



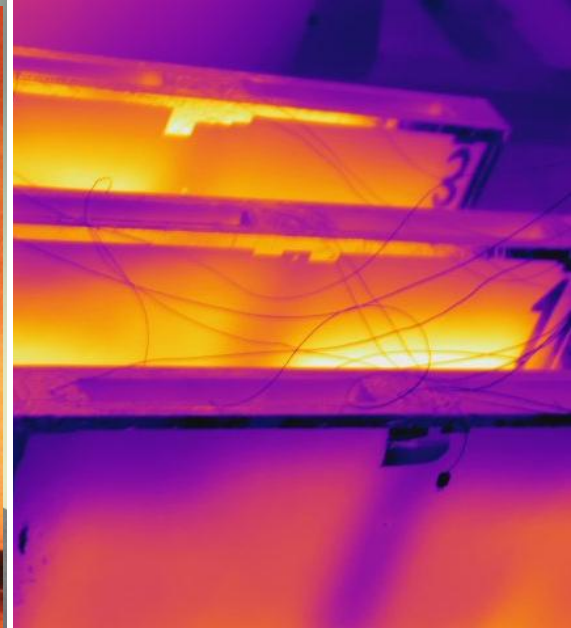
FIRE SAFETY CHALLENGES OF TALL TIMBER BUILDINGS *A SWEDISH PERSPECTIVE*

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Research Institutes of Sweden

Wood Building Technology



Tall Timber Buildings in Sweden



Limnologen, Växjö

8 stories



Folkhems trähus, Sunbyberg

8 stories

Tall Timber Buildings in Sweden



HSB Trähus, Stockholm

C.F. Møller

34 stories



Hotell med Skybar och Kulturhus, Skellefteå

White Architects

20 stories

Debate & Media

Fire Safety in high rise timber buildings Media perspective

Positive

Höga trähus är framtiden
yle (09-2016)

Brandsäkerhet i höga trähus
Husbyggare (10-2015)

Brandsäkra trähus med himlen som tak
Byggnyheter (11-2013)

Negative

Höga trähus på tapeten
Brandsäkert (10-2015)

Brandskydd i höga trähus är en utmaning
Dagens Samhälle (08-2016)

Larm om brandsäkerhet i höga trähus
Lantbruk & Skogsland (01-2017)

Debate & Media

Fire Safety in high rise timber buildings Media perspective

Positive

arguments used:

- § *Better structural fire-performance than steel building*
- § *Predictable structural fire performance*
- § *Statistical studies of fires in tall timber buildings Sweden showed no evidence of increased damage compared to other types of buildings*

Negative

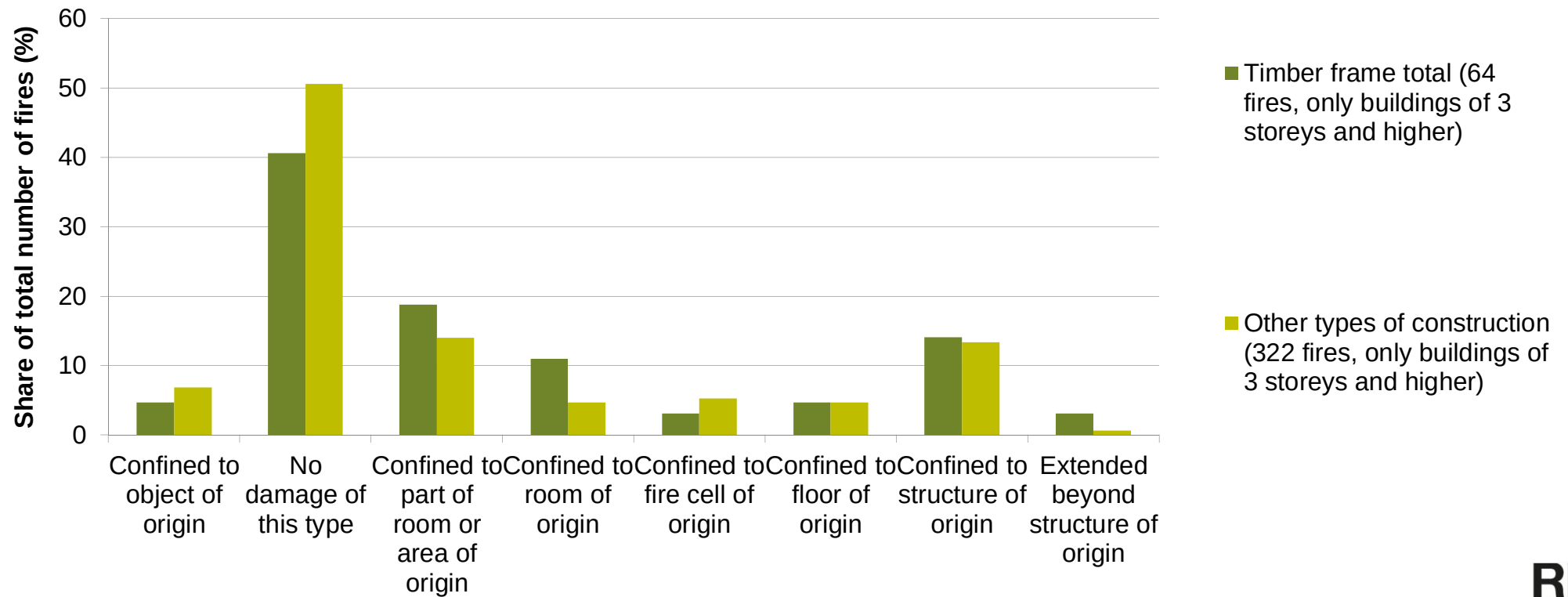
arguments used:

- § *Regulations focus mostly on life-safety. However, property protection has not been considered sufficiently.*
- § *Sprinklers could limit the fire spread, but cause a lot of irrecoverable damage*
- § *Water damage caused during extinguishment can cause significant damage*
- § *Fire spread has caused significant damage in a recent fire (Klintbacken, 2013)*

Statistical data

What do we know about water damage after a fire?

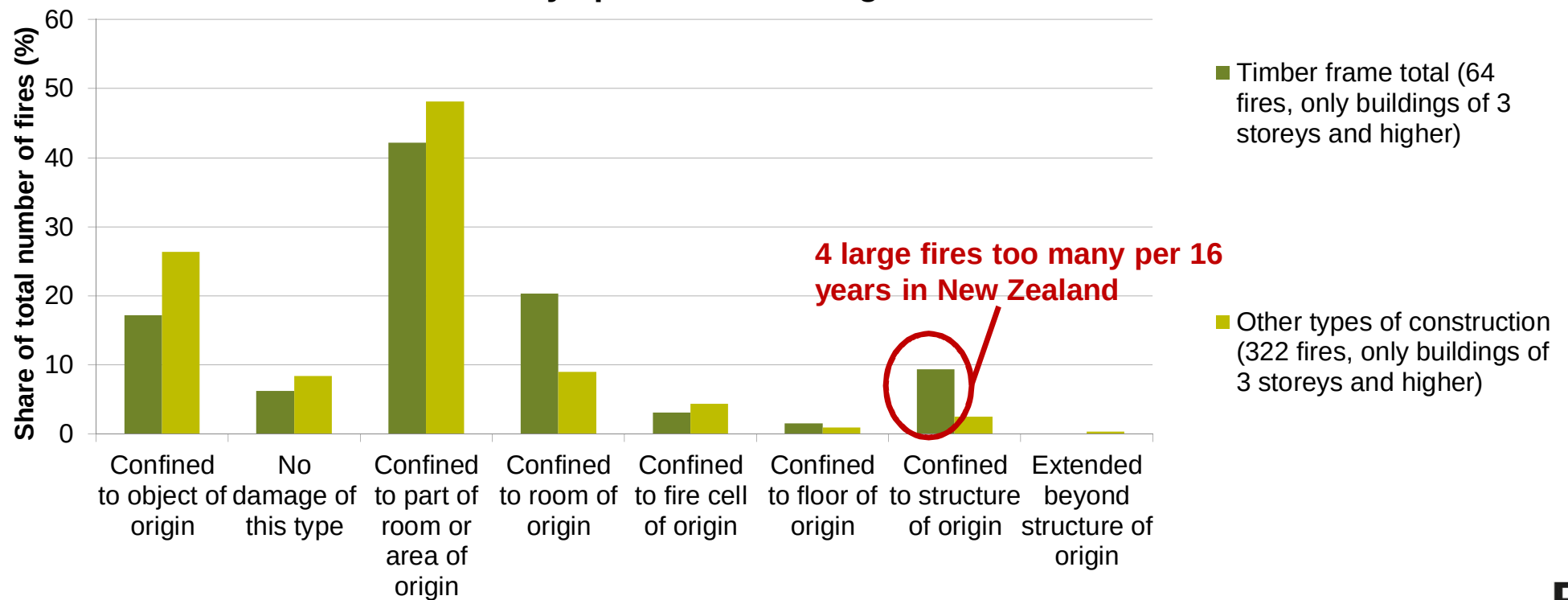
Water damage New Zealand Statistics (2000-2016) Only apartment buildings ≥ 3 stories



Statistical data

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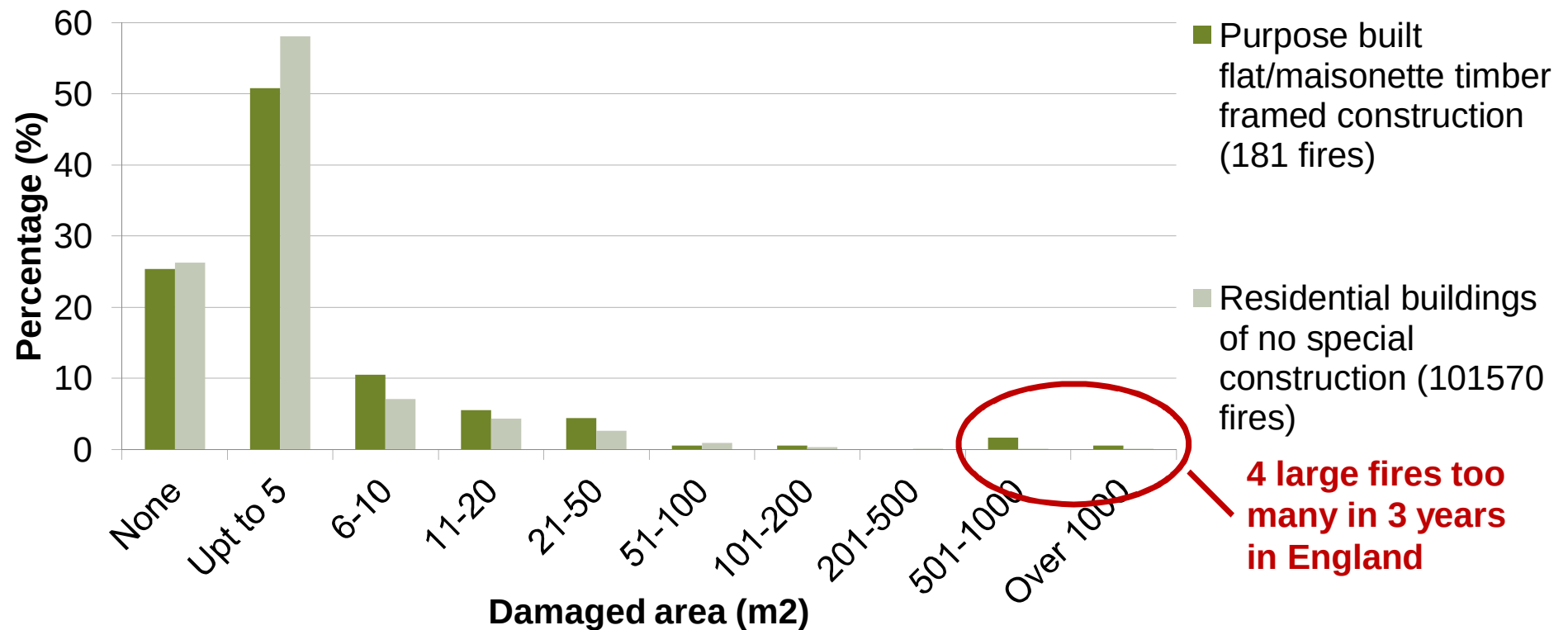
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Statistical data

What do we know about water damage after a fire?

Fire Damage England Statistics (April 2009 – March 2012)



Challenges

§ *Limiting fire spread*

§ *Limiting water damage*

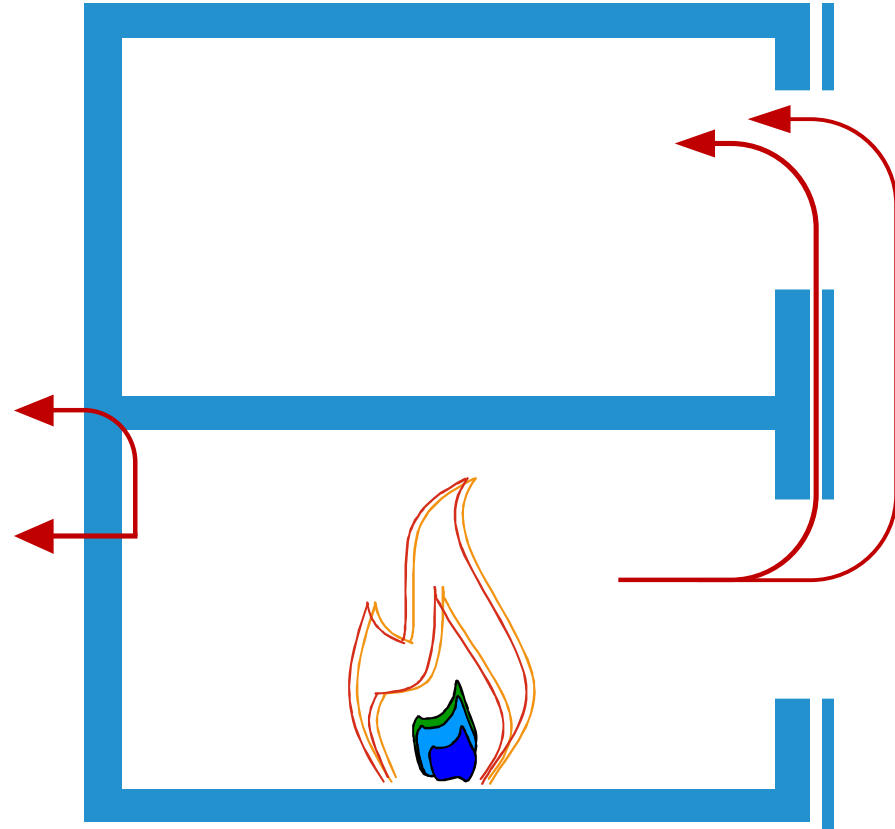
§ *Exposing timber surfaces*

- *Estimations of the influence of exposed timber in a fire*
- *Estimations of the structural behaviour of timber in these fires*

Limiting Fire Spread

Important aspects for limiting fire spread:

- Limiting fire spread through an envelope from fire compartment to compartment.
- Limiting fire spread through cavities
- Limiting fire spread via the facade



Limiting Fire Spread

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- Limiting fire spread through an envelope from fire compartment to compartment.
- **Limiting fire spread through cavities**
- Limiting fire spread via the facade

Background:

Example of a cavity fire:
Student house Klintbacken in Luleå (2013-08-31)



Limiting Fire Spread

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- Limiting fire spread through cavities
- Limiting fire spread via the facade

Background:

- The fire started in a pan in a kitchen
- The fire spread to the attic and decayed
- Afterwards the fire spread through the facade and reignited other fire compartments



Limiting Fire Spread

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Background:

- Because it was hard to find and extinguish the fire, the damage was high



Limiting Fire Spread

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Strategy:

1. Use suitable fire stops with suitable dimensions
2. Use suitable connections between fire stops



Limiting Fire Spread

Stacked connection

In-line connection

Glass wool
without plastic



Glass wool with
plastic



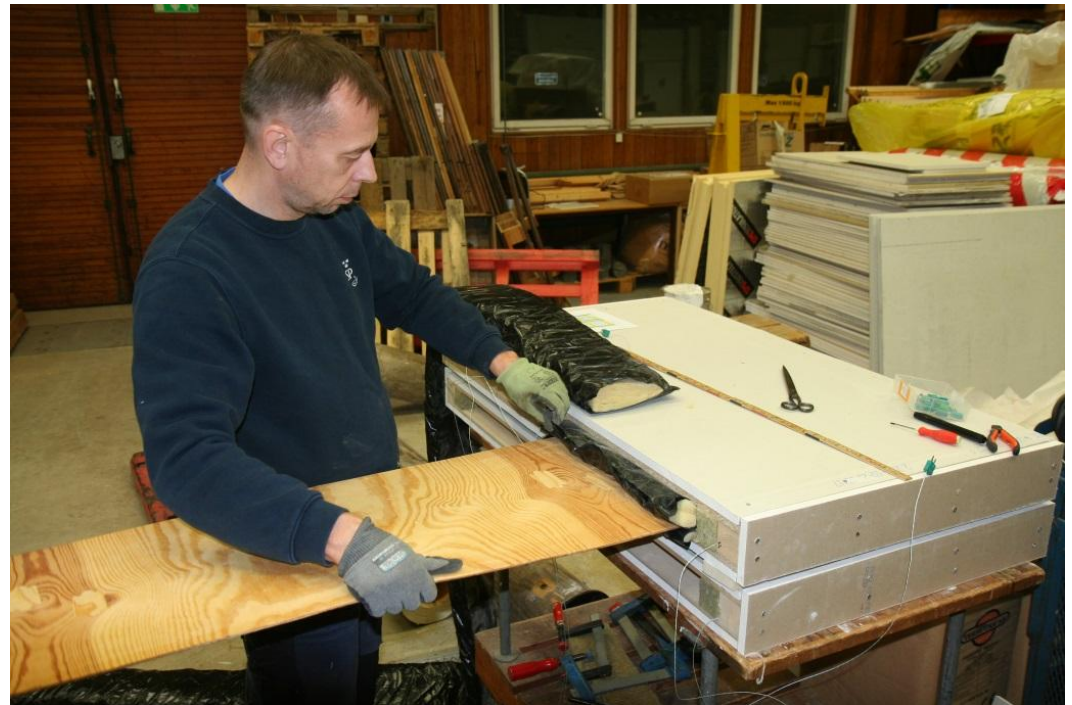
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3. Use tested installation techniques



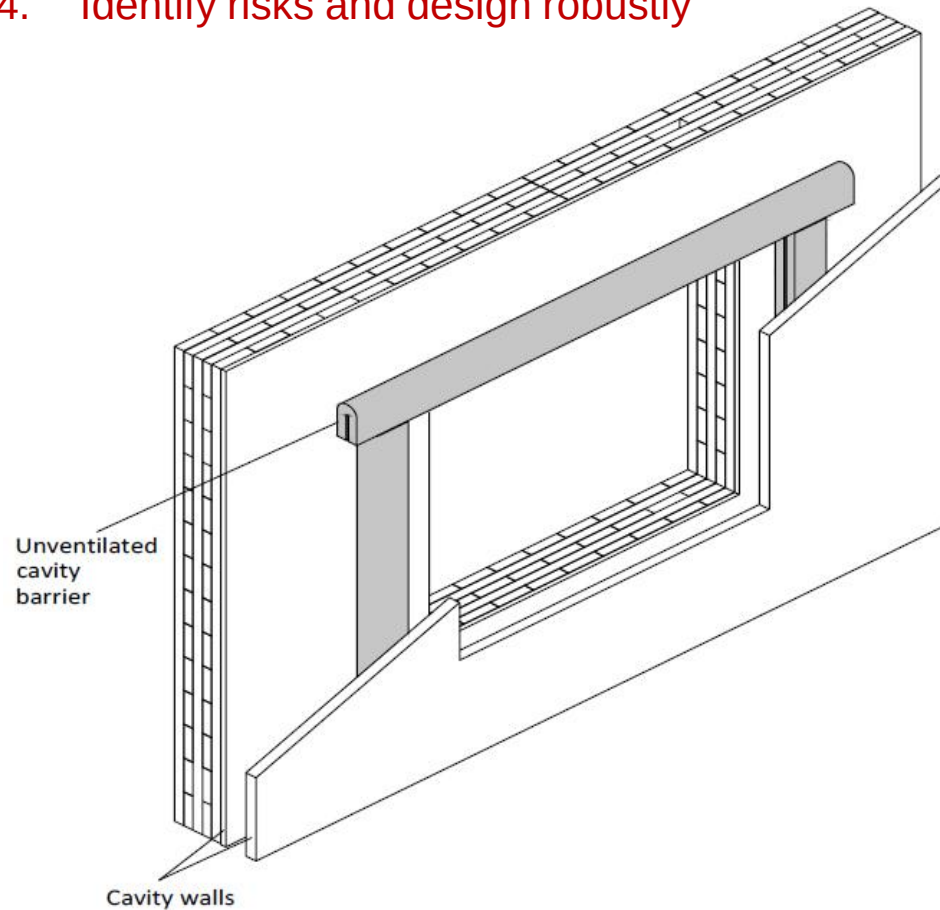
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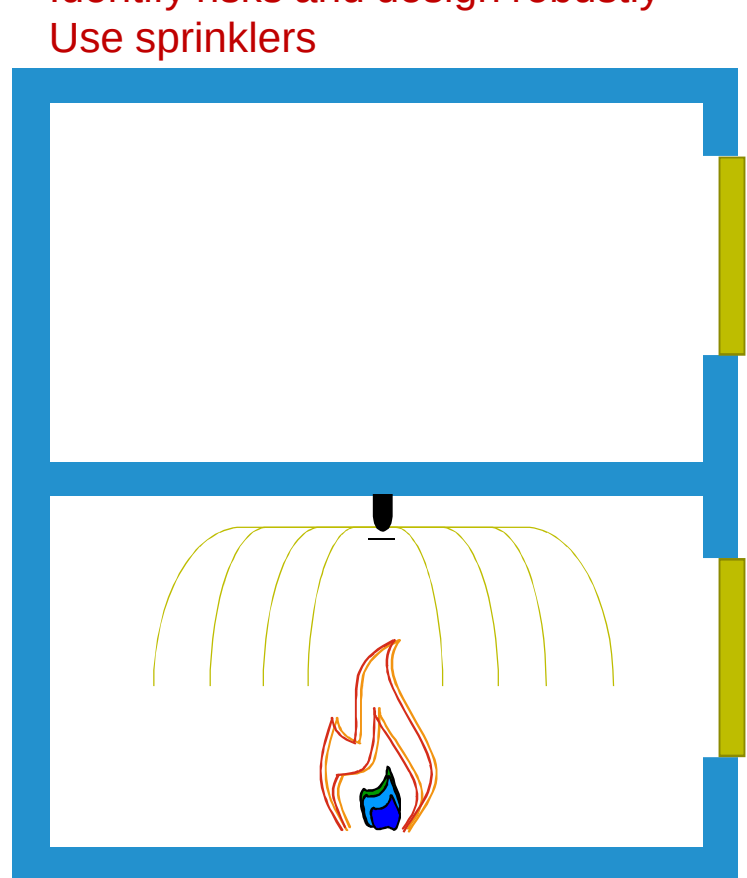
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6. Make connections and penetrations smoke and air tight



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6. Make connections and penetrations smoke and air tight
7. Extinguish effectively!!!



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Exposing timber

- 44 tests of compartment fire tests have been summarised. Only 7 of them comprised exposed walls
- 6 tests have been performed this year in the USA (NFPA, RISE, NIST, NRC Canada)
- 5 tests will be performed before the summer (ICC)
- 5 compartment fire tests has been performed in the UK (BRE, University of Edinburgh)
- 1 Compartment test will be performed in Talinn (RISE)



Exposing timber

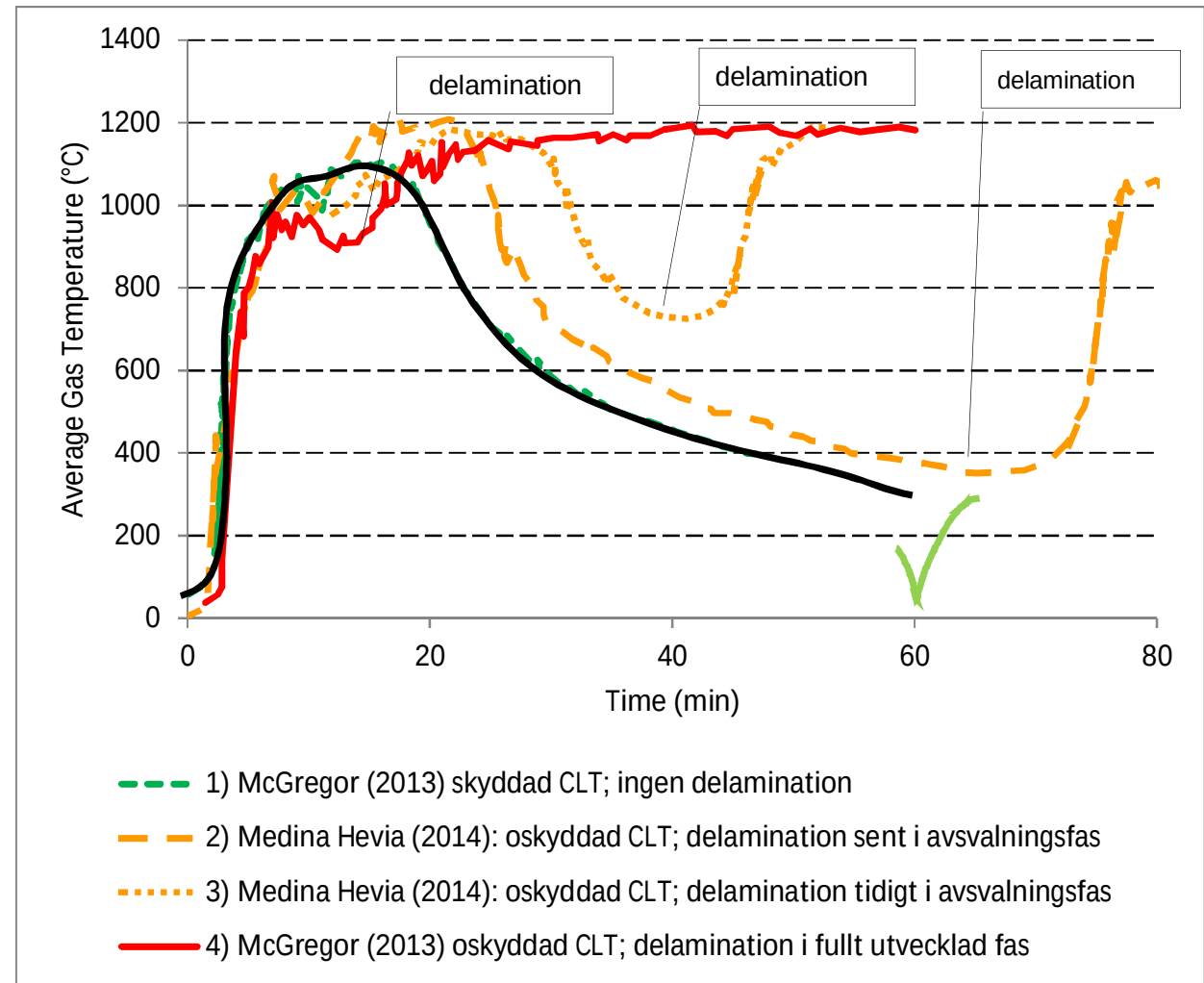
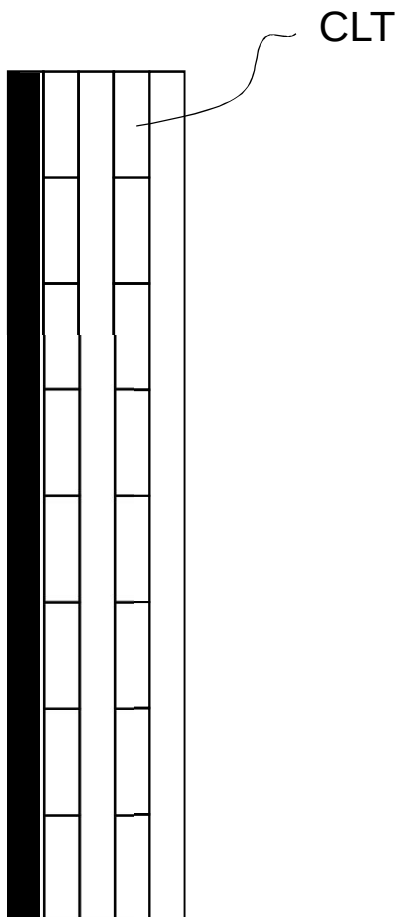
Goal of ongoing research

- Development of calculation models
- Having visible (exposed) CLT in a fire safe fashion



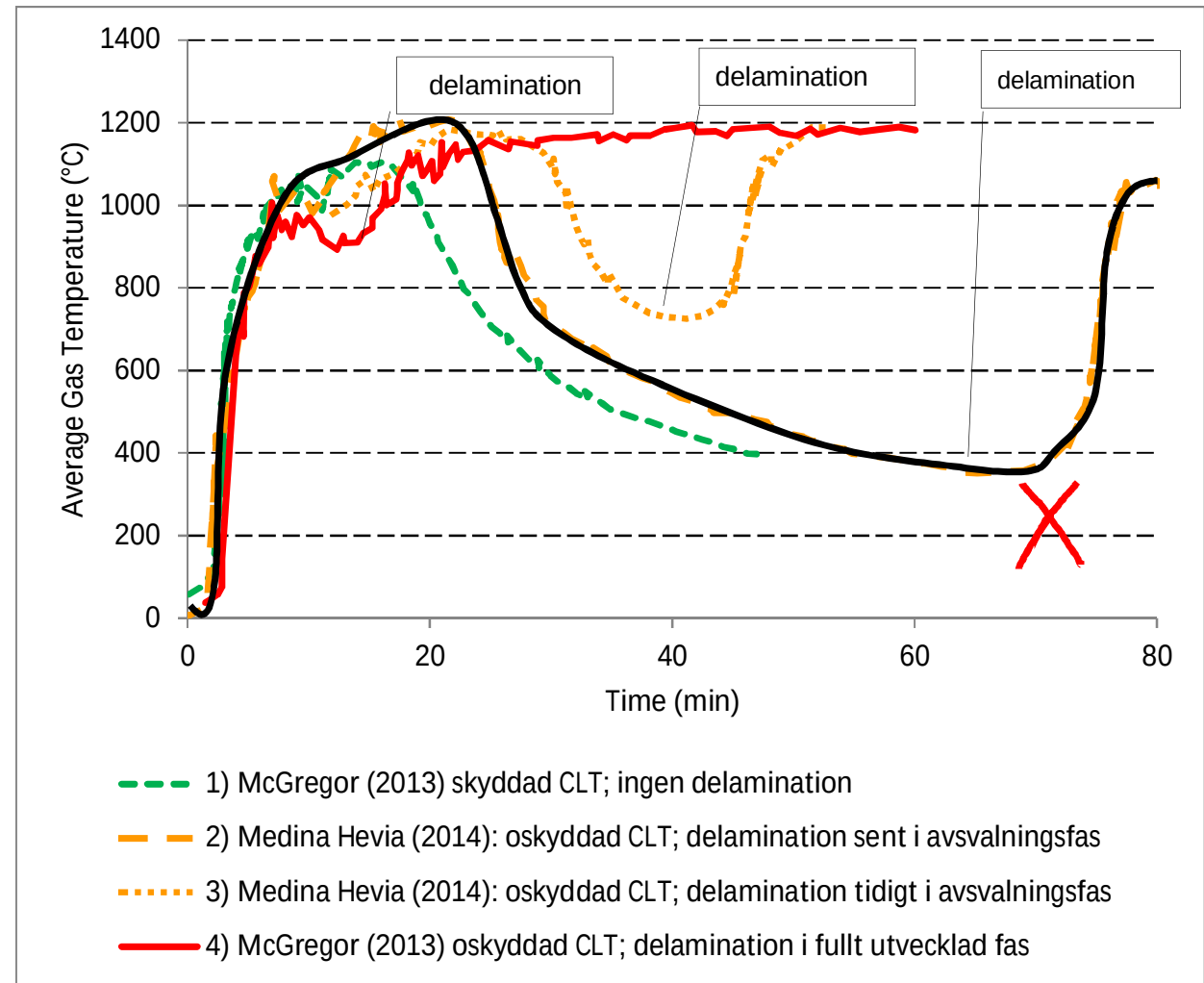
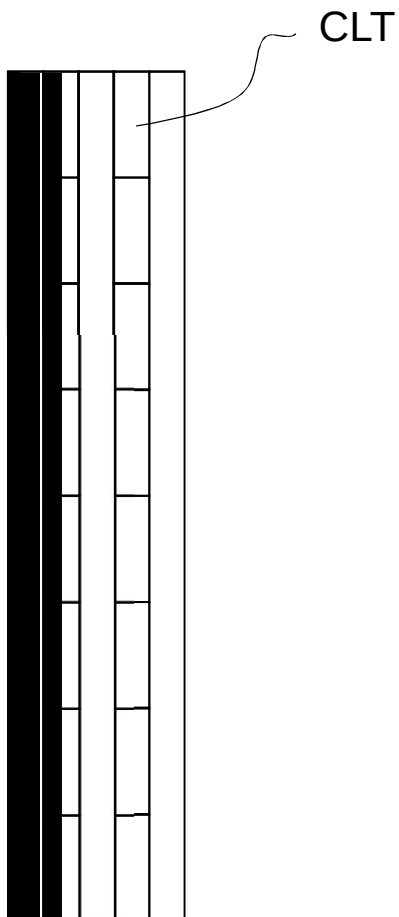
Exposing timber

Effect of delamination



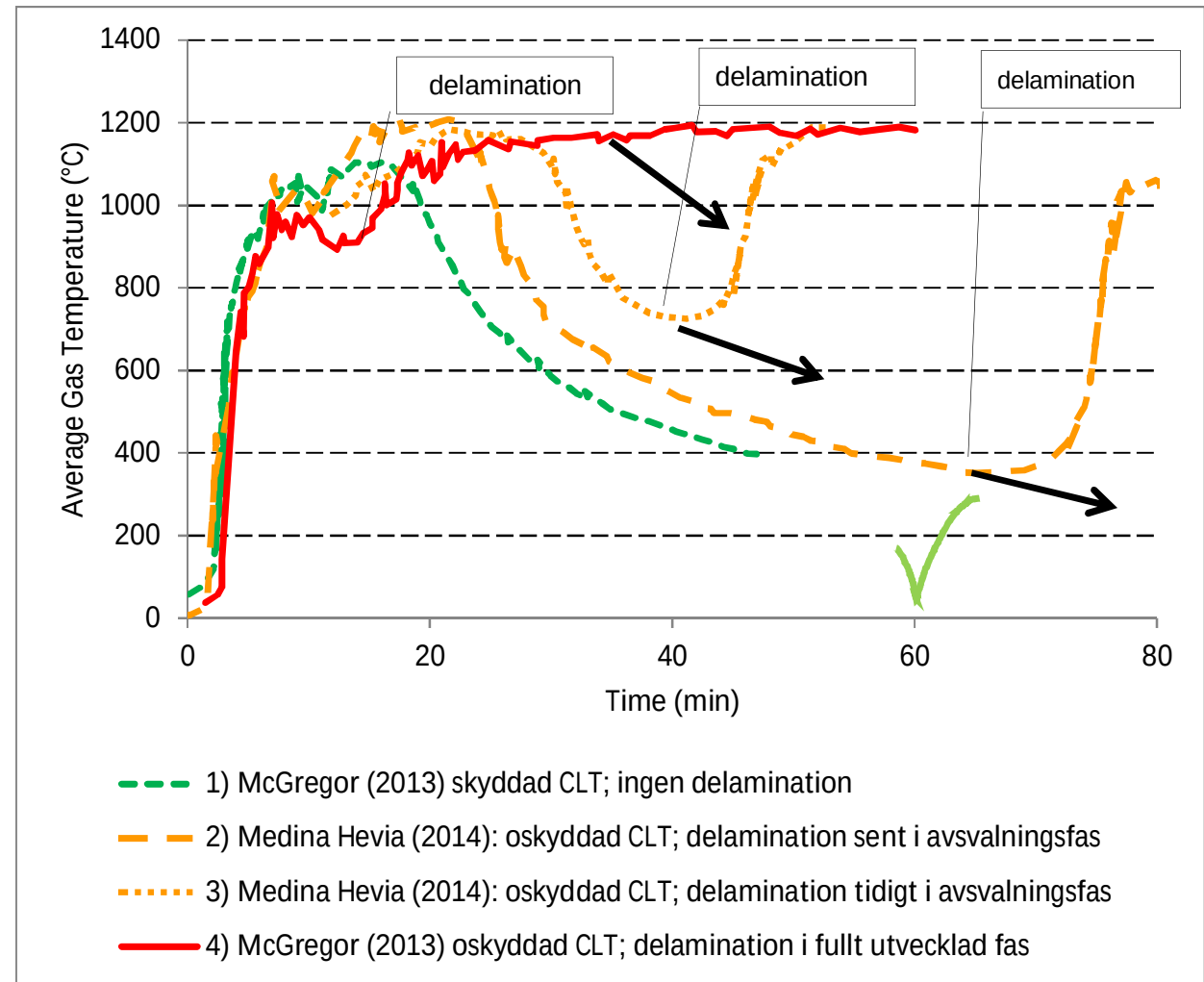
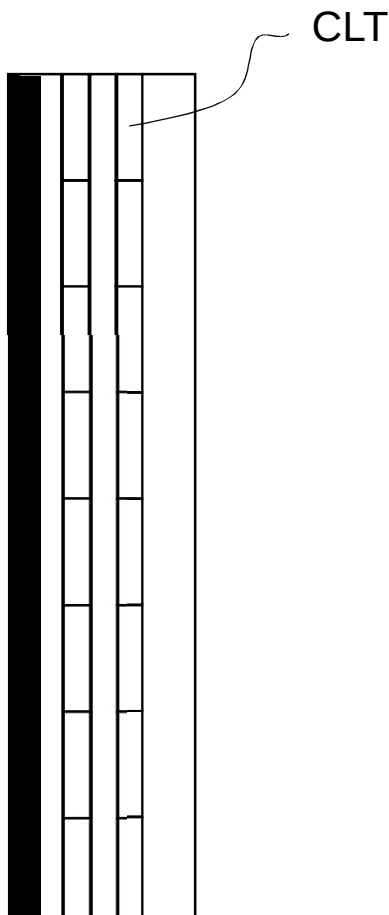
Exposing timber

Effect of delamination



Exposing timber

Effect of delamination



Exposing timber

Recent progress and findings:

- A model has been developed to include the contribution of timber to a fire
- The consequences of delamination do not always lead to second flashover

Ongoing work

- The influence of adhesives on the potential to delaminate
- Design for self-extinguishment

Challenges

§ *Limiting fire spread*

§ *Limiting water damage*

§ *Exposing timber surfaces*

- *Estimations of the influence of exposed timber in a fire*
- *Estimations of the structural behaviour of timber in these fires*

We are making progress but we are not quite there yet



TACK!

Fire Safety Challenges of Tall Timber Buildings A
Swedish perspective

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Research Institutes of Sweden

**Hållbar Samhallsbyggnad
Träbyggande och boende**

