Structural anchor advances

New European legislation has made it more important than ever that engineers and specifiers understand if products are fit for purpose.

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Introduction
By Alastair Soane

Anchors are key components in many structures and may be part of safety critical systems. In recent years the fixings industry has identified potential problems with the selection and installation of their products and have taken steps to improve awareness of correct procedures.

The use of anchors ranges from carefully planned and executed installations that are integral with the permanent works to one off applications as a quick fix for an immediate problem. There is often an impression that resins have magic properties and can be used in any circumstances to produce a permanent and strong bond for anchors or to replace missing rebars.

Records show that there have been many anchor failures, some resulting in fatalities including lining failures in the Boston Big Dig tunnel (2006), Japan's Sasago tunnel (2012) and the Balcombe rail tunnel in the UK (2011) which was a near miss.

CROSS (Confidential Reporting on Structural Safety) newsletters have also reported a number of heavy ceiling failures in cinemas and other venues which could have caused tragedy. Sudden, catastrophic, and progressive collapses have occurred where a single fixing has failed, sometimes after many years, and the additional load thrown onto adjacent fixings causes them to fail in sequence.

The reasons for most problems are known and plenty of good advice is available on the selection, installation, and testing of new anchors. In 2012 a new British Standard, "BS 8539:2012 Code of practice" was published for the selection and installation of post-installed anchors in concrete and masonry. Further information is given at www.structural-safety.org including the recently published "Alert: Tension systems and post-drilled resin fixings".

Alastair Soane,
Director, Structural-Safety

Foreword
By Mark Hansford

Construction products are not commodity products. They are safety critical." So Jan Coumans, technical commission chairman of the European contractors federation FIEC told European Commission officials at a stakeholder conference late last year. The conference was convened to discuss a shift in legislation around the certification of many construction products through the 1 July 2013 replacement of the Construction Products Directive with the Construction Products Regulations (CPR).

It's a complex piece of legislation. Fundamentally designed to make it easier to get new products to market, the repercussions are still being worked through. Concerns are that it will now be easier to shift sub-standard products – certainly that was the concern being raised by Coumans at the conference.

He fears that the move will trigger an increase in structural failures, for which contractors will be held accountable.

At the core of the change is the subtle rebranding of the already poorly-understood acronym ETA. Instead of having to demonstrate a product's fitness for purpose in use in order to obtain a "European Technical Approval", manufacturers now must simply demonstrate that the product meets certain performance criteria as set out in a "Declaration of Performance" in order to receive a "European Technical Assessment".

It's created confusion.

"One expectation of CE marking and [the acronym] ETAs is that they confirm that the product meets a given specification," admits Rainer Mikulits, managing director of the Austrian Institute of Construction Engineering and president of the European Organisation for Technical Assessment (EOTA), the European Commission-backed body responsible for running the assessments programme.

"That is no longer the case. It just confirms that a product conforms with a declared performance criterion.

"It is a change in philosophy and it is a concern," he says.

Mikulits questions the decision to give the manufacturer the power to decide which specific properties of his product would be tested.

"It is a little bit like Christmas. The CPR states that 'the performance of these essential characteristics is to be agreed by the manufacturer and the assessment body.'

"The ETA is no longer an assessment of the fitness for use."

What it means is that now, more than ever, it is important to understand what creates a quality product.

Because whatever the legislation, products like chemical and mechanical anchors are safety critical – used widely for a multitude of purposes from holding up suspended ceilings in tunnels to holding down crash barriers alongside motorways.

Read on to find out more about the regulatory changes, and what you can do to ensure that the products you use or specify are fit for purpose.

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Meeting the standards

CE marks

By Ruby Kitching

CE marking is mandatory for standard construction products such as wood nails, but remains voluntary for innovative systems such as structural anchors.

> **"It could be easy for a specifier to forget that, for non-standard products, a CE mark doesn't mean it will be suitable for all applications"**
> Mark Fort, Hilti

When any new legislation comes into force, ripples of uncertainty spread across the affected industries as people start to doubt whether what used to be standard practice is still permitted. In the case of the construction industry, legislation contained within the Construction Products Regulation (CPR) – which was fully enforced on 1 July 2013 – is causing uncertainty about whether construction products, including structural anchors, are up to the job.

The regulation, in European Commission speak, ensures the provision of "reliable information on construction products in relation to their performances". For manufacturers, the CPR enforces a common technical standard, validated by a CE symbol, for the safe, traceable, high quality manufacture of a product for use in EU countries.

But CE marking is not mandatory for all construction products, and here is where the uncertainty begins.

"Contractors, designers and specifiers often ask me whether CE marking is mandatory for certain products. And I have to tell them it isn't – it is only mandatory for products which have straightforward or standard properties such as nuts, bolts or even wood nails," says Hilti anchor product manager UK Mark Fort.

"Products such as anchors (fixings which generally connect a steel plate to concrete by mechanical or chemical bonding) are classed as "innovative solutions" rather than "standardised products". As such, not all anchors have to be CE marked if used in the EU.

"For these products, there is not always a CE marking standard because they are products which have been developed to perform above and beyond a standard product," says Fort.

Indeed, if standard testing were to be imposed on such products, it would stifle their development and crush competition between manufacturers.

Fort explains that CE marking for structural anchors – and most of Hilti's products – is gained through a voluntary, rather than mandatory process in accordance with a "European Assessment Document" (EAD). The EAD is a set of guidelines established by leading industry players, outlining the general characteristics and end uses of a product as well as the method and criteria for assessing the performance of an "innovative solution".

Evidence: A Declaration of Performance outlines a product's exact application and capabilities

For an anchor, the EAD outlines the type of loading the product can be subjected to, the allowable spacing between anchors, grouping and distances to the edge of a baseplate.

"The document allows for different test levels numbered from 1 (most stringent) to 12, and this demonstrates the scenarios in which the product can be used," explains Fort.

The process of being granted a CE mark for use on a non-standard product, such as a structural anchor, then involves an appointed technical assessment body carrying out a European Technical Assessment on the product to validate its performance. A "Declaration of Performance" (DOP) document outlines the exact details of a product's application and capabilities.

Bearing in mind that there is a considerable cost attached to assessing a product, and that having a CE mark is voluntary for non-standard construction products, not all manufacturers will put their products forward for assessment. There is also a greater cost – up to £500,000 – for testing a product under more rigorous level 1 conditions, such as in a fire or under seismic conditions, to

THINGS TO REMEMBER WHEN SPECIFYING

- Construction Products Regulation 2011 (CPR) was enforced from 1 July 2013
- A "European Technical Assessment" (ETA) for CE marking is only valid for the product that has been tested and in the tested base material. For example, if a manufacturer only holds an ETA for an M10 stud anchor then the M12 stud anchor cannot be assumed to hold an ETA
- The specifier is responsible for determining whether the ETA (for non-standard products) or Harmonised European Standard (for standard products) is appropriate for a product's intended application.

ROGUE REPORTS

When CE marking is not mandatory, some manufacturers create "home-made tests", which may lead to unreliable or even incorrect results.

"We are seeing some manufacturers generating their own test reports, rather than using approved testing houses to carry out testing," warns structural fastenings manufacturer Hilti's UK anchor product manager Mark Fort.

Bone fide CE marking tests, where available, are generally much more onerous and incorporate a larger safety factor than in-house tests, he says. The approval system usually requires five tests on different sizes (not all sizes) in each of the various test sequences (seven or eight with different purposes), although for some tests only three are required. This information is then used to establish the characteristic resistances and the partial safety factors to be able to produce a design resistance. The ETA includes all the factors that are required to produce an anchor design to EN 1992-4, something which is not normally available from less detailed testing.

the least onerous level 12 conditions, which cost only a few thousand pounds.

"With so many standard products using a CE mark as a sign of quality, it could be easy for a specifier to forget that for non-standard products, a CE mark doesn't mean it will be suitable for all applications," says Fort. He warns that alarm bells should ring if a product is priced too cheaply, a situation which commonly arises when buying products from outside the EU.

"It could mean that the product has only undergone minimal testing and is unsuitable for many [more onerous] applications," he says.

"If a product is not CE marked, it may still be perfectly suitable for a given application"
Mark Fort, Hilti

So here is the crux of the problem: a product may be CE marked, but this may not mean it is suitable for all applications. "A CE mark alone says very little about a product such as an anchor," says Fort.

"It just says that the anchor has been subject to some kind of testing – it doesn't say to what level."

This is where close scrutiny of a CE marked product's DOP is essential. The DOP document explains what a product is, what it does and how it performs. Prior to the CPR coming into force, this information was stated in a document called a "European Technical Assessment".

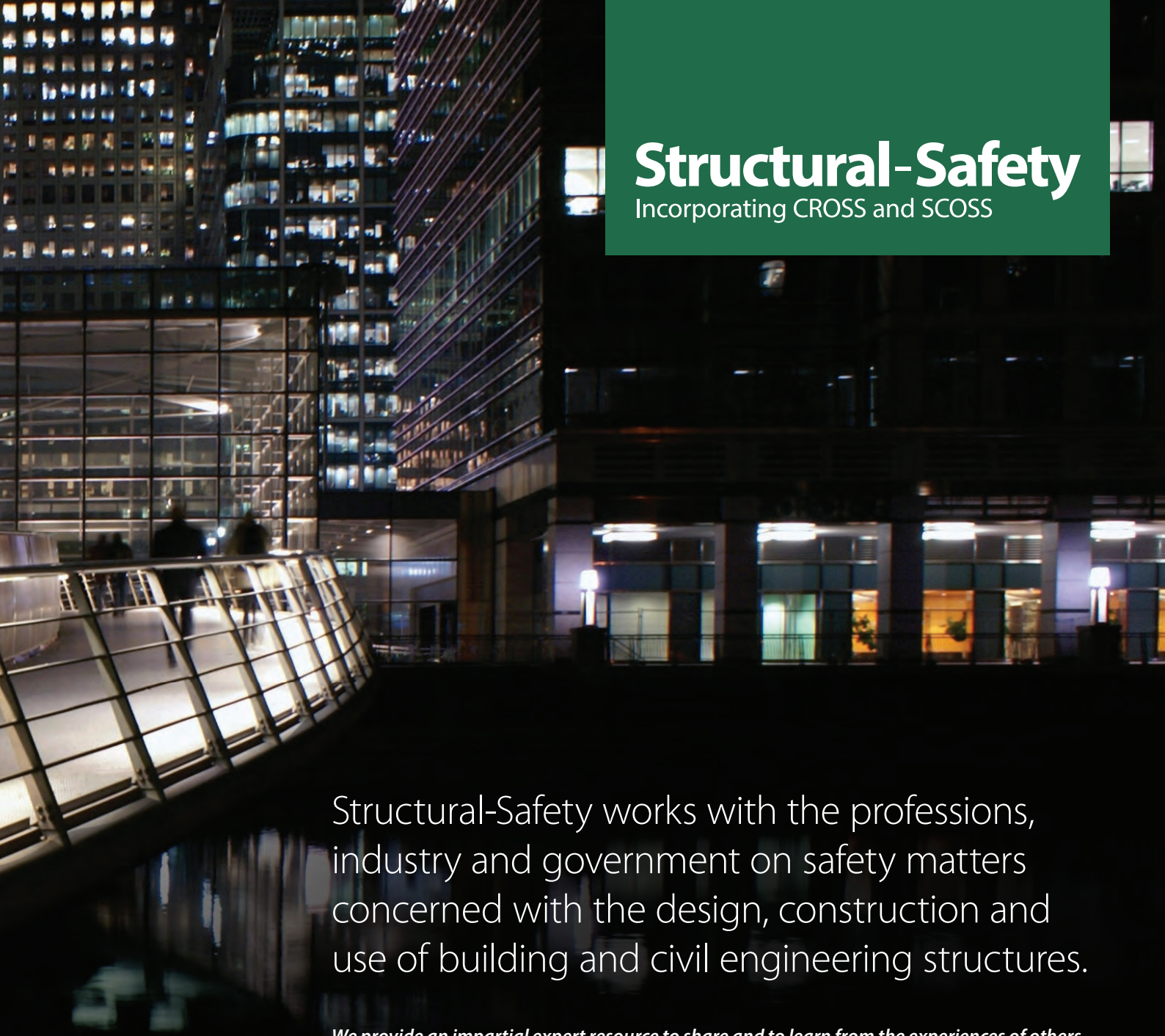
In the absence of CE marking, it follows then that there is an increased risk that a product may not perform as well as the manufacturer is stating, since it has not undergone the rigorous testing and quality assurance that CE marking demands.

Standard products such as nuts and bolts covered by what is known as a "Harmonised European Standard" must have a CE mark. If such a product has not been CE marked, it should not be specified.

But there are situations where it may be impossible for a non-standard product to be CE marked. This could be because the product is considered an "innovative solution" which has no established testing standard, so it cannot be tested in line with CE marking guidelines.

"Don't forget, if a product is not CE marked, it may still be perfectly suitable for a given application," assures Fort. He is concerned that CE marking has become a buzzword for quality and that a product without a CE mark, which might still be suitable for a particular job, might be disregarded.

"Innovative solutions" such as specialist fasteners, installation systems and structural anchors do not have EU-approved standards because they are too bespoke, but may have undergone testing and verification to a very high standard. To give confidence to the market, Fort adds: "Non-CE-marked products made by Hilti are internally tested, evaluated and manufactured according to the same assessment procedures applied to CE-marked products."



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