Kansas Department of Transportation
Highway Traffic Noise Policy and Guidance
Effective June 23, 2022

Table of Contents

1.0 Introduction

1.1 Purpose

This document contains State of Kansas Department of Transportation (KDOT) Highway Traffic Noise Policy and Guidance, also referred to as the *KDOT Highway Noise Policy*. The guidelines contained within this document have been reviewed and approved by Federal Highway Administration (FHWA). These guidelines provide information about how traffic noise impacts are determined and how noise abatement is considered, pursuant with requirements of Title 23 United States Code of Federal Regulations, part 772 (23 CFR 772). This policy supersedes all previous State of Kansas Highway Traffic Noise Polices/Guidance, effective June 23, 2022.

1.2 Background

During the rapid expansion of the Interstate Highway System and other roadways in the 20th century, communities began to recognize that highway traffic noise and construction noise were environmental impacts. In the 1972 Federal-aid Highway Act, Congress required the FHWA to develop a noise standard for new Federal-aid highway projects. The FHWA Noise Standard provides national criteria and requirements for highway agencies, but also allows flexibility in approaching the problem of highway traffic and construction noise. Under NEPA, impacts and measures to mitigate adverse impacts must be identified, including identification of impacts for which no or only partial mitigation is possible.

1.3 Fundamentals

In order to understand this document, some knowledge about the attributes of sound is necessary. The following is a basic synopsis of sound and noise.

Sound is created when an object moves, causing vibration or waves in air molecules. When vibrations reach our ears, we hear sound. Sound levels are measured in units called decibels (dB). Sound levels cannot be added with simple arithmetic because the decibel is a representation of a larger value measured on the logarithmic scale. Addition of sound from different sources is based on the relative difference of sound level of the two sources. In general, if two sources of sound differ by:

- 0 – 1 dB, add 3 dB to the higher level (example 60 dB + 60 dB = 63 dB);
- 2 – 3 dB, add 2 dB to the higher level (example 60 dB + 62 dB = 64 dB);
- 4 – 9 dB, add 1 dB to the higher level (example 60 dB + 70 dB = 71 dB);
- 10 dB or more, add 0 dB (example 60 dB + 70 dB = 70 dB).

Adjustment for high- and low-pitched sounds an average person can hear is called "A-weighted levels" or dBA. Highway traffic noise is assessed using dBA measurements. Noise is further described by its average level over time. For highway traffic noise analysis, an hourly equivalent sound level, or Leq(h), is the constant, average sound level that contains the same amount of sound energy over the time period as does the varying levels of actual traffic noise. Generally, the human ear perceives changes in sound levels as follows:

- 1 dBA – no perceptible change;
- 3 dBA – barely perceptible change;
- 5 dBA – readily perceptible change;
- 10 dBA – perceived as twice as loud.

The primary sources of highway traffic sound are tires, engines and exhaust. These sources are further influenced by the overall number of vehicles, type of vehicles, distance between traffic and receptor(s),

speed, and topography. Additional more complicated factors affecting traffic sound may include elevated or depressed highway / terrain, dense vegetation, and shielding from buildings and walls. For example, sound will be greater from any vehicle laboring up a steep incline; however, this may not be problematic if there is low-volume traffic, with virtually no heavy trucks. The following provides approximate changes in sound levels for cause-and-effect relationships:

- If traffic count is doubled: increase of 3 dBA;
- If speed limit is lowered by 5 miles per hour: decrease of 1 dBA;
- If distance is doubled over pavement: decrease of 3 dBA;
- If distance is doubled over grass: decrease of 4.5 dBA.

In addition to understanding sound attributes, there are many unique terms relative to highway traffic noise analysis that are contained within this document. The following table provides a list of terms and their definitions.

Definitions

absolute criterion	One of the two FHWA criteria for determining noise impacts. The absolute criterion deals with the actual or predicted sound level. – see Section 2.3.
activity category	Classification of different types of property usage adjacent to a project. See FHWA Noise Abatement Criteria.
Average Daily Traffic (ADT)	The average 24-hour traffic count (vehicles per day). Typically, the total amount of traffic during a stated period (usually one year) divided by the number of days in that period. The ADT is used to calculate the Design Hourly Volume (DHV).
benefited receptor	Recipient of an abatement measure receiving at or above 5 dB insertion loss.
date of public knowledge	The date of approval Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR 771.
design year	The future year that a highway is designed, usually 20 years.
design hourly volume	Forecasted traffic count reflecting "worst hour" conditions by design year.
equivalent receptor	Representative locations for receptors - See Table 2.
existing noise or sound levels	The "worst hour" sound level resulting from the combination of natural and mechanical sources and human activity usually in a particular area.
feasibility	The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.
impacted receptor	A recipient that is predicted for traffic noise impact to be above the absolute and/or relative criteria in the design year.
insertion loss	Actual acoustical benefit resulting from a noise abatement measure, measured as a predicted change in sound level (dBA).
Ldn	Day-night noise levels.
Leq	The equivalent steady state sound level which in a stated period of time contains the same acoustic energy as the time varying sound level during the same time period, with Leq(h) being the hourly value of Leq. This measurement is utilized by KDOT for highway traffic noise analysis.
low volume highways	A highway with ADT of 1,200 vehicles per day or less in the design year.
multi family dwelling	A residential structure containing more than one residence. Each residence in a multifamily dwelling shall be counted as one receptor when determining impacted and benefited receptors.

Noise Abatement Criteria (NAC)	FHWA Noise Abatement Criteria – Federal Highway Administration, thresholds of sound levels according to different land uses. See Table 1.
noise berm	An earthen embankment used as a noise barrier.
Noise Sensitive Area (NSA)	Grouping of receptors exposed to similar noise sources and levels, traffic volumes, traffic mix and speed, and topographic features.
noise reduction design goal	Optimum desired noise reduction determined from calculating the difference between future build noise levels with abatement, to future build sound levels without abatement. KDOT's noise reduction design goal is to achieve a minimum of seven (7) dBA insertion loss for the majority (>50%) of benefited receptors or a minimum of an eight (8) dBA insertion loss for at least one impacted Activity Category B receptor that will benefit from the noise barrier.
permitted	A commitment to develop land as evidenced by issuance of a building permit.
property owner	An individual or group of individuals that holds a title, deed, or other legal documentation of ownership of a property or a residence.
reasonableness	The combination of economic, environmental and social factors considered in the evaluation of a noise abatement measure.
receiver	A modeled point in the Traffic Noise Model, representative of more than one receptor(s).
receptor	A discrete or representative location of a noise sensitive area(s), for any of the land uses listed in Table 1, FHWA Noise Abatement Criteria.
relative criterion	One of the two criteria from the FHWA Noise Abatement Criteria for determining noise impacts. The relative criterion deals with the change in predicted sound level. – see Section 2.3
residence	A dwelling unit, either single or each dwelling unit in a multi-family dwelling.
statement of likelihood	A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time the environmental document is being approved.
substantial noise increase	For a Type I project, an increase of *more than* 10 dBA.
traffic noise impacts	As result of a highway transportation project, sound levels will approach or exceed FHWA Noise Abatement Criteria (NAC) for absolute impact and/or existing sound levels are forecast for substantial increase for relative impact.
Type I Project	See Section 1.4
Type II Project	A Federal, Federal aid or State funded project proposed to provide acoustic protection for receptors that were in existence prior to the construction of the roadway. This program is voluntary for state participation; KDOT does not currently have a program for Type II Projects.

1.4 Applicability

This KDOT Highway Traffic Noise Policy is not applicable to projects on toll roads (unless the toll road is under KDOT's jurisdiction); local, state and federal projects not subject to FHWA approval, and results from highway traffic noise analysis made public under previous KDOT Highway Traffic Noise Policies.

Type I

The KDOT Highway Traffic Noise Policy applies to Type I transportation improvements that require FHWA approval regardless of funding sources or is funded with Federal-aid highway funds. A transportation improvement with any Type I work is a Type I Project and a traffic noise analysis is required for the entire project. The criteria are as follows:

1) Construction of a highway on new location; or,

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

    a) Substantial horizontal alteration – a project that halves the distance between the traffic noise and the closest receptor between the existing conditions to the future build conditions; or,
    b) Substantial vertical alteration – a project that removes shielding therefore exposing the line-of-sight between receptor and traffic noise sources. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise sources and receptor; or

3) addition of a through-traffic lane(s) described as follows:
    a) High-Occupancy Vehicle Lane (HOV), High-Occupancy Toll (HOT) lane, bus lane or truck climbing lane;
    b) auxiliary lane, except for when the auxiliary lane is a turn lane;
    c) addition or relocation of interchange lanes or ramps added to a quadrant for completion of an existing partial interchange;
    d) restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or

4) addition of a new or substantial alteration of a weight station, rest stop, ride share lot or toll plaza.

Type I Projects with undeveloped land require noise analysis if a building permit has been issued by the local agency with jurisdiction by the date of public knowledge.

Type I Projects with undeveloped land that is not "permitted", by date of public knowledge do not require noise analysis, however future noise levels pursuant to 23 CFR 772.16(a), must be determined and provided to the local jurisdictions.

A traffic noise analysis is required for all build alternatives under detailed study in the National Environmental Policy Act (NEPA) process. That is, all reasonable alternatives that have been retained for detailed analysis in the Categorical Exclusion (CE) documentation, Environmental Assessment (EA) or Environmental Impact Statement (EIS) and NOT rejected as unreasonable during the alternatives screening process. For Tier I Environmental Impact Statements or other studies that will examine broad corridors, the appropriate scope and methodology of the noise analysis should be discussed with FHWA.

Projects that involve noise emanating from more than one mode of transportation require noise analysis. Failure to evaluate these other sources of noise may result in ineffective noise abatement. The use of the

Ldn noise descriptor to combine all noise levels is required. The following models are required for calculation:

- **aircraft noise** – Federal Aviation Administration's Aviation Environmental Design Tool (AEDT)
- **highway project includes a rail line** – FHWA Noise Measurement Handbook, June 2018
- **railroad project**- Federal Railroad Administration's Guidance on Assessing Noise and Vibration Impacts
- **transit noise** – Federal Transit Administration's Transit Noise and Vibration Impact Assessment Manual, September 2018
- **construction noise** - Calculation is usually not necessary for highway traffic noise analysis, due to construction noise being temporary in nature. For large urban transportation improvements, the FHWA Roadway Construction Noise Model (RCNM) may be incorporated into the project, if there is project specific input. However, for the majority of KDOT transportation improvements, low-cost easy-to-implement measures for abating noise are incorporated into the plans and specifications of a project. These may include limiting times of construction, muffler requirements of equipment, location of haul roads, eliminating tail gate banging, ambient sensitive back-up alarms, community rapport, and mechanisms for bringing forth concerns about a project.

Type II

This program is voluntary for state participation; KDOT does not participate in Type II of retrofitting highways for noise barriers.

1.5 Three-Part Approach to Highway Traffic Noise Abatement

Effective control of the undesirable effects of highway traffic noise requires (l) noise compatible planning, (2) source control through less-loud vehicles, (3) and when feasible and reasonable, abatement of highway traffic noise for individual projects. The first component is traditionally an area of local responsibility. The other components are the joint responsibility of private industry and / or Federal, State, and local governments. As part of the environmental review process for transportation projects, Kansas Department of Transportation is required to determine if predicted noise levels could result in noise impacts. If there are impacts, methods are considered for noise abatement. If the methods are deemed feasible and reasonable then noise abatement measures are implemented.

2.0 Noise Analysis

2.1 FHWA Computer Software Model

Pursuant with 23 CFR 772.9, the current FHWA Traffic Noise Model (FHWA TNM) or any other computer software model acceptable to FHWA, is required for predicting sound levels and for designing noise barriers.

Receptors are grouped within their respective Noise Sensitive Area (NSA), and then assessed for noise impacts by activity category.

Average pavement type shall be used for prediction of noise levels unless another pavement type is approved by FHWA.

Model validation is required to confirm its accuracy, in order to proceed with analysis. Sound level measurements are performed adjacent to the project with simultaneous traffic counts. When the results of the model are within +/- 3 dBA of the measured sound levels in the field, the model may then be utilized for predicting sound levels. If there are differences, explanations must be provided.

Not every receptor needs sound levels measured, however enough measurements (whether it be number of repetitions or site locations) must be collected for computer modeling to validate the results. Existing sound levels are measured for fifteen minutes. For low volume highways, measurements are conducted for thirty minutes.

The validated traffic noise model may divide the overall transportation improvement into many separate roadways representing different traffic flow patterns and changes in traffic volume. Traffic is concentrated along the centerline of each roadway. These collectively influence the model's calculation of noise levels.

Site characteristics specific to the transportation improvement are represented in the model. Some factors include dense vegetation, shielding from building rows, depressed or elevated terrain and other variables affecting the transmission of sound between the source and receptor.

Sound levels are calculated to a tenth of a decibel. KDOT does not round up results from TNM modeling. For example, a result of 65.6 dBA is not rounded up to 66 dBA, and an insertion loss of 4.6 dBA is not rounded up to 5 dBA.

The cost index factor for input into the FHWA computer software model of a preliminary noise barrier represents actual unit cost of noise barriers constructed in Kansas.

2.2 Determining Conditions and Predictions

Receptors and Site Selection

All those within project limits must be identified, including receptors on permitted land. Receptors are classified according to their activity category as defined in the FHWA Noise Abatement Criteria (NAC), see Table 1. Sound levels are modeled at sites that represent the area(s) of frequent use. A site may be selected to represent other receptors that share an NSA. For projects on new alignment, sites are selected at representative receptor locations. Primary consideration is for exterior areas of human use.

Equivalent Receptors

In some cases, receptors cannot be represented as a residence. Therefore, different types of frequent human use (as described within the NAC) are defined as receptors with representative locations, see Table 2. Other circumstances with different interpretations for equivalent receptors must be within the intent of FHWA regulations, and the reasons shall be fully documented in the report. In all cases, the corresponding activity category Leq(h) applies.

Worst-case Existing Conditions

This is the first of three steps towards determining highway traffic noise impacts for receptors. The same FHWA computer software highway traffic noise model from validation is again utilized. The receptors and existing highway geometry remain in original locations, and the traffic data from the field measurements is replaced with worst-case existing traffic data. This step is necessary because field measurements only represent a "snapshot" in time. If the validation effort indicated adjustments, those values are applied. Transportation improvements on new alignment do not have traffic data so ambient sound levels are measured adjacent to the project and those are used for representing existing conditions.

Future No-Build Conditions

In accordance with NEPA requirements, sound levels are required to be compared in Future No-Build and Future-Build scenarios associated with transportation improvements. Therefore, the same computer software noise model with receptors and existing highway geometry in original locations is again utilized, and traffic data is replaced with the design year traffic volume without the transportation improvement.

Future Build Condition

The results from modeling Future Build Conditions are used for assessing all receptors with traffic noise impacts. In this scenario, the actual geometry of the project is input into FHWA computer software model, including design year traffic volume, and posted speed limit. All traffic noise impacts must be identified; therefore, the receptors remain in their original positions unless they are right-of-way takes. Because this model represents the transportation improvement, it is also used for preliminary noise barriers if traffic noise impacts are identified, and noise abatement is considered.

Interior Sound Levels

Typically, sites are areas where outdoor activity is limited to a brief transit from a parking facility to an interior activity area such as a library, temple, office building, etc. Interior sound levels are calculated by subtracting a noise reduction factor according to the following:

Interior Noise Reduction Factors (activity category D)		
Building Type	Window Condition	Noise Reduction
All	open	10 dBA
Light Frame	ordinary sash	20 dBA
	storm windows	25 dBA
Masonry	single glazed	25 dBA
	double glazed	35 dBA

2.3 Identifying Highway Traffic Noise Impacts

FHWA defines a noise impact as occurring when either or both of the following criteria are met:

1) **absolute** – noise levels approach or exceed the NAC.
2) **relative** – future noise levels substantially exceed existing sound levels.

The NAC (Table 1) strikes a balance between noise levels that are desirable and feasible. Traffic noise levels do not normally reach levels that result in hearing damage, and what constitutes an "annoyance" or hindrance to sleep is difficult to quantify on a large scale. Speech impairment however was usefully applied as a condition that reflects a compromise between noise levels that are desirable and those that are achievable and was found not to be arbitrary and capricious.

The values from the NAC are only to determine impacts and are not used as a design goal for considering noise abatement measures.

An impacted receptor is one in which the sound levels approach or substantially exceed the NAC criteria. FHWA allows each individual state transportation agency to define “approach” and “substantially exceed”. KDOT’s definition of these terms is as follows:

1) **approach** – one (1) dBA below the levels shown for the activity category in question.
2) **substantially exceed** – equal to or greater than ten (10) dBA.

For example, a noise impact would occur at a residence (Activity Category B) if the existing sound level is 53 dBA and the predicted noise level is 64 dBA because the increase of 11 dBA meets relative criterion.

Activity Category A receptors are rare and must be approved by FHWA. Activity Category F does not warrant noise abatement consideration.

If traffic noise impacts are identified, noise abatement measures must then be considered for all impacted receptors.

A noise analysis may be more in-depth when noise impacts are detected or when a project has many additional lanes, receptors, interchanges, and other variables. Conversely, a noise analysis will have little detail when the project is simple and noise impacts are not predicted. If traffic noise impacts are not identified, the traffic noise analysis is considered complete. This determination, if applicable, shall be stated in the Noise Study Report.

Although the level of evaluation varies among transportation improvements, performing a noise analysis in and of itself does not imply that other future actions such as noise abatement are inevitable. If the analysis predicts traffic noise impacts, then the analysis proceeds for considering measures to abate traffic noise. Only those measures for noise abatement deemed feasible and reasonable, may be incorporated into project plans and specifications.

2.4 Feasible and Reasonable

Noise compatible planning is traditionally an area of local responsibility. KDOT encourages local government officials to review documentation about future noise levels when regulating land development If noise abatement measures are considered, they must be both feasible and reasonable. Feasibility pertains to acoustical and engineering consideration of the project, such as topography, access, drainage, safety, and maintenance. Reasonable criteria imply common sense and judgment in consideration of overall benefits and adverse social, economic and environmental effects.

Traffic noise abatement measures may include altering the horizontal and/or vertical alignments, using traffic management measures such as modifying speed limits, traffic control devices, time-use restrictions for certain vehicles, and prohibition of certain vehicle types, purchasing buffering zones if the land is undeveloped, and constructing noise barriers or noise berms within the highway project right-of-way. A noise barrier provides abatement for approximately 200' from a highway. The following are not considered for noise abatement measures: quieter pavements unless approved by FHWA and planting of vegetation or landscaping. KDOT will not participate in the evaluation of construction of traffic noise barriers for a project where development was not permitted prior to the date of public knowledge of the transportation project.

2.5 Noise Barriers

A noise barrier incorporated into a project requires specific evaluation of feasible and reasonable criteria.

A third party may contribute funds to make functional or aesthetic enhancements to a noise barrier already determined to be feasible and reasonable.

The *Feasibility Criteria* represent initial assessment for a noise barrier. If the design meets feasibility criteria, then *Reasonable Criteria* will be evaluated. Reasonable criteria pertain to social, economic and environmental factors. If any conditions for feasible or reasonable criteria do not comply, the barrier design is deemed not feasible or reasonable, whichever applies. *Optional Reasonable Criterion* (f) is subjective but could influence decision-making.

Feasibility Criteria

a) Safety and Maintenance
The barrier shall not excessively restrict sight distance, restrict drainage or exacerbate potential flooding. If snow and ice remain in the driving lanes of the shadow zone of a noise barrier, the height of the barrier may be considered not feasible. For maintenance reasons, access is needed to both sides of the barrier. Maintenance agreements may be required with other public authorities or private individuals. Construction of a noise barrier shall not cause extensive maintenance to maintain the safety on the roadway.

b) Acoustical
If significant non-highway noise sources exist in the project area (such as major rail line or airports) the acoustical effectiveness of the noise barrier may be compromised. Barriers will not be constructed when other noise sources result in the noise barrier not being acoustically feasible for the highway traffic noise impacts. An acoustically feasible noise barrier must have a minimum of three first row impacted receptors and must achieve at least a five (5) dBA highway traffic noise reduction for 80% of first row impacted receptors. Receptors that achieve the 5 dBA are then considered benefited by the barrier.

Reasonable Criteria

a) Insertion Loss (Definition of Benefited Receptor)
A minimum of five (5) dBA insertion loss per receptor is counted as one benefited receptor. Other receptors not impacted but receiving a five (5) dBA benefit are counted in the evaluation (non-impacted benefited receptors). The benefited receptors are utilized in calculations for cost-effectiveness.

b) Noise Reduction Design Goal
The noise barrier must achieve a minimum of seven (7) dBA insertion loss for the majority (>50%) of benefited receptors or a minimum of an eight (8) dBA insertion loss for at least one impacted Activity Category B receptor that will benefit from the noise barrier.

c) Cost effectiveness
KDOT will utilize the square footage per receptor (sf/r) criteria for determining cost-effectiveness. Barrier cost-effectiveness is defined as area of noise barrier per benefited receptor and shall be calculated by taking the total area of a proposed noise wall divided by the number of benefited receptors determined for the noise wall. For a noise barrier to meet the cost effectiveness criteria, barrier cost effectiveness shall not exceed 1,200 square feet per benefited receptor. Barrier cost information, in dollars per square foot of wall, will be analyzed and submitted to FHWA every five years.

d) Public Notification
The benefited receptors of a proposed noise barrier design are required to be notified by any reasonable and easily verifiable means. The notification should include dimensions and location of the proposed noise barrier and a ballot. The ballot will indicate a set deadline to be returned and indicate how ballots will be scored for approval/denial of a noise barrier. The notification

shall also indicate that after construction of a noise barrier, KDOT will not consider perceived damages or loss of visibility to properties.

e) Public Approval
The presence of a noise barrier may present certain concerns such as excessive shading, constricting airflow, safety risks for exterior activities, and creating a tunnel-like environment for benefited receptors. Therefore, in order to move forward with construction of a noise barrier, viewpoints are solicited in the form of ballots. One ballot is assigned to each property with the following weighted points:

- Benefited property owner per residence / unit = 1 point
- Benefited tenant per residence / unit = 1 point

A noise barrier shall be permitted when the majority of the points indicate approval of the barrier. Support for or opposition of a noise barrier is based on responses received, provided that 50 percent or more of the points available are returned from benefited owners and tenants by the deadline. If a majority of points are not returned, then a reminder by any reasonable and easily verifiable means will be sent extending the deadline as appropriate. If a majority of benefited receptors still do not respond, KDOT will make a final determination on the noise abatement.

f) Optional Reasonable Criterion
Because noise abatement is for areas of frequent human use where lowered noise would be of benefit, it is acceptable to give less consideration for abatement to areas of mixed zoning or development and to areas where existing local plans call for zoning changes to a less noise sensitive use.

3.0 Documentation and Notification

3.1 Noise Study

The Noise Study Report should include information presented in the following outline. The intent is to provide statewide uniformity and consistency. However, contingent upon project specifics, other relevant information and variations may be included.

1. Project Description overview with regional map; Purpose; Statement of Compliance with FHWA 23 CFR 772
2. Sound \ Traffic noise fundamentals including brief paragraph about noise analysis
3. FHWA Noise Abatement Criteria (NAC); land use/activity categories from NAC associated with the project
4. Existing sound level measurements, statement that sound level meter is calibrated yearly, and certification is stored in Environmental Services at KDOT
5. Name of FHWA traffic noise computer software model, model validation, origin of traffic data for input into of the FHWA computer software model, presentation in tabular form of receptors' existing sound levels and their predicted noise levels with respective activity category
6. Discussion about receptors with traffic noise impacts and local map of receptors with traffic noise impacts
7. If necessary, consideration of possible abatement measures; noise barrier discussion of feasibility and reasonableness
8. Construction noise paragraph (page 7)

9. Local Officials' Statement – Indicate a copy is being provided to local officials in affected jurisdictions
10. Summary, including an abatement proposal and a Statement of Likelihood

The sketches of sites where field measurements were taken and printouts from sound level meter field measurements will be stored in the project files.

3.2 Local Public Officials Notification

The local jurisdiction shall be provided a copy of the Noise Study Report. If traffic noise impacts were not identified, this information shall be stated in an abbreviated final Noise Study Report.

For transportation improvements meeting Type I criteria with undeveloped land that is not permitted, the local jurisdiction shall be informed that:

- The information is being provided as an effort to minimize future traffic noise impacts on currently undeveloped lands.
- Three-Part Approach to Highway Traffic Noise Abatement and noise compatible planning at the local level.
- The best estimation for design year noise levels from the edge of the nearest travel lane to where noise impacts would occur. At a minimum, the distances to the noise impacts shall represent residential and commercial activity categories. The information may be presented in a tabular form or alternatively as contours on a map.

Table 1: Federal Highway Adminstration Noise Abatement Criteria (NAC)

[Hourly A-Weighted Sound Level—decibels (dB(A)) (1)]				
Activity Category	**Activity Criteria** (2) Leq(h)	L10(h)	**Evaluation Location**	**Activity Description**
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B (3)	67	70	Exterior	Residential
C (3)	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E (3)	72	75	Exterior	Hotels, motels, offices, restaurants/bars and other developed lands, properties or activities not included in A – D or F.
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--	--	Undeveloped lands that are not permitted.
(1) Either Leq(h) or L10(h) (but not both) may be used on a project. (2) The Leq(h) and L10(h) Activity Criteria values are for impact determination only and are not design standards for noise abatement measures. (3) Includes undeveloped lands permitted for this activity category.				

Table 2: Equivalent Receptors to Residence

Description	**Method**
Residences and Multi-Family Dwellings	Primary consideration is for exterior areas of frequent human use, usually back yards of single-family homes. For multi-family dwellings, a receptor shall be placed at individual exterior activity areas that face the noise source, such as balconies. If no exterior areas of frequent human use are present, no further noise analysis is required.
campgrounds	one receptor = MML for each year-round formal site one receptor = each formal site
day care centers and schools	one receptor = MML
parks	one receptor = each formal outdoor activity within boundary one receptor = MML if no outdoor activity areas
picnic areas	one receptor = cluster of tables
trails	one receptor = MML
trail crossings	one receptor = each formal trail crossing
amphitheaters and auditoriums active sports areas and recreation areas	one receptor = MML If utilized primarily in late hours, use appropriate traffic volume.
cemeteries (area for memorial services, not individual gravesites)	Each exterior area distinctly recognized for human activity is counted as one receptor if the area is adjacent to the highway.
hospitals and medical facilities	
libraries	
playgrounds	
places of worship, public or nonprofit institutional structures, and public meeting rooms	
radio studios, recording studios, television studios	
hotels and motels	
offices	
restaurants / bars	
Because noise abatement is for areas of frequent use where lowered noise would be of benefit, seasonal use and hours of usage may be necessary. Primary consideration is for exterior areas of frequent human use.	
MML – Midwest Median Lot = 12,000 square feet, round from 0.28 acre per U.S. Census Bureau, Current Housing Reports, Series H150109, American Housing Survey for United States	