

Abstract research project nr. P 52-5-4.206-2035/19

*Evaluation of new safety factors to determine the fire load density in the course of the amendment of EN 1991-1-2 Annex E*

The current version of Annex E of DIN EN 1991-1-2 Annex E contains a safety concept which enables the calculation of fire load densities as design values. The safety concept described in Annex E is based on Schleich's considerations and is used in particular for performance-based fire design. As in most European countries, the safety concept is not applicable in Germany either. In Germany, this safety concept is replaced by the safety concept of Annex BB of DIN EN 1991-1-2/NA. Essential criticisms of the safety concept of Annex E of EN 1991-1-2 are the derivations of the ten safety factors for safety measures (e.g. extinguishing measures, fire brigade, etc.), which are determined depending on the fire compartment size and type of use. In addition to the lack of transparency and the multitude of factors, safety factors are multiplied for measures that cannot be considered independently of each other. Furthermore, the safety factors are only taken into account for the calculation of the fire load density and not for the calculation of the heat release rate, which is particularly relevant for structural elements with low fire resistance. In the draft of EN 1991-1-2 Annex E, CEN TC 250/SC1/WG4 proposed a modification of the safety concept which, similar to the German safety concept, should take into account a reference to the reliability classes according to DIN EN 1990. For this purpose, a further safety factor for determining the rated fire load density  $\delta_{q3}$  and for the heat release rate  $\delta_{Q1}$  is introduced.

Within the research project, the basic principles on which the modification of the safety concept of EN 1991-1-2 Annex E is based were examined. Further the modified safety concept were evaluated in comparison to the German safety concept of Annex BB of DIN EN 1991-1-2/NA. On the basis of selected categories of use and structural elements (steel, composite, wood, reinforced concrete), the practical application safety concept of the draft of Annex E of EN 1991-1-2 in comparison to Annex BB of DIN EN 1991-1-2/NA are compared.

The selected comparative calculations as well as the comparison of the safety concepts show that a higher safety level is achieved with the application of Annex BB of DIN EN 1991-1-2/NA in comparison to the draft of Annex E of EN 1991-1-2. Based on the systematic comparative calculations and the consideration of the safety concepts of the draft of Annex E of EN 1991-1-2 and Annex BB of DIN EN 1991-1-2/NA can be concluded that the impact on the member of natural fire curve of Annex BB of DIN EN 1991-1-2/NA is greater than the impact of natural fire curve of the draft of Annex E of EN 1991-1-2. This difference leads to more conservative results of Annex BB of DIN EN 1991-1-2/NA. Furthermore, the essential points of criticism (intransparency of the safety factors, multiplication of the safety factors, safety factor for the heat release rate) are retained in the draft of Annex E of EN 1991-1-2. An application of the safety concept according to the draft of Annex E of EN 1991-1-2 cannot be recommended in Germany.