Numerical model for the thermal analysis of composite steel- concrete shallow floor beams

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ABSTRACT

Composite steel-concrete beams embedded in floors (slim-floors) are being increasingly used in new residential, industrial and commercial projects, as well as in singular buildings. However, the current fire design codes used in Europe EN 1994-1-2[1] do not provide calculation tools for this type of composite beams. Specifically, simplified models to calculate the temperature distribution over the cross-section are not available in the code, and the designer may obtain these temperatures from tests or advanced calculation models.

In 2001 the European Convention for Constructional Steelwork (ECCS) presented a method for the temperature distribution in slim floor beams which was included in the "Model Code on Fire Engineering"[2]. It shows a distribution of temperatures, which was inferred from a thermal analysis of different cross sections using software calibrated against test data carried out by British Steel[3], TNO (The Netherlands)[4] and ETH[5].

In this paper, the development of an advanced thermal model to predict the slim-floor cross-sectional temperature distribution using a commercial finite element analysis package is presented. This developed model is calibrated using tests from bibliography and it may serve as a basis to propose new simplified formulae in future work, which may be useful for practitioners.

Particularly, Shallow Floor Beams (SFB) are analysed in this paper. The usage of these slim-floor typologies is also assessed through the developed advanced model, in order to obtain the most favourable configurations.

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