Predicting Bushfire Exposure Conditions for a Building Using Numerical Heat Transfer Modelling

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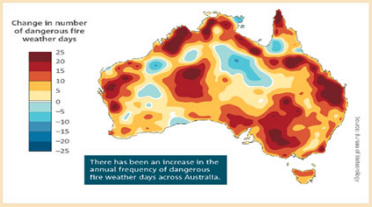
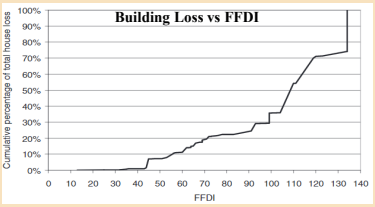
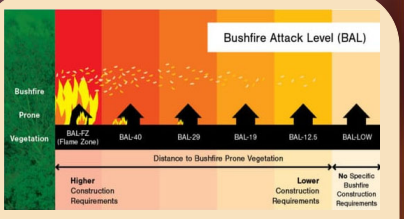
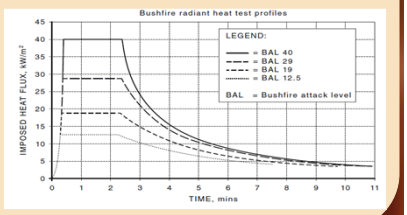
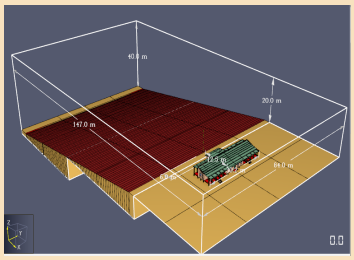


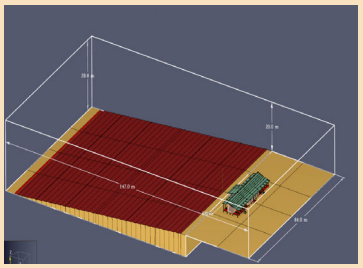


The aim of this research study is to model the impact of design grassfires on a **heritage-listed building** using **numerical heat transfer models for** varying topographic conditions and to **identify vulnerable building elements** with the overall goal of **improving bushfire resilience**.



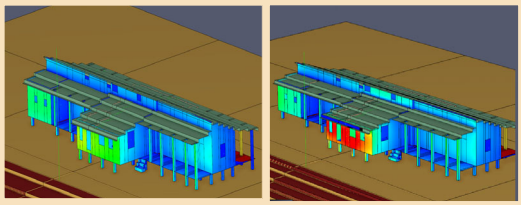


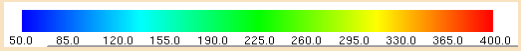


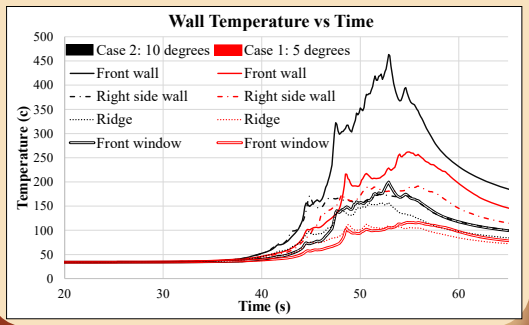


External Wall Temperature

Case 1: 5º slope **Case 2: 10º slope**



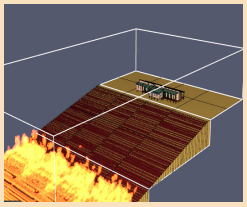


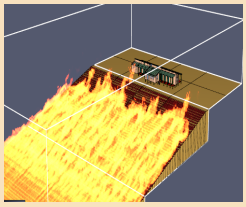


Modelling results

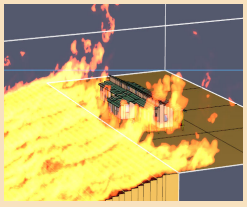
- Using **PyroSim** and **Fire Dynamic Simulator** two grass fires were considered with 5 and 10º slopes, under **GFDI 30** conditions.
- The fuel load and weather conditions correspond to **BAL-40 conditions.**
- The radiant heat flux **exceeded the classification**, with **direct flame** contact observed in both cases.
- The highest increase in temperature was on the **front fire-side wall**, with **charring occurring** above 200ºC.
- The **rapid temperature increases** in the glazing can result in **cracking (failure).**

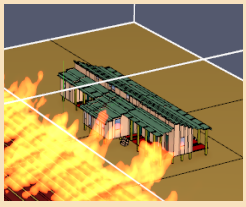
Fire spread up a 10º slope



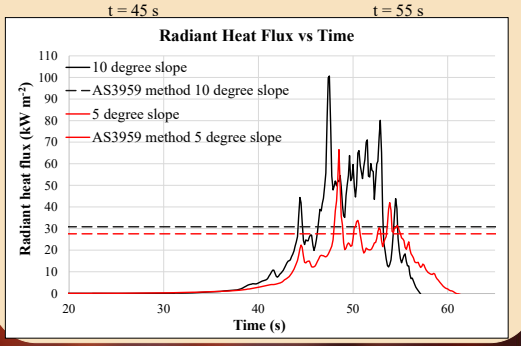


t = 30 s t = 40 s

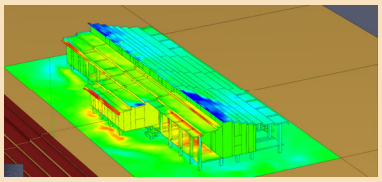




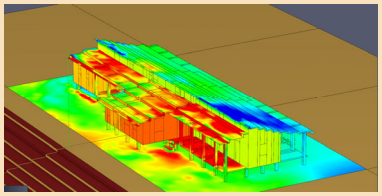
t = 45 s t = 55 s

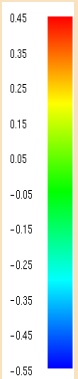


Wind Pressure Coefficient - without fire



Wind Pressure coefficient - with fire





- **Fire-enhanced winds** were shown to increase the wind pressure and suction on the building, which can **damage the exterior** cladding **allowing embers and hot gases to enter the building.**
- The methodology used can be **extended to buildings with different architectural features**, topographic, climatic and fuel conditions, to model the impacts of bushfire on buildings and **identify critical structural elements and design features in the current structures to be retrofitted**.

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Acknowledgement

The authors would like to thank and acknowledge the computational resources provided by QUT's High-Performance Computing (HPC) facility, and Thunderhead Engineering for the PyroSim software academic license.