

Conon Bridge, Flood Defence

Sustrans, a charity organisation that prides itself on connecting people and places to make walking and cycling more accessible, awarded Aarsleff Ground Engineering a challenging project to investigate and stabilise the foundations of a former railway (masonry) bridge in Padiham.

Challenges

The three main challenges included; working in a cobble riverbed, with risks of seasonal flashing and water level increases; working around an unstable bridge, the presence of invasive species around the river bank access point and establishing a compound within an area with limited access and working close to public recreational areas where manoeuvring plant and materials had to take careful consideration.

Emergency works to stabilise the bridge foundations was an important objective to Sustrans, the local authorities and service providers due to the local values which this structure provided.

Solution

- Alongside designer Soil and Structures, Aarsleff's team established a Principle Contractor worksite and install access and a secure compound adjacent to the bridge. Two entrances were installed with the main access point to the north requiring a 1:10 ramp and working platform into the riverbed using clean quarry stone providing the main site access upstream for both workers, plant and equipment. A secondary access point of a temporary a scaffolded stairway was located downstream of the site for pedestrian access and grout station access.
- A work area was established using a temporary a cofferdam which surrounded the site area with any excess water pumped back into the river. To minimise the risk of

silt being pumped back into the riverbed and potentially disrupting the surrounding environment migrating fish, straw bales used around the cofferdam and boreholes to act as a filter to remove/reduce pollution risk and arising from drilling operations controlled with sand bags.

- Firstly a series on inclined boreholes were drilled to locate the 2nr roadways upstream of the viaduct. Stop-ends were created in the 2 roadways by using MP355, a 2 part polyurethane injection resin that expands on contact with water in the flooded roadways and fills the void.
- Following this, more boreholes were drilled into the roadways towards the bridge structure. A down borehole CCTV was used then to investigate the workings and determine the extend of collapses. Due to the presence of artesian water is was agreed to simultaneously treat the voids underneath the roadways with 28 tonnes of cement pfa grout, as well as using lance resin grouting to inject into the cobbles beneath the bridge foundations.
- Resin was injected into an array of lance injection points, again using 2700 litres of the Masterroc MP355 product due to its ability to expand under water, filling voids in the ground and helping secure the footing of the bridge.



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Objectives

Objective 1: bulk fill 'grouting' of residual voiding within the mine working roadways through polyurethane resin injection to create stop ends and infill with bentonite grout due to artesian pressure.

Objective 2: Permeation grouting of residual voiding within the overlying granular superficial soils through polyurethane resin injection lances.

Project Breakdown

Construction of the bridge was completed in 1876 as part the of the East Lancashire line (Usually known as the Great Harwood loop) which operated until Padiham power station closed in 1993.

The structure now forms part of the National Cycle Network (Route 685) and the short 2.2 mile section creates links between the local town centres, quick access from residential areas to Padiham Memorial park and also carries critical fibre optics services and utilities to Shuttleworth Mead Business Park which now occupies the former power station site.

Historic Mining Records

Historic mining records from the Arley Coal seam identify two significant roadways circa 14.0m below the central bridge arch ground level and which run in a north easterly direction. It is recorded that mining in of the roadways took place in 1877 and subsequently caused significant disruption to the bridge foundations and flooding resulting in the mineworkers immediately abandoning the site with potentially a lack of competent bedrock cover thickness.

Collapsed Mine

In 2021 structural subsidence in excess of 300mm was noted over a two month period, and it was considered that a mineworking collapse resulted in a loss of soil support lost under the bridge pier.

Limited ground investigation was undertaken which positively noted the position of the former roadway and provided information that there was a presence of pressurised water within the former mine workings which were acting as a pipeline for ground water flow. The collapsed workings and crown hole which propagated to bedrock surface or close to allow a conduit of groundwater which began to wash out finer material from the soil around the bridge pier.

The aim of the ground stabilisation works around the pier was to re-establish competent support to the underside of the eastern pier of the bridge. The works were sequenced to reduce risks from loss of upward hydraulic pressure created by the artesian flow.



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Scope of Works:

Bulk fill workings
Resin injection of soils

Contractor:

Sustrans

Construction period:

4 weeks

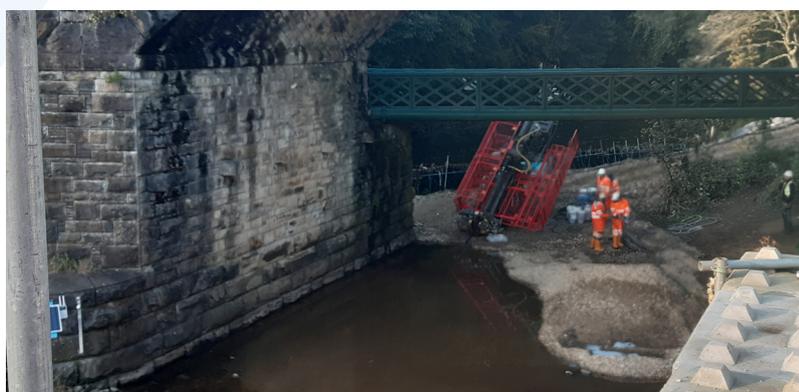
Equipment:

C6xP Drilling Rigs



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