Eden Brows, Armathwaite, Carlisle, Cumbria

Project case study

Product
Bespoke concrete piles, slab and retaining walls

Volume
9,000+ cubic metres

Client
Network Rail

Contractor
Story Contracting Ltd

Overview

Hanson Concrete worked with specialist contractor Story Contracting to tackle one of the biggest engineering challenges ever faced by Network Rail. A severe landslide at Eden Brows, Cumbria – caused by extreme weather conditions – resulted in the closure of the Carlisle to Settle railway for 14 months and led to extensive and complex repair works to safeguard the future of the line.

Project description

The Carlisle to Settle railway suffered a severe landslide, resulting in closure of the historic line from February 2016 to May 2017. Over 500,000 tonnes of earth was dislodged along a 130m stretch, which was 70m wide and continued to move at a rate of approximately 30cm each month. The site was constantly monitored for movement and this was a factor that had to be carefully considered during repair. Adding to the challenge was the location; the site was only accessible through densely populated and environmentally important woodland supporting protected flora species and wildlife.

Eden Brows is close to two geological faults and the line is located 200m from the river Eden and 70m above on a severe incline. These factors, coupled

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with access issues, resulted in numerous complex engineering solutions having to be developed to execute a successful repair.

The initial phase of concrete repair works required the installation of 226 piles, 660mm in diameter and up to 20m in length, protected by a steel outer casing, placed with laser precision in two rows. Reinforcement comprised a cage consisting of B40 bars with 16mm links which were specifically designed for the project and weighed in excess of 2.5 tonnes each.

The concrete had to remain workable long enough to be delivered to the remote site in a highly fluid condition but, once placed and compacted, had to maintain structural stability with no excessive bleed, settlement or static segregation.

After placement, the material had to set rapidly and gain its 28-day characteristic strength in only seven days to allow the strict deadline to be met. A bespoke piling solution was formulated in Hanson's laboratory and delivered to test piles within four days. Working on a 24-hour basis over the Christmas and New Year period in 2016, all 226 piles were placed successfully, as programmed, without any issues.

These two rows of anchored, contiguous bored piles support a 1m thick by 75m long concrete slab and 4m high retaining wall with a 3m thick track formation above it. This resulted in a 5,000m3 concrete 'shelf' that provides a solid and stable base for the future and that will remain intact and structurally safe in the event of any further land disruption.

The concrete for the structural slab and cast-in retaining wall was grade C40/50 and the material was subjected to the same transportation issues as the piling concrete. Placement by long line pump was required with extended workability life and the mix formulation was carefully controlled from a thermal dynamic perspective.