

UQ Fire Project #2019.04

OPEN FLOOR PLAN TIMBER COMPARTMENT FIRE DYNAMICS

Advisory Team

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Keywords

Timber, fire dynamics, open plan compartment fires

Background and motivation

Timber as a construction material is seeing a rapid growth in its use at the moment; this is a result of strong environmental credentials and a drive for an improved end user experience in offices and residential developments. This has been enabled by the development of both engineered timber products and the structural engineering knowledge required to build taller timber buildings or new structural forms in modern timber developments. However, one of the major obstacles to the realisation of expressed timber in buildings is the necessity to meet fire safety requirements which often result in fully encapsulated timber buildings, or 'timber reinforced gypsum buildings'.

Much of the work ongoing to understand the behaviour of timber in compartment fires and to enable expressed timber is done in compartments which would lend themselves to a regime 1, ventilation controlled, fire. This has led to the demonstration of the concept of self-extinction of burning timber in fires and the identification of criteria for this; and this is contributing with further work studying the impact of timber on the existing compartment fire framework.

However, the majority of applications with exposed or expressed timber are very large compartments, compartments which lend themselves to a regime 2, or travelling, fire. There is therefore a need to understand the impact that expressed timber surfaces in a large open plan compartment have on the fire dynamics and if open plan timber compartments can lend themselves to travelling fire behaviour or if some modification to this concept needs to be introduced.

Research objectives

- 1) To undertake literature review of fires in large compartments and to identify the assumptions of these models which may be challenged by the presence of expressed timber
- 2) To propose a scale test which could be efficiently carried out and which demonstrates the impact of timber linings on the fire dynamics in a large compartment
- 3) To carry out the test and to critically evaluate the findings in comparison with the findings of the literature review

Methodology

This project will be largely desk based, with one experiment to be carried out towards the end of the project.

Recommended literature

- [1] Emberley, R. (2017) Fundamentals for the Fire Design of Cross Laminated Timber Buildings; PhD thesis The University of Queensland
- [2] Stern-Gottfried, J. (2011) Travelling Fires for Structural Design; PhD thesis. The University of Edinburgh
- [3] Hadden, R., Bartlett, I., Hidalgo, J., Santamaria, S., et al. (2017) Effects of exposed cross laminated timber on compartment fire dynamics Fire Safety Journal Volume 91, July 2017, Pages 480-489