Openings in sandwich elements

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ABSTRACT:

Sandwich panels with flat or lightly profiled faces often form the façade of a building. Due to different requirements like windows, doors or ducts, it is necessary to cut openings into the face of a building. These openings reduce the load bearing capacity of sandwich panels. At present, openings in sandwich panels require an additional substructure, which transfers the loads to the main structure. These replacements lead to additional assembly work and are often optically not wanted.

The aim of the project is to find possibilities and to develop calculation models to avoid this kind of substructure. Depending on the size of the opening, different measures are possible:

For some openings no strengthening is necessary. If the opening is in a lower stressed part of the panel or the size of the opening is very small, the panel can carry the load without any kind of substructure. For these cases there already exist calculation models.

For small openings within one panel, it seems to be obvious to look at the single element only. If the panel is not able to carry the load, it has to be strengthened. Therefore one solution is a supporting frame, which is integrated in the opening and diverts the loads around it. Also additional profiles – integrated in the joints - can be used to increase strength and stiffness of the panel and to reduce the stress concentration in the corners of the openings. A calculation model shall be developed to determine the load bearing capacity of the strengthened panel.

For large openings and openings across the longitudinal joint it is necessary to include the neighbouring elements in the load transfer. Therefore, detailed information on the rigidity of the longitudinal joint and the torsional rigidity of the panels is needed. Also for this case, a calculation model shall be developed to describe the load transfer around the opening and to the adjacent panels.

First test results for single elements and element formations with strengthened openings are presented. Also test results for the stiffness and bearing capacity of the longitudinal joint are shown. All these tests are part of the European research project EASIE (www.easie.eu). In addition,
comparative calculations with existing calculation proposals for openings without window frames and a calculation proposal for the load transfer across the joints are part of this paper.

The long-term objective is to generate a calculation model for sandwich elements with different kind of strengthening. This model should be only dependent on parameters which can be derived from some basic tests.

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