

Geosynthetic Solutions for Railways



Market Potential?



Exemplary Data

	Netherlands	Switzerland	Germany
Area [km ²]	41.548	41.285	357.121
Population [m]	16,7	8,0	81,4
Population density [inhabitants/km ²]	402	193	230
Operation length [km]	2.809	3.038	33.400
Track length [km]	6.500	7.400	61.400
Rail Passengers [Million/p.a.]	365	357	1.100
Train runs [N/inhabitants/p.a.]	22	45	14
Operation length / Area [km/km ²]	0,07	0,07	0,09
Rail Passengers / Operation length [m/km]	0,13	0,12	0,03

Rail Baltica

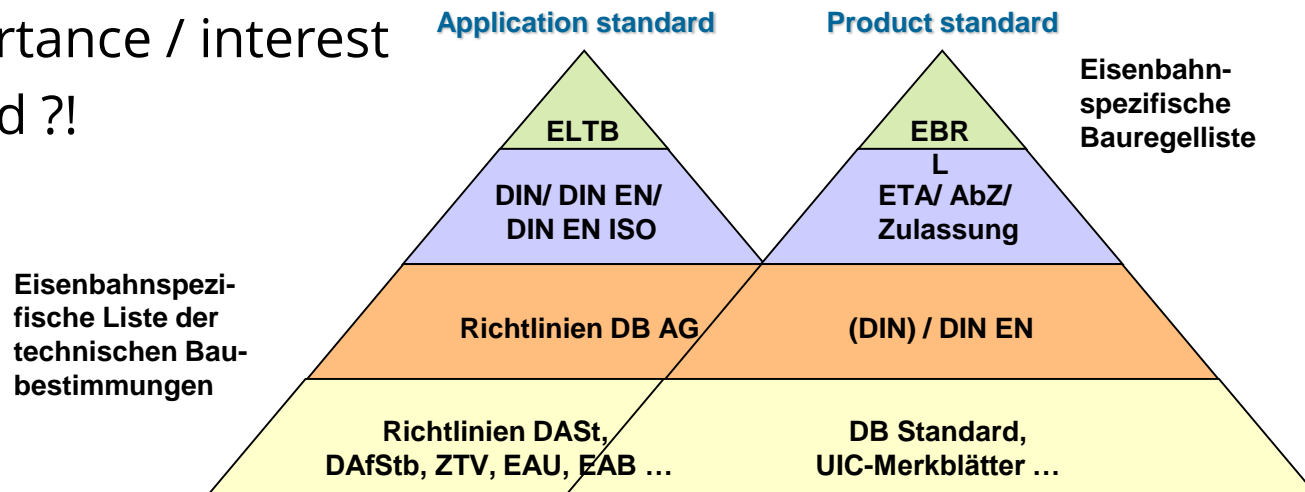


Length	950 km
Country	Poland, Lithuania, Latvia, Estonia, Finland
Speed	200 ... 250 km/h
Cost	3,68 billion Euro
Track width	1524 mm

Challenges / potentials

- High loading
- High dynamic component of loading
- High demand for safety and reliability
- High public importance / interest
- Strongly regulated ?!

- Low budget...
- NO time



Because of that?

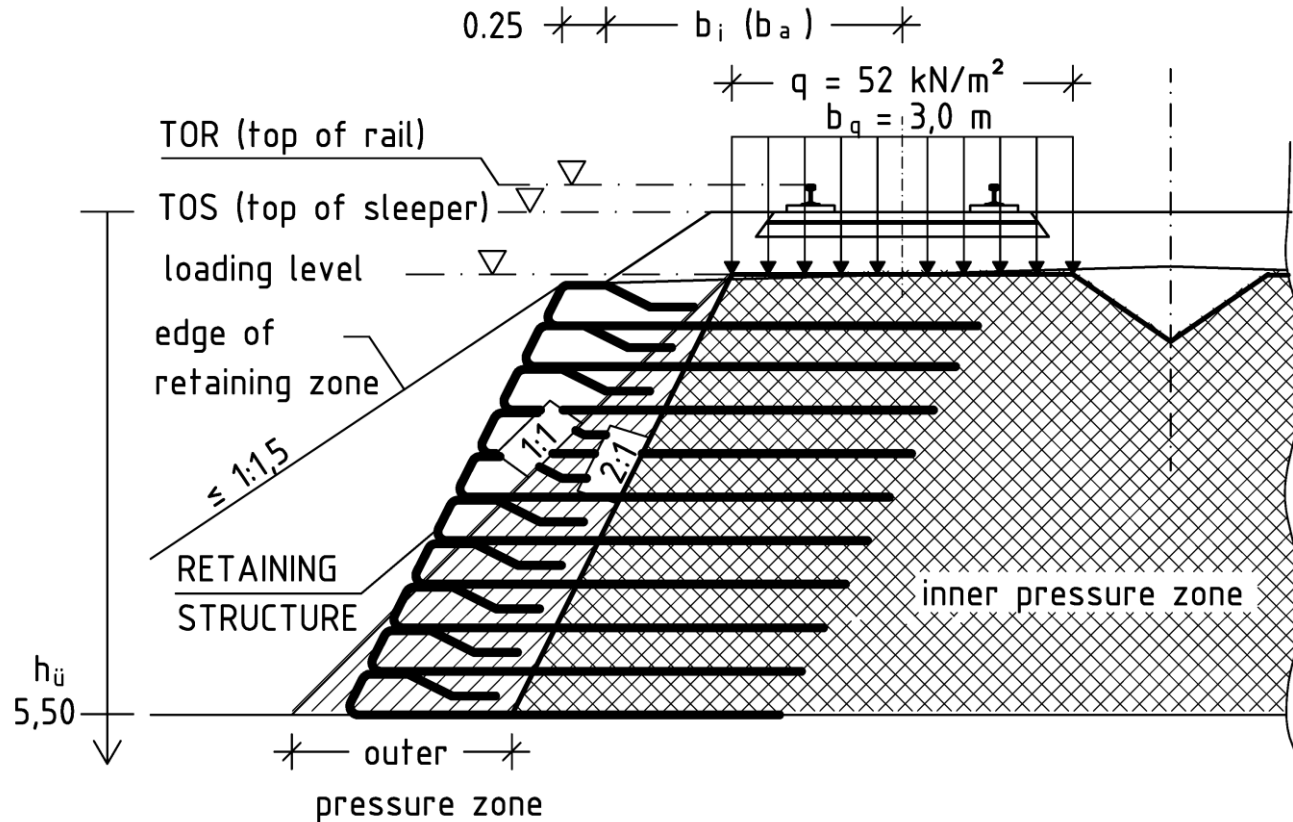
must not

prohibition

Bedeutung der modalen Hilfsverben		
Modale Hilfsverben	Umschreibung	Bedeutung
muß müssen	ist (sind) zu ... hat (haben) zu ... darf (dürfen) nur ...	Gebot
darf nicht dürfen nicht	ist (sind) ... nicht zugelassen ist (sind) ... nicht zulässig wird abgelehnt	Verbot
soll sollen	ist (sind) grundsätzlich zu ... ist (sind) in der Regel zu ...	Regel Grundsatz
soll nicht sollen nicht	ist (sind) grundsätzlich nicht zu ... ist (sind) in der Regel nicht zu ...	
darf dürfen	ist (sind) ... zugelassen ist (sind) ... zulässig ... auch ... (nicht: ... kann (können) läßt (lassen) sich ...)	Erlaubnis
muß nicht müssen nicht	braucht nicht ... zu ...	
sollte sollten sollte nicht sollten nicht	ist (sind) nach Möglichkeit zu ... ist (sind) im allgemeinen zu ... ist (sind) ... nach Möglichkeit nicht zu ... ist (sind) ... im allgemeinen nicht zu ... ist (sind) ... nur ausnahmsweise zuzulassen	Empfehlung

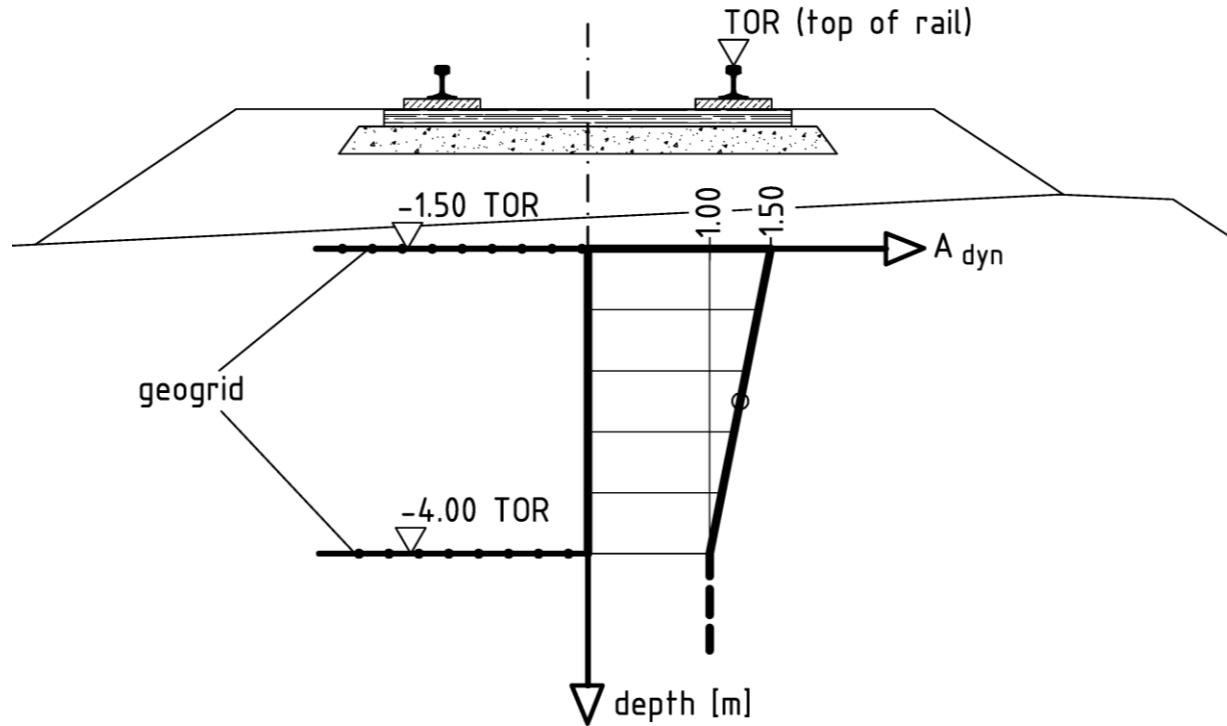
from: RiL 836

Influence of Dyn. Loading

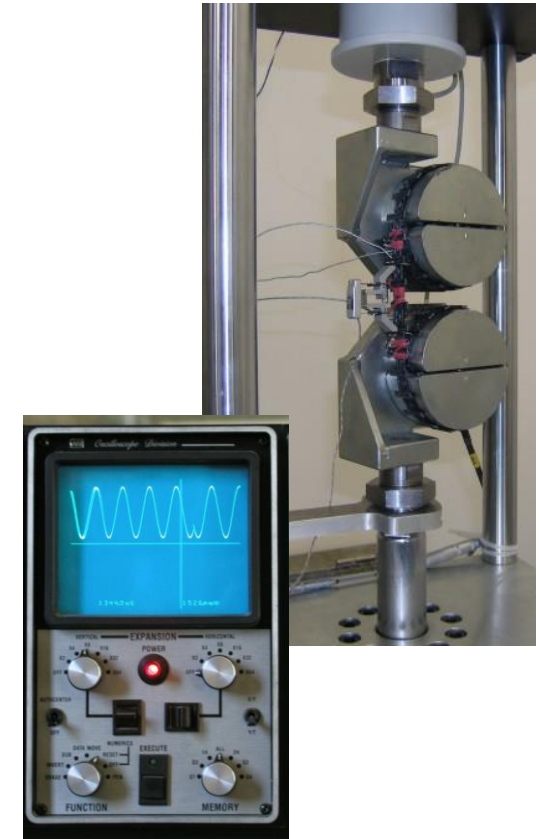
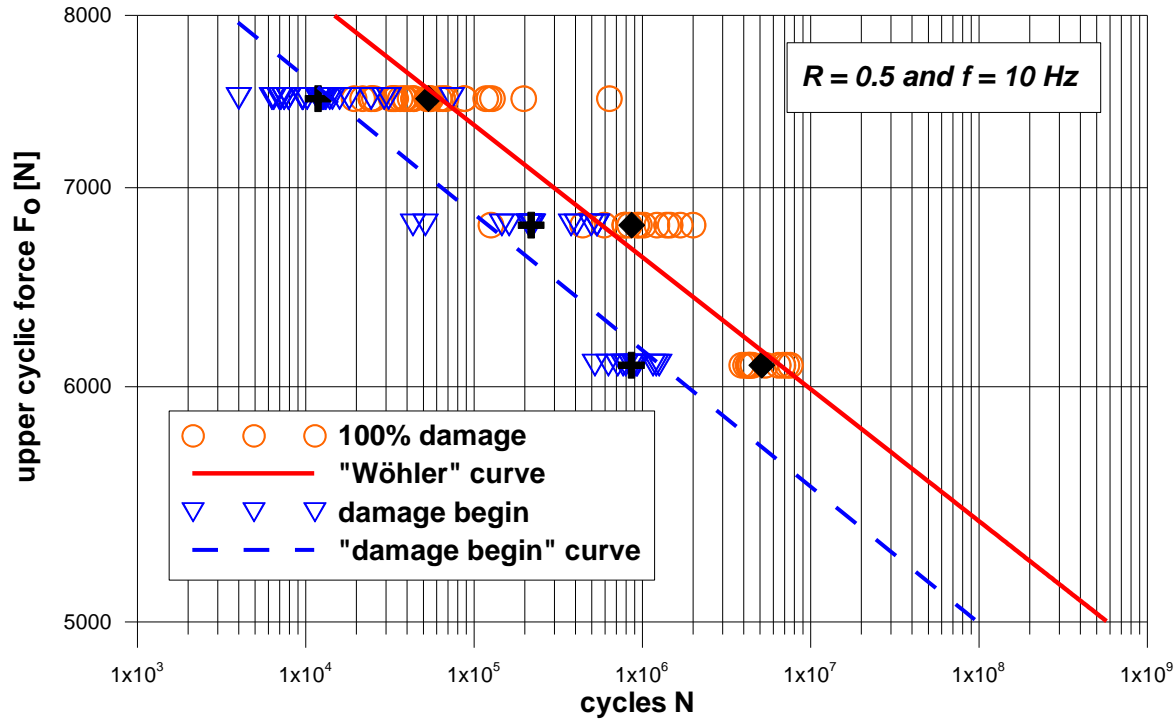


$$F_d = \frac{UTS}{RF_{cr} \times RF_{inst} \times RF_{env} \times RF_{dyn} \times f_s}$$

Reduction Factor for Dynamic Loading



“NO problem” for PET, PVA, AR



Our Solutions at a Glance

Noise Barriers

Bridge Abutments

Bridging of Sinkholes

Embankment Foundation

Stormwater Storage

Base Reinforcement

Tunnel Waterproofing

GRS

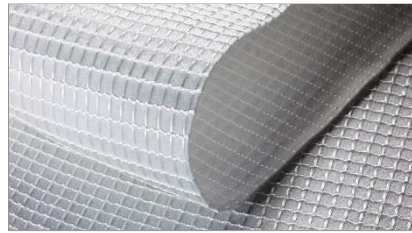
Temporary Roads

Oil Absorption

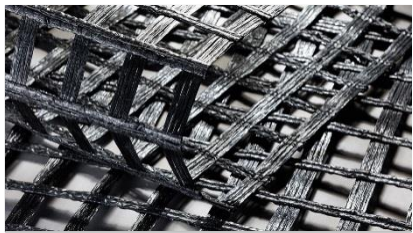
Base reinforcement with our Basetrac Portfolio



Basetrac Duo-C



Basetrac Duo



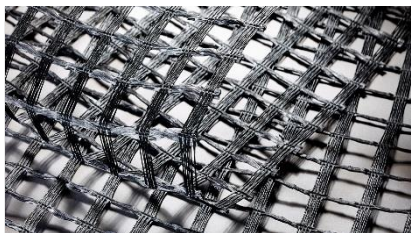
Basetrac Grid



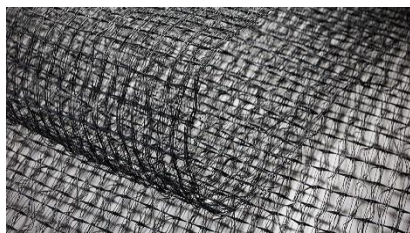
Basetrac Nonwoven



Basetrac®



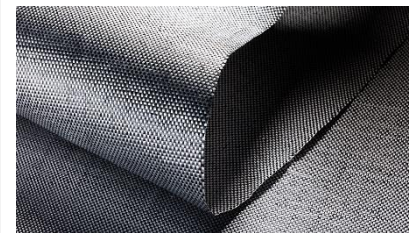
Fortrac



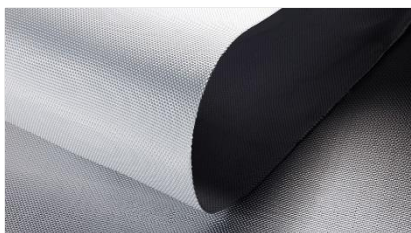
Fortrac 3D



Stabilenka



Robutec



Ringtrac



Tektoseal Clay



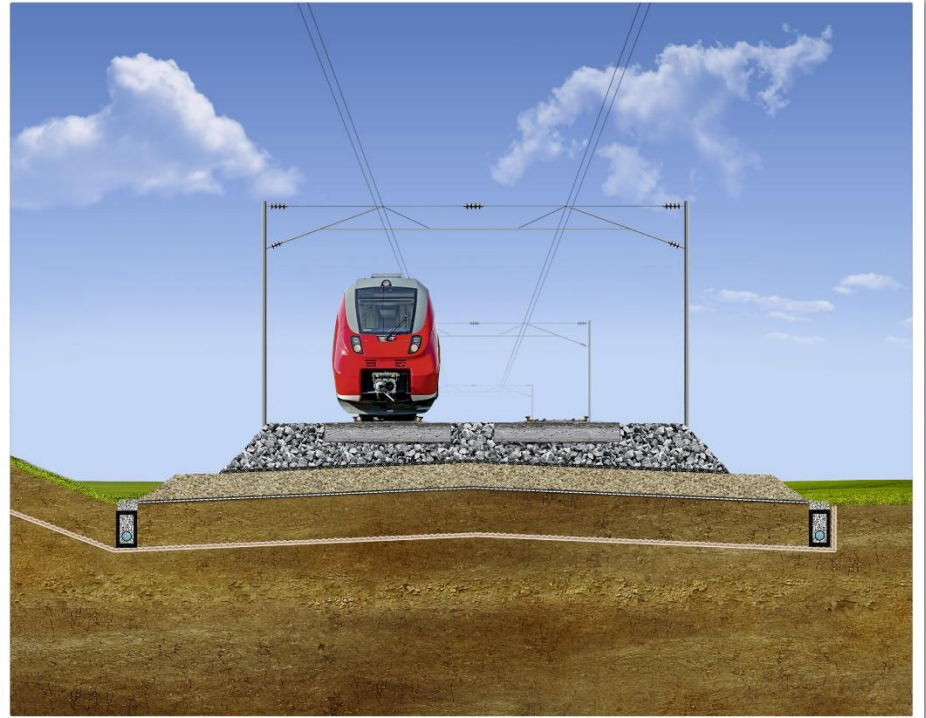
Tektoseal Active AS

Extension of service life

Cost savings due to lower base course thickness

Easy installation without memory effect

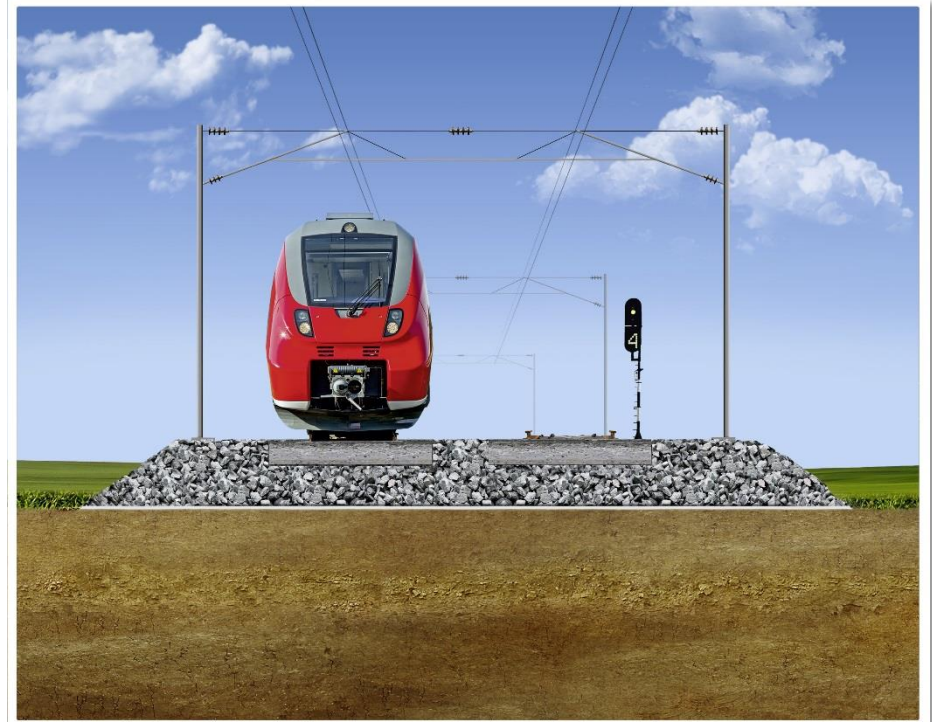
HPQ- certified products



Improved bearing capacity

Easy installation thanks to suitable roll widths

HPQ- certified products





Reference Project:

Railway line Wernstein-Passau, Austria



Embankment Foundation



Bridging of Sinkholes



Deep Foundations on Piles



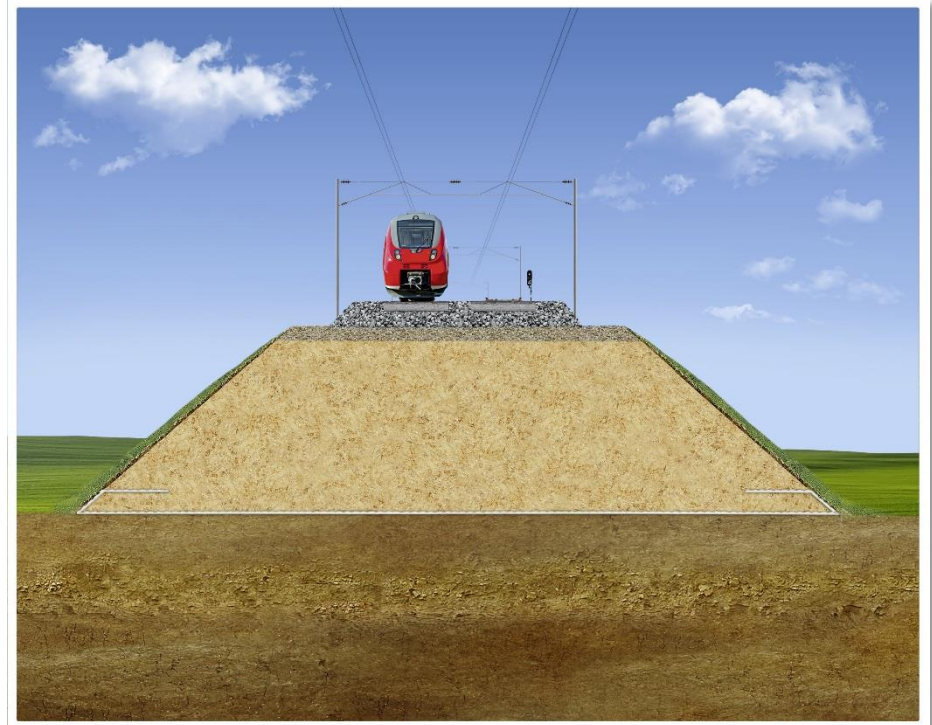
Geotextile Encased Columns

Rapid subsoil consolidation

High structural stability

Savings on fill material

Accommodation of differential settlement

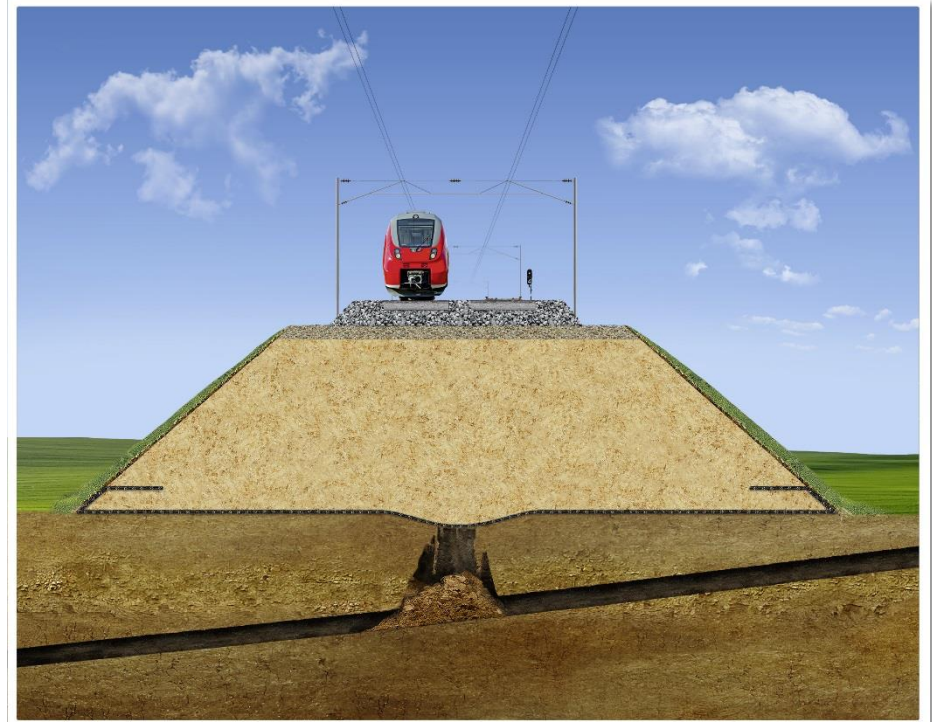


Structural stability in areas prone to sinkholes

Cheaper and more eco-friendly than reinforced concrete

Cost-effective product selection

Inherent safety reserves to accommodate unexpected loads from large sinkholes



Bridging Sinkholes?

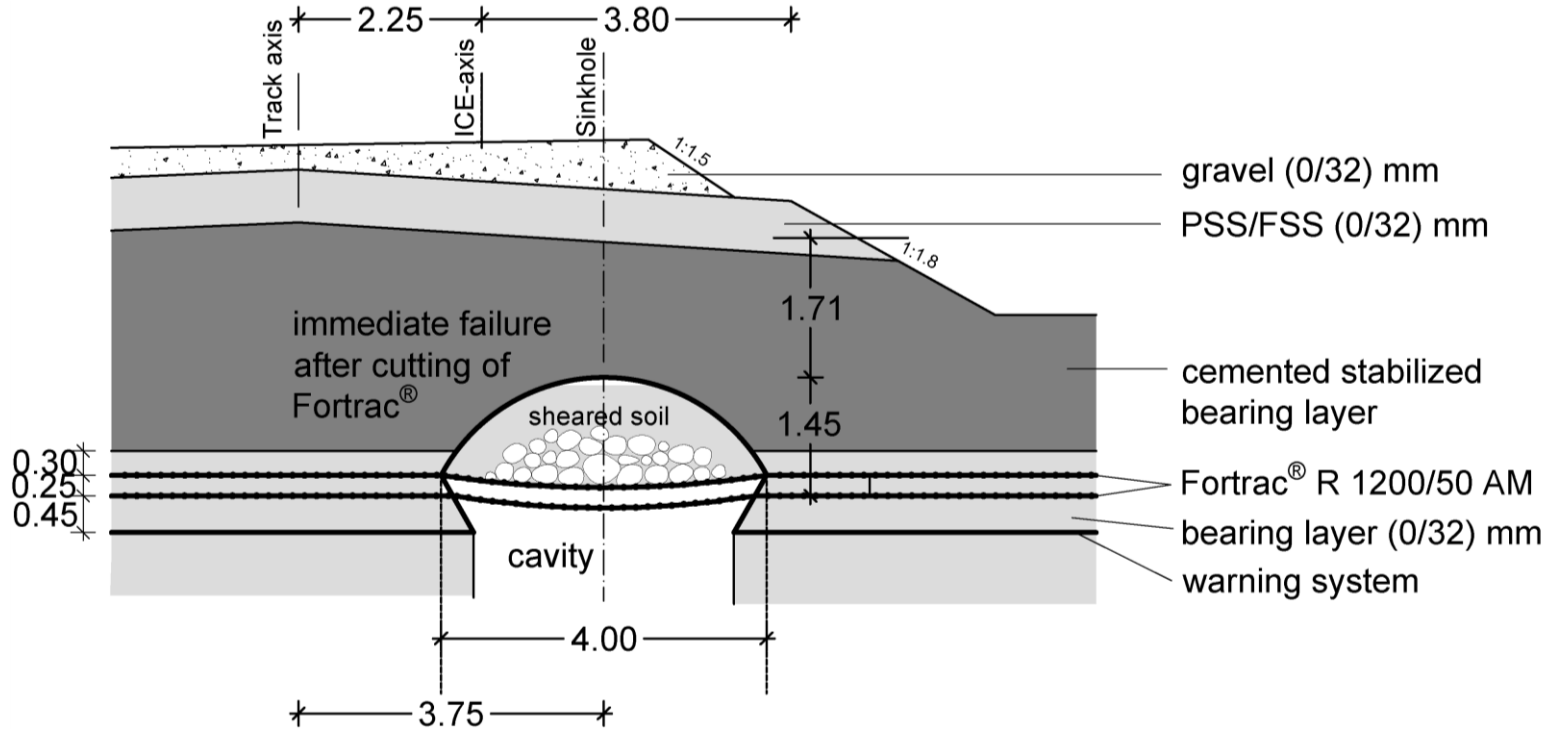
Reference:
Stuttgart Korntal



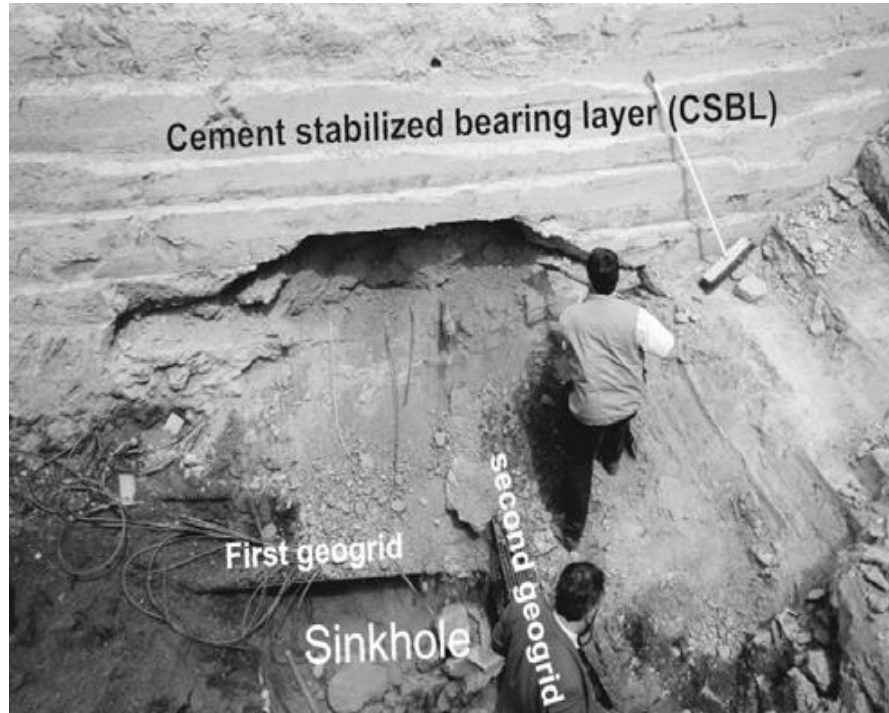
	NBS Knoten Gröbers	Stuttgart Korntal	Frose - Nachterstedt
Length of stretch	800 m	600 m	1200 m
Design speed	250 km/h	120 km/h	160 km/h
Reason for subsidence	Mining	Karst Erosion	Mining
Design Void diameter	4,0 m	1,2 m	3,0 m
Design life to verify max. tolerated deflection	3 Months	120 Years	12 Months
Geogrid reinforcement	1200/100 AR (perp) 1200/100 AR (long)	R 400/80 T (perp) R 600/120 T (long)	1200/100 AR (2 x long)
Polymer	Aramid (AR)	Polyester (PET)	Aramid (AR)
Ultimate strength in MD	1200 kN/m	400 kN/m 600 kN/m	1200 kN/m
Ultimate strain	~ 3 %	~ 9,5%	~ 3 %
Thickness of reinforced fill above geogrid	3,50 m	1,55 m	2,75
Fill-material	Gravel (0/16) mm stabilised soil	Gravel (0/63) mm	Gravel (0/45) mm
Design approach	Membrane / Arching (FEM)	Membrane (R.A.F.A.E.L and B.G.E.)	Membrane (R.A.F.A.E.L)
Construction time	2000...2002	2010	2012



NBS – Knoten Gröbers



Real scale test embankment NBS – Knoten Gröbers (1998)



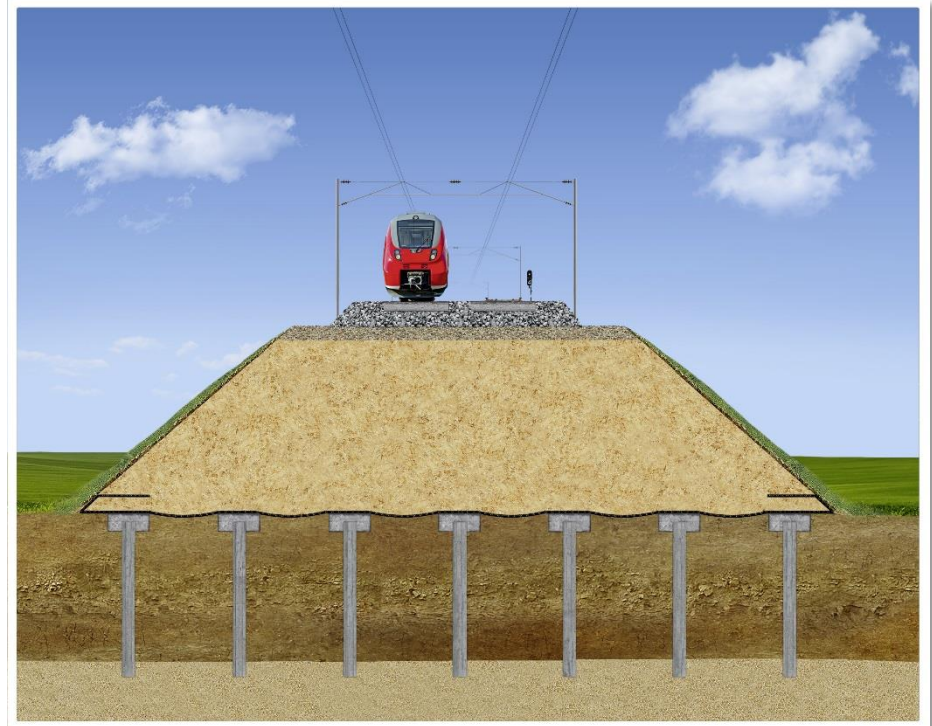
Installation of Fortrac R 1200/100-10 AM



High structural stability

Utilisation of arching action for load transmission

High efficiency due to large pile grid



Piled Embankment/ Reference List Germany

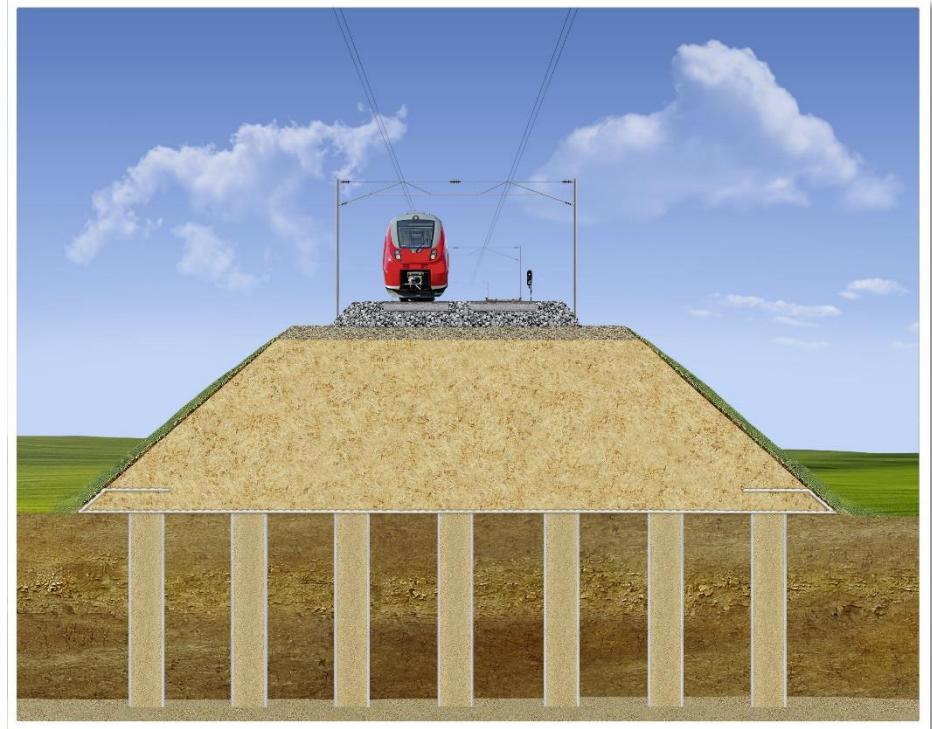
Jahr / year	Projektname / name of project	Bauunternehmen / building contractor	Anwendung / application	Produkt / product
1994	DB-Strecke Hannover-Berlin Südumfahrung Stendal	Heilit & Wörner Berlin	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® 200/30-30 PP-Bändchengewebe NaBento®
1994	Schnellbahnstrecke Hannover-Berlin Bereich Werder-Brandenburg	Hofmann & Maculan/Porr/Universale	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® 150/150-30
1995	DB-Strecke Hannover-Berlin Bereich Uchtspringe	Johann Bunte GmbH & Co. 26871 Papenburg	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® 400/200-10
1995	Schnellbahnstrecke Hamburg-Berlin Bereich Fierack-Vietznitz	Westa-Bau GmbH 10348 Berlin	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® 60/60-20
1996	Bahnhof P...			
1996	DB-Strecke	Eichholz GmbH & Co. KG 01705 Freital	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® R 500/125-20 M
	DB-Strecke	Richard Schulz Neuburg	Bahnbau / Railway Construction	Fortrac® R 200/30-30 Fortrac® R 200/40-30
1999	Stendal-U "Harper-N	Deutsche Gleis- u. Tiefbau 39175 Königsborn über Raab Karcher Harsleben	Bahnbau / Railway Construction	Fortrac® 55/30-20
1999	Stendal-U	Arge Wittfeld/ Matthäi/ Bauer	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® R 400/80-30 T
2003	ABS HH-B	Balfour Beatty Rail, Pritzwalk	Bahnbau / Railway Construction	Fortrac® R 600/120-30 T Fortrac® R 400/80-30 T
2003	ABS HH-B	Grötz, Kabelsketal	Bahnbau / Railway Construction	Fortrac® R 1200/100-10AM
2004	Priegnitz-4 Wittstock	Hasselmann, Barka/Werra	Bahnbau / Railway Construction	Fortrac® R 600/120-30 T
2004 bis 2006	ABS 29/1 Augsburg-Olching Abschn. Mering- Altheigenberg	Hartung-Bau GmbH & Co. KG 36041 Fulda	Bewehrung über Pfählen/ pfahlähnlichen Gliedern / reinforcement over piles	Fortrac® R 430/100-15 T Fortrac® R 560/115-15 T

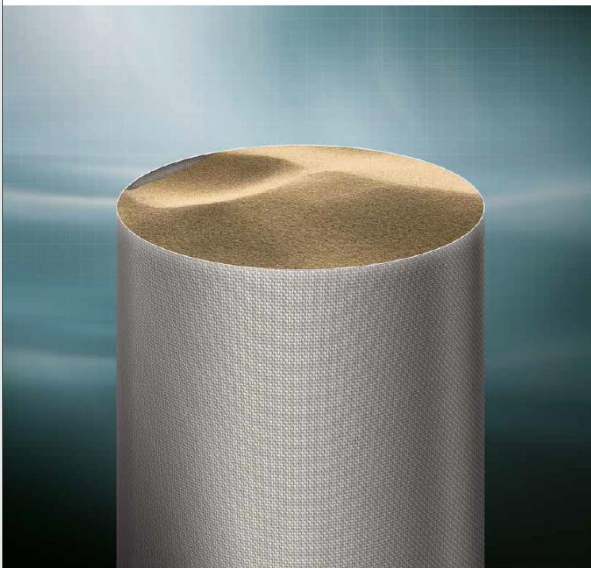


Extremely reliable due to high ductility

Rapid consolidation speeds up constructions

Cost-efficient thanks to use of locally sourced mineral mixes (sands)





The Geotextile-Encased Column

Column Integrity for Load Transmission in Extra-Soft Soils

Innovative foundation

- The Ringtrac foundation system takes the form of a regular arrangement of columns containing low modulus material placed in a sand matrix.
- The geotextile encased column provides reinforcement of the extra-soft soils. The structural part of the geotextile encased column provides strength through friction between the columns. The extra-soft soils are made in a fabric structure space.

How the system works

All the extra-soft soils are reinforced in the column fabric which naturally allows load transmission between the columns. The geotextile fabric encased column is reinforced and acts as the main load-bearing element. The structural part of the geotextile encased column provides strength through friction between the columns. The extra-soft soils are made in a fabric structure space.

Casing

- Shoring: Hydraulic spreader control beam technology
- 30-70 cm diameter at max. 400 kN
- Basic weight of up to 1.500 kg

Column size

- Columns from 10 to 120 cm
- Columns with 10 to 100 cm
- Columns with 10 to 100 cm

Fill

- Backfilling: 0.40-0.60 mm maximum size (see also: geotextile fabric)
- Fill: 0.40-0.60 mm maximum size (see also: geotextile fabric)

Drainage function

- Highly permeable: 100 m/s
- Highly permeable: 100 m/s

Reliable Ground Improvement

Particularly for Soils with Very Low Bearing Capacity

Challenges and goals

The design of reliable foundation structures must take into account the soil conditions, loads and requirements, and the construction method. The design must also take into account the soil conditions and the construction method.

Comparison of methods and solutions

Selection of the most suitable foundation method is dependent on the soil conditions, loads and requirements, and the construction method. The design must also take into account the soil conditions and the construction method.

Special performance features offered by Ringtrac columns

- High stability during and after construction
- Simple construction, fast and easy to install
- Highly permeable geotextile fabric, high water absorption
- Retention of soil during construction
- Highly permeable geotextile fabric, high water absorption
- Highly permeable geotextile fabric, high water absorption
- Highly permeable geotextile fabric, high water absorption

Methods of constructing embankment foundations

Soil reinforcement, Soil retention, Vibro stone column, Ringtrac column, Ringtrac column.

The Geotextile-Encased Column System

How the system works

The columns ensure that the structure bears and transmits through the soil without the need for a structure and soil preparation. The columns ensure that the structure bears and transmits through the soil without the need for a structure and soil preparation.

Applications

- Subsidence and soil embankment
- Soil retention
- Soil retention
- Soil retention

Up to 50% fewer columns

50% fewer columns compared to other foundation methods.

The following design parameters can be used to adapt the system to virtually any construction application

- Column diameter
- Column length
- Column spacing
- Column spacing

Column grid

A regular column grid is typically selected for retaining walls and embankment foundations.

Horizontal reinforcement

The horizontal reinforcement is provided by the geotextile fabric encased column. The horizontal reinforcement is provided by the geotextile fabric encased column.

Design

The design is based on the soil conditions and the load requirements. The design is based on the soil conditions and the load requirements.

Key Ringtrac System Benefits at a Glance

Reliable

- High stability during and after construction
- Simple construction, fast and easy to install
- Highly permeable geotextile fabric, high water absorption
- Retention of soil during construction
- Highly permeable geotextile fabric, high water absorption
- Highly permeable geotextile fabric, high water absorption

Fast

- Simple construction, fast and easy to install
- Highly permeable geotextile fabric, high water absorption
- Retention of soil during construction
- Highly permeable geotextile fabric, high water absorption

Cost-effective

- Highly permeable geotextile fabric, high water absorption
- Retention of soil during construction
- Highly permeable geotextile fabric, high water absorption

Cost-neutral

in direct comparison to vibro stone columns

HUESKER Ringtrac software

Reliable design to meet any challenge

Ringtrac is a design software application program developed by HUESKER engineers. It is used for the design and calculation of Ringtrac columns and embankment foundations.

Integral computation

- Integration of the design and calculation of Ringtrac columns and embankment foundations.
- Integration of the design and calculation of Ringtrac columns and embankment foundations.

Ringtrac®
Reliable Ground Improvement for Weak Soils

HUESKER
Ideen. Ingenieure. Innovationen.

- System description
- Installation techniques
- Application areas
- Design
- QA and Tolerances
- Case studies of GEC application within DBAG
- Product (design) data



Zulassung des Gründungssystems "Geokunststoffummantelte Säulen - GEC" (Geotextile Encased Columns)

Zulassung

Mit Schreiben vom 04.03.2015 - 21.43-21izbie/004-2101#011-(033/10-Zul) wurde der STRABAG AG, Direktion Großprojekte Nord-West, 50679 Köln, die Zulassung zur Betriebserprobung für das Gründungssystem "Geokunststoffummantelte Säulen - GEC" (Geotextile Encased Columns) für den Einsatz bei den Eisenbahnen des Bundes erteilt.

Stand 04.03.2015

Location	Year of construction	subsoil	Max. length of column
ICE-Strecke Karlsruhe – Basel	1996	Clay / silt	6,0
S-Bahnausbau Zorneding – Grafing (S5)	1998/1999	Clay / silt	10,5
Lübeck/Hagenow Land Rostock –Stralsund	1999/2000	Peat / organic clay	5,0
Baden-Baden - Appenweier	2000	Paeat / clay / silt	8,0
Oldenburg - Wilhelmshaven	2003/2004	Peat / clay	10,0
Chemnitz-Hilbersdorf	2007	Silt / loam	12,0
Blankenberg - Warnow	2007/2008	Paeat / swamp	20,0

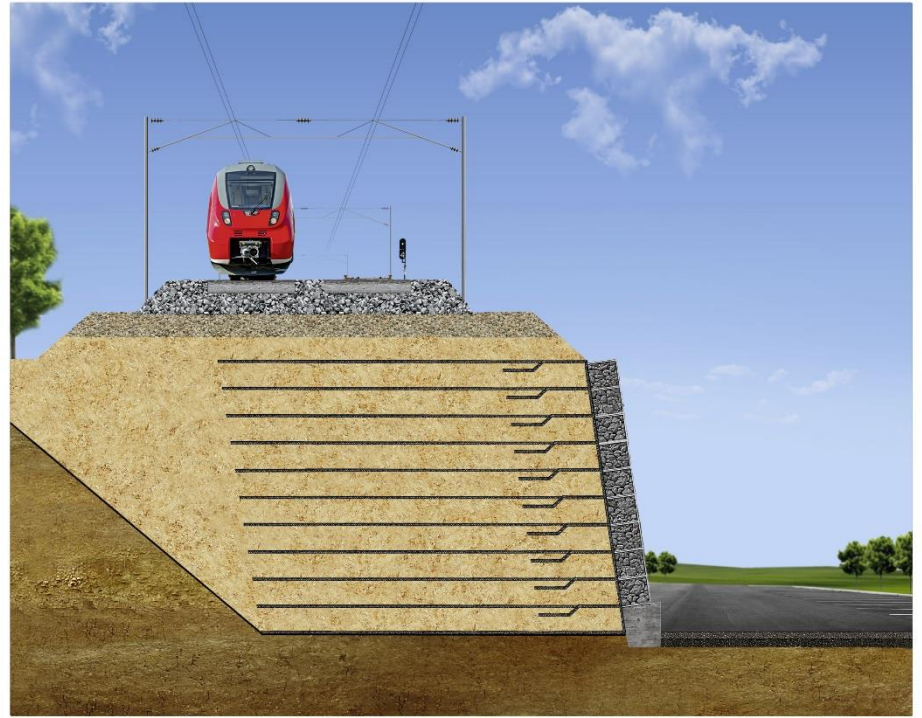


Customised design options

Rapid, cost-effective installation

Technical consulting by HUESKER engineers

Space-efficient due to small base area



Up to 11dB sound absorption

Straightforward GRS construction

Harmonious integration in natural setting

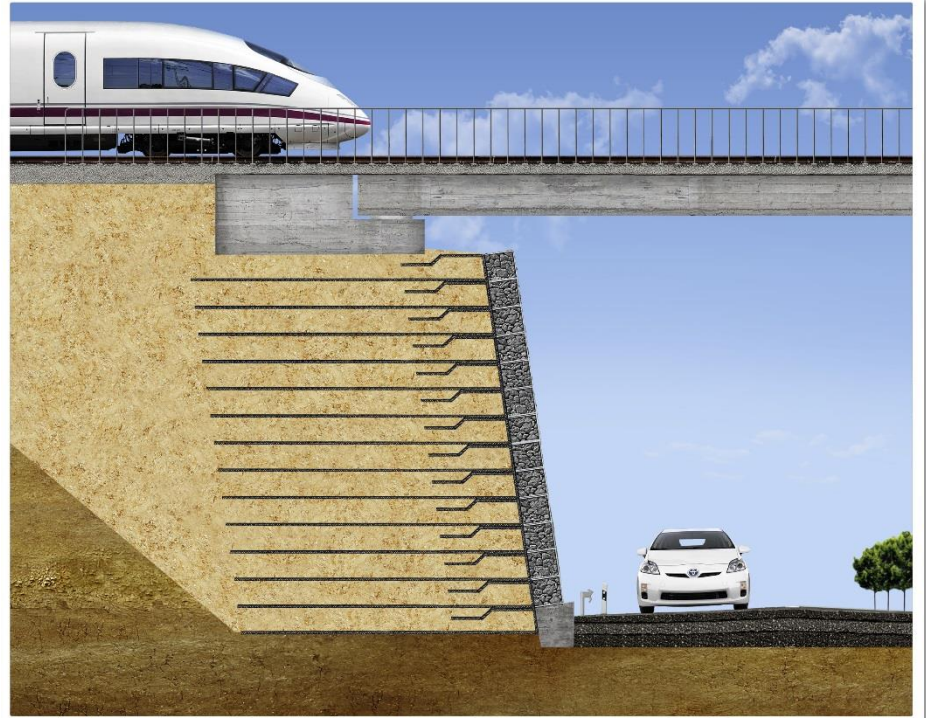


Fast, efficient construction

High ductility

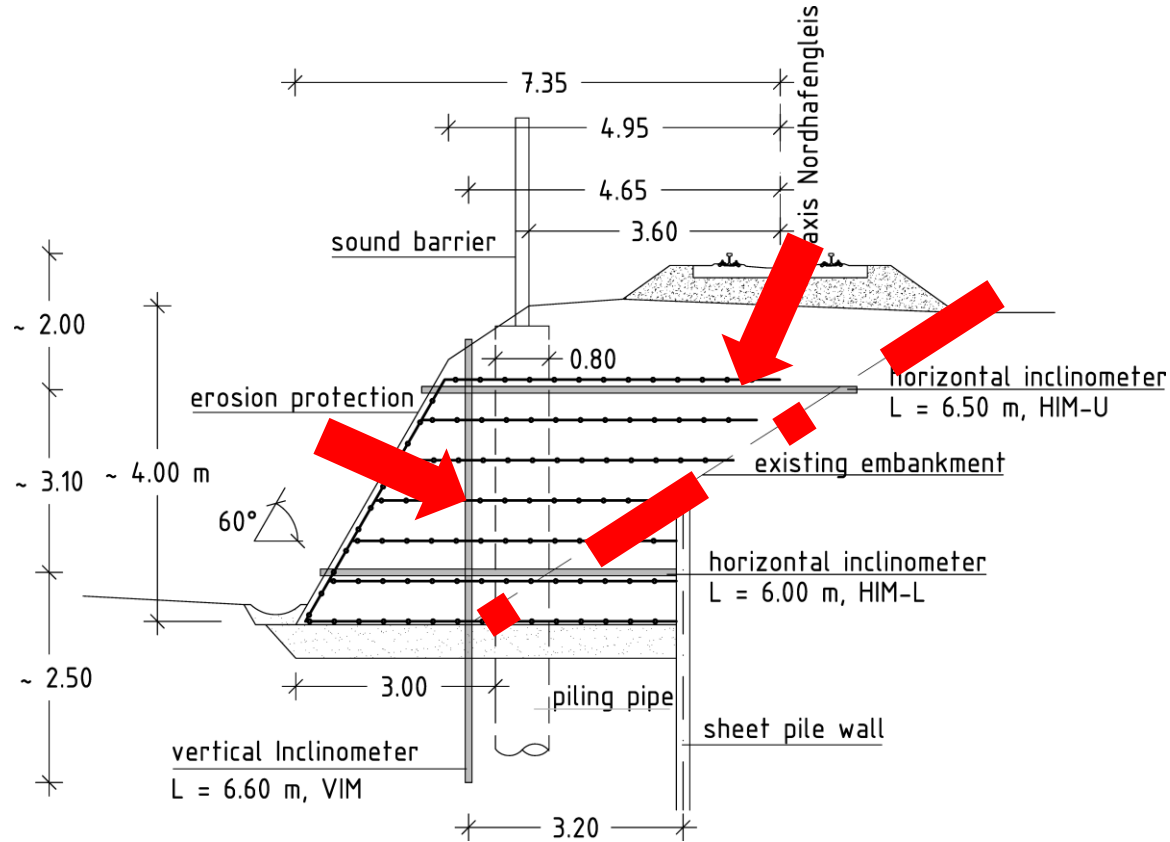
Eco-friendly

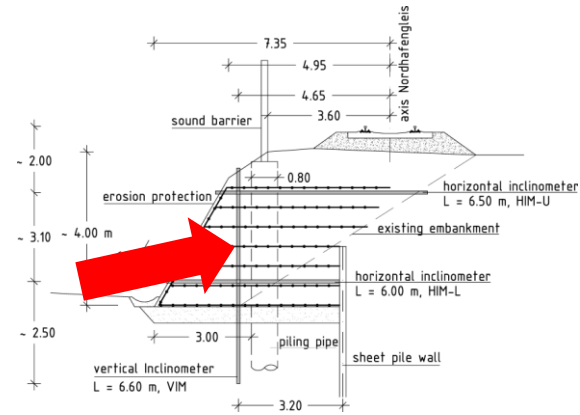
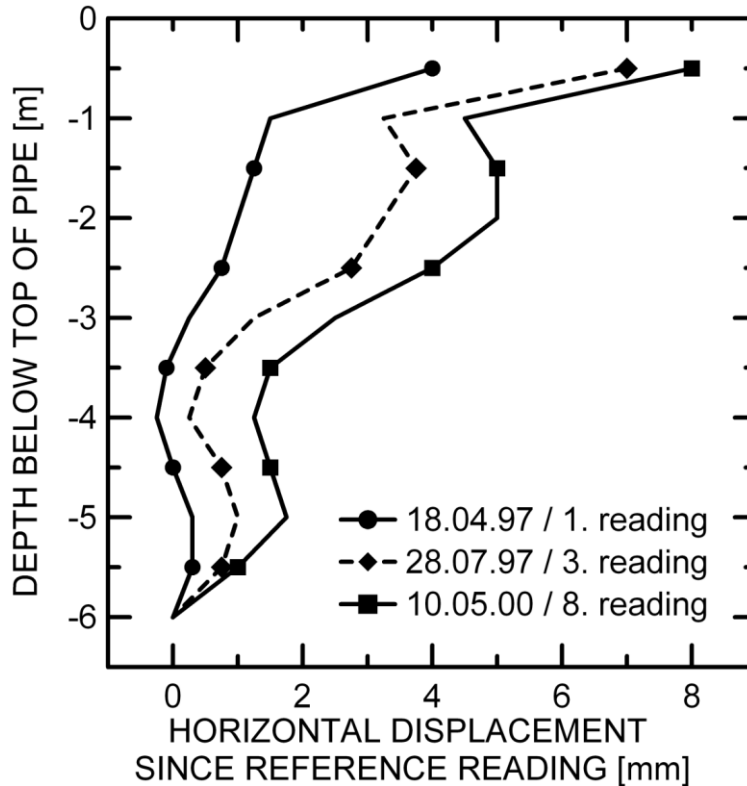
Attractive facing design

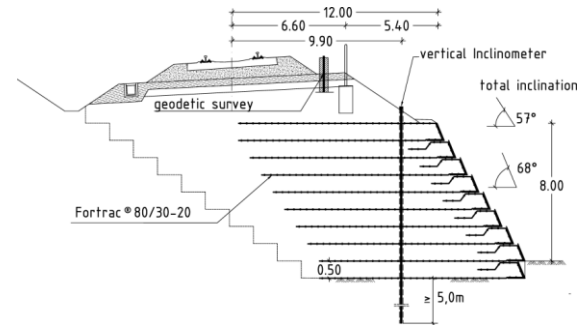
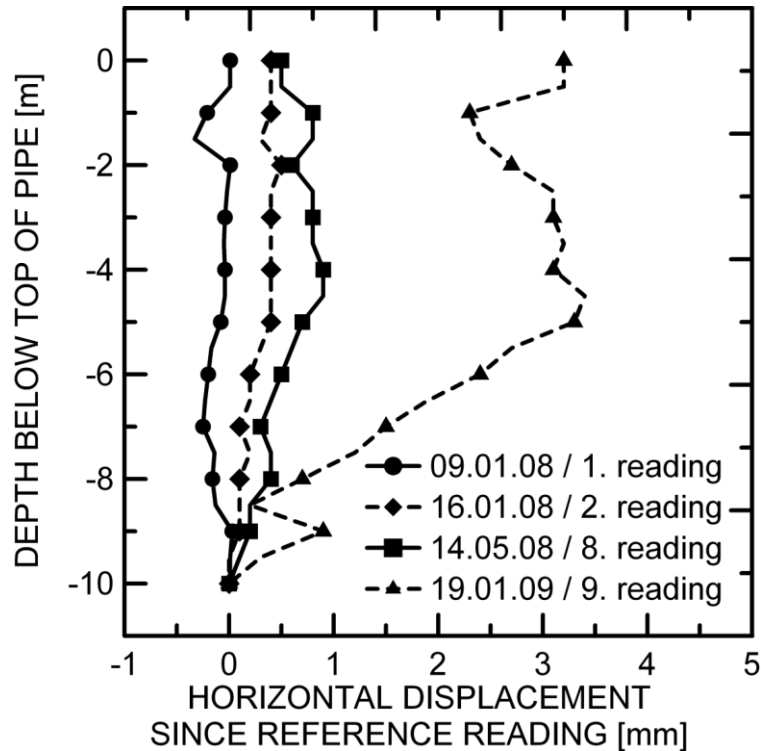


	Cologne - Mülheim	Hanover - Ledeburg
Vehicle / Category	ICE / TSI: III (urban)	Cargo track (VW-Works)
Design speed	60/80 km/h (max. 100 km/h)	ca. 40 km/h
Height	ca. 8 m	ca. 5 m
Inclination	57°	60°
Facing	Green	Green
Subsoil	Sand / gravel	replacement with sand (0.5 m) loam (1.5 m) sand (2 m) clay (2 m)
Fill-material	Fine and medium grain sand, SU*	Gravel sand, G,s,u' (0/32) mm
Geogrid	Fortrac 80/30-20 (PET)	Fortrac 80/30-20 (PET)
Commissioning	December 2007	April 1997
Occasion for the construction	Upgrading an existing embankment for ICE traffic (improving stability)	Widening of existing embankment to create an additional track

Steep Slope / Hanover



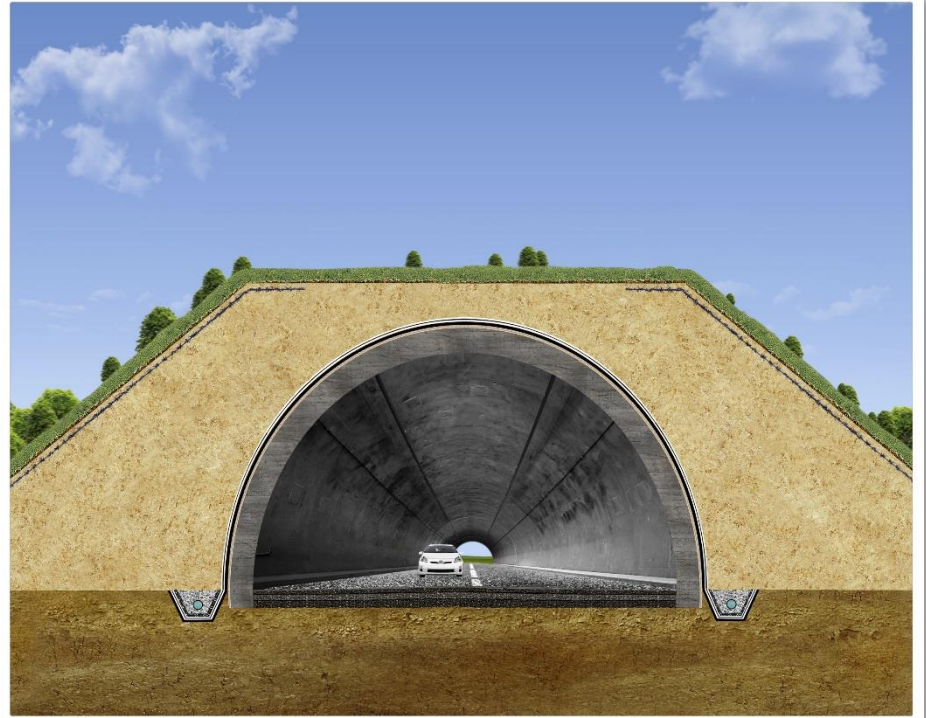




Patented system solution

No water seepage behind membrane

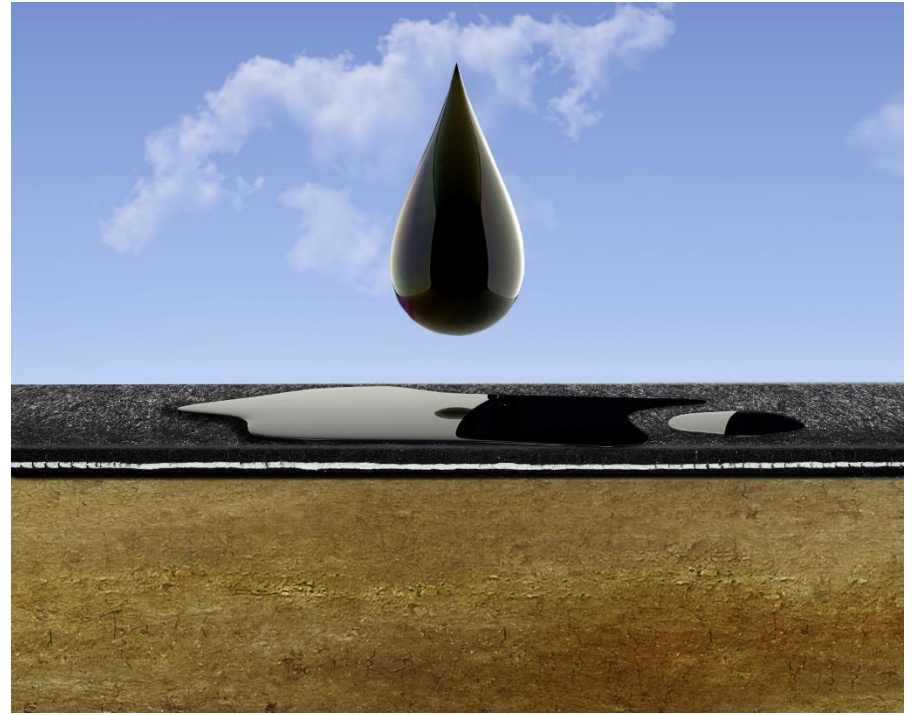
Extended service life of structure



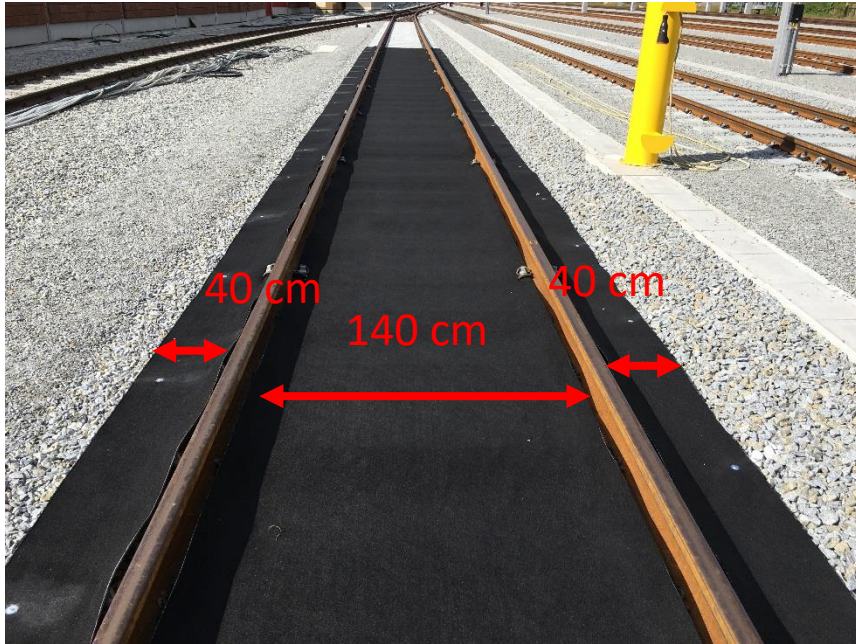
Reliable oil absorption, even over wide areas

High mechanical strength

Straightforward installation and removal



On site pictures

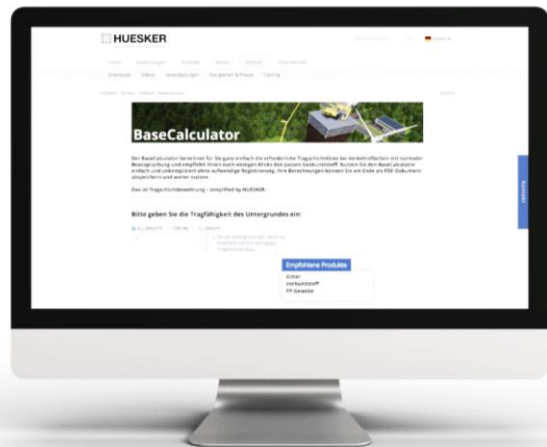


Reliable increase in bearing capacity

Savings on base course material

Lower maintenance costs





BaseCalculator

➔ HUESKER Website (.de / .it / .co.uk)



Interaction Flexibility

➔ HUESKER Website / Youtube Channel

Stormwater Holding Basins

Controlled discharge of large quantities
of water

Reliable lining

Cost-effective product selection



Any Other Directions We Could Take?



Further Potentials?

- # ASK and LISTEN to your customer!
- # Environmental protection
- # Asphalt (reinforcement) as track-foundation
- # Automatic assesment of track condition (smart textiles)
- # Absorbing vibration or noise?

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VDEI AKADEMIE

FÜR BAHNSYSTEME

Stellen Sie noch heute die Weichen für Ihre Zukunft.

VDEI-Akademie | Fachtagungen | Seminare | Workshops | Presse | Partner

Seminare



Schwerpunkte und Themen der Seminare sind aus den VDEI-Fachbereichen Infrastruktur, Technische Ausrüstung, Fahrzeuge, Verkehrs- und Betriebssteuerung sowie aus den Bereichen Umwelt-, Brand- und Arbeitsschutz bei Bahnen. Die Dozenten kommen aus diesen Bereichen, verfügen über langjährige praktische Erfahrung und bringen die Teilnehmer auf den neuesten Stand der Technik und der Regelwerke.

April 2015						
Mo	Di	Mi	Do	Fr	Sa	So
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Veranstaltungen

16.04.2015
Workshop 10-15 - Geokunststoffe im Erd- und Ingenieurbau

21.04.2015
RIL 813.0460 – Fördertechnik in Personbahnhöfen planen

[Jahresübersicht](#)

Upcoming Events

< DECEMBER 2017 – APRIL 2018 >

Agenda

Collapse All Expand All

DEC 13
Wed

IGS UK/EGGS: Geotextiles – A UK Classification System for Basic Separation and Filtration @ The Geological Society, Burlington House, London

Dec 13 @ 5:30 pm – 8:00 pm

APR 18
Wed

IGS UK Symposium: Use of Geosynthetics in Rail: Towards 2025 @ National Rail Museum, York

Apr 18 @ 9:00 am – 5:00 pm

< DECEMBER 2017 – APRIL 2018 >

Subscribe

Our Solutions at a Glance

Noise Barriers

Bridge Abutments

Bridging of Sinkholes

Embankment Foundation

Stormwater Storage

Base Reinforcement

Tunnel Waterproofing

GRS

Temporary Roads

Oil Absorption



Networking is our Core Competence

Geosynthetic Solutions for Railways



HUESKER

Ideen. Ingenieure. Innovationen.

Available w47!

Thank You for Your Attention!

