

# Fire Rating Timber In Construction

Group Surface ratings

Timber façade cladding

Structural timber specific design options.



# TODAYS LEARNING OUTCOMES

## 1. Pre-design Phase

- Identify the key factors influencing and impacting on **project costs** when fire rating timber substrates.
- **Specification requirements** of fire rating the timber substrate and the impact on building design.



# TODAYS LEARNING OUTCOMES



## Conceptual design

- **Fire Report:** Identify the fire rating required for the timber substrates to ensure compliance with the New Zealand Building Code (NZBC):
  - What is a Group Rating for interior and exterior timber?
  - What fire rating is required for exterior timber cladding?
  - Can I fire rate timber to give it a minute rating? Eg 60mins FRR or 60/-/-

# TODAYS LEARNING OUTCOMES

## Final Design Phase

- Recognise the importance of the **limitations** of fire rating timber substrates with coatings.
- **Design considerations** when detailing with fire rated timber substrates.
- Installations in the appropriate interior/exterior zones.
- Recognise why exterior timber may require a Group rating or Type A rating.



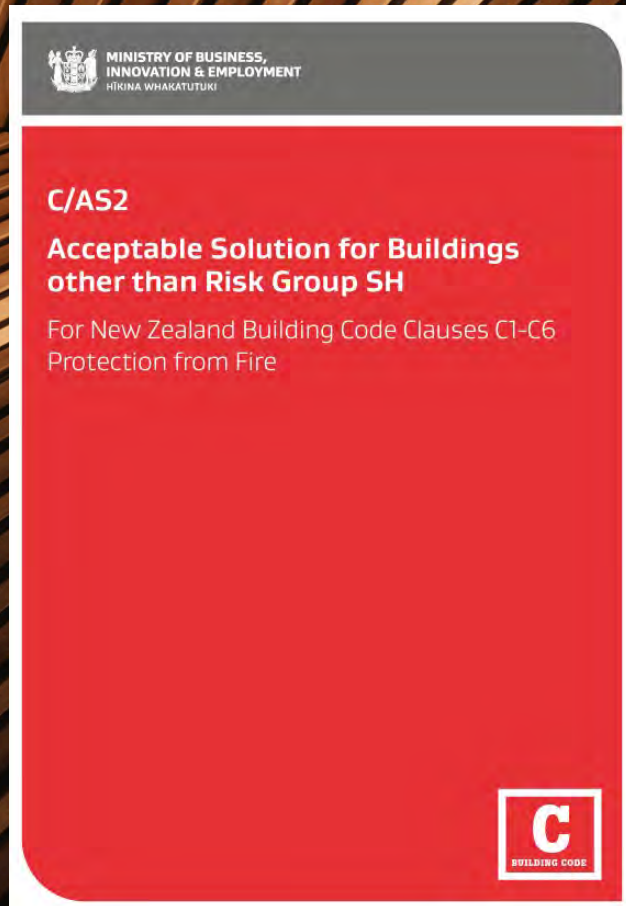
# TODAYS LEARNING OUTCOMES

## Consent Documentation

- Product NZ Building Code compliance requirements and certification.
- Conveying fire rating requirements in the drawing package.
- Requirements of the consent package.

# TIMBER FIRE COMPLIANCE

New Zealand Building Code C1-C6.



## GROUP SURFACE RATING

Internal and external timber surfaces  
Expressed as a number 1 to 4

## TYPE A TYPE B

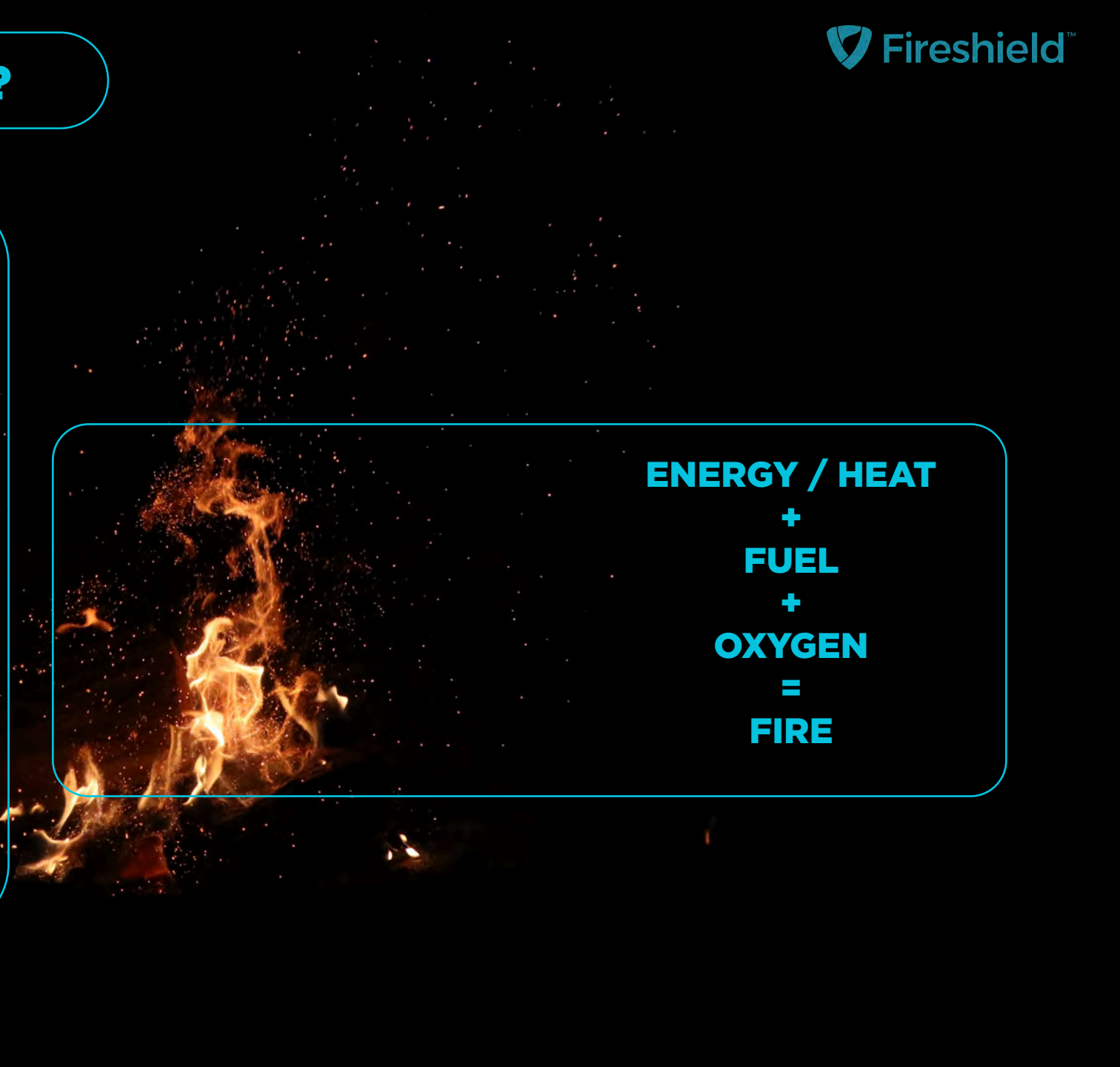
Exterior cladding / façade protection  
Expressed as a Type A or B

## FIRE RESISTANCE RATING

Structural timber protection  
Expressed in minutes (FRL)

## WHY DOES TIMBER BURN?

- An energy source heats the timber (**fuel**) to a very high temperature, @150°C heat decomposes the cellulose material (timber)
- Some of the decomposed material is released as volatile gases or **smoke**.
- The rest of the material forms a **char** which is all of the unburnable minerals in the wood.
- When the volatile gases reach approximately 260°C the compound molecules break apart, and the atoms recombine with the oxygen to form water, carbon dioxide and other products. They burn.



**ENERGY / HEAT**  
+  
**FUEL**  
+  
**OXYGEN**  
=  
**FIRE**



# Group Surface Ratings

**EXTERIOR + INTERIOR**



# WHY PROTECT SURFACE FINISHES?

- What makes surface fires so dangerous?
  - Faster growing fire.
  - Less time to escape.
  - Higher fire risks.
- Group surface ratings provide:
  - Slower growing fire.
  - More time to escape.
  - Lower fire danger.

# SURFACE FINISHES & THE NZBC

- C3/AS1 New Zealand Building Code : Fire Affecting Areas Beyond The Source.
- Buildings must be designed and constructed so that there is a low probability of injury or illness to persons **not in close proximity** to a fire source.
- **Group ratings** are to allow safe escape from a building.
- The Group Number is a numeric representation of the **performance** achieved during the certified fire test.
- The **Group Numbers are 1-4** (least to most combustible).
- Affects all materials not only timber.
- Automatic sprinkler systems can lower the required Group number.



# GROUP NUMBERS

## GROUP 1

Does not flashover after 10 mins @ 100 kW + additional 10mins @ 300kW.  
e.g. Concrete, FC Sheet, 0.4mm sheet metal etc.

## GROUP 2

Reaches flashover after 10 mins @ 100kW heat source.  
e.g. Some treated combustibles.

## GROUP 3

Reach flashover after 2 mins, but before 10 mins @ 100kW heat source.  
e.g. Typical solid timbers.

## GROUP 4

Reaches flashover before 2 mins @ 100kW source  
e.g. Natural cedar and other light timbers

# GROUP NUMBERS

**GROUP 1**

**GROUP 3**



# SURFACE RATING EXCEPTIONS

## C/AS2 4.17.6

When using the acceptable solution for compliance, the following are examples of items that are exempt from Group Surface Ratings:

Marae buildings using traditional Māori construction materials (eg, tukutuku and toetoe panels)

Handrails & general decorative trim such as architraves, skirtings, window components, including reveals

**Max. 5% of the surface area**

permanently installed openable wall partitions

**Surface area of not more than 25% of the divided room floor area or 5.0 m<sup>2</sup>**

**Not more than 3.0 m wide**

Timber joinery and structural timber building elements constructed from solid wood, glulam or laminated veneer lumber

Pipes and cables used to distribute power or services

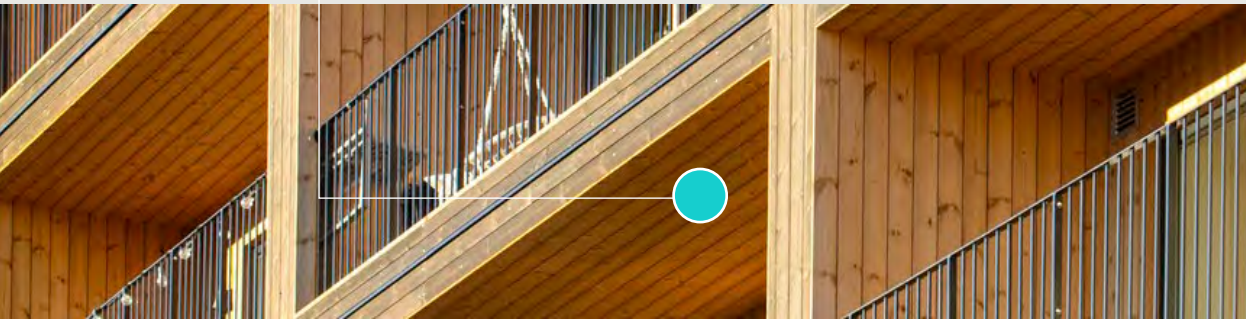
Small areas of non-conforming product within a firecell

**No more than 5.0 m<sup>2</sup>**

Electrical switches, outlets, cover plates and similar small discontinuous areas

# GROUP 1-S TIMBER SURFACE

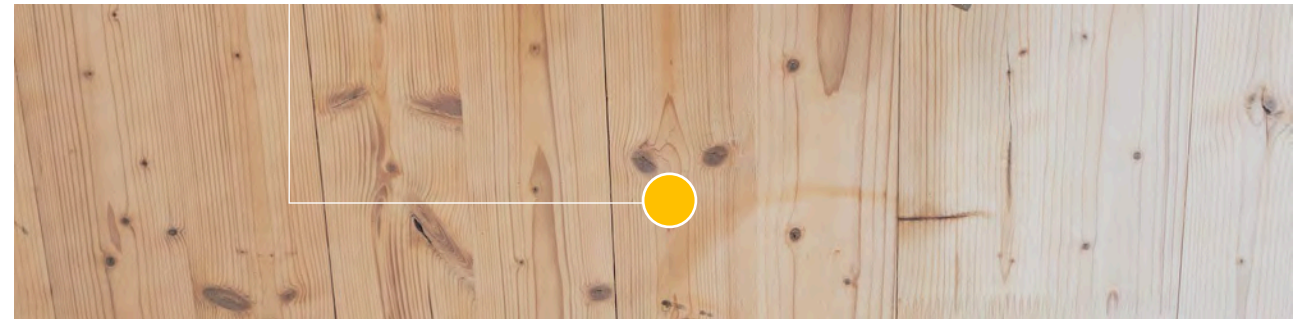
## EXTERIOR



### Timber Protection Options:

- Polymeric fire-retardant impregnation e.g **WoodSAFE Exterior**
- Imitation timber products. e.g **Wood grain tile**
- Not able to use clear intumescent coatings.

## INTERIOR



### Timber Protection Options:

- Polymeric fire-retardant impregnation e.g **WoodSAFE**
- Imitation timber products e.g **Wood grain tile**
- Clear intumescent coatings. e.g **Fireshield TimberClear**

# PRACTICAL EXAMPLES

Timber ceiling linings may require group rating

- Intumescent coatings appropriate in dry spaces.
- Impregnated timbers.
- FR MDF board.

Timber structure: no group rating required if exception applies

## INTERIOR

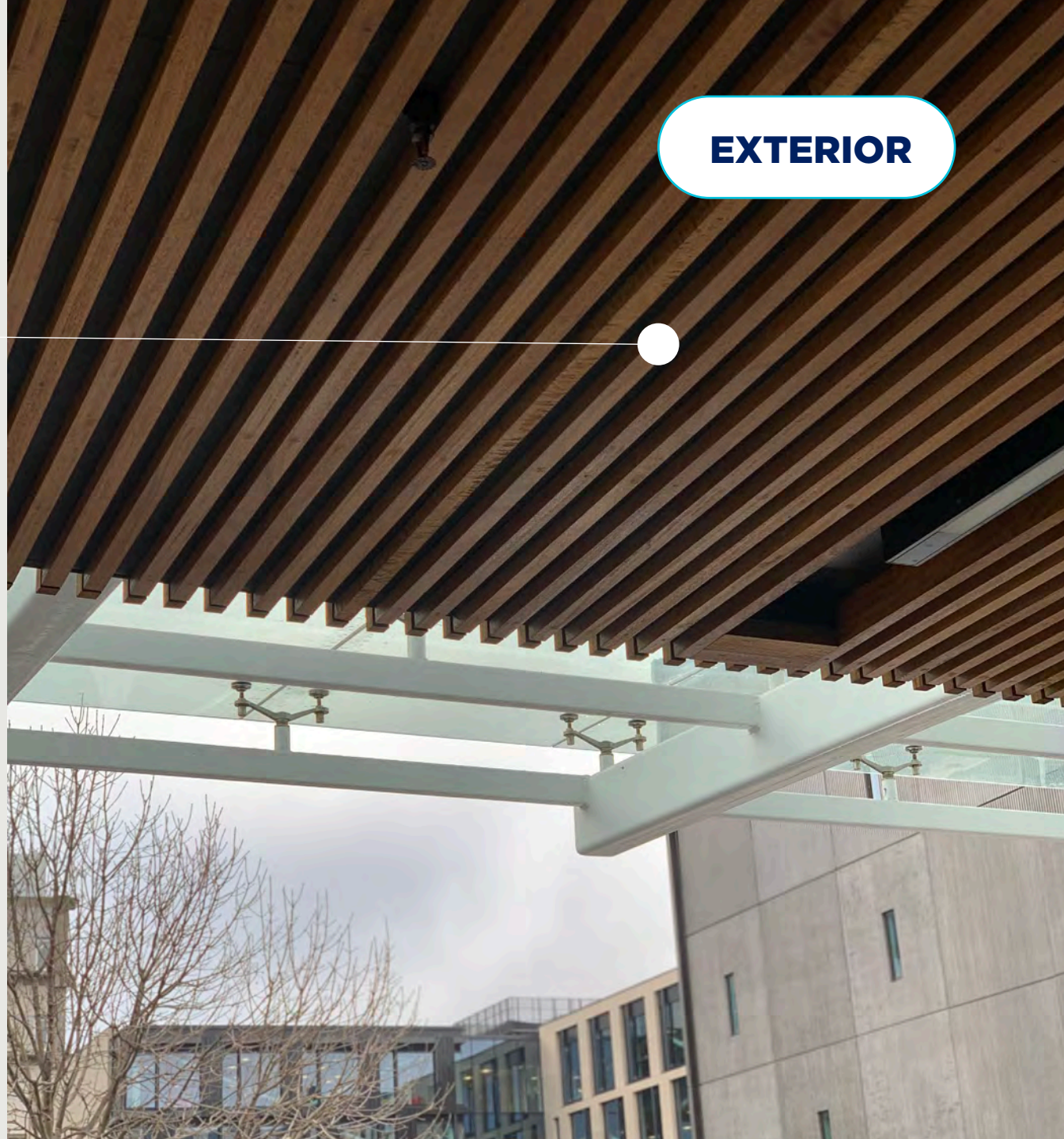


# PRACTICAL EXAMPLES

Timber soffit may require Group rating.

- Intumescent coatings not appropriate in exterior wet zones.
- Polymeric Impregnated timbers ok.
- Artificial timbers

**EXTERIOR**







# TIMBER CLADDING

**EXTERIOR**

# TIMBER EXTERIOR CLADDINGS

What makes external surface fires so dangerous?

- Fast external fire growth.
- Less time to escape.
- Higher fire risks.

1st January 2017 a restriction on the use of combustible external cladding was introduced into the NZBC.

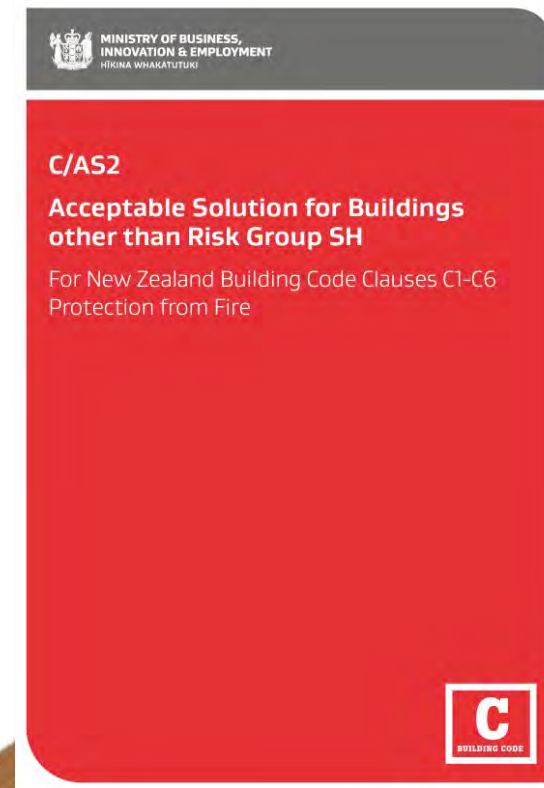
The maximum height for timber clad buildings was limited to 10 metres.

As a result, **timber was no longer used as an external cladding** on buildings over 10mtrs in height.



# TIMBER CLADDINGS & THE NZBC

- **C7.1.1 C/AS2 New Zealand Building Code : Fire Affecting Areas Beyond The Source.**
- Type A certified timber claddings using a fire retardant is subject to a ATSM D 2898 **weathering test prior to the fire test.**
- Type A certified timber claddings must be fire tested in accordance with ISO5660 or AS/NZ 3837.
- **The entire cladding system** must be Type A rated.



## C3 FUNCTIONAL REQUIREMENTS

C3.1 Buildings must be designed and constructed so that there is a

**low probability of injury  
or illness**

to persons

**not in close proximity to  
a fire source.**



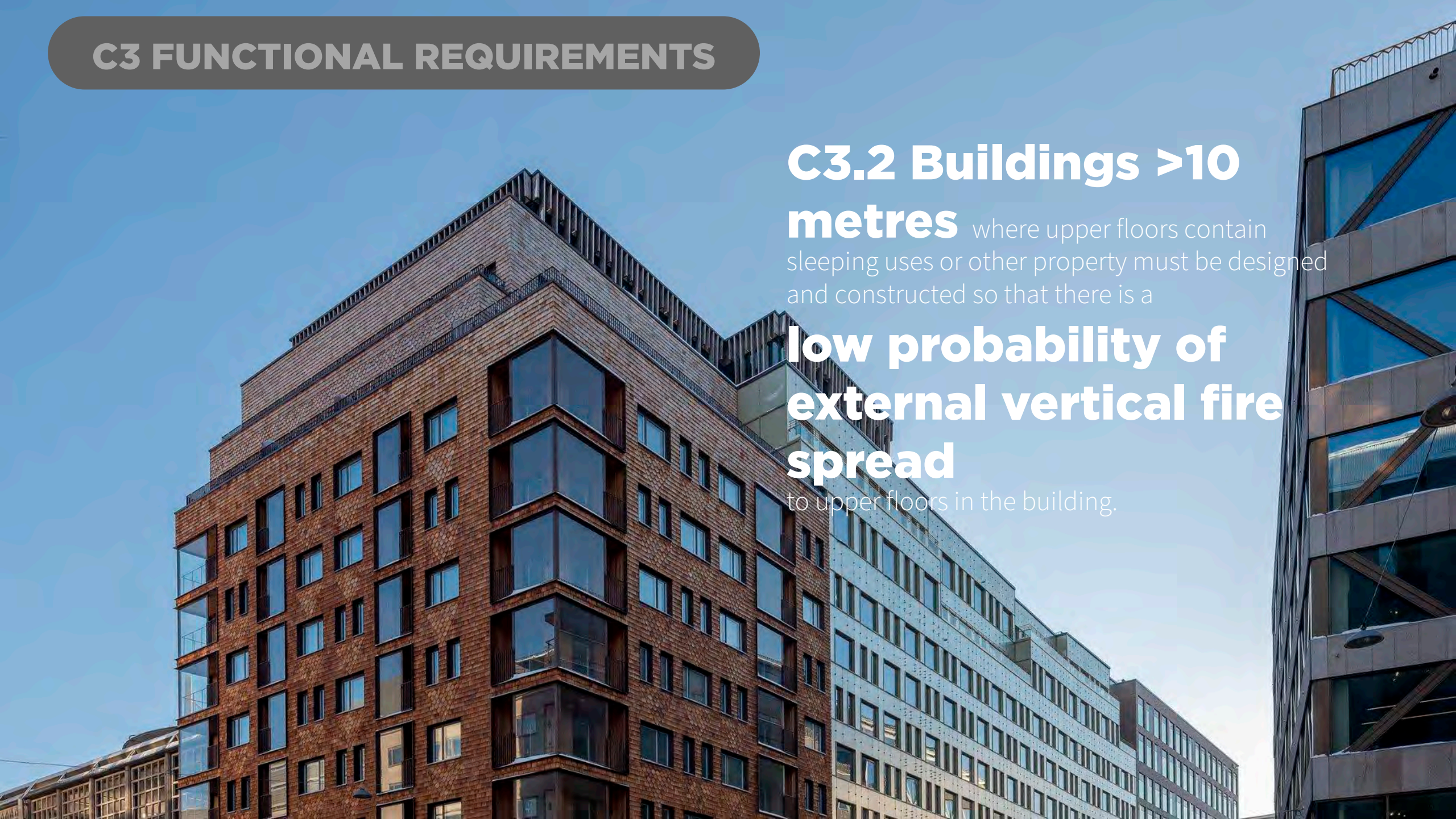
## C3 FUNCTIONAL REQUIREMENTS

### C3.2 Buildings >10 metres

where upper floors contain sleeping uses or other property must be designed and constructed so that there is a

### low probability of external vertical fire spread

to upper floors in the building.



## C3 FUNCTIONAL REQUIREMENTS

C3.3 Buildings must be designed and constructed so that there is

**a low probability of  
fire spread to other  
property**

vertically or horizontally

**across a boundary**

# TIMBER CLADDING CLASSIFICATION

## TYPE - A

- Peak heat release rate  $\leq 100 \text{ kW/m}^2$  and total heat released  $\leq 25 \text{ MJ/m}^2$ .
- Required in buildings over 10 mtrs height **or**
- Within 1 mtr of a boundary.
- Buildings containing risk group SI

## TYPE - B

- Peak heat release rate  $\leq 150 \text{ kW/m}^2$  and total heat released  $\leq 50 \text{ MJ/m}^2$
- Buildings containing risk group SI:
  - Buildings under 10mtrs in height **or**
  - > 1mtr of a boundary.



## TIMBER TYPE-A WALL SOLUTION

- Cannot use clear Intumescent coatings on timber.
- Artificial timber systems can be used such as vinyl wrapped aluminum.
- **Ammonium phosphate** impregnation fire retardant systems leach from the timber and are not certified Type A.
- **Polymeric** fire-retardant impregnation does not leach.
- **Fireshield WoodSAFE Exterior** is the only polymeric fire rated impregnation system certified Type A in NZ.



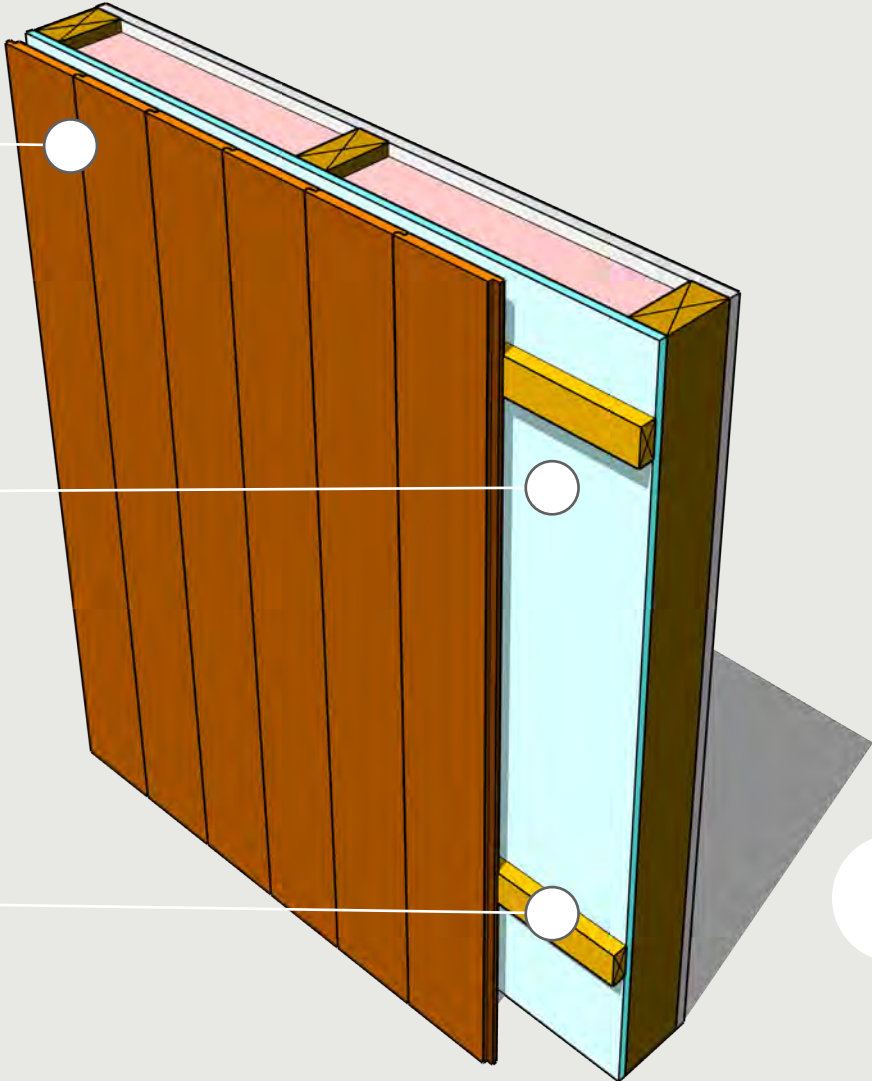


# TIMBER TYPE-A WALL SOLUTION

**TYPE-A timber cladding**

**TYPE-A building wrap**

**TYPE-A cavity battens**



**+ Fire Rated Cavity Closers**









# STRUCTURAL TIMBER

**SPECIFIC DESIGN**

# STRUCTURAL TIMBER

- Applies to all CLT, LVL and Glulam structural timber members.
- The standard for design is NZS3603:1993 Amendment 4.
- Structural timber fire protection involves char rate calculation.
- Specific design is available.

Extract from NZS3603:1993, available testing methods for compliance:

## 9.2 Fire resistance ratings

Fire resistance ratings for load bearing timber elements or assemblies shall be established by:

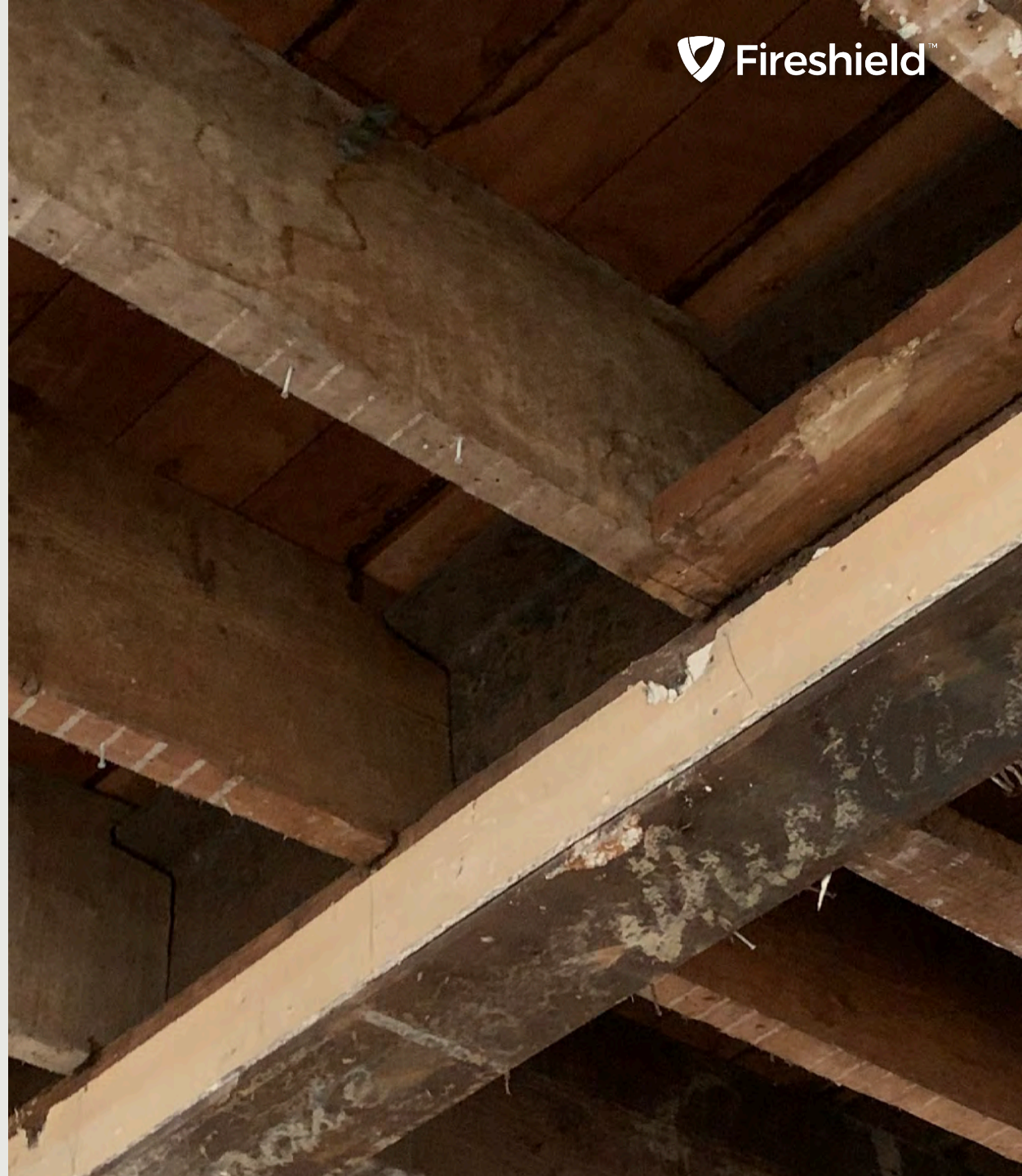
- (a) Standard fire tests in accordance with AS 1530 Part 4 or other approved standard, or
- (b) Extrapolation from standard tests using well established criteria, or
- (c) Calculation in accordance with design criteria set out in this document, or
- (d) Determination of the time taken to the start of charring of the load bearing timber elements when shielded by appropriate materials and subjected to the thermal environment of the standard fire test.



# PRACTICAL EXAMPLE

## Project Brief:

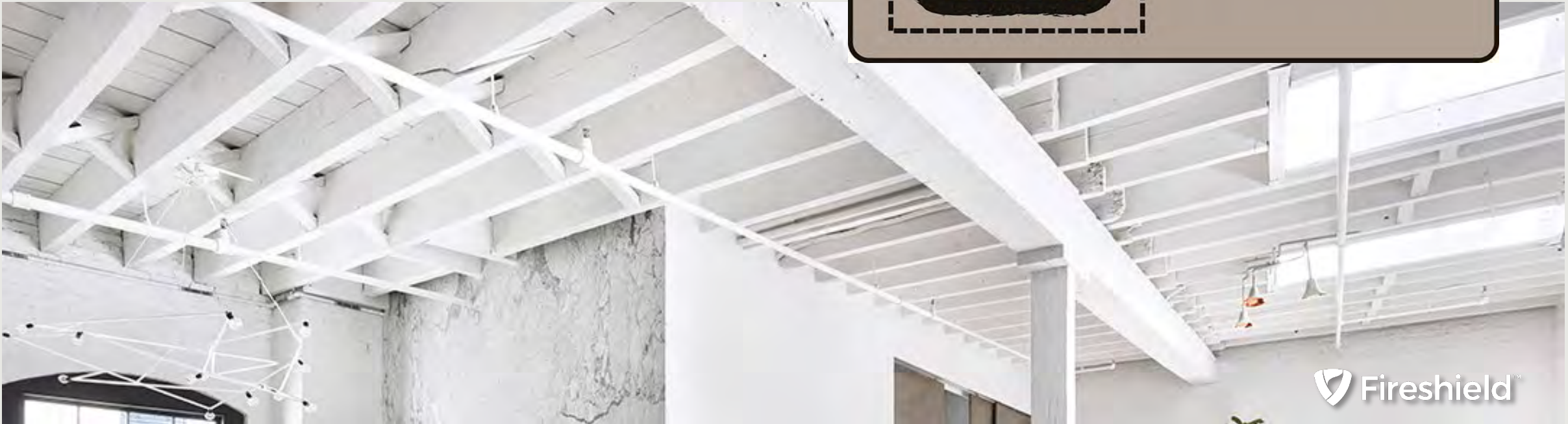
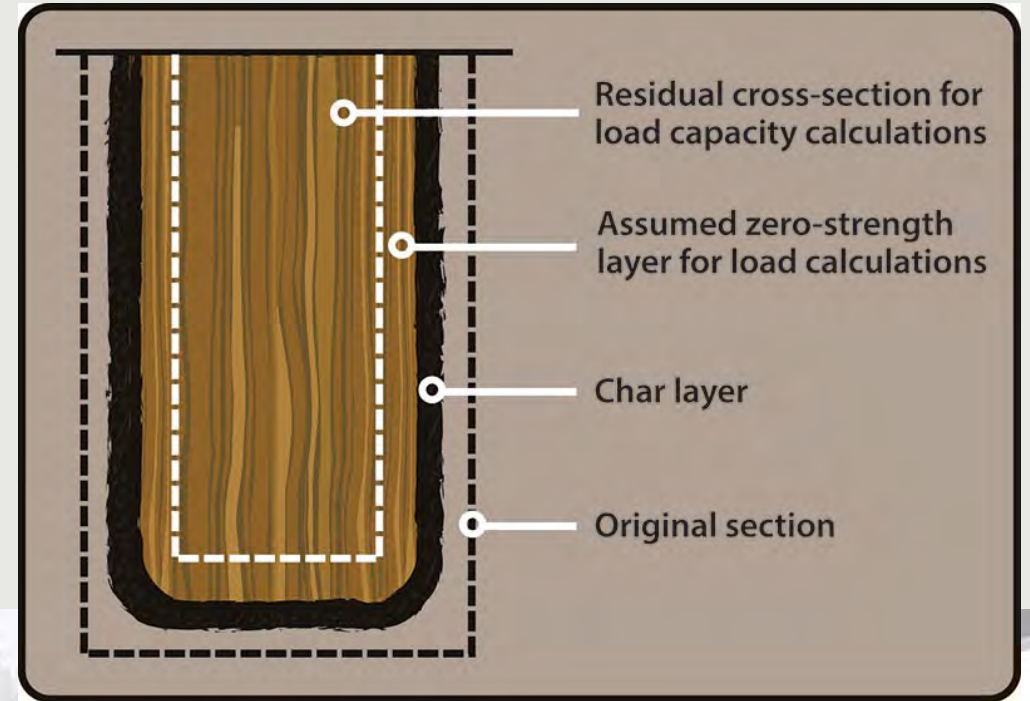
- Historic multi storey building refurbishment.
- Existing exposed structural timber members + timber floor requires **30min FRR.** (30/-/-)
- Options for protection:
  - Clad in fire rated boarding.
  - Use NZS3603 char rates.
  - Protect with intumescent coating to reduce natural char rates. (Specific design required)
- Design Considerations required for specific design:
  - Sealant to floors boards.
  - Tongue and groove protection.
  - Penetrations into joists for services.
  - Floor penetrations for vertical stacks.



# PRACTICAL EXAMPLE

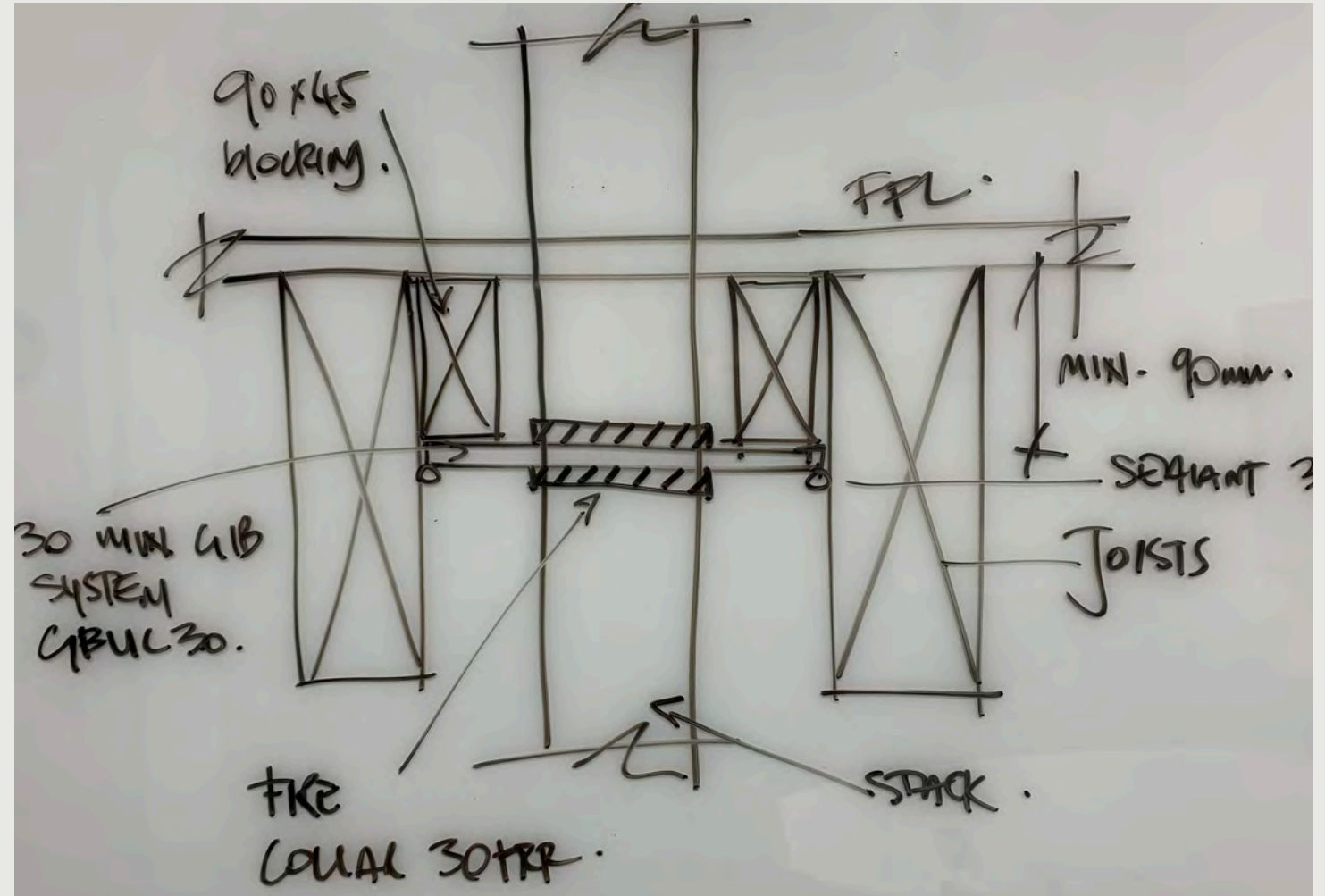
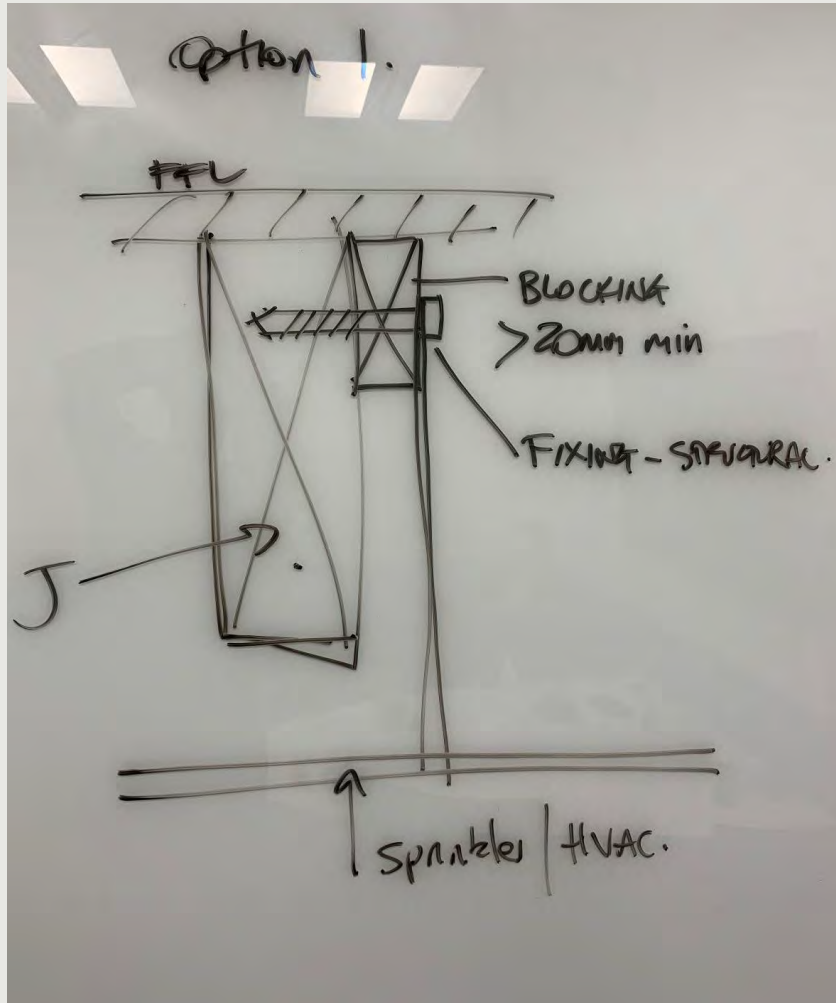
## Solution:

- Reduce the natural char rate of timber using intumescent coating TimberWhite. (reduced from 0.7mm/minute = 21mm +7mm = 28mm char reduced to 8mm char)
- Solution uses laboratory structural timber testing and evidence: accepted by Auckland City Council.
- PS1/PS4 issued.



# PRACTICAL EXAMPLE

## Solution: detail sketches





# FIRESHIELD COATINGS

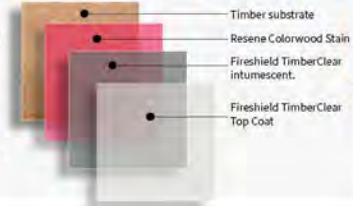


## SYSTEM SPECIFICATION SHEET

### TimberClear + Top Coat + Stain

#### SYSTEM INFORMATION

- Resene Colorwood Stain + TimberClear basecoat (intumescent) + TimberClear Top Coat (sealer)
- Fireshield timber intumescent system for C1 interior zones on interior timber battens, wall and ceiling linings.
- Achieves **Group 1-5 Surface Rating** to timber substrates. See Fireshield for C2 and C3 (ISO 12944-2) interior environments, areas where constant air humidity is over 75%.
- Only to be applied by Registered Applicators in accordance with Fireshield Application Instructions, TDS and MSDS.



System Name	TimberClear-NZ-02-C1
ISO 9223:2012 Zone	C1 Interior (heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels)
Substrate	Interior timber substrates 6mm thick + ≥338 kg/m <sup>3</sup> density. See TDS for full requirements.
TimberClear System Description	Fireshield® TimberClear is a single component, water based clear intumescent basecoat for the fire protection of interior timber. It must be top coated with TimberClear Top Coat. Fireshield TimberClear Top Coat is a single component, solvent based clear lacquer sealer for use over the TimberClear intumescent basecoat.

#### COATING SYSTEM

COAT	PRODUCT	TDS CODE	THINNER	APPLICATION	FILM BUILD	Clean Up
First Coat	Resene Colorwood	D59	Water See TDS for maximum	Speed Brush / Spray	23 microns DFT	Water
Second Coat	TimberClear intumescent basecoat	TD-FSTCAUNZ-03	DO NOT THIN	Spray	Minimum 230 microns WFT (150 microns DFT)	Water
Third Coat	TimberClear Top Coat	TD-FSTOPNZ-05	Bio Solvent: Lacquer Thinner Std Solvent: Resene 7A	Spray	Minimum 70 microns WFT (30 microns DFT)	Bio Solvent: Lacquer Thinner Std Solvent: Resene 7A

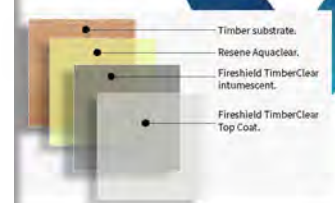
#### SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination including dirt, salts, oil and grease. If required, clean as per AS/NZS 2311 Sec 3.2.7, any contaminant left on the surface will affect the visual appearance of the Fireshield® timber ICS system. Timber must be allowed to equilibrate in a location protected from the weather to near 23 final in-service conditions, to avoid shrinkage or swelling after installation and coating. Dressed timber should be smooth, and free from raised or woolly grain, planing bars, or other machining defects. The standard of finish should be appropriate to the end-use (see NZS 3610 and NZS 3617). Rough-sawn timbers should be thoroughly brushed with the grain to remove dust and dirt before coating.

\* Spray application is always recommended, if application is by brush or roller, further coats may be necessary to achieve the recommended DFT.

\*\* WFT is thickness of wet paint required to achieve the specified 'Dry Film Thickness' assuming no thinner is added.

### + Sealer



System Name	TimberClear-NZ-02-C1
ISO 9223:2012 Zone	C1 Interior (heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels)
Substrate	Interior timber substrates 6mm thick + ≥338 kg/m <sup>3</sup> density. See TDS for full requirements.
TimberClear System Description	Fireshield® TimberClear is a single component, water based clear intumescent basecoat for the fire protection of interior timber. It must be top coated with TimberClear Top Coat. Fireshield TimberClear Top Coat is a single component, solvent based clear lacquer sealer for use over the TimberClear intumescent basecoat.

COAT	PRODUCT	TDS CODE	THINNER	APPLICATION	FILM BUILD	Clean Up
First Coat	Resene AquaClear	D59	Water See TDS for maximum	Speed Brush / Spray	23 microns DFT	Water
Second Coat	TimberClear intumescent basecoat	TD-FSTCAUNZ-03	DO NOT THIN	Spray	Minimum 230 microns WFT (150 microns DFT)	Water
Third Coat	TimberClear Top Coat	TD-FSTOPNZ-05	Bio Solvent: Lacquer Thinner Std Solvent: Resene 7A	Spray	Minimum 70 microns WFT (30 microns DFT)	Bio Solvent: Lacquer Thinner Std Solvent: Resene 7A

All surfaces to be coated should be clean, dry and free from contamination including dirt, salts, oil and grease. If required, clean as per AS/NZS 2311 Sec 3.2.7, any contaminant left on the surface will affect the visual appearance of the Fireshield® timber ICS system. Timber must be allowed to equilibrate in a location protected from the weather to near 23 final in-service conditions, to avoid shrinkage or swelling after installation and coating. Dressed timber should be smooth, and free from raised or woolly grain, planing bars, or other machining defects. The standard of finish should be appropriate to the end-use (see NZS 3610 and NZS 3617). Rough-sawn timbers should be thoroughly brushed with the grain to remove dust and dirt before coating.

\* Spray application is always recommended, if application is by brush or roller, further coats may be necessary to achieve the recommended DFT.

\*\* WFT is thickness of wet paint required to achieve the specified 'Dry Film Thickness' assuming no thinner is added.

# FIRESHIELD TIMBERS



# Case Studies



## CASE STUDY

### Kilden Kindergarten

Kilden Kindergarten was the first Oslo Plus-Energy kindergarten designed to accommodate 200+ children. The use of natural building products and being energy self-sufficient were central to the project design brief.

Size	1702m <sup>2</sup>
Location	Oslo, Norway
Date	2018
Fireshield Systems	Timber Whitewash + TimberWhite <sup>FR</sup>
Substrate	Timber boarding + timber battens
Architects	Link Arkitektur, Norway
Awards	-

The building's outer surface is conceived of like a weather skin that knits together the roof and walls as a structural whole. Parts of the existing building are re-used in outdoor timber structures or as fillers. The kindergarten is situated in a residential area adjacent to large green spaces.

The Architects wanted to specify timber battens and boarding to the interior walls and ceilings because of its sustainability and natural durability. The issue faced was providing a safe environment for the children with a Group 1 equivalent surface rating to the timber.

Fireshield Timber Whitewash was chosen because it allowed the timber grain to remain visible while being a durable intumescent coating. The opaque finish also reflects light around the space, providing a bright, inviting environment for the children to play in. For extra durability, an approved clear topcoat was applied over the Timber Whitewash.

TimberWhite2FR was chosen for a pigmented timber solution where a solid colour was needed on the walls.



## CASE STUDY

### Ostermalm Market

The design of the Osterman Market building took considerable care; it required a balance of quality while using lightweight, cost-efficient and sustainable materials befitting the nature of the building.

Size	1970m <sup>2</sup>
Location	Stockholm, Sweden
Date	2016
Fireshield Systems	TimberClear <sup>FR</sup> + Top Coat (Matt)
Substrate	Timber linings + CLT structure
Architects	Gert Wingårdh, Johan Eklind and Joakim
Awards	EU mies 2017 for Contemporary Architecture

The Market Hall is located in the centre of Stockholm and houses food stalls and restaurants. Wingårdh created a large hall with a massive ceiling height of 11 metres. Daylight penetrates the space from the short façades and the six triangular roof lights.

The building interior has an exposed timber structure consisting of a latticework of glulam beams resting on columns of cross-laminated timber. The choice of wood had several advantages. The relatively light weight of the structure meant that a minimal concrete foundation was possible saving time and money.

It is also a renewable resource with a negative carbon footprint. The issue for Gert Wingårdh and his team was to be able to provide a durable, Group 1 equivalent clear fire rating to the timber surfaces in a non-conditioned environment that houses food outlets, kitchens and hundreds of people every day.

Fireshield TimberClear1FR + Top Coat (Matt) was their coating of choice, used on the timber glulam and plywood linings it provides the maximum Group 1 equivalent rating. TimberClear1FR allowed the Architects the freedom to design with a natural resource, timber.



## CASE STUDY

### Magasinet Cultural Centre

Magasinet was built in 1898 as a storage hall for the railroad. Today it is a centre for cultural events where it operates as an office, film and photo studio and as a venue for exhibitions and concerts.

Size	1000m <sup>2</sup>
Location	Stockholm, Sweden
Date	2006
Fireshield Systems	TimberWhite <sup>FR</sup> + ArchitecturalWhite <sup>FR</sup>
Substrate	Timber linings + exposed steel structure
Architects	Tengbom, Sweden
Awards	Lomma kommuns byggnadspris

Sweco's architects designed the new extension to the existing storage hall. The new extension is a modern design, which is in line with the multifaceted cultural activities that are conducted within the space. Inside, the rooms are filled with light from the skylights, and the walls consist of white painted wood panelling with ground concrete flooring.

The Architect wanted to use natural timber linings on the walls and ceilings, the issue was achieving a clean finish that could cope with the amount of natural light coming into the space from the skylights above and offer a Group 1 equivalent fire rating. The exposed steel members needed a smooth finish with a dark topcoat.

Fireshield TimberWhite + approved topcoat system was installed to achieve a Group 1 equivalent fire rating to the timber panelling on the walls and ceilings. The clean finish of TimberWhite was critical, given the amount of natural light flooding the space from the skylights above.

Fireshield ArchitecturalWhite4FR + approved topcoat has been used on all the visible black steel columns and beams. ArchitecturalWhite's fibre free finish contributed to the clean lines of the steel members, especially with such a dark topcoat being chosen.





**Q & A**

**ANY QUESTIONS?**