Retrofit Soundproofing

Practical solutions for quieting homes

BY JOSEPH DRAGO

I've been a renovation contractor in the Boston market for more than 26 years. Roughly 15 years ago, I noticed that more and more people were asking me about noise problems—perhaps a loud neighbor or a bothersome air conditioner compressor. Many of these people had done research online about soundproofing materials and would ask me to implement some method that they had learned about. As a result, we started to do more of that work, and now soundproofing accounts for a major share of what we do.

None of those materials are produced in our local area, and nobody around here stocks them either. So I had to order the materials shipped in from out of state on a job-by-job basis. That was expensive, but as long as the customer was willing to pay for it (which many were), we did it.

Then about five years ago, my oldest son, Steve, graduated from college and wanted to join my company. I said, "Here's an idea: Do some research on soundproofing materials and techniques. We can start distributing that stuff as well as installing it, and you can run that division." Today our soundproofing division, New England Soundproofing (based in Waltham, Mass.), is an integral part of our business. We stock materials in quantity to get a better price. We distribute materials, we do jobs ourselves, and we train other contractors in how to do the work using materials we supply. But we

Photos: Ted Cushman


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Carpet Floor Soundproofing


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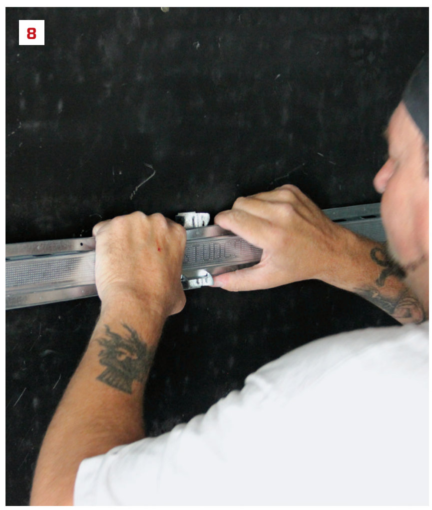
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still do general remodeling—kitchens, baths, additions, and the like. So when we install soundproofing, we also take care of any demolition, framing, drywall, trim, and painting that is part of the job—whatever the customer needs.

Before I learned about soundproofing, I used to simply install cavity insulation when I thought there was a need to block sound. Since then, I've learned that doesn't really work. Insulation helps a little, but there's a lot more to a complete sound-control solution. In this article, I'll describe some of the materials and systems we recommend to prevent noise intrusion, looking at the most common building assemblies we encounter.

WALL & CEILING ASSEMBLIES

Photo **1** shows a model that we take to home shows and that we use to teach our contractor classes. If you were to hold the wall mock-up over your head, it could be a ceiling mock-up—the principles are the same for both assemblies. Our model represents a wall whose other side is the neighbor's property, where we can't change anything. We want to block noise on the neighbor's side from traveling into our client's side.

Insulation. Starting with bare studs, we place sound-blocking insulation in the stud cavities—either Roxul rock wool or Quiet Insul, a cotton insulation made from recycled blue jeans. Both carry the same fire rating and have the same soundproofing value. We tend to use Quiet Insul for overhead situations because rock wool sometimes breaks apart and exposes the workers to irritating fibers. But in terms of cost and performance, they're equivalent. Cavity insulation is a minor part of the assembly. It prevents sound from echoing around inside the stud bay, and it slows down the sound wave. By the time the sound moves through the insulated cavity and hits the next layer of material, it has lost some energy. But that benefit is small.

Sound barrier. The next layer is the sound barrier—a heavy, black "mass-loaded vinyl" (MLV) membrane **(2)**. We have our own MLV product, named "Sound Barrier." It's the workhorse for stopping airborne sounds such as loud voices, radio and TV, or clanging pots and pans. Sound Barrier comes in two thicknesses (⅛ inch and heavy-duty ¼ inch). The thinner version weighs 1 pound per square foot (psf), and the thicker version weighs 2 psf. Either one is best installed a bit loose, rather than taut, so that it can absorb and deaden the sound waves by flexing along the plane of the material.

Applying a 130-pound roll of Sound Barrier is heavy work for the crew. Obviously it's even more work to roll it out across a ceiling (see photo, page 51) than onto the wall. We've been working on various rigs and jigs to solve this problem, but usually it just calls for muscle—at least three men to get a roll nailed into position. We secure the material to studs or joists with wide-head roofing nails, using a roofing nailer.

It's important to tape all the joints in the Sound Barrier to prevent sound from bypassing it. We seal every seam, typically using a special tape made of the same MLV material with a blue release paper. All seams—including seams between sheets in the field—at the edges **(3)**, and in corners **(4)**, must be tightly sealed.

On ceilings, we're not always confident that the adhesive of the seam-sealing tape will hold and that the tape won't tear. So we've developed a tougher cord-reinforced tape, which we apply over the top of the standard Sound Barrier tape **(5)**. We had to work with the tape's manufacturer and try several different pressure-sensitive-adhesive (PSA) formulas before we found a PSA that would reliably stick to the Sound Barrier. The product we finally settled on comes to us in 4-foot rolls that we cut into a 5-inch or 6-inch width for use on the job (we also distribute this tape along with the rest of our soundproofing products).

Once the Sound Barrier is up, the crew can cut around wall receptacles or light fixtures with a drywall knife and tape the membrane to electrical boxes. Another critical step is sealing the electrical boxes with mass-loaded soundproofing putty. Otherwise, sound will infiltrate the room through air holes in the boxes.

Furring. The next component in this assembly is drywall furring composed of clips and hat channel. The channel we use on ceilings is stiffer than the kind we use on walls because the heavy-duty ceiling channel has to support the gravity load of drywall. The clips fasten to the studs with screws through a plastic washer or bushing **(6, 7)**. The washer decouples the studs from the clips (the screws touch the studs and the washers, but they don't touch the metal of the clips). Then the hat channel snaps into the clips **(8)**. This component absorbs vibrations that come from the studs and keeps the sound from passing into the drywall. It also creates an air space between the drywall and the MLV sound barrier where sound can disperse and dissipate and get absorbed, instead of being transferred to the drywall. The channel we use on ceilings is stiffer than the kind we use on walls because the heavy-duty ceiling channel has to support the gravity load of drywall.

We lay out the clips on a staggered pattern, skipping every other stud on each course and alternating between courses. That way one vibrating stud won't transmit sound into the drywall because the studs that flank it will absorb and dampen the sound energy.

It's helpful to be precise when you snap the lines and attach the clips, especially with the ceiling hat channel. If your clips aren't quite lined up, the channel will fight you all day as you're trying to squeeze it into the clips.

If space is tight, one option is to attach strips of ¼-inch QuietWalk (MP Global Products)—a resilient sound-absorbing pad underlayment made of recycled tires—to the studs before installing the drywall. This makes for a thinner assembly, but it will not decouple the drywall as effectively as clips and channel. Still, it does somewhat dampen the vibration of the studs, and it creates a thin air space behind the drywall that helps attenuate sound.

Drywall. The final layer in the assembly is the drywall itself. We use two layers of ⅝-inch drywall laminated together with Green Glue, a viscous elastic adhesive. You can also buy the sound-deadening drywall already laid up, under the brand name QuietRock. We use regular drywall and Green Glue because it costs less than QuietRock for basically the same thing. The mass of the drywall deadens the energy of the sound waves that make it that far, while


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the viscoelastic adhesive absorbs even more sound energy and decouples the two layers of drywall from each other.

As a final step, we seal drywall joints at panel edges and wall corners with an acoustic caulking. Omitting any of these steps can seriously degrade the wall's performance.

WALKING SURFACES

Floors, like walls, may allow airborne noise to pass through from the room above to the room below, or vice versa. As discussed, the floor/ceiling assembly is insulated and has a sound barrier and isolated drywall on the ceiling below. But a bigger problem with floors is structure-borne noise, particularly the sound of footfalls.

If the floor is carpeted, we can install a special soundproofing carpet pad. This quiets the sound of footsteps on the floor, of people dropping things, and the like. The pad has a top surface of Sound Barrier and a sponge-like bottom layer. The Sound Barrier absorbs the sound of voices or other airborne noise in the room and blocks the sound waves from traveling into the floor. But the Sound Barrier also soaks up the energy of footsteps or other floor impacts, and the sponge layer further disperses the impact energy. The composite carpet pad also suppresses noise that originates downstairs and prevents the sound energy from entering the upstairs room.

Under wood or tile flooring **(9)**, we apply QuietWalk on top of the Sound Barrier. The exact installation of the QuietWalk varies, however, depending on the finish flooring material. Floating engineered laminate flooring or ceramic tile can be glued directly to the QuietWalk underlayment with flooring adhesive or tile mastic. But for conventional nail-down hardwood strip flooring, we advise gluing another layer of ¾-inch plywood subflooring on top of the QuietWalk material, then nailing the flooring to the plywood. That way, flooring nails won't short-circuit the sound-deadening membranes and transmit sound energy directly into the structure below.

STAIRWELL PARTY WALLS

Retrofit soundproofing of the party wall between two condo units has become our bread and butter in recent years. Typically in this scenario, there is another stairwell on the other side of the wall, belonging to the unit next door, but because we are working for only one party, we can treat only one side of the assembly.

This work is labor-intensive. On the project shown here, we had to put down cardboard and plastic to protect the existing stairs, and we had to set up and take down our working staging every day because the owner was living in the unit while we did the work. Obviously, it would have been cheaper and better to build the wall with effective soundproofing in the first place.

Because it was a retrofit, we started with demolition. The crew tore off the existing drywall by hand **(10)**, making occasional cuts with a recip saw **(11)**. The existing drywall was tight to the skirtboard running along the wall, and there was no space available for building out the wall with clips and channel, as previously described. This meant we had to tear out the existing spray foam insulation by hand **(12)**, taking care not to damage existing plumbing or wiring in the wall.

ASSESSING THE PROBLEM

We get a lot of calls from customers in recently built Boston condos who are hearing too much noise from the unit next door. There are rules now in the building code about soundproofing in condominiums and apartment buildings, but the code doesn't tell you how to build an assembly, it just tells you the rating you have to achieve.

Party walls, floors, and ceilings are rated according to a "Sound Transmission Class," or "STC," that indicates how well they impede the passage of sound. The higher the STC, the better the element performs (that is, the less sound is transmitted). By code, walls between multifamily dwelling units should have an STC of 50 (if measured in the laboratory) or 45 (if measured on site in the field).

For a price, you can test any space to find out if it complies, but if the building fails the test, it's still up to you to figure out how to make it pass.

Our company can perform the tests to measure the noise in an existing building and find out if the dwelling passes the STC 45 rule. But I don't push this, and here's why.

First of all, the code-required STC, like everything else in the code, is only a minimum. STC 45 or 50 is not very good. In a condo that just passes the code, you can still hear loud conversations, loud televisions, or thumping and bumping from next door. And how much a person is bothered by any kind of noise is subjective; it depends as much on somebody's sensitivity to noise as it does on the measurable sound.

Another problem is that the engineering to scientifically measure sound is expensive—testing takes all day and costs thousands of dollars. (A full description of the testing procedures is beyond the scope of this article, but you can get an idea of what's involved by reading about ASTM E90 and ASTM E989 and related field testing, as well as RT-60 reverberation testing.) If the clients are heading to court with a lawsuit, at the end of the day, they'll have an engineering

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We replaced the foam insulation with special acoustic rock wool fiber batts. (We don't have an official sound-abatement contribution for either open-cell or closed-cell plastic foam insulation, but experience tells us that the relatively dense foam increases sound transmission through walls.)

Once the wall was stripped and de-nailed, we applied our Sound Barrier material, carefully fitting it around any complicated shapes, such as the ceiling beams **(13)** and other bump-outs. At 1 or 2 psf, the mass-loaded vinyl is heavy, taking a lot of effort to apply, particularly when it needs to be carefully fitted. On the other hand, the material cuts easily with a drywall knife **(14)**, making it simple to shape.

We nailed off the Sound Barrier **(15)** and taped all the seams **(16)**. This last step is critical: Open seams in a sound barrier are like holes in an air barrier—they significantly reduce the barrier's effectiveness.

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document that they can take with them. But even if they were to win their lawsuit, it would probably only require bringing the house up to the minimum code, which may not make them happy. Finally, the testing isn't that helpful for planning the construction—our experience tells us much more about solving the problem than expensive instruments can. So unless a customer is dead set on going to court, I don't recommend the engineering tests.

Instead, when I visit a building where a customer has a noise complaint, I listen to get an idea of the problem. At the same time, I judge how sensitive the client is to noise. I've had people say, "There! You hear that?" when my decibel meter wasn't reading a thing. With couples, sometimes a certain type of sound bothers one partner, but the other doesn't even notice it. It's important to understand the client's perception of the noise, early on.

We also have to understand the nature of the noise. There are different kinds of sound, and they travel differently. Voices or amplified music travel through the air. To stop those, we use a combination of air-sealing and sound-absorbing material.

Footsteps, on the other hand, are an example of "impact sounds" that travel through structural framing, not air. (Bass notes from a subwoofer also travel through framing.) Structure-borne noise is harder to stop because it requires the framing to be isolated from other framing or from the space in the room.

Sometimes, we can stop one type of sound but not the other. So I may have to tell a client, "Yes, I can quiet things down, but I can't eliminate all the noise. You might not be completely satisfied."

And of course, there's the budget: It may be possible to eliminate the problem by tearing out walls or floors and reframing, but most clients don't want to spend $30,000 to do it. So the trick is to understand the source of the noise, its mode of travel, and the occupant's sensitivity, and to communicate with the client about what our methods can achieve given the budget.