Sound insulation between dwelling units

Ball, W. H.

Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/20338541
Technical Note (National Research Council of Canada. Division of Building Research); no. TN-180, 1954-08-01

NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF BUILDING RESEARCH

No. 180

TECHNICAL NOTE

NOT FOR PUBLICATION FOR INTERNAL USE

PREPARED BY W.H. Ball CHECKED BY APPROVED BY R.F.L.

PREPARED FOR General Distribution DATE August 1954

SUBJECT Sound Insulation Between Dwelling Units

Most modern building codes require that walls and floors separating dwelling units provide sound insulation to reduce the passage of sound between units.

It is the purpose of this article to discuss the principles of sound transmission in buildings and methods of reducing sound transmission.

Noise may be transmitted between living units by the following means:

1. By transmission of air-borne sounds through cracks in the separating structures such as might occur between sheets of material, around water pipes or conduits, and through the ducts of heating or ventilating systems;

2. By direct transmission through the various portions of the separation which act as diaphragms set in motion by the sound waves striking them.

The prevention of sound transmission by the first means is not always easy to accomplish. Cracks, however, can be kept to a minimum. Duct-work presents the most difficult problem but sound transmission through it can be reduced by the use of an acoustic filter in the duct system.

The prevention of sound transmission by the second means has received considerable study in the laboratory and sound insulation factors (sound transmission loss in decibels) have been published for many wall, ceiling and floor constructions.

In the case of walls between living units it has been found that the weight of the wall per unit area is the most important factor in determining its sound insulation. Of secondary importance is the nature of the material and the manner in which it is fastened at the edges. Solid walls of burned clay or concrete masonry about 8 inches thick generally meet an acceptable standard of sound insulation.

Walls constructed on a framework of wood or metal must generally be built in two or more unconnected layers in order to achieve an acceptable standard of sound insulation. The sound energy is dissipated in passing from one layer to the next and by a proper selection and assembly of materials can be made quite small.

The following wall constructions are listed as being representative of the type of construction that should provide acceptable noise reduction for use between living units:

1. Staggered wood studs (preferably with separate plates top and bottom), $\frac{1}{2}$-inch fibreboard each side, scratch and brown coats of gypsum plaster each side, and smooth white plaster finish;

2. Wood studs, gypsum lath attached to studs each side with special flexible clips, followed by scratch, brown and finish coats of plaster;

3. Solid 8-inch brick or concrete plastered both sides;

4. Walls of 4-inch masonry units with lath and plaster, each side mounted on wood furring strips.

There is a general misconception that the sound insulation value of an ordinary partition wall can be greatly increased by using some kind of fill material between the studs. In many cases, in fact, the air space is acoustically better than if a fill is used.

Floor-ceiling combinations are even more difficult to insulate against sound because not only is it necessary to consider air-borne noises but in addition there is a special class of noises produced in the structures which should be considered. Impact noises such as may result from walking, the movement of furniture, and the direct transmission of vibrations from such equipment as a piano or radio should be controlled. It is generally more difficult to provide effective insulation against such noises than against air-borne noise.

The cost of providing a floor-ceiling combination which would have equal sound transmission reduction properties in respect to air-borne and structure-borne noises would, in most cases, be prohibitive. It is likely that it would be more reasonable to use a construction which has less resistance to the transmission of structure-borne noises, and to supplement this with the use of resilient pads under the radio, piano or other objects which could transmit vibrations to the floor. Rubber or cork tiles and carpets also will assist in reducing the noise caused by walking.

The following floor-ceiling constructions are listed as being representative of the type of constructions that should provide acceptable reduction of air-borne and structure-borne noises on the basis suggested above:

1. Wood joists; lath and plaster on lower side; rough flooring, ½-inch fibreboard, and flooring of rough and finish flooring laid on nailing strips;

2. Wood ceiling joists supporting ½-inch fibreboard and plaster; separate wood floor joists supporting rough and finish floor;

3. Same as (2) with floating floor described in (1) will provide a combination with increased resistance to both air-borne and impact noises;

4. The sound insulation of a masonry floor can be greatly improved by the use of a floating flooring and special suspended ceiling. The method of attaching the nailing strips for the flooring is probably of secondary importance but for the suspended ceiling flexible hangers should be used.

Certain materials, commonly classed as acoustical materials, are often used on the interior surfaces of walls and ceilings to improve listening conditions in rooms. They do not, however, prevent the passage of sound from one room to another. This method of sound control within a room should not be confused with the reduction of sound transmission into adjacent rooms or living units.

The examples of wall and floor-ceiling combinations cited in this article have been included only as typical constructions. They may not always be acceptable as separations between living units where there is a specific requirement for fire resistance. The requirement for fire resistance should be determined from the local building code.

(This note is based on data published in Building Materials and Structures Report BMS 17 and Supplements 1 and 2 of the U.S. National Bureau of Standards.)