

June 2003 emap construction network £5/\$8

GROUND ENGINEERING

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**Sock it to 'em:
sand piles support
Hamburg Airbus complex**

Geosynthetics focus

GEOSYNTHETICS



The geotextile encased sand columns support a dyke surrounding a reclaiming area.



Sock it to 'em

Geotextile-encased sand columns are enabling the reclamation of 160ha site on the banks of the River Elbe in Germany. Gareth Beazant reports.

Sand piles encased in geotextile "socks" are being used on a huge extension to the Airbus factory on reclaimed land by the River Elbe just north of Hamburg.

The 160ha site required 62,000 of Huesker's geotextile encased columns (GECs) in diameters of 600mm and 800mm to support a 2.3km dyke around a reclaiming area. The €1.2M (£850M) contract will allow Airbus to build its A380 or "Euro jumbo" passenger aircraft.

Installation of GECs (GE

December 2002) begins by vibrating a steel casing into the ground to the load bearing layers. The casing has two flaps at the bottom which are forced closed during driving, displacing the ground.

Huesker Synthetic's round weave Ringtrac is connected to a funnel and put into the top of the casing. The tube is then filled with sand and the casing vibrated out. This removal compacts the sand and stresses the geotextile, generating a high horizontal stress that makes it stiffer than surrounding soil. Huesker says

that the advantage of Ringtrac is that it is seamless – the seam is where sand piles usually fail.

Once the GECs are in place, a safe level of shear strength is attained so that loading can be applied in a very short time.

"The original proposal was to have a steel sheet piled wall all the way around and then build a dyke," explains Björn Hoffmann of contractor Möbius. "But that would have taken a lot more time and use about 70,000t of steel which just wasn't available."

It is estimated that using GECs has shaved two years off the programme for building a sheet piled dyke. In the end, a sheet pile wall was used for one section where the Elbe tides were at their strongest.

More reclamation is now under way to extend the factory's runway to handle the giant aeroplanes. Progress has been rapid, with Möbius installing 25 piles an hour to depths between 8m and

15m. For the runway extension, two teams have started at either end of the water and will meet in the middle.

As with the main dyke, temporary surcharges are being used where necessary, taking a total of 10.5M.m³ of sand so far.

Construction of the main dyke began in March 2001 and now

GEOSYNTHETICS

Strawberry fields forever

At first glance, work appears to have ground to a halt on a new motorway through one of northern Europe's largest fruit-growing regions.

Vast amounts of sand line a 12.3km stretch of the Elbe Valley, making it look more like a desert than a construction site. The sand is playing a part in preparing the ground for a section of the 30km A26 Hamburg to Stade motorway in Germany.

Beneath the surrounding apple and strawberry fields lies about 10m of poor, almost unusable ground. Most of it is sodden, and some is below sea level.

Piling was not an option because of the cost of having to go so deep to find solid ground and concerns about the environmental impact of spoil disposal.

Instead, it was decided to surcharge along the route, using sand to squeeze out the vast amounts of water in the soil and to accelerate ground settlement.

The first step was to lay a non-woven Huesker Synthetic geotextile and a separation layer to even out any irregularities. A shallow layer of fill on was placed on top and covered with a high strength Huesker woven geotextile, chosen to withstand the high loads during surcharging.

Depending on the load above, the material used was Stabilenka 200, 400 or 600 (the number indicates the longitudinal ultimate tensile strength in kN/m).

To avoid any slipping, the geotextile was lapped back into the sand at a higher level, with more sand placed on top. Expanded polystyrene was considered for the surcharge but this proved too expensive and its long term environmental effects have not been analysed.

Where the soil was worst, the sand layer was up to 12m high. A total of 3M.m³ of sand has been used in the surcharging. Most of it will be moved along the route as work progresses.

One of the problems in using such high piles of sand is the risk that it would blow into the nearby surrounding apple orchards and strawberry fields. To avoid costly compensation claims by farmers, barriers were tested along some sections. The preferred method, however, has been to plant grass to stabilise the sand piles.

Water displaced by the surcharge was another consideration. Drains have been installed at regular intervals to channel it into the River Elbe. However, its high iron levels give the water a red tinge and it has to be cleared before coming anywhere near the orchards or again, compensation claims from the farmers would be inevitable.

Iron content is between 30 and 50 parts per million, way above the recommended 2ppm for healthy tree growing. Filters and retention ponds in the drainage ditches extract the iron before it is circulated back into the water system.

To ensure settlement is going according to plan and check that a nearby railway line is not affected, monitors have been installed at regular intervals.



Vast amounts of sand surcharge accelerate settlement on the route.



GEC columns are being trialled for a showpiece bridge.



High iron content tinges the groundwater red.

"Two small projects in Germany have used similar schemes and the future looks promising for the method. It takes time, and that is the problem, as time is money," says Hans Joachimoff of IGB.

Surcharging and settlement is due to be complete in 2005 when the sand will be removed and motorway construction will start. When the road opens in 2012, it is hoped that it will alleviate one of Germany's busiest and most dangerous routes.

A total of 750,000m² of Huesker geosynthetics have been used so far. As on the Airbus project, Möbius is considering using geotextile-encased sand pile columns for a showpiece bridge over the railway and has carried out a number of tests.



work is progressing with surcharging and building Airbus facilities. To speed consolidation, 1.75M vertical drains with a total length of 24,500km have been installed.

About 8.5M.m³ of sand has already been placed inside the dyke area. An estimated 11M.m³ will eventually be used.