



**Networks are our Strength**

Geosynthetic Solutions for Railways

 **HUESKER**  
Ideen. Ingenieure. Innovationen.

# Meeting the Challenges of Railway Engineering

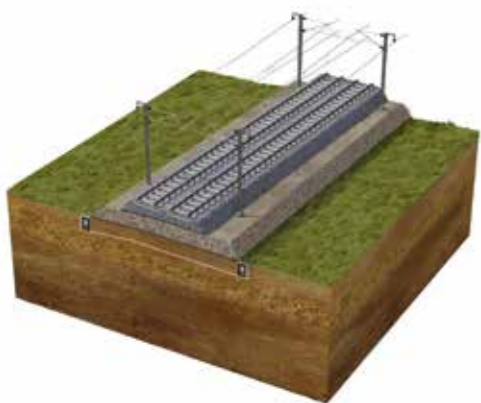
Discover the immense benefits offered by HUESKER's geosynthetic engineering solutions.



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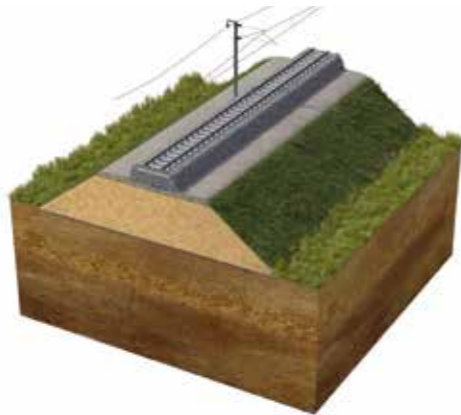
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Base Reinforcement



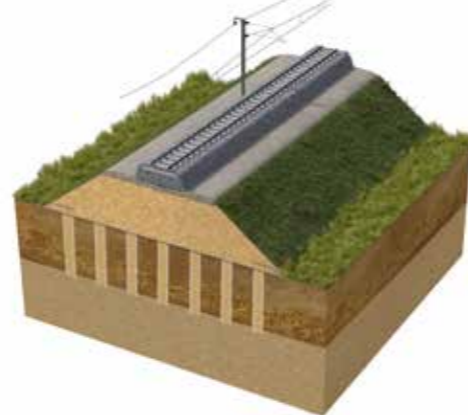
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Embankments on Soft Soil



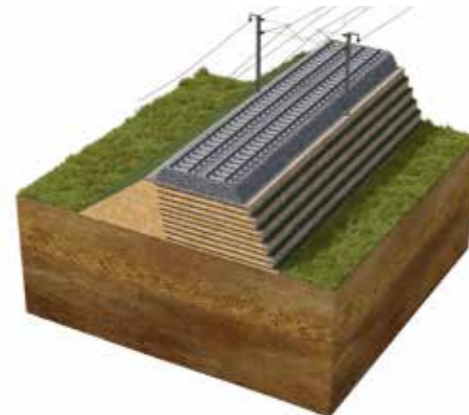
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# Our Track Record in Railway Engineering

**Rail projects pose a wide variety of challenges. This makes engineering know-how, cost awareness and, above all, experience, key prerequisites for the design, installation and maintenance of railway structures.**

HUESKER not only delivers reliable product quality, it also offers a full range of support services meeting the most rigorous standards. The company's experience is built on countless rail projects implemented worldwide. Its credentials are underlined by a decades-long partnership with German rail operator Deutsche Bahn, as a reliable supplier of HPQ. (manufacturer-related product qualification) compliant products.

You will be amazed at the diverse applications of our geosynthetics in railway engineering. As well as base reinforcement, our core competencies also cover embankment construction, geosynthetic-reinforced earthworks as well as linings, cappings and groundwater protection.

## Our product solutions

- guarantee durable performance, even under high dynamic loads
- reduce maintenance intervals and costs
- are DB-certified and have a successful, decades-long track record
- ensure the careful use of natural resources
- meet the utmost demands on modern railway infrastructure
- offset any occurring settlement

## HUESKER Services

HUESKER services begin with providing the customer with initial advice and end with supporting the realisation of the project on site. What we provide are safe, customised, ecologically sound and economically viable project solutions.

### Engineering Services

- **Technical design**  
Our engineers assist design practices by performing verifiable design calculations in accordance with international codes of practice.
- **Technical consulting**  
We will recommend the appropriate product types for your specific requirements.
- **Project-specific placement plans**  
We will prepare installation and placing recommendations plus installation diagrams.

### Product Services

- **Custom-designed product solutions**  
We will assist you in developing custom-fabricated products to meet your particular requirements.
- **Alternative solutions**  
We will propose alternative design solutions as well as recommendations for adjustments and optimisations.

### Documents

- **Certificate**  
Our products have numerous certifications. These have been issued by BAM, BAW, BBA, EBA, IVG and SVG, depending on the product type.
- **Installation guidelines**  
Technical guidelines will help you to ensure the best practice installation of your product on site.
- **Tender documents**  
We would be happy to provide you with proposals for your specification texts.

### On-The-Spot

- **On-site instruction**  
Where required, our application technicians can offer installation assistance related to the specifics of product installation.
- **Training**  
Product and application-specific instruction.

# Our Products for Railways

The demands placed on embankments, base courses and neighbouring structures are sometimes extreme: high dynamic loads, subsoils with very low bearing capacity, environmental protection, spatial constraints, noise control and many more.

**Yet, whatever the requirements, HUESKER can deliver the appropriate solution.**

## Basetrac® Duo-C / Basetrac Duo



### Geocomposite fulfilling reinforcement, separation and filtration functions for very soft soils

Our Basetrac Duo-C composites, made from polymer-coated geogrids and nonwovens, are the number one solution for base reinforcement on soils with very low bearing capacity.

## Basetrac Grid



### Flexible, high-tensile geogrid

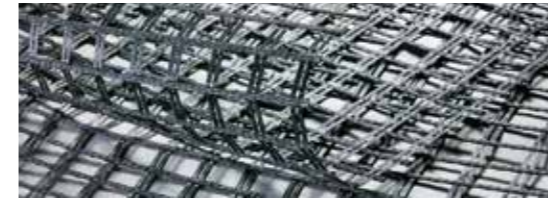
Base reinforcement with Basetrac Grid guarantees absolute reliability, even under high dynamic loads. The grids are polymer-coated to provide high UV stability while minimising installation damage.

## Basetrac Nonwoven



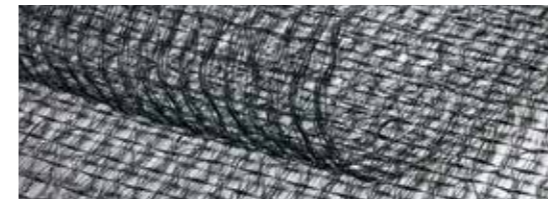
### Separating and filter nonwovens for base course and drainage

The nonwovens act as a barrier to protect the base course material or drainage medium from the migration of fine soil particles from the subgrade. This ensures that the bearing capacity of the base course and drainage performance remain unaffected.



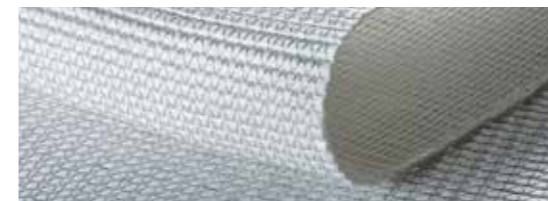
## Fortrac®

Flexible, high-tensile, high-modulus geogrid for demanding reinforcement applications in embankments, earthworks and base courses.



## Fortrac 3D

Reinforcement grid with additional erosion control function for steep slopes.



## Stabilenka®

World-famous woven fabric with exceptionally high tensile strengths, ideal for embankments on soft soil.



## Robutec®

Extra high-modulus, low-creep, alkali-resistant woven fabric for challenging embankment foundations.



## Ringtrac®

Reliable foundation system comprising geotextile-encased columns for soft strata with extremely low bearing capacity.



## Tektoseal® Clay

High performance geosynthetic clay liners for ground-water protection and contaminated site remediation.



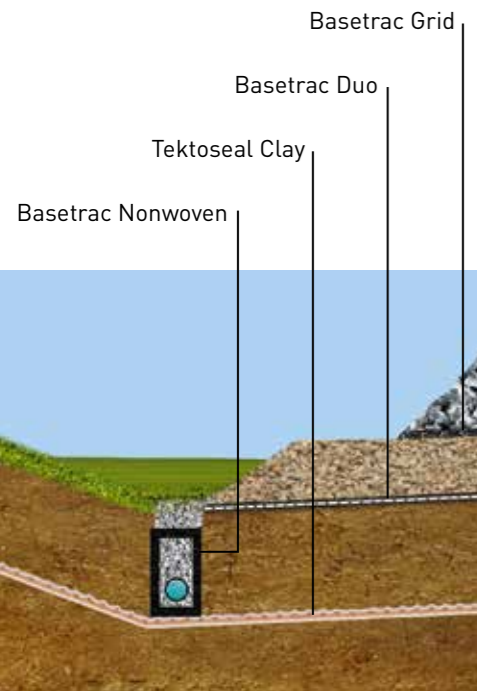
## Tektoseal Active

Active geocomposite with barrier and filter function for polluted surface water and leachate.

# Base Reinforcement

## Full-scale subgrade improvement

Growing traffic loads, poor drainage and deteriorating track ballast stability all contribute to the need for the rehabilitation of existing railway lines. The aim of these improvement schemes is to enhance the serviceability and extend the lifespan of linear infrastructure assets. The track bed must be able to accommodate and transmit high dynamic loads over a long service period with minimal deformation and wear. The base course construction is dictated, among other things, by the subgrade bearing capacity, the projected load levels and any applicable groundwater protection requirements. Here, HUESKER offers a wide variety of potential solutions based on its Basetrac product portfolio.

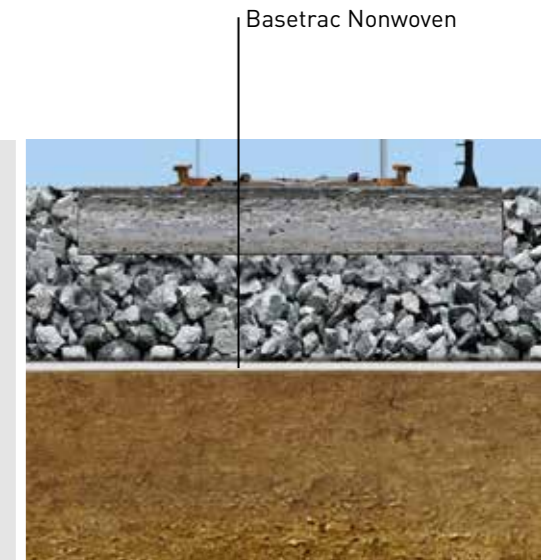


### Benefits

- Extension of service life
- Cost savings due to lower base course thickness
- Easy installation without memory effect
- HPQ-certified products

## Limited subgrade improvement

As an alternative to full-scale track subgrade improvement, specific factors and limited service periods may allow the incorporation of nonwovens directly below the track bed. The installation of highly robust nonwovens with a separation and filtration function immediately below the ballast improves surface water drainage and prevents the migration of fine particles into the crushed stone, thereby improving the bearing capacity of the base course. Our Basetrac product portfolio offers certified nonwovens for these applications.



### Benefits

- Improved bearing capacity
- Easy installation thanks to suitable roll widths
- HPQ-certified products

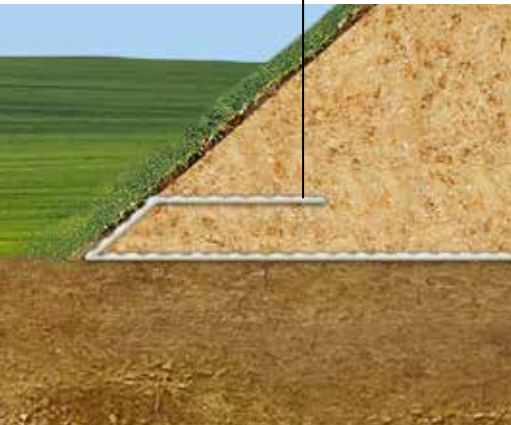


# Embankments on Soft Soil

## Embankment foundations

To ensure reliable, cost-efficient rail operations, railway embankments are required to offer particularly high structural stability, with a minimum of permissible deformation. With tensile strengths of up to 2,800 kN/m, reinforcement fabrics such as Stabilenka and Robutec help to speed up progress on site while reliably protecting against slope or soil shear failure. Where, for example, the use of binder modified fill materials produces an alkaline environment, then HUESKER's Robutec polyvinyl alcohol (PVA) wovens are the products of choice.

Stabilenka, Robutec



### Benefits

- Rapid subsoil consolidation
- High structural stability
- Savings on fill material
- Accommodation of differential settlement

## Bridging of sinkholes

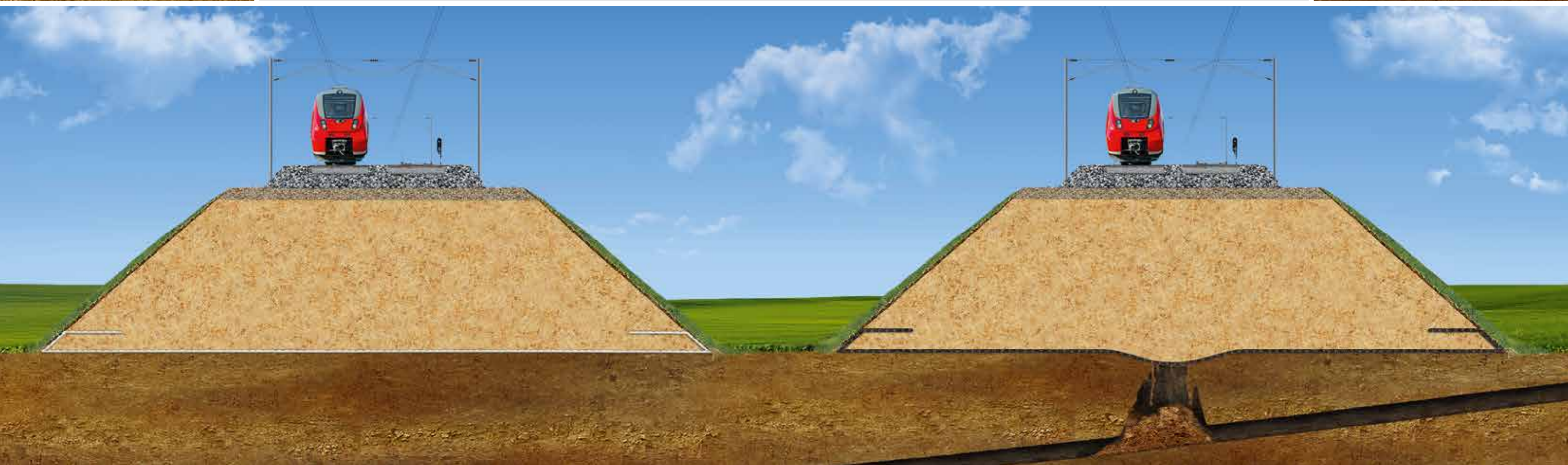
Sinkholes pose an extreme risk for rail traffic. Boasting tensile strengths of up to 3,000 kN/m coupled with high tensile stiffness, our Fortrac geogrids offer both temporary and permanent protection in areas prone to sinkholes. Not only do they eliminate the need for costly, ecologically unsustainable and less ductile reinforced-concrete structures, they are also able to cater for project-specific requirements through selection of the most suitable raw material, e.g. polyester, PVA or aramid, for the geogrid. Moreover, their inherent spare capacity can be mobilised for the short-term to accommodate sudden loads imposed by unforeseen, large-diameter sinkholes.

Fortrac



### Benefits

- Structural stability in areas prone to sinkholes
- Cheaper and more eco-friendly than reinforced concrete
- Cost-effective product selection
- Inherent spare capacity to accommodate unexpected loads from large sinkholes

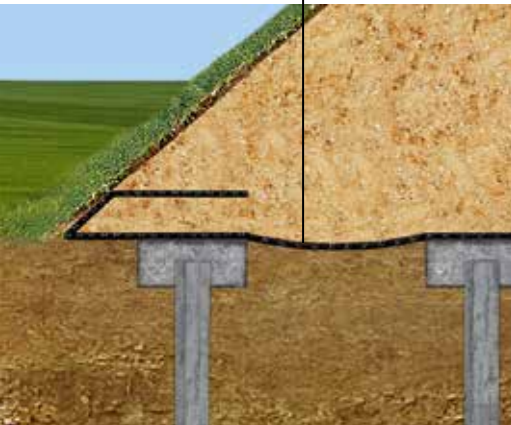


# Deep Foundations on Weak Soils

## On piles

The design of reliable embankment foundations on weak soils poses a major challenge. In addition to large-scale settlement and lateral deformation, potential risks include bearing and slope failure, or even the squeezing out of soft soil from beneath the embankment base. Where piling is installed, Fortrac geogrids allow the formation of a stable soil arch above the piles to ensure the low-settlement transmission of loads to the deeper foundation. No raked piles are required at the perimeter. At the same time, the broad selection of high-modulus, low-creep Fortrac geogrid types allows optimisation of the overall cost.

Fortrac



### Benefits

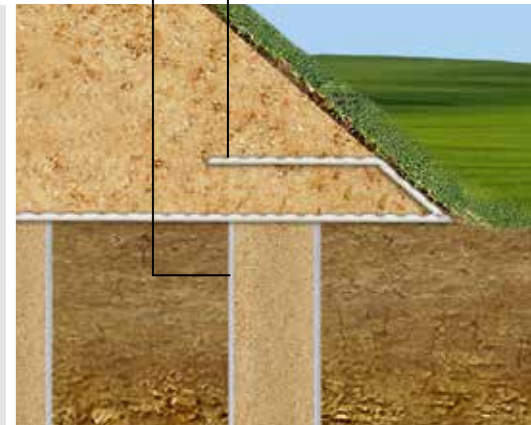
- High structural stability
- Utilisation of arching action for load transmission
- High efficiency due to large pile grid

## With geotextile-encased columns

As one of the safest foundation systems for very weak subsoils, geotextile-encased columns are ideally suited to railway engineering applications. The system, which has already been used in soft strata with  $c_u < 15 \text{ kN/m}^2$ , offers high ductility and adaptability to variable subsoil conditions. Given that the dewatering effect of the Ringtrac columns, as "mega-drains", vastly speeds up consolidation times, over 90% of settlement takes place during the construction period. Furthermore, creep settlement is reduced by 50-75% compared to unimproved ground. Locally sourced mineral mixes can be used as the fill material.

Ringtrac

Stabilenka



### Benefits

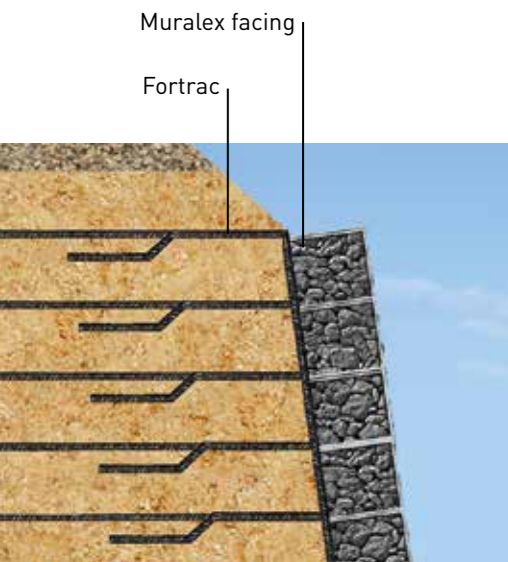
- Extremely reliable due to high ductility
- Rapid consolidation speeds up construction
- Cost-efficient thanks to use of locally sourced mineral mixes (sands)



# Geosynthetic-Reinforced Soil (GRS)

## Embankments

Noise bunds, bridge abutments and steep slopes – often demanding to design and build – are a typical feature rail projects. Here, HUESKER’s geosynthetic-reinforced soil systems offer innovative and cost-effective solutions. Key advantages of GRS structures over conventional methods include their wide ranging design options, high stability and rapid onsite installation. The settlement-resistant GRS systems allow simple and efficient assembly, even for extra steep slopes.



- Benefits**
- Customised design options
  - Rapid, cost-effective installation
  - Technical consulting by HUESKER engineers
  - Space-efficient due to small base area
  - Wide ranging applications



## Facing systems

One key advantage of GRS systems is the wide range of design options for the facing assembly. As the perfect combination of civil engineering and landscape architecture, they allow the structure to blend harmoniously with its landscape setting while also creating an eye-catching feature for passers-by.



**GRS Fortrac Muralex**



**GRS Fortrac Natur**



**GRS Fortrac with prefabricated panels**



**GRS Fortrac Natur S**

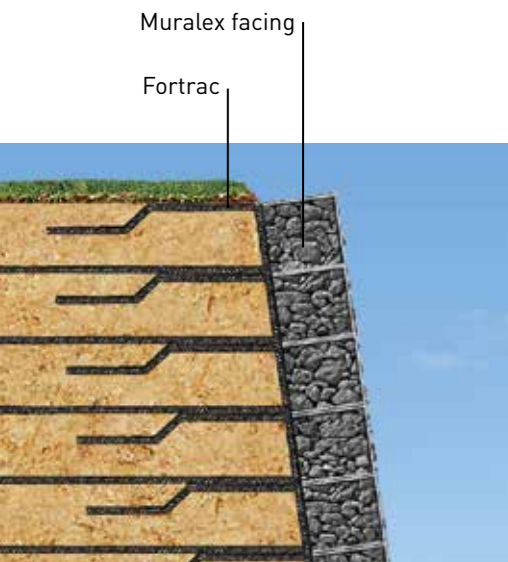


**GRS Fortrac Blockstein**



## Noise barriers

Special construction works are sometimes needed in densely populated areas to reduce the noise disturbance for local residents. GRS retaining walls, with full or partial gabion facings, for the stabilisation of embankments can be specially designed with sound absorption properties that allow them to double up as noise barriers. In Germany, the regulations and requirements governing noise control structures alongside traffic routes vary between the different federal states. Having tested various systems, HUESKER has developed a number of high-performance solutions allowing a sound absorption of up to  $DL_a \geq 8-11$ dB.

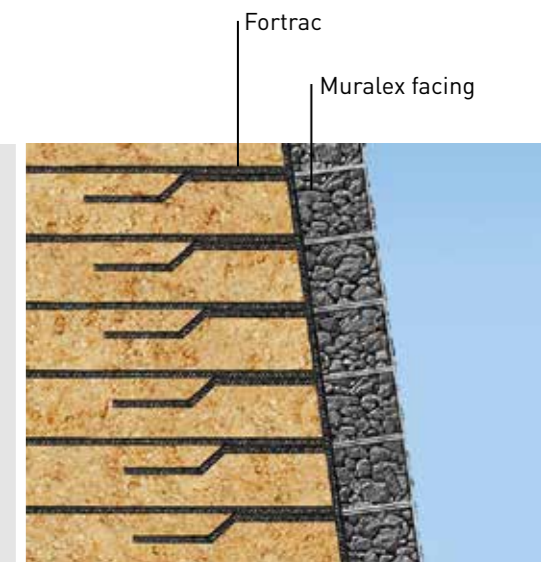


### Benefits

- Up to 11dB sound absorption
- Straightforward construction
- Harmonious integration in natural setting

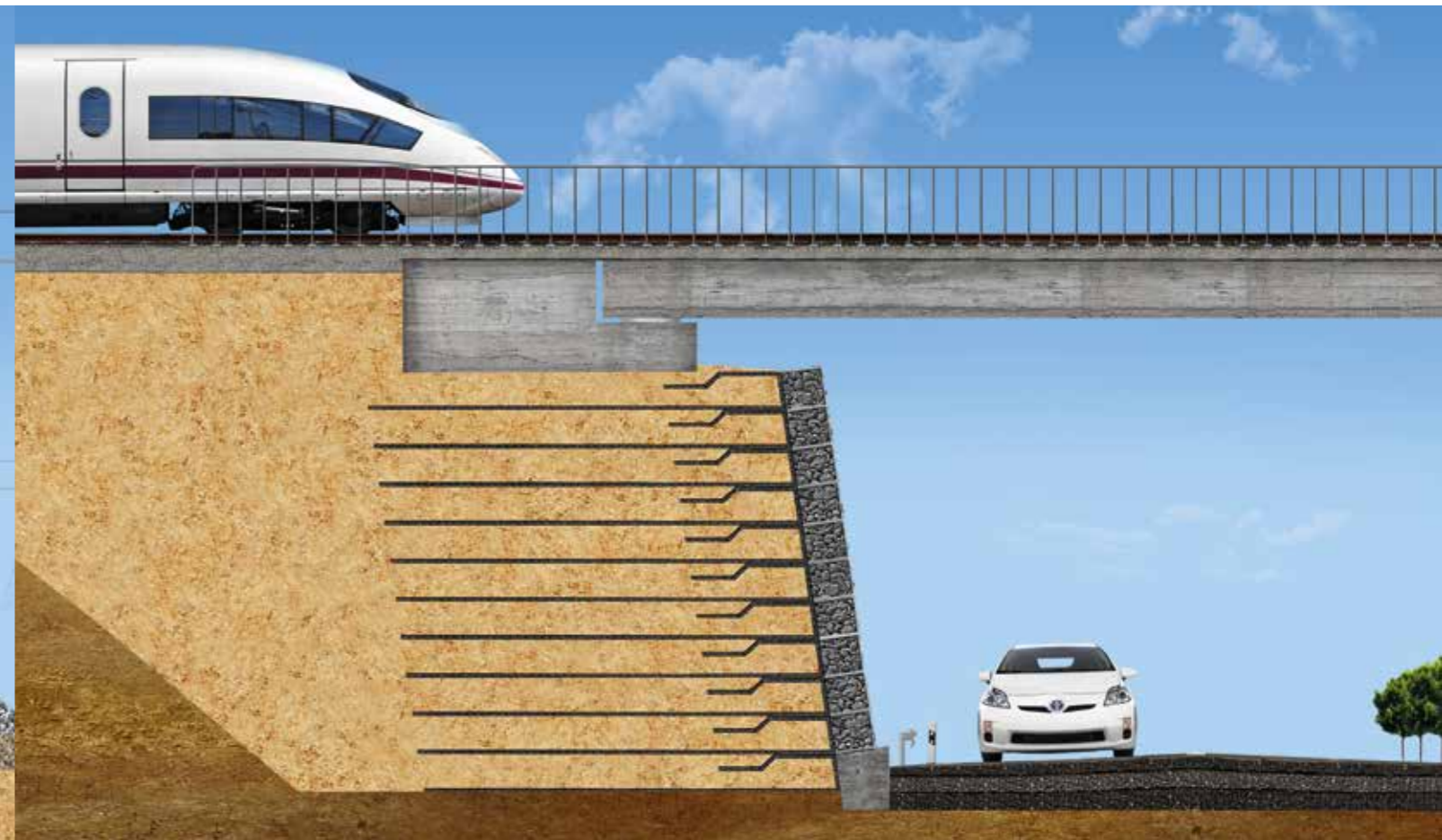
## Bridge abutments

Reinforced-soil bridge abutments can be designed for direct load bearing or as part of a composite supported solution with loads partly transmitted by concrete elements, possibly in conjunction with deep pile foundations. Clients can also choose between passive and active systems, depending on whether the abutment facing is to be constructed as a load-transmitting element. GRS systems are extremely flexible and are now part of standard practice in many countries.



### Benefits

- Fast, efficient construction
- High ductility
- Eco-friendly
- Attractive facing design



# Special Applications

## Tunnel waterproofing

Alongside bridges, tunnels rank among the most complex structures needed for railways. A major challenge on these projects is to ensure reliable waterproofing of the tunnel cross-section. HUESKER's answer is the specifically-developed "infiltration-proof double membrane", which rules out any risk of leakages and the free spread of water within the waterstop compartments. Our Tektoseal Clay geosynthetic clay liners ensure enhanced reliability and durability.

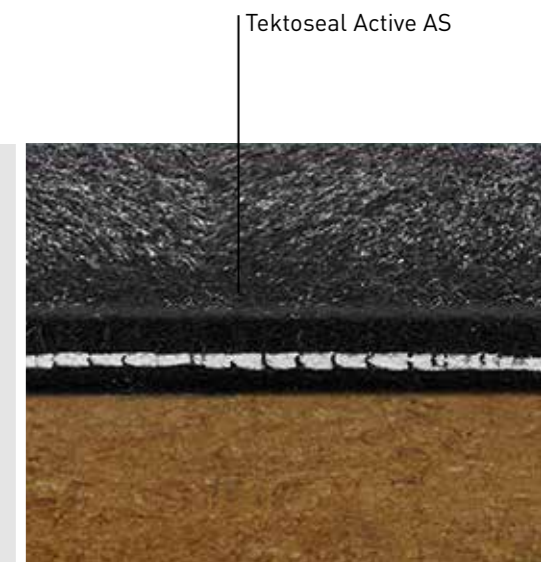


### Benefits

- Patented system solution
- No water seepage behind membrane
- Extended service life of structure

## Oil absorption and groundwater protection

Shunting tracks, engine sheds, maintenance depots and other unpaved storage areas are susceptible to ground contamination from oil, grease and similar petrochemical products. At the same time, simple measures can be taken to eliminate the risk of soil and groundwater pollution. Tektoseal Active AS is an active geocomposite that binds harmful pollutants and prevents their infiltration into the groundwater. Key merits include the product's high robustness and delivery in rolls to simplify installation.



### Benefits

- Reliable oil absorption, even over wide areas
- High mechanical strength
- Easy to install and remove

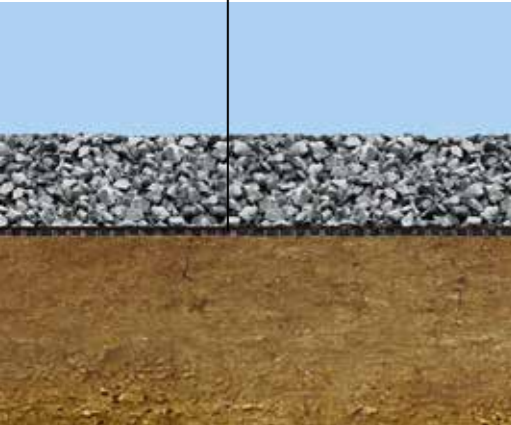


# Railside Applications

## Temporary roads

Both new rail projects and maintenance works generally require the construction of haul roads and other temporary access routes. These are normally subject to short, but intensive use. Particularly on sites with weak subsoils, geosynthetic solutions are often the simplest means of minimising investment and maintenance effort. Our Basetrac portfolio offers suitable products for any application – from simple separating and filtration elements to double-layer reinforcement to accommodate high loads on soft soils.

Basetrac



### Benefits

- Reliable increase in bearing capacity
- Savings on base course material
- Lower maintenance costs

## Stormwater storage

Stormwater holding basins are designed to allow the controlled discharge of large quantities of temporarily stored water. Given that the surface water may be polluted, the key component of such structures is a reliable lining system. HUESKER offers a comprehensive range of geosynthetic clay liners that are specifically designed for this function.

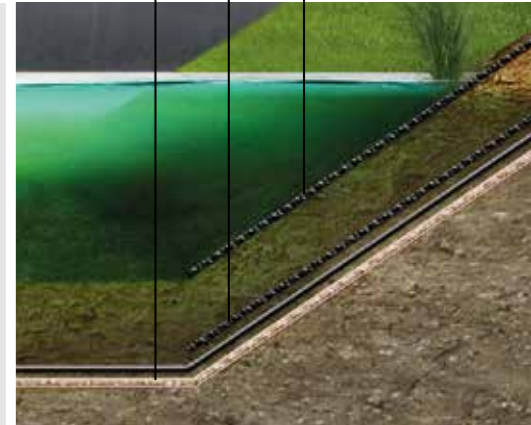
### Benefits

- Controlled discharge of large quantities of water
- Reliable lining
- Cost-effective product selection

Tektoseal Clay

Fortrac

Fortrac 3D



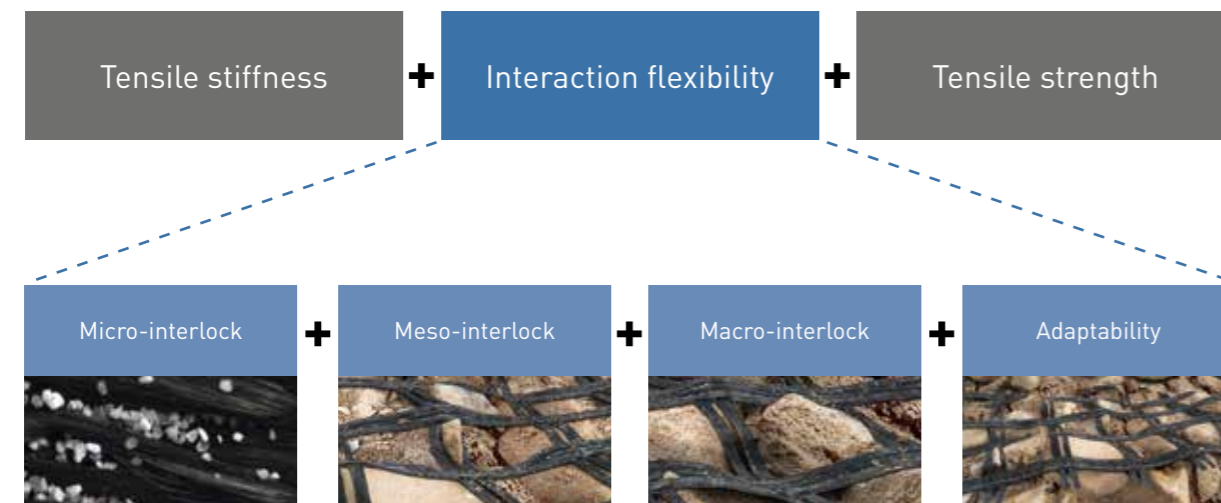
# HUESKER Plus

## The value of interaction flexibility for railways

Geogrids serve to improve the mechanical properties of soils. To resist forces with only minor deformation, they need to exhibit a certain amount of tensile stiffness. Yet, the grid must not be too rigid or it will inhibit the accommodation of forces by the soil itself.

Good interaction flexibility implies a perfect blend of macro, meso and micro-interlock plus a high degree of adaptability to the soil. This substantially improves the interaction or bond between soil and reinforcement.

To compensate for structural deficits in the works, a certain degree of tensile strength is also required. Basetrac geogrids excel not only by their good tensile stiffness and tensile strength, but also by their very high interaction flexibility – a property offered only by flexible geosynthetics.



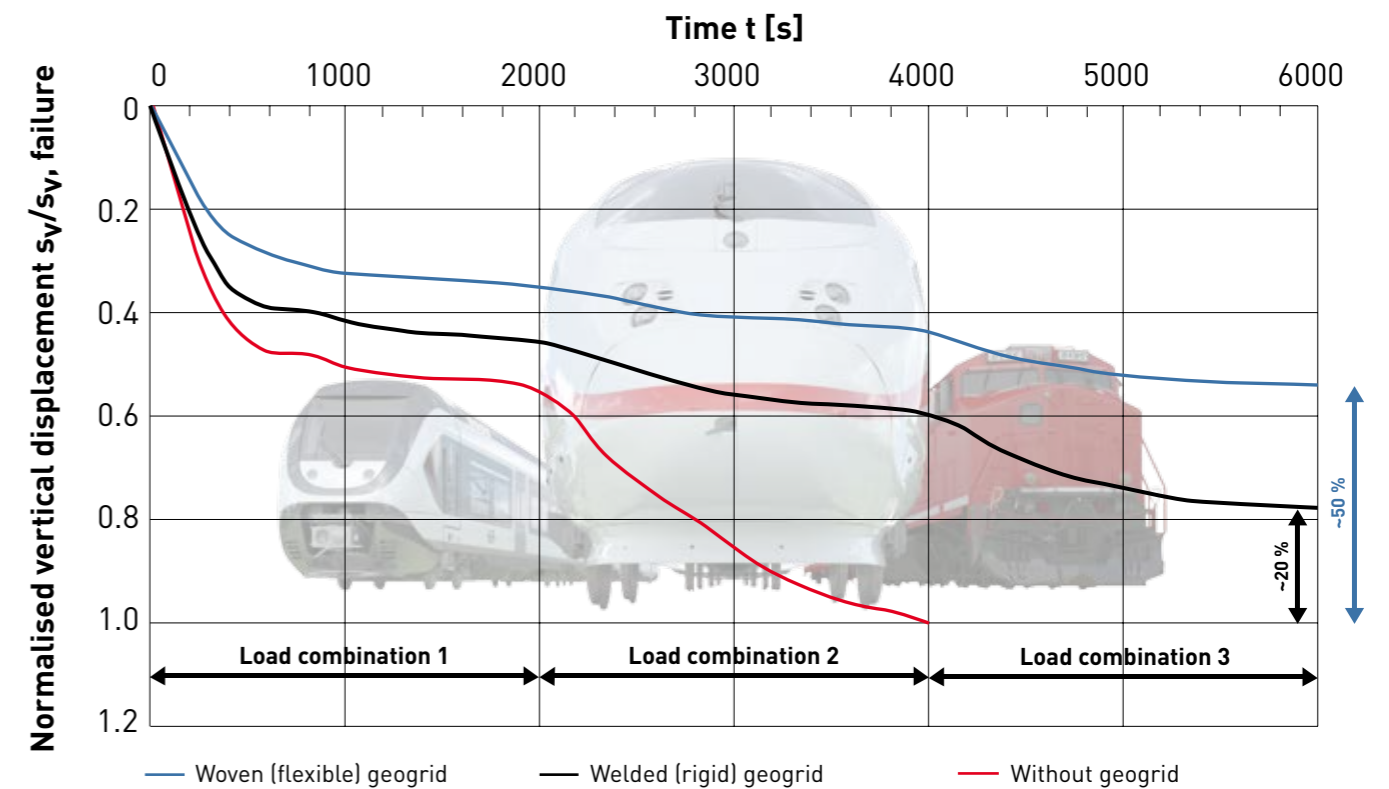
Rough-surfaced geogrids achieve microscopic interlock with soil particles (friction).

Favourable surface texture of geogrids promotes interlock between geogrid ribs and soil particles.

Mesh openings allow interlock of stones with geogrid.

Flexible geogrids are capable of adapting to unevenness in soil during/after compaction.

The following graph summarises the results of a study published in 2012 (Lackner, C.). It demonstrates the performance of flexible geogrids compared to that of rigid grids. The study shows the base course settlement over time – normalised by the displacement for unreinforced soil – for the two grid types when subjected to three typical railway load combinations.



(Lackner, C. [2012], Prestressed reinforced soil – Concept, investigations and recommendations, dissertation, Graz University of Technology)



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