

A BURNING ISSUE: SAVING LIVES THROUGH FIRE SAFETY ENGINEERING



The tragic events of 9/11 emphasised the need for buildings to be designed to be truly resistant to fire. It is also important to understand how fires grow and spread, in order to plan evacuations and access for firefighters.

Research into fires in buildings has been a unique strength of the University of Edinburgh's BRE Centre for Fire Safety Engineering for more than 40 years. Researchers in the Centre are developing new design methodologies and frameworks, and tools for analysing fire initiation, growth and spread.

Structural and fire safety engineers across the European Union, the US and Canada, as well as international fire safety bodies, are implementing Edinburgh researchers' results in order to design safer, more economical and sustainable buildings.

According to engineering consultancy giant Arup, the BRE Centre has produced 'design tools and methodologies [that] are now being used in some of the world's most iconic new structures including Heron Tower, the Shard, and others'.

RESEARCH WITH IMPACT

DETECTION, CONTAINMENT AND SUPPRESSION OF FIRES

We carry out theoretical, experimental and computational investigations of compartment fire ignition, spread and eventual development to flashover and post-flashover phases, as well as the structural response to fire.

A key advance since 2008 has been to create an integrated approach to addressing fire safety problems in modern buildings, including the detection and suppression at incipient and early fire development phases, organising fire service intervention, and forensic assessment of damage after the fire.

PERFORMANCE-BASED BUILDING DESIGN

The BRE Centre leads the world in the performance-based structural design of buildings for fire resistance, considering the full-structural response and treating fire as a design load.

Our researchers have developed and implemented computational techniques to describe both the fire dynamics and the structural response. This has led to new regulatory frameworks to engineer better fire-resistance into buildings from the start.

The Centre's research leaders include Professors Luke Bisby, Albert Simeoni and Asif Usmani, and Doctors Pankaj Pankaj, Tim Stratford, Stephen Welch, Rory Hadden, Graham Spinardi and Ricky Carvel.

TRANSFORMING INDUSTRY PRACTICE AND INTERNATIONAL REGULATIONS

Edinburgh University research is providing the engineering input to modernising regulations for designing and assessing the fire safety of new buildings. This work has transformed industry thinking, practice and regulation globally about structural design for fire.

The expertise of the University's BRE Centre is sought by international building and fire code committees, including the American Concrete Institution, the British Standards Institute, and the International Council on Tall Buildings and Urban Habitat.

NEW MODEL OF DESIGN CONSULTANCY

The BRE Centre has created an entirely new type of design consultancy in performance-based structural fire engineering. This is being applied to great advantage by, for example, Arup and BuroHappold, in the construction of buildings in the UK and elsewhere.



Heron Tower

Heron Tower, completed in 2011 in Bishopsgate, London, is a good example of how BRE Centre researchers worked collaboratively with the major multinational buildings firm Arup on fire dynamics and structural response in a large multi-storey building with open plan compartments and a central atrium. Without this research, Heron Tower could not have been approved or built.

Arup's Director of Technology Practices says Edinburgh's BRE Centre has 'established structural fire engineering as a mainstream skill, and has also created an entirely new class of engineering consultancy and exciting business opportunities for Arup and others'.

RELEVANT RESEARCH PUBLICATIONS FROM THE FIRE SAFETY ENGINEERING GROUP

Drysdale, DD (2011) *An Introduction to Fire Dynamics*, 3rd ed, John Wiley & Sons, 576pp, ISBN 978-0-470-31903-1.

Usmani, AS, Rotter, JM, Lamont, S, Sanad, AM and Gillie, M, (2001) 'Fundamental principles of structural behaviour under thermal effects', *Fire Safety Journal*, 36(8): 721-744.

Lamont, S, Lane, B, Jowsey, A, Torero, JL, Usmani, AS and Flint, G (2007) 'Innovative Structural Engineering for Tall Buildings in Fire', *Structural Engineering International*, 16(2): 142-147.

Usmani, AS, Chung, YC and Torero, JL (2003) 'How Did the WTC Collapse: A New Theory', *Fire Safety Journal*, 38(6): 501-591.

Law, A, Stern-Gottfried, J, Gillie, M and Rein, G (2011) 'Influence of travelling fires on a concrete frame', *Engineering Structures*, 33: 1635-1642.

CONTACT

Professor Luke Bisby
Arup Chair of Fire and Structures
School of Engineering
William Rankine Building
The King's Buildings
Edinburgh EH9 3JL
+44 (0)7707 203462
luke.bisby@ed.ac.uk
eng.ed.ac.uk/fire

If you require this document in an alternative format, such as large print, please contact:

Communications and Marketing

Tel: +44 (0)131 650 2252

Email: communications.office@ed.ac.uk



THE UNIVERSITY of EDINBURGH