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BEHAVIOUR OF CONCRETE STRUCTURES IN FIRE

ABSTRACT

This paper provides a "state-of-the-art" review of research into the effects of high temperature on concrete and concrete structures, extending to a range of forms of construction, including novel developments. The nature of concrete-based structures means that they generally perform very well in fire. However, concrete is fundamentally a complex material and its properties can change dramatically when exposed to high temperatures. The principal effects of fire on concrete are loss of compressive strength, and spalling - the forcible ejection of material from the surface of a member. Though a lot of information has been gathered on both phenomena, there remains a need for more systematic studies of the effects of thermal exposures. The response to realistic fires of whole concrete structures presents yet greater challenges due to the interactions of structural elements, the impact of complex small-scale phenomena at full scale, and the spatial and temporal variations in exposures, including the cooling phase of the fire. Progress has been made on modelling the thermomechanical behaviour but the treatment of detailed behaviours, including hygral effects and spalling, remains a challenge. Furthermore, there is still a severe lack of data from real structures for validation, though some valuable insights may also be gained from study of the performance of concrete structures in real fires.

KEYWORDS

concrete, fire, high temperature, modelling, spalling

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