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Objective and Performance-Based Design in Structural Fire Engineering

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Objective and performance-based design of structures in fire are gaining growing interest as rational alternatives for the traditionally adopted prescriptive code approach. This interest has led to the introduction of such design approaches in the National Building Code of Canada, International Code Council, National Fire Protection Association, and ASCE 7, which specifies the minimum design loads for buildings and other structures. Although engineers widely use performance-based methods to design structural components subjected to static and dynamic loads, adoption of such methods in fire engineering is still very limited. The main reason for this limitation is the needed extensive knowledge of heat transfer calculations and advanced structural analysis techniques, which account for properties of fire-damaged elements, and fire-induced strains.

Research efforts at Western University aim at providing comprehensive understanding of fire-structure interaction and assessing the performance of different structural systems. The outcomes of the ongoing investigations provide engineers with simplified procedures to predict fire severity of non-standard (natural) fires and the structural response of reinforced concrete members exposed to various fire scenarios. This presentation will summarize the effect of fire on concrete structures and provide information about the ongoing research at Western. Methods to evaluate the effective stiffness and capacity of RC sections will be presented. Their use to assess the deformation behavior of columns, beams, slabs, walls, and frames exposed to fire will also be covered.