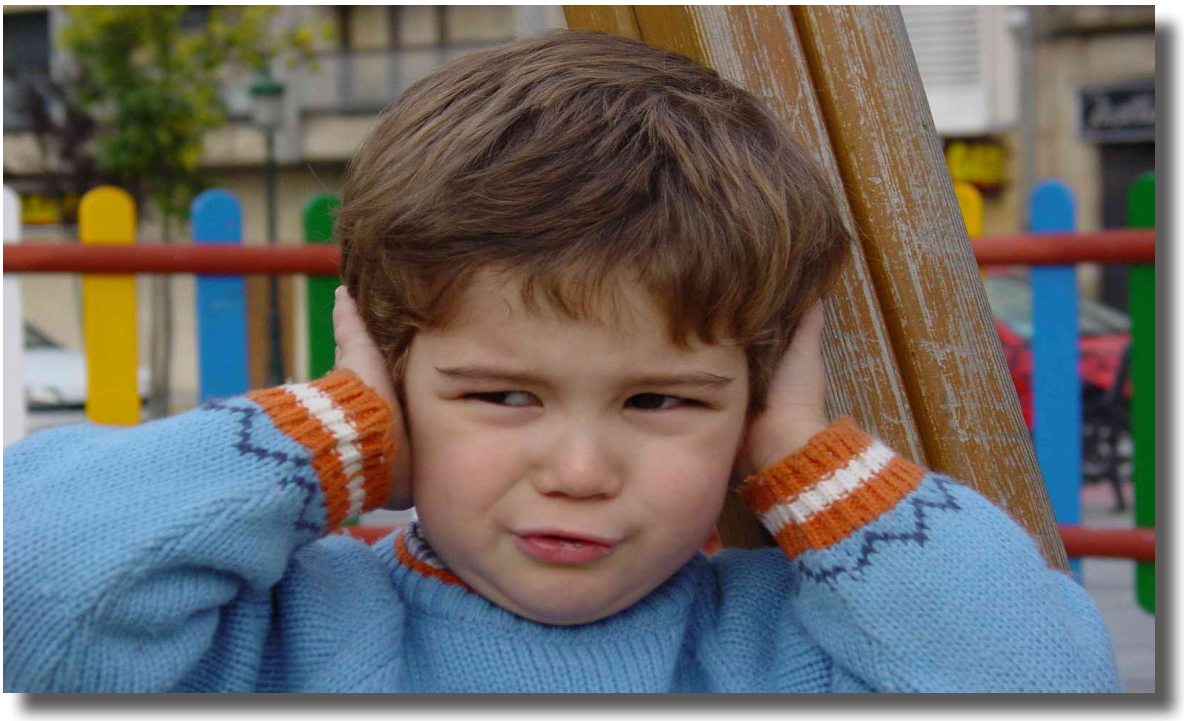
Acoustic Protection

Fact Sheet



In a time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists. – Eric Hoffer

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The acoustical properties of a built environment can render the environment pleasant and peaceful, or disruptive and aggravating. Porous finishes tend to absorb sound, whereas smooth shiny surfaces tend to reflect sound, thereby causing noise interference. The exact level at which a person is disturbed by noise is subjective, and thus varies from individual to individual. IBE cites several adverse effects to noise exposure including: loss of concentration; increase of blood pressure; release of stress hormones; contraction of blood vessels (stenosis); decreased digestion due to negative impact on peristalsis; and ulcers.

Varnish that seals all surface pores creates a very smooth surface. As a result, the sound absorption capacity of this surface will be very low. Since sound waves are easily reflected, noise levels will be higher. This is to be avoided in indoor environments, especially those with large surface areas. Mass wall materials on the interior of a home not only contribute to a more even climate, but when used in the proper locations, they can also block airborne noise transference between rooms. Adding mass or insulation between floors can also help to prevent airborne transfer of noise between stories. Acoustic isolation is required to prevent vibrational transfer of noise. Staggering studs helps avoid this problem, so there is no sound bridge in a wall or floor.

Outdoor-Indoor Transmission Class is a standard that is used to rate the transmission of outdoor sound into indoor spaces. It is more heavily weighted to the lower frequencies of air, rail and road traffic. Some municipalities in the U.S. have established day-night noise level standards in decibels which building envelopes must withstand. Window and door openings are structural weak points with respect to sound transmission from air and ground traffic. Several things can be done to lessen this sound transmission, such as careful detailing and good insulation around the window framing and increasing the layers and quality of the glass.

From a Building Biology perspective, a window's main purpose is to open and let in fresh air. Making the windows more sound-proof, in conjunction with mechanical air filtration/ventilation, can improve living conditions in homes where street noise exists at unacceptable levels. Homes can be designed with quiet central courtyards and intentionally planned with quiet rooms, such as bedrooms facing the courtyards and with ample operable windows. The building itself can act as a sound buffer for the quiet interior courtyard. Utility rooms and more active rooms (such as kitchens) can be placed on the traffic side of the building, with minimal glazing. However, these measures do not replace good municipal planning, which includes separation of major thoroughfares from dwellings and employing planted, bermed green zones between the two.

Insulation will noticeably reduce airborne noise and improve the Sound Transmission Class (STC) rating of exterior walls. Staggered or double stud walls achieve higher ratings than single stud walls. Metal stud walls perform better than wood stud walls, although they are not desirable according to Building Biology principles. Putting surfacing board on resilient channel can improve the STC rating of an assembly, as can adding additional layers of drywall. Solid masonry walls that are thicker than 6 inches will also achieve acceptable STC levels. From a building biology standpoint, these are a very viable solutions, since the walls will also add thermal mass for climate control.

In North America, acoustic tiles are commonly used for commercial buildings and schools, and are sometimes used in residential construction. They are designed to reduce noise and hide services (i.e. wiring, duct work) above the ceiling in dropped ceiling designs. Cellulose fibers with a facing of Kraft paper are the most common material used for ceiling tiles. Gypsum is also sometimes used, but this material introduces the same health issues as drywall (or sheet rock). Associated health problems with gypsum are mostly related to the dust, mainly affect the installation worker, as the small fibers splinter off at the edge of each panel. However, this problem can be aggravated as the dust from the "industrial gypsum" may contain a substantial amount of toxic pollutants (i.e. heavy metals). Additionally, a large variety of petrochemicals may have been captured in the industrial cleaning process. It is also possible that "industrial gypsum" is radioactive. Further, the mining of gypsum has a negative environmental impact, and disposing large amounts of toxic industrial gypsum is fraught with challenges.

The Kraft paper used as facing for the tiles is often made from recycled newspaper which could cause a health effect in sensitive people. Many old acoustic tiles contain asbestos, which leads to lung problems from the very fine and shape dust. Builders should take precautions (i.e. use masks), and sensitive individuals must test the entire system (drywall, Kraft paper, joint compound, and wall cover) to ensure it does not cause health problems.