Tensar*tech* GreenSlope System
Channel Tunnel Rail Link, CTRL 342, London
UK, 2003

Constructing the GreenSlope face of the steep 8m high railway embankment

BENEFITS OF THE TENSAR SOLUTION

Savings of approximately £700k by using site won chalk fill, lime stabilised, rather than imported granular material as fill for the reinforced embankment.
Minimum intrusion into environmentally sensitive reed beds by using steep 60-degree embankment slopes. Time and cost savings by avoiding a reinforced concrete slab over the piles.

PROJECT BACKGROUND

The existing North Kent railway line (NKL) had to be connected to the new high speed CTRL by constructing an 8m high embankment over soft, environmentally sensitive marshland.

THE TENSAR SOLUTION

Tensar Basetex high strength geotextile reinforced load distribution platform 1m thick, spanning a grid of driven cast in-situ piles. Tensar uniaxail geogrids as reinforcement for the steep, lime stabilised chalk embankment above the load distribution platform, using a wraparound vegetated face. Approximately 115,000 m2 of Tensar uniaxial geogrids and 75,000m2 of Tensar Basetex were installed between April–September 2003.

TECHNICAL PROJECT DESCRIPTION

The CTRL is Britain's first true high-speed railway line and largest P.F.I. scheme to date (£5.2bn). Once fully completed in 2007, its 108km of high speed line will link the Channel Tunnel to London. Contract 342 is located at Ebbsfleet, N W Kent and forms part of Section 2 of the CTRL. As part of Contract 342 works, a new railway embankment, approximately 220m long was required to connect the existing NKL railway to the CTRL.
Locally the site was a marshland area covered with reed beds Groundwater was encountered at ground level. Ground conditions comprised up to 1.6m of made ground overlying low strength alluvial clays, to a depth up to 6 or 7m below ground level. Medium dense to dense gravel was encountered towards the base of the alluvium for the most part, which was underlain by the Upper Chalk Formation at approximately 6 to 10m below ground level.
The poor ground conditions and tight tolerance requirements dictated the need for a piled embankment. For economic reasons a geosynthetic reinforced platform was designed to carry the embankment lateral loads and spread the vertical embankment loads on to the piles. Driven cast in-situ concrete piles were used and the platform was designed to BS 8006 with a 120-year design life. The Contractor chose Tensar Basetex, a high strength knitted geotextile to reinforce the load distribution platform. A purpose made lifting beam was used to place the 4.4m wide rolls. Due to the steep slopes of the overlying reinforced embankment, the base layer required a return anchorage detail, which was provided by wrapping it around a gabion basket thrust block. (Elsewhere on Contract 342 a low-height unreinforced railway embankment was constructed on top of a load distribution platform which also used Basetex, but without a gabion anchorage.)

In order to limit encroachment on to the ecologically sensitive marshland and also minimise the number of piles the embankment footprint was reduced by designing with geogrid reinforced 60-degree slopes. The original design required approximately 37,000 m3 of Class 6I/6J imported granular fill. However there was a surplus of Class 3H chalk available on site, albeit with a high moisture content (m.c.>28%) and low density. A Value Engineering exercise was therefore carried out by HNH JV. This included trials, to investigate stabilisation of the chalk by site rotavation with quicklime to 'dry' the material. It was found that 2% lime achieved a m.c. of 23-28% and that compaction to a maximum 10% air voids was satisfactory to meet the design parameters. Cost savings of approximately £700k resulted, in addition to the obvious environmental benefits.
However lime stabilisation of the chalk created an exceptionally alkaline local environment, with pH measurements of about 12.5. Tensar uniaxial geogrids are manufactured from high density polyethylene and can resist extremely aggressive chemical environments and were shown to be suitable here. Tensar uniaxail geogrids were installed to form a 60 degree wraparound face which retained a hessian lining and a seeded topsoil layer.

Client:	Project Manager:	Contractor:	Contractor's Designer:
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