Sound Transmission

Application Note

Rev. 1.3 | 14-07-2020

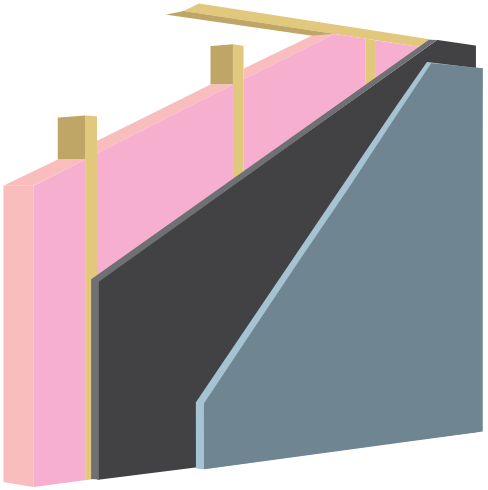
Introduction

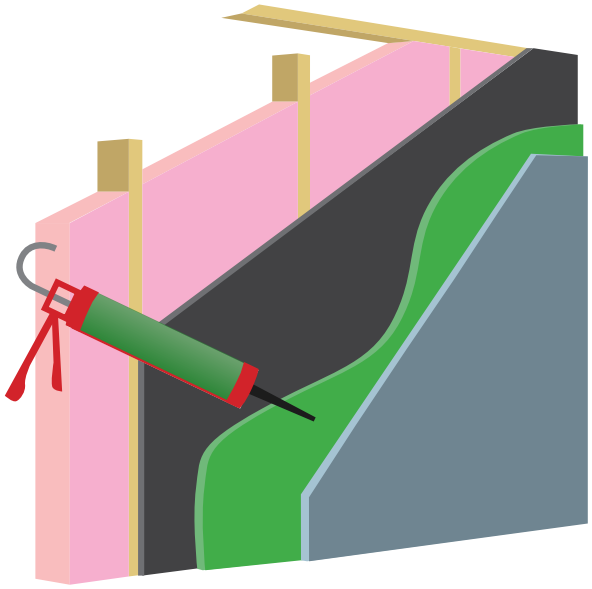
Sound transmission is the spread of sounds through materials and air. It is an important area of consideration when planning any loudspeaker system, and where possible should be planned for at the design stage, before any construction takes place.

In any typical home or commercial space, relatively loud sources of sound are usually audible in other areas of the building, most prominently in spaces with shared boundaries. When planning an audio system, thought must be given to its intended use and if sound transmission is likely to be an unwanted byproduct. For example, in a ground floor home cinema (where relatively high volume levels are desirable) directly beneath a child's bedroom (where silence is desirable in the evenings and at night) its use would be compromised where there is poor sound isolation between the two spaces. Multi-room audio systems are another case where results can fall short of expectation without taking the appropriate steps to isolate the different zones. This could result in unrelated sources in different zones bleeding into each other. There are 4 main targets when addressing unwanted sound transmission:

1: Increase surface mass

More mass between spaces will reduce sound transmission in the vast majority of cases. Using multiple layers of plasterboard is a common approach to building up mass, and using layers with differing densities / stiffnesses / thicknesses will provide better isolation because each material will affect different areas of the sound spectrum. For example, using a sheet of high density plasterboard with a sub-sheet of plywood is a good idea, or a top sheet of high density board and a bottom sheet of 15mm standard board. Acoustic underlay (adding mass AND damping) can also be very effective in reducing sound trasmission between floors.





2: Add damping

By introducing compliance (or 'springiness') into a structure, some of the impact of sound waves on its surfaces will be absorbed before entering the wall or ceiling framing, and transmission is thus reduced. An effective step is to use an acoustic barrier mat (such as Acoustiblok) between the stud frame and the plasterboard substrate. This is a rubber membrane that will add damping as well as partly decoupling the board from the frame. Alternatively, where a multiple-skin wall has been used, Green Glue can be used to provide panel damping between the layers. This is incredibly efficient at damping panel vibration and reducing mechanical sound transmission.
Another option is to use a resilient clip and hat channel for plasterboard installation. This uses rubber isolation mounts within the clips to isolate the hat channel and plasterboard from the stud frame. This kind of system can be used on both sides of the treated wall.

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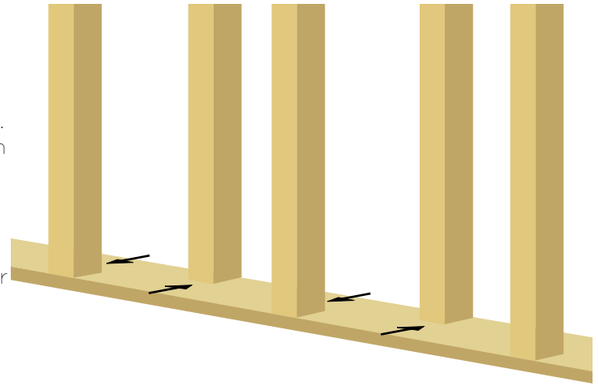
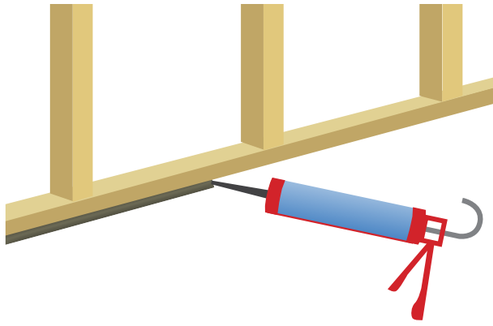
3: Isolate / decouple

This method physically decouples the two sides of the wall, greatly reducing the vibrational energy transferred from one side to the other. The easiest construction method here is a staggered stud wall. This is a common construction method where each stud is only attached to one side of the wall, with studs on alternating sides, reducing the direct transmission path across the structure. To go a step further, rather than staggering the studs, separate stud frames can be constructed for either side of the wall. This will increase cavity depth, but is even more effective at hindering transmission since the direct mechanical transmission path is further reduced.





4: Block air paths.

Mechanical transmission and airbourne transmission work together as sound propagates thoughout a structure. Sealing up air pathways between spaces where isolation is desired a very simple step to take. Specialist acoustic rated caulking is available for this purpose; usually a paintable acrylic based material which has intumescent qualities for fire protection. This means they can be used extensively for fire proofing and sound-proofing internal frames and sealing joints. Noise flanking paths for airborne noise such as passive ventilation ducts that may connect adjacent rooms may be less obvious but are equally important.

In-wall / in-ceiling speakers

When compared to traditional in-room loudspeakers, all in-wall / in-ceiling speakers will exhibit different transmission properties due to the fact they are directly coupled to the finished surface and can be exposed to the cavity space, but with proper preparation this should not be an issue. Amina recommends and supplies sealed back-boxes which typically reduce rearward sound projection by 26dB in the mid-frequencies, as well as creating a tuned acoustic cavity for the loudspeaker panel. Cavity spaces should be air-sealed and filled with high-mass insulation (for example Rockwool RW45A).

Plasterboard back-boxes, when used in conjunction with Amina's range of CV backboxes have proved to be very effective in further reducing sound transmission between rooms for high SPL applications. Plasterboard backboxes can be constructed quickly and easily using materials that are typically to hand on site. (Detailed plans are outlined on the next page.)

In all cases there are always many solutions to reduce sound transmission problems, and the above is only intended as a guide to the most common and efficient methods of isolation. For advice or questions relating to sound transmission, please contact the technical team at Amina.

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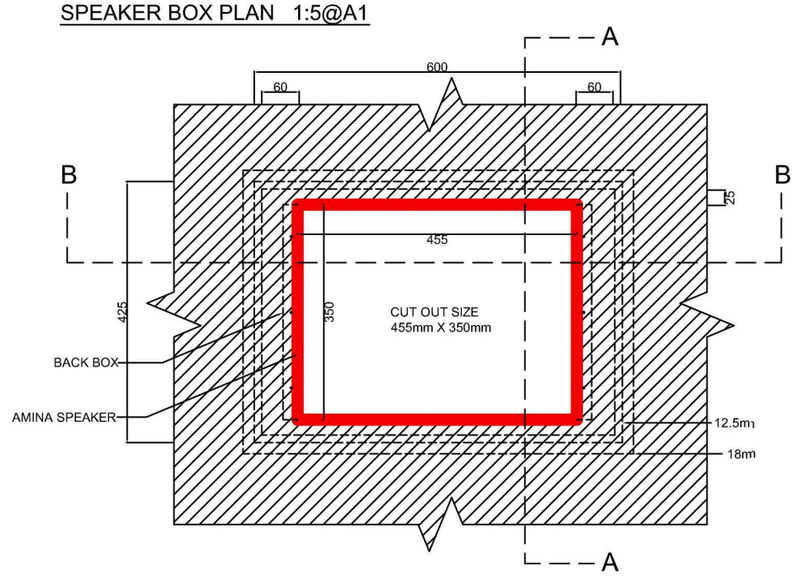
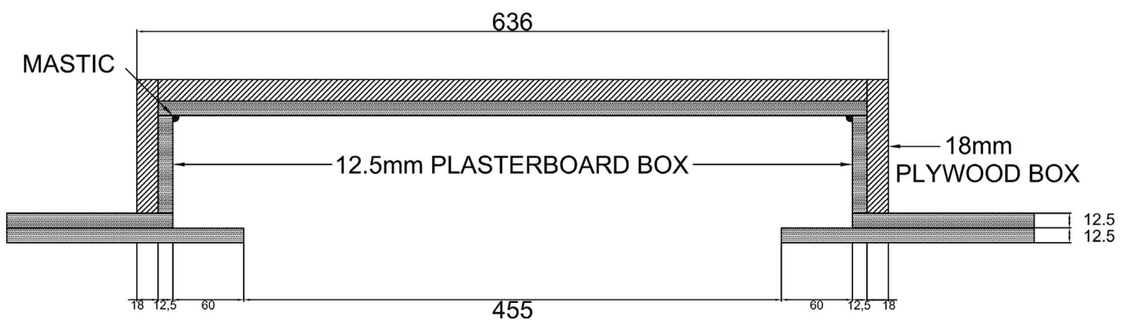
SPEAKER BOX PLAN 1:5@A1





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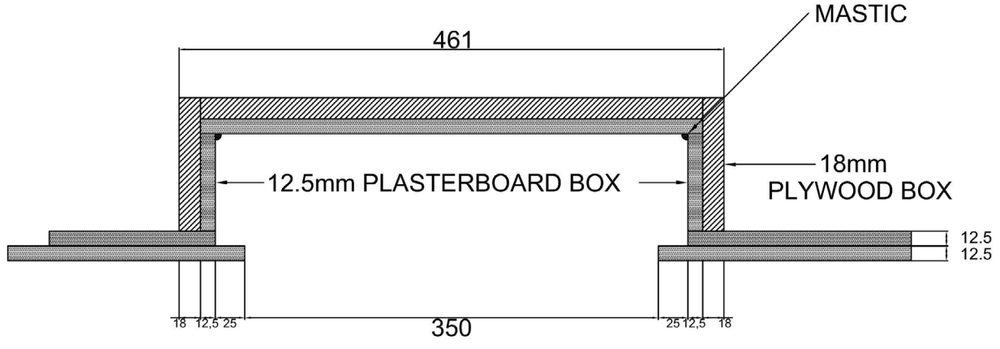

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