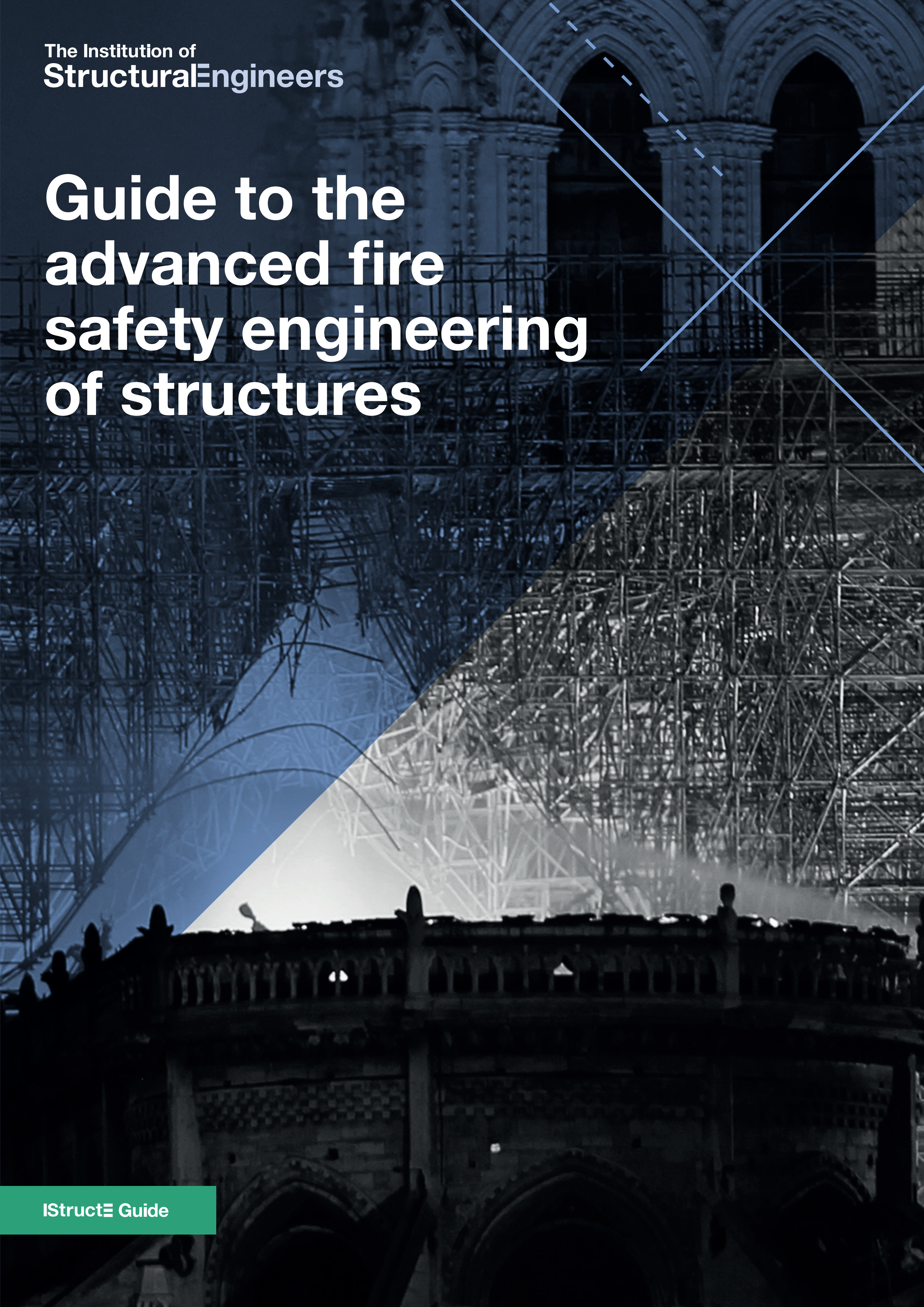
The Institution of StructuralEngineers

Guide to the advanced fire safety engineering of structures



IStructE Guide

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Guide to the advanced fire safety engineering of structures

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Front cover images: See Figures 6.1, 6.3, 6.4 and 6.7 for details.

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GLOSSARY

CFD: Computational fluid dynamics (CFD) models are used to solve the fluid movement within a compartment to predict smoke and fire development.

Emissivity: Indicates the efficiency of an emitting surface as a radiator, with a range between zero and 1.0. An ideal 'black-body' radiator has an emissivity value of 1.0.

Fire compartment: A space within a building enclosed by separating members (e.g. wall, floor) tested to the required fire resistance. The space may extend over one or more storeys.

Fire load: The energy released by combustion of materials in a space.

Flashover: A relatively rapid transition between the fire which is essentially localised around the items first ignited and the general conflagration when all surfaces within the compartment are burning.

Fully developed fire: A fire stage after flashover where all combustibles within the compartment are burning.

Localised fire: Fire involving only a limited area of the fire load in the compartment and where flashover has not occurred.

Natural fire curves: Temperature-time relationship of fire gases in a compartment determined on the basis of the physical properties of compartment, fire load and ventilation conditions.

Plume models: Mathematical model for representing the rising column of fire and smoke of a localised fire.

Standard fire test curves: A well-defined fire exposure curve used in standard fire tests for verification of fire resistance.

Time equivalence: Defined as the exposure time in a standard fire resistance test which gives the same heating effect on a structure in a given compartment.

Zone models: Mathematical model that divides the fire compartment into different control volumes or zones and defines the temperature in each zone based on the conservation of mass and energy.

FOREWORD

This *Guide* is at the forefront of the advanced analysis of structures and has come from a compelling need to better predict the performance of real structures in real fires and follows on progressively and logically from the earlier *Guide*, *Introduction to the fire safety engineering of structures*. It has been designed to help the engineer to deliver a level of finesse and flexibility for problem solving and value that is not available via the traditional prescriptive route embodied in the majority of building regulations.

One of our most important messages concerns the effectiveness of the process, which is essential for controlling the quality for both the designer and approving authority. It supports and borrows from the IStructE report *Guidelines for the use of computers for engineering calculations*, which emphasises the need for clear responsibility and an effective review process. The approach also exemplifies the methodology that would be necessary to logically increase levels of safety to meet business needs and to respond to natural extreme events or other unusual scenarios.

The Task Group has benefited from excellent comments from engineers and academics from around the world. This has greatly enhanced the breadth and the depth of this publication ensuring that the *Guide* has applicability in many countries because it relies on the basics of science and engineering.

I would like to thank all members of the Task Group and its Secretary, Berenice Chan, for their help in producing this *Guide*. In addition, I would like to recognise the significant contribution of Professor Colin Bailey of University of Manchester who drafted the *Guide*, under the direction of the Task Group. This has been a challenging document to develop and Colin's hard work and effective response to the requirements of the Task Group, in a timely manner, is much appreciated.

M Green
Task Group Chairman