

UQ Fire Project #2020.04

A PRIORI OPEN PLAN COMPARTMENT FIRE MODELLING

Advisory Team

Dr David Lange (d.lange@uq.edu.au)

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Background and motivation

Fires in open plan compartments have been studied by several groups and researchers over the past decade. Methodologies for defining fire evolution have relied on simplifying assumptions and existing models to describe the temperature evolution as a function of space and time.

A novel technique for studying such fires has been developed at UQ. This has led to the identification of a possible recasting of travelling fire methodologies without such simplifying assumptions. The aim of this project is to refine and test this recast methodology.

Research objectives

- 1) Formalise the proposed recast travelling fire methodology
- 2) Show that the methodology can be used to predict a-priori the fire development in an experiment of an open plan compartment
- 3) If time permits, to further explore the evolution of fires in open plan compartments with different configurations of openings and internal obstruction geometry

Methodology

This project will require the development of the proposed model in either matlab or in excel. Experiments will then be defined and carried out using the existing test rig to further validate this model.

This project would best suit an 8-unit thesis.

Potential students are expected to have passed FIRE3700 (introduction to fire engineering). It is preferable, although not essential, that potential students will also have passed FIRE 7620 (fire dynamics).

Recommended literature

- [1] Juan P. Hidalgo, Tristan Goode, Vinny Gupta, Adam Cowlard, Cecilia Abecassis-Empis, Jamie Maclean, Alastair I. Bartlett, Cristián Maluk, José M. Montalvá, Andrés F. Osorio, José L. Torero, The Malveira fire test: Full-scale demonstration of fire modes in open-plan compartments, Fire Safety Journal, Volume 108, 2019, <https://doi.org/10.1016/j.firesaf.2019.102827.XXXXXXX>
- [2] J. Stern-Gottfried, G. Rein, Travelling fires for structural design Part II : design methodology, Fire Saf. J. 54(2012)96–112 <https://doi.org/10.1016/j.firesaf.2012.06.011>
- [3] E. Rackauskaite, C. Hamel, A. Law, G. Rein, Improved formulation of travelling fires and application to concrete and steel structures, Structures 3(2015)250–260 <https://doi.org/10.1016/j.istruc.2015.06.001>
- [4] X. Dai, S. Welch, A. Usmani, A critical review of “travelling fire” scenarios for performance-based structural engineering, Fire Saf. J. 91(2017)568–578 <https://doi.org/10.1016/j.firesaf.2017.04.001>
- [5] J. P. Hidalgo, et al., An experimental study of full-scale open floor plan enclosure fires, Fire Saf. J. 89(2017)22–40 <https://doi.org/10.1016/j.firesaf.2017.02.002>.