

NFCA®

National Fireproofing Contractors Association

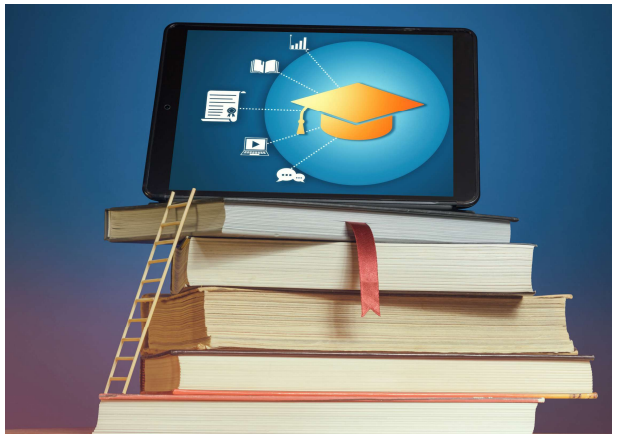
WEBINAR

WWW.NFCA-ONLINE.ORG

Dr Gabby Peck, Ph.D., MRSC
Technical Director

National Fireproofing Contractors Association

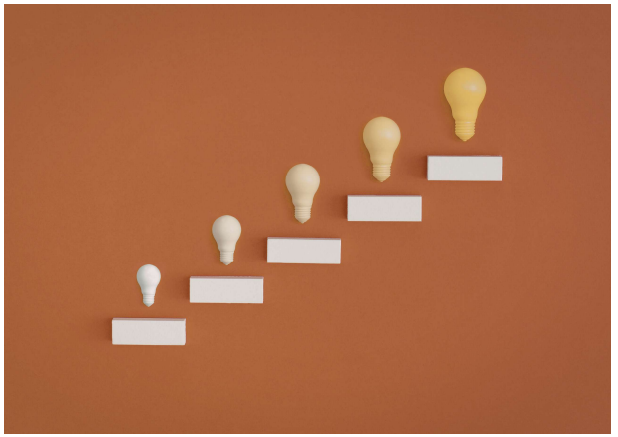
OUR MISSION



EDUCATE



ADVOCATE



ADVANCE THE PASSIVE

FIRE INDUSTRY GLOBALLY

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WHERE YOU'LL SEE US...

UL Standards & Engagement

bsi.

NFPA®

ICC INTERNATIONAL CODE COUNCIL®

ASTM INTERNATIONAL

gabby@fcia.org

National Fireproofing Contractors Association

WHAT:



To educate & advocate for the passive fire industry

Speak, Write, Advocate & Promote

ICC

CSI

CSC, FFMIA, ON

BOA, ON FMIA

RAIC

NFPA

Centre for Campus Fire Safety

Fire Marshalls

Code officials

GET INVOLVED

JOIN A COMMITTEE

CONTRIBUTE IDEAS & NETWORK

ADVANCE YOUR PROFESSOINAL DEVELOPMENT

MAY 2026
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FREE

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Elevate your fireproofing standards with NFCA's expert resources.

The National Fireproofing Contractors Association (NFCA) has crafted dynamic, industry-consensus Standard Practices and Quality Assurance Procedures to guide the precise application and quality assurance procedures of fireproofing products, such as SFRM and IFRM. These are the industry authority documents, designed to ensure compliance and excellence and uniform industry practices, provide clear, actionable guidelines for contractors and construction professionals to achieve consistent, high-quality installations that meet rigorous safety and performance standards.

Explore the NFCA Approved documents below, essential tools for enhancing building safety and project success.

- NFCA 100 Standard Practice for the Application of Sprayed Fire-Resistive Material
- NFCA 200 Field Quality Assurance Procedure for the Application of Sprayed Applied Fire-Resistive Material
- NFCA 300 Standard Practice for the Application of Intumescent Fire-Resistive Material
- NFCA 400 Field Quality Assurance Procedure for the Application of Intumescent Fire-Resistive Material

FREE

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2025

12/16/2025 - 'What the Structural Fireproofing Discipline Needs to Know about Firestopping Penetrations and Fire-Resistive Joints' with Bill McHugh (FCIA), Carl Fernald (PCI -Tampa), Gus Mancini (Gleeson Powers), and Rich Walke (CTI)
11/11/2025 - 'The Most Commonly Misunderstood Code Requirements for Structural Fire-Resistance: Part II' with Tony Crimi (AC Consulting Solutions), Bill McHugh (NFCA), and Rich Walke (CTI)
09/17/2025 - 'Fireproofing Fluted Metal Decks-to-Beam Connections' with Bill McHugh (NFCA), Carl Fernald (Performance Contracting, Inc.), and Rich Walke (CTI)
08/05/2025 - 'The Most Commonly Misunderstood Code Requirements for Structural Fire-Resistance' with Tony Crimi (A.C. Consulting Solutions), Bill Koffel (Koffel Associates), Bill McHugh (NFCA), and Rich Walke (CTI)
07/15/25 - Thermal & Ignition Barrier Requirements for Foamed Plastic with John Dalton (Saint-Gobain)
06/17/25 - Growing the Available Market While Unlocking Carbon Savings in Steel Buildings with Galen Burrell (Saint-Gobain)
04/14/25 - Excellence in Fireproofing Projects - The 2025 NFCA Award of Excellence Winning Projects
03/25/25 - Fireproofing Materials and Fire-Resistance
02/25/25 - Fireproofing Inspection with Bill McHugh (NFCA)
01/14/25 - The ASTM E119, UL 263, and CAN/ULC S101 Fire Test Standards with Rich Walke (CTI)

2024

FREE

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Fireproofing Products

Fireproofing protection products protect structural steel framed buildings and are categorized into Sprayed Fire-Resistive Material (SFRM), Intumescent Fire-Resistive Material (IFRM) and Rigid Board Fire Protection. The following information separates products into these several categories and is intended to provide general information about various types of fire protection products. Manufacturer's information can be easily accessed by clicking on the Manufacturers name in the Manufacturers Section of this web site. Product details are available at the manufacturers website.

- Sprayed Fire-Resistive Materials (SFRM)
- Intumescent Fire-Resistive Material (IFRM)
- Rigid Board Fire Protection

National Fireproofing
Contractors Association

GET ACCREDITED:



NFCA online exam registrations now open for August ‘26





NFCA IFRM & SFRM Contractor Accreditation Programs



UL Solutions Qualified SFRM Contractor Program



IAS AC 291 Accreditation Program

MAY 2026
gabby@fcia.org

OUR EVENTS ‘26...

COMPLETED

02 PFP’CON DUBAI

DUBAI, Dubai World Trade Centre

JAN 12TH TO JAN 14TH



COMPLETED

01 PFP CON

Las Vegas, NV

March 30th

to

April 3rd

PFPCON 2026

Bring on ‘27!





TO OUR MEMBERS, FRIENDS, SPONSORS SUPPORTERS & BOARD

National Fireproofing Contractors Association

Welcome to

TODAY'S SESSION

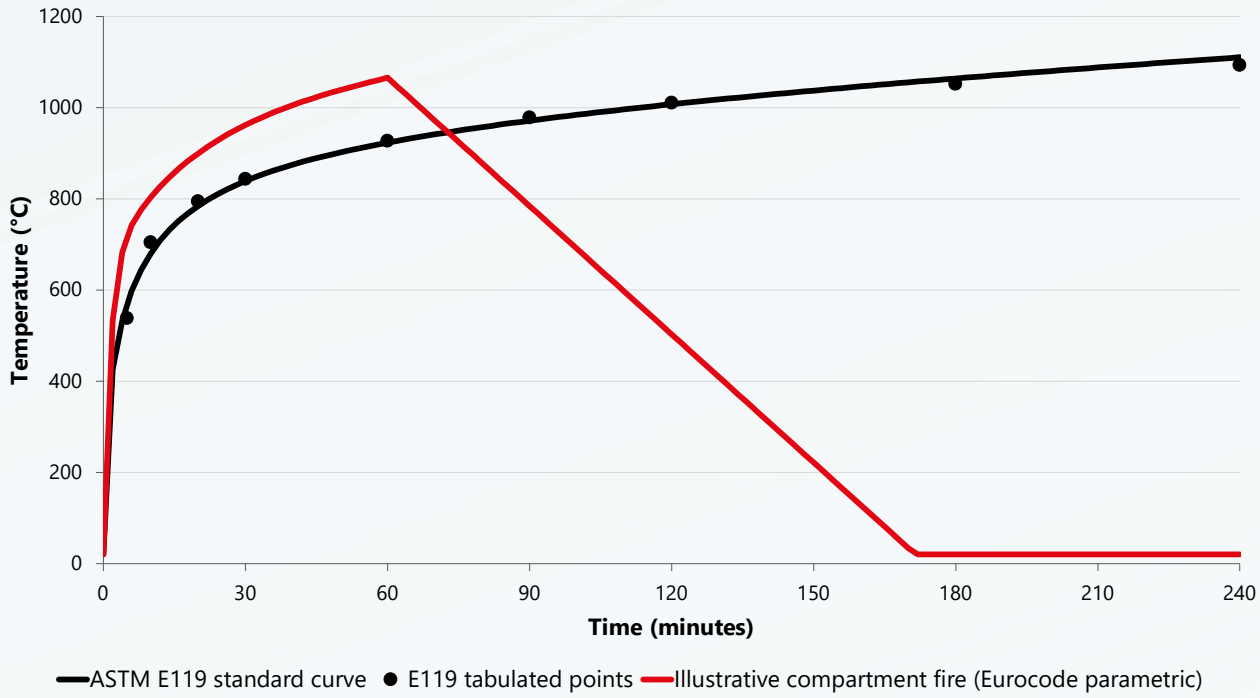
Turning Up the Heat? The Standard Fire Curve, Performance-Based Design and What It Means for Fireproofing

Dr Gabrielle Peck, Ph.D., MRSC, Technical Director, NFCA



A rating describes performance in a standard furnace test.

Furnace curve vs a real fire



Real fire

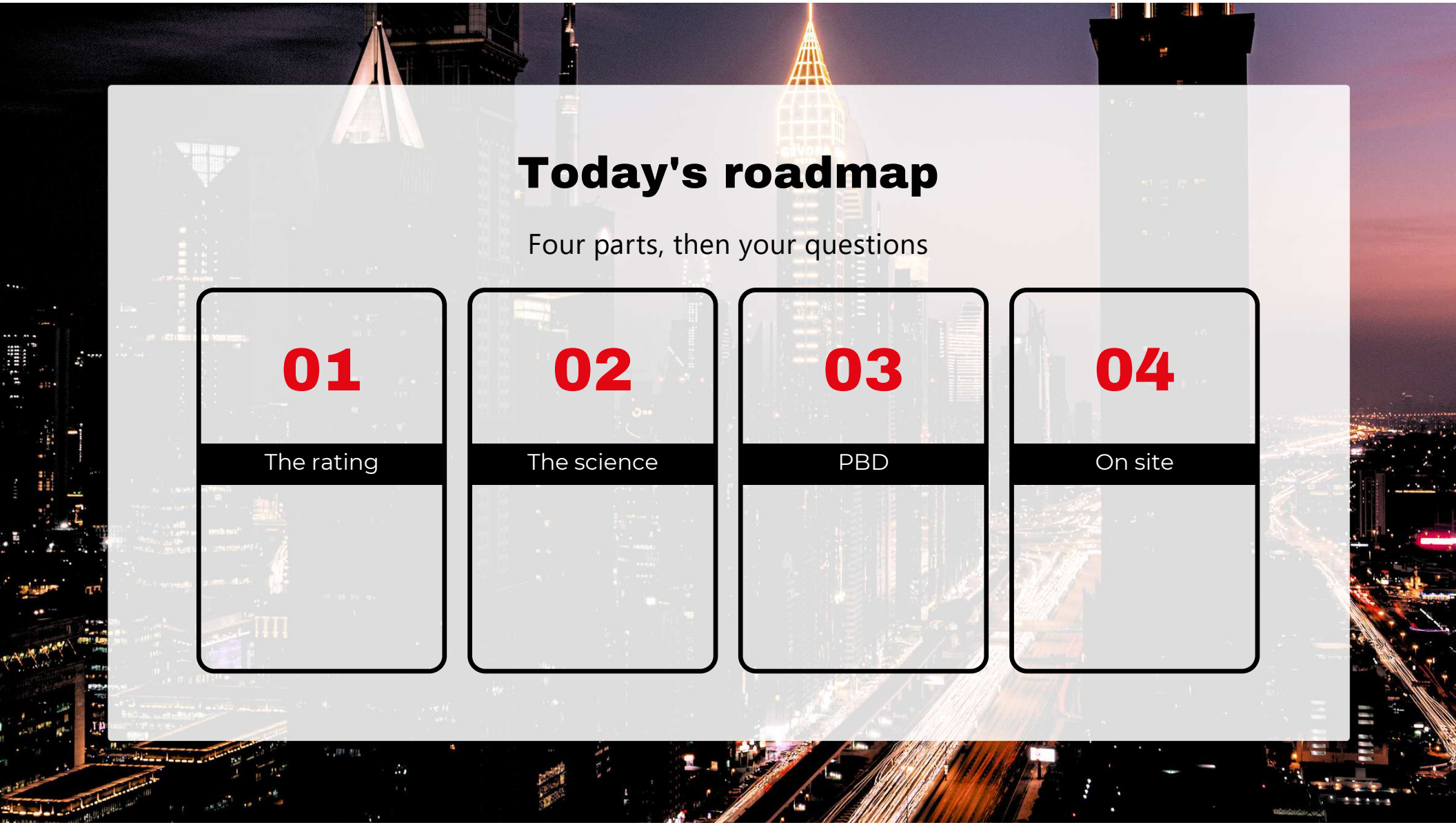
Rises faster and peaks hotter (about 1065 °C at 60 min here)

Then cools as the fuel burns out

Furnace

Never cools. It keeps climbing for as long as the test runs

Illustrative only: EN 1991-1-2 Annex A curve, opening factor 0.06 m^½, b = 1160 J/m²s^½K, fire load 300 MJ/m² (total area). E119 line from the standard approximation equation.



Today's roadmap

Four parts, then your questions

01	02	03	04
The rating	The science	PBD	On site



PART 01

The rating

The curve: 1916 to today

- Early fire tests varied from lab to lab
- Industry wanted one shared yardstick
- An ASTM committee led by Ira Woolson drafted a standard curve
- No surviving document explains exactly how its shape was chosen

1917-18

Proposed via ASTM; published as ASTM C19

1928

Ingberg burns real office contents and proposes equal-area

Today

Same curve in ASTM E119 / UL 263; 2024 IBC 703.2.1 still points to them

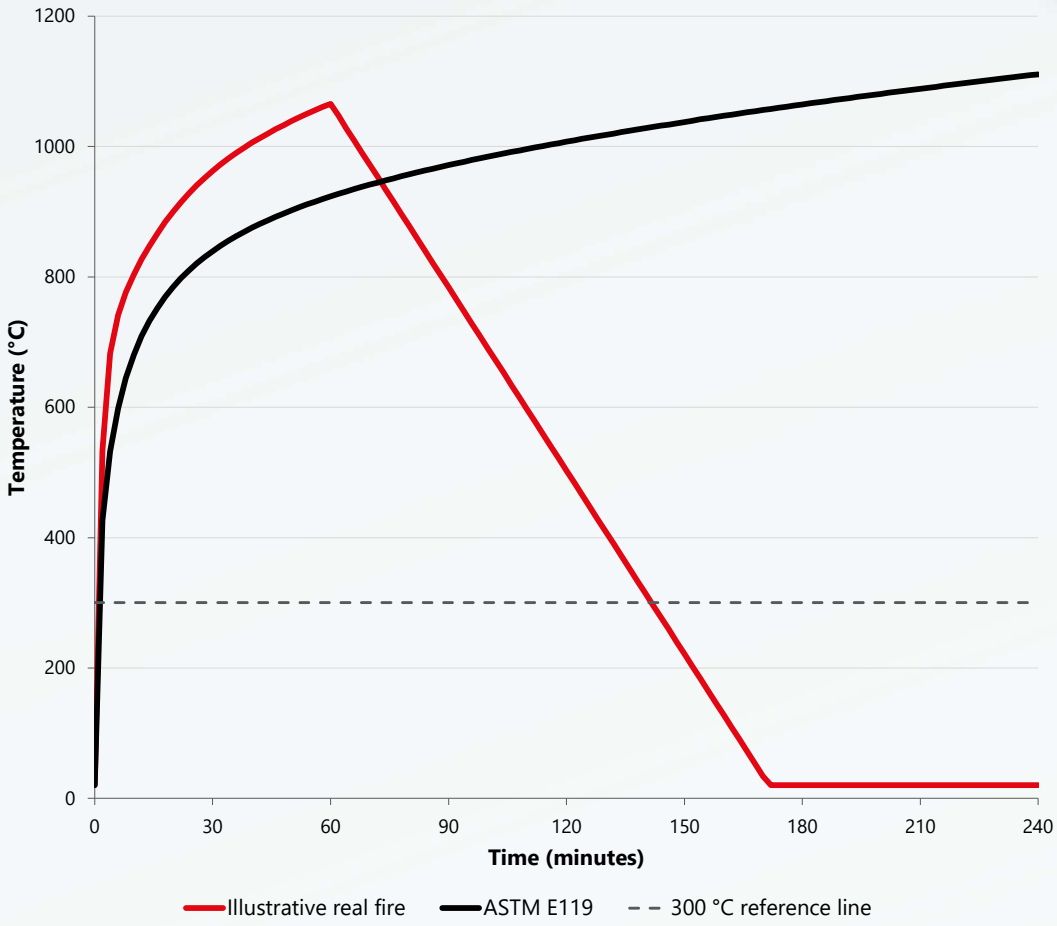
The curve, point by point

Time	°F	°C (approx.)
5 min	1000	538
10 min	1300	704
30 min	1550	843
1 hour	1700	927
2 hours	1850	1010
4 hours	2000	1093

No cooling phase: it keeps rising for as long as the test runs

ISO 834, used outside North America, runs almost the same path

Ingberg's equal-area idea





Same area = same severity?

Area under this fire matches E119 run for ~118 minutes

So it would be called about a 2-hour fire, even though it peaked hotter and earlier

Inside the furnace

Exposure

Furnace follows the standard curve

Load

Assemblies carry their design load

Thermocouples track the steel

Test stops when a criterion is reached

Rating = time achieved

Then compared across products

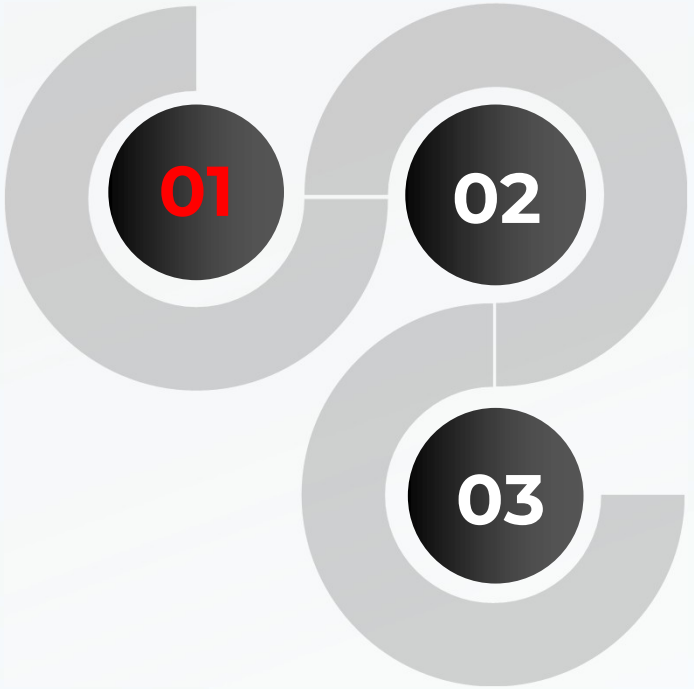


Steel ratings: beams and columns

How steel members earn a rating

- Beams, loaded: the beam in its floor assembly carries its load for the rating period
- Steel-temperature limits. Beams: average ≤ 1100 °F (593 °C), any point ≤ 1300 °F (704 °C)

  Columns: average ≤ 1000 °F (538 °C), any point ≤ 1200 °F (649 °C)



Restrained & unrestrained ratings

Two classifications from the same floor test

Restrained



Assembly held against thermal expansion. Restraint can help, so the code asks for proof the real building qualifies.

Unrestrained



Free to expand. Judged on tighter criteria, including steel temperature. The default unless shown otherwise.

Design listings

Design No. X-000 (ILLUSTRATIVE)

Restrained assembly rating: 2 hr

Unrestrained assembly rating: 2 hr

Unrestrained beam rating: 2 hr

1. Steel beam: W8x28 min. size

2. Sprayed material: listed types only, thickness per beam table

3. Min. avg. density as stated in the listing

4. Steel clean, or primed with compatible primer

5. Floor: concrete over steel deck

Which rating? Restrained or unrestrained

Minimum member size, and W/D limits

Thickness AND density, together

Substrate and primer conditions

Illustrative mock-up for teaching. This is NOT an actual UL design. Always read the current listing.

Why the curve has lasted 100+ years



- Repeatable in any lab
- Fair comparison of products
- A century of test data
- **Code ratings are calibrated to it**
- Simple to specify and inspect

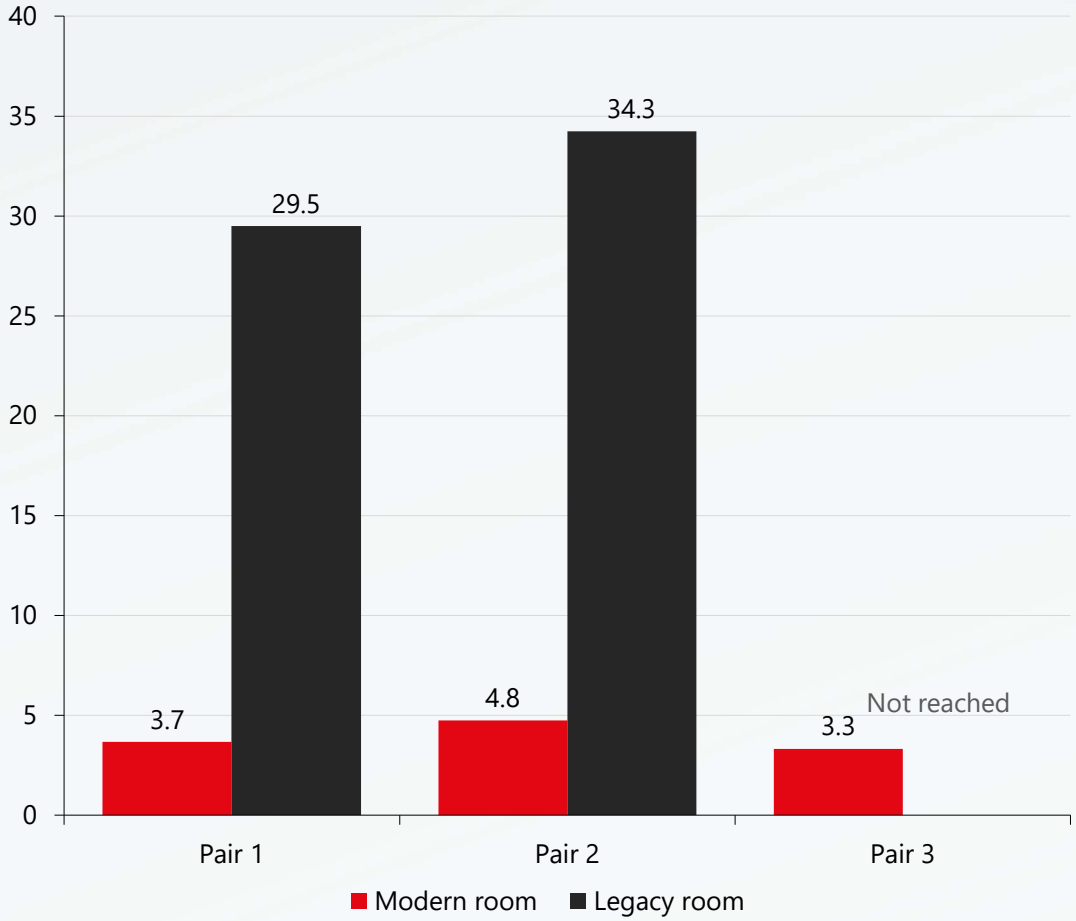

The curve isn't a fire.
It's a ruler.



THE DEBATE

Should the curve be more severe?

Time to flashover (minutes)





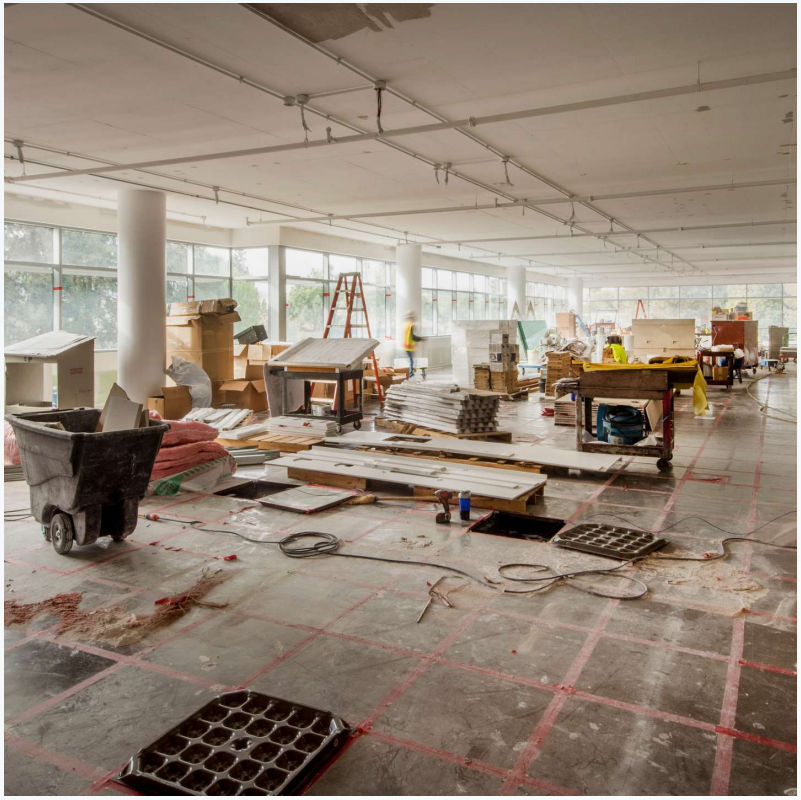
700%+

longer to flashover in the legacy rooms

Source: Kerber, Fire Technology (2012), Table 8

More fuel, more space

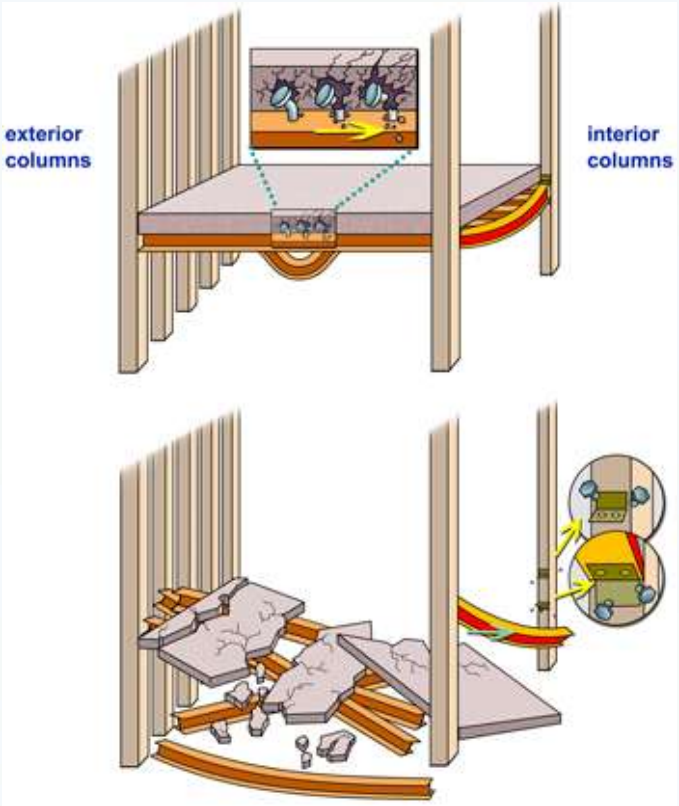
- More plastics and synthetics in contents
- Open plans: more fuel and more air in one space
- Large glazed facades change ventilation
- On big floor plates, fires can travel, heating steel at different times
- Real fires decay and cool; the furnace never does
- Design fuel loads vary by occupancy, so there's no single 'real fire'



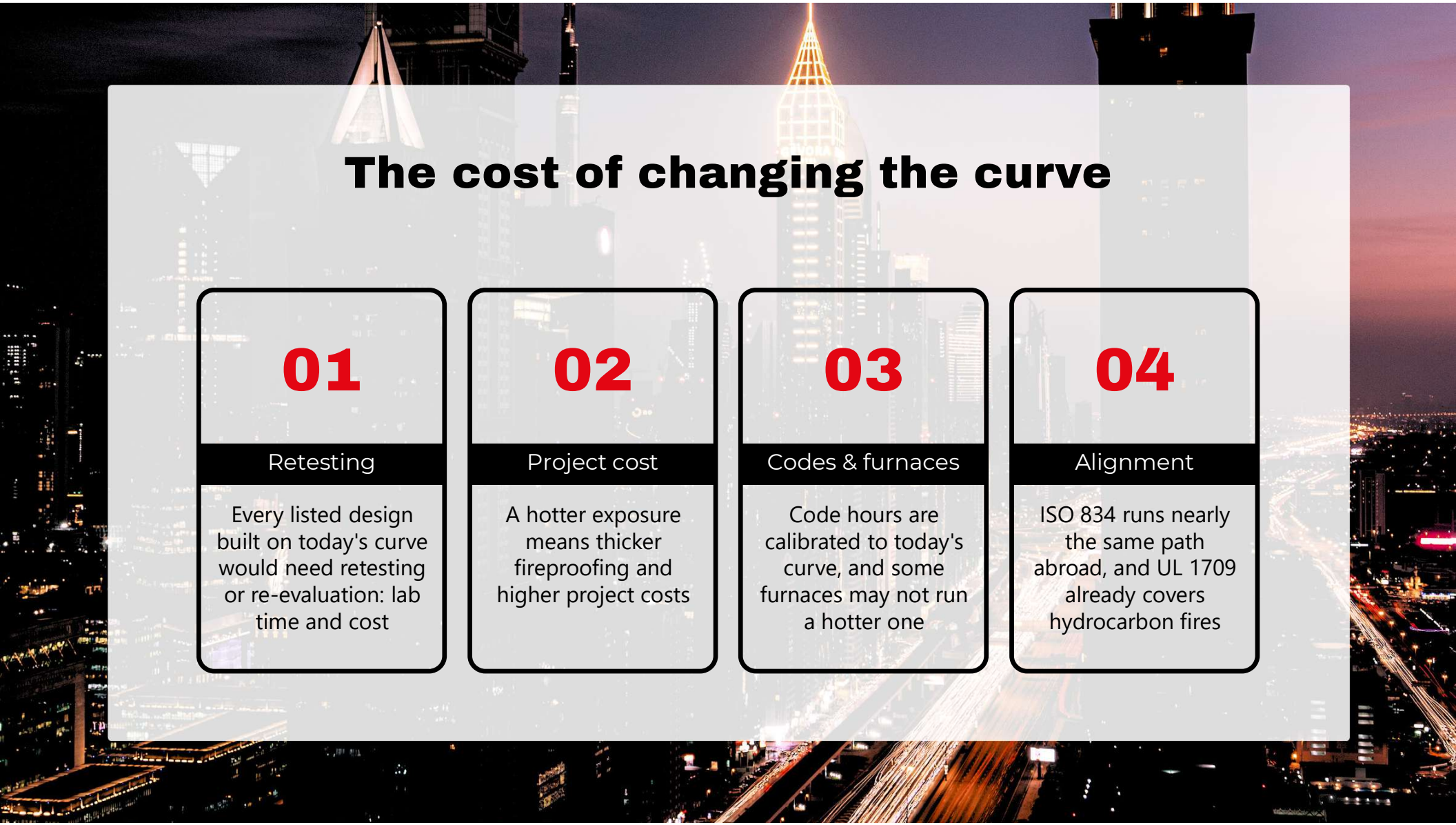
Open floor plate during construction

Case study: WTC 7 (2001)

- 47-storey office building; fires burned for almost 7 hours
- No water for the sprinklers
- Floor beams expanded and pushed a girder off its seat at Column 79
- Occurred at or below about 400 °C (750 °F)
- First known total collapse of a tall building primarily due to fire



Graphic: NIST, thermal expansion in WTC 7 (NCSTAR 1A)



The cost of changing the curve

01

Retesting

Every listed design built on today's curve would need retesting or re-evaluation: lab time and cost

02

Project cost

A hotter exposure means thicker fireproofing and higher project costs

03

Codes & furnaces

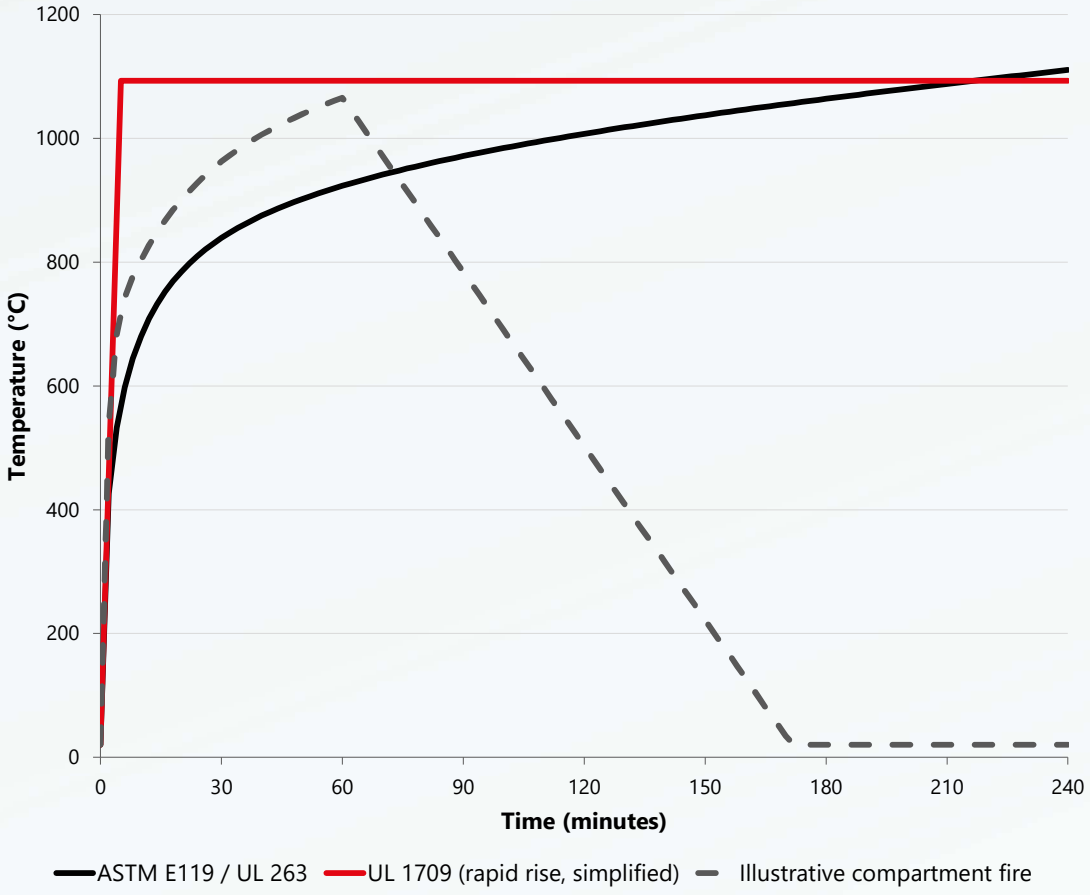
Code hours are calibrated to today's curve, and some furnaces may not run a hotter one

04

Alignment

ISO 834 runs nearly the same path abroad, and UL 1709 already covers hydrocarbon fires

Three exposures, one chart



UL 1709

Already exists for hydrocarbon fires: 2000 °F (1093 °C) within 5 minutes, then held

E119

Reaches 1093 °C only at 4 hours

Real fire

Depends on fuel, air and the room. It also cools

Both sides are right about different questions.

Fire science asks: how hot can a real fire get?

The code asks: how do products compare fairly?





PART 02

Prescriptive and PBD designs



Same safety goal, different designs

Amount, location and type differ because of

1	2	3
Heat	Materials	System
How heat is generated and transferred	How steel and fireproofing degrade	How the whole structure responds

Real compartment fires

- Growth, flashover, fully developed fire, then decay
- Gas temperature = heat released vs heat lost
- ASTM: the exposure may not represent all fire conditions

Growth

Fuel ignites; fire spreads until flashover



Fully developed

Losses: openings (convection + radiation), boundaries (conduction)

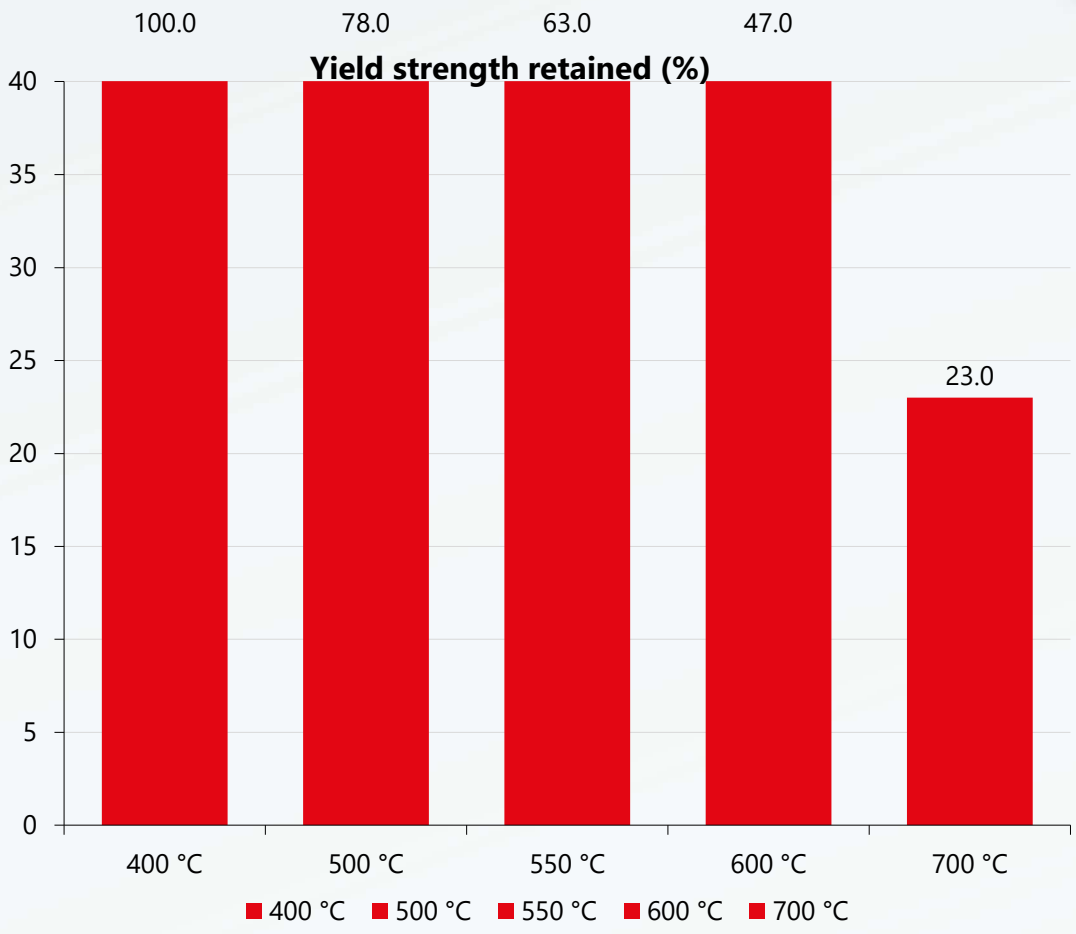


Decay

Fuel burns out and gases cool. The furnace never does



Steel weakens as it heats



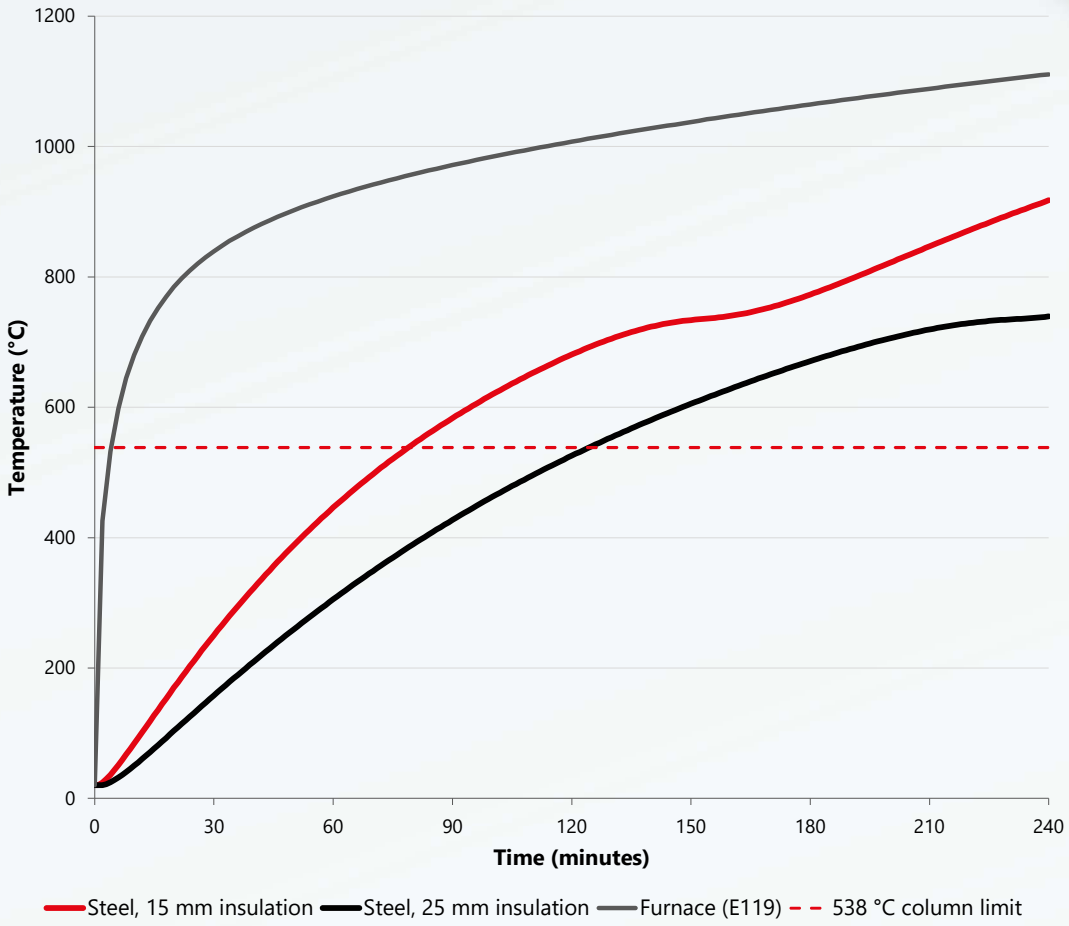


~47%

yield strength left at 600 °C

EN 1993-1-2 Table 3.1 (550 °C interpolated). Stiffness drops earlier, above ~100-200 °C

Thickness buys time





15 mm: 538 °C at ~79 min

25 mm: 538 °C at ~124 min

Illustrative EN 1993-1-2 calculation, generic insulation (k = 0.10 W/m·K, 300 kg/m^3), section factor 150 m^{-1}. Not a listed product.



SFRM vs intumescent

Passive insulation: thickness, density, conductivity

SFRM

Reactive: swells often 10-100× into a porous char

INTUMESCENT


Both systems:
limit the heat.

The scientific difference

Aspect	Standardized prescriptive testing	Performance-based design
Fire exposure	Fixed rising curve, no decay	Scenario-specific (parametric, CFD, etc.), includes decay
Structural scope	Isolated member/assembly	Whole system (redistribution, membrane action)
Failure criterion	Temperature rise, load capacity under test load	Explicit performance objectives for the scenario
Resulting protection	Thickness from listing for a given rating	Optimized based on calculated temperatures and system response



PART 03

PBD: the modelling chain

Three routes in the 2024 IBC

Section 703.2: how a fire-resistance rating can be established

703.2.1

Tested assemblies

ASTM E119 or UL 263 listings

703.2.2

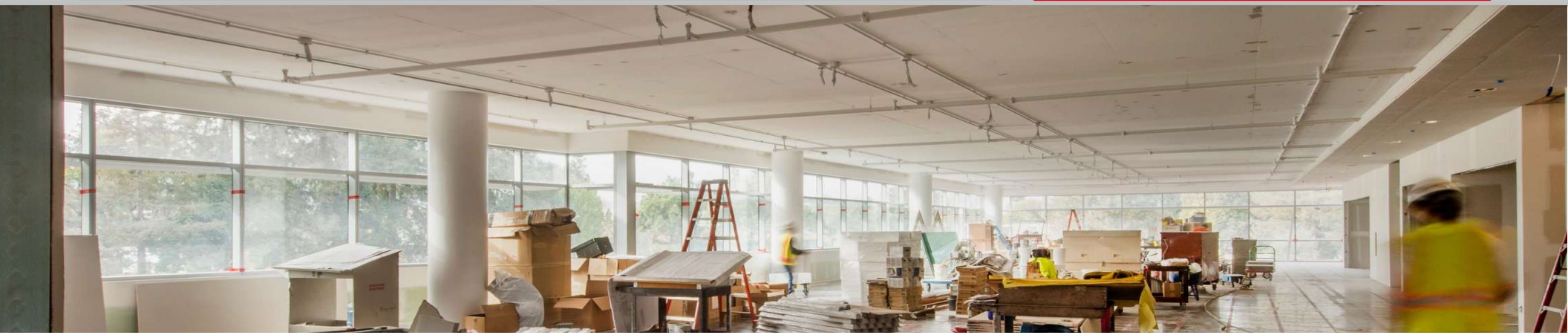
Analytical methods

Approved sources, Section 721 prescriptive designs, Section 722 calculations, engineering analysis, certified designs

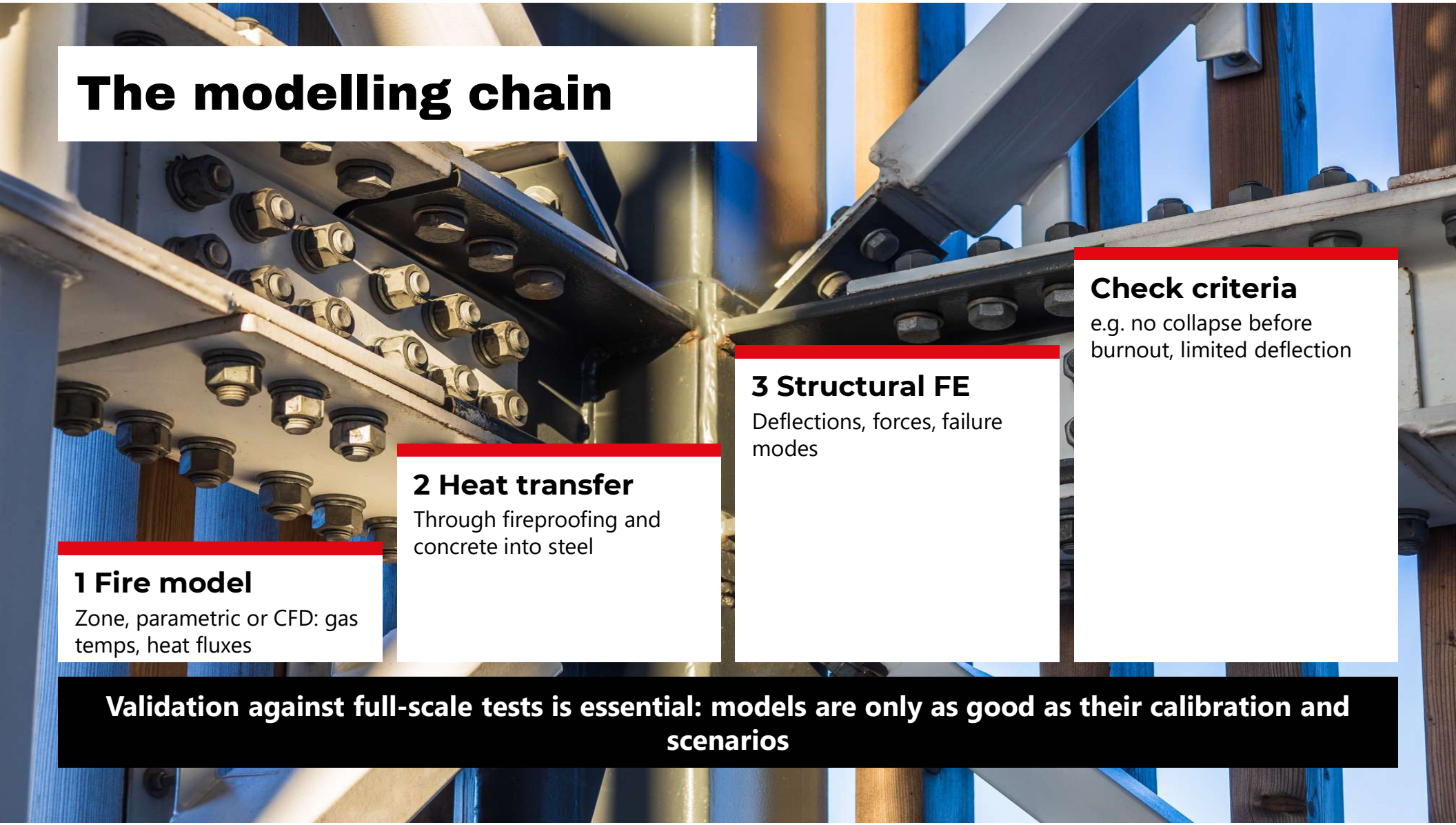
703.2.3

Approved alternative method

Via Section 104.2.3. The usual door for performance-based structural fire design



The modelling chain



1 Fire model

Zone, parametric or CFD: gas temps, heat fluxes

2 Heat transfer

Through fireproofing and concrete into steel

3 Structural FE

Deflections, forces, failure modes

Check criteria

e.g. no collapse before burnout, limited deflection

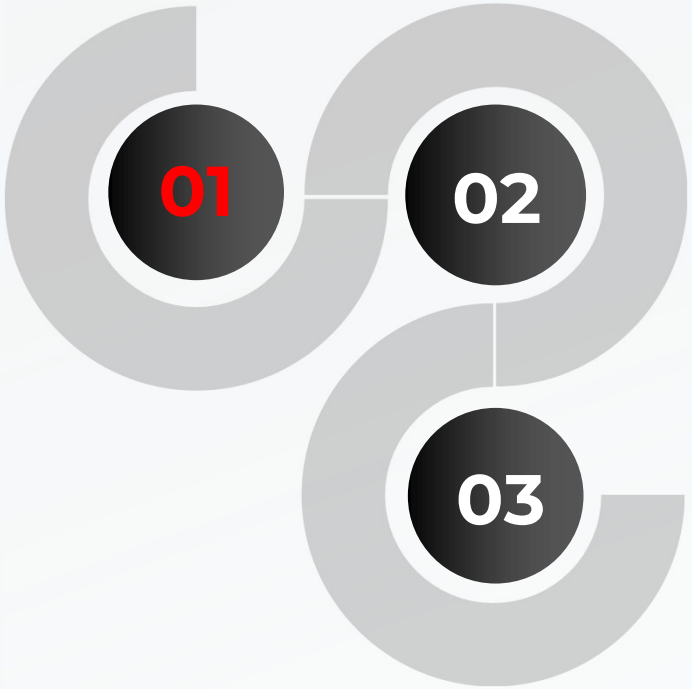
Validation against full-scale tests is essential: models are only as good as their calibration and scenarios

Step 1: Fire model

What fire does the structure face?

- Zone model, parametric curve, or CFD (e.g. FDS)
- Output: gas temperatures or heat fluxes consistent with the compartment and fuel

Scenarios: fuel load, ventilation, fire location, travelling fires

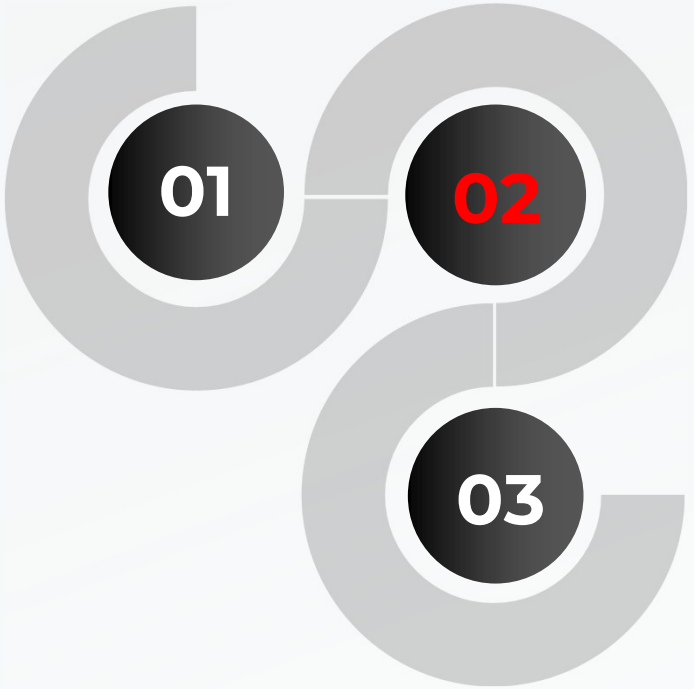


Step 2: Heat transfer

From fire to steel

- Temperature field through the fireproofing (and any concrete) into the steel
- Temperature-dependent properties; convection + radiation from the fire

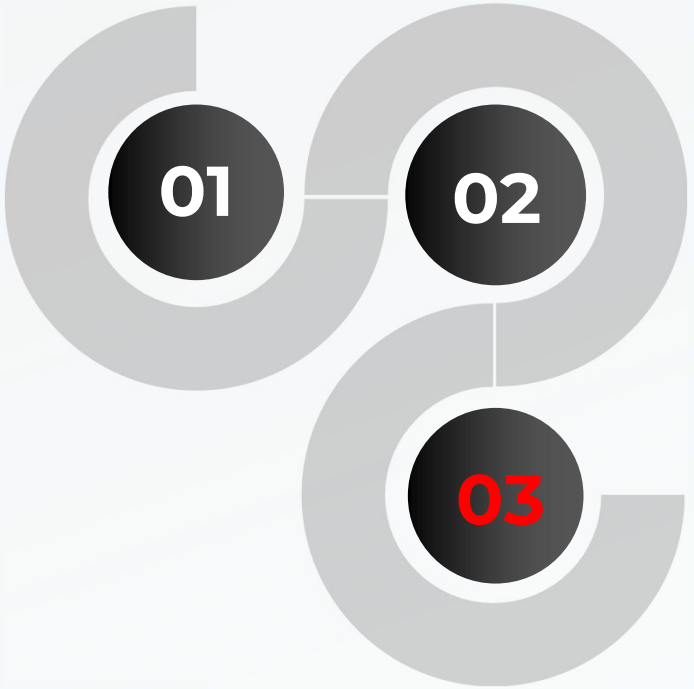
Section factor (W/D) and insulation set how fast the steel heats



Step 3: Structural analysis

From steel to structure

- FE model: temperature-dependent strength, stiffness and thermal expansion
- Checks explicit criteria: no collapse before burnout, limited deflection, reliability target



Who checks the engineer?

- The approving side is often the weak link: few officials see structural fire PBD regularly
- Independent peer review is common practice for PBD submittals
- Models are only as good as their calibration and the scenarios chosen





What the ASCE / Pankow exemplar designs found (2020)

1 less fireproofing in one design's moderate fire scenario

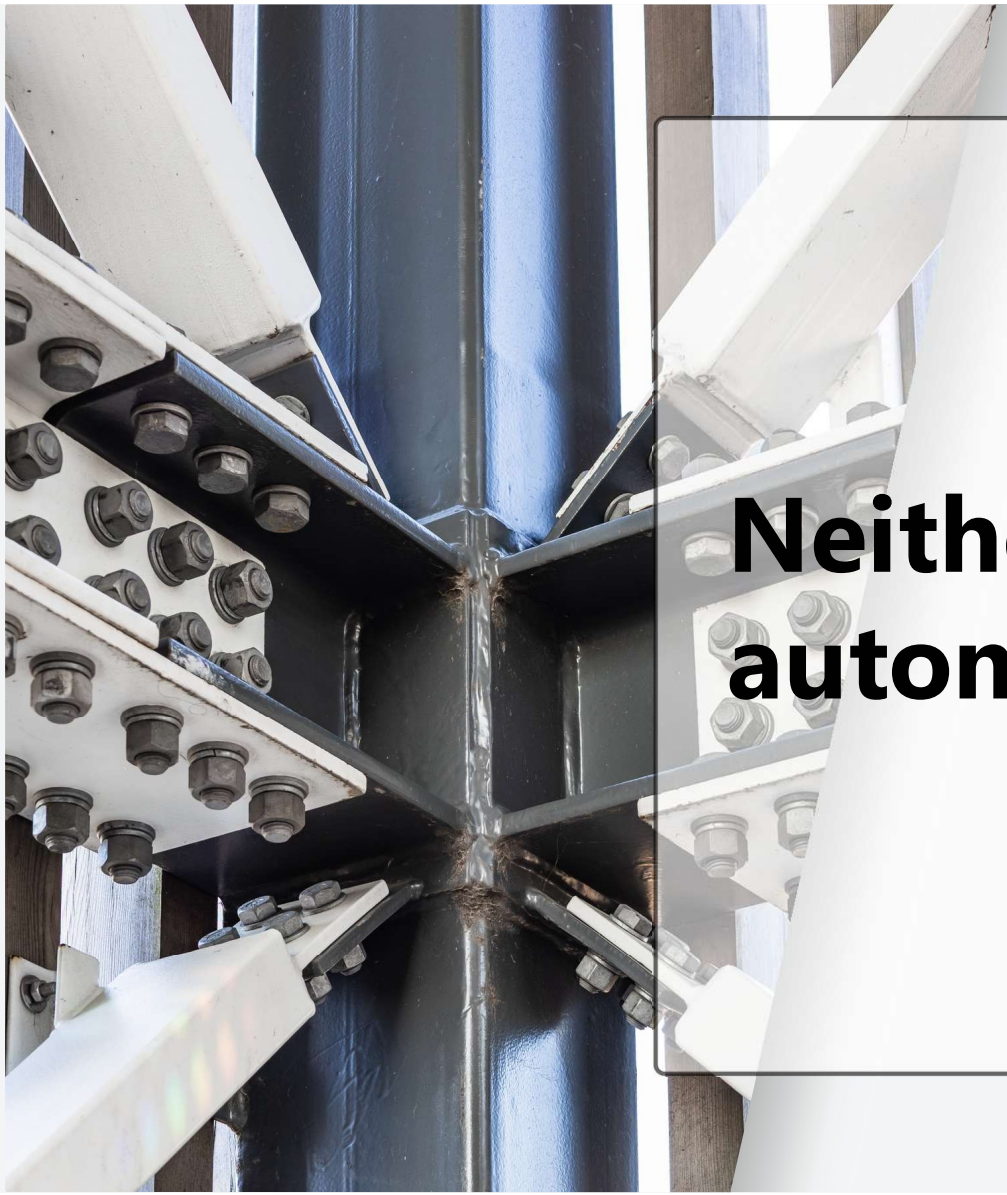
2 more for that same design in its severe scenario

3 extra protection beyond beam connections in one scenario

Four regionally diverse example buildings, designed with ASCE 7-16 Appendix E. Results vary by building and scenario.



Sometimes less, sometimes more



Neither is automatically safer

The risk difference (1 of 2)

Issue	Test-based / prescriptive	Performance-based
Main risk	Real fire differs from the standard curve; system effects ignored	Wrong inputs, modeling errors, or poor assumptions
Where mistakes show up	Usually during application or inspection (thickness, coverage)	During analysis (harder to spot) or if scenarios are incomplete
Ease of catching errors	Relatively high	Lower: needs competent reviewers

The risk difference (2 of 2)

Issue	Test-based / prescriptive	Performance-based
Consequence of error	Often localized or detectable by inspection	Can be systemic if key assumptions are wrong
Safety margin	Built into the test criteria and listings	Must be deliberately added by the engineer



PART 04

What this means for fireproofers

Five changes on PBD jobs

1. More variable specifications
2. Application quality matters even more
3. Stronger documentation and inspection
4. Business and scheduling effects
5. Skills and coordination

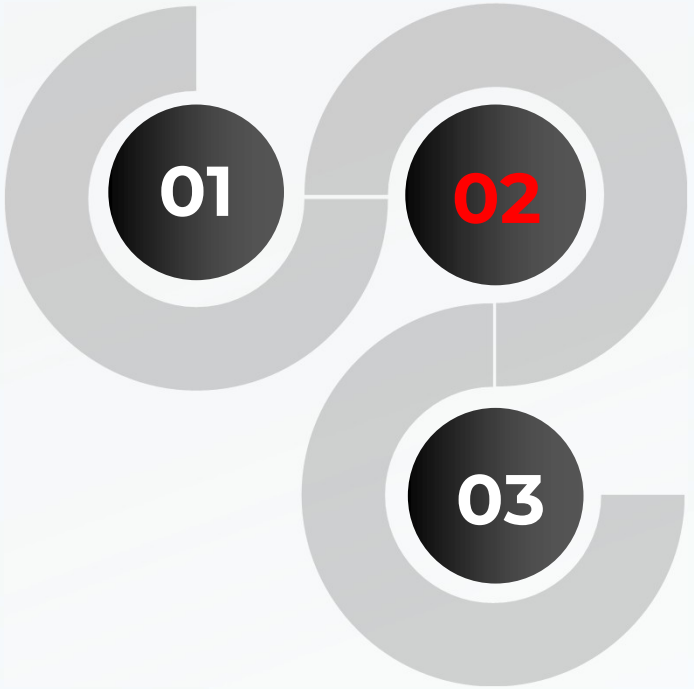


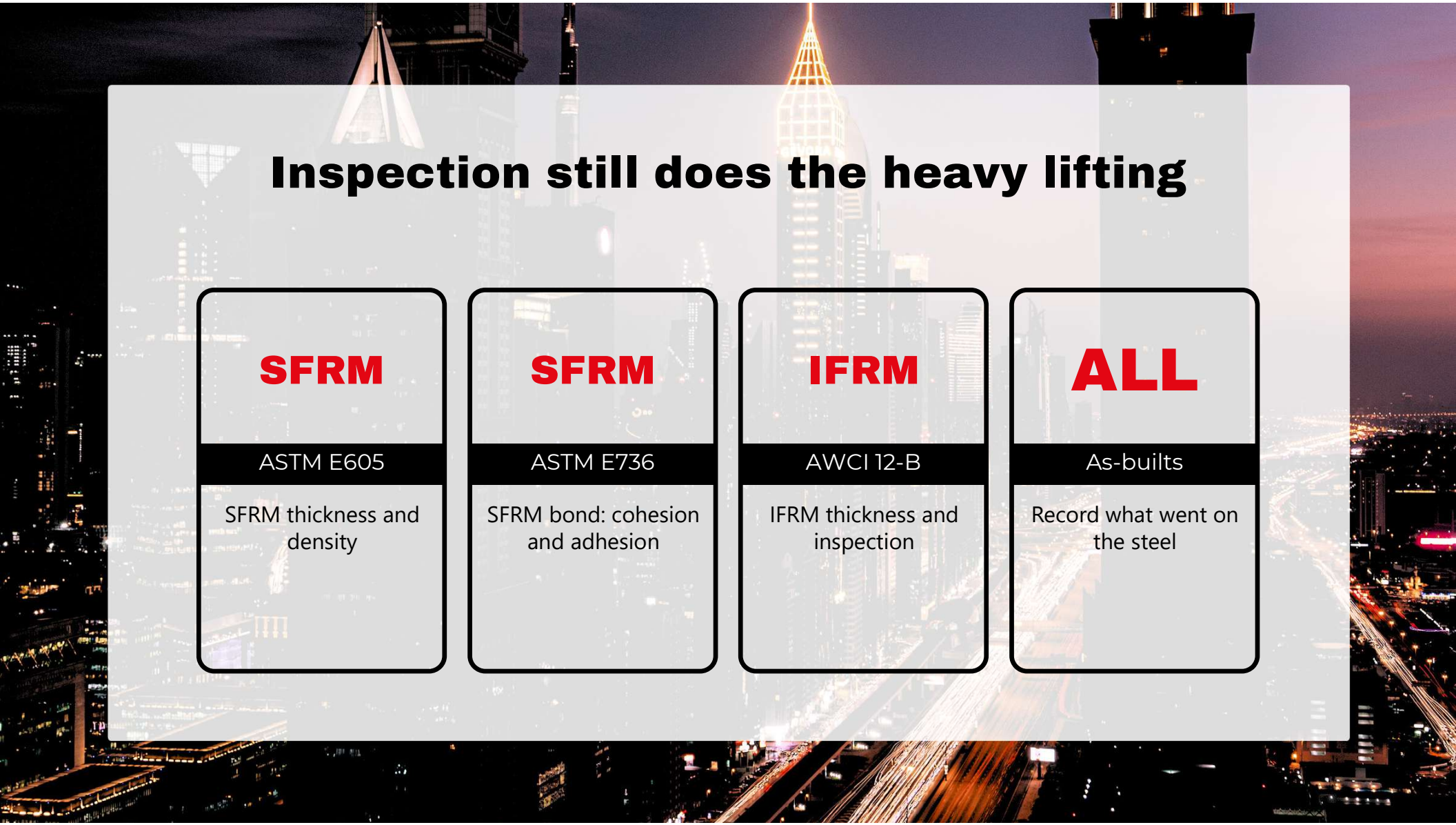
Application quality

BOTH rely on the as-installed system

- Surface preparation and thickness control
- Primer/topcoat compatibility and curing conditions

Poor application can invalidate the engineered performance.





Inspection still does the heavy lifting

SFRM	SFRM	IFRM	ALL
ASTM E605	ASTM E736	AWCI 12-B	As-builts
SFRM thickness and density	SFRM bond: cohesion and adhesion	IFRM thickness and inspection	Record what went on the steel

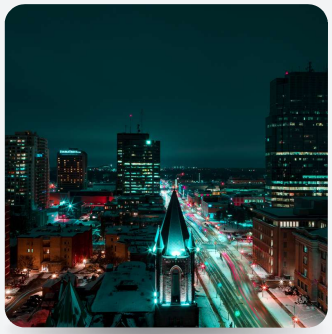
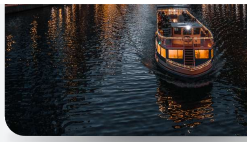
Who does what

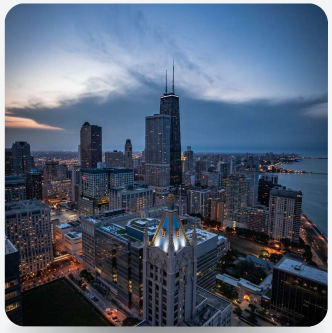
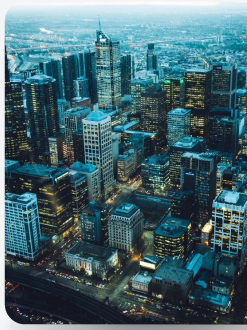
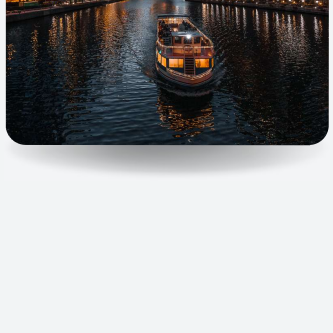
Engineer of record	Official + peer reviewer	Contractor	Special inspector
Designs and sets the thickness	Approve the design	Installs as specified	Verifies on site

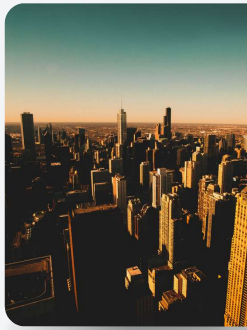
Each step depends on the one before. If the installed work doesn't match, the whole chain breaks

National Fireproofing Contractors Association






Next NFCA webinar

Tuesday, December 15, 2026, 1:00-2:00 pm CT

'Mistletoe, Milestones & Unwrapping the Year Ahead'

National Fireproofing Contractors Association



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