FIRE HAZARDS IN MODERN SUSTAINABLE TIMBER BUILDINGS

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IMPERIAL

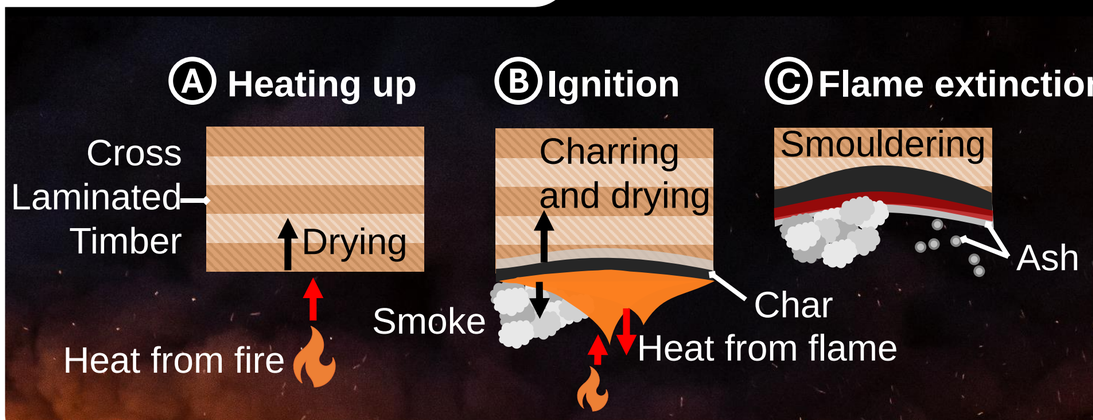
STEM for BRITAIN

MODERN TIMBER BUILDINGS

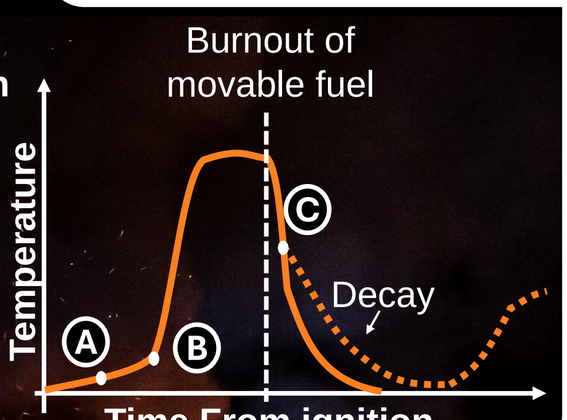
37%

CO2 from the construction industry globally (UNEP)

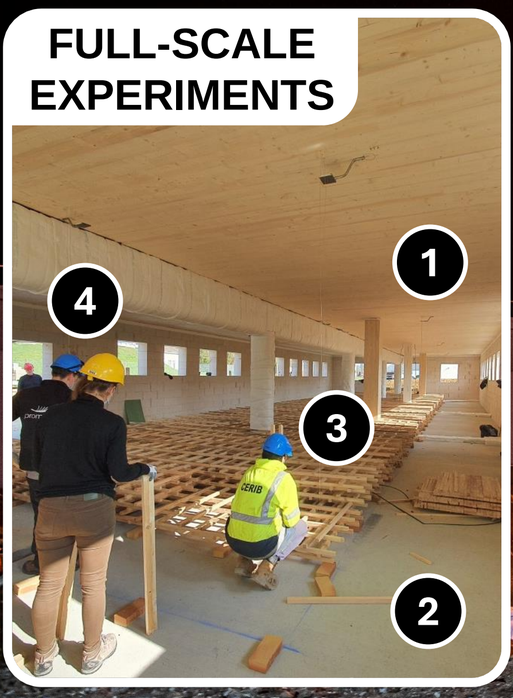
TIMBER FIRE BEHAVIOUR



COMPARTMENT FIRES



FULL-SCALE EXPERIMENTS



1. Mass timber ceiling
2. 352 m² floor area
3. Wood crib fuel load
4. Compartment openings

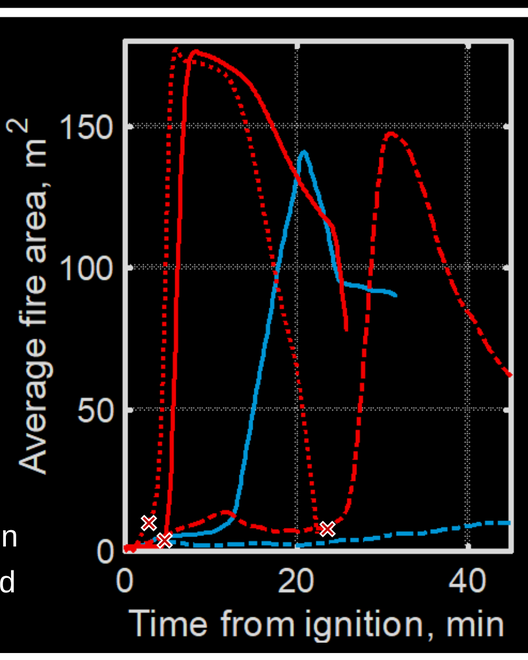
VISUAL DIAGNOSTICS

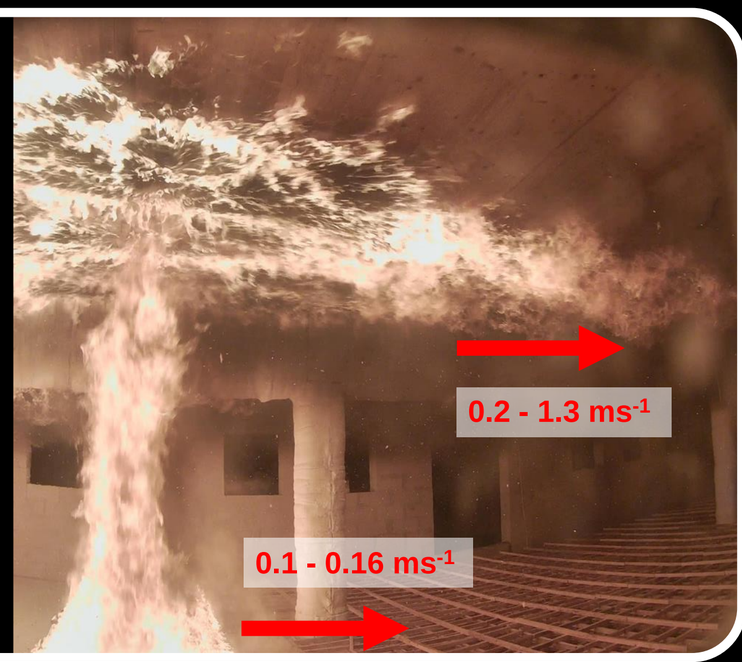
30 high temperature–resistant cameras designed to visually study fire hazards.

FLAME SPREAD

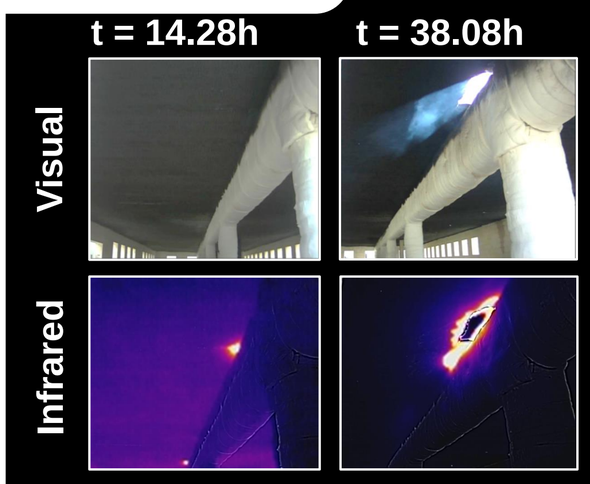
3.7 ×

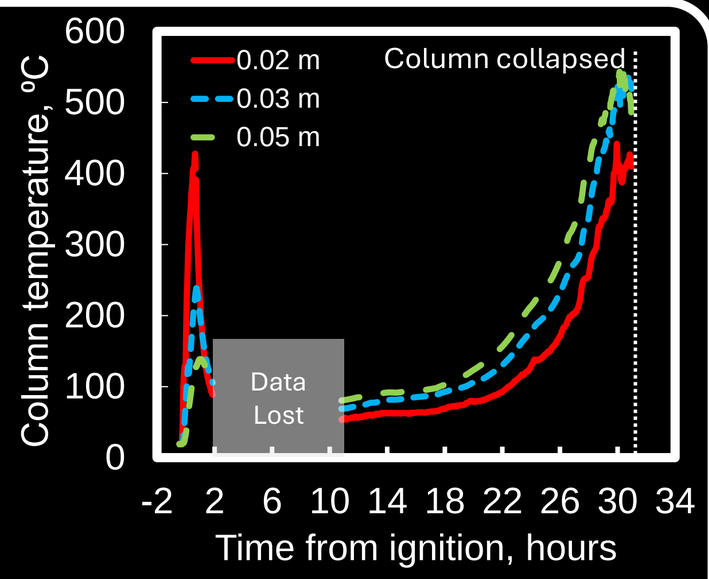
Greater rate of flame spread with a timber ceiling.





SMOULDERING





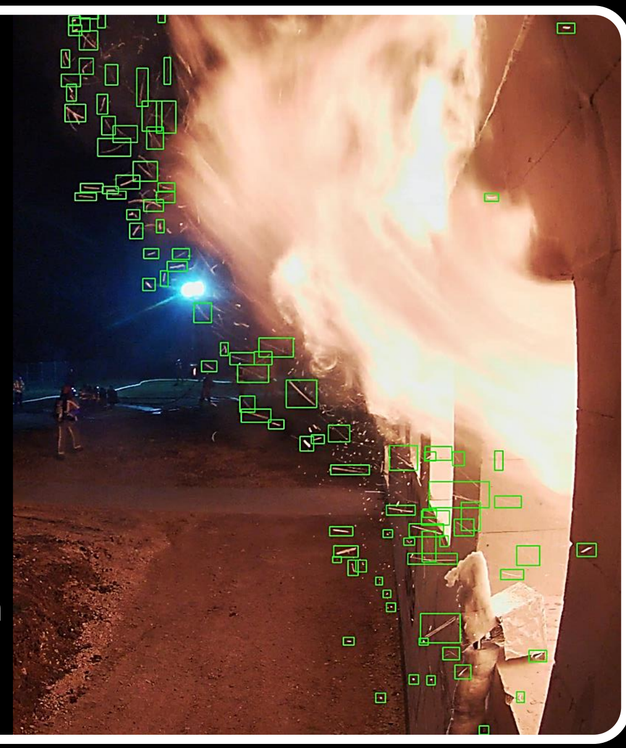
- Localised smouldering can occur for days after flaming, leading to collapse.
- Post-fire Investigation identified 19 key locations susceptible to smouldering.
- An average of **5.8 hotspots per 100 meters of timber edge** occurred.

FIREBRANDS

- Firebrands (embers) can ignite nearby buildings.
- Particle streak velocimetry used to track firebrands
- Greater velocities in external flaming region (maximum of 12 ms^{-1}).

230,000

Firebrands per minute from the whole compartment



CONCLUSIONS

- The use of timber construction can improve sustainability, aesthetics, construction times, and costs.
- Fire in timber buildings is **a complex challenge** that needs in-depth research to understand.
- Three hazards that have not been studied significantly in the literature were characterised, including flame spread, smouldering of timber elements, and firebrands transported from openings.
- **This research characterises fire hazards that are not addressed in building design so that they can be tackled future modern timber buildings globally.**

References and related publications

UKRI

ARUP

Background image credit to Arup & CERIB