A Look at Environmental Noise, Part I: Some Basics on Noise and Weighting Filters

At Wieland Acoustics, we enjoy educating people at all levels about our specialty. This is the first in a series of five articles that will look at various aspects of environmental noise. We hope the series will provide insight and information for our readers.

What is Noise?

No matter what type of noise you wish to consider, whether it's transportation noise, occupational noise, entertainment noise, or general community noise, it helps to have an understanding of what noise is. Noise is unwanted sound. What is a "noise" to you may be a sound to someone else; there is always a subjective component to the term.

A sound is produced when something vibrates rapidly enough to generate a disturbance or pressure wave in the surrounding medium. Most sounds are created by vibrating surfaces and turbulent air. When we measure noise, we are quantifying a *sound pressure level*. The unit of measurement of sound was named after Alexander Graham Bell. The *bel* proved unwieldy for practical purposes, so it was divided by ten (deci-) to arrive at the familiar *decibel,* abbreviated *dB.*

The decibel is a logarithmic unit. This means that if you want to add together the noise from two sources, the sound levels cannot be added arithmetically, i.e., 5 dB plus 5 dB does not equal 10 dB. Actually, the sum is 8 dB. Noise levels must be added in a logarithmic manner or, as it's frequently described, "on an energy basis".

Types of Noise Sources

There are three basic types of noise sources: a line source, from which the sound waves travel in a linear manner (e.g. cars on a freeway); a plane source, where the noise travels within a specific plane (such as noise created inside a cylinder by a piston); and a point source, from which noise radiates in all directions. For every doubling of distance away from a point source, there is a decrease in noise level of 6 dB. This is known as the *inverse square law*. For line sources, noise levels decrease by 3 dB for every doubling of distance.

Sound Weighting

The healthy human ear is most sensitive to sounds in the range of 1,000 Hz to 5,000 Hz. But there are sounds that exist outside this range to which we are less sensitive. Noise measurement devices, called *sound level meters*, have built-in *weighting filters*. The filters enable the meter to de-emphasize some frequencies, and emphasize others.

The filter most frequently used is the *A-weighting filter*, which emphasizes frequencies to which the human ear is most sensitive. A measurement taken using the A-weighted filter is noted as *dB(A).* Other filters include a "C" weighting (used for measuring low frequencies) and a "D" weighting (usually used for aircraft noise). The sound level meter can also be used to obtain unweighted readings.

Representative Noise Levels

To determine whether a community noise can objectively be described as "quiet", "noisy" or just plain "loud", we need some reference levels. Examples of common sounds we hear are: a soft whisper, 30 dB(A), a noisy office, 55 dB(A), freeway traffic, 65 dB(A), and a power lawn mower, 90 dB(A). (We once measured an action movie inside a theater at 93 dB(A). Now that was *loud*!)

Next Article

In our next article in this series, we'll look at how communities limit their exposure to environmental noise with rating levels and nuisance factors.