

## Spotlight

### Geogrids favour Foulness

Value engineering resulted in Huesker's Fortrac geogrids being used to control differential settlement during the construction of approach embankments to a new road bridge over the River Foulness in East Yorkshire.

Under an ECC target cost contract, Mowlem Northern Civil Engineering was responsible for the design of the Welham road bridge on the A614 near Goole.

The client, East Riding of Yorkshire Council, specified very tight limits on the allowable surface and differential settlement on the bridge structure and approach embankments.

Ground conditions alongside the river consisted of 5m of peat and 1m to 2m of soft silts and sands overlaying 2m to 3m of firm laminated clays. Sands, gravels and mudstone underlie these superficial deposits at 12m below existing ground level.

Tight serviceability criteria and poor ground conditions led Mowlem and its designer Pell Frischmann to choose a piled solution. Huesker was brought in as its geogrids had been used successfully on the A63 Selby Bypass, 15km west of the Welham bridge.

The embankment was



*A change in pile layout allowed the same grade of geosynthetic to be used in both directions on the embankment.*

constructed using driven, cast insitu piles with flared heads to depths of 12m to 13m. The core of the main embankment was designed using PFA fill with a mine stone shoulder. These lightweight, locally available fills reduced the loadings on the piles, allowing the pile spacings to be optimised.

The original indicative design was based on a square pile arrangement with a reduced pile spacing beneath the bank seats.

The British Standard BS8006 approach to geosynthetic reinforcement design details two orthogonal layers of high strength reinforcement. However, increasing the pile spacings along the length of the embankment, and decreasing the spacings across it, enabled the same grade of geosynthetic reinforcement, Fortrac 800, to be used in both directions.

Longitudinal geosynthetic reinforcement was also extended 30m into the transition zone beneath the embankments, beyond the first and last piles. Not only did this provide anchorage

but it also helped to limit the potential for differential settlement between piled and un-piled embankments.

PFA fill, which tends to exhibit a pozzolanic reaction, was omitted from the zone immediately above the edge piles and replaced with a granular wedge of a more dilatant fill. This also helped to compensate for differential settlements at the base of the embankment.

In addition, loose compressible soil was placed between the first six rows of piles at the low ends of the embankment to encourage the geosynthetic reinforcement to develop its tension while the first few layers of overlying embankment fill were placed.

Mowlem's 40 week design and construct contract for the A614 realignment was part of a three year framework agreement with the East Riding of Yorkshire Council.

The scheme, which involved constructing a new 1km section of 9.3m wide carriageway and the new bridge, was completed in October 2004.