

# A tale of two bridges



*Mike Sanderson of ABM Precast Solutions describes two very different projects that demonstrate the versatility of concrete. As a construction material it frequently meets the practical needs of mass transport infrastructure but it can also function on a smaller scale, be pleasing to the eye and contribute to a better quality of life.*

**A** £500 million programme by Scottish Roads Partnership for Transport Scotland is under way to ease congestion and improve traffic flow on the M74, M73, M8 and connecting roads. As part of this scheme, the Raith interchange will become a triple-level crossing offering significant savings in journey times. To create the new bridge, 42m-long, nine 90-tonne, prestressed W form concrete bridge beams have been installed.

Both U and W form beams are increasingly popular with highway authorities for a number of reasons.

Rasti Schreiber, design manager at ABM Precast, explains, “Client demands and bridge technology are both changing. Increasingly, highway authorities want to eliminate central piers as this creates safer roads and gives greater road capacity and flexibility.

The availability of 35–45m precast beams makes this achievable, even if the bridge is highly skewed, as was the case at Raith. Consequently, fewer beams are required, making the installation process simpler, quicker and more efficient and meaning the contractor can proceed to cast the bridge deck and dispense with the costly heavy-lift crane more quickly.

“Light and strong U- and W-beams are regularly used for integral bridge construction, which can be a more cost-effective solution than simply supported bridges as bending moments are more evenly distributed. As the W-beams are frequently spaced at up to 4m apart, the availability of lightweight GRP permanent formwork, which can be installed without the need for heavy-lifting equipment, improves the speed and efficiency of the in-situ deck construction.”

Above: Beams were precisely positioned alongside those installed earlier. When all nine beams were in place, crews were on hand to install formwork and place reinforcement in preparation for casting the bridge deck.



Above: The beams for the Raith interchange project were manufactured in steel formwork using a high-quality self-compacting concrete.



Above: Transporting the nine 42m-long, 90-tonne beams was a major logistical operation that required the co-operation of highway authorities along the route.

### Casting

Casting the 42m-long W-beams gave rise to several technical considerations. Each W-beam was cast in a single process into steel moulds. The size and complexity of the space to be filled required a high-quality self-compacting concrete that could flow to fill the formwork quickly before the application of heating to ensure rapid and uniform curing. Beams achieved a minimum compressive strength of 50MPa, before the 1700-tonne prestress load was applied. These are believed to be the largest prestressed W-beams fabricated on the UK mainland.

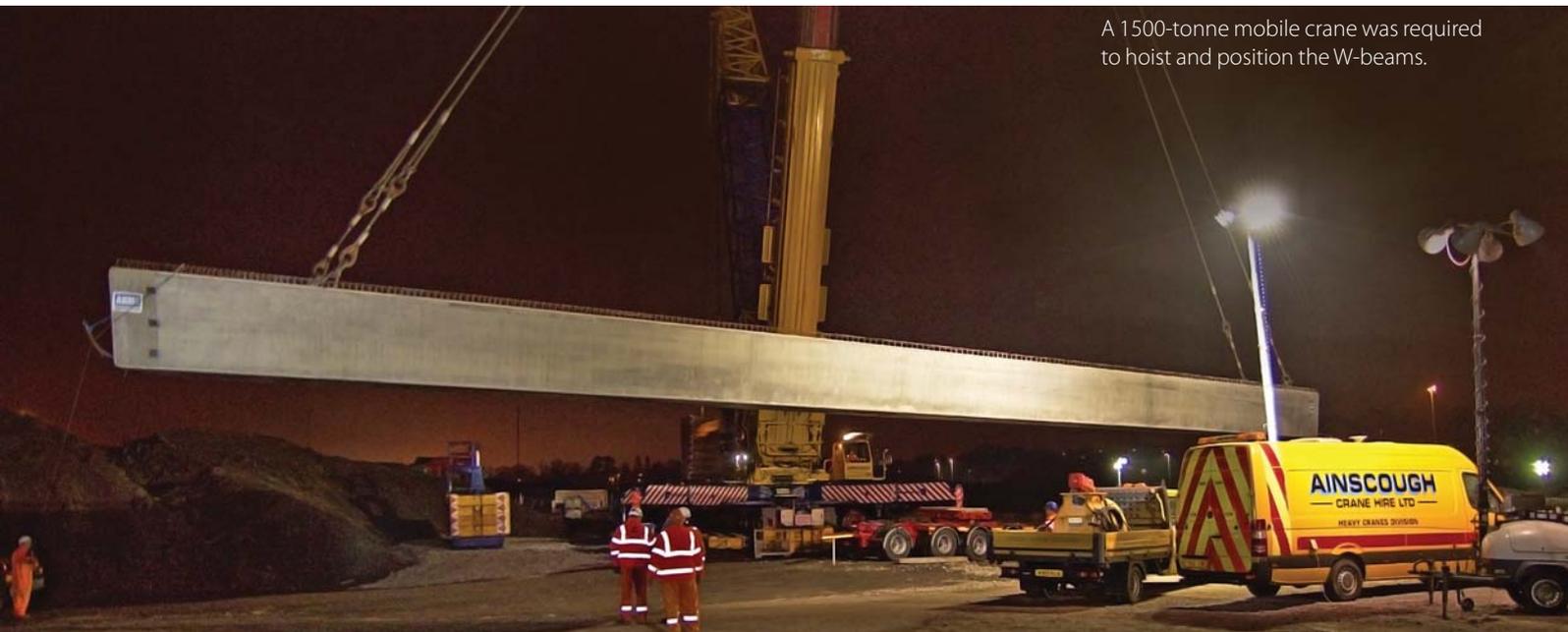
The Raith Interchange is a noted pinch point on the Scottish motorway system so installation took place over three night-time operations, timed from midnight to 4 am. Work is proceeding at other junctions where

the M8 and M74 merge to improve east-west and north-south traffic flows within the Glasgow to Edinburgh corridor. This in turn is expected to bring economic benefits such as higher productivity, greater appeal to investors and a generally more vibrant economy.

Casting of the W beams took place in the ABM Precast yard in Tuxford, Nottinghamshire before they were transported to site 260 miles by road on steering bogie trailers.

### Jellicoe Water Gardens

Sixty years after they were first laid out by Geoffrey Jellicoe, the master planner of Hemel Hempstead, the water gardens – a key element in his vision of a ‘city in a park’ – were in need of restoration. In particular,



A 1500-tonne mobile crane was required to hoist and position the W-beams.



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the artificial canal at the core of the town required attention, including seven bridges that connect the centre of the new town to green space and car parks beyond. Four of these were arched and three flat decked. On inspection, the bridges, cast in-situ from reinforced concrete, were found to be unsound and beyond practical repair.

### Retention

Retention of the bridges was essential, with designers and Historic England keen to replicate the original Jellicoe design. The shallow arch was a deliberate ploy by Jellicoe to slow pedestrians and give them time to appreciate the tranquillity of the water, green space and wider urban vista beyond. Clever use of different levels, such as hiding the car park at a lower level, allow the eye to link close and distant green spaces, creating an impression of a much larger, open green area.

The bridges were functional but Jellicoe also wanted them to be elegant, so support is provided by a central spine that is largely hidden under the shadow of the bridge. To further emphasise lightness, the bridge decks are feathered toward the edges, so only this is prominent. The curvature is then emphasised by a simple steel parallel balustrade, with spandrels placed radially rather than vertically.

### Arched bridges

A uniform radius design was adopted for all the arch bridges that were cast off-site at the ABM yard in Nottinghamshire. The bridges have common design features but differ in width and span.

To meet this requirement, wooden formwork – with modular elements that could be added or removed to give the desired configuration – was selected as the most adaptable. Reinforcement cages were placed into the formwork before casting.

Arched bridges are generally cast from the edge and rotated to their true position after curing, but the deep beam at the core of each Jellicoe bridge necessitated as-placed casting. The arch necessitated that a concrete of low consistence was selected, in contrast to the self-compacting concrete used in the Raith W-beams. This enabled the mix to be manually distributed and compacted in the formwork before steel float finishing to achieve a U3 finish.

Jellicoe had a clear purpose in his masterplan to set busy urban life against a more tranquil setting. Water and greenery were key elements in this and with the restoration of the water park Hemel Hempstead regains something of his original vision of a ‘city in a park’. ■

Above left: Jellicoe bridge in place. Once positioned, the substantial beam supporting the structure is less evident and the slenderness of the deck is more apparent.

Above right: The Jellicoe bridges were cast at ABM's Nottinghamshire yard. The central load-bearing rib providing support for the decking is a major feature.