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# UK looks set to follow bi-directional test route

Bi-directional load tests are almost routine in the US and Far East but they are barely used in Europe. One man is on a mission to change this, as Paul Wheeler reports

IT MIGHT not be the kind of thing he would mention at a dinner party, but Dr Melvin England is a world authority on pile testing. And, after 13 years with Cementation, he recently jumped ship to establish a European base for Loadtest, a US company that specialises in 'bi-directional' or 'O-Cell' static load testing, in the UK.

Dr England joined Cementation in 1990 from the defence industry, where he had developed guidance systems for missiles. Cementation's board of directors, then led by Dr David Greenwood, brought him in initially "as a pair of fresh eyes with a fundamental physics background" to develop the company's role in the emerging market of pile integrity testing and instrumentation.

"I quickly came to the view that there was a tendency within the industry to overstate the value of some of the tests," says Dr England.

He was also soon convinced that the only reliable way of determining a pile's settlement behaviour under working conditions is by long-term static load testing, and this belief has provided the focus for his work since.

The Osterberg O-Cell – named after its developer, US professor Jorj Osterberg – is an exciting development, Dr England insists, because it is fundamentally a static load test method. The clever bit, he explains, is that instead of requiring a reaction system at the ground surface against which the pile is loaded, the O-Cell uses the test pile's capacity to provide the resistance to the reaction load.

'The higher the load, the bigger the advantage of using O-Cells'

**Dr Melvin England, Loadtest**

This is achieved by casting a sacrificial jack – the actual O-Cell – into the pile. This separates the pile into two elements, one of which is tested against the other.

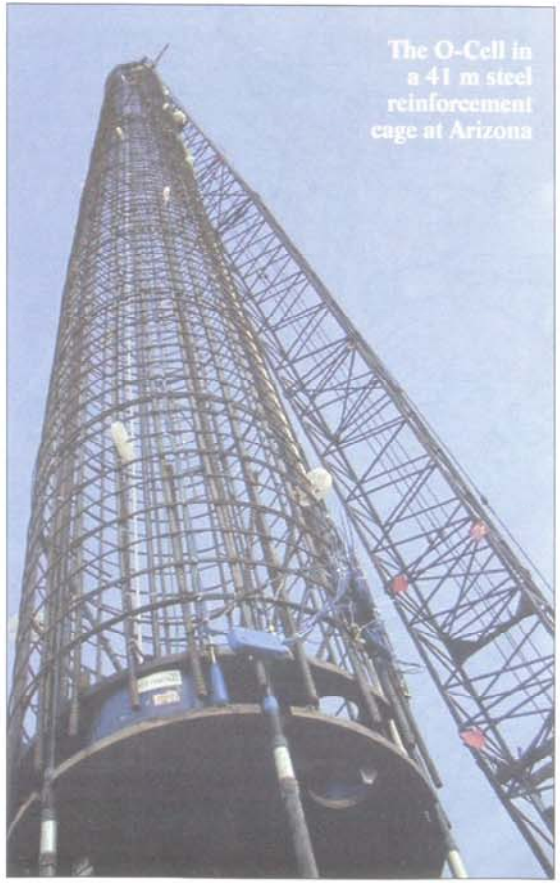
In its basic application, the O-Cell is positioned at the bottom of the pile. When you jack down the cell you are measuring just the resistance at the pile base, and when you push up, you are measuring just the skin friction provided by the pile shaft.

As a result, says Dr England, "it is easier to optimise the pile design to take account of the available skin friction and end bearing".

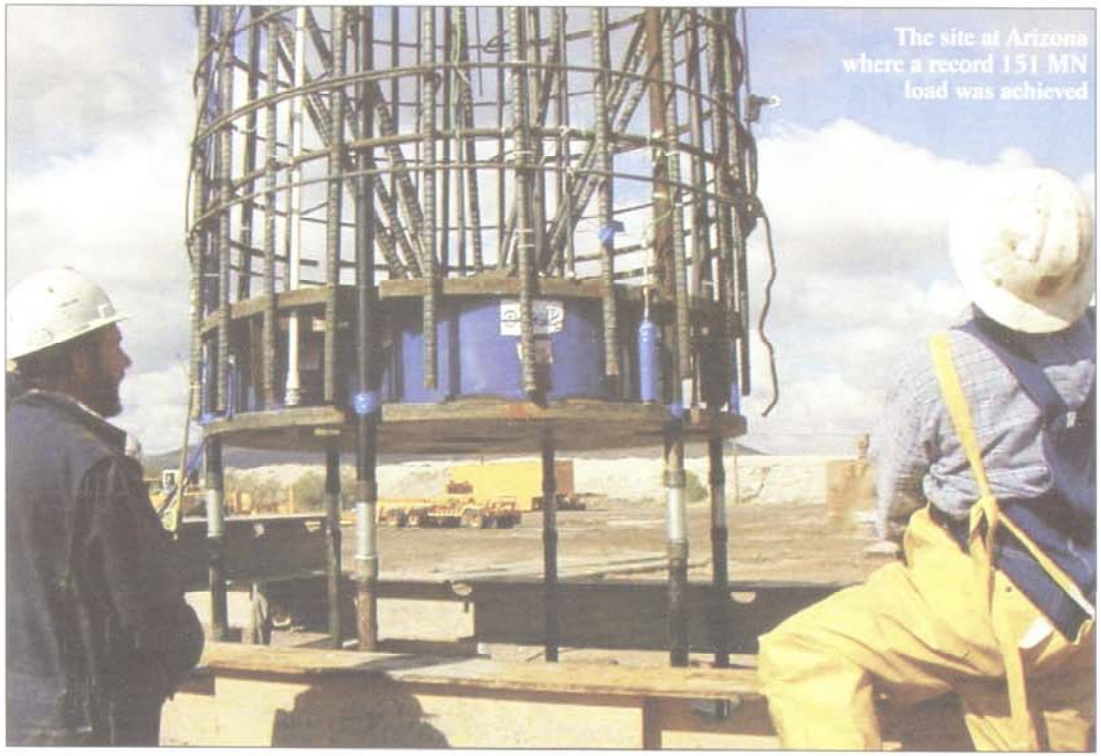
By using multiple jacks you can achieve extremely high loads. The record to date is 131 MN (131,000 tonnes), achieved using nine jacks positioned at intervals along the shaft of a test pile in Arizona. That is almost four times the highest capacity load test achieved using a conventional top-loaded static load test.

While bi-directional load tests have become almost routine in the US and Far East, in Europe you could count on your fingers the number of tests carried out to date.

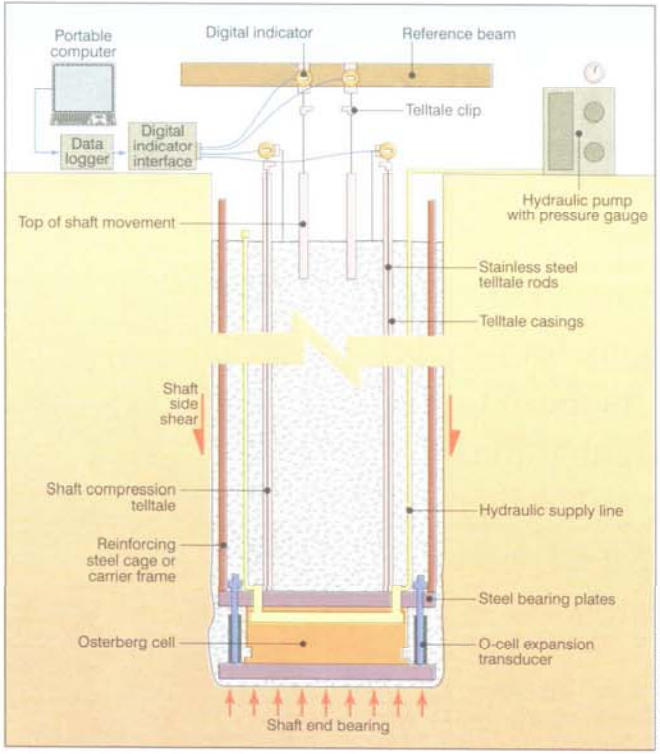
Dr England mentions the widely held misconception that bi-directional testing is very expensive. But he insists this is just not true. He estimates that around 100 pile tests conducted each year in the UK using conventional static load tests could be conducted more cheaply using bi-directional testing.



The O-Cell in a 41 m steel reinforcement cage at Arizona



The site at Arizona where a record 151 MN load was achieved




A cross-section of the O-Cell that Dr England is hoping will catch on in Europe

"Essentially it becomes cost-effective at around 5 MN," he says. "And the higher the load, the bigger the advantage of using O-Cells."

The fact that bi-directional load tests are now being offered as a locally sourced service, should also help win over any sceptics, he adds.

Additionally, he says, as the technique takes off and he is able to establish permanent European-based support facilities – rather than shipping in equipment and testing crews from the US – so the cost will reduce, making the approach competitive at lower test loads.

Dr England's move from Cementation reinforces his claim that he is offering clients an independent testing service – comprising automated conventional static load tests (a system he developed but now offers under a licence agreement with Cementation) and O-Cell static load testing. His attempts to develop such a service were thwarted while he remained with Cementation. "There was clearly an independence issue – competitors didn't take too well to the idea of inviting a rival to test the performance of their piles," he says.

## Heresy in the piling world?

IN WHAT amounts to near heresy in the piling world, the technical director of one of the UK's leading piling contractors last month made a presentation at a top-level geotechnical symposium at City University in which he questioned the value of pile testing.

Pile testing, said Viv Troughton, technical director of Stent, accounts for five per cent of the turnover of the UK piling market – and on some projects it is 10 per cent or more of the foundation cost. "When the typical cost of a preliminary test pile corresponds to 175 m of 450 mm diameter CFA piling, we have to question whether this represents good value," he said.

Mr Troughton points out that we accept shallow foundations without testing them, and in the Netherlands – where admittedly geological conditions are more predictable – there have been just seven static load tests since 1945. So why the preoccupation with expensive static load tests here, where there might be 2,000 such tests a year?

The counter argument is well rehearsed. Pile testing reduces risk by verifying the design and providing quality control. It is a requirement of building control and can save money.

The problem is that too often pile tests are carried out without any clear engineering objectives, because pile testing specifications are not usually written by foundation specialists. There is rarely a clear strategy, and both testing method and testing criteria are often inappropriate.

The experts assembled at City University also suggested that attention is too often focused on how piles behave at ultimate failure – which of course requires the test pile to be loaded way beyond its serviceable state – and not at its performance at working load.

"We need to move away from the attitude where we're doing pile tests just so we can tick the box," argues Dr Melvin England. "The great thing about static load tests is that by optimising the design, the potential for savings can be tremendous."

Geotechnical engineering has to be conservative, he adds, because the ground is variable. But removing some of the unknowns, by high-quality pile testing, for example, allows a designer to be less conservative.