CHANGING SIDES

A complex series of operations will see a new, widened viaduct take the place of the current weight-limited structure at Heilbronn in Germany. Helena Russell reports from the site

In April 2019 traffic is due to be diverted onto the steel deck which will cary the highway over the Neckar River to the concrete viaduct *(Via6West/Michael Endres)*

Drivers on the A6 highway at Heilbronn in southern Germany are blissfully unaware of the drama that will shortly unfold on the construction site alongside the existing bridge. With acoustic barriers running the full length of the 1960s viaduct, travellers are not yet able to appreciate the extent of the work that is currently under way, but next year all that will change.

In a major series of operations, the traffic will be shifted to the new parallel structure, the old bridge – some 1.3km long in total – will be dynamited or cut into pieces and removed by barge, and a second structure will be built in its place.

But the excitement won't end there – the subsequent stage in this huge undertaking will see traffic diverted onto the second new bridge, in preparation for the last part of the work, in which the 1.3km of new bridge deck that is currently being built will be shifted laterally by 21m to its final position.

The eventual outcome of this series of operations will see the existing bridge being replaced by a new twin structure with improved capacity and life expectancy, and the piers that are currently supporting the new bridge deck being demolished and removed entirely.

Despite being relatively young – the existing structure was built in 1967 – the viaduct is in a poor state with a reduction in traffic lanes from three to two in each direction, a speed limit and a truck weight limit of 8t in force. This bridge is composed of a series of different structural types which carry the motorway across the wide valley and the Neckar River, which flows along the eastern edge of the site. Unusually, the old bridge has 70m-long post-tensioned concrete box girder spans on the western side where they only span a small single carriageway highway, but contractor Bauarge A6 West senior site engineer Carsten Schulz explains that this was to accommodate plans at the time to divert the river – plans that never came to fruition.

Bauarge A6 West is a joint venture of contractors Hochtief Infrastructure and Johann Bunte, with design by K&S engineering consultants. The JV is charged with building the new bridge as part of a much larger widening project on approximately 25km of the A6 highway. This public-private partnership contract sees the concession company carrying out the widening and improvement works and then maintaining and operating the highway – both the newly-widened section and an additional 22km of existing highway – throughout a total concession period of 30 years. The A6 is a major link across Germany which is used by traffic between the Czech Republic and Belgium, and it carries an estimated 100,000 vehicles per day.

Construction work on the site began in July 2017 and the next major milestone is set to take place in April 2019. This is when the new deck that is currently being built on temporary piers must be ready to carry traffic, freeing up the existing structure to be demolished. Given that the existing bridge is restricted to two lanes in each direction, the diversion onto the new deck should represent an immediate improvement for travellers, with three lanes in each direction being available on the 18.5m-wide structure.

This configuration will remain for around two years, while the old bridge is demolished and new piers are built along the same alignment, as well as the deck for one carriageway. Towards the end of 2021, the contractor estimates that the second new deck will be ready to receive the highway traffic – all six lanes of it – freeing up the first deck to be prepared for the final operation. Completion deadline is 2022.

This rather complex construction process is made necessary by the need to ensure that the final alignment of the widened highway is on the same line as the existing one


The new bridge deck is being built on temporary piers as it will subsequently be shifted onto the line of the existing viaduct

– to eliminate any additional land-take either on the route of the bridge, or at the tie-ins at either end. On the east side of the river there is also a school which would have to be moved if the bridge was to be relocated.

When *Bd&e* visited the site the focus was on the 820m-long concrete viaduct deck construction, which is being built using a movable scaffolding system supplied by Berd which is equipped with its patented Organic Prestressing System. The viaduct also includes a 520m-long steel deck which crosses the Neckar River on spans more than 120m long and is being built by subcontractor Plauen Stahl Technologie. This bridge was built by incremental launching from the other side of the river, with the final launch taking place earlier this year.

The operation to shift the deck laterally by 21m is still some time away – more than three years at least – with quite a number of critical path operations to complete before then. Movement of the concrete deck will be carried out by specialist subcontractor VSL and will require hydraulic jacks on every second pier to control the movement closely. The steel deck will be moved separately using hydraulic jacks on each pier, and the operation will be performed by specialist subcontractor Hebetec.

The Berd underslung MSS M38-I has been working on the site since the summer of 2017 after it was delivered and assembled at the west end of the bridge. The first span crosses a highway and one of the main challenges that Berd's technical team faced was to adapt the MSS for this task. It required some complex adjustments to the MSS in order to avoid clashing with the abutments, added to which there was limited time in which to complete the span as it required closure of the road below. With the learning curve now well and truly overcome, the machine is working to an eight working-day cycle with each launch taking a few hours, geometry control being carried out the following day, and rebar assembly taking place the day after. When *Bd&e* visited at the start of October, preparations were being carried out in advance of construction of span number 19 of 22. All of the spans on the structure are 38m long except those at each end, which are shorter.

This particular construction system is being used at the request of the client, explains Schulz; he notes that the relocation process for moving the MSS forward from one span to the next is a lot quicker than for a traditional movable scaffolding system. Once the full 820m of this bridge deck is completed, the equipment will be dismantled and stored, ready for reassembly on the new piers that are to be built on the line of the old bridge.

There will be a one-year hiatus between dismantling and reassembly, but civil engineer Francisco Camões of Construgomes, the subcontractor which operates the Berd equipment, explains that they will try to minimise the amount of disassembly works that are necessary.

"There are two reasons for this," he explains. "The first is to make the process of dismantling and reassembling the movable scaffolding system faster, and the second is to minimise the number of bolts that have to be replaced, as the bolts can only be used once."

Schulz explains the demolition process that will be taking place during this hiatus – four different methods are necessary to deal with the various types of bridge structures that make up the crossing, and the differing conditions at each location along the viaduct.

For the long-span post-tensioned box girders at the western side of the bridge, blasting is planned to bring them down, while the remainder of the viaduct over the land will be removed by use of mechanical demolition. The spans over the river will be cut into pieces and lowered down onto barges by strand jacks, while those that cross the railway on the far east side will be enclosed, cut into pieces and lifted out using a 1,200t crawler crane. Access here is restricted to possession times, so there will be some restrictions on the timings and operations. The work will be carried out by specialist demolition subcontractor Max Wild. Hochtief construction manager Sebastian Wollnik explains that explosives will only be used for the post-tensioned spans, and then in fact only for the piers of these spans. "The explosives will be used on the piers, which will bring the box girder spans down to the ground, after which they will be broken up by mechanical means," he says.

As yet it is difficult to get a full impression of what the final bridge structure will look like, despite the site team already having a year of construction completed. But the piers for the first new bridge deck are necessarily utilitarian, given that they are due to be demolished within the next few years once the bridge deck completes its final journey.

In fact the permanent piers are quite demanding in their form and surface finish, and while construction of the vast majority won't start for a year or more, the contractor has successfully completed a trial run to build the first pair at the steel/concrete bridge intersection. As Wollnik explains, the old, new and temporary piers are all very close together at this location, and it made sense to build the permanent piers at the same time as the temporary piers when access was relatively easy. Once the two decks finally meet, the site will be much more congested and construction of the new piers would have been a lot more tricky. But ground conditions are favourable here, confirms Schulz; piled foundations are only needed under the river piers – the remainder of the piers will be supported by straightforward raft foundations. Piers range in height from 11m to 13m across the full length of the viaduct.

The steel bridge deck which will carry the highway across the Neckar River has a distinctive shape which consists of a parapet and edge beam all in one – the main structural members have been brought above the deck and shaped to suit the distribution of the forces along the spans, resulting in a dramatic and sculptural form.

The main girders were brought to the site in around 50 pieces, and assembled and welded on the east bank of the river before being launched over the piers in four separate phases with a 50m-long launching nose at the leading edge. Precast concrete slabs are placed on the girders, followed by reinforcement, before a 200mm-thick concrete slab is poured on the top. A final, short launch of 250mm was still to be completed when *Bd&e* visited the site, to push the structure clear of the abutments, after which the launch bearings were due to be changed out for permanent bearings in anticipation for the traffic changeover.

Subcontractor Construgomes is also responsible for the construction of the concrete deck parapet, which is being cast using Peri formwork and is currently following on behind the MSS at a rate of around 100m per week. Camões expects that this work will be completed by February next year ■


The new deck under construction on the left, and the old viaduct on the right