

Sound Advice

Helpful Information from *Stewart Acoustical Consultants*

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THE THUMP IN FRAME STRUCTURE FLOORS

By Noral D. Stewart

Frame structures whether wood or steel have more inherent flexibility than heavy concrete construction. This introduces a problem in the floor-ceiling structures that is impossible to eliminate and very difficult to significantly improve. The floors in these structures can behave like a large drum head when excited by footsteps. The whole floor and ceiling structure moves slightly, producing a low bass sound distinctly different from impact on a hard surface.

This thump on the frame structure is not resolved using carpet or resilient materials under hard surfaces. In fact, research shows these elements actually make the thump slightly worse, though not enough to counteract their benefit for higher frequency sound. Efforts to resolve this problem with better isolation of the ceiling from the floor have not been fully successful. The problem is that the air within the space cannot compress fast enough to prevent moving the ceiling at these low frequencies of concern.

The major research on the problem which concentrated on 13 foot spans found that attempts to improve the situation by stiffening the floor structure reduced the absolute amplitude of the sound but shifted it to a higher frequency where the ear is more sensitive, resulting in no perceived improvement. Anecdotal observations indicate the sound is often more noticeable for longer spans of similar design. Stiffness decreases strongly with span length. The addition of weight such as gypsum concrete theoretically helps by lowering the frequency to a range where the ear is less sensitive but not increasing amplitude. Deeper trusses or more of them can increase stiffness some but have less effect than span length. In some cases, steel beams might be used to break a large span and add some stiffness.

The typical measurement of impact sound transmission does not measure sound below 100 Hz in frequency which is where most of the thump is. It does have some influence on the measured Impact Isolation Class (IIC) and is a reason why it is hard to get the IIC of frame structures as high as can be achieved with concrete structures. Thicker resilient pad materials are usually necessary on frame structures than with heavy concrete.

Another side effect of flexibility in a floor is the potential for squeaks. Ideally the subfloor should be both glued and screwed to the joists to minimize this risk. Proper installation of resilient channel without excessive overlap of joints is also helpful.

Buyers of condominiums in frame structures must be warned of the thump and that it is a natural effect of the structure that cannot be eliminated.