Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 77 (1998)

Artikel: Rehabilitation of large panel buildings using ETICS
Autor: Vogdt, Frank Ulrich
DOI: https://doi.org/10.5169/seals-58269

Rehabilitation of Large Panel Buildings using ETICS

Frank Ulrich VOGDT
Dr. Engineer
IEMB e.V.
Berlin, Germany

Frank Ulrich Vogdt, born 1956, received his civil engineering degree from the Technical University Berlin in 1982 and his Dr. engineering degree in 1994. Since 1997 he is head of the department Structural Research at the Institute for Rehabilitation and Modernisation of Buildings (IEMB).

Summary

For large panel buildings in Central and Eastern Europe with three layer elements it is useful to apply thermal insulation to increase thermal protection, weather-resistance and to guarantee durability. The most economic form of such additional measures are external thermal insulation composite systems (ETICS). However, these ETICS are loaded on three layer panels in the area of the element joints due to the joint movements from the thermally and hygrically induced face concrete deformation. The investigations described below show that ETICS with suitable materials have sufficient bridging capabilities in order to be used on three layer walls.

Remaining Joint Movement

After applying ETICS the still remaining joint movement is due to

- thermal influence - daily and yearly
- hygric influence - yearly and long-term drying.

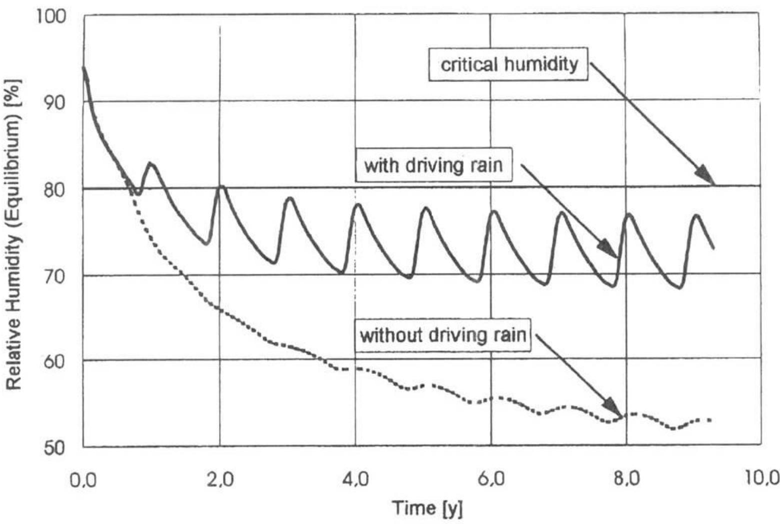

Figure 1: Hygric influence: Relative humidity (equilibrium) of the outer layer concrete after applying ETICS (here: mineral system)

In order to determine the magnitude of movement it is necessary to find the characteristic values of the outdoor climatic conditions. These results were used to calculate the influential condition values of temperature and balance humidity (Fig. 1) for the facing layer using unsteady heat and moisture flow computation. The deformation of the outer layer was calculated and thus the magnitude of joint movement was determined. These results were confirmed by calculations using in-situ recorded data. For a regular three layer panel an expansion of the vertical joint between two outer layers of 6.2-m-elements max $\Delta w_{tot} \cong 2.5$mm can be assumed.

Bridgeable Joint Movement

On top of the widened joint, the plaster of each ETICS suffers strain from shrinkage as well as from changes in temperature and moisture. Shrinkage tests have shown that fully strained plaster releases 85 – 95% of its theoretical restrain stress by creeping.

Based on the FE-method and using the "Fictitous Crack Model" according to Hillerborg, Bazant and Duda the bridgeable joint movements were estimated for the above loading cases. The calculation results were verified during joint extension tests.

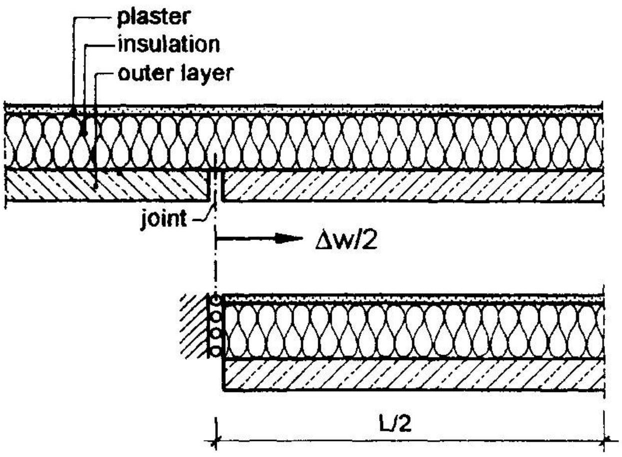

Figure 2: System of FEM-calculation

The result of the calculation is:

- Bridging properties improves with increasing thickness, decrease in shaer modulus of the insulation as well as increased stiffness of plaster.

- Conventional, mineral-based ETICS are unable to withstand under uncracked condition. Crack widths can be reduced to a harmless measure by coordinating plaster matrix and glass fabric (wire lath).

- Conventional, mineral thin plaster systems behave more favourably than mineral thick plaster systems (light plaster).

As a rule, ETICS with insulation thickness from 60 mm upwards and conventional, thin plaster systems or those using resin-based mortar have satisfying bridging properties.