B180 Zeitz-Theissen Bypass Sink-hole Safeguards with Stabilenka® 1000/100

Stabilenka®

HUESKER
REPORT

*Forward placement of the stone layer onto pretensioned **Stabilenka**® 1000/100*

The Zeitz-Theissen bypass was constructed in 1999 in the course of joining the B180 to the B91. A 480m length of newly constructed road in this area traverses an abandoned mineworking, so the risk of subsidence was highly rated. As a result it was decided to include a high-tensile polyester fabric, **Stabilenka**® (tensile strength: 1,000 kN/m lengthwise and 100 kN/m widthwise), as sink-hole bridging reinforcement. According to a mining analysis carried out by the Halle Mining Authorities, this old mining region can be prone to funnel-shaped sink-holes (cavities) up to 3.5 metres in diameter (D). The section of road at risk is an embankment region, with fill heights (H) of 2.0 to 2.5 metres above the reinforcement level.

The static calculations for the sink-hole bridging reinforcement were produced by HUESKER Synthetic's engineering applications department and approved following examination by the Halle Highway Construction Office. The design of the bridging effect was produced to British Construction Standard BS 8006. Also taken into account with regard to the load-bearing behaviour of geosynthetic reinforcement were the designload standard used in Germany (DIN 1072) and the 'Code of Practice for the Use of Geotextiles and Geogrids in Highway Earthworks Construction', issued by the FGSV [Research Institute for Highways & Transportation] in August 1994. Given the relatively flat condition of the reinforcement (H/D = 2.0/3.5 = 0.57 up to H/D = 2.5/3.5 = 0.71), the loadbearing behaviour was best reflected by the British design method, as a permanent load reduction or arching effect could hardly arise in this situation. The advantage of this design method was its capacity to forecast the anticipated settlement behaviour of carriageway surface level as a function of selected reinforcement. The method also made it possible to determine the 'appropriate' reinforcement for the carriageway's permissible settlement level.

Zeitz-Theissen Bypass - completed

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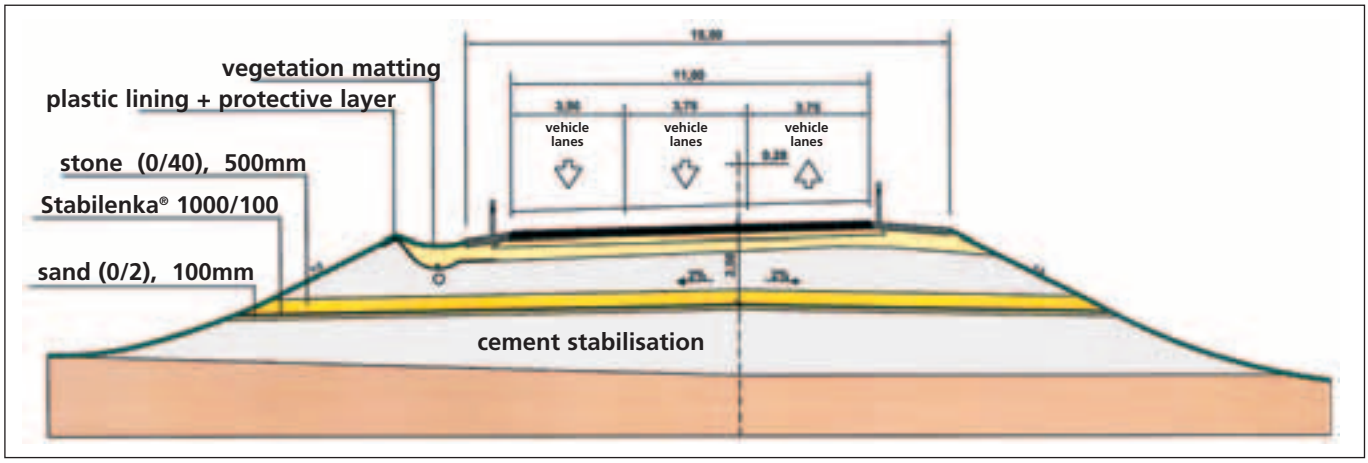

cross section at station 0 + 280.00

The Halle Highway Construction Office imposed the following bridging effect requirements for this situation:

- **durability of the reinforcement in soil with assured parameters for at least 60 years**
- **carriageway allowed to sink no more than 50 mm under SWL 60 traffic-loads**
- **loading period after sink-hole opening, up to 2 weeks (i.e. before pressure grouting the cavity).**

Under the basic conditions outlined above, a required design strength (Fd) = 283.5 kN/m was determined for a uniaxial bridging effect (a uniaxial transfer of main tensile force in the longitudinal direction of the road), allowing for an admissible extension of e = 4.3% (given a loading period of 2 weeks).

These requirements were met by a HUESKER geotextile of high-modulus, high-tensile polyester, namely **Stabilenka®** 1000/100. Following the installation plan a total of 26 rolls of **Stabilenka®** were 'made to measure' to keep material costs to a minimum. The maximum length of the rolls supplied was 120 metres (roll weight including steel tube: 12 kN (1,200 kg)).

The transfer of tensile force from one geotextile width to the next in the principle loading direction was by friction. The required overlap length was calculated as 10.0 metres. A stone layer (0/32), 100 mm depth, was placed between the longitudinally overlapped widths to increase the angle of internal friction. The widths (5.0 m roll width) were provided with a 500 mm overlap transverse to the road axis. This overlap provided sufficient protection against 'self-opening of the overlap', because the theoretical mutual displacement of the widths at the point of overlap cannot be any greater than 280 mm in the event of a sink-hole.

It is important to place sink-hole bridging reinforcement precisely and to install the lengths in a taut condition. HUESKER have

*HUESKER's development - a special-purpose device for laying and pre-tensioning **Stabilenka®** 1000/100*

developed and tested a special device for this purpose, which can transport, unroll and pre-tension geogrids and geotextiles, controlling the tensile force in the process. Tension during tightening is measured electronically and is continuously shown on a display screen. This device is protected as a registered design. In the project described, **Stabilenka®** was covered by the front tipping method with a pre-tensioning force of 2 kN/m, ensuring the geotextile's strength is quickly mobilised at the first sign of a sink-hole and smoothly bridges over the cavity.

Thanks to very good preparatory work, the contractor, Streicher GmbH, working with the unrolling and tensioning device provided by HUESKER Synthetic, installed about 14,000 m² of **Stabilenka®** 1000/100 in taut condition and in the exact position in just a few days.

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