Addressing Transportation Noise Problems — An Overview

Transportation noise is something that most of us have to live with. Fortunately, at least with traffic and railroad noise, the impact can be reduced with barriers. In this article, we'll take a look at ground transportation noise sources, various noise standards that are often applied, tools for analyzing noise levels, and alternatives that are available for controlling noise.

Traffic Noise Sources

We all know that some vehicles are noisier than others, and that they sound different from each other, but why is that? What exactly is it that's making the traffic noise we hear as we try to relax in our homes or yards? It isn't as simple as it may at first seem.

Traffic noise is generated primarily by a vehicle's propulsion system (engine, exhaust, intake, fan) and its tires. Surprisingly, propulsion system noise is basically independent of vehicle speed, but is highly dependent on engine speed. Conversely, tire noise depends largely on vehicle speed. In fact, for both trucks and cars, there is a speed beyond which the tires make more noise than the propulsion system. Other vehicle noise sources include air turbulence created as the vehicles race by, and the type of pavement on which they are traveling.

Railroad Noise Sources

For railroads, the primary noise sources are interactions between the wheels and rails, the propulsion system of the railcars and locomotives, and aerodynamic noise (with high speed trains). Interaction noise is predominantly a function of train speed and track type. (Jointed rail is noisier than welded rail.) However, propulsion system noise is independent of train speed; instead, it depends on the engine's load. While the locomotive obviously generates a higher *maximum* noise level than the railcars, it is interesting to note that a train's railcars often generate as much *sound energy* as a locomotive during a train pass because there are so many more of them.

Noise Standards

Who regulates ground transportation noise? In the case of federally-funded highways and freeways, the U.S. Federal Highway Administration (FHWA) has established noise abatement criteria that limit the average noise level during the noisiest 1-hour period of the day. Many states have adopted these same criteria for state-funded highways. Traffic noise on local streets is regulated by the City or County in which the streets are located. These standards are usually expressed in terms of a 24-hour weighted average noise exposure level. In addition, the State of California Vehicle Code regulates the maximum noise level individual vehicles can create.

In the case of railroad noise, the regulatory scheme is less clear. The U.S. Environmental Protection Agency (EPA) regulates the amount by individual locomotives and railcars, but only for interstate rail carriers. There is no regulation of the overall noise level that can be generated by operations on an interstate rail line.

For rail transit lines, the American Public Transit Association (APTA), the U.S. Urban Mass Transportation Administration (UMTA), and the Federal Transit Administration (FTA) have developed design guidelines that consider noise; however, these guidelines are voluntary. Some local communities have regulations that limit the noise levels generated by operations on a rail transit line.

Analytical Tools

When assessing noise impacts, we have to look to the future. How much traffic will a street or highway carry in the future when the area is built out? How many trains per day will pass through a neighborhood when the rail line reaches capacity? Fortunately, there is no lack of analytical tools for predicting future noise levels next to a street, a highway, or a rail-road, even if it hasn't been built yet. Research studies over the years have led to the development of sophisticated computer models that have proven to be reasonably accurate in the field. Acoustical consultants use their field measurements and working knowledge to improve the accuracy of these models.

Noise Control

The acoustical consultant has no control over the noise level generated by individual ground transportation noise sources, except, perhaps, in the case of designing a new rail transit system. In this case, the consultant can assist by developing specifications that will minimize wheel/rail interaction noise.

Usually, however, the consultant's bag of tricks is limited to noise barriers: what kind, where, and how high. While this may seem straightforward, with today's analytical tools and variety of barrier materials, the analysis can be quite sophisticated. Traditional block or concrete noise barriers can be inexpensive, but they also reflect noise, which can limit their effectiveness. Sound absorptive barriers can provide more noise reduction than traditional barriers for a given height because they minimize reflections. Using a highly detailed analysis, a sound absorptive barrier material can be selected that is especially effective at the sound frequencies generated by the traffic or trains. Earthen berms are similar to sound absorptive barriers, but require more right-of-way. Nowadays, there are even glass block walls which are effective and attractive.

In short, transportation noise control is a very interesting field for the acoustical consultant, and as the analysis grows more complex, it's becoming more interesting all the time!