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Sound Choices in Acoustical Drywall

New generation products deliver enhanced sound suppression solutions that reduce cost and offer revenue opportunities to developers.

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Continuing Education

Use the following learning objectives to focus your study while reading this month's Continuing Education article.

Learning Objectives - After reading this article, you will be able to:

1. Discuss basic concepts around airborne and impact sound issues in structures
2. Recognize several methods of reducing noise pollution in buildings
3. Specify cost-effective sound control techniques
4. Explain the ?green? impact of sound-absorptive drywall solutions

Street traffic, a barking dog, home theaters, loud music from the condo next door: as the world gets ever noisier, people are pressing for peace and quiet in their environments. In single and multifamily structures, hotels, schools and virtually every type of construction, occupants are increasingly demanding quiet surroundings—and will litigate to achieve them. To satisfy today's sophisticated and demanding consumers, builders and developers are constantly looking to improve the acoustical performance of their structures.

Manufacturers are following suit with specialized products. Next generation acoustical solutions obtain enhanced sound and noise control using standard drywall material in a thin panel construction that is as easy to install as conventional drywall. The most advanced of these products achieve acoustical performance exceeding that of multiple layers of standard drywall with just one panel. These acoustical drywall sheets are available in ½-inch, 5/8-inch, ¾-inch and 1-inch thicknesses and are mounted to one or both sides of a stud wall instead of multiple layers on one or both sides of a stud wall, without compromising fire resistance. Furthermore, the thinner wall assemblies yield additional re-saleable square footage that can significantly impact a project's top and bottom line. Code compliance is another benefit: These acoustical drywall products are fire-rated (ASTM E 84 and ASTM E 119) as well as lab (ASTM E 90-05) and field performance-tested.

In addition to familiarizing the readers with the basics of noise transmission and industry standards, this article will compare available methods of sound control to answer the question: what advantages do new generation acoustical control products really offer?

Acoustical performance is key in today's multifamily housing arena.

Photo courtesy Supress Products

Available Sound Control Solutions

Designing or upgrading a building to incorporate proper sound control can be a complicated effort, requiring the collaboration of architect, acoustical engineer and developer. The best time to consider sound solutions is always the sooner the better, as post-construction modifications or retrofits are inefficient and costly.

A typical residential wall is made of drywall rigidly attached to both sides of a stud frame, which can be either metal or wood. Because of the rigid connection, as sound waves hit one side of the wall, the drywall on the other side will vibrate. Because there is nothing to isolate or absorb the sound, noise is easily transmitted through the wall and throughout the nearby floor and ceiling. The standard party wall—a single layer of 5/8-inch drywall on each side, wood studs, and no insulation—has a Sound Transmission Class (STC) rating of 34, which performs so poorly that loud speech can be easily understood.. Architects should note that a condo/townhome/apartment wall with an STC rating of 34 does not meet UBC code requirements of STC 50+. Several strategies can increase a wall's STC rating, and often an effective approach involves combining one or more of these methods.

Sound Ratings: What They Mean

There are two types of ratings used for sound control: **Sound Transmission Class (STC)**, which measures airborne sound, such as speaking, music, etc.; and**Impact Insulation Class (IIC),** which measures impact sound, such as that from people walking, moving chairs, dropping objects and the like. The current International Building Code requires a minimum IIC rating of 50 for both, and 45 if field-tested.

Sound Transmission Class (STC). Sound transmission class is a number rating of how well a building partition—wall, ceiling, floor, door—blocks airborne sound. For interior walls, STC values are derived from ASTM E 90, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions." ASTM E 90 measures a partition's ability to reduce the transmission of airborne sound at 16 frequencies between 125 Hz and 4,000 Hz, the frequency range of speech.

Following are some generally accepted facts about STC ratings.

- Loud speech can be understood fairly well through an STC 30 wall but should not be audible through an STC 60 wall.
- An STC of 50 is a common building standard and blocks approximately 50 dB from transmitting through the partition. But STC 50 is not enough to stop loud music from a neighbor's stereo which can exceed 100 dB. Although an STC 50-rated assembly will satisfy the building code requirement, residents may still be aware of, if not understand, loud speech from an adjacent apartment.
- STC 55 or STC 60 should be specified in sensitive areas where sound transmission is a concern. At STC 55, extremely loud sounds such as loud music from a neighbor's stereo will heard so faintly that the vast majority of the population will not be disturbed.
- Luxury accommodations are considered to require more stringent design goals of as much as STC 60. At STC 60 and above, considered the ultimate in soundproofing, most sounds will not be audible. Walls rated STC 65 and above are generally reserved for ultra-luxury hotels and multi-family structures or purpose-built home theaters.

The only thing is, there are inherent weaknesses in the STC rating system. STC ratings are heavily weighted toward speech frequencies, and are less accurate for a partition's ability to block low frequency noise, such as the bass in music, mechanical equipment noise, transportation noise or other sound with low-frequency energy below 125 Hz. STC ratings also represent testing in optimum laboratory conditions, and are rarely achieved in real world situations. The difference between Laboratory and field STC ratings stem from a structure's flanking paths—the small holes, roof voids, even windows and doors which decrease a wall's acoustic insulation. Consequently, the Field Sound Transmission Class or "FSTC" can be five to ten points lower than the laboratory STC. Yet regardless of what STC is selected, it is critical to control and seal all air-gaps and penetrations. Failure to do so can degrade the sound blocking capability of an assembly.

Impact Isolation Class (IIC). As STC ratings refer to airborne noise, IIC ratings target structure borne noise. The term IIC refers to a measure of isolation effectiveness of building structures from impact noises such as slammed doors, footsteps, dropped articles, etc. in a multi-family building. Impact noises can be transmitted through walls, floors, and ceilings throughout a building and re-radiated at distant locations. The higher the IIC rating, the better the isolation. IIC is measured and stated in accordance with ASTM Standard numbers C634 and E989 and tested via the methodology of ASTM Test Method E492. Generally speaking, IIC values are not heavily influenced by the extent of solid mass in the structure, but are usually dependent on the presence of some sort of resilient material in the assembly that can isolate and absorb the energy created by impacts.

Acoustical drywall panels come in the same standard thicknesses as drywall.

Photo courtesy Supress Products

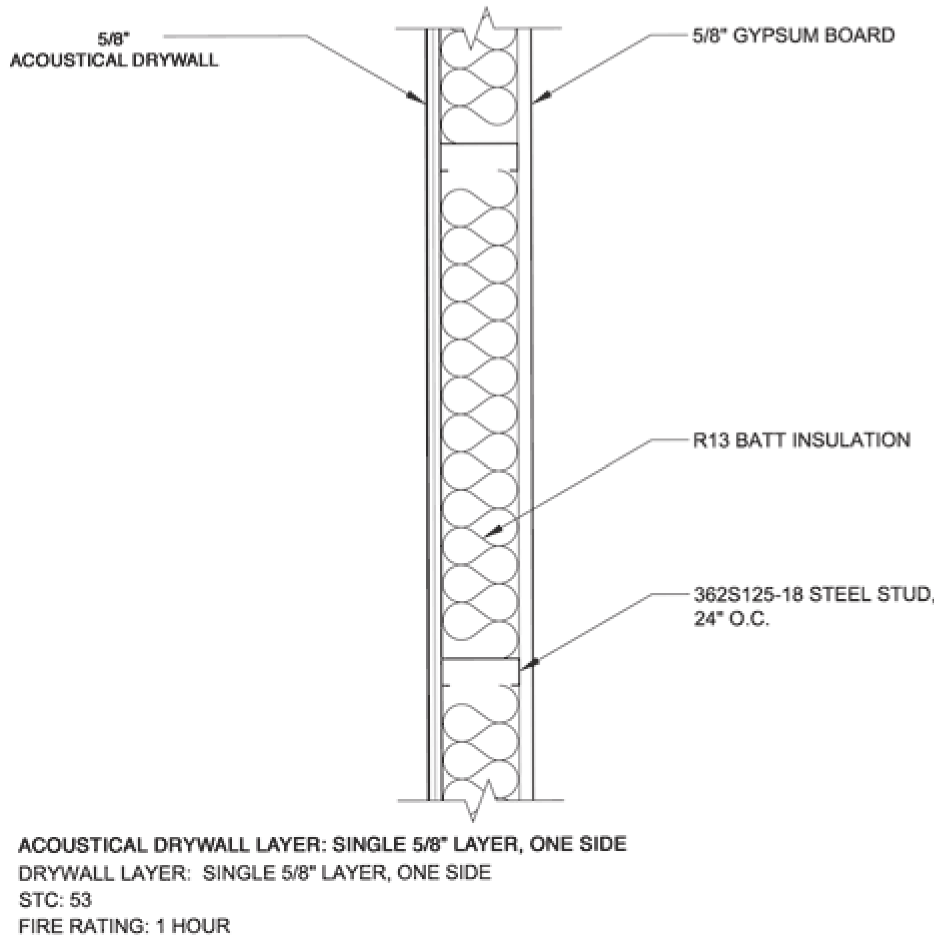
Acoustical Drywall

There are modern ways to create acoustically better structures. New technology is fast replacing traditional methods, achieving better acoustical performance without the mass, labor or expense of the legacy methods. "Sound is the number one issue in the drywall industry today," says drywall contractor Mike Mayock, Mayock Drywall, San Rafael, California. "With acoustical drywall, you're saving space commercially, you're eliminating litigation after the house is built. It's something so simple to do compared to old sound suppressing techniques."

On the market for more than two years, one type of new technology product makes use of damping, an acoustical process that decreases the wall's ability to conduct vibration and minimizes resonance problems. Essentially, the 5/8-inch-thick version of this drywall consists of two thinner layers (two 5/16 inch, or one ¼ inch and one 3/8 inch sheets of drywall sandwich a sound-absorbing viscoelastic polymer-based laminate layer. The wall assembly would consist of one layer of 5/8-inch acoustical drywall on one side of the stud and one layer of standard 5/8-inch drywall on the other side of the stud. When one side of the sandwich starts to vibrate the middle polymer layer shears the sound vibration and converts that energy into heat.

The benefits are discussed below:

Wall Assembly Drawing: New Construction — Metal Studs



Source: Supress Products

Acoustical Performance. Next-generation constrained layer damping products offer high-performance sound and vibration absorption, with the most advanced meeting high acoustical standards (STC 61-78+), impact isolation (IIC 51-74) and vibration absorption while featuring non-toxic, biodegradable, and a 2-hour fire-resistance rating (ASTM E 119).

Adding Back Re-Saleable Square Footage. As mentioned previously, a metal-stud wall with three or four layers of fired-rated drywall is a typical sound wall in a multifamily structure. Most sound walls have sound insulation in the cavities as well as the double layer of drywall, or are a configuration which includes staggered studs.

Acoustical drywall can achieve the same or better acoustical performance in just one layer, which means that effectively two or three layers of conventional drywall (and additional layers of insulation) can be replaced with one layer. "Even with the higher material cost of acoustical drywall, the less actual board needed combined with lower labor costs add up to significant savings," says Gregg Jacobs, Vice President of Operations for Supress Products, which manufactures suppressive building materials for use by architects and professional builders. "In a condo situation that means adding back a considerable amount re-saleable square footage to the project. In some cases that can translate into millions of dollars in a prime condo project in a major city."

Acoustical panels have real-world value-engineered savings versus traditional methods which use conventional drywall, resilient channel and sound clips.

Mold Resistant. Drywall is the type of material that, when exposed to moisture, promotes mold growth quickly and easily. On a scale of 0 to 10, some acoustical panels have achieved a mold suppression score of 10 in the ASTM D 3273 test, indicating no mold growth in a 4-week controlled laboratory test, the highest possible on the ASTM D 3273 test. Standard drywall products score about a 5 on this test, which means that standard drywall needs special care in terms of packaging for shipment, storage prior to installation and storage during inclement weather conditions on the job site. Considering new construction and newly retrofitted buildings are built very tightly so that energy efficiency is maximized, the lack of air movement in these buildings often promotes the growth of mold and the propagation of mold spores, further compounding problems and requiring mitigation or removal expense for builders, building owners and occupants. Acoustical drywall which offers mold-resistance maintains a distinct advantage over standard drywall products and sound-suppressing techniques.

A Green Product. Acoustical drywall improves sustainability by eliminating one-third to one-half of the drywall required in traditional wall assemblies while delivering enhanced acoustical results. Since drywall consumes a lot of energy during manufacturing, reducing the amount of drywall in the wall assemblies saves energy and eliminates the transportation and waste associated with those additional layers, all of which have a positive environmental impact.

Further, laminates and adhesives made of non-toxic, water-based materials result in minimal off gassing, another environmental positive. The other material which is non-toxic is the viscoelastic, polymer-based laminate in between the layers of drywall. Any waste material from the acoustical drywall is environmentally friendly so it can be recycled without any adverse environmental impact.

Drywall gypsum manufactured in the United States as opposed to Asia will reduce energy to ship overseas. Manufacturers with production plants across the United States can further reduce energy consumption associated with shipping its product across North America. Shipping via rail is nearly four times more efficient that trucking. According to statistics offered by Union Pacific, since roughly 200,000 pounds of acoustical drywall can be placed on one center beam railcar versus just 45,000 pounds on a truck.

Thin Panel Construction. Panels come in standard ½-inch, 5/8-inch, ¾-inch, and 1-inch thicknesses, with each successive width offering additional sound attenuation properties. Some acoustically engineered drywall can achieve levels of soundproofing up to STC 78; ¾-inch panels are recommended for home theater applications and 1-inch for professional recording studios, as these panels have the capability to reduce low frequency noise. Depending on the wall construction, the 1-inch acoustical product can achieve STC 80+.

The Metal Factor. There are different types of acoustical panels, some of which use metal and ceramic. Acoustical panels that use sheets of metal and cement or ceramic in layers in an effort to boost acoustical performance and fire resistance pose problems—they are difficult to cut and install correctly, and interfere with or prevent cellular calls, wireless network transmissions, and general communication with and between other wireless devices.

Effective in Remodeling. Acoustical drywall can also be effective in renovation and remodeling situations. The panels can be added directly to the existing standard drywall on one or both sides of the wall assembly and to the existing ceiling. No demolition is needed, nor is there any need to remove paint from the walls, provided the walls are in reasonable condition. An existing room in a condo, an office or even a whole structure that is undergoing conversion from rental apartments to condominiums can be readily upgraded. Other applications include existing hotel and motel rooms where excessive noise is a factor; a single layer of panel can be applied directly to walls and ceilings.

Easy Installation. Because the acoustical drywall panels install and finish just like standard drywall, no special skills are required and installation can generally be handled by existing drywall crews, enabling builders to keep their labor costs in line.

The panels can also be easily cut with standard commercial drywall routers and saws. It is important to measure the space and cut the panel to size, minimizing the gaps between panels and with other surfaces. Due to the aggressive nature of air- and structure borne sound, a contiguous application of the acoustical drywall should be made on all surfaces, meaning walls from floor to ceiling and with 100 percent coverage on ceilings, boxing-in recessed lighting, audio speaker fixtures, etc. with the same thickness of panel. Every gap between the panels and any cut-outs or penetrations for electrical outlets, pipes, fire sprinkler nozzles and such should be sealed with special acoustical sealant. After cutting, the panel is put in the correct position and attached with standard drywall screws measuring the appropriate length for the material and job. The acoustical panels may be applied to either wood or steel framing or directly on top of existing walls. Detailed installation instructions are often available on manufacturers' websites.

How Sound Travels

Sound can be classified into categories depending on its source:

- Airborne sound travels through the air, as in conversation, traffic noise, or music.
- Structure borne sound is transmitted through walls in the form of vibrations.
- Flanking sound, or sound leakage occurs through doors, windows, or other wall, floor and ceiling penetrations that create paths for sound.

In a residential setting, sources of structure borne sound are washers and dryers, exhaust fans, and footsteps. Airborne sound becomes structure borne when it passes through floors, walls, and ceilings. Structure borne sound becomes airborne when it is radiated by a wall. Air- and structure borne sound are very aggressive in nature and tend to spread out through the entire building. Open attic areas and plenums above acoustical ceilings allow sound to travel. Unless these paths are fully sealed—and that includes openings for recessed lighting, audio speakers, electrical outlets, fire sprinklers and the like—sound energy may pass through these areas, too, reducing overall acoustic performance. To suppress any unwanted sound perceived as coming through a common wall, sound control coverage may have to be extended to the adjacent hard flooring surfaces, walls, ceilings or virtually any penetration in walls, ceilings or floors.

Traditional Methods

As an alternative to acoustical drywall, several traditional techniques can be used to control sound. Alternatively, acoustical drywall can work in concert with traditional techniques such as using multiple layers of standard drywall, channels, sound boards, insulation and resilient clips.

Adding Multiple Layers of Drywall. In simple terms, the thicker or heavier the structure, the harder it is for sound waves to penetrate it. But other factors must be taken into consideration. Adding layers of standard drywall to a wall will help to block the path of noise. Merely doubling a wall's mass, however, will not double its STC rating. In fact, going to four layers of drywall on a typical stud wall yields only a small benefit, garnering only a 4-5 dB improvement. Changing a wall's sound attenuating capacity means making significant changes in mass. Often, the sheer amount of mass that would yield meaningful benefits would be impractical from a cost perspective and would also reduce the usable square footage of a structure. Simply adding multiple layers of drywall to a standard wall is considered by some to be the least effective way to improve sound proofing.

Adding Absorptive Material. Adding insulation as absorptive material within the assembly will block some sound just as it blocks airflow. The key benefits of insulation are best realized with mid- and high-frequency noise, such as conversation; however, insulation does lose its effectiveness against the low end of the frequency spectrum, such as that troublesome bass from the neighbor's stereo. Insulation will have little or no effect on structural noise, so the HVAC system or a vibrating dishwasher or washer/dryer will continue to be audible. Better sound control can be achieved via damping materials added to the assembly; these materials reduce the vibrations allowed to pass through to the adjacent room.

Mechanical Decoupling. Breaking sound's vibration paths by decoupling, or disconnecting two sides of a wall, will decrease vibration and increase transmission loss far better than merely adding successive layers of mass to a wall assembly. Structurally decoupling the drywall panels from each other can result in considerable improvements in STC, though only in that part of the spectrum well above the low frequency resonance.

The same goal—reducing the sound movement from one side of the wall to the other through the studs—can be achieved to various degrees by different decoupling methods, including sound clips, resilient channels, double stud walls or staggering the joints between panels of drywall. Double stud walls offer the greatest potential to boost sound control and can achieve STC ratings of as high as 63 with improved low-frequency transmission loss, as well.

Long used as an inexpensive approach to sound control, the resilient channel can add up to five or more STC points, though that is not usually enough to gain significant noise reduction. To boost sound control capabilities, mass can be increased or absorbent material added within the wall cavity to cushion the channels and "soak up" the sound waves. Hat channels, Z-channels and similar systems resemble true resilient channels, but are too stiff to allow movement, and consequently are acoustically ineffective. After installation, it is advisable to check the wall for flex—no "give" means the channels are too rigid to be acoustically effective.

Its complicated installation process has earned the resilient channel a poor track record. Proper installation is critical. A contractor can "short out" the resilient channels by merely screwing long screws into the wood studs behind the channel—a misstep that will cancel out any advantage of using a resilient channel. Industry experts note that the vast majority of resilient channels are faulty due to poor installation, and some architects and engineers are reluctant to specify them for that reason.

Sound Boards. Made of compressed wood, sound boards function as a thick paper cushion or damping layer between studs and drywall, with the assembly addressing sound control on two fronts. The drywall provides the mass to inhibit sound transmission, while the lighter-weight sound board traps noise in higher frequencies passing between rooms or exterior walls. The extra labor and material cost required to achieve relatively minor increases in STC, constitute the main drawback in sound boards as an effective sound solution.

Many of these traditional methods have substantial drawbacks, notably their tendency to increase labor and material costs. Further, in some cases, the depth of the required partition takes up valuable floor space. Installation is critical and often complicated. Even seemingly minor installation mistakes will have a direct bearing on the effectiveness of the technique.

Why Sound Control Matters

For years, interior walls were made of large studs covered with wood lath and several layers of plaster—a far cry from the thin walls that are prevalent today. Consequently, noise is on everyone's agenda, from consumers to regulators to litigators.

How Sound is Measured

Decibels. A decibel (dB) is a unit that measures the*intensity* of a sound. The decibel scale is logarithmic rather than linear. The smallest audible sound, near complete silence, is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than silence is 20 dB. A sound 1,000 times more powerful is 30 dB. Here are some common sounds and their decibel ratings:

Near total silence	0 dB
A whisper	15 dB
Normal conversation	60 dB
A lawnmower	90 dB
A rock concert	120 dB
A gunshot	140 dB

Distance influences a sound's intensity. The farther away the noise source, the less its power. It is generally accepted that prolonged exposure to a sound above 85 dB can cause hearing loss. Voices will have to be raised in order to be heard over an 85 dB sound. A rule of thumb is if you can't carry on a normal conversation with someone and you have to shout to be heard, the sound is more than 85 decibels. In general, 85 decibels is considered the safe limit for an eight-hour workday. Anything over that — more noise or longer exposure — can cause permanent hearing damage. The National Institute for Occupational Safety and Health (NIOSH), which has set the safe limit for noise exposure at 85 dB for 8 hours a day, maintains that each time the noise level increases by 3 dB, safe exposure time is cut in half. For example, at 88 dB, the permissible exposure time would be 4 hours, and at 91 dB, the permissible exposure time is 2 hours.

Hertz. Another important measure of sound is*frequency*, which measures the number of vibrations per second and is expressed in Hertz (HZ). The human ear can hear frequencies between 20 HZ to about 20,000 HZ, though the audible frequency range becomes narrower with age. Low frequency sounds have a low pitch, such as a human's heartbeat. High frequency sounds have a high pitch, such as a dog whistle. At the lower end of the frequency response spectrum are bass sounds—generally below 310 HZ. Midrange frequencies from 310 HZ to 12,000 HZ include the human voice and musical instruments such as piano. Examples of the highest frequencies, from about 12,000 to 20,000 HZ, include the highest notes produced by the human voice, a dog whistle, cymbals and certain string instruments.

Consumer Demand

The discerning tastes of consumers have worked to create the trophy building. "Developers are asking for so much more out of every square foot," says builder Adam Elias of Idaho-based Elias Construction. "We're building much, much nicer houses than we did ten years ago, and buyers of these houses are more sophisticated than they've ever been." Today's apartment and condo dwellers are paying top dollar for their units—and with high expenditures come high expectations, particularly when it relates to having a quiet space. Adding to the demand for silence is the fact that more Americans are working at home—a scenario that makes acoustical isolation and the immunity of a dwelling unit to city and neighbor noise even more of a priority.

Today's consumers demand a quiet living space.

Photo courtesy Supress Products

Shortage of Quiet Building Sites

Consumer demands are complicated by the dwindling supply of first-rate developable land, and builders are forced to construct properties in less than ideal areas. "All the good sites are gone," says Mike Doty, AIA, Michael Doty Associates, Architects, PC, of Ketchum, Idaho. "We find ourselves designing projects on sites with more constraints, such as next to a highway, where people wouldn't have taken that on ten years ago."

Awareness of Noise Pollution

There is a growing realization among consumers that noise should be considered a pollutant in the same way as any environmental contaminant, and that sounds which are disturbing and loud are not only annoying, but they can actually produce adverse physical and psychological effects in humans. Studies also show that for Americans living in multi-family residences, noise—and particularly loud music—is the prime complaint. Research documents that exposure to noise is seen as producing conditions from aggression to hypertension, high stress levels, tinnitus and hearing loss. Because it keeps the body in an alert state and causes chronic stress, noise pollution has been linked with heart attack and strokes. According to a 2008 study in the *European Heart Journal*, any noise louder than 35 decibels—whether it's from passing traffic or a snoring partner—causes an increase in blood pressure even when the person remains sleeping.

Building Codes

New, sophisticated building codes require architects to create, and builders to produce, air-tight structures with exceptional strength and fire-resistance. Unfortunately, these safe practices result in buildings that are also efficient at transmitting unwanted noise and sound energy throughout, just like a network. Formerly, between adjacent condos were double walls with a one-inch air space—just enough space to dissolve noise. The stricter codes meant lining the inside of the walls with fire-rated drywall, which has narrowed the gap and, consequently, the wall's ability to dissipate sound. All residences and commercial properties are prone to this issue, with multi-family buildings the most prone to sound complaints due to the close proximity of neighbors, living adjacent, above and below.

At the same time, the Uniform Building Code (UBC) contains requirements for sound isolation for dwelling units in the so-called Group-R occupancies, which include hotels, motels, apartments, condominiums, monasteries and convents. Requirements relate to both airborne and structure borne noise and will be detailed below.

Litigation

Increasingly, sound that travels through a structure's shared walls has become of concern to architects and developers and for good reason—they can be held legally accountable for poor acoustics. With the rising awareness among homeowners of noise standards stipulated in building codes, there has been a surge over the last decade in construction defect claims. Sound is a major source of litigation for builders, second only to mold intrusion. California enacted a law that gives even more specific rights to condo and town home buyers. SB 800 was signed into California law on September 20, 2002, and applies to new construction intended to be sold as individual dwelling units, whether as single-family homes or attached units. This law grants rights to owners of new construction for a one-year warranty for noise transmission from adjacent units. Other states are following suit. In an effort to ward off excessive litigation, a "right to repair," which could allow homeowners and builders to avoid a lawsuit by attempting a good faith repair, is on the books in more than 30 states. The take away from the spate of actual litigation and good faith repairs is that the most cost-effective solution is to stop noise problems before they happen.

With sound control in the built environment, one thing is clear: as an issue it is here to stay. Demanding consumers, potential lawsuits, stringent building codes and the deleterious effects of noise on human health and welfare will force the building industry to adopt cost-effective acoustical control measures in their projects. Architects have an ever-evolving raft of sound control methods and technologies from which to choose—a situation that demands careful consideration of the right tools for a particular project. Adam Elias sums it up neatly. "As builders, we better understand sound and how it works, or we're going to be driven out of the market."

STC ratings are not an accurate gauge of a wall's ability to block low frequency noise, such as the bass in music.

Photo courtesy Supress Products

Quieting The Home Theater/Music Room

Completely soundproofing a home theater can be an expensive proposition. Modeled after the approach to isolate recording studios and concert halls from outside sounds and vice versa, the top method is to construct a "room within a room," or a set of double walls such that nothing in one wall touches anything in the other. While this may truly soundproof an area, it is too expensive for most home theater projects.
While a quiet room is typically around 40 dB, a high-end home theater might produce sounds up to 110 dB. A considerable portion of the sounds coming from home theaters will be music or movies, both of which are high in low frequency sound. While convention says that the wall between the two rooms should have an STC rating of 60, that is only part of the picture. An STC rating measures only mid- and high-frequency sound, not low frequencies.

Popular sound control methods for home theaters usually involve either sound barriers or sound absorption. Sound barriers can include fiberglass, some sort of foam or even fabric-covered walls and ceilings—none of which offer sufficient reduction in sound through the walls. Other family members or even neighbors will still be able to hear sounds coming from the theater.

Alternatively, acoustical drywall can be added directly to the existing standard drywall on one side or on both sides of the wall assembly and to the existing ceiling—with no demolition necessary. Thanks to its vibration-reducing capabilities, acoustical drywall that makes use of constrained layer damping—a viscoelastic layer sandwiched between two pieces of drywall—performs very well in home theaters. The ¾-inch- and 1-inch-thick panels address the low frequency base sounds and are equally, if not more effective than several layers of conventional drywall without the weight and bulk of the added mass. Constrained layer damping on a wall that has been decoupled can produce even greater results in sound reduction.

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