

HIGH RISE BUILDING CONSTRUCTION MATERIALS AND FIRE RISK

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IN THE WAKE OF A NUMBER OF SIGNIFICANT FIRES INVOLVING HIGH RISE BUILDINGS, THERE IS INCREASED INTEREST IN UNDERSTANDING THE FIRE RISK ASSOCIATED WITH VARIOUS CONSTRUCTION MATERIALS. HIGH RISE BUILDINGS POSE SPECIFIC CHALLENGES FOR FIRE SAFETY, NOTABLY IN TERMS OF EGRESS STRATEGY, FIREFIGHTING OPERATIONS, AND INCREASED CONSEQUENCES OF FAILURE.

CLADDING MADE FROM ALUMINIUM WITH A POLYETHYLENE CORE

The Grenfell Tower fire in June 2017, which resulted in the loss of 72 lives and the destruction of the building, is probably one of the best-known recent examples of a high rise building fire.

It is clear that the use of combustible materials in the external wall of Grenfell Tower, principally in the form of the aluminium composite material (ACM) rainscreen cladding, but also in the form of combustible insulation, was the reason why the fire spread so quickly to the whole of the building¹.

These panels have a polyethylene core, which acted as a source of fuel. The principal mechanism for the spread of the fire horizontally and downwards was the melting and dripping of burning polyethylene from the crown and from the spandrel and column panels, which ignited fires lower down the building. Those fires then travelled back up the building, thereby allowing the flame front to progress diagonally across each face of the tower. The resultant

inquiry noted that the widespread use of combustible rainscreen cladding panels and insulation on the exterior of buildings and the introduction of new kinds of building materials in external walls may have increased the risk of Grenfell Tower type fires, but improvements in the regulations relating to fire safety and the requirements for testing and certification of materials, should be capable of mitigating that risk in the future.

USE OF MASS TIMBER

An academic review by researchers from Johns Hopkins University found that the use of mass timber for high rise structures requires special consideration because of the combustible nature of the material².

When timber elements are not shielded from the fire by insulative protection and encapsulation, these elements contribute to the fuel load, altering the fire dynamics by increasing the duration and intensity of the fire. An additional

consideration is that the construction phase presents a higher fire risk. Fire protection measures such as sprinklers and encapsulation may be absent in the construction phase, leaving large quantities of exposed timber at risk of an accidental fire.

NCC AND THE USE OF STRUCTURAL STEEL

All construction materials react to fire in different ways, but steel is known for its durability, non-combustibility and fire-resistant characteristics. When properly designed and constructed, a structural steel frame can retain its structural integrity for an extended period of time in the event of fire and prolonged exposure to elevated temperatures. Not only does this allow safe egress for occupants, it can limit structural damage and allow the structure to be assessed and reinstated safely, quickly and cost-effectively.

The National Construction Code (NCC) provides for two approaches in satisfying performance requirements (including for fire safety), the deemed-to-satisfy solution utilising prescriptive requirements and the performance-based solution, whereby the performance requirements are satisfied by an engineered approach. The ASI strongly encourages exploration of performance-based approaches, termed fire-engineered design, for all but the most straightforward steel structures. This value engineered approach provides significant opportunity for enabling more cost-effective solutions.



FURTHER INFORMATION

ASI offers several eLearning courses on this topic, including 'Performance coatings for steelwork - corrosion and fire protection' and 'Fire and structural steelwork'. Scan the QR code for details.



¹ Grenfell Tower Inquiry: Phase 1 Report Overview, October 2019

² Timber High Rise Buildings and Fire Safety (commissioned by World Steel Association), September 2020