STRUCTURES IN FIRE FORUM

STRUCTURES IN FIRE FORUM – 26TH SEPTEMBER 2025

ISTRUCTE HQ, BASTWICK STREET, LONDON, EC1V 3PS

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Provisional Agenda (20 minute talks with 10 mins Q&A):

STRUCTURES IN FIRE FORUM

10:00 – 10:30 Registration and Coffee

"Review of existing aluminium material tests at post-fire conditions and comparison to full scale fire test scenarios".

Nibaldo Navarro Castro, University of Hertfordshire

In recent years, the mechanical properties of materials have been investigated under post-fire conditions to ensure the safety of firefighters after a fire and to understand the damage level of materials after elevated temperature exposure. This presentation discusses key aspects of such tests, including heating rate, cooling method, and soaking time, and compares them with real fire scenarios such as fire tests conducted on steel frames (Cardington tests) or aluminium roofs. Additionally, post-fire experimental results on aluminium alloy AA6082-T6 will be presented, along with mechanical properties reduction factors and material models.

"Thermal and Mechanical Behaviour of MBT Rebar Couplers under Elevated Temperature Conditions".

Matthew Alford, University of Edinburgh

This study investigates the performance of MBT steel reinforcement couplers under elevated temperatures, representing realistic fire scenarios in reinforced concrete structures. Tensile tests were conducted on couplers subjected to increasing thermal exposure, with loading applied up to the maximum serviceability limit state (SLS) load for reinforcement.

"Thermo-Mechanical Behaviour of Preloaded Low Cement Concrete Under Heating and Cooling Phase of Fire Exposure".

Mahadev Rokade, University of Edinburgh

Understanding concrete's behaviour under fire, especially during cooling, is vital for fire safety. This study compares OPC concrete (CS1) and 50% GGBS replacement (CS2) using 100 mm × 200 mm cylinders, preloaded to 30% of 90-day strength, heated to 600 °C, and cooled to ambient, 200 °C, or 400 °C under load. Digital Image Correlation tracked strain. Staged cooling improved strength retention: CS1 retained 65–78% of original strength, CS2 retained 57–70%. CS2 showed slightly lower residual strength but stable behaviour, supporting its use as a lower-carbon, fire-resistant alternative.

12.00 – 13.00 Lunch

"Structural Fire Response to Multi-storey Fires"

Momoi Suda, Arup

Atria and open stair connections between floors form part of the design aspirations for many modern office buildings. These features introduce a risk of fire affecting multiple floors simultaneously, which can threaten the structure in different ways to a single floor fire, particularly for steel frame structures. This presentation provides an overview of the challenges, the practical considerations and possible approaches to evaluating structural fire behaviour in multi-floor fires, as well as design measures which can be implemented to address the risks. The presentation will be based on a case study from a recent Arup commercial project.

"Strategic use of stainless steel to improve the performance of steel structures in fire – key findings from the RESIST project".

Chunyan Quan, University College London

The EPSRC-funded RESIST project aims to enhance the resilience of new and rehabilitated steel buildings by strategically incorporating stainless steel elements in critical locations, such as beam–column connections, thereby exploiting its superior fire performance while maintaining cost efficiency. Post-fire material properties of novel stainless steel plates and bolts were experimentally examined. Through numerical analysis, the behaviour of hybrid steel–stainless steel endplate and angle cleat connections at elevated temperatures was investigated, indicating that hybrid connections exhibit greater ultimate resistance and rotation capacity than pure carbon steel connections. Finally, new design methods were developed to predict the full-range fire response of these connections.

“Calculating capacity of Light Gauge Steel under fire load (and why testing is inadequate).”

Stephen Napper, MMCEngineer Ltd

In this talk I propose a calculation tool using Trimble Tedds and formula from BS 5950 part 8 and EN 1993 Part 1 Part 2 amongst others to calculate member capacity of cold formed steel at elevated temperatures. With this tool, coupled with data from fire tests of board systems with studs, we will be able to state the time it takes heat to transfer from fireside to hot flange of a member thus allowing us to state fire rating in terms of time and member capacity. Ultimately, it is envisaged that in conjunction with collaboration with board manufacturers users will be able to select boards, specify a temperature design then check members as part of a full structural design giving project specific design checks for structure under fire loads.

14.30 – 15.00 Coffee

“Consistent approaches to Monte Carlo Analyses for Fire Severity”.

Yavor Panev, Arup

In the UK, probabilistic approaches are sometimes used by fire engineers as part of ‘fire severity’ or ‘time equivalence’ analyses, to determine the appropriate structural fire resistance for a building (typically offices). Currently there is a lack of official guidance with regards to setup and implementation of such probabilistic calculations. This talk will discuss common pitfalls with regards to analysis methods, input choices, sample size estimation and results interpretation, amongst other things. It will be based on Arup’s commercial experience as both designer and third-party reviewer.

“A comprehensive approach to understanding how openings shape the fire performance and structural response of CLT walls in compartment fires”.

Juan Carlos Pina, Universidad de Santiago de Chile

This study investigates the thermo-mechanical performance of cross-laminated timber (CLT) walls under compartment fire conditions, focusing on the influence of wall configuration and architectural openings. A sequentially coupled CFD–FEM approach is used, combining Fire Dynamics Simulator (FDS) for fire modelling and ANSYS for thermal and buckling analyses. Parametric studies are performed on CLT walls with 3, 5, and 7 layers, and openings of varying size and orientation. Results show that openings significantly alter fire dynamics and structural response. Constant-width openings lead to higher internal temperatures and buckling losses, while walls with more layers show improved post-fire stability and reduced degradation.

'Post-fire damage quantification of a cut-and-cover concrete tunnel'.

Thomas Thienpont, University of Ghent

Fires in road tunnels can cause significant damage to the load-bearing structure, sometimes leading to long closures for repairs. To prevent severe damage, and to improve fire resistance, roadway tunnels are often equipped with passive fire protection boards. These boards reduce direct heat exposure, but damage can still occur due to restrained thermal expansion and changes in the internal forces. This presentation summarizes results from a numerical study on a concrete cut-and-cover tunnel, focusing on the quantification of post-fire damage for different levels of passive fire protection.

16.30 – 16.45 END