

KENTUCKY TRANSPORTATION CABINET

NOISE ANALYSIS AND ABATEMENT POLICY

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INTRODUCTION

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 had become important environmental impacts. In the 1972 Federal-aid Highway Act, Congress required the Federal Highway Administration (FHWA) to develop a noise standard for new Federal-aid highway projects. While providing national criteria and requirements for all highway agencies, the FHWA Noise Standard at 23 Code of Federal Regulations (CFR) Part 772 gives state highway agencies flexibility that reflects state-specific attitudes and objectives in approaching the problem of highway traffic and construction noise. Traffic noise sources include tire pavement noise, engine noise and exhaust noise. Construction noise is associated with the construction phase of the project and can include trucks, excavators, pile driving and other equipment noise. Construction noise is temporary in nature, lasting only as long as the project construction.

In addition to defining traffic noise impacts, the FHWA Noise Standard requires that noise abatement measures be considered when traffic noise impacts are identified for Type I Federal projects. Noise abatement measures that are found to be feasible and reasonable must be constructed for such projects. Feasible and reasonable noise abatement measures are eligible for Federal-aid participation at the same ratio or percentage as other eligible project costs.

The Kentucky Transportation Cabinet (KYTC) recognizes the adverse effects that traffic noise may have on the citizens of the Commonwealth and will consider and evaluate reasonable measures to minimize these effects. Noise considerations are a part of the planning, design and construction of a highway project. The identification of noise sensitive sites or areas shall be done early in the planning phase of the project. During project development, detailed analyses will be undertaken to assess specific traffic noise impacts and abatement measures at locations that may experience increased traffic noise levels as a result of the project. Concern for noise impacts continues into the construction phase with emphasis on minimizing disruption from construction noise.

In instances where changes in the traffic volume or composition of the vehicle mix may adversely increase traffic noise levels in areas where abatement measures were initially not warranted, additional analysis and possible abatement measures may be considered on a case-by-case basis for inclusion in the State Highway Plan. (See TRAFFIC NOISE ABATEMENT CONSIDERATIONS FOR STATE-FUNDED RETROFIT PROJECTS)

PURPOSE

This policy describes KYTC's implementation of the requirements of the FHWA Noise Standard. Where FHWA has given the highway agency flexibility in implementing the standard, this policy describes the highway agency approach to implementation. The policy addresses traffic noise prediction requirements, noise analyses, noise abatement criteria (NAC), and requirements for informing local officials. It was developed by KYTC, with review and concurrence by FHWA, and is effective July 13, 2011, replacing all previous KYTC policy/guidance on the assessment of traffic noise impacts and abatement measures to be considered for highway projects.

DEFINITIONS

The following definitions apply to the terms used in KYTC Policy in consideration of noise impacts and abatement measures:

1. **Benefited receptor.** KYTC defines a benefitted receptor as the recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dB (A).
2. **Common Noise Environment.** A group of receptors within the same Activity Category in Table 1 that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections or cross-roads.
3. **Date of public knowledge.** The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR part 771.
4. **DEA.** Kentucky Transportation Cabinet's Division of Environmental Analysis.
5. **Decibel (dB).** A logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level.
6. **Decibel A-weighted (dB(A)).** Frequencies to which the human ear does not respond are filtered out when measuring and predicting highway noise levels resulting in the A-weighted scale.
7. **Design year.** The future year used to estimate the probable traffic volume for which a highway is designed, typically a minimum of 20 years into the future at the time of project initiation.
8. **Existing Noise Levels.** The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.
9. **Feasibility.** The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.
10. **FHWA.** Federal Highway Administration.
11. **Impacted Receptor.** A receptor that has a traffic noise impact.
12. **KYTC.** Kentucky Transportation Cabinet.
13. **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 .
14. **Multifamily 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 benefitted receptors.
15. **NEPA.** National Environmental Policy Act.
16. **Noise Abatement Criteria (NAC).** Sound pressure levels established by the FHWA that act as a standard for noise abatement measures giving consideration to specific land uses (refer to Table 1).
17. **Noise Barrier.** A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including stand alone noise walls, noise berms (earth or other material), and combination berm/wall systems.
18. **Noise Reduction Design Goal.** The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. For KYTC projects, the noise reduction design goal shall be 7 dB(A) for a minimum of 40% of all benefitted receptors.
19. **Noise.** Unwanted or unpleasant sound in the audible range.
20. **Permitted.** A definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.
21. **Planned Development.** A land use, such as a residence, school, or church/place of worship, that received a building permit from the local agency with permitting authority but has not been constructed at the time of noise analysis and that is potentially noise sensitive.
22. **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.
23. **Reasonableness.** The combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

24. **Receptor.** A discrete or representative location of a noise sensitive area(s), for any of the land uses (Activity Categories) listed in Table 1.
25. **Residence.** A dwelling unit. Either a single family residence or each dwelling unit in a multifamily dwelling.
26. **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.
27. **Substantial Construction.** The granting of a building permit, prior to right-of-way acquisition or construction approval for the highway.
28. **Substantial Noise Increase.** KYTC defines a substantial noise increase as a 10 dB(A) or greater increase in noise levels in the design year compared to the existing noise level.
29. **Traffic noise impacts.** Impacts which occur when the predicted traffic noise levels approach or exceed the noise abatement criteria (NAC) listed in Table 1 for the future build condition, or when the predicted traffic noise levels demonstrate a substantial noise increase over existing noise levels.
30. **Traffic Noise.** Noise associated with traffic, such as engine noise, exhaust, and tire contact with the pavement.
31. **Type I Project.** (1) The construction of a highway on new location; or, (2) The physical alteration of an existing highway where there is either:
 - (i) Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,
 - (ii) Substantial Vertical Alteration. A project that removes shielding, therefore, exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,
 - (3) The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or,
 - (4) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,
 - (5) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,
 - (6) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,
 - (7) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.
 - (8) If a project is determined to be a Type I project under this definition then the entire project area as defined in the environmental document is a Type I project.
32. **Type II Project.** A proposed Federal or Federal-aid highway project for noise abatement on an existing highway. Kentucky does not have a program for use of federal funds for noise abatement along existing highways where no other federal improvements are being proposed.
- Type III Project.** A Federal or Federal-aid highway project that does not meet the classifications of a Type I or Type II project.

APPLICABILITY

This policy applies to all Type I Federal or Federal-aid Highway Projects authorized under Title 23, United States Code. Therefore, this policy applies to any highway project or multimodal project, including those administered by Local Public Agencies (LPA), that:

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

The requirements of this policy apply uniformly and consistently to all Type I federal projects throughout the Commonwealth. If there are any questions about whether a project is subject to this policy or the FHWA Noise Standard, contact the KYTC Division of Environmental Analysis (DEA) in the Frankfort Central Office. Due to the long lead time required to complete a traffic noise study, questions regarding the applicability of this policy should be addressed as early in project scoping as practicable.

For ongoing federally-funded projects, authorized prior to the effective date of this policy, noise analysis and abatement decisions may be advanced in accordance with the policy in effect at the time of the project authorization. The Project Team, at its discretion, may opt to apply this policy to ongoing projects, however, if applied, the project shall adhere to all aspects of the policy. All projects authorized after July 13, 2011 shall comply with this policy.

This policy is not applicable to federal projects defined as either Type II or Type III. KYTC does not consider use of federal funding for abatement of these project types.

TRAFFIC NOISE PREDICTION

Pursuant to 23 CFR 772.9, any traffic noise analysis required for a project must use the FHWA Traffic Noise Model (TNM) which is described in "FHWA Traffic Noise Model" Report No. FHWA-PD-96-010, including Revision No. 1, dated April 14, 2004, or any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM.

When developing the environmental document to satisfy the requirements of the National Environmental Policy Act (NEPA), future noise levels for all reasonable build alternatives must be predicted. This does not include those alternatives determined to be unreasonable that are rejected prior to detailed analysis. If any segment or component of an alternative meets the definition of a Type I project, then the entire alternative is considered to be Type I and is subject to the noise analysis requirements.

Average pavement type must be used for prediction of future noise levels. If any other pavement type is being considered for a project, that pavement type may not be used in the TNM model without approval from the FHWA.

Noise contour lines may be used for project alternative screening and land use planning purposes but are not to be used to determine traffic noise impacts. Noise contour lines shall be based on modeled noise levels for the project area from the TNM and shall be drawn parallel to the proposed highway at distances from the centerline in 5 dB(A) increments. This requires modeling traffic noise at receptors adjacent to the highway. This will be required for projects in areas with comprehensive zoning and planning requirements in order to present noise impact information to local officials for consideration of future land development pursuant to 772.17. Additional questions on TNM should be directed to the Traffic Noise Specialist in DEA for clarification.

Traffic noise predictions for a project are to be based on projected traffic volumes for the design year (usually 20 years from the date of completion) and worst noise hour. Worst noise hour may not occur during AM and PM rush hour. Special attention should be paid to situations where congestion during rush hour impedes traffic flow and thus does not represent worst case noise conditions. Monitoring during peak hour traffic would not, in this case, allow for an accurate assessment of the traffic noise impact. In instances where the source of the traffic noise is a multilane facility, the model shall be developed to consider each lane individually and compile the data collectively for all of the lanes.

In some areas, seasonal or weekend traffic may be heavier, depending on attractions in the area. These cases should be discussed with the KYTC Noise Specialist on a case-by-case basis to determine the appropriate scheduling of noise monitoring and traffic counts.

Typically, KYTC allows grouping of receptors by determining a single receptor to be representative of a small group. Prior to collection of field data, proposals for grouping of receptors shall be discussed with the KYTC Noise Specialist. Any other questions or unusual circumstances that may affect data collection or input parameters should similarly be discussed with the KYTC Noise Specialist.

ANALYSIS OF TRAFFIC NOISE IMPACTS

The following methodology will be followed by KYTC in conducting traffic noise analysis for Type I Projects:

1. All data collection and analysis shall be consistent with FHWA guidance on the use of Traffic Noise Model 2.5, or most current FHWA-accepted version, including technical manuals, user guides and validation information. The methods shall also comply with "Measurement of Highway Related Noise"¹, as well as other applicable FHWA guidance. Receptor site locations shall be identified that are representative of the activity category (common noise environment) of the area. Site locations shall also be considered for any planned development in the vicinity of the project. Receptors shall be selected within close proximity of the proposed roadway or roadway improvement and beyond the proposed right of way. Any questions regarding receptor locations must be resolved with the KYTC Noise Specialist. Decibel (dB(A)) measurements will be taken at representative receptor site locations such as residential neighborhoods, commercial and industrial areas, parks, churches, schools, hospitals, libraries and other potentially noise sensitive locations to adequately characterize the project area. Measurements will be recorded for a period of no less than ten minutes, while simultaneously conducting a traffic count during either AM and PM peak traffic hours or worst noise hour. Measurements are to be taken in exterior areas of frequent human use, usually at an area between the right-of-way line and the building. Proposed monitoring locations and modeling methods for multifamily dwellings with multiple levels shall be approved by the KYTC Noise Specialist prior to the measurements being taken.

Consideration of interior noise impacts is appropriate at properties such as churches, hospitals, libraries and similar institutions. Interior readings are not required unless predicted exterior noise levels exceed the interior NAC by more than 10 dB(A). For buildings with windows that are fixed closed, interior noise readings are not required unless the predicted exterior noise levels exceed the interior NAC by more than 20 dB(A). Interior readings are also not required if exterior readings approach or exceed the NAC and thus abatement measures are already under consideration. When such readings are appropriate, proposed monitoring locations and modeling methods shall be

¹ Cynthia S.Y. Lee, Gregg G. Fleming, Measurement of Highway Related Noise (U.S. Department of Transportation Research and Special Programs Administration, FHWA-PD-96-046 DOT-VNTSC-FHWA-96-5, May 1996)

consistent with FHWA's "Measurement of Highway Related Noise" and approved by the KYTC Noise Specialist prior to the measurements being taken.

Measurements shall also be taken in areas of planned development. For situations where no structures are identified on available plans, the KYTC Noise Specialist shall be consulted to discuss the location for noise monitoring. Noise abatement considerations will not be given to areas where there are no existing receivers or planned development. Development which occurs adjacent to a proposed highway project after the date of public knowledge but prior to project construction shall not be eligible for mitigation.

2. Existing ambient noise levels shall be monitored during peak traffic hours or worst noise hour and under meteorologically acceptable conditions (wind speed less than 12 miles per hour and dry pavement) at appropriate receptors. Noise level monitoring will be conducted at each receptor site for a period of at least ten minutes during the AM and PM peak traffic condition or worst noise hour with an ANSI-approved type 1 or type 2 noise meter that has been factory calibrated in accordance with the manufacturers recommendations. Calibration requirements shall also apply to all equipment and accessories related to the meter, including the microphone, and calibrator. Documentation of the factory calibration shall be submitted as an appendix in the traffic noise impact analysis document. A manual traffic count of vehicles, by type, shall be taken simultaneously with the noise level monitoring in order to obtain data to validate the noise prediction model. Vehicle types shall be classified as car/light truck, medium truck, heavy truck, bus or motorcycle. For situations where interior noise readings are necessary, the KYTC Noise Specialist shall coordinate the location and methods for conducting interior noise readings and the traffic count.
3. Using traffic counts and site specific monitoring data, existing noise levels are to be calculated using the most current edition of the FHWA TNM. The model is considered validated if noise levels calculated by the model are within +/- 3 dB(A) of actual monitored levels at each site. If the difference is greater than +/- 3 dB(A), additional field data is to be collected to validate the model or, if there is an explanation for the discrepancy, a detailed discussion shall be provided in the traffic noise impact analysis document.
4. The noise impacts of the proposed project are to be assessed based on the design year noise levels predicted by the model and guidance in the following sections related to land uses (activity categories) described in Table 1.
5. If projected noise levels approach (within one dB(A)) or exceed the NAC levels listed in Table 1, or a substantial noise increase of 10 dB(A) or greater is predicted, additional modeling shall be performed to analyze the effectiveness of noise abatement measures such as earthen berms and/or structural noise barriers.
6. The Feasibility and Reasonableness, as described in subsequent sections of this policy, shall be considered for any abatement measure determined to be effective.

A traffic noise impact analysis document, detailing the analysis described above and including all appropriate content as outlined in the Noise Impact Assessment Guidance and Accountability Form (GAF) is required for documenting the results of the noise study.

NOISE ABATEMENT CRITERIA (NAC)

Table 1 defines and describes various Activity Categories and their respective Noise Abatement Criteria (NAC). In areas where a combination of activity categories is present, the analysis shall consider the appropriate NAC for any activity category represented. The traffic noise analysis shall include an evaluation of noise impacts for all land use categories that are present within the project area.

Table 1

| Activity Category | Description of activity category(land use) | Activity Criteria Leq(h) * | Evaluation Location |
|-------------------|--|----------------------------|---------------------|
| A | 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 its intended purpose. | 57 | Exterior |
| B** | Residential | 67 | Exterior |
| C** | 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 | 67 | Exterior |
| D | 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 | 52 | Interior |
| E** | Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. | 72 | Exterior |
| 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. | ----- | ----- |

*The Leq(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

**Includes undeveloped lands permitted for this activity category.

Activity Category A includes lands on which serenity and quiet are of extraordinary significance and serves an important public need. Examples of lands that have been analyzed as Category A include the Tomb of the Unknown Soldier, a monastery, outdoor prayer areas and amphitheaters. KYTC will consider Category A sites on a case-by-case basis, as these land uses are not typically encountered. Documentation of the land use shall be submitted to the KYTC Noise Specialist, who will contact the FHWA Division Office and, if necessary, FHWA Headquarters to seek concurrence with the Category A designation.

Activity Category B includes exterior areas of single or multifamily homes and mobile home parks. Noise measurements are taken in exterior areas of frequent human use where traffic noise would

interfere with normal conversation such as on balconies, patios or in the backyard of the residence. In multifamily units, balconies that have potential outdoor use and common areas, such as patios, club houses or pools are used.

Activity Category C includes exterior areas of non-residential lands as listed in Table I under Activity Category C such as section 4f properties, schools, parks, cemeteries, etc. These land uses are analyzed for traffic noise impacts by taking exterior readings in areas of frequent human use such as in school playgrounds, sports fields and similar areas.

Activity Category D includes certain land use facilities listed in Activity Category C that may have interior uses. These land uses shall be analyzed for traffic noise impacts per procedures found in FHWA's "Measurement of Highway Related Noise".

Activity Category E includes exteriors of developed lands that are less sensitive to highway noise. These land uses are analyzed for traffic noise impacts by taking exterior readings in areas of frequent human use, such as a pool area, or courtyard in accordance with FHWA's "Measurement of Highway Related Noise".

Activity Category F includes land uses that are not sensitive to highway traffic noise and do not require noise analysis per 23CFR 772.

Activity Category G includes undeveloped land. If permitted, the area shall be analyzed for traffic noise impacts by collecting sound measurements and conducting modeling, as described in the previous section, using the activity category that best describes the proposed future land use. In areas regulated by local comprehensive planning and zoning requirements, future noise impacts are to be modeled and the information conveyed to local officials and included in the project environmental documentation. The modeling shall identify the distance from the edge of travelled way to the NAC for all exterior land use categories. In cases where the land is not permitted prior to the date of public knowledge, noise abatement is not required nor is abatement eligible for federal aid at a future date.

TRAFFIC NOISE ABATEMENT CONSIDERATIONS FOR TYPE I PROJECTS

A traffic noise impact is considered to occur when either of the following conditions is predicted:

1. The noise level predicted for the design year approaches (i.e. within 1 dB(A) or exceeds the NAC for the land use category affected (see Table 1);
2. A substantial increase over existing noise level (≥ 10 dB(A)) is predicted for the design year. This criterion is independent of the NAC and may result in a defined noise impact even though the NAC may not be approached or exceeded.

KYTC will consider noise abatement measures whenever a traffic noise impact has been predicted. Federal funds may be used for noise abatement measures when:

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

The following noise abatement measures may be considered for incorporation into a Type I project to reduce traffic noise impacts.

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

2. Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.
3. Alteration of horizontal and vertical alignments.
4. Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise.
5. Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

KYTC is not part of an FHWA approved quiet pavement pilot program; therefore, the use of quiet pavement is not an acceptable option to provide noise abatement for a project.

Feasibility

When determining the acoustic feasibility of a proposed abatement measure, KYTC shall consider whether the measure provides a substantial noise reduction (>5 dB(A)) for a reasonable percentage of impacted receptors to warrant consideration. Though the objective of the proposed abatement shall be to achieve the noise reduction design goal (7 dB(A) for a minimum of 40% of all benefitted receptors), if a proposed barrier will not provide a minimum 5 dB(A) reduction for more than 50% of the impacted receptors, it will not be considered acoustically feasible.

Engineering or constructability issues may render an abatement measure infeasible. In determining if site characteristics are suitable for barrier construction, KYTC shall consider numerous factors including safety, maintenance, drainage and access. Engineering judgment may dictate that a barrier is not feasible if:

1. A substantial noise reduction (≥ 5 dB(A)) for more than 50% of the impacted receptors is not achievable.
2. The barrier would pose overriding safety (visibility issues) or maintenance (drainage and right of way access) problems as determined by the AASHTO Green Book, Roadside Design Guide or Manual of Uniform Traffic Control Devices (MUTCD).

Reasonableness

The determination of reasonableness of a proposed abatement measure shall be based upon three primary factors: cost effectiveness; the noise reduction design goal and the desires of the benefitted receptors.

Desires of Benefitted Receptors: The views of the benefitted receptors and property owners will be considered in determining the reasonableness of noise barriers. Input from the benefitted receptors and property owners shall be gathered as outlined in this section. When the majority of benefitted receptors and property owners, engaged through the public involvement process, are opposed to construction of a noise barrier, KYTC will give great deference to these opinions in making a final determination regarding the reasonableness of the measure regardless of whether the proposal satisfies all other criteria for consideration. Similarly, where the majority of the benefitted receptors and property owners involved in the public involvement process are in support of noise barrier construction, and the proposal satisfies all other criteria for consideration outlined in this policy, KYTC shall incorporate the abatement measures into the project. It should be noted that if the benefitted receptors reject a noise barrier and then later change their opinion, the project would be considered a Type II project by FHWA. Since KYTC does not have a Type II program, noise abatement would only be considered as described in the Traffic Noise Abatement Considerations for State Funded Retrofit Projects section of this policy.

The public and local officials will be advised through the NEPA public involvement process if traffic noise impacts are expected to occur. A Noise Abatement Public Meeting will be held with benefitted receptors at each location where noise barriers were identified in the final environmental document as feasible, cost effective, and "likely to be constructed." Benefitted receptors shall be identified and notified of the meeting and their opportunity for input into the determination for inclusion of noise mitigation measures into the project. This public meeting will include:

1. A brief program on highway traffic noise to explain and demonstrate the characteristics of highway noise, the effects of noise barriers in attenuating noise, and the types of structural noise barriers being considered.
2. Specific details of the barrier proposed for each affected area including location, design, height, and length.
3. Discussion of alternatives to barrier construction.
4. Responses to questions and suggestions from the property owners.
5. Solicitation of the owners' and residents' preference of noise abatement measures by ballot (see "Kentucky Transportation Cabinet Noise Analysis Calculation Guide"). One owner ballot and one resident ballot shall be solicited for each benefitted receptor. Ballots shall be weighted in accordance with the following:

- 3 points/ballot for benefitted front row property owners
- 1 point /ballot for all other benefitted property owners
- 1 point/ballot for all benefitted residents

Ballots shall be made available at the public meeting for completion by benefitted owners and/or benefitted residents who may attend. Benefitted receptors who do not provide ballot input at the meeting shall be surveyed to determine their preference. Properties with special use such as churches, schools, playgrounds etc. shall be weighted in a manner similar to that described under the Cost Effectiveness paragraphs of this section. The voting member shall be identified as the leader or head of the organization such as the school superintendent, park superintendent, etc. For each such property, both a resident and owner ballot shall be solicited, weighted to account for equivalent residences and, if appropriate, further weighted in accordance with the respect to paragraph 5 of this section.

All benefitted residents and property owners shall have a period of thirty (30) days following the Noise Abatement Public Meeting to cast their votes. Barrier walls shall include access doors and/or provisions for fire hydrant hookups spaced as specified after meeting with local fire officials to discuss site specific needs. Barrier walls will only be constructed when a simple majority of affirmative ballots, after appropriate weighting, indicate a preference for the abatement.

Cost Effectiveness: To ensure a degree of reasonableness in assessing the mitigation at a particular location, the cost per benefitted receptor shall be calculated. Examples of this calculation are provided in the "Kentucky Transportation Cabinet Noise Analysis Calculation Guide." The equation for calculating this value is:

$$\text{Cost per Benefitted Receptor (CBR)} = \frac{\text{Cost of the Noise Barrier (\$)}}{\text{Number of Benefitted Receptors}}$$

Where:

- Cost of the Noise Barrier (\$) = Total anticipated cost of the noise barrier including design, right of way, utilities and construction
- Number of Benefitted Receptors = the total number of receptors receiving a noise reduction of at least 5 dB(A)

The "Cost of the Noise Barrier" shall be based upon the engineer's best estimate of total barrier costs. KYTC shall assume an average cost of \$30/sf of barrier wall. In preparation of the Engineer's Estimate for the noise wall, the Project Manager shall only adjust this average to account for site specific factors, such as extraordinary drainage issues, obvious extraordinarily high right of way expenses, major utility relocation expenses, etc., that clearly will result in higher than average costs. KYTC shall review the average cost of barrier construction at least every five years to assure use of reasonable costs in this analysis. Reevaluation may occur more frequently if considered appropriate by KYTC and FHWA.

The "Number of Benefitted Receptors" shall be a total count of all benefitted receptors including those in single and multifamily residences, as well as an accounting for special uses identified as Activity Category C, D or E, including parks, schools, churches, day care facilities, etc. When a multifamily dwelling has a common exterior area of frequent human use, each unit of the multi-family dwelling that has access to that common exterior area shall be included in the feasible and reasonable analysis. Apartment buildings or multi-family dwelling units with no frequent human exterior use will not require any type of noise analysis.

For Activity category C,D or E uses, the property shall be considered by calculating an equivalent number of residences for input into the CBR formula using the following equation:

$$\text{Equivalent Residences} = \left(\frac{\# \text{ Persons}}{2.5 \text{ persons per avg household}} \right) \left(\frac{\text{Avg Daily Hours Use}}{24 \text{ hours per day}} \right)$$

~ OR ~

$$\text{Equivalent Residences} = \left(\frac{\# \text{ Persons}}{2.5 \text{ persons per avg household}} \right) \left(\frac{\text{Avg Weekly Hours Use}}{168 \text{ hours per week}} \right)$$

Where:

- "# Persons" are those people who use the facility within 500 feet of the proposed edge of pavement. Where the facility is a building, such as a church, school or daycare, persons using the structure shall be included if any portion of the structure lies within 500 feet of the proposed edge of pavement. Structures lying totally beyond 500 feet shall not be counted as benefitted receptors. The number of persons shall be established through consultation with the school, church, day care, etc. and shall be based upon the greater of either the number enrolled or capacity of the facility. Where use involves a park, trail, or other exterior activity, the facility official shall be consulted to determine the use that occurs within 500 feet of the proposed edge of pavement and the extent of that use.
- "Avg Daily Hours of Use" or "Avg Weekly Hours of Use" is the average number of hours during which the "# Persons" use the facility within the 500 foot area adjacent to the proposed highway. The average should account for all time that the facility is not in use such as nights and weekends.

A \$35,000 CBR is established as a reasonable maximum threshold for this value. Locations with a CBR of \$35,000 or less will be considered cost effective candidates for noise barrier construction. Locations where the CBR exceeds \$35,000 will not be considered cost effective and abatement measures shall not be incorporated into the project unless it meets "Other Reasonableness Criteria" (see below.). Third party funding CANNOT be used to make up the difference in cost between the reasonable cost allowance and the actual cost. Third party funding can only be used to pay for additional features such as landscaping, aesthetic treatments, etc. for noise barriers that meet cost-effectiveness criteria.

Benefitted receptors that would otherwise not meet cost effectiveness requirements, may be grouped together (common noise environments) and the cost of noise abatement averaged in an effort to meet cost effectiveness requirements where noise abatement is deemed appropriate.

Due to potential fluctuation in project delivery and construction costs, the CBR shall be reevaluated at least every five (5) years. Reevaluation may occur more frequently if considered appropriate by KYTC and FHWA.

Noise Reduction Design Goal: KYTC's noise reduction design goal is 7 dB(A) for a minimum of 40% of all benefitted receptors. For the purpose of determining cost effectiveness of a proposed abatement measure, benefitted receptors are considered those that will receive a minimum 5 dB(A) noise reduction. Noise reduction estimates shall be solely based upon the results of the TNM. Receptors receiving less than a 5 dB(A) reduction in noise from a proposed abatement measure shall not be considered as benefitted receptor for the purpose of calculating cost effectiveness.

Other Reasonableness Considerations: KYTC shall provide additional consideration to circumstances where absolute noise levels are considered extraordinary or the difference between the build and no build future condition is greater than 10 dB(A) and exceeds the NAC. Additional consideration shall be afforded by allowing a higher than average cost for each benefitted receptor meeting the defined criteria. This shall be accomplished by reducing the total cost of the barrier by the total value of all adjustments as calculated in accordance with this section.

The method for adjusting the CBR calculation shall be:

$$CBR = \frac{(Cost\ of\ the\ Noise\ Barrier\ (\$)) - (Total\ Value\ of\ Adjustments)}{Number\ of\ Benefitted\ Receptors}$$

Absolute noise levels shall be considered extraordinary if they exceed 77 dB(A). Each benefitted receptor predicted to experience noise levels exceeding 77 dB(A) shall be afforded an additional \$1,000 per dB(A) over this limit. The Total Value of Adjustment for absolute noise level shall be calculated based upon the number of benefitted receptors where predicted noise levels are excessive and the degree to which they exceed 77 dB(A). The calculation shall be as follows:

$$\begin{aligned} & \textit{Total Value of Adjustment for Absolute Noise Levels (\$)} \\ & = \sum \{ \textit{Receptor 1} [(Predicted Noise Level dB(A)) - 77 dB(A)] \times \$1,000 \} \\ & + \{ \textit{Receptor 2} [(Predicted Noise Level dB(A)) - 77 dB(A)] \times \$1,000 \} \dots \} \end{aligned}$$

An adjustment to the cost calculation shall also be made for each benefitted receptor where the predicted noise level exceeds the NAC and the difference between the predicted noise level and the No Build condition exceeds 10 dB(A). The Total Value of Adjustment shall be calculated as follows for each receptor meeting these criteria:

Total Value of Adjustment for Receptors having a

> 10dB(A) Increase and Exceeding the NAC (\$)

$$= \sum \{ \text{Receptor 1 } [(\text{Predicted} - \text{No Build dB(A)}) - 10 \text{ dB(A)}] \times \$1,000 \}$$
$$+ \{ \text{Receptor 2 } [(\text{Predicted} - \text{No Build dB(A)}) - 10 \text{ dB(A)}] \times \$1,000 \} \dots$$

Documentation and Reporting

The results of traffic noise analysis shall be documented in the traffic noise impact analysis document. The report shall address the content as prescribed by the Guidance and Accountability Form (GAF) and shall be formatted as detailed in the most current edition of the KYTC Environmental Procedures Manual. The report shall identify all areas where noise abatement measures are considered feasible and reasonable in accordance with this policy. The report shall also identify areas where a traffic noise impact is identified to potentially exist but noise abatement measures are not considered feasible or reasonable. The findings of the traffic noise impact analysis document shall be summarized and incorporated into the NEPA documentation developed for the project. For areas where abatement measures have been determined to be feasible and reasonable, KYTC shall fully discuss these conclusions in the NEPA document. The document must include a statement of likelihood such as "For the proposed project, structural noise barriers are warranted for further consideration at [*insert location description(s)*] for alternative(s) [*insert alternative designation(s) or description(s)*]." The final decision regarding abatement measures will be made during detailed design considering information gathered during the public involvement process.

KYTC shall maintain an inventory of all constructed noise abatement measures. The inventory shall build upon the existing database and include parameters such as abatement type, cost, average height, length, year of construction and all other parameters as required by 23 CFR 772.13(f). The inventory, in spreadsheet format, shall be maintained by the Traffic Noise Specialist in the DEA.

TRAFFIC NOISE ABATEMENT CONSIDERATIONS FOR STATE-FUNDED RETROFIT PROJECTS

Noise abatement projects that will be advanced using state funds shall be programmed through KYTC's Highway Plan (HP). Potential projects may typically be identified by citizens, local governments, legislative officials or others. KYTC shall consider such requests when developing a recommendation for highway projects to be included in the HP. Similarly, requests for consideration of these projects may also be voiced to legislative officials. Final approval of the HP rests with the Kentucky General Assembly which may, at its discretion, include such projects in the HP. State funded noise abatement projects that are legislatively approved by inclusion in the approved HP shall be developed in accordance with the directives of the legislature.

COORDINATION WITH LOCAL OFFICIALS

Coordination with and providing information to local officials is critical to a developing a comprehensive approach to creating livable communities adjacent to highways. Impacts of highway traffic noise can be reduced through a program of shared responsibility. Requests to approve land use changes adjacent to the highways should consider the current and predicted traffic noise. Approval of land uses adjacent to a highway that are particularly noise sensitive should be an informed decision and should only occur after careful consideration. Thus, where local government exercises control over land development through planning and zoning ordinances, KYTC shall share predicted noise levels along highway corridors and techniques that can be used to minimize highway noise related impacts to adjacent properties. KYTC shall provide this information to local officials for all Type I projects developed within these local jurisdictions.

Documentation of early coordination efforts shall be presented within the project's final environmental document. Approval of the environmental document is considered the date of public knowledge. **KYTC is not responsible for providing noise abatement for development that occurs adjacent to the proposed highway project that was not permitted as of the date of public knowledge.** Noise abatement measures for properties developed after the date of public knowledge should be

considered by the local government or developer as permits and approvals for these land use changes are considered. Noise abatement measures would be considered for these developments in the future, should another Type I project be proposed.

Information developed through the KYTC environmental process will be made available to appropriate local officials by the Chief District Engineer for use in evaluating proposed land use changes. The KYTC will provide the best estimates of future highway traffic noise levels for both developed and undeveloped lands in the immediate vicinity of the project. For undeveloped properties, KYTC shall provide minimum buffer distances to structures that should be maintained in order to prevent the occurrence of traffic noise impacts. This can be accomplished by developing noise contours or providing other data to adequately convey the information. This shall be incorporated within the final environmental document for the project, which shall be provided to the local officials.

Construction Noise

Construction noise is unavoidable but temporary in nature and reasonable efforts will be made to reduce impacts to receptors to the extent practicable. For a majority of projects, construction will not persist in a given area for a long period of time. In the unusual instance where construction will persist for a period longer than two years and where impacts to nearby receptors are determined to be likely, the project team shall have the flexibility to incorporate construction noise abatement measures into the project. This may involve shielding of equipment with acoustic barriers, restricting certain types of work to specific hours of the day, requiring source control on equipment (mufflers) or other measures to reduce noise impacts.

