

## **Durability of sealing layers on non-massive base substructures**

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### **Summary Account**

In masonry construction, sealing layers in base areas are generally applied to solid substructures made of brickwork or concrete. By contrast, in wooden constructions, for example in prefabricated timber panel houses, there are usually timber panels in the lower plinth area, which can be used as substructures, on which the sealing layers are applied. Even in massive constructions, insulation layers are frequently not installed behind perimeter boards, but on the exterior of the building.

The Aachen Institute (“Aachener Institut für Bauschadensforschung und Bauphysik – AlBau gGmbH”), which has been concerned with research into building failure for more than thirty years, has now carried out a project about recommendable constructions, which was supported by the Federal Office for Building and Regional Planning („Bundesamt für Bauwesen und Raumordnung – Initiative Zukunft Bau”).

The research study is based on a survey among experts for building damage and for timber panelled construction and among manufacturers of sealing layers. Of the 1,169 experts and manufacturers asked in the survey, 132 provided detailed information. 22 building experts reported on 97 damage-free buildings, in which the sealing layers had been applied to substructures of timber or insulation materials. On the other hand, there were 94 examples of inadequate performance pointed out by 21 participants concerning sealing layers on non-massive substructures.

Substructures sensitive to deformation and cracking (27% of cases) as well as insufficient preparatory treatment of the base surface (16%) are predominantly specified as reasons for damage. Other reasons are the incompatibility of the sealing with the special conditions during installation, and the insufficient dimension of sealing layers (both 16%). Faulty or imprecise information by manufacturers is rarely considered to be responsible for failure, nor does the neglect of climatic conditions during installation of the sealing cause any serious problems.

Regardless of what had caused the damage in the plinth area of buildings, the visible results were the same: flaking plaster rendering, humidity in the wall cross section, mould formation and moisture penetration on the inside of exterior walls.

Existing building regulations so far only cover the sealing of the lower plinth area when it is applied to massive substructures of concrete or brickwork. For non-massive substructures made of timber or wood-based panels, stricter requirements than for massive substructures must be established, because even minimal leaks can lead to considerable damage. Substructures consisting of insulation materials can generally be classified according to their sensitivity to humidity. Sealing layers on moisture-resistant materials, such as rigid polystyrene foam, are likely to be exposed to higher mechanical stress than those on massive substructures, because the surface below is more elastic. However, this type of construction has been used on flat roofs for decades and has proved successful.

The study has shown that sealing layers on surface areas, but also at the connection of the sealing to structural components below ground level, to profiles of level thresholds, and at the upper joint to the façade above, have proved to function adequately, provided that they are installed with professional care.

The most important criteria are (1) if the sealing to be applied is compatible with the material of the underlying surface, (2) if the insulation material is not likely to be damaged by the substructure, for example by mechanical movements of the connecting edges, and (3) if the material is resistant to higher mechanical stress.

When the connections of the sealing layer in the base area are exposed to splashing or accumulating water, they must be joined to the surrounding structural components in such a way that water cannot penetrate behind the sealing.

Provided that a few additional requirements are fulfilled, the reliability of sealing layers in base areas on non-massive substructures will be similar to those on massive surfaces, which are specified in the regulations. Consequently, moisture-resistant insulation materials which fulfill the additional requirement of resistance to mechanical stress can also be named in the regulations as being unrestrictedly suitable substructures.

Moisture-sensitive, non-massive substructures such as timber and wood-based materials will also be appropriate as long as the principles of building physics are considered and reliable measures are taken to prevent the entry of water at the edges of the sealing. In view of the risk of considerable damage being caused by even slight leaks, moisture-sensitive substructures of timber or wood-based materials should not be used in the plinth area up to 5 cm above the surrounding ground level. In the space above this limit, such substructures can be sealed without the likelihood of humidity penetrating within the timber or wood-based materials.