

NOISE POLLUTION 101:

HOW IS SOUND TRANSMITTED?

Whether silencing barking dogs and noisy neighbors or ensuring the privacy of hotel guests, health-care patients and the like, understanding the basics of how sound travels is essential in designing and constructing a more sound-proofed space that keeps excessive noise out – or in – depending on intended use. Sound travels along two primary paths; through the air and through the materials of the structure.

Airborne noise can creep under, around and through standard doors and windows. It can snake around edges of drywall sheets, through electrical or plumbing openings... basically any way in or out it can find. Once free, sound waves expand and take over their new found space. Sounds from adjoining rooms or street sounds from outside are examples of airborne noise. (FIG. 1)

Structure-borne noise travels directly through walls and floors when physical contact with a component occurs i.e. foot traffic from the floor above or hammering on a common wall. Striking the surface material on one side causes vibrations that are transferred to the airspace inside the wall or floor and then to the material on the other side making it possible for the noise to be heard. (FIG. 2)

HOW IS SOUND MEASURED?

Sound transmission is indicated in two ways; frequency and intensity.

Sound frequency is a measure of the number of sound waves, or vibrations per second, that reach the human ear within a given period of time. One vibration is called a hertz (Hz). The human ear typically has a range of 16 to 20,000 Hz. Our ears translate sound frequency into pitch, which can be high or low depending on the frequency, or hertz, level. The lower the hertz level, the lower the pitch; the higher the hertz level, the higher the pitch.

Sound intensity, or volume, is measured in decibels (dB) – and clearly is the most desirable to control. Below are typical dBA levels of common sounds and how the change in dB changes the perception of loudness. (FIG. 3)

FIG. 3 TYPICAL NOISE LEVEL COMPARISONS	
dB LEVEL	NOISE SOURCE
10	Normal breathing
20	Rustling leaves
30	Quiet conversation
50	Normal conversation
60	Loud television
80	Noisy office
100	Loud car horn
120	Jet plane take-off (100 feet)
130	Threshold of pain
CHANGE IN dB LEVEL	CHANGE IN PERCEPTION OF VOLUME
1 dB	Generally not perceptible
3 dB	Just barely perceptible
5 dB	Clearly noticeable
10 dB	Twice or ½ as loud
20 dB	Four times or ¼ as loud

FIG. 4 DECOUPLING DEFINED

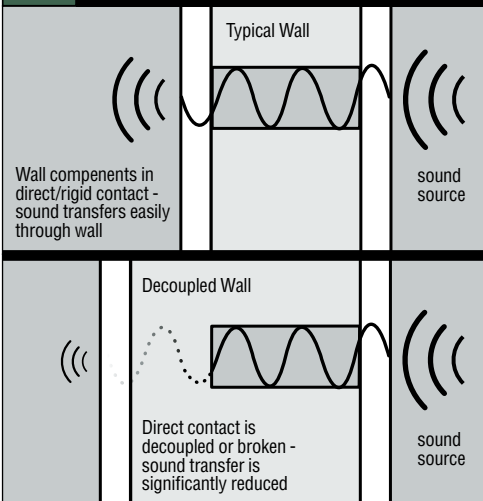


FIG. 5 STAGGERED STUD ASSEMBLY

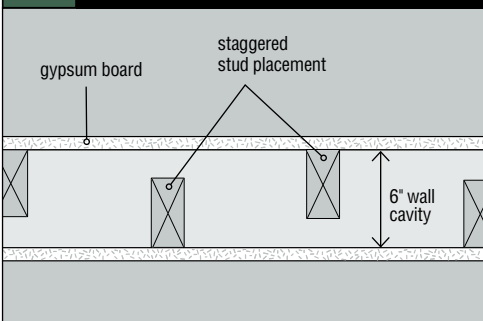
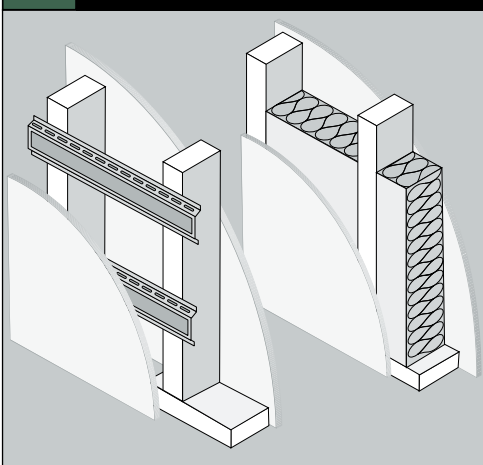


FIG. 6 RESILIENT CHANNELS AND INSULATION



HOW DO YOU CONTROL IT?

Minimizing noise infiltration room to room and from the outside in is a high priority for architects and builders alike. It can be a daunting task – and one that requires strategic design and well-chosen materials that absorb sound. There are four general techniques for sound abatement:

1. Eliminate the source. If the source is a tenant next door, this is obviously not a viable option...but you can minimize the source by “decoupling” the framing in walls. Sound is nothing more than vibration – and vibration travels most easily along a solid direct path. By separating the drywall on one side from the drywall on the other side, you decouple the solid pathway and the sound vibration will not travel as effectively. Less vibration means less noise. (FIG. 4)

Methods of decoupling include:

Double Stud and Staggered Stud Wall Assemblies - Eliminates the hard connection through the studs from the gypsum board on one side to the gypsum board on the other. Requires extra materials, labor and a deeper wall cavity. (FIG. 5)

Resilient Channels and Resilient Clips - Flexible metal channels or resilient clips of rubber or metal eliminate the direct rigid pathway that transmits sound vibrations. Proper installation is critical and can be inadvertently compromised if a nail driven into the wall creates a path between the gypsum board and a stud i.e. hanging pictures, etc. (FIG. 6)

While decoupling reduces much of the vibration that causes the unwanted noise, trapped air within a hollow wall cavity still vibrates, enabling some sound to be heard through the walls.

2. Absorb the noise. By increasing the amount of insulation inside the hollow wall cavity, you can absorb

some of the unwanted noise vibration. It’s important not to pack or compress the insulation in order to keep the density low, yet fill the entire space thoroughly. Commonly used insulation materials include: cellulose, mineral wool, recycled cotton and fiberglass. (FIG. 6)

3. Add mass. Basically, the heavier the wall, the less it moves. This means fewer vibrations and less noise. Generally two layers of 5/8" drywall are used. Other heavy materials include plywood, OSB and cement board.

4. Design smart. Location, location, location...when it comes to designing a space that’s relatively buffered from transient noise, placement of rooms, common areas, windows and doors are key. Things to consider:

- positioning private rooms away from noisy areas
- creating noisy-to-noise and quiet-to-quiet floor plan
- placing windows as far away as possible from common walls
- using closets, stairways and corridors as buffers against air-borne sound
- employing materials that are specifically designed to reduce noise

And take the time to spec smart.

When you combine the thicker walls and the deeper wall cavity needed for double or staggered stud assemblies and extra insulation, the quest for noise reduction can start to add up in terms of premium square footage...and don’t forget the cost of extra labor and materials. Specifying products that are designed to address sound transmission can save you time, money...and head off complaints down the road. Especially important for developers of multi-family projects in which noise complaints are a very real issue.

HOW DO YOU MEASURE PRODUCT PERFORMANCE?

Industry and government standards have been established in an effort to ensure comfortable noise levels in both residential and commercial buildings.

Sound Transmission Class (STC) is the most common acoustical rating. STC evaluates acoustical performance based on how effectively doors, walls and floors block noise from adjoining rooms. The STC system is measured in dB and is based on a series of ratings determined by ASTM International. The rating represents the difference in dB between the source room and the receiving room. An STC-55 rating or above is considered a high-quality building or luxury multi-family unit where residents expect relative peace and quiet. An STC-50 rating has been designated in model building codes as the minimum allowable design rating for unit-to-unit multi-family construction.

Impact Insulation Classification (IIC) is measured in dB and determines the sound impact from floor to ceiling in a structure. IIC is not used to measure airborne sound penetration or absorption in walls. The IIC rating increases with improved performance of the floor, its component sub-flooring, the ceiling materials as well as the framing and insulation separating the two.

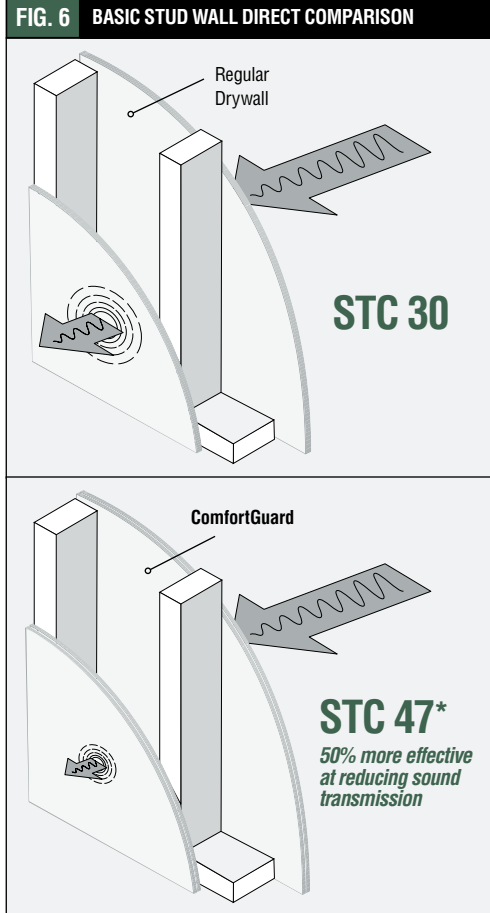
Noise Reduction Coefficient (NRC) is measured in percentages where the number 0 is no absorption and the number 1 (100%) is total absorption of the sound tested. The test is performed by placing the material on the floor in the test room and measuring the absorption of the sound when the material is exposed to four frequencies: 250 Hz, 500 Hz, 1000 Hz and 2000 Hz. NRC is not used to measure total assemblies.

HOW DOES COMFORTGUARD[™] SOUND-DEADENING GYPSUM BOARD MEASURE UP?

As you know, gypsum board is a good way to add mass to a wall. It's heavy, it's cost effective and it absorbs sound well. ComfortGuard takes it to another level. Designed from the ground up to be the best sound-resistant gypsum solution out there, ComfortGuard features two separate Type X gypsum panels, each including a mold- and moisture-resistant core and facers, laminated together using a viscoelastic polymer. With this pliable adhesive between its two rigid panels, ComfortGuard turns a normal wall into a highly noise-resistant wall with STC ratings ranging from 50-70 with no extra effort or special tools. Just score deeply, snap and hang – no saw required. Plus, ComfortGuard adds fire, water and mold resistance as well as an impressive recycled content making your project that much greener.

Sound Ratings and Transmission Results. When tested in a basic stud wall assembly in accordance with ASTM C423, a wall built with ComfortGuard produced an STC value of 47 compared to a value of 30 for standard gypsum board. ComfortGuard is over 50% more effective at reducing sound transmission than standard gypsum panels. (FIG. 6)

Used in a range of common sound wall assemblies, it can help deliver optimum STC ratings. When used in tandem with double stud or staggered stud wall construction – ComfortGuard can boost STC values substantially – with no risk of compromising the sound protection performance as with resilient channels or clips. ComfortGuard is a simple sound design solution that improves the effectiveness of any assembly, even the most elaborate.



*For basic stud wall assembly. ComfortGuard can bring STC ratings ranging from 50-70 when used in assemblies designed for sound control.

ASK US

about our approved U.L. assemblies using ComfortGuard Sound-Deadening Gypsum Board.

ComfortGuard is the ideal material for schools, hotels, hospitals, multi-tenant commercial or residential construction – or any project requiring a high level of sound protection as well as outstanding fire and mold resistance.

For more information on ComfortGuard's outstanding sound ratings, fire, mold and moisture resistance as well as the green benefits, visit our website.

