Multi-disciplinary

Client:
Brockley Whins Embankment

Location:
Boldon Colliery, South Tyneside

Summary

A complex emergency embankment stabilisation scheme at Brockley Whins Station comprising a 15,000 tonne berm and a 13m long 9m span Multiplate Arch culvert extension.

Project Overview

Boldon Colliery, South Tyneside – LEN3 95m 0550yds to 95m 0660yds

Located 300 metres west of Brockley Whins Metro Station on the Longlands, Eaglescliffe and Newcastle Line (LEN3), a 20 metre high embankment carries Metro and Network Rail passenger and freight services between South Hylton & Newcastle Airport. At the centre of the site a twin bore masonry arch culvert (Bridge 282), carries the River Don beneath the embankment flowing northwards.

The track layout comprises of two tracks, the Up and Down lines, and due to deterioration in the track quality, a temporary speed restriction of 20mph has been imposed. The site has a long history of movement requiring various interventions over the years, including a concrete block retaining wall, sheet piles, soil nails, grouting and construction of a berm. All previous interventions had varying levels of success, but ultimately failed to halt ground movements.

Network Rail's Design Delivery Team designed a 15,000 tonne granular fill berm combined with new slope and toe drainage systems to counteract the deep seated failure through the embankment fill material. Right at the centre of the repair was the twin bore masonry arch culvert, which needed to be extended by 13 metres downstream to accommodate the new shallower embankment profile created by the berm.

Stakeholders

This complex project required additional land take to facilitate the repair, and had an impact on a number of other stakeholders to steer the project to a successful conclusion including Network Rail's geotechnical, structures & drainage teams, South Tyneside Council, the Environment Agency, Natural England, Northumbrian Water, Nexus, the general public and our railway neighbours. Regular two weekly meetings with key stakeholders was key to bringing all parties together and steering the project to a conclusion that was fit for all stakeholders.

A 450mm combined sewer dissected the railway right through the proposed foundations for the culvert extension and berm construction, further constraining the design solution, which was under stringent time pressure to provide a prompt repair to relieve speed restrictions on the railway. Following a review of several options, to avoid conflict with the combined sewer, we decided upon using a custom designed Multiplate Arch System designed and supplied by Asset International Structures.

Temporary Works

One of the challenges on site was the design and installation of temporary works around the existing twin bore masonry arch headwalls to create the space required to connect the new Multiplate Arch to the existing structure. The proposed sheet piled wall was secured in place with platipus anchors and pattress plate ties. Legato concrete blocks were also installed to secure the toe of the piles, which provided support to the required excavations and the failed over steep slopes above.

Once temporary works were in place, works could progress on the Multiplate Arch System, which was backfilled above to complete the construction of the berm and re-graded embankment slope to complete the slope stabilisation works.

Key works undertaken

- 15,000t Berm Construction
- 13m long, 9m span Multiplate Arch installation
- Reinforced concrete structures to support the Multiplate Arch and form headwall structures
- Sheet piled wall temporary works
- Platipus anchors to assist temporary works structures
- New filter drainage system throughout the site
- Counterfort drainage to the slopes
- Track geometry monitoring (7 days a week)
- Masonry repairs to the existing culvert structure

Successes

- Custom designed Multiplate Arch System culvert extension, provided a quick and efficient solution to avoid conflict with a 450mm Northumbrian Water combined sewer.
- Frequent combined communication with multiple stakeholders to bring the project to a successful conclusion; thank you to all stake holders involved, including Network Rail, South Tyneside Council, the Environment Agency, Natural England, Northumbrian Water, Nexus, the general public and our railway neighbours.
- Pro-active approach from the delivery team leading up to the Covid-19 lockdown and good application of control measures in line with CML's Covid-19 Management Plan, minimising delays to the completion of the stabilisation works.
- Complex temporary works structures designed and installed working closely with our design partners and supply chain.