Washington State Department of Transportation

2011 Traffic Noise Policy and Procedures

ANNOTATED VERSION TO HIGHLIGHT CHANGES FROM 2006 POLICY

July 13, 2011

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1. Introduction

The Federal Highway Administration (FHWA) requires state departments of transportation to develop noise policies that will apply to projects within that state. FHWA considers the procedures outlined in the WSDOT Environmental Procedures Manual (EPM) and on the WSDOT Air Quality, Noise, and Energy Program webpage to be an extension and refinement of the requirements set out in 23 CFR 772 for roadway related traffic noise when applied to projects that require FHWA approval in Washington State, including projects administered by local agencies. Fulfillment of the procedures set out in the document assures that the federal noise standard for roadway traffic noise is met.

This document provides criteria for conducting traffic noise analysis, evaluating traffic noise impacts and determining the need for abatement consistent with federal highway traffic noise standards 23 CFR 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise" (2010).

The purpose of this document is to provide a means for the Washington State Department of Transportation (WSDOT) and project sponsors associated with WSDOT, in conjunction with other programs, to equitably treat citizens seeking relief from highway traffic noise.

2. When is Traffic Noise Analyzed?

The department evaluates traffic noise from highways under two sets of circumstances defined as Type I (new construction) and Type II (retrofit) projects. Type III projects are federal projects that do not typically require a noise analysis.

Type I Projects

After a transportation project is defined, the first step in the noise analysis process is to determine whether the project includes a Type I activity.

Type I projects have the potential to increase traffic noise levels and/or create traffic noise impacts for noise sensitive receivers, including homes, apartments, and other land uses with noise sensitive areas of frequent outdoor human use. Regardless of segment length, Type I activity criteria apply equally to roadways, bus lanes, re-striping for new lanes, weigh stations, toll plazas, ride-share lots, ramps and interchange lanes, and auxiliary lanes, except when the auxiliary lane is a turn lane. Refer to 23 CFR 772 for full list of Type I activities.

A traffic noise analysis is required by law for federally funded projects and required by state policy and procedures for roadway projects that incorporate any one of the following elements:

1. Construction of a highway in a new location
2. Significant changes to the horizontal or vertical alignment of an existing highway
3. Increases the number of traffic lanes on an existing highway
4. Substantial alteration to the ground contours surrounding roadways (e.g., removes or alters natural or previously constructed berms)

Comment [TVS1]: Existing best practice new to policy.

Significant Changes in Alignment

A significant horizontal re-alignment is defined as halving the distance from the edge of the outside lane of the highway to the nearest noise sensitive receiver (see Section 5 – *Identification of Noise Impacts* for more detailed information). A significant vertical re-alignment is defined as creating a new line-of-sight from a receiver to traffic.

Comment [TVS2]: New definition. Previously, 20' vertical increase with consideration of new lines-of-sight to receivers.

Alteration of Ground Contours

Projects that substantially alter the ground contours surrounding roadways must also be evaluated for impacts and abatement. For example, the removal or lowering of an earthen berm alongside the roadway creates a new line–of-sight to traffic and is considered a Type I project.

Type II Projects

Type II projects are known as "retrofit" projects because they provide noise abatement for neighborhoods that were established before many of our highways were built or expanded. Traffic noise abatement was not considered for roadway projects prior to May 14, 1976, so the Type II program provides a process for advancing stand-alone noise abatement projects to the Governor's Office and legislature for funding consideration.

The development and implementation of Type II projects are not mandatory requirements of U.S.C. 23 109(i) or 23 CFR 772. Type II noise walls in Washington State are prioritized according to WSDOT criteria but must be feasible and reasonable so that they are eligible for federal aid. WSDOT criteria for prioritizing Type II projects have been approved by FHWA.

To be eligible for the Type II program, homes must have been constructed prior to May 14, 1976, and have current traffic noise impacts. Eligible locations are evaluated on current traffic noise levels, the number of benefiting residences or residential equivalents, cost of abatement, and the achievable noise reductions. All the eligible locations statewide are then ranked, or prioritized, according to these criteria. The resulting rank-ordered list of projects is compiled to become the state Noise Retrofit List.

Noise Retrofit List

The Noise Retrofit List is divided into Tier 1 and Tier 2 project locations Tier 1 projects are the top 10 ranked projects on the Noise Retrofit List and are identified as high priority projects so they can be recommended to the legislature for funding. Tier 2 projects are all the other projects that have been evaluated but are not currently recommended for funding. The retrofit list is dynamic and projects may shift priority as the list is updated with new/different criteria and new projects are added.

Comment [TVS3]: Ranking and Priority List existed previously. Tier 1 and Tier 2 divisions are new.

Locations across the state have been reviewed, but it's possible that some locations have been missed. To request that a neighborhood be considered for the Noise Retrofit List, please contact the WSDOT Air Quality, Noise, and Energy Program.

Funding Type II Projects

When evaluating a neighborhood for the retrofit list, only residences with a date of development prior to May 14, 1976, are considered for the location's ranking. However, it often makes sense to consider abatement for an entire neighborhood when the eligible homes are mixed in with homes built after 1976.

Before a project on the Noise Retrofit List is advanced for executive budget review through the Capital Program Development & Management Office (CPDM), the WSDOT Air Quality, Noise, and Energy Program shall be contacted to ensure the noise analysis is current and to provide a detailed (but still "planning level") cost estimate. Cost estimates provided for project inclusion in the Highway Construction Program shall include the cost of providing feasible and reasonable abatement to the entire contiguous neighborhood.

Comment [TVS4]: Existing best practice new to policy.

Timing

Type II projects are normally constructed in order of their priority but may be constructed out of priority as part of a Type I project, part of some other project, or as a result of legislative direction. However, projects using federal-aid shall be funded in order of priority.

Comment [TVS5]: Previously, Type 2 projects did not use federal aid funds. Now eligible for federal funding.

Feasibility and Reasonableness for Type II Projects

Type II projects are treated similarly to Type I projects and abatement should be feasible and reasonable. A screening level analysis is performed to determine the project's relative priority of the retrofit list. Locations where abatement is not feasible and reasonable in the screening level analysis aren't removed from the list until a more detailed analysis is completed. If a detailed analysis is conducted, for example, as part of a Type I project, and the project is found to be not feasible and reasonable, the project shall be removed from the Noise Retrofit List.

Comment [TVS6]: New requirement.

Noise Compatible Planning

Noise compatible planning discourages noise sensitive land uses near high traffic roadways. In an effort to reduce the burden on the state for funding noise abatement, WSDOT encourages the adoption of noise compatible planning principles into local government planning and zoning codes and ordinances. WSDOT will engage in public outreach to educate jurisdictions about noise compatible planning. At the request of local jurisdictions, WSDOT will also provide technical assistance to improve the jurisdiction's understanding of local traffic noise levels, share examples code language and concepts, and assist with noise compatible code and ordinance adoption.

Type II Projects in Type I Noise Study Areas

If a Type II project location is within the noise study area for a Type I capital project (new construction or reconstruction), abatement should be evaluated for feasibility and reasonableness, similar to a Type I project. If abatement at the Type II project location is not feasible and reasonable, and it is a Tier 1 retrofit project, an additional funding request to the WSDOT Region should be considered as part of project scoping in the budget development process. If abatement at the Type II project location is not feasible and reasonable, the project shall be removed from the Noise Retrofit List.

Comment [TVS7]: New section and content. Gives PEOs more flexibility when a Type 2 noise wall is in their project area.

Type III Projects

Not all federal aid projects have the potential to increase traffic noise levels. Projects that do not meet the criteria for Type I or Type II projects are classified as Type III projects. Type III projects do not normally require a noise analysis because they do not typically increase traffic noise levels at nearby noise sensitive properties. Generally, the list of projects described in 23 CFR 771.117(c) and (d) comprise the list of Type III projects, except where the project clearly meets the definition of a Type I or Type II project.

Comment [TVS8]: New project type (3). This is generally just a term for projects that DO NOT need a noise study.

However, it is possible that a Type III project could have the potential to increase traffic noise levels for sensitive receivers. This policy does not preclude a noise analysis for projects that might create a new noise source but do not meet the Type I or Type II criteria. For Type III projects where a new noise source may be created by the project, the WSDOT Air, Noise, Energy Program will make a recommendation on the need for a noise analysis to the project engineer.

3. Analysis Locations

All outdoor frequent human use areas, including those in areas zoned for commercial use, will be included in a traffic noise analysis. In areas without frequent outdoor human use, noise levels shall also be determined at representative locations for land use planning purposes.

A smaller noise study area may be allowed for some projects that do not receive FHWA funds nor require any FHWA approvals and these changes are described in Appendix 1.

Comment [TVS9]: This was previously a stand-alone memo that is no incorporated here.

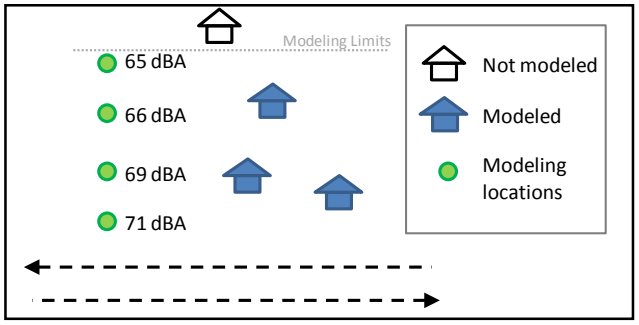
Determining the Noise Study Area

The noise study area must be large enough to include all receptors between the project limits that may experience traffic noise impacts, including non-residential land uses described in the NAC Table. This may require the analyst to collect model validation measurements and/or model receivers at regular distance increments to validate the FHWA Traffic Noise Model (TNM) and determine the approximate distance that noise impacts will extend out from the road for all modeled scenarios. Modeled receivers shall extend beyond the distance where impacts can be modeled to verify that the full impacted area is captured (Exhibit 1).

Comment [TVS10]: Previously, a 500' distance from the fog line defined the noise study are for all projects. New analysis procedure shown in Exhibit 1.

For contiguous neighborhoods that originate within the project limits where no logical end point can be identified within the project limits, mitigation may extend beyond the project limits until a logical end point for the mitigation (e.g., noise barrier) is reached, as identified by the acoustical analyst. If the number of sensitive receivers located beyond the project boundary is the reason that mitigation is infeasible or unreasonable, the analyst shall limit the size of proposed mitigation to within the project boundary.

Exhibit 1: Noise Study Area and Receiver Locations



Determining Receiver Locations

Normally, only areas of frequent outdoor human use for Category A, B, C and E land uses (Exhibit 7 of Section 5 – *Identification of Traffic Noise Impacts*) are considered for traffic noise analysis and abatement. However, where appropriate, indoor receiver locations may be considered for Activity Category D properties. Indoor receivers shall be located at the

Comment [TVS11]: New requirement. Previously, interior noise levels were only consider for public/non-profit buildings with noise sensitive interior activities.

communal interior space nearest the traffic noise source. An indoor analysis shall only be done after exhausting all outdoor analysis options.

For all land use types, ground floor outdoor use areas are the primary consideration. For projects with a large number of residences or residential equivalents, it is not necessary to have traffic sound level predictions at every residence or residential equivalent (see subsection *Residential Equivalency Calculations*). However, sufficient representative sound level prediction locations ("modeled receivers") shall be included to accurately represent the sound level conditions for every noise sensitive receiver within the study area.

Comment [TVS12]: Existing best practice new to policy.

Modeling Noise Sensitive Receiver Locations

The noise analysis shall identify and consider traffic noise impacts for all Category A-E land uses within the Study Area. All representative locations that are modeled and measured shall be described in text and visually on a map within the report.

Comment [TVS13]: Existing best practice new to policy.

First Row Receivers

The determination of "feasibility" (see Section 6- *Consideration of Traffic Noise Abatement)* is weighted towards receivers that will be most affected by a noise barrier. In general, these receivers are directly behind the modeled noise wall. On some projects with an elevated roadway, the "first row" receivers may not be the receivers closest the roadway, because the closest receivers don't have a clear line-of-sight to traffic. In other locations, the first row receivers may be partially shielded by other homes, but still have a direct line-of-sight to traffic from the area of frequent outdoor human use on their property. First row receivers should be clearly identified in the noise analysis and representative modeling locations for first row receivers should only represent first row receivers.

Multi-Family Dwellings

Ground floor outdoor use areas are the primary consideration. In multi-family dwellings where balconies may represent the only potential area of frequent outdoor human use, locations above the ground floor shall be considered for impacts if the area is large enough for a chair.

For multi-family dwellings with common exterior areas, e.g., swimming pools or playgrounds, each unit with access to that common area shall be included in the analysis as part of the residential equivalency calculation for the common area. The number of residential equivalents applied to a location should consider capacity limitations of these areas. If the multifamily dwelling has a shared/common outdoor use area and no individual outdoor use area, the residential equivalent at the common area of frequent outdoor use can be considered an adequate representation of the dwelling unit. If the unit has an individual outdoor use area and a shared/common outdoor use area, the more affected of the two locations may be considered.

Comment [TVS14]: New requirement. Previously, focus was on the private residential outdoor use or a standard residential equivalent calculation for any outdoor use area. New requirement is expected to result in higher RE values for outdoor common areas.

Residential Equivalency Calculations

Comment [TVS15]: Similar content to this section was part of stand-alone memo (D22-22). Now relevant content included in policy.

Residential equivalents are used to equate the use of common outdoor use areas to individual outdoor use areas. To determine residential equivalency for parks or other non-individual

household uses, three types of information must be established: the usage factor of the area, the number of users, and the equation of users to residences.

1. The default usage factors here (Exhibit 3) shall be used unless the analyst has documentation supporting a unique usage factor. If a site is not accurately represented here, the analyst may determine a more appropriate usage factor and provide supporting justification. Justification must include, but not be limited to, posted open hours, usage information from facility staff, portion of property impacted.

Exhibit 3: Default Usage Factors:

Site	Hours/Day	Days/Week	Months/Year	Usage Factor
Hospital	24	7	12	1
Place of Worship	6	3	12	0.11
School	10	5	9	0.22
Park	10	7	5	0.17

Exhibit 4: Example of Usage Factors Calculations for a School

10 hours per day	/	24 hours in a day	=	0.42
5 days per week	/	7 days in a week	=	0.71
9 months per year	/	12 months in a year	=	0.75
Usage factor	=	0.42 x 0.71 x 0.75	=	**0.22**

2. The number of users should be based on an average number of people using a facility at any given time and the source of this number should be documented in the noise analysis. For example, campgrounds often track how many people reserve campsites and these number may be available from Washington State Parks. Site furniture or parking spaces can also inform user number estimates.
3. Either the Washington State or county averages, when available, can be used for the number of people per household. State data is available at: http://quickfacts.census.gov/qfd/states/53000.html. More specific data can be used when available and appropriate. For example, the average number of people per unit in an apartment complex may be available from the apartment complex manager.

Exhibit 5: Example Residential Equivalency Calculation for a School

Description	Values
Usage Factor - School	0.22
Average number of users at one time	X 200
Average number of people per household (WA State avg.)	÷ 2.53
Residential equivalents	**17**

A full description of the residential equivalency variables, calculation for each variable (Exhibit 5), and the final residential equivalency calculation shall be included in the appendix of the noise analysis.

Date of Public Knowledge

The Date of Public Knowledge is the original date of approval of the initial National Environmental Policy Act (NEPA) Record of Decision (ROD), Finding of No Significant Impact (FONSI), or State Environmental Policy Act (SEPA) document for a transportation project. Until this date, the project sponsor is responsible for considering noise impacts and evaluating abatement for any new development with an approved building permit. After this date, provision of noise abatement becomes the responsibility of local communities and private developers, unless a new Type I project occurs in the area.

4. Determination of Sound Levels

Measurements are not used to determine traffic noise impacts, unless a new roadway is being constructed where no road previously existed. Instead, a traffic noise model is constructed to represent existing traffic, topography, and receiver locations. Sound level measurements are used to ensure that the traffic noise model accurately reflects the noise environment at various locations throughout the projects area. If the model accurately reflects sound levels at the measurement locations, additional topographic and project features and updated traffic can be added to reflect the conditions in the future with the project. The future condition sound levels are evaluated for traffic noise impacts and abatement.

Measuring Sound Levels

Field measurements must be conducted along all existing or proposed roadway segments that may be affected by the proposed project with emphasis on areas with frequent outdoor human use. To assure the noise model is valid and accurate, field measurements of current sound levels shall be compared to modeling of the same situation. This comparison is for model validation and descriptive purposes only, and is not used to depict existing conditions. Existing, future No Build, and Build conditions shall be modeled to ensure consistent comparisons between conditions. The site review and sound level measurements should also consider major noise sources in the area from non-highway transportation, industry, or other background sources.

If a sound level reading cannot be explained by field notes, adding appropriate shielding objects (e.g., building rows) into the model, or evaluating non-project highway background sound levels, then additional measurements or a site review may be needed to support a different ground type, shielding object, background level, or the elimination of the measurement from the model validation process.

Measurement Methods

Measurements shall be made in accordance with the procedures in FHWA's *Measurement of Highway-Related Noise*. All measurements and reference to sound levels will be in dBA L_{eq}. The 15-minute L_{eq} is an accepted professional substitute for an hourly L_{eq}. All field measurements will be at least 15 minutes in duration. Measurements may be discontinued sooner if the L_{eq} has not changed in the last 5 minutes of the measurement when the number is rounded to the nearest whole number. All measurements must have stabilized after 10-minutes to be valid.

Measurement Equipment

Measurements shall be taken using a time integrating Type II (or better) microphone and sound level meter on the A-weighted decibel setting. This meter shall be calibrated once per year by a certified laboratory or process per product specifications and ANSI S1.4.1983 Type I Sound Level Meter specifications according to the Reference Test Procedure using equipment traceable to the National Institute of Standards and Technology (NIST).

Measurement Location

Field measurements shall be taken to represent the various distances of receivers to the roadway, topography, and major physical shielding conditions that may exist on a project. Locations should represent outdoor use areas or interior common area (e.g., living room) noise levels, as appropriate.

Traffic

Field measurements shall be taken when traffic is moving in free flow conditions and should not reflect congested traffic conditions near, or during, the AM/PM peak traffic periods or during uncommon traffic events.

Noise Model Validation

Measured sound levels are compared to the modeled values representing the current site conditions (traffic, topography, etc.) to validate the accuracy of the noise model. Traffic counts should be taken at the same time as the noise measurements, documenting the number of heavy trucks, medium trucks, buses, and light duty vehicles ("vehicle mix"). Modeling of the current sound levels using the traffic volumes and vehicle mix counted for each location shall be within 2.0 dBA of the measured sound levels after adjustment factors have been applied and shielding objects have been included in the model. Any use of adjustment factors shall be described in the report. The comparison of measured to modeled values (or "validation") shall be documented in the noise analysis for each measurement location.

Interior Sound Level Measurements

Comment [TVS16]: New section and content. The reference document describes how to evaluate interior noise. See Exhibit 6 for more information.

Where appropriate for Activity Category D receivers, interior noise measurements should be collected and used for model validation. Adjustment factors from the interior noise reduction factors described in *FHWA-DP-45-1R, Sound Procedures for Measuring Highway Noise: Final Report* should be described and added to measured interior sound level values in TNM.

Determination of Worst Hourly Noise Levels

Traffic noise impacts are considered for the hour with the highest average noise levels, or the "worst hourly noise levels." The same hour should be used for all modeled conditions. Two methods can be used to determine and model the traffic conditions that yield the hour with the highest average noise levels. The selected method shall be used to model the Existing, No Build, and Build conditions.

1. Use the most current FHWA acceptable traffic noise model to determine the traffic conditions for each hour of the day that yield the worst hourly noise conditions. This procedure will need to be repeated for all areas under analysis.
2. The WSDOT preferred method for determining traffic noise levels is to model the higher of the AM/PM peak hour traffic and vehicle mix (cars, medium trucks, heavy trucks) traveling at the speed limit, unless justification for speed changes are included. The modeled speed(s) shall be documented in the analysis.

In both cases, the analysis must be sufficient to determine all impacts, as well as, identify the number of receivers who could benefit from abatement. Care should be taken when using either approach as changes in traffic composition (particularly the percentage of heavy trucks) can affect traffic sound levels.

If peak hour traffic volumes are not available, 10% of total daily volumes (ADT) can be used to represent this hour. If vehicle mix data is not available, estimates shall be generated in consultation with the appropriate WSDOT region Traffic Office.

Projection of Existing and Future Year Sound Levels

Existing Year Sound Levels

For projects with a new roadway, where no road previously existed, measurements shall represent the Existing conditions, unless a model can be validated based on traffic noise from nearby roadways. For all other projects, existing condition sound levels shall be modeled, not measured, so that the methodology and results are consistent with the projection of future year sound levels. Existing condition traffic generated by the Traffic Office for the project shall be used to model the Existing condition. Existing conditions may reflect a different year than the year the analysis is conducted.

Projection of Future Sound Levels

The same procedure used to determine the existing worst hourly noise levels is used to determine the future ("design") year's worst hour noise levels for the No-Build and Build conditions. Traffic growth projections will come from the Traffic or Project Engineering Office and shall be in accordance with the most recent growth data from the responsible Regional Transportation Planning Organization, Metropolitan Planning Organization or other agency as appropriate.

Traffic noise projections and modeling methods shall be consistent with the Federal Highway Administration *Traffic Noise Model Report* or other methodologies approved by FHWA.

When no outdoor human use areas are present, interior sound level increases for Activity Category D land uses in the No Build and Build conditions should be predicted using TNM with adjustment factors to account for indoor sound levels.

Modeling Sound Levels using the FHWA Traffic Noise Model (TNM)

All noise sensitive receivers shall be modeled individually or with representative receivers in TNM. Existing conditions shall be modeled using the worst hour noise levels for the existing year. This year will be defined by the environmental document and/or the engineering design team. The same model used to validate the sound level measurements shall be used in the Existing and No-Build conditions with no changes to model inputs except for traffic volumes and vehicle mix.

Comment [TVS17]: Existing best practice new to policy.

For common areas of frequent outdoor use where residential equivalencies are used, modeled receivers may be placed in areas where use is expected to occur most frequently. For example, receivers may be located at campsites in campgrounds or picnic areas in some parks.

Any features added to the Build condition model, such as noise walls or safety barriers, that are also present in the Existing and No-Build conditions shall be added to those models. For example, barriers create a new terrain line along their alignment that can affect modeled sound levels. When a noise barrier is added to the Build condition model, a corresponding zero foot tall noise wall must be added to the Existing and No-Build models, where appropriate, to ensure an equal comparison of noise levels between alternatives. Any model changes that are present in the Existing and No Build conditions should be re-validated with existing measurements. Any changes that prevent model validation shall be documented in the noise analysis.

Comment [TVS18]: Existing best practice new to policy.

The noise analysis shall include a table that identifies the Existing, No Build and Build condition noise levels for each modeled receiver location.

Modeling Non-Ground Floor Receivers

Comment [TVS19]: Existing best practice new to policy.

Modeled receivers above or below the ground floor should only represent other receivers with outdoor use areas at a similar height, relative to the project roadway. If behind or adjacent to structures, these structures should be included in the model.

Interior Sound Level Modeling

Comment [TVS20]: New section and content.

Interior sound levels can be modeled using TNM. The analyst can either use adjustment factors to change outdoor noise values in the receiver input dialog box within TNM or model outdoor noise levels using TNM then apply a sound reduction factor off-model. When possible, interior noise measurements should be used for model validation.

Unless alternate documentation is included in the noise analysis, indoor sound reduction factors described in Exhibit 6 from *FHWA-DP-45-1R, Sound Procedures for Measuring Highway Noise: Final Report* shall be used.

Exhibit 6: Noise Reduction Factors for Residential Structures

Building Type	Window Condition	Noise Reduction Due to Exterior of the Structure
All	Open	10 dB
Light Frame	Ordinary Sash (closed)	20 dB
Storm Windows		25 dB
Masonry	Single Glazed	25 dB
	Double Glazed	35 dB

The windows shall be considered open unless there is firm knowledge that the windows are kept closed for most of the year.

All assumptions and calculations for interior locations and sound levels shall be documented in the noise analysis.

Screening Projects for Noise Impacts

All Type I projects require a noise analysis. For some projects, a screening analysis can be performed using the FHWA TNM.

The FHWA TNM look-up tables and the FHWA TNM LookUp program cannot be used for noise analysis in environmental documentation. The look-up tables and LookUp program can still be used for outreach to local jurisdictions about noise compatible planning.

Approved Screening Method

Comment [TVS21]: New screening method approved in WA only.

A straight line model design using the FHWA Traffic Noise Model (TNM) can be used to screen projects that are unlikely to experience noise impacts, such as low volume roadways. Validation of the straight line model is not required. A straight line model describes a worst-case scenario with higher sound levels than would be expected in detailed modeling when prepared as follows:

- The model shall use the Build condition traffic information and receiver distances from the roadway to determine traffic noise impacts in the Build Condition and compare the Existing condition to the Build condition to determine whether substantial sound level increases (at least 10 dBA) are expected.
- Roadways shall extend at least 1500 feet beyond the final receiver(s) perpendicular to the roadway on either side of the project.
- Any relevant external noise sources shall be considered (may require measurements).
- No topography shall be included in the model, only the roadway(s), receiver(s), and traffic information.
- Representative receiver locations can be used. They shall, at a minimum, include receiver location(s) closest to the roadway and receivers placed at 50’ increments from the roadway to determine the distance from the roadway to which impacts extend.

If any traffic noise impacts are modeled, a detailed model shall be prepared according to the full measurement and modeling procedures.

5. Identification of Traffic Noise Impacts

23 CFR 772 defines noise impacts as "impacts which occur when the predicted traffic noise levels approach or exceed the Noise Abatement Criteria (NAC)(Exhibit 7), or when the predicted traffic noise levels in the design year will substantially exceed the Existing condition noise levels."

The department considers a predicted sound level of 1 dBA below the NAC as sufficient to satisfy the condition of “approach”, or approaching the NAC, required by FHWA for all land use categories. For example, where the NAC is 67 dBA for outdoor use at a residence, a noise level of 66 dBA is considered an impact. Receivers are also considered impacted when the worst hourly traffic noise is predicted to increase 10 dBA (“substantial increase”) or more between the Existing and Build conditions.

Exhibit 7: Noise Abatement Criteria (NAC) by Land Use Category

Comment [TVS22]: Some new category labeling. The changes are not substantive.

Activity Category	$L_{eq}(h)$* (dBA) at Evaluation Location	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential (single and multi-family units)
C	67 (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 (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	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. Includes undeveloped land permitted for these activities.
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

**$L_{eq}(h)$ are A-weighted (dBA) hourly equivalent steady state sound levels used for impact determination and are not design standards for abatement.*

A traffic noise impact occurs when the traffic noise level is predicted to approach or exceed the NAC in the design year Build condition or a substantial increase is predicted between the Existing and Build conditions. The primary consideration of impacts is made for first floor areas of frequent outdoor human use. A feasibility or reasonableness determination cannot precede the determination of impacts.

Comment [TVS23]: New clarification. Basically, noise studies cannot determine a noise wall to be NOT feasible or reasonable without first analyzing it.

Interior Noise Impacts

Interior noise impacts shall be considered for Activity Category D land uses with no outdoor use areas. If interior noise impacts are considered, the property may need to be visited in order to determine the building characteristics and apply the appropriate interior reduction factor in the model.

Comment [TVS24]: New section and content.

Verification of Traffic Noise Impacts

If impacts are identified through modeling, the analyst should do two things before considering abatement:

1. Verify that receiver locations are representative of outdoor use areas. For single family residences, outdoor use areas are most often in the backyards. Modeled receiver locations for shared outdoor use areas will depend on the context and intensity of use. The analyst can perform site visits or use aerial photography to look for evidence of the areas of most frequent outdoor human use.
2. Verify that any structures providing shielding to outdoor use areas are included in the model.

6. Consideration of Traffic Noise Abatement

Noise abatement will only be considered after noise impacts have been identified. Where abatement is considered, at a minimum, either noise walls or earthen berms ("noise barriers") shall be evaluated. The following FHWA-approved noise abatement may also be considered, where appropriate.

Comment [TVS25]: Previously required to evaluate 6 different type of abatement for each project.

- Traffic management measures (e.g., traffic control devices, time-use restrictions, prohibition of certain vehicle types, or modified speed limits)
- Change of roadway's vertical or horizontal alignment
- Acquisition of property for buffer zones
- Acoustic insulation of Activity Category D structures

It may be possible to incorporate some of the above noise abatement into the project as design features to avoid traffic noise impacts. However, these design features can only be considered "traffic noise abatement" when they are found to be feasible and reasonable.

The relevant criteria to consider when evaluating noise abatement measures are captured with an analysis of feasibility and reasonableness.

- **Feasibility** is a combination of acoustic and engineering considerations that asks the question - "Can abatement be constructed that achieves a meaningful reduction in sound levels?"
- **Reasonableness** is evaluated after abatement is found to be feasible and assesses the practicality of the abatement measure based on a number of factors. Required factors are cost effectiveness, consideration of the viewpoints of the property owners and residents of benefited receptors, and noise abatement performance (noise reduction design goal).

Initial recommendations about whether noise abatement will be feasible and reasonable can be made early in the design/environmental documentation phase. However, it is WSDOT policy to make final decisions on the construction of noise barriers after the final horizontal and vertical alignments are determined and a detailed engineering analysis of the feasibility and reasonableness of noise abatement can be made. Barriers that meet WSDOT's criteria, as accepted by FHWA, will be constructed. Appendix 3 - *Traffic Noise Analysis and Mitigation Process* outlines the analysis process and timing in more detail.

Feasibility

Feasibility is a combination of acoustic and engineering considerations. All of the following must occur for abatement (e.g., noise barrier) to be considered feasible.

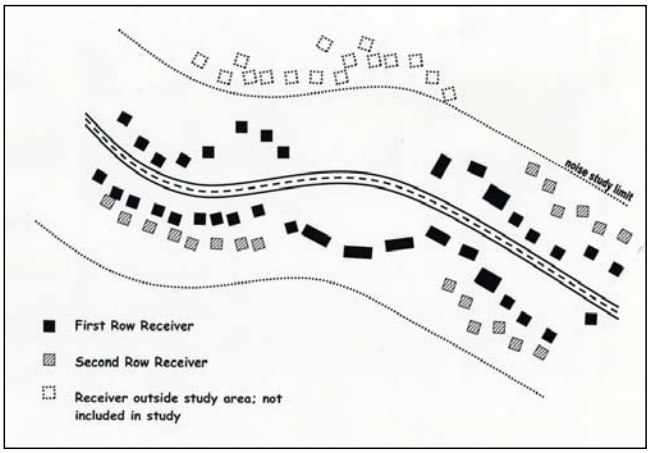
- Abatement must be physically constructible.
- The majority first row impacted receivers must obtain a minimum 5 dBA of noise reduction as a result of abatement (insertion loss), assuring that every reasonable effort will be made to assess outdoor use areas as appropriate.

Acoustic Considerations

In order for this policy to adequately cover complex ground terrain, elevated roadways, roadways through cut-slopes, and other configurations, the first row decibel reduction calculation (feasibility) will use first row receivers as identified according to the steps below and the best professional judgment of the analyst and WSDOT's Air, Noise, Energy Program.

Step 1: Identify the first row of receivers from an aerial perspective. If traffic noise impacts are identified, additional modeled receivers may need to be added to the model to provide sufficient information for determining the feasibility of abatement. In most situations, first row receivers are the nearest receivers to the roadway along the entire length of the project. On some projects, first row receivers in one location may be further from the highway than 2nd/3rd row receivers in other locations in the same neighborhood. See Exhibit 8 for more details.

Exhibit 8: Example Locations of First and Second Row Receivers

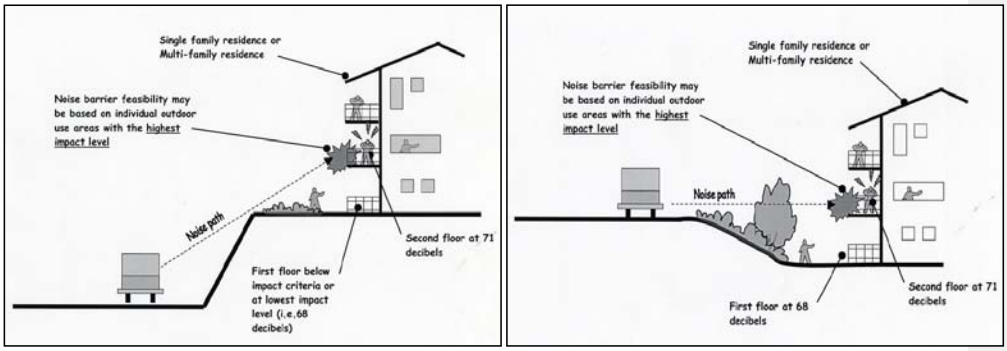


Step 2: Identify the first row of receivers from the front and appropriate sides of the buildings. In most situations, the first row receiver should have a direct line of sight to traffic. At times, traffic noise from elevated roadways on fill or naturally elevated topography does not impact receivers within the descending noise shadow, but instead impacts

second or third row receivers with a more direct line-of-sight to vehicles traveling along the roadway. For these situations, the first row of receivers with a direct line-of-site to the roadway shall be counted as the "first row" per the feasibility criteria. If receivers that are not closest to the roadway are being considered first row receivers, justification shall be documented.

Note that the first row may be positioned at locations higher than the ground floor as described in Exhibit 9.

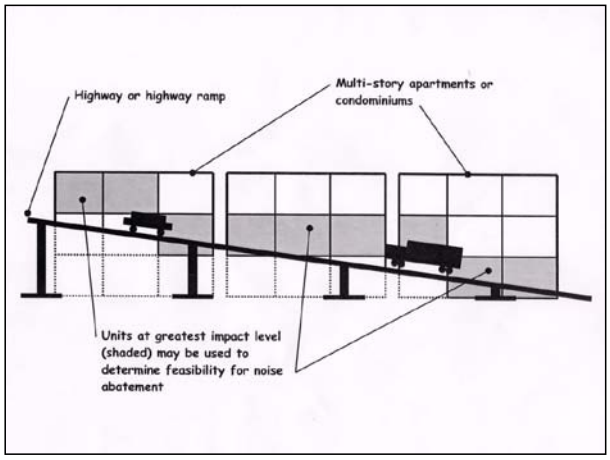
Exhibit 9: Identification of First Row Receiver above the Ground Floor



Step 3: If including receiver locations above the ground floor, the analyst shall only account for viable outdoor use areas. Outdoor use areas must include enough space to reasonably place a chair. For multi-story residences, only one unit per vertical column of a building can be considered a 1st row receiver (Exhibit 10). Priority should be given to ground floor outdoor areas of frequent outdoor use, with a direct line of sight to traffic, when determining 1st row receiver location.

Identify the appropriate line-of-site for impacted receivers and count only one receiver per story within the vertical column of the building.

Exhibit 10: Determining First Row Receivers by Line of Sight



Engineering Considerations

Safety factors that should be considered in the feasibility assessment of noise abatement include: maintaining a clear recovery zone, redirection of errant vehicles, ensuring adequate sight distance, and fire/emergency vehicle access. The consideration of abatement may also include potential environmental impacts to wetlands, property access, placement of utilities and stormwater control facilities, and construction on steep slopes. Engineering considerations should be made in concert with the project engineering office.

Reasonableness

Once noise abatement is determined feasible, the analyst will assess whether the abatement is reasonable. Noise walls, or other types of abatement, will only be constructed by the department if they have been determined reasonable after thoroughly evaluating the three criteria below.

Cost Effectiveness

The cost of noise abatement sufficient to provide at least the minimum feasible noise reductions must be equal to or less than the allowable cost of abatement for each noise wall location analyzed. Based on noise wall costs from 2007-2010, the current average costs for Washington State are below:

- Type I Noise Walls: $51.61/ft^2
- Type II Noise Walls: $75.10/ft^2
  Note: When part of a Type I noise wall project, Type II noise walls shall use the Type 1 average cost.

Comment [TVS26]: New noise wall costs to use for reasonableness. While this does not affect the sq ft values in Exhibit 11, it does change the Column D allowances applied to each receiver. Column D = [cost/ft2] * [allowed wall size]

Either the barrier size or cost outlined in Exhibit 11 can be used to describe the reasonableness evaluation. However, a cost description must be included if there are non-standard additional

costs, or costs that would not occur "but for" the barrier (e.g., additional foundation costs for steep slopes, unique drainage requirements, etc.). Additional cost estimates for abatement are added to the planning level costs as part of the reasonableness evaluation.

Barriers are evaluated independently for feasibility and reasonableness, with some exceptions for barrier systems (see Section 6 - *Barrier Systems*). On projects where noise barriers are considered for multiple locations, noise barriers, or barrier systems, a feasibility and reasonableness evaluation will be done for each area independently.

Allowable costs are shown in Exhibit 11 and are a function of the current planning level barrier cost ($51.61 in 2010) multiplied by the allowable wall size for receiver benefitting from the noise wall. The table shows the allowable costs for each receiver based on the predicted Build condition noise levels or sound level increases. Higher noise levels, or larger sound level increases, are allowed more money for abatement.

The cost evaluation used to determine WSDOT planning level cost estimates for a standard noise wall includes the following examples:

1. Noise barrier construction labor and materials, including clearing and grubbing and the acquisition of property needed for the noise barrier;
2. Traffic management measures, as necessary only for the barrier construction;
3. A percent of the total project's workforce mobilization costs;
4. Sales tax.

Exhibit 11 – Reasonableness Allowances

Column A	Column B	Column C	Column D
Design Year Traffic Sound Decibel Level (dBA)	Noise level increase as a result of the project (dBA)[2]	Allowed Wall Surface Area Per Qualified Residence or Residential Equivalent	Allowed Cost Per Qualified Residence or Residential Equivalent[1]
66		700 Sq Feet	$36,127
67		768 Sq Feet	$39,636
68		836 Sq Feet	$43,146
69		904 Sq Feet	$46,655
70		972 Sq Feet	$50,165
71	10 (substantial, step 1) [3]	1,040 Sq Feet	$53,674
72	11 (substantial, step 1)	1,108 Sq Feet	$57,184
73	12 (substantial, step 1)	1,176 Sq Feet	$60,693
74	13 (substantial, step 1)	1,244 Sq Feet	$64,203
75	14 (substantial, step 1)	1,312 Sq Feet	$67,712
76	15 (substantial, step 2)[4]	1,380 Sq Feet	$71,222

(1) Current costs based on $51.61 per square foot constructed cost developed in 2011.
(2) If the noise level increases 10 dBA or more as the result of the project (Column B), follow the allowed wall surface and cost for the level of increase in Column C in lieu of the total design year sound decibel level in Column A. For total highway related sound levels at 76 or more dBA or the project results in an increase of 15 or more decibels, continue increasing the allowance at the rate provided in the table unless circumstances determined on a case-by case basis require an alternative methodology for determining allowance.
(3) Step 1 is when the noise levels are 10 to 14 dBA over future No Build condition traffic noise as a result of the transportation project.
(4) Step 2 is when the noise levels are 15 or more dBA over existing traffic noise as a result of the transportation project (or total highway related noise levels are between 76 and 79 decibels). Additional consideration for abatement may be considered under these circumstances.

Design Goal Achievement

The minimum feasibility design goal for abatement on all projects is at least 5 dBA of noise reduction for the majority of impacted front row receivers and, for reasonableness, at least 7 dBA of reduction for one receiver. Noise walls cannot be recommended if they do not achieve the design goal. In addition to the design goal requirement, WSDOT will make a reasonable effort to get 10 dBA or greater insertion loss (noise reduction) at the first row of receivers for all projects where abatement is recommended.

A larger noise barrier than the minimum feasible and reasonable size shall be constructed when a barrier is highly cost effective. A barrier is considered highly cost effective when it reduces noise levels behind the barrier by 10 dBA, or more, for at least 50% of front row receivers at less than 75% of the maximum reasonable cost allowed for abatement.

If abatement is determined to be feasible, cost-effective, and can achieve the design goal for abatement, then the assumption shall be that the abatement is reasonable.

Impacted and Benefited Receivers

Impacts are considered for locations at, or above, the NAC or locations where traffic sound levels are expected to increase by, at least, 10 dBA in the Build versus Existing condition. Benefited receivers are properties that receive, at least, 5 dBA of sound level reduction from abatement, regardless of whether they are impacted. The same cost reasonableness value that is applied to receivers with Build condition noise levels of 66 dBA is applied to benefited receivers below the NAC in the Build condition.

Other Considerations

Noise Barrier Construction Timing

When noise barriers are recommended on a project, every effort should made to construct the noise barriers early in the project to reduce potential annoyance from construction noise.

Comment [TVS27]: New terminology for practices of ensuring wall is feasible and reasonable.

Comment [TVS28]: New section and content.

Comment [TVS29]: New definition. Important change for public involvement process.

Vegetation Preservation

All reasonable efforts should be made to preserve vegetation in the line-of-sight between the highway and adjacent communities during construction, whether or not noise abatement is proposed.

Landscaping is not eligible for federal aid as noise abatement.

Barrier Systems

At times, barriers placed side-by-side at one location may provide co-benefits or one barrier can provide additional benefit behind the second barrier or vice versa. There may also be cases where two barriers are feasible together, but not independently. These situations are referred to as barrier systems.

Impacts behind Existing Noise Barriers

Impacts identified behind an existing noise barrier, where noise impacts were mitigated due to a past project, will be analyzed similarly to areas without barriers for new Type I projects. If impacts are identified, an analysis shall be conducted to determine if abatement is feasible and reasonable, including the costs of retrofitting an existing barrier or constructing a new barrier to replace the old one.

Abatement for Elevated Structures

Costs for noise abatement on elevated structures may be much higher than on the ground. The actual cost of the elevated abatement, in addition to any modifications of the structure to support a barrier that are solely due to noise abatement, shall be used against the allowance in Exhibit 11 to evaluate reasonableness.

Barrier Heights

Efforts should be made to design noise barriers that are tall enough to block the view of truck exhaust stacks. For design purposes, a truck exhaust stack height of 13 feet (4 meters) above the roadway should be used. This is not meant to be a minimum barrier height requirement.

WSDOT design standards require that elevation changes between noise barrier panels use two foot increments and barriers should be modeled accordingly.

Comment [TVS30]: Existing best practice new to policy.

Aesthetic Treatments

Consideration of aesthetic barrier treatments, artwork, re-vegetation, and any increased cost for an alternative barrier construction material with transmission losses lower than 20 dB per frequency across 500 – 5000 Hz range shall not be included in the reasonableness cost calculations. Decisions about aesthetic treatments, re-vegetation and barrier material choice is based on applicable department practices and funding availability.

Barrier Reflections

Reflections of sound between two parallel plane surfaces, such as noise barriers or retaining walls on both sides of a highway, can reduce the effectiveness of individual barriers and

contribute to overall noise levels. Reflective noise can also be a problem when a barrier is only built on one side of a roadway. Studies suggest that problems with barrier reflections can be avoided if the ratio of the receiver/parallel barrier location-to- barrier height is at least 10 to 1. For example, two parallel barriers 10 feet tall should be at least 100 feet apart to avoid barrier performance reductions due to reflected noise. The same is ratio should be used to avoid sound level increases on the side of the roadway opposite a barrier.

Parallel barriers should be modeled using TNM and the value used for the Noise Reduction Coefficient (NRC) must comply with American Society of Testing and Materials (ASTM) Recommended Practice C 384-95a (Impedance Tube Method), or ASTM Recommended Practice C 423-90a (Reverberation Room Method) and users should document which method was used.

Absorptive Materials

Comment [TVS31]: New section and content.

Absorptive material should only be considered when the 10:1 receiver/parallel barrier location-to- barrier height ratio cannot be achieved. Consultation with the WSDOT Air, Noise, and Energy Program is required for consideration in other circumstances where absorptive barriers may be effective. Absorption can be modeled for parallel barriers in TNM. However, TNM version 2.5 cannot accurately model sound absorption for single barriers. For single barriers, off-model calculations may be needed and any calculations or alternative methodologies shall be described and are subject to review and approval by the WSDOT Air, Noise, and Energy Program.

Multi-Modal Projects and Projects with Joint Federal Lead Agencies

Comment [TVS32]: Existing best practice new to policy.

Some projects may involve multiple federal agencies. For projects involving non-highway facilities and/or requiring approval from other federal agencies, noise analysis procedures different from those required by FHWA, not outlined in detail here, may be required. For example, both the Federal Transit and Railroad Administrations have their own policies for evaluating transportation noise impacts and considering abatement. When appropriate, the transportation noise analysis shall be performed in accordance with the policies and procedures outlined by the approving federal agencies. This may require multiple types of analysis for the same project. Consultation with the WSDOT Air Quality, Noise, and Energy Program is strongly recommended for these projects.

Consideration of Scenic or Desirable Views

Residents living adjacent to a highway may have scenic or desirable views that they wish to maintain. If noise abatement is warranted, when possible, noise abatement measures may be designed which effectively reduce traffic noise while maintaining views. Abatement must still be feasible and reasonable. Consideration of desirable views should be included when assessing abatement measures, but no conclusions should be made until after interagency consultation and community input has been received, per Section 10 – *Public Involvement*.

Improving the Noise Environment when Abatement is not Feasible or Reasonable

Comment [TVS33]: Previously a stand-alone document. Full text in Appendix 2.

Enhanced community-scale shielding may be available for select major state roadway projects involving roadway expansion. Selection of projects depends on available budgets and timing when standard noise abatement is not warranted. The process of developing community-scale shielding is accompanied by additional community involvement. The concept is to showcase lower-cost options on a continuum from "green" to "gray". The options of shielding range from additional vegetation to low-height visible structures.

The enhanced shielding may provide measurable noise reduction in some locations or only provide psychological relief by blocking the line-of-sight with vegetation. More information on shielding options and the related community involvement process is included in Appendix 2 - *Improving the Noise Environment When Standard Options Aren't Applicable.*

Pursuant to 23 CFR 772.15, none of the measures listed above are eligible for Federal participation as noise abatement.

Extenuating Circumstances

The historical significance of an area or the presence of any long-term efforts to maintain the character or cultural value of a sensitive area should be considered. More consideration is given to areas with larger increases over Existing condition sound levels. This gives greater consideration to projects for highways in new locations and major reconstruction than it does to projects of smaller magnitude.

Noise abatement will be considered for historic properties and other Category C land uses when sound levels are determined to affect criteria for which the property is eligible. These properties will be considered for noise abatement based on their existing use, pursuant to the regulations implementing Section 106 of the National Historic Preservation Act and Section 4(f) of the USDOT Act, when applicable.

A predicted design year increase of 30 or more dBA over existing sound levels, or an absolute traffic sound level of 80 dBA or more will receive additional consideration and may exceed the above-mentioned cost per residence or residential equivalent outlined in Exhibit 11.

7. Exemptions

Changes in operational speed of the highway and installations of turn pockets that are independent of and cannot be directly linked to Type I highway improvements are exempt from noise study under this policy. Also exempt from traffic noise analysis and abatement are transportation related improvements for activity types that would not influence the sound environment. Examples include non-motorized bicycle and pedestrian pathways and low speed maintenance roads or tracks that are not typically open for public travel, provided that placement of such non-motorized paths and maintenance roads would not change topography in such a way as to trigger a traffic noise impact from an adjacent highway.

8. Decision to Recommend Noise Abatement

The final decision whether to recommend noise abatement to FHWA will normally be the responsibility of WSDOT Air Quality, Noise, and Energy Program managers with concurrence from the Design Project Engineer. At the request of the FHWA Washington Division office, WSDOT Air Quality, Noise, and Energy Program managers will provide a letter of concurrence on the conclusions of each noise study for federal aid projects. The letter shall clarify that the final decision whether to provide noise abatement will be made during the final design phase and after the public involvement process has concluded.

9. Acoustical Analyst Qualifications

Any lead acoustical analyst or staff member responsible for the assessment of traffic noise impacts, traffic noise abatement, or review and approval of final noise reports shall at a minimum have completed the FHWA course "The Fundamentals and Abatement of Highway Traffic Noise," the more current NHI Course: “142051 Highway Traffic Noise,” or equivalent as determined by the WSDOT Air, Noise, and Energy Program.

10. Public Involvement

Public involvement must occur when traffic noise abatement is recommended for Type I and Type 2 projects; even when public involvement is not required as part of the NEPA or SEPA processes. Public opinion must be considered when making a determination of reasonableness for traffic noise abatement. Noise abatement will not be planned if more than 50% of eligible property owners oppose the proposed noise abatement.

Comment [TVS34]: Soliciting public opinion was previously at the discretion of the PEO. Now it is required whenever abatement is proposed.

Methods of Public Outreach

When public input is solicited for a project, the project engineering office and the WSDOT Air Quality, Noise, and Energy Program manager will decide on the appropriate method and level of initial public involvement. The purpose of the public involvement is to ensure that the opinions of the affected communities are known to the department and that every effort to provide feasible and reasonable noise abatement to an impacted community is taken. Public involvement is also necessary to keep the adjacent communities informed of the actions of the department and what to expect in the future with the project. Throughout the outreach process, the public will be given opportunities to provide feedback on the project.

Depending on the size, controversy and impact of the project, actions to involve the public may include:

- Open houses,
- Community group briefings,
- Environmental document hearings,
- Mailers,
- Workshops,
- Community polling, and/or
- Joint WSDOT/Citizen committees.

Public outreach will include information on specific characteristics of the proposed noise abatement including the approximate height, length and alignment of noise barriers.

If opposition to the proposed abatement is expressed by members of the community within the noise study area during the public involvement process, the project engineering office will be responsible for the following:

- Ensure that the department is aware of these concerns;
- Document the concerns;
- Consider changes to the design if possible;
- Respond to those who expressed concerns; and
- Conduct a poll of eligible property owners and residents.

Community Polling

Polling should be conducted as early in the design process as possible to verify the opinions of people impacted by the project and benefitting from the proposed barrier. The results of the

poll are considered when determining whether a barrier or other practical mitigation is reasonable, and thus implemented.

The presumption is that abatement is desired by the affected community. However, a formal poll of the opinions of eligible property owners and residents shall be conducted if opposition from members of the community within the noise study area is expressed during the public involvement process. Noise abatement will not be planned if, after community polling is conducted, it is documented that the majority (>50%) of the impacted and benefitting receivers within the study area oppose the proposed noise abatement.

Polls, petitions, or surveys of the community's desires will only be considered valid if the following occurs in conjunction with other criteria of this chapter:

- Performed by WSDOT or WSDOT representatives;
- Contain the address, signature and printed name of property owner and/or residents along with their expressed opinion concerning abatement.

Receiver Eligibility and Weighting

The opinions of impacted and benefitted receivers are considered eligible for formal polling. The purpose of abatement is to noticeably reduce noise for those most affected by highway traffic noise. Noise barriers primarily benefit and/or affect those closest to the wall, so weighting of eligible receivers is based on their locations within the noise study area. Specific weighting of polling responses from benefitting receivers is as follows:

- First row eligible receivers are granted 1.5 votes per residential unit.
- Eligible receivers beyond the first row are granted 1.0 vote.
- If eligible receiver locations are not owner-occupied, the opinions of both the renter and property owner shall be considered. When the two opinions differ, the renter's opinion shall reduce the weight of the property owner's response for that unit by one-half. When polling responses are not received from the renter, the property owner's vote will represent the voting unit.
- Non-residential units identified as sensitive receivers (churches, schools, public parks, cemeteries, etc) will be evaluated on a residential equivalent basis. Eligible receivers in the first row will receive 1.5 votes for each residential equivalent, and benefitting receivers beyond the first row will be granted 1.0 vote. Eligible receivers will always receive at least one vote.
- Noise sensitive receivers within the study area that can demonstrate a negative effect to their property values from the proposed abatement, but are neither impacted nor benefitted, may be eligible for a maximum 1.0 vote.

Comment [TVS35]: New section. Previously, only the opinions of property owners were considered.

After the votes are tallied, the department will evaluate the results in combination with other feasibility and reasonableness considerations to make the final decision about whether noise abatement will be included in the project. Noise abatement will not be planned if more than 50% of weighted votes oppose the proposed noise abatement. If the weighted votes support the noise abatement, but changes to the project in final design make noise abatement no

longer feasible or reasonable, noise abatement will not be included in the project. In the event of a tie, the department may seek input from additional stakeholders.

Alternative parameters and voting guidelines may be identified for projects with unusual topography, cultural, or historic significance (e.g., structures over water, historic districts) and need to be evaluated by the WSDOT Air Quality, Noise Energy Program on a case-by-case basis. FHWA approval is required for alternative voting procedures used on federal aid projects.

Documentation of Public Involvement Process

The project engineering office or project sponsor will be responsible for ensuring that the opinions of each community are known to the department and that correspondence and written documentation is completed. Polling should be conducted using certified mail to ensure that ballots are received. The same people surveyed shall be notified of the department's final decision regarding abatement.

Additional public involvement when there is significant community concern about excessive traffic noise

For locations where noise levels are above impact criteria but abatement is not feasible and reasonable and there is significant community concern about noise, the project design team may augment its community involvement activities to conduct specific outreach. This outreach is intended to identify community concerns and priorities regarding traffic noise and determine if there are other possible low-cost solutions to the community concerns that can be accommodated within the existing project budget.

Enhanced community-scale shielding may be available for state highway projects involving roadway expansion. Per 23 CFR 772, these efforts are not eligible for federal-aid highway funds. More information on shielding options and the related community involvement process is included in Appendix 2 - *Improving the Noise Environment When Standard Options Aren't Applicable.*

11. Coordination with Local Officials

Noise compatible land use and zoning surrounding high traffic corridors and highways is one of the most effective means of preventing impacts to property owners and residents. Following completion of a traffic noise discipline report, the department will assist local governments by providing them with copies of the highway traffic noise analysis and report for projects within their boundaries (23CFR772). Provision of the noise report is intended to inform local jurisdictions about anticipated future noise levels so that local decision-makers can plan appropriately.

The WSDOT Air Quality, Noise, and Energy Program will work with local officials to develop an understanding of Noise Compatible Planning principles and coordinate on the incorporation of noise compatible planning elements into their local zoning codes, plans, or applicable ordinances. See Section 2 – *When is Noise Abatement Provided?* for more details about the Type II program.

WSDOT will update local governments, staff, and elected officials, as appropriate, through the department's public involvement process, as outlined in the WSDOT Design Manual Chapters 210 and 220, on the new Noise Compatible Planning requirements and traffic noise analysis information distribution elements contained herein. Local officials shall be invited to all community meetings or traffic noise-related meetings and public open houses.

12. Construction Outside of Right of Way

Normally, noise abatement built pursuant to this policy shall be evaluated and constructed within state right of way. There may be cases where right of way is not the most prudent location for abatement, but abatement may be reasonable if constructed on adjacent property. In these cases:

- The department's abatement cost reasonableness allowance is limited to normal cost for abatement on state right of way;
- The adjacent property owners allow access and easements as necessary to construct and maintain the abatement; and
- Any additional cost to acquire access, acquire property, provide alternative access, or provide additional infrastructure to accommodate access must be added to the barrier cost calculation and compared to the normal reasonableness cost allowance of the abatement to determine whether the proposed abatement is reasonable.

13. Individual and Local Agency Participation

WSDOT and other jurisdictions must follow this policy and comply with environmental justice and non-discrimination requirements, and the equal protection clauses of state and federal constitutions. To do so, where abatement costs would exceed the allowable limits as set in the this policy, the department may not accept additional funding from local agencies, improvement districts, or private parties to make the abatement reasonable if it would not be considered reasonable without the additional funding.

Local agencies, improvement districts, or private parties may contribute to the abatement to make the barrier taller, longer or more appealing, only if the abatement was already found to be feasible and reasonable. In cases where abatement is not reasonable per this policy, local agencies or improvement districts may also elect to fund the total amount for the noise abatement provided that the local agency or improvement district maintain all aspects of the abatement (e.g., graffiti control, repairs) per local a agreement with WSDOT, and there is no cost to the state.

14. Highway Construction Noise

Construction noise is temporary but may affect nearby property owners or residents. During project development, and before construction begins, project office staff should consider ways to reduce or mitigate the impacts of construction activities. All reasonable methods shall be incorporated in the plans and specifications of the contract.

In most cases, daytime noise from construction activities is exempt from state and local laws. However, in some cases, coordination with, or permits from, local agencies may be needed. For temporary night construction noise, a variance or exemption from the municipal or county codes is typically required. Local jurisdictions may need to be contacted to clarify local regulations, determine if a permit is required, and discuss if there are concerns or restrictions that could affect the project. Some acoustical information and analysis may be needed before the local agency will grant a permit. This is done on a case-by-case basis.

In general, the noise analysis should identify the local regulations that apply to construction noise under standard situations. The acquisition of applicable permits or variances is typically handled by WSDOT through a process separate from the noise analysis.

These same regulations apply to maintenance activities in all but emergency situations. In the latter case, the police department and the local permitting agency should be contacted and notified of the situation at the earliest possible opportunity.

15. Design-Build Projects

Design-build and design-bid-build projects require the same noise analysis outlined in these policies and procedures. Design changes that may occur as part of the design-build process will trigger a re-analysis of traffic noise impacts and consideration of abatement when they have the potential to increase traffic noise levels for nearby noise sensitive land uses. These design changes include any Type I activity (see Section 2 – *When is Traffic Noise Abatement Analyzed*). However, the determination of whether an incremental change in topography or the horizontal or vertical roadway alignment is considered significant and require an update to the analysis shall be made in coordination with the WSDOT Air Quality, Noise, and Energy Program.

When design changes trigger new abatement or alter previously planned abatement that has been reviewed by the affected community, the public involvement process shall be re-initiated.

All changes or updates to the Traffic Noise Analysis shall be reviewed and approved by the WSDOT Air Quality, Noise, and Energy Program for consistency with WSDOT policy.

Comment [TVS36]: Existing best practice new to policy.

Comment [TVS37]: Existing best practice new to policy.

17. Definitions

ABATEMENT: A reduction in degree or intensity.

APPROACH: 1 dBA below the set FHWA Noise Abatement Criteria (NAC). See Exhibit 7 for NAC levels.

AUTOMOBILES: All vehicles with two axles and four wheels designed primarily for transportation of fifteen or fewer passengers (automobiles and vans), or transportation of cargo (light trucks). Generally, the gross vehicle weight is less than 10,000 pounds (4,500 kilograms).

A-WEIGHTED SOUND LEVEL (dBA): The sound pressure levels in decibels measured with a frequency weighting network corresponding to the A-scale on a standard sound level meter as specified by ANSI S1.4-1971. The A-scale tends to suppress lower frequencies, (e.g., below 1,000 Hz) and best approximates the sound as heard by the normal human ear.

AFFECTED PROPERTY OWNERS (RESIDENCES or RECEIVERS): All noise sensitive properties that are impacted by traffic noise, that benefit from the proposed noise abatement, or that are located directly behind the barrier and will have visual blockage as a result of proposed abatement.

BACKGROUND SOUND: The total of all sound in a system or situation, independent of highway traffic noise under study.

BARRIER: A solid wall or earth berm located between the roadway and receiver location that provides noise reduction.

BENEFITED RECEIVER: Noise sensitive property (receivers) modeled to receive a 5 dBA or greater traffic sound level reduction as a result of the proposed abatement.

CFR: The Code of Federal Regulations.

DATE OF PUBLIC KNOWLEDGE: The original date of approval of the initial National Environmental Policy Act (NEPA) Record of Decision (ROD), Finding of No Significant Impact (FONSI), or State Environmental Policy Act (SEPA) document. If there are two conflicting dates for state and federal environmental documents, the NEPA document date shall take precedence.

DEPARTMENT: Washington State Department of Transportation, also known as WSDOT.

DESIGN YEAR: The future year used to estimate the probable traffic volume for which a highway is designed. A time, usually 20 years from the year construction is scheduled to begin, is generally used.

EXISTING SOUND LEVEL: The current sound level, made up of all natural and human-made sounds, normally present at a particular area.

HEAVY TRUCK: Any vehicle having three or more axles and designed for the transportation of cargo. Generally, the gross weight is greater than 26,000 pounds (12,000 kilograms).

HIGHWAY: The entire width between the right of way boundary lines of every publicly maintained travel way when any part thereof is open to the public use for purposes of motorized vehicular travel. A highway may also refer to, or be referred to, as a street or a road.

IMPACTED COMMUNITY: A grouping of acoustically sensitive receivers that reflect the group of citizens exposed to traffic noise levels at least approaching the noise abatement criteria or increasing to substantially exceed existing sound levels due to a project.

INSERTION LOSS: The noise reduction provided by a sound barrier.

LEQ: The equivalent steady-state sound level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same period.

MAJORITY: Defined as equal to, or more than, 51.0% of residents or residential equivalents.

MEDIUM TRUCKS: All vehicles having two axles and more than four wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 10,000 pounds (4,500 kilograms) but less than 26,000 pounds (12,000 kilograms).

NOISE: Generally, noise is unwanted sound. For purposes of this document, noise is sound levels that approach or exceed the NAC, or a sound level increase of 10 dBA or more from a project.

NOISE ABATEMENT CRITERIA (NAC): The sound levels at, or above, which are considered to be a highway traffic noise impact, as defined by FHWA in 23 CFR 772. WSDOT considers traffic noise to create an impact for residences or residential equivalents when noise levels are at, or approaching (within one dBA) the NAC. See the NAC table above in Section 5 – *Identification of Traffic Noise Impacts*.

PERMITTED DEVELOPMENT: A new development is so designated when the developer has shown a definite interest to develop the land within a reasonable amount of time and has reached a point where he/she can no longer practically change plans. For noise analysis purposes, the commitment is identified as the date the building permit is issued.

SEVERE TRAFFIC SOUND LEVEL IMPACTS: Traffic sound levels of 80 dBA Leq and higher for outdoor activity areas.

SHIELDING OBJECTS: Natural or artificial barriers (e.g., natural topography, house rows, vegetation) between a noise source and receiver.

SIGNIFICANT CHANGE IN HORIZONTAL OR VERTICAL ALIGNMENT:
A significant horizontal re-alignment is defined as halving the distance from the edge of the outside lane to the nearest noise sensitive receiver (see Section 5 – *Identification of Noise Impacts* for more detailed information). A significant vertical re-alignment is defined as creating a new line-of-sight from a receiver to traffic.

SOUND LEVEL MEASUREMENTS: Measurements taken by the acoustics analyst or qualified staff person to calibrate and validate the traffic noise model.

SOUND LEVEL METER CALIBRATION: A step to assure accuracy of a sound level measurement instrument (meter). Occurs in two circumstances:

(1) An independent annual test of the sound level meter to assure that it is within a certain accuracy range per National Institute of Standards and Technology (NIST) standards, and
(2) During field use of the microphone, equipment is checked using a calibrator before and after a sound level measurement to assure sound level meter accuracy at the time of the measurement.

SUBSTANTIALLY EXCEED, TIER 1: A 10-dBA increase over existing sound levels.

SUBSTANTIALLY EXCEED, TIER 2: A 15-dBA increase over existing sound levels.

TRAFFIC THROUGH-LANES: A portion of the paved roadway surface (highway) on which motor vehicles are allowed to travel. Interchange ramp lanes are considered as traffic through lanes except when expanded to add vehicle storage.

TRAFFIC NOISE IMPACTS: Impacts occur when the predicted traffic sound levels approach (within one dBA) or exceed the Noise Abatement Criteria or when the predicted traffic sound levels substantially exceed the existing sound levels.

TYPE I PROJECTS: Applicable to new construction or re-construction. Reference 23 CFR 772 for full list of Type I activities. Typical Type I activities include:

1. Construction of a new highway
2. Significant changes to the horizontal or vertical alignment of an existing highway
3. Increases the number of traffic lanes on an existing highway
4. Substantial alteration to the ground contours surrounding roadways (e.g., removes or alters natural or previously constructed berms)

TYPE I AREAS: Area(s) within a project where Type I project activities occur.

TYPE II OR RETROFIT PROJECTS: A proposed project for traffic noise abatement on an existing highway or highway configuration. These are typically stand-alone projects and construction of these noise abatement measures is not necessarily associated with projects that provide traffic capacity improvements. However, properties and communities must meet the conditions of WSDOT's Type II retrofit program.

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

VALIDATION: Comparison of measured traffic sound levels with current modeled traffic sound levels in the same location to ensure the traffic noise model is constructed properly. The difference between measured and modeled sound levels must be within 2.0 dBA.

WORST CASE NOISE HOUR: A period of 60 minutes throughout a (24) hour day in the existing year and future design year that reflects the peak traffic noise hour, usually associated with the peak traffic hour but not in every instance (e.g., where high traffic volumes cause vehicle speeds to drop far below the posted speed). This hour should not be used for field sound level measurements used to validate the traffic noise model.

WSDOT: refers to the Washington State Department of Transportation, also known as the department.

18. References

1. Washington State Department of Transportation (WSDOT) Directive D22-22.
2. United States Code of Federal Regulations (CFR) Part 772 (23 CFR Part 772), May 2, 2002.
3. Federal Highway Administration Report "Measurement of Highway-Related Noise." May 1996.
4. Federal Highway Administration Special Report, "Highway Construction Noise: Measurement, Prediction and Abatement." May 2, 1977.
5. Federal Highway Administration Technical Advisory T6160.2, "Analysis of Highway Construction Noise." March 13, 1984.
6. Federal Highway Administration Traffic Noise Model Report, “FHWA-PD-96-010”, February 1998 and Revision No. 1 April 1, 2004.
7. Federal Highway Administration Report Number FHWA-EP-00-005, DOT-VNTSC-FHWA-00-01, “FHWA Highway Noise Barrier Design Handbook”, Final Report, February 2000.
8. National Highway System Designation Act of 1995.
9. "Fundamentals and Abatement of Highway Traffic Noise", September 1980.
10. FHWA directive "Highway Traffic Noise: Analysis and Abatement ", Revised December 2010.
11. Uniform Vehicle Code and Model Traffic Ordinance 1992, SS 1-27.
12. Rochat, Judith L. and Gregg G. Fleming. 2004a. Validation of FHWA’s Traffic Noise Model (TNM): Phase 1. FHWA-EP-02-031, DOT-VNTSC-FHWA-02-01. (reference still needed?)
13. Rochat, Judith L. and Gregg G. Fleming. 2004b. Addendum to Validation of FHWA’s Traffic Noise Model (TNM): Phase 1. FHWA-EP-02-031 Addendum, DOT-VNTSC-FHWA-02-01 Addendum.
14. Federal Transit Administration “Transit Noise and Vibration Impact Assessment”, April 1995 (or newer version when available).
15. US Department of Transportation/Federal Highway Administration, “Manual for Uniform Traffic Control Devices”, part 3, sections 3.B.01, 04 and 06, Millennium Edition, December 2000.
16. Federal Highway Administration memo, HEP-41, from Bob Armstrong, “Highway Traffic Noise Analysis for Cemeteries, Trails and Trail Crossings”, June 16, 1995.

Appendix 1 – State Funds Option

Project offices have the option of limiting the traffic noise analysis areas on projects that do not use FHWA funding or require FHWA approvals. Instead of analyzing all areas adjacent to the roadway between the full project limits, this policy allows limiting analysis to the specific location(s) adjacent to where Type I noise activities occur on a project (refer to the list of Type I activities below). The State Funds Option also describes a screening process to reduce the burden of analysis on projects where there are no sensitive receivers present or where noise barriers are not likely to be feasible and reasonable.

Applying the State Funds Option does not absolve projects from mitigating traffic noise impacts when they are generated by the project. Instead, this policy is intended to promote the responsible use of transportation funds by focusing analysis and mitigation on areas where traffic noise impacts are caused by a project and are directly tied to project activity. This policy is consistent with WSDOT's commitment to environmental protection.

How does the WSDOT State-Funds Option Noise Policy differ from how FHWA evaluates traffic noise?

Using the state-funds option, traffic noise is addressed using the same methodology as is required by FHWA for federally-funded projects, except for three major differences. These alternatives methods of evaluation can be used independently or in combination.

1. The limits of the Type I activity, not the full project limits, may be considered the lateral study area boundaries. Exhibits 12-14 provide examples of how the scope of the noise analysis can differ for state-funds only projects compared to federal-aid projects.

2. A screening level traffic noise analysis using a "straight line" noise model using TNM (described in Section 4 – *Determination of Sound Levels*) may be considered sufficient for some projects where noise barriers are not likely to be considered reasonable/feasible, even when traffic noise impacts are expected. This screening level method is applicable for rural/low-density residential areas and/or areas with numerous access roads or driveways that would restrict the effectiveness of a noise barrier1.

3. When there are no sensitive receivers located adjacent to a project Type I activity, a noise impact analysis is not required. However, for the purposes of public disclosure, a "straight line" noise model using TNM, described in Section 4 – *Determination of Sound Levels* must be run to disclose sound levels adjacent to the roadway for noise compatible land use planning efforts.

1 Breaks in a noise barrier severely limit the barrier's effectiveness. A barrier must extend beyond the final home at least four times the distance that the final home is from the barrier to prevent "end around" noise.

Exhibit 12: Examples of Noise Study Area Difference between Federal-Aid and Non-Federal Aid Projects – Significant Horizontal Re-Alignment

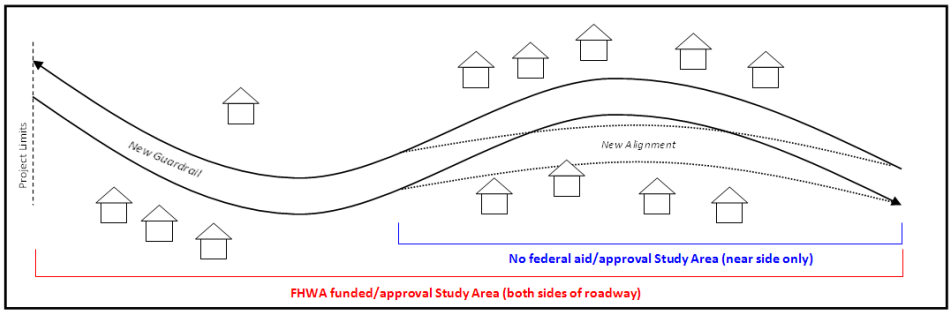
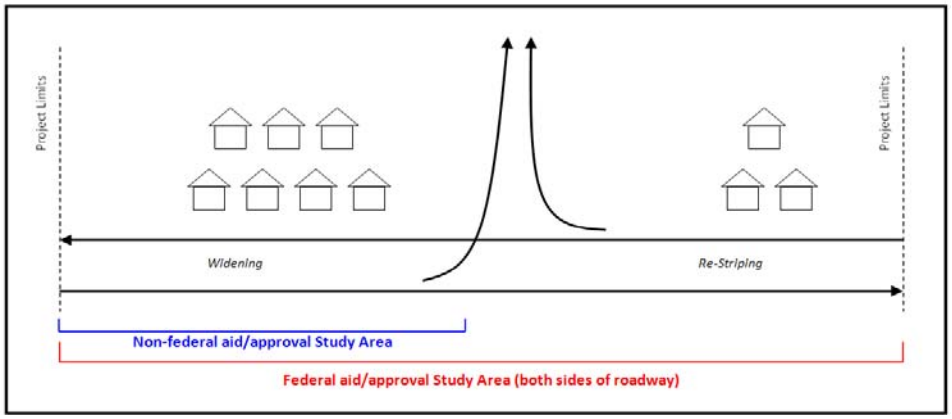


Exhibit 13: Examples of Noise Study Area Difference between Federal-Aid and Non-Federal Aid Projects – Type I and Non-Type I Activity on Single Project



When using the state-funds option, other evaluation criteria are consistent with the methodology used on federally-funded projects, including the noise abatement criteria (66 dBA), the extension of noise analysis boundaries when adjacent to contiguous neighborhoods, and the feasibility and reasonableness evaluation for noise barriers.

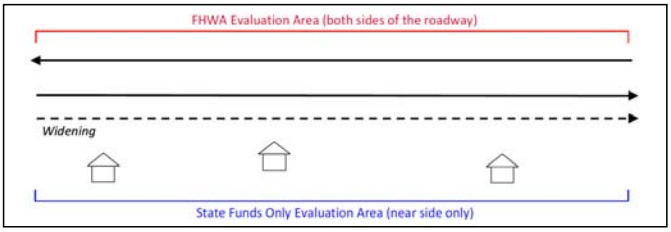
The State Environmental Policy Act (SEPA) process requires the disclosure of changes to traffic noise levels regardless of whether noise sensitive receivers are present. This requirement can be met using a straight line TNM screen to evaluate areas adjacent to Type I activities, and not the full project boundaries. When a project team elects to pursue the state-funds option, SEPA environmental documentation for the project must fully disclose changes to the noise environment and evaluation area boundaries if applicable. Standard SEPA environmental checklist response language is provided in the appendices to this policy.

Exhibit 12 demonstrates the differences between the State-Funds Option and federally funded noise study requirements when a project includes horizontal realignment of the roadway. With federal funding the noise analysis is required on both sides of the road for the entire length of the project. With the State-Funds Option, evaluation of noise impacts and abatement is triggered for the near-side receivers because the roadway re-alignment will bring the traffic noise source closer to the residences. Evaluation of traffic noise impacts may not be required for receivers on the opposite side because the traffic noise source is shifted away from residents on the far side of the road, which will lower traffic noise levels for them. Installation of new guardrail alone does not require noise analysis.

When should the State-Funds Option be considered for a project?

The State-Funds Option is intended for use on projects where there is clear division of activities (Type I vs. non-Type I) and the effect of those activities will not directly influence traffic noise levels for all sensitive receivers within the full project boundaries. For example, the State-Funds Option may be appropriate for projects where widening occurs on only one side of a roadway and receivers on the non-widened side of the roadway will not experience traffic noise level increases directly attributable to the widening (see Exhibit 14).

Exhibit 14 - Comparison of the federal noise study area to the potential noise study area with the State-Funds Option – single side widening



The state funds option allowing the use of the WSDOT approved screening method is also appropriate for areas where a Type I activity occurs but there are no sensitive receivers or where the density and/or location of sensitive receivers make the possibility of mitigation highly unlikely (not reasonable/feasible).

In contrast, the State-Funds Option may not be appropriate when Type I activities on one part of the project will directly increase noise levels for all sensitive receivers within the project limits. For example, if a project widens one side of a roadway to the inside median and brings new traffic closer to the opposite side of the highway. Although widening does not occur on both sides of the roadway, the project would still have the potential to increase traffic noise levels on both sides of the roadway.

Topography, land use patterns, and the presence or absence of sensitive receivers will influence the exact application of the State-Funds Option on a project. Consultation with the WSDOT ANE

Program is required to determine the precise area where traffic noise effects are directly attributable to Type I project activities.

What other considerations should be made before applying the state funds option?
There are four primary issues to consider before applying the State-Funds Only provision on a project.

1. **Study Area -** If the State Funds Option is applied to a project, the noise study area must include all areas adjacent to the limits of the Type I activity. To ensure equitable application, the study area may extend only beyond the lateral Type I activity boundaries if there are no natural breaks in receiver locations (e.g. contiguous neighborhood) or if a receiver is located at the project end point and mitigation must extend beyond the receiver to prevent traffic noise from curling around the noise wall edge.
2. **Funding Changes -** If a project's funding source changes to include federal funds, a full noise analysis of all areas between project limits will be required by federal rule. If the decision to access federal aid on a project is made late in the project development process, there is potential that the project schedule could be delayed and the project budget could be affected depending on the time it takes to prepare the additional noise analysis and whether new/additional noise barriers are required on the project as a result of the additional noise analysis.
3. **Public Disclosure -** In the environmental documentation and during the public information process, the reduced scope of the noise analysis must be disclosed. This could present challenges during the public information process with residents not included in the State Funds Option study area.
4. **Screening Model -** If a "straight line" TNM screening analysis is performed and traffic noise levels are over66 dBA, or an increase of 15 dBA over the No Build conditions, a full TNM model shall be used to determine the potential for traffic noise abatement. Depending on the presence and density of sensitive receivers, additional consideration may include a full TNM model run to determine the reasonableness/feasibility of mitigation, including noise barriers.

Example of State Funds Option traffic noise analysis language

Under the scenario presented in Exhibit 12, the following would be included as the traffic noise analysis:

- Project Title and brief description of Type I activities.
- Disclosure statement describing application of the State Funds Option on the project. For example:
  The WSDOT state funds noise policy is being applied to the Project Name which is funded entirely by state sources. The project will shift the roadway more than one-half the distance to the nearest receiver adjacent to the eastbound travel lanes and, therefore, is considered a significant horizontal re-alignment and a Type I activity that has the potential to increase traffic noise levels for the neighborhood adjacent to the eastbound direction of traffic from MP XX.XX - MP XX.XX. The project will shift traffic

away from receivers adjacent to the westbound direction of traffic and lower traffic noise levels are expected in the neighborhood adjacent to the westbound travel lanes than without the project.

Since there is a clear distinction between the potential for traffic noise impacts directly related to Type I project activities in the separate neighborhoods adjacent to eastbound and westbound SR XX and no federal funds are being pursued, the project office has elected to evaluate traffic noise per the WSDOT state funds policy for non-federal aid projects outlined in WSDOT Noise Policy and the WSDOT Environmental Procedures Manual. The State Funds Option allows the traffic noise analysis to be restricted to those areas directly affected by Type I activities on a project. For Project Name, traffic noise analysis was restricted to the eastbound side of SR XX between the limits of the planned re-alignment from MP XX.XX - MP XX.XX.

If at any time federal funds are used on the project, the entire noise study area within between the full project limits, on both sides of the roadway, will need to be analyzed per WSDOT noise policy and procedures.

- Traffic data used to perform traffic noise analysis including vehicle mix (Auto, Medium and Heavy Truck volumes) and existing and future speeds.

- A "straight line" TNM screening model shall show noise levels for 50' increments from the edge of the roadway to a point where traffic noise is below the NAC for residential land use for Build and No-Build conditions. If full TNM model is constructed, then Existing, Build and No-Build traffic noise levels at all sensitive receivers, or representative locations, shall be included.

The WSDOT approved screening method provides "worst case" values for traffic noise and was used to evaluate future traffic noise levels with and without the project (Screening values are attached). Traffic noise levels between XX and XX dBA are expected at the nearest receiver and no substantial increases over the No Build scenario are expected.

- Recommendation for/against mitigation.

A noise wall is not recommended for this project. Although noise levels would exceed the 66 dBA noise abatement criteria at XX residences, the low-density of the residences in the area adjacent to the Type I activity, within the noise study area adjacent to the eastbound traveled lanes, make noise barrier mitigation neither feasible nor reasonable. The allowable (reasonable) wall size is insufficient to satisfy WSDOT feasibility requirements for sound level reductions, per 2011 WSDOT noise policy.

Sample SEPA checklist response when using the state funds option

(For Question B.7. - Environmental Health, b. Noise)

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

- Describe the existing noise environment in the project area, both from the existing highway, and from other land uses if applicable.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

- ***Construction Noise:*** *The temporary nature of construction noise means that any construction noise effects will be of limited duration. In most jurisdictions, construction noise is exempt from sound level restrictions during daytime hours. If night work is planned, a night noise variance will be needed from the local jurisdiction.*
- ***Traffic Noise:*** *A "straight line" TNM model was used according to the State Funds Option outlined in the 2011 WSDOT noise policy and procedures for non-federal aid projects (2011). The project will XX* (widen, realign, add lanes) *which is considered a Type I activity and has the potential to increase traffic noise for areas adjacent to MP XX.XX – XX.XX. The noise abatement criteria for residential land use are 66 dBA. In the future Build scenario, traffic noise is expected to be 66 dBA at approximately distance from the pavement edge, compared to 66 dBA at approximately distance in the No Build scenario.*

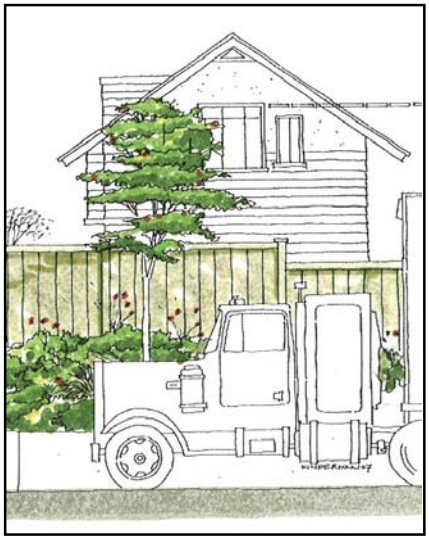
3) Proposed measures to reduce or control noise impacts, if any:

- *No sensitive receivers are present within the Type I study area and, therefore, no mitigation measures are recommended.*
- *There are number residential receivers that are expected to be impacted by the Type I activity attributable to the project. However, because of the distance separating the homes, abatement is not reasonable/feasible per 2011 WSDOT noise policy.*

Appendix 2 - Improving the Noise Environment When Standard Options Aren't Applicable

Community-scale noise alternatives that transportation projects may consider where noise impacts do not meet requirements for noise abatement, but opportunities for enhancements exist within the project scope.

When abatement is not reasonable and feasible, federal funding can only be used for eligible activities per 23 CFR 772.



Executive Summary

This document describes situations when enhanced community-scale shielding may be available for major state roadway projects involving roadway expansion. Selection of projects depends on available budgets and timing when standard noise abatement is not warranted. The process of developing community-scale shielding is accompanied by additional community involvement. The concept is to showcase lower-cost options on a continuum from "green" to "gray". The options of shielding range from additional vegetation to low-height visible structures.

The enhanced shielding may provide measurable noise reduction in some locations or only provide psychological relief by blocking the line-of-sight with vegetation.

Application

Transportation related noise can be distracting and annoying for many residents living near major roadways. Limited budgets for transportation agencies and federal requirements mean

that consideration of noise abatement (like noise walls and berms) is evaluated only for transportation projects that will install new roadway, add lanes to existing roadway, or significantly realign a roadway (horizontally or vertically).

There may be extended opportunities for some major state roadway projects within available scopes and budgets to improve the noise environment for those communities where official noise abatement is not reasonable or feasible according to state and federal rules. In other words, there may be areas where noise abatement is considered ineffective or does not meet our cost-benefit requirements, but we can still look for options.

The following document describes various opportunities and methods that a project may consider to improve the noise environment, either physically or psychologically, for wayside residents using lower cost options. These methods are also intended to enhance community participation and awareness as transportation projects affect noise sensitive areas within existing neighborhoods where standard noise abatement is not warranted.

WSDOT transportation design teams shall evaluate these opportunities when input from community involvement identifies a significant community concern about effects on quality of life due to excessive traffic noise.

Guidance for additional public involvement when there is significant community concern about excessive traffic noise

Major state roadway projects follow public involvement procedures that are established in Chapter 460 of WSDOT Roadside Manual[2], Chapter 210 of the Design Manual[3], Chapter 410 of the Environmental Procedures Manual[4], and federal environmental regulations. These procedures may include hosting a certain number of public meetings and hearings, placing newspaper advertisements, sending out fliers, providing opportunities to review environmental review documents and project designs, and more to assure that the project meets its legal obligations and gathers appropriate input from affected communities about the project. For those locations where noise levels are above impact criteria but abatement is not warranted and there is significant community concern about noise, the project design team shall augment its community involvement activities to conduct specific outreach. This outreach is intended to identify community concerns and priorities regarding traffic noise and determine if there are other possible low-cost solutions to the community concerns within the existing project budget. These steps may include:

- Additional public, neighborhood association, or small scale residential meetings with residents to identify the nature of their traffic concerns and brainstorm and discuss options during or after completion of the official environmental process.
- Set up a volunteer community subcommittee (e.g., steering committee, advisory committee) of select community representatives with diverse perspectives and skills to

2 http://www.wsdot.wa.gov/publications/manuals/fulltext/M25-30/Roadside.pdf
3 http://www.wsdot.wa.gov/publications/fulltext/Policy/DesignManual/desEnglish/210-E.pdf
4 http://www.wsdot.wa.gov/publications/manuals/fulltext/M31-11/410.pdf

work with the project to craft solutions and work with their neighbors on an effective outcome.
- Polling, questionnaires asking community members what method of involvement would work better for them.

Typical roadside and community issues

At times, community coordination and input reveal that aesthetic shielding is not desired by the majority of residents affected by the transportation project. In such cases, the project designer may consider other issues that residents may be concerned about. Examples may include:

- bus stops
- view screening or clearing
- sidewalks
- access/ land – for example, enabling residents who share a border with state right of way to extend their activities onto state right of way if a structure is offset in a location that is not easily maintained by WSDOT.
- water features (masking)
- incorporate alternative design principles in harmony with surroundings
- sound absorbing materials placed on retaining walls
- choice of alternative methods for retaining walls that use earth instead of concrete
- private property owners building a fence on public ROW
- private plantings to cover chain link ROW or block view of road themselves provided that no permanent structures are established
- safety concerns -- people from roadway hopping over ROW fence onto private property (higher fence or increase security in some way)
- Light pollution – placement and direction of permanent roadway lighting
- Air quality – dust-particulate control of highway – using plantings to alleviate perception
- View and placements of signage (perhaps that residents do not want to see – e.g., placard for available businesses at the next exit)

Enhanced Shielding Opportunities

The main concepts for this document cover two areas of interest when considering other options to improve the noise environment. These concepts may not measurably reduce the noise levels, but they may affect the psychological impressions of adjacent listeners.

1. Start with green (vegetation) solutions and move to gray (human made) elements
2. Community scale

Starting with **"green"** and moving to **"gray"** means looking at opportunities for improvement starting with natural elements like vegetation and earthen/topographical features (also referred to as "green" features). That continuum extends through more intrusive placement of structures ("gray" features) that fit the **"community scale"** of the neighborhood. Unlike official noise barriers which can extend up to 30 feet high, "community scale" structures such as solid fences and visual barriers are intended to be no more than six to eight feet high and fall within

the local jurisdictional height restrictions without overpowering the existing neighborhood features already in place.

Green (the benefits of vegetation)

Vegetation has many functions and adds value to the roadside. Functions include:

- Screening
- Enclosing
- Blending
- Buffers
- Water quality filtering
- Perception of noise protection
- Increased oxygen production for air quality
- Corridor continuity
- Visual quality, and among others[5]

Western Washington is renowned for its lush vegetation. Eastern Washington has a varied palette of more drought resistant plants. Vegetation enhances, and in many ways defines, the quality of life for many of us. Vegetation is used to enhance the visual experience along the highway corridor and provide continuity. Plantings can be used to blend the roadway with and reflect the character of and transition to the adjacent areas. Plants can also be used to define a community from the roadway. In such cases the plantings viewed from the road blend with the corridor plantings and the vegetation viewed from the neighborhood blends with and transitions into the neighborhood. If the plantings are accompanied by solid barriers, then lower story vegetation (shrubs and groundcover) on either side may be very different to showcase these goals.

Recent research has shown that vegetation may reduce stress, decrease recovery time following surgery, may lower crime rates[6], may have economic benefits for business districts[7], and may increases real estate values[8] as opposed to areas that don't have vegetation. Plants can also shield the view of noise sources and create a more psychologically soothing noise environment. Very densely planted vegetation can absorb more high frequency noise than low frequency noise. Humans usually find high frequency noise more disturbing. Plants sequester carbon and generate oxygen. Friends of Trees, a non-profit organization, estimate that a mature tree in Portland sequesters 223 pounds of carbon annually4.

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5 For a more extensive list of functions see Chapter 800 of the Roadside Manual

6 Wolf, K. L. 2003. Ergonomics of the City: Green Infrastructure and Social Benefits. In C. Kollin (ed.), Engineering Green: Proceedings of the 11th National Urban Forest Conference. Washington D.C.: American Forests. http://www.cfr.washington.edu/research.envmind/UF/AmForErg.pdf

7 Wolf, K. L. 2005. Business District Streetscapes, Trees and Consumer Response. Journal of Forestry, 103, 8, 396-400. http://www.cfr.washington.edu/research.envmind/CityBiz/BizTreesAll_JFor.pdf

8 McPherson, E.G., S.E. Maco, J.R. Simpson, P.J. Peper, Q. Xiao, A.M. VanDerZanden and N. Bell. 2002. Western Washington and Oregon Community Tree Guide: Benefits, Costs, and Strategic Planting. Silverton, OR: International Society of Arboriculture, Pacific Northwest
http://www.fs.fed.us/psw/programs/cufr/products/5/CUFR_164_Western_WA_OR_Tree_Guide.pdf

Vegetation can be planted alone or in conjunction with earth berms or solid barriers. Design teams must take care in choosing appropriate planting options that will be self-sustaining. Given WSDOT maintenance budget constraints, once planted there will be minimal care of the area, other than mowing in appropriate locations.

"Roadside Classification Plan" on how to incorporate vegetation in transportation projects

The *Roadside Classification Plan* (WSDOT Manual 25-31, 1996) establishes the policy to coordinate and guide the management of Washington State highway roadsides. The Roadside Classification Plan (RCP) categorizes the roadside in five classifications. These classifications have guidelines for vegetation, land forms, and architectural treatments and are used to restore the roadside during maintenance and construction activities. They also are used during environmental retrofit projects.

Enhancement of vegetation will require following the policies outlined in the *Roadside Classification Plan* and must follow the goal of a sustainable roadside with lowest life cycle cost. The emphasis is placed on use of native plant species in order to achieve a more sustainable roadside. Given WSDOT budget constraints, once planted the roadside receives minimal care.

Development of solutions for roadside treatment shall involve the WSDOT Region Landscape Architect. If the designer team or communities identify treatments that are outside of the *Roadside Classification Plan,* the treatments must be approved by the WSDOT Headquarters Landscape Architect prior to use on projects.

WSDOT makes planting choices with entire corridor themes in mind

Corridor continuity provides a high level of visual quality of our highways by providing unity and improving intactness. Also, corridor continuity provides predictability for the driving public and simplifies maintenance requirements. Maintaining corridor continuity blends the highway into the natural and built environment and provides visual cues to the driver and limits distractions. Because of this, it is important to WSDOT to maintain corridor continuity. Vegetation and strategic use of materials, colors, and textures contribute to the unifying elements that provide corridor continuity.

There is no set length for a corridor. A corridor may be easily defined by a specific road such as Interstate 405 or it may be a segment of a highway such as State Route (SR) 99 through Seattle. If a corridor planning study has not been done for a segment of roadway, WSDOT advises the designer to look on either side of the project to pick up visual elements that may define the corridor. The existing visual elements can be used as a guide to transition and blend with new elements. If a Roadside Master Plan or Architectural Guidelines exist for an area within a highway corridor, then WSDOT advises the designer to use those documents to guide their design. If none of these documents exist then the designer needs to involve the Region Landscape Architect and the State Architect to identify logical corridor end points.

Transitions between corridor treatments need to occur gradually. The length of these transition areas depends on the speed of the roadway. For a freeway setting the transition area might be over several miles. For a slower speed facility the transition area may be between one-half and one mile. Elements from the corridor should be used to transition and introduce new elements.

In some cases it may be desirable to use other types of fencing, barriers/walls, or architectural treatments than is the standard for that corridor. This may be acceptable if the introduced element is or can be permanently screened by vegetation. It is desirable that the vegetation used to screen be in place before the element is installed. If the screen is not present then WSDOT encourages the designer to designate plantings that include a mixture of fast growing plants and longer lived, but slower growing plants to provide a permanent screen.

Incorporating community scale walls/barriers into the roadside design

There are a host of materials that WSDOT and other agencies may consider to provide visual and aesthetic screening along the roadway. In order to improve the noise environment for wayside residents the material must be solid and provide no breaks, openings, or gaps in the material. Examples of potential materials include standard concrete crash barriers, fences, and walls already detailed in WSDOT Standard Plans. Other options include solid wood fencing and six to eight-foot tall structures made from metals, composites, plastics, concrete, rubber, foam, and more.

The WSDOT new products group led by the headquarters Materials group in Tumwater, Washington spearheads the evaluation and acceptance of new materials for use along the roadside. Product approval includes input from many key stakeholders in WSDOT, including maintenance, safety, structures, acoustics, architecture, and landscape architecture. For a list of approved or provisionally approved noise related products, please contact the WSDOT Air, Noise, Energy Program.

To continue with the “continuum of green to gray” identified at the start of this document, if a design team wishes to include a solid fence or structure of some kind into the project in an effort to shield residents or slightly improve the noise environment, the design team shall also link placement of the structure with an appropriate vegetative planting plan to shield the structure with vegetation. The following sections outline various concepts to include when pairing shielding structures with vegetation.

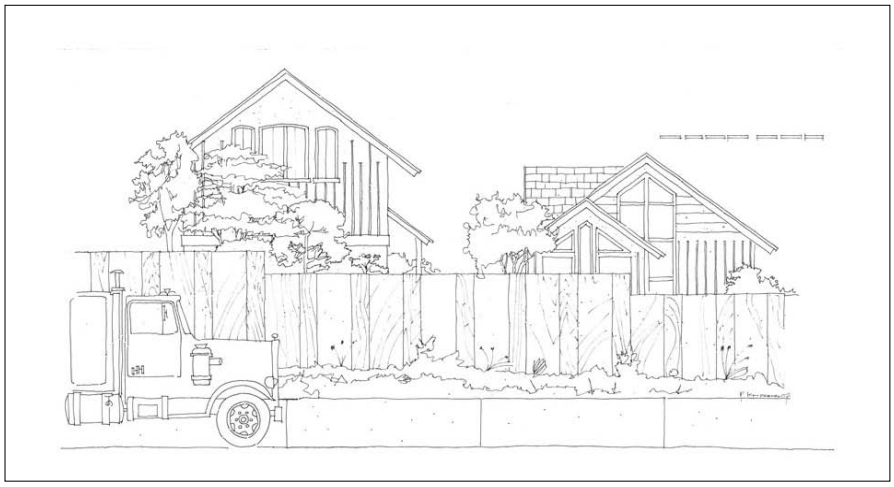
Earth berm/organic structures

Earth berms are by nature a “green” and effective noise shield, and can sometimes be incorporated on projects that have available right of way. Create berms with slopes that have a maximum steepness of 2:1 and plant trees and shrubs to provide long term erosion control. Compact the soil on the outer 2 feet of the berm surface only by cat track method to allow maximum ability for the plants to survive.

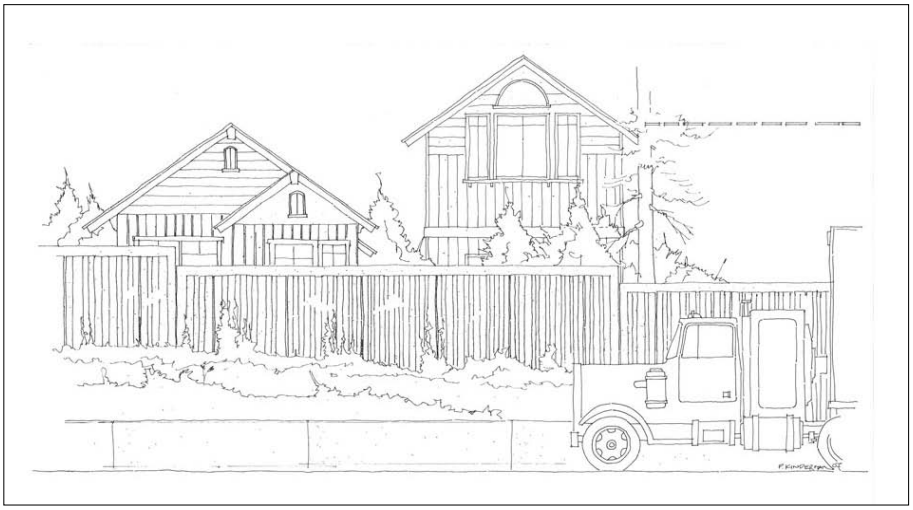
Non-organic structures (barriers, fences, and walls)

For locations where plants are intended to visually screen the structure, "hiding" it in some way, the designer may consider reducing the amount of texturing or aesthetic treatment than for barriers in more exposed areas. For example, barriers that span ravines where they are not visible may be constructed with less texturing or aesthetic treatment to save funds.

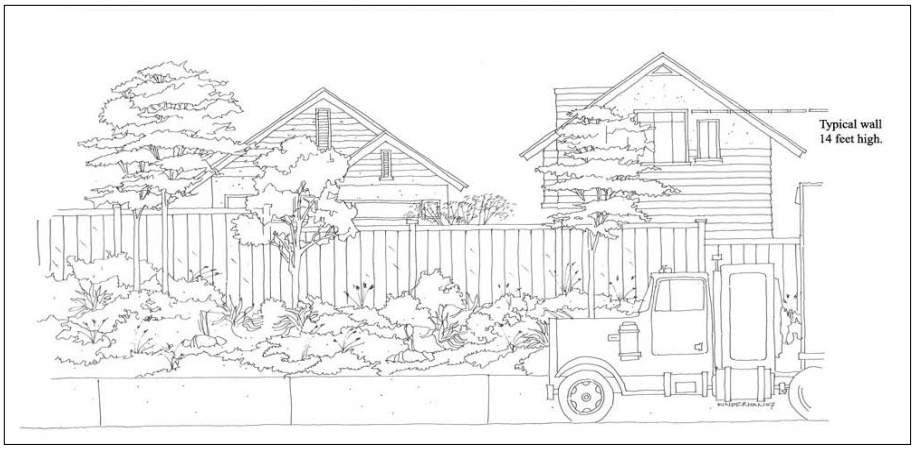
If vegetative covering is not an option for the structure, the designer must evaluate other aesthetic treatments (designs, colors/tints) that will help the structure blend into the corridor theme of the roadway and may reflect the character of the community. The following four examples show wood, random board design concrete, plastic, and concrete block illustrations that are intended to be solid, yet fit into the community scale of the area.



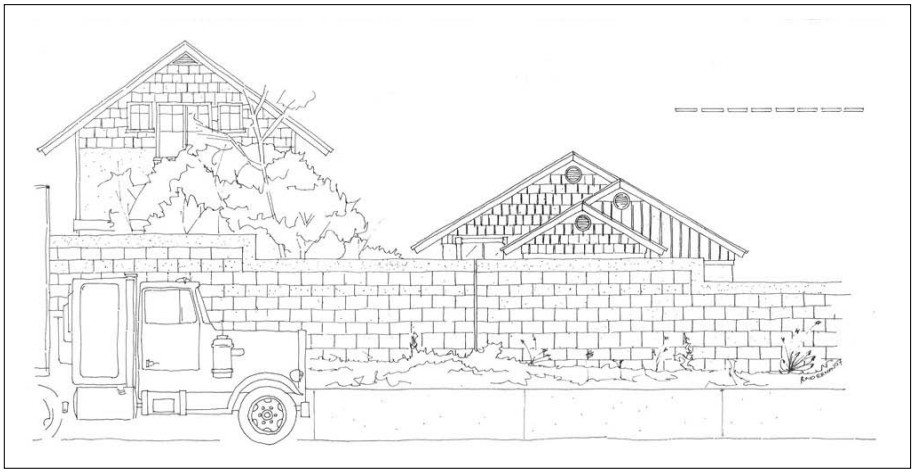
Example of community scale <u>wood</u> wall 6 to 8 ft high. Dashed line above roof on the right shows typical noise wall height at 14 ft.



Example of community scale <u>random board</u> wall 6 to 8 ft high. Dashed line near the roofline on the right shows typical noise wall height at 14 ft.



Example of community scale <u>plastic wall with vegetation</u> at 6 to 8 ft high. Dashed line through the roofline on the right shows typical noise wall height at 14 ft.



Example of community scale block wall 6 to 8 ft high. Dashed line above the roof on the right shows typical noise wall height at 14 ft

Vegetation and aesthetic treatments for structures facing the roadway

Structures set back against the Right of Way (ROW) line or offset from the shoulder with sufficient width to plant shall be planted using the following criteria:

- Work with the Region or Headquarters Landscape Architects to develop the appropriate planting design that will blend with the context and be sustainable over time.
- Use the Roadside Classification Plan (RCP) treatment levels for the classification9 and the design manual clear zone and line of sight requirements
- If a Roadside Master Plan has been developed for the project area through the Context Sensitive Solutions process, the planting design shall incorporate those recommendations.
- Design plantings to meet any commitments made in the permit process.
- Follow guidance in Design and Roadside Manual standards for design of roadside planting.
- Blend the proposed vegetation to match the existing vegetation (if the existing vegetation fits with roadside classification).
- Design plantings to be appropriate for available width of planting area.
- Roadside design for areas that WSDOT will be responsible to maintain must be maintainable and sustain over time. Seek maintenance office input to incorporate maintenance constraints, abilities and access needs within their budget constraints.
- Secure city buy off and maintenance agreement for plantings that the local jurisdiction (or designee) will maintain.

9 See the Roadside Classification Log found in the back of the RCP.

- Design set backs from structures based on operational or maintenance requirements of structures or plantings.

The WSDOT Region Landscape Architect or Headquarters Region Liaison Landscape Architect shall be the lead for design of any roadside vegetation treatments. It is critical to coordinate with the area maintenance staff during the design phase so that they will be able to maintain the plantings after the plant establishment period. Project leads need to contact local agencies and adjacent landowners, either individually or in public meetings, to gather feedback on the proposed plantings and help work through any expectations for the look and feel of the area once the project is complete. If the plantings will be turned over to a local agency, it is critical that the local agency representative be an active team member during the design phase to ensure that the local agency receives a product that it can maintain and that reflects its city.

Planting along a freeway is very different than planting along a city street. The first difference is the speed scale. At 60 miles per hour (MPH) a viewer is moving at 88 feet per second. This means that the designer needs to avoid minute details in the plantings or structural treatments because they will be too small to be seen. These speeds also require that fixed objects, such as trees, be set further back from the edge of the shoulder to provide a recovery zone. On the other hand, an urban roadway with lower speeds and stop lights needs to have more detailed designs. Not only will they be seen but in some cases the details may help slow the traffic down by constricting the perceived visual width of the corridor when combined with other more urban features like sidewalks and curbs.

Structures on the shoulder of the roadway

Structures on the shoulder are the most difficult to screen with vegetation. However, there are some design features that can be incorporated to help soften their visual effect. These structures usually have a safety barrier section at the bottom so that cars do not snag on the structure's pattern and support columns. Provided that snagging hazards are eliminated, the structure could be set back slightly from the safety barrier to provide a planting strip for shrubs and vines. The structure could be staggered to provide pockets for planting and to provide visual relief, or slots could be provided at the base of the structures to provide planting pockets for vines. Such pockets or slots may only be viable if irrigation is also evaluated to assure successful plant establishment and long-term viability of the desired vegetation and they do not pose a roadside hazard.

Designers must account for additional maintenance needs when considering these types of options. Maintenance needs may include access points or access doors, lane closures to conduct maintenance, etc. Designers need to work closely with their regional maintenance office when considering these types of features.

Structures not on the right of way (ROW) line -- but not on the shoulder

At times solid screening can neither be on the ROW line nor on the shoulder. Because of topography, drainage, or roadway design requirements, they may be somewhere in the middle of the roadside area or at the top of a retaining wall. If there is room in front, on the roadway side of the retaining wall, then the designer needs to use the guidelines listed above. If there is not enough room in front of the screen to follow those guidelines then the designer needs to consider the following:

- For shielding set on top of retaining walls, set the shielding back to allow for a planting strip.
- Use narrow planters or slots in the screening to allow for plantings (vines) to cover structures.
- Put in planting pockets or stagger walls to provide planting areas.
- Consider maintenance access and safety on steep planted slopes or areas between mainline and interchange ramps. Hand rails or tie-off appurtenances may need to be installed.

Plantings on structures facing homes or other sensitive receivers

Depending on project budgets there may be greater discretion for aesthetic treatments for the back sides of structures. Examples of choices include sealant color, mural type, and use of various patterned form-liners to provide texture on the wall face. There are simple ways to provide relief to the flat gray surface of a wall, such as providing various textures or patterns on the wall face. Although WSDOT is ultimately responsible for the choice of treatment, neighborhood and local jurisdiction involvement is key.

Structures that have houses backing up to them

There are several options to choose from depending on agreements with adjacent property owners and WSDOT maintenance preferences.

- Plant nothing (except grass) and let the homeowner plant and maintain the area to blend with their yard. (Note: Produce a brochure that lists desirable characteristics of plants and possible list of plants applicable to the specific area.)
- Work with the Roadside Classification Plan, property owner, and WSDOT Landscape Architect and maintenance area staff to choose appropriate low maintenance plantings.
- In order to allow for preserving the structural integrity of wall structures, adjacent landowners are not allowed to attach structures, such as trellis, to the walls; however a structure can abut the wall.

Structures that have roads or other public spaces behind them

- Use the same criteria as planting in front of walls on secondary roads.
- Defer to the city or county's landscape ordinance or agreements up to the cost of standard treatments. The local jurisdiction must pay for any improvements beyond standard unless part of environmental commitments.
- Local jurisdiction (or designee) must maintain all improvements beyond standard.
- If the planting is in a city with a population less than 25,000 or a county and WSDOT is doing the maintenance of the planting, then the plantings will be in accordance with WSDOT base treatments (RCP) and local maintenance and operations requirements. Plantings on both sides of the fence shall be consistent.

Options not available at this time

(1) Quieter pavement

WSDOT is experimenting with various ways to reduce the tire-pavement noise coming from both asphalt and Portland cement concrete pavements. These quieter pavement designs are experimental features at several limited locations in Washington. WSDOT selected these locations carefully based on their traffic volumes, project timing, and locations that enable appropriate data gathering. Until WSDOT completes the experiments to determine the noise quantity, noise quality, safety, and durability of these test sections, experimental quieter pavement will not be considered as a viable long-term method to improve the noise environment for wayside residents.

WSDOT is also working with other states and national research projects to better understand the potential characteristics and longevity of quieter pavement designs.

(2) Transparent and translucent materials

At this time WSDOT does not recommend the use of transparent or translucent materials along public roadways. WSDOT has not resolved issues of cost, long-term maintenance and replacement responsibilities, cleaning regimes (especially on structures and near sensitive water bodies), graffiti, and fair treatment of view-sheds to adequately decide where and when to use transparent or translucent barrier material.

(3) Changes to private structures

In the same way that WSDOT does not modify private structures for noise abatement, WSDOT will not make improvements on private structures in the context of improvements to the noise environment. For the purposes of this guidance, WSDOT will not insulate, caulk, replace windows and doors, install weather-stripping, provide air conditioning, or make other improvements to private structures to reduce long-term operational road noise.

Summary

WSDOT intends for this document to help guide transportation designers, architects, and landscape architects in when and how they can choose alternative shielding options and community improvements when a community experiences high noise levels but does not qualify for full noise protection. It is important to use an interdisciplinary approach to address solutions for these locations in your design. People that use this document must note that these "community scale" options may not dramatically improve the noise environment for residents or render an area quiet. These methods are meant to provide low-cost, small changes that may improve the noise and aesthetic environment for wayside residents. Some locations may experience greater benefits than others due to the local topography, distance to the roadway, orientation of buildings to the roadway, residential construction techniques, and more.

This document is also meant to help guide designers with options available in working with community residents and city officials when deciding the best course of action for specific corridors that may have unique characteristics and values to specific groups.

It is important to document your process in your design documentation.

If you have questions

Or, if you need clarifications about how to use this document, contact the Washington State Department of Transportation Noise Program through Environmental Services at (360) 705-7483 or Roadside and Site Development Program (360) 705-7242.

Appendix 3 - Traffic Noise Analysis and Mitigation Process

Answer to *"When are noise reports and/or recommendations final?*

The traffic noise analysis and mitigation process from the preparation of a noise report to the final noise wall design (or decision not to build) can be confusing. The following provides clarification to project teams and outlines a recommended "standard" process, but acknowledges that variations to this process are likely because of the differences among projects.

Environmental Review: NEPA/SEPA Discipline Report

1. The noise analyst models project elements affecting noise that include traffic, topography, and the location of noise sensitive receivers. If impacts are revealing through modeling, then mitigation is evaluated.
2. Mitigation is compared to the feasibility (sound level reductions, constructability) and reasonableness (barrier size/cost, public input, noise reduction design goal). If mitigation is feasible and reasonable, the report recommends the noise barrier in a statement of likelihood. Changes to the project during final design may change the determination of whether or not a noise barrier is feasible and reasonable or the final design of the abatement itself.
3. 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 and reasonable noise abatement alternative.
4. The traffic noise discipline report can be finalized. However, if any new noise sensitive receivers are approved for building permits before the Date of Public Knowledge, the report must be re-opened.

Note: Design Phase and Public Involvement steps (below) may be incorporated into the report before it is finalized or these changes can be included in project file at the Project Office's discretion.

Design Phase (if noise wall recommended)

5. The project team reviews the recommended noise wall height and alignment to determine if there are conflicts with noise wall construction, such as utility location or steep slopes that were not caught during the discipline report review.
6. If conflicts exist, additional design details and potential for increased construction costs (beyond "standard" noise wall) are provided to the noise analyst by the project team. Additional costs are those that occur only because of the noise wall.
7. If the updated noise wall costs are still less than the allowable costs per WSDOT Noise Policy, a new barrier height or alignment may be recommended. If the new barrier costs

exceed the allowable costs, the previous recommendation may be rescinded by the Air, Noise and Energy Program.

8. The results of changes to project or noise wall design are documented in a memo for the project file or included in the discipline report at the discretion of the Engineering Project Office.
9. Pursuant to 23 CFR 772.13(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.

Public Involvement

The noise wall discussion may be introduced to the public before the Design Phase, but any community polling (optional) should happen after the final design is established so that people understand the location and height of the proposed wall before the polling is conducted.

10. Any changes to the noise wall design as a result of public involvement should be documented and added to the project file or discipline report at the discretion of the Engineering Project Office.

Final Determination

11. If the recommendation to build/ not build a noise wall changes during the Design Phase or after Public Involvement, a memo approved by the Project Office, that clarifies the new decision will be sent from Air, Noise, Energy Program Manager to FHWA Division Office.

Appendix 4 - Contents of the Traffic Noise Analysis/Study

The traffic noise study should describe the procedures used in developing and performing the analysis and considerations made in arriving at the appropriate conclusions. The report should be easily understood by both the technical reviewer and the layperson and be presented in a plain talk format. WSDOT Noise Policy and related procedures provide guidance on the required elements of the noise study. The following outlines the minimum requirements for a traffic noise study that are required for approval by the WSDOT Air, Noise, and Energy Program.

Consultant qualifications

- Documented completion "The Fundamentals and Abatement of Highway Traffic Noise," the more current, NHI Course: “142051 Highway Traffic Noise,” or equivalent as determined by the Air, Noise, and Energy Program. This requirement may be satisfied if the document reviewer meets these qualifications.

Project description, including

- Official project limits
- Detailed description of any Type I activity
- Description of all project alternatives
- Existing and Design years

Existing and design year traffic, including:

- Traffic volumes
- Speeds modeled
- Vehicle mix (cars, medium & heavy trucks)
- Source for traffic information

Land use description, including:

- Land uses throughout the project area
- Topography
- Non-traffic noise source, if appropriate
- Map of noise sensitive receiver locations (including all Category A - E locations)
- Confirmation of that no new building permits have been approved (or are pending approval) for noise sensitive land use in the study area

Validation process, including:

- Description of measurement locations
- Description of traffic recorded (volumes, speed, vehicle mix) during validation measurements
- Measurement equipment and methodology
- Graphic describing validation locations

- Table comparing validation measurements to modeled results; reported to nearest one-tenth of decibel (model validation is the only place the noise results should be reported in tenths of decibels).

Existing and projected sound levels in the design year for all alternatives, including:

- Graphic verification of noise study area; distance from roadway to 66 dBA at representative locations
- Graphic showing modeling locations
- Description of the noise sensitive properties represented by each modeled location
- Table comparing the Existing, No Build, and Build condition noise levels for each alternative
- All reported sound levels shall be rounded to the nearest whole decibel
- Identify impacts for each modeled receiver
- Model file(s) showing Validation, Existing, No Build, and Build conditions

If impacts occur in the Build Condition(s)

Feasibility, including:

- Description of the type(s) of abatement considered
- Description of modeling to determine the minimum feasible abatement
    - TNM Model file(s) that include barrier or other abatement considered
- Description of any engineering considerations/challenges

If abatement is feasible

Reasonableness, including:

- Description of the cost effectiveness evaluation (*Table preferred)*
- If cost effective, determination of design goal achievement
    - TNM Model file(s) that include barrier or other abatement considered
- If cost effective, status of Community Input process

If Community input is received

- Method of determining property owners' and residents' opinions and the results of such if abatement is recommended and there is potential community concern about noise barrier placement;
- Complete basis for recommendation regarding abatement, including:
    - Abatement design; if a barrier is recommended, include panel heights and alignment(s)
    - Identified challenges or unknowns to be resolved during final design
    - Description of any relevant other considerations or extenuating circumstances per Section 6 of WSDOT Policy

Description of potential for construction noise to affect noise sensitive receivers

- Requirements for noise variances from local jurisdiction