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Editorial

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It is often said that glass is a fascinating material; but why so? Glass has been used in buildings since Roman times and is a ubiquitous material in contemporary buildings so it is certainly not a new or unfamiliar material; yet it retains a degree of fascination. Perhaps the reason is that glass has several characteristics that are seemingly contradictory. For example, it is transparent yet relatively dense, it is very durable yet it is sensitive to surface flaws, it can be very strong yet it fails in a brittle manner.

The principal raw materials used to make glass – silicon dioxide (silica sand), sodium carbonate (soda) and lime (calcium carbonate) – produce an inert and very durable material, but the irregular and uncrystallised molecular structure that gives glass its transparency makes it very sensitive to flaws and it fails in a brittle manner that can cause injury. In the first paper of this themed issue, Vandebroek *et al.* (2015) quantify this sensitivity to surface flaws by establishing the edge strength of glass for commonly used edge finishes (ground, arrissed and as-cut). They also show that this approach is useful for forensic engineering. This is followed by a paper by Johns and Clubley (2015), who develop a methodology to simulate the transient dynamic loading and response of glazing subjected to blast loading. Their methodology is validated by means of full-scale blast trials and overcomes some of the limitations of single-degree-of-freedom models that are commonly used to assess blast performance of glazing by, for example, including a capability to model fragment trajectories.

One of the most challenging aspects of glass construction is how to devise structurally efficient load-bearing connections between glass components. Adhesive connections have the potential to outperform bolted connections as they can reduce stress concentrations typically found in bolted connections. In the third paper in this issue, Dispersyn *et al.* (2015) develop a new glass design method for adhesive connections, based on the method of superposition of local and global components, that provides a simplified and less laborious design. Despite its challenges, the effective connection between glass and other materials provides an excellent opportunity to create an engineered composite component that combines the desirable characteristics of glass with the useful mechanical properties of the material to which glass is bonded. The fourth and fifth papers show that such engineered composite glass elements have a significant amount of potential. In the first of these two papers, Netusil and Eliasova (2015) devise and evaluate adhesively bonded composite I-beams consisting of a glass web and steel flanges, in which they perform experimental, analytical and numerical work to explore the performance of the load-bearing steel–glass beams. The second of these two papers by Ber *et al.* (2015) involves the testing of adhesively bonded timber–glass composite walls. In this paper, the authors describe the material-level tests for selecting and characterising the adhesive, followed by quasistatic and dynamic testing of full scale timber–glass composite wall panels.

The other drivers for the increasing popularity of glass are the step-change improvements in glass manufacture and processing over the last 60 years. As a result glass is now used in load-bearing locations that were hitherto reserved for other materials, and that design guidelines and standards have yet to catch up with the new and novel applications of glass in buildings. The last two papers of this special edition address this shortcoming. Bedon and Amadio (2015) propose a Eurocode-based approach for determining the buckling capacity of glass columns and beams, in which they use experimental data and numerical simulations to validate the buckling curves for monolithic and laminated glass. The final paper by Lenk and Lambert (2015) deals with practical aspects of finite-element analysis in structural glass design. The principles of typical modelling procedures are discussed, and the specific techniques of sub-modelling and sub-structuring are introduced. The authors use real-world projects to illustrate the methods put forward in their paper.

This themed issue provides an excellent snapshot of the exciting research and development in structural glass. However, the surge in the demand for research in this field and the significant and rapid growth in the research activity in recent years are such that this themed issue on structural glass is likely to be followed by a second one on this topic in the near future.

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