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## Role of composite joints on the performance of steel-framed buildings in fire

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All structural members exposed to fire heat up, but the rate of temperature rise in each member is different. Joints in a steel-framed building tend to heat up slower than the material within the span of the beam because of the presence of additional materials (bolts, plates, angles, etc.) and due to their shielded location (i.e. usually beneath a composite floor). EN 1993-1-2:2005 suggests temperatures at joints of between 62% and 88% of that in the beam lower flange temperature at mid-span. The design guidelines presented in the current codes of practice for the design of steel-framed buildings in fire conditions are based on results of isolated member tests carried out in a laboratory that followed a prescribed standard fire curve. The laboratory testing conditions were obviously different from the real situation wherein the structure is subjected to natural fires. It has been known for many years, from observations of accidental fires, that structural members behave better in fire when they constitute part of a structural arrangement than when they are tested in isolation. These observations have been confirmed by results from experimental fire tests conducted on full-scale multi-story steel-framed buildings. It has been demonstrated that members that form part of the structure can withstand much higher temperatures than those tested singly due to the ability of the joints to resist the effect of fire and re-distribute the forces to the adjacent cold resign in the vicinity of the affected areas. Also, the restraint to thermal expansion by other connected members has significant influence on fire resistance of steel-framed buildings. This has raised doubts concerning the conservative design approaches provided by current fire engineering design codes. The attack on the twin towers of the World Trade Centre in New York on 11 September 2001 has prompted close examination of the way in which buildings can fail in fires and has brought into the public eye the hazards that fires can pose to major building structures. This paper examines the effects of fires on multi-story steel-framed buildings and the role of composite joints in enhancing their fire resistance. This provides vital knowledge of the behavior of real buildings and will allow for the construction of safer buildings in the future.

### Biography

Khalifa S Al-Jabri obtained his PhD in Structural Fire Engineering from Sheffield University, UK in 2000. He is currently Professor and Head of the Department of Civil and Architectural Engineering at Sultan Qaboos University, Oman. He published more than 110 papers in international journals and conferences. His main research interests are behavior of structures in fire, use of waste materials in Civil Engineering applications and Seismic Hazard Assessment. He is peer reviewer in more than 30 journals and is also the Editorial Board Member of several journals such as *Structural Fire Engineering Journal*.

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