

Structural anchor advances

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

Special report
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Structural anchor advances special report



Contents



04
Structural anchors
There is a wide range of specification criteria



06
CE Marks
Effects of regulations on products



08
Testing
Product validation gives anchor products credibility



10
Securing anchors
Chemical and mechanical anchors

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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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Anchor points

Structural anchors

By Ruby Kitching

When specifying a structural anchor, environment, safety and manufacturer preference are all factors taken into account, along with specific design criteria.

Designers and specifiers have many different ways of deciding which products should be used on their projects. Summed up, the engineers and contractors working on large and small, public and private projects interviewed by NCE make their choices based on function and manufacturer confidence.

Ensuring the fixing is adequate in terms of loading, edge distance and spacing fulfils functional requirements. But a large part of specifying the type of fixing relies on personal experience and precedence.

Only in the extreme case of safety-critical nuclear projects do clients pre-approve products. For more run of the mill projects, a designer has all the innovative fixing systems in the world to choose from, and this can often be a problem.

Six specifiers were interviewed by NCE about how they went about choosing structural anchors.

Some choose to outline just a basic scheme and seek recommendations from a reputable anchor manufacturer, while others use software to assist hand calculations for straightforward bulk detailed design. For more bespoke arrangements, they might seek validation from a



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Andy Hurst, Atkins

manufacturer's technical experts.

Atkins senior structural engineer Andy Hurst works on decommissioning, new-build and modification projects within the UK's nuclear sector.

"Typically, we specify mechanical anchors, although where certain situations allow them, chemical anchors are specified," he explains. "Our clients typically prescribe the acceptable types of fixing that we can consider for a project, and knowing what type of anchors are certified by manufacturers for certain types of loading (e.g. dynamic/fatigue/shock), and in certain situations (e.g. tensile zone), we are able to specify a product which is appropriate and approved by the regulatory bodies."

"Products may need to be galvanised or stainless steel, for example, and compliant with seismic

Safety critical: Structural anchors are specified throughout building and civil engineering



codes," he adds.

Due to access restrictions on nuclear modification projects, complex arrangements of anchors may be required and, for these situations, Hurst resorts to the anchor manufacturer's technical support service for advice.

"We choose a manufacturer for its pedigree. That's essential to us. As a designer, when I specify a product, I have to be confident of its performance, as I can always be challenged on the merits of a particular anchor's selection."

Often personal experience influences the type of anchor chosen by a designer, but for many it is the ease with which technical data can be accessed that dictates which manufacturer's products are used.

"The ease of use of technical

literature and software, as well as the ease of installation within the specified environment, contribute to our decision-making process," says Balfour Beatty senior temporary works designer Khalid Mutter.

The close relationship between manufacturer and specifier also allows the manufacturer to gather information about market needs, which influences product development.

Contractor AD Bly Construction project manager Vulie Major says he chooses manufacturers he can trust.

For all designers, health and safety is an important consideration. But many of those interviewed by NCE felt that, in choosing a reputable manufacturer, they were also buying into high safety standards, particularly for dust and vibration.



"We specify manufacturers who are known to be industry leaders as it gives us the assurance that they will check for health and safety compliance," says Walker Associates associate Chris Pound.

"Of course we carry out risk assessments on the whole job."

For Skanska project engineer Bernard Humphrey, his preference is to specify cast-in details which do not require post-drilled anchors, but refurbishment projects and late design changes often require anchor solutions.

Some of the biggest challenges concerning installation are due to reinforcement obstructing drilling and the subjectivity of cleaning out holes ahead of installing resin anchors, he adds. "Most importantly, whoever is installing them has to be properly

trained. Our site teams ensure that the manufacturer's instructions are followed."

Aware of the challenges of adequate hole preparation for resin anchors, Hilti has developed the HIT-HY 200 SAFEset system (see pp10-11). AD Bly is using the system at a housing project in Brentford, London to connect precast stairs to a concrete services core.

Idom Merebrook senior structural engineer Humberto Escalona also regularly specifies Hilti anchors for use in the aviation, nuclear and rail sectors. "It is a brand with many years' experience with products we have used many times before," he says. "We also know they have people on site giving technical advice and that they give a high quality service."



"We specify manufacturers who are known to be industry leaders as it gives us the assurance that they will check for health and safety compliance"
Chris Pound,
Walker Associates

And with this brand confidence, comes confidence in health and safety, he adds.

"We assume Hilti, as a trusted manufacturer, will provide guidance to the contractor on how power tools should be used, for example, to prevent problems associated with hand-arm vibration."

Hilti has also developed products such as hollow drill bits connected to universal vacuum cleaners to reduce harmful dust inhalation (see pp10-11).

New regulations also influence the suitability of any product specified for use in construction. Hilti anchor product manager Mark Fort explains the background to CE marking, part of the Construction Products Regulation (CPR), and its safety-critical relevance for specifiers on subsequent pages of this report (see p6).

Most of the specifiers interviewed by NCE felt that they were aware of the CPR coming into force in July last year and the importance of CE marking – to provide "reliable information on construction products in relation to their performances" – but they felt it was the manufacturer's responsibility to provide data on the range of testing undertaken for each product.

They all felt that an overriding

reason for choosing products from a trusted manufacturer was that they could be relied upon to be abreast of legislative changes and ensure products were compliant.

"The presence of a CE mark provides some confidence that a product complies with a minimum standard," says Arup associate Colin Roberts. "However, for many applications we are looking for high-end products from reputable manufacturers with strong research and development and technical back up, not simple compliance."

He is doubtful as to how well CE marking and technical approvals are understood in the industry. While CE marking is now mandatory for products covered by a harmonised European Standard, there are still product categories that do not need to be marked. "In all cases it is important that the product we specify has been rigorously tested and is appropriate for the service conditions," he says. In this respect, he says that specifiers need to be able to rely on the integrity of the manufacturer's data and advice.

Roberts notes that there is concern in the industry about fraudulent certification of products, particularly imports from developing countries.

He is aware of two recent examples, one concerning high strength bolts and the other scaffolding clamps. After a spate of failures, investigations showed in both cases that the products did not comply with the relevant standards, even though the paperwork claimed that they did. It is vital, he says that critical load-bearing products are procured from reputable sources and that there is traceability through the supply chain.

However, Humphrey does consider it to be the contractor's responsibility to ensure products used on site are properly certified for use and CE marked where appropriate.

"As a contractor/designer, you see that the responsibility ends with you, and whatever is specified must be right for the job," he says.

"So we look at the approval documents to check, say, that if the product is for indoor use only, that is where it is being used."

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