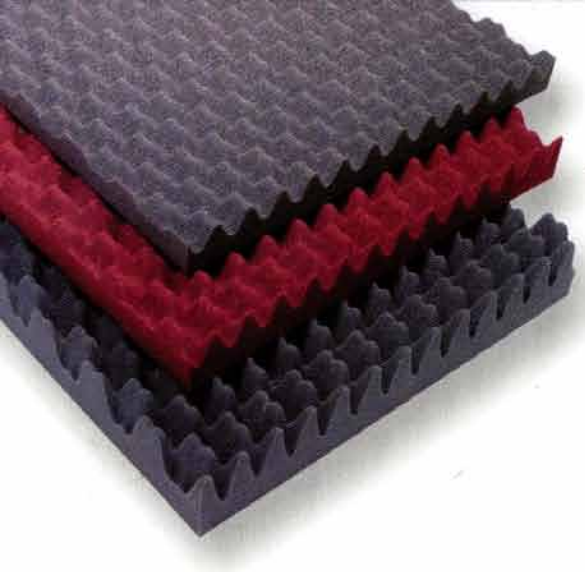

A Primer On Materials Used For Acoustical Treatment

By Nick Colleran

Recent times have seen dramatic changes in the quality and quantity of church sound. Much like live Gospel recording, the sound control of a professional studio is now needed in the church with a praise band.

Scanning the radio dial, and not listening closely to the words, it is difficult to hear the difference between Contemporary Christian music and [secular Pop]. The message may be quite different but the sound and acoustical requirements are the same.

The sanctuary sounds "heavenly" for choir and pipe organ may be completely unsuitable for the higher sound levels of a modern worship service. At low levels, the sound of an acoustic guitar and voice will fade before it reaches the walls. Drums and amplified instruments will reach the room boundaries and what comes back from those surfaces can create problems. Such problems can only be solved with proper acoustical materials and design.

What are acoustical materials?

In the broadest sense, acoustical materials are anything and everything that affect sound or noise (unwanted sound) in quality and intensity. (My definition. These are sweeping generalizations that will hopefully make the subject easier to understand.)

Acoustical materials used for sound control generally fall into a few broad categories: absorbers, barriers, diffusers, and isolation devices. Not much has changed since sound was invented, except possibly that a few of us spell diffuser with "–or" these days.

Absorbers are sometimes called "fuzz" by acousticians since things that are soft and porous ("fuzzy") tend to muffle or absorb sound. The more porous pathways there are in a material, the better the absorption. The sound gets trapped and loses energy trying to find its way out and bounces back with much less intensity.

In commercial acoustics, the most prevalent absorbers for public spaces are compressed fiberglass (glass wool), often incorrectly called "703" and rock wool (mineral fiber). Fiberglass is more prevalent in the United States while rock wool finds wider use in Europe. Both of these materials meet Class A (or Class 1) fire safety standards. These are most often found as the core material (substrate) in fabric-covered panels.

For lighter absorption there are wall carpets made of synthetic fiber. Floor carpet, although possibly a good absorber, does not always meet fire code for wall mounting where there is increased oxygen flow.

The most "bang for the buck" (or maybe it's reduced "bang" for less bucks), is polyurethane acoustical foam. This is easily formed into wedge shapes by convoluting. The foam blocks are compressed by mating rollers and sliced by a straight blade. The resulting pattern is a three-dimensional surface with increased surface area. Someone once told me that the surface area of one square foot of a four-inch anechoic wedge foam has a surface area of four and one half square feet. It is easy to see why absorption numbers exceed the 1.00 limit of a square foot of open window.

Unfortunately, foam has several drawbacks: flame, fume and fragility. While the acoustical foam used by the established brands should not be confused with the "foam used for acoustics" in the recent nightclub fire.

it will not pass code for public spaces, high rise buildings and most other applications. A foam substitute, cellular Melamine (white foam) will. This material developed by BASF and sold under several different trade names, is now being used in fabric-covered panels that have the added benefit of being able to be bent to conform to curves It has found wide use in ceiling tile configurations requiring Class 1 materials. Applied to the surface of the tile, it provides very high sound absorption and allows a variety of designs.

The next category, **barriers**, provides mass to block sound. The fuzzy stuff (absorbers) will prevent sound bouncing back to create flutters, echo, and sustained reverberation but it won't soundproof. It requires something heavy, dense and massive, with no openings to stop transmission.

In the early days recording studios used double layers of 5/8-inch "green board", a dense gypsum product to block sound. Lead foil was often included as a layer. When it came time to "get the lead out", mass-loaded vinyl came into use. This is another product sold under many different trade names from several sources. Buyers are cautioned to check freight

cost since it is as "heavy as lead". That's why it works. One-eighth inch of barrier blocks more sound than a two-inch, solid core oak door. It is popular both for its effectiveness and the fact that is more forgiving to install than lead foil.

Diffusers (or diffusors), are sound-scattering devices . They lower the intensity of sound by spreading it around rather than eliminating it altogether as an absorber would. I often refer to this as acoustical crowd control, breaking up or dispersing the sound that is "milling around" and causing trouble. There are several commercial units each with a different mathematical basis often determining its operating range. With properly designed diffusion a room will feel bigger and more open

and it will be more difficult to determine where the walls are located since reflections return to the listener's ear at many different time intervals rather than one big "slap back". A church praise band will no longer be forced to play within the two tempos (one fast, one slow) corresponding to the timing of the bounce back from the rear wall.

Some more traditional diffusers, polycylindrical barrel shapes, are actually used more for bass trapping. Bass trapping is a counter-intuitive term. A bass trap actually prevents the lower frequencies from reflecting back out-

of-phase and canceling. Bass build-up heard in the corners may actually be

a perception due to absence of bass in the middle of the room. Properly sized traps can tune a room's response, something that cannot be accomplished electronically. (A frequency boost with an equalizer will also boost the out-of-phase cancellation at the same frequency, unless the room is correct.)

Although there are more variations, the last element we will discuss is **isolation devices**. Sound travels through structures. For this reason, recording studios use a separate foundation slab for control room and studio. The ability to isolate sound gets worse as frequencies get lower. In fact, the bass can often be louder down the hall than near the source.

To avoid this problem, speakers may be hung with isolation hangers which are basically acoustical shock absorbers. Drywall may be hung on resilient channel with recently developed isolation clips (another product sold under several names as a distributor house brand). Floors may be floated on neoprene or other resilient pads. Where the floor cannot be floated, heavy platforms on isolation pads for drums and electric instruments, will prevent transmission at the source. (The author once built a sand-filled platform for a drum booth and floated it on nine truck tires to prevent the bass "kick" drum vibration from travelling through the floor and exciting the acoustic piano.)

All of these topics require much more space for an in-depth discussion than this article allows. I could say that a book could be written on this, but many already have. Hopefully, there is enough here to encourage your reading.

Nick Colleran is a past president of the Society of Professional Audio Recording Studios (SPARS) and a principal of Acoustics First Corporation. As a former recording engineer, he has recorded more Gospel groups than he can remember both in the studio and on location in their own sanctuary.

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