STRUCTURES IN FIRE FORUM

STRUCTURES IN FIRE FORUM – 29TH SEPTEMBER 2023

THE INSTITUTION OF STRUCTURAL ENGINEERS
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Agenda (20 minute talks with 10 mins Q&A):

10.00 – 10.30 Coffee

"Fire in Historic Building".
Wulan Shofa Aisyah, University College London

Fire is not receiving the attention it deserves in structural engineering compared to other hazards. Especially in historic buildings, where the cultural aspect will be the most complicated challenge to address in addition to life-saving concerns. Ways need to be investigated to better understand how to deal with heritage structures under fire. In this project, Fire Dynamic Simulator (FDS) is being used to study the development of fires, with the case of Notre Dame: one of the most iconic Gothic Architecture in the world.

"Advanced analysis of structure in fire using a general structural analysis software: application to a large industrial building".
Iolanda Del Prete and Becky MacDonald, Buro Happold

Accurately predicting realistic steel frame behaviour in fire traditionally requires the use of advanced fire specific finite element software. This is a long and costly exercise, requiring large computational resources and is therefore often impractical in complex projects. On the other hand, more accessible software packages such as RFEM lack some functionality required for analysing structures affected by fire. This presentation explores the possibility of using these software packages to analyse structures in fire by presenting the workflow currently utilised by Buro Happold.

"Is fire engineering (structural) dead?".
Craig English, Semper

This is a thought-provoking discussion about how the regulatory system worked before Grenfell and how the regulatory system works now. It is a consultant's view based on nearly 25 year of consulting experience. I will use a project example and analogies with other scientific / engineering disciplines to try and put our thoughts / concerns (which I believe are shared throughout the industry) into context.

12.00 – 13.00 Lunch

"A review of the role of polypropylene fibres in increasing the permeability of heated concrete".
Hussein Cadosch, University of Edinburgh

Polypropylene (PP) fibres have been shown by a vast number of researchers to decrease the likelihood of heat induced spalling in concrete, however, disagreements remain about the exact mechanism through which they exert their influence. In this presentation, a review of the available research work from the prism of permeability is presented. It is observed that there is a strong correlation between the geometry of the fibres and their effect on crack fraction, and consequently, permeability. Dynamic thermomechanical analysis (DMTA) of PP fibres at elevated temperatures show that the fibres lose close to 70% of their stiffness at 100 °C. The loss of stiffness also leads to permeability increases in concrete samples before the fibres reach their melting temperatures.

"*Contaminated concrete removal using controlled heat-induced spalling.*"
Panagiotis Apostolopoulos, University of Sheffield

The work explores the potential to remove layers of contaminated concrete from nuclear structures by using controlled heat-induced-spalling. To achieve adequate spalling control, the thermal-hygral-mechanical phenomena developing in heated concrete are studied through a combination of experiments and numerical models. The work discussed the reliability of current experimental techniques, as well as the limitations of existing models.

"Consequence-oriented fire intensity optimisation for structural design under uncertainty".
Andrea Franchini, University College London

Risk-based design and assessment methods are gaining popularity in performance-based structural fire engineering and usually begin by defining fire scenarios. This approach, proven highly effective for other hazards such as earthquakes, might not be optimal for fire safety design. Indeed, an ad-hoc design variable selection

(and/or optimisation) to reduce - up to completely cancel - fire intensity is possible, making fire scenarios additional design outputs. Hence, this presentation describes a structural design methodology named consequence-oriented fire intensity optimisation that embraces such features.

14.30 – 15.00 Coffee

"The 'fire problem' of a steel beam penetration through compartment walls".

Edwin Ayala, Semper

In applications where a steel beam passes through a compartment fire-rated wall in a building, there is a likelihood for the steel beam to act as a 'thermal bridge.' This can result in temperatures at the compartment adjacent to the one where the fire originates reaching a critical threshold (i.e., failure of the insulation criteria). Even with an unprotected or protected steel beam (using fire-rated boarding or intumescent coating), this issue may arise. The aim of this presentation is to explore the fundamentals of this 'problem' and discuss how one may demonstrate that compartmentation is maintained during a fire.

"Development of a European approach to assess the fire performance of facades".

Octavian Lalu, BRE

The presentation will delve into the procedures for large-scale fire testing of cladding systems. It will discuss an ongoing research project that aims to fulfil a request from the Standing Committee of Construction (SCC). The project aims to provide regulators of EC Member States with a harmonized approach to regulate the fire performance of façade systems. Currently, the research project is in the development phase, and the focus of the presentation will be on the calibration and round robin exercise.

"Fire resistance of loadbearing light gauge steel frame (LSF) walls exposed to fire on both sides: A systematic review and numerical study".

Izzy Inerhunwa, OFR Consultants

Industry reports highlight uncertainties in the performance of loadbearing light gauge steel frame (LSF) walls exposed to fire on both sides. This study systematically reviewed existing research on LSF walls exposed to various heating and design conditions. The review found a lack of research on double-sided fire exposure, emphasising the need for further studies and identifying key influencing factors including fire time-temperature relationship, load ratio, and insulation. The findings were then used to inform numerical modelling of LSF walls under various fire conditions, thereby establishing a framework for future investigations of LSF walls subjected to fire on both sides.

16.30 END