Editorial

Glass is a highly popular material amongst modern architects. The transparency of glass creates lightness and exciting buildings may result. Yet, at the same time glass is feared by structural engineers because of its brittleness. It is difficult to find solutions for structural glass components and connections as accepted research based design rules are lacking. Glass still tends to be used primarily as a transparent infill without structural meaning, as it was used for centuries.

The last decades we have witnessed an increasing research effort into bridging the gap between the architect's wishes and structural engineer's reluctance in using glass as a load-bearing material. The research towards glass is multi-disciplinary. It covers glass production and processing techniques and materials oriented research, with annealed glass, heat-strengthened glass, fully tempered glass and forming techniques aiming at an increase of material strength and toughness. Other research is directed towards new assemblies for transparent components, using partitioning and lamination techniques, also including transparent ductile foils that make the final composite less brittle. A further category of research is the development of structural hybrids. Intelligent combinations of glass and steel have been put forward, glass-composite mixes, while even glass-concrete and glass-timber hybrids have been reported. These open up the way to transparent or translucent structural elements like beams, columns, floors and even shells, including connections.

This special issue of HERON is devoted to structural glass. Seven recent research advances from The Netherlands and Belgium are reported.

At TU Eindhoven, Huveners, Van Herwijnen et al. drew up the idea of utilizing the in-plane stiffness of glass panes to stabilize a steel framework, thus circumventing the need for bracings. Experimental results are reported with emphasis on the glued connections between glass pane and frame.

At TU Delft, Eekhout launched Zappi as a metaphor in the mid 90's for finding a new-yet-to-be-developed material that is transparent as well as structural. Since then, Veer made several contributions with colleagues and students, ranging from material enrichment to structural elements. Four papers are included in this HERON on this topic. Louter proposed and tested a reinforced glass beam concept, where cracked glass is not fatal but compensated by ductile reinforcement, similar to reinforced concrete. Based on lessons from an All Transparent Pavilion, build as technology demonstrator in 2004, Bos reports on the need for a combined

probabilistic/consequence-based safety approach for structural glass. Subsequently, Veer touches a critical point from the materials science perspective: can we rely on the strength of glass as a single value or is that value 'non-transparent' from the statistical point of view? Finally, De Richemont and Veer describe experimental research on glass-aluminum bonded joints, in the design context of the All Transparent Pavilion.

At Ghent University, Belis, Van Impe et al. are performing research on structural glass. In this issue, they present a combined experimental and numerical study on cold bending of laminated glass panels, directed towards the increasing demand for curved glass and free-form applications.

For slender laminated glass components, buckling is an important consideration. This topic is treated by Blaauwendraad who uses his experience in applied mechanics to derive a new generic formula for the buckling force, taking into account different interlaminate foil properties.

HERON usually covers research towards common civil and building engineering materials, like steel, concrete, soils, masonry and timber. It is hoped that this special issue of HERON on structural glass gives new perspectives to the readers. New research connections may be established, e.g. between quasi-brittle concrete and fully brittle glass, between the world of computational fracture mechanics and experimental glass research, or in terms of the search for new hybrids. Also, international efforts by e.g. IABSE and national efforts via e.g. CUR and Knowledge Centre Glass will trigger further research and valorisation in structural glass.

Guest editor: Jan Rots
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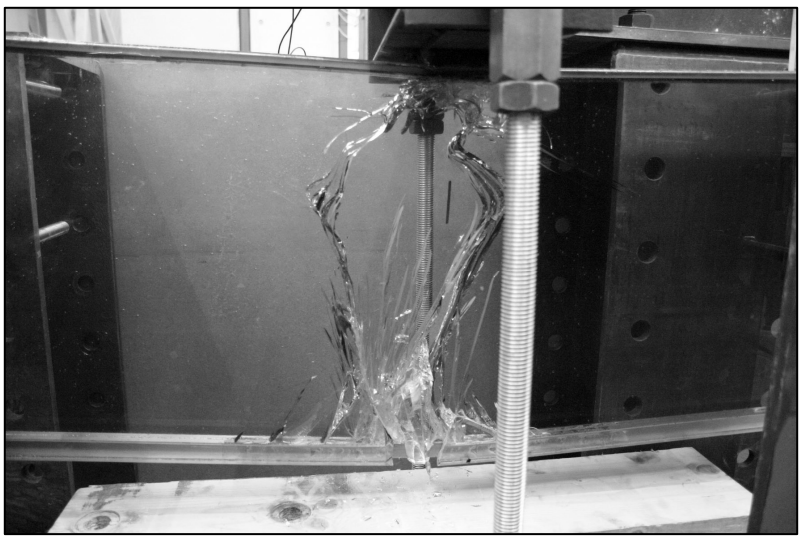
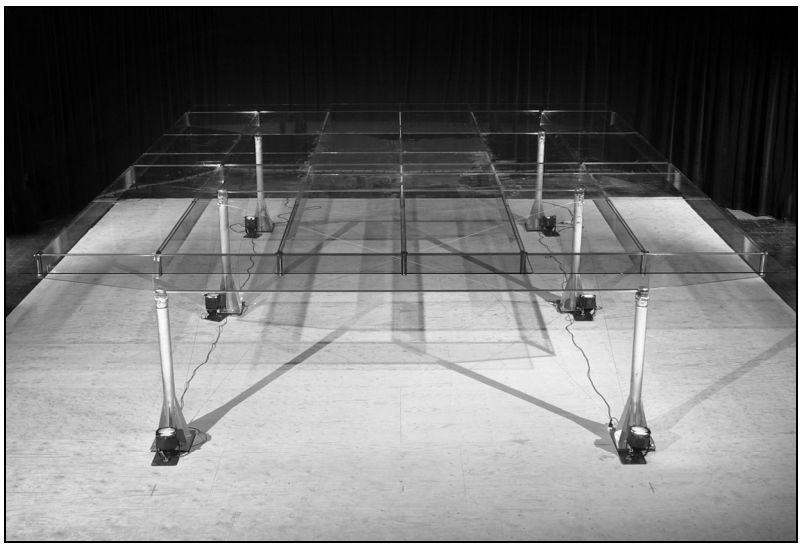
Reinforced glass component with post-peak residual strength;
The beam is loaded by TU Delft students and faculty members.



Zoom-in on the reinforced glass beam



All Transparent Pavilion