Mossband Embankment, M6 Extension, Guardsmill, UK
Basal Reinforced Embankment using Piles & Fortrac® MP Geogrids

Introduction

The Mossband Embankment forms part of the new M6 motorway extension, crossing the West Coast Main Line railway near Guardsmill, Cumbria. The geotechnical design involved piling, basal reinforced platforms, ground improvement and reinforced soil slopes. The M6 Extension project between Carlisle and Guardsmill completes the M6 motorway to the southern end of the M74 which runs northwards into Scotland. This section of road was formerly dual carriageway, (A74T), posing safety problems and conflicts between local and agricultural vehicles and high speed traffic, especially at entry / exit points.

The 9km long project was essentially a widening process to increase the running lanes of the A74T to three in both directions. The new embankment at Mossband was constructed offline to carry the motorway across the West Coast Main Line, to the west of an existing viaduct, which it replaced. Additionally a new bridge crossing the River Esk, to the south of Mossband, was also constructed.

Solution

The geotechnical challenges unique to the Mossband Embankment were primarily the depth and weakness of the alluvial deposits under the proposed route. Typically the ground comprises a desiccated crust some 0.5 to 1.2m thick overlying a soft, silty alluvium to depths of up to 6m below which there was up to 4m of dense sand and gravels overlying a silty clay down to the Sherwood sandstone bedrock.

The embankment is up to 10m in height and where greater than 4m high the design was for Vibro Concrete Columns (VCC) to be used, founded at 6 to 9m depth in the sands and gravel. The 450mm diameter VCC piles had a design safe working capacity of 1000kN. In total approximately 4300 piles were used for the approach embankments. These piles had 800mm diameter pile caps cast separately on to them after they had been formed.

In areas where the embankment was not piled the design specified the use of band drains on a variable triangular spacing. Approximately 18,600 drains were installed.
Embankments on Piles

Earthworks and Foundation – Embankments

through a Class 6C drainage layer /working platform down to the sands and gravels thereby allowing the dissipation of excess pore water pressures in the alluvium to occur as the embankment fill was placed. Above the VCC piles a low strain, high strength, 1200kN/m, geosynthetic reinforcement geogrid (Fortrac® 1200 MP) was used to provide lateral restraint across the pile caps and transfer the vertical loading to the piles themselves. The Basal Reinforced Platforms (BRPs) were designed in accordance with BS8086, 1995, ‘Code of practice for reinforced soil and other fills’, and the specified geogrid had BBA certification. The design of the BRP reinforcement was strain limited to 3% to ensure compatibility between the lateral strain extension of the reinforcement and the inherent limitations of the concrete piles.

The same code of practice was used for the design of the reinforced side slopes, with reference to HA 68/94. The side slopes were again reinforced with low strain, BBA certified geogrids (Fortrac® MP), with strengths ranging from 110kN/m to 35kN/m. The reinforcement was placed at 600mm vertical lifts with no wrap around to the front face. A 3D geomat was detailed to retain a veneer of topsoil over the face of the embankment to support the subsequent vegetation of the slopes.

The Mossband embankment was originally designed to have side slopes at an angle of 1 in 2, however by steepening the embankment sides to a 1 in 1 slope with the use of Fortrac® geogrids the overall footprint width of the piled embankment could be reduced by some 10m. This directly saved costs by reducing amount of piling required, the embankment fill volume and the time saving which could also be converted into a monetary figure.

The Advantages

- Reduction in embankment piled footprint by steepening side slopes with geogrid reinforcement
- Use of site won materials within embankment to enhance sustainability
- Low strain high strength basal reinforcement used for compatibility with concrete piles
- Customised roll lengths minimising waste and increasing site efficiencies.

Location: M6 Extension Guardsmill, Mossband Embankment, UK
Client: UK Highways Agency
Consultant: Capita Symonds (Grontmij)
Contractor: Carillion
Year of Construction: 2006–2008
Products: Fortrac MP Geogrids® 1200, 110, 80, 55, 35

Fortrac® is a registered trademark of HUESKER Synthetic GmbH.