Sound Control Manual − Sound Construction
Impact Structure−Borne Sound

Impact sound originates when one body strikes another, such as in the case of footsteps, hammering, and falling objects. Even though some of the energy is eventually conducted to the air, the sound is still classified as impact.

Impact sound travels through the structure with little loss of energy if the structure is continuous and rigid. Thus tenants without enough heat could often pound on a radiator and notify the superintendent (and all of the other tenants as well) of the situation.

Transmission of impact sound can be controlled by isolation, absorption and elimination of flanking paths, and offset by the introduction of masking sound. Limpness in the construction affects transmission of impact sound, but is difficult to introduce because of the structural requirements of the assembly.

Mass plays a secondary role in teh isolation of impact sound. The benefit of mass in a sound control construction is its resistance to being set into vibration. In retarding airborne sound, this is very effective becuase the sound energy is small. With impact sound, the energy is greater and is applied directly to the construction by the sound source with little energy loss. Thus, the mass of that surface is immediately set into motion. For this reason, concrete slab construction at 100 psf is only slightly more effective in retarding impact sound than simple wood frame construction at 10 psf.

While leaks in a floor−ceiling assembly must be sealed to stop the transmission of the airborne sound associated with impact, they play no part in retarding the transmission of the structure−borne sound.

Impact Isolation
If the surface receiving the impact, such as a floor, can be isolated from the structure, the impact sound will not be transmitted. Likewise, if the structure can be isolated from the ceiling below, the impact sound will be restricted from traveling into the room below.

Isolation of the ceiling of the receiving room can be accomplished with resilient mounting of the drywall panels or lath. This still allows some sound from above to enter the structure and travel to other rooms. Resilient subflooring materials such as insulation board and uderlayment compounds are effective, as is heavy carpet over thick underpad. A combination of these methods is necessary to produce idea attenuation of impact noise.

Other sources of structure−borne sound, such as motors, flushing toilets, dishwashers, garbage disposals, blowers, and plumbing, can be isolated from the structure by resilient mounting procedures.

Absorbing Impact Sound
The use of sound attenuation blankets is as effective in impact sound control as in

controlling airborne sound. Of course, the diaphragms (floor and ceiling) must be isolated, or the sound will travel through the connecting structure.

Structural Flanking Paths

One of the most frequent causes of sound performance failure in a floor−ceiling assembly is flanking paths. Impact sound produces high energy at the source; this energy will follow any rigid connection between constructing elements with little loss. For example, in a child's tin−can telephone, sound will travel better through the tight string stretched between the cans than through the surrounding air.

Some of the most common flanking paths are supplied by plumbing pipes, air ducts and electrical conduit regidly connected between the floor and ceiling. Continuous walls between floors, columns or any other continuous structural elements will act as flanking paths for impact sound. In fact, any rigid connection between the two diaphragms will effectively transmit impact sound.

Masking Impact Sound

While masking sound can be useful in continuous impact sound such as a slightly noisy blower, it cannot be loud enough to cover irritable impact noises such as footsteps, slamming doors, or noisy garbage disposal units.

Impact Sound Transmission Rating

Assemblies designed to retard the transmission of impact sound are tested for performance in a manner similar to that for airborne sound assemblies, The floor−ceiling assembly is constructed between two rooms and microphones are positioned in the recieving room to record the pressure of the transmitted sound.

The impact sound source is a standard tapping machine. It rests on the floor of the test assembly and drops hammers at a uniform rate and impact energy. The sound produced depends to some extent on the floor surface material. The transmitted sound is measured and recorded at six microphone locations and three locations of the tapping machine. The results are corrected to a standard absorption so that results from different laboratories may be compared.

The results, recorded at sixteen 1/3−octave bands, are plotted and compared with a standard contour criteria curve in much the same manner as Sound Transmission Class determinations.

[Insert Figure 55]

Impact sound rating methods have been established by the Federal Housing Administration. The earliest, a single−number rating system called Impact Noise Rating (INR), was based on a fixed criterion curve (INR−0) shown in Figure 55 (above). The Impact Sound Pressure Level (ISPL), recorded at sixteen 1/3−octave frequency bands, was plotted on the graph and compared with the INR−0 curve. The INR rating was obtained by adjusting the ISPL curve vertically until the average of all the points above the INR−0 curve was no more than 2 db, and no point more than 8 db above the INR−0 curve. The amount that the ISPL curve was moved became the INR; if the ISPL curve was moved down 3 db, the INR was −3; if the ISPL curve could be moved up 7 db, the INR was +7, etc. The disadvantages of this system were the negative numbers and the lack of relationship to STC values (Figure 55, above).

[Insert Figure 56]

The National Bureau of Standards has since developed a new system for use in FHA standards. To determine this new Impact Insulation Class (IIC), the ISPL curve is plotted on a graph as shown in Figure 56 (above). The criterion curve is then shifted to the lowest point where no point on the ISPL curve is more than 8 db above it, and the sum of all ISPL deviations above it is no more than 32 db (an average of 2 db per frequency). The location of the criterion curve at 500 Hz is projected to the IIC scale, right of graph, to read IIC rating (Figure 56, above).