A unique construction solution: the Gröbers high speed railway junction, located on an area with potential sinkholes

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Knoten Gröbers, Aerial view 2001

Active sinkhole

The problem

A railway junction with up to 7 tracks alongside each other is located on a former coal mining area where extraction took place at depths as shallow as 30 m up until the 1930s. The railway embankment, with two tracks for high speed (ICE) trains (up to 300 km/hr), needs to be protected from potential sinkholes and unacceptable settlements (max. 3 mm differential settlement over 1.5 m rail spacing).

The solution

All detected cavities were injected with cement grout. The embankment was then constructed with a special over-bridging system:

- Firstly, a cement stabilised base layer (0.4 m thick);
- Secondly, a mineral layer (0/16 and 0/32), including warning layer, and two **Fortrac®** Geogrid layers with strengths up to 1200 kN/m, reinforcing in two directions (0.95 m thick);
- Finally, an upper cement stabilised bearing layer.

Over the cement stabilised bearing layer, a nonwoven seperation layer was placed before installing the frost protection mineral layer in accordance with German Railway regulations DS 836.

As soon as a sinkhole becomes active, the warning layer will register its exact location. Then the **Fortrac®** Geogrids, with aramid yarns longitudinally and polyvinylalcohol yarns in the cross direction, will be activated, reinforcing the embankment and upper cement stabilised bearing layer (the system having a design life of one month). Within the

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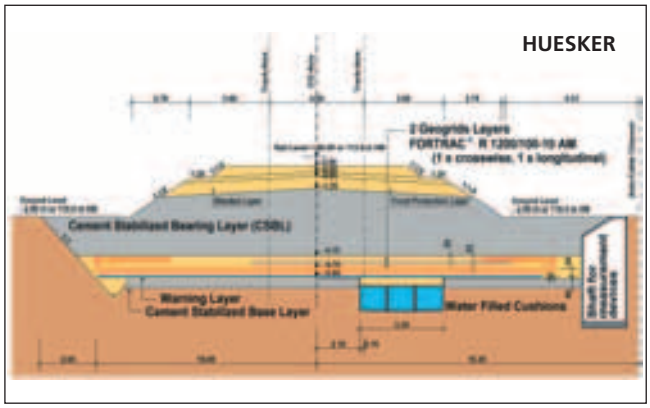
Result of an active sinkhole



Testfield Gröbers
Simulation of a sinkhole 4,0 m x 8,0 m

month, the sinkhole must, and can, be injected without the need to close the railway tracks.

This unique system provides a solution combining a geosynthetic bearing layer with a computer operated warning system, resulting in permanent control of the situation.

Location:	Gröbers, between Halle and Leipzig, Germany
Client:	German Rail (DB Projekt Verkehrsbau GmbH)
Design:	VEPRO (tracks) KuK (construction works) HUESKER Synthetic (geosynthetics) Glötzl GmbH (warning system)
Contractor :	ARGE „Knoten Gröbers”
Year of construction:	2000 - 2002
Products:	**Fortrac®** R 1200/100-10 AM 215,000 m² including nonwoven composite warning layer

Installation of warning layer and monitoring system

Installation of **Fortrac®** Geogrids R 1200/100-10 AM

HUESKER Synthetic GmbH
Fabrikstraße 13-15 • D-48712 Gescher/Germany
Phone +49 (0) 25 42 701 -0 • Telefax +49 (0) 25 42 701 -499
Internet: www.huesker.com • E-mail: info@huesker.de