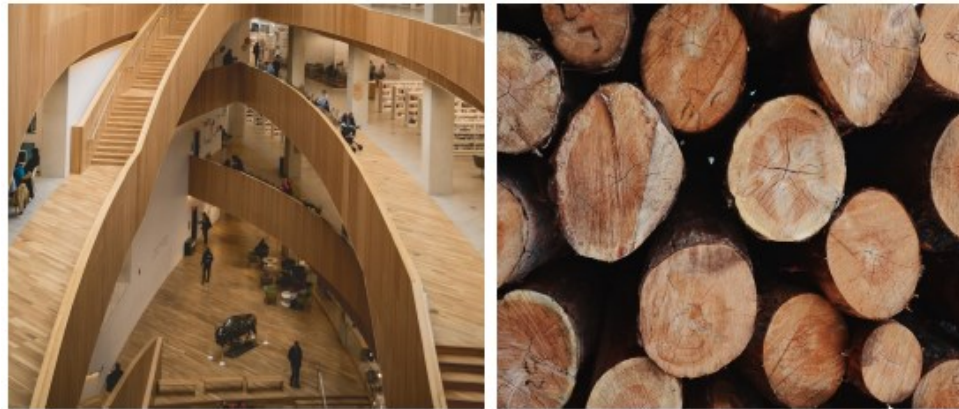


A coastal scene at sunset. The sky is a mix of light blue and orange, with a few wispy clouds. In the background, a row of multi-story buildings is silhouetted against the bright horizon. The ocean is dark blue with white-capped waves breaking in the foreground. Numerous people are scattered across the water, some appearing to be swimming or surfing. The word "RED" is overlaid in the center in a large, bold, red, sans-serif font.

RED

Carl Pettersson
BSc Fire Safety Engineer
MSc Risk Management

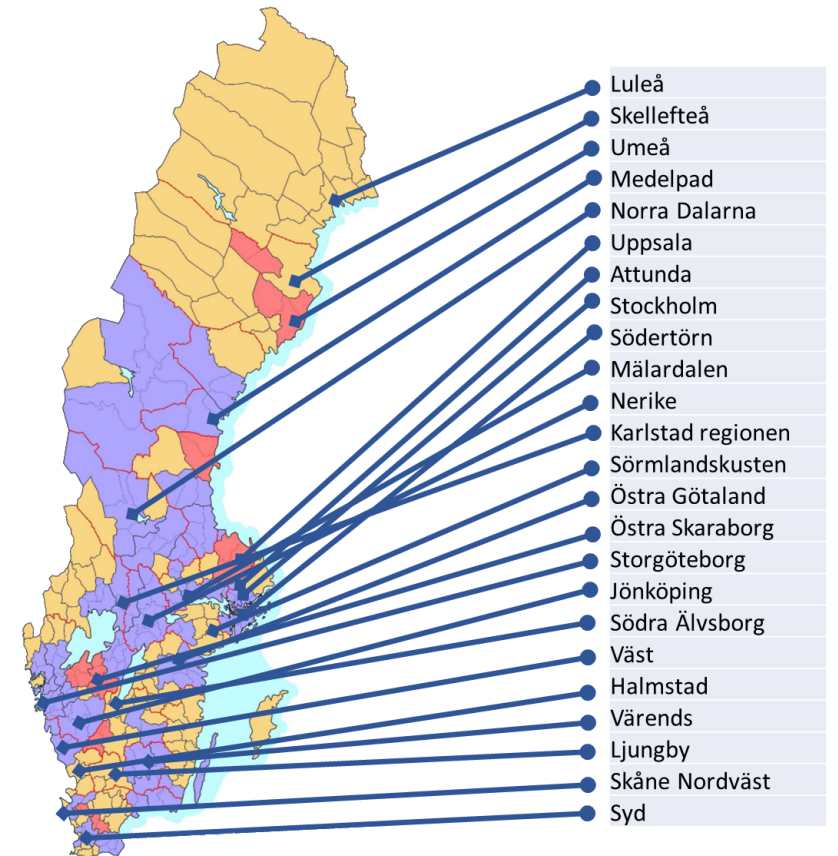


Fire Safety in Timber Buildings -
A review of existing knowledge

Carl Pettersson



- **COST Action CA20139,**
Holistic design of taller
timber buildings
(HELEN)
- **Network – Fire brigades**



Gävle, Sweden, City Fire 10 July 1869
13 000 people lost their homes

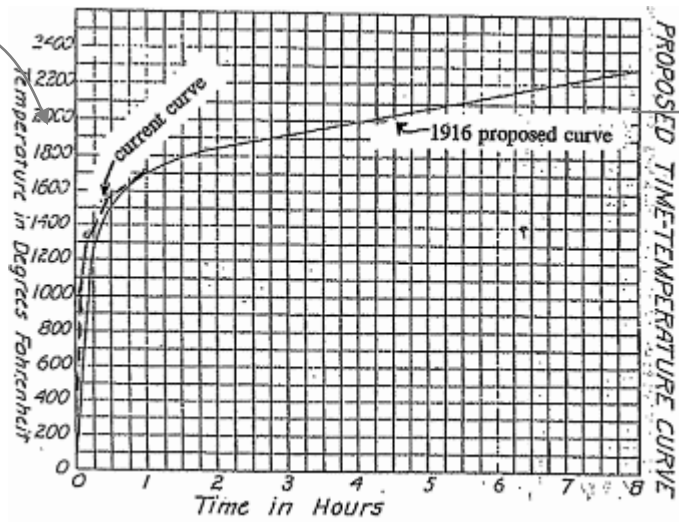


Fire resistance - temperature curve



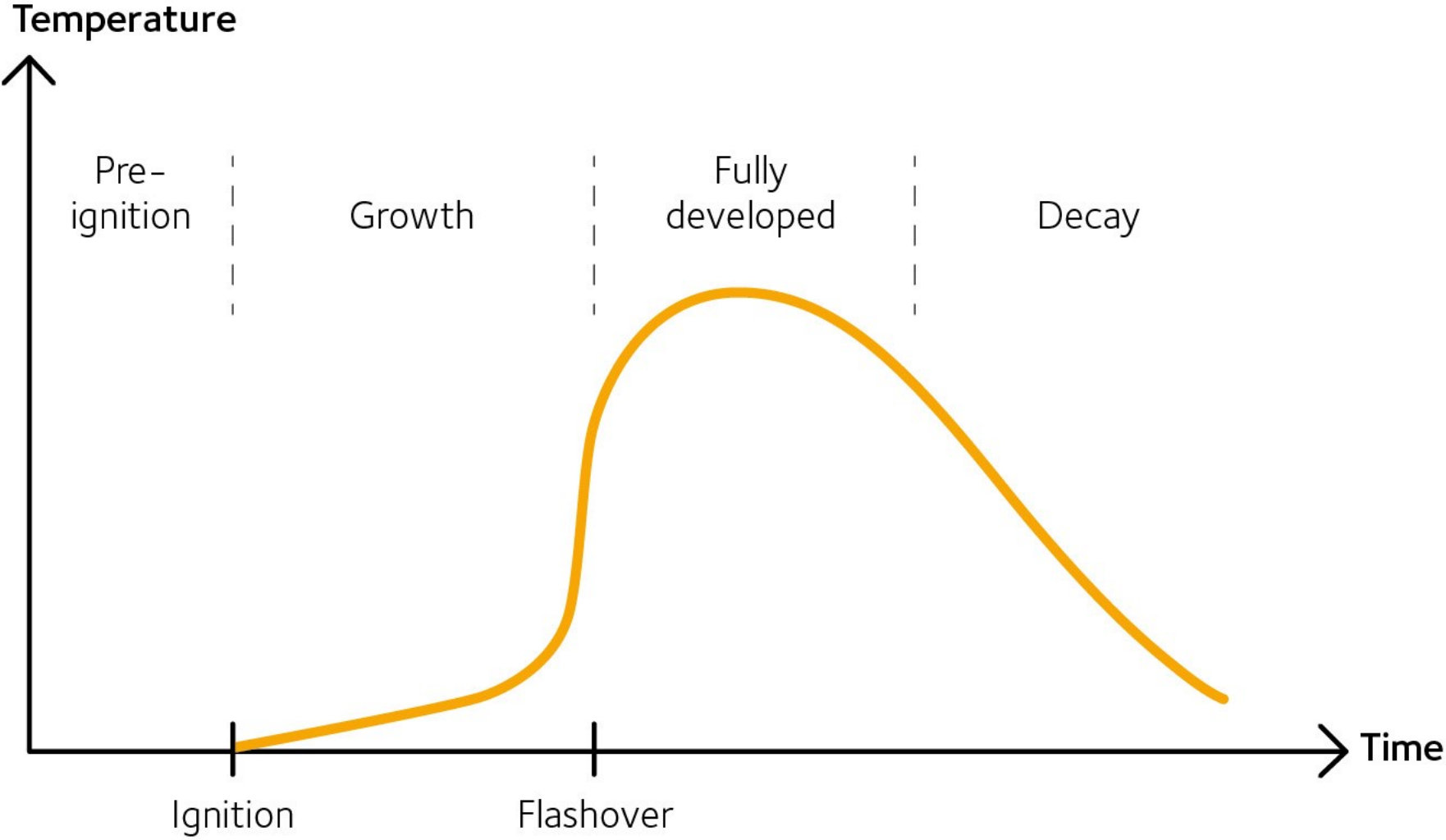
1919
The standard
fire curve
"ASTM E119"

1922-1928
Simon Ingberg (US)
- Fire tests with varied
fuel load



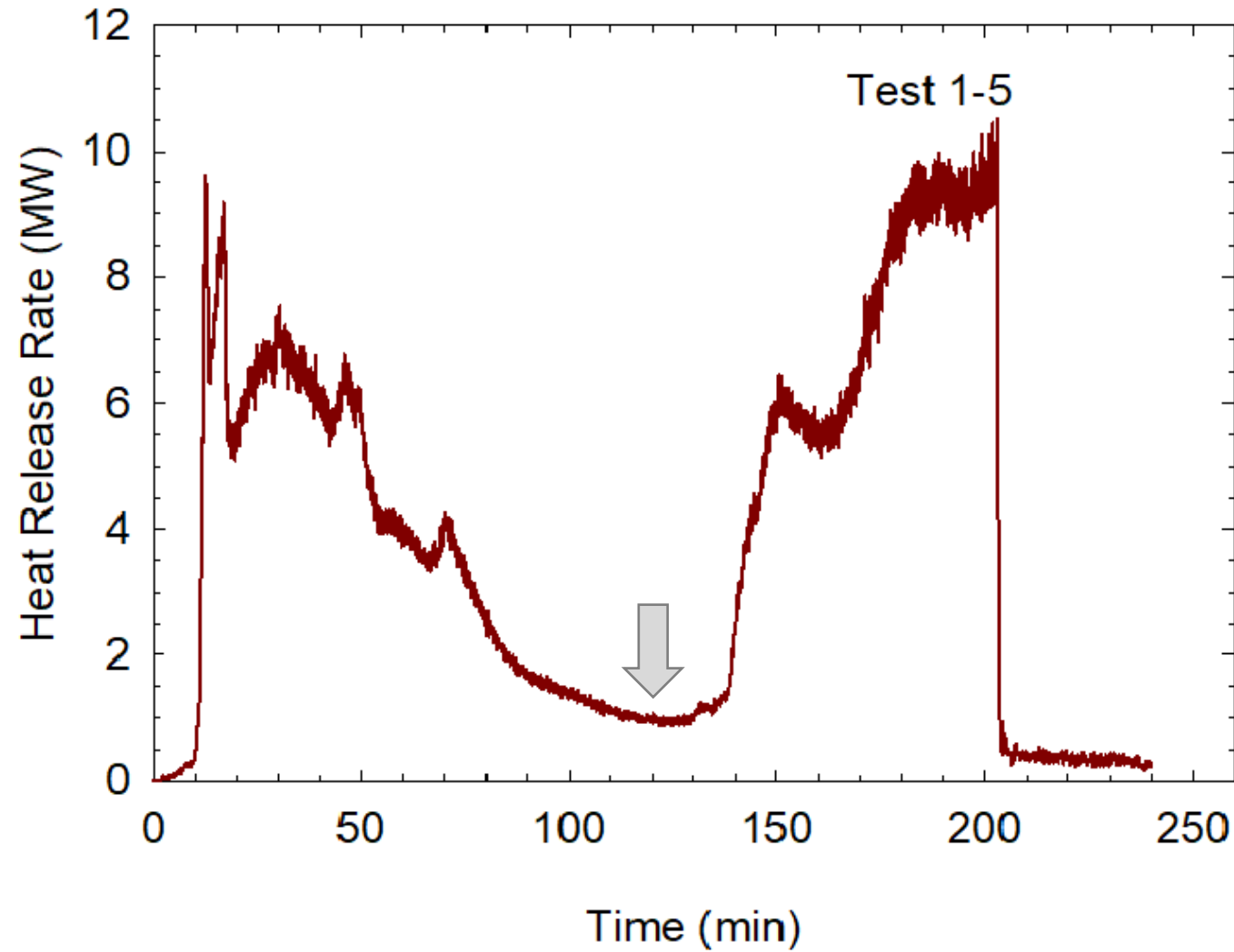
2023

Fire resistance – temperature curve



Exposed timber

Fire Safety Challenges of Tall Wood Buildings – Phase 2: Task 3 -
Cross Laminated Timber Compartment Fire Tests
Fire Protection Research Foundation, the National Research Council
Canada and the National Institute of Standards and Technology



- Geometry and ventilation
- Exposed surfaces
- Type of glue and thickness of lamellas
- Duration of fire exposure

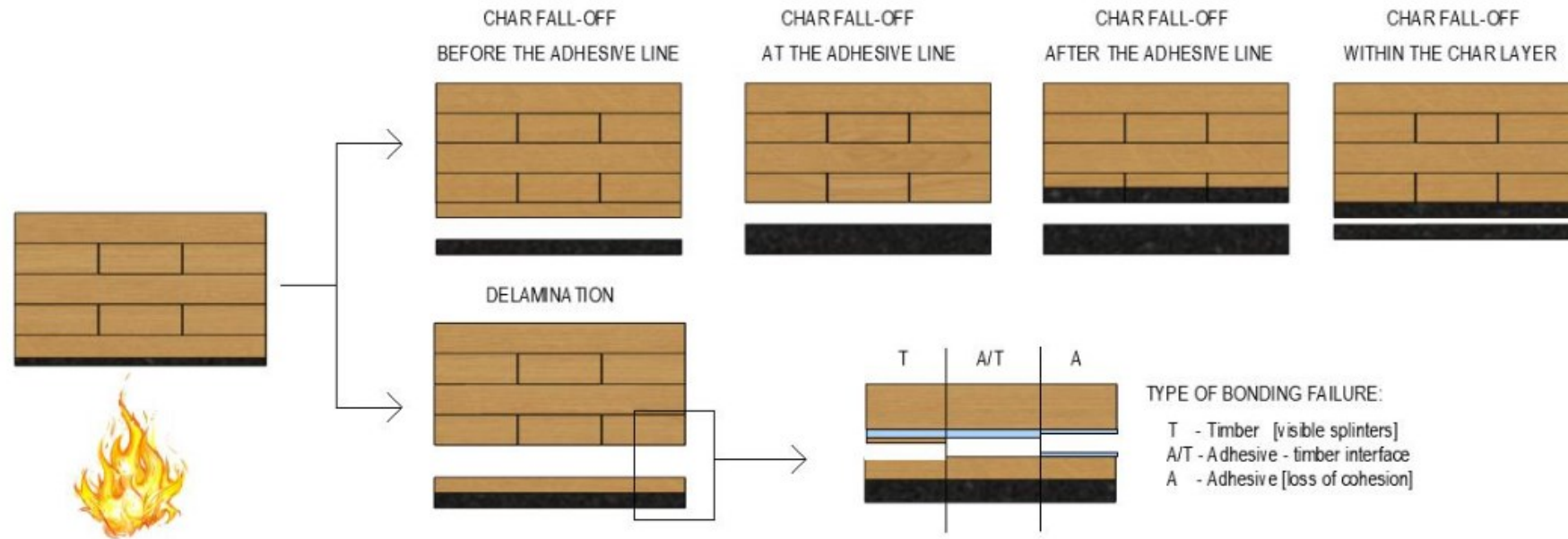
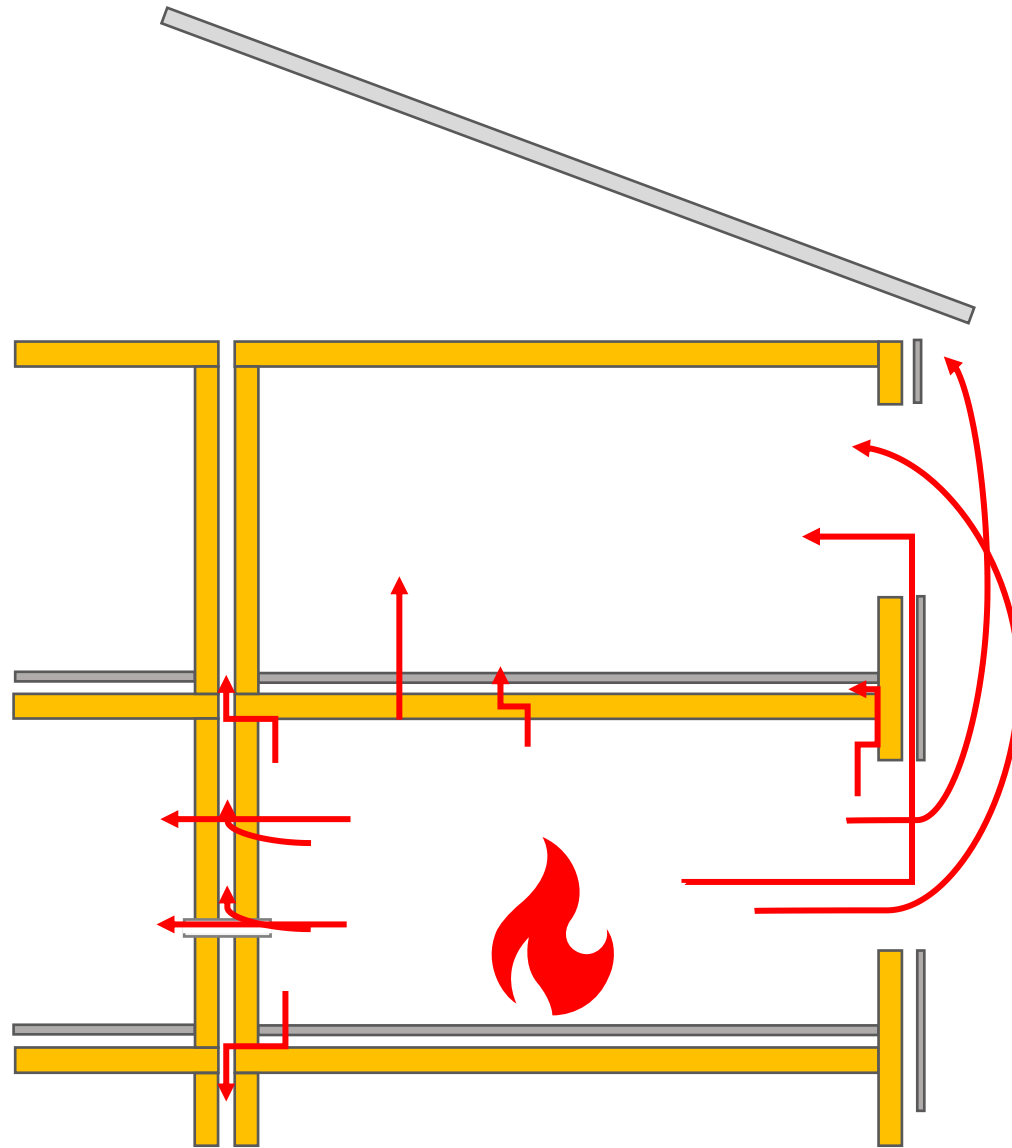


Figure 2. Debonding – the difference between char fall-off and delamination, and failure description at the bond line

Fire spread



Fire spread - facade

Barking fire - 2019

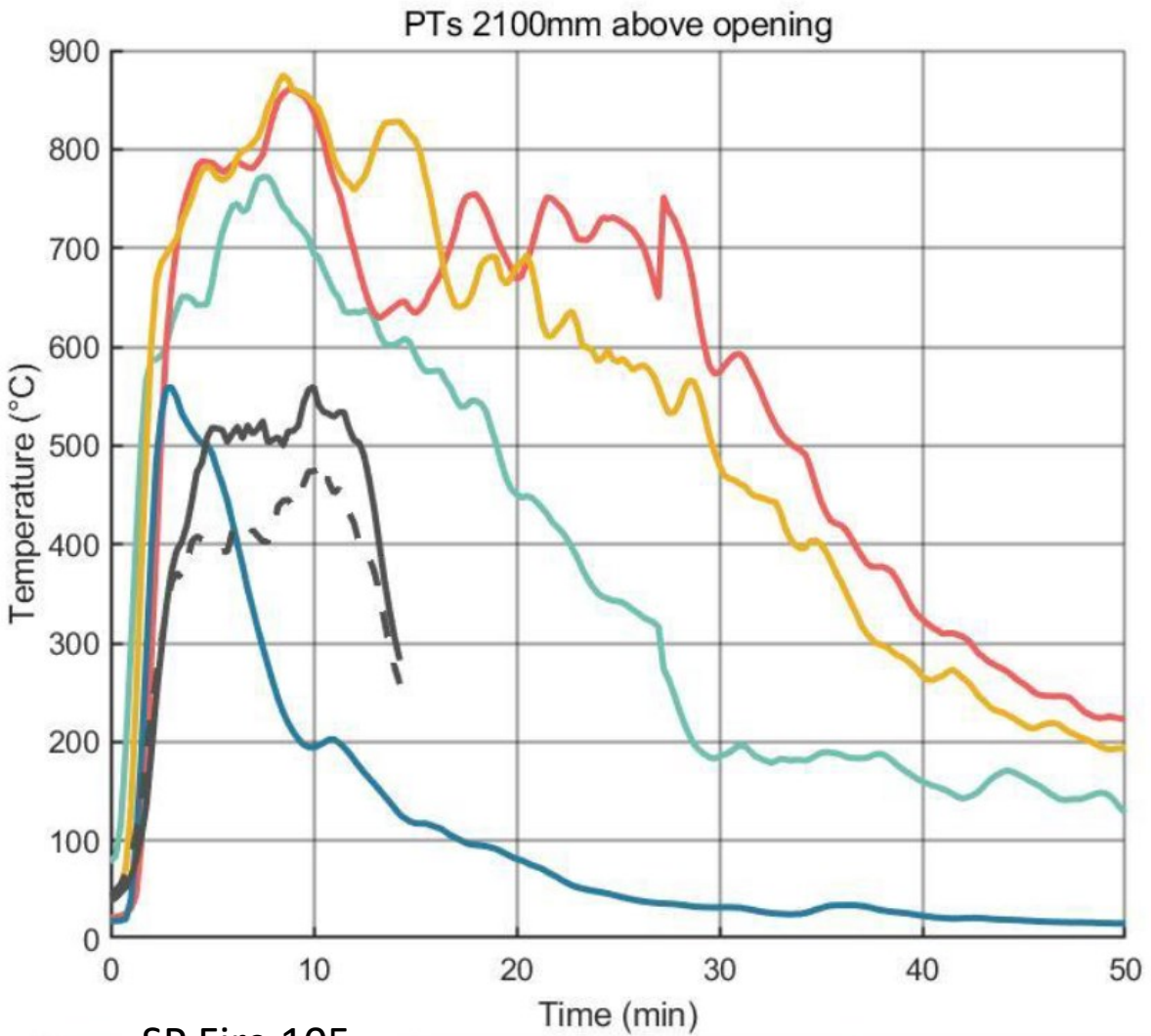
Grenfell fire - 2017

Milano fire - 2021



Fire spread - External

Exposure from mass timber compartment fires to facades
Johan Sjöström, Daniel Brandon, Alastair Temple, Emil Hallberg, and Fredrik Kahl
RISE Report 2021:39



SP Fire 105



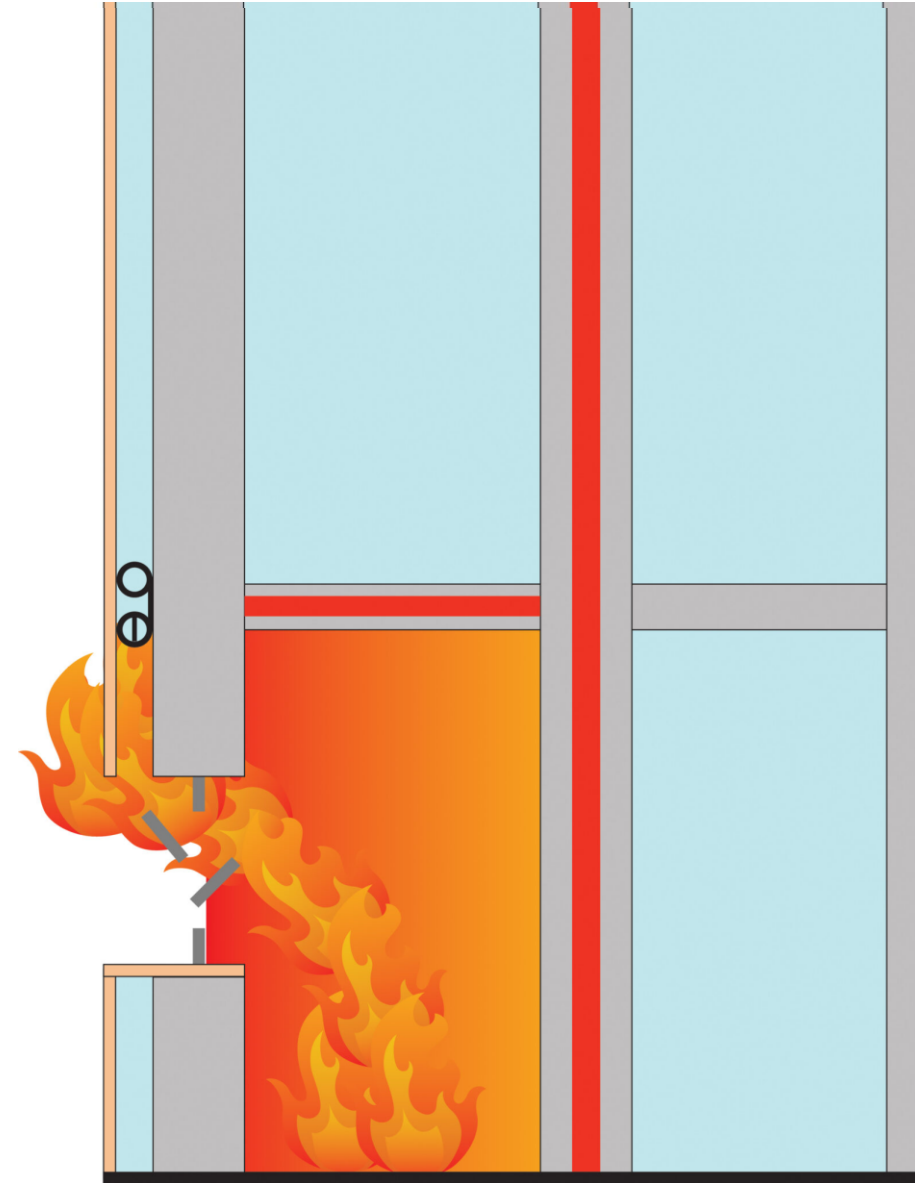
Durability of Reaction to Fire Performance



Fire spread - External

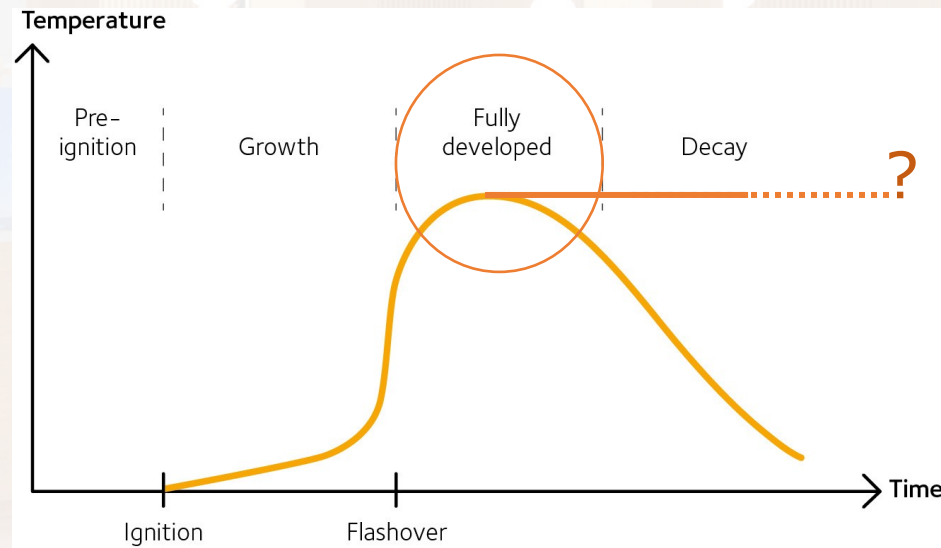


Fire spread - External



Exposed timber internally

- Fire compartments
 - Penetrations
 - Openings (doors, windows, shafts)
 - Joints
- Loadbearing capacity
 - Length of fire exposure

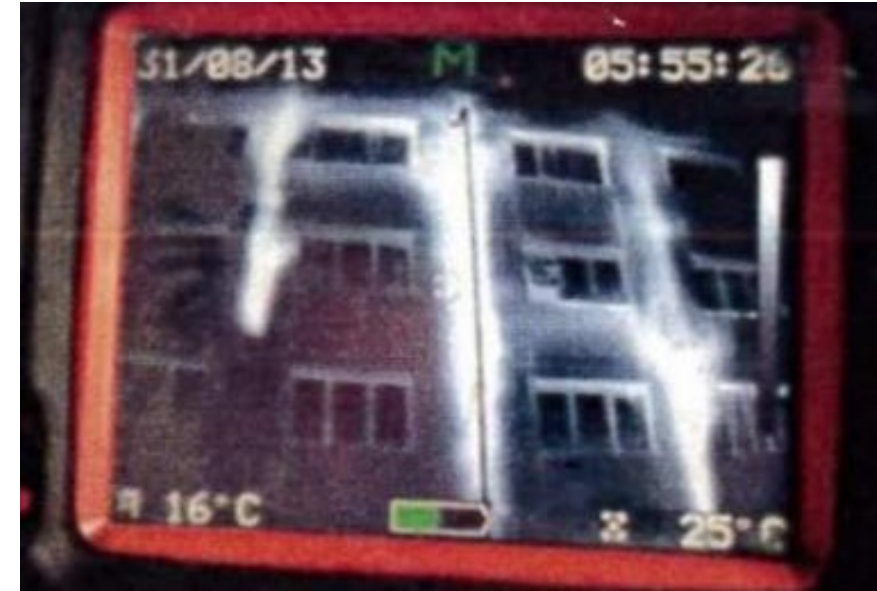


Fire spread – cavities

Summary Report Fire Safe implementation of visible mass timber in tall buildings – compartment fire testing Daniel Brandon RISE Report 2020:94



Fire spread – cavities



Fire spread – joints

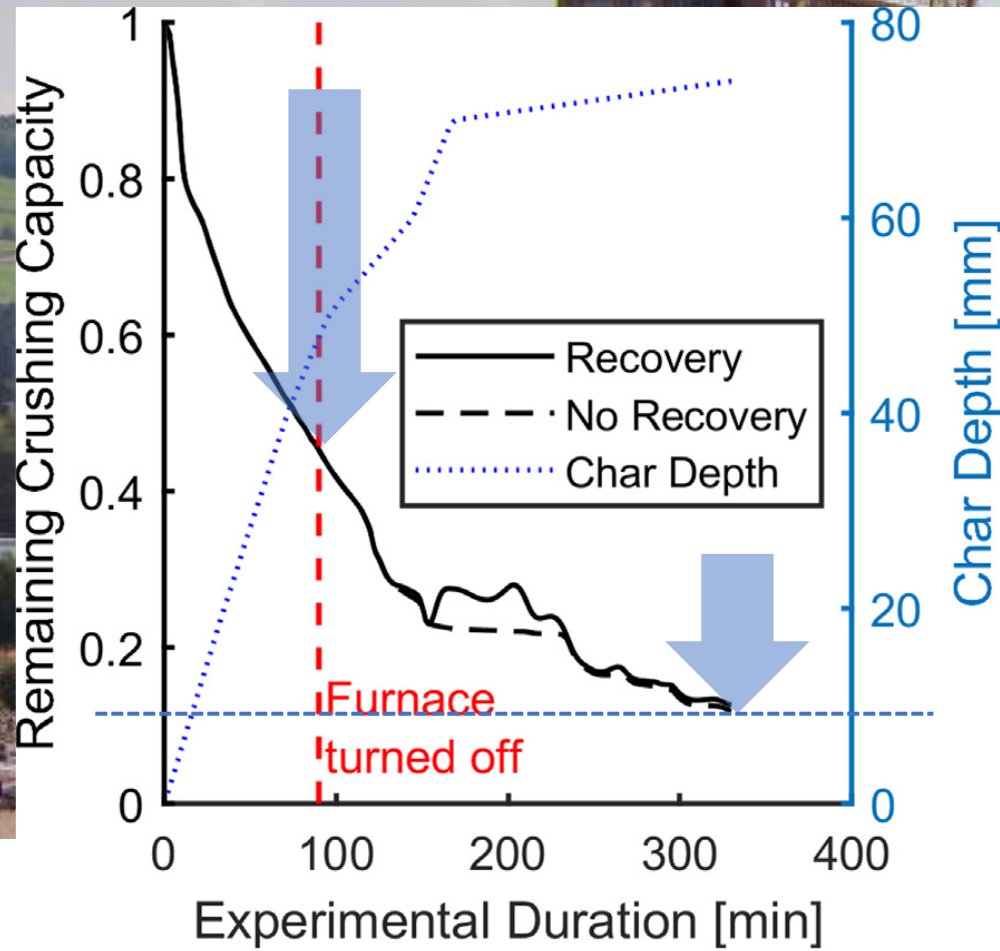
- Movement over time.
- Document the protection during built.
- Inspect and maintain protection.



Burnout?

Structural capacity in fire of laminated timber elements in compartments with exposed timber surfaces (2019)
Felix Wiesner, Luke A. Bisby, Alastair I. Bartlett, Juan P. Hidalgo, Simón Santamaria, Susan Deeny, Rory M. Hadden

- Tested 90 min in according to fire curve
- Measured temperature during 330 min



“

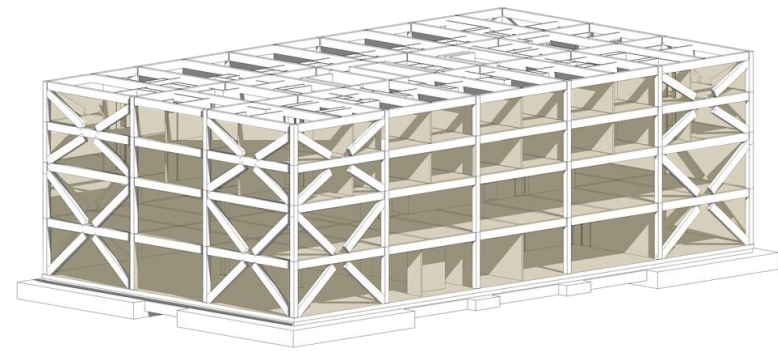
For some (predominantly combustible) construction methods, compliance with building regulations alone might have little relevance to a building's insurability

”



RISCAuthority UK *Insurance challenges of massive timber construction and a possible way forward,*
Revision 1.0 January 2022

Insurance recommendations Sweden



≥ 4 storeys

OFFICE

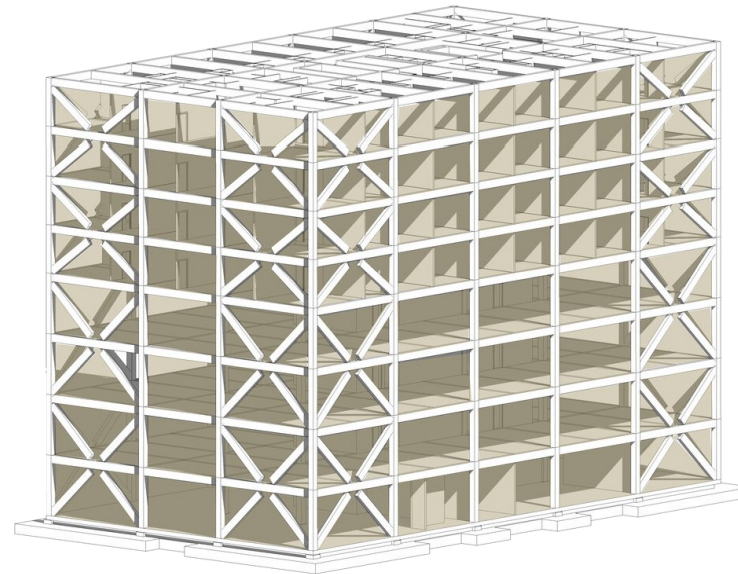
RESIDENTIAL

EN 12845

EN 16925

Automatic sprinkler system

Residential sprinkler system



8 storeys

OFFICE

RESIDENTIAL

EN 12845

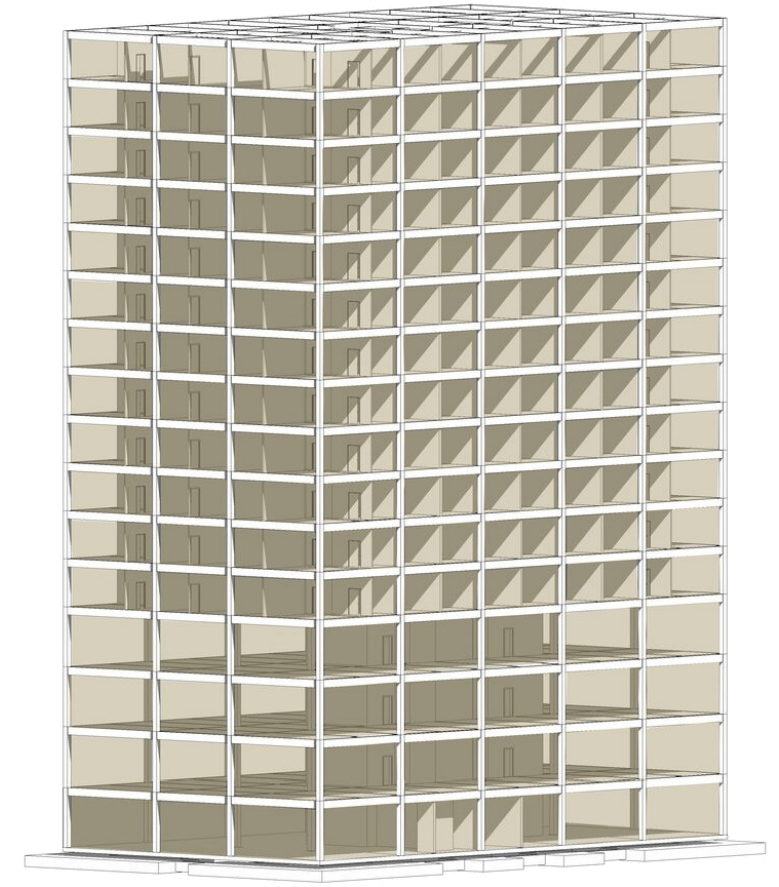
EN 16925

Automatic sprinkler system

Residential sprinkler system

EN 12845

Automatic sprinkler system



+ 16 storeys

OFFICE

RESIDENTIAL

EN 12845

EN 12845

Automatic sprinkler system

Automatic sprinkler system



The need for fire brigade intervention may lead to extensive water damage

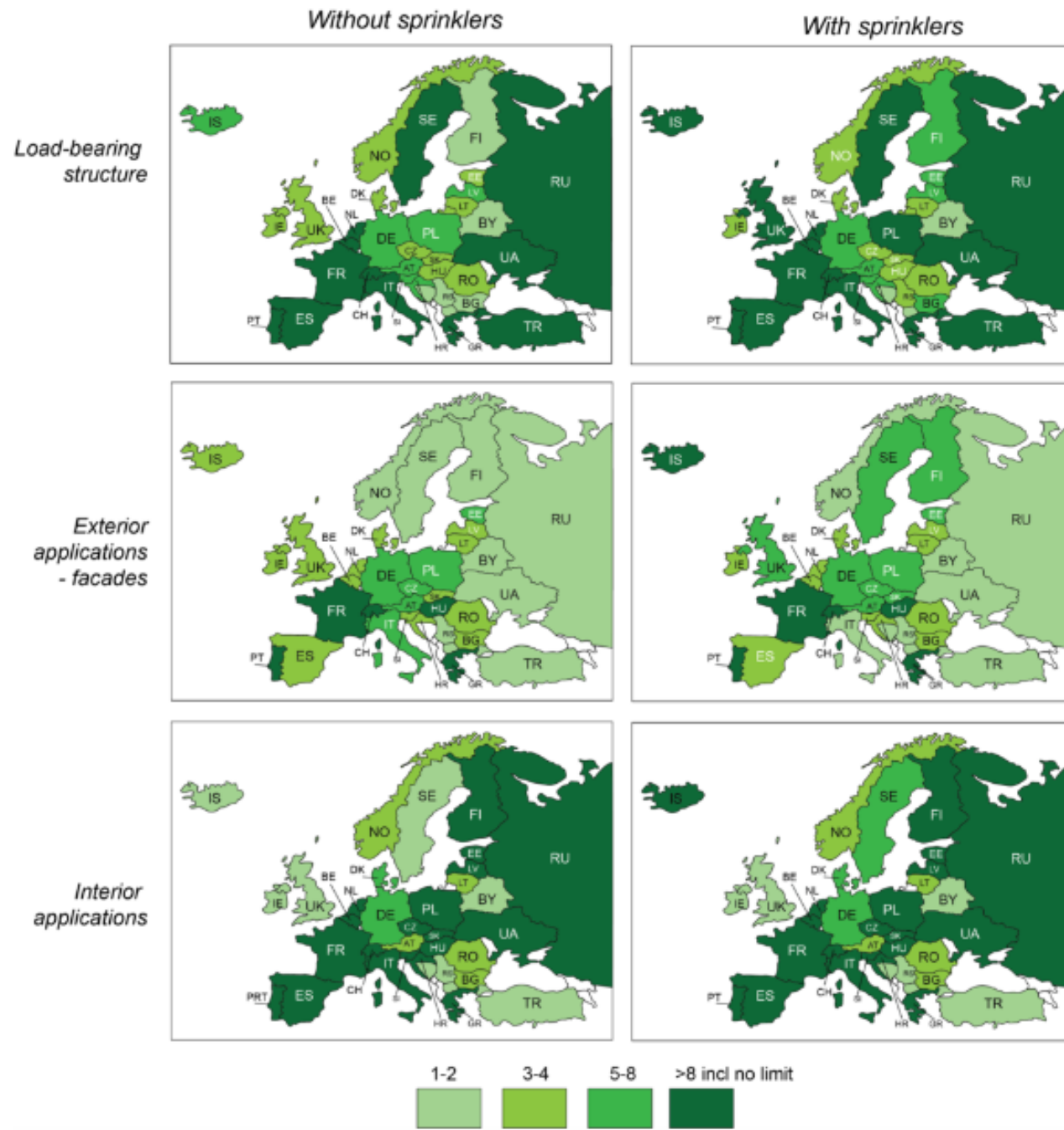


Figure 1: Allowable wood use in different applications for residential buildings in Europe.

To conclude

- Due to the potential of high consequences, it is important to reduce the possibility of both:
 - Small fires (fire spread in cavities)
 - Large fires (extended fire duration and fire spread)
- The fire behaviour is influenced by many factors.
- Reducing the fire growth and the potential involvement of timber structures in a fully developed fire is the most effective fire safety measure.

Carl Pettersson

+46 703 103 332

carl.pettersson@redfireengineers.se

RED

A scenic view of a beach at sunset. The sky is a mix of light blue and orange, with the sun low on the horizon. In the background, a row of buildings is silhouetted against the bright sky. The foreground shows the ocean with gentle waves breaking onto the shore. The word "RED" is overlaid in large, bold, red letters in the center of the image.