Wood-RISE Alliance Webinar

Fire design of exposed mass timber in apartments

By Dr. Daniel Brandon

Project Team

Daniel Brandon

Johan Sjöström

Alastair Temple

Emil Hallberg

Fredrik Kahl

RI. SE
Research Institutes of Sweden

Fire Safe Implementation of Visible Mass Timber in Tall Buildings

https://www.ri.se/en/what-we-do/projects/fire-safe-implementation-of-mass-timber-in-tall-buildings

Project manager:

American Wood Council

Contractor:

RISE, Research Institutes of Sweden

Project team at RISE:

Daniel Brandon

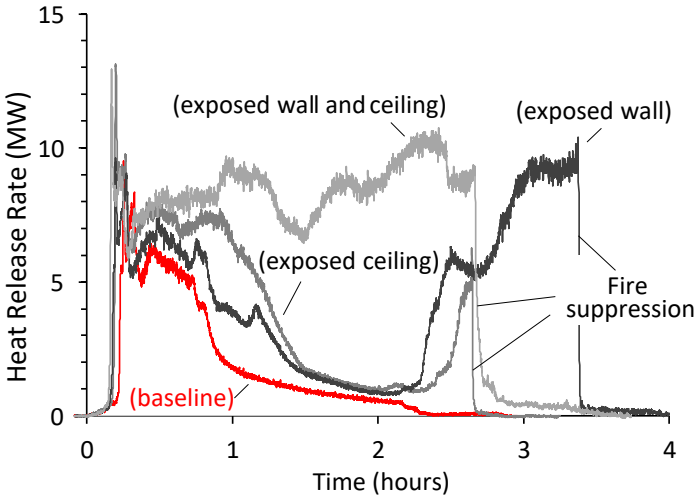
Johan Sjöström

Alastair Temple

Emil Hallberg

Fredrik Kahl

Background



NFPA

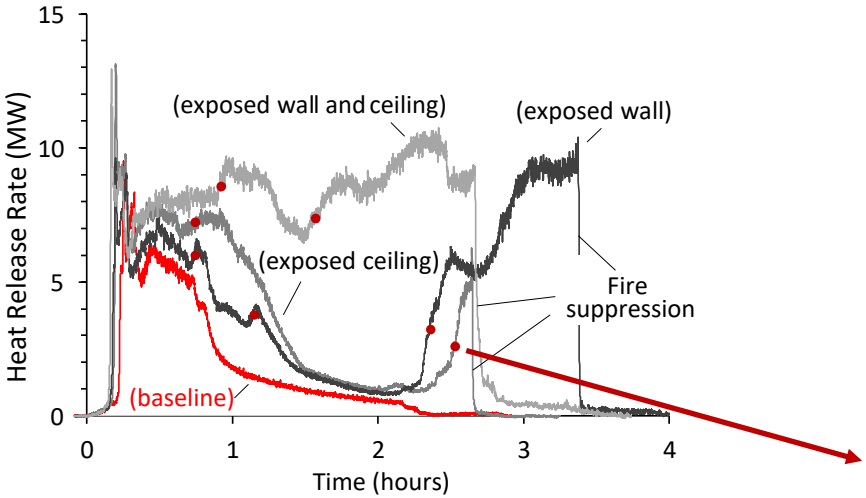
NRC·CNRC

RISE Research Institutes of Sweden

NIST National Institute of Standards and Technology

tests at NIST National Institute of Standards and Technology

Background



NFPA

NRC·CNRC

RISE
Research Institutes of Sweden

NIST
National Institute of Standards and Technology

tests at NIST National Institute of Standards and Technology

Background

Adhesive test: ANSI/APA PRG 320(2018)

CLT product test: Eurocode 5 (expected 2023)

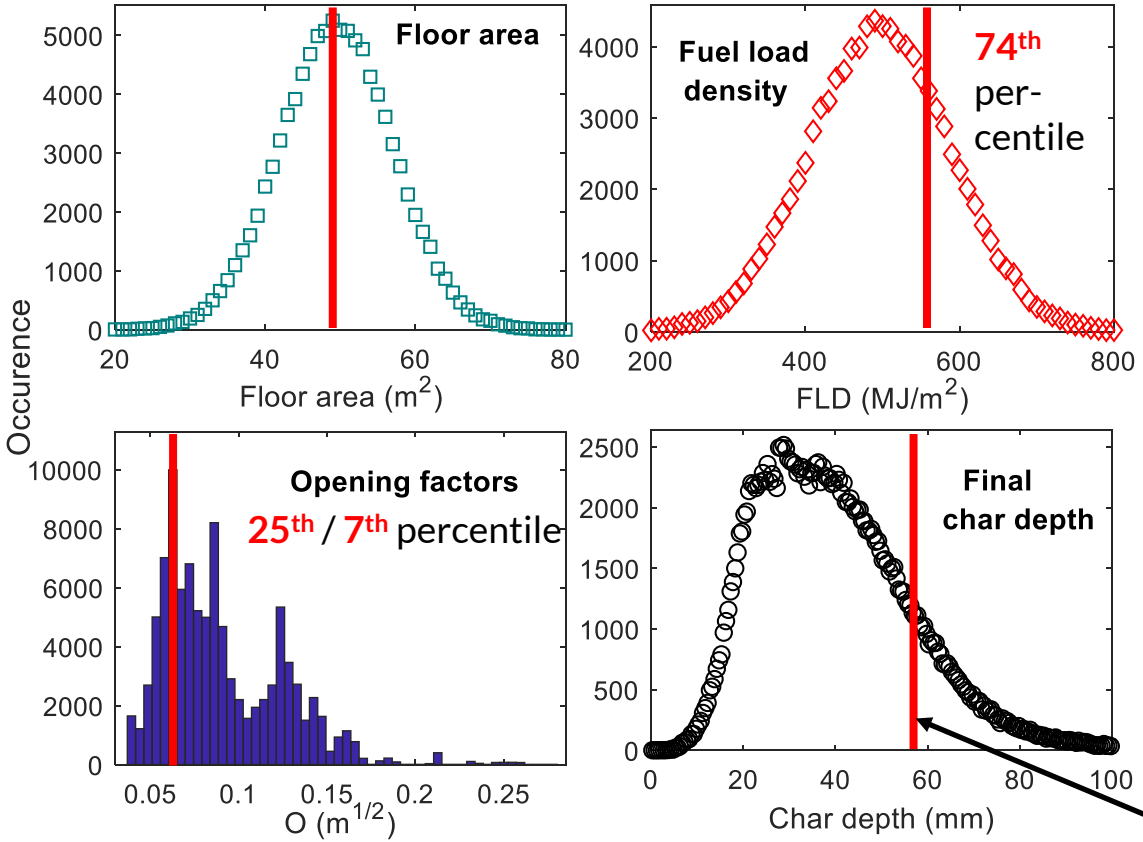
Objectives

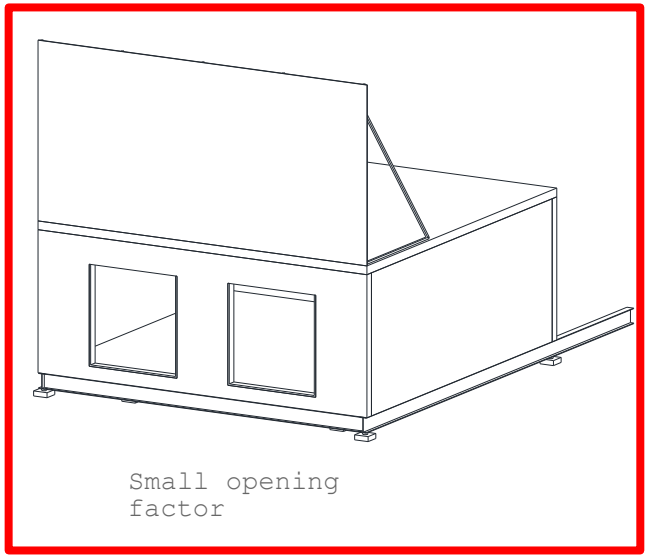
- Design and perform 5 compartment fire tests with PRG 320-2018 compliant CLT & varying amounts of exposed mass timber areas.
- Assess against criterion: decay of the fire is required to be continuous until 4 hours after ignition.

Secondary objectives

- Predictive modeling
- Design and test intersections between exposed mass timber members
- Record façade exposure allowing for comparisons with standard façade testing methods.
- Case study for restoring exposed CLT members after a fire.

Design values – *Severe* but *representative*

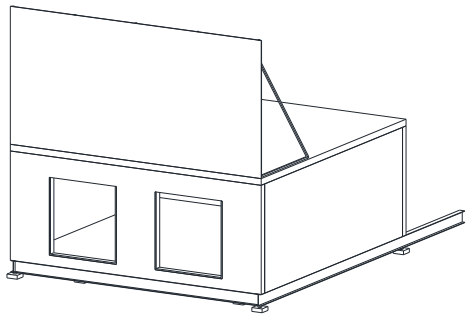




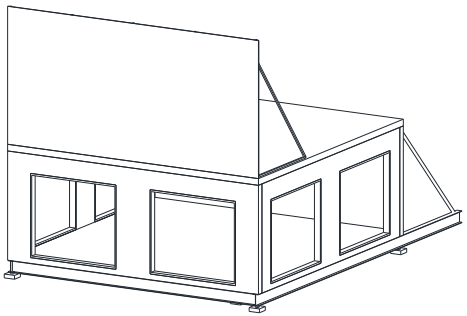
- Floor area 49m^2
- Opening factor 0.062m$^{1/2}$)
- Fuel load density 560 MJ/m^2
- **85th percentile damage**

Severe but *representative* – Opening factor

Test 1, 2, 3 and 5

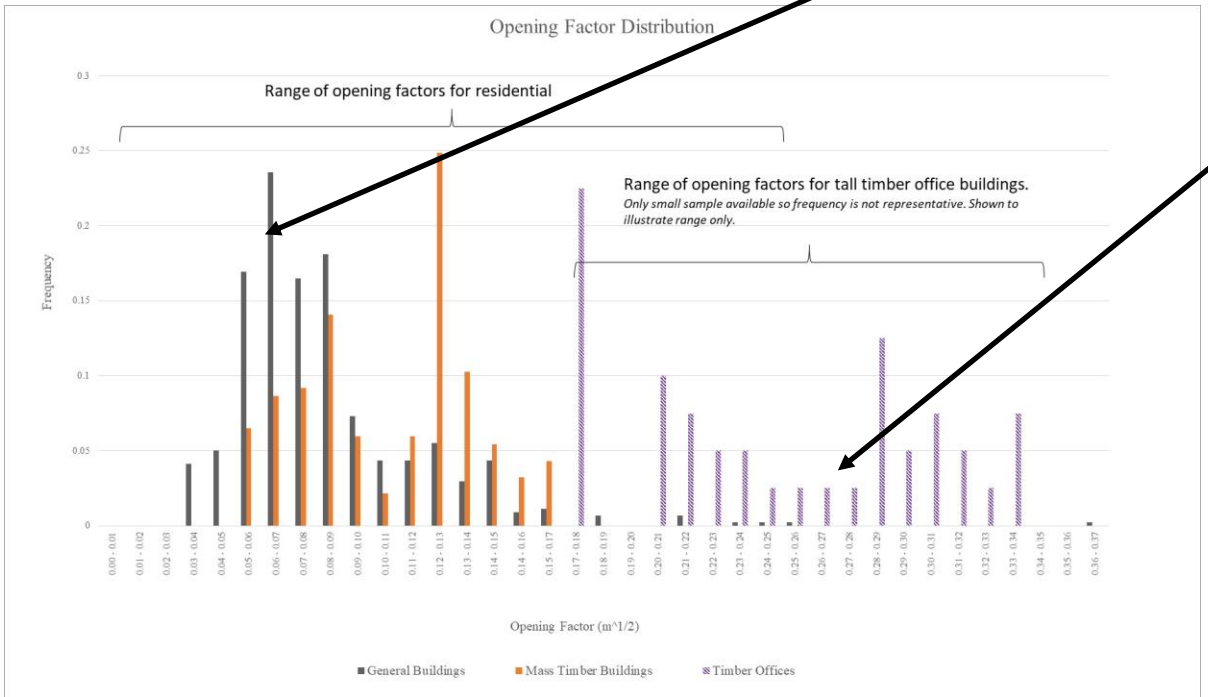


Small opening factor

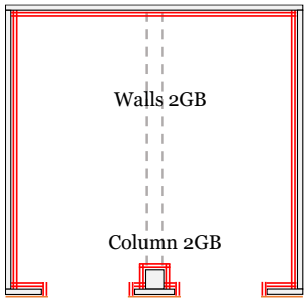


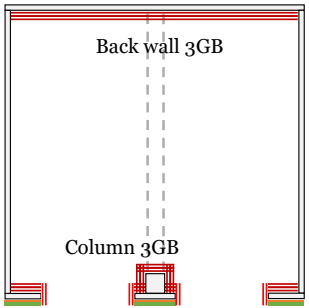
Large opening factor

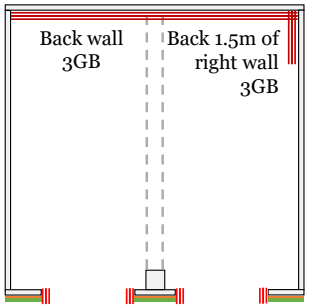
Test 4

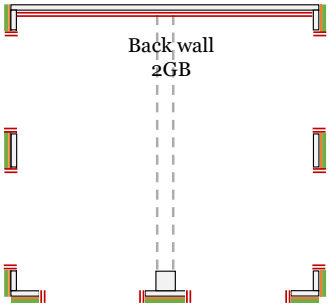


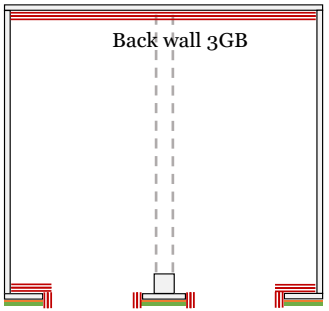
Test 1	Test 2	Test 3	Test 4	Test 5











Configurations based on a combination of:

- Performance of the previous test
- Modeling predictions
- Opinion of the steering group

Fuel load

Fire scenario - videos

Test 1 - Exposed timber: 53.8 m^2

Test 2 - Exposed timber: 91.2 m^2

Test 3 - Exposed timber: 96.2 m^2

Test 4 - Exposed timber: 77.9 m^2

Test 5 - Exposed timber: 97.2 m^2

NIST
National Institute of Standards and Technology

Reference <u>without</u> PRG320(2018) compliance
Exposed: 67 m^2

Fire scenario - videos

Test 1 - Exposed timber: 53.8 m^2

Test 2 - Exposed timber: 91.2 m^2

Exposed walls intersecting in a corner: Yes

Test 3 - Exposed timber: 96.2 m^2

Test 4 - Exposed timber: 77.9 m^2

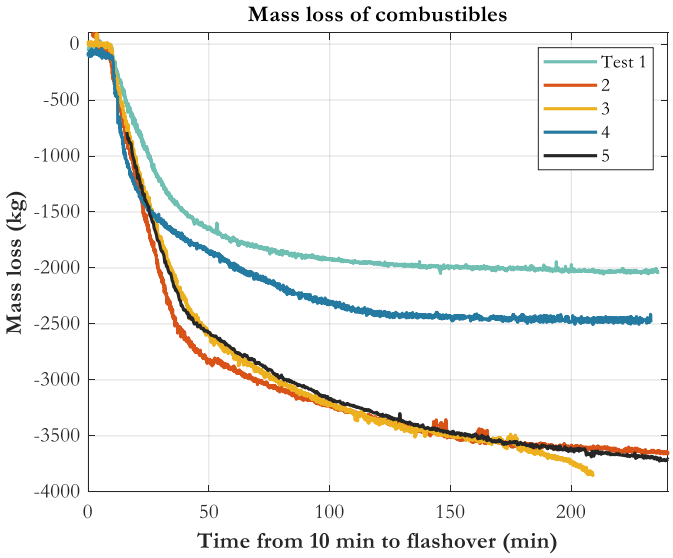
Exposed walls intersecting in a corner: No

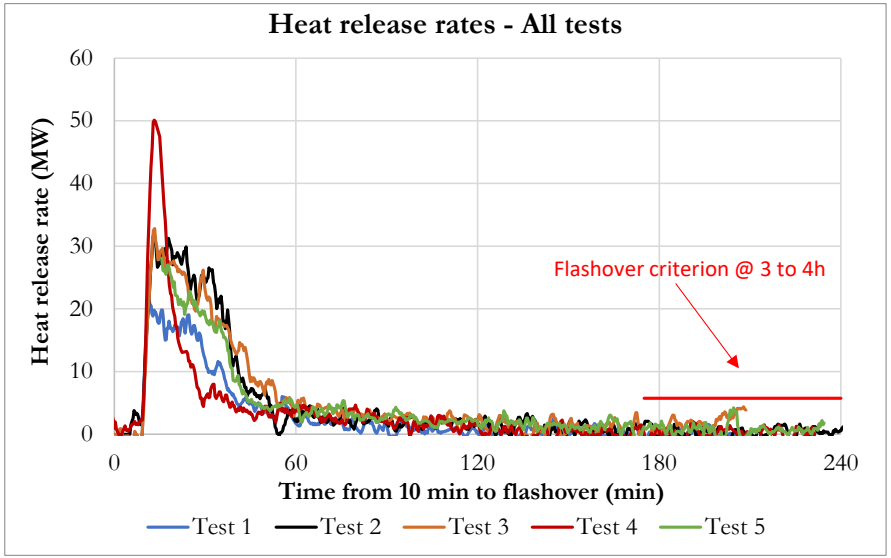
Test 5 - Exposed timber: 97.2 m^2

NIST National Institute of Standards and Technology

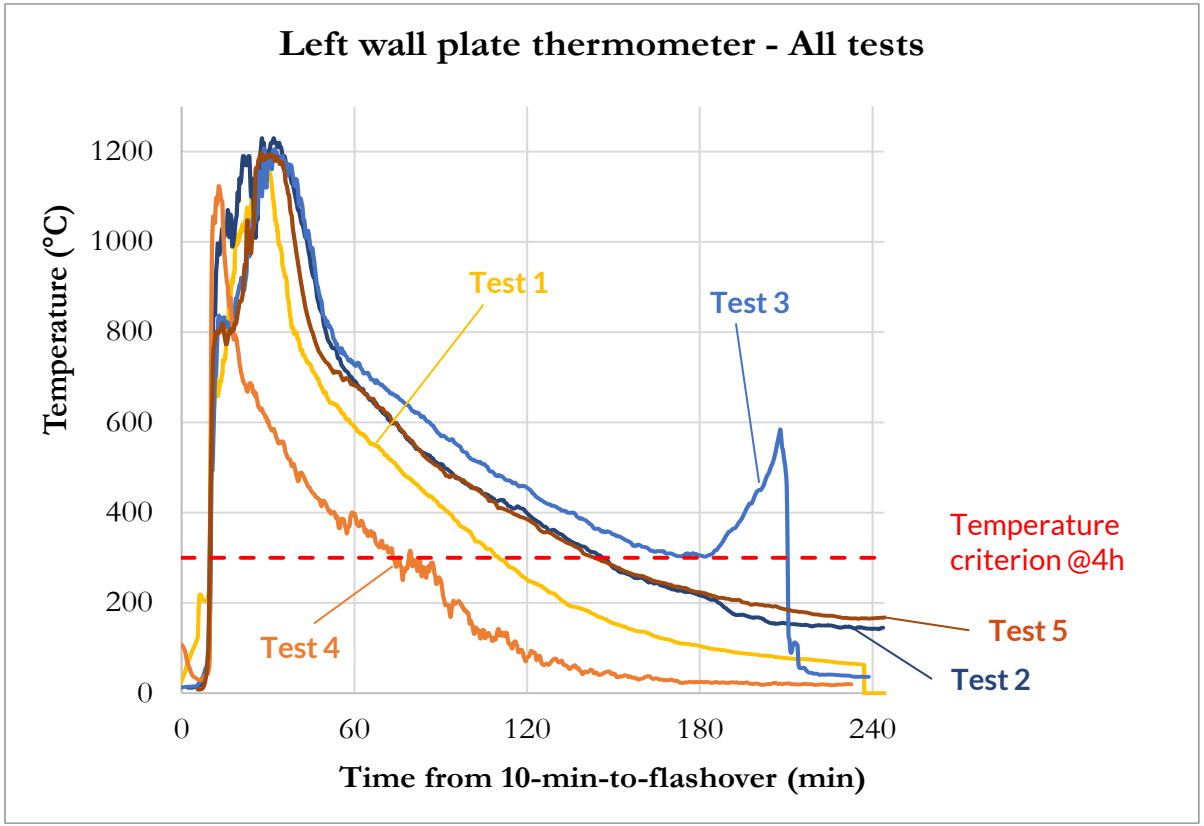
Reference without PRG320(2018) compliance
Exposed: 67 m^2

Fire scenario – mass loss and heat release rate

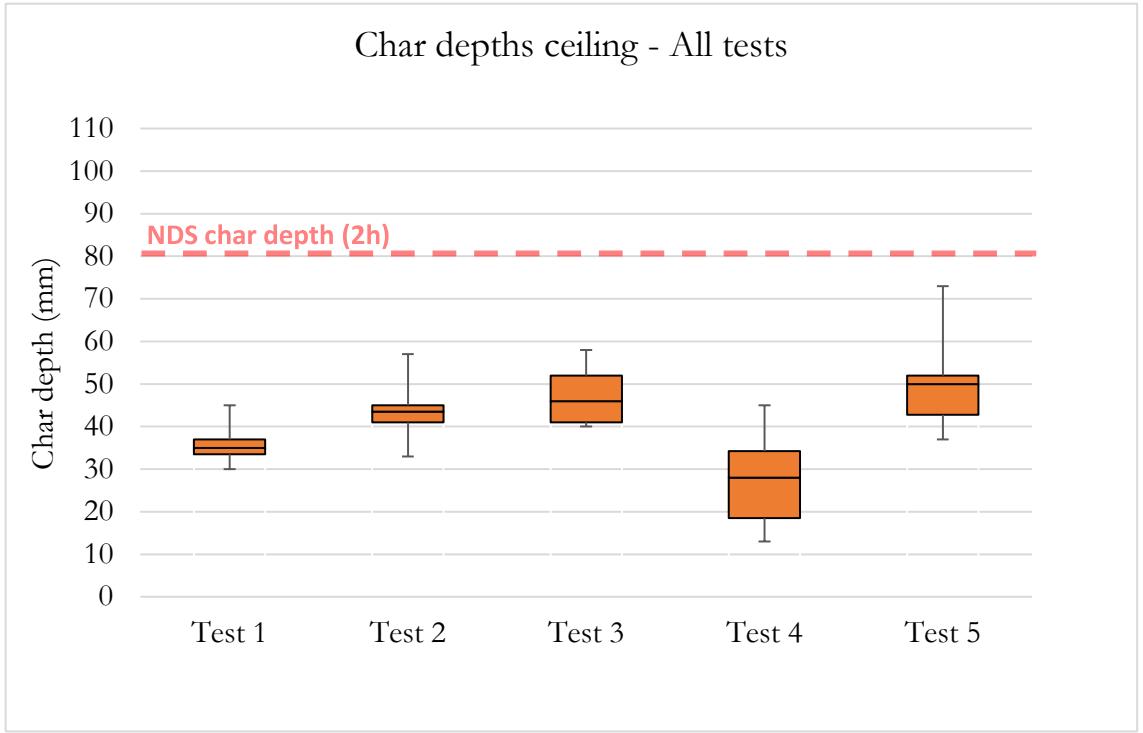




Fire scenario – mass loss and heat release rate



Fire scenario – mass loss and heat release rate



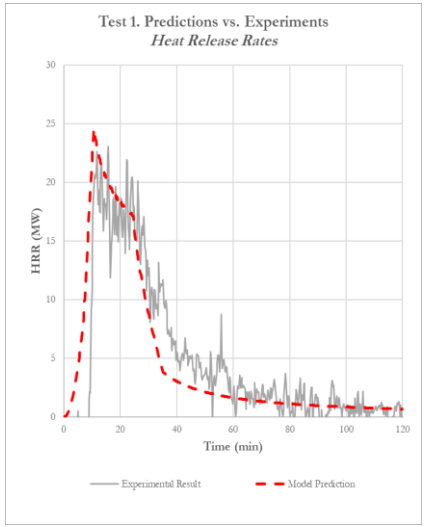
Conclusions

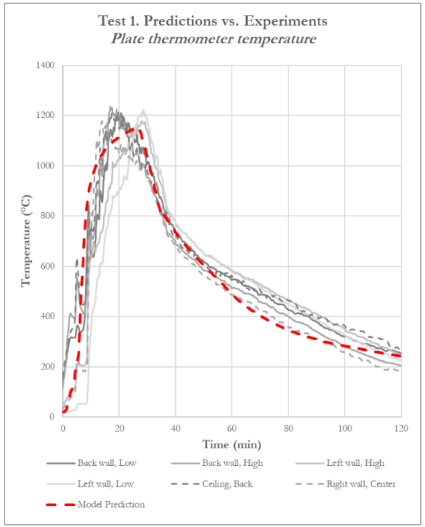
- Fire in the compartment with the ceiling exposed and walls protected with 2 layers type-X gypsum boards, decayed at least up to 4 hours after ignition.

- Fires in compartments with significant areas of additional exposed wall surfaces, decayed at least up to 4 hours after ignition, with one exception where exposed wall surfaces intersected in corners and increased damage in the bottom of corners was observed.

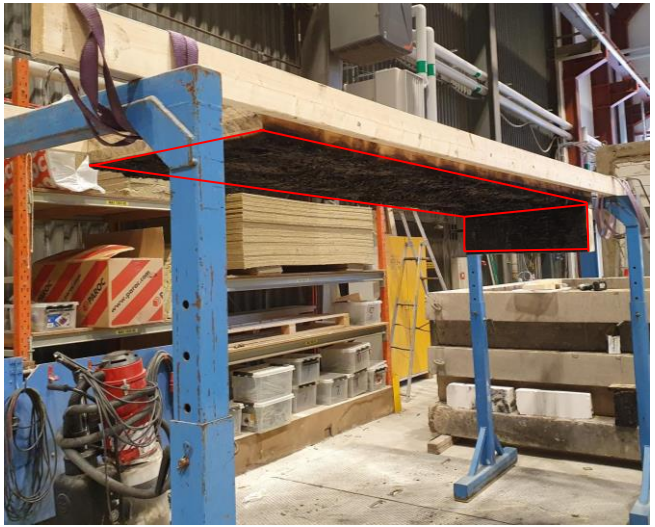
Other topics of the project

Predictive modeling





Restoration of exposed CLT



https://www.ri.se/en/what-we-do/projects/fire-safe-implementation-of-mass-timber-in-tall-buildings

Webinar

Fire design of exposed mass timber in apartments

Dr. Daniel Brandon

RI. SE
Research Institutes of Sweden