

Monday May 11th 2026

Milan Fire Brigade Command

FIRE SAFETY AND HIGH-RISE BUILDINGS

Regulatory Developments and Technical Responses

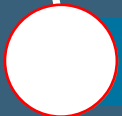


FIRE SAFETY AND HIGH-RISE BUILDINGS: Regulatory Developments and Technical Responses

“Davide Luraschi”



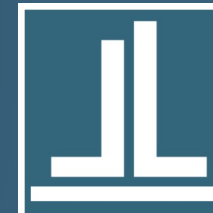
Member of the Fire Safety Commission of the Order of Engineers of Milan



Adjunct Professor in Fire Safety Engineering - Politecnico di Milano



Former President - Vice President of the College of Engineers and Architects of Milan



LDA

LURASCHI DEDIONIGI & ASSOCIATI
INGEGNERIA E ARCHITETTURA

“Why ‘FIRE SAFETY AND HIGH-RISE BUILDINGS’?”

“Because we LIVE within Buildings... and within Cities.”

“Because Cities Change and Evolve.”



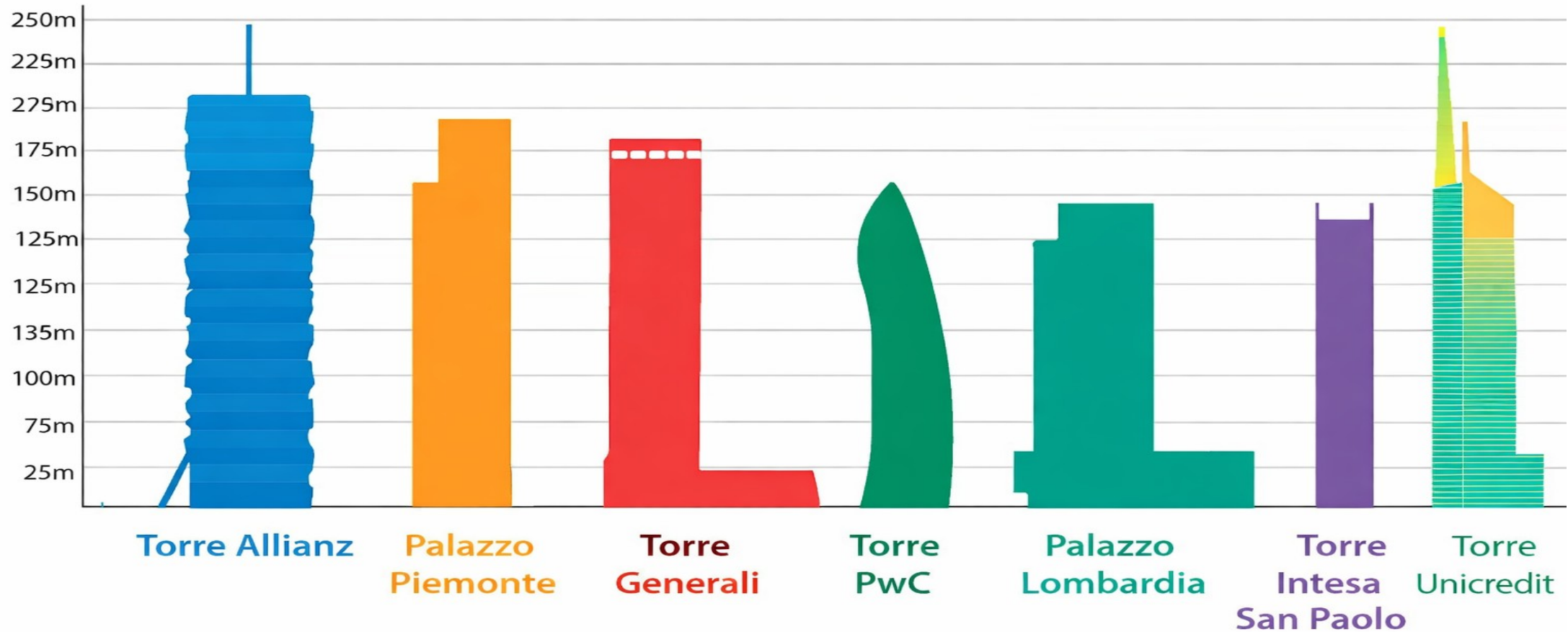
“Because Cities Change and Evolve.”



“Because Cities Change and Evolve.”

And buildings, even in our cities, are rising higher and higher.

I più alti grattacieli d'Italia - Schema altezza piano copertura





Indeed, Cities Burn — Often, and Far Too Much.

Because Cities Change, Evolve... and Can Burn.

Indeed, Cities Burn — Often, and Far Too Much.



Dubai (2012)



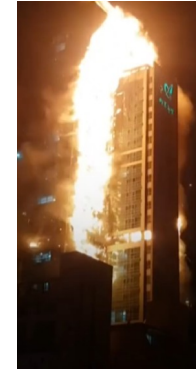
Dubai (2015)



Grenfell Tower UK (2017)



Poland (2019)



Sud Corea (2020)



Torre del Moro – Ita
- (2021)



China- (2021)



China- (sett 2022)



Istambul Turchia
(ott 2022)



Roma (2023)



Valencia (E) (2024)



Dubai (giugno 2025)



Hong Kong – Wang Fuk Court (26–28
novembre 2025)

Why?

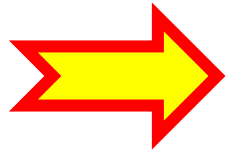
Mainly for 4 Reasons

- 1 Fire Safety is still a discipline that remains far too underestimated.
- 2 Fire Safety is considered expensive
- 3 Limited understanding of fire behaviour and the principles that govern it.
- 4 Compliance often stops at the legal minimum

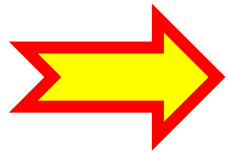
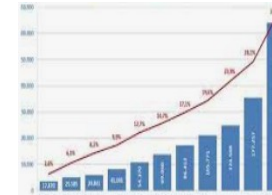
1

Fire Safety is still a discipline that remains far too underestimated..

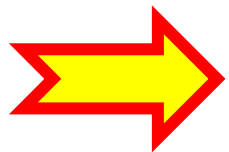
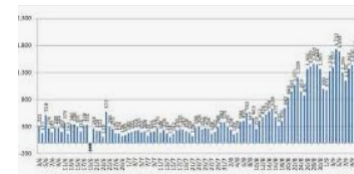
Fire risk is often perceived as a 'remote' possibility



Fires do happen — and far more often than we think.



There are still far too many fire victims worldwide



Economic losses are severe and continue to rise.



Fonte: Organizzazione Mondiale della Sanità



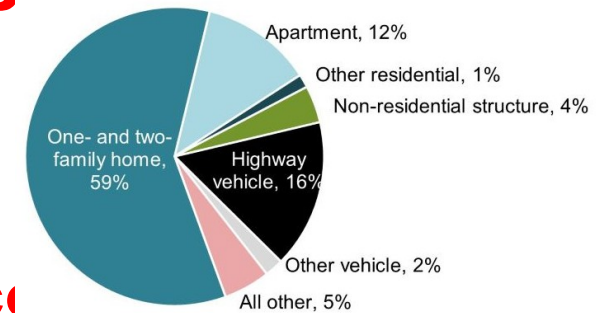
1

Fire Safety is still a discipline that remains far too underestimated..

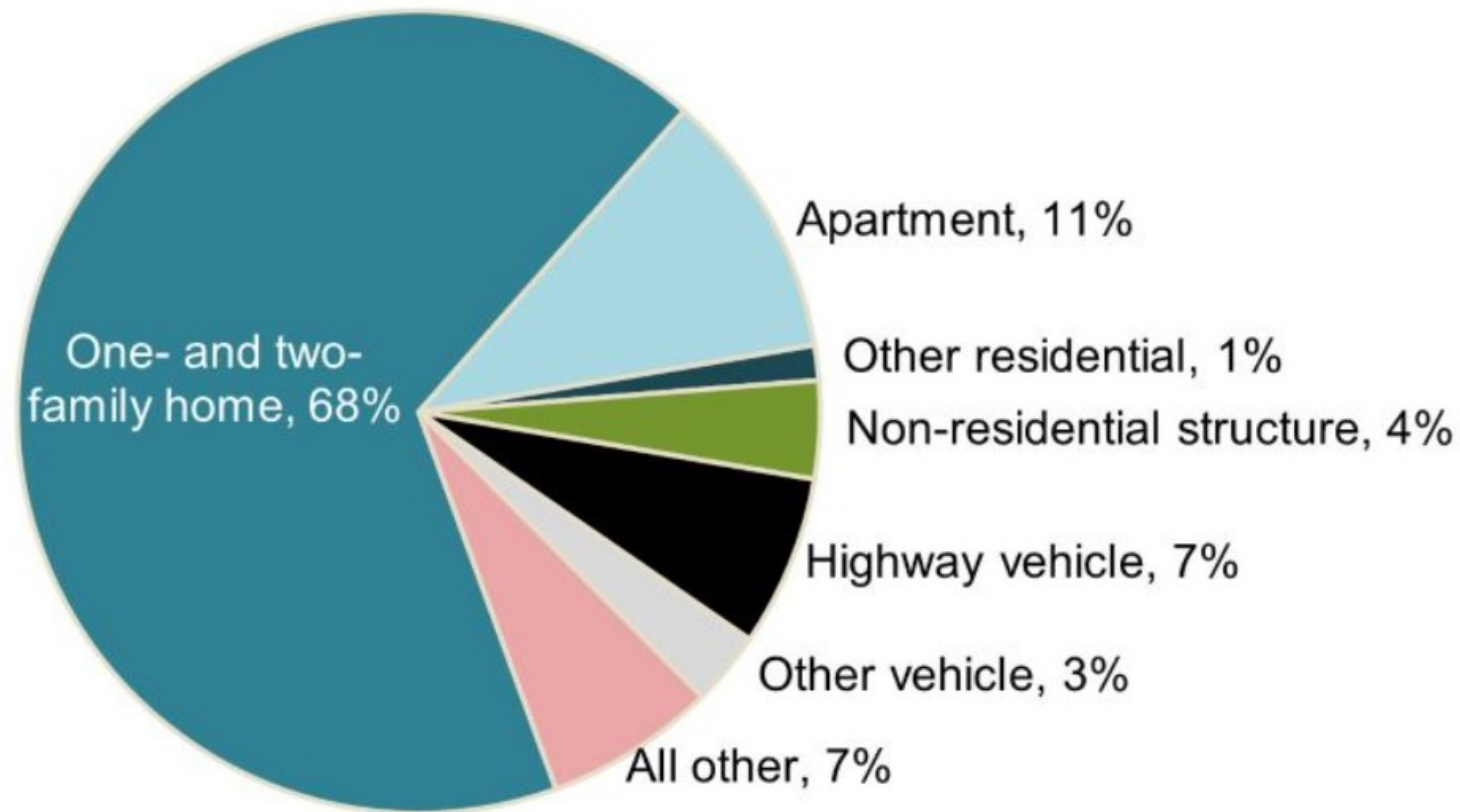
🔥 The National Fire Protection Association (NFPA) **estimates** that in the **US:**

- **The fire department responds to a fire every 21 seconds**
- **In Residential buildings : 382.500**
- **One home structure fire was reported every 88 seconds**
- **One home fire-related injury occurs every 45 minutes**
- **One home fire-related death occurs every 2 hours and 19 minutes**
(3.790 total)

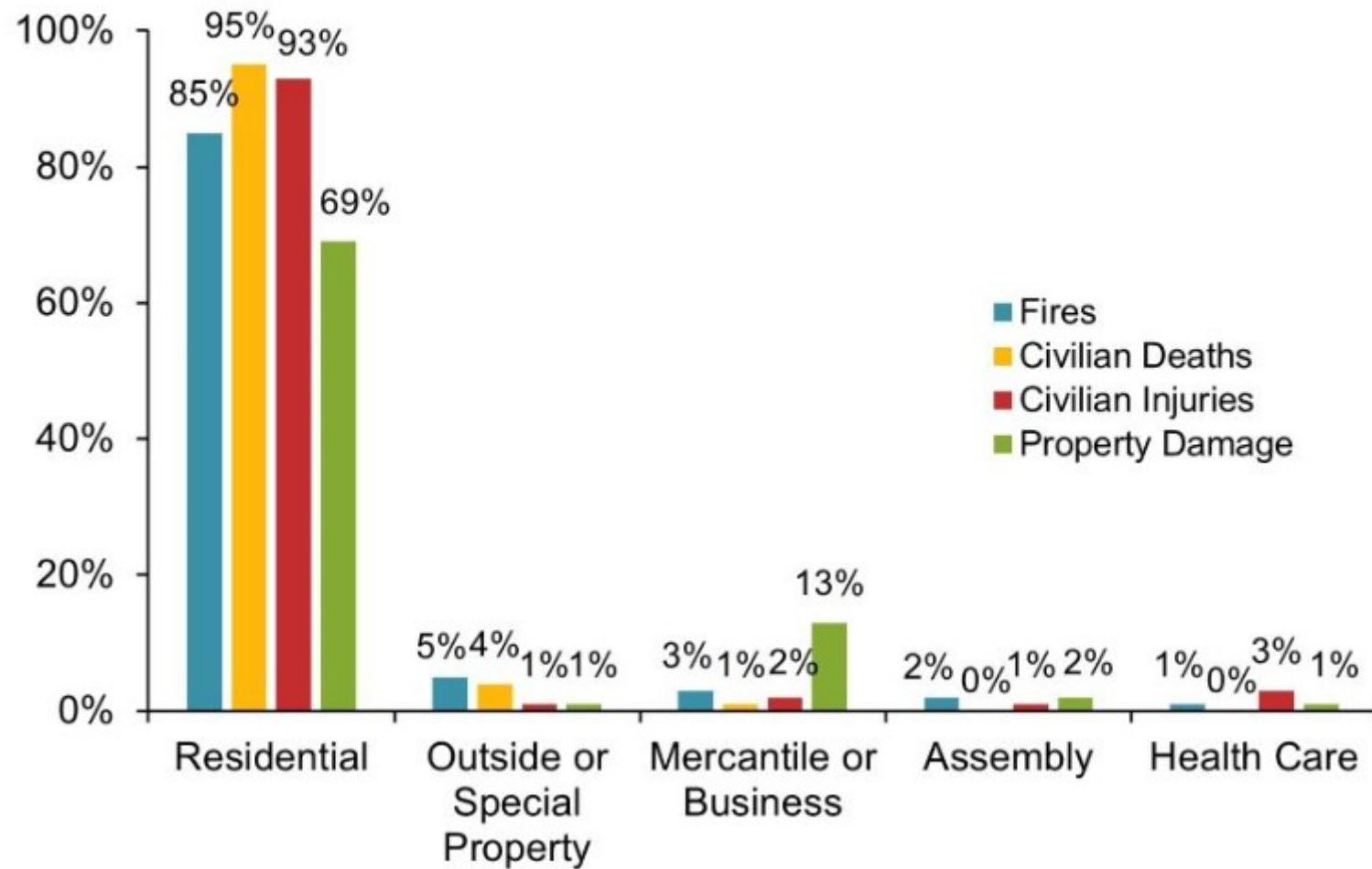
**Civilian fire deaths
Incident type and
occupancy : NFPA 2022**



**Figure 9. Civilian fire deaths
by incident type and occupancy: 2023**



**Figure 1. Reported High-Rise Fires by Property Use,
Estimated Annual Averages 2019–2023**





Urgent technical rescue operations, divided by type, carried out by the National Fire Brigade in 2024

Interventi di soccorso tecnico urgente suddivisi per tipo, effettuati dal C.N.VV.F. nel 2024



~ 619 per day



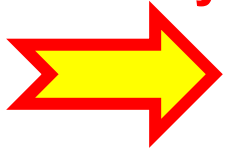
Is Fire Safety really a 'Cost' ??



=



Yet in reality



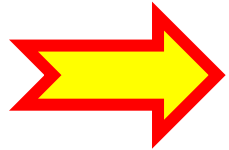
Investments in Safety... allow you to **SAVE**

Yet in reality



An opportunity to increase the property's **PERFORMANCE**

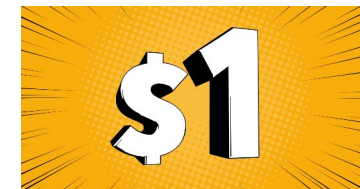
Is Fire Safety really a 'Cost' ??



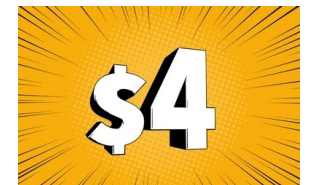
Investments in **SAFETY** generate **SAVINGS**

The ROI of Workplace Safety: How Prevention Saves
~~You Money~~

«Every dollar invested in safety yields, on average, about 4 dollars in savings»



Vs



Fonte actalentservices.com/insights/articles/building-a-workplace-safety-culture
socalfirstaid.com/the-roi-of-workplace-safety-how-prevention-saves-you-money/

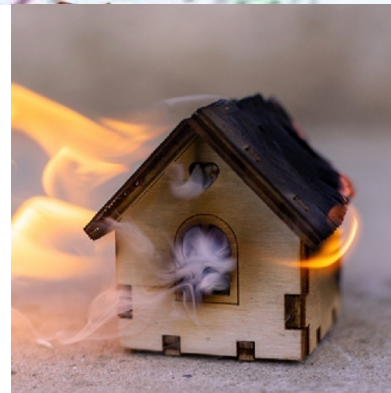
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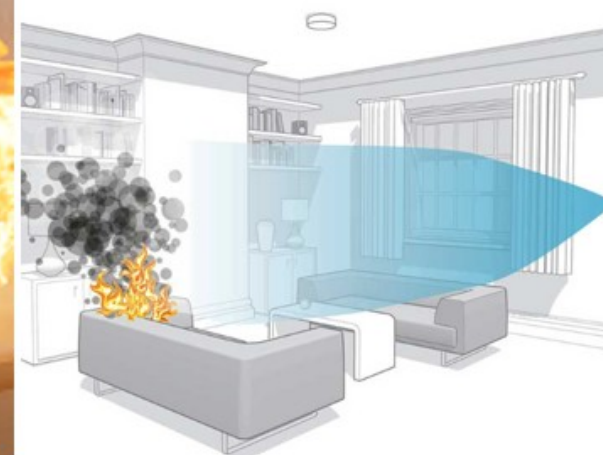
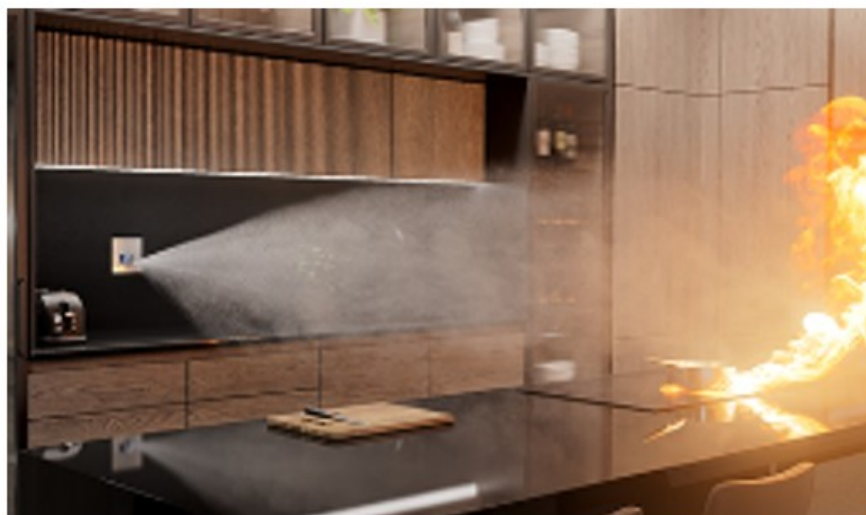


Is Fire Safety really a 'Cost' ??



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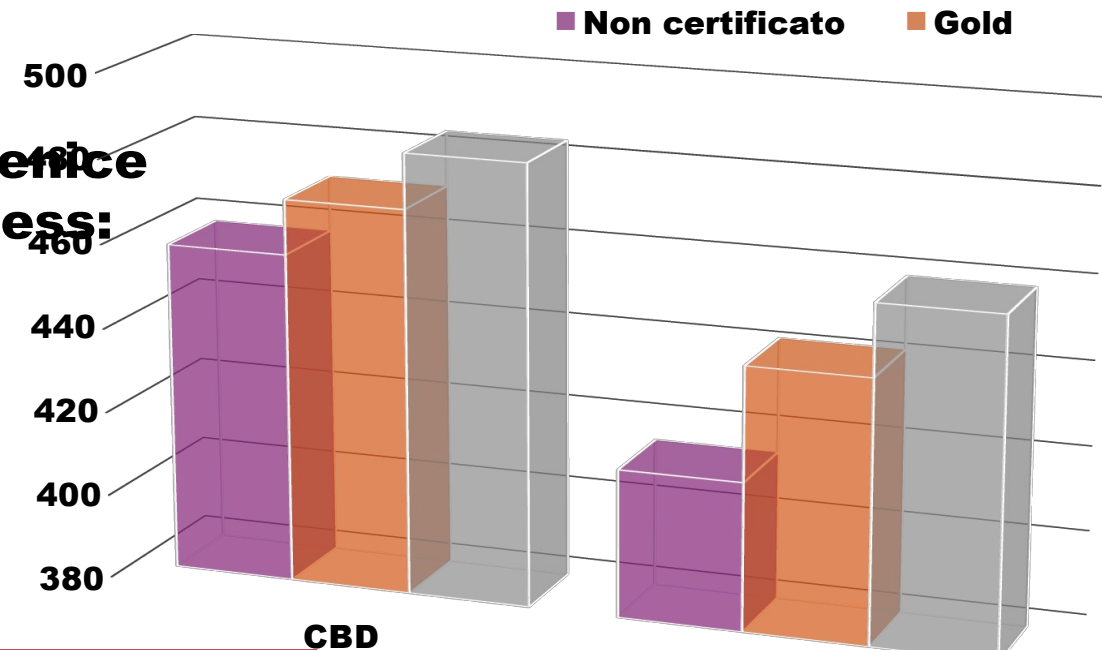
Tax Incentives or Fiscal Bonuses?



THE IMPORTANCE OF QUALITY – SUSTAINABILITY PROTOCOLS'

➤ **“Green Building: Values and Trends”**
a study conducted by Iuav University of Venice
REbuild BRE, GBCI Europe, and the to assess:

➤ **Increase in Property Value**



**«+7% for LEED Gold-certified buildings
+11% for LEED Platinum-certified buildings**

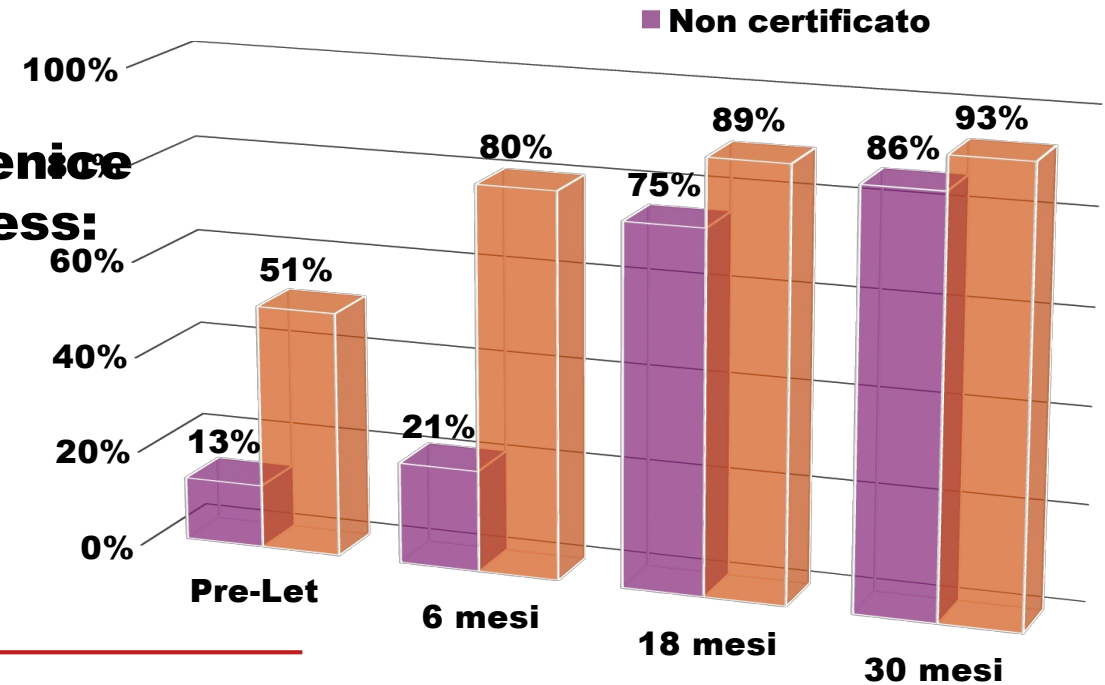


Fonte: REbuild, Cbre, GBCI Europe e Iuav

THE IMPORTANCE OF QUALITY – SUSTAINABILITY PROTOCOLS'

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➤ **Property absorption times**



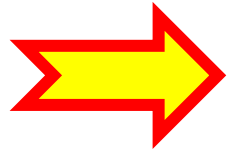
«Shorter absorption times for
LEED-certified buildings» up to
2 yrs



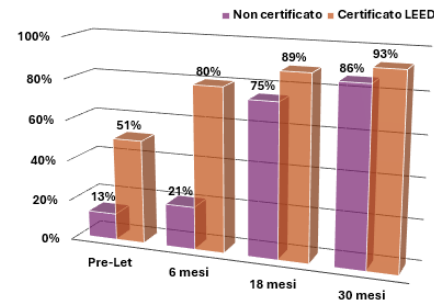
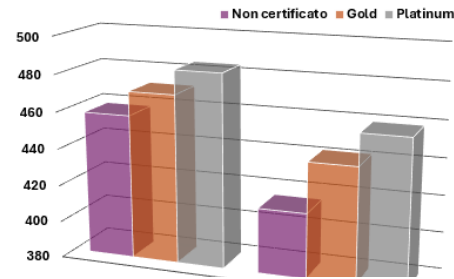
Fonte: REbuild, Cbre, GBCI Europe e Iuav

Is Fire Safety really a 'Cost' ??

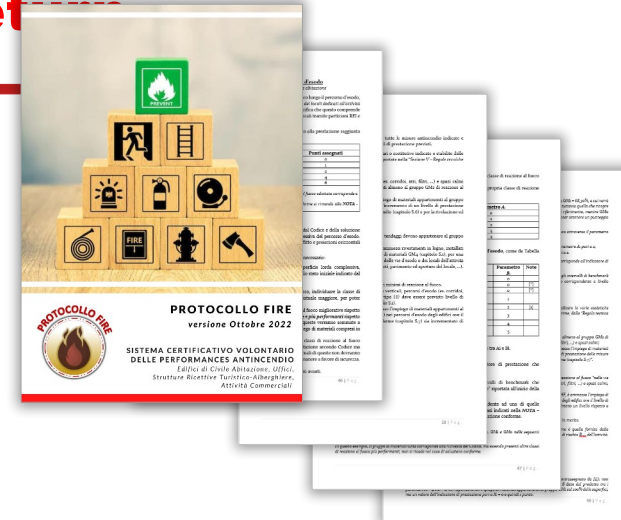
SUSTAINABILITY PROTOCOLS



Opportunity to improve the property's performance
Opportunity to increase the asset's financial return



Voluntary performance-based certification method for fire-safety evaluation



Fonte: REbuild, Cbre, GBCI Europe e luav

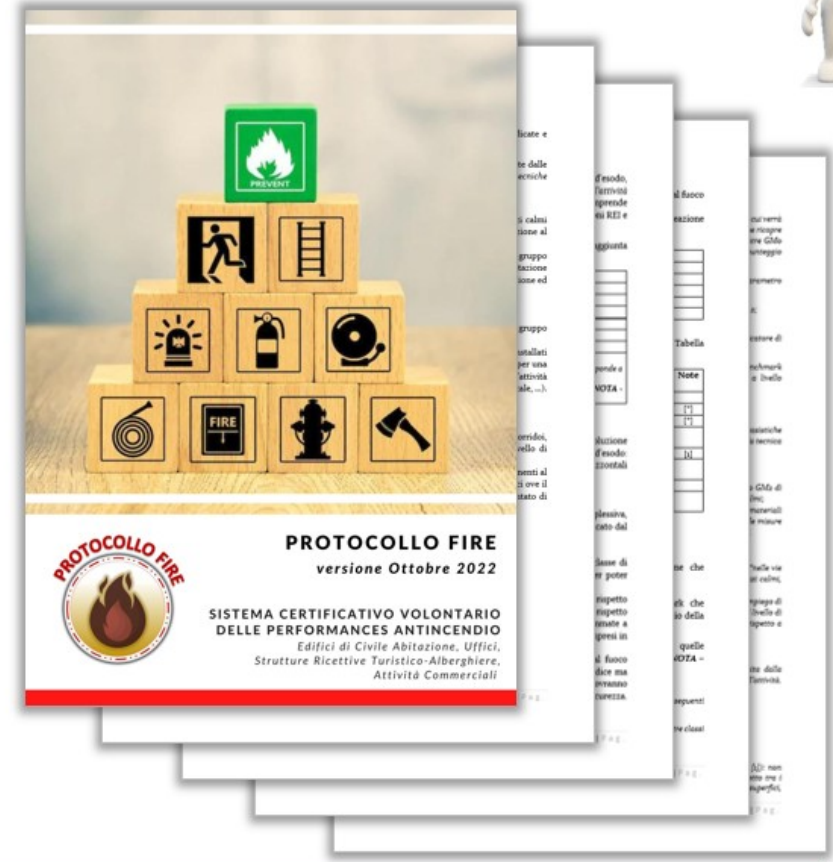
Is Fire Safety really a 'Cost' ??

➤ “Pyrausta FIRE Certification Protocol”

**Voluntary
performance-based
certification method
for fire-safety
evaluation**



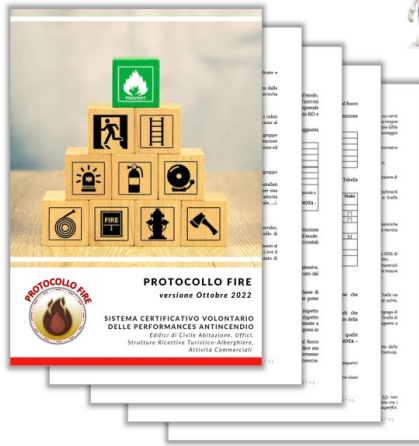
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COLLEGIO DEGLI INGEGNERI
E ARCHITETTI DI MILANO

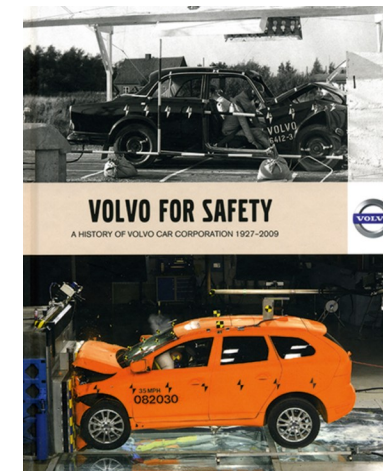
Is Fire Safety really a 'Cost' ??

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1563
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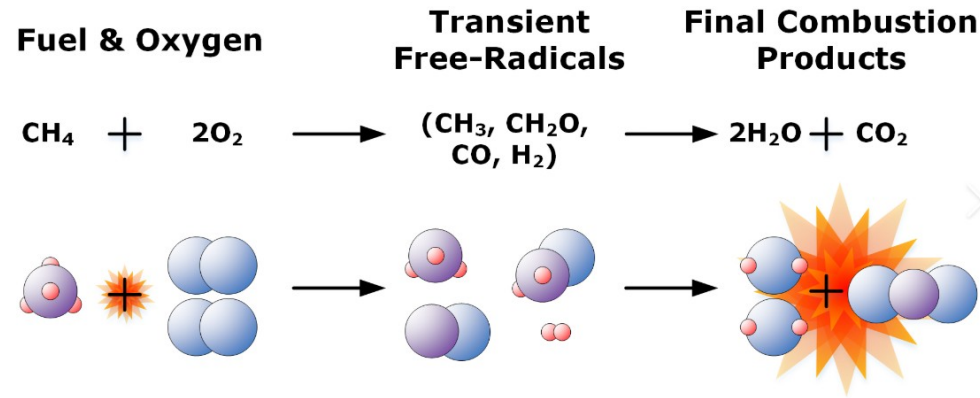


The "**Volvo Lesson**" is a foundational case study in **marketing and brand strategy**, proving that engineering-driven safety can build immense, enduring brand equity.

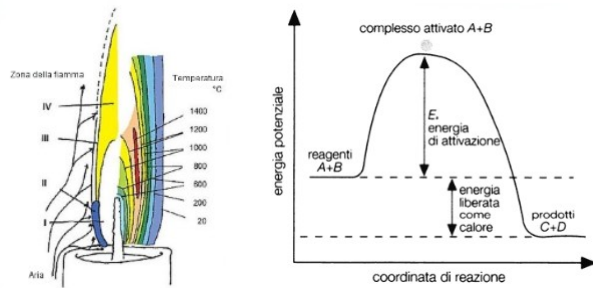
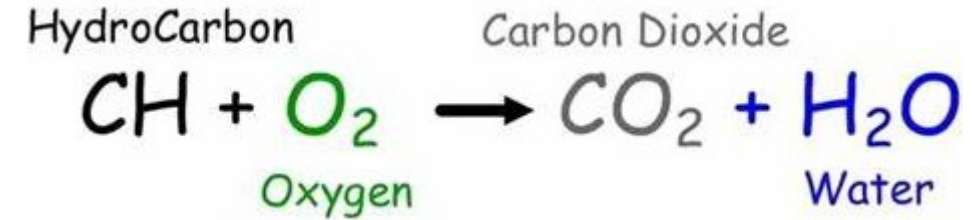
By anchoring its identity in **saving lives rather than just speed or luxury**, Volvo established a premium, trustworthy, and indispensable market position.



Limited knowledge of fire behaviour and its governing mechanisms



(Stoichiometric combustion reaction of methane)

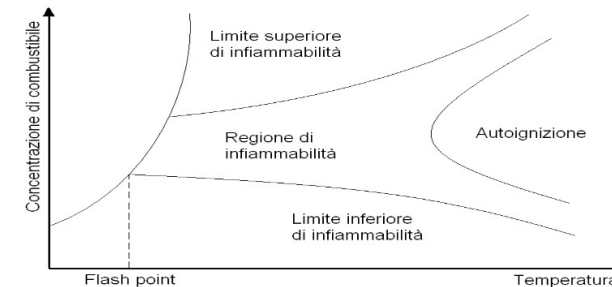
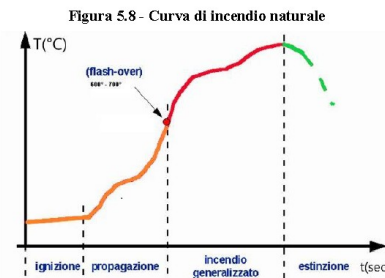
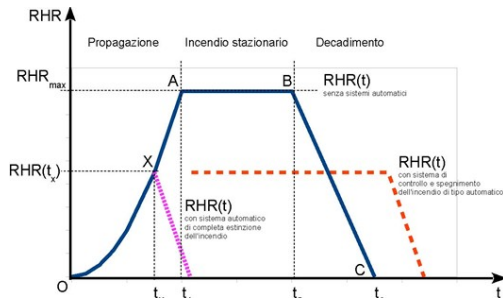


$$P_{\text{incendio}} = \frac{1000}{t_{\alpha}^2} \cdot t^2 \text{ (kW)}$$

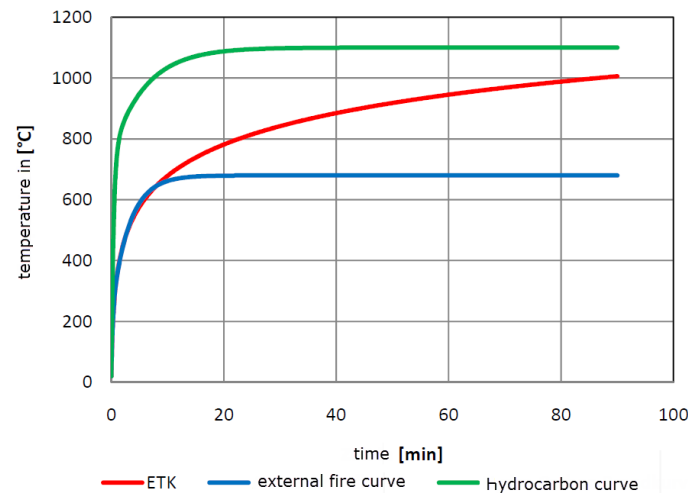
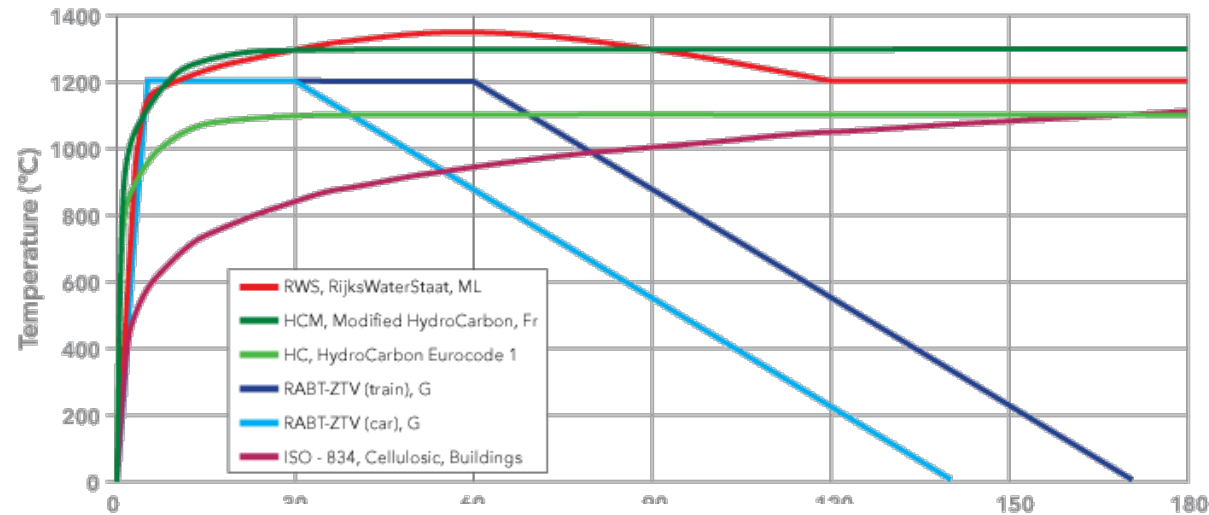
Fire evolution – growth stage

$$C_p \cdot (T_{\text{fumi}} - T_{\text{amb}}) \cdot t_{\alpha}^2$$

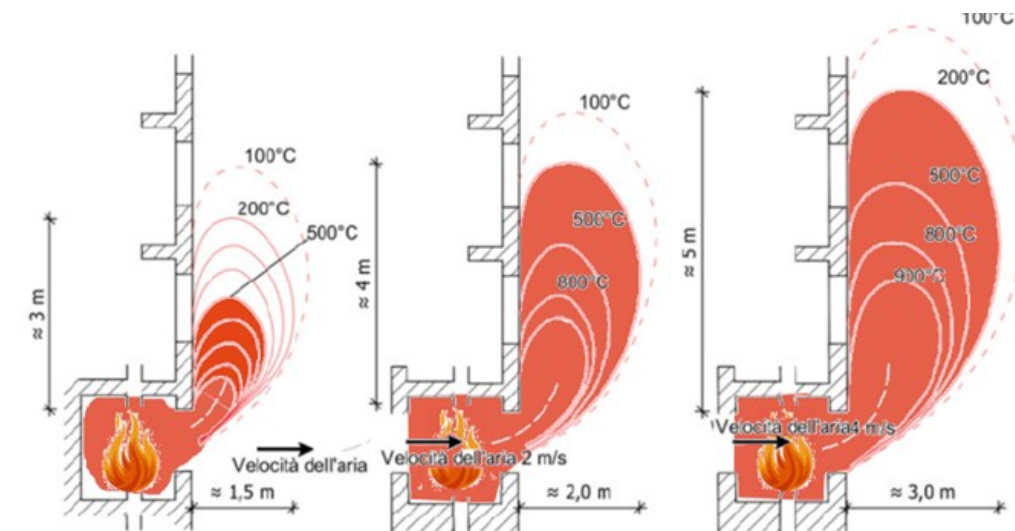
From fire power
to smoke production dynamics



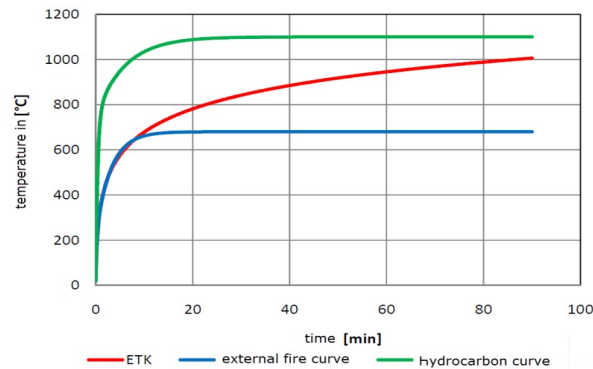
Combustion limits of
thermosetting
polymeric materials



• It is well known that many combustible construction materials have auto-ignition temperatures ranging from **250 °C to 500 °C**



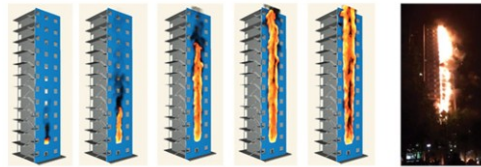
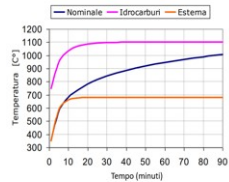
The assumption that **external fire** is somehow “less important” has led to overlooking fire spread and the effects of **fire on the building's exterior**



Materiale	T (°C) auto accensione
sughero	450-500°C
Carta	220-230 °C
Legno	220-250°C
schiume poliuretatiche	320-420° C

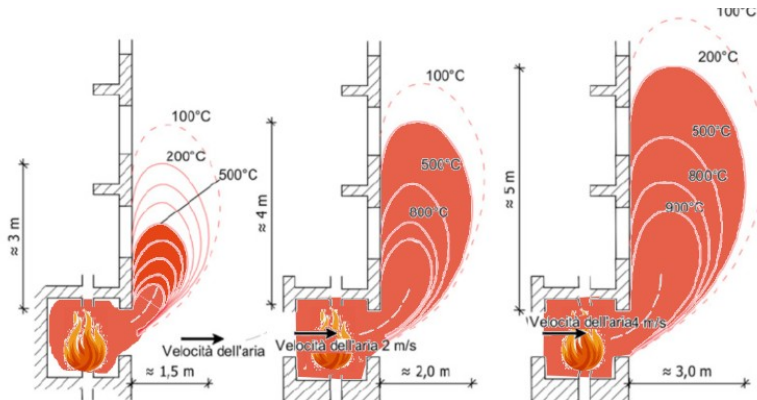


Materials..Burns



Predicted fire spread using numerical techniques (FDS) in a model building

Actual fire spread in Grenfell accident UK (2017)



3

Limited knowledge of fire behaviour and its governing mechanisms

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has led to overlooking fire spread and the effects of **fire on the building's exterior**

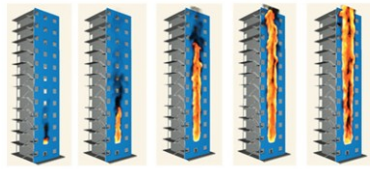
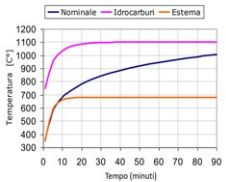
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The assumption that external fire is somehow “less important”

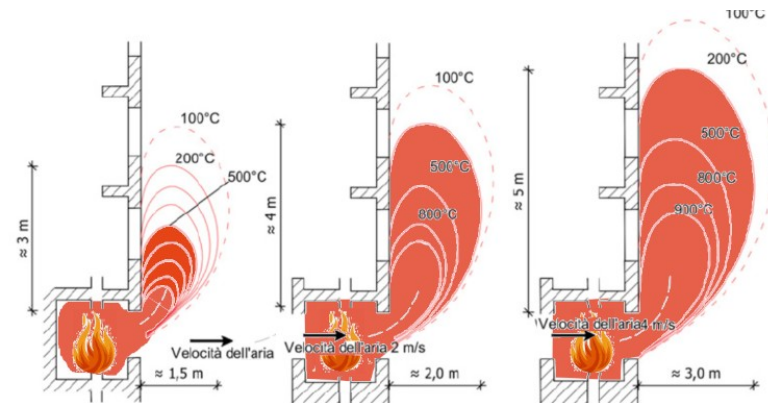
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Predicted fire spread using numerical techniques (FDS) in a model building



Actual fire spread in Grenfell accident UK (2017)

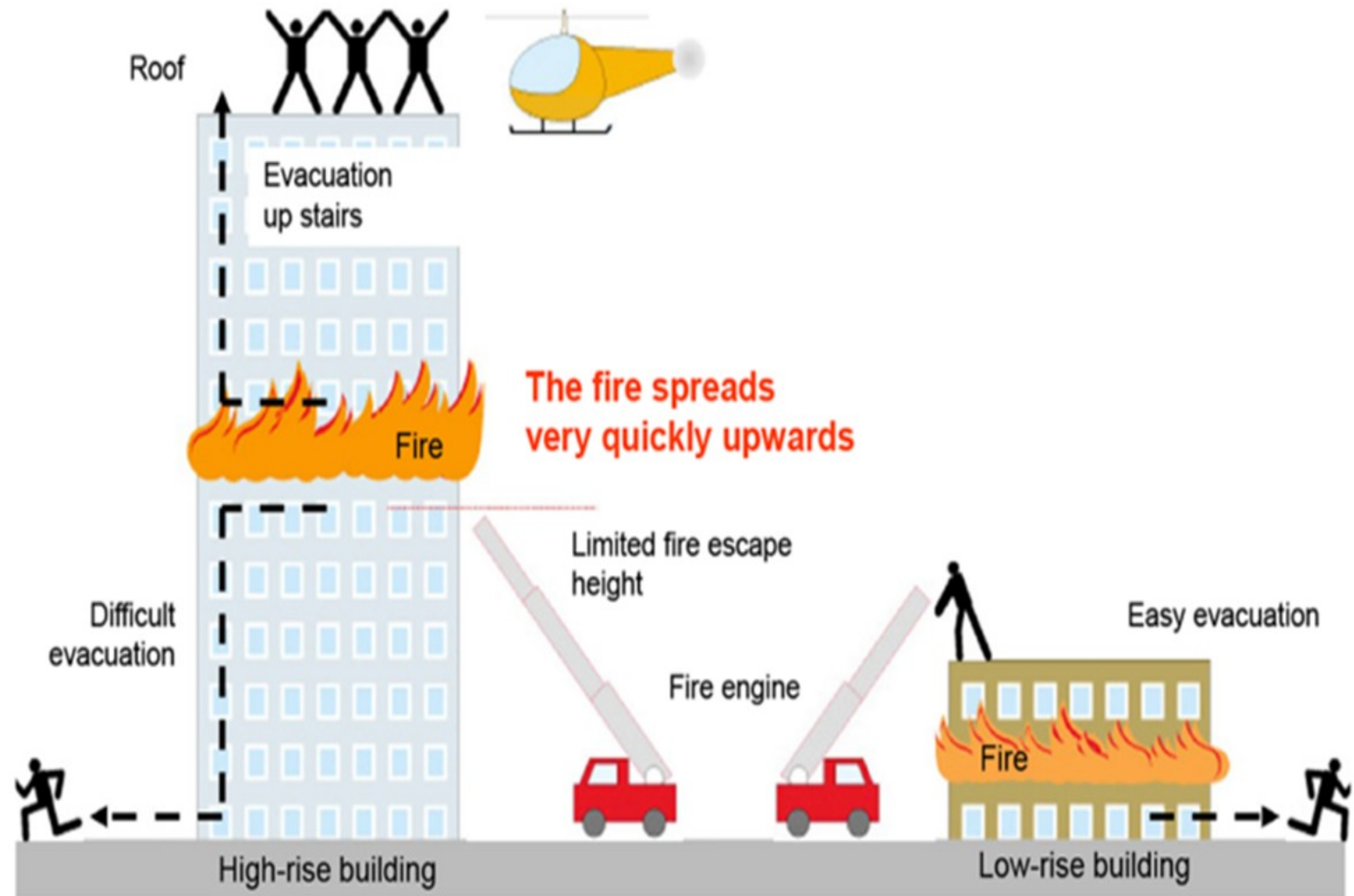


Are buildings actually uniform in their fire-safety behaviour?



Fire Safety in High-Rise Buildings: A Challenge

- Longer evacuation distances and times
- Evacuation strategies
- Fire-fighter accessibility
- Smoke fluid dynamics
- Fire control



Perhaps we should examine what the inventors of skyscrapers actually did.

The History of Skyscrapers in 5 Points:

- 1) The **Steel Revolution** (1850–1870)The industrial-scale production of steel in the mid-19th century made it possible to construct buildings significantly taller than traditional load-bearing masonry would allow.
- 2) The **Invention of the Safety Elevator** (1853)Elisha Otis introduced the safety elevator equipped with an automatic braking system. Without this innovation, vertical development and high-rise buildings would not have been feasible.
- 3) The **Great Chicago Fire** (1871)The fire destroyed a large portion of the city, creating the need for taller, stronger, and more efficient buildings during reconstruction. This event set the stage for the emergence of the Chicago School.

Perhaps we should examine what the inventors of skyscrapers actually did.

The History of Skyscrapers in 5 Points:

- 1) The Birth of the **Chicago School** (1870–1890) A group of architects and engineers — William Le Baron Jenney, Daniel Burnham, John Root, Louis Sullivan, Holabird & Roche — developed a new architectural paradigm based on: steel skeletal structures, lightweight curtain walls, large glazed surfaces, functional and rational design principles.
- 2) **William Le Baron Jenney**: The Father of the Skyscraper Jenney designed the **first true skyscraper**, the **Home Insurance Building** (Chicago, 1885), a 10-story structure supported by a fully metal frame. It is universally recognized as the **starting point of high-rise construction**.



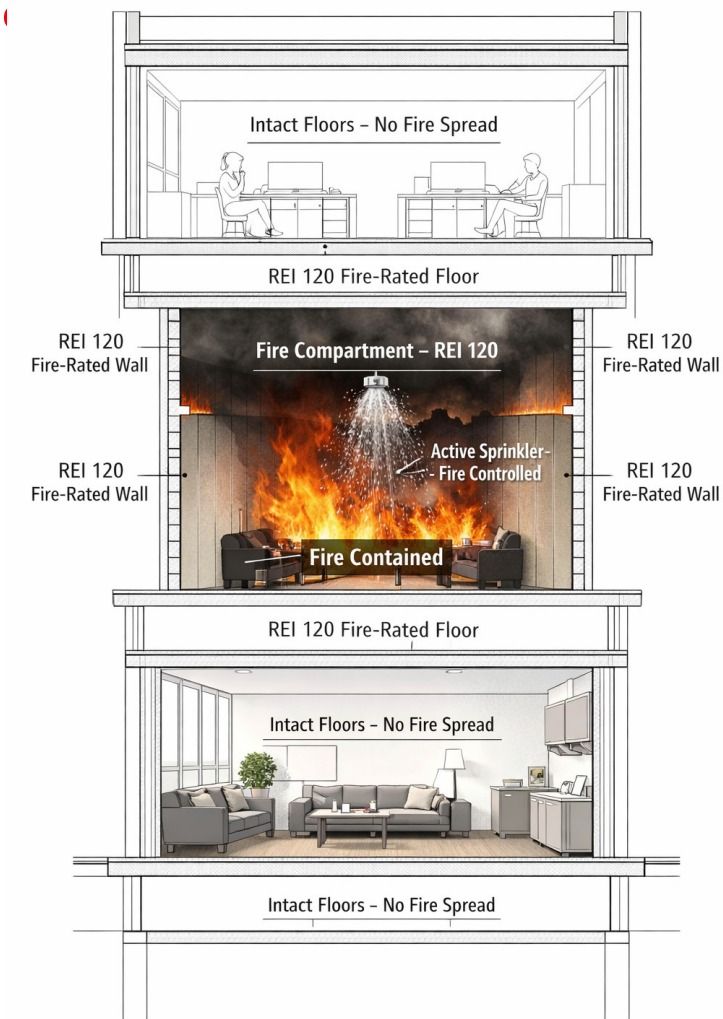
Anno	Glass	Aluminum/ACM	Stone	Porcelain
2005	55%	25%	15%	5%
2010	58%	26%	11%	5%
2015	60%	25%	10%	5%
2020	62%	26%	8%	4%
2025	60%	25%	10%	5%

NFPA reports that 96% of residential high-rise buildings are equipped with sprinkler systems. According to the NFPA High-Rise Building Fires Report:

- 96% of residential high-rise buildings have sprinklers
- 91% of office high-rise buildings have sprinklers
- 97% of healthcare high-rise buildings have sprinklers

The weighted average across all high-rise occupancies is approximately 92–95%.

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Key Data on Fires in the United States (NFPA 2025)



Fires in High-Rise Buildings (annual average 2019–2023)

Comparative Analysis

- **Residential buildings: 382,500 fires in 2022, accounting for 73% of all fires**
- **High-rise buildings: 14,830 fires per year (2019–2023 average), accounting for approximately 3.9% of fires**

High-Rise Building Fires - Tucker McGree October 2025

nfpa.org/news-blogs-and-articles/nfpa-journal/2025/11/14/united-states-high-rise-building-fires-research-report

Key Data on Fires in the United States (NFPA 2025)

- **residential fires (Low-rise buildings) are more than 25 times more frequent than fires in High-rise buildings**



Key Data on Fires in the United States (NFPA 2025)



Fire incidence rate per 1,000 events since 2009

High-rise vs. low-rise buildings



A. High-Rise Buildings

Occupancy	Civilian Deaths per 1,000 Fires	Civilian Injuries per 1,000 Fires	Average Loss per Fire
Apartment or other multi-family housing	2.9	43.1	\$4,300
Hotel	0.0	20.9	\$12,600
Dormitory	0.7	14.3	\$1,300
Office building	0.0	19.3	\$19,800
Care of the sick	0.0	25.0	\$8,800
Average of the five occupancy groups	2.5	39.5	\$5,100

B. Buildings that Were Not High-Rise

Occupancy	Civilian Deaths per 1,000 Fires	Civilian Injuries per 1,000 Fires	Average loss per fire
Apartment or other multi-family housing	3.9	40.0	\$12,500
Hotel	3.1	35.3	\$25,800
Dormitory	0.2	7.3	\$3,900
Office building	0.4	11.8	\$33,600
Care of the sick	0.6	24.1	\$20,000
Average of the five occupancy groups	3.6	37.9	\$13,300

“High-Rise”
Buildings

Hotel 0 - 20,9
Apt 2,9 - 43,1

“Low-Rise” Buildings

Hotel 3,1 - 35,3
Apt 3,9 - 40

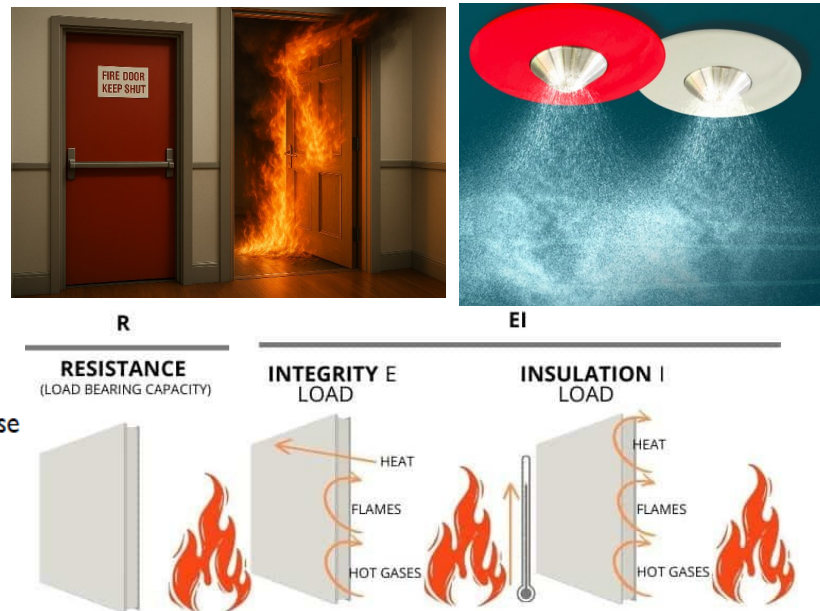
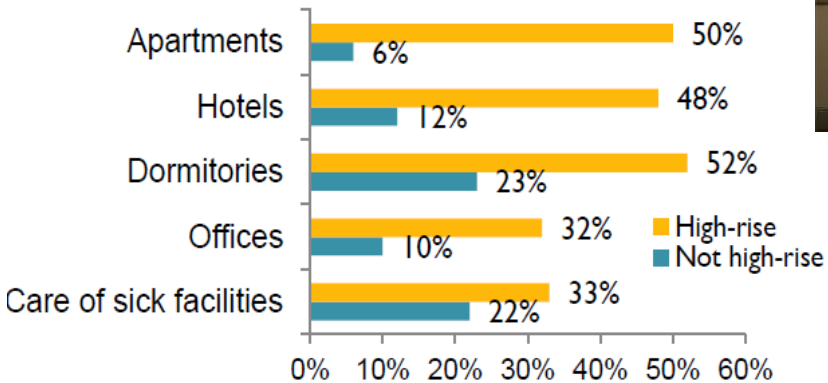
Fire Safety in High-Rise Buildings: A Challenge

High-rise buildings generally have—compared to low-rise buildings — **structures** with **higher fire-resistance ratings**.

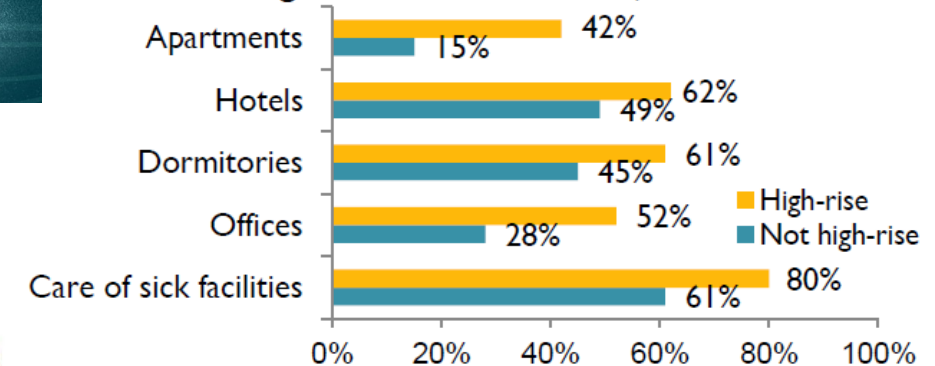
High-rise buildings are more likely than low-rise buildings to be equipped with **automatic extinguishing systems (sprinklers – watr mist)**.

These protection features help prevent fire spread — and we'll see why!

Presence of Fire-Resistive Construction in Fires, 1994-1998



Presence of Wet-Pipe Sprinklers in Fires Excluding Partial Systems and Buildings Under Construction, 2009-2013

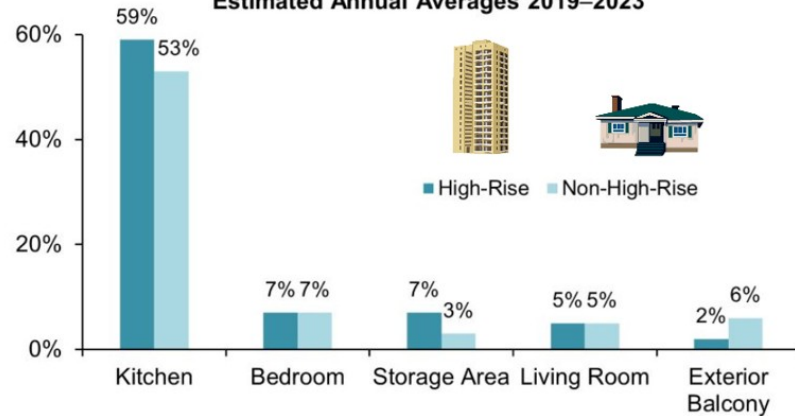


Fire Safety in High-Rise Buildings: A Challenge

Comparison between high-rise and low-rise buildings in terms of **fire origin location**

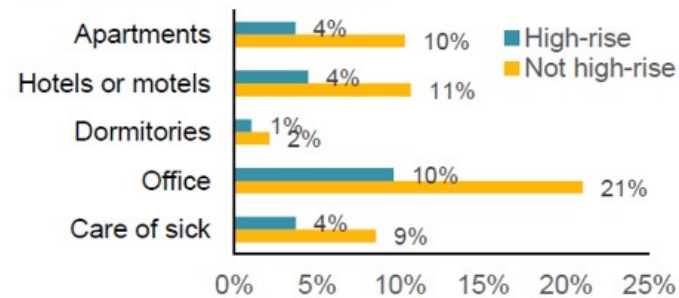
In multi-story buildings, fires are **less likely to spread beyond the room and floor of origin** compared to fires in lower-rise buildings.

Reported Structure Fires in Multifamily Dwellings with 7+ Living Units by Area of Origin
High-Rise vs. Non-High-Rise,
Estimated Annual Averages 2019–2023

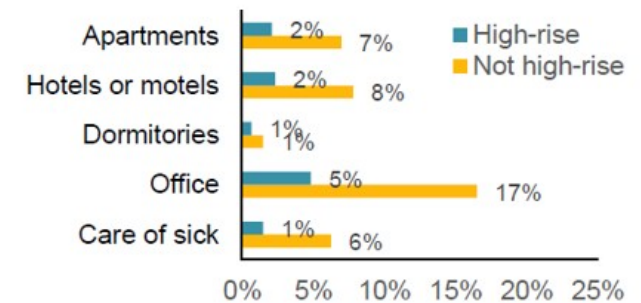


Fire spread beyond the room and floor of origin

A. Beyond room of origin.



B. Beyond floor of origin



Fire Safety in High-Rise Buildings: A Challenge

“High-Rise Buildings”:

lower percentages of flame damage beyond the room of origin compared to “low-rise” buildings

Thanks to:

- **Fire protection systems**
- **Fire-resistant construction features**



Fire Safety in High-Rise Buildings: A Challenge

“High-Rise Buildings”:

lower percentages of flame damage beyond the room of origin compared to “low-rise” buildings

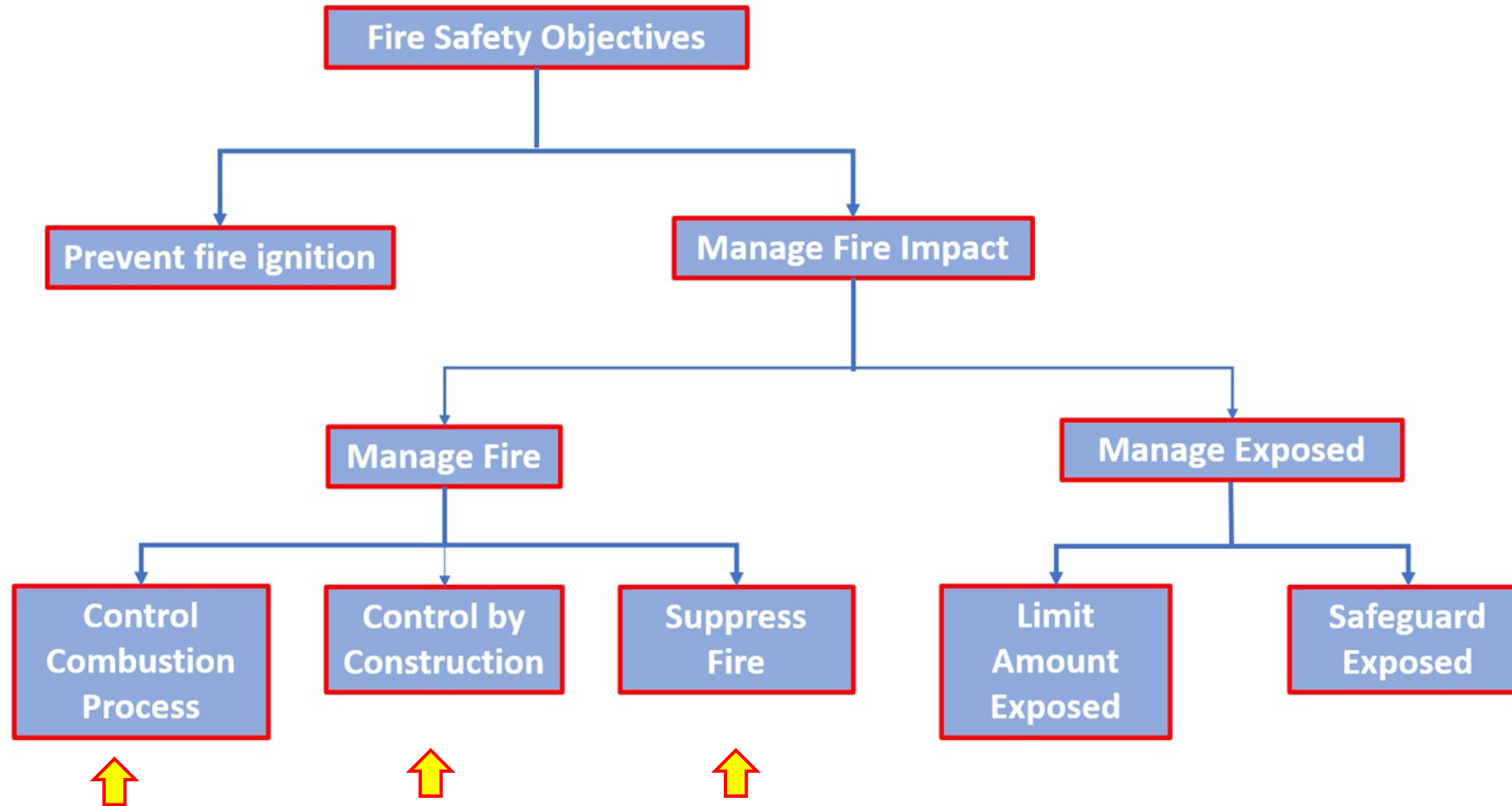
Breakdown by occupancy type

- **Apartments:** 4% of fires in high-rise buildings vs. 10% in low-rise buildings
- **Hotels:** 4% in high-rise vs. 11% in low-rise
- **Offices:** 10% in high-rise vs. 21% in low-rise
- **Health-care facilities:** 4% in high-rise vs. 9% in low-rise

Here's why

Fire Safety in High-Rise Buildings: A Challenge

Fire Safety Concepts Tree

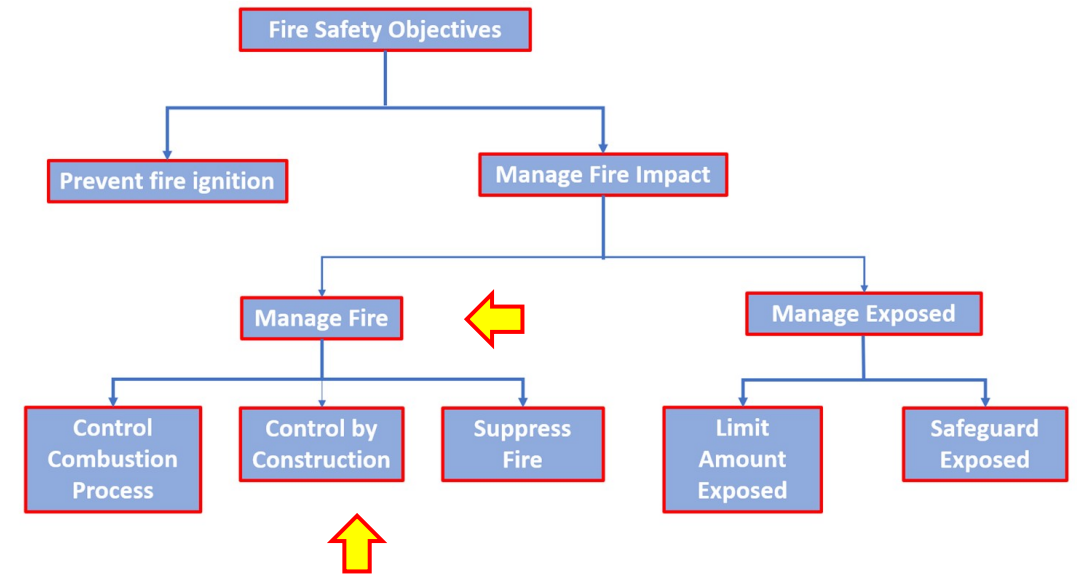


Fire Safety in High-Rise Buildings: A Challenge

Knowledge & Technology — In practice

Control by Construction

Manage Fire



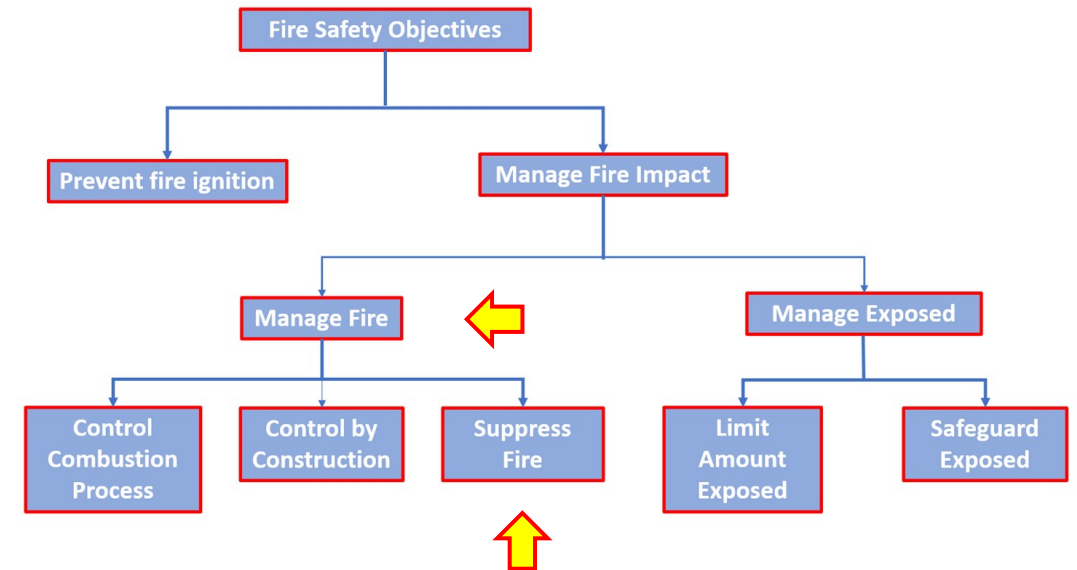
Management – containment

Generally and primarily achieved through the use of **fire-resistant materials** and good **fire-reaction performance materials**



Fire Safety in High-Rise Buildings: A Challenge

Knowledge & Technology — In Practice



Management – containment – extinguishment

Generally and primarily achieved through the use of **water** as the preferred extinguishing agent

But... despite all this... fires still



..ans so.. What can we do?



From Torre dei Moro to Torre Seta

Redefining the concept of safety.

A project by:



AFC – ing Antonio Corbo



DLA – ing Davide Luraschi

Supported by...



From Torre dei Moro to Torre Seta

Compliance is limited to the regulatory minimum



“Pushing further”

Fire safety design is not *merely* the literal application of a code. It is something more: the pursuit of the best possible solution to reduce and mitigate risk to acceptable minimum levels, acknowledging that zero risk does not exist.

“We are firmly convinced that it is necessary to raise the level of safety, to offer something more... for a better and safer world!”

“We need to set a new Quality Standard.”



Water Mist



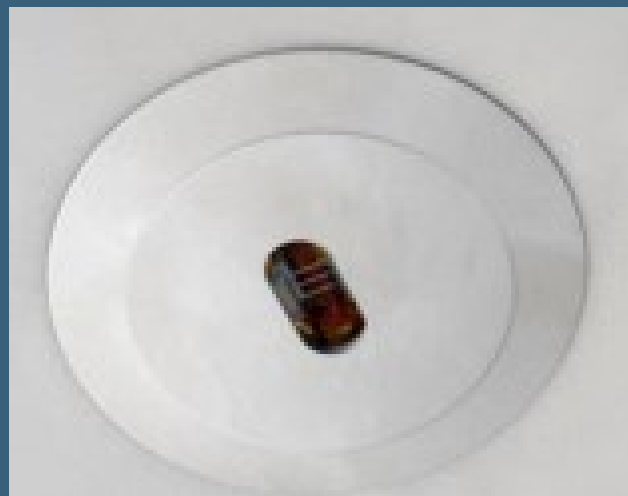
Uso intelligente dell'acqua
(90% in meno rispetto ai
sistemi tradizionali)



Ridotti danni a strutture e
ambienti



Ridotti danni a strutture e
ambienti

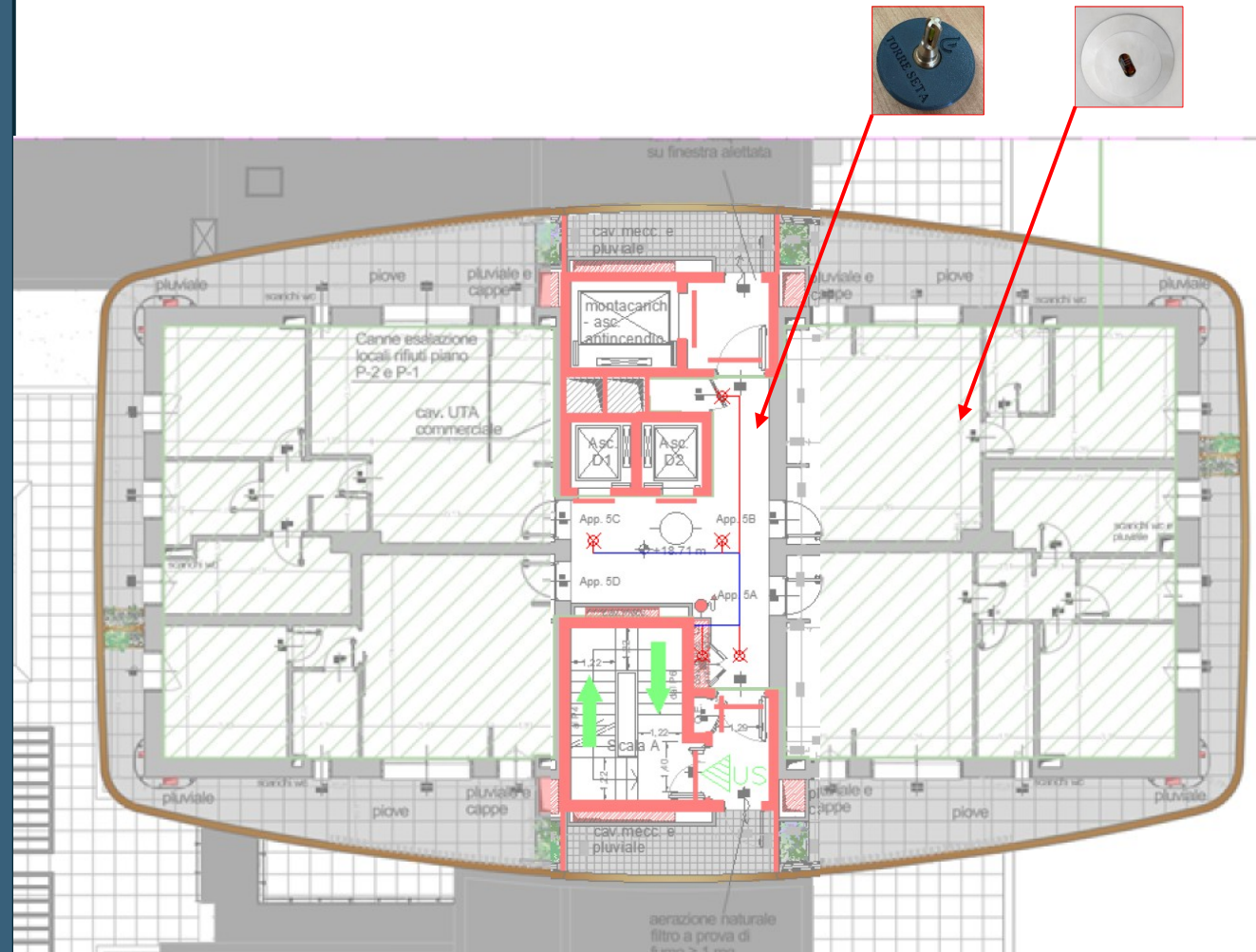


II Progetto

“Fire protection of the **common areas** of Torre Seta (formerly Torre dei Moro) through a **high-pressure water mist automatic extinguishing system**.”

All common areas from floor 1 to floor 18 will be fully protected. At no additional cost....

From floor 2 to floor 19, the system may be extended to the residential units. Only the material cost will apply.





tema sistemi
FIRE TECHNOLOGY

SEBINO
FIRE AND SECURITY



4

Compliance is limited to the regulatory minimum

Closing thoughts

- Cities change. Safety must change with them, learning, adapting, improving.
- Investing in safety means protecting lives, increase assets value, and the future of our cities. And create more value!
- “We are convinced that we must offer something more... for a better and safer world.”
- Fire Safety Design is not code checking. It is ethical design.

Thank you for your attention

prof.c.ing. **Davide Luraschi**

**Former President of the Collegio degli
Ingegneri e Architetti di Milano Lecturer in Fire
Safety Engineering – Politecnico di Milano**

 www.Luraschi.it



I professionisti si sono adoperati e si prestano in maniera volontaria e senza alcun compenso, senza interessi economici personali.

- www.nfpa.org/education-and-research/research/nfpa-research/fire-statistical-reports/high-rise-building-fires Fires
- <https://www.nfpa.org/education-and-research/research/nfpa-research/fire-statistical-reports/fire-loss-in-the-united-states>
- Annuario Vigili del Fuoco 2025
- Multihazard Mitigation Council & FEMA

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actalentservices.com/insights/articles/building-a-workplace-safety-culture