

Finite Element Modelling of Post-Tensioned Timber Beams under Fire Conditions

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In order to implement innovative timber structures globally, performance-based design using numerical models are often required. A model was developed to simulate post-tensioned (PT) timber beams in FEM software ABAQUS and compared to three furnace beam experiments. A sequentially coupled heat transfer – mechanical analysis was developed and validated. The timber was treated as orthotropic both in elasticity and plasticity, and was modelled with temperature-dependent properties. The simulation results showed good agreement with both the thermal results and the mechanical analysis. The thermal results matched the thermocouple readings well and the char depths were predicted to within 4 mm. The failure modes and times were accurately predicted (within 5% accuracy), and the deflection behaviour was reasonably predicted compared to the experimental data.