BERW ROAD BRIDGE, PONTYPRIDD

Steve Jones of **Concrete Repairs Ltd** (**CRL**) discusses the challenging repair project to the White Bridge, a historic structure in south Wales. The bridge needed thorough structural surveying, careful gunite and reinforcement repair, and a design life extension of 50–60 years.

The Berw Road Bridge, or White Bridge as it is known locally, is Grade II* listed by Cadw (the Welsh Government's historic environment service) and provides access over the River Taff in Pontypridd, Wales. The bridge was built in 1908–1909 in association with LG Mouchel & Partner, pioneer of the reinforced concrete construction 'Hennebique system'. The bridge spans the 35m river, with a total length of 54m and when built was the longest reinforced concrete arch in Britain. In 1968, the bridge deck was replaced and the remaining arch elements clad in gunite.

WEIGHT RESTRICTION

The road carried by the Berw Road Bridge is an unclassified 20mph road with a 7.5-tonne weight restriction. Initially, Rhondda Cynon Taf County Borough Council (RCTCBC) expressed a desire to increase the load-carrying capacity to 40 tonnes. However, at the start

(Photo: Rhondda Cynon Taf Council.)

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MAIN IMAGE, OPPOSITE PAGE:
Berw Road Bridge following completion of repairs in July 2024.

ABOVE:
State of the bridge at the commencement of repair works.

LEFT:
Construction of the original bridge in 1908.

of the scheme, no assessments had been undertaken to determine if this was feasible. There was also a lack of contemporary survey information available for the bridge, in particular details of the existing gunite cladding and the potential repairs to the concrete structure beneath the gunite.

SCOUR SURVEYS

Following the flooding caused by Storm Dennis, the bridge was closed as scour surveys found extensive undermining to the south pier foundation. The bridge reopened with the original 7.5-tonne rating once scour repairs had been carried out to the south pier and apron.

As the bridge is a Cadw-listed historic structure, all intrusive works needed to be planned and agreed with Cadw prior to being implemented. In particular, the overall appearance and texture of any concrete repairs needed to be trialled and agreed with Cadw.

To embark on a refurbishment scheme, some important information needed to be determined:

- What state was the main structure in and what defects was the protective gunite layer hiding?
- What was the current strength of the bridge and to what level could it be feasibly strengthened?
- How could the bridge be accessed and repaired while still meeting environmental and structural constraints?

Following a competitive tender, CRL was awarded the two-stage contract. CRL engaged WSP to carry out a structural analysis to assess the current strength of the bridge, to consider the possibility of increasing the load capacity and to formulate associated options for structural repair of the bridge.

CRL Surveys carried out a structural survey of the bridge, including reinforcement make-up and condition of the underlying concrete. Checks were also conducted on the condition of the existing gunite layer applied in the 1960s. It was found that approximately 60–70% of the gunite was delaminated. WSP's structural assessment report confirmed the overall load rating for the bridge to be 7.5 tonnes and repairs needed to be undertaken to maintain the integrity of the bridge.

The council was looking for a 50–60-year design life for the structure post-repair. It was decided to carry out some trials to understand how easily the gunite could be removed (hydro-demolition was not an option due to the low concrete strength), what the condition of the reinforcement fabric in the gunite was and how best to match the replacement gunite to the existing to satisfy Cadw requirements. Once

ABOVE MIDDLE:
Gunite was removed and new reinforcement fabric fixed to the substrate.

ABOVE:
Coating the reinforcement.

the trial area had been removed, it was found that there were areas of spalling underneath the gunite. This necessitated making a judgement call on the potential quantity of concrete repairs that could be found over the entire structure. Different float finishes (steel and wood) were used on the trial patches, to enable Cadw to assess the various options.

SCOPE OF WORKS

On completion of the trials, CRL worked closely with the RCTCBC to scope the elements of the works. This involved producing an agreed specification with an associated Bill of Quantities. A provisional quantity, which was identified as a contract risk, was assigned to potential repairs beneath the gunite cladding. To prevent future incipient corrosion, Vector Corrosion Technologies was tasked with developing a design for the galvanic anodes to be used in the concrete repairs. All the works needed to be approved under a 'Listed Building Consent', which was granted by Cadw.

These early contractor involvement (ECI) works, early engagement and assistance given to the client led to CRL being awarded the contract to carry out the works in May 2022 under an NEC 4 form of contract.

A designed scaffold, which was required to be undertaken under a flood risk activity permit (FRAP) agreement, was needed to provide access to the various areas of the structure where repair works had to be carried out. This meant the scaffold had to be kept out of the river, necessitating a suspended solution supported by the unrepaired arch. Fortunately, some ground support for the scaffolding

FAR LEFT:
Repairs were largely broken out by hand breakers.

LEFT:
Anti-carbonation coating being spray applied.

RIGHT:
A suspended scaffold system was required to carry out the works.

BELOW RIGHT:
Bridge once repair works had been completed and scaffolding removed.

was possible at either end of the bridge on the pier foundation bases. These were used to support the scaffold bases and the unsupported sections were then cantilevered out to obtain maximise coverage. This still left three middle sections that needed to be fully suspended from the bridge. Crouch Waterfall undertook the assessment, working with PSS Scaffolding and its designer TAD Scaffold Engineering to produce an acceptable design.

As anticipated, once the removal of the existing gunite began, it was found that there were a large number of concrete repairs required, some of which were quite extensive. In order to preserve the structural capacity of the bridge, Crouch Waterfall undertook a review of the individual elements to advise on a sequence of repairs that could be undertaken safely. Repairs were largely cut out by hand breakers and the reinforcement was prepared and cleaned. The removal of the existing gunite also revealed a layer of reinforcement fabric fixed to the substrate. Cadw required that this be reinstated in keeping with the original existing fabric. A fabric of a similar gauge and size was sourced, and trials of the replacement fabric were approved by Cadw.

GUNITE

The repairs and new gunite were sprayed back using Fosroc DS sprayed mortar, in line with BS EN 1504[1]. A steel trowel finish was chosen for the gunite rather than the plastic float finish that was suspected to be the method of finish on the original gunite cladding. It was a requirement that the finish had to match the contours and angles of the structure in fine detail, with a tolerance of ±5mm. This was challenging on some elements of the structure, especially the sweeping arches, which had to continue with one unbroken run despite the works being completed in separate phases. It was a Cadw requirement that the spraying and subsequent finishing had to look as though it was all completed in one continuous run rather than a phased cycle.

Finally, the concrete structure was coated in Fosroc Dekguard A Plus anti-carbonation coating to restore the Berw Road Bridge ('White Bridge') to its original colour and former glory.

Further works included inspecting, cleaning and painting the brackets supporting the existing gas main that was suspended from the bridge, as well as various works to the balustrades, including repainting the parapet railings.

Additional scour protection remedials were carried out to the north side of the bridge and works to the top deck were also undertaken to improve the drainage and replace the wearing course and waterproofing across the bridge. The bridge was successfully reopened to traffic in July 2024.

It is pleasing to note that, thanks to the improved scour protection works, the refurbished Berw Road Bridge successfully withstood the recent testing conditions of Storm Bert and Storm Darragh, which brought significant river levels. C

Reference:

1. BRITISH STANDARDS INSTITUTION, BS EN 1504. *Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. Part 1 – Definitions*. BSI, London 2005.