

Breaking away from the herd

A novel bridge design using steel piles integrated with the piers also showcased a new quiet and low vibration pile pressing system. Max Soudain reports.

Milton Keynes is synonymous with concrete. Not just its famous herd of concrete cows; the stuff is used in its office buildings, houses and roads.

But in the bridge building world at least, concrete's supremacy is being challenged with a new design using steel piles extended out of the ground to form the bridge piers.

Construction of Whaddon Road bridge has been so successful that Milton Keynes council is considering specifying the design for all new road bridges in its area.

The contract also saw first use of Dawson Construction Plant's push-pull system for installing high modulus steel piles.

Consultant Pell Frischmann developed the design for the Whaddon Road bridge, incorporating piled foundations reaching up to the bridge deck. Ground conditions were stiff to very stiff boulder clay with some lenses of silty sand.

A high, fluctuating groundwater table meant there were potential problems using rotary bored or CFA piles, so driving the piles was the preferred option. However, as the bridge is only 50m away from a residential area, noise and vibration had to be kept to a minimum.

The solution was to use Dawson's push-pull system, which employs up to six, 200t capacity hydraulic cylinders to drive standard profile sheet piles in a number of configurations, from walls to box piles. Each cylinder grips a pile and acts



independently from the others, with piles pushed in turn.

Initial reaction is provided by the weight of the press (a four cylinder arrangement weighs about 12t) and by the rope crowd system on the rig – the Liebherr LRB255 leader rig used on the Milton Keynes contract can generate 40t. Further reaction for each push of up to 600mm is provided by the other piles.

Vibration and noise generated is similar to that generated by the crawler rig, says Dawson

Construction Plant engineering director Mark Lee, adding that the technique is "several times faster than other pile pressing systems".

Final design of the Whaddon Road bridge, approved after lengthy discussions with client English Partnerships, consists of a slender deck supported by 16 high capacity steel box piles, eight for the abutments and eight forming the combined piles and piers. Each pile is formed from four Hoesch Larssen 43

Steel vs concrete

Mark Lee of Dawson Construction Plant says the push-pull system was initially marketed on its low noise and vibration but as interest grew, its "eco-friendly" aspects became increasingly important.

"Little is said about recycling foundations, especially in urban areas," he says. "But where there are many old concrete foundations that cannot be reused and are difficult to remove, sites can become 'sterile'."

Steel piles, on the other hand, can be pulled out of the ground once the structure has reached the end of its design life and either re-used or the steel recycled, he says. "And there is no time limit for pulling – even though the ground grips the piles, there is always a good chance they can be pulled out."

Other benefits of steel over concrete are that little or no spoil is created during installation – "so there is no tipping tax and no lorries are needed to take spoil away," Lee says – and there

are no holes to backfill once the piles are removed.

Material costs are reduced and can be controlled better. "Often it is difficult to gauge how much concrete is needed." This helps reduce the number of deliveries and allows them to be better timed, which is important in inner city areas where access is often restricted to night-time.

"Steel can be delivered before it is needed, whereas concrete has to be delivered when the pile is ready and casting is dependent on weather," Lee says. "At Whaddon Road Bridge, all the steel for the 16 piles and columns was delivered on just one lorry."

Concrete piles often need testing after installation, he says. While the box piles at Milton Keynes were tested, steel bearing piles can be tested during driving. In the push-pull system, this is achieved by measuring the pressure applied by the cylinder to move the pile.

"Interlock friction has to be deducted – this can be calculated by pressing a single sheet pile," Lee says.

Dawson's new push-pull system installed the steel box piles through a guide frame.

