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Building

Impact sound insulation under floor tiles

1 General

Ceramic tiles and slabs are highly estimated for flooring in tropical and subtropical countries. They are hard-wearing, have a high heat capacity, and remain cool. Their one drawback is that they attenuate sound much less than soft floor covering, e. g. carpeting. Thus, although they are comparatively thick, they transmit footstep sound. Consequently, they necessitate special insulation against impact noise. Some examples are cited in this publication to illustrate points that must be observed in planning and laying tiled floors insulated against impact noise.

The literature in placing impact noise insulation under tiled floors is scanty. As a consequence, the erroneous thought holds sway that a tiled wearing surface could not be laid over floating floors, because the tiles would be unable to withstand the pinpoint loads imposed by the legs of heavy furniture. In actual fact, however, the load is borne solely and exclusively by the underlying concrete floor and not by the tiles or the bed of mortar. All that is required is to ensure that the tiles are carefully laid and completely and firmly embedded in the mortar.

The following examples have been selected to demonstrate that tiles can also be laid in living quarters and humid rooms and that thin-bed techniques have recently been extended to embrace tiled floors.

2 Tiled floor in a living room

In this structure, the sub-floor is covered by a layer of flexibilized expanded Styropor panels. Bitumen felt is then laid over the Styropor in order to avoid the acoustic bridges that could be formed if the screed were to flow through the joints between the Styropor panels into the sub-floor. A strip of Styropor board of 1 cm thickness is placed vertically along the periphery and must project slightly above the upper edge of the subsequent floor covering.

Thus the concrete flooring slab rests in a trough formed by the layer of insulation covered by bitumen felt, and it does not come into direct contact with any other part of the building. Tiles can then be laid on it by conventional techniques. The total thickness of the screed, the tiles, and the mortar in which the tiles have been laid is about 6 – 7 cm. Once the mortar has set, the projecting Styropor strips at the edges are trimmed to the height of the tiles. The joints at the walls can then be covered by tiled, wooden or plastics skirting.

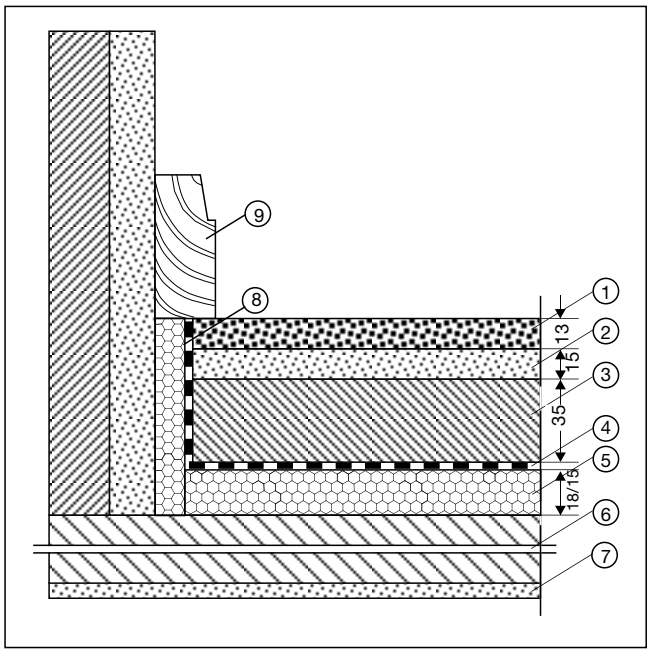

Fig. 1 Tiled floating floor in a living room

1 Floor tiles
2 Bed of mortar
3 Screed
4 Bitumen felt (250 g/m² felt)
5 Flexibilized Styropor board (insulating layer)
6 Sub-floor
7 Plaster
8 Strip of Styropor board
9 Skirting

3 Tiled floor in a humid room with PVC skirting

The main point in this design is that the walls are tiled before the floor. Flush stoneware skirting extends almost to the sub-floor, from which it is separated by a gap of 1 – 2 cm width. The advantage of this design is that a plumb and square surface is formed, against which the peripheral strip of Styropor board can be placed. The tiled floor can then be laid as described in Section 2, and the joint between the wall and the floor can be covered by an extruded PVC profile.

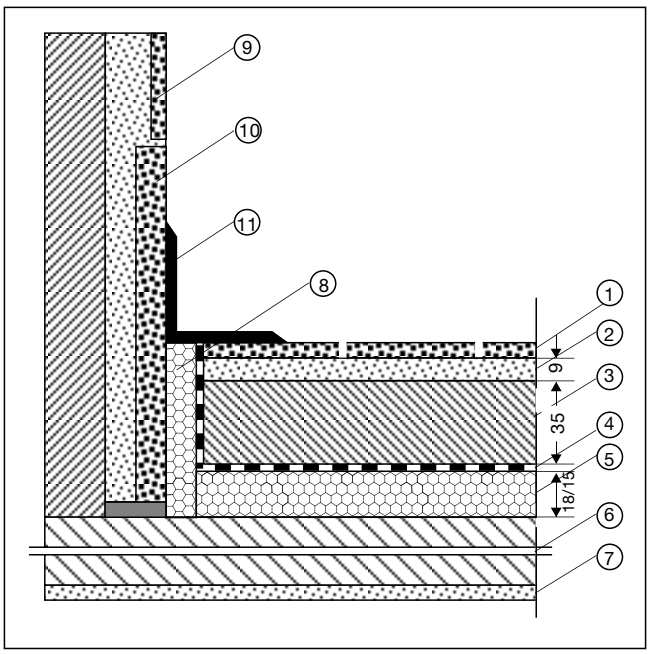

Fig. 2 Tiled floating floor in a kitchen

1 Floor tiles
2 Bed of mortar
3 Screed
4 Bitumen felt (250 g/m² felt)
5 Flexibilized Styropor board (insulating layer)
6 Sub-floor
7 Plaster
8 Expanded Styropor edge strips
9 Ceramic tiles
10 Stoneware skirting
11 Plastics profile

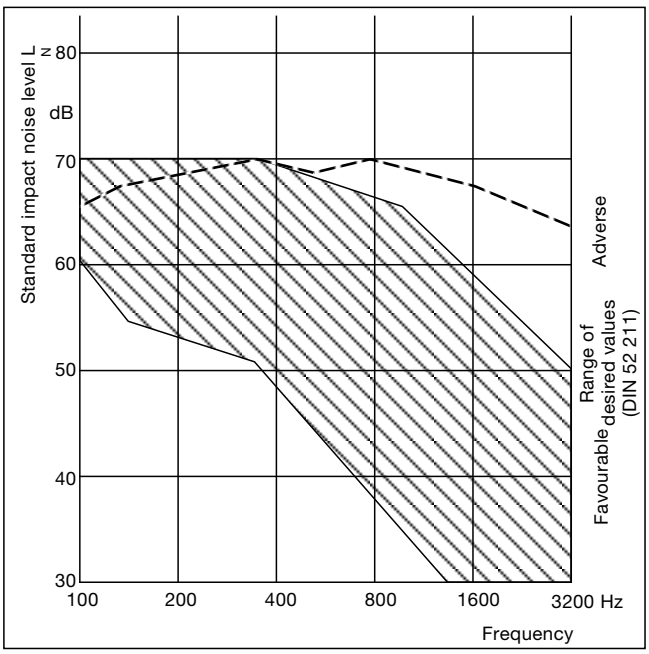

Fig. 3 Impact noise insulation provided by a floor made up as is shown in Fig. 2

4 Tiled floor with straight skirting in a humid room

In the example shown in Fig. 2, the strip of Styropor board at the edges has to be covered by a permanently elastic sealant or by wood or plastics skirting. If it is not desired that the joint be so visible or that a skirting of a different material is used, the method illustrated in Fig. 4 can be adopted. Once the floor has been tiled, the joints have been filled, and the strip of insulation has been trimmed, an elastic sealant in the form of a tape of 4 mm thickness is laid along the line on which the skirting has to be placed. The reason for inserting a tape of 4 mm thickness in a joint of only 3 mm height (cf. Fig. 5) is that the tape is compressed somewhat by the weight of the stoneware skirting. In order to eliminate any likelihood that some mortar may enter the strip of insulation through the space between the tape and the base of the wall, a roll of elastic sealant is placed on the tape to form a tight seal against the wall.

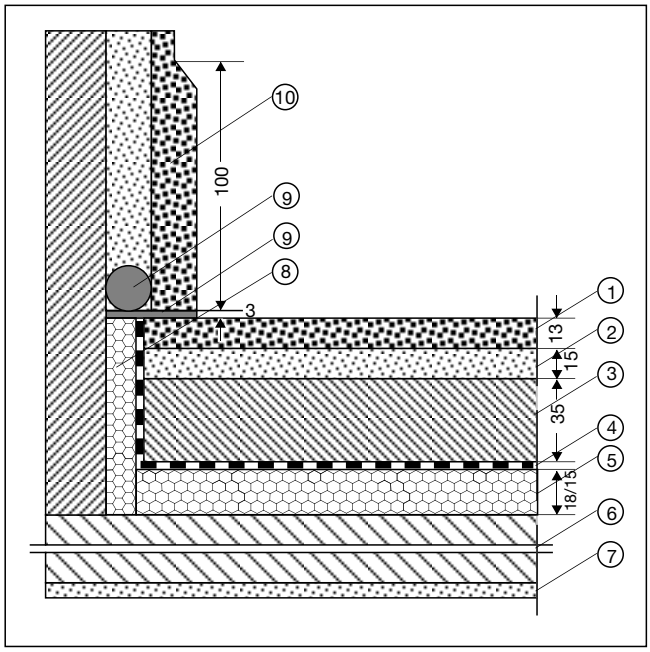

Fig. 4 Tiled floating floor in a kitchen

1 Floor tiles
2 Bed of mortar
3 Screed
4 Bitumen felt (250 g/m² felt)
5 Flexibilized expanded Styropor board (insulating layer)
6 Sub-floor
7 Plaster
8 Strips of Styropor board
9 Permanently elastic sealant
10 Stoneware skirting

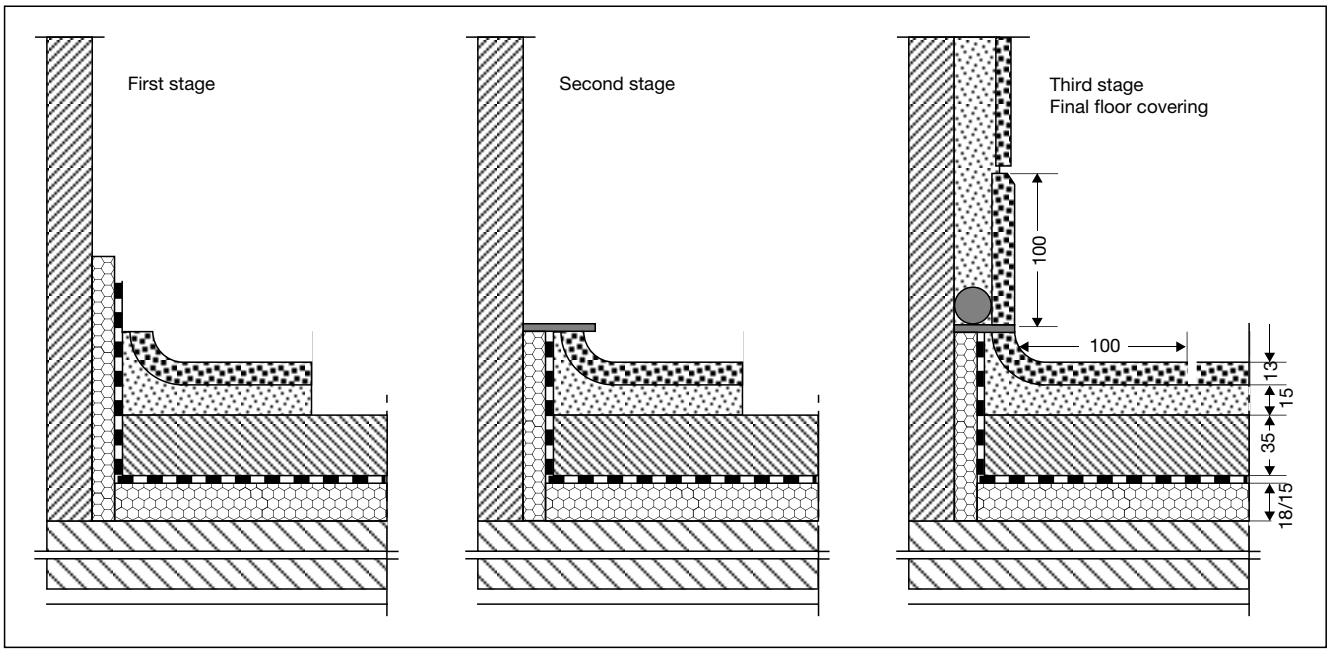

Fig. 5 Tiled floating floor with concave skirting

5 Tiled floor with concave skirting in a humid room

The sharp corners formed by straight skirting are often undesirable, e. g. in bathrooms. They can be easily avoided by concave skirting.

The procedure is the same as that described in Section 4 and is illustrated in Fig. 5.

6 Thin-bed techniques

The established method of laying tiles in a thick bed of mortar ensures the necessary adhesion and compensates unevenness at the surfaces. However, modern glazed or unglazed tiles are very smooth and are manufactured to close tolerances. They can thus be laid on existing insulated screeds much more economically by thin-bed techniques. For instance, one man can lay about 4 m² of tiles in an hour by the thick-bed method; and about 10 m² in an hour, by thin-bed techniques.

7 Requirements for applying thin-bed techniques

The surface to be tiled should be absolutely smooth, firm, and unabradable. The best substrate for a durable bond is a cement coat.

8 Thin-bed mortars and adhesives

Various cements, depending on the substrate and the requirements, are used for thin-bed techniques:

(a) Mixtures of Portland cement, sand, and polymer dispersions

(b) Concrete-bonding mortars, which consist of a dry mixture of sand, cement, and synthetic resins

(c) Synthetic resin adhesives in the form of liquid one-component and two-component cements

Thin-bed techniques obviate the need to water the tiles. The adhesion is ensured by a uniform, thin layer of the cement, but no compensation can be made for significant unevenness in the substrate.

9 Laying tiles by thin-bed techniques

In standard practice, the walls are tiled before the floor.

The first step in tiling the floor is to smooth the sub-floor with a cement mortar. Afterwards, the edge strips of expanded Styropor are glued to the wall with a dispersion-type or contact adhesive (Fig. 6).

Flexibilized 1.0 m x 0.5 m expanded Styropor panels of 18/15 mm thickness are laid on the smoothed sub-floor (Fig. 7) and covered with the bitumen felt (Fig. 8). A reinforced cement screed of 35 mm thickness is laid over the insulation (Fig. 9).

The sealant inserted between the screed and the wall tiles (Fig. 10) must be flexible. This is because the joints must remain watertight, even if the floor moves under load, and a flexible medium prevents impact sound transmission.

The final step is to lay the ceramic tiles. In the example shown here, 5 cm x 5 cm tiles of 4 mm thickness were laid in a mosaic pattern in a 1-mm bed of concrete-bonding mortar composed of sand, Portland cement and a plastics dispersion (Figs. 11–13).

10 Impact noise insulation of tiled floating floors laid by thin-bed techniques

Evidence of the good acoustic insulation that can be achieved by tiled floating floors laid by thin-bed techniques is given in Fig. 15.

Measurements have revealed that tiled floors laid by thin-bed techniques more than satisfy the proposals for enhanced impact noise insulation laid down in German standards (DIN 4109, Part 2).

Fig. 6 Strips of insulation laid against the walls of a room to be tiled

Fig. 7 Insulating layer consisting of flexibilized expanded Styropor board

Fig. 8 Some of the insulating layer covered with bitumen felt

Fig. 9 Reinforced screed

Fig. 10 Sealing the joints at the edges with an elastic sealant

Fig. 12 Tiled mosaic floor

Fig. 11 Laying the ceramic tiles in a bed of mortar of 1 mm thickness

Fig. 13 Joint between wall and floor tiles filled with elastic sealant

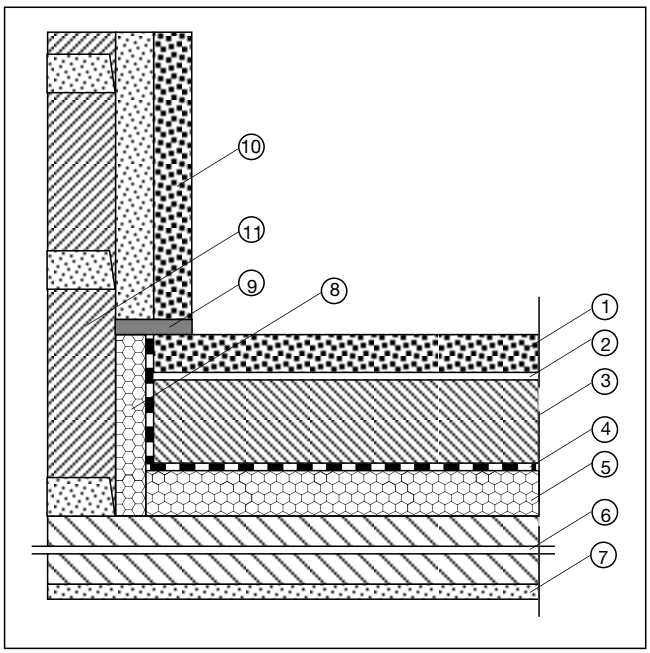

Fig. 14 Cross-section through the completed floor

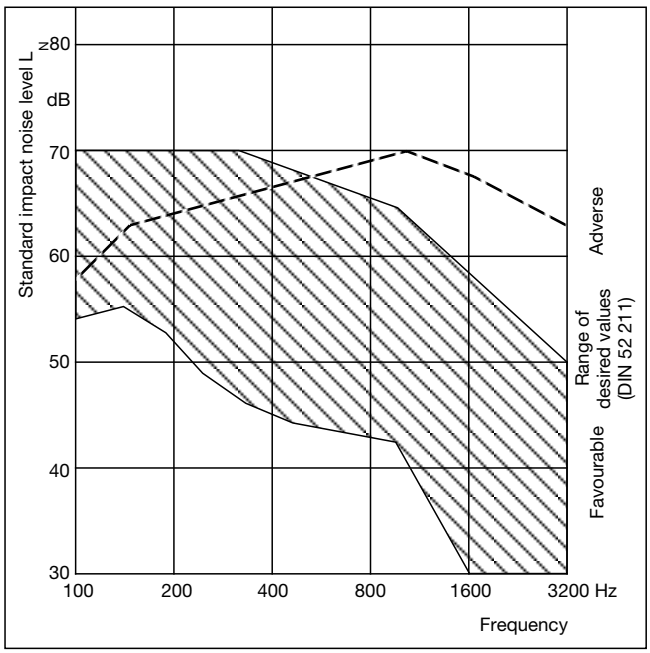

Fig. 15 Impact noise insulation for the floor structure

1 Floor tiles
2 Concrete bonding mortar of 1 mm thickness
3 Screed of 35 mm thickness
4 Bitumen felt (250 g/m² felt)
5 18/15 mm insulating layer consisting of flexibilized expanded Styropor board
6 Sub-floor of 140 mm thickness
7 15-mm layer of plaster
8 Expanded Styropor edge strips
9 Elastic sealant
10 Stoneware skirting
11 Brickwork

11 Conclusions

Tiles can be economically laid on floating floors that have been insulated with flexibilized expanded Styropor board. A well-designed structure certainly meets the requirements laid down in the German standard on sound insulation in buildings (DIN 4109). In fact, measurements have revealed that the levels of impact noise insulation that can thus be obtained are much more favourable than those specified in the standard.

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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