Hawkridge Dam

Concrete repairs

By Paul Godfrey BEng (Hons) CEng MICE CEnv

Hawkridge Dam, located about 5km west of Bridgwater, is one of the impounding reservoirs feeding Ashford WTW and is owned by Wessex Water. It was designed by John Taylor & Sons and built for the Borough of Bridgwater in the early 1960s as a water supply reservoir. The reservoir is formed by a mass concrete gravity dam across a relatively steep sided valley. The dam is just over 200m long with a maximum height to the roadway of about 27.2m above the broad foundation level in the valley bottom. It consists of 17 (No.) 12.19m wide monoliths, and the valve shaft monolith which is 7.32m. The dam has a near central overflow comprising the two monoliths immediately adjacent to the valve shaft and two arms consisting of five and seven monoliths to the south and north respectively.

View from southern side of Hawkridge Dam - Courtesy of Wessex Water

Inspections

Every 10 years, under Section 10 of the Reservoirs Act 1975, all reservoirs are to be thoroughly inspected by an independent Reservoir Panel Engineer to review the safety of the structure. This inspection was undertaken by Halcrow Consulting Engineers on 23 June 2009. At this inspection no recommendations were made in the interests of reservoir safety; however the maintenance requirements were listed to improve the life of the structure, including concrete repairs to be undertaken to the upstream and downstream dam faces, the underside of the spillway bridge deck and beams. Also, the vertical surface joint sealant in the expansion joints to the upstream and downstream faces of the dam should be replaced.

In January 2010, The Wessex Water client procured a specialist concrete condition survey of the structure from Concrete Repairs Limited (CRL) to ascertain the condition of the structure and quantify volumes of the concrete repairs required to increase the lifespan of the structure, including recommendations of the type of repairs to be carried out.

This project was given to Wessex Water Networks 2 workstream in April 2010, with a client target date of 31 December 2012. Atkins was appointed as the design consultant, and Wessex Engineering and Construction Services (WECS) delivering and managing the required works on site.

Project delivery - workstreams

Wessex Water is recognised by Ofwat as one of the most efficient water and sewerage companies in England and Wales. In order to sustain its success, the company has created framework contracts called workstreams to assist in the delivery of its AMP5 capital investment programmes.

These workstreams consist of staff from its own internal engineering and construction group, leading external consultants, plus its own internal civil construction business, WECS. By engaging with high performing consultants and contractors, Wessex Water intends to further improve the efficiency of its project delivery process through;

- Collaborative early stage involvement.
- The maximisation of team working principles.
- Rigorous planning.
- Robust project management.

Design, implementation, challenges

The CRL report was analysed by Atkins Structures and Reservoirs teams to review and determine the scope of works required to meet the project brief, and to also quantify the extent and type of repairs required. The damage to the concrete faces had been caused by the spalling of reinforcement in the concrete structure.

The largest challenge with the project was the temporary access works required to enable the concrete repairs to be carried out. The workstream decided to re-engage Concrete Repairs Ltd to carry out the repairs to the structure, to utilise their concrete repair specialism and existing learning they had gained from carrying out the structural survey back in January 2010. CRL was engaged as a sub-contractor to WECS as the repair specialist under the principle contractor. WECS role as principle contractors was to manage day to day site activities.

Temporary access works

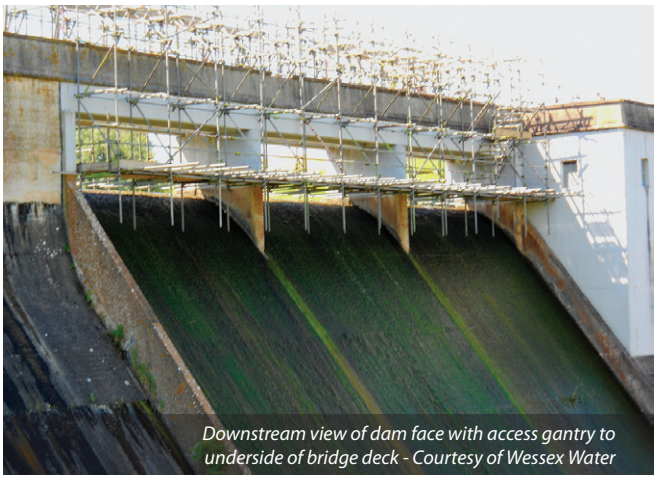
There were two distinct areas that required man access to carry out repairs. These areas had challenges, with working over water and at height. These areas were the underside of the spillway bridgedeck and the sloping sides of the upstream and downstream dam faces. The workstream invited access specialists Giraffe Access to present access solutions to the workstream which Giraffe Access implemented once agreed, acting as part of the delivery team as a sub-contractor to CRL.

To access the underside of the bridge-deck to carry out the repairs, a hanging cantilever platform was designed and implemented. This allowed water to spill over the spillway in times of flood, with no loadings on the spillway itself and at the same time, allow access across the dam crest and spillway bridge for Wessex Water operational staff.

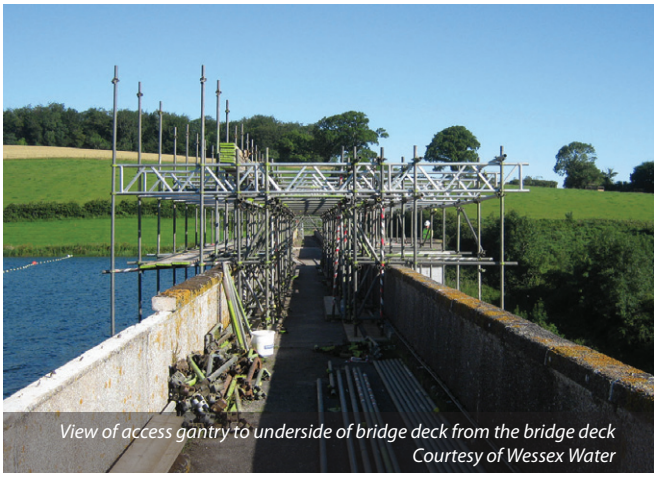
To access to the dam faces, discussions were held about provision of a full scaffold structure to the upstream and downstream faces. The workstream team reviewed the requirement and methodology of the concrete repairs, including evaluation of loadings and the tools required, and implemented a cradle system developed by Giraffe Access at a suitable cost.

Dam face concrete repairs

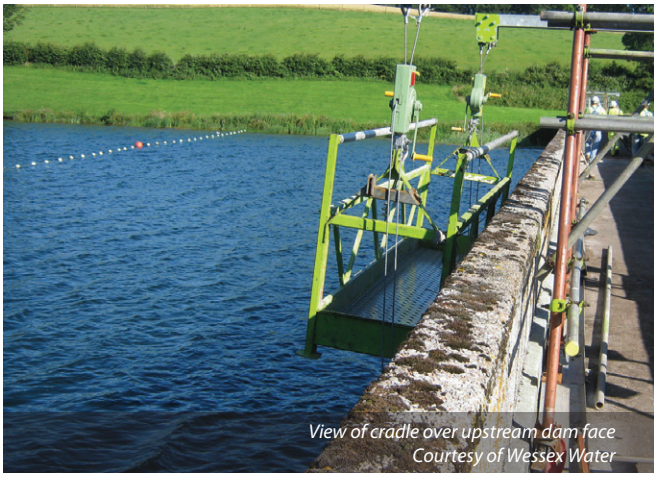
The areas of defective concrete identified in the CRL report caused by concrete spalling are typically shown by the photograph below. The defective concrete was repaired by applying a standard



Downstream view of dam face with access gantry to underside of bridge deck - Courtesy of Wessex Water



View of access gantry to underside of bridge deck from the bridge deck Courtesy of Wessex Water



View of cradle over upstream dam face Courtesy of Wessex Water

View of typical concrete spalling of the underside of the bridge deck Courtesy of Wessex Water

concrete proprietary patch repair system consisting of saw cutting all defective concrete identified to the extremities and broken out to a minimum depth of 10mm to avoid feather edging and to provide a square edge to the repair.

The repair surface was cleaned to remove any dust, unsound or contaminated material, oil, paint, grease, corrosion deposits or algae by scrubbing or the use of a proprietary degreaser. All corroded steel in the repair area was fully exposed and all loose scale and corrosion deposits removed. The reinforcing steel and repair substrate was primed prior to application of the concrete repair mortar.

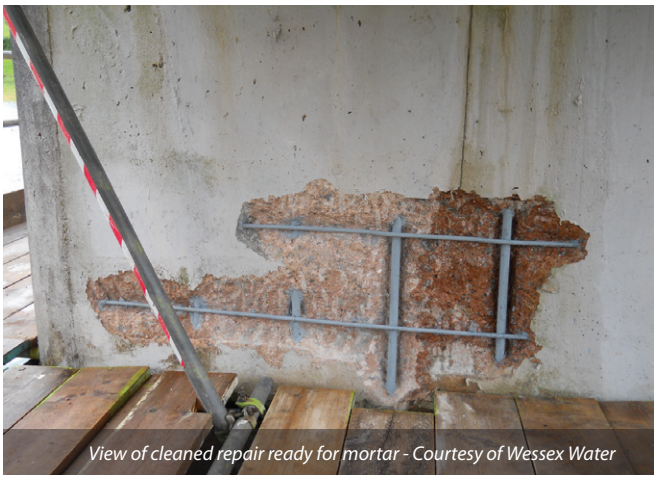
The existing vertical mastic sealant at the upstream and downstream faces concrete expansion joints of the dam were time expired and no longer functional and consequently were removed and replaced using a proprietary joint filler and sealant.

To do this effectively, the surface chases within which the new sealant was placed had to be prepared by reforming these in places by local concrete repair or by chasing out the original recesses, priming the bond surfaces and inserting resilient fillers and debonding tape at the base of the chase. The joint filler was then replaced by using a suitable polysulphide material. All these activities were carried out by hand.

Delivery programme

The programming of the project was to take advantage of the natural summer drawdown of the reservoir to reduce the health and safety risk with working over water.

The summer of 2012 was one of the wettest on record and the site team had weather and flooding challenges on a regular basis. The site team developed and implemented a traffic light system to mitigate the possibility of additional horizontal loading on the bridge deck gantry caused by flood water, with set reservoir warning levels to allow for workforce evacuation of the under deck gantry when reservoir flood levels are rising due to rainfall in the upstream catchment.



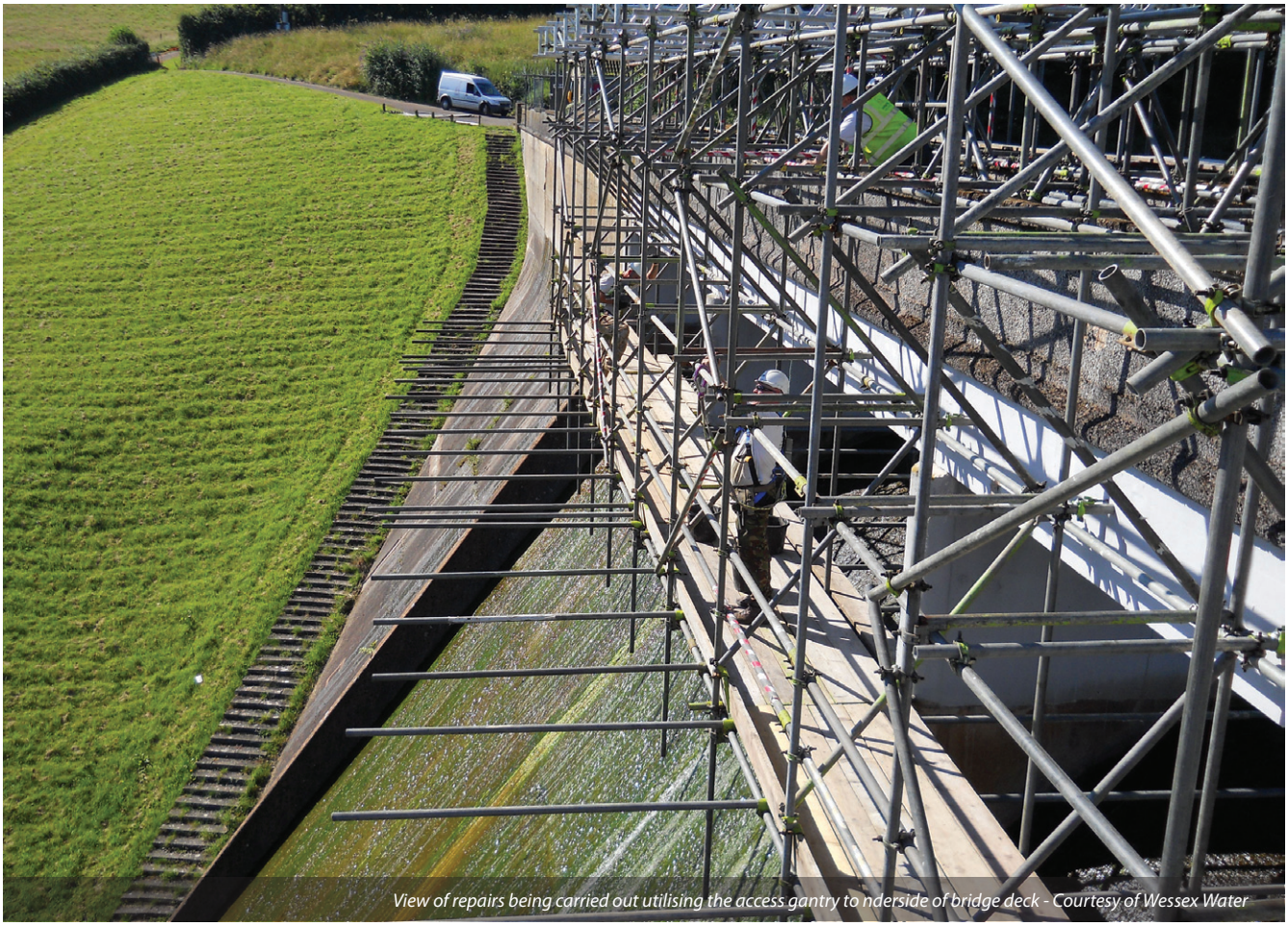
View of cleaned repair ready for mortar - Courtesy of Wessex Water

Conclusion

The project was initially priced at £318,000 for the Wessex Water Networks 2 workstream to deliver. Works commenced on site on 18 June 2012 and were completed on 17 September 2013 for a cost of £272,000.

The Editor & Publishers thank Paul Godfrey, Programme Manager with Wessex Water, for providing the above article for publication.

The author would like to thank Wessex Engineering and Construction Services, Concrete Repairs Limited (John Drewett) and Giraffe Access for their input and assistance with this paper.



View of repairs being carried out utilising the access gantry to nderside of bridge deck - Courtesy of Wessex Water