MDOT Highway Noise Analysis and Abatement Handbook

Special Notes *are in Italics*

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

3.1 CRITERIA FOR DETAILED HIGHWAY TRAFFIC NOISE ABATEMENT MEASURES

3.2 HIGHWAY TRAFFIC NOISE ABATEMENT MEASURES

Receptor Unit Soundproofing or Property Acquisition

3.3 NOISE ABATEMENT DETERMINATION

Three-Phased Approach of Noise Abatement Determination

Non-Barrier Abatement Measures

3.3.1 Phase 1 – Identifying Noise Impacts

Not Having a Highway Traffic Noise Impact

3.3.1.1 NAC Standards for Land Use Categories

Category C and D Analyses

3.3.2 Phase 2 – Feasibility Criteria for Noise Barriers

Greater than 5 dB(A) Highway Traffic Noise Reduction

3.3.3 Phase 3 – Reasonableness Criteria for Noise Barriers

3.3.3.1 Cost per Square Foot of Noise Barrier

3.3.3.2 Cost per Cubic Foot of Earthen Berm

3.3.3.3 Cost-Effectiveness Calculations

Allowable Cost Per Benefited Receptor Unit (CPBU)

Benefiting Receptor Unit Eligibility

Analyzing Apartment, Condominium, and Single/Multi-Family Units

Abatement for Non-First/Ground Floors

Construction and Technology Barrier Construction Tracking

3.3.3.4 Viewpoint of Benefiting Residents and Property Owners

3.3.3.5 Design Year Attenuation Requirement

3.4 CATEGORY C LAND USE ACTIVITY AREAS

Public Parks

Land Use Category D

Table of Contents continues on the next page

Return to Traffic Noise Home Page Return to Handbook Main Menu

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

3.5 LAND USE CONFORMITY CONSIDERATIONS

3.6 COMPLETING THE NOISE ABATEMENT DETAILS FORM

Documentation in the Noise Abatement Details Form

3.7 HIGHWAY TRAFFIC NOISE BARRIER DESIGN: GOALS AND COMMITMENTS

3.7.1 Highway Traffic Noise Barrier Goals (Barrier Optimization)

Barrier Optimization

Noise Barrier Heights on Structures

3.7.2 Highway Traffic Noise Abatement Commitments

Statement of Likelihood

Return to Traffic Noise Home Page

Return to Handbook Main Menu

3.0 STEP 3 – 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 indentifies 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.

Return to Traffic Noise Home Page Return to Handbook Main Menu Return to Top

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 D

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.

Return to Traffic Noise Home Page Return to Handbook Main Menu Return to Top

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?

Return to Traffic Noise Home Page Return to Handbook Main Menu Return to Top

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 in-formation 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 ft^2. 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 ft^2 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 ft^2 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 ft^2 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 ft^2) 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 \$44,187 (2014) where noise mitigation was determined to be reasonable. The cost per benefited receptor unit is annually adjusted to the consumer price index (CPI). Although \$44,187 per benefited receptor unit is the allowable upper limit in the reasonableness determination, a reasonable (and possibly optimized) noise barrier may cost much less then \$44,187 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 loses.

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.