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FACTS ON NOISE CONTROL

Reprinted & condensed from American Plywood Industry, Tacoma, WA (W/F 198)

Noise originating outside an office or apartment is controlled largely by the location of the site, by the floor plan, and by landscaping. Background noise of this type is an important consideration because it helps mask intermittent intruding sounds. For example, an intruding noise that would be intolerable in a quiet suburb might go unnoticed in a busy city where traffic hum may mask noises from an adjoining room without the background noise itself seeming unpleasant. (Of course, a sudden, obtrusive noise, as distinguished from a general level of background noise, is disturbing in any contest.)

Because of the reduced level of background noise, suburban garden office/apartment projects will usually require higher levels of sound insulation than those in a busier environment.

Noise between units and within a unit is controlled through construction methods and materials that interrupt sound transmission paths. Such noises are transmitted through airborne paths or by impact and structural vibrations.

TYPES OF NOISE

Airborne noises, such as traffic, voices, television, etc., penetrate through walls, doors and other structural elements. Open windows, cracks around doors, heating and ventilating ducts, and other imperfectly sealed openings may also "leak" airborne noise.

Structural vibrations are set up from the vibrations of mechanical apparatus such as heating fans and plumbing fixtures. Unless plumbing is properly isolated (as by acoustically designed hangers), annoying sounds can be transmitted throughout the entire structure.

Impact sounds are produced by falling objects, footfalls and mechanical impacts. Since the most annoying and critical impact sounds are transmitted through the floor, floor constructions are rated for impact noise reduction, as well as for sound transmission.

BUILDING DESIGN

The proper design and layout of the building can do much to eliminate noise problems. Consideration should be given to such points as location and orientation of the building, landscaping, segregation of "quiet" areas, and offsetting of entrance doors.

Good construction can minimize sound problems, but all details must be carefully watched. Sound leaks can be sealed with non-porous, permanently resilient materials, such as acoustical caulking materials and acoustically designed gaskets and weather-stripping. Piping can be wrapped or caulked. Airborne and impact noise can be controlled through properly designed and constructed wall and floor assemblies.

NOISE MEASUREMENT

The ability of walls and floors to reduce noise is measured over the most important part of the hearing range (from 125 to 4,000 cycles per second) and the results reduced to a Sound Transmission Class, or STC number. (Sound Transmission Class [STC] is determined in accordance with ASTM E90 and ASTM E413. Field Sound Transmission Class [FSTC] is determined in accordance with ASTM E336).

The significance of STC numbers is illustrated in the following chart from the Acoustical and Insulation Materials Association. (In comparing rated constructions, remember that 3 db is the smallest difference that the human ear can clearly detect. Thus, differences of 1 or 2 points may be considered negligible. Also, note that even this general comparison is valid only with respect to a given level of background noise.)

STC RATINGS	
25	Normal speech can be understood quite clearly.
30	Loud speech can be understood fairly well.
35	Loud speech audible but not intelligible.
42	Loud speech audible as a murmur.
45	Must strain to hear loud speech.
48	Some loud speech barely audible.
50	Loud speech not audible.

FLANKING PATHS

Acoustical ratings do not reflect the effect of noise that bypasses, or "flanks" the specific construction. "Flanking" can increase noise transmission significantly. For example, a heating duct in a wall normally having an STC of 48 could reduce the STC for the combination to around 30, if it were not properly isolated.

Other significant flanking paths occur through back-to-back electrical and plumbing outlets, and joist spaces continuous over partitions. All flanking paths should be taken into account and eliminated if at all possible. Otherwise, sound reduction by floor and wall construction may prove ineffective. ☐

ADDITIONAL ARTICLE ON REVERSE

NOISE CONTROL

Reprinted & condensed from JLC / July 1991 (W/F 198)

The STC number for the barrier is meant as a total, or composite, number that includes the leakiest paths—cracks and doors—as well as the wall or floor. To give an idea of what the numbers mean, see below "Sound Control Ratings".

SOUND CONTROL RATINGS	
25	Normal speech can be easily understood.
30	Loud speech can be understood.
35	Loud speech can be heard, but not understood.
42	Loud speech audible as a murmur.
48	Some loud speech barely audible.
50	Loud speech not audible.

A typical residential interior wall — 2x4 studs at 16 inches on-center faced with ½" drywall on each side — is rated around STC 34.

PLUG THE LEAKS FIRST

The smallest crack can degrade the sound resistance of a wall system by a surprising amount. For example, if a composite wall (one with a door) 12'6" long by 8' tall starts out rated at STC 40, an ungasketed 1/16" crack around the door will drop the rating to STC 29. Other paths are electrical outlets (particularly if they are positioned back-to-back), switch boxes, telephone outlets, and heating ducts. Sealing these gaps is your first priority in strengthening a sound barrier.

Sealing electrical boxes is relatively simple. Many of the same approaches and materials used to seal electrical outlets against air leakage and heat loss are effective in sound control. Install fiberglass insulation behind the box. Then seal all openings in the box and between the box and the wall finish with flexible caulk, such as silicone or polyurethane. Pull the outlet or switch out of the box far enough to allow you to reach inside and caulk each hole or gap. To seal the gap between the box and the drywall finish, you'll probably get a better bond with polyurethane or acrylic latex caulk than with silicone.

Make sure any cracks between the wall and floor are caulked with an acoustical sealant. Such sealants stay soft and flexible, so they won't crack.

Shared heating ducts between adjacent rooms are a real nuisance. The best—but not easiest—fix is to decouple the ducts and run a separate supply duct from the furnace to the room needing quieting. If you can't do this, lining the ducts with acoustic insulation will absorb some of the airborne sound.

And while you are sniffing out air-borne sound paths, don't neglect any recessed lights in the ceiling, if the space above the ceiling communicates with the noisy room. One option is to replace the units with surface-mounted fixtures. Seal the holes in the junction boxes, as with electrical outlets.

DOORS – THE NEXT HURDLE

Doorways leak sound through cracks and openings and through the door itself. To seal air paths around doors, use a flexible gasketing similar to what you would use to weather-strip an outside door. Add either a weather-stripped threshold or other device to seal the crack at the base. If the door has louvers, plug them with a solid panel or replace the door with a solid door.

If gasketing the door won't provide enough sound control, you have to upgrade the door as well. But what is enough? A good rule of thumb for a doorway is to shoot for an STC rating within 10 points of the wall STC number. The effect of a typical interior door on the total barrier is large enough to make the door the first upgrade priority.

Doors, the weakest part of the sound barrier between rooms, can be improved from a poor STC rating of 15 to around STC 35 by plugging openings (such as louvers), sealing cracks with gasketing, and replacing hollow-core with solid-core units. Further improvement up to STC 55 requires double the door, which probably means fattening the wall as well.

The more the wall resembles a diaphragm (think of a drumhead), the more sound it transmits between rooms. As with a drumhead, you break down a diaphragm action of a wall by disconnecting it from its supports. You likely can't do this with the primary wall and maintain structural integrity, so look for ways to make any construction added for sound control vibrate separately from the primary wall and the house structure, particularly the floor.

Options for upgrading walls to control sound transmission basically come down to adding mass (good for stopping low frequencies, less so for high); insulating the cavity; and adding a second wall system independent of the primary wall.

The cheapest and easiest choice is to simply add a layer of drywall to one side, gaining an improvement of 3 decibels. All other measures require the removal of the face layer of drywall from one side of the wall in order to get to the wall core.

The airborne sound rating for a standard 2x4 stud wall with ½" gypsum drywall on each side is about 34 – satisfactory for most room separation requirements.

The chart below provides information on STC ratings for a variety of building component materials.

STC RATINGS FOR VARIOUS BUILDING COMPONENT MATERIALS	
DOORS (operable with gasketed frame unless otherwise noted)	Hollow core wood door....**19** Solid core wood door....**26** Solid core wood door (sealed)....**28** Two solid core wood doors....**33** Steel door with urethane core (sealed)....**26**
GLASS (glazed)	¼" plate glass....**26** 1/8" insulated plate glass, ½" air space....**32**
WALL	2x4 wood stud with ½" gypsum board....**34** 6" concrete block....**43** 2 ½" steel stud with 2 layers of ½" gypsum board each side....**46**