MDOT Highway Noise Analysis and Abatement Handbook

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APPENDIX A – GLOSSARY

The majority of the definitions that follow are taken directly from 23 CFR 772.5. Definitions proceeded by an asterisk (*) are added by MDOT.

B

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

C

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

***Context Sensitive Solutions**: A collaborative, interdisciplinary approach involving stakeholders for the development of a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, cultural, and environmental resources, while maintaining safety and mobility.

D

Date of Public Knowledge: The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR 771.

***dB(A)**: The unit of measurement for sound level (loudness) on an A-weighted logarithmic scale, that is, adjusted to closely match what humans hear.

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

***Dwelling Unit**: Any room or set of rooms used as a living space by one or more persons. One dwelling unit is counted as a single receptor.

***Dwelling Unit Equivalent**: The receptor count for public use areas such as parks, schools, libraries, and churches. Appendix D details how dwelling unit equivalents are counted.

E

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

F

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

I

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

L

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

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

M

Multi-family Dwelling: A residential structure containing more than one residence. Each residence in a multi-family dwelling shall be counted as one receptor when determining impacted and benefited receptors.

N

***Noise Abatement Criteria (NAC)**: Federal Highway Administration's (FHWA) classification of absolute values in relationship to land use which, when approached or exceeded, require the consideration of highway traffic noise abatement measures.

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

Noise Reduction Design Goal: The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement.

P

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

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

R

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

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

Residence: A dwelling unit. Either a single family residence or each dwelling unit in a multi-family dwelling.

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S

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

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

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

***Substantial noise change:** A 10 dB(A) increase or decrease of the existing level of a traffic noise level as compared to the design year traffic noise level.

T

Traffic Noise Impacts: Design year build condition noise levels that approach, (equal to one dB(A) less than the NAC), or exceed the NAC level for the future build condition; or design year build noise levels that create a substantial noise increase over the existing noise level.

Type I Project:

1. The construction of a highway on a new location; or,
2. The physical alteration of an existing highway where there is either:
    a. Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition and the future build condition; or,
    b. Substantial Vertical Alteration. A project that removes shielding therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment or the highway or by altering the topography between the highway traffic noise source and the receptor; or,
3. The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a high-occupancy vehicle (HOV) lane, high-occupancy toll (HOT) lane, bus lane, or truck climbing land; or,
4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,
5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,
6. Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,
7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.
8. If a project is determined to be a Type I project per 23 CFR772.5 then the entire project area as defined in the environmental document is a Type I project.

Type II Projects: A Federal or Federal-aided highway project for noise abatement on an existing highway. A state's participation is not mandatory and may choose not to implement a Type II program.

Type III Projects: A Federal or Federal-aided highway project that does not meet the classification of a Type I or Type II project. Type III projects do not require a noise analysis.

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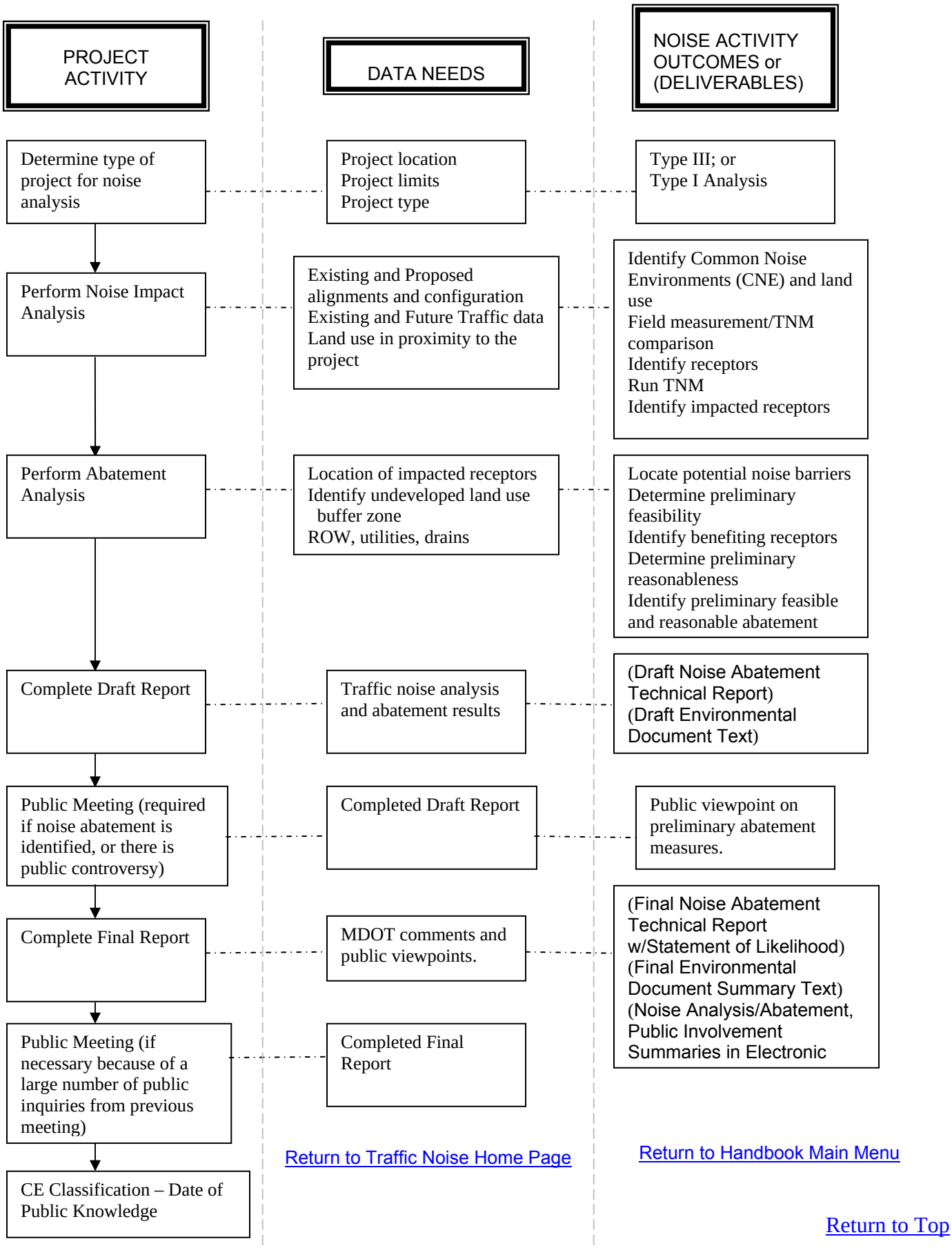
APPENDIX B - Categorical Exclusion Noise Analysis Process Flowchart

Classification



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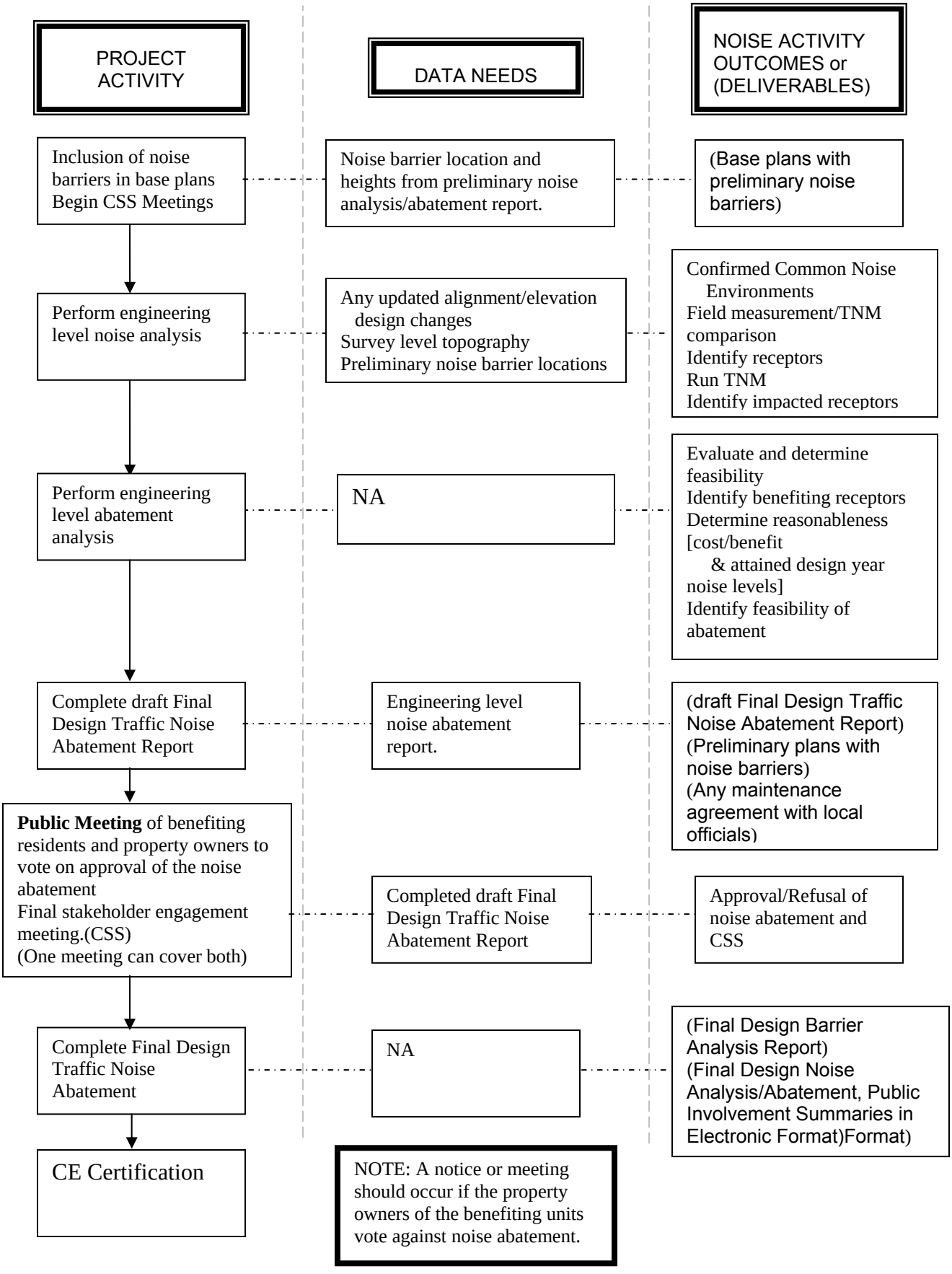
Certification



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APPENDIX C - Type II Project Rules and Procedures

The Type II noise abatement program is a voluntary federal aid program in which the Michigan Department of Transportation (MDOT) participates. MDOT Commission Policy on Noise Abatement, #10136 (July 31, 2003), states:

> "MDOT will construct Type II noise barriers only in the years when MDOT's Road and Bridge Program, excluding maintenance, exceeds $1.0 billion, adjusted to the Consumer Price Index (CPI) using 2002 as the base year. MDOT will not spend more than one half of one percent of the budget on noise barriers. MDOT will give priority to those communities where the freeway was constructed through an existing neighborhood and 80 percent or more of the existing residential units were there prior to the construction of the freeway. Communities must make application to MDOT and provide a local match of 10 percent of the cost of the noise barrier."

Noise abatement must meet feasibility and reasonableness; the same as with Type I noise abatement, plus:

- eighty percent of the dwelling units within 500 feet of a limited access highway preceded the highway or the last major capacity improvement approved before November 28,1995,
- zoning and building regulations are in place to preclude future noise abatement needs,
- Type I noise abatement analysis from a previous study did not find abatement to be unfeasible or unreasonable, and
- the government entity in which the abatement is located must provide 10% of the total construction cost - due at the time of construction.

The process begins when a local government agency completes an application for a Type II noise abatement measure for the upcoming fiscal year. The application form, along with instructions for completing it, is available on the web at http://mdotwas1.mdot.state.mi.us/public/webforms/public/1871.pdf. The deadline for submitting the application and for which fiscal year it will apply is indicated on the form. A new application must be submitted each fiscal year. MDOT will follow 23 CFR 772, FHWA guidance, and the rules and procedure in this Handbook in conducting the noise abatement analysis. The remaining process and additional requirements for Type II follow.

1. A scoping of the area will be conducted by MDOT in the area described in the application to verify land use and identify the common noise environment.
2. MDOT will conduct a traffic noise impact and abatement analyses which will provide preliminary costs of the abatement. The noise abatement analysis report will be provided to the local authorities.
3. MDOT will prioritize the fiscal year's Type II noise abatement project based on the following formula:

$$\frac{\text{dB(A) above the NAC (Table 1)} \times \text{\# of impacted dwelling units}}{\text{Total Preliminary Cost}/\$100{,}000}$$

4. MDOT will develop noise abatement through the Preliminary Engineering Phase (PE) based on the priority list and available funding. An engineering level abatement analysis and context sensitive design public meeting will be held during the PE Phase. Also, a more accurate assessment of the noise abatement's feasibility and reasonableness will be determined during this phase.
5. All noise abatement will follow MDOT design standards. Noise abatement will be provided along the shoulder only where a roadside barrier would other wise be present.

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6. MDOT will maintain the structural integrity of the noise abatement structure and will be responsible for the aesthetic condition of the structure on the freeway side only. MDOT will conduct discussions with local authorities on developing a maintenance or easement agreement for structural and aesthetic maintenance on the residential side of the structure, or on both sides when the structure is on the residential side of a service road that is not MDOT property.
7. During the PE Phase local authorities must agree, through agreements, resolutions, and/or ordinances, to provide:
    - Ten percent of the construction cost of the noise abatement at the time of construction
    - Aesthetic maintenance on the residential side of the structure, or on both sides when the structure is on the residential side of a service road.
    - Structural maintenance after five years when the structure is on the residential side of a service road.
8. Public involvement is an important aspect of the noise abatement reasonableness determination. A majority of the benefiting residents and property owners must in favor of the abatement as a reasonableness condition. This meeting should be held after a draft of the PE noise abatement analysis report is complete.
9. The Context Sensitive Solutions process invites input from all stakeholders in the aesthetics and structural elements of the noise barrier. The CSS process ensures that all state and federal requirements and regulations are followed and communicated to the public as part of stakeholder engagement. Acoustic characteristics as determined in the noise abatement analysis of the noise barrier will not be modified or compromised as a result of stakeholder engagement activities.
10. A hardcopy and electronic copy of a Final Type II Noise Abatement Report which includes the data and information regarding the noise analysis, abatement, and public involvement for the Type II abatement will be provided to local officials, the Region or TSC, and Lansing Office.

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APPENDIX D – Activity Categories C, D and E Quantitative Procedures

Activity Categories C includes the exterior areas of a variety of nonresidential land use not specifically covered in Category A or B. See Table 1, page 10 for the listing of the land uses. A quantification procedure to help determine the reasonableness of providing mitigation for the area has been developed (see the example at the end of this section). This quantification procedure is designed to more equitably assess special land use areas and provide a standard method of evaluation. Consult with Lansing Office and the Region or Transportation Service Center (TSC) for any questions on this procedure.

MDOT's method determines the number of receptors and dwelling unit equivalents (DUE) by dividing up the special use area based on the typical square footage of the lot size of the communities adjacent to the project. The DUE is used in the cost effectiveness portion for reasonableness determination. The process follows:

- Identify the Common Noise Environment (CNE) typical residential lot size in square feet (ft^2) in the adjacent or nearest residential development within a reasonable distance.
- Use TNM to determine noise impacts and the depth of the impact into the area.
- Calculate the noise impacted area of frequent human use activity within the activity area.
- Calculate and divide the area within the activity area receiving the noise impact by the typical residential square footage.
- The resulting number is the number of benefiting dwelling unit equivalents to include in the reasonableness determination.

The section of a park that is wooded or open and is without evidence of frequent human use activity should be subtracted from the total noise impacted area and not used in the area calculation for the number of dwelling unit equivalents for the reasonableness determination.

Linear parks that parallel the highway will be divided using the average frontage of an adjacent residential development even if the park is not as deep as the average residential lot. One receptor will represent each "lot" and will count as one (1) dwelling unit equivalent in the reasonableness determination.

NOTE –*Concentrated Exterior Activity Areas in Category C*

Exterior activity areas where large groups congregate in a relatively small area (e.g., a pool, amphitheater, skate park, or ball diamond) should use the formula for Activity Category D to determine the DUE.

Example: The typical lot size in the adjacent or nearest residential development is 60'x120' or 7,200 square feet (ft^2). Noise modeling predicts noise impacts from the project to a distance of 350'. A park in the community is adjacent to the project and has 1000' of frontage. The total impacted area of the park is 350,000 ft^2. Divide this by the typical lot size of 7,200 ft^2 for an equivalent number of receivers equal to 48.6. The park is representative of 49 receivers.

Activity Category E includes hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F, will evaluate the DUE of Category E receptors using methodologies consistent with the methodologies use to evaluate Category C receptors.

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Activity Category D includes interior space of some facilities from Category C. See Table 1, page 10 for the listing of the facilities. The following formula is used to aid in calculating the dwelling unit equivalent (DUE) and is meant to take in account the intensity and frequency of use:

Dwelling Unit Equivalent (DUE) = # Occupants ÷ (Average persons per household) x Usage

 # Occupants = # People (Facility's capacity limit, number of students, employees and/or visitors).
Average persons per household = 3 (2000 Census State average person per household rounded up)
Usage = # of Daily Hours Used ÷ 24 [Hours per day] x # Days Used per Year ÷ 365 [Days per Year] (or # Days Used per Week ÷ 7 [Days per Week] for a year around operation)

Examples:

Civic auditorium has a capacity of 1200 with an average time of events lasting 6 hours 70 days in a year.

DUE = 1200 ÷ 3 x (6 ÷ 24 x 70 ÷ 365)
DUE = 1200 ÷ 3 x .0479
DUE = 19.16 (20 rounded up)

Medical office that is open 6 days a week from 8am to 9pm that has 8 employees and averages 52 visitors a day.

DUE = 60 ÷ 3 x (13 ÷ 24 x 6 ÷ 7)
DUE = 60 ÷ 3 x .4643
DUE = 9.286 (10 rounded up)

Outdoor pool with a 300 person capacity limit and is open everyday from Memorial Day to Labor Day, 9am – 10pm.

DUE = 300 ÷ 3 x (13 ÷ 24 x 102 ÷ 365)
DUE = 300 ÷ 3 x 0.1514
DUE = 15.14 (15 rounded up)

Amphitheater with a 1000 person capacity limit with a 4 hour performance every Thursday through Sunday evening from Memorial Day to Labor Day.

DUE = 1000 ÷ 3 x (4 ÷ 24 x 56 ÷ 365)
DUE = 1000 ÷ 3 x 0.0256
DUE = 8.53 (9 rounded up)

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APPENDIX E - Highway Traffic Induced Vibration

There are no Federal requirements directed specifically to highway traffic induced vibration. All studies the highway agencies have done to assess the impact of operational traffic induced vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. In fact, normal living activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic. Address vibration concerns on a case-by-case basis as deemed appropriate in the noise analysis or in standalone vibration analysis report. The following is the contact information regarding vibration:

Michigan Department of Transportation
Structural Investigations
Secondary Complex
8885 Ricks Rd
P.O. Box 30049
Lansing, MI 48909
(517) 322-5707Page intentionally left blank

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APPENDIX F – Noise Abatement Details Form (MDOT Intranet fill-in form: 1697)

PROJECT NOISE ABATEMENT DETAILS FORM

	DATE:
JOB NUMBER:	PROJECT NAME:
PROJECT MANAGER:	TYPE I ____ TYPE II ____
NEPA CLASSIFICATION (CIRCLE ONE): CE EA EIS	FHWA APPROVAL DATE*:

PROJECT LOCATION

REGION:	TSC:		
COUNTY:	CITY:		
ROUTE:	CONTROL SECTION:	BMP:	EMP:

All Analyzed Abatement Measures **(F/R = Feasible & Reasonable, CNE = Common Noise Environment)**

CNE ID	BARRIER ID	F/R (Y/N)	CNE ID	BARRIER ID	F/R (Y/N)	CNE ID	BARRIER ID	F/R (Y/N)

Fill out the following **COMMON NOISE ENVIRONMENT (CNE) INFORMATION** form; one for each CNE

Public meeting dates, locations and number of attendees:

Dates	Location	# of Attendees

SIGNATURES

Project Manager:	DATE:
Lansing Office Rep**:	DATE:
Noise Report Preparer and Firm:	DATE:

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* CE approval, FONSI, or ROD - becomes the Date of Public Knowledge

** Traffic Noise Abatement Specialist or Traffic Noise Engineering Technician

COMMON NOISE ENVIRONMENT (CNE) INFORMATION

JOB NUMBER:	CNE ID:	
LOCATION DESCRIPTION:		
CONTROL SECTION:	BMP:	EMP:
NAC CATEGORY(IES):	NUMBER OF IMPACTED RECEPTORS:	
HIGH/AVERAGE dB(A):	NUMBER WITH HIGHEST dB(A):	

____ No noise abatement required

NOTE: For a CNE that includes undeveloped land, attach a graphic showing the potential noise impacted buffer zone.

Abatement Measure(s) used (detailed in Section 3.2 of Handbook), check all that apply:

____ Construction of noise barriers (Number of barriers = ____)

If a noise barrier (wall, berm, or combination) is the chosen abatement measure, fill out the following **Noise Abatement Description** form; one for each barrier if there are multiple barriers in one CNE.

Attach graphics showing the plan and elevation views of the barrier. The plan view should include the location of the impacted and benefiting receptors, and any obtained ROW. The elevation view should, if possible, include any features or texturing.

____ Traffic management measures*

____ Alteration of horizontal and vertical alignments*

____ Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone.*

____ Noise insulation of Activity Category D land use facilities*

* Provide details in the space at the bottom of this page (include type of measure, general location description, decibel reduction, any costs, and any other pertinent information)

Details of other abatement measures

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NOISE BARRIER DESCRIPTION

JOB NUMBER:	CNE ID:	BARRIER ID:	INVENTORY ID* :

* Filled in by C&T Noise Technician

Feasibility

Percent of impacted receptors with 5dB(A) reduction: _____ (≥75)

Significant Safety or Construction concerns: _____No _____ Yes _____ Yes, but resolvable (If either yes, attach an explanation of problem and the resolution, if applicable)

Significant Utility or Drainage concerns: _____No _____ Yes _____ Yes, but resolvable (If either yes, attach an explanation of problem and the resolution, if applicable)

Reasonableness

Percent of benefiting property owners and residents in favor of abatement: _____ (≥50)

Number of receptors receiving a 10 dB(A) reduction: _____ (≥1)

Percent of receptors receiving a 7 dB(A) reduction: _____ (≥50)

Cost per benefiting receptor unit: _____

Is the abatement Feasible and Reasonable? _____ Yes _____ No

As Built Abatement Specifics

NAC CATEGORY(IES) PROTECTED:			YEAR OF CONSTRUCTION:	
BARRIER LOCATION	ROUTE:	CS:	BMP:	EMP:

Average distance from edge of pavement: _____

Additional ROW required? ____No _____Yes (If yes, specify on attached graphic) ROW cost: _____

BARRIER DIMENSIONS	AVE HEIGHT:	LENGTH:	AREA (SINGLE FACE):
FOUNDATION TYPE:			MATERIALS USED:
FINAL COST	OVERALL COST:	UNIT COST PER FT^2:	

Average insertion loss/noise reduction (by model) _____ dB(A)

Features (absorptive, surface texture, color, design, etc.…)

_____

_____

_____

_____

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APPENDIX G - Consultant Noise Abatement Analysis Activities and Deliverables

The consultant noise abatement analysis activities and deliverables are presented here in summary form. The process of the noise abatement analysis and its deliverables are presented within this Handbook. However, consultation with the appropriate Michigan Department of Transportation (MDOT) personnel involved in the project will occur to define the details of the analysis and extent of the deliverables as they relate to the specific project. The Early Preliminary Engineering (EPE) and Preliminary Engineering (PE) Phases entail different but progressive elements for noise abatement determination. Chapter 7.0 *STEP 7 – Reporting Results of Highway Traffic Noise Analyses* provides guidance on the documentation.

The noise analysis will be conducted in compliance with 23 Code of Federal Regulations (CFR) Part 772, the National Environmental Policy Act (NEPA), Federal Highway Administration (FHWA) *Highway Traffic Noise: Analysis and Abatement Guidance*, January 2011, and the rules and procedures as defined in this Handbook.

Early Preliminary Engineering (EPE) Phase

Activities:

1. Conduct noise analysis as part of the environmental clearance for preliminary determination on noise abatement.
    a. Prepare all necessary documentation in hardcopy and electronic formats.
2. Conduct or participate (depending on whether prime or sub) in a public information meeting; this includes but not limited to mailings, press releases, presentations, graphics; the gathering and documenting of public comments.
    a. Noise abatement analyses and deliverables for Environmental Assessments (EA) or Environmental Impact Statements (EIS) are typically included with other environmental factors during document review and public involvement.
    b. Noise abatement analysis for a Categorical Exclusion (CE) will call for the noise abatement analysis specific public involvement.

Deliverables:

1. Draft and Final *Noise Abatement Analysis Report*s
    a. Relevant text and graphics within environmental document sections
2. Public involvement materials (hardcopy)
    a. Mailings, press releases, presentations, graphics, public comments and MDOT responses
3. EPE noise abatement analysis data in electronic format
    a. Final noise abatement analysis report
    b. Relevant environment document sections and graphics
    c. TNM data inputs and outputs
    d. Public involvement press releases, presentations, and graphic boards
    e. Any noise abatement related public comments and MDOT responses

NOTE – If no feasible or reasonable noise abatement is identified in the EPE Phase then the results are recorded in the environmental document and no noise analysis is conducted in the PE Phase.

Preliminary Engineering (PE) Phase

Activities:

1. Conduct an engineering level of noise abatement analysis using data based on the findings from EPE Phase (topography, utilities, geotechnical, drainage, etc.).
    a. Prepare all necessary documentation in hardcopy and electronic formats.
2. Conduct or participate (depending on whether prime or sub) in public meetings; this includes but not limited to mailings, press releases, presentations, graphics; the gathering and documenting of public comments; ballot distribution, collection and tabulation. There are a minimum of two meetings:
    a. Benefiting property owners only vote on noise abatement,
    b. Stakeholders (affected property and community officials) viewpoint and aesthetics (part of the CSS process)
3. Conduct/Participate in the Context Sensitive Solution/Design process for noise abatement in coordination with the MDOT Roadside Development Unit.
4. Participate in the final determination on noise abatement based on the analysis and public involvement processes.

Deliverables:

1. Draft and Final *Final Design Highway Traffic Noise Report*s
2. Public involvement materials (hardcopy)
    a. Mailings, press releases, presentations, graphics; public comments and MDOT responses; public meeting sign-in sheets; ballots and voting results
    b. 3-D computer graphic renderings of noise abatement (prefer photorealistic)
3. Final Design Noise abatement analysis data in electronic format
    a. Final Design Highway Traffic Noise Report
    b. TNM data inputs and outputs
    c. Public involvement press releases, presentations, and graphic boards
    d. Noise abatement related public comments and MDOT responses
    e. Public meeting sign-in sheets

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APPENDIX H

MDOT 3903 (3/98)		Page 1 OF 2	
MDOT Michigan Department of Transportation	**COMMISSION POLICY**	IDENTIFIER: 10136	EFFECTIVE DATE: July 31, 2003
		SUPERCEDES DATED: July 19, 2002	
RESPONSIBLE OGANIZATION: Executive Bureau			
SUBJECT: Noise Abatement			

Federal environmental regulation 23 CFR 772 defines two types of projects. Type I is "a proposed federal or federal-aid highway project for the construction of a highway on new location or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes" (23 CFR 772.5[h]). If noise impacts are identified, noise abatement measures must be considered and implemented where reasonable and feasible. The Michigan Department of Transportation (MDOT) follows all Federal laws, regulations, and guidelines for Type I noise abatement.

Type II, or voluntary, abatement is a proposed federal or federal-aid highway project for noise abatement on an existing highway.

This policy addresses Type II noise abatement to limit the intrusion of highway noise into adjacent residential areas to reasonably achievable levels consistent with the U.S. Department of Transportation's Code of Federal Regulations (CFR), and taking into consideration MDOT's life-cycle cost analysis and safety requirements, as well as other technical and financial implications. To achieve this objective the Michigan State Transportation Commission (Commission) supports the following four approaches to alleviate traffic noise impacts:

1. ***Reduction of Noise at the Source***. Reduction of traffic noise by design or treatment of the road surface is the most cost-effective noise control available to MDOT. Within the group of noise abatements that are reasonable and feasible under 23 CFR 772, and after MDOT's life-cycle cost analysis has selected a pavement type and other technical and financial constraints, MDOT will use the quietest surface texture available when repaving/reconstructing a freeway in residential areas.

2. ***Noise Abatement***. MDOT will attempt to locate, design, construct and operate state highways to minimize the intrusion of traffic noise into adjacent areas. When noise impacts occur, they may be attenuated by the most reasonable and prudent means.

   MDOT will construct Type II sound walls only in years when MDOT's Road and Bridge Program, excluding maintenance, exceeds $1.0 billion, adjusted to the Consumer Price Index (CPI) using 2002 as the base year. MDOT will not spend more than one half of one percent of the budget on sound walls. MDOT will give priority to those communities where the freeway was constructed through an existing neighborhood and where 80 percent or more of the existing residential units were there prior to the construction of the freeway. Communities must make application to MDOT and provide a local match of 10 percent of the cost of the sound wall.

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3. ***Encouraging Compatible Adjacent Land Use***. Cities and counties have the power to control development by adoption of land-use plans and zoning, and by subdivision, building or housing regulations. The Commission encourages those who plan and develop land, and local governments controlling development or planning land use near known freeway locations, to exercise their powers and responsibility to minimize the effect of highway vehicle noise through appropriate land-use control. Where such land-use regulations are not in place, cities, townships and counties will not be eligible for MDOT noise mitigation assistance.

4. ***Noise Abatement by Others***. The Commission encourages developers and local governments to coordinate their efforts to mitigate highway noise. This effort must be done without encroachment of MDOT's property right-of-way unless it is determined to be necessary, and authority granted to permit others to construct a sound barrier in the state's right-of-way. The barrier's design must meet MDOT's geometric, structural, safety and maintenance standards. MDOT shall assume no review authority or responsibility of any kind for the structural integrity or the effectiveness of a sound barrier constructed by others.

MDOT will monitor noise mitigation best practices in other states and provide an activity report to the Commission annually.

The Department shall develop instructions for the implementation of this policy.
Adopted by the Michigan State Transportation Commission on July 31, 2003.

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APPENDIX I - 23 CFR PART 772--Procedures for Abatement of Highway Traffic Noise and Construction Noise

SECTIONS

772.1 Purpose.

772.3 Noise standards.

772.5 Definitions.

772.7 Applicability.

772.9 Traffic noise prediction.

772.11 Analysis of traffic noise impacts.

772.13 Analysis of noise abatement.

772.15 Federal participation.

772.17 Information for local officials.

772.19 Construction noise.

Table 1 to Part 772--Noise Abatement Criteria

Authority: 23 U.S.C. 109(h) and (i); 42 U.S.C. 4331, 4332; sec. 339(b), Pub. L. 104-59, 109 Stat. 568, 605; 49 CFR 1.48(b).

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Sec. 772.1 Purpose.

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

Sec. 772.3 Noise Standards.

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

Sec. 772.5 Definitions.

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

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

Date of Public Knowledge. The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR part 771.

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

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

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

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

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

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

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

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

Noise Reduction Design Goal. The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. The noise reduction design goal shall be at least 7 dB(A), but not more than 10 dB(A).

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

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

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

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

Residence. A dwelling unit. Either a single family residence or each dwelling unit in a multi-family dwelling.

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

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

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

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

Type I Project.

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

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

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

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

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

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

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

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

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

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

Type II Project. A Federal or Federal-aid highway project for noise abatement on an existing highway. For a Type II project to be eligible for Federal-aid funding, the highway agency must develop and implement a Type II program in accordance with section 772.7(e).

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

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Sec. 772.7 Applicability.

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

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

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

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

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

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

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

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

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Sec. 772.9 Traffic noise prediction.

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

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

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

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

Sec. 772.11 Analysis of traffic noise impacts.

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

(1) For projects on new alignments, determine traffic noise impacts by field measurements.

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

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

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

(1) Each alternative under detailed study;

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

(i) Activity Category A. This activity category includes the exterior impact criteria for lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential for the area to continue to serve its intended purpose. Highway agencies shall submit justifications to the FHWA on a case-by-case basis for approval of an Activity Category A designation.

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

(iii) Activity Category C. This activity category includes the exterior impact criteria for a variety of land use facilities. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.
(iv) Activity Category D. This activity category includes the interior impact criteria for certain land use facilities listed in Activity Category C that may have interior uses. A highway agency shall conduct an indoor analysis after a determination is made that exterior abatement measures will not be feasible and reasonable. An indoor analysis shall only be done after exhausting all outdoor analysis options. In situations where no exterior activities are to be affected by the traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities, the highway agency shall use Activity Category D as the basis of determining noise impacts. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.
(v) Activity Category E. This activity category includes the exterior impact criteria for developed lands that are less sensitive to highway noise. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.
(vi) Activity Category F. This activity category includes developed lands that are not sensitive to highway traffic noise. There is no impact criteria for the land use facilities in this activity category and no analysis of noise impacts is required.
(vii) Activity Category G. This activity includes undeveloped lands.
(A) A highway agency shall determine if undeveloped land is permitted for development. The milestone and its associated date for acknowledging when undeveloped land is considered permitted shall be the date of issuance of a building permit by the local jurisdiction or by the appropriate governing entity.
(B) If undeveloped land is determined to be permitted, then the highway agency shall assign the land to the appropriate Activity Category and analyze it in the same manner as developed lands in that Activity Category.
(C) If undeveloped land is not permitted for development by the date of public knowledge, the highway agency shall determine noise levels in accordance with 772.17(a) and document the results in the project's environmental clearance documents and noise analysis documents. Federal participation in noise abatement measures will not be considered for lands that are not permitted by the date of public knowledge.

(d) The analysis of traffic noise impacts shall include:
(1) Identification of existing activities, developed lands, and undeveloped lands, which may be affected by noise from the highway;
(2) For projects on new or existing alignments, validate predicted noise level through comparison between measured and predicted levels;
(3) Measurement of noise levels. Use an ANSI Type I or Type II integrating sound level meter;
(4) Identification of project limits to determine all traffic noise impacts for the design year for the build alternative. For Type II projects, traffic noise impacts shall be determined from current year conditions;

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

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

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

Sec. 772.13 Analysis of noise abatement.

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

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

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

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

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

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

(1) Feasibility:

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

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

(2) Reasonableness:

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

(ii) Cost effectiveness of the highway traffic noise abatement measures. Each highway agency shall determine, and receive FHWA approval for, the allowable cost of abatement by determining a baseline cost reasonableness value. This determination may include the actual construction cost of noise abatement, cost per square foot of abatement, the maximum square footage of abatement/benefited receptor and either the cost/benefited receptor or cost/benefited receptor/dB(A) reduction. The highway agency shall re-analyze the allowable cost for abatement on a regular interval, not to exceed 5 years. A highway agency has the option of justifying, for FHWA approval, different cost allowances for a particular geographic area(s) within the State, however, the highway agency must use the same cost reasonableness/construction cost ratio statewide.

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

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

(v) In addition to the required reasonableness factors listed in Sec. 772.13(d)(5)(i), (ii), and (iii), a highway agency has the option to also include the following reasonableness factors: Date of development, length of time receivers have been exposed to highway traffic noise impacts, exposure to higher absolute highway traffic noise levels, changes between existing and future build conditions, percentage of mixed zoning development, and use of noise compatible planning concepts by the local government. No single optional reasonableness factor can be used to determine reasonableness.

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

(f) Abatement Measure Reporting: Each highway agency shall maintain an inventory of all constructed noise abatement measures. The inventory shall include the following parameters: type of abatement; cost (overall cost, unit cost per/sq. ft.); average height; length; area; location (State, county, city, route); year of construction; average insertion loss/noise reduction as reported by the model in the noise analysis; NAC category(s) protected; material(s) used (precast concrete, berm, block, cast in place concrete, brick, metal, wood, fiberglass, combination, plastic (transparent, opaque, other); features (absorptive, reflective, surface texture); foundation (ground mounted, on structure); project type (Type I, Type II, and optional project types such as State funded, county funded, tollway/turnpike funded, other, unknown). The FHWA will collect this information, in accordance with OMB's Information Collection requirements.

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

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

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

(3) Documentation of highway traffic noise abatement: The environmental document shall identify locations where noise impacts are predicted to occur, where noise abatement is feasible and reasonable, and locations with impacts that have no feasible or reasonable noise abatement alternative. For environmental clearance, this analysis shall be completed to the extent that design information on the alterative(s) under study in the environmental document is available at the time the environmental clearance document is completed. A statement of likelihood shall be included in the environmental document since feasibility and reasonableness determinations may change due to changes in project design after approval of the environmental document. The statement of likelihood shall include the preliminary location and physical description of noise abatement measures determined feasible and reasonable in the preliminary analysis. The statement of likelihood shall also indicate that final recommendations on the construction of an abatement measure(s) is determined during the completion of the project's final design and the public involvement processes.

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

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

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

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

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Sec. 772.15 Federal participation.

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

(1) Traffic noise impacts have been identified; and

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

(b) For Type II projects.

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

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

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

(c) Noise Abatement Measures. The following noise abatement measures may be considered for incorporation into a Type I or Type II project to reduce traffic noise impacts. The costs of such measures may be included in Federal-aid participating project costs with the Federal share being the same as that for the system on which the project is located.

(1) Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.

(2) Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.

(3) Alteration of horizontal and vertical alignments.

(4) Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type I projects only.

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

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Sec. 772.17 Information for local officials.

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

(1) Noise compatible planning concepts;

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

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

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

Sec. 772.19 Construction noise.

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

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

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

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

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