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*by Chris Corbisier*

*Planning land use with highway traffic noise in mind can help local agencies improve residents' quality of life.*

According to the most recent data available from 1987, noise from highway traffic affects more than 18 million people in the United States. As highway systems continue expanding, increased traffic volumes result in higher levels of traffic noise for residents of adjacent neighborhoods. New residential development typically occurs near roadways because of the ease of traveling to work, school, and leisure and shopping activities. But as open space for new development becomes scarce, must people simply accept increases in highway traffic noise? Not necessarily.



Locating commercial developments near the highway, as with this strip mall in northern Virginia, is preferable to putting a residential neighborhood close to traffic noise.

Avoiding a noise problem frequently is more effective than trying to correct an existing one using noise barriers. FHWA encourages developers, government officials, planners, and private citizens to consider ways to address highway traffic noise before—rather than after—frustrating problems arise. One solution is noise-compatible land-use planning.

Through advance planning and shared responsibility, local governments and developers, working cooperatively with Federal and State governments, can plan, design, and construct new development projects and roadways that minimize the adverse effects of noise from highway traffic. Noise-compatible land-use planning encourages the location of less noise-sensitive land uses near highways, promotes the use of open space separating roads from developments, and suggests special construction techniques that minimize the impact of noise from highway traffic.

## Sound Basics

Acousticians define sound as a sensation in the ear created by pressure variations or vibrations in the air. What qualifies as *noise*, or unwanted sound, tends to be subjective. That is, sound that one person perceives as music may be noise to someone else.

Sound is composed of many frequencies, some of which may affect one person more than another. Because engineers measure sound in decibels (dB) on a logarithmic scale, when two sources of sound, each measuring 70 dB(A), are added together, the resulting sound level is not 140 dB(A) but 73 dB(A). The (A) refers to a weighting scale that approximates the manner in which humans hear higher frequencies better than lower frequencies.

Levels of highway traffic noise typically range from 70 to 80 dB(A) at a distance of 15 meters (50 feet) from the highway. These levels affect a majority of people, interrupting concentration, increasing heart rates, or limiting the ability to carry on a conversation. The noise generated by a conversation between two people standing 1 meter (3 feet) apart is usually in the range of 60-65 dB(A). Most people prefer the noise levels in their homes to be in the 40-45 dB(A) range, similar to the levels found in a small office. A reduction of sound from 65 to 55 dB(A) reduces the loudness of the sound by one half, while a reduction of sound from 65 to 45 dB(A) results in a loudness reduction of one quarter.

## Reducing Noise from Highway Traffic

FHWA recognizes three broad approaches for reducing noise from highway traffic: source control, mitigation measures associated with the design of road projects or their operation, and noise-compatible land-use planning.

Source control in the United States involves regulating and enforcing the level of noise emissions from newly manufactured medium and heavy trucks with a gross vehicle weight rating of more than 4,525 kilograms (10,000 pounds). The level of noise emitted by trucks has decreased by 3 dB(A) in the past 20 years. Noise from automobiles, however, is not regulated.

Road measures to reduce highway traffic noise include restricting truck access and adjusting the timing of traffic signals. Other options to consider early in the planning stages are depressing the highway (constructing the highway below grade) or moving it farther away from sensitive areas. Constructing a noise barrier (i.e., a wall, an earthen berm, or a combination of wall and berm), however, is the most common measure employed to mitigate noise associated with highway projects.

The third approach, noise-compatible land-use planning, aims to guide residential development in such a way that sensitive land uses are not located adjacent to a highway. Also, neighborhoods and the houses themselves are planned, designed, and constructed to minimize the impacts of traffic noise.

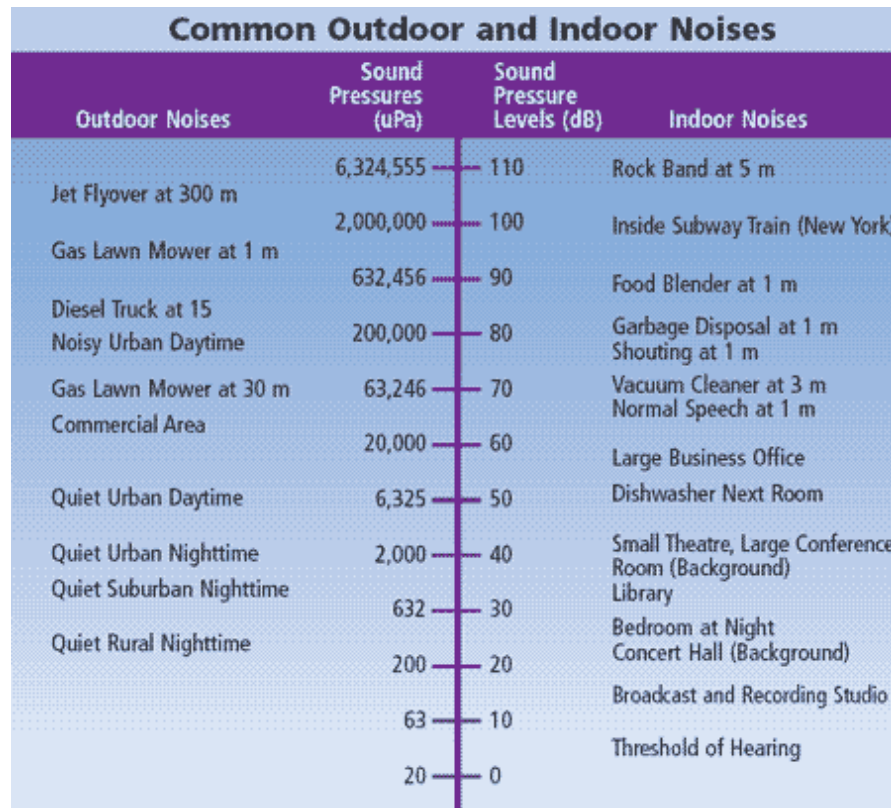
## Benefits of Planning Ahead

Noise-compatible land-use planning can have a positive effect on a community's aesthetics, quality of life, and finances. Land-use planning provides appealing alternatives for reducing traffic noise without the use of barriers, which are more intrusive and visually and physically restrictive. When State departments of transportation (DOTs) or communities use noise-compatible land-use planning to create quiet zones rather than constructing noise barriers, they can use the money saved for additional roadway improvements or maintenance programs.

Many people perceive noise barriers as the best answer to eliminating or reducing the impact of highway traffic noise, and State and local DOTs have constructed many miles of barriers over the years. However, indications are that Federal and State funding for noise barriers may be restricted in the future. In fact, existing Federal legislation already prohibits FHWA participation in the construction of most noise barriers for new development that occurs near existing highways. (See Title 23 of the Code of Federal Regulations, 23 CFR 772.13(b).)

"A lot of municipalities just don't even think about noise," says Eric Zwerling, director of the Rutgers Noise Technical Assistance Center at the State University of New Jersey and president of the Noise Consultancy, LLC,

"but the bottom line is that it's much, much cheaper to design for quiet than to remediate afterwards. Spending additional time upfront helps residents avoid disrupted lives and costly retrofits, and could help municipalities and State DOTs avoid the problem and expense of addressing incompatible adjacent land uses."



Source: FHWA

### Development Tips

In areas where land is still undeveloped adjacent to highways, communities can guide development toward commercial and industrial purposes, which are not as noise-sensitive as residential uses. Locating commercial development next to highways also affords businesses added visibility and accessibility to existing and future customers.

Another option is to create attractive open spaces next to roads for recreational uses. Undeveloped open space can serve as a buffer zone between the highway and residential areas. The land may be used as a park, and it can give the highway the visual effect of being a greenway. Buffer zones often are ideal locations for utilities and retention basins for site drainage. Planting vegetation in buffer zones provides the additional benefit of psychological relief for residents by blocking their view of the highway.

In denser urban areas, where available land is diminishing and people often prefer to live close to highways for ease of travel, planners can consider other abatement measures. Options include zoning requirements for residential areas that mandate setbacks (added distance) from the highway or ordinances to create exterior or interior noise limits. Communities can use the following approaches to encourage noise-compatible land-use planning:

- Planning, zoning, or other legal means, such as subdivision or development standards, building codes, health codes, or occupancy permits.
- Municipal controls, including land or easement purchases, or the acceptance of land donations.
- Public education to inform citizens, developers, and planners of the options for structures and land uses that can exist in harmony near a roadway.
- Site planning, architectural design, and construction methods that incorporate acoustical considerations.

According to Mark Pfefferle, a planning coordinator for the Maryland-National Capital Park and Planning Commission, increased traffic and growth are driving Montgomery County, MD, to update its noise guidelines for subdivisions. "The least desirable areas for residential developments have been passed over," he says, "but now developers are looking to build near major highways to accommodate the rapid growth in the region." Pfefferle says that Montgomery County had noise guidelines in place since 1983, but now the county uses the FHWA Traffic Noise Model to assess the noise problem.

"Noise is an issue that people should not avoid," he adds. "I lived in a noise-impacted area and hated it. The more information you have, the better you can mitigate noise and improve the living environment for residents."



This expanse of grass and trees creates a buffer between the highway and the residential community behind it.

### Acoustical Solutions

Acoustical planning—designing a site or building a house with noise considerations in mind—also can help address the problem. For example, building homes behind existing hills can help block noise. Privacy walls, intended to reduce residents' views of the highway, can be extended a few feet higher to block much of the noise from entering the first floor of a residence.

The Arizona Department of Transportation (ADOT) considers future expansion of highways when designing and constructing noise barriers.

"When building new walls for projects, we increase the footing size to accommodate a [1.2-meter] 4-foot extension on top of whatever is constructed originally," says Angie Newton, senior transportation planner with ADOT. "If you build a new wall knowing that there may be a need to raise it due to a future widening or capacity increase, you avoid having to tear it down and spend a lot of money just to get a few extra feet."

ADOT is developing a document to provide local governments and developers with a better understanding of the agency's roles and responsibilities in planning, designing, constructing, and maintaining freeway corridors. Including answers to frequently asked questions and recommendations on how to deal with issues ranging from noise mitigation and rights-of-way to utility coordination during construction, the document offers guidance to help municipalities work together to manage growth effectively.

When there is a privacy wall or a noise barrier, placing single-story homes nearest the highway can help protect interior activities, particularly sleep. Since residential developments often include pools, tennis courts, clubhouses, and parking garages in their layouts, placing these activities near the highway can buffer the noise before it reaches residential areas.

Acoustical architectural measures also can reduce the effects of noise from highway traffic. When designing the floor plan for a residence, the architect or builder can place rooms that are less sensitive to noise (e.g., kitchens, bathrooms, and laundry rooms) on the side of the home nearest the highway, opening up space farther from the road for bedrooms and living areas. The architect also can design the house so that it shields the backyard, which has no walls or roof itself to block traffic noise.

Other architectural considerations include: (1) minimizing the number of windows and doors facing the highway; (2) installing double- or triple-paned glass windows and solid-core doors; (3) sealing areas around doors; (4) installing sound-deadening materials such as fiberglass insulation in walls; (5) increasing the building mass; (6) increasing the rigidity of materials used in construction, such as using brick or concrete instead of wood; (7) providing air spaces in walls, floors, and ceilings; (8) using rigid metal frame connectors in exterior walls not made of masonry to dampen vibrations from the exterior that may transmit through walls; and (9) installing staggered studs, air conditioning, and noise dampers on air intakes.



This privacy wall blocks residents' views of the highway and helps reduce traffic noise.

### Carrington Development

An excellent example of noise-compatible land-use planning is the Carrington residential development in Fairfax County, VA. A required 60-meter (200-foot) setback normally provides a buffer zone between residences and the Dulles Toll Road to reduce traffic noise, but because the developer offered to use acoustical planning and construction, the county granted permission to build additional homes closer to the highway. To receive the allowance, the developer needed to ensure that the interior noise level for the new homes was lower than 55 dB(A) during the day and 45 dB(A) at night. (It should be noted that acoustical planning and construction provide interior, but not exterior, noise-reduction benefits.)

According to a November 14, 2002, article in *The Washington Post*, "Living in High Style by the Side of a Road," Americans are willing to accept higher noise levels outdoors in return for convenient access to a highway. At the same time, the role of outdoor activities, which are most affected by highway noise, appears to be shrinking along with the size of backyards. Citing a statistic from the National Association of Home Builders, the author of the article explains that the average size of new single-family homes has grown since 1990, but the average size of lots has shrunk by 12 percent. The article concludes that people are not spending as much time outdoors in their yards; instead, they prefer to have larger houses.

### Land-Use Plans

What does it take to incorporate noise compatibility into a land-use plan? The key ingredient is a shared desire to address the noise problem. Residents, planners, developers, and elected officials must work cooperatively to achieve the goal of an improved community for all.

Reducing noise from highway traffic has a price. Developers may bear additional costs for design alternatives that result in fewer homes being built (unless the alternative of denser development is permissible). Builders also may incur costs for using more sound-absorbent materials in construction; however, they often can recover these costs through higher sale prices or rental fees for quieter homes. When developers set a standard for sensitivity and high quality in construction, they contribute to the long-term value of the homes they build.

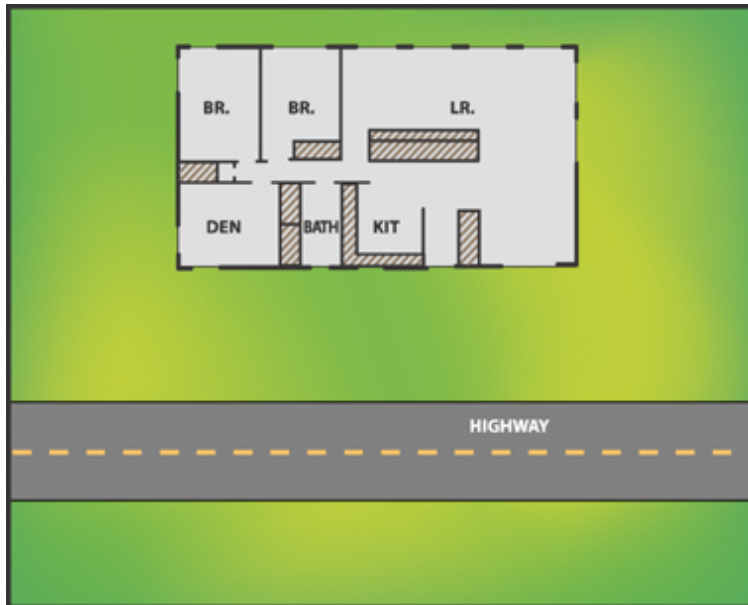
Local governments may need to fund administrative costs for including standards for noise compatibility into their guidelines and ordinances for land use. But in many cases the benefit of improving the overall quality of life for residents (and possibly avoiding future complaints about highway traffic noise) justifies the expenditures.





Source: FHWA

As shown in this illustration, a parking garage can shield residential areas from a highway.



Source: FHWA

Architects can place less noise-sensitive rooms, such as kitchens and bathrooms, closest to the highway, as illustrated in this floor plan.



Source: FHWA

This schematic shows that a house can shield its backyard from traffic noise, making outdoor activities more pleasant.

### A Sound Future

For successful continued growth in urban and suburban areas, highways and new development must be compatible. By sharing the responsibility for addressing the problem of highway traffic noise, municipalities and developers can plan communities to be more livable and achieve a much less expensive alternative to constructing noise barriers as after-the-fact solutions to mitigate highway traffic noise.

See *"Walls of Fame," Public Roads, May/June 2003* for information about context-sensitive and aesthetic noise barriers.

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For more information about noise-compatible land-use planning, see the FHWA brochure, *"Entering the Quiet Zone: Noise Compatible Land Use Planning,"* available online at [www.fhwa.dot.gov/environment/noise/quietzon/index.htm](http://www.fhwa.dot.gov/environment/noise/quietzon/index.htm), or contact Chris Corbisier at 202-366-1473, [chris.corbisier@fhwa.dot.gov](mailto:chris.corbisier@fhwa.dot.gov).

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