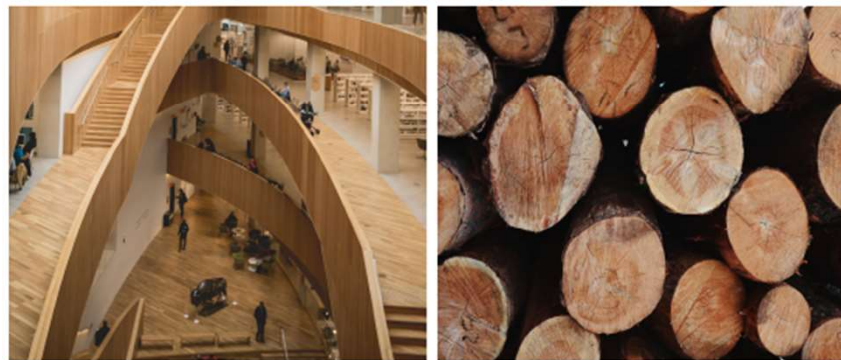




RED

Carl Pettersson
BSc Fire Safety Engineer
MSc Risk Management



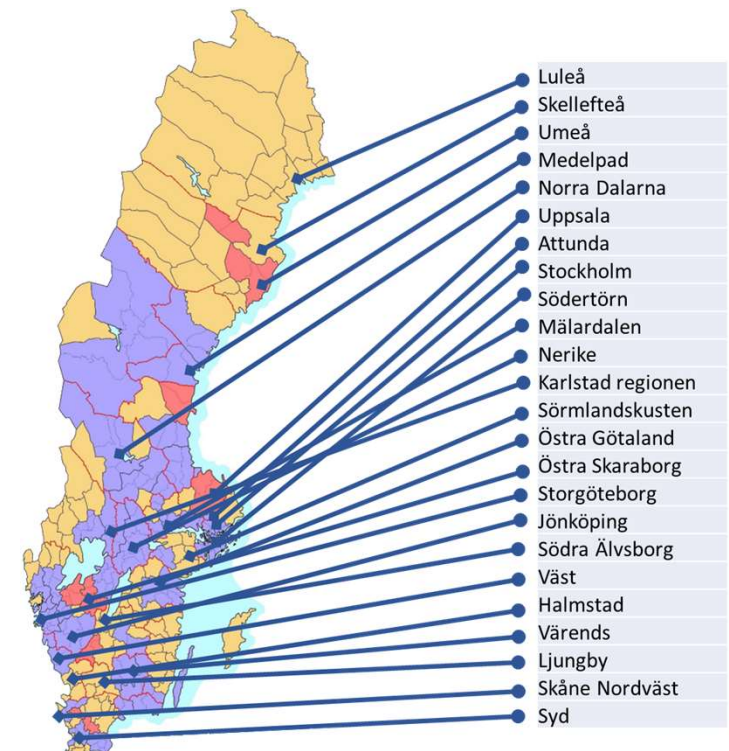
Fire Safety in Timber Buildings -
A review of existing knowledge

Carl Pettersson



Brandforsk

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



Luleå
Skellefteå
Umeå
Medelpad
Norra Dalarna
Uppsala
Attunda
Stockholm
Södertörn
Mälardalen
Nerike
Karlstad regionen
Sörmlandskusten
Östra Götaland
Östra Skaraborg
Storgöteborg
Jönköping
Södra Älvsborg
Väst
Halmstad
Värends
Ljungby
Skåne Nordväst
Syd

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



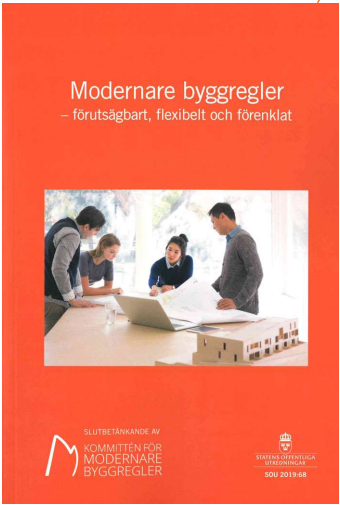
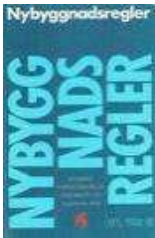
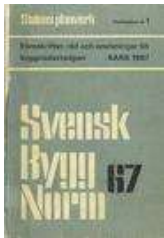
The Swedish building code requires fire safety for:

- 1. Occupant safety
- 2. Initial fire brigade intervention

New class for buildings
> 16 storeys or
> 2500 occupants
2011 BBR 19

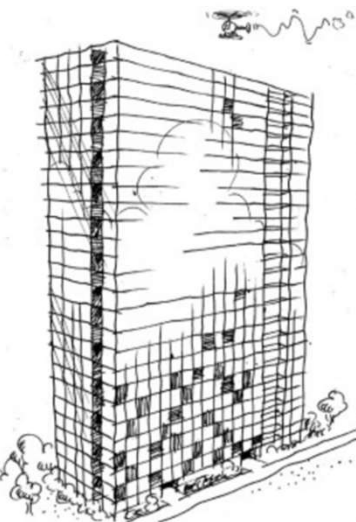


Combustible structure ≤ two storeys,
Except timber beam floor ≤ four storeys.



The building code should be predictable and at the same time flexible to allow new technical solutions.

BrO - MYCKET HÖGT SKYDDSBEHÖV



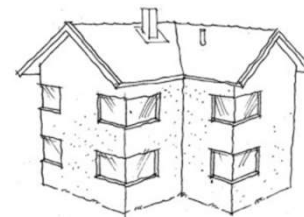
- > 16 Våningsplan
- Sjukhus
- Samlingslokal ovan/under markplan
 - > 1000 pers. om Vk 2B
 - > 300 pers. om Vk 2C
- Samlingslokal i markplan i Vk 2C om > 600 pers
- Byggnader i Vk 5D

Br1 - STORT SKYDDSBEHÖV



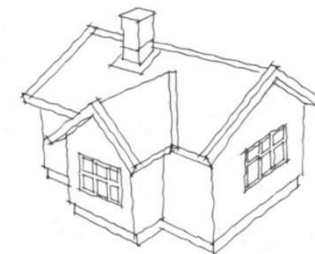
- 3 eller flera våningsplan
- 2 våningsplan om
 - Vk 4, Vk 5A, 5B eller 5C
 - Vk 2B eller 2C på plan 2

Br2 - MÅTTLIGT SKYDDSBEHÖV



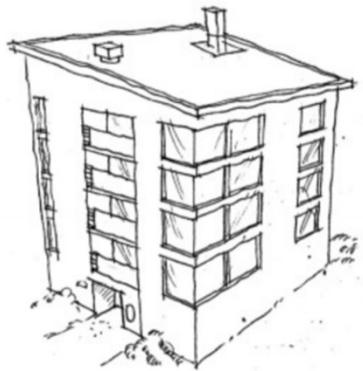
- Småhus i max 3 plan
- 2 våningsplan där
 - Fler än 2 bostadslägenheter och bostad, bostad/arbetsrum i vindsplanet
 - Vk 2B eller 2C i markplan
 - Byggnadsarea > 200m², inte sektionerad med brandvägg
- 1 våningsplan där
 - Vk 2B eller 2C
 - Vk 5B eller 5C

Br3 LITET SKYDDSBEHÖV



- Övriga byggnader som inte klassas som BrO till Br2

Br1 - STORT
SKYDDSBEHÖV



Typical requirements

Load bearing R60-R90 (subject to expected fire load)
External façade A2-s1d,0 or SP Fire 105 tested
Fire compartment size < 2,500 m²
Internal surfaces K₂10/B-s1d,0 or A2-s1d,0
1,2 m vertical distance between windows

With sprinkler system

Reduced to R60

D-s1d,0 up to 8 storeys

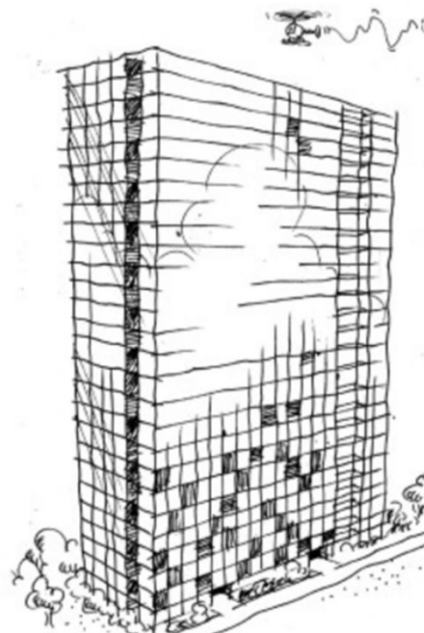
Unlimited m²

D-s2,d0 (not egress route)

No vertical distance

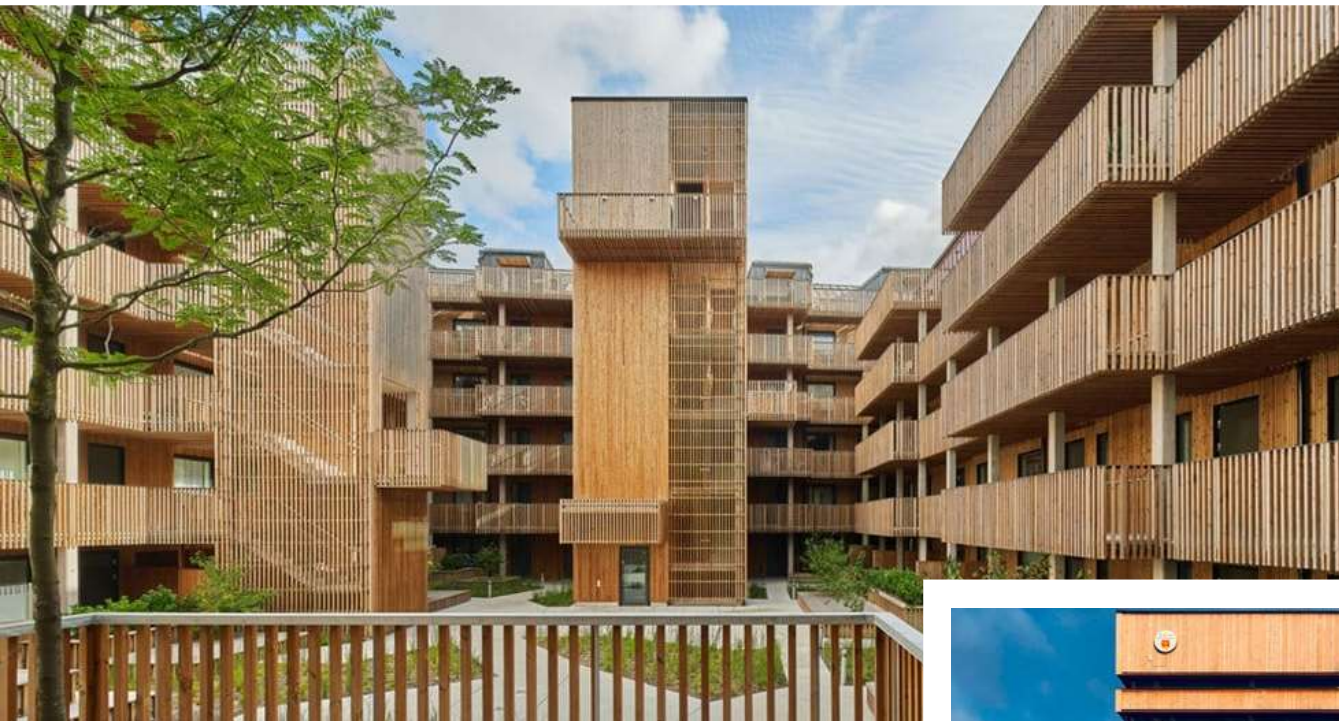


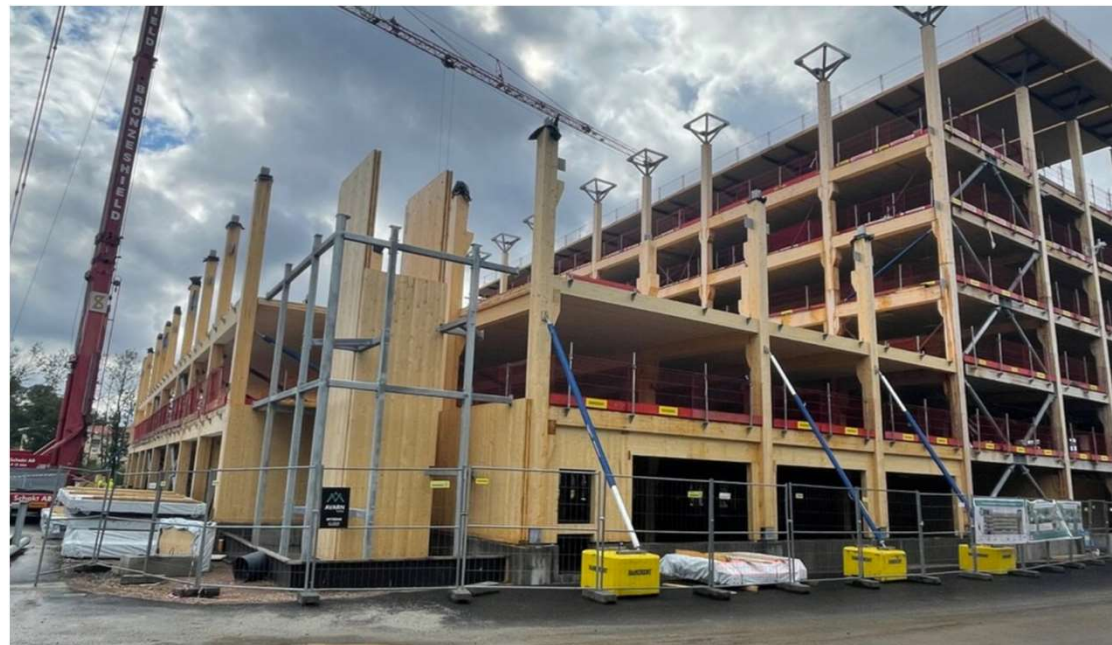
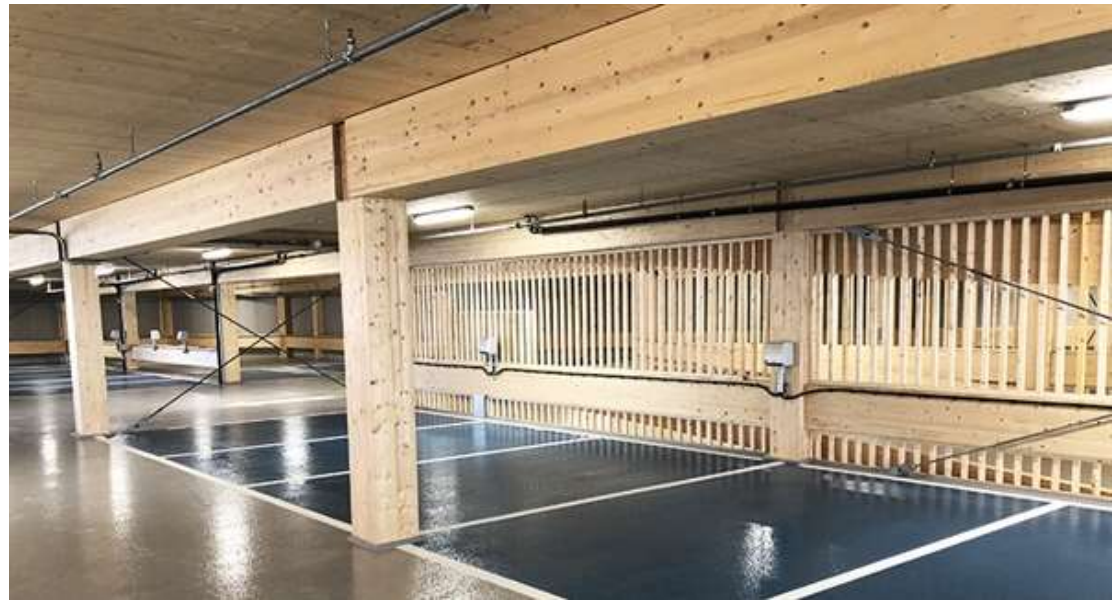
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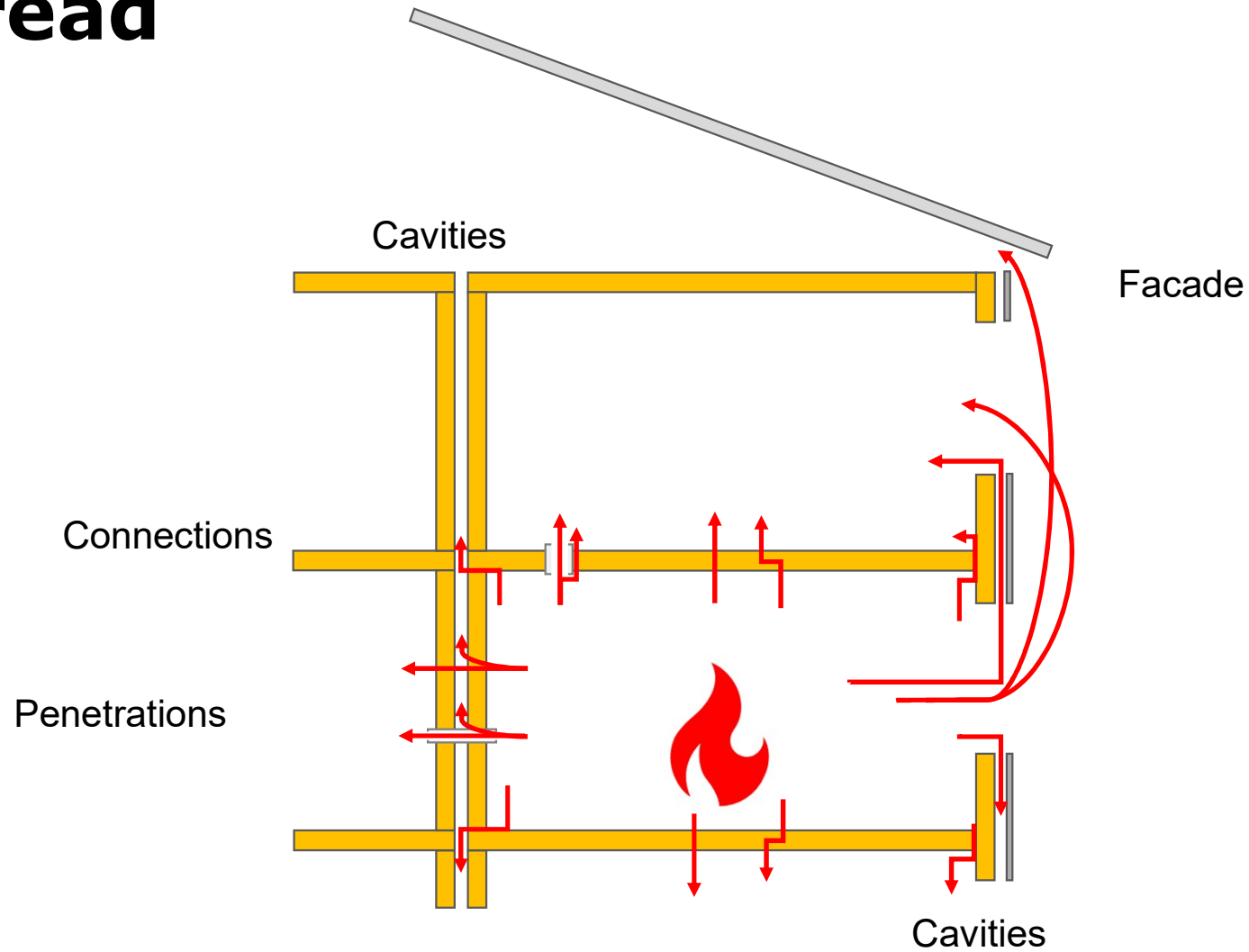
+ sprinkler

+ 2
reductions



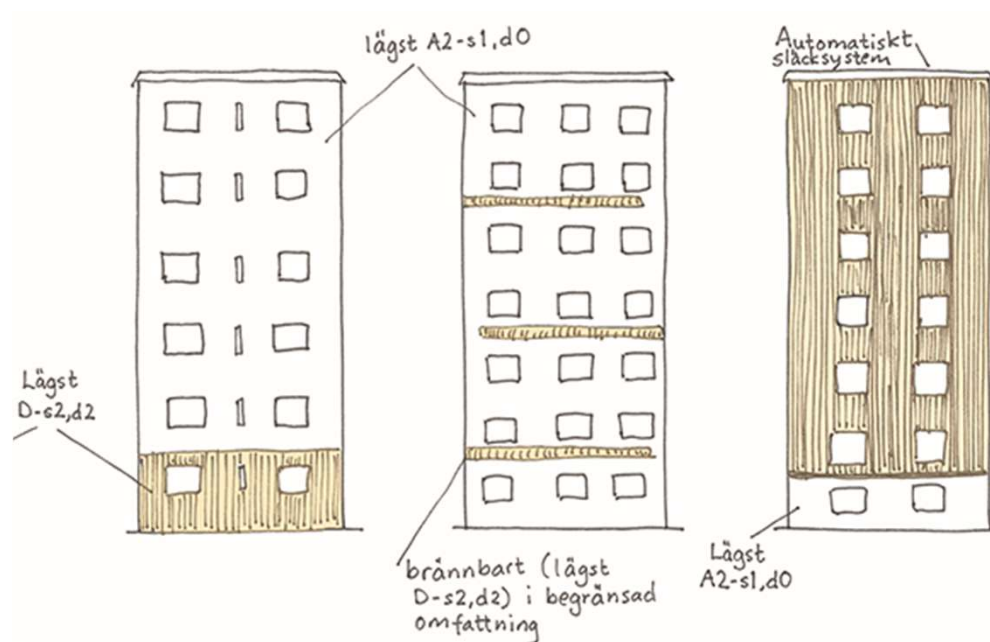


Fire spread



Fire spread - facade

Combustible façade options < 8 storeys



SP Fire 105 tested



Fire spread - facade

Barking fire - 2019

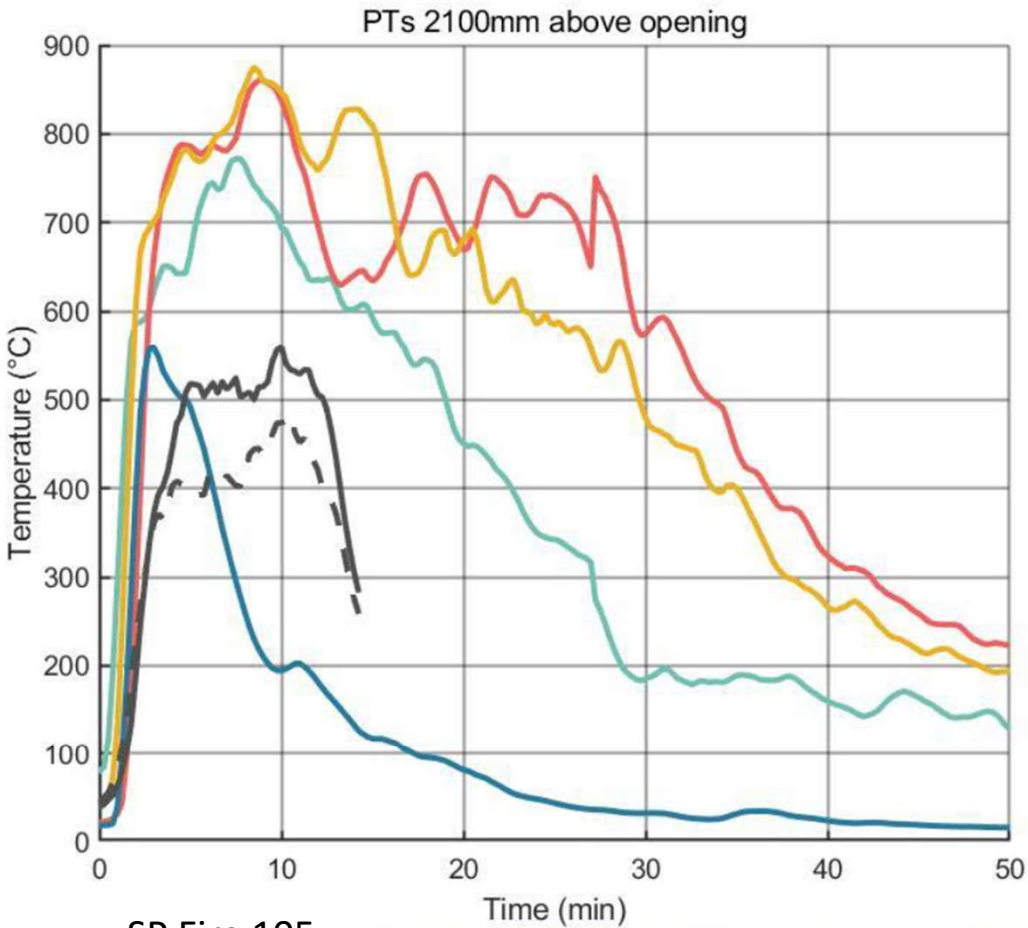
Grenfell fire - 2017

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



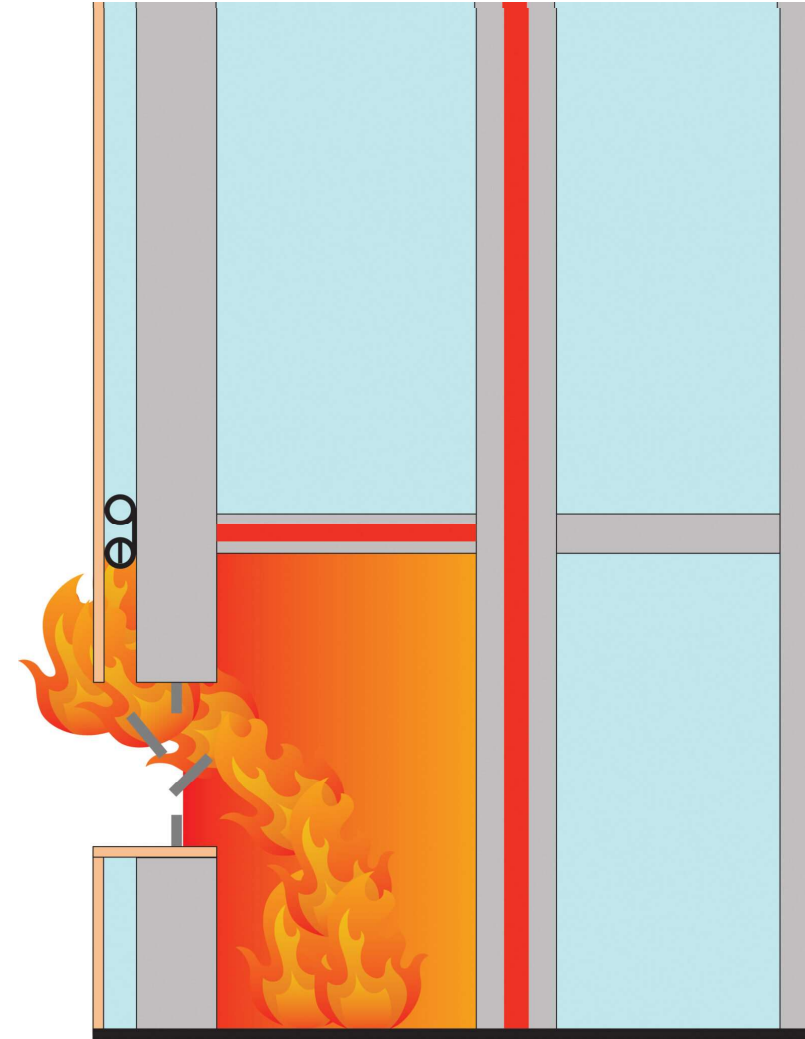
Durability of Reaction to Fire Performance



Fire spread - External

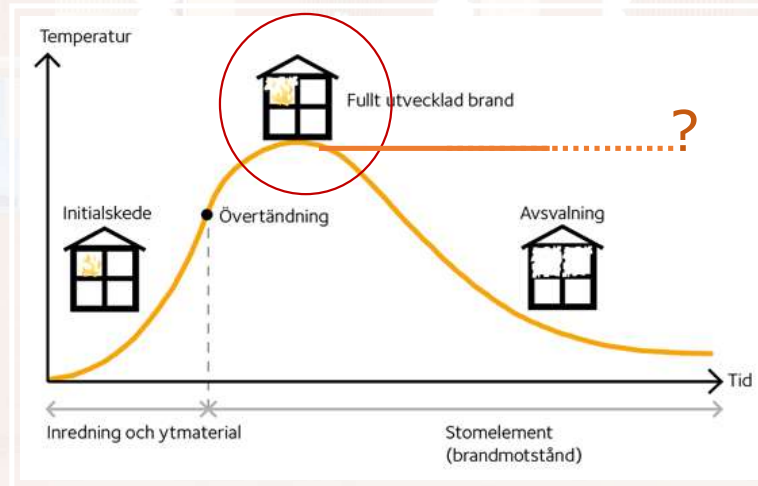


Fire spread - External



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

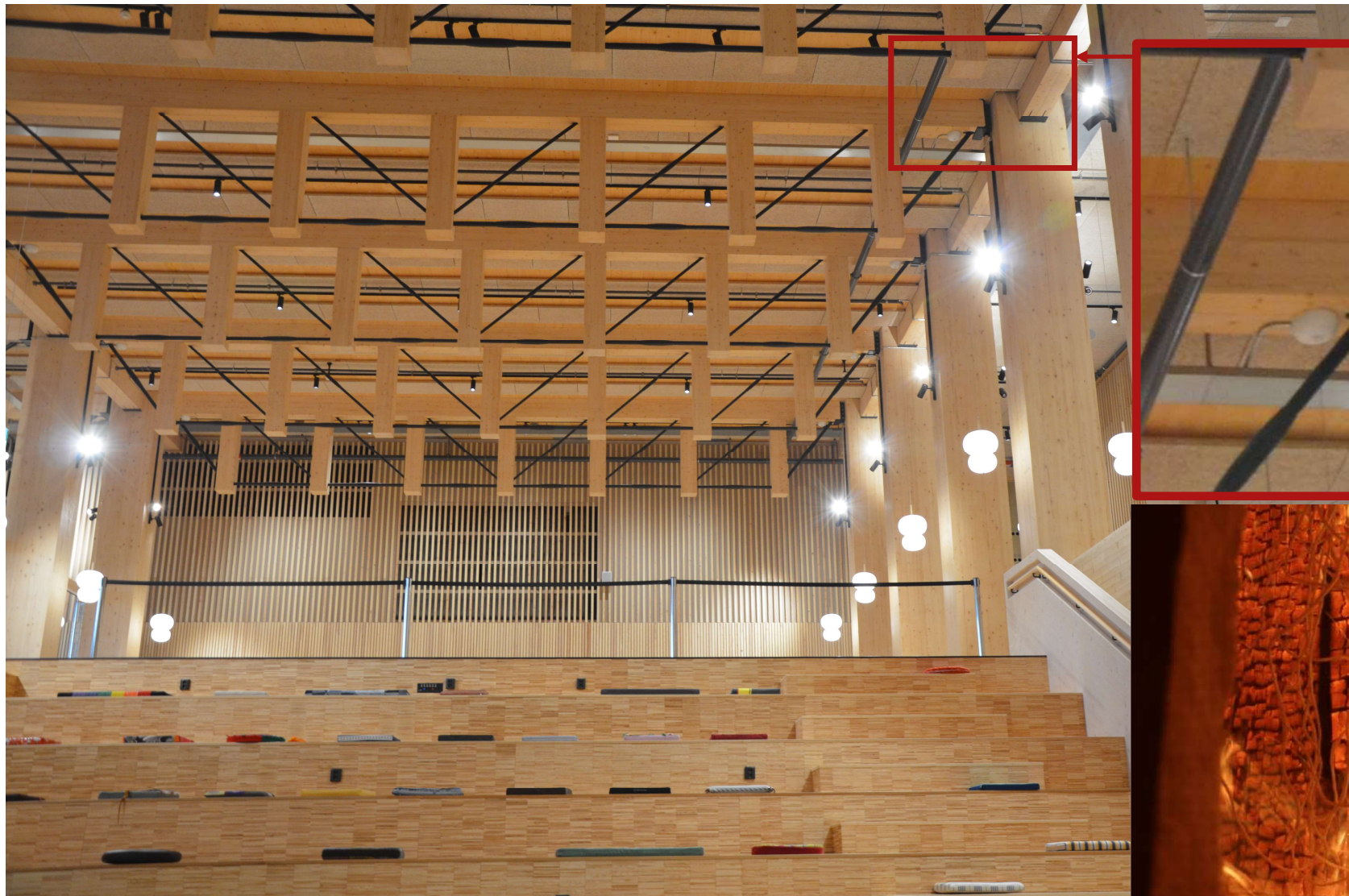
Summary Report Fire Safe implementation of visible mass timber in tall buildings – compartment fire testing Daniel Brandon RISE Report 2020:94

Movement over time.

Document the protection during built.

Inspect and maintain protection.





During construction

Hemsedal 2022



Foto: VG-Tipser



Foto: Pål Harald Uthus

Example



Example



Example



Example



Example



Example



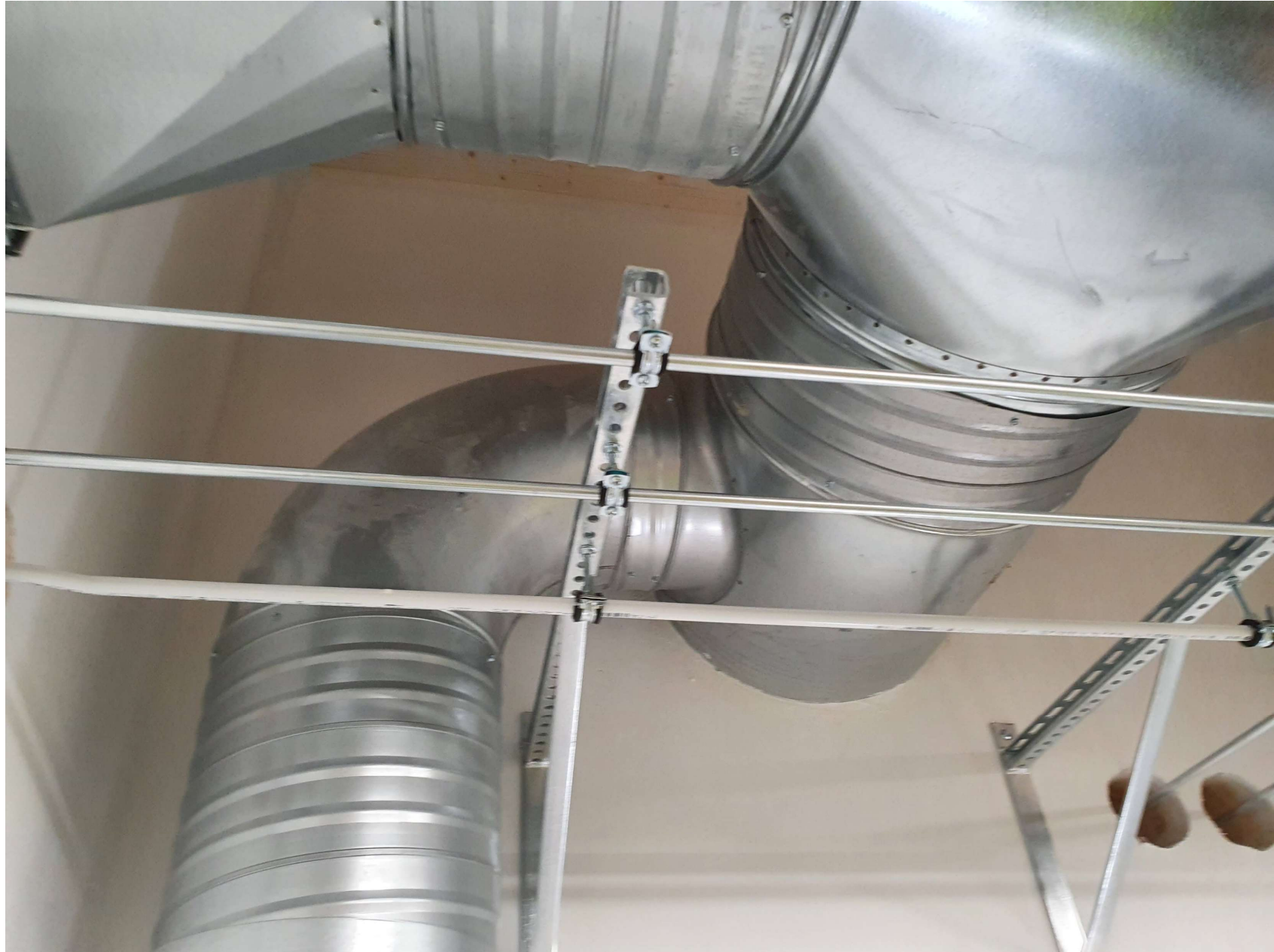
Example



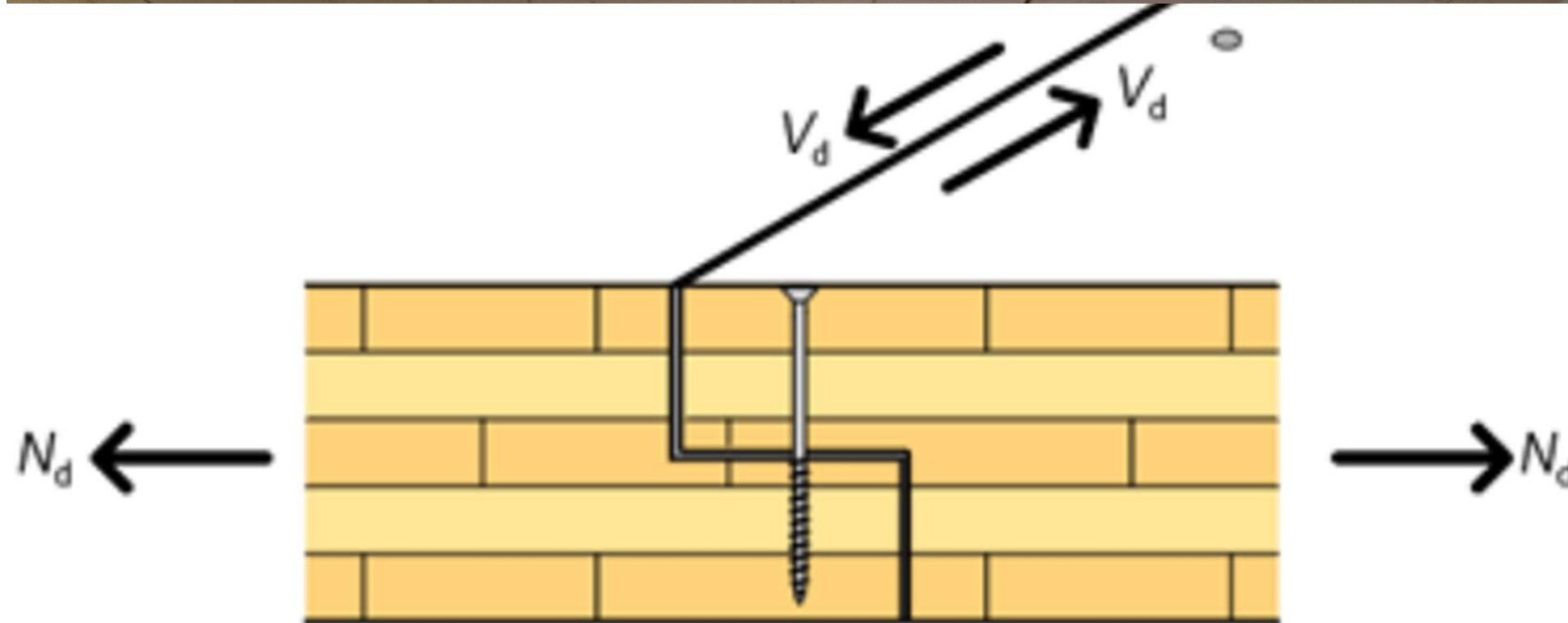
Example



Example



Example





Example



Modernare byggregler
– förutsägbart, flexibelt och förenklat



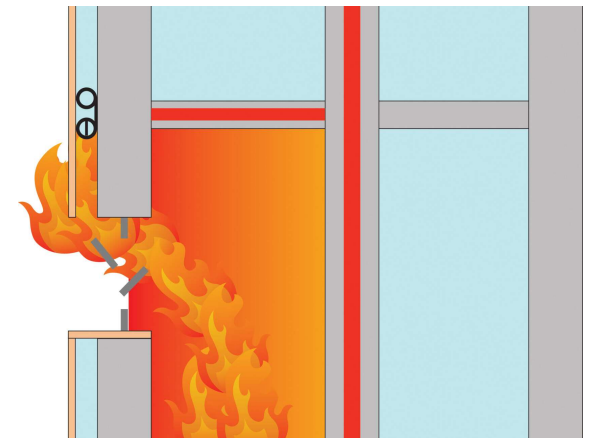
SLUTBETÄNKANDE AV
KOMMITTÉN FÖR
MODERNARE
BYGGREGLER

STATENS OFFENTLIGA
UTREDNINGAR
SOU 2019:68

Fire load from the structure to be considered:

- 1. Encapsulated timber structure**
- 2. Sprinkler protection**
- 3. Demonstrate that the timber can withstand burnout**
- 4. Increased fire resistance.**

Fire separation to protect fire spread to and via “concealed spaces”.



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