Restoring a Historic Suspension Bridge in Multiple Work Stages

PRODUCTS

DYWIDAG Strand

Anchors

Unbonded Tie Bars

UNIT

DYWIDAG UK

LOCATION

United Kingdom

TIMELINE

04-2021 - 11-2021

SCOPE

Supply

Test Installation

Supervision

Technical Support

DYWIDAG specified and supplied critical ground engineering components which were used to construct the newly designed foundation anchorage section of the Union Chain Bridge, which links England and Scotland.

Context

The 200-year-old Union Chain Bridge links England and Scotland at the Historical site of Horncliffe in Northumberland, crossing the River Tweed to Fishwick in Berwickshire Scotland.

The foundation engineering aspect of the project was critical in order to preserve the historic 200-year-old Union Chain Bridge. It was the world's longest wrought iron bar chain and link suspension bridge when it opened in 1820 and remains the oldest suspension bridge still carrying traffic.

Solution

The Union Bridge preservation project was complex, involving multiple stakeholders. 7no DYWIDAG Strand Anchors were installed through a newly constructed reinforced concrete Waling, foamed into the top parapet wall of the existing masonry abutment. Originally constructed into the English hillside to anchor the main chain links to the opposite tower.

The specialist contractor Keller GE, hired by Spencer's for the installation, used a drilling technique generally referred to as a 'Drill & Case' method utilising a 'down the hole' hammer head. Drilling conditions proved to be difficult due to the local rock strata.

This type of DYWIDAG ground anchor was selected due to the poor or weak ground conditions on the hillside behind the existing stone abutment structure. The Geotechnical engineers (Remedy) were required to design a system of anchoring which would achieve greater anchor loads that were uniformly distributed over the full bond lengths of each 7no Strand Anchors in this location.

Situated on the Scottish side of the River Tweed, the world's oldest, free-standing, Masonry Pylon road bridge has been restored using the locally sourced Swinton sandstone, quarried by Hutton Stone. The Tower is anchoredto the ground via Compression Struts which, in turn, are bolted to our DYWIDAG PT arrangement cast within the mass concrete ground block. A large fabricated Head Plate were designed and installed to make the final connection through the Thrust Block to the Tension Tie Bars.

This methodology & design was repeated on the English side of the Bridge and bolstered by the introduction of 7no DYWIDAG Strand Anchors drilled and cased through a newly constructed re-inforced concrete Waling, foamed into the top parapet wall of the existing masonry abutment. Originally constructed into the English hillside to anchor the main chain links to the opposite Masonry Tower.

In addition we supplied DYWIDAG unbonded tension tie bar specified from 32mm dia 950/1050 grade N/mm2 pre-stressing bars (PST Bar) to be in accordance with BSEN 10138-4 pre-stress load = 534kn; as well as 32no unbonded Tie Bars 2mtr and 2.5mtr lengths, complete with galvanised head plates size 260mm 2 x 40mm deep c/w trumpet tube welded to rear.

We used a locking-off process: essentially we were instructed to "lock off" 32 number 32mm Ø dia WR tendons as per the attached photographs, 16 bars installed per side of the bridge anchor point locations, 32 total PST bars and they were locked off at 534kN per tendon/bar.