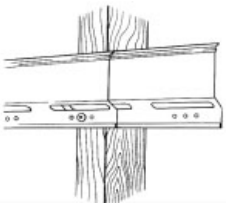
Resilient Channels: A Proven Liability

As captured from various government and industry leading sources.

Walls with higher STC values have been achieved for years using a variety of construction techniques. Today, many high-quality multi-family projects target STC-65. Code is now STC-50 for minimum "for sale" construction and for rentals that might be converted to "for sale". Even though most resilient channel assemblies are not able to meet such requirements, they still show up in projects, usually due to a lack of understanding about newer, reliable technologies (such as Sound Proofing Drywalls).

Resilient Channel is Easily Short Circuited



When installed correctly in pristine lab settings, resilient channel improves STC ratings by about 5-7 points or more, depending on construction. However, resilient channel is easily "short circuited", so very careful handling and construction techniques must be followed — so careful in fact, that few, if any, can actually achieve the desired result in the field. For instance, no screws can ever touch a stud or floor/ceiling assembly, drywall must not touch floors or adjacent walls or ceilings, no pictures or shelves can be hung on the wall where the fastener screws into the studs, etc. If even one does, it can destroy any gain that would have been had on the entire wall.

Noise is the #2 Litigation Issue in Multi-Family

Recent investigation (often due to litigation) has shown that resilient channel construction has a post-construction failure rate (STC designed value) of 90%. Given nationwide litigation history and concerns regarding party walls and floor/ceiling assemblies, especially in multi-family, one must be beyond careful using this technique, if one were to still use it at all.

Acoustical engineering consultants are frequently called in to provide expert testimony in issues that result in mediation, arbitration and litigation. The failure rates and causes of failure have been accumulated over a growing body of such field investigations using field STC measurements. Often, the acoustical engineer has to invade the wall to find the culprit. Litigation on noise issues is becoming more frequent, and the cost of litigation and settlements have risen sharply.

90% Failure Rates = High Contingencies

With the established 90% field failure rates of resilient channel, many large developers set aside up to $30,000 per unit for future litigation and warranty repair costs, litigation that has often included noise issues due to RC failure. While using resilient channels is appealing only from a construction cost perspective (ignoring litigation risk), developers, architects, and builders must be fully aware of the difficult construction requirements, as well as the post-construction failure rate and litigation risk before still considering using them.

Senate Bill SB 800

In addition to nationwide litigation, California enacted a law that gives even more specific rights to condo and townhome buyers. SB 800 was signed into California law on September 20, 2002. It applies to new construction intended to be sold as individual dwelling units, whether as single-family homes or attached units. It was sought by plaintiffs' attorneys in response to a court decision, which precluded recovery in tort for construction defects that had not yet caused property damage or physical injury. SB 800 is codified at Civil Code §§895, et seq and establishes a one year warranty specifically for "Noise transmission from adjacent units in attached structures (runs from date of original occupancy of the adjacent unit)." This law is creating a further flood of litigation in California, and other states are now in process of enacting similar laws.

Caveat Emptor

For those still considering using resilient channel construction, the following page contains a comprehensive list of issues that one must be aware of before a project begins. Source: these problems were compiled from numerous conversations with acoustical engineers, construction litigation attorneys, construction insurance agencies, architects, GCs and drywall subcontractors.

Summary

Resilient channels pose a significant risk of failure in floor/ceiling and party wall assemblies. Lab specifications showing STC 43-55 often result in field-tested STCs in the 34–38 range. Failures trigger litigation and warranty claims and damage the project brand, reputation, word of mouth and resale values.

1. **The original RC-1 used in most lab tests no longer exists.** USG stopped making the product in 1985. Most test results are based on STC tests conducted 10 or more years ago on different fabrications. As there is no standard for RC channel fabrication, the various resilient channels available vary greatly in their resilient (stiffness) characteristics. Using currently available RC channels that are often too stiff or that have holes the wrong size or shape results in reduced STC values. There are few current RC channels available that have recent test results based on their actual fabrication and design.
2. **Dead on arrival.** RC channels are thin and prone to damage from shipping or on-the-job storage. Any bend in the channel can cause shorting. We have multiple reports of damaged RC channels that are deployed because by the time the damage is perceived, it is too late to re-order.
3. **The RC channels are placed too close together.** If this happens, the composite stiffness of the wall will be too high and will result in reduced sound insulation.
4. **The RC channel is often drawn on the architectural plan and/or installed upside down.** In such instances, the weight of the drywall pushes the channel into the studs (instead of pulling it way from the studs when installed properly) thus causing a short circuit in the wall, resulting in poor sound insulation.
5. **The RC channel extends too far and touches an adjoining wall.** This error causes a short circuit in the wall resulting in radically degraded sound insulation.
6. **A screw is placed incorrectly.** While the drywall is being attached to the resilient channel, a screw that accidentally attaches into a stud or touches a stud at any point will short circuit the wall and result in poor sound insulation.
7. **Insufficient gap between the wall with the resilient channel and any adjacent wall.** If the drywall attached to the RC channel touches the drywall on the adjoining wall, the wall will be short circuited, resulting in reduced STC value.
8. **Drywall is not installed properly.** If the subcontractor adds drywall that is beyond spec (e.g. adding a layer of Type X to meet fire code), the resulting structure can sag, and the weight of the drywall on the resilient channel can cause the wall to touch the floor, causing a short circuit in the wall, resulting in poor sound insulation.
9. **Electrical junction boxes attached to the stud and to the wall.** This common error causes a short circuit in the wall and result in poor sound insulation. This mistake is easy to make with the faceplate, which must also be isolated, or by not cutting enough of the drywall away around the junction box. The same principle applies to ceiling attachments such as lighting and fans.
10. **Gaps around the junctions.** If junction boxes at the wall are sealed with standard caulk that hardens over time (instead of non-drying non-skinning acoustical sealant), or not sealed with anything, this will cause a short circuit (or air gap) in the wall, resulting in poor sound insulation.
11. **Resilient ceiling.** If the ceiling is also resilient, the walls and the ceiling cannot touch each other. To achieve this, it is recommended the walls be put up before the ceiling. This is counter to standard drywall installation practice.
12. **Actions of other subcontractors.** When RC channels are used in floor/ceiling assemblies involving stuffing materials into the open truss, the risk is magnified. Plumbing, HVAC and electrical materials are routinely attached inside the small cavities in ways that guarantee short-circuiting the RC channel.
13. **Green wood warping.** Most multifamily housing (such as west of the Mississippi River) is made of the less expensive green wood, which dries after installation. The drying process can distort the framing by as much as 1/2" in extreme situations; 1/4" is common. This torque can bring the RC channel in contact with other elements and cause a short circuit.
14. **Moisture & humidity warping.** In high-humidity areas (such as the Eastern seaboard), humidity can bow and buckle drywall, 1/4" to 1/2" in many cases. This distortion can bring the RC channel in contact with other elements and cause a short circuit.
15. **Foundation settling.** Foundation settling, the #3 cause of litigation, is a common occurrence. A 1/4" or 1/2" settling distortion can bring the RC channel in contact with other elements and cause a short circuit.
16. **Language barriers.** The high incidence of RC failure contrasts with good results established in the top labs. This discrepancy points out the need to have highly trained, disciplined personnel supervising and performing the installation. In many construction crews, many of workers are foreign-born. The ability to communicate in English fluently, understand and execute written and verbal instructions for something as delicate as RC channels is required.
17. **Owner/tenant actions.** If, during the life of the property, the owner or tenant installs materials to the wall, such as a picture or lighting, the wall can easily be short circuited. In the case of hotels, many products are routinely attached to the walls for various reasons, including anti-theft and seismic restraint: bed head-board, writing desks, open shelving system, closet shelving, refrigerator, safe, sconces, mirrors, paintings, bathroom shelving, television wall stands, decorative wall hanging, crown molding, baseboard, wainscoting. For rigidity and security, these products are attached to the studs by screws, which invariably cause a short circuit and significantly reduce the STC rating of the wall. Similarly, if RC channels are used in ceiling construction, any lighting (including track lights and ceiling fans) introduced post construction could reduce the ceiling's STC value. Also, any retrofit for new communication technology, that requires a junction box to be attached to the wall will significantly reduce the wall's STC value. This is particularly risky because the location of the studs and RC channels is hidden and difficult to find post construction. Either the wall or ceiling has to be left alone for the life of the property or significant post-construction risk occurs.
18. **Furniture.** If the owner (or hotel guest) moves heavy furniture (e.g. bed, desk) against the wall with force, it can cause the resilient channel to bend slightly and touch the studs, thus causing a short circuit in the wall, reducing the wall's STC value.

Other factors driving up risk:

19. **Availability.** The current shortage of steel (i.e. China) has forced RC channels into allocation.
20. **Inspections.** In several states, RC channels have developed such a contentious reputation that a special inspection must be completed before the wall or ceiling can be closed up. Scheduling a special inspection can take several days.

Resilient Channel Update

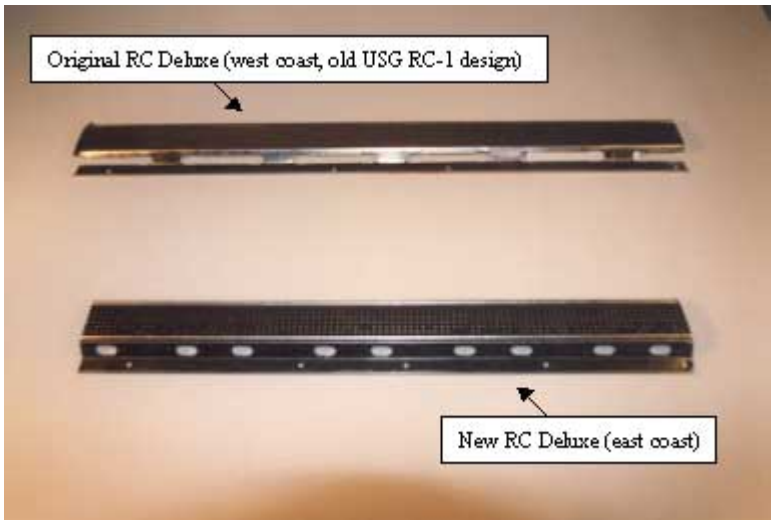
One of the most cost-effective acoustical products for improving the sound transmission loss of a wall or floor/ceiling system is the resilient channel. Resilient channels are commonly used in multi-family housing projects, especially projects with wood frame construction, but they can be used in any application where sound transmission is a concern. Most resilient channels are ½" thick and have a cross-section shape similar to ½ of a hat channel, with only one leg attached to the supporting structure and the other edge floating freely. They are typically constructed from 25-gauge sheet steel, and they contain holes in the web of the channel to provide flexibility. The fundamental purpose of the resilient channel is to provide a means for attaching gypsum board to the supporting structure without actually permitting the gypsum board to directly contact the supporting structure. It is the de-coupling of the gypsum board from the framing that provides the improved sound transmission loss.

The resilient channel was developed by USG in the 1960's. According to Stan Roller, the product was not originally designed to provide improved sound attenuation, but rather to avoid cracks in drywall where the direction of the framing changes. The original product was called RC-1, and it underwent numerous acoustical tests. In fact, the USG RC-1 product has been used in approximately 99% of all sound transmission loss tests of wall or floor/ceiling assemblies using resilient channel conducted at Riverbank over the last 40 years.

Over the years there have been numerous copycat versions of the RC-1 design. Most use 25-gauge steel, but some of the other design variables (width, shape, and hole pattern) were always different. This photo shows some of the various designs that are currently on the market.

About 10 years ago USG stopped manufacturing RC-1 because they were getting less than 5% of the total market. This is unfortunate because it is the only product that has gone through rigorous tests to prove how well it really works. The rights to the RC-1 design were sold to Unimast at that time, and the product was marketed and sold under the name "RC Deluxe". The situation was made a little more complicated because Unimast also made two other resilient channels: RC-2 and URC. No longer is it sufficient to specify only the manufacturer's name if you wanted to specify a tested product.

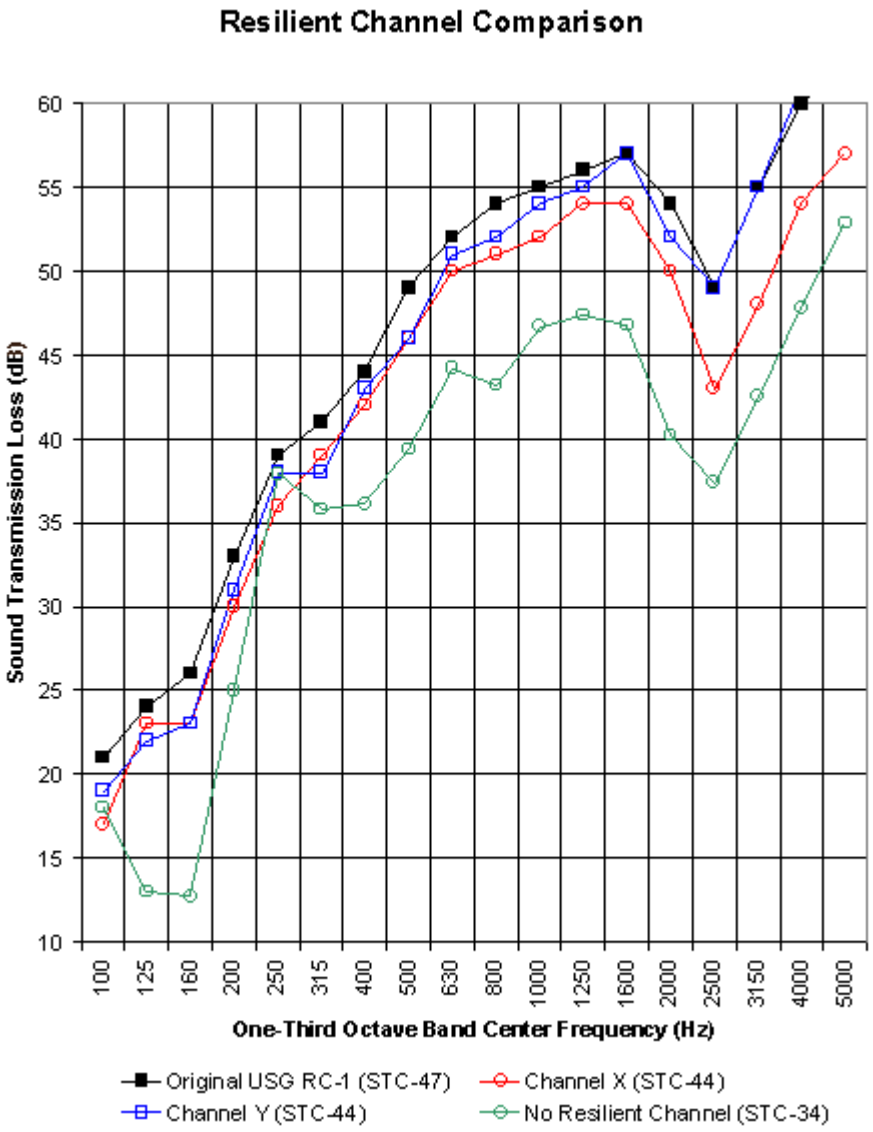
Sometime during the past 5 years Unimast added new tooling machines and began manufacturing the "RC Deluxe" channel with two different hole patterns (see photo below). All other design features remained the same. The channel with slotted holes is the original USG RC-1 design. The channel with oval holes is the new design, which has not been tested for acoustical performance. According to Paul Waggener at Unimast, the slotted (or "dog-bone") hole design is generally available in the mid-west and on the west coast. The new oval hole design is found almost exclusively on the east coast. So now if you want to specify resilient channels that have been tested for acoustical performance you can no longer use just the manufacturer's name and the product name. You must somehow specify that the hole pattern in the channel have the "dog-bone" slotted shape. It should also be mentioned that the length of the dog-bone hole is 3 inches and the width of the slot is 3/8". The slotted dog-bone holes are spaced 4 inches on center, so there is 1 inch of solid sheet steel between adjacent holes.



A little-known (but important) design element of the original USG resilient channel is the location of the framing member in relation to the slotted holes. If you look at the original RC-1 design you will note that there are 1/8" diameter holes every 4 inches for screws to attach the channel to the framing members.

According to former USG employee, Stan Roller (a current member of NCAC), it is very important from an acoustical performance standpoint for these slotted holes to be centered on the framing members, if you want to achieve the maximum performance from the resilient channel. As you can see from the above photo, the screw hole spacing in the new RC Deluxe design varies (4 inches, 3 inches, or 5 inches). Mr. Roller is convinced that the new design (which is sold primarily on the east coast) will not perform as well as the original design if it is ever tested.

I know of two "other" resilient channel manufacturers that have actually had their products tested at Riverbank Acoustical Laboratories to see how they compare to the original USG RC-1 design. Both lab tests were single stud walls using 2x4 wood studs (16" o.c.) with one layer of 5/8" gypsum board on each side and 3-1/2" thick fiberglass insulation in the stud cavity. One test was conducted in 1985 and the other in 1986. In all cases the resilient channels were installed horizontally at 24" on centers on the source side of the test facility. The test results are shown in the attached graph. Note that the wall system using the USG RC-1 channel achieved an STC rating of 47, compared to 44 for both of the "copycat" designs. I should also point out that the STC rating for all three tests is determined by the transmission loss in the 160 Hz one-third octave band, because that band has 8 deficiencies in all 3 tests. By the way, Stan Roller also believes that the difference between the original USG RC-1 and other copycat designs will be even greater if tested with 2 layers of gypsum board instead of a single layer. An interesting note: one of these two manufacturers was actually promoting these results to their customers because they were under the false impression that a lower STC rating meant lower sound levels and therefore improved performance.



Of course, the difference between the various channels can be negated if the channel is not installed properly. The most common error is to screw through the resilient channel into the framing. This is best avoided by using a screw that is not too long. The recommended screw length is 1" for the first layer of 5/8" board and 1-5/8" long screws for the second layer of 5/8" board. I recently conducted a field test where the contractor used screws that exceeded these recommendations. I pointed this out to him as he started to install the gypsum board, and he told me that he would avoid the studs with his long screws by marking the stud locations on the ceiling and floor.

After the test was completed the gypsum board was removed from the wall and I found 21 locations in a 100 square foot wall area where the screws passed through the resilient channels into the framing.

Another common error is to install resilient channels directly over a solid surface, such as a layer of shear plywood or an existing layer of gypsum board. Many tests have shown that this does not work (even if you use the correct screw length to avoid penetrating into the surface layer) because of the coupling created by the narrow (1/2 inch deep) air cavity. In most cases the degradation is so bad that you are likely to get better acoustical performance with direct attachment.

In the past few months Worthington Industries has purchased Unimast. According to Paul Waggener, they are currently in the process of combining their product lines, and there is no way to know for sure what they will do with the resilient channel product line. Acoustical consultants and architects should

be aware that Unimast RC-Deluxe products that were sold on the east coast during the past 5 years are probably the new (untested) design with oval holes. If you want to specify the tested product that was originally designed by USG, you must also specify the hole pattern (3/8" wide slots 3" long, spaced 4 inches on center). If you are on the east coast, be prepared for a modest surcharge to ship the material from the mid-west manufacturing plant.

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