

Steeling the mighty Murray

Modifying a river lock and weir system



A new system for passing river traffic through the weir structure on the Murray River in time of flood is being built using steel. Modifications are being carried out over time at the rate of around one lock and weir a year. In February 2003 Bowhill Engineering was contracted by York Civil to be part of the operation, the first of its kind on the River Murray. To date, Bowhill Engineering's job has involved modifications to Lock and Weir 7, 8 and 9 to create a navigable pass, and construction of a Fishway.

The navigable pass section of the weir permits lock operators to remove a section of the weir when the river is in flood. Vessels then pass through the weir, instead of through the lock chamber or over the fixed weir, in flood conditions. Prior to modification, divers were exposed to danger as they shimmed down the upstream side of the needle beams in flood water, to align the beams on the bottom of the weir sill.

The new system of removable deck units and reduced height piers is alleviating those risks and allowing lock operators ease of installation/removal in flood waters by use of their existing rail cranes. Each lock and weir unit had taken around 50 tonnes of steel to build and, when complete, around 550 tonnes will have gone into the new system.

Design phase

The first challenge in the design phase was to establish the basic methodology, as this type of installation had not been done before. As the project progressed the capacity of the existing rail cranes to lift the new removable deck sections was an issue, as was the water velocity and drag to which the units would be subject in flood conditions. The longevity of the units in a splash zone environment also had to be considered. Many thousands of hours of design time by Adelaide based URS Engineers went into producing the contractual drawings.

Once designed, Bowhill Engineering had to produce fast and accurate drawings to allow enough time to complete the fabrication, surface treatment and construction of the project.

3D Modelling the key to success

Rowan Eggers, Bowhill Engineering's internal draftsman, completed the structural/mechanical steel detailing. Jeremy Hawkes, Managing Director of Bowhill Engineering said that: "We accurately measured the completed cast in items using electronic survey equipment and then transferred that information onto our mechanical design software (ProGroup Inventor 8) so that an accurate project model could be built. Rowan used the survey data to construct the dimensionally correct site components, including the new reduced height and full height piers, the existing weir sill, full height piers and lock chamber. He then detailed the removable deck units to accurately fit the site conditions."

"The powerful mechanical engineering software allowed us to create the deck units and build and simulate movement of the project before it was physically built in the workshop. Many alterations were made as a result of the information from the software model, including the theoretical weight of the deck units, which turned out to be critically important, as it was actually too heavy for the existing lock rail crane to handle," Hawkes concluded.

As a result the deck units were redesigned with less weight, before the units were physically built, and it would have been too late to rectify. The structure was complex with dimensionally close tolerances, for example, tie down rods had no more than 2mm tolerance with little or no adjustment to compensate on site.

Jeremy Hawkes said that: "Given the large number of components and sub-components, it was a comfort knowing that the drawings were produced from a 3D model and, when parts were produced, they were part of the final assembly. This gave us the assurance that when things changed the software identified all the areas affected, and allowed modifications to be made. The software allowed the entire construction team the ability to scroll around and view all the components in better than real life and identify issues with member clashes, bolt clearances and operational concerns."

Complex fabrication

Because the removable deck units were redesigned to be lighter, they took on an even more intricate form and were more complex to fabricate. The lighter sections, and increased bracing to spread the load, made distortion a bigger issue. Strong-backs had to be specially designed with pre-camber to compensate for the high forces experienced from the large fillet welds specified on the many connections. The exact pre-camber required was determined by trial and error but, in the end, an impressive result was achieved.

Project team

Client: South Australian Water

Head Engineering Contractor: York Civil

Design Engineer: URS Engineers

Steelwork Contractor: Bowhill Engineering

Steel Detailer: Bowhill Engineering

Coating Supplier: Jotun Protective Coatings

Right page top: Installation of the removable deck units was a seamless operation.

Right page bottom: Lock and weir on the Murray River.



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