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23 MAY 2024

MMC
A Fire Engineers Perspective

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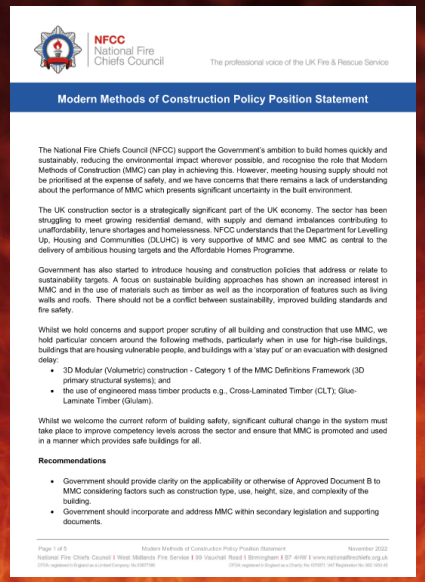
Modern Methods of Construction (MMC)

- **Climate Crisis**
- **Housing Emergency**
- **MMC widely considered part of the solution**
  - LGS and Timber Frame
  - Volumetric/Modular
- **Fire Safety Challenges**

MMC Fire Safety Industry Concerns

- **Limited expertise, consistency, competency and guidance in dealing with fire safety aspects**
- **Limited test and research evidence**
- **Concerns regarding resilience:**
  - Heavy reliance on detailing, workmanship
  - Heavy reliance on internal linings to provide fire resistance to structure
- **NFCC UK Statement on MMC**
  - Recognise the need for MMC but are concerned
  - Conflict between sustainability and Fire Safety
  - Needs much more expertise, guidance, scrutiny, research and testing.
- **How do we address these concerns, provide confidence in MMC systems?**



NFCC
National Fire Chiefs Council

The professional voice of the UK Fire & Rescue Service

Modern Methods of Construction Policy Position Statement

The National Fire Chiefs Council (NFCC) support the Government's ambition to build homes quickly and sustainably, reducing the environmental impact wherever possible, and recognise the role that Modern Methods of Construction (MMC) can play in achieving this. However, meeting housing supply should not be prioritised at the expense of safety, and we have concerns that there remains a lack of understanding about the performance of MMC which presents significant uncertainty in the built environment.

The UK construction sector is a strategically significant part of the UK economy. The sector has been struggling to meet growing residential demand, with supply and demand imbalances contributing to unaffordability, tenure shortages and homelessness. NFCC understands that the Department for Levelling Up, Housing and Communities (DLUHC) is very supportive of MMC and see MMC as central to the delivery of ambitious housing targets and the Affordable Homes Programme.

Government has also started to introduce housing and construction policies that address or relate to sustainability targets. A focus on sustainable building approaches has shown an increased interest in MMC and in the use of materials such as timber as well as the incorporation of features such as living walls and roofs. There should not be a conflict between sustainability, improved building standards and fire safety.

Whilst we hold concerns and support proper scrutiny of all building and construction that use MMC, we hold particular concern around the following methods, particularly when in use for high-rise buildings, buildings that are housing vulnerable people, and buildings with a 'stay put' or an evacuation with designed delay:

- 3D Modular (Volumetric) construction - Category 1 of the MMC Definitions Framework (3D primary structural systems); and
- the use of engineered mass timber products e.g., Cross-Laminated Timber (CLT); Glue-Laminate Timber (Glulam).

Whilst we welcome the current reform of building safety, significant cultural change in the system must take place to improve competency levels across the sector and ensure that MMC is promoted and used in a manner which provides safe buildings for all.

Recommendations

- Government should provide clarity on the applicability or otherwise of Approved Document B to MMC considering factors such as construction type, use, height, size, and complexity of the building.
- Government should incorporate and address MMC within secondary legislation and supporting documents.

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NFCC recognise that MMC has a role to play to provide much needed housing and infrastructure, but stress that the safety of MMC needs to be considered. We are concerned that MMC buildings are being designed, approved and built under a regulatory system that has been described and accepted by Government as 'not fit for purpose' even for traditional construction techniques. To ensure the industry is not creating legacy building safety issues, additional safeguards are needed to ensure there is not an influx of potentially unsafe MMC buildings being constructed while necessary regulatory reforms are in progress.

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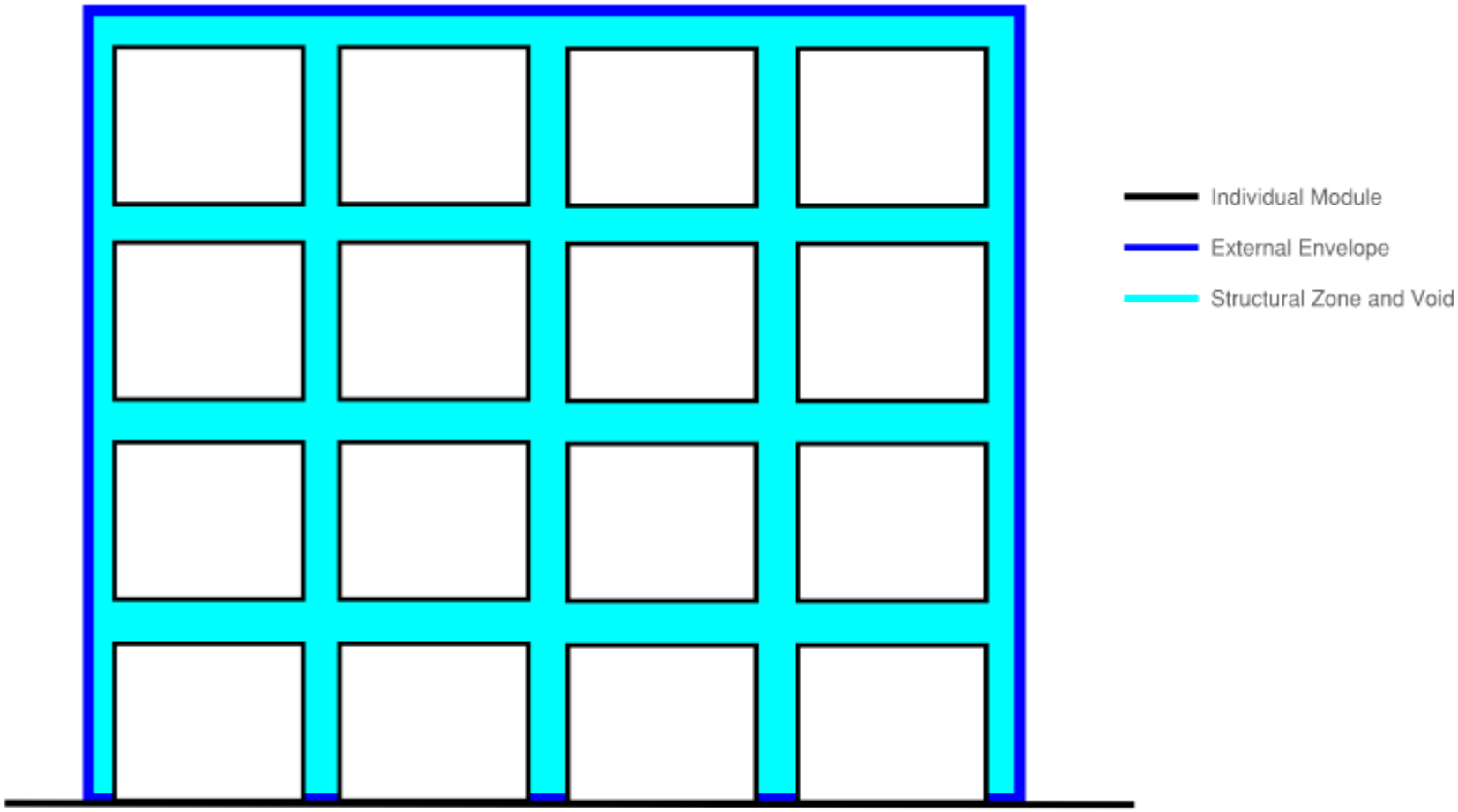
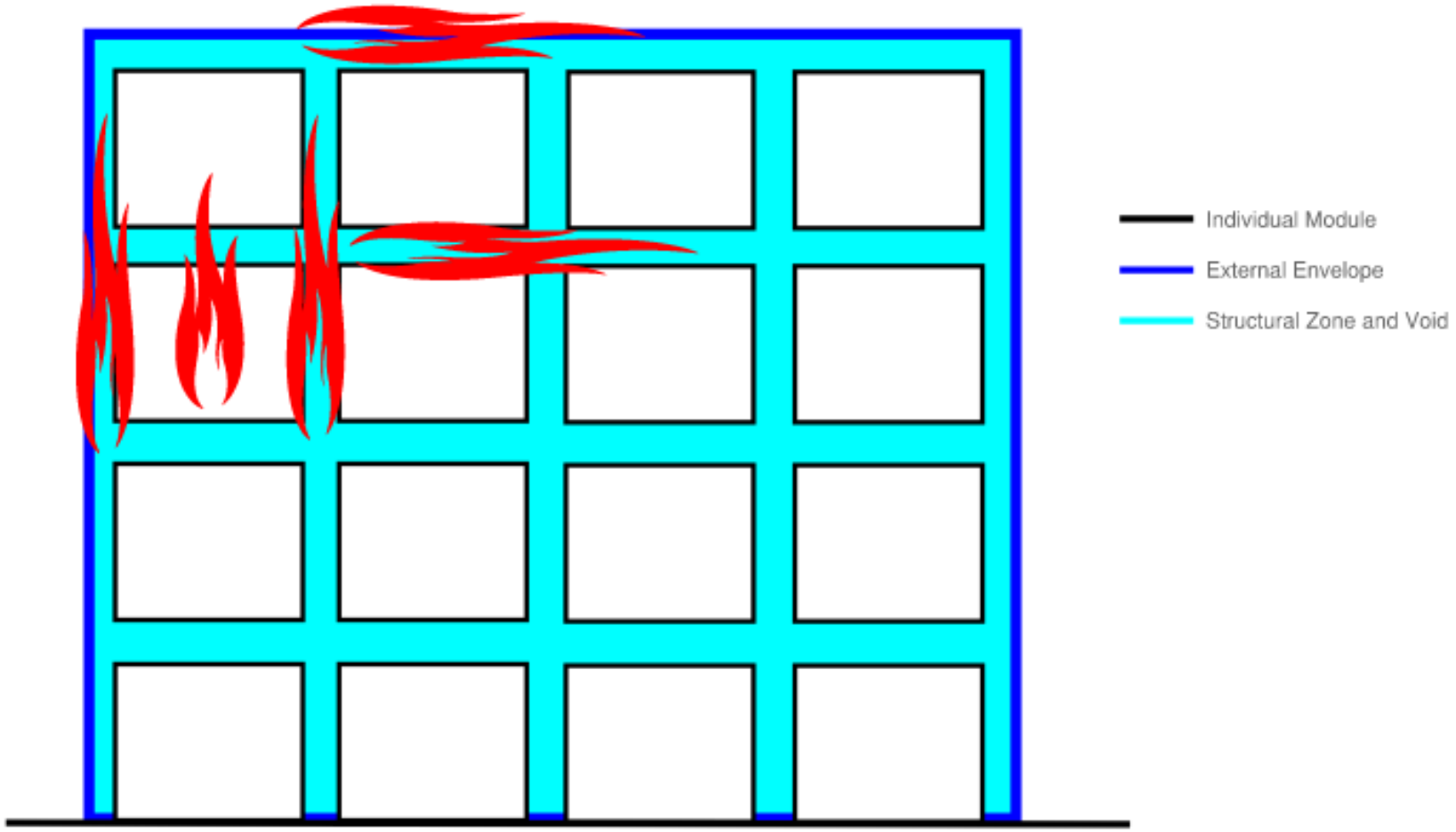

Individual Module
External Envelope
Structural Zone and Void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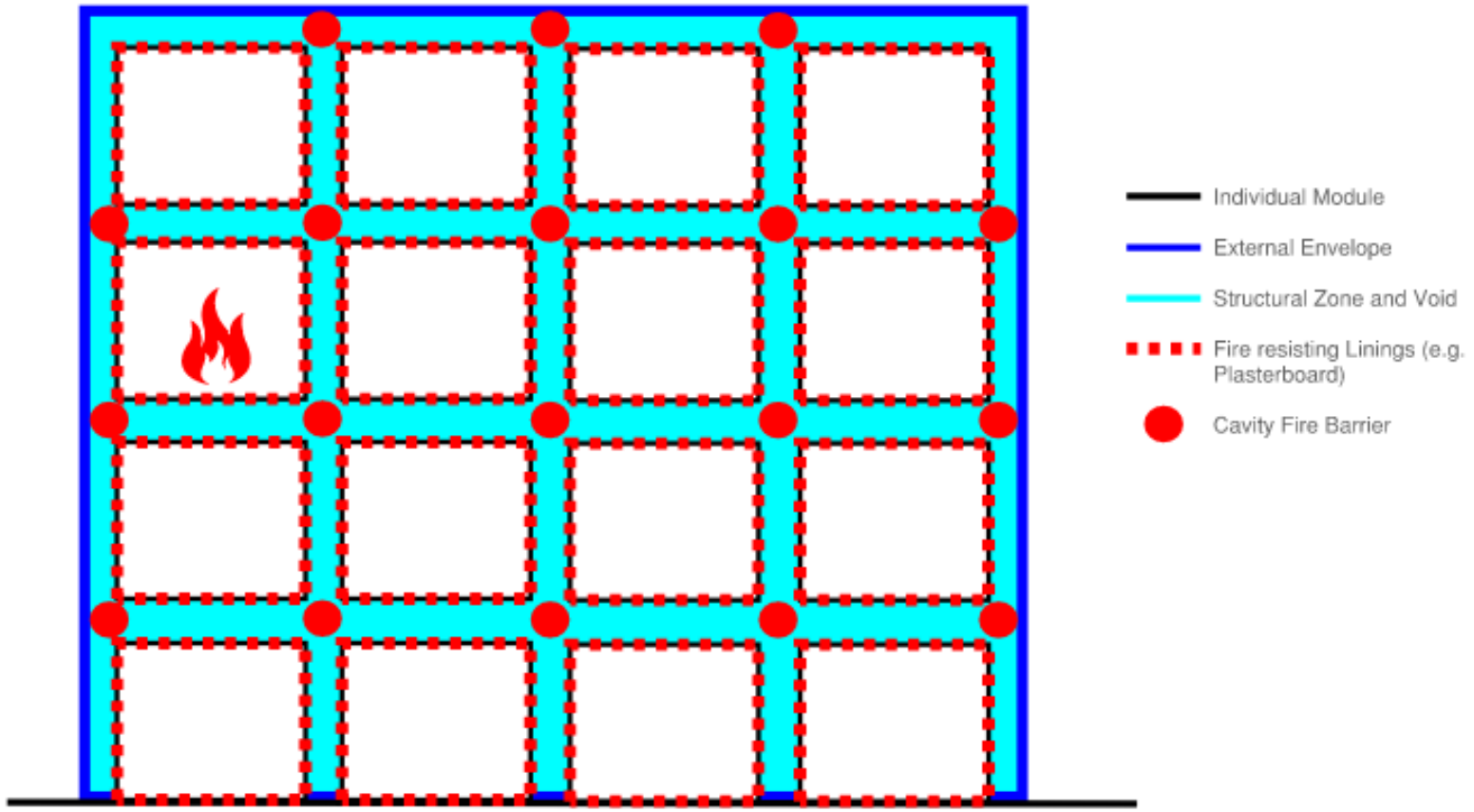
Individual Module
External Envelope
Structural Zone and Void
Fire resisting Linings (e.g. Plasterboard)
Cavity Fire Barrier

Comparison of typical Traditional vs MMC arrangements

Traditional

- **Elements of structure fire protected individually**
  - RC Frame fire resistance inherent in concrete cover
  - Steel Frame intumescent painted or encased
- Internal plasterboard wall linings provided for internal fire separation only, not structural fire protection.
- Floors and walls create natural breaks, typically the only extensive interconnecting voids are in external walls
- **Implications of failure of internal plasterboard linings:**
  - **fire spread locally**

MMC

- **Elements of structure not fire protected individually**
- Internal plasterboard wall and ceiling linings provided for both internal fire separation AND structural fire protection
- Large number of interconnecting voids containing unprotected structure throughout.
- **Implications of failure of internal plasterboard walls:**
  - **Fire spread locally; and**
  - **Fire spread potentially beyond via interconnecting voids; and**
  - **Fire protection to structure and structural collapse.**
- Consequences of failure of plaster board linings to limit fire spread into structural void zone are potentially much greater when compared with more traditional construction.

Varying Levels of fire safety risk:

Higher Risk	**Lower Risk**
High rise	Low rise
Sleeping risk	Awake familiar occupants (e.g. offices)
‘Stay Put’	Simultaneous evacuation
High density housing	Low density low rise housing (e.g. individual dwelling houses)
Hospitals (Progressive horizontal evacuation)	
Care facilities	

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Regulations and Guidance

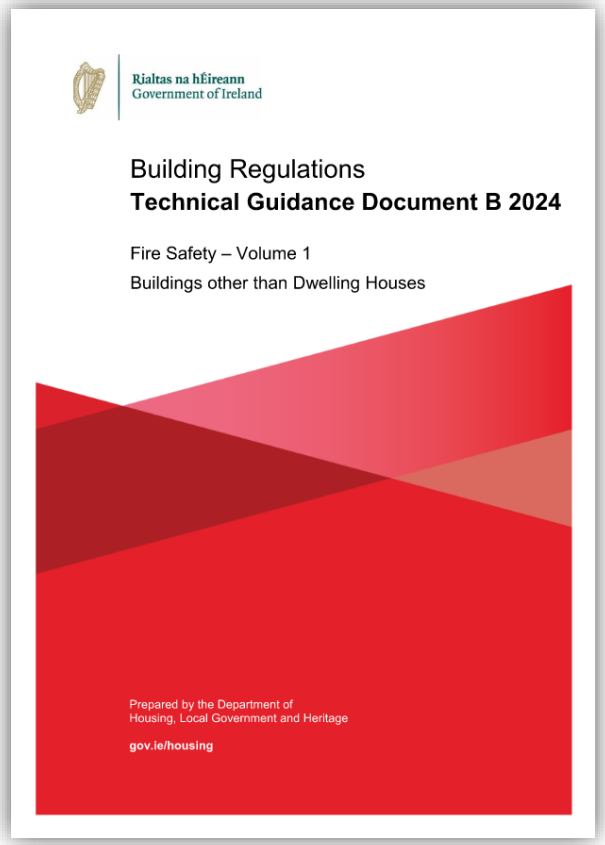
Building Regulations

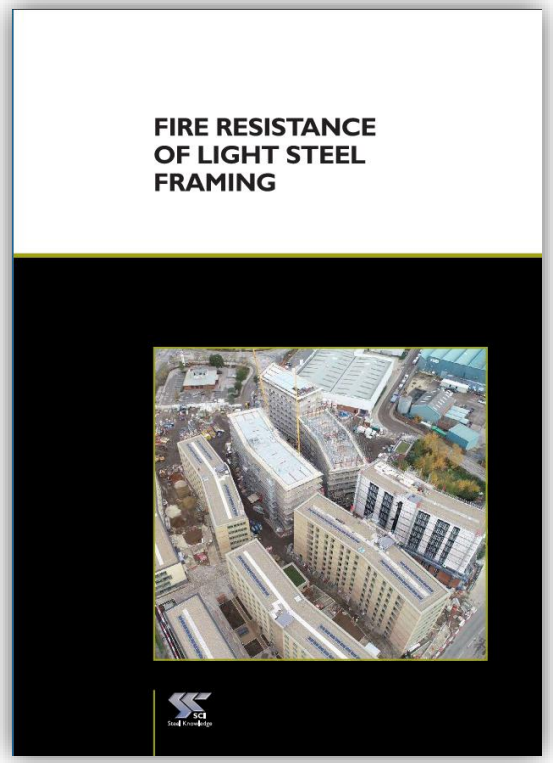
Guidance

- *Technical Guidance Document B (TGD B) 2024*
  - no specific MMC guidance or recommendations

- *BSI: PAS 8700 Modern Methods of Construction*
  - being drafted but will only address houses and apartments, not hotels, hospitals, prisons etc.

- *Steel Construction Institute (SCI): P 424 Fire Resistance of Light Steel Framing*
  - LGS guidance with some modular guidance





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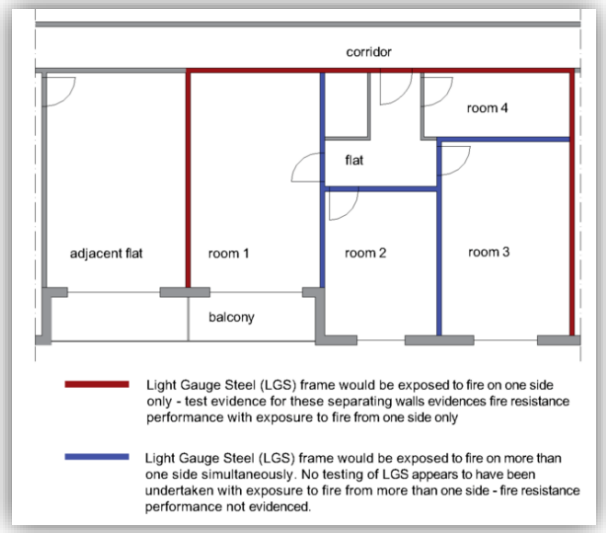
Regulations & Code Guidance

- **Building Regulations, the requirement:**
  - 'A building shall be so designed and constructed that, in the event of fire, its stability will be maintained for a reasonable period'
- **Is current guidance suitable for MMC?**
- **Structural Frame, Beam or Columns**
  - TGD B recommends fire protection from all exposed sides
- **Floors: TGD B recommends protection from underside only**
  - But what about MMC where the structural frame is within the floor build-up?
  - Structural frame is exposed to fire above if only under boarded
- **External Walls: TGD B recommends protection from inside only:**
  - But what about MMC where structural frame is typically only protected on inside, non-fire resisting cladding on outside?
  - External flaming can affect overall structural frame
- **Loadbearing wall: TGD B recommends each side separately**
  - But what about when the wall is exposed on both sides to fire?
  - **<u>No proposed changes to clarify this issue in the new TGD B</u>.**

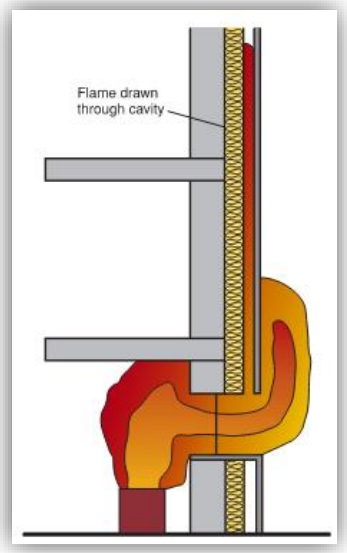
Table A1 **Specific provisions of test for fire resistance of elements of structure, etc.**

Part of building	*Minimum provisions when tested to the relevant (7) European standard (minutes)*	Minimum provisions when tested to relevant parts of BS 476 (1) (minutes)			Method of exposure
		Loadbearing capacity (2)	Integrity	Insulation	
1. Structural frame, beam or column	R*	*	No provision	No Provision	Exposed faces
2. Loadbearing wall (which is not also a wall described in any of the following items)	R*	*	No provision	No provision	each side separately
3. Floors (a) floor in upper storey of a 2 storey house (but not over a garage)	R 30, REI 15	30	15	15	from underside (3)
(b) any other floor including compartment floors	REI*	*	*	*	from underside (3)
4. Roofs Any part forming an escape route	REI 30	30	30	30	from underside (3)
5. External walls (a) any part less than 1 m from any point on relevant boundary	REI*	*	*	*	each side separately
(b) any part 1m or more from the relevant boundary	RE*, REI 15	*	*	15 (4)	from inside
6. Separating wall (5)	RE* (min 60)	* (min 60)	* (min 60)	* (min 60)	each side separately
7. Compartment wall	REI*	*	*	*	each side separately

Table A1 of TGD B



Concerns over single sided testing



External fire spread

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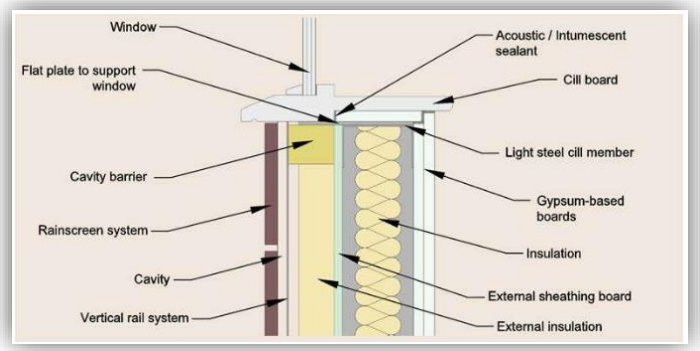
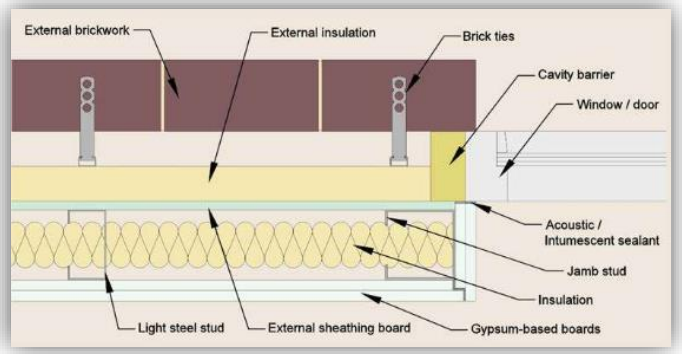
MMC Detailing and Installation Challenges – LGS/Timber Frame

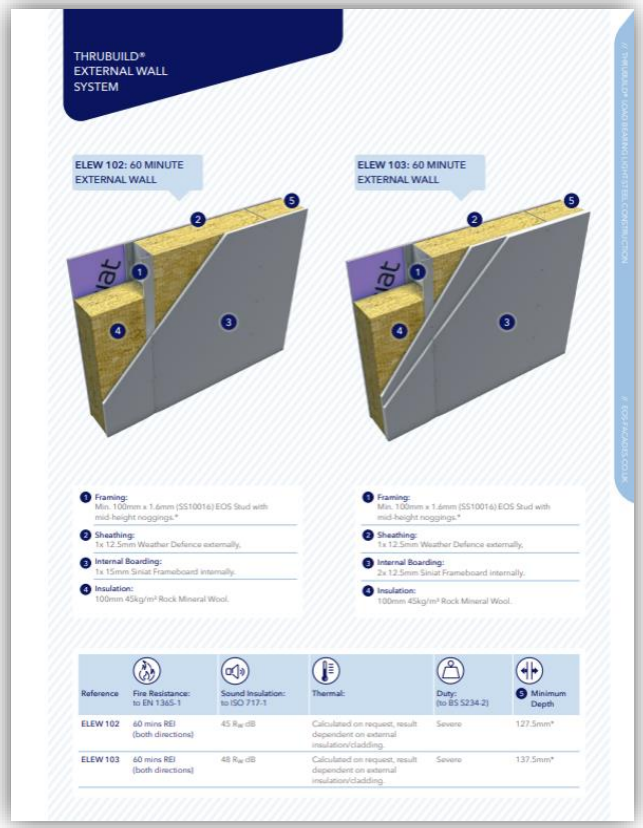
- **Detailing around interfaces and weak points**
  - e.g. window and door openings, Roof etc.
- **Limited test evidence for installations on site**
  - Exposure from external

Examples of poor detailing at walls/windows

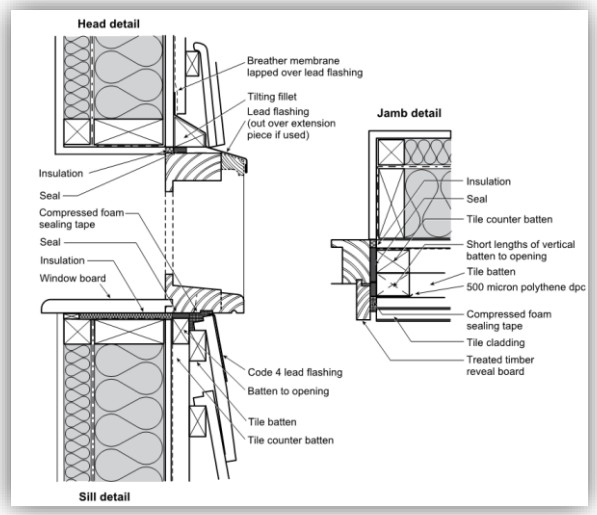




SCI LGS guidance for window reveals



Fire resisting sheathing boards with test evidence



Timber frame window reveal guidance

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MMC Detailing and Installation Challenges – LGS/Timber Frame

- **Detailing in non-standard situations, interfaces**
- **Is there direct test evidence for installations on site?**
  - Fire stopping – test evidence in loadbearing wall?
  - Addition of heavier rolled steel box sections
  - A-typical situations
  - Two sided exposure to fire
  - Exposure from external/above
- **Practical challenges with heavy reliance on boarded fire protection**
  - Workmanship
  - Fire spread during construction for timber
  - Resilience






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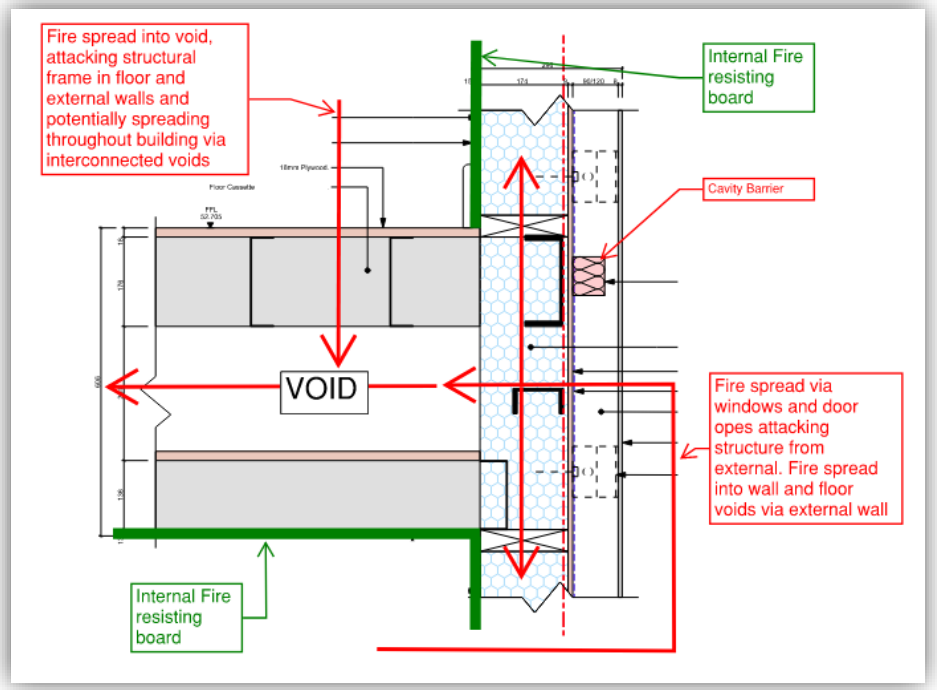
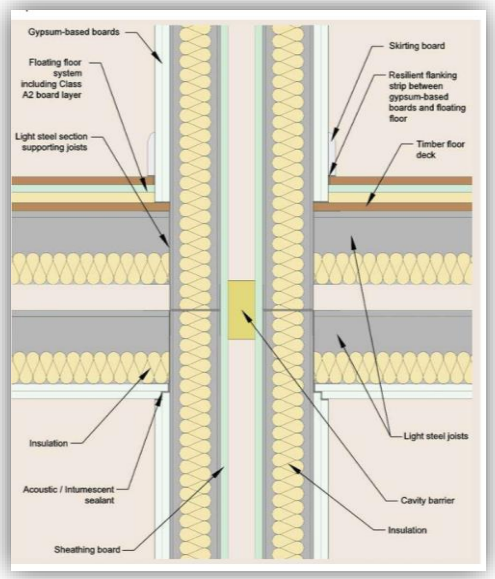
MMC Detailing and Installation Challenges – Volumetric Modular

- **Limited test evidence for:**
  - Fire stopping
  - External fire exposure (Walls)
  - Fire exposure from above (Floors)
  - Tolerances at junctions between modules
  - A-typical situations
  - Two sided fire exposure
  - Interconnecting voids: performance of cavity barriers?
- **Factory production is not a panacea for workmanship issues – these can still happen**
- **BCAR inspections & QA vital at factory and on site**
- **Practical challenges with heavy reliance on boarded fire protection – detailing, workmanship, resilience.**



Potential routes for fire to spread assuming plaster board integrity maintained



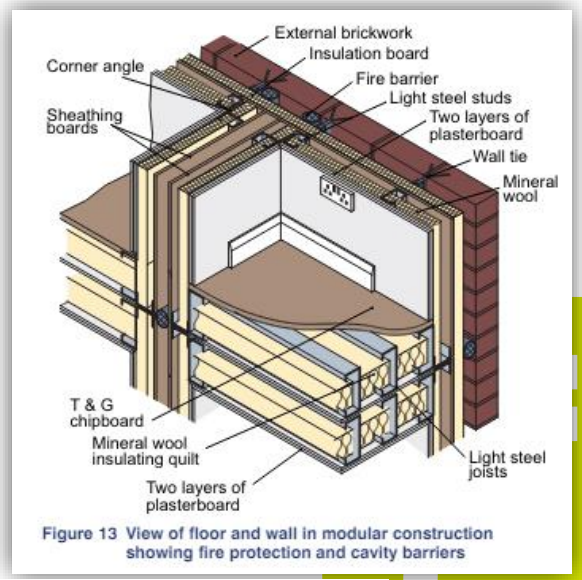


Figure 13 View of floor and wall in modular construction showing fire protection and cavity barriers

SCI guidance for cavity barriers in modular voids

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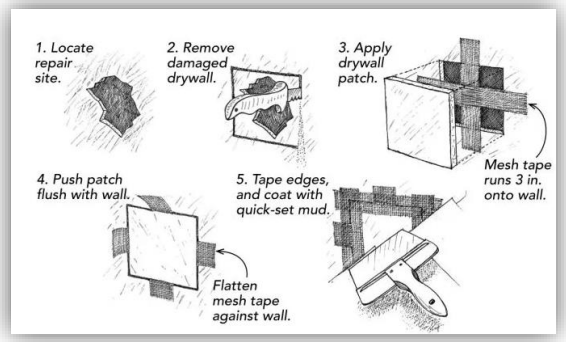
Resilience

- **Typically 60 year lifetime required**
- **How can we ensure that the tested wall and ceiling integrity is maintained and fire stopped appropriately throughout the lifetime?**
- **Reliance on O&Ms?**
- **Regular inspection?**
  - Practicality of regular access to all private dwellings?
  - Can we realistically expect that repairs/remodelling/renovations rewiring will all be done in accordance with the tested MMC system manufacturer repair instructions?
  - Awareness of building owners/responsible persons that it is an MMC building and how important internal linings are?
- **How much resilience is present in the systems to deal with this eventuality?**
- **Can systems be designed to be more resilient?**
  - Individually protect structural members?
  - Provide a sacrificial service zone vertically and horizontally?
  - Provide more robust segregation at regular intervals?
  - Significantly reduce interconnectivity of voids in MMC?
  - Carry out large scale testing and structural resilience assessments?
  - Restrict higher risk MMC systems to lower risk buildings?
  - Fire Suppression?

Recessed TV by resident

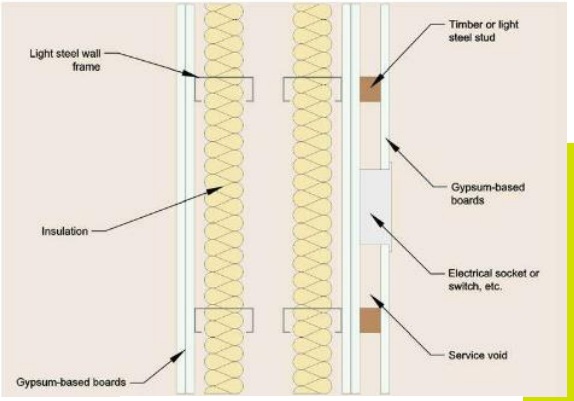
Rewire of dwelling 2 to 3 times during lifetime

Damage, wear and tear



Non fire resisting repair 'hacks' on internet

Ad Hoc DIY modifications/repairs by residents



Sacrificial service zone layer

Key aspects for MMC Industry to consider: Knowledge, Evidence and Robust Implementation

- Raise awareness & competency, share knowledge
- Make sure testing is representative and extensive
- Remove/reduce obstacles to testing, sharing of knowledge and evidence based design
- Employ robust detailing, particularly at interfaces
- Consistency: MMC specific fire safety guidance
- Consider resilience from start to finish and throughout building lifetime
- Employ a practical performance based approach….based on evidence
- Rigorous QA implementation and documentation in factory and on site
- Ask the difficult questions, don’t assume someone else will