Update on the Use of Steel Resilient Channels for Constructing Sound Rated Walls

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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 multifamily 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 1/2 in. thick and have a cross-section shape similar to 1/2 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 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 board to directly contact the 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 1960s. 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 employing 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. Figure 1 shows some of the various designs that are currently on the market.

About 10 years ago USG stopped manufacturing RC-1 because they had less than 5% of the total market. This is unfortunate because it is the only product that has gone through the 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 want to use a tested product.

In the past 5 years Unimast added new tooling machines and began manufacturing the "RC Deluxe" channel with two different hole patterns (see Figure 2). 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 midwest and on the west coast. The new oval hole design is found almost exclusively on the east coast. Now, if you want to specify resilient channels that have been tested for acoustical performance you can no longer use the manufacturer's name and the product name. You must also specify that the hole pattern in the channel is the 'dog-bone' slotted shape. It should also be mentioned that the length of the dog-bone hole is 3 in. and the width of the slot is 3/8 in. The slotted dog-bone holes are spaced 4 in. on center, so there is 1 in. of solid sheet steel between adjacent holes.

An important but little-known design element of the original USG resilient channel is the location of the framing member in relation to the slotted holes. Looking at the original RC-1 design you will note that there are 1/8 in. diameter holes every 4 in. 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 to achieve maximum performance from the resilient channel. As you can see from Figure 2, the screw hole spacing in the new RC Deluxe design varies (4 in., 3 in. or 5 in.). Roller is convinced that the new design (sold primarily on the east coast) will not perform as well as the original design if it is ever tested.

At least two 'other' resilient channel manufacturers have tested their products at Riverbank Acoustical Laboratories to see how they compare to the original USG RC-1 design. Both lab tests were single stud walls using 2×4 wood studs (16 in. on-center) with one layer of 5/8 in. gypsum board on each side and 3-1/2 in. 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 in. on-center on the source side of the test facility. The test results are shown in Figure 3. 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

Figure 1. Some of the various resilient channel designs that are currently on the market.

Figure 2. Different hole patterns in the "RC Deluxe" channel.

for all three tests is determined by the transmission loss in the 160 Hz 1/3 octave band because that band has 8 deficiencies in all 3 tests. Furthermore, Roller also indicates 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.

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 in. for the first layer of 5/8 in. board and 1-5/8 in. long screws for the second layer of 5/8 in. 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 sq. ft. wall area where the screws passed through the resilient channels into the framing.

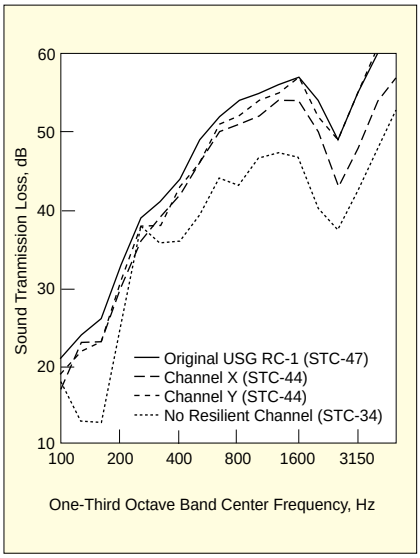

Figure 3. Resilient channel comparison.

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 in. 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 what will happen to 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 in. wide slots, 3 in. long, spaced 4 in. on-center). If you are on the east coast, be prepared for a modest surcharge to ship the material from the midwest manufacturing plant.

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