INDOT's Goal for Noise Reduction

INDOT's goal for substantial noise reduction is to provide at least a 7 dB(A) reduction for first-row receivers in the year the barrier is constructed. However, conflicts with adjacent properties may make it impossible to achieve substantial noise reduction at all impacted receptors. Therefore, the noise reduction design goal for Indiana is 7 dB(A) for a majority (greater than 50 percent) of the first-row receivers.

Highway Traffic Noise Barriers:

- Can reduce the loudness of traffic noise by as much as one-half
- Do not completely block all traffic noise
- Can be effective regardless of the material used
- Must be tall and long with no openings
- Are most effective within 200 feet of a highway (usually the first row of homes)
- Are designed to be visually appealing
- Are designed to preserve aesthetic values and scenic vistas
- Do not increase noise levels perceptibly on the opposite side of a highway
- Substantially reduce noise levels for people living next to highways

Sources:

U.S. Department of Transportation, Federal Highway Administration "Keeping the Noise Down" Highway Traffic Noise Barriers website http://www.fhwa.dot.gov/environment/noise/noisebarriers

Indiana Department of Transportation Traffic Noise Analysis Procedure (2011) http://www.in.gov/indot Environmental Services Division

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Noise Barriers

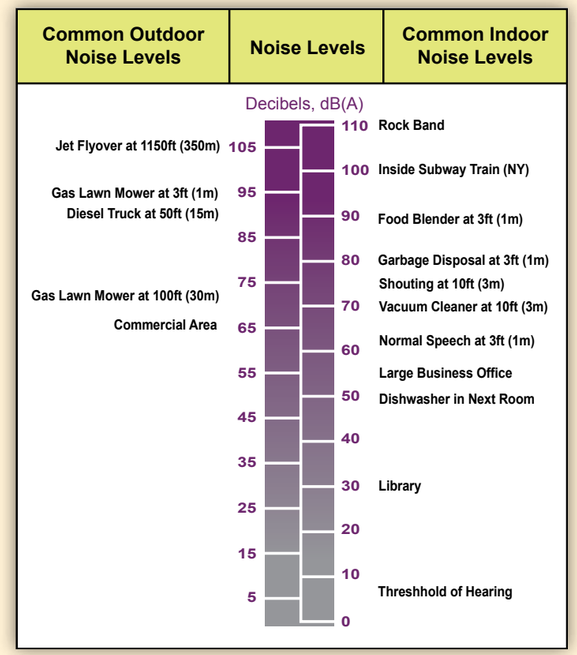
Indiana citizens play an important role in shaping decisions that affect their communities.

The Indiana Department of Transportation recognizes that providing information and eliciting public input on transportation decisions is crucial to fulfilling its mission to plan, build and maintain facilities that best meet Indiana's needs.

What is Noise?

Noise is defined as unwanted sound and can come from man-made and natural sources. Sound levels are measured in decibels (dB) and typically range from 40 to 100 dB.

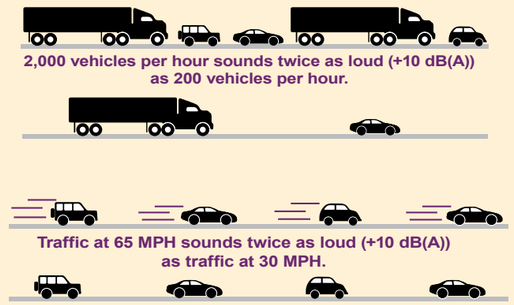
Because human hearing is limited in detecting very high and low frequencies, "A-weighting" is commonly applied to sound levels to better characterize their effects on humans. A-weighted sound levels are expressed as dB(A).



Because noise in our daily environment varies over time, and sustained noise levels (such as a nearby highway) interfere with our daily activities to a greater extent than short, louder noises (such as a single car horn), traffic noise analyses typically consider average noise levels over a one-hour period.

Change in Sound Level	Perception
3 dB(A)	Barely Perceptible
5 dB(A)	Clearly Perceptible
10 dB(A)	Twice as Loud

The volume and speed of vehicles traveling on a roadway significantly contribute to overall noise levels.



What Causes Traffic Noise?

The level of highway traffic noise depends on three factors:

- Volume of traffic
- Speed of traffic
- Number of multi-axle vehicles

As any of these factors increase, noise levels increase. Traffic noise can also be increased by defective mufflers and steep inclines that require truck engines to labor. Traffic noise can be decreased by distance, terrain, vegetation, or man-made obstacles.

Who Regulates Highway Noise? What is the Noise Impact Level?

The Federal Highway Administration (FHWA) has developed regulations regarding noise analysis on federally funded highway projects, and INDOT has outlined its implementation guidance in its Traffic Noise Policy.

The policy establishes two criteria for identifying an impact resulting from a project:

(1) Ascertaining where future predicted noise levels would approach or exceed a set of Noise Abatement Criteria (NAC) established in the FHWA regulations. For outdoor uses in residential areas, the NAC is 67 dB(A); INDOT defines "approaching the NAC" as within 1 dB (66 dB(A)) for residential areas). Therefore, locations where future noise levels are predicted to be 66 dB(A) or higher are considered "impacted."

(2) Ascertaining locations where noise levels are expected to increase by 15 dB(A) or more over existing levels.

How Are Noise Levels Predicted?

The FHWA Traffic Noise Model (TNM) measures traffic noise factors to generate a 3-D model that can predict noise levels during the noisiest hour of the day. Based on noise levels predicted with and without a proposed project, the model identifies where noise impacts occur and mitigation should be considered.

How Can Noise Be Reduced?

Traffic noise can be potentially reduced by modifying either the source of the noise (speed, volume or type of vehicles), the location of the receiver (the person who hears the noise), or the path by which the noise reaches the receiver. Because it is impractical to reduce the speed, volume or type of vehicles on a highway, or to relocate residences solely due to noise impacts, the most common approach to mitigating noise is the construction of noise barriers.

What is a Noise Barrier?

Noise barriers are solid obstructions built between the highway and homes or residences along a highway.

Effective noise barriers typically reduce noise levels by 5 to 10 dB, which reduces the loudness of traffic noise by as much as one-half.

Noise barriers do not completely eliminate noise, but rather reduce overall noise levels. The closer you are to the barrier, the greater reduction in noise is achieved. Noise barriers can be created from earth mounds or "berms" along the roadside, from high, vertical walls, or from a combination of berms and walls. Earth berms have a very natural appearance and are usually attractive. They also reduce noise by approximately 3 dB more than vertical walls of the same height. However, earth berms require a lot of land, especially if they are tall. Walls require less space, but they are usually limited to 25 feet in height for structural and aesthetic reasons.

When is a Noise Barrier Considered?

INDOT considers traffic noise barriers if it determines there will be traffic noise impacts, such as when a proposed project involves the construction of a new highway or the reconstruction of an existing highway that significantly changes the horizontal or vertical alignment or increases the number of through-traffic lanes. Construction of a new interchange also warrants a noise study.

When is a Noise Barrier Proposed?

INDOT proposes a noise barrier when a noise impact occurs and a barrier is considered to be feasible and reasonable. Under FHWA regulations, a noise barrier is determined to be feasible if it achieves at least a 5 dB(A) reduction in traffic noise for the impacted property parcels (the receptors) nearest the noise source. INDOT's goal for substantial noise reduction is to provide at least a 7 dB(A) reduction for receptors in the year the barrier is constructed. A barrier must also be reasonable, meaning the barrier must meet INDOT's cost-benefit analysis and be desired by landowners.

What is a Benefited Receptor?

Benefitted receptors are those property parcels that receive a minimum 5 dB(A) reduction in future noise levels. A first-row receiver is the first receptor property parcel adjacent to the roadway. Undeveloped land that is permitted or has a foundation under construction can be a first-row receiver. There is no set distance requirement.

What is a Feasible Noise Barrier?

INDOT requires noise abatement measures to be based on sound engineering practices and standards and requires that any measure be evaluated at the optimum location.

Noise barriers require long, uninterrupted segments to be effective. As such, if there are existing roadway access points and/or driveways, it is not feasible to construct effective noise barriers. Engineering feasibility also takes into account topography, drainage, safety, barrier height, utilities, and access and maintenance needs, which may include right-of-way considerations. In situations where engineering considerations make noise barriers unfeasible, the noise analysis will explicitly state the reasons (topography, drainage, safety, or other factors).

INDOT requires that noise barriers achieve a minimum 5 dB(A) reduction at a majority (greater than 50 percent) of the impacted noise receptors (those that would receive a reduction of at least 5 dB(A)). If a barrier cannot achieve this acoustic goal, it is not considered to be acoustically feasible.

What is a Reasonable Noise Barrier?

The cost of constructing a noise barrier is a significant factor in determining if a barrier is considered to be reasonable or not. To determine cost-effectiveness, the estimated cost of construction (including installation and additional necessary construction, such as foundations or guardrails) is divided by the number of benefited receptors. INDOT Traffic Noise Analysis Procedures consider a material and design cost of $25,000 or less per benefited receptor to be cost-effective.

Development in which a majority (more than 50 percent) of the receptors was in place prior to the initial construction of the roadway in its current state will receive additional consideration for noise abatement. The criteria for cost-effectiveness in these cases is 20 percent greater ($30,000 per benefited receptor).

INDOT continues to monitor advances in technologies in addition to evaluating other methods of addressing traffic noise and its related impacts.

INDOT uses $30/square foot to estimate noise barrier construction cost.
A cost per benefited receptor of $25,000 or less is considered cost-effective.
The cost per benefited receptor rises to $30,000 if a majority of benefited homes were built prior to initial construction of the roadway in its current state.

What is a Noise Survey and Why is it Important?

After a noise barrier is determined to be feasible, a noise survey helps determine if it is reasonable. A significant part of a reasonable determination is gathering input from impacted residents, businesses, and other stakeholders in close proximity to a proposed barrier.

A noise survey is a general questionnaire to respondents to solicit basic information, including their name, address, preferences regarding a barrier, and any general comments they wish to provide. The survey is mailed to each benefited resident. If the property owner is different from the current resident, both the owner and resident are surveyed. The concerns and opinions of the property owner and the resident will be balanced with other considerations in determining whether a barrier is appropriate.

The noise survey includes a response postcard, a brief description of the project, barrier locations under consideration, and information on the basics of traffic noise.

All responses or opinions regarding barriers must be expressed in writing to INDOT, by either letter, email or the response postcard.

Proposed noise barriers can cause conflicts in mixed-use developments, as barriers to protect residences may block line-of-sight to adjacent businesses. If a barrier is proposed directly adjacent to the property line of a business, the business will be solicited for input to determine its concerns about line-of-sight. If a mutually satisfactory compromise cannot be reached between businesses and residences, the barrier may end at the property line dividing the two areas.

What Does a Noise Barrier Look Like?

Noise barriers typically consist of concrete panels placed between steel supports. The height and location of a barrier is determined by the TNM analysis. The color and texture can vary, and INDOT seeks the input of adjacent property owners.

CUSTOM ROCK ASHLAR | FLAT ASHLAR | DRY STACK STONE | INDIANA ASHLAR STONE

How Does a Noise Barrier Work?

Noise barriers reduce the sound from a busy highway by either absorbing the sound, transmitting it, reflecting it back across the highway, or forcing it to take a longer path to receivers. A noise barrier must be tall enough and long enough to block traffic noise from the area that is to be protected. Noise barriers provide very little benefit for homes on a hillside overlooking a highway or for buildings which rise above the barrier. A noise barrier can achieve a 5 dB noise level reduction when it is tall enough to break the line-of-sight from the highway to the home or receiver. After it breaks the line-of-sight, it can achieve approximately 1.5 dB of additional noise level reduction for each meter of barrier height.

To effectively reduce the noise coming around its ends, a barrier should be at least eight times as long as the distance from the receiver to the barrier.

Does a Barrier Increase Noise on the Opposite Side of the Highway?

Residents adjacent to a highway sometimes believe that their noise levels have increased because of construction of a barrier on the opposite side of the highway. However, field studies have shown that this is not true. If all the noise striking a noise barrier were reflected back to the other side of a highway, the increase would be theoretically limited to 3 dB. In practice, not all of the acoustical energy is reflected back. Some of the energy goes over the barrier, some is reflected to points other than the homes on the opposite side, some is scattered by vegetation, and some is blocked by vehicles on the highway. Additionally, some of the reflected energy is lost due to the longer path that it must travel. Measurements made to quantify this reflective impact have never shown an increase of greater than 1-2 dB. This increase is not perceptible to the average human ear.

What if I Don't Want a Noise Barrier?

Although owners of residential property generally support barrier construction, some commercial property owners may prefer to not have a barrier adjacent to their property. For example, a business that relies on highway visibility to attract customers may not prefer a barrier, despite the noise reduction benefit. Prior to approving construction of a barrier, INDOT surveys affected property owners to gauge their interest, and a majority of those owners must support construction.

Can Trees Act as a Noise Barrier?

Vegetation, if it is high enough, wide enough, and dense enough that it cannot be seen over or through, can decrease highway traffic noise. A wide strip of trees with very thick undergrowth can lower noise levels. Ninety feet of dense vegetation can reduce noise by 5 dB. However, it is not feasible to plant enough trees and other vegetation along a highway to achieve such a reduction. As it pertains to noise, trees and other vegetation can be planted for psychological and/or aesthetic benefit, but not to physically lessen noise levels.

Who Maintains a Noise Barrier?

INDOT constructs noise barriers only on INDOT property and is responsible for maintaining them.

Your Input Matters

INDOT strives to understand the needs of residents and businesses that may be impacted by traffic noise. Public input is an important consideration when determining whether noise abatement is appropriate for an area. For more information, contact your local district.

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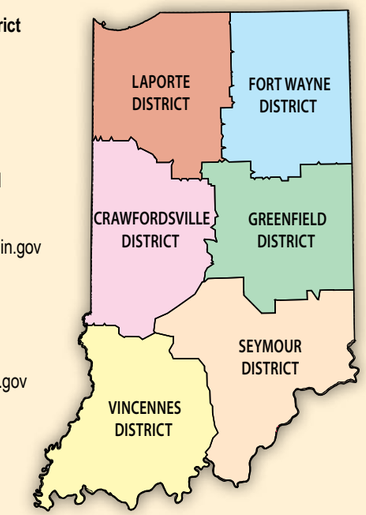

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