# German Railways, Extension Line 51, Uelzen-Stendal
# Reinforced with Fortrac® Geogrid

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## Construction Work in Progress

Deutsche Bahn AG is engaged in extending the important interregion Uelzen-Stendal west-east link under the terms of the 'German Unity-Transport Projects' initiative. A consortium of construction firms comprising Matthäi, Bothe and Meyer won the contract for this construction work. Over the section from km 571.16 to km 571.60, at 'Harper Mühlenbach', the extension line 51 runs along an embankment up to 6 metres high on a base of some 10 metres wide.

This section has only been in single-line operation since 1945. The line is now being upgraded to two ballasted tracks and electrified for a speed of $V_E$=160 km/h. The overall safety of the existing railway embankment is inadequate for the additional load arising from this development. The extra loads can also be expected to lead to settlement due to peat layers in the subsoil. A widening of the embankment at its natural slope angle was out of the question for ecological and economic reasons. Accordingly, the design engineers produced a superimposed, geogrid-reinforced steep slope up to 3 metres in height and inclined at 45°. The German Federal Railways Office's 'individual approval' was already obtained for this work.

A special proposal developed by HUESKER Synthetic was introduced in close co-operation with all parties involved. Based on several successful projects already conducted for Deutsche Bahn, the embankment was built up over precaste cemented stone columns covered horizontally by a geogrid reinforcement. The columns and reinforcement increased overall stability and provided a virtually settlement-free foundation for the body of the embankment with its extra-steep side slopes.

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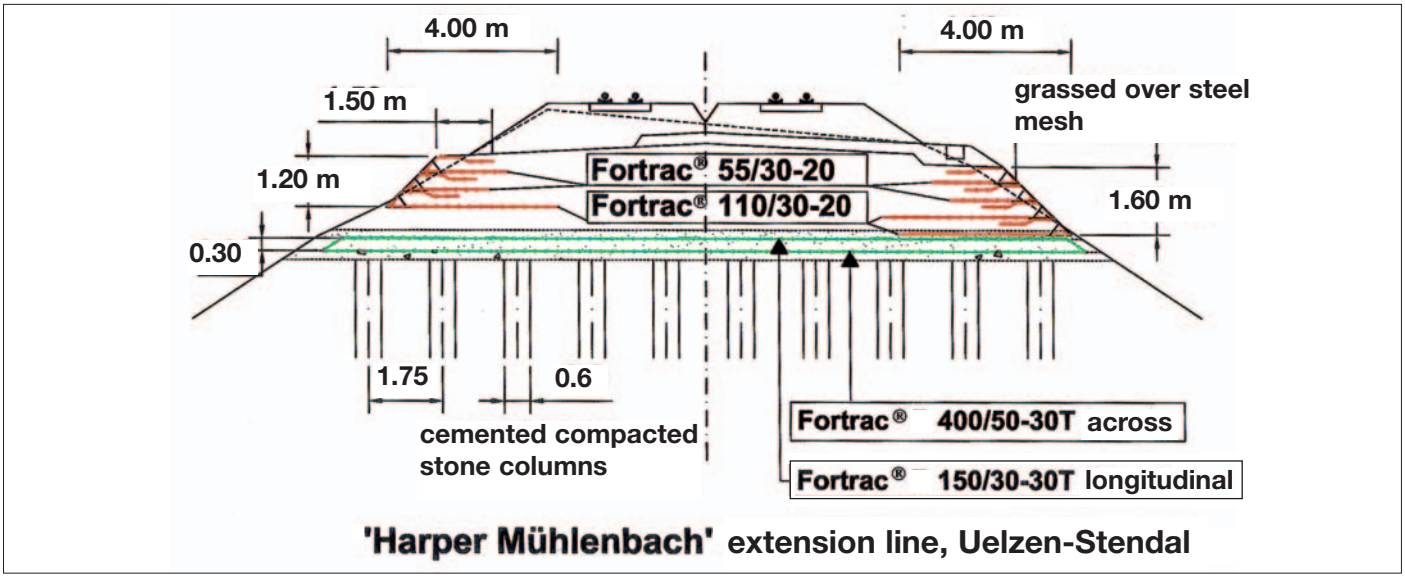
## Requirements imposed on the geosynthetic reinforcement




'Harper Mühlenbach' extension line, Uelzen-Stendal

The expensive approach of the initial design by securing the side slopes of the embankment with back-anchored sheet pile walls was abandoned. The existing embankment was removed to a precisely defined level. Cemented compacted stone columns (dia. 600 mm) were then piled through the remaining embankment, down to the load-bearing subsoil. The column spacing was 1.75 meters. **Fortrac®** geogrid (400 kN/m short-term tensile strength) was then laid on top of a 200 mm thick levelling course across the embankment axis with a 150 kN/m geogrid longitudinally along the embankment axis. The superimposed extrasteep embankment was then built above, without difficulty and as initially designed.

The grassed Textomur® supporting construction was used to keep the angle of the slope at precisely 45°. This system comprises prefabricated sections of steel mesh backed with a vegetation nonwoven material. The slope was stabilised with **Fortrac®** geogrid of the required tensile strength at each level. Topsoil was then placed over the face of the slope. A mineral aggregate (internal friction > 32.5°) was used as embankment fill material and compacted in layers to $D_{pr}$ = 97%. The slope was subsequently grassed by the hydro-seeding method.

The extra-steep railway embankment is now capable of taking the new tracks without widening the embankment footprint. All in all, the alternative proposal involving horizontal reinforcement over piles and extrasteep slopes with **Fortrac®** geogrid resulted in the required construction work being completed more economically.


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