

Analyzing and processing of actual research results on fire behaviour of prestressed hollow core slabs

This report consists of a survey of standards and approval requirements for prestressed hollow core slabs in case of fire together with an overview of corresponding research findings. The „Deutsches Institut für Bautechnik“ is planning to introduce new regulations for the approval of prestressed hollow core slabs. This report and collection of actual research results may be used as a basis for the development of new criteria.

The actual approval requirements regarding the resistance in case of fire are not sufficient. Fire test and real fires underline this statement. The actual design is focussed on providing a minimum concrete cover and a minimum distance between the prestressed steel bars. This does not prevent a preliminary failure due to anchorage failure or shear failure.

The impact of restrained elongation due to cold adjacent slabs and the surrounding structure is often discussed in literature. Researchers identified that cold adjacent slabs and a stiff surrounding system have a positive effect on the resistance of prestressed hollow core slabs in case of fire. A normative regulation regarding this matter is not possible because the real bearing and surrounding system is never known exactly. Hence, the positive effect of the restrained elongation cannot be formulated in a general and conservative way.

Making use of concrete with a low thermal elongation came along with less deformation of the plates in fire tests. The composition of the concrete used needs to be deposited at the DIBt. Furthermore, the process of fabricating prestressed hollow core slabs is easy to reproduce und control. Hence, it might be contemplated to include the positive effect of the ingredients in the approval requirements.

The numerical modelling of prestressed hollow core slabs is not yet fully developed. Even the multi-spring element developed in New Zealand produced results differing significantly from deformations measured in fire tests. Hence, it is still necessary to investigate prestressed hollow cores in laboratories to earn more information about the performance in case of fire. The revision of DIN EN 1168 and the corresponding Annex G, which deals with the requirements in case of fire, is a reasonable approach to enhance the safety of the design process. But still, the preliminary version of the new standard includes inaccuracies regarding the testing and application of prestressed hollow core slabs. As a consequence, it is reasonable to continue requiring separate verifications for the fire resistance in future.