FORSCHUNGSINITIATIVE Zukunft BAU

SHORT REPORT

Title

Energetic and mechanical optimization of the wall-floor-junction of monolithic exterior walls of masonry with passive house standard

Az.: SF-10.08.18.7-11.11

Motive / Initial Position

The aim of this research project is to solve the fundamental problem, which is caused by the increasing of thermal demands on single-layer exterior walls. The monolithic construction is to be adapted to the new requirements of energy saving in order to maintain the competitiveness of traditional construction type of masonry. The optimization of the wall-floor-junction by minimizing the thermal bridge effect had the top priority; however, it was based on the solution of the mechanical problem.

Scientific scope

Within the research project, the effects of shorten support length was analysed. With the help of experimental, numerical and engineering investigations, effects on the behaviour of the system and the failure of partially supported floor slabs in the ultimate limit state and the involvement of the front unit were focused. Based on the present material and structural behaviour, constructive conclusions were derived and developed with a decent for practical detection model for partially supported floor slab. From a vulnerability assessment, approaches for the further development of the detail could be recommended.
At the beginning of the project it was necessary to find the unique approach with the required reduction of the support length and the materials to be used. Based on an evaluation of different geometry and material combinations on wall-slab-junctions specifies in the material, the physical requirements, as well as the constraints and the targets (required bearing length) were clarified out for the structural analysis, Figure 1. With tests on cut-outs of wall-slab-nodes and numerical analysis the fracturing process was examined in order to accurately describe the behaviour of using the results of the wall-slab-junction at the ultimate limit state.

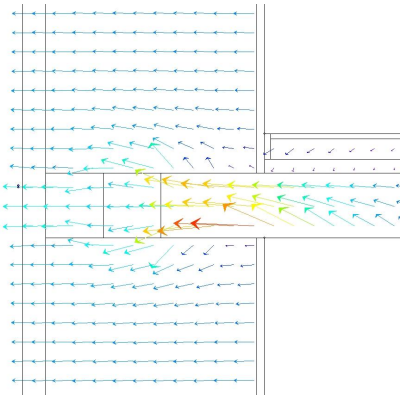

Figure 1 Direction of heat flow

While the assessment of the thermal bridge effect is resolved scientifically, a first-time intensive discussion of the fracture behaviour of partially supported slab is required.

The code DIN 18530 requires at a displaceable support (no slide bearing) to take a separating layer between the slab and unreinforced walls in general. In order to decouple the slab and the wall of each other reduces the risk of cracking as a result of major deformation (shrinkage, deflection under loads). This type its support is not provided in principle for slabs on the mezzanine, but is generally recommended. The decoupling of the slab to the wall construction has to carry out at the top and bottom of the junction logically (Figure 2).

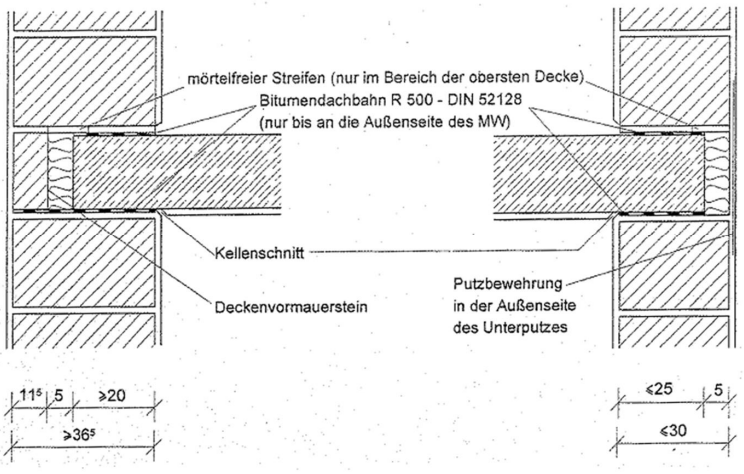

Figure 2 Examples of the Wall-slab-junction used now taken from Avak / Steinek

Numerical preliminary investigations were carried out in preparation of the experimental studies (experimental setup, loading). Points of interest were all areas of the optimized wall-ceiling-node system with highest stresses occurring (exceeding the material strength).

In the preliminary tests, show high horizontal stress at the first unit layer above and below the floor slab (Figure 3).

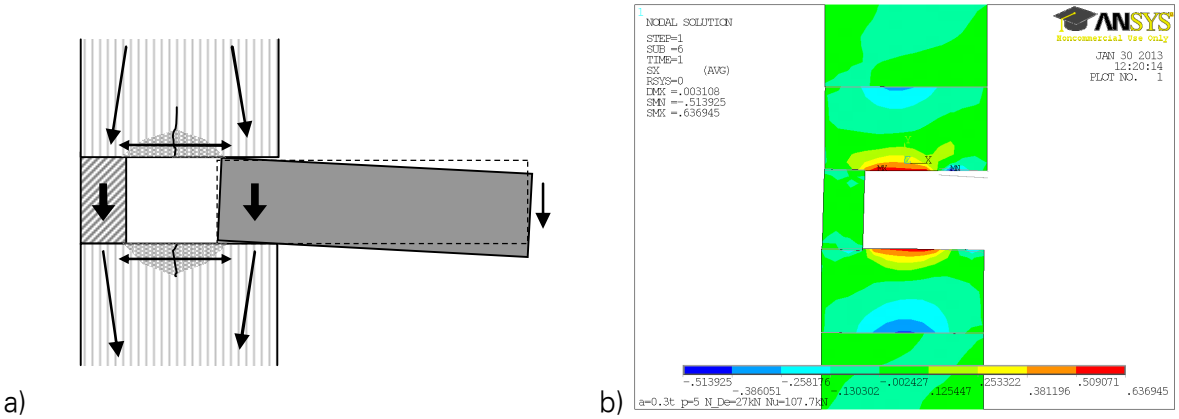

Figure 3 *a) scheme of lateral tension (levelling mortar layer not displayed); b) lateral tension (slab and levelling mortar layer not displayed)*

After the thermal investigation, tests were carried out to the support length up to a value of 0.3*t*. The standard reference test has a support depth of 0.5*t*.

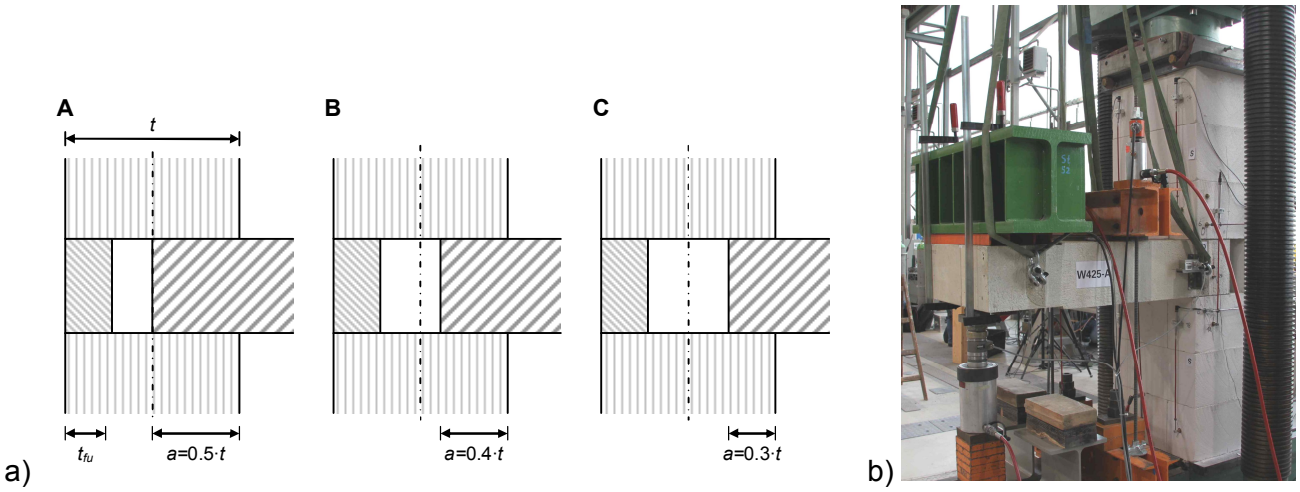

Figure 4 *a) test setup, b) test specimen in the testing machine*

Resulting from simulations, parameter studies and experiments, several verification procedure for the partly supported slab could be developed. These different procedures differ in the kind of boundary conditions.

Conclusion

In result of the research project important knowledge could be collected and confirmed under the requirement for reduction of the transmission thermal losses, which are important for the further development of the masonry construction. To that belongs the contribution of the facing unit in the height of the floor slab and the reduction of the bearing length up to 30% of the wall thickness. The requirements on thermal bridge free structures can be fulfilled.

A design model was developed for verification of the wall-floor-junction which is suitable for an introduction into the practice provided together with the involved industries. The aims of the research project can be seen as fulfilled.

Key data

Short Title: Optimization of the monolithic slab connection for passive houses
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