

UQ Fire Project #2019.20

TIMBER CHARRING UNDER VERY HIGH HEATING CONDITIONS

Advisory Team

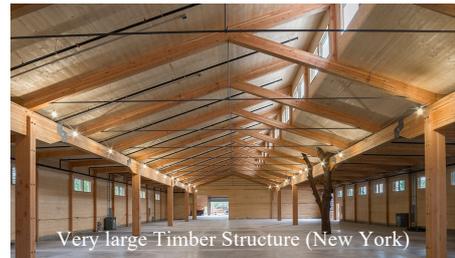
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Background and motivation

The use of modern, engineered timber products and design of novel structures is becoming rapidly popular in Australia and worldwide. The performance of load-bearing timber structures during and after a fire is a challenging within the context of ensuring the structural stability of a building structure.

Today's fire safe design of timber structures relies on knowing the charring rate of timber during fire for calculating the loss of cross section of timber elements (columns, beam, slabs); hence enabling the analysis for the structural performance during and after fire. Moreover, the contribution of fuel to the compartment fire is related to the rate at which the rate at which timber is charring. Charring of timber is known to be influenced by species of timber, moisture content, oxygen conditions, heating conditions, among others. Having said that, design guidelines around the world provide charring rate estimates for engineers to use in their calculations. A wide range of heating conditions (very low and very high) is yet to be described within the scope of a single experimental study.



Research objectives;

- 1) Perform experiments measuring the charring rates for a wide range of heating conditions.
- 2) Evaluate the influence of no char fall off against the char falling off upon loss of adhesion (influence by the orientation of timber during burning).
- 3) Investigate the validity of timber charring rates in current available literature.

Methodology

This project will be based on experimental testing, data analysis, and simple heat transfer modelling.

Recommended literature

- [1] Brandon D. and Östman B. 2016. Fire Safety Challenges of Tall Wood Buildings – Phase 2: Task 1 – Literature Review (FPRF-2016-22). Fire Protection Research Foundation (NFPA).
<https://www.awc.org/pdf/tmt/TMT-LiteratureReviewTallWoodFire-1811.pdf>
- [2] Bartlett A, Hadden R, and Bisby L. 2019. A Review of Factors Affecting the Burning Behaviour of Wood for Application to Tall Timber Construction. Fire Technology, 55:1 1-49.
<https://link.springer.com/article/10.1007%2Fs10694-018-0787-y>
- [3] Whyte R and Dietenberger M. 2010. Fire Safety of Wood Construction, U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory.
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