UQ Fire Project #2019.17

BEHAVIOUR OF TIMBER GLASS COMPOSITE BEAMS IN FIRE

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Background and motivation

Glass is seeing a growing interest as a structural material as a result of its relatively good strength to weight ratio and the obvious aesthetic benefits of its use as in buildings. However due to the sensitivity of glass to thermal shock and the considerably temperature-dependent behaviour of interlayer materials as a result of their visco-elastic nature, the mechanical behaviour of laminated glass will be severely influenced by exposure to fire.

One promising application of structural glass is in the use of timber glass composites, where glass forms the web of a beam formed with timber flanges. However this introduces issues associated with shading of the glass resulting in large in plane gradients that could contribute to failure mechanisms of the beams.

Research objectives

1) This project aims to carry out finite element modelling of timber glass composite beams to further explore their behaviour in fire.
2) Heat transfer modelling should be undertaken accounting for the effects of transmissivity, absorptivity and reflectance of the glass. Mechanical modelling should then account for the resulting temperature distribution in glass beams exposed to different boundary conditions and considering accounting also for the charring of the timber flanges.
3) Different configurations of timber glass composite beams should be further explored to identify possible promising layups and details.

Methodology

This project will be based on finite element and desktop studies.

Recommended literature

[1] M. Debuyser; J. Sjöström; D. Lange; D. Honfi; D. Sonck; J. Belis; Behaviour of monolithic and laminated glass exposed to radiant heating; Construction and Building Materials; http://dx.doi.org/10.1016/j.conbuildmat.2016.09.139

[2] C. Louter and A. Nussbaumer, “Fire testing of structural glass beams; initial experimental results,” in Proceedings of Glass-Con Global Conference, Boston, PA, USA, July 2016.