
MICHIGAN DEPARTMENT OF TRANSPORTATION HIGHWAY NOISE ANALYSIS AND ABATEMENT HANDBOOK

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Introduction

I.1 Purpose of Handbook

This Handbook is in compliance with the Michigan State Transportation Commission's Policy on Noise Abatement (#10136) and supersedes the Michigan Department of Transportation's (MDOT) *Procedures and Rules for Implementation of State Transportation Commission Policy 10136 Noise Abatement*, dated July 31, 2003. This Handbook provides policy, procedures and guidance regarding highway traffic noise impact assessment, analysis, and reporting for Type I and Type II highway projects through the Early Preliminary Engineering Phase (EPE), where Environmental Clearance is done in accordance with the National Environmental Policy Act (NEPA) of 1969, and Preliminary Engineering (PE) Phase, where design is done.

Highway traffic noise impact analysis, abatement procedures, criteria, coordination requirements, and reporting guidance contained herein are based on the Federal Highway Administration's (FHWA) Title 23 Code of Federal Regulations, Part 772 (23 CFR 772), July 13, 2010 (see Appendix I). All transportation improvement projects developed in conformance with MDOT's guidelines shall be in conformance with those mandated by FHWA. This Handbook implements the requirements of 23 CFR 772 to Federal projects authorized under 23 USC throughout the State of Michigan.

I.2 Organization of Handbook

MDOT's procedure for assessing and analyzing the noise impacts of Type I and Type II projects is outlined in the 7-Step process listed below.

- Step 1 – Initial Project Level Scoping and Determining the Appropriate Level of Noise Analysis
- Step 2 – Noise Analysis Initial Procedures
- Step 3 – Determining Highway Traffic Noise Impacts and Establishing Abatement Requirements
- Step 4 – Additional Considerations for Final Design Noise Barrier Analysis
- Step 5 – Construction Noise Consideration
- Step 6 – Public, Municipality, and Agency Involvement
- Step 7 – Reporting Results of Highway Traffic Noise Analysis

These steps are for organizational purposes only and are intended to illustrate the progression that is undertaken when conducting Type I and Type II projects through the project development stages for transportation improvement projects.

NOTE – *Applicable Early Preliminary Engineering and Preliminary Engineering Steps:*

Step 1 should occur when the Type I, Type II or Type III project is initially identified. The applicable sections of Step 2 through Step 7 should be addressed during both the Early Preliminary Engineering (EPE) Phase and the Preliminary Engineering (PE) Phase of a proposed transportation improvement project. Attention should be given to any changes that occurred in the project area between the time the environmental clearance document was approved and the completion of final design activities. When federal funds are associated with the project, coordination with FHWA should occur throughout the project's development.

I.3 Policy Statements

MDOT follows all Federal laws, regulations, and guidance for highway noise abatement. The Michigan State Transportation Commission Policy (10136) (Appendix H) addresses MDOT's commitment. This Handbook details activity in Type I and Type II noise abatement to limit 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 pavement life-cycle cost analysis and safety requirements, as well as other technical and financial implications. The Michigan State Transportation Commission supports four approaches to achieve this objective to alleviate traffic noise impacts summarized in the following:

- **Reduction of Noise at the Source** – Reduction of potential traffic noise by design to avoid areas of sensitive receivers, or through available treatment, if any, of the chosen road surface type are the most cost-effective noise controls available to MDOT.
- **Noise Abatement** - When noise impacts are identified through the NEPA process, feasible and reasonable noise abatement measures shall be incorporated into the project. Use of road surface treatment is not an acceptable noise abatement measure and is not eligible for Federal-aid participation
- **Encouraging Compatible Adjacent Land Use** - 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.
- **Noise Abatement by Others** - The Commission encourages developers and local governments to coordinate their efforts to mitigate highway noise without encroachment of MDOT's right-of-way unless authority is granted.

I.4 Qualifications Necessary to Perform Noise Analysis and Abatement Design

Only individuals (MDOT or consultant staff) qualified in the field of highway traffic noise impact analysis shall be responsible for the highway traffic noise analysis for MDOT's transportation improvement projects. In order to be considered qualified, the person performing the analysis must have demonstrated experience in conducting highway traffic noise analyses for transportation improvement projects and must have exhibited a working knowledge of the procedures outlined in Report Number FHWA-DP-96-046, *Measurement of Highway-Related Noise*, May 1996; 23 CFR 772; and the State Transportation Commission's Policy on Noise Abatement (10136,) and the rules and procedures as defined in this handbook. The qualified individual must also have successfully completed the following:

- MDOT approved highway traffic noise analysis training; and
- Training on the most current version of the approved FHWA noise analysis computer model.

A copy of the individual's certificate of training must be included in their employer's prequalification packet provided to MDOT Lansing Office. Refresher and additional training may be necessary as a result of advanced highway traffic noise modeling technologies and changes in highway traffic noise policy and/or procedure.

I.5 Time-Related Factors and Their Effects on Noise Studies

Several factors may influence the conduct of noise studies, the evaluation of noise impacts, and the selection of feasible and reasonable noise abatement features. The factors presented below are generally related to the influences of changes that may occur over time and/or between various phases of a project's development.

I.5.1 Effects of Noise Guidance Revisions

It is the intent of MDOT to update its noise guidance material on an as-needed basis to respond to policy changes and technical enhancements. Most recent example is this handbook (which supersedes MDOT's *Procedures and Rules for Implementation of State Transportation Commission Policy 10136 - Noise Abatement*).

Noise studies may have been performed in accordance with noise policies and guidance which have subsequently been modified. If CE determination, FONSI or ROD has not been issued before effective date of this revised MDOT policy, MDOT and other project applicants should consult FHWA to determine what revised or new noise analyses should be prepared. If the final NEPA approval has been issued before the effective date, the need to revise or update noise analyses will be discussed during the consultations as required by 23 CFR 771.129 before MDOT and other project applicants seek subsequent FHWA approvals.

I.5.2 Using Different Traffic Noise Models and Versions

It is the intent of MDOT to utilize the most up-to-date and efficient modeling techniques in order to provide the most accurate and comprehensive noise analyses for its projects, as long as:

- these modeling techniques do not result in a reduction in the number of areas considered for noise abatement compared to the areas considered in previous noise studies and
- the newer modeling techniques do not result in any reduction of abatement measures determined to be likely based on the noise modeling performed in the previous noise studies.
- The model is approved by FHWA for use in noise abatement analyses.

NOTE – *Mandatory Use of the FHWA Traffic Noise Model version 2.5 (TMN2.5[®])*

23 CFR 772.9(a) states that the TNM2.5[®] model must be used for traffic noise analysis, or “any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM.” (Refer to 23 CFR 772.9(a) in Appendix H)

I.5.2.1 Using Different Versions of the FHWA TNM

For some projects, previous noise analyses may have been performed during earlier project phases using a currently outdated version of the FHWA TNM. Additional noise analyses for these projects may now be required because of a new project phase, the need to reevaluate the project, or for some other reason. In such instances, it is suggested that the most current version of the FHWA TNM be used for additional noise modeling.

I.6 Contact Information

MDOT will issue updates and/or make modification to this Handbook as necessary. Please direct questions, comments, or suggestions about this Handbook to the MDOT Lansing Office at one of the following addresses:

Traffic Noise Abatement Specialist
Michigan Department of Transportation
Environmental Section
425 W. Ottawa Street, 3rd Floor
P. O. Box 30050
Lansing, MI 48909
(517) 241-2445

Traffic Noise Engineering Technician
Michigan Department of Transportation
Structural and Environmental Noise
Investigations
Secondary Complex
8885 Rick Road
P. O. Box 30049
Lansing, MI 48909
(517) 322-6138

1.0 STEP 1 – Initial Project Level Scoping and Determining the Appropriate Level of Noise Analysis

The need for highway traffic and construction noise analyses are initially discussed during the planning and environmental scoping of the Early Preliminary Engineering (EPE) phase of the transportation improvement project's development process. This is done to assess the potential for future highway traffic noise impacts of the proposed transportation improvement project on the sensitive receptors in the study area. No receptor unit or community shall be denied the consideration of highway traffic noise mitigation or denied full and fair participation in the decision-making process on the basis of its national origin, color, race, or income. Such scoping assessments are generally qualitative in nature, performed at the Region level in coordination with the Lansing Office, and focus on noise-sensitive sites and communities in close proximity to the proposed improvements.

It is MDOT's policy to assess the highway traffic noise impacts of a transportation improvement project and to give consideration to the appropriate avoidance, minimization, and/or mitigation measures for those projects with noise impacts identified. Projects are classified based on the scope of the improvements, and the appropriate level of noise analysis, as outlined below, should be performed.

Type I Project – The construction of a highway on a new location or the physical alteration of an existing highway. Type I projects include:

- Substantial horizontal or vertical alteration
- Addition of a through-traffic lane, inc. HOT, HOV, bus lane, truck climbing lane,
- Addition of an auxiliary lane, except turn lanes
- Addition or relocation of interchange ramps added to a quadrant to complete an existing partial interchange
- Restriping for the purposes of adding a traffic through-lane or auxiliary lane
- Adding a new or substantially altering a weigh station, rest area, ride-share lot or toll plaza

Type II Project – The construction of noise barriers on an existing highway not associated with a major highway project. This is a voluntary federal-aid program in which MDOT has participated. See Appendix C for details. **MDOT's Type II noise abatement program is suspended indefinitely due to budget constraints.**

Type III Project – These Federal or Federal-aid highway projects are those not classified as a Type I or Type II. Often these projects fall under the Categorical Exclusion (CE) guidelines and do not require a noise analysis. These can include rehabilitation of an existing highway (non-capacity improvements), online bridge replacements/rehabilitations, non-through lane intersection improvements (i.e., turning lanes), etc.

NOTE - Substantial Horizontal or Vertical Alteration

Definition from: FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance*:

“Changes in vertical alignment cover a variety of scenarios that are not limited to physical changes to the roadway. Changes to side slopes or other terrain features may also result in a Type I project. A project that exposes a receptor to a new noise source due to a vertical change or includes vertical changes that expose the receptor(s) to previously a shielded traffic source(s) is a Type I project. For example, a project that involves cutting back a slope that exposes a receptor to an existing highway is a Type I project. Similarly, a project that changes at grade intersection to an overpass is a Type I project, because it substantially alters the vertical alignment of the roadway, exposes receptors to a new noise source and the operational improvements likely result in increase speeds and more noise.

Changes in the horizontal alignment that reduces the distance between the source and receiver by half or more result in a Type I project.”

NOTE – *Noise Analysis and Abatement Process Summary Tables* are a quick view of the noise analysis processes for EA and EIS through the Early Preliminary Engineering and Preliminary Engineering Phases and are available as a separate document. A separate Categorical Exclusion (CE) flowchart is included in Appendix B.

1.1 Avoidance Techniques

Typical highway traffic noise avoidance techniques should be preliminarily discussed during the scoping portion of all Type I projects, where practical. The avoidance techniques may include placing the design below grade or in cut (i.e., lowering highway profile) and/or moving proposed roadway away from noise-sensitive receptor(s). Although these are only examples of applicable techniques, it is important that avoidance techniques be considered in order to eliminate or minimize the potential for highway traffic noise impacts wherever practical. It is recognized that highway traffic noise is not the only factor being considered during the EPE phase. All potential avoidance techniques should be incorporated into the early preliminary engineering scope of work for detailed analysis.

1.2 Determination of the Need for a Noise Analysis

The determination of the need for a noise analysis for a Type I project depends on the presence of noise sensitive land uses in proximity to the proposed project. Land uses that are sensitive to transportation noise impacts are identified in Table 1, found on page 10. The determination of the need for a noise analysis is not dependent on the length of the project corridor or the NEPA class of action.

NOTE – Controversy related to non-noise issues does not, in itself, dictate that a noise study is required.

1.2.1 Two Determinations for Noise Abatement Analysis

1.2.1.1 Noise Abatement Analysis is Not Required

Type I projects where there are no noise sensitive land uses approximately within a 500 foot buffer are not required to conduct a noise analysis. However, the 500 foot measure is a rule-of-thumb determination and should not be taken as an absolute, particularly in urban and suburban areas. The Lansing Office and FHWA should be consulted if there are questions.

Type III projects are exempt from noise analysis. Type III projects include:

- Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, or adding shoulders
- In kind bridge rehabilitation, reconstruction, or replacement
- Auxiliary lanes that are turn lanes
- Improvements to existing rest areas and truck weigh stations that do not add capacity or move traffic closer to sensitive receivers
- Rideshare activities, except new rideshare lots or expanded ride share lots that meet the definition of Type I project.

1.2.1.2 Noise Abatement Analysis is Required

As stated before, the presence of noise sensitive land use in proximity to a Type I project requires a noise analysis to determine if there are any noise impacts and, if so, is noise abatement warranted. A noise analysis involves field measurements for TNM comparison, computer noise modeling using TNM, and abatement analyses when impacts have been identified. The analysis is a three-phased approach aimed at answering and addressing the following questions (refer to pages 19-30 for a detailed description).

1. Are there traffic related noise impacts on noise sensitive land uses as a result of the project?
2. Is it feasible to provide highway traffic noise abatement from an engineering and acoustical standpoint?
3. Is it reasonable from a public desire, cost/benefit, and noise attenuation benefit consideration to provide highway traffic noise abatement?
4. Will highway construction noise affect nearby properties? (pages 35-36)

The magnitude of the project and the complexity of the noise-related issues involved will determine the extent of the documentation and public involvement. If any part of a project meets the criteria for a Type I project, the entire project is a Type I project. The identification of a noise sensitive land use(s), whether isolated or spread out, require that the noise analysis be done for the entire project. It may be necessary for the larger, more complicated project to plan to have a periodic highway traffic noise analysis data file review throughout the project's lifespan. This quality-control measure will prevent and/or identify any highway traffic noise analysis issues during the early stages of the proposed transportation improvement project. Coordination with the Transportation Service Center (TSC), Region Office, Lansing Office, and

FHWA personnel is critical during the early stages to ensure the proper level of noise analysis is conducted.

2.0 STEP 2 – Noise Analysis Initial Procedures

2.1 Consideration of Areas Sensitive to Noise

The entire project limits of a transportation improvement project will be surveyed for noise sensitive land use areas during its Planning and Scoping Phases. Local officials must be contacted to determine if vacant land is currently permitted for development, or is likely to be permitted prior to the date of public knowledge. Aerial photography and field reconnaissance are necessary for identifying and/or verifying the location of noise-sensitive land uses and highway traffic noise sources. Land uses that are sensitive to transportation noise impacts are identified in FHWA’s Noise Abatement Criteria (NAC) table, see Section 2.3 with Table 1 (page 10).

2.2 Common Noise Environment (CNE) Determination

CNEs should be delineated as areas of common highway traffic noise influence throughout the entire project limits of the proposed transportation improvement project. CNE boundaries typically do not traverse over any major and/or substantial highway traffic noise influence source (i.e., existing or proposed roadways). Grouping similar areas into CNEs also assists in evaluating mitigation, organizing reports, and facilitating discussions.

NOTE - *Developed and Developing Lands: Permitted Developments*

Highway traffic noise analyses will be performed for developed lands as well as undeveloped lands when they are considered permitted developments. Undeveloped lands will be deemed to be permitted if a noise-sensitive receptor listed in Table 1 (page 10) under Categories B, C and E has received a building permit from the local agency with jurisdiction at the time of the date of public knowledge. Undeveloped lands without building permits will be analyzed to identify a buffer zone to inform local officials where noise compatible land use zoning or development should be considered to avoid future traffic noise impacts for sensitive receptors.

In the case of a subdivision, if at least one building permit within the approved development plan has been received from the local agency with jurisdiction at the commencement of the EPE Phase highway traffic noise analysis, then the entire subdivision will be deemed to be permitted. When the proposed subdivision is a phased development, MDOT should only consider noise abatement when a building permit is issued within the phase within the traffic noise impact zone or buffer. If the phase with a permitted lot is outside of the traffic impact zone, then the subdivision will not be considered for abatement.

2.3 FHWA Noise Abatement Criteria (NAC) Land Use Activity Categories

The land uses must be identified based on the FHWA Noise Abatement Criteria (NAC) which separates land uses into activity categories based upon similar activities and assigns each an A-weighted decibel level. The levels aid MDOT in identifying noise impacts. Section 3.3.1 details how MDOT defines an impact.

Table 1

**FHWA Noise Abatement Criteria (NAC)¹
Hourly A-Weighted Sound Level in Decibels (dB(A))**

Activity Category	Activity Criteria ²		Evaluation Location	Activity Description
	Leq(h) ³	L10(h) ⁴		
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B ⁵	67	70	Exterior	Residential
C ⁵	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E ⁵	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	----	----	----	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	----	----	----	Undeveloped lands that are not permitted

¹ MDOT defines a noise impact as a 10 dB(A) increase between the existing noise level to the design year predicted noise level, OR a predicted design year noise level that is 1 dB(A) less than the levels shown in Table 1.

² Either Leq(h) or L10(h) (but not both) may be used on a project. MDOT uses Leq(h). The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

³ Leq is 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.

⁴ L10 is the sound level that is exceeded 10 percent of the time (90th percentile) for the period under consideration, with L10 being the hourly value of L10.

⁵ Includes undeveloped lands permitted for this activity category

2.4 Determination of Existing Conditions

2.4.1 Selecting Monitored and Modeled Receptor Sites

Areas to be considered for the placement of monitored and/or modeled receptor sites should include individual sites that are in close proximity and could be impacted by the project. The location of monitored and modeled receptor sites should be consistent throughout the entire project limits.

NOTE – *Calibration of Noise Meters:*

All highway traffic noise meters and acoustical field calibrators should be calibrated once a year or in accordance with manufacturers' specifications. A copy of the certificate of calibration for each piece of equipment used in the study for the period that highway traffic noise monitoring occurred for the proposed transportation improvement project should be included in the project technical files.

2.4.1.1 Field Measurement/Monitor Sites

A monitored receptor site should be placed in every CNE area with attempts to represent an entire community as a whole. Field measurement, or monitoring, is primarily used to confirm that the TNM model inputs reflect site conditions, so only a few representative sites are necessary. The monitoring should occur at the ROW line. Avoid placing monitors on private property. However, additional monitoring sites or sites located on private property may be required if the roadway noise is not the dominant source of noise, where there is unusual topography, or under special circumstances, such as U.S. Department of Housing and Urban Development (HUD) properties. MDOT Lansing Office should be consulted in these cases. Modeled receptor sites for the purpose of TNM confirmation should be the same site as the monitored site.

2.4.1.2 Modeled Receptor Sites

Modeled receptor sites for the purpose of determining existing conditions should be in all areas necessary in order to establish highway traffic noise impacts; to evaluate the noise barrier location, length, and height; to provide individual residential noise level information; as well as at specific locations due to the nature of the transportation improvement project (i.e., topography, locations of special concern). Professional judgment should be used when placing modeled receptor sites. FHWA requires giving primary consideration to exterior areas of human activity when locating modeled receptor sites (see NOTE – *Exterior Areas of Frequent Human Use* on the next page). Historic and Section 4(f) properties should also be included during the monitoring/modeling phase of the noise analysis. Please see Section 7.1.5 and Section 7.1.6 for additional information when considering historic and Section 4(f) properties.

NOTE – Multi-family Dwelling Units

When analyzing areas with multi-family dwelling units, such as apartments or condominiums, the analyst must identify all dwelling units' exterior areas of frequent human use which may experience highway traffic noise impacts. This may include units above the ground level, such as balcony/deck locations. Consider abatement for all identified highway traffic noise impacts and implement abatement that is feasible and reasonable.

NOTE – Exterior Areas of Frequent Human Use:

In accordance with Title 23 CFR 772.11(b):

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

and Title 23 CFR 772.11 (c)(2)(iv):

“Activity Category D... 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...”

Contact MDOT Lansing Office Environmental Staff prior to performing interior monitoring activities.

2.4.2 Worst-Case Highway Traffic Noise Hour

Highway traffic noise analysis should begin by determining the worst-case existing noise hour(s) within the project area. The Region and, when needed, Lansing Office should discuss the traffic characteristics during the EPE Phase in order to adequately determine the worst-case highway traffic noise hour(s). As such, it is necessary to evaluate hourly traffic volume, speed, and composition to the extent such data are available. There are several techniques to help determine the existing worst-case highway traffic noise hour(s), including the following:

1. Evaluation of Peak and Off-Peak Traffic Data

In most cases, experience has shown that the peak traffic hour is the noisiest hour of the day. However, on occasion, conditions such as capacity, effects on vehicle speed, higher-than-normal off-peak truck percentages, or unusual hourly traffic distribution may cause the noisiest hour of the day to be different from the peak traffic hour of the day. Evaluation may be based on the review

and/or analysis of historical traffic data, predicted traffic data, supplementary traffic counts, or a combination thereof.

2. 24-Hour Monitoring Sites with Evaluation of Diurnal Traffic Patterns

If there is some question as to the worst-case highway traffic noise hour, it may be necessary to conduct 24-hour monitoring to determine the worst-case highway traffic noise hour(s). In this case, 24-hour monitoring should be done in conjunction with evaluating the existing diurnal traffic patterns to determine the existing worst-case highway traffic noise hour. The worst-case highway traffic noise hour may not necessarily correspond with the design year hour since traffic scenarios may vary as a result of the proposed transportation improvement project. Therefore, design year peak highway traffic noise hours will have to be confirmed using the existing 24-hour data, diurnal traffic patterns, and compositions. Major projects and projects with public controversy related to highway traffic noise may necessitate 24-hour monitoring. In these cases, the report will include projected 24-hour data, diurnal traffic patterns, and compositions.

3. Public Comment

Public comment may also produce some helpful information on the noisiest day of the week or the noisiest hour of the day.

4. Combination of two or all of the above techniques

2.4.3 Monitoring Existing Noise Level Determination

Existing noise is the current noise level, comprised of all natural and man-made noises, considered to be usually present within a particular area's acoustic environment, including existing roadways. Existing noise levels are monitored for one or more of the following reasons:

- comparing noise measurements with the output from the FHWA TNM at locations currently influenced by existing highway traffic noise sources;
- determining existing noise levels for proposed roadways on a new alignment;
- assisting in determining the existing worst-case traffic noise hour (as referenced in Section 2.4.2); and/or
- supplementing other noise-related data in defining the existing noise environment.

2.4.4 Monitoring Unique Conditions

When a unique condition is proposed whereby highway traffic noise level predictions (derived by the techniques discussed above) cannot accurately assess the future acoustical environment, it may be necessary to monitor a similar location elsewhere if such a location has similar characteristics. Such a technique may be applicable to projects with parking lots, covered roadways, tunnels, transit facilities, extreme rough surface pavements, open-grated bridge decks, and parallel or multiple noise barriers, etc. This technique shall be used in coordination with the Region and Lansing Offices.

2.5 Noise Modeling (Prediction of Existing and Future Conditions)

2.5.1 FHWA Model

Noise modeling of existing and future roadways is an effective tool for predicting noise levels, noise impacts, and the potential benefits of noise abatement. The noise-modeling process includes several steps, which are outlined below. Generally, the modeling process includes noise model validation, modeling of worst-case traffic noise existing conditions, and modeling of future build-conditions associated with a proposed transportation improvement project.

The currently approved FHWA TNM2.5[®] is the required tool for the prediction of existing and future noise levels associated with transportation improvement projects. The FHWA TNM should be used only after a thorough understanding of this document and only by qualified individuals that have a thorough understanding of how to use the FHWA TNM, as defined in the Introduction section of this Handbook.

2.5.2 Traffic Speed Determination

23 CFR 772.9(d) states, “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.” The posted speed or operating speed may be used to predict highway traffic noise levels on Type I and Type II projects. It is required to use the operating speed if it has been determined to be consistently faster than the posted speed limit. For proposed roadways, it may be difficult to determine the potential operating speed of the future roadway. In these situations, it is recommended to use the design speed.

Under no circumstances should any speed below posted be used for noise modeling purposes, even if congestion and slower speeds are anticipated in the peak travel hour(s). In congested corridors, it may be more appropriate to model off-peak travel hours, representing the balance of maximum vehicle volume traveling at maximum speeds. Refer to Section 2.4.2 - Worst-Case Highway Traffic Noise Hour to address this issue. According to FHWA Guidance, “loudest noise hour” usually occurs at a time when truck volume and vehicle speeds are the greatest, typically when traffic is at or near generally free-flowing conditions.

2.5.3 Field Measurement and Modeled Noise Levels Comparison

2.5.3.1 Purpose

Existing field measurement noise levels need to be compared with the FHWA TNM noise level predictions for the traffic conditions observed during the monitoring period, thereby verifying the accuracy of the computer model. This comparison of measured and modeled noise levels must be documented in the noise analysis report. The noise report must contain the measured and modeled noise level for each noise monitoring location in table format, with reported changes in noise level between the monitored and modeled value.

The monitoring methodology for the determination of existing conditions should be consistent with measurement procedures as stated in FHWA's *Measurements of Highway-Related Noise*, May 1996, and supplemented by professional judgment. Short-term noise field measurements, for modeling verification purposes, can be taken at any time with all noise measurements occurring under generally free-flow traffic conditions.

2.5.3.2 Limitations

These procedures are not applicable in situations where the existing acoustical environment is not dominated by an existing highway traffic noise source. TNM is not capable of accurately determining existing noise levels where highway traffic noise is not the dominant contributing acoustical characteristic. Generally, the procedures are intended for sites that are currently influenced by highway traffic noise and will be similarly affected by the proposed transportation improvement project. In areas dominated by background (non-roadway) noise sources, monitored noise levels should be used to determine existing worst-case noise levels in place of modeled noise levels, thereby accurately representing the existing noise environment. Professional judgment should be used when selecting sites to be used for determining worst-case noise levels in such areas.

2.5.3.3 Procedure

The noise modeling validation procedure typically is as follows.

1. Obtain short-term (15 minute) traffic noise level field measurements along the project corridor at the MDOT right-of-way line at one or two locations within a CNE depending on its length. Observe and record traffic volumes on all influencing roadways (classifying the appropriate vehicular types based on FHWA vehicle types) and determine the average vehicular speed (can be performed using radar equipment, driving through the project area, distance/time calculations, etc.).
2. Calculate the noise levels using the computer modeling software after having input the traffic characteristics witnessed during noise monitoring (expanded to one hour), site geometry, and any other pertinent existing features.

3. Compare the field-observed values to the predicted values. If the difference between the two values is less than ± 3 dB(A), this is an indication that the model is within the accepted level of accuracy. If observed noise levels differ from modeled noise levels by greater than ± 3 dB(A), a careful examination of the observed data and predicted data should be undertaken to determine the reason(s) for this margin of error. The qualified professional is required to reexamine the input parameters and look for obvious differences such as meteorology, pavement conditions, obstructions, reflections, non-traffic (background) noise sources, ground type, etc. In the event a logical explanation for the difference cannot be made, the field measurements at that location(s) should be repeated.
4. If the observed noise levels differ from the modeled noise levels by greater than ± 3 dB(A), and after thorough examination of the observed and predicted data, it may be practical to establish an “adjustment factor” to be applied to modeling results in certain cases. Adjustment factors could also be applied if the difference between observed and modeled noise levels is less than ± 3 dB(A). Adjustment factors should be used sparingly and not applied globally unless every measurement is off in the same direction by a similar amount. If that occurs, the issue is most likely due to an environmental factor. If adjustment factors are used, they must be discussed and documented. Contact the Lansing Office prior to establishing or implementing adjustment factors.

2.5.4 Determining Worst-Case Existing Conditions

Once the validation model is deemed accurate, the noise analyst must develop worst-case existing TNM data to predict worst-case existing noise levels within the project area. This step is accomplished by replacing the witnessed traffic data (during the monitoring phase) with worst-case existing traffic data derived from traffic engineers and applying these data to the existing roadway geometry.

Model receptor sites should be placed throughout the project area as described in Section 2.4.1. The existing worst-case noise levels then serve as a basis for the MDOT “substantial increase” noise abatement criteria. However, exclude measurements in areas dominated by extraneous, non-highway noises, such as: air compressors, barking dogs, leaf blowers, construction equipment, etc. Please refer to model validation limitations for more information.

2.5.5 Design Year Build Conditions

The final step of the noise impact modeling process (before abatement modeling) is the development of the future design year build conditions noise model. This assessment can include single or multiple build alternatives, depending on the magnitude of the environmental project (i.e., CE, EA, or EIS). Typically, CE assessments present one build alternative, EA documents can present one or multiple build alternatives, and EIS documents typically present multiple build alternatives. When multiple build alternatives are analyzed in an environmental document, noise levels, noise impacts, and potential noise abatement measures for each build alternative must be documented to the same level of detail.

In areas of a proposed project build alternative that contain no noise-sensitive receptors, noise modeling may not be necessary. However, in areas that contain noise-sensitive receptors, noise modeling should be detailed enough to identify all noise impacts and to thoroughly evaluate noise abatement feasibility and reasonableness (see Section 3.0). Future condition noise modeling is an evolving process, and noise model refinements are typically necessary throughout the process to determine the extent and locations of noise impacts, the number of impacted receptors, the effectiveness of noise abatement, and the number of benefited receptors. Additional modeling sites are often added throughout the modeling process to clearly define the depth of noise impact, the number of impacted receptors, and the number of benefited receptors.

The design year noise levels for each alternative can then be compared to the FHWA/MDOT noise abatement criteria and to existing noise levels to determine if noise impacts will occur for each project alternative. The FHWA/MDOT noise abatement criteria are discussed in detail in Section 2.3. If noise impacts occur, noise abatement must be considered.

NOTE – MDOT’s Definition of a Noise Impact

MDOT identifies a noise impact as:

- a 10 dB(A) increase between the existing noise level to the design year predicted noise level, or
- a predicted design year noise level that is 1 dB(A) less than the NAC levels as shown in Table 1.

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3.0 STEP 3 – DETERMINING HIGHWAY TRAFFIC NOISE IMPACTS AND ESTABLISHING ABATEMENT REQUIREMENTS

3.1 Criteria for Detailed Highway Traffic Noise Abatement Measures

Flexibility is an important element of good highway traffic noise abatement decision-making criteria and procedures. The criteria and procedures should be objective enough to be quantifiable. They should also be flexible enough to allow the decision-makers to make meaningful judgments on a project-by-project basis.

As stated in Section I.3 Policy Statements of this Handbook, it is MDOT's policy to implement noise abatement measures when they are determined to be feasible and reasonable. The following parameters should be assessed to make the determination for feasibility and reasonableness. The decision to recommend or not recommend a highway traffic noise abatement option(s) should be based on the consideration of all of the parameters discussed below and not just any one parameter. This allows for the identification of the overall benefits, including the effect of such abatement on social, economical, and environmental factors.

3.2 Highway Traffic Noise Abatement Measures

23 CFR 772.13(c)(1) states, 'At a minimum, the highway agency shall consider noise abatement in the form of a noise barrier.' The following abatement alternatives, which are listed in 23 CFR 772.15(c), are permitted and can be evaluated where applicable.

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 property must remain undeveloped. 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.

NOTE – Receptor Unit Soundproofing or Property Acquisition:

Soundproofing of Activity Category D land use facilities listed in Table 1 or acquisition of buffer property should not be considered without prior coordination with the Lansing Office. The MDOT Region Real Estate representative must be contacted during any discussions on land acquisition. This coordination must occur prior to any discussions with the public. **Property acquisition for the purpose of creating a buffer zone will be considered for unimproved property only and not for purchasing of homes or developed property.** This issue will be dealt with on a site-by-site basis.

3.3 Noise Abatement Determination

Noise abatement determination is a three-phased approach.

1. Are there noise impacts?
2. Is it feasible to provide highway traffic noise abatement from an engineering, safety and acoustical standpoint?
3. Is it reasonable to provide highway traffic noise abatement based on the consideration of the cost/benefit, viewpoint of the majority of the benefiting residents and property owners, and in providing sufficient attenuation?

NOTE – Three-Phased Approach of Noise Abatement Determination:

Noise abatement design is driven from the results of the noise analysis (i.e. noise levels). All analyzed noise barriers must progress to the “feasible” phase. All feasible noise barriers, regardless of the number of receptor units protected, must then progress to the “reasonableness” phase. Following the completion of both phases, a determination can be made related to the feasibility and reasonableness of noise abatement options.

NOTE – Non-Barrier Abatement Measures:

While noise barriers (walls and/or berms) are by far the most common forms of highway noise abatement, the “non-barrier” abatement measures listed in Section 3.2 should also be evaluated in terms of their feasibility and, if feasible, their reasonableness. TNM will be used in the evaluation of non-barrier noise abatement. Contact the Lansing Office for guidance.

The three-phased approach for recommending noise abatement and for determining the feasibility and reasonableness of noise barrier is discussed below.

3.3.1 Phase 1 – Identifying Noise Impacts

This first phase of the process is to identify the impacted receptors as modeled in TNM.

23 CFR 772.5 describes highway traffic noise impacts as “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.” 23 CFR 772.11(f) states, “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”

MDOT defines “approach” as 1 dB(A) less than the levels of the NAC shown in Table 1. MDOT defines a substantial noise increase as a 10 dB(A) increase between the existing noise level to the design year predicted noise level. Either condition identifies a noise impact.

NOTE – *Not Having a Highway Traffic Noise Impact:*

Noise abatement is required to be analyzed for all impacted receivers. A noise abatement measure is not required to extend to include receptors that are not identified as having a highway traffic noise impact. However, a non-impacted receptor may receive a benefit from noise abatement constructed to protect nearby impacted receptor(s) and must be included in the reasonableness determination.

Receptor units that satisfy these criteria warrant further consideration for highway traffic noise abatement. Noise abatement will be considered only for the identified impacted receptors.

3.3.1.1 - NAC Standards for Land Use Activity Categories

The following list are the noise impact criteria for the NAC land use activity categories found in Table 1 on page 10. Activity Categories F and G are not included because there are no impact criteria for the land use facilities and no analysis of noise impacts is required.

Land Use Activity Category A

Highway traffic noise abatement shall be considered whenever the design year total predicted noise levels approach or exceed 57 dB(A) Leq(h), or there is a substantial noise increase between existing and design year predicted noise levels.

Land Use Activity Category B

Highway traffic noise abatement shall be considered whenever the design year total predicted noise levels approach or exceed 67 dB(A) Leq(h), or there is a substantial noise increase between existing and design year predicted noise levels.

Land Use Activity Category C

Highway traffic noise abatement shall be considered for exterior areas of a variety of nonresidential land uses not included in Categories A or B. This category may include public or private facilities. Traffic noise abatement shall be considered whenever the design year total predicted noise levels approach or exceed 67 dB(A) Leq(h) or there is a substantial noise increase between existing and predicted noise levels.

Land Use Activity Category D (Interior)

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 abatement 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. Consult the Lansing Office prior to indoor analysis.

NOTE: Quantification procedures for Activity Categories C and D are found in Appendix C

Land Use Activity Category E

This activity category includes the exterior impact criteria for developed lands that are less sensitive to highway noise. Highway traffic noise abatement shall be considered whenever the design year total predicted noise levels approach or exceed 72 dB(A) Leq(h), or there is a substantial noise increase between existing and design year predicted noise levels.

Land use Categories F and G do not require noise abatement analysis.

NOTE – *Category C and D Analyses*

If an enclosed facility in Category C has evidence of an exterior area of frequent human use then the exterior use area and the interior (using activity Category D standards) should be analyzed. If either exterior area or interior are impacted then exterior abatement measures (found in section 3.2 - *Highway Noise Abatement Measures*) should be considered and analyzed. Use Table 6 in FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance*, January 2011, to aid in predicting the interior noise impacts

If exterior abatement measures for Category C are found not to be feasible or reasonable, and there is a Category D impact, then consider sound insulation.

3.3.2 Phase 2 – Feasibility Criteria for Noise Barriers

A feasible noise barrier is one that has no construction impediments, meets safety requirements for the traveling public, and provides at least 5 dB(A) noise reduction at 75% of the impacted receptors. To determine feasibility for a highway traffic noise barrier, the following six acoustical and engineering parameters need to be considered.

1. Can a noise reduction of at least 5 dB(A) be achieved by 75% of impacted receptors?
2. Can the noise barrier be designed and physically constructed at the proposed location?
3. Will placement of the noise barrier cause a safety problem? (Reference Chapters 2 and 3 in AASHTO's "Green Book", *A Policy on Geometric Design of Highways and Streets*, 2004)
4. Will placement of the noise barrier restrict access to vehicular or pedestrian travel?
5. Will the noise barrier impact utilities or will the utilities impact the noise barriers?
6. Will the noise barrier impact drainage or will the drainage impact the noise barrier?

NOTE – *Greater than 5 dB(A) Highway Traffic Noise Reduction:*

A noise reduction of 5 dB(A) is required for a noise barrier to be determined to be feasible. Once the proposed noise barrier is determined to be feasible and reasonable, it should be optimized to provide a balance between the most obtainable insertion losses per additional cost. Refer to the “Barrier Optimization” section (Section 3.5.1) for further information and requirement on how to achieve an optimized noise barrier.

3.3.3 Phase 3 – Reasonableness Criteria for Noise Barriers

A determination of noise barrier reasonableness will include the consideration of the parameters from the following subsections. The FHWA lists three required reasonableness factors: cost effectiveness, viewpoints of the benefiting receptors, and achievement of noise reduction design goals. FHWA lists optional reasonableness factors in 23 CFR 772.13(d)(2)(v) that can be added to but not overrule the required reasonableness factors. When making a determination of noise barrier reasonableness, the parameters used during the EPE Phase (NEPA process) are considered preliminary with the definitive reasonableness consideration to be made during the PE Phase. When performing a reasonableness analysis for the environmental clearance document, some parameters are not fully quantifiable at this stage of the analysis (e.g., specific construction costs). In the following descriptions of reasonableness parameters, a clear indication will be made when they specifically relate to final design.

3.3.3.1 Cost per Square Foot of Noise Barrier

Based on various barrier cost data calculated and/or obtained by MDOT, the cost index factor assumed for the manufacturing and installation of noise barriers shall be \$45.00 per ft². The square footage (measured from the finished grade line at the base of the noise barrier to the top of the noise barrier) of the recommended noise barrier should be multiplied by \$45.00 to get the cost of the noise barrier. This square footage may be obtained from the FHWA TNM output files or determined by other methods, such as spreadsheet calculations.

The \$45.00 ft² amount includes the cost of the noise barrier panels, posts, foundations, right-of-way, and grading. The square foot amount also includes additional costs required solely for the construction of the noise barrier (i.e., right-of-way/property acquisition/utility relocation); these costs will be added to the cost calculations of the noise barrier. The manufacturing and installation costs may vary on a project-by-project basis. Additional costs over the \$45.00 ft² for the construction of the noise barrier (i.e., right-of-way/property acquisition/utility relocation) determined during the PE Phase will be added to the cost calculations of the noise barrier. This decision will be made by the appropriate Region or Transportation Service Center (TSC) on a project-by-project basis with coordination with Lansing Office. If such a decision is made, a detailed discussion in the Final Design Highway Traffic Noise Report justifying this decision is required.

3.3.3.2 Cost per Cubic Foot of Earthen Berm

First, the feasibility of the use of an earthen berm will be determined based on adequate depth of ROW, topography along the roadway, and the achievement of a 5 dB(A) noise reduction for 75%

of the impacted receptors. During the EPE phase, \$45.00 ft² will be used as a factor in determining reasonableness. During the PE phase, the cost of an earthen berm should be calculated on a case-by-case basis depending on the project's earthen material availability, cost of bringing in excess earthen material, and acquisition of additional right-of-way, if needed. The allowable cost per benefiting unit (CPBU) (see text box that follows) will be used as the cost factor to determine whether an earthen berm is reasonable.

3.3.3.3 Cost-Effectiveness Calculations

The cost effectiveness of noise abatement is determined by dividing the total cost of the noise abatement (based on \$45.00 ft²) by the number of benefiting receptor units. The quotient is compared to the allowable cost per benefited unit (CPBU).

Noise abatement cost effectiveness meets the reasonableness factor in the EPE Phase, as recorded in the environmental documentation, when the CPBU is no more than 3% above the allowable CPBU. This takes into account unknown costs of some of the noise abatement parameters. Noise abatement cost effectiveness meets the reasonableness factor in the PE Phase as recorded in the final design traffic noise report when the CPBU is equal to or less than the allowable CPBU. This takes into account that costs are more accurately determined during the PE Phase.

See Appendix D to aid in determining the number of benefiting units for Categories C and D.

NOTE – Allowable Cost Per Benefited Receptor Unit (CPBU):

MDOT has chosen an allowable CPBU of \$42,509 (2012) where noise mitigation was determined to be reasonable. The cost per benefited receptor unit is annually adjusted to the consumer price index (CPI). Although \$42,509 per benefited receptor unit is the allowable upper limit in the reasonableness determination, a reasonable (and possibly optimized) noise barrier may cost much less than \$42,509 per benefited receptor.

NOTE - Benefiting Receptor Unit Eligibility

A receptor that receives a 5 dB(A) or greater insertion loss as a result of the proposed noise barrier will be considered a benefited receptor unit. Benefits to non-impacted receptors should be considered ancillary, and the proposed noise barrier measure will not be specifically designed to reduce noise levels at non-impacted receptors regardless of the resulting insertion losses.

NOTE – *Analyzing Apartment, Condominium, and Single/Multi-Family Units:*

Since apartment and condominium buildings often share common outdoor use activities, it may be difficult to determine and analyze impacts and benefits. Professional judgment should be used and the MDOT Lansing Office consulted when such difficulties arise in the project area. The type and size of the facility and its location in relationship to the residential units are factors to consider in determining the number of benefiting units. In some cases the apartment complex outdoor use area, such as a pool, will have a capacity limit posted, and that number limit will be used when determining the number of dwelling unit equivalents. See Appendix D for an example.

All single-family dwellings will be considered as one receptor unit regardless of the house or lot size.

Professional judgment should be used in determining the presence and location of outdoor activity areas for both apartments/condominiums and single-family dwellings.

NOTE – *Abatement for Non-First/Ground Floors:*

Highway traffic noise barriers are often unsuccessful in providing highway traffic noise reductions for any floor other than the first/ground floor of receptor units for structures at roadway level. This is due to the inability to construct a noise barrier to the height necessary to provide effective noise mitigation while still being reasonably cost-effective for those non-first/ground floors (i.e., not feasible or reasonable). Abatement for second or higher floors will be considered when the structure is below grade and the second or higher floors are level with the roadway.

NOTE – *Construction and Technology Barrier Construction Tracking:*

In accordance with 23 CFR 772.13(f), the FHWA asks all State Departments of Transportation to assist them in updating the Highway Traffic Noise Barrier Listing. MDOT's Construction and Technology Division will track the items as listed in the regulations.

3.3.3.4 – Viewpoint of Benefiting Residents and Property Owners

The noise abatement measure must be acceptable to the majority of the residents and property owner who benefit from the noise abatement. Only those benefiting residents and property owners are solicited and polled for the approval of the abatement. See Step 6 for a detailed description of the public involvement process.

3.3.3.5 – Design Year Attenuation Requirement

The noise abatement measure must provide a design year traffic noise reduction of 10 dB(A) for at least one benefited receptor and at least a 7 dB(A) reduction for 50% or more of the benefited receptor sites.

3.4 Category C Land Use Activity Areas

Within Activity Categories C, in Table 1 (page 10), there are several land use activities that are difficult in quantifying the number of receptor units for these land use activities. The context of the special land use activity areas within the community will be taken into consideration when determining noise abatement reasonableness. MDOT uses a dwelling unit equivalent method in most cases to determine the number and placement of receptors within a special use activity area. Contact MDOT's Lansing Office for consultation on the placement of receptors Category C land use activity areas. Appendix D provides further explanation and example noise analysis for these areas.

NOTE – Public Parks:

A highway traffic noise impact on a public park, picnic area, recreation area, or playground may result in a constructive use of a Section 4(f) property determination. Contact the 4(f) specialist in the Lansing Office Environmental Section for consultation for input on definition of active use area.

NOTE – Land Use Category D

Category D includes interior noise for certain facilities that are listed in Category C and have no observable exterior areas of frequent human use. One or two picnic tables do not necessarily indicate frequent human use. Professional judgment and discussions with the property owner should be used in determining the context and frequency of use. The number of receptors will be determined by the context, frequency of use, facility size and capacity limit or number of employees. See Appendix D for an example.

3.5 Land Use Conformity Considerations

Local community authorities are encouraged by MDOT to employ noise compatible land use development along the highway corridors. MDOT will show a presentation on noise compatible land use planning along highways to local officials where a Type I project is located to encourage noise compatible land use planning on undeveloped land along the highway. The implementation of such noise compatible land use provisions in zoning ordinances are looked favorably upon by MDOT for Type II noise abatement applications, but are not a strict reasonableness requirement.

3.6 Completing the Noise Abatement Details Form

After the feasible and reasonable analysis is completed, the rationale for the areas where noise mitigation is warranted must be documented in a Noise Abatement Details Form (MDOT form #1697) for each CNE. The Noise Abatement Details Form includes a Noise Abatement Description sheet. A separate Noise Abatement Description sheet will be prepared for each noise abatement measure within a CNE.

A Noise Abatement Details Form must be completed for each noise-impacted area that warrants highway traffic noise abatement consideration in accordance with MDOT and FHWA guidelines. The project manager has the responsibility to see that the form is filled out. Begin obtaining information for the form during the EPE Phase of the preliminary design process. Graphics or plans showing the noise abatement and impacted/benefiting units will be a part of the form. The forms must be finalized prior to completion of the Final Design Highway Traffic Noise Report. A copy of the form is included in Appendix F. The forms will become part of the permanent project file and must be considered as important reference documents.

NOTE – *Documentation of the Noise Abatement Details forms:*

The details form associated with each CNE's proposed noise barrier or noise barrier system must be incorporated into the Final Design Highway Traffic Noise Report. The final submissions of the final design documents must have the details forms signed by the Project Manager, a Lansing Office noise specialist, and the qualified professional(s) who performed the highway traffic noise analysis. The details forms do not have to be signed on draft final design document submissions. These details forms will document, within the administrative record, the feasibility and reasonableness of providing highway traffic noise abatement measures for the transportation improvement project. It will also provide the FHWA noise abatement inventory requirement as stated in 23CFR 772.13(f).

3.7 Highway Traffic Noise Barrier Design: Goals and Commitments

3.7.1 Highway Traffic Noise Barrier Goals (Barrier Optimization)

It is important to optimize the noise barrier design to achieve the most effective noise barrier in terms of both noise reduction (insertion loss) and cost. Several optimized options of noise barrier heights should be provided as a chart in either the text or as an appendix. All Final Design Highway Traffic Noise Reports should present the following noise barrier design options.

1. Noise barrier height and length consistent with NEPA document recommendations;
2. Line-of-Site option;
3. Optimized noise barrier option;
4. Where noise barriers are proposed on bridge parapets, provide an option which models a noise barrier on structure that best fits the structure and provides a 5 dB(A) noise reduction;
5. Any other options deemed necessary

Although at least a 5 dB(A) reduction is required to meet the feasibility criteria, the following tiered noise barrier abatement goals should be used to govern barrier design and optimization:

- Reduce design year traffic noise by 10 dB(A) for at least one benefited receptor and provide at least a 7 dB(A) reduction for 50% or more of the benefited receptor sites. This is a required reasonableness factor
- If possible, reduce future highway traffic noise levels to the low-60 decibel range.
- If possible, reduce future highway traffic noise levels to back to existing noise levels..

NOTE – Barrier Optimization:

When optimizing the proposed noise barrier, the three-tier set of abatement goals should be evaluated, when practical, in terms of establishing noise reductions for impacted receptors only (not for non-impacted receptors) within their area of frequent outdoor activity. The relationship between noise barrier cost and noise barrier performance is non-linear. This means that noise benefits typically increase with increased barrier height and/or length; however, at some point, further increases in barrier height and/or length result in smaller and smaller increases in benefit until a point of diminishing returns is reached. A point can be identified where a potential noise barrier provides the best balance between cost and benefit. Final design highway traffic noise barriers should seek to maximize benefits while minimizing cost, given the need to achieve predetermined design goals and maintain noise barrier feasibility and reasonableness.

NOTE – Noise Barrier Heights on Structures:

When optimizing noise barriers on bridge parapets, they must be in compliance with bridge design and bridge construction standards and shall be dealt with on a project-by-project basis. Coordinate with MDOT Bridge Design Unit when establishing noise barrier heights on bridge structures. This coordination should occur as early as possible in the project development process and, at the latest, prior to submitting the Final Design Highway Traffic Noise Report to MDOT Lansing Office for review.

3.7.2 Highway Traffic Noise Abatement Commitments

Highway traffic noise abatement commitments are made at two times during a project's development: in the EPE Phase through environmental clearance and in Final Design.

1. EPE Phase/Environmental Clearance

Before adoption of the final environmental clearance document, the MDOT shall identify highway traffic noise abatement measures for each impacted location which are feasible and reasonable. At this stage, it is unlikely that exact barrier location, abatement types, right-of-way requirements, etc. can be determined.

However, approximate barrier location and height information should be known at this time. For the areas where abatement considerations are being recommended, the final environmental clearance document must contain the Statement of Likelihood. The data and information regarding the noise analysis, abatement and public involvement will be recorded electronically to be made available to the pertinent personnel during the PE Phase.

NOTE – *Statement of Likelihood:*

All environmental clearance documents must have this general statement relating to proposed noise mitigation: “Based on the studies thus far accomplished, the Michigan Department of Transportation intends to install highway traffic noise abatement in the form of a barrier (or barriers) reflected in Table ____ in this document. The preliminary indications of likely abatement measures are based on preliminary design for barrier cost(s) and noise reduction as illustrated in Table ____ in this document. 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 and aesthetics of the abatement measures(s) will be made upon completion of the project’s final design and the Context Sensitive Design process.”

2. PE Phase/Final Design

During the PE Phase, the exact location, abatement types, aesthetic treatments, right-of-way requirements, etc. should be determined and be a part of the final recommendation for highway traffic noise abatement. The viewpoints of property owners and residents will be solicited during this phase on their desire to have the abatement and on the aesthetics. A detailed discussion for each recommended noise barrier should be presented in the Final Design Barrier Analysis Report. The data and information regarding the final design noise analysis, abatement, public involvement, aesthetics and maintenance agreement will be recorded electronically and copies given to the TSC, Region, and Lansing Offices.

4.0 STEP 4 – Additional Considerations for Final Design Highway Traffic Noise Barrier Analysis

4.1 Final Design Considerations and Measures

The need for a project to move into a final design noise study is dependent upon the extent of noise impacts, likelihood for providing abatement, and potential for design changes that may affect the acoustics and findings of the NEPA study. The majority of Type I projects should proceed into a final design noise study to ensure that design changes do not alter impacts. In addition, land use changes (e.g., conversion from residential to commercial) may preclude a barrier's construction or potentially create the need for a barrier that was not evaluated in the NEPA phase (e.g., new residential development that meets the "Date of Public Knowledge" test). The level of effort required for the final design noise study should be commensurate with potential for design change, land use modifications, and impact severity/abatement potential as outlined in the environmental clearance documents. The majority of final design noise assessments will involve a detailed reanalysis of the project using refined engineering based on data provided from the EPE Phase noise analysis, public involvement through the Context Sensitive Solutions (CSS) process, and concurrence from FHWA.

Highway traffic noise abatement shall be reconsidered in light of more exact designs and project alignment refinements during the PE Phase. Abatement shall then be considered based on reanalysis of the roadway/noise receptor relationships and community input.

A highway traffic noise analysis conducted during the PE Phase shall primarily be concerned with abatement of noise impacts identified during the EPE Phase in the environmental documentation. The goals of a final design noise analysis are to:

- determine if the proposed highway traffic noise abatement measures from the EPE Phase noise analysis remain feasible and reasonable;
- determine if the benefiting receptors want the noise abatement;
- determine the desires of the stakeholders (local officials and affected property units) through the CSS process to incorporate appropriate aesthetic treatments (this does not include the desirability for or against the abatement measure); and
- finalize any maintenance agreements that were made with the local authorities.

NOTE- *Affected Property Units*

Affected property units are those dwelling units or commercial properties that may or may not receive a benefit from the noise abatement but are located behind or aside the abatement as such that it has an unobstructed view of the noise barrier; this includes rental units.

The highway traffic noise analysis data file from the EPE Phase shall be reviewed as the first step in the refinement process for final design abatement. Close attention should be paid to the public coordination and comments conducted during the EPE Phase (particularly in areas where abatement is warranted). When final alignment boundaries are set, the final design study should

commence according to the procedures set forth in this Handbook. The draft version of the Final Design Highway Traffic Noise Report should be compiled and submitted to the Region or TSC Office, (whichever is appropriate) and the Lansing Office for concurrence prior to conducting public meetings where barrier options and recommendations are presented.

The first public meeting should occur after concurrence between FHWA and MDOT with the draft version of the Final Design Highway Traffic Noise Report. If the benefiting residents and property owners choose to accept the highway traffic noise abatement being recommended, then the process proceeds through the CSS process and Preliminary Design stage where the aesthetics and structural details of highway traffic noise abatement will be refined. After the community accepts the final highway traffic noise abatement design at a second stakeholder engagement meeting, noise abatement proceeds to the final design stage and construction phases.

NOTE – *Final Design Refusal of the Proposed Noise Barrier:*

At any time during this process, the benefiting residents and property owners have the option of refusing highway traffic noise abatement, at which time the decision is documented in the Final Design Highway Traffic Noise Report and the process ends.

If, as a result of refined engineering, the project limits become extended, the noise-sensitive receptors within the extended areas need to be assessed for highway traffic noise impacts. The justification for extending the project limits must be discussed in the Final Design Highway Traffic Noise Report. **The project limits are not to be extended solely for providing additional noise abatement to noise-sensitive receptors.** Noise abatement will not be considered for noise-sensitive receptors where there is no traffic noise impact from the project.

4.2 Date of Public Knowledge

Developed and undeveloped lands are required to have been permitted by the *Date of Public Knowledge* to be eligible for abatement consideration during the PE Phase. The Date of Public Knowledge shall be the date that a project's environmental analysis and documentation is approved (i.e., the date of approval of a CE, date of the issuance of the Finding of No Significant Impact for an EA, or the date of the Record of Decision for an EIS). The evaluation, design, and/or construction of any noise abatement after this date become the responsibility of local communities and private developers.

The Date of Public Knowledge and a thorough discussion of undeveloped lands (those permitted or not) must be documented within the text of the Final Design Highway Traffic Noise Report. Refer to Section 7.2 *Final Design Highway Traffic Noise Report: Format, Content, and Processing* for documentation details. This is in addition to the documentation required on the Noise Abatement Details Forms.

If substantial changes are made to the selected alignment (e.g., horizontal/vertical as defined in 23 CFR 772.5 *Type I Projects* [2][i]and [ii]) during the PE Phase that may result in changes to the noise environment, MDOT is responsible for assessing impacts only where the substantial

alignment occurs. This must be done for developed lands as well as undeveloped lands which are considered permitted at the time the change is assessed in the PE Phase noise analysis.

4.3 Context-Sensitive Solutions (CSS)

The MDOT Roadside Development Unit will lead the CSS process during the PE Phase, and will coordinate stakeholder meetings in regard to CSS. The CSS process will require a voting survey of all the stakeholders in regard to its determinations. Refer to *Step 6 – Public, Municipality, and Agency Involvement* in this Handbook for assistance on the public involvement process.

NOTE – *Stakeholder in Noise Abatement Aesthetics*

Stakeholders in the context sensitive design of noise abatement include: local officials, local, state and federal agencies, public and private organizations, and affected property units. The stakeholders should involve representatives from each of these groups. Coordinate with MDOT Roadside Development in identifying specific groups or organizations.

In order to achieve a successful noise barrier design, a noise barrier must be acoustically effective, structurally sound, safe for the motorist, durable, and visually attractive. Moreover, a noise barrier should complement the community for which it is abating noise. The relationship of the proposed noise barrier to the environment is a primary factor in the aesthetics that cannot be ignored. Location, color, texture, material, shape, placement, and detail all influence the effect of the barrier on the environment. The landscape, which provides a basis for the highway's character, will impact the style of the barrier. All of these factors and their incorporation in the noise barrier design will determine the aesthetics and, ultimately, the public acceptability of the noise barrier. Below are only a few considerations that each Region Office or TSC may consider on a project-by-project basis. Reference the FHWA *Highway Noise Barrier Design Handbook*, February 2000 for a more comprehensive discussion of a wide variety of considerations.

- Texture details and color of the noise barrier.
- Tree/shrub plant material and ground covers should be considered where planting space is available, while also considering maintenance requirements. Tree replacements should be considered as a minimum requirement to offset vegetative losses for construction of the wall. The appropriate Region/TSC Office should coordinate with the Roadside Development Unit to determine the type, amount, and placement of plant material on the highway side of the noise barrier. Although not necessary, community and municipality input can be considered. **It must be understood that vegetation is not a substitute for noise abatement.**
- Consider providing a barrier kick plate for protection from landscaping equipment and snow removal machinery.
- Consider providing a cap on the top of the noise barrier or integrally cast into the barrier panels. When a noise barrier varies in height, angled or sloped barrier panel tops may be considered as a way to smooth out and “blend” the noise barrier into the surrounding environment.

NOTE - *Community Specific Icons, Seals, or Shields*

Funding from the community or local government may be used for aesthetic enhancements such as specific wall graphics (e.g. city seals), plantings, etc. However, third party funding cannot be used to contribute funds when the reasonableness cost criteria is not met. See section 6.5 *Third-Party Funding Options* on page 40.

4.4 Value Engineering and Contractor-Suggested Changes

Highway traffic noise abatement measures shall be evaluated with respect to current MDOT value engineering policies during Base Plan Preparation and prior to construction and/or changes proposed by the contractor. This shall be done in order to determine if the application of value engineering concepts are warranted. The currently approved noise model program is an excellent tool to optimize the noise abatement being proposed. Specific information regarding highway traffic noise abatement value engineering will be distributed to MDOT Lansing Office and to the Regions, as appropriate.

NOTE – *Value Engineering Effects on Acoustical Profiles and Aesthetic Commitments:*

Value engineering should not jeopardize the proposed noise barrier in terms of its acoustical profiles, aesthetics, or contractor-suggested changes. Changes to roadway profile or alignment may affect the acoustical profile. Typically, commitments to acoustical profiles and aesthetics (i.e., sloped top panels, full panels, post type, landscaping, etc.) occur during the public involvement process and therefore cannot be removed from the project as the result of value engineering or as the result of the contractor requesting alternatives. The Regions or TSCs should coordinate with the professional(s) designing the noise barrier to determine, through the use of the currently approved computer-modeling program, if value engineering changes are compatible with the abatement commitments made during the public involvement process.

4.5 Applications for Absorptive Noise Barrier

Depending on the specifics of the transportation improvement project, an absorptive-faced noise barrier may be analyzed for parallel barrier configurations (a barrier located on both sides of the freeway), or for locations where there are parallel communities and only one side gets a barrier, and where the ratio of the distance between the barriers to barrier-height is less than 10:1 (e.g. a configuration such that a 100-foot cross section is flanked on both sides by noise barriers at least 10 feet high). Coordination with the Lansing Office is required for these situations.

The final determination for the use of an absorptive treatment will be made in consultation with the Lansing Office and FHWA personnel based upon review of the noise data. Under no circumstances should the use of absorptive treatment be presented to the public until approval from the Lansing Office and FHWA has been obtained.

5.0 STEP 5 – Construction Noise Consideration

Construction noise should be addressed as part of the development of any transportation facility. Roadway construction is often conducted in proximity to residences and businesses and should be controlled and, if necessary, monitored in order to avoid excessive impacts. The reaction by a community to construction-generated noise can threaten construction schedules. In general, a project's schedule can be maintained by balancing the type, time of day, and duration of construction activities; considering the intent of local noise control requirements; and being proactive to community concerns.

For MDOT projects, potential construction-related noise impacts from transportation improvement projects should be evaluated on a project-by-project basis, considering land uses/activities identified, construction measures being used, and public concern. The level of analysis can range from qualitative to quantitative analyses, depending on the anticipated level of impact. Consult with the Lansing Office in determining the level of construction noise analysis and possible associated activities.

5.1 FHWA Roadway Construction Noise Model (RCNM)

To aid in the analysis of construction-related noise impacts, the FHWA has developed the FHWA Highway Construction Noise Handbook and the FHWA Roadway Construction Noise Model (RCNM) for the prediction of construction-related noise. This model is not required for use on federal-aid projects; however, it can be used for the prediction of construction noise during the EPE and PE Phases. The FHWA RCNM predicts noise from construction operations based on a compilation of empirical data and the application of acoustical propagation formulas. It enables the calculation of construction noise levels in more detail than manual methods while avoiding the need to collect extensive amounts of project-specific input data. The Highway Construction Noise Handbook and the RCNM are available online through the FHWA's Web site at:

http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook00.cfm

5.2 Source Control

In devising construction noise-control strategies, an important option is to control the noise at the source. By specifying and/or using less noisy equipment, the noise impacts produced by construction of a highway facility can be greatly reduced or even eliminated. Source control requirements may have the added benefit of promoting technological advances in the development of quieter equipment. Additional options to reduce anticipated construction-related noise impacts should focus on limiting the time of day or allowable duration for specific activities in noise-sensitive areas or planning construction staging-areas in a practical way, away from noise-sensitive areas and activities.

If the project activity includes any nighttime (10pm-7am) construction or demolition of any bridges at any location near a residential area, special measures should be considered to reduce the potential for sleep disruption. The FHWA Handbook also addresses nighttime construction activity.

NOTE – *Construction Noise-Related Coordination with Locals*

When construction noise is an issue, the Region should coordinate with the communities and local municipalities to establish periods of time when construction activities that cause high noise levels should not occur. Any time construction noise specifications are required to be included, detailed coordination is suggested with MDOT and the local municipality. The residents adjacent to the barriers will be notified 2 weeks prior to any barrier construction activity.

5.3 Construction Noise Documentation

Based on the degree of information available at this phase, the effects of construction noise should be documented in the Environmental Clearance document and Final Design Highway Traffic Noise Report. In doing so, the temporary nature of the impacts should be noted. An indication of the types of construction activities that can be anticipated and the noise levels typically associated with these activities can be obtained from existing literature or from the FHWA RCNM. Utilizing a common-sense approach, traffic noise analyses should identify measures to mitigate potential highway construction noise impacts. Low-cost, easy to implement measures should be incorporated into project plans and specifications (e.g., work-hour limits, equipment muffler requirements, location of haul roads, elimination of “tail gate banging,” reduction of backing up for equipment with alarms, community rapport, complaint mechanisms). For example, the following language may be incorporated:

“Construction of the proposed project will result in a temporary increase in the ambient noise level in the vicinity of the roadway. The construction contract specifications should require that the contractor adhere with all Federal, state, and local noise abatement and control requirements. Construction noise on this project should be controlled by measures including but not limited to having construction equipment in good repair and fitted with "manufacturer recommended" mufflers.”

or

“The Michigan Department of Transportation is committed to abatement of construction noise at the locations identified in (Table, Figure, Chart, etc.) contingent on the following considerations:

1. detailed construction noise analysis and design considerations during the PE Phase;
2. community input regarding sequence of operations and time and activity constraints;
3. site and source control of construction; and
4. safety and engineering aspects.

It is likely that the noise abatement measures for the identified construction noise-impacted areas will be carried out if found to be feasible and reasonable based on the contingencies listed above.”

6.0 STEP 6 – Public, Municipality, and Agency Involvement

6.1 Degree and Type of Involvement

The degree and type of public/municipality/agency involvement will vary from project to project. Public involvement activities for projects requiring the consideration of highway traffic noise should allow for presentations and subsequent discussions of both highway traffic noise and construction noise levels and impacts related to the Type I and Type II projects. Opportunities for such involvement should be provided as appropriate during both the EPE Phase during the environmental document preparation and the PE Phase through the CSS process. The *MDOT Guidelines for Stakeholder Engagement* (January 2009)⁶ document can help you determine an appropriate level of stakeholder engagement for your project. Discussion should relate to issues such as:

- noise compatible land use planning;
- highway traffic noise levels;
- highway traffic noise-related impacts;
- highway traffic noise abatement options;
- areas where highway traffic noise abatement is not feasible and reasonable.

NOTE – *Final Design Noise Abatement Public Meeting(s)*:

Preliminary Engineering (PE) Phase noise abatement public meetings should not be conducted until the draft version of the Final Design Highway Traffic Noise Report is approved by the Region or TSC, Lansing Office and FHWA. Highway traffic noise abatement commitments and aesthetics will be finalized at the final design stakeholder engagement meeting(s). The results of the final design noise abatement public meeting(s) will be included in the final version of the Final Design Highway Traffic Noise Report.

6.2 Local Officials

An effort shall be made to inform local officials, within whose jurisdiction(s) the highway project is located, of ways to prevent future highway traffic noise impacts on currently undeveloped lands. This information could be presented in the form of a document or by meeting with the officials. The information, whether by document or meeting, should be conducted before or during the early stages of the noise analysis. The following bullets [from 23 CFR 772.15(b) and 17] include the information that should be provided.

- Noise compatible land use planning concepts;
- The best estimation of future noise levels (for various distances from the highway improvement) for undeveloped lands or properties from the edge of the nearest

⁶ http://www.michigan.gov/documents/mdot/MDOT_Guidelines_For_Stakeholder_Engagement_264850_7.pdf

travel lane of the highway improvement where the future noise levels meet MDOT's definition of "approach" for undeveloped lands or properties within the project limits.

- Non-eligibility for federal-aid participation for Type II projects. For Type II projects, noise abatement measures will be approved only for projects that were approved before November 28, 1995, or are proposed along lands where land development or substantial construction predated the existence of any highway. The granting of a building permit must have occurred prior to right-of-way acquisition or construction approval for the original highway. Noise abatement measures will not be approved at locations where such measures were previously determined not to be reasonable and feasible for a Type I project.

Once a noise barrier has been identified as meeting feasibility and reasonableness during the EPE Phase, during the PE Phase MDOT will conduct discussions with local authorities on developing a maintenance or easement agreement for functional enhancements (e.g. fire hydrants, emergency access doors), and aesthetic and structural 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.

The agreements, resolutions, or ordinances will be recorded in the Final Design Highway Traffic Noise Report

NOTE – *Local Officials Vote on Noise Abatement Construction*

Local officials as a body do not have a vote on the preference for or against noise abatement construction. The construction of noise abatement is solely based on the vote of property owners and residents of benefiting units. Local officials cannot override the desires of the property owners and residents benefiting units for or against noise abatement construction.

6.3 Benefited Receptors/Community

Noise abatement will not be approved without documentation that the public involvement process had been followed during the EPE and PE Phases. Coordination with the public is a very important part of successful noise abatement. A good community relations effort can often prove to be the most effective highway traffic noise mitigation component. The specific number and schedule of meetings will be made by MDOT and its consultants based on the extent of the project and level of controversy or public interest.

Information on FHWA and MDOT noise abatement regulations, rules and procedures will be presented within the public meetings held as required by NEPA during the EPE Phase. After the draft Noise Abatement Technical Report is approved by MDOT and FHWA, the public meetings will include explanations on the study results, identify preliminary findings on feasible and reasonable noise barrier locations, explain the Statement of Likelihood, and the public involvement process during the PE Phase. Typically, during the NEPA process for an EIS or EA,

the noise abatement analysis information is presented along with other environmental concerns and analyses. A Categorical Exclusion with noise impacts will include a meeting specifically on the noise abatement analysis, if there are no other environmental concerns. If the noise analysis during the CE Classification phase does not identify any feasible and reasonable noise abatement, then no public meeting is required. The public will have an opportunity during this meeting to provide comments on the study and provide any insight that may aid in the assessment of the noise environment during the PE Phase. The method of collecting comments will be determined on a project-to-project need based on the scope of the project and the level of controversy. All comments regarding the traffic noise analysis will be included in the final Noise Abatement Technical Report and in the Highway Traffic Noise Analysis Data File (Refer to *STEP 7 – Reporting Results of Highway Traffic Noise Analyses*, Subsection 7.1.4)

The public involvement process during the Preliminary Engineering (PE) Phase is to give the property owners and residents of the benefiting receptor units the opportunity to voice their opinions on the noise abatement, and, along with the other stakeholders, on the aesthetics and functional elements (such as emergency vehicle or fire hydrant access) of the noise abatement. The property owners and residents of the benefiting receptor units will have the opportunity to vote for or against noise abatement construction after the draft Final Design Highway Traffic Noise Report is approved by MDOT and FHWA. The initial stakeholder engagement meeting, as part of the Context Sensitive Solutions (CSS) process, may be held at the same meeting on the vote on noise abatement. Stakeholder engagement public meetings with affected property units and local officials are held for their input on the aesthetics of the abatement such as color, texture, landscaping, etc. Subsequent community meetings allow for a refinement of the abatement design, keeping in mind the acoustic, engineering, and safety considerations until agreement is reached.

At any time during this process, up to the publication of the Final Design Highway Traffic Noise Report the majority of the property owners and residents of the benefiting receptor units may decide that they do not want noise abatement. If this is the case, the decision not to accept the proposed noise abatement recommendations shall be documented in the Report.

6.4 Voting Procedures

The method of obtaining votes (i.e., flyers, door-to-door, public meeting, etc.) shall be determined by the MDOT Region Office or TSC on a project-by-project basis and must be recorded in the environmental documentation how each benefiting receptor unit owner or resident voted. The method must be conducted in a manner that definitively assures that all benefiting units have had an opportunity to vote and provide comment on any noise abatement measure. The public meeting notices should include a voting method for those who may not be able to attend a public meeting such as return ballots, web based, or any survey technology that also assures that the voter is a benefiting unit property owner or resident.

6.4.1 Voting on the Construction of the Noise Barrier

A meeting during the PE Phase shall be conducted, as previously stated, so the property owners or residents of benefiting units will have the opportunity to vote on whether they are in favor of the proposed noise barrier. Only the owners and residents of those receptor units that benefit from noise abatement may vote. This is an essential factor in determining reasonableness of the

noise abatement. Only one vote per benefited unit will be accepted with the exception of rental dwelling units (See the following note – *Rental Unit Owner and Tenant, and Special Use Areas Voting*). Of all the votes tallied, 50% or more of the benefiting units must vote in favor of noise abatement. The absence of returned surveys or attendees to public meeting may be considered as an affirmative vote for noise abatement. Final interpretation of the voting results will be made by MDOT and its consultants, considering all the feedback gained during the public involvement process.

NOTE – *Voting Against Noise Abatement*

The property owners and residents of benefiting units will be informed before the vote that a decision against noise abatement at a specific location means no future noise abatement, including Type II, will be considered or approved for that specific location. Only a Type I scenario will trigger a future noise abatement assessment at that location.

NOTE – *Rental Unit Owner and Tenant, and Activity Category C Areas Voting:*

The property owner and tenant will receive notice of the public meetings regarding noise abatement. The property owner of a rental benefiting dwelling unit(s) will count as one (1) vote per benefiting unit for or against a noise barrier and/or a barrier’s aesthetics. The owner may delegate this authority to an office/property manager if one is available. The tenant of an individual benefiting dwelling unit will count as a one-half (0.5) vote. For Activity Category C areas such as churches, schools, and park/recreational fields, the vote(s) will be accepted only from the governing authority that owns or manages the area in question.

NOTE – *Condominium Complexes:*

Condominium complexes will be viewed the same as any other residential property.

6.4.2 Voting on the Color & Texture of the Noise Barrier

The MDOT Roadside Development Unit will coordinate the CSS process in the stakeholder collaboration for the color, texture, landscaping, etc. In general, all stakeholders will have equal votes and status as to the aesthetics of the noise barrier. In the case of conflicting desires, those affected property units that abut the noise barrier, abut the right-of-way line, or have an unobstructed view of the noise barrier will receive greater consideration than those receivers that have an obstructed view of the barrier. Professional judgment will be required in making this determination. It is recommended that the project team tally the votes and summarize the results on project mapping to facilitate decision making in reconciling conflicting desires. Final interpretation of the voting results will be made by MDOT and its consultants, considering all feedback gained during the public involvement process.

6.5 Third-Party Funding Options

Third-party funding is limited to aesthetic and functional enhancements above and beyond that for which MDOT is responsible. Third-party funding will be limited to aesthetic enhancements requested such as specific wall graphics (e.g. city seals), plantings, etc. and cannot be used to contribute funds when the reasonableness cost criteria is not met. Any additional costs associated with the desires of a municipality/community to have special graphical designs (i.e., standard color/texture vs. imprinted or painted graphical designs) on either the residential side or the highway side of the proposed noise barrier must be paid for by the municipality/community.

Regardless of contribution sharing, no barrier will be funded by MDOT which does not meet the feasibility and reasonableness requirements. The Region Office or TSC must work with those providing the funding to work out the details of the agreement. Once the noise barrier components (posts, panels, caps, etc.) are ordered, the third party is committed to the funds associated with the agreement, and no changes will be made to the order unless the third party is willing to absorb the additional cost associated with the order change. All third-party funding agreements must be addressed in a non-discriminatory way and documented in the Final Design Highway Traffic Noise Report.

NOTE - *Screening Barrier or Walls*

MDOT Lansing Office, Region Office, and/or TSC may receive requests for a barrier (structure or vegetative) to screen traffic in lieu of noise abatement which did not meet feasibility and reasonableness. The term, “screening barrier” or “screening wall” is not noise abatement and should never be used in the context of noise abatement and MDOT discourages their use or to create the perception of noise abatement.

If the MDOT TSC or Region Office decides to use a screening wall or barrier for aesthetic purposes, then the adjacent property owners must be informed that this screening is not meant for noise abatement. Screening walls are an enhancement for the adjacent properties. Screening walls should only block the line of sight of the majority of the traffic. The view of the top of tractor-trailer should not be taken into consideration in the design of a screening wall or barrier. MDOT Roadside Development should be contacted and utilized in regard to the use, design, and aesthetics of any screening activities such as walls or vegetative screens.

However, a screening wall or a vegetative screen can be kept in a project manager’s toolbox for use in ROW negotiation with adjacent land owners. Contact an MDOT Real Estate representative and the Lansing Office Environmental Section before any ROW and enhancement negotiation.

6.6 Responding to Traffic Noise Nuisance Calls or Type II Abatement Requests

MDOT periodically receives requests to provide noise abatement along existing highways. The MDOT noise abatement policy is currently limited to construction of Federal-aided Type I noise abatement. The following standardized letter should be used when responding to inquiries concerning abatement on existing highways.

Example MDOT Traffic Noise Nuisance Calls or Type II Response Letter

Dear Resident:

This letter is in response to your interest in constructing noise barriers on existing highways. The Michigan Department of Transportation's (MDOT) noise abatement policy is currently limited to construction of warranted noise barriers as part of a highway projects listed in the federal regulation 23 CFR 772.5 definition of Type I projects which include a project on new alignment or for a major reconstruction project which adds travel lanes. There is no federal guidance requiring the construction of noise barriers on existing highways nor are there federal funds for these projects.

MDOT does have a Type II noise abatement program which is voluntary and provides for Federal-aided noise abatement for existing highways. However, due to budgetary constraints MDOT's Type II is suspended until further notice.

While we periodically receive requests for noise abatement along existing roadways, we have been unable to accommodate them due to resource constraints.

Thank you for your continuing interest in Michigan's Transportation Program. Please reference the federal regulation 23 CFR 772 and MDOT noise policy, rules and procedures handbook for further information. If you have any further concerns regarding this issue, please feel free to contact MDOT in the future.

7.0 STEP 7 – Reporting Results of Highway Traffic Noise Analyses

7.1 Environmental Clearance Reporting

It is the responsibility of the MDOT Region and Lansing Offices and the qualified professionals performing the highway traffic noise analyses to ensure that the results of the highway traffic noise analyses are accurately documented in all sections where it may apply within all the environmental clearance documents [Section 106, Section 4(f), Noise Analysis Report, and CE/EA/EIS] for that transportation improvement project. A separate noise analysis report will be required for any projects requiring a highway traffic noise analysis as part of a CE, EA, or EIS with a summary included as part of the main document.

The scope and magnitude of a noise analysis is determined by the extent of anticipated noise effects, not on the NEPA classification. A project may be classified as an EIS due to significant wetland impacts but have no noise-sensitive sites in the project area. In this case, no noise analysis would be required. Conversely, a CE project for a roadway widening within the existing right-of-way in an already noisy area may require a detailed noise analysis. Step 1 provides further direction on scoping the appropriate level of analyses. Refer to MDOT's "Document Preparation Process and Procedures Guide for NEPA Documents", June 2009 in preparing an EA or EIS.

7.1.1 Noise Analysis Report

A noise analysis report should adhere to the following outline, however, any additions, deletions or alterations to the document can be discussed with the MDOT Lansing Office.

7.1.1.1 Requirements for Noise Analysis Report

1. Executive summary
2. Purpose of the report
3. Project description
4. Discussion of basic traffic noise concepts
 - Discussion of basic acoustic concepts
 - Federal policies and guidelines
 - State rules and procedures
5. Discussion of methods used to analyze project
 - FHWA Traffic Noise Model (TNM)
 - Field measurement and model comparison
6. Discussion of traffic impacts for conditions analyzed (including traffic data)
 - Identification and description of each Common Noise Environment (CNE)
 - Existing conditions
 - Design year build alternative/s

7. Federal and State Mitigation Guidance
 - Feasibility and reasonableness
 - Mitigation strategies
8. Discussion of Mitigation
 - Identify modeled abatement
 - Identify feasible and reasonable abatement
9. Discussion of conclusions and recommendations
10. Statement of Likelihood (Page 30)
11. Discussion of construction impacts
12. References
13. Appendices
 - Field survey data
 - Ground view graphic showing noise barrier(s) with the heights of the panel sections

The TNM input/output data and files in electronic format should accompany the report.

NOTE - All discussions on background information (regulations, policy, guidance, noise basics, and analyses methodologies) should be the most basic information without elaboration.

7.1.1.2 Map Elements

A road map (without aerial imagery) showing the extent of the project should be included with the project description. Other maps should include all noise analysis information, but the complexity and extent of the project will determine if the information should be divided between one or two maps. The map should include the proposed alignment and lane configuration with all of the listed features (below) or could be separated to two types that have one map including the elements with one asterisk and the other with the two asterisks.

- Common Noise Environment boundaries*
- Field measurement locations*
- Receiver locations*
- Impacted receivers highlighted*
- Buffer on undeveloped land*
- All considered noise barrier locations (with recommended noise barriers highlighted)**
- The benefiting units for each noise barrier indicated (point symbols, not linear or area)**

7.1.1.3 Tables with column headings

The following are the suggested tables that should be included within the noise analysis report. The number does not indicate what the table number would be in the document. An added column indicating project alternatives should be included in the appropriate tables for alternative analyses. Variations on the table configurations can be discussed with MDOT.

1. *Noise Abatement Criteria* – Copied directly from Table 5 in FHWA’s “Highway Traffic Noise: Analysis and Abatement Guidance” add a footnote defining MDOT noise impact definition and that MDOT does not use the L10 descriptor.
2. *Model Validation* - Monitor receiver ID, location description, Time of monitoring, Traffic numbers, Measured dB(A), Monitored dB(A), dB(A) difference
3. *Traffic* - Corridor section ID, Corridor extent description, Existing and predicted traffic (autos, medium and heavy trucks)
4. *Sound/Noise Levels* - Receiver ID, Location description (e.g.: address), Existing sound levels, Predicted sound levels, Difference in sound levels, and, within the table, the row of impacted receivers highlighted
5. *Barrier Description(s)* - Barrier ID, Location, Length, Average Height
6. *Barrier(s)* - Barrier ID, No. of -10 dB(A), -7dB(A) Attained (Y/N), Total Cost, No. of benefiting units, Cost per benefiting units, Feasible (Y/N), Reasonableness (Y/N)
7. *Appendix* - Barrier ID, Receiver ID, Existing (Level, Impacted [Y/N]), Predicted Noise Level - no Build (Level, Impacted [Y/N], Difference), Predicted Noise Level - Build (Level, Effectiveness [dB(A) +/-])

NOTE - Maps and tables should be placed immediately following the text describing their subject.

Tables for Barrier Description(s) and Barrier(s) could be combined if space allows.

7.1.2 Noise Analysis Summaries

The sections within the EA/EIS documents the noise analysis sections need to provide introductory material in brief and focus primarily on the analysis. The synopsis of the analysis should center on the essential elements that lead to the noise analysis conclusions and refer readers to the noise analysis report for more detailed information. The mitigation section should identify only the barriers that meet feasibility and reasonableness, a statement on the Context Sensitive Solutions (CSS) process, construction noise (and vibration, if necessary) and include the Statement of Likelihood.

7.1.3 NEPA Reevaluations

The purpose of a NEPA re-evaluation process is to determine if the project and environmental information developed to date is still valid. Any NEPA documentation or decision must be reevaluated if there are changes to the project design/concept/scope, applicable regulations, surrounding environment, impacts or proposed mitigation that were not previously addressed.

The following is the text from 23 CFR 771.129:

- a) A written evaluation of the draft EIS shall be prepared by the applicant in cooperation with the Administration if an acceptable final EIS is not submitted to the Administration within three years from the date of the draft EIS circulation. The purpose of this evaluation is to determine whether or not a supplement to the draft EIS or a new draft EIS is needed.
- b) A written evaluation of the final EIS will be required before further approvals may be granted if major steps to advance the action (e.g., authority to undertake final design, authority to acquire a significant portion of the right-of-way, or approval of the plans, specifications and estimates) have not occurred within three years after the approval of the final EIS, final EIS supplement, or the last major Administration approval or grant.
- c) After approval of the ROD, FONSI, or CE designation, the applicant shall consult with the Administration prior to requesting any major approvals or grants to establish whether or not the approved environmental document or CE designation remains valid for the requested Administration action. These consultations will be documented when determined necessary by the Administration.

[52 FR 32660, Aug. 28, 1987; 53 FR 11066, Apr. 5, 1988, as amended at 74 FR 12530, Mar. 24, 2009]

7.1.4 Highway Traffic Noise Analysis Data File

A highway traffic noise analysis data file shall be prepared using the data obtained from the EPE highway traffic noise analysis. The highway traffic noise analysis data file shall serve as a guide in the analysis of highway traffic noise impacts during the PE Phase of the transportation improvement project when final alignments have been established and engineering data are available for final detailed analysis of predicted highway traffic noise levels, impacts, and abatement features. The highway traffic noise analysis data file shall contain a discussion of the methodology and computer program(s) utilized and all relevant data used to arrive at the recommendations in the environmental document.

The highway traffic noise analysis data file shall be collected into an electronic format and contain all data collected and analyzed to perform the highway traffic noise analysis such as:

- project number, project description, date of FHWA approved environmental document
- highway traffic noise monitoring field data sheets;
- all inputs for highway traffic noise computer analyses;

- all final outputs of computer analysis including noise barrier optimization analyses;
- list of software and their versions used for noise analysis, graphic illustration, and document creation;
- maps used to lay out the highway traffic noise analysis input parameters, including receptors and highway segments plotted along with their coordinates;
- proposed noise barrier type, size, and location data; and
- public comments, coordination, and responses related to noise issues.

The highway traffic noise analysis data file shall be compiled following the completion of the EPE Phase and one copy shall be sent to the project manager for inclusion in the Region or Transportation Service Center (TSC) Offices project file and two to the Lansing Office (one to each: the Environmental Section and the Construction and Technology Division). Since several of the above items could possibly generate large documents, electronic storage (i.e., CD-R, or DVD-R) is recommended. The project number, project name, date of FHWA approved environmental document should included on the electronic storage label and accompanying memo. The memo should also include the list of software and their versions used for noise analysis, graphic illustration, and document creation.

7.1.5 Section 106 Evaluations

Highway traffic noise analysis for a Section 106 evaluation shall be identified as a part of the overall transportation improvement project. The highway traffic noise analysis will focus on the question of whether there is a noise impact on a Section 106 property. If there is a noise impact on a Section 106 property, the Michigan State Historical Preservation Office (SHPO) will make the decision on the effects finding using the information gained from the highway traffic noise analysis. FHWA will make the final determination on whether the noise impact is an Adverse Effect. Contact MDOT Lansing Office Cultural Resource Staff for proper Section 106 procedures.

7.1.6 Section 4(f) Evaluations

Highway traffic noise analysis for a Section 4(f) evaluation shall be identified as a part of the overall transportation improvement project. The highway traffic noise analysis will focus on the question of whether there is a constructive use of a Section 4(f) property. If a constructive use is determined, the noise analysis then becomes directly related to the subject Section 4(f) analysis, documentation, and resulting legal mitigation commitments which must be carried out. The determination of constructive use as it pertains to noise impacts on a Section 4(f) property is made by FHWA by reviewing the information from the highway traffic noise analysis. FHWA will make the determination based on whether the increased highway traffic noise levels interfere substantially with the use and enjoyment of a noise-sensitive receptor protected by Section 4(f), such as hearing the performance at an outdoor amphitheatre, the sleeping area of a public campground, the enjoyment of a historic site where a quiet setting is a generally recognized feature or attribute of the site's significance, or the enjoyment of an urban park where serenity and quiet are significant attributes. Also, the Section 4(f) document and mitigation commitments must be referenced in the Final Design Highway Traffic Noise Report. Contact MDOT Lansing Office Section 4(f) specialist for proper Section 4(f) procedures.

According to the following sections of 23 CFR 774.15(f), FHWA states that a constructive use does not occur in the following situations:

“(2) The impact of projected traffic noise level of the proposed highway project on a noise-sensitive activity do not exceed the FHWA noise abatement criteria as contained in Table 1 in part 772 of this chapter, or the projected operational noise levels of the proposed transit project do not exceed the noise impact criteria for a Section 4(f) activity in the FTA guidelines for transit noise and vibration impact assessment.

(3) The projected traffic noise levels exceed the relevant threshold in paragraph (f)(2) of this section because of high existing noise, but the increase in the projected noise levels if the proposed project is constructed, when compared with the projected noise levels if the project is not built, is barely perceptible (3 dB(A) or less). “

As stated in the above regulation, Section 4(f) places a higher threshold for highway traffic noise as it pertains to constructive use impacts as compared to the general highway traffic noise thresholds. Therefore, in order for highway traffic noise levels to be considered to have a constructive use under Section 4(f), there must be:

- a. a future highway traffic noise level that approaches or exceeds an $Leq(h)$ of 67 dB(A), or
- b. existing noise levels which approach or exceed 67 dB(A) and a predicted increase with the future build alternative greater than 3 dB(A) or more above the predicted No-Build Alternative noise level.

As already stated, FHWA will make the determination of constructive use as it pertains to noise impacts on a Section 4(f) property.

The noise barrier itself could be determined to have a constructive use as described in 23 CFR 774.15(e)(2) where:

“The proximity of the proposed project substantially impairs aesthetic features or attributes of a property protected by Section 4(f), where such features or attributes are considered important contributing elements to the value of the property.”

This situation is more likely to occur with historic properties in which case the State Historic Preservation Office (SHPO) will be brought into consultation with MDOT and FHWA.

NOTE – *Cultural and Section 4(f) Resource Coordination:*

Consultation and coordination with those responsible for the resource must be carried out and documented in the Environmental Clearance and Final Design Highway Traffic Noise Reports.

7.1.7 Title VI and Environmental Justice

When assessing highway traffic noise, Title VI and Environmental Justice must be adhered to. No one, on the basis of national origin, color, race (and, for Environmental Justice, minority and low income), should be denied the benefits of highway traffic noise abatement, and fair participation will be provided (during the public involvement process) in the decision-making process. Further information can be obtained regarding Title VI and Environmental Justice from the following FHWA website: <http://www.fhwa.dot.gov/environment/ejustice/facts>. For further assistance on this issue, contact the Lansing Office Project Planning Division.

7.2 Final Design Highway Traffic Noise Report: Format, Content, and Processing

The Final Design Highway Traffic Noise report is meant to document the final noise abatement design, the public involvement process and results, any maintenance agreements between the local officials, and any construction noise mitigation activities.

7.2.1 Final Design Highway Traffic Noise Report Format and Content

The Final Design Highway Traffic Noise Report should include, at least, the information presented in the following outline. Although the intent is to provide statewide uniformity for all Final Design Highway Traffic Noise Reports, there is the understanding that, in many cases, additional information and variations to the following outline may be necessary due to project specifics.

1. Executive Summary
 - A synopsis of the project and proposed noise abatement commitments
2. Introduction
 - Background, design year, and specific details of the project, including the preferred alternative and side road improvements
 - Regional and project location maps
 - EPE noise abatement results and commitments summary
 - Date of public knowledge
3. Discussion of Methods used to Analyze Project
 - Monitoring and modeling methodology used
 - Years considered
 - Field measurement and model comparison

4. Discussion of traffic impacts for conditions analyzed (including traffic data)
 - Identification and description of each Common Noise Environment (CNE)
 - Any alignment or elevation changes since EPE Phase
 - Existing conditions
 - Design year build conditions
5. Discussion of noise abatement
 - Modeled noise abatement
 - Confirm feasibility and reasonableness
 - Noise barrier matrix indicating the height of the noise barriers at each location where the height changes (i.e., barrier profile) and whether the barrier is ground-mounted or on structure.
6. Construction noise consideration and abatement opportunities
 - Identification and discussion of construction noise impacts and possible abatement opportunities and recommendations
8. Public involvement process
 - Discussion of public involvement efforts during the NEPA clearance process and include any public comments concerning the preliminary noise abatement commitments
 - Discussion of public involvement efforts during the PE Phase and voting results related to desire for a barrier (including community meetings, individual meetings, and special coordination)
 - Voting results for the barrier's location/color and texture
 - Abatement commitments: acoustic profiles and aesthetics

Appendices:

- List of preparers and reviewers

The following information should be included with the report in electronic format:

- FHWA TNM input and output data and files, traffic data used in the analysis, pertinent correspondence
- Supporting CAD files
- Copy of the highway traffic noise portion of the NEPA clearance document (if determined to be necessary)

NOTE – *Final Design Highway Traffic Noise Report Graphics:*

The entire Final Design Highway Traffic Noise Report should follow the guidance in Section 7.1.1.2 *Map Elements*.

7.2.2 Final Design Highway Traffic Noise Report Processing

Upon completion of a draft Final Design Highway Traffic Noise Report and prior to any public meeting(s), the appropriate Region Office or TSC, under its letterhead and signature, shall

forward three copies to the MDOT Lansing Office: one each for the Environmental Section, the Construction and Technology Division, and the Roadside Development (CSS) Unit for review. After this review, if comments are provided, the draft report will be returned to the project manager at the Region Office or TSC for revisions before Lansing Office approval. Once revised and approved, one draft report will be forwarded to FHWA for its review and concurrence. It is MDOT's practice to provide error-free documents (including grammatical and typographical errors) to FHWA. However, concurrent review by MDOT and FHWA may be required due to schedule limits. The comments will be returned to the project manager for revision of the draft Final Design Highway Traffic Noise Report. In the letter transmitting the comments to the Region Office, FHWA shall determine the appropriate processing for the revised document and indicate when it should be released for public review and comment.

NOTE – FHWA Review Requirements:

Type I and Type II projects utilizing federal funds for noise barriers must be reviewed by FHWA.

Once it has been determined that the draft Final Design Highway Traffic Noise Report is in an acceptable form, the Region Office or TSC may make it available for public and local agency review and conduct the necessary public meeting(s). After receipt of the public and agency review comments on the draft Final Design Highway Traffic Noise Report, the Lansing and Region Office or TSC shall analyze the comments and determine if:

- Additional noise impact assessment is required to address comments; and
- Noise abatement measure commitments have changed.

Once these have been considered, the final version of the Final Design Highway Traffic Noise Report shall be submitted to the Lansing Office. The final version of the Final Design Highway Traffic Noise Report shall be processed in the same manner as the draft version of the document.

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8.0 - REFERENCES

8.1 Federal Acts/Regulation

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005
Transportation Equity Act for the 21st Century (TEA-21) of 1998
FHWA Federal-Aid Policy Guide Title 23 Code of Federal Regulations Part 772
National Environmental Policy Act of 1969 (NEPA), as amended

8.2 Federal and State Policy, Guidance, and Directives

FHWA Report Number FHWA HEP-06-015, “FHWA Highway Construction Noise Handbook”, August 2006
“FHWA Road Construction Noise Model (FHWA RCNM) User’s Guide”, January 2006
“FHWA Traffic Noise Model[®] Version 2.5 User’s Guide (v. 2.5 Addendum)”, April 2004
FHWA Report Number FHWA-EP-00-005 “FHWA Highway Noise Barrier Design Handbook”, February 2000
FHWA Report Number FHWA-PD-96-046, “Measurements of Highway-Related Noise”, May 1996
FHWA Report Number FHWA-HEP-10-025 “Highway Traffic Noise: Analysis and Abatement Guidance”, January 2011
FHWA Technical Advisory T 6640.8A, “Guidance For Preparing and Processing Environmental and Section 4(f) Documents”, October 30, 1987
MDOT State Transportation Commission Policy on Noise Abatement - #10136
“MDOT Environmental Procedures Manual”, July 28, 2010
“MDOT Document Preparation Process and Procedures Guide for NEPA Documents”, June 2009
MDOT 2003 Standard Specifications for Construction
MDOT State Transportation Commission Policy on Context Sensitive Solutions - #10138

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APPENDIX A - GLOSSARY

The majority of the definitions that follow are taken directly from 23 CFR 772.5. Definitions preceded 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.

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 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 per 23 CFR772.5 then the entire project area as defined in the environmental document is a Type I project.

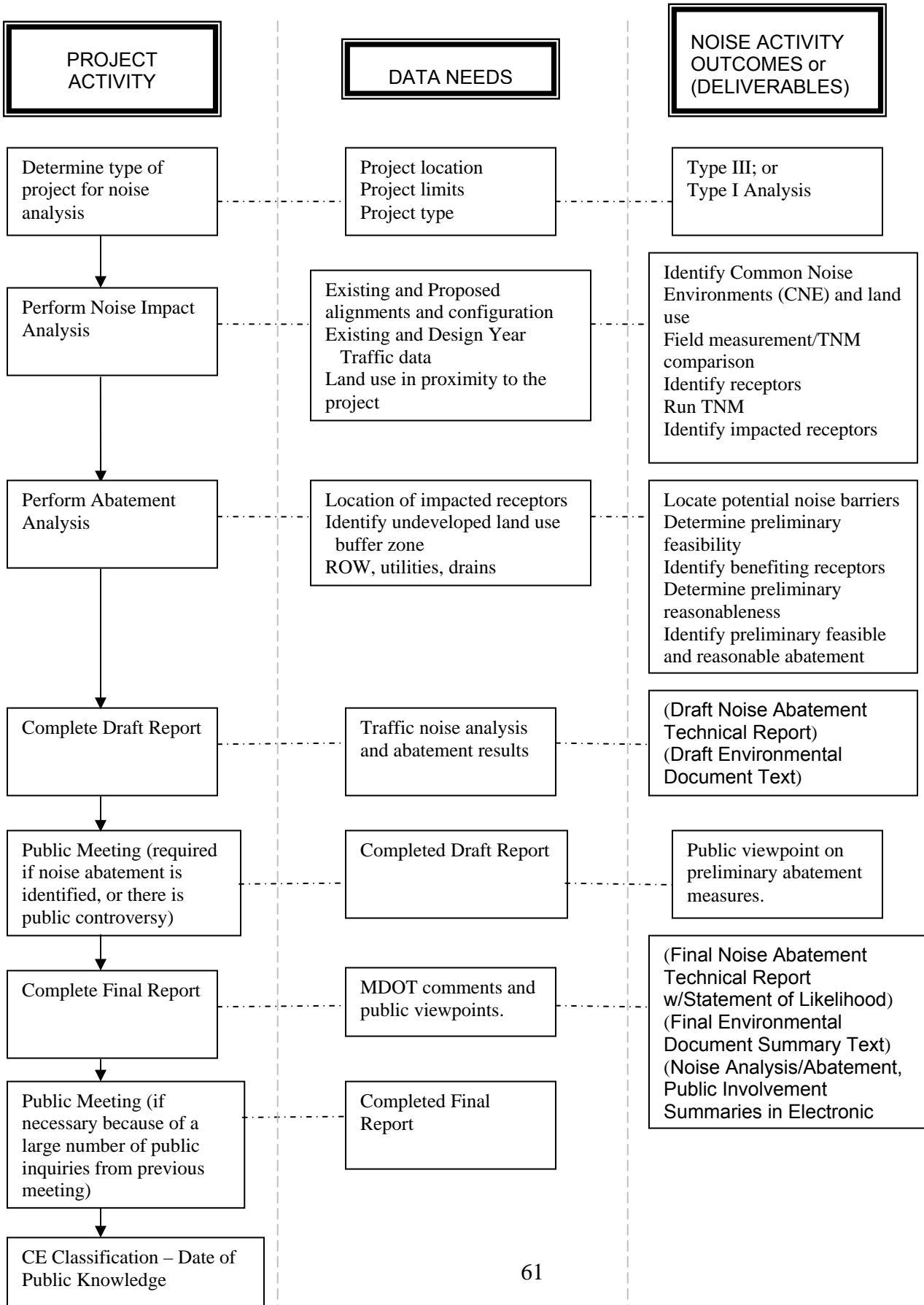
Type II Projects: A Federal or Federal-aided highway project for noise abatement on an existing highway. A state's participation is not mandatory and may choose not to implement a Type II program.

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.

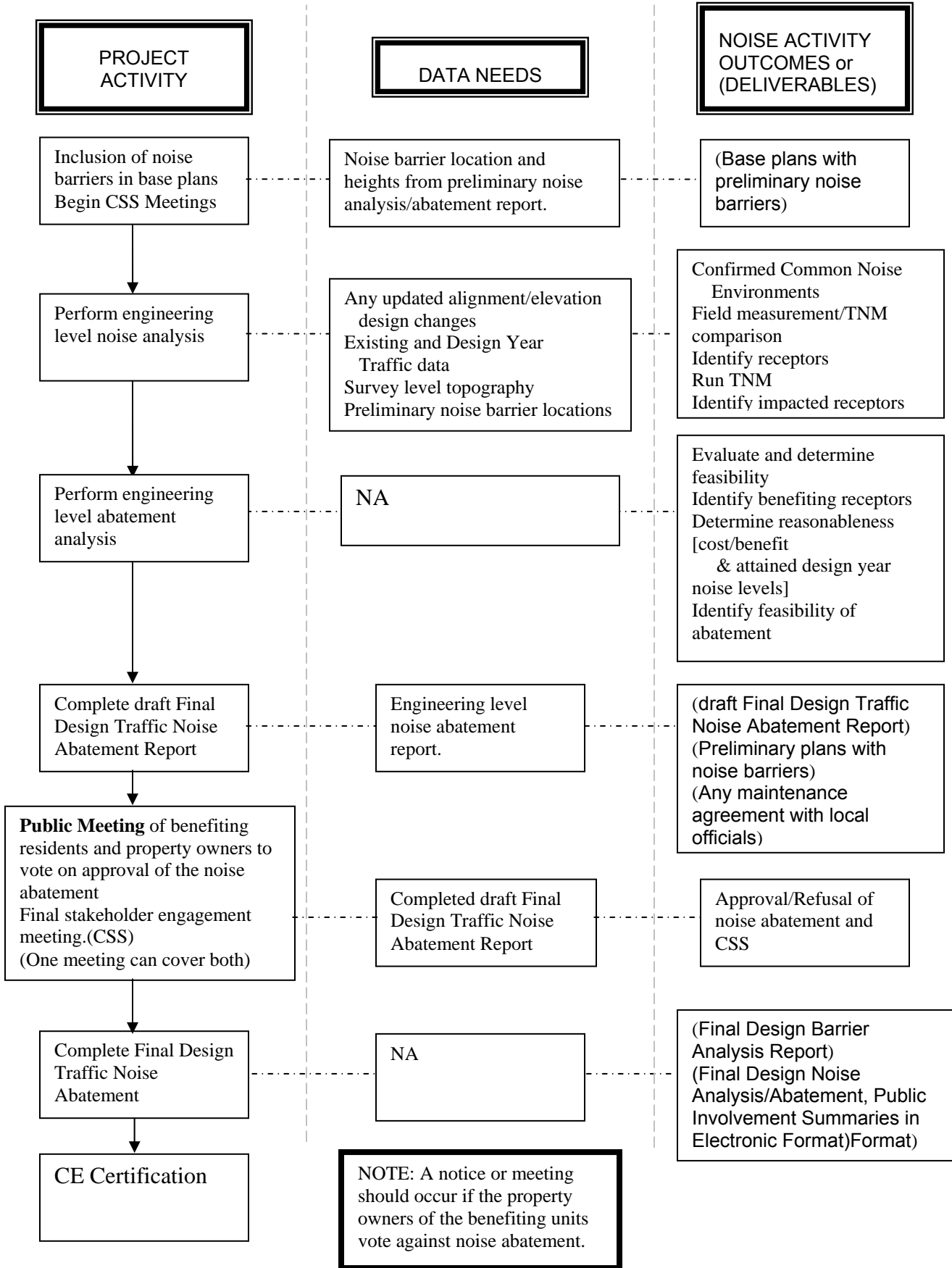
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APPENDIX B - Categorical Exclusion Noise Analysis Process Flowchart

Classification



Certification



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:

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

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 otherwise be present.
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 be 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.

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 (ft²) 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 (ft²). 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 ft². Divide this by the typical lot size of 7,200 ft² 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.

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:

$$\text{Dwelling Unit Equivalent (DUE)} = \# \text{ Occupants} \div (\text{Average persons per household}) \times \text{Usage}$$

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 \div 24 [Hours per day] \times # Days Used per Year \div 365 [Days per Year] (or # Days Used per Week \div 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.

$$\text{DUE} = 1200 \div 3 \times (6 \div 24 \times 70 \div 365)$$

$$\text{DUE} = 1200 \div 3 \times .0479$$

$$\text{DUE} = 19.16 \text{ (20 rounded up)}$$

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

$$\text{DUE} = 60 \div 3 \times (13 \div 24 \times 6 \div 7)$$

$$\text{DUE} = 60 \div 3 \times .4643$$

$$\text{DUE} = 9.286 \text{ (10 rounded up)}$$

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

$$\text{DUE} = 300 \div 3 \times (13 \div 24 \times 102 \div 365)$$

$$\text{DUE} = 300 \div 3 \times 0.1514$$

$$\text{DUE} = 15.14 \text{ (15 rounded up)}$$

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

$$\text{DUE} = 1000 \div 3 \times (4 \div 24 \times 56 \div 365)$$

$$\text{DUE} = 1000 \div 3 \times 0.0256$$

$$\text{DUE} = 8.53 \text{ (9 rounded up)}$$

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:

* 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

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....)

Page intentionally left blank

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 Reports*
 - 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 Reports*
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

APPENDIX H

MDOT 3903 (3/98)		Page	1	OF	2
	<h3>COMMISSION POLICY</h3>	IDENTIFIER		EFFECTIVE DATE	
		10136		July 31, 2003	
		SUPERCEDES DATED			
RESPONSIBLE ORGANIZATION: 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.

MDOT 3903 (3/98)		Page	2	OF	2
	COMMISSION POLICY	IDENTIFIER		EFFECTIVE DATE	
		10136		July 31, 2003	
		SUPERCEDES DATED			
RESPONSIBLE ORGANIZATION: Executive Bureau					
SUBJECT: Noise Abatement					

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.

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).

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.

Sec. 772.7 Applicability.

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

- (1) Requires FHWA approval regardless of funding sources, or
- (2) Is funded with Federal-aid highway funds.

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

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

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

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

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

Sec. 772.9 Traffic noise prediction.

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

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

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

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

Sec. 772.11 Analysis of traffic noise impacts.

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

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

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

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

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

(1) Each alternative under detailed study;

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

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

(ii) Activity Category B. This activity category includes the exterior impact criteria for single-family and 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)(2)(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)(2)(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)(2)(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 alternative(s) under study in the environmental document is available at the time the environmental clearance document is completed. A statement of likelihood shall be included in the environmental document since feasibility and reasonableness determinations may change due to changes in project design after approval of the environmental document. The statement of likelihood shall include the preliminary location and physical description of noise abatement measures determined feasible and reasonable in the preliminary analysis. The statement of likelihood shall also indicate that final recommendations on the construction of an abatement measure(s) is determined during the completion of the project's final design and the public involvement processes.

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

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

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

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

Sec. 772.15 Federal participation.

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

- (1) Traffic noise impacts have been identified; and
- (2) Abatement measures have been determined to be feasible and reasonable pursuant to Sec. 772.13(d) of this chapter.

(b) For Type II projects.

- (1) No funds made available out of the Highway Trust Fund may be used to construct Type II noise barriers, as defined by this regulation, if such noise barriers were not part of a project approved by the FHWA before the November 28, 1995.
- (2) Federal funds are available for Type II noise barriers along lands that were developed or were under substantial construction before approval of the acquisition of the rights-of-ways for, or construction of, the existing highway.
- (3) FHWA will not approve noise abatement measures for locations where such measures were previously determined not to be feasible and reasonable for a Type I project.

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

- (1) Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.
- (2) Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.
- (3) Alteration of horizontal and vertical alignments.
- (4) Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type I projects only.
- (5) Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

Sec. 772.17 Information for local officials.

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

- (1) Noise compatible planning concepts;
- (2) The best estimation of the future design year noise levels at various distances from the edge of the nearest travel lane of the highway improvement where the future noise levels meet the highway agency's definition of "approach" for undeveloped lands or properties within the project limits. At a minimum, identify the distance to the exterior noise abatement criteria in Table 1;
- (3) Non-eligibility for Federal-aid participation for a Type II project as described in Sec. 772.15(b).

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

Sec. 772.19 Construction noise.

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

- (a) Identify land uses or activities that may be affected by noise from construction of the project. The identification is to be performed during the project development studies.
- (b) Determine the measures that are needed in the plans and specifications to minimize or eliminate adverse construction noise impacts to the community. This determination shall include a weighing of the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.
- (c) Incorporate the needed abatement measures in the plans and specifications.