

Teretek® Fills Underwater Voids to Stabilise Kimberley Rail Bridge Piers Following Floods

PROJECT PROFILE

T18E001

mainmark



INDUSTRY

Infrastructure

STRUCTURE

Heritage railway bridge

PROBLEM

Bridge piers compromised by scour

LOCATION

Mersey River, Tasmania

DURATION / YEAR

1 day / 2019

TECHNOLOGY

Teretek®

BUSINESS UNIT

Mainmark Australia

Summary

The heritage listed Kimberley Rail Bridge is a vital part of Tasmania's Burnie to Hobart Rail Freight Corridor. Originally built in 1884 and then extended in 1976, the bridge stretches 76m over the Mersey River and is one of three remaining wrought iron structures still in use in the Tasmanian rail network.

During the devastating floods in 2016, one of four Kimberley Rail Bridge spans collapsed as a result of scour (erosion in the riverbed) affecting the western abutment. This left the rail line between Burnie and Brighton impassable, impacting the State's freight transportation.

Urgent works were undertaken to rebuild the collapsed western-most span and abutment with modern materials, creating a new superstructure made of steel, supplementing the original wrought iron spans.

Once the rail line resumed operation, TasRail identified further scour under the edges of two of the mass concrete piers supporting the bridge. The two piers form part of the original bridge construction and consist of 3m wide and 8m long mass concrete columns that are founded in the river bed, with an elevation of 7.7m-8.6m above the riverbed.

To determine the extent of scour a carefully coordinated inspection was led by engineering consultants Pitt & Sherry, using a team of divers and a 3D sonar survey. It was determined that the riverbed had scoured away around some edges of the piers exposing the underside of the pier footing.

Numerous remediation approaches were considered, including installing concrete sheet piles which would require temporary damming of the river and excavating, or the more extreme measure of decommissioning the bridge entirely and rebuilding it.

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The solution chosen involved placing pea gravel aggregate in the larger scour areas and surrounding the exterior of the pier footing with a combination of large and small geofabric sand bags to contain the pea gravel and prevent the aggregate from being washed out by the river flow.

Based on prior experience, Pitt & Sherry recommended that Mainmark's proprietary Teretek® resin injection solution be used to bind the aggregate and reduce the voiding, to increase the longevity of the scour resistance protecting the bridge piers. Mainmark was contracted to complete remediation works under project managers, VEC Civil Engineering.

Objectives

The key objective was to restore long-term stability of the Kimberley Rail Bridge piers, by remediating all areas that had been undermined by scour to the piers and to protect each bridge pier from any further scour.

Mainmark was required to inject Teretek resin into the aggregate to fill 8 underground voids surrounding the bridge piers and to restore structural integrity without impacting the Mersey River.

Solution

Prior to injecting Teretek, dive teams needed to clear underwater vegetation, place the aggregate into the voids and insert one 50mm galvanised water pipe into the centre of each void to allow Mainmark technicians to guide the resin injection tubes directly into the treatment area.

The injection process involved meticulous planning, with site access extremely limited due to the flowing river and proximity to an operational railway. The ground surrounding the embankment was softened by moisture, and with no roads to the site, the area had to be accessed through an adjacent farm property.

A single self-contained Mainmark Rig, with all equipment and material needed for project delivery, was positioned as close to the injection site as possible on the bank of the river. This allowed the crew to run the resin delivery hoses along the ditch in the railway deck during specified "safe times", to

deliver the Teretek resin to the affected areas.

Teretek increases ground bearing capacity, fills voids, and has no detrimental effects on the environment. Following injection, the engineered resin immediately expanded to fill the space, binding with the aggregate to create a consolidated mass which filled each void and prevented further scouring under the bridge piers.

Although two days were allowed for project delivery, Mainmark successfully completed works within a single day, and without causing any major disruption to the rail service.

The bespoke methodology proved to be far quicker, more efficient and much less disruptive than the alternative options considered for remediating the bridge piers.

Project Manager Tristan Burns stated that TasRail was satisfied with the project results, considering the unique nature of the project and the complexities involved:

"The works were undertaken adjacent to an operating rail line and a sensitive site with environmental and local stakeholder constraints. VEC and Mainmark undertook the works in a safe and methodical manner. The repairs will ensure structural integrity of the piers in future floods which will preserve the heritage structure for many years to come."



Divers preparing to inspect scour