor should be placed no closer than 50 feet from the edge of pavement on the trail that best represents the worst expected traffic noise condition.

**Cemetery** – One receptor should be counted for each area of formalized memorial gathering facility. Individual grave sites, access ways and informal activity areas are not considered sensitive receptors; however, each section of the cemetery as defined through consultation with the operator, which may have informal gathering areas, should be assigned one receptor. If there are no formalized or operator defined informal

gathering areas, a generalized receptor should be placed within the property that best represents the worst expected traffic noise condition.

**Section 4(f) Sites** – Section 4(f) sites encompass three types of sites: parks and recreation areas, wildlife refuges and historic sites.

- Parks & Recreation Areas – addressed above.
- Wildlife Refuges – Wildlife or waterfowl refuges typically have limited or no human activity area and would therefore not be subject to noise analysis. However, on-site trails or observation areas should be treated under NAC Activity Category C as defined in this section.
- Historic Sites – For historic sites that have exterior areas with frequent human use (historic houses), one receptor should be counted for each site with such use. For historic sites without frequent human use, no noise analysis is necessary.

If no outside areas of frequent human use are present on an Activity Category C land use, no further noise analysis is required. Documentation of this finding shall be placed in the project file.

**ACTIVITY CATEGORY D:** An indoor analysis shall be conducted only after all outdoor analysis options have been exhausted and after a determination has been made that exterior abatement measures will not be feasible or reasonable.

If interior noise levels will be analyzed, a visual inspection of the building construction should be conducted to estimate the noise reduction provided by the building structure. The building noise reduction estimate should be based on the building noise reduction factors found in Table 6 of the FHWA *Highway Traffic Noise: Analysis and Abatement Guidance, June 2010*. It is assumed that windows will be closed in buildings with air conditioning. The estimated building noise reduction factor is subtracted from the predicted design year noise level at the building façade to determine if the interior noise level is likely to approach or exceed the interior NAC. If it has been determined that an interior noise analysis should continue, one receptor should be placed at each interior area of frequent human use closest to the noise source.

If no interior areas of frequent human use are present in the building, further noise analysis is not required. Documentation of this finding shall be placed in the project file.

**ACTIVITY CATEGORY E:** When determining traffic noise impacts for Activity Category E developed lands, primary consideration will be given to exterior areas of frequent human use. Receptors should be placed at an outside activity area that best represents the worst expected traffic noise condition. Care should be taken to prevent shielding by objects or buildings. If no exterior areas of frequent human use are present on a Category E land use, no further noise analysis is required. Documentation of this finding shall be placed in the project file.

**ACTIVITY CATEGORY F:** No highway noise analysis is required for Category F land uses under 23 CFR 772.

**ACTIVITY CATEGORY G:** 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 appropriate for the permitted type of development.

For land that is not permitted for development by the date of public knowledge, the SDDOT will provide information to local officials within whose jurisdiction the Type I highway project is located, as described in Section 14 of this document. The information provided to local officials shall be documented in the project file. Noise abatement for such lands will not be eligible for federal-aid participation.

### APPENDIX 3: STATEMENT OF LIKELIHOOD EXAMPLE

**PROJECT \_\_\_\_\_ PCN \_\_\_\_\_ COUNTY**

Project location

Description of work

Based on noise analysis conducted thus far, the SDDOT intends to install highway traffic noise abatement measures in the form of (identify type of abatement measure) at the following location(s) along the project:

\_\_\_\_\_ .

These preliminary indications of likely abatement measures are based on preliminary design for a barrier cost of \$\_\_\_\_\_ which will reduce the noise level by \_\_\_ dB(A) for \_\_\_ residences. If it subsequently develops during final design that these conditions have substantially changed, the abatement measures might not be provided. A final decision of the installation of noise abatement measure(s) will be made upon completion of the project's final design and the public involvement processes.