

ACOUSTICS: SCIENCE OR BLACK MAGIC?

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How often have you visited an attraction, dark ride, park, shop, or restaurant and felt physically and emotionally drained when you left the establishment? If your bad experience was not due to the lack of service, it very well may have been because of the acoustical environment. The room may have been too loud and reverberant, or the equipment in the adjacent room was too noisy and could be heard through the wall or door. The question is how to reduce the noise and make the environment pleasurable yet still allow the room's activity to draw us in. Adding egg crates and carpet to the walls does not always work.

Acoustically there are three things we must worry about in the design or remodel of any facility. The first is keeping unwanted noise from getting into, or escaping from, the theater or attraction. The second is controlling noise generated by the facility's mechanical systems, circulating pumps, air conditioners, heaters, blowers, or show set items. The third is the coloration or the control of reverberation and echoes within the facility. (Figure 1.)

To improve the acoustical environment, we must determine how each of these factors relate to one another. The first thing we want to do when we are working on a project is to make sure the exterior noise is reduced or attenuated to a level that is quieter than

what the background ambient show sound level will be. By making sure that exterior noise intrusion (airplane flyover noise, traffic noise, or other attraction noise) is quieter than the background sound level within a space, we know that the sound from the exterior sources will not be heard in the room we are working on. The ability of a partition to block sound is described by its Sound Transmission Class (STC) rating. Generally, the more massive and thicker an assembly, the higher the STC rating, the more sound the partition will block. We can also block a similar amount of sound by separating two lighter-weight structures with a large airspace. A six-inch masonry wall and a double stud wall essentially block the same amount of sound. (Figure 2).

The background ambient noise within a space is described by its Noise Criteria (NC) rating. The lower the NC rating, the quieter the space. Mechanical equipment (fans, compressors, circulating pumps, etc.) all radiate a certain amount of noise, each with a very different characteristic acoustical signature. Through experience, careful calculations, and close coordination with the rest of the design/construction team, these mechanical systems can have their noise reduced to levels that will not affect the guests.

The final critical issue in the acoustical design of

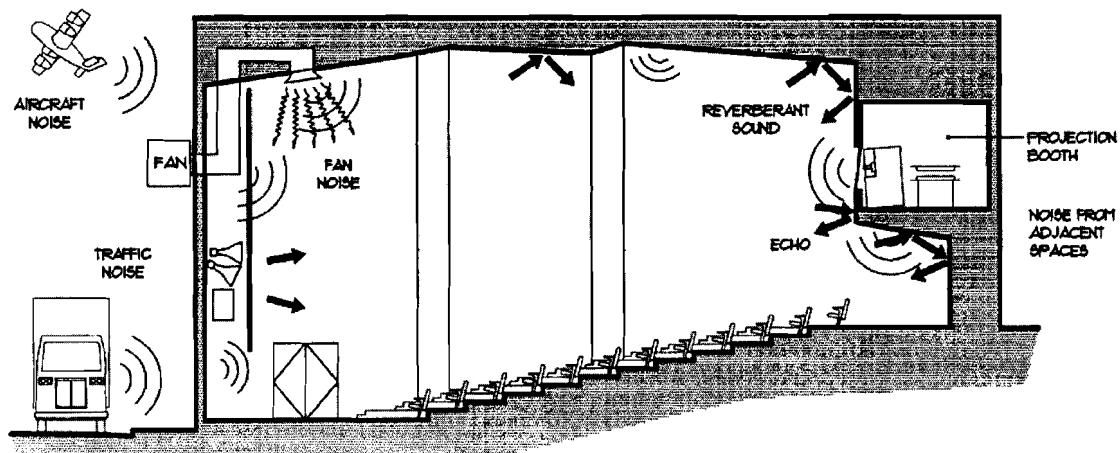


FIGURE 1

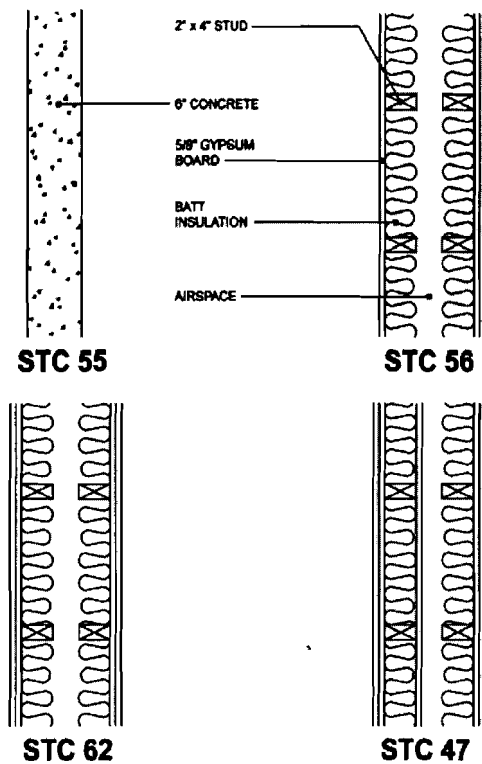


FIGURE 2

any space is controlling reverberation (the amount of sound that is built up within a space) and echoes. Reverberation is nothing more than a series of echoes that occur so rapidly we cannot distinguish where the sound is coming from. The acoustical finishes within a room are probably the easiest to defer, then add back in later, and still allow the acoustical environment to be improved after the facility opens. A very careful line must be walked to make sure the space is functional yet the acoustical environment is not too harsh and reverberant as to drive patrons away.

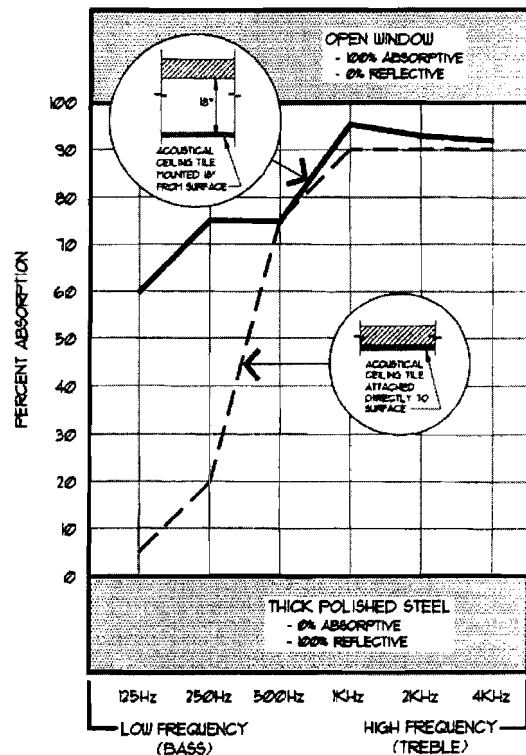
Adding carpet or gluing acoustical tile to a wall will typically not improve the acoustical environment of a space. Sound is a multi-dimensional experience, both in frequency and loudness. The lower the frequency (bass notes) the longer the acoustical wavelength.

The higher the frequency (treble) the shorter the wavelength. The high frequency sound of a back-up beeper on a truck or a video game is easily absorbed by carpet and glue-on acoustical tile material. However, the thump or boominess of the car stereo next to you at

a stoplight is not affected by the thin absorbent properties of acoustical tile or carpeting. To absorb low frequency energy, thick porous materials (draperies, batt insulation, or acoustical plasters) are needed. In a well designed acoustical environment, material selection is as important acoustically as it is for the visual interior design.

Acoustically, we do not like to have all surfaces finished with the same material and have the same general reflective properties. Figure 3 shows the effects of the mounting condition of a material.

If you remember the basics, acoustics becomes a science, not black magic. We must understand the three factors that control the guest's acoustical experience for any project: the noise source (how loud or how quiet the source is), the area between the guest and the source (is it a wall, a floor/ceiling assembly, or is it the room itself), and finally how loud is the room or the background noise around the guest. These principles need to apply to theaters, live stages, and indoor amusement parks, as well as outdoor facilities.



SOUND ABSORPTION BY FREQUENCY

FIGURE 3

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