STRUCTURES IN FIRE FORUM – 12th May 2023

Elm Lecture Theatre, Nucleus Building, Kings Buildings, Thomas Bayes Rd, Edinburgh EH9 3FG

STRUCTURES IN FIRE FORUM

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

10.30 – 11.00 Coffee

"Mitigation and mechanism study of fire spalling of concrete using recycled tyre fibres".
Yifan Li, University of Sheffield

*Polypropylene (PP) fibres have been used in concrete to tackle fire-induced spalling. This study investigated polymer and steel fibres recycled from waste tyres as sustainable alternatives to virgin fibres for fire spalling control. Fire spalling experiments were conducted on 500*500*250 mm concrete specimens using a radiant panel heating and loading system. The results indicate that both recycled steel fibre and polymer fibre are effective to mitigate fire-induced spalling. To investigate the mechanisms by which recycled polymer fibres mitigate fire-induced spalling, neutron and X-ray tomographies were conducted. The test results confirm the role of recycled polymer fibres in accelerating the drying rate of concrete at elevated temperatures.*

"Meta-analysis of code-based design methods to quantify the fire resistance of concrete columns".
Mahadev Rokade, University of Edinburgh

This presentation looks at Eurocode, Australian, Chinese, Indian, and US design methods for reinforced square concrete columns and assesses them against a) the database that most were developed on, and b) more recent experimental data. The work will show what differences are found when looking at the different experimental datasets, and where the current codes are good and bad in predicting the fire resistance of RC columns.

"Achieving fire resistance for non-standard buildings"
Zena Protcenko, Arup

Arup undertook a structural fire protection optimisation of a large-scale retrofit concrete-steel hybrid building. FEA was used to assess performance and demonstrate the stability of the optimised structure against representative worst-case design fire. The model identified high impact of transferred elements and column pinned connections that are present in the structure on the overall fire performance of the building. In the presentation, we will cover the observed structural behaviour and main collapse mechanisms, as well the design decisions that lead to this structural response.

12.30 – 13.30 Lunch

"Hold the (bond) line"
Antonela Colic, University of Edinburgh

Fire induced delamination of mass timber elements is commonly attributed to the weakening of the bond line, which occurs because of exposure to both thermal and mechanical stresses, as well as the movement of the moisture front. An experimental investigation was conducted on cross-laminated timber, bonded with two different one-component-polyurethane adhesives that are currently prevalent in the market. Prior to testing, the samples were conditioned to two different moisture levels, followed by exposure to two transient thermal loads and one sustained structural load. The bond line's performance was evaluated using the critical bond line temperature, displacement rate, and visual assessment of the failure time and mode.

"Structural hazards of smouldering fires in timber buildings"
Harry Mitchell, Imperial College London

Smouldering, a slow, persistent, and flameless form of combustion, can continue for days and hours following flames. Smouldering of mass timber has rarely been reported in timber experiments due to many experiments being stopped shortly after flames. This work presents observations following the end of flames in three large compartment experiments with cross-laminated mass timber ceiling and glulam columns, known as CodeRed. Visual and infrared imaging was used to track smouldering, extinction, suppression, transition to flaming, and formation of holes.

"CFD representations of travelling fires - from crib to compartment scale"

Stephen Welch, University of Edinburgh

Simulation-based approaches for characterising the fire behaviour of travelling fires are a potentially valuable complement to experimental studies, providing useful insights on evolving boundary conditions for structural response. The potential for "scaling-up" is discussed with reference to a "stick-by-stick" CFD model calibrated for an isolated crib, of 2.8m diameter (Liège TRAFIR test), applied for case of a uniformly distributed fuel bed within an open compartment of 15m x 9m (Ulster TRAFIR test series). The results in terms of the fire spread and burn out predictions are encouraging, and the heat release rate evolution is also consistent with the experimental value.

15.00 – 15.30 Coffee

"Facade fire performance of low carbon structures"

Martyn McLaggan, University of Sheffield

An open access flammability database of cladding materials was developed at the University of Queensland to provide the needed data for building-level quantified fire risk assessments. An engineering framework was outlined detailing how to obtain this information, and a competency framework was developed to define the necessary skills and knowledge needed to implement this in buildings. This presentation summarises the key aspects in those frameworks, the application to real buildings, and the implications that this has for fire safety engineering and structural fire engineering.

"BS8414 type test on precast concrete cladding panels"

Tony Jones, Concrete Centre

Brief report on BS8414 test on a precast concrete cladding system.

16.30 END

Map of Uni Campuses – search for Nucleus Building – map on next page also.

How to get here

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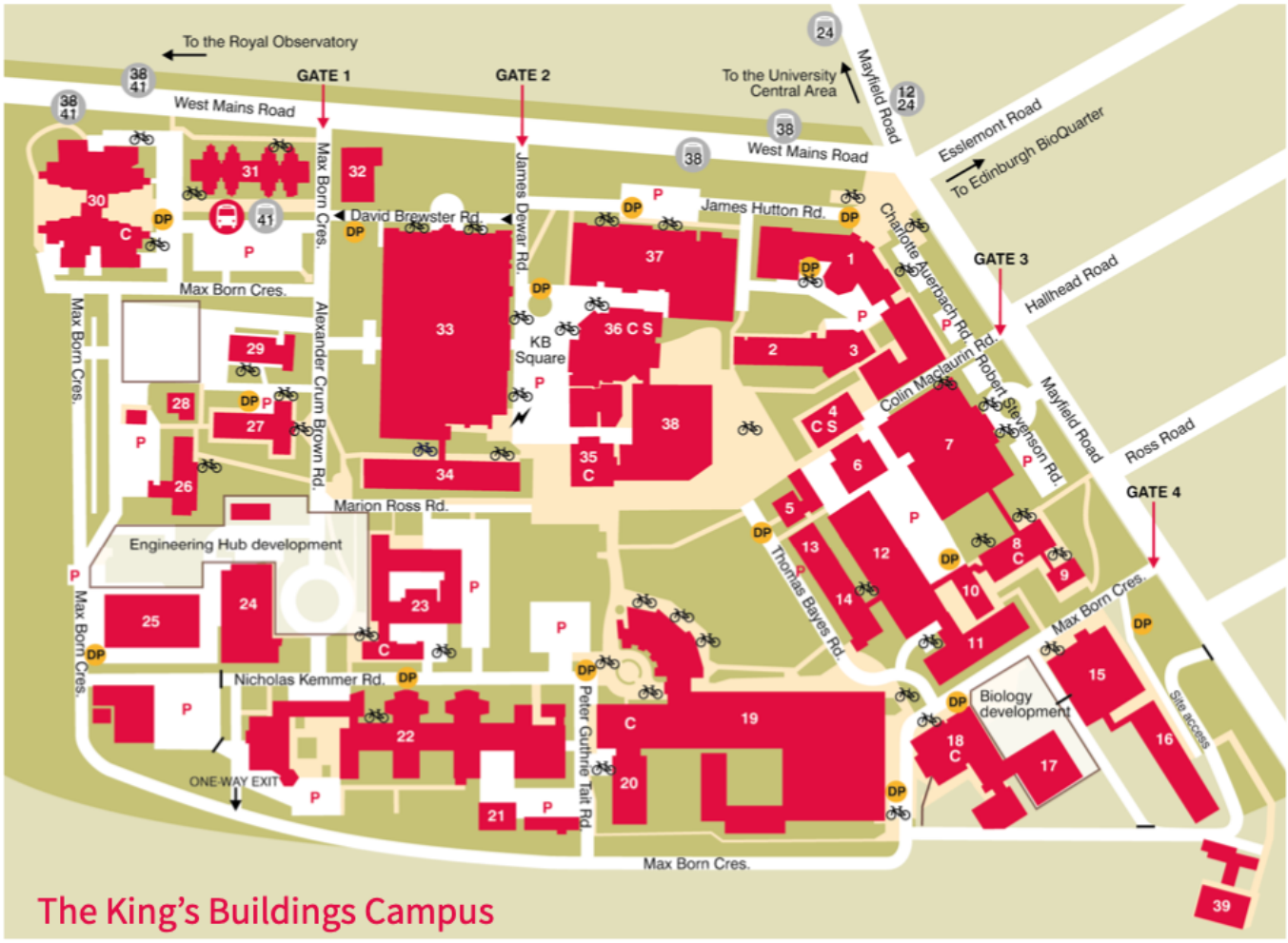
https://forms.office.com/e/E1ydtWHGug



The King's Buildings Campus

14 Alexander Graham Bell Building
11 Alrick Building
32 Arcadia Nursery
1 Ashworth Building
34 Christina Miller Building
29 Crew Annex
27 Crew Building
26 Crew Laboratory
15 Daniel Rutherford Building
17 Darwin Building
6 Engineering Structures Lab
20 Erskine Williamson Building
21 Estates Hub
10 Faraday Building
12 Fleeming Jenkin Building
25 FloWave Ocean Energy Research Facility
39 Glasshouse
37 Grant Institute
8 Hudson Beare Building
9 Hudson Beare Lecture Theatre
19 James Clerk Maxwell Building; Learning and Teaching Cluster
5 John Muir Building
2 John Murray Building
33 Joseph Black Building
36 KB House: EUSA
3 March Building
4 Mary Brück Building
30 Murchison House
38 Nucleus
35 The Noreen and Kenneth Murray Library
22 Peter Wilson Building (SRUC)
23 Roger Land Building
7 Sanderson Building
24 Scottish Microelectronics Centre
31 Student accommodation
18 Swann Building
28 UK Biochar Research Centre
16 Waddington Building
13 William Rankine Building

Bike racks
C Cafe
DP Disabled permit parking
Electric car charging point
Pedestrian area
P Permit parking
Public bus
S Shop
Shuttle bus to the Central Area
Traffic barrier

The timetable for the shuttle bus between the Central Area and the King's Buildings can be viewed at: **www.ed.ac.uk/shuttle-bus**