HUSHFRAME®
SILENCE THE NOISE

# Raft® Connectors

**Noise & Vibration Isolating**
**Structural Decoupling Connectors**

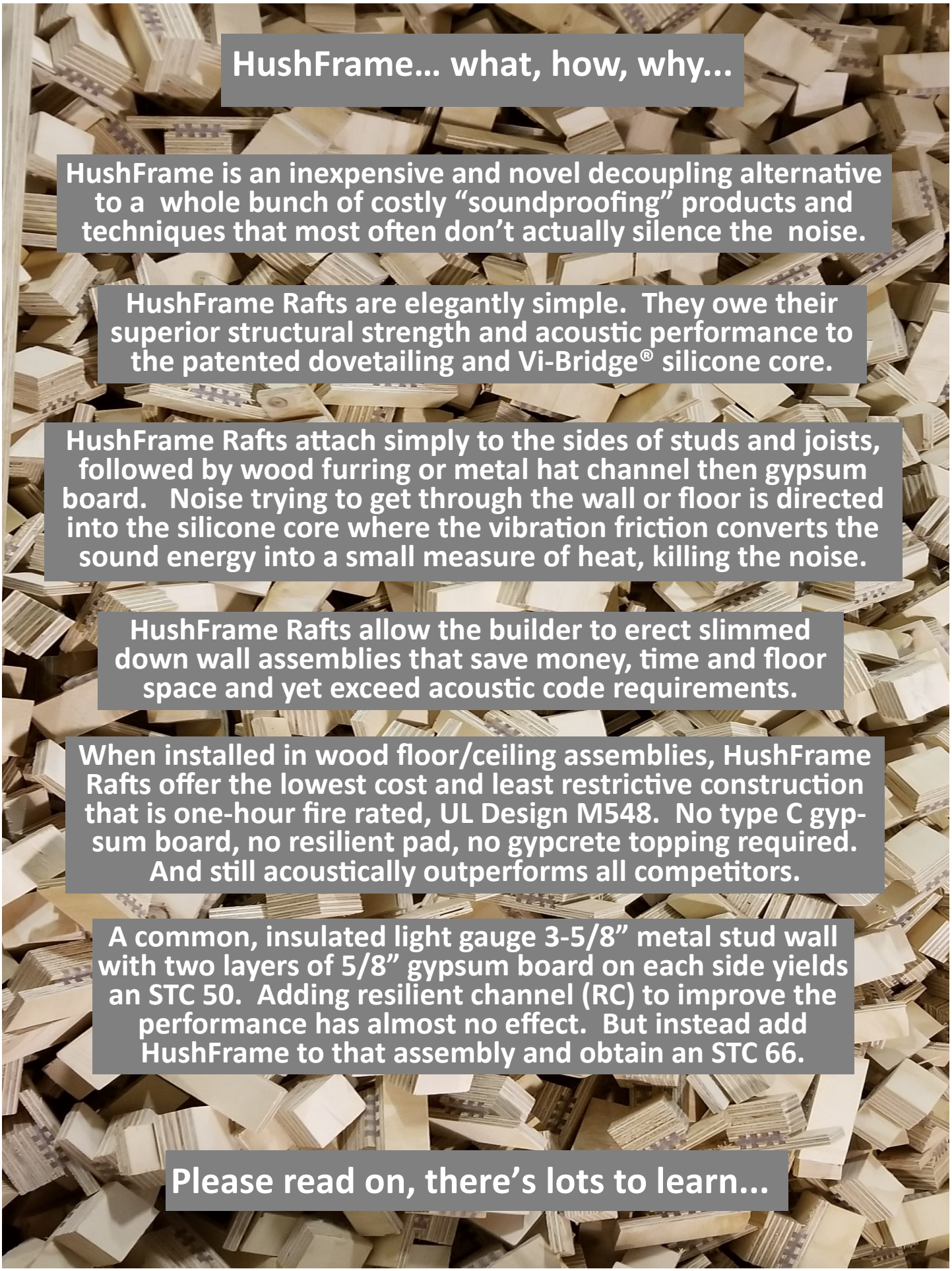
**For controlling the movement of sound through walls, floor/ceiling assemblies, and associated components of buildings.**

CLASSIFIED UL®


Distributed by:

**BCD, LLC**
**Building Component Development**
**55 Woodrock Rd., Bay 9**
**E. Weymouth, MA 02189**
**781-803-3382**
**sales@HushFrame.com**

**Proudly made in the USA**



# HushFrame… what, how, why...

HushFrame is an inexpensive and novel decoupling alternative to a whole bunch of costly "soundproofing" products and techniques that most often don't actually silence the noise.

HushFrame Rafts are elegantly simple. They owe their superior structural strength and acoustic performance to the patented dovetailing and Vi-Bridge® silicone core.

HushFrame Rafts attach simply to the sides of studs and joists, followed by wood furring or metal hat channel then gypsum board. Noise trying to get through the wall or floor is directed into the silicone core where the vibration friction converts the sound energy into a small measure of heat, killing the noise.

HushFrame Rafts allow the builder to erect slimmed down wall assemblies that save money, time and floor space and yet exceed acoustic code requirements.

When installed in wood floor/ceiling assemblies, HushFrame Rafts offer the lowest cost and least restrictive construction that is one-hour fire rated, UL Design M548. No type C gypsum board, no resilient pad, no gypcrete topping required. And still acoustically outperforms all competitors.

A common, insulated light gauge 3-5/8" metal stud wall with two layers of 5/8" gypsum board on each side yields an STC 50. Adding resilient channel (RC) to improve the performance has almost no effect. But instead add HushFrame to that assembly and obtain an STC 66.

## Please read on, there's lots to learn...

**HushFrame** is about sound… and noise.

Noise is described as unwanted sound.

In buildings, that noise is vibrational energy that travels in waves.

Those waves deliver noise to your ears by vibrating through walls and floor/ceilings.

Air-borne noise waves begin as speech, music, or perhaps traffic and enter the walls and floor/ceilings when it collides with their surfaces.

Structure-borne noise waves begin as footsteps, banging, or dragging furniture and enter the floor/ceilings through direct mass impact.

The ability of walls and floor/ceilings to resist the air-borne noise from getting through is measured as a rating known as the **Sound Transmission Class** or **STC.**

The ability of the floor/ceilings to resist the structure-borne noise from getting through is measured as a rating known as the **Impact Insulation Class** or **IIC.**

Both the **STC** and the **IIC** are expressed as a number, and for fighting noise the bigger the number the better. But more on that in a moment… first this:

The numbers used to measure sound are units called **decibels** or **dB's**, for example…*

| | | |
|---|---|---|
| **Painful Acoustic Trauma** | **140** | Shotgun blast |
| | **130** | Jet engine 100 feet away |
| | **120** | Rock concert |
| **Extremely Loud** | **110** | Car horn, snowblower |
| | **100** | Blow dryer, subway, helicopter, chainsaw |
| | **90** | Motorcycle, lawn mower, convertible ride on highway |
| **Very Loud** | **80** | Factory, noisy restaurant, vacuum, screaming child |
| **Loud** | **70** | Car, alarm clock, city traffic |
| | **60** | Conversation, dishwasher |
| **Moderate** | **50** | Moderate rainfall |
| **Faint** | **40** | Refrigerator |
| | **30** | Whisper, library |
| | **20** | Watch ticking |
| | dB levels | |

So, when your neighbor on one side has two young children who scream relentlessly, and the guy in the condo above is hard of hearing and insists on heavy metal music at nightclub volumes each night, you want respectable **STC** and **IIC** ratings for the walls and floor/ceiling separating you. Here's how that works… Generally speaking **STC** and **IIC** numbers correlate to decibels, only inverted or upside down, meaning the number represents how many decibels they silence. The bigger the number the less noise gets through. Consider the following…

* decibel chart courtesy of blogspot.com

When you have a **100 dB** noise (what we test with in the acoustic lab) attacking your common wall from the neighbor's side, you need a **50 STC** rated wall (the legal minimum) to limit that noise level on your side to **50 dB.**

The following chart will give you an idea of how **STC** ratings of walls correspond to noise levels you have to live with. If your wall or ceiling has a Lab STC 55 rating, as shown, you will normally be able to hear music from the neighbor.

| Lab STC | Field STC | Subjective Description of Effectiveness |
|---|---|---|
| 30 | 25 | Most sentences clearly understood |
| 35 | 30 | Many phrases and some sentences understood without straining to hear |
| 40 | 35 | Individual words and occasional phrases clearly heard and understood |
| 45 | 40 | Medium loud speech clearly audible and occasional words understood |
| **50** | **45** | **Loud speech audible, music easily heard** |
| 55 | 50 | Loud speech audible by straining to hear, music normally can be heard and may be disturbing |
| 60 | 55 | Loud speech essentially inaudible, music can be heard faintly, particularly bass notes |
| 65 | 60 | Music bass notes "thump" occasionally audible |
| 70 | 65 | Effectively blocks most air-borne noise sources |

The building codes mandate that at a minimum, walls and floor/ceilings separating dwelling units from each other and from common or mechanical areas of buildings, must have a lab tested **STC 50**, which is allowed to test as **STC 45** in the field. This **five** point reduction allows for a lack of understanding and attention to detail by the construction workers. So you can see in the chart above, if the neighbor listens to loud music and your walls and floor/ceilings are built to the minimum legal standard, then you're listening to that music as well.

The chart above reflects the reality of how **STC** values play into acoustic privacy in building construction. Most manufacturers and sellers of acoustic products publish **STC** charts that depict acoustic privacy in the **50-55** range, and this is false and misleading. It is a tactic employed to support the sale and use of inferior performing acoustic attenuation products.

**Actual acoustic privacy *begins* with an STC in the 60's.**

One last point before we move on. Sound transmission ratings in decibels are logarithmic. Simply stated this means that the reduction of noise emanating from a built wall that has its **STC** rating improved by **three** points will likely go unnoticed. Bump that to **five** points and most listeners will notice, but when the rating is improved by **nine** to **ten** points, the human ear perceives that as a **50%** reduction in the noise. This shows that if you want to satisfy the occupants of your dwellings, you have to swing for the acoustic fences, the **60's**.

So to understand how to defeat noise, let's first take a look at how typical residential buildings are built...

# Wall Section

Walls are typically framed with wood or metal studs and floor/ceilings are generally framed with TJI, open-web truss, or solid sawn wood joists. Walls and ceilings are typically covered with gypsum board panels and floors generally receive a wood panel sub-floor followed by many different finish floor toppings ranging from a simple additional layer of wood to more complex assemblies consisting of resilient underlayment padding followed by a layer of gypcrete and then various finishes including ceramic tile, vinyl sheeting, floating composites. Some type of soft insulating material is typically placed in the stud and joist bays.

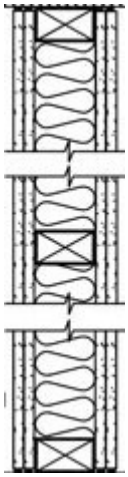
A simple framed **Single Wood Stud** wall built from **2x4** wood studs, with **5/8"** fire code gypsum board on each side and fiberglass batt insulation in the stud bays can achieve an **STC 36**, far short of the code mandated **50**.

**Tranmission Loss of Single Stud Walls**
**(California Office of Noise Control, 1981)**

Single Wood Stud Wall - 2 x 4 Stud
1 Layer 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 15 | 25 | 35 | 34 | 32 | 37 | 40 | 40 | 43 | 44 | 45 | 37 | 34 | 41 | 47 | **36** |

By adding a **second layer of the 5/8" gypsum board to each side of the Single Wood Stud wall** it is possible to achieve an **STC 45**, still far short of the code.



**Tranmission Loss of Single Stud Walls**
**(California Office of Noise Control, 1981)**

Single Wood Stud Wall - 2 x 4 Stud
2 Layers 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 24 | 40 | 37 | 36 | 42 | 45 | 46 | 48 | 50 | 51 | 54 | 55 | 50 | 47 | 51 | **45** |

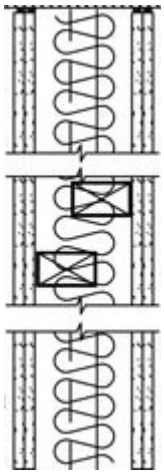
So builders build **Staggered Wood Stud** walls with twice as many **2x4**s placed on opposite sides of **2x6** plates that can achieve an **STC 46**, and again, still short of the code.

**Transmission Loss of Staggered Stud Walls**
**(California Office of Noise Control, 1981)**

Staggered Wood Stud Wall
2 x 4 Studs on a 2 x 6 Plate
1 Layer 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | 36 | 40 | 43 | 45 | 45 | 45 | 46 | 47 | 49 | 50 | 49 | 45 | 42 | 46 | 53 | **46** |

By adding a second layer of the **5/8”** gypsum board to each side of that **Staggered Stud** wall it is possible to obtain an **STC 53**, meeting code but not achieving acoustic privacy.



**Transmission Loss of Staggered Stud Walls**
**(California Office of Noise Control, 1981)**

Staggered Wood Stud Wall
2 x 4 Studs on a 2 x 6 Plate
2 Layers 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 39 | 45 | 45 | 49 | 49 | 52 | 53 | 54 | 55 | 56 | 57 | 54 | 50 | 53 | 57 | **53** |

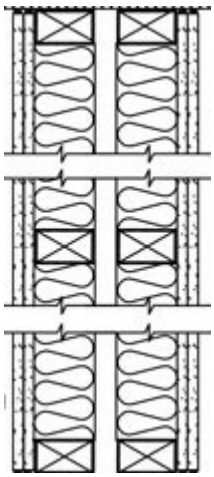
To achieve a higher level of sound attenuation, a common practice is to build **Double Stud** walls: two parallel walls separated by a one-inch air gap that can achieve an **STC 56**, again meeting code but not achieving acoustic privacy.

**Transmission Loss of Double Stud Walls**
**(California Office of Noise Control, 1981)**

Double Wood Stud Wall
2 x 4 Studs Separated by a 1" Gap
1 Layer 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 41 | 44 | 44 | 51 | 56 | 56 | 58 | 61 | 62 | 63 | 62 | 53 | 52 | 58 | 62 | **56** |

Lab testing of **Double Stud walls with two layers of 5/8” gypsum board on each side** achieved an **STC 58**, satisfying the code but not the need for acoustic privacy.



**Transmission Loss of Double Stud Walls**
**(California Office of Noise Control, 1981)**

Double Wood Stud Wall
2 x 4 Studs Separated by a 1" Gap
2 Layers 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 38 | 43 | 48 | 51 | 54 | 57 | 59 | 61 | 65 | 69 | 70 | 70 | 67 | 68 | 70 | **58** |

Similar in dimension, **simple framed metal walls built from metal studs** offer an improvement in attenuation over wood stud walls, typically **Five STC** points, due to the inherent flexibility of the lightweight metal.

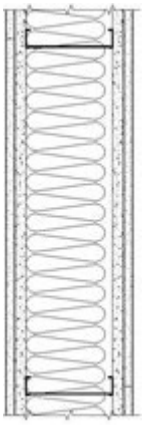
A framed wall built from **3-5/8" 26** gauge metal studs with batt insulation and **5/8"** gypsum board on each side can achieve an **STC 44**.

**Transmission Loss of Single Metal Stud Walls**
**(California Office of Noise Control, 1981)**

Single Metal Stud Wall - 3-5/8" Stud
1 Layer 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 35 | 40 | 42 | 43 | 48 | 52 | 55 | 57 | 57 | 57 | 54 | 45 | 40 | 44 | 50 | **44** |

Double the gypsum board on each side of the metal stud wall and it can achieve **STC 50**, just making the code minimum.



**Transmission Loss of Single Metal Stud Walls**
**(California Office of Noise Control, 1981)**

Single Metal Stud Wall - 3-5/8" Stud
2 Layers 5/8" Drywall Each Side
With R-11 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 37 | 42 | 45 | 48 | 50 | 51 | 52 | 52 | 52 | 51 | 49 | 49 | 48 | 48 | 50 | **50** |

Metal studs can also be used to construct staggered stud and double stud wall assemblies but it's far more common to find wood employed here.

## Ceiling Section, STC & Impact Insulation Class (IIC)

The building codes also require that the floor/ceiling assemblies separating dwelling units from each other and from common or mechanical areas of buildings, must have a lab tested **IIC 50**, which like the **STC**, is allowed to test as **IIC 45** in the field.

**A simple framed wood joist floor/ceiling** built from **14"** TJI joists, with a **3/4"** wood panel subfloor, **3/4"** wood finish floor, **6"** soft cavity insulation, and a one layer **5/8"** gypsum board ceiling installed on wood furring yields both an **STC 50** and an **IIC 38**.

**Transmission Loss of Wood I-Joist Floor Assembly**
**(BCD,LLC Test Data - RAL™ TL14-320)**

14" Wood I-Joists
2 Layers 3/4" OSB Panels
1 Layer 5/8" Drywall on Wood Furring
With 6" Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 29 | 31 | 40 | 41 | 44 | 46 | 51 | 54 | 54 | 55 | 53 | 51 | 48 | 51 | 59 | 65 | 72 | **50** |

**Impact Sound Transmission Test Wood I-Joist Floor Assembly**
**(BCD,LLC Test Data - RAL™ IN14-021)**

14" Wood I-Joists
2 Layers 3/4" OSB Panels
1 Layer 5/8" Drywall on Wood Furring
With 6" Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | IIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 78 | 76 | 80 | 79 | 78 | 76 | 75 | 73 | 70 | 68 | 64 | 61 | 59 | 61 | 59 | 51 | 43 | 33 | 38 |

Adding a second layer of **5/8"** gypsum board to the ceiling results in lifting the performance to an **STC 52,** but only an **IIC 42**, way short of the code. **Herein lies the significant challenge of getting buildings to code and beyond. There must be a better way.**

**How noise moves through these building assemblies is quite simple.**

The sound waves travel very efficiently through rigid materials, so when the noise collides with the gypsum board or flooring surface there are two pathways available. The first results from what's known as a "**Line Connection**", where the rigid surface "membrane" (gypsum board/plywood) makes contact with and is fastened across the full face of the studs or joists providing a broad, rigid path across and through the assembly, i.e. a mechanical coupling. The second is known as an "**Air Spring**", where a mass-air-mass resonance occurs. It happens in the stud/joist bay cavities, where a volume of air is trapped, boxed in by the framing members and the back sides of the membrane panels. In the open cavity the sound waves reverberate and the resulting cavity resonances carry the noise from one side to the other, similar to a mechanical coupling. Noise can and does often also find ways to "flank" an assembly. "**Flanking"** is when noise finds a way to escape over, under, around, or through the mass of assembly components. This can result from gaps under doors, poorly installed electrical receptacles, ductwork, and plumbing penetrations that are not properly sealed. Paths can be created simply by failing to seal the perimeters of an acoustic assembly with a non-hardening caulking compound.

**Those small details absolutely matter in acoustics.**

So regardless of whether the initial source of the noise is air-borne or structure-borne, they both have to travel on the same pathways to cross through a building assembly. Simple strategies for defeating noise movement involve adding "**Mass"** to an assembly, some heavy dense material, typically involving extra layers of drywall. Then there's "**Absorption**": adding materials that will "absorb**"** vibration energy, think soft insulation batts in stud and joist bays, or a layer of resilient underlayment added to a finish floor composition. "**Sealing**" the assembly perimeters and other flanking paths with an acoustically compatible caulking compound, flexible gaskets, putty pads and the like are other options. A critical and most effective arrow in the strategy quiver is "**Decoupling**", which essentially means separating the assembly into two parts and denying the noise vibration energy a bridge to cross between them. On the upper end, an example of decoupling would be in a recording studio where two independent, high mass, and heavily insulated parallel walls are built side by side on separate plates of dense

resilient material. On the low end, a thin metal perforated furring strip known as "**Resilient Channel**" (**RC**) is attached in rows perpendicular to the faces of the studs or joists after which the gypsum board is attached to the furring, with some noise attenuation expected from the resilience of the furring strips.

**So the first strategy to defeat assembly noise is absorption.**

Get some soft insulation material in assembly cavities to defeat the air spring. There are a number of manufacturers offering specialized "acoustic" insulation, but here we find some smoke and mirrors. Certified acoustic laboratory testing has taught us that basic unfaced fiberglass batt insulation does the job perfectly. You can expect a **3-5 dB** improvement for the first **3-1/2"** thickness of the batts and roughly **1 dB** per inch up to **8"** where it starts to drop off. Stuffing insulation that's fatter than the depth of the framing members will likely create a structural bridge between the panels due to stiffening from batt compression and reduce its effectiveness. Cavity insulation has its limits. And under no circumstance should rigid or closed cell foam insulation be used in an acoustic assembly if you wish to avoid litigation, for the simple reason that the lack of resiliency in the material turns the assembly into a drum.

A dense absorptive wall to wall carpet with a heavy foam or jute pad underneath is a remarkably effective answer to structure-borne (**IIC**) noise in floor/ceilings, but this amenity has generally fallen out of favor. And while this strategy can typically add **20 dB** to the **IIC** rating of the floor, it has its limitations in that it offers very little in the way of improvement of the airborne performance, in the range of **3-5 dB** of the **STC** rating.

**The second strategy employed to defeat noise is adding mass.**

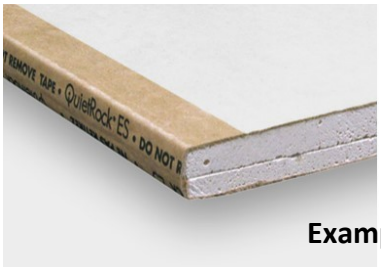
Typically as layers of gypsum board on walls and ceilings, and various thicknesses of cementitious and gypsum based topping materials employed as underlayment for floor systems. There are also numerous specialty products that are based in mass theory, such as Mass Loaded Vinyl (MLV), resilient glue for sandwiching layers of gypsum panels in place, and a line of prefabricated hybrid laminated gypsum panels that boast a resilient or damped core.

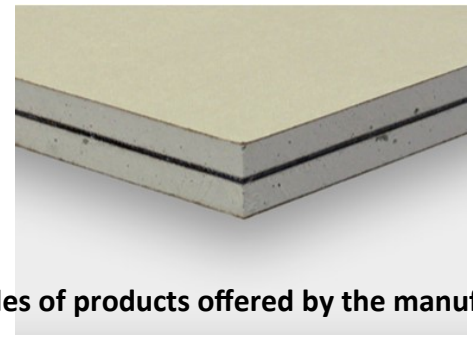
In a nutshell, MLV claims superior performance against some noise frequencies due to the resilient make-up of the material but the reality is that this is an old product developed at a time when alternatives didn't exist. At best, when installed in a simple wood stud wall built with single layer gypsum board a gain of **6 dB** in transmission loss is possible. When installed in a ceiling any gain in **STC** or **IIC** is negligible. This product is very difficult to handle, install, and with a material cost **5-10** times that of a layer of gypsum board (which outperforms it), it has no place in a contemporary assembly.

On to that colored "glue" that's applied to the surface of gypsum board and then sandwiched by an additional layer of gypsum board. Marketed as a damping product it has shown some efficacy in simple wood stud walls and joist ceilings. A **6 dB STC** and **7 dB IIC** improvement is claimed when installed in a resiliently isolated wall or floor/ceiling assembly.

Material cost is in the **$1.25-$1.50** per sq. ft. range. This is a damping material and not an adhesive, so as the "glue" isn't actually a glue, the cover sheet of gypsum board requires screw attachment through to the framing, "short-circuiting" the assembly by allowing the noise vibration energy to travel across the screws from the framing to the gypsum board surface.

Most gypsum board manufacturers have gotten into the acoustical products market by offering specialty boards that contain either an extra dense compound, mixtures of fibers, or a laminated core of some damping material sandwiched between two gypsum sheets. One product line contains as many as six layers, including a steel sheet in the mix, and weighs **220 lbs.** for a **4'x 8'** panel. Most require cutting with a special saw and with a few exceptions these panels are not suitable to be used on ceilings.



**Examples of products offered by the manufacturer QuietRock**

And these products are expensive, ranging from a **1/2"** board for **$1.75** per sq. ft. to that **220** lb. **1-3/8"** giant that costs upwards of **$12.50** per sq. ft. Considering the cost of typical **Type X 5/8"** board is in the **30** cents per sq. ft. range, you have to think long and hard about what you will be getting here. A **3-5 dB** gain over standard board is the norm, although that **1-3/8"** panel is claiming an **8 dB STC** improvement. And there're those pesky screws short-circuiting.

**A more complex strategy to defeat noise involves what is know as "Decoupling"**

Where the finish assembly membrane is denied line connection with the surface of the studs or joists and is instead attached via "**Point Connections**". In one such scenario the membrane attaches to a metal "**Resilient Channel**" ("**RC**") which in turn is attached in rows perpendicularly to the faces of the framing members thereby limiting the area of connection to each "**Point**" of contact. In a second decoupling scenario, the membrane attaches to metal resilient "**Hat Channel**" which is in turn inserted into the slotted faces of small metal devices known as "**Resilient Sound Isolation Clips**" (**Clips**). The **Clips** attach to the faces of the framing members in spaced rows, and in a manner similar to the **RC**, create point connections that limit the pathway available to the noise energy. There are also a few other decoupling strategies for floor/ceilings that incorporate things like "**Spring Hangers**" and comprise suspended ceiling systems. And don't forget those **staggered stud and double stud framed walls**, those are also employing a type of decoupling by separating the connection of one wall membrane to the opposite.

**Decoupling is by far the most effective way to control noise transmission through walls and floor/ceiling assemblies.**

Resilient Channel, **RC**… you see it everywhere, on walls and ceilings, mostly in wood-framed buildings, but it's everywhere. Builders flock to it, and I use that phase purposefully. Where can you find a readily available, inexpensive, quick and simple to install, and broadly accepted noise control solution that comes with laboratory testing certification that your walls and floor/ceiling assemblies meet the minimum building code requirements? **RC**, that's where. Invented by USG (United States Gypsum) in the 1970's, they exited the business in the late 1980's and it's now manufactured by a number of companies who ride on the back of lab testing results nearly a half century old. Not saying the lab tests are no longer reliable, I'm saying the technology is outdated, greater understanding of noise control now exists, and we need to take a hard look at how we're currently constructing buildings that are going to be occupied for the next 50 or 100 years. We can do better to ensure the privacy and the quality of life of the occupants of these projects. There are sensible alternatives.

Properly installed in a simple wall or floor/ceiling assembly that's wood-framed with an extra layer or two of gypsum board, **RC** will provide a bare minimum **50 STC** or **50 IIC** rating that gets the building code official off your back. **Properly installed** is the operative phrase here, and consider this… USG (and others) estimates from their experience that **80%** or more of the installations of **RC** in floor/ceiling assemblies are short-circuited and failed. Here's an excerpt from a USG publication titled **"Fire & Sound in Multifamily Floors",** as follows:

*"The most common problem for both fire and sound in a floor/ceiling assembly is the use of the wrong length screw when attaching the wallboard to the RC-1 channel. All UL Designs require a 1-1/4 in. (32mm) minimum length screw to attach the RC-1 channel to the truss or joist. A 1 in. (25mm) maximum screw is required to attach the first layer of 5/8 in. (16mm) wallboard to the RC-1 channel. However, the wallboard is typically fastened with a screw that exceeds the 1 in. (25mm) maximum length. If the longer screw penetrates the RC-1 and anchors into the truss or joist, you have effectively caused the floor/ceiling assembly to fall well short of the designed STC and IIC numbers. More importantly, if the screw anchors into the truss or joist on the first layer of wallboard, you have no UL fire rating."*

**And they go on to say:**

*"In every UL Design, regardless of the number of layers of wallboard on the ceiling, the first layer of wallboard is supposed to be attached with a 1" (25mm) screw as a maximum length. Per the UL Designs, if this screw exceeds 1' (25mm), you do not have a fire rating and you will lose up to 10 STC and IIC points if these screws penetrate the trusses or joists. When the screw that attaches the wallboard to the ceiling penetrates through the RC-1 channel and into a framing member, the RC-1 channel is short-circuited. This has effectively eliminated the value of the RC-1 channel.* ***<u>An estimated 80% or more</u>*** *installations have short-circuited RC-1 channels in floor/ceiling assemblies. It is rare that a drywall contractor knows what length screw is required by the UL Design. They will typically use a 1-1/4 in. (32mm) length screw because that is what they usually use when attaching 5/8 in. (16mm) wallboard to the wall studs."*

That's just the beginning of why the industry should move away from what is the lowest

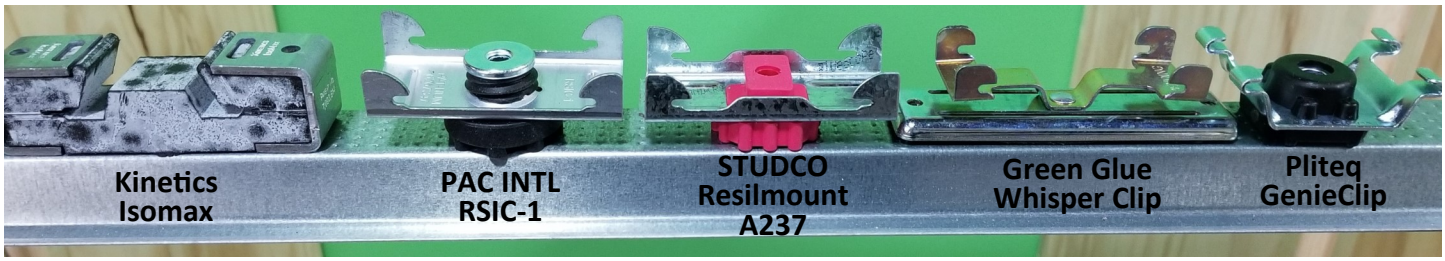
common denominator for noise control. **RC** is very weak in tension so nothing can be mounted on walls or floor/ceilings built with it unless the fixture is fastened through the resilient membrane and hard connected to the structural frame behind, which short-circuits the assembly and renders the **RC** acoustically ineffective. Another way of saying useless.

The published acoustic lab test data for **RC** shows the installation spacing as **24"** on center. Under **UL** Design for fire-rated ceiling installations, this spacing is only allowed for **RC** if there is **no insulation** material in the assembly cavities, the lack of which obviously removes any hope for acoustic attenuation. Quite the paradox. And for assemblies that use a **maximum** of **3-1/2"** batt insulation attached directly on the underside of the subfloor sheathing, **UL** Design requires **RC** spacing of no greater than **16"** on center, and for any further variation, such as placing the insulation batts directly on top of the ceiling gypsum panels (common practice) or using a thicker insulation batt, say **5-1/2"** (even more common) then **UL** Design requires even tighter **RC** spacing of no greater than **12"** on center. Do you have any idea what effect that tight channel spacing has on the **STC** and **IIC** values published for those **24" o.c.** assemblies? No you don't, because if they have been lab tested, the results have not been published. Expect significant acoustic degradation. The cost for the material varies widely between manufacturers and channel design, typically **$.50** to **$1.50** per lineal foot. If you have a **12"** on center installation to accommodate fire rating, the average cost would be around **$1.00** per square foot.

**RC** isn't used in conjunction with metal stud assemblies for sound control. As we've seen, the inherent flexibility of light gauge metal studs by themselves provides a **5** point **STC** improvement over wood studs, and the RC offers no further **STC** gain when installed in the metal assembly. But while **RC** is shown to be an unreliable and limited product, decoupling is still king.

**Let's take a look at the decoupling Clips on the market.**

And how and what they do. They are typically made from metal and incorporate an elastomeric polymer, like neoprene, to provide some isolation from the faces of the assembly framing members they attach to. A more robust resilient metal furring channel called **Hat Channel** (because of its profile) is secured to the legs of the **clips** via a friction fit (hence 'clip') and gypsum panels are then attached to the hat channel. **Clips** are used in wall and floor/ceiling assemblies in spaced rows similar to **RC** and when properly installed, provide an effective and reliable **STC** and **IIC** improvement. Below are some common examples of what's in the marketplace. With Isomax and Whisper Clip, the hat channel is installed in the clip, then the clip is attached to the structure. The others mount structurally first, then hat channel is squeeze snapped in place.



The material cost of these **clips** range from **$4.50** to **$6.25** per piece not including hat channel and the similar acoustic performance of assemblies incorporating the various **clips** lends support to the argument that mechanical decoupling is a superior standalone solution for combatting noise. A simple wood stud partition built with hat channel and **clips** will exceed the code with a single layer of gypsum board on each side of the wall, possibly reaching an **STC 56**. Double the layers of gypsum board and **STC 62** is possible.

But there are fundamental weaknesses and limitations with the use of **clips** in decoupling assemblies. All **clips** require metal hat channel furring which will not accommodate accessory attachment, similar to **RC**, requiring wood blocking attached to the structural frame for any shelving, cabinets, chandeliers, ceiling-mounted flat screens, or the like, which causes short-circuiting that defeats the decoupling.

All these **clips** are designed to be mounted on the face of the framing members. Hat channel is rigid and unbending, requiring flawless installation alignment of the **clips** on the framing member faces, and any warped, bowed, twisted, or crooked distortion of a wood framing member is problematic. A few of the manufacturers offer **clips** with brackets attached which allow mounting to the side of joists. This configuration allows for the furring to be recessed into the joist bay or extended below the joist plane to accommodate irregular joist alignment or plumbing, electrical, and mechanical clearance. These are not designed for use in wall assemblies and you should expect to pay **$8.50** per piece for this product.

**Examples of clips with side-mount brackets**

The squeeze snap installation of the hat channel is very stressful for carpenters, making those **clips** that require this step unpopular in the field. As you can see in this photo the carpenter is wearing heavy work gloves for protection and the stress on the hand creates a high level of discomfort that can lead to disabling ligament and tendon strain. To combat this, it's not unusual to see a carpenter utilizing a large pair of slip-joint pliers to perform this task, and if not carefully done the furring will be disfigured and compromised.

Assemblies that incorporate **clips** are inappropriate in seismic loading situations (areas prone to seismic activity) due to the fact that the hat channel is merely nested in the **clips** and not hard fastened allowing for unrestricted lateral movement. Accordingly, any acoustic attenuation project requiring decoupling efficacy in earthquake prone areas will have to consider what product to pursue as a replacement for **clips.** California certainly comes to mind as a region in need of an effective option.

**Clips** are primarily metal, not environmentally green, and are generally ineffective at helping to control low frequency noise. And installation in a fire rated assembly can get complicated. Consider this; when installed in a one-hour fire-rated **UL** Design assembly, as we saw with **RC**, the floor/ceiling construction requirements are far more restrictive than the assemblies the manufacturers depict with their acoustical assemblies.

For example in a **14' x18'** acoustical floor/ceiling assembly, the clip manufacturers show a device spacing of **24" x 48"** which would require a total of **48** devices to secure the hat channel. Because that ceiling has batt insulation in the joist bays to boost the **STC** and **IIC** ratings, in order to be one-hour fire-rated, **UL** Design **L576** requires Resilmount A237 clips to be installed in a pattern no larger than **12" x 48"** which increases the number of clips for that ceiling from **48** to **122**. And if you choose to go with Pliteq Genie clips or Pac Intl. RSIC-1 clips, **UL** Design requires a installed pattern no larger that **12" x 24"** which increases the number of clips for that ceiling from **48** to **163**.

**14' x 18" Wood Truss Floor/Ceiling Assembly Comparative Analysis**

| Devices | Batt size | Channel spacing required | Device spacing required | Devices required | Subfloor topping required | Total cost* | Cost per sq. ft.* | STC min. 50 | IIC min. 50 | UL Design | Seismic install | Type X gypsum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HushFrame 300 Rafts | 6-1/2" R-19 | 24" o.c. | 24 x 24 | 72 | none | $3,522 | $13.90 | **61** | **56** | M548 | Yes | Yes |
| Kinetics Isomax clips | 6-1/2" R-19 | 24" o.c. | 24 x 48 | 48 | min. 3/4" gypcrete | $4,591 | $18.20 | 51 | 54 | L583 | No | No |
| Resilmount A237 clips | 6-1/2" R-19 | 12" o.c. | 12 x 48 | 122 | 1x4 T&G, gypcrete, or 15/32" plywood | $4,870 | $19.30 | 53 | 53 | L576 | No | No |
| Pliteq Genie clips | 6-1/2" R-19 | 12" o.c. | 12 x 24 | 163 | 1x4 T&G, gypcrete, or 15/32" plywood | $5,014 | $19.90 | 53 | 53 | L576 | No | No |
| PAC Intl. RSIC-1 clips | 6-1/2" R-19 | 12" o.c. | 12 x 24 | 163 | 1x4 T&G, gypcrete, or 15/32" plywood | $5,259 | $20.80 | 53 | 53 | L576 | No | No |
| Resilient channel | 6-1/2" R-19 | 12" o.c. | n/a | n/a | gypcrete | $4,600 | $18.20 | 53 | 50 | L576 | No | No |

*Costs of assembly construction obtained from RS Means, Building Construction Costs 2017 and reflect identical structural components. Channel, device spacing, and floor finish requirements as dictated by UL design. Costs calculated using 15/32" plywood underlayment as the least expensive floor finish requirement for Resilmount, Pliteq, and Pac Intl. devices.

That's a very big impact on the economics of the assembly, and an unknown effect on the acoustic performance due to the fact that if such a densely decoupled assembly has been formally lab tested with these devices, the results have not been published.

The preceding chart shows how various sound control decoupling products affect the material costs of a **14' x 18' wood truss floor/ceiling assembly** that achieves a **one-hour UL** fire rating and conforms to minimum **IBC** codes of **STC 50** and **IIC 50 .** Only **HushFrame** leaves you free to add any floor finish you wish on top of the wood subfloor panel, no restriction, no gypcrete or delay and still obtain the best **STC** and **IIC** ratings for the lowest cost over any alternative.

**So let's talk about HushFrame**

The newest arrival onto the sound control stage and an elegant and simple answer that checks all the boxes. A green product manufactured with plywood produced from farm raised pine trees and containing no formaldehyde. Very wood and metal construction friendly , simple and flexible installation, the only decoupling product that accommodates both wood furring and metal hat channel. When installed in walls with wood furring no additional blocking is required for the direct attachment of cabinets and accessories to the decoupled assembly. Greater shear and tensile strength than other decoupling products for robust loading. Side mounting on the framing members accommodates recessed, flush, or extended positioning in the bays. The highest **STC** and **IIC** performance across the broad spectrum of wall and floor/ceiling assemblies.

**Technically, a very simple idea that really delivers.**

Scientifically, **HushFrame** owes its superior structural performance to the large area of dovetail interface between the components and its acoustic performance to the **Shore A** hardness of **25** property of the pure silicone core. Silicone is an absorptive material and the Raft performance is a result of the viscous drag mechanism of absorption where the transiting vibration friction converts the sound energy into a small measure of heat.

OK, so for the non-scientific types who just want a simple explanation… **HushFrame** is crazy strong because of the large surface area of the silicone core that provides a lot of contact and grip between the two wooden mount elements. **HushFrame** is acoustically more effective than **clips** because the noise has to go through the soft silicone core where it bogs down and can't move forward.

So where other sound control products offer varying degrees of success in preventing noise from migrating through walls and floors, **HushFrame** rafts actually consumes the noise energy in the large Vi-Bridge silicone mass. You could say that HushFrame literally feasts on noise.

This developer installed HushFrame in a dense grid to offset the challenges posed by shallow **12**" deep trusses, single layer gypsum ceiling, and hardwood flooring with no pad or gypcrete.

# HushFrame in Walls

**HushFrame** rafts installed in a simple **2x4** wood-stud wall with wood furring and a single layer of gypsum board on each side yields an **STC 53**, offering a cost conscious multi-family builder the absolute least expensive demising wall that exceeds acoustic code and is only **5-3/4"** deep, preserving valuable floor space.

**Transmission Loss of Single Stud 2x4 Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL14-317)**

Single Wood Stud Wall - 2 x 4 Stud
1 Layer 5/8" Drywall Each Side
One side Wood Furring on HushFrame Raft Connectors
With R-13 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 34 | 39 | 45 | 50 | 52 | 56 | 58 | 59 | 60 | 60 | 60 | 56 | 57 | 63 | 67 | 53 |

Should floor space be an even larger concern, **HushFrame** rafts installed in a simple **2-1/2"** metal-stud wall with metal hat channel and a single layer of gypsum board on each side yields an **STC 54**, creating a very thin wall that exceeds the acoustic code and is only **4-7/8"** deep.

**Transmission Loss of Single Metal Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL19-333)**

Single Metal Stud Wall - 2-1/2" Stud
1 Layer 5/8" Drywall Each Side
One side Metal Hat Channel on HushFrame Raft Connectors
With R-13 Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 30 | 33 | 41 | 45 | 52 | 55 | 58 | 61 | 62 | 62 | 63 | 61 | 55 | 58 | 63 | 68 | 72 | 54 |

For high performance single wood-stud walls, add the **HushFrame** rafts and then double the gypsum board on each side of the wall. This yields an **STC 60** when **2x4** studs are used in conjunction with wood furring. If you use **2x6** wood studs and wood furring that assembly will yield an **STC 63**.

**Transmission Loss of Single 2x6 Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL14-327)**

Single Wood Stud Wall - 2 x 6 Stud
2 Layers 5/8" Drywall Each Side
One side Wood Furring on HushFrame Raft Connectors
With R-19 Batt Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 46 | 49 | 52 | 57 | 59 | 61 | 65 | 66 | 67 | 67 | 68 | 64 | 66 | 72 | 76 | 63 |

And for high performance in single metal-stud walls, **HushFrame** is a standout once again. When installed in a **3-5/8"** stud wall with **R-13** batt insulation and metal hat channel, the assembly yielded an **STC 65**.

**Transmission Loss of Single Metal Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL19-325)**

Single Metal Stud Wall - 3-5/8" Stud
2 Layers 5/8" Drywall Each Side
One side Metal Hat Channel on HushFrame Raft Connectors
With R-13 Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 42 | 46 | 51 | 55 | 59 | 63 | 66 | 68 | 70 | 71 | 73 | 71 | 63 | 67 | 72 | 77 | 81 | 65 |

Add the maximum number of electrical outlets permitted by **UL** standards into that wall and if you attach them to the furring that has been decoupled with HushFrame, the assembly only loses a single **STC** point.

**Transmission Loss of Single Metal Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL19-326)**

Single Metal Stud Wall - 3-5/8" Stud
2 Layers 5/8" Drywall Each Side
One side Metal Hat Channel on HushFrame Raft Connectors
Maximum electrical boxes attached to the Hat Channel
With R-13 Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 41 | 44 | 50 | 53 | 58 | 61 | 64 | 66 | 66 | 68 | 71 | 70 | 63 | 67 | 72 | 77 | 80 | 64 |

And wrapping the electrical boxes in putty pads had absolutely no impact on the acoustical performance of the wall, highlighting the effectiveness of the HushFrame decoupling of the hat channel, and by extension the electrical boxes attached to it.

**Transmission Loss of Single Metal Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL19-327)**

Single Metal Stud Wall - 3-5/8" Stud
2 Layers 5/8" Drywall Each Side
One side Metal Hat Channel on HushFrame Raft Connectors
Maximum electrical boxes attached to the Hat Channel
Putty Pads Encasing all Electrical Boxes
With R-13 Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 42 | 44 | 50 | 54 | 58 | 62 | 64 | 66 | 69 | 70 | 73 | 71 | 63 | 67 | 72 | 76 | 80 | 64 |

And if you change out the **R-13** batts for **R-19**, the wall yields a very impressive **STC 66**.

**Transmission Loss of Single Metal Stud Walls with HushFrame**
**(BCD,LLC Test Data - RAL™ TL19-327)**

Single Metal Stud Wall - 3-5/8" Stud
2 Layers 5/8" Drywall Each Side
One side Metal Hat Channel on HushFrame Raft Connectors
With R-19 Batt Insulation

| 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | 5 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 44 | 47 | 52 | 54 | 60 | 63 | 67 | 69 | 70 | 72 | 74 | 72 | 65 | 69 | 75 | 78 | 81 | **66** |

That doesn't mean that you can stuff **R-30** batts in that cavity and continue to see gains in the **STC** performance, you won't. Your results will actually go the other way. When you compress the fiberglass batts, you actually stiffen them and reduce their damping effect. The reason our **3-5/8"** metal stud wall performed better with the **R-19** was simply because the additional cavity space created by the **HushFrame** rafts and hat channel was available to be filled. Simple.

And I know what you're thinking, "Maybe I'll put HushFrame on both sides of the wall and shoot for the moon!" Well, not so fast… we tested that in numerous wall assemblies and the results were somewhat surprising. An **STC** increase of **3** points in the wood stud walls and an **STC** boost of only **1** point in the metal framed assemblies. So the conclusion has to be that once you have effectively decoupled one side of the building assembly, further gains will be hard to come by. Realistically, the only option for a greater STC rating at this point is to add additional layers of gypsum panels, and even that strategy will disappoint. Maybe you pick up **3** or **4** points when you add the first extra layer on one side of the single layer assembly, then maybe you pick up **2** or **3** points when you add an additional layer on the second side. But then things really slow down, maybe to the extent of **1** point per layer. Not noticeable.

Builders and developers are quick to dismiss the use of decoupling products in demising walls, discrediting them as an expensive, fussy, extra step that requires informed installation skills and painful attention to detail. Instead they invariably default to one of two solutions for their noisy wall problems: double stud walls that exact a significant toll in lost floor space but achieve code mandated acoustic compliance, OR single stud walls strapped in **RC** furring that preserves the floor space, and on its best day just meets the basic legal acoustic requirement without margin for error, and on its typical day falls way short of the legal minimum. The building inspectors review the drawings and specifications, the architects and consulting engineers put their stamps on working drawings that assume best practices in installation and no one performs an as-built acoustic review to see what actually happened with that wall.

And it would invariably fail, but who's there to notice? Only the people living there, not the builder. And while that, let's call it an intellectual omission, is not a criminal act, it's certainly the subject of many, many legal briefs as occupants seek relief from the code failure before a judge. Well, it's not so easy to escape unscathed when it comes to noise in the more complex construction of floor/ceiling assemblies.

# HushFrame in Floor/Ceilings

Floor/ceilings are another situation entirely simply because they have to simultaneously deal with air-borne noise transmission and structure-borne noise transmission. Attempts to meet code mandated **STC** and **IIC** ratings of floor/ceilings through the use of **RC** is unwise as the **USG** publication explains here on page **11**. The vast majority of RC installations result in failure to obtain even the bare minimum of code-mandated efficacy.

The lowest cost, simplest path to obtain minimum code results and beyond is to decouple the floor/ceiling assembly. And as the chart here on page **14** clearly demonstrates, **HushFrame** rafts are in a class of their own in this application. It shows that **HushFrame**:

1. Is the least expensive installed decoupling product
2. Provides superior **IIC** performance over the competition
3. Outperforms the competition in **STC** performance, **8-10** points
4. Is the only decoupling device to pass UL with Type-X ceiling board
5. Is the only device to pass UL with just **3/4**" sheathing, nothing additional
6. Is the only decoupling device that accepts direct seismic furring attachment

So where a deep truss wood floor assembly can meet the bare minimum **STC** requirement of the building code as shown here…

**Transmission Loss of Wood Framed Floor/Ceilings**
**(BCD,LLC Test Data - RAL™ TL14-320) - Baseline**

14" I-Joists - 2 Layers 3/4" OSB Unfinished Floor
1 Layer 5/8" Drywall Ceiling Side
Ceiling Drywall on Wood Furring no Decoupling Connectors
With R-22 Mineral Wool Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 31 | 40 | 41 | 44 | 46 | 51 | 54 | 54 | 55 | 53 | 51 | 48 | 51 | 59 | 65 | 50 |

That same assembly fails miserably when it comes to conforming to the bare minimum IIC requirement of the building code, as depicted here.

**Impact Insulation Class of Wood Framed Floor/Ceilings**
**(BCD,LLC Test Data - RAL™ IN14-021) - Baseline**

14" I-Joists - 2 Layers 3/4" OSB Unfinished Floor
1 Layer 5/8" Drywall Ceiling Side
Ceiling Drywall on Wood Furring no Decoupling Connectors
With R-22 Mineral Wool Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | IIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 76 | 80 | 79 | 78 | 76 | 75 | 73 | 70 | 68 | 64 | 61 | 59 | 61 | 59 | 51 | 43 | 38 |

And as that chart on page **14** shows, when **RC** or the competing **Clips** are installed in a **UL** fire rated floor/ceiling assembly the **STC** ratings range from **STC 51** to **STC 53** and the **IIC** ratings range from **IIC 50** to **IIC 54**.

The certified acoustic lab reports don't lie, and as you can see in the charts below, **HushFrame** installed in that floor /ceiling assembly obtained an **STC 61**, which is **8-10** points higher than the competition resulting in a perceived reduction in noise of an additional **50%** over those competitors. And **HushFrame** outperformed them all in **IIC** ratings as well.

**Transmission Loss of Wood Framed Floor/Ceilings**
**(BCD,LLC Test Data - RAL™ TL14-324)**

14" I-Joists - 2 Layers 3/4" OSB Unfinished Floor
2 Layers 5/8" Drywall Ceiling Side
Ceiling Drywall on Wood Furring on HushFrame Raft Connectors
With R-22 Mineral Wool Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | STC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | 45 | 47 | 48 | 52 | 55 | 58 | 61 | 63 | 66 | 65 | 68 | 69 | 74 | 93 | 86 | 61 |

**Impact Insulation Class of Wood Framed Floor/Ceilings**
**(BCD,LLC Test Data - RAL™ IN14-024)**

14" I-Joists - 2 Layers 3/4" OSB Unfinished Floor
2 Layers 5/8" Drywall Ceiling Side
Ceiling Drywall on Wood Furring on HushFrame Raft Connectors
With R-22 Mineral Wool Insulation

| 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 K | 1.3 K | 1.6 K | 2 K | 2.5K | 3.2 K | 4 K | IIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 59 | 60 | 57 | 56 | 55 | 57 | 55 | 53 | 49 | 49 | 42 | 38 | 35 | 24 | 16 | 56 |

When it comes to floor/ceiling assembly soundproofing, **HushFrame** outperforms the competition while simultaneously offering the lowest cost and least restrictive assembly composition that has obtained a UL one-hour fire rated design approval.

One last point I'd like to make. Where UL fire-rated designs require metal hat channel in the assembly, to provide decoupled structural mounting support for cabinets and such, all that's required is the installation of a few extra **HushFrame** rafts with wood furring attached running parallel with the hat channel. No such option exists for **Clips** or **RC**.