Research & Facade Fires

TOC

1. Innovation Blind Spot
2. Learning from tests
3. Ongoing research

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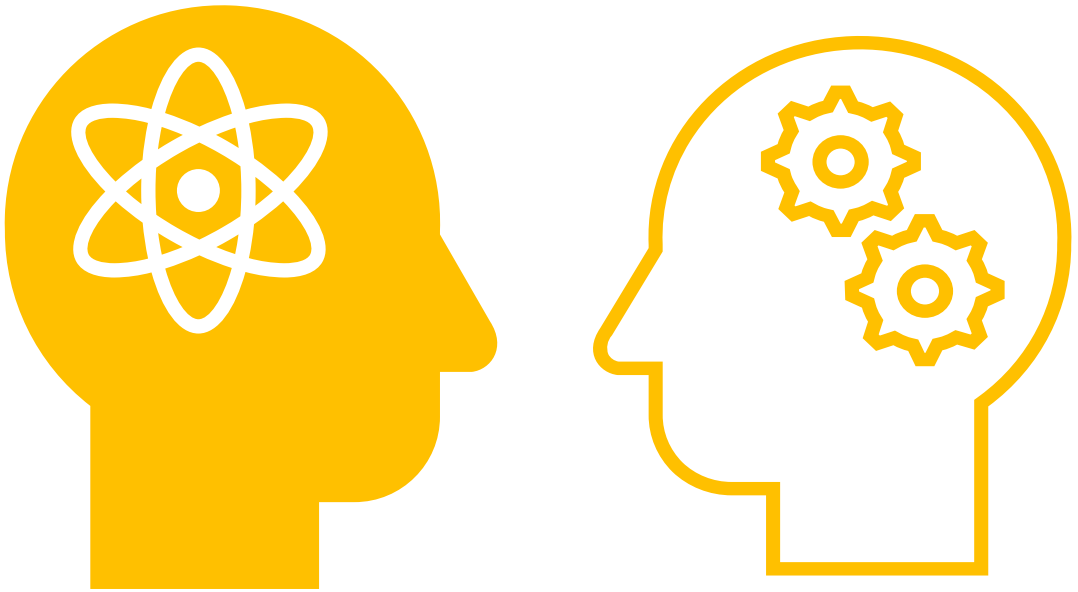
Imperial College London

Tall Buildings fire safety network

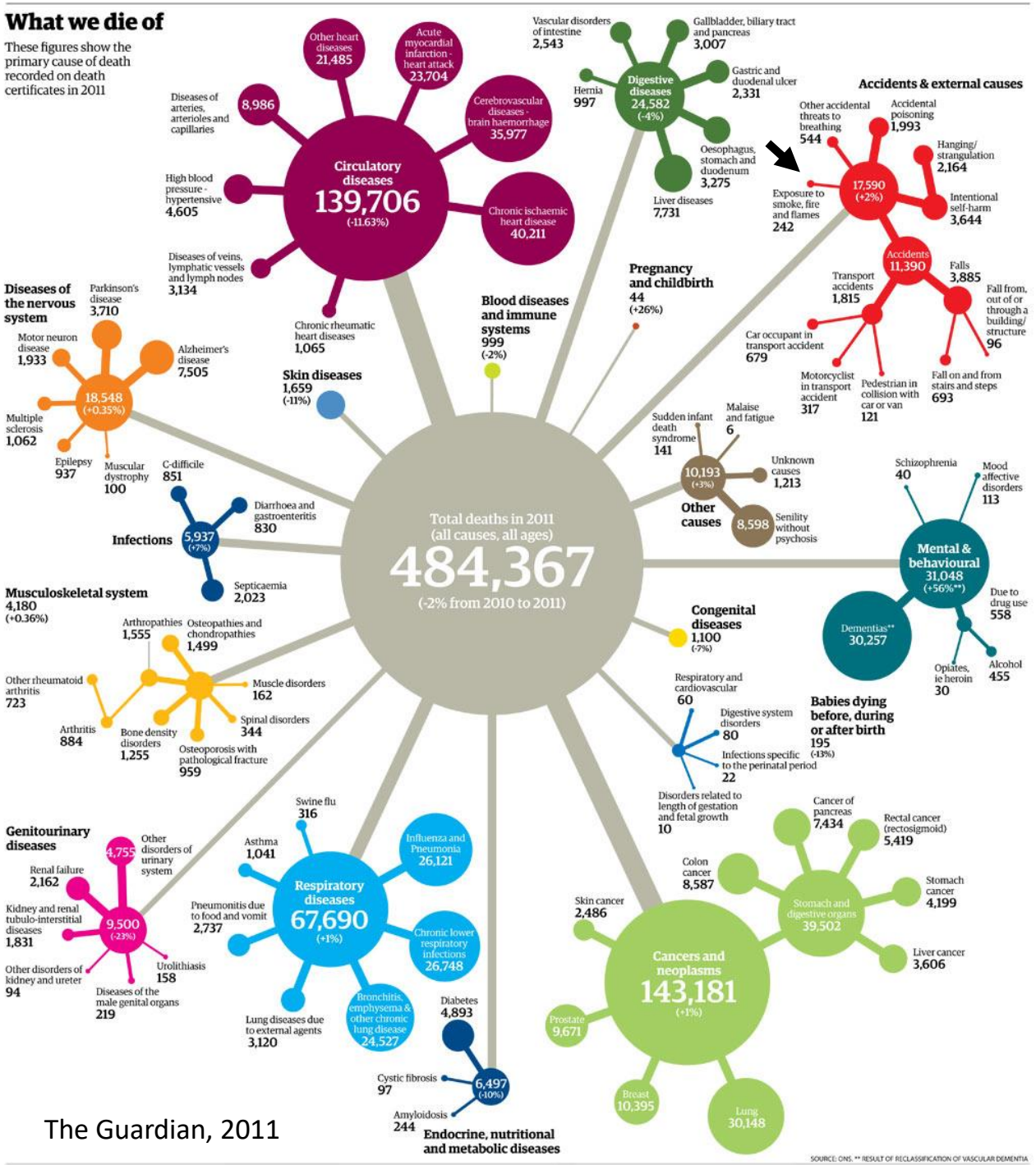
7th International High Rise/Tall Building Fire Safety Conference?
London, May 2022

Science and Engineering



Managing Expectations

Currently, there are no theories, models, or experimental series that can explain facade fires.



The Guardian, 2011

UK Causes of Death, 2011

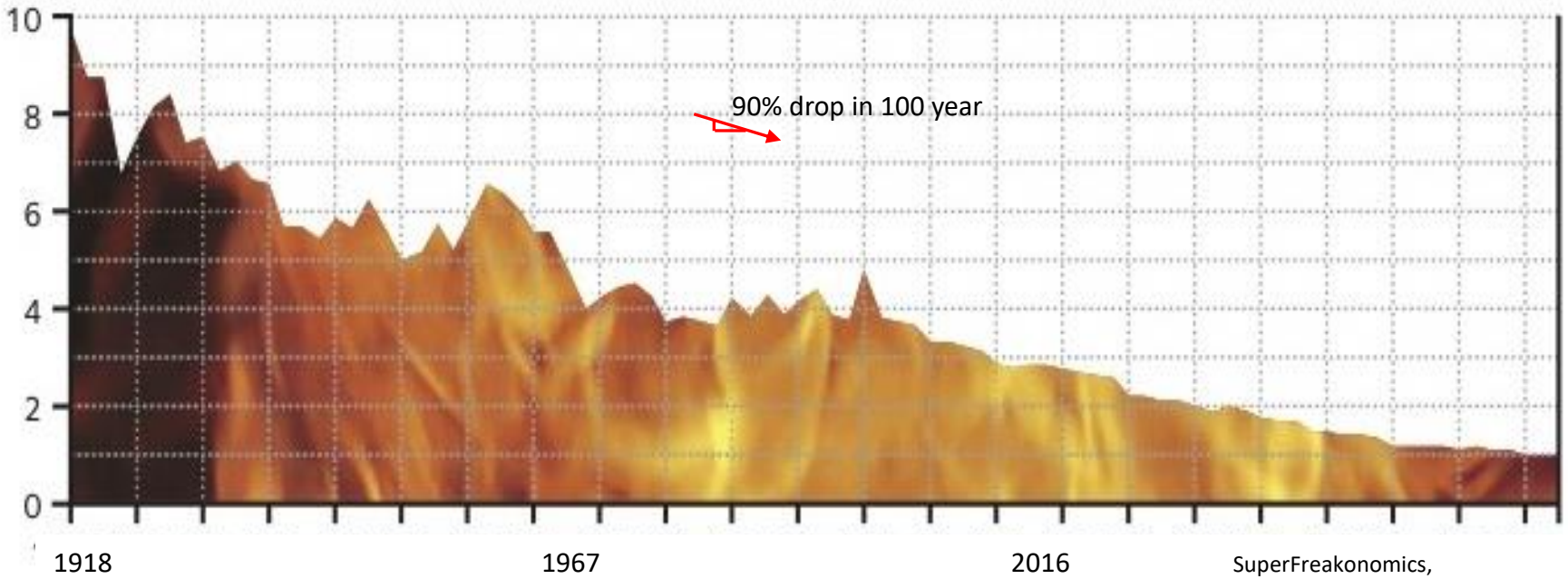
Fire is 2.1% of all accidental deaths.

More than drowning but less than food ingestion.

Deaths due to falls are 16 times higher.

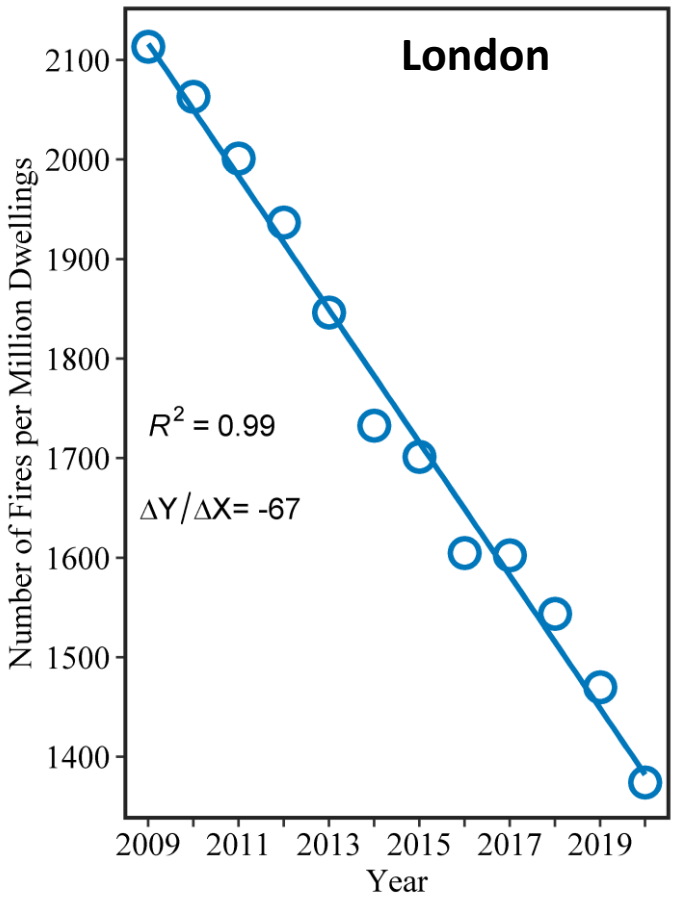
It used to be unsafe

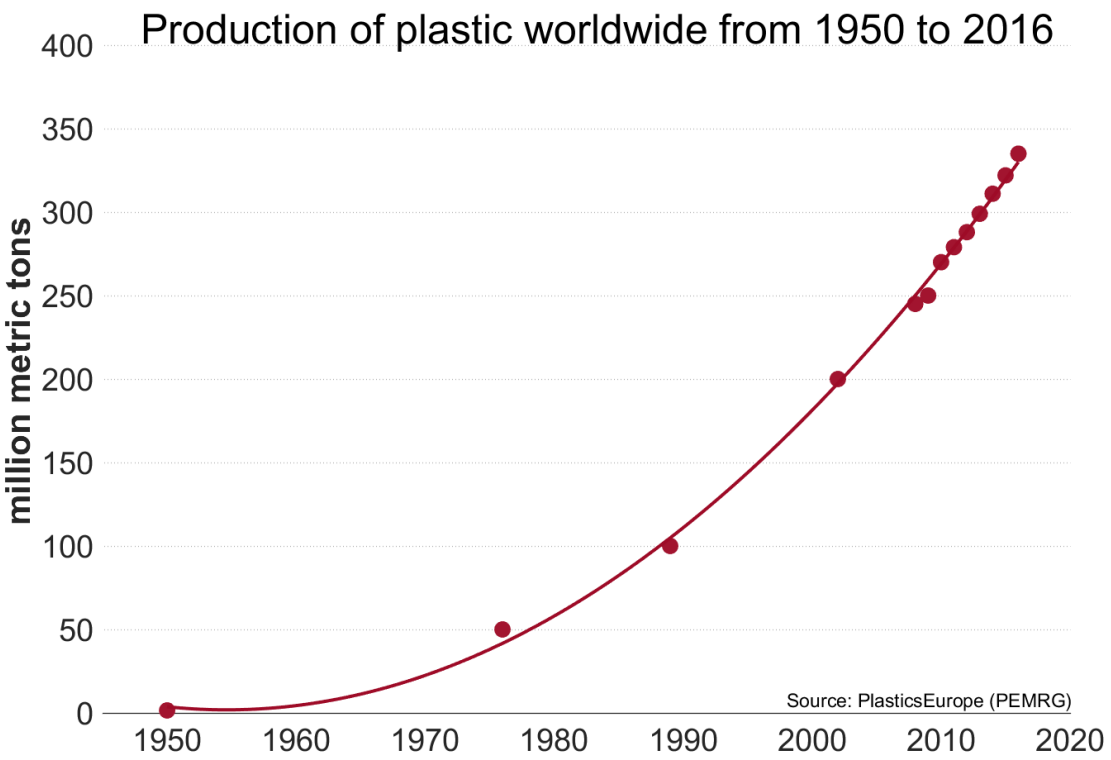
USA data: Fire deaths vs. time



SuperFreakonomics, Illustrated 2010

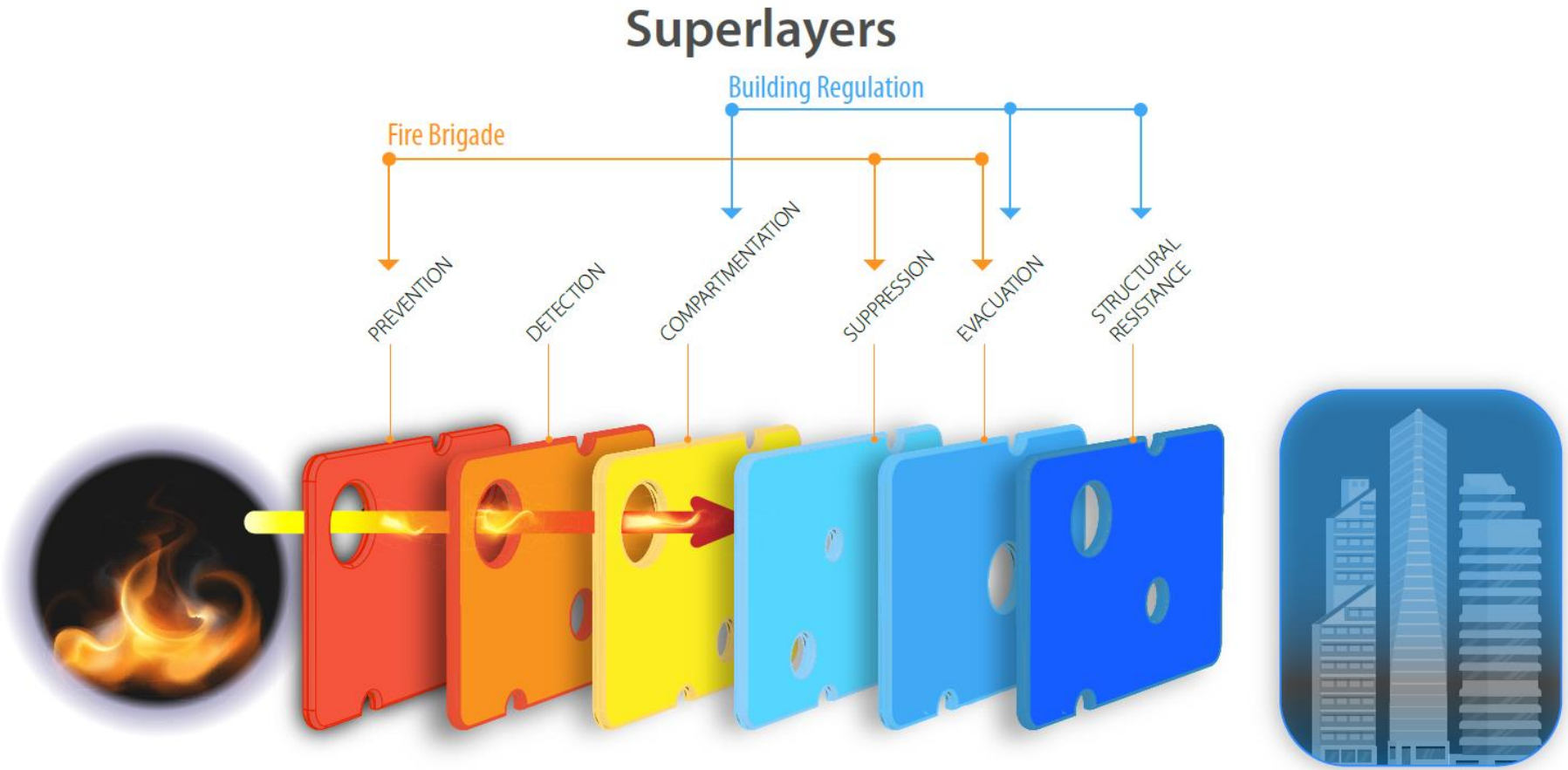
Contradictions?





1. Layers of fire protection
2. Fire Inequalities
3. Innovation Blind Spots

Answer #1: Layers of Fire Protection



The multiple layers of fire protection in buildings

Each layer may have imperfections, so multiple layers improves safety

Answer #2: Fire Inequalities

kindling
FIRE SAFETY FOR ALL

Author(s): Angelo Verzoni. Published on November 1, 2020.

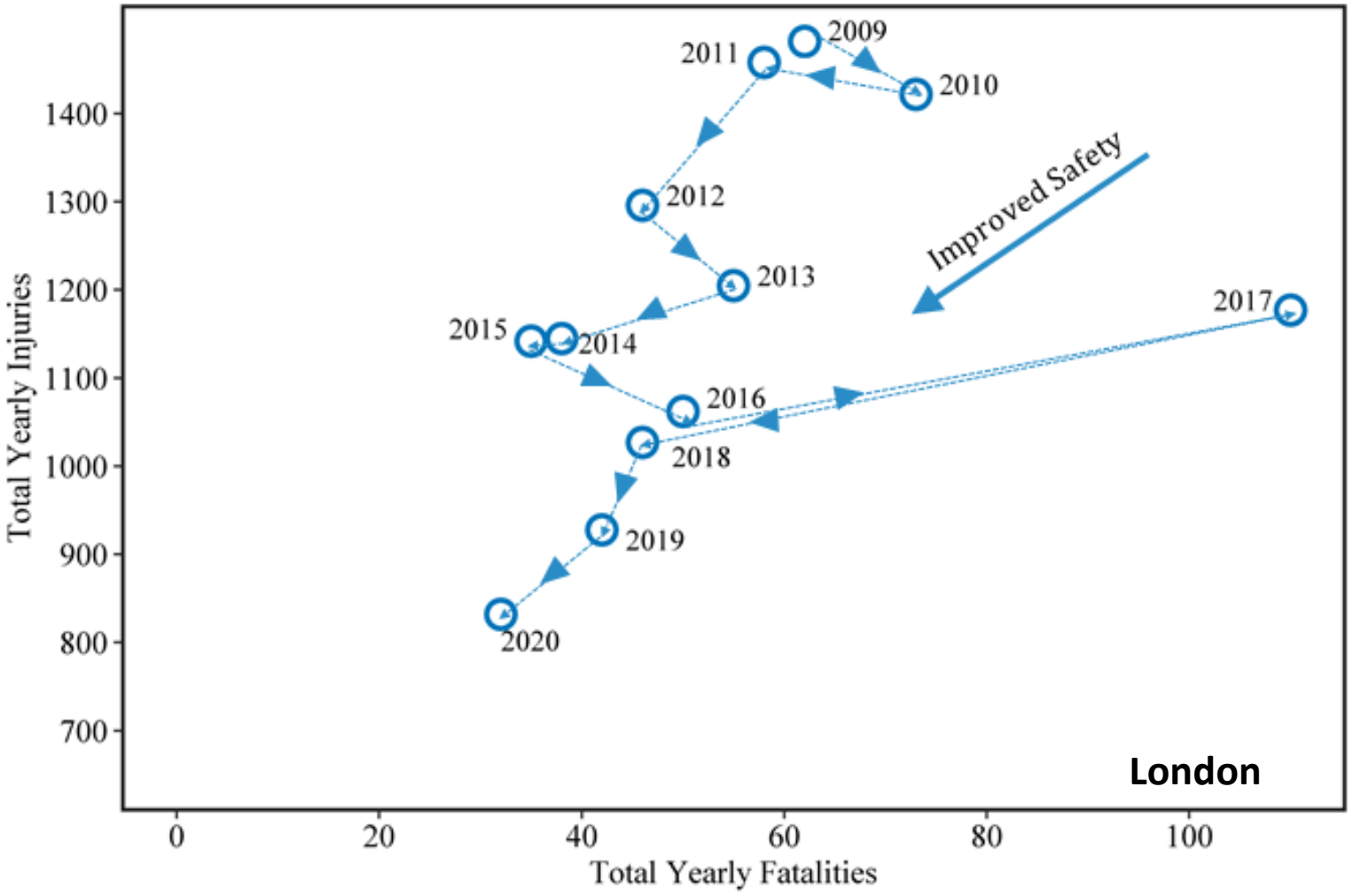
Safety for the Afflicted

For millions of people living in refugee camps or informal settlements, fire is an ever-present threat to their lives, families, and livelihoods. A young fire safety engineer hopes to address this threat and improve the lives of the displaced and disenfranchised around the world.

INTERVIEW CONDUCTED AND EDITED BY ANGELO VERZONI

- Fighting fires is costly (UK £7 billion/yr).
- Despite tremendous progress in protecting lives, fire causes 5% of injury-related deaths worldwide (war causes 2%).

Answer #3: Innovation Blind Spots



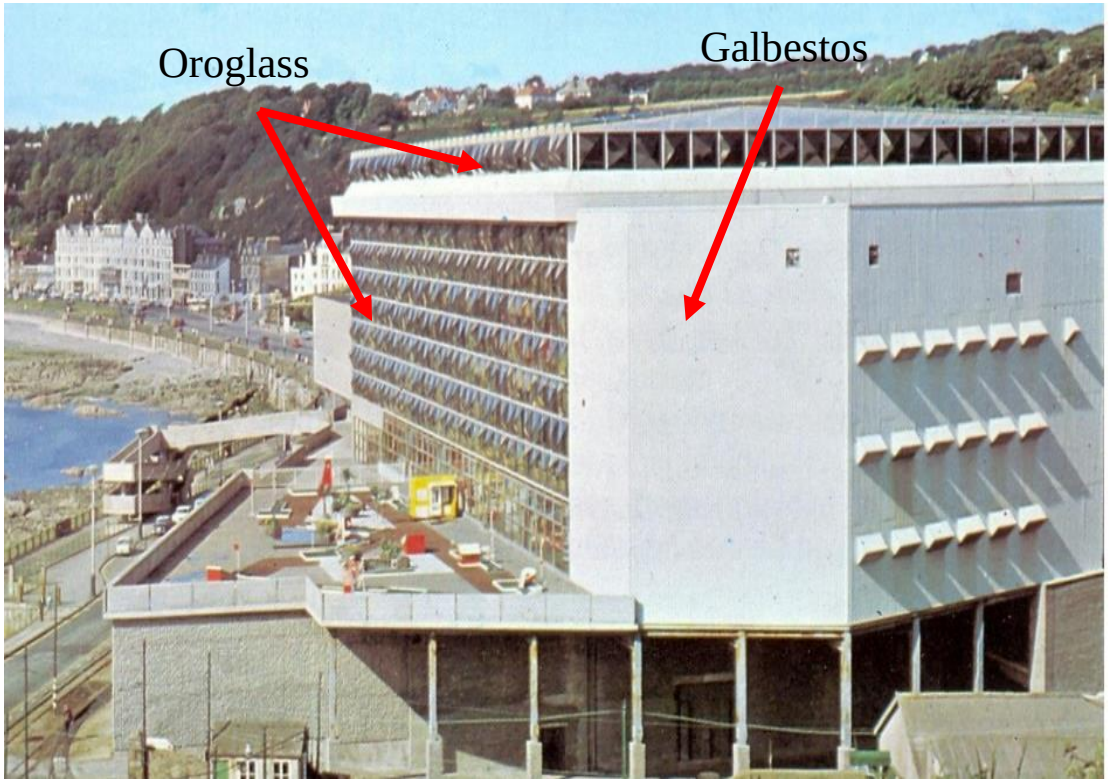
The built environment is always changing. Fire safety must keep up with innovation.

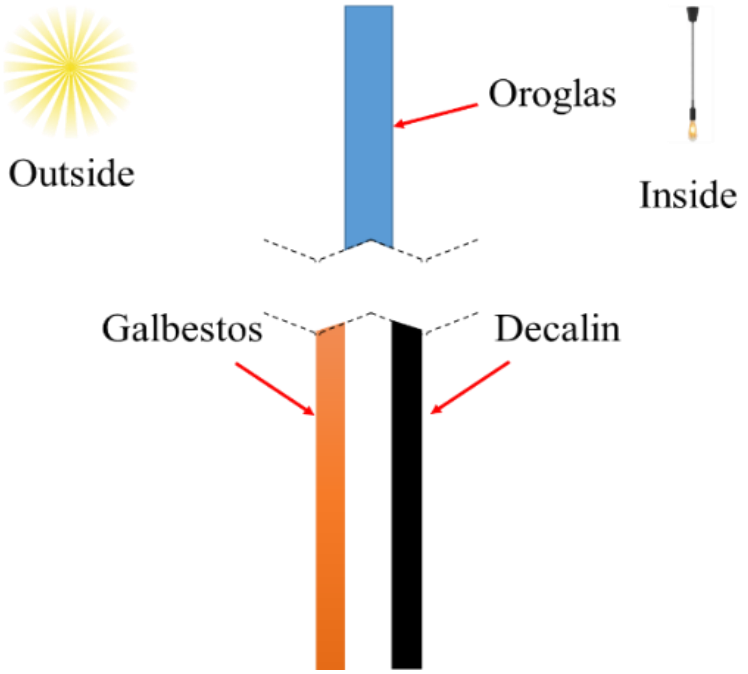
- **Novel materials and features** arrive before their fire behaviour is understood.
- **Architect's** dreams are the nightmares of fire engineers.
- Challenges arrive and **engineering solutions** provide safer buildings.

Facade Fires: Innovation Blind Spot

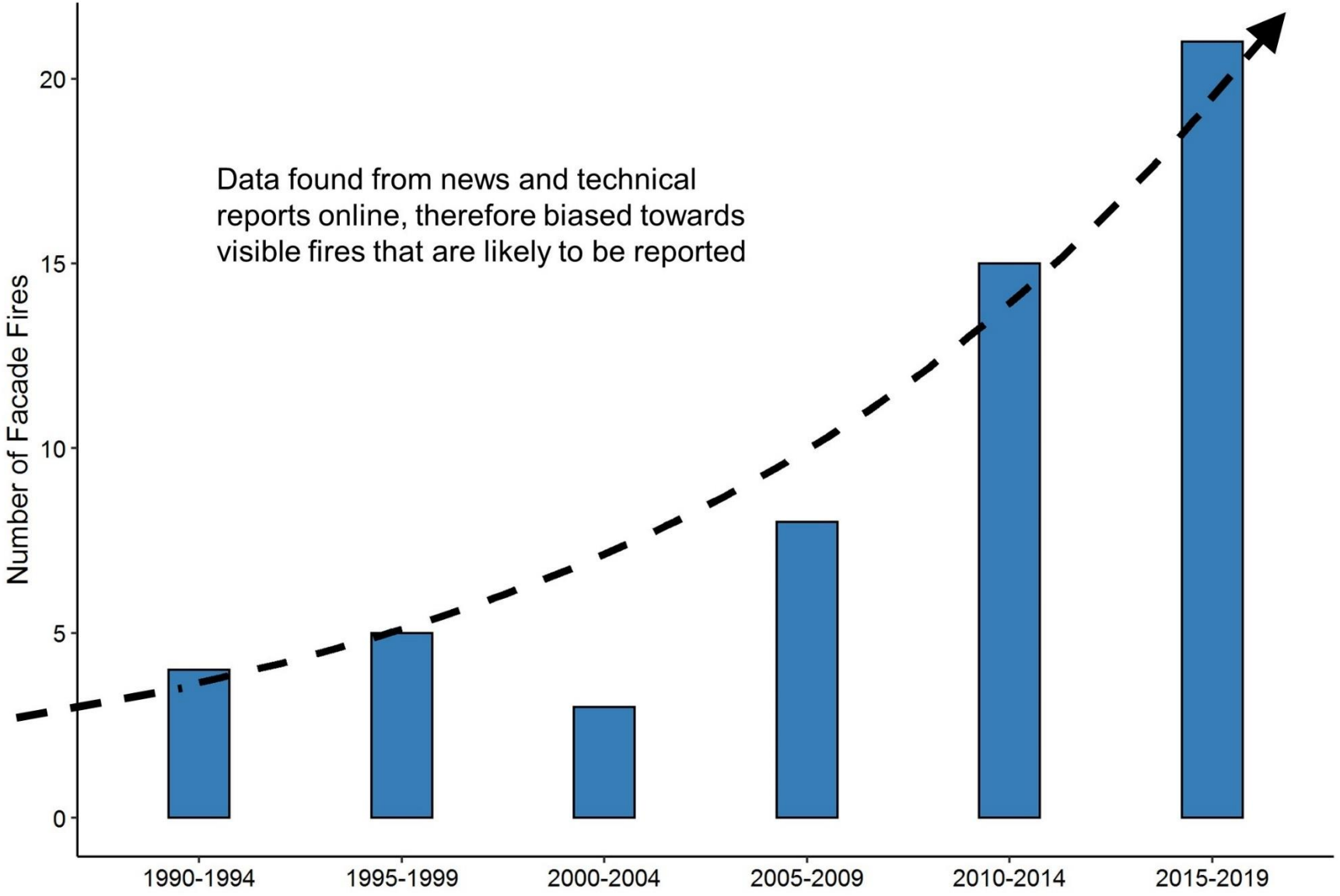
2013 facade fire in Grozny, Chechnya. huffingtonpost

Fire in Summerland Leisure Centre, Isle of Man 1973, 50 deaths





Facade fires worldwide



Facades are a Multi-Objective Design

Wind Loading

Thermal Insulation

Moisture Control

Aesthetics

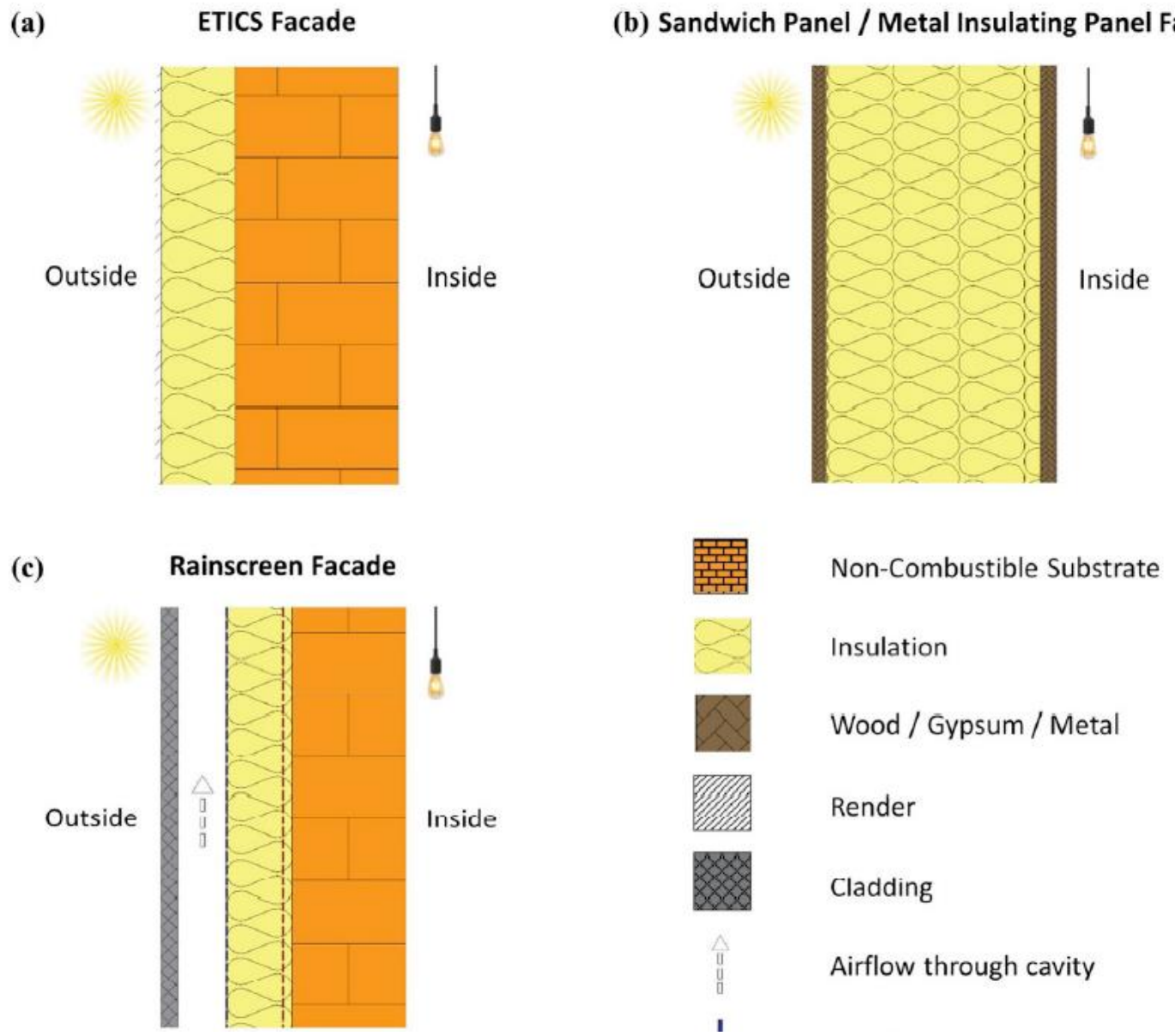
Weight

Internal Lighting

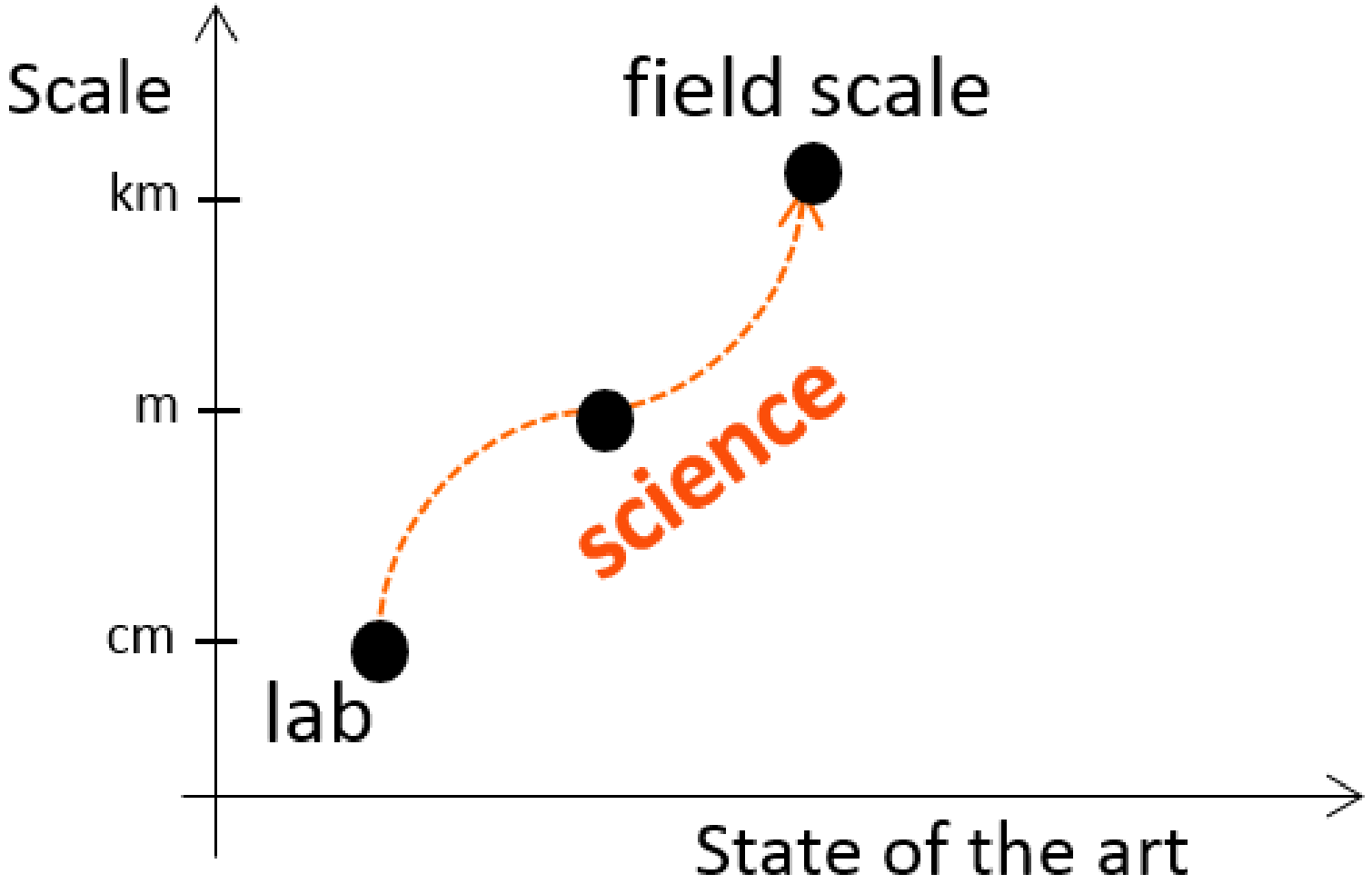
Sound Insulation

Fire Safety

Facades with Combustible Elements



Bottom Up & Top Down



Top Down

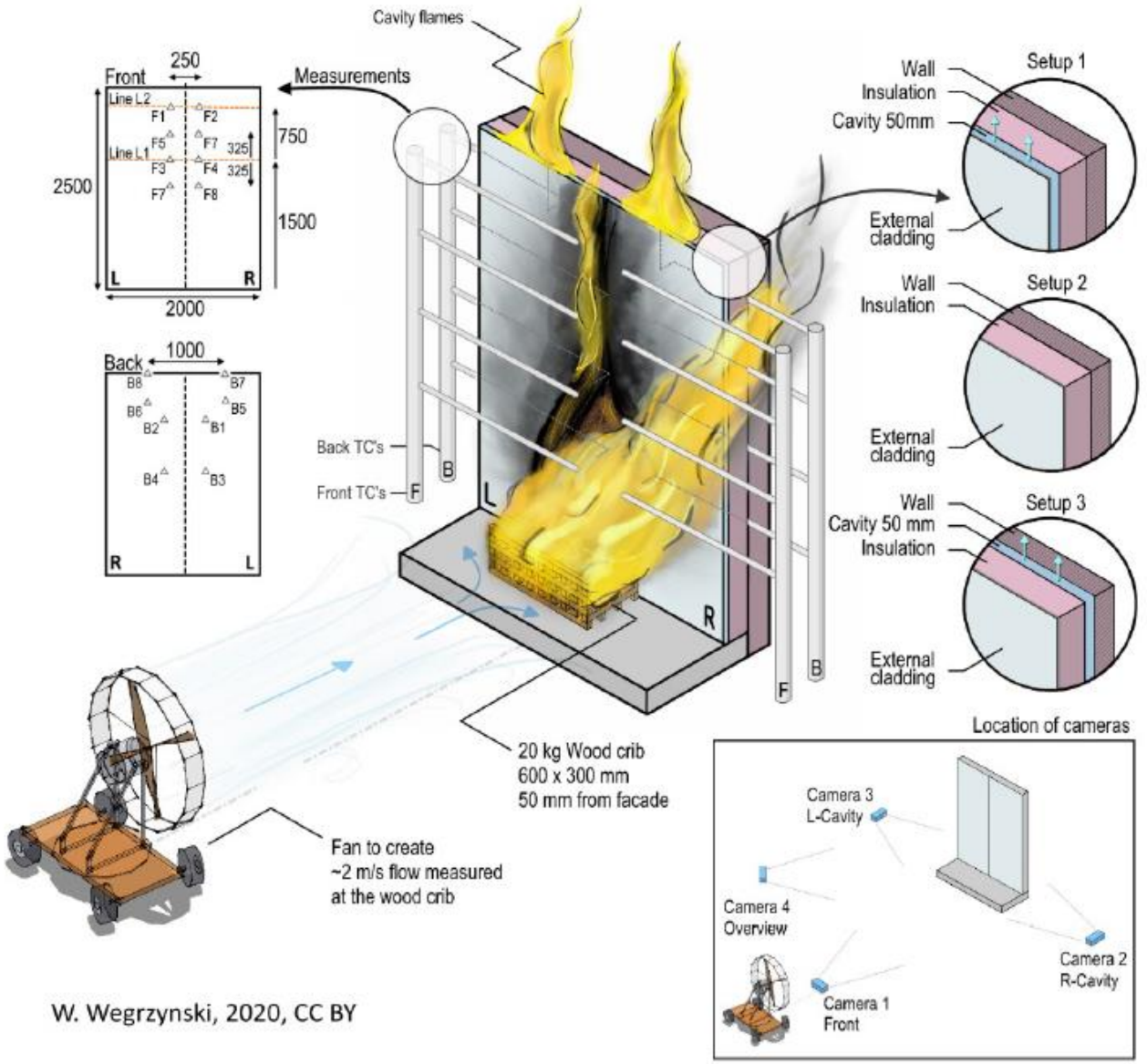
Contents lists available at ScienceDirect

Building and Environment

journal homepage: http://www.elsevier.com/locate/buildenv

KRESNIK: A top-down, statistical approach to understand the fire performance of building facades using standard test data

Matthew Bonner [a], Wojciech Węgrzyński [b], Bartłomiej K. Papis [b], Guillermo Rein [a,*]



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Pass / Fail Criteria Observed	Flammability Index Value
No failure criteria observed	1
Continued burning after 30 min	2
Flaming above 1.5 m after 15 min	3
Flaming above 2.25 m after 15 min	4
Falling droplets, solid residue, or large parts	

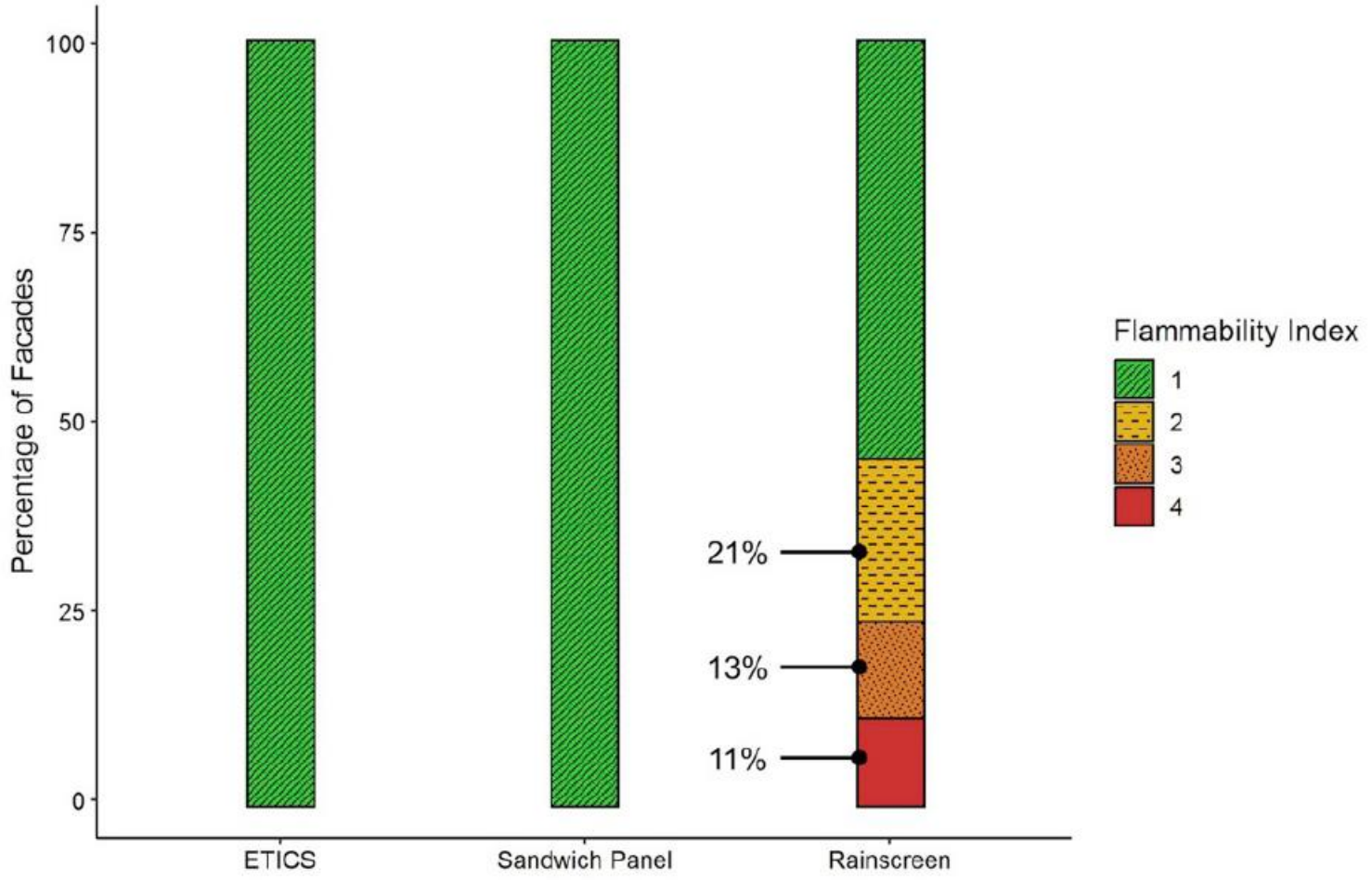

Fig. 7. Bar plot of the percentage of facades that fail for different facade types. There were a total of 24 ETICS, 21 Sandwich Panels, and 38 Rainscreen facades

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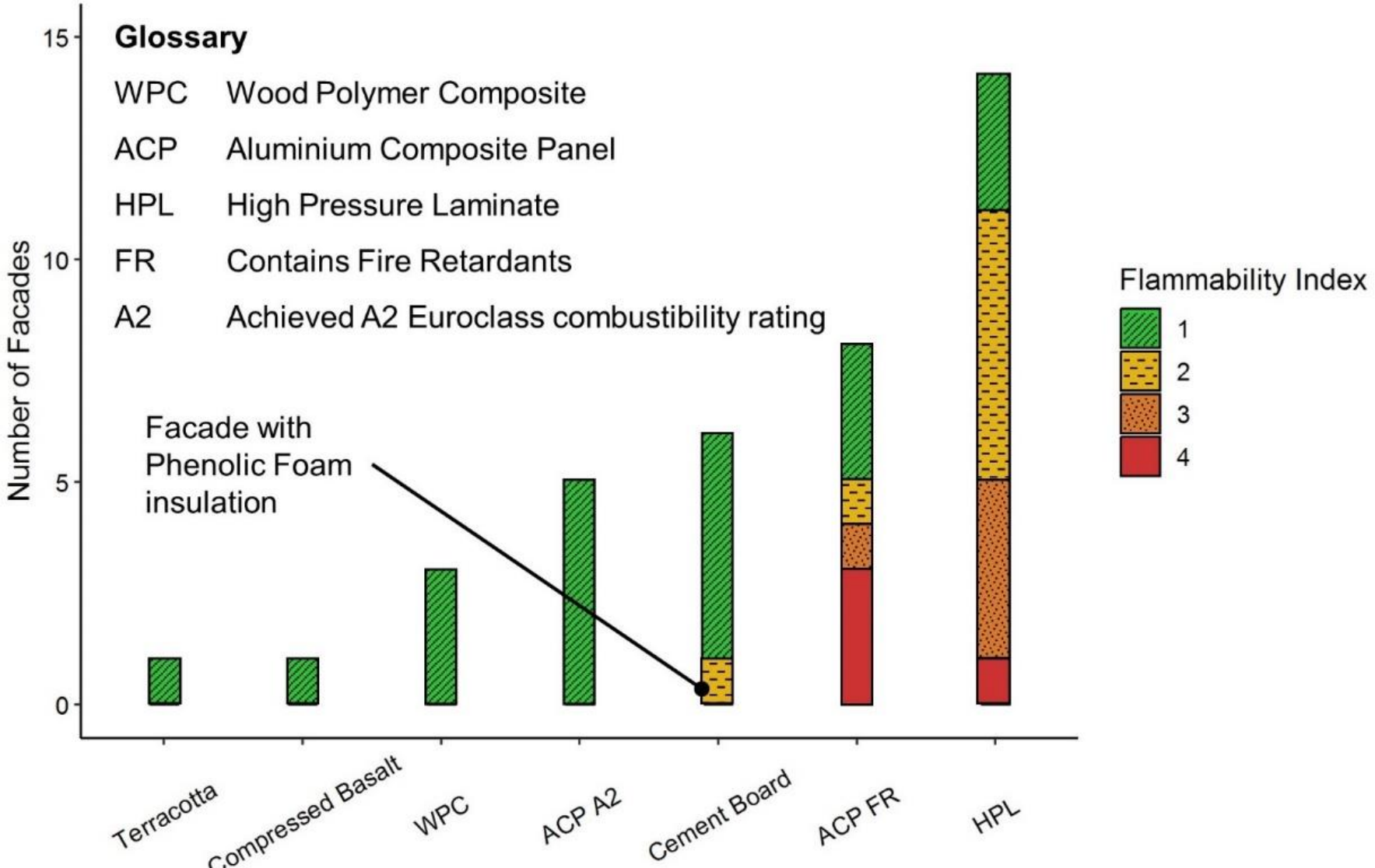
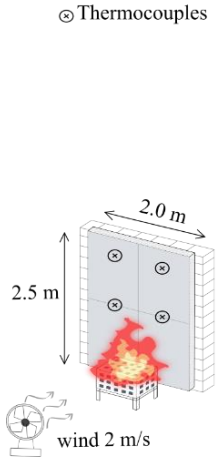


Ongoing research

We are inspired by Prof Emmons from Harvard who in 1986 studied the fire standards for insulating panels. He discovered a complete lack of agreement between different countries.

We selected 5 international standards and 5 facade types: 25 tests...



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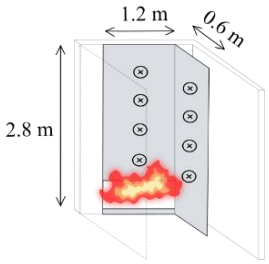
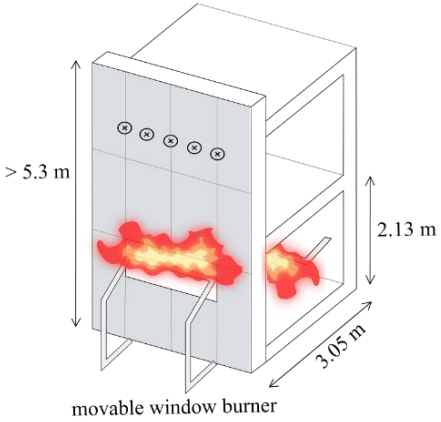
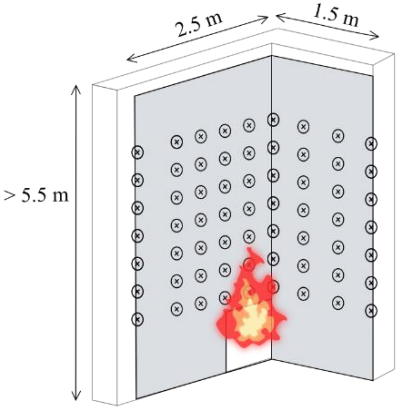


ISO 13785-1



NFPA 285



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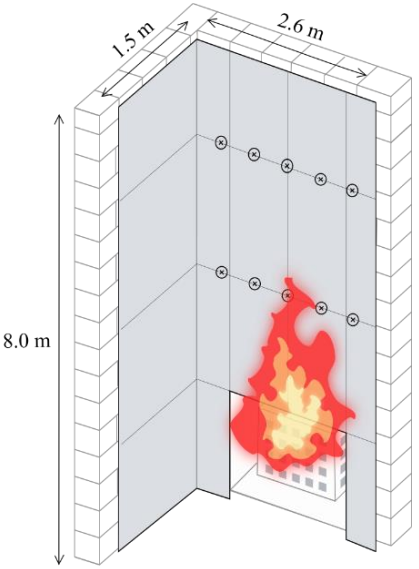
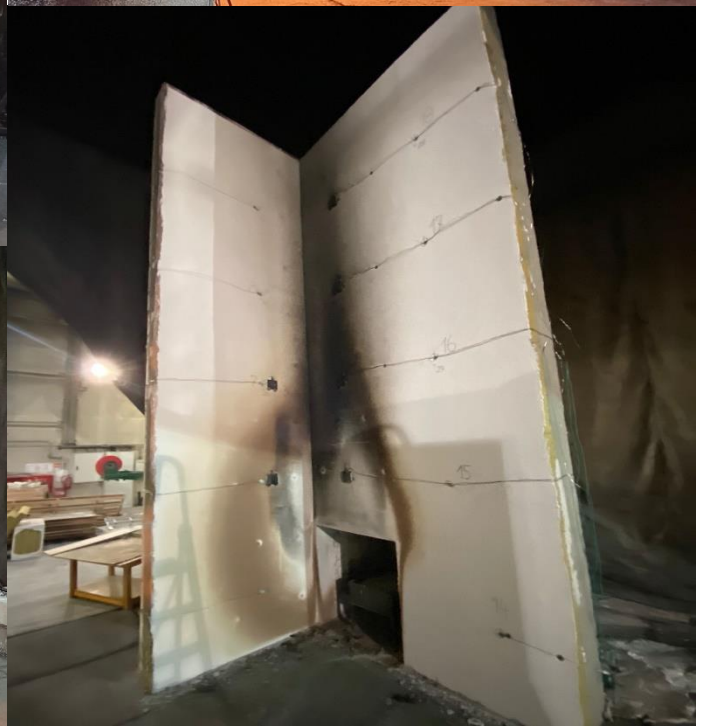


BS 8424

Facade Type	Cladding	Insulation
ETICS	N/A (render)	Mineral Wool
ETICS	N/A (render)	EPS
Rainscreen	HPL (Euroclass B)	Mineral Wool
Rainscreen	HPL (Euroclass B)	Phenolic Foam
Rainscreen	Mineral Board	Phenolic Foam





NFPA and BS

Conclusions

- Fire Engineering must keep up with building **innovation** and avoid blind spot.
- Currently, there are **no theory**, models, or experimental series for facade fires.
- Facades are **systems**, not just materials.
- The **cavity** greatly augments the flammability of the facade.
- More research is coming.

ARUP

EPSRC
Engineering and Physical Sciences Research Council

SFPE
Engineering A Fire Safe World ®

Berkeley Group

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