Thought Leadership

Steve Morgan On: Applications and Limitations of Acoustical Walls

Though acoustical walls do have their applications as noise control measures, these applications are limited by the nature and behaviour of sound itself. While acoustical walls can be engineered using materials that absorb noise to minimize the reflection of sound off the barrier, sound can still diffract, traveling over and around the wall. Placing an acoustical wall on one side of a noise source mitigates noise in the space directly adjacent to the wall, opposite the sound source, known as the wall's *sound shadow*. The only significant sound attenuation an acoustical wall can perform is found within this sound shadow created by the wall. If the receiver point or affected residence falls outside of the sound shadow, a wall provides little to no attenuation value.

Applications

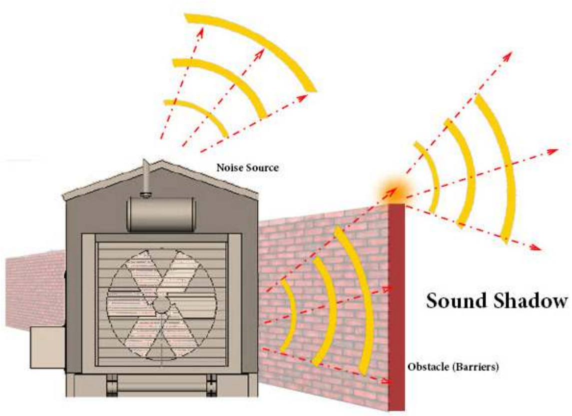
That said, acoustical walls do have some noise mitigation applications for which they are effective. They are, for example, frequently useful in cases where noise regulations are based on distance or property lines. In these instances, a facility is required to meet a certain decibel level at the property line itself or within a specified distance from the facility. When facilities are required to meet such property line-based regulations, even if no affected residences or sound sensitive areas are nearby, the use of an acoustical wall can be extremely efficient and cost-effective in meeting the technicalities of the regulations. Too often, however, such regulations may be in place in spite of the presence of affected nearby residences located outside of the sound shadow, and this is where problems tend to arise. Meeting technical specifications will have little positive impact on the surrounding community and often does not prevent community complaints as a result.

Acoustical walls can be more efficient and cost-effective solutions when it comes to temporary applications, such as drilling and fracking.

Other useful applications include blocking highway noise, as a wall or barrier tends to be most effective at attenuating noise from low sound sources, such as tires and vehicle exhausts. For residents living next to high-traffic roads and within the sound shadow of the wall, significant noise reduction can be achieved. This is usually the case for the first two or three rows of homes separated by the wall from the noisy highway, though the value of an acoustical wall for residents beyond that sound shadow is minimal at best. One possible advantage in such cases is the aesthetic value of not *seeing* a highway or industrial facility. To some extent, this can result in psychological benefits; when residents do not see a noise source, they tend not to notice the noise as much, or they are more likely to attribute that noise to ambient sources, reducing the likelihood of complaints, however marginally.

Limitations

The efficacy of an acoustical wall is highly dependent on a number of variables, including the location of residences or receptor points, the building materials of the wall itself, the height of the wall and sound sources, the distance between the noise wall and the equipment as well as between the noise wall and the receiver, and the characteristics of the surrounding terrain.



As discussed earlier, receptor points or residences that do not fall within the sound shadow experience little to no benefit from the presence of an acoustical wall. By their nature, acoustical walls are very directional—where the sound shadow will fall depends upon the exact location of the wall itself, both in terms of its distance from the sound source(s) and from the intended receptor point. A wall constructed along the east side of a facility can expect a positive effect for receptor points within the sound shadow to the east but little to no effect for those beyond that sound shadow. Additionally, it is likely to have no effect on receptor points in the north or south, but may actually have a negative effect on receptor points to the west. This latter case occurs because, depending on the composition of the wall, sound may reflect off the barrier and add to noise in the opposite direction. In this same manner, the wall can make a facility *louder* and result in additional vibration by acting as a speaker over which the sound is conducted and transmitted. If integrated into the construction of the wall, materials engineered to absorb noise can help to mitigate these issues.

Height is also an important variable both in regard to the wall, the noise sources in need of attenuation, and the anticipated receiver point. To have any effect, an acoustical wall must be taller than the tallest noise source. At minimum, it must be tall enough to block the line of sight between the receiver point and the tallest sound source – if the receiver is uphill or across a valley from the site, the wall is ineffective. This poses a unique set of engineering challenges.

In applications like highway noise, this is less of a concern, as the majority of noise sources are close to the ground, though large trucks can be an issue. On industrial facilities, the tallest noise source can be high above the facility itself. This may require the use of a wall so high that it becomes both difficult and costly to erect, and may also pose a serious engineering challenge in the presence of heavy wind loads. If your tallest noise source towers above the ground at 15 metres, such as an engine exhaust pipe, this requires the acoustical wall to be even taller than this noise source. Addressing the challenges and hazards of such a wall would require extensive engineering, design, foundation, and field work, increasing costs significantly. In these cases, acoustical walls are rarely an effective noise control solution.

The closer an acoustical wall is to the noise source, the more effective it will be. Therefore, these walls tend to be placed as close as possible to facility equipment to ensure the greatest noise attenuation, but this too can be problematic. An inappropriately placed acoustical wall positioned too close to equipment can actually hinder the operation of that equipment, particularly in regard to cooler air flow or engine air intake, presenting yet another safety hazard while potentially damaging both equipment and productivity. Likewise, an acoustical wall placed as close as possible to an affected residence is most effective, but it is rarely feasible or desirable to install a 20 foot acoustical wall in someone's backyard—or worse, in their *front* yard.

Due to reliance on the sound shadow of the wall for effective attenuation, the efficacy of acoustical walls is also highly subject to the characteristics of the surrounding terrain. For example, a resident who falls within a sound shadow on flat terrain may be entirely excluded from the effects of the sound shadow in hilly terrain, achieving little to no value when the resident is high upon a hill, but potentially gaining value when situated in a valley below the structure.

Conclusion

There are many options for acoustical walls, depending on the permanence and intended application of the structure. The constitution of the wall itself can range from an acoustic blanket hung on a frame, to a 6-inch thick wall structure filled with mineral fiber to absorb noise. While the applications of an acoustical wall are limited, they nonetheless retain a useful place in a noise control arsenal when properly used. Given careful consideration of the variables that impact the efficacy of an acoustical wall, the possible negative effects on facility function, and with an eye to the results you ultimately want to achieve, it is possible to make an informed decision regarding whether or not an acoustical wall is the best solution for the noise control needs of your facility. If an acoustical wall doesn't fit the bill, many other efficient, cost-effective options are available, including acoustical buildings and enclosures, engine exhaust silencers, cooler fan silencers, and other noise control equipment engineered to the specific needs of your facility.

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