Sound Advice

Helpful Information from ***Stewart Acoustical Consultants*** 919-858-0899
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"ACOUSTICAL" MATERIALS

By Noral D. Stewart

All materials have some kind of acoustical property. However, the term "acoustical material" is usually applied to a material that absorbs a majority of the sound impinging upon it rather than reflecting the sound. These prevent undesirable sound reflections that could result in clearly perceived echoes, slightly delayed echoes that reduce the clarity of speech, increased noise levels, or excessively long reverberation. They are also used inside walls to improve the sound blocking or insulating ability of the wall, though these materials themselves are not acoustical insulators.

Sound absorbers are usually porous materials that turn sound into heat. These absorb primarily the higher frequencies unless the material is very thick. At thickness of one to two inches is practical to absorb mid-frequencies well. Examples of these materials are fiberglass, mineral fiber, partially open-cell foams (not Styrofoam), shredded wood fiber, un-painted porous concrete block, heavy drapery in folds, and carpet. Such materials are often mistakenly called sound insulators because many but not all are also good thermal insulators. Vibrating panels and tuned cavities are also used to absorb low frequency or bass sound. A gypsum or wood-panel wall with an air cavity or a suspended ceiling can be a good bass absorber. Some fiberglass wall panels have high-density surface layers that improve bass absorption. A fiberglass batt or panel covered with a non-perforated film will reflect high frequencies, but absorb mid frequencies and even low frequencies if the fiberglass is thick enough. Special concrete blocks with slots to their cavities are the most common cavity absorber.

Our ears expect most rooms will have more absorption at higher frequencies. However, if the difference between the absorption at high and low frequencies is too much, the room will sound "boomy." This often occurs with thin porous materials applied to hard surfaces. Examples are large amounts of one-inch or thinner treatment in large rooms, or thin wall carpets that can only absorb very high frequencies well. The opposite and strange sounding effect can occur when large quantities of film-faced fiberglass metal-building insulation are exposed in a room. One must carefully select materials to balance the absorption. This is especially important in rooms that will be used for music, or where very natural sounding speech is desired. Most, but not all, suspended acoustical ceilings are better balanced than most wall treatments. They achieve good bass absorption acting as a panel with an airspace above. One way of balancing a room is to use a combination of materials with opposite characteristics.

The performance of an acoustical material is measured by the Sabine absorption coefficient. This will vary with frequency and with the thickness and mounting of the material. Thicker porous materials and those mounted with an airspace behind them will have more absorption at low frequencies. A widely publicized rating is the misnamed "Noise Reduction Coefficient" or NRC. This is the average absorption at 250, 500, 1000, and 2000 Hz. It can be very misleading. Two materials can have very different characteristics producing very different results but a similar NRC rating. NRC results also can be influenced by tuning systems to be absorptive only at the frequencies in the average, and not in the broad range in between. The NRC is being replaced by the Sound Absorption Average or SAA which averages the absorption at many more frequencies to eliminate this problem.