SRL
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Acoustic News

Absorption - Theory and products

Reverberation is such a core component of architectural acoustics that it is often called a room's "acoustic". The next two issues will cover absorption. This issue will look at acoustically absorbent and reflective products. In the next issue we will cover where and how to best use these different materials in a project.

Simply put, reverberation is the amount of time it takes for sound in a space to die away. Lots of acoustically reflective surfaces in a space make the space reverberant (think squash court) while lots of acoustic absorption reduces acoustic reflections (think cinemas).

Acoustically reflective surfaces

These are hard, and usually flat: concrete, brick, plaster, wood, metal, glass, vinyl, etc. and all ceiling tiles not listed as "acoustic"…

When noise hits reflective materials, the vast majority bounces off, like light bouncing off a mirror. If uneven, the noise will scatter more, but will still bounce.

Reflective surfaces are needed to stop a space feeling too "dead". Bright and open spaces usually need to feel bustling to support the atmosphere. Auditoria usually have reflective surfaces around the stage to help reflect sound from the stage to the audience.

Acoustically absorbent surfaces

These broadly fall into three groups: "porous", "membrane" and "cavity" absorbers. Porous absorbers of practical thickness work well at mid to high frequencies (speech, cutlery); membrane and cavity absorbers work well at low frequencies (truck engines).

Porous absorbers are open mesh structures like glasswool or mineral wool panels. Don't confuse them with thermal insulation panels with closed structures, such as expanded polystyrene, which don't absorb noise. You should be able to blow air through a porous absorber.

Porous absorbers are limited by their practical depth. At 50mm thick, porous panels will absorb speech and higher frequencies really well. Given the space, a 1 metre thick panel would absorb most audible frequencies, but not many rooms have this space, so we have to look elsewhere for low frequency absorption.

Membrane or panel absorbers convert sound energy into vibrations in the panel, so they work well at the resonant frequency of the panel, which is often relatively low. The most common membrane absorbers in buildings are suspended ceilings, lightweight walls and glazing.

Cavity absorbers were invented by a guy called Hermann von Helmholtz in the 1850s. They absorb specific (low) frequencies. They are seldom seen in their pure form, but their principles are used in perforated timber and plasterboards.

Practical products

OK, so that's the theory. What are the practical products? There are three main types on the market: glass / rock / mineral fibre panels, ceiling grids, and perforated hard boards.

> Porous absorbers work well at mid to high frequencies, cavity absorbers are best at low frequencies

Ceiling grids are the most common. They work as part porous, part membrane absorbers; sticking the tiles to the soffit would significantly reduce their low frequency performance.

Fibre panels are usually surface-mounted wall panels, or floating canopies. They are good at high frequencies, but have negligible low frequency performance.

Perforated hard boards combine membrane (a big board) and cavity (holes with depth) effects to give good low frequency absorption. Put mineral wool in the cavity for some porous absorber effect, and improve high frequency performance.

Remember that perforated panels must be in an enclosed box to work - you can't just suspend a piece of perforated timber on a wire!

Get test data!

The performance of especially perforated panels is not possible to accurately predict. Insist on test data from the supplier. If they haven't tested it, why not? If suppliers are serious about their products, they must test them.

Great, now what?

That's the theory and products. In the next issue we will look at where these products should be used in practice.