AWARD
CASTLEFORD FOOTBRIDGE

ARCHITECT - MCDOWELL + BENEDETTI
STRUCTURAL ENGINEER - TONY GEE AND PARTNERS LLP
STEELWORK CONTRACTOR - ROWECORD ENGINEERING LTD
MAIN CONTRACTOR - COSTAIN LTD
CLIENT - WAKEFIELD METROPOLITAN BOROUGH COUNCIL

The £4.8 million bridge has been funded by Wakefield Council, Yorkshire Forward and English Partnerships. It creates a safe new pedestrian route uniting the north and south of Castleford's riverside community connecting Aire Street to Mill Lane.

Building the bridge’s three piers in the deep and often fast flowing river was one of the main challenges. A cluster of piles beneath each pier was initially considered, but constructing a cofferdam would have been tricky – not least because the ground conditions consisted of cracked and weathered mudstone. Instead, the main contractor decided to support the piers on single, cased piles measuring 1800mm in diameter. This immediately reduced the construction footprint and minimised the duration of the piling. The pile casings provided a mini cofferdam within which preparation works for installing a precast pile cap could be carried out safely in the dry.

With the piles in place, a prefabricated box known as a ‘limpet’ was clamped onto the pile cap before installation. Once the pile cap and limpet were in position on top of the pile, the area inside the limpet could be pumped dry to create a watertight working area for the connection of the pier bases below water level. The pile cap, pier base

judges’ comment

A robust and exciting link between parts of Castleford, across the River Aire. High quality engineering design and construction techniques have led to an outstanding result, which in turn has transformed peoples’ regard for themselves and their town.

A triumphal demonstration of infrastructure improving the quality of life.

and pier are held down by four high tensile bars, positioned 4m deep within the pile.

All three foundations were completed in time for the arrival of the steel legs, despite the site team having to contend with two major floods which swelled the river to record levels and swamped the site for over three weeks, making work in the river impossible. Of primary concern was keeping hold of the crane mounted jack-up barge due to the velocity of the river. The jack-up barge was a vital aid to all lifting and piling operations during the floods.

The 131m span is made up of seven spans, four 26m main spans and three 9m spans over the support piers. A twin steel box girder forms the spine of the structure. The girder varies in depth around the outer curve in order to counter the span differential between the boxes. This variation in depth rises out of the deck to provide a bench for those using the bridge. The top flanges of these double height girders curve in two directions providing a natural cross fall to the flange from the fabrication process. The curved geometry of the bridge presented great challenges with respect to setting out and providing pre-camber information. Circular hollow sections, each topped by a tapering section terminated in a solid steel machined fork-head, support the box girder deck.

The curved nature of the bridge presented a complex articulation to overcome as the support legs are inclined in two planes and the line of the deck varies over the connection. This connection challenge was overcome by utilising a complex arrangement of spherical bearings and bimetallic isolation. The development of a connection with this level of multi-axial flexibility facilitated a swift installation of the deck.

Cantilever brackets at approximately 1m centres along the bridge provide the bridge width. The cantilevers support the complex timber arrangement and the handrail posts. The hardwood decking runs along the line of the bridge and is supported at regular intervals by timber bearers that sit within the cantilever brackets. The boards are fixed to the bearers with a bespoke hidden fixing that locks into a groove in the lower half of the board.

The connections and support to the timber decking are consistent throughout the bridge in the main deck area and the bench. The risk of bimetallic corrosion had to be considered in many connections. The bridge is a combination of S355 J2 steel and grade 1.4401 stainless steel – with the majority of the latter being used in the architectural features. Isolation could be achieved in most locations with nylon pads and top-hat washers. However, the pin arrangement required a harder wearing compound to carry the 100 tonnes design load and isolate the duplex stainless steel pin from the mild steel machined head which was achieved by inserting a fibre-wound bushing into the connection.

The steel v-shaped piers are each prestressed through a pre-cast concrete pile cap and onto a 1.8m diameter concrete monopile that is socketed into the mudstone at each pier. This prestressing process was carried out inside a temporary steel limpet structure bolted to the concrete pile cap to provide a dry operation which was critical to establishing the geometry of the bridge piers.

The narrow streets beside the river were filled by some of the biggest mobile cranes in the country – the clearance between the houses being so tight that the cranes' wing mirrors had to be removed. But even this tested the cranes to their limits to lift the carefully assembled segments of bridge into place.

The result is a truly breathtaking bridge.