CROSS Safety Report

Concerns about the fire resistance of resin anchors

This month's report raises concerns regarding the fire performance of resin-based anchoring systems and fibre-reinforced polymer strengthening solutions used within building structures, particularly in retrofit and alteration projects.

Reporter's submission

The reporter describes concerns arising from recent project experience where the fire resistance of resin-based anchors and resin-dependent strengthening systems is not fully addressed during design or implementation. These issues are observed particularly in retrofit projects to existing structures and during mid-construction alterations or remedial works.

Resin anchors and fibre-reinforced polymer (FRP/GRP) strengthening systems are identified as potentially vulnerable to elevated temperatures, as resin materials may experience significant reductions in strength at relatively low temperatures compared with structural steel. The reporter notes that conventional structural fire protection approaches a=pplied to steelwork may not provide equivalent protection for resin-based systems. In some cases, even where components are embedded within concrete or externally fire-protected, heat transfer through connected elements may result in local temperatures exceeding the resin's glass transition temperature, potentially compromising structural performance.

The reporter suggests that, in practice, designers or installers may assume that anchoring systems or strengthening solutions will achieve adequate fire performance when protected as part of the wider structural system. A general lack of awareness of the temperature sensitivity of resin-based materials is identified as a potential contributing factor. The reporter also notes that some products and installation approaches may originate from infrastructure or civil engineering sectors where structural fire resistance requirements differ or are addressed through alternative means.

Underlying causes are considered to include assumptions regarding equivalence between different anchor types, uncertainty regarding responsibility for verifying fire performance, and gaps in coordination between architects, structural engineers, fire engineers and specialist contractors.

Learning points highlighted include the importance of verifying fire resistance performance for proprietary anchoring and strengthening systems, ensuring that relevant test evidence or assessment data supports required structural performance during fire exposure, and promoting greater awareness of the distinct behaviour of resin-based systems compared with traditional structural elements.

The full CROSS Safety Report is available on the CROSS website (report ID: 1546) at **www.cross-safety.org/uk/safety-information/cross-safety-report/concerns-about-fire-resistance-resin-anchors--1546**.

Expert Panel comments

The Panel notes that the issue of fire performance of resin-based anchors and strengthening systems is not widely understood within the design community. Panel members highlight that many structural engineers, architects, and other designers may not routinely consider the behaviour of resin materials in fire conditions, particularly in retrofit or remedial applications. As a result, there is potential for inappropriate assumptions to be made regarding their performance when exposed to elevated temperatures.

Panel members emphasise that resin anchors are not inherently unsuitable for use in fire conditions, but are highly dependent on the specific product, resin chemistry, and the availability of appropriate fire test data. Some experts consider that where systems have been tested and classified for fire resistance, their use can be appropriate. However, there is concern that such verification is not consistently sought or clearly demonstrated in practice.

Concerns regarding situations where resin-based systems contribute to structural capacity under ambient conditions were expressed by the Panel. It is noted that, unless their performance in fire can be robustly demonstrated, these systems should not be relied upon when assessing structural stability in fire. In such cases, the structure should be evaluated assuming that the contribution of the resin-based system is lost. The Panel highlights that designers should ensure that a viable load path is maintained throughout the required fire duration, and that overall structural stability is preserved under fire exposure.

Current design approaches for fibre-reinforced polymer strengthening often assume that the strengthening is ineffective in fire conditions, with structural capacity assessed accordingly. However, there is concern that this approach may not always be applied consistently or rigorously, particularly where retrofit works or mid-construction changes are undertaken.

The Panel also highlights the potential for heat transfer through connected elements, such as steel components, to raise local temperatures within resin systems, even where they are embedded or nominally protected. This reinforces the need for cautious design and a clear understanding of material behaviour under fire conditions.

Finally, the Panel notes that this issue reflects broader challenges in coordination and responsibility across disciplines. There may be uncertainty regarding who is responsible for verifying fire performance of proprietary systems, particularly where products are introduced during construction or sourced from sectors with different fire performance expectations. The Panel considers that improved collaboration and clearer allocation of responsibility are required to ensure that fire performance is properly addressed.