Highway Noise Control With HMA

by Wayne Jones, Asphalt Institute Field Engineer

Although noise-wall barriers have been the standard response to noise abatement requirements for highways, selection of HMA pavements provides comparable noise reduction and is much less expensive. *This article describes how roadway noise is measured and the benefits of using HMA for noise reduction.*

In the world today, noise has become one of the most pervasive forms of environmental pollution. Noise is everywhere. It affects our lives at home, at work and at play. Wherever people live there is noise. Noise, by definition, is any unwanted or excessive sound. It can be a nuisance, interfering with sleep, work or recreation, and in extreme situations, it can lead to anxiety, stress and other health problems.

As we know from our high school science classes, sound waves are created when an object moves or vibrates. When these waves reach our ears, they cause our eardrums to vibrate, sending signals to the brain that we interpret as sound. A measurement of the wave traveling through the air is used as an indication of the intensity of sound or its volume, and is described in terms of a scale called the decibel (dB). Noise measurements made by filtering high- and low-pitched sounds—approximating the way an average person hears sounds—is called the *A-weighted level* or dBA.

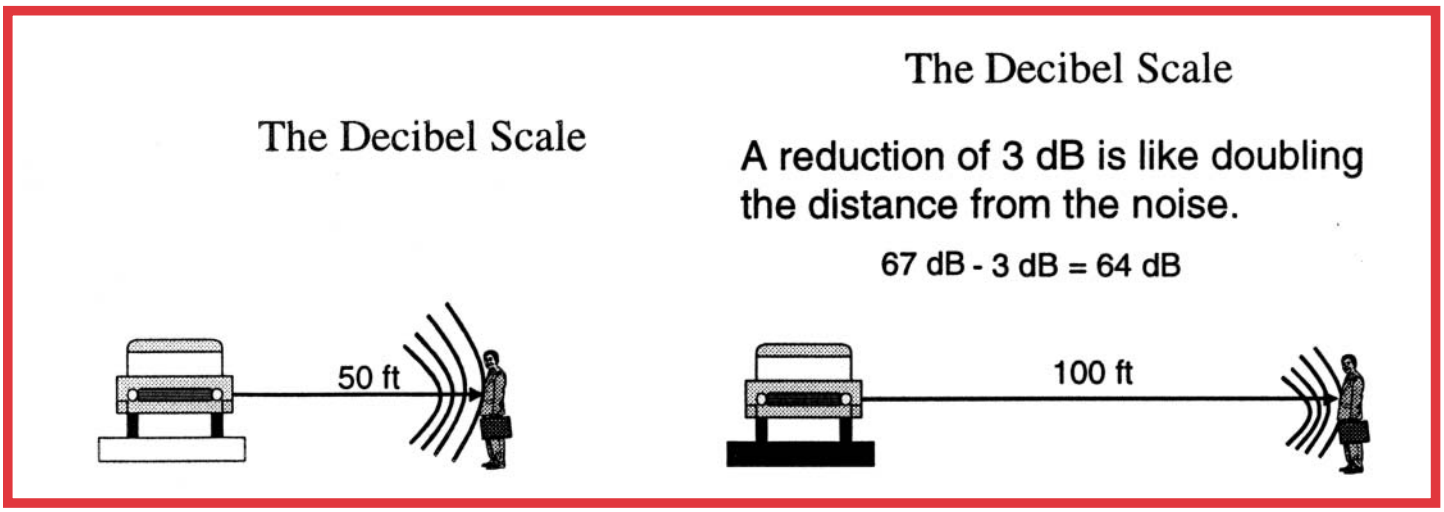
The dBA scale begins at zero, which represents the faintest sound that can be heard by humans with very good hearing. Conversations take place in the 50 dBA range and a chainsaw whines at about 100 dBA. Normal highway traffic sounds rank about 75 dBA and jet airliners around 90 dBA. For most people, discomfort starts in the 70 to 80 dBA range, with the threshold of pain around 140 dBA. The Federal Highway Administration (FHWA) has chosen 67 decibels as the point where state and federal agencies must consider reducing the noise level.

The perception of loudness varies for each individual, so there is no precise definition of loudness. However, based on sound tests, most people consider a sound level increase of 10dBA to be twice as loud. In other words, to the average listener, 70 dBA is twice as loud as 60 dBA. A rehabilitated highway with added capacity can increase the sound level by 10 dBA or more.

Abatement Options

Any type of rehabilitation that adds lanes, significantly changes alignment or increases capacity requires a noise study. The key component of the study is the modeling of the new acoustical landscape by using actual project design data and plugging it into a noise modeling software package that projects the changes caused by the rehabilitation. The generally accepted definition of excessive noise is an increase of 10 dBA.

If abatement is needed, the construction of noise walls is the current answer. Barrier wall construction currently costs between $1.3 and $3 million per mile, depending on how much other construction is going on



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at the same time. If the wall is built during the rehabilitation project, then wall construction can be piggybacked onto ongoing construction expenses. If the wall is a stand-alone project, then it will cost more.

If the noise increase is below 10 dBA, then mitigation is not required. The agency will not have to build an expensive—many times ugly—difficult-to-maintain noise wall that is ineffective at best.

When a noise barrier wall is constructed, there is a significant noise drop immediately behind the wall. The problem is that those buildings that are on hillsides, at intersections or driveways or anywhere there is an opening in the wall, will not benefit from noise reduction. In some cases where noise walls are built parallel to one another, noise reflections or echoes of the sound waves off the opposite wall can actually increase noise levels at a location near the highway.

Studies show that when all these inefficiencies are considered, the average noise reduction from noise barriers is approximately 7 dBA. Other noise abatement options such as vegetation or green walls have the same limitations.

Quiet HMA

Research in the U.S. and Europe shows that a Stone Matrix Asphalt (SMA) or Open-Graded Friction Course (OGFC) mix will reduce highway noise by 3 to 5 dBA. To the average person, this reduction is the same as doubling the distance between the source of the noise and his location. Studies show that the general ranking from the quietest to the loudest pavement surfaces is:

- OGFC
- SMA
- Dense-graded asphalt
- Broom-finished PCC
- Transverse-tined PCC

The quietest OGFC can be as much as 7 or more dBA quieter than a transverse-tined PCC pavement.

For worst-case situations, a French product called Twinlay® can be as much as 7 to 12 dBA quieter than PCC pavements. This product won an environmental award for quiet pavements.

When comparing the noise reduction that is possible by choosing HMA pavement—up to 7 dBA—we see how much more practical pavement surface selection is than construction of noise barrier walls.

Wayne Jones is the Asphalt Institute Field Engineer for Indiana, Michigan, and Ohio. Jones currently serves as AI's "noise expert."

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Great Valley Noise Issue

By Carlos Rosenberger, Asphalt Institute Field Engineer

The 600-plus families comprising the Great Valley Association (GVA) are letting their voices be heard. These suburban Philadelphia residents are letting the Pennsylvania Department of Transportation (PaDOT) know that GVA wants the upcoming reconstruction and expansion of Route 202, Section 300, to be an asphalt pavement rather than a PCC pavement.

GVA's main concern is the noise level of the existing PCC and the increase in noise level that will come with additional lanes and more traffic. The GVA people asked the Pennsylvania Asphalt Pavement Association (PAPA) and the Asphalt Institute (AI) to inform them about the advantages of asphalt pavements, especially their ability to reduce noise.

GVA families were advised that noise walls can be built, trees and shrubs can be planted and the pavement surface can be designed to reduce noise. An NCHRP study concludes, "In general when dense-graded asphalt and PCC pavements are compared, the dense-graded is quieter by 2 to 3 decibels."

Three decibels may not seem like much, but it can make a significant reduction in the sound we hear. A three-decibel reduction corresponds to doubling the distance from the noise, reducing traffic volume by 50 percent or reducing traffic speed by 25 percent.

The GVA is not alone in their desire to reduce highway noise. Families living near I-275 in Michigan, residents along I-280 in California and people living close to I-95 in New York state have voiced complaints about the noise level of concrete pavements that are near, or that pass through, their neighborhoods. And the GVA scenario is a repeat of an earlier conflict about pavement noise in the Philadelphia area.

I-476, known locally in Philadelphia as the Blue Route, was originally designed as a PCC pavement. But it was constructed with asphalt because the residents of Swathmore College and Nether Providence demanded that the pavement reduce noise. Together, they approached PaDOT, objected to the noise level that would be caused by PCC pavement and, with the help of an acoustical engineer, were able to get the pavement changed from PCC to asphalt. Today, the Blue Route is performing admirably and local residents are pleased with the noise reduction.

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