

Modern Methods of Construction

Nottingham Insurance Institute

InsurED

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Agenda

- 1** What is MMC?
- 2** What are the key drivers?
- 3** Where is MMC encountered?
- 4** Examples of techniques & materials
- 5** Key challenges / case studies
- 6** Test standards & approvals
- 7** The future
- 8** Final thoughts
- 9** Questions

What is MMC?

Barker Report (2004) :

Modern methods of construction are about better products and processes. They aim to improve business efficiency, quality, customer satisfaction, environmental performance, sustainability and the predictability of delivery timescales.

Modern methods of construction are, therefore, more broadly based than a particular focus on product. They engage people to seek improvement, through better processes, in the delivery and performance of construction.

Also:

- **May involve new technology**
- **Both composite & traditional materials / components**
- **Principally off-site fabrication / on-site assembly**

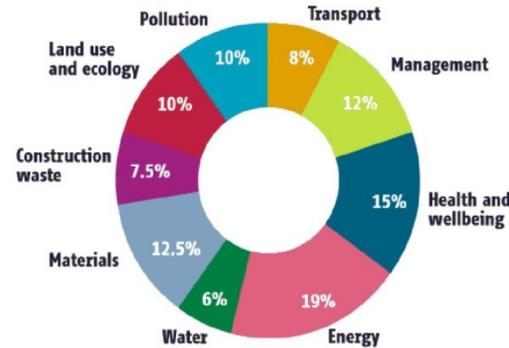
Off site: manufactured in a controlled environment such as a factory;
or at specially created temporary facilities closer to the construction site

On site: systems and components assembled
on site; may use innovative &/or conventional
building techniques

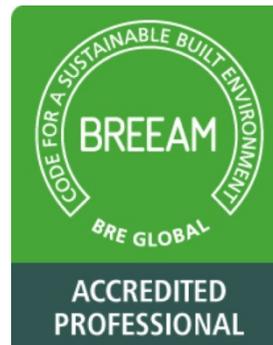
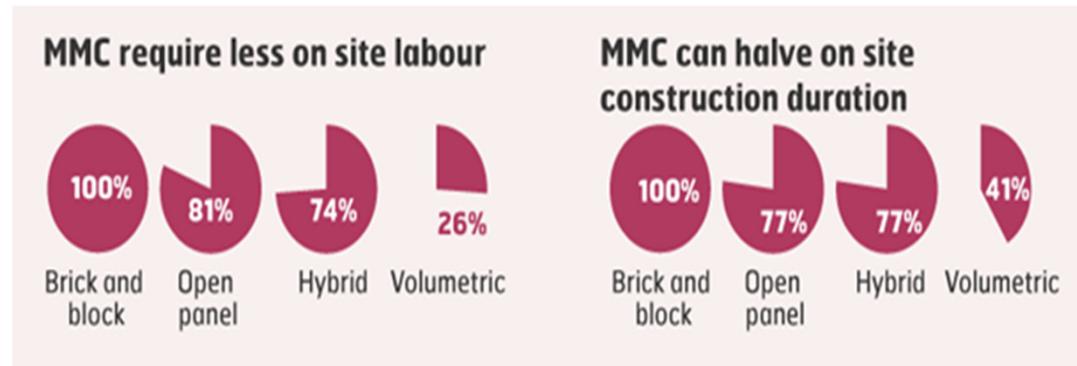


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MMC drivers



- Speed of construction
- Improved quality control through precision manufacturing off-site
- Efficiency
- Reduced construction cost
- Reduced replacement / repair time
- Health & Safety
- Building Regulations / Scottish Standards of Construction
- Political pressure
- Environmental / green credentials



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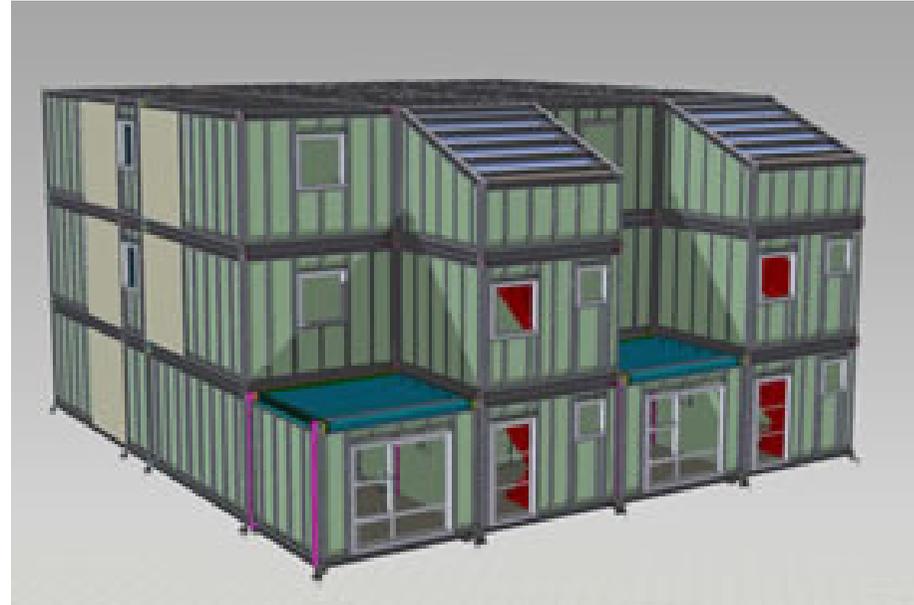
MMC – Where is it encountered?

- Housing sector
- Hostels, student accommodation
- Education, health care, hospitals
- Hotels e.g. Premier Inn, Travel Lodge etc
- Fast food restaurants eg. McDonalds, Burger King, Pizza Hut
- Retail outlets e.g Tesco metro stores
- Office / business accommodation
- Industrial units

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Volumetric (modular) construction



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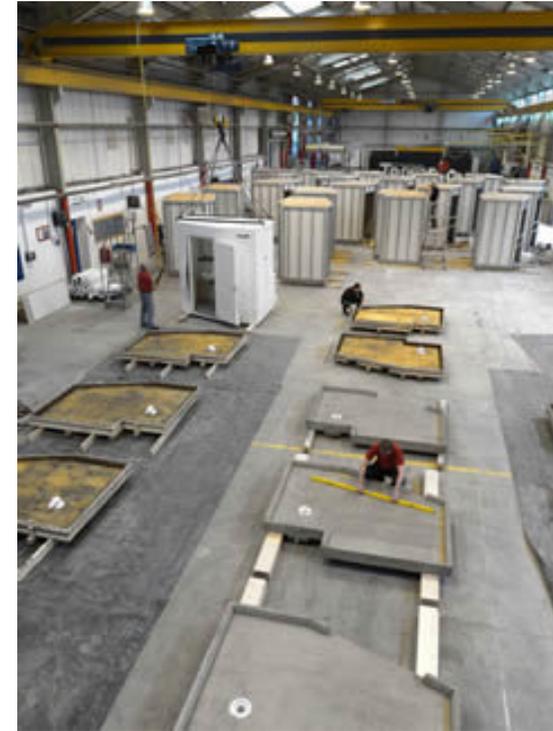


Erection of volumetric (modular) construction



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Pods



Panellised construction systems



SIPs – structural insulation panels

Timber frame: Maybe not such a modern method?



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Cross laminated timber / Glulam



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9 storey block of flats- 9 weeks to build Constructed entirely of timber (CLT)



Factory production of panels with half bricks / brick slips



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Concrete construction elements



Factory engineered concrete (FEC)



Insulated concrete formwork (ICF)



Tunnel form

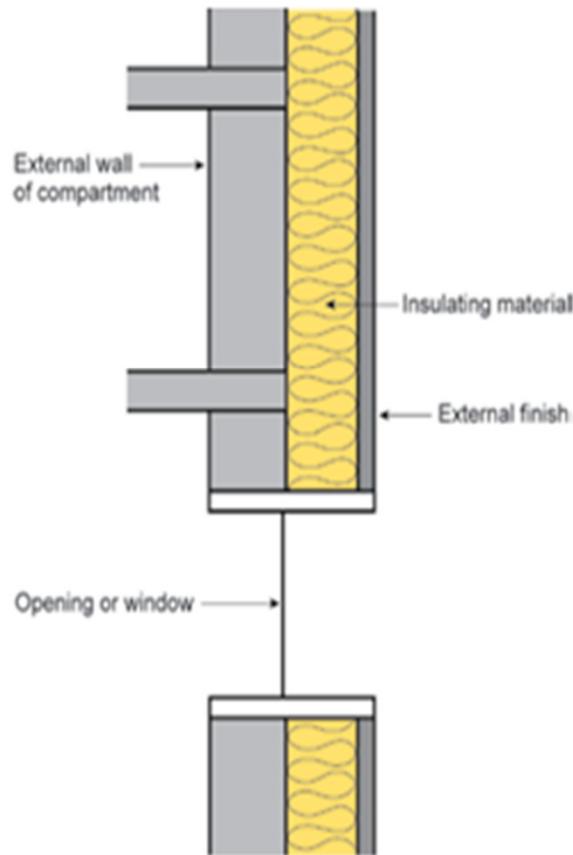


Twin wall

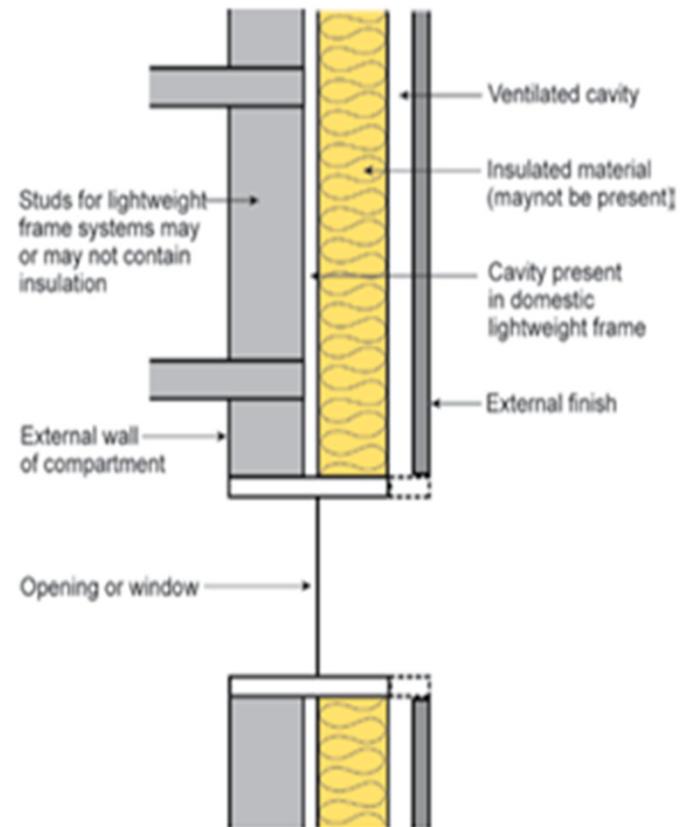


Building Research Establishment (BRE): Definition of cladding systems

Non-ventilated cladding system

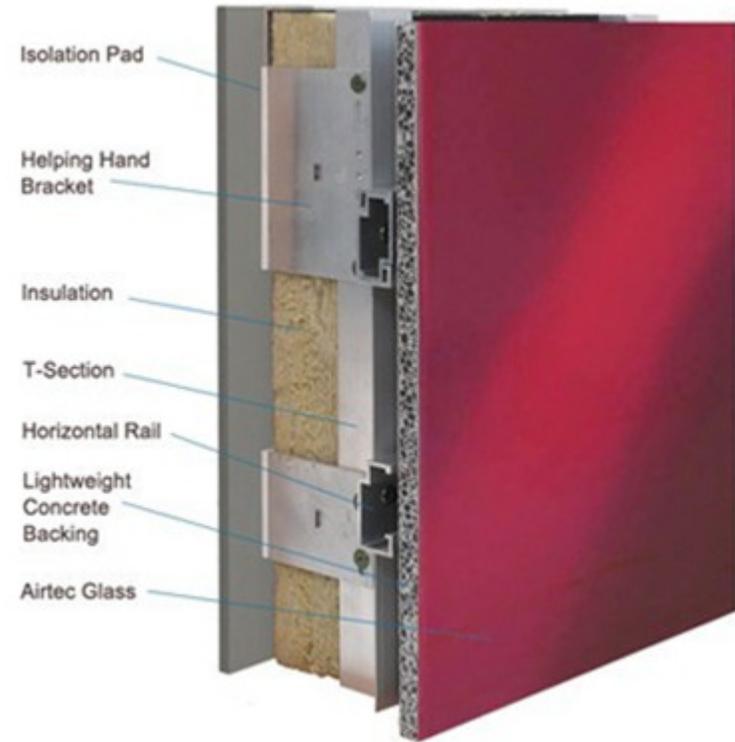
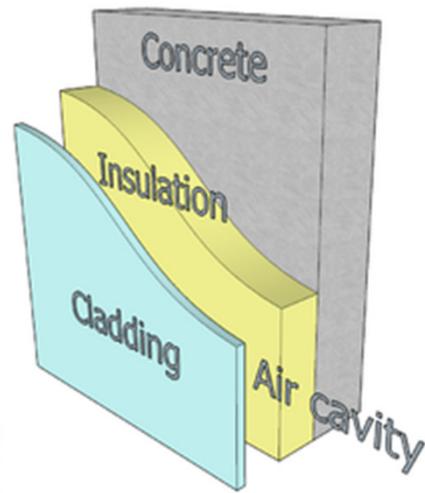


Ventilated cavity cladding system

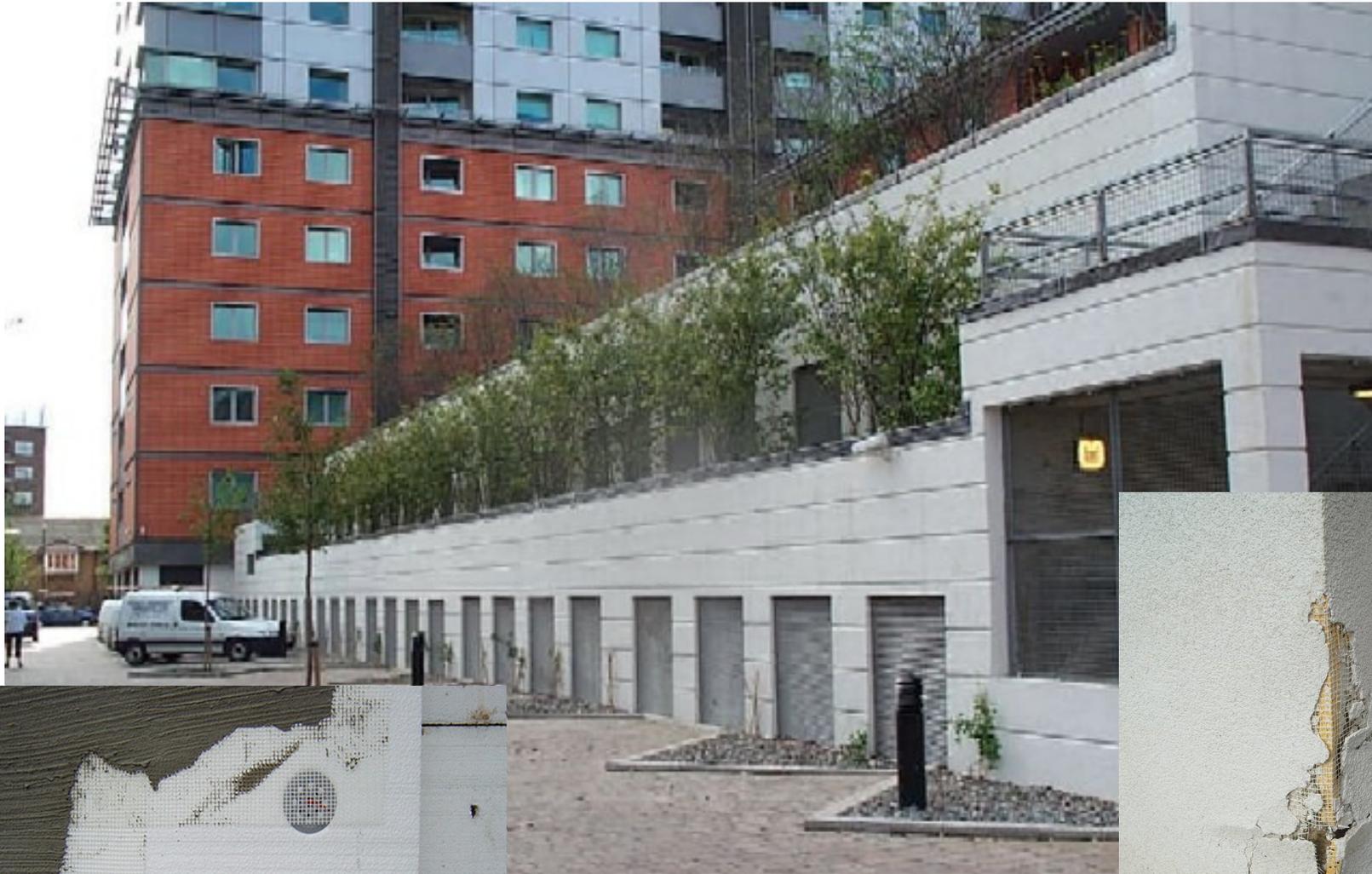


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External cladding systems



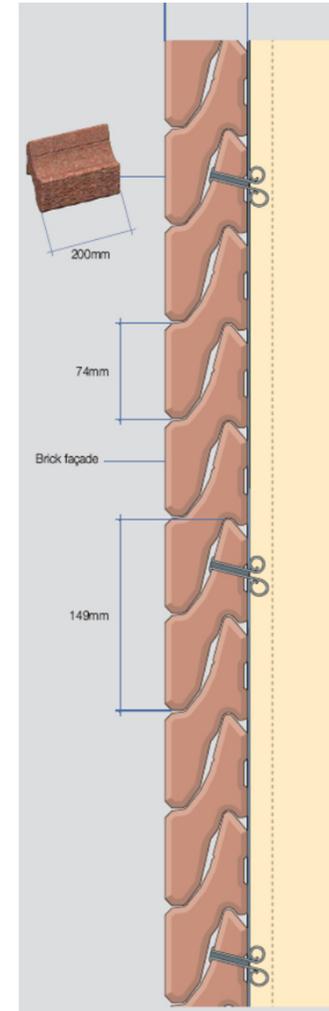
External cladding systems



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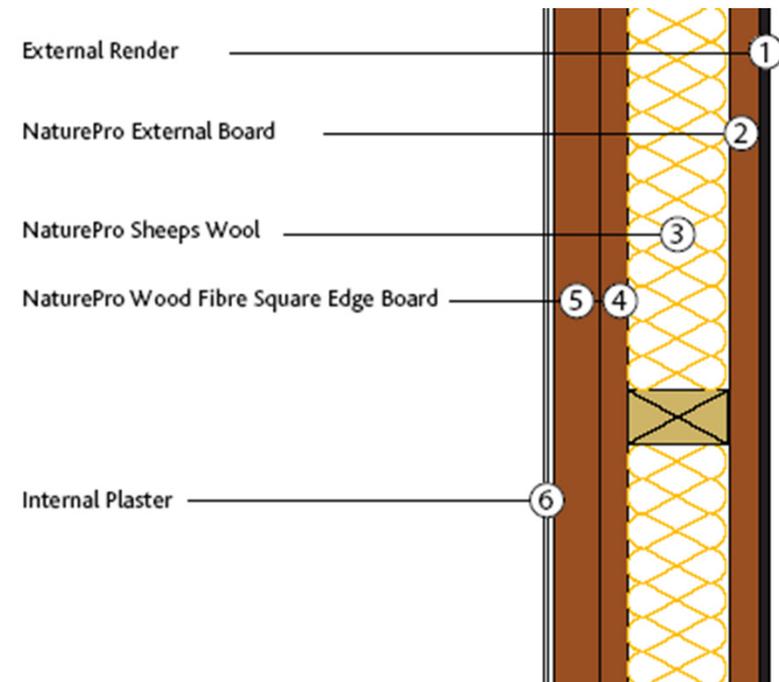


Thermabrick (Kingspan)



LPS 1181: Part 2 approved

Sheep's wool insulation



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Hempcrete



House of straw: 'Eco-buildings'



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'Slate' / 'tile' roofing



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Renewable energy

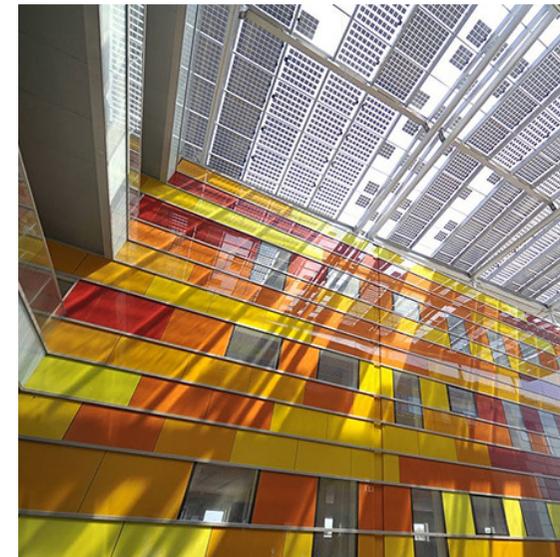
Ferrier Point

Approximately 50% of the south facade is covered in PV (photovoltaic) type solar panels



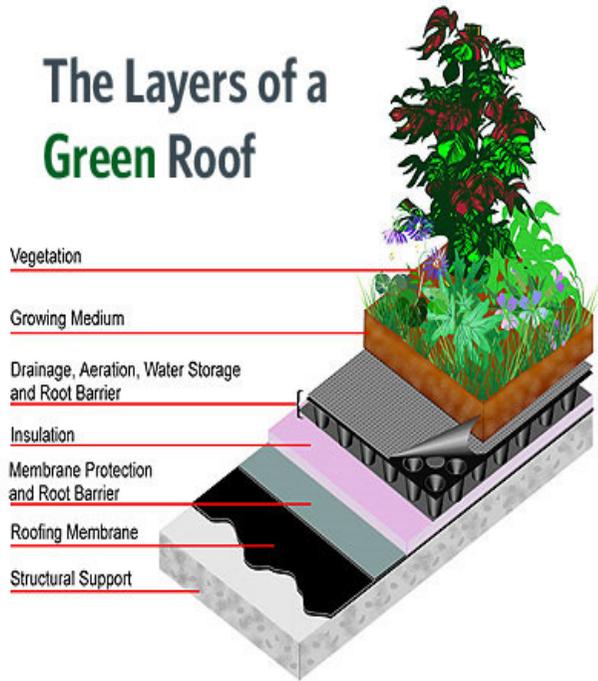
PV glazing

Solar cells sandwiched between sheets of glass, converting light into electricity (eg Dubai)



Green walls / roofs

The Layers of a Green Roof



Key challenges

- Identification of materials: crucial but often difficult
- F&RS concerns re-identification, how to tackle fires, finding seat of fire, & may adopt a defensive strategy
- Fire performance / resistance: use of combustible / highly combustible materials? use of non-approved (3rd party accredited) products? toxicity?
- Creation of vertical / lateral flues & voids within the structure: is fire-stopping present and adequate? can fire / smoke spread undetected?
- External cladding systems can encourage fire spread
- Lightweight framework: resistance to excessive deflection? early collapse?
- Quality & competency of installation / lack of maintenance or repairs

Key challenges

- Breach of fire barriers by trades / occupants; no follow up fire stopping
- Slow progress of appropriate standards / lack of approved products
- Tests based on samples in ‘mint condition’
- No extensive fire loss database to work from / EML considerations
- Resilience / durability?
- Building regulations focus on life safety only: recent changes (post ‘Hackitt review’) a good first step, but limited
- Use of “value (or fire) engineering” may reduce overall property protection / resilience

Key challenges

Not just fire:

- Flood
- Wind
- Climate change
- Impact
- Theft
- Transit risks
- EL / PL
- Business disruption

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Undetected fire spread



HRB & External cladding systems



Knowsley Heights, 1991



Garnock Court, 1999



Lakanal House, 2009

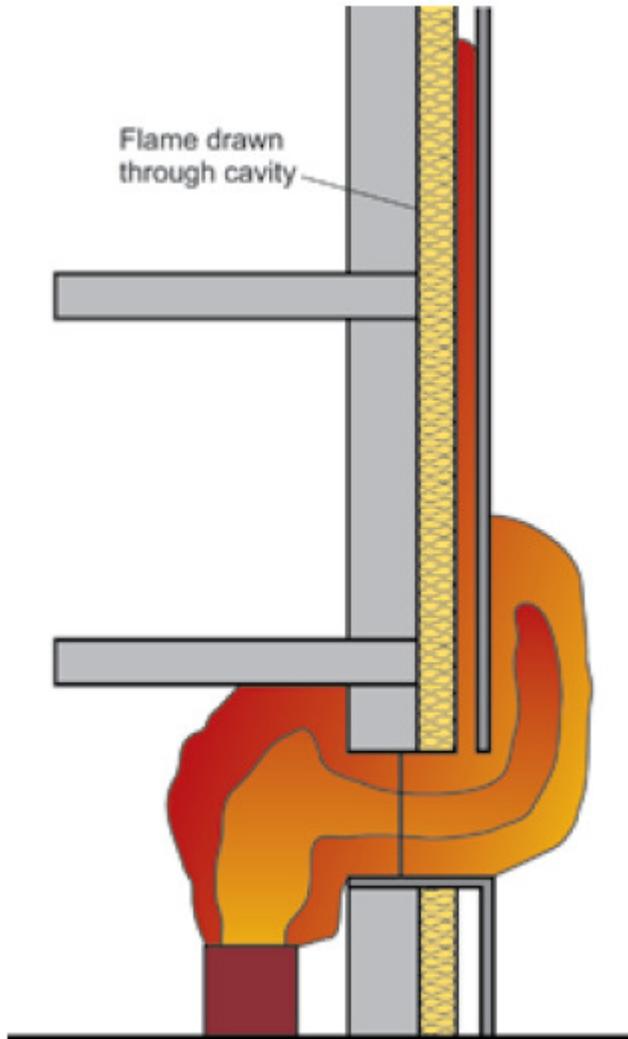


Grozny City Towers, Chechnya
2013



Polat Tower, Istanbul, 2012

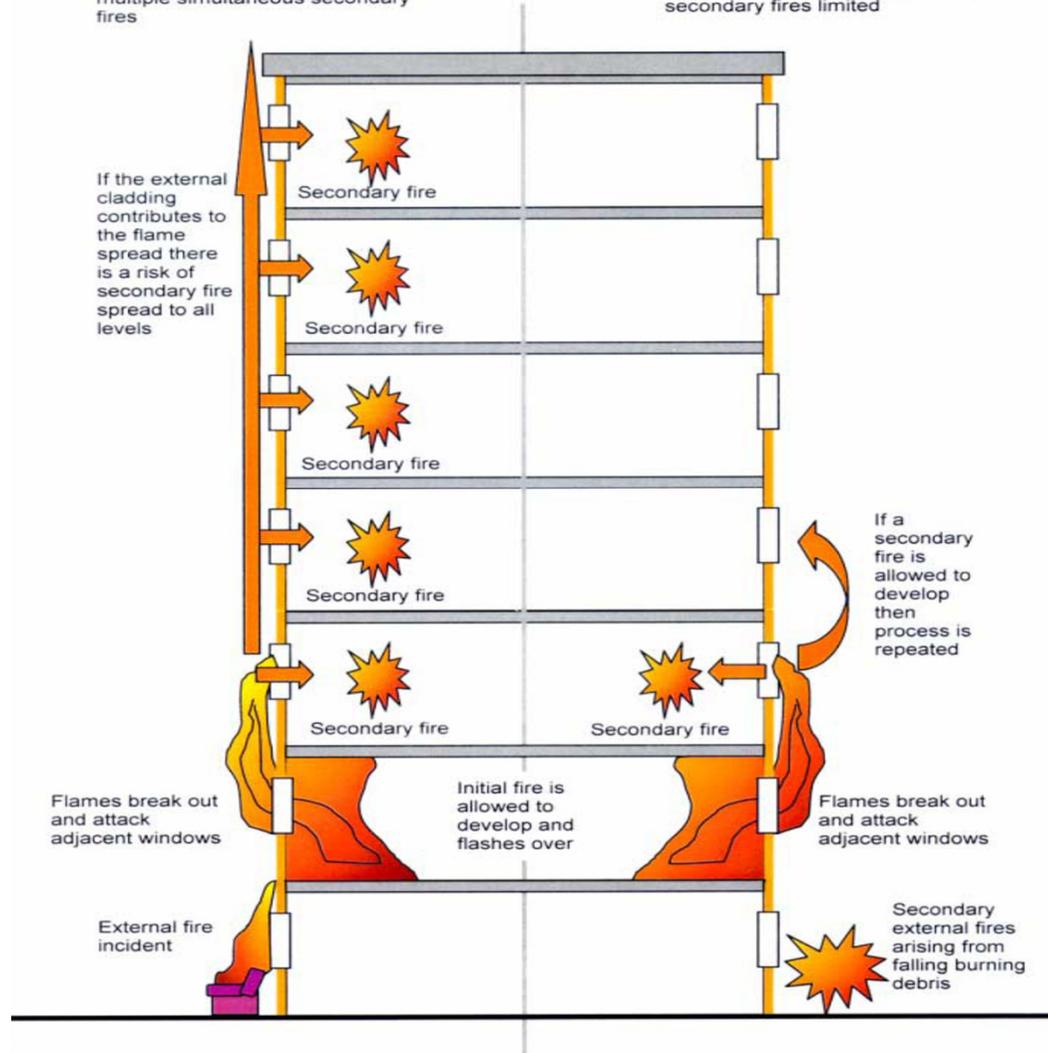
HRB & External cladding systems



Rapid Fire Spread

Cladding system contributes to flame spread resulting in risk of multiple simultaneous secondary fires

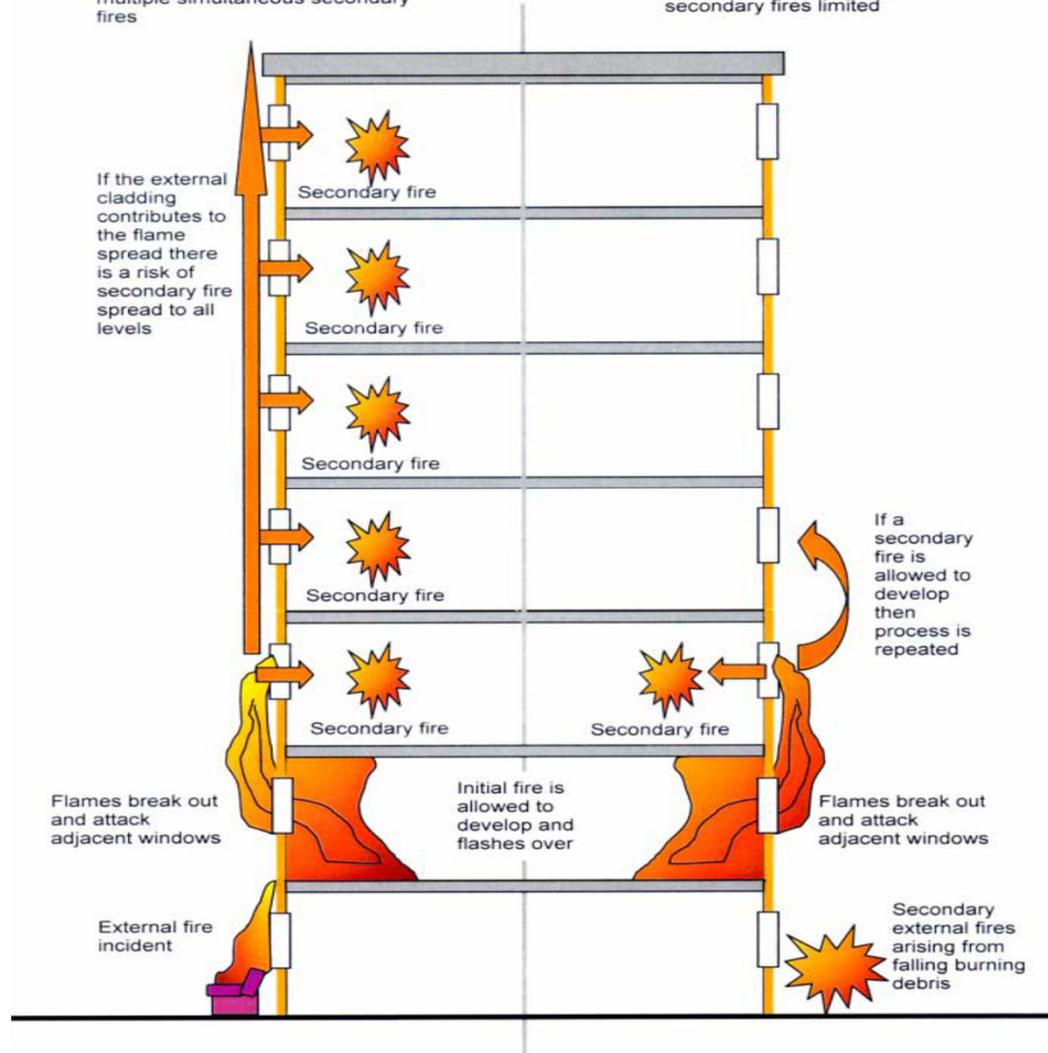
If the external cladding contributes to the flame spread there is a risk of secondary fire spread to all levels



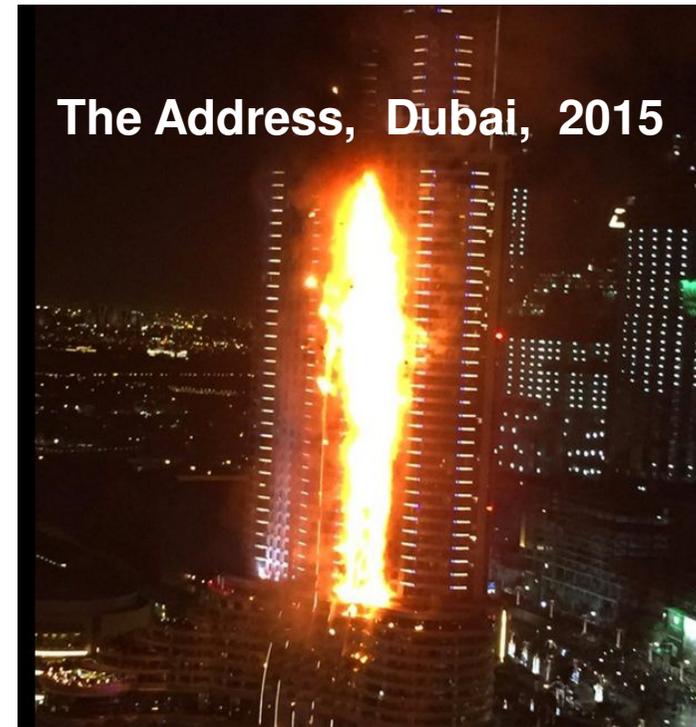
Restricted Fire Spread

Cladding System does not contribute to flame spread. Risk of secondary fires limited

If a secondary fire is allowed to develop then process is repeated



Commercial **ACM cladding systems**

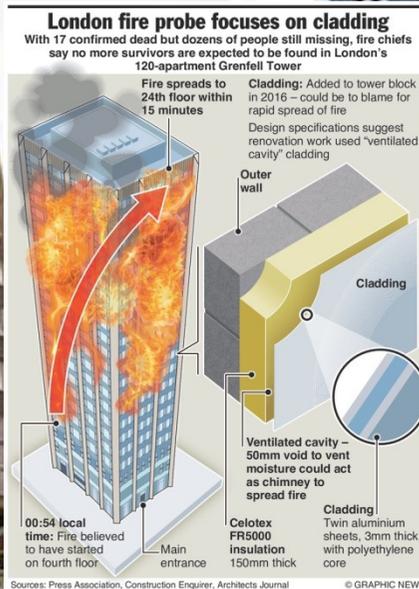
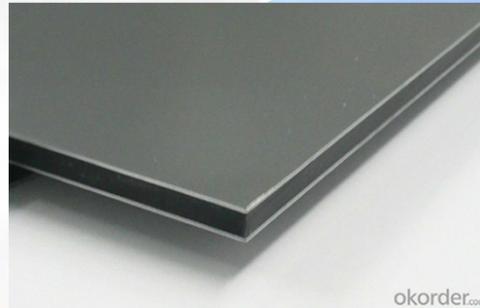


Built c.1974

Refurbished May 2016



**GRENPELL TOWER
PRE-REFURB IN 2011**

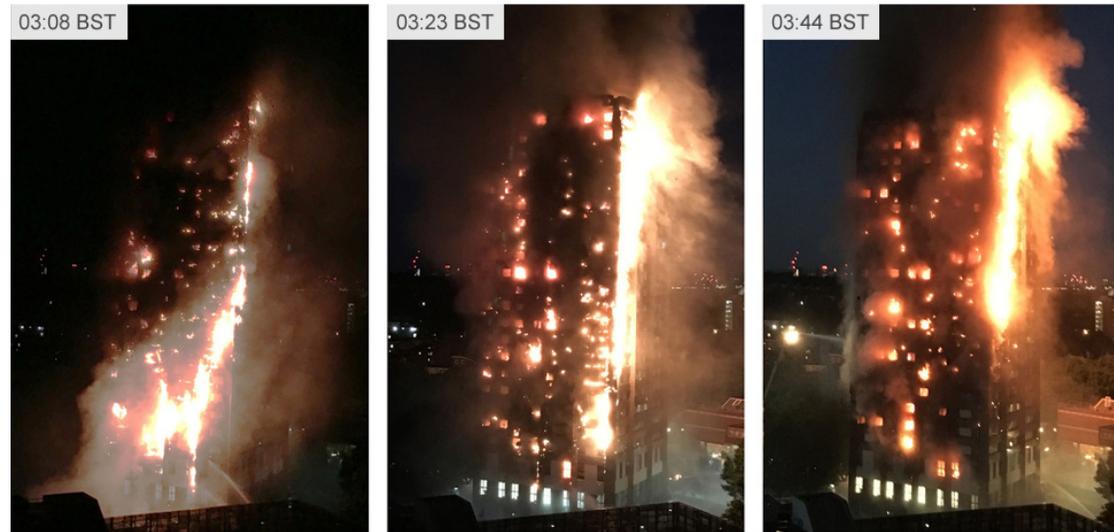


Sources: Press Association, Construction Enquirer, Architects Journal © GRAPHIC NEWS



**POST-REFURB
WITH NEW CLADDING**

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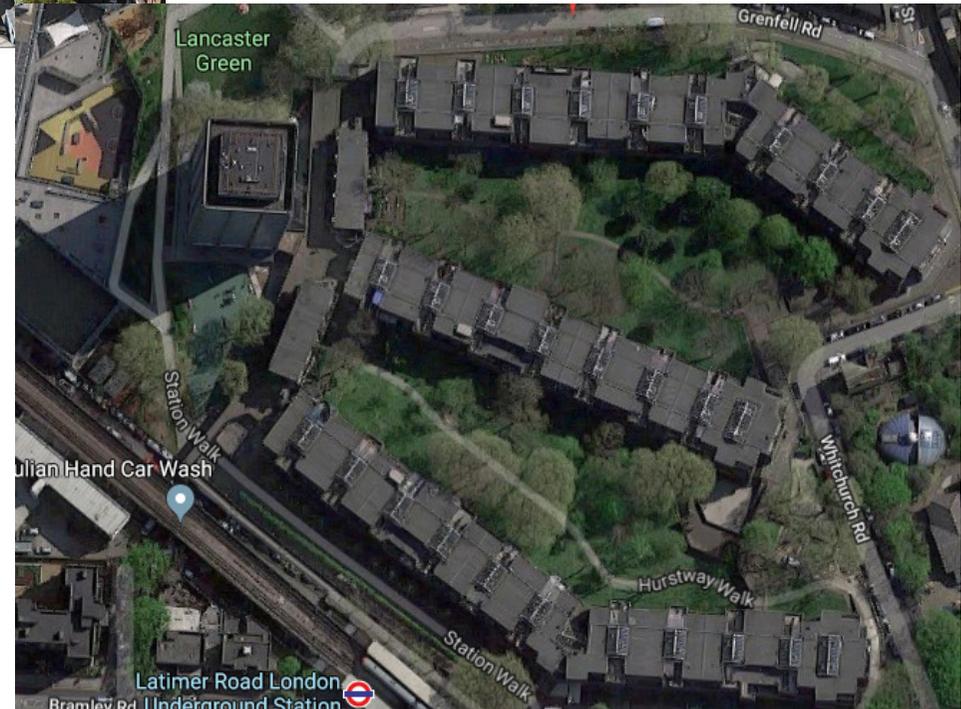


Grenfell Tower, 2017

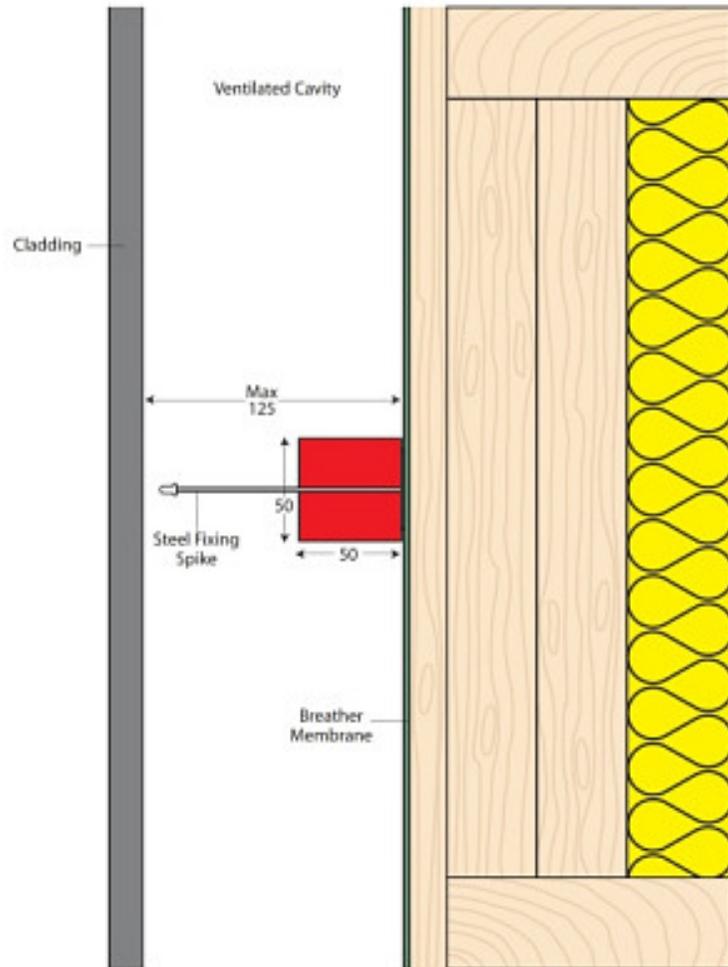


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The site surrounding Grenfell Tower



Cavity fire barriers



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University



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Timber framed block of flats



Timber frame fires – in course of construction





Low cost modular flats in Leeds:
built 2000, demolished 2005 owing to concerns over
stability in strong winds.

Test standards & approvals

LPCB (Loss Prevention Certification Board)

- **LPS 1581:** for non-load bearing external cladding systems applied directly to masonry substrate (includes rain screen cladding & ETICS)

NB: Currently 3 approved products- includes EPS insulated cladding systems (Dryvit)

- **LPS 1582:** for non-load bearing external cladding systems fixed to & supported by structural steel frame (includes rain screen cladding & ETICS)

NB: Currently 3 approved products- includes EPS insulated cladding systems (Dryvit)

Test standards & approvals

LPCB (Loss Prevention Certification Board)

- **LPS 1181:**
 - Part 1:** Cladding products for external envelope of buildings
 - Part 2:** Sandwich panels / built-up panel systems for internal use in a building
 - Part 3:** Cladding (sandwich panel walls / ceilings) used in POD construction
- **LPS 1208:** Composite construction elements (walls; cavity barriers; floors; roofs)

Test Standards / Approvals

- **BS 8414:** Fire performance of external thermal insulation for walls of multi-storey buildings
- **BS 476 series:** Fire tests on building materials / structures
- **BS EN 13501 series:** Fire classification of construction products / building elements
- **Eurocodes:** International codes of practice for design of buildings / civil engineering structures (includes fire design)

Test standards & approvals

Factory Mutual – FM (US based testing / standards)

Testing at the FM Global Research Campus. Follow up includes surveillance audits of manufacturing sites on approved products.

FM Approval - relevant testing:

FM 4411 – Cavity Walls & Rainscreen

FM 4881 – Class 1 Exterior Walls



These are large scale tests using a re-entrant corner (as per BRE testing).

NFPA tests are considered to be an intermediate-scale multi-storey fire test and not to the level of the FM tests.

Test standards & approvals

BRE (Building Research Establishment)

- **BPS 2020** (*residential*): requirement to meet B/- Regs re: safety & functionality, & audit of production control facilities by certifying body

Plus enhanced performance standards:

- Fire
- Energy
- Security
- Flood
- Environmental profiling



HM Government

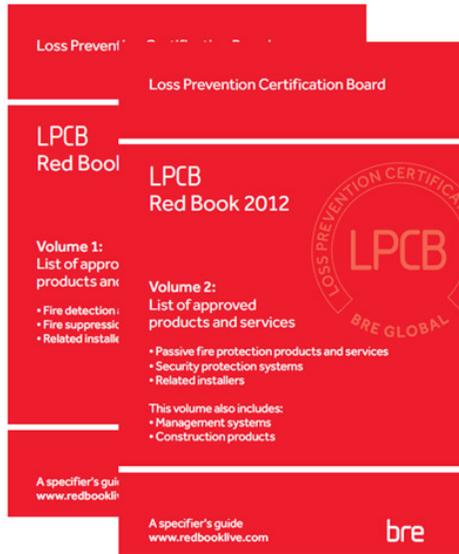
- **From 21st December 2018 the Building (Amendment) Regulations comes into force.**
- This states that materials becoming part of an external wall, or specified attachment, of a relevant building (over 18 metres high) are of European Classification **BS EN 13501-1 Class A1 or Class A2-s1,d0. It applies to new buildings or to refurbishment work** where external wall work is involved.
- The regulation applies to buildings occupied as follows: **residential schools, hospitals, residential care homes, student residences or accommodation blocks. However, hostels, hotels or boarding houses are excluded unless converted into residential accommodation.**



HM Government

- Amendments to Approved Document B also made during November & December **including changes to definitions and fire door testing.**
- The Government are **considering the wider implications** – ie ban on combustible materials for other building types (under 18m) / other occupancies.
- The original view to ban **desk top assessments** as a substitute for the results of an actual fire test is being re-thought. Reportedly, there are simply not enough test facilities worldwide to cope, so mandating competency for desk top assessors is now being seriously considered.
- The Government have given local authorities the **powers to remove and replace unsafe aluminium composite material (ACM).**
- **The Building Regulation amendments are not retrospective.**

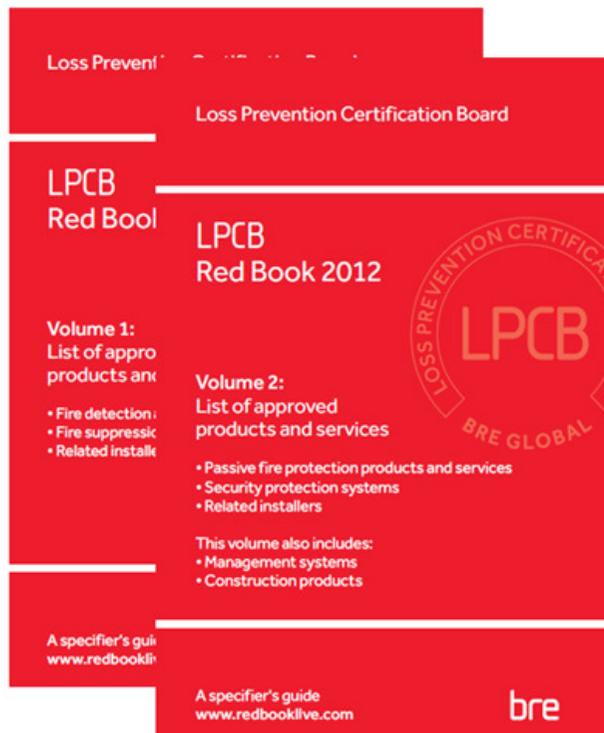
Where do you go to check if a product / material has achieved a test standard / approval?



www.redbooklive.com



What about installer competency?

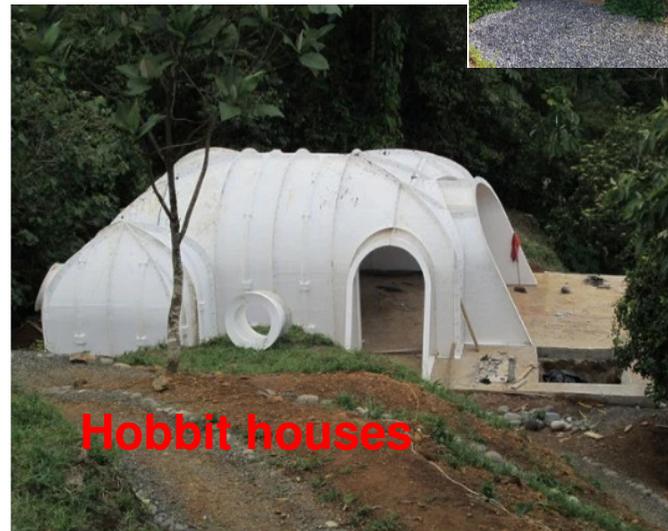
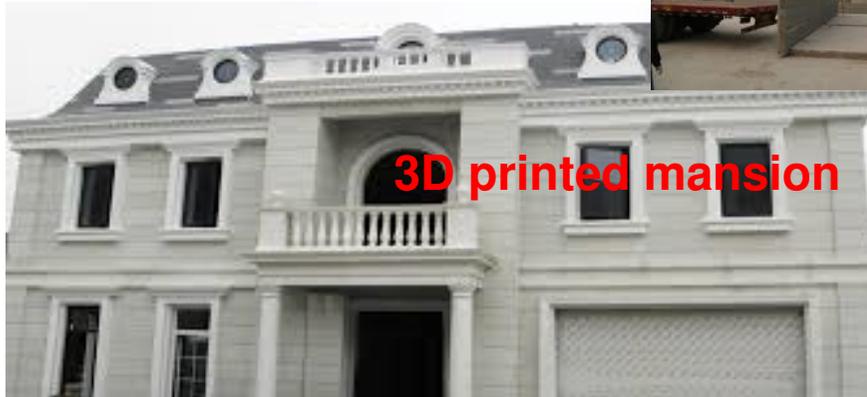


FIRAS Installer Certification Scheme

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- **LPS1500: approved installer of fire resisting compartmentation system**
- **LPS 1531: approved installer of passive fire protection products**

The future



Final thoughts

- Here to stay
- Establish & understand construction materials used
- Discourage use of combustible / highly combustible materials
- Understand how put together & impact on potential fire risk
- Look for & encourage use of standards / approvals: materials & contractors
- Large / full scale v sample testing
- May state ‘tested to...’; though doesn’t mean the product / material has passed or been ‘technically’ assessed against the test!
- Fire safety regimes in place ASAP (ie fire stopping / fire compartments etc, including fire cavity barriers for cladding systems)
Education of occupiers & trades
- High standard of management / housekeeping / arson prevention
- Early involvement in new build / refurbishment contracts essential
- Remember, MMC / cladding systems do not start fires!

