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BEGRID TG

Geogrids

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KEY ADVANTAGES
at a glance

→ Reinforcing effect in the foundation course; evens out settlement

→ Increased load-bearing capacity due to plate effect; immediately resilient and load-bearing substrate

→ Quick and simple installation

→ Easy and cost-effective construction method

BEGRID TG
Geogrids

Probably the most demanding range of applications for geosynthetics is the reinforcement of structures. The products used form the basis for safe and durable solutions that would not be possible using traditional earthwork methods or would be technically difficult and costly.

This is why geogrids have been successfully used as a reinforcing material in the construction of earthworks and infrastructure for many years.

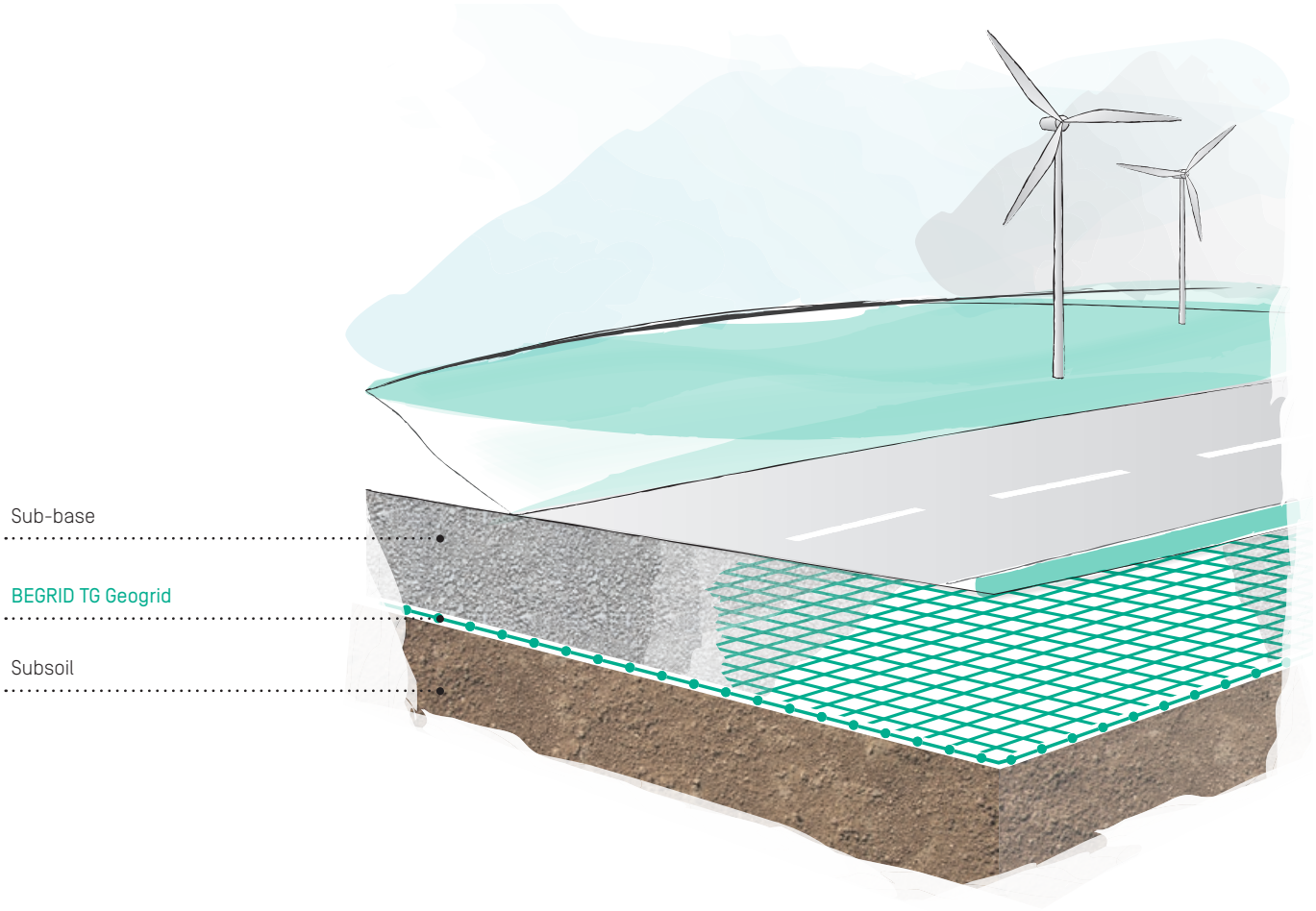
The mode of action of BEGRID TG Geogrids is simple and effective. Loads within the structure are distributed across a wide area by the geogrid before being transferred to the subsoil, thus avoiding any overloading caused by point loads. This avoids the need for costly and laborious earthworks, such as soil improvement measures or the replacement of soil with load-bearing material.

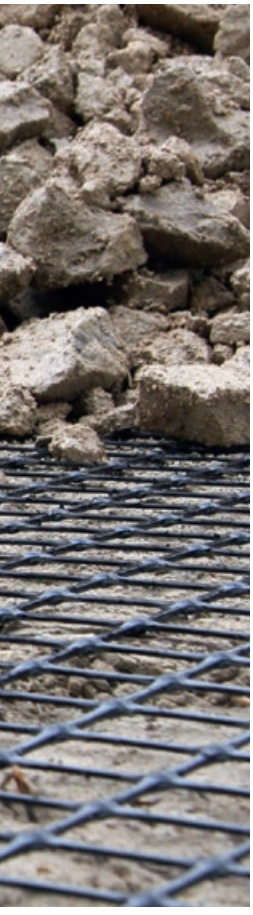
PRODUCT DETAILS
and properties

BEGRID TG Geogrids produce excellent results in terms of reinforcement.

BEGRID TG is made from UV-resistant polypropylene (PP) membranes. In the production process, a predefined pattern of holes is punched into the membranes, which are then stretched laterally and longitudinally. This forms a dimensionally stable geogrid with low elongation.

The extremely robust and rigid grid structures consist of monolithic ribs and integral junctions. In contrast to other types of geogrid, no jointed nodes are formed during production. The geogrids are instead formed from a single piece of material.
These typical product characteristics make BEGRID TG particularly well suited for use in civil engineering and road construction projects where the load-bearing capacity of the soil is poor.





The raw material, polypropylene (PP), used to make the BEGRID TG Geogrids also has high microbiological and chemical resistance in natural and contaminated soils. The robust material structure gives the geogrids good weathering resistance and excellent resistance to damage during installation. These outstanding properties make the BEGRID TG Geogrid a durable and versatile reinforcement product.

BEGRID TG Geogrids, with their stiff knots and good dimensional stability, are available in a range of mesh sizes and with tensile strengths of 15 to 40 kN/m. They are easy to lay on site and offer the design engineer simple and cost-effective solutions.

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BEGRID TGV – Geogrids with additional non-woven filter fabric

When geogrids are used as reinforcement on fine grained soils, or in the vicinity of bodies of water, or where the groundwater level is high, a suitable non-woven fabric is required, in addition, to act as a separating and filtering layer. This fabric prevents different types of soil from mixing and avoids the risk of soil particle migration, while still allowing water to pass through.

The composite product BEGRID TGV was specially developed for this type of application.

BEGRID TGV is made from the tried-and-tested geogrids of the BEGRID TG range, which are then fitted with an additional non-woven filter fabric in the factory.

The non-woven fabric satisfies the requirements of geotextile robustness class GRK 3, as specified in the “Merkblatt über die Anwendung von Geokunststoffen im Erdbau des Straßenbaues M Geok E” (Leaflet on the use of geosynthetics in earthworks for highway construction). It demonstrates good mechanical and hydraulic filtration efficiency in common types of soil.

The reinforcing properties of the BEGRID TG Geogrid are not adversely affected by the non-woven filter fabric. In fact, the advantages of the two components complement each other.

Since the geogrid and fabric are combined, there is less work involved on site than if separate layers were used. It also makes laying easier in cases where the subsoil cannot support heavy construction equipment and the “end tipping” method has to be used.

This is why BEGRID TGV is the ideal solution for construction site access roads, for sub-base reinforcement in roads and traffic routes in marshland or where the subsoil is muddy, and for the construction of pipe bedding on substrates with a low load-bearing capacity.

The BEGRID TGV Geogrid compensates in situations where the foundation soil varies greatly across the site.

FUNCTIONS
BEGRID TG / BEGRID TGV

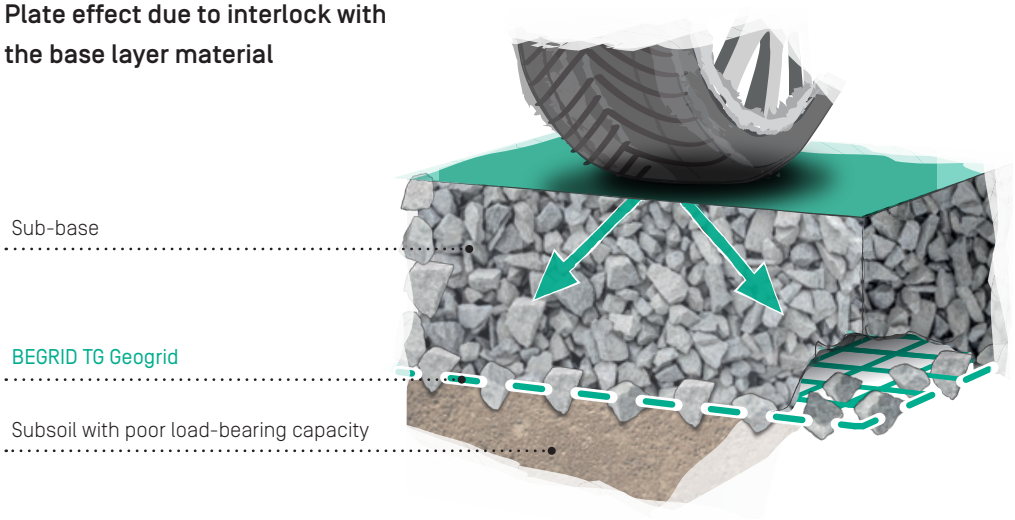
BEGRID TG

Reinforcement

The effective action of BEGRID TG Geogrids is based on their ability to absorb high tensile forces while exhibiting low elongation and low creep. Since BEGRID TG Geogrids are installed between or beneath layers of soil to improve the mechanical properties of the layers, they have the particular advantage of allowing the grains of the fill material to interlock with the geogrid.

The inherent rigidity of BEGRID TG Geogrids creates the so-called “snowshoe effect”. The grains of the sub-base material interlock with the wide mesh structure of the grids below. The combined action of the BEGRID TG and the bearing course material results in a plate effect, which distributes and transfers the loads across an extended area. This effect makes it possible to transform non-load-bearing surfaces into areas that can be trafficked or built on. In this way, natural sludge ponds, landfill sites, moorland, peat and waterlogged soils can be built on without any additional and expensive technical measures.

Plate effect due to interlock with the base layer material



BEGRID TGV with added non-woven fabric

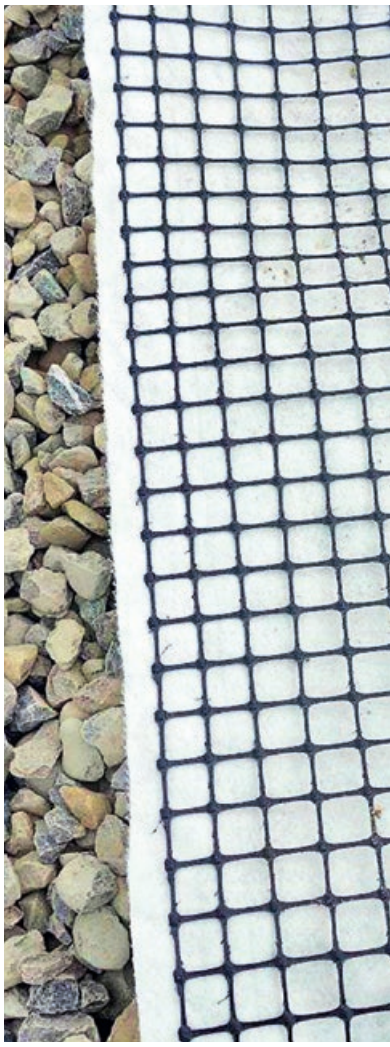
Separation

The non-woven fabric of the BEGRID TGV composite geotextile keeps different layers or types of soil separated from each other in order to maintain the quality of the layer structure and ensure long-term use of the overall structure. In addition, the non-woven fabric ensures that the different layers, such as the high-quality sub-base layer and the subsoil, do not mix with each other under mechanical stress during the construction phase and the subsequent period of use.

Filtration

The filtering function of a non-woven fabric is necessary if, in addition to the separation of layers, the ingress of water needs to be taken into account. In this case, both the filtering and separating functions play an essential role. If the non-woven fabric is correctly dimensioned, the fabric and the soil combine to form a stable filter system.

The non-woven fabric of the BEGRID TGV was specially selected to ensure a suitable aperture size and the highest possible water permeability.



BEGRID TGV is supplied with a non-woven filter fabric that is bonded to the grid in the factory and conforms to geotextile robustness class GRK 3.

TECHNICAL DETAILS
at a glance

When selecting a geogrid, it is particularly important to ensure that the sub-base material interlocks well and does not just sit on top of the geogrid. Soils that are too fine or too coarse are therefore unsuitable. The mesh size of BEGRID TG Geogrids is specially designed to ensure that the grains of sub-base materials can interlock optimally through the apertures of the geogrid and remain firmly in position.

Experience has shown that when grids are used with the classes of base layer materials used in road construction, square grid openings should comply with the following requirements: In order to ensure good interlocking with the geogrid, the fill material should be a mixture of well-graded, non-cohesive, mineral aggregates. The largest grain size should not be smaller than approximately half the mesh size of the grid and not larger than two-and-a-half times the mesh size.

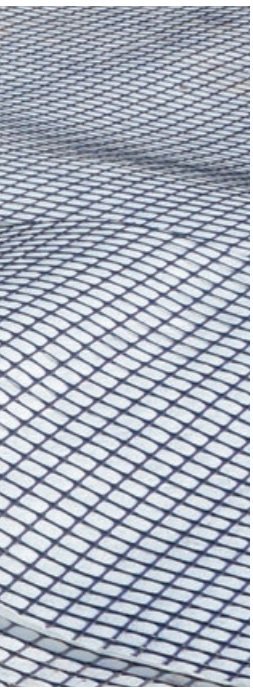
For BEGRID TG S products with a square mesh size of 40 x 40 mm, we recommend the use of frost protection and bearing course materials 0/22, 0/32, 0/45 and 0/56 mm in accordance with the ZTV SoB-StB 04 (Terms of Contract and Guidelines for the Construction of Binderless Layers in Road Construction). For BEGRID TG L products with a mesh size of 66 x 66 mm, the largest grain size should not be smaller than 32 mm and not larger than 150 mm.

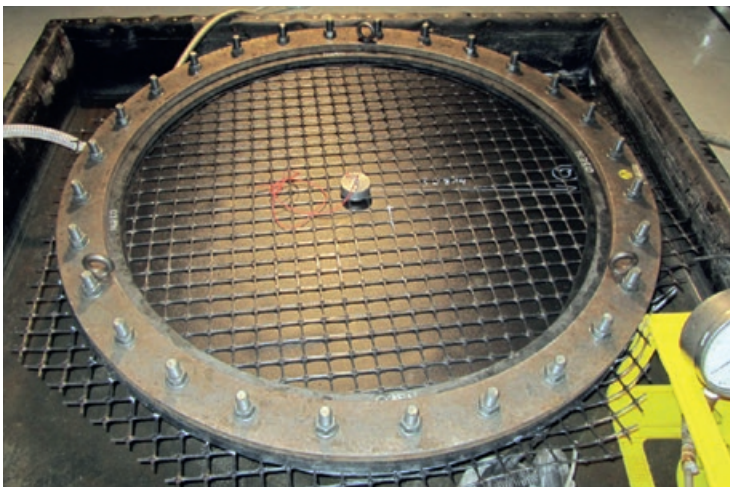
Directionally-independent absorption of forces

In order to assess a geogrid's capacity to absorb tensile forces in all directions, the so-called burst pressure test can be employed. This test involves tensioning the geogrid circularly on an air cushion (membrane).

The air cushion is inflated, causing the geogrid to bulge. The pressure is continually increased until the geogrid bursts. Because pressure is applied across the entire area of the test material, the burst pressure determined in the test gives a good reference value for the maximum capacity of a geogrid to absorb tensile forces within its plane, independently of the material geometry.

These tests show that the loading capacity of stretched, monolithic, knot stiff geogrids with similar force-elongation behaviour is primarily determined by the rigidity of the knots and the mass per unit area of the geogrid. This test makes it possible to determine the axial stiffness at specific elongations, which helps in assessing the efficiency of the reinforcement.





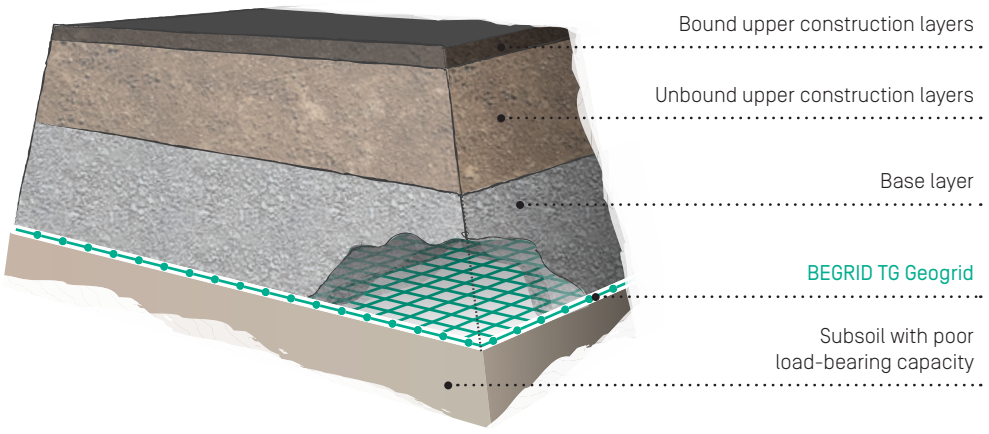
Burst pressure test to determine the geogrid's capacity to absorb tensile forces

APPLICATIONS
BEGRID TG / BEGRID TGV

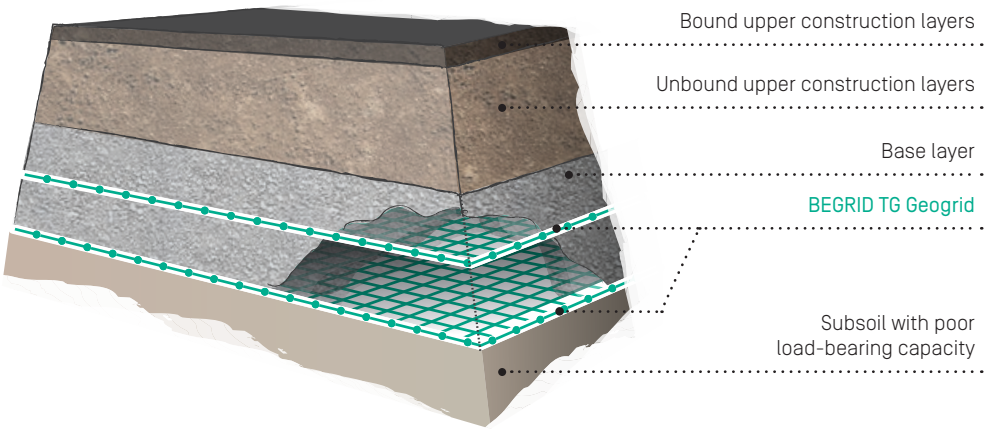
Geogrids are used primarily for reinforcing soils, stabilising surfaces and improving load-bearing capacities in the construction of roads and traffic infrastructure.

However, even in technically demanding applications, such as the reinforcement of steep embankments and support structures, building over sludge lagoons, constructing load transfer mattresses and installing securing layers in land slip areas, BEGRID TG Geogrids also offer safer and more cost-effective solutions than traditional construction methods. Service roads, parking areas, cycle paths, construction site access roads and trafficked surfaces are also common fields of application.

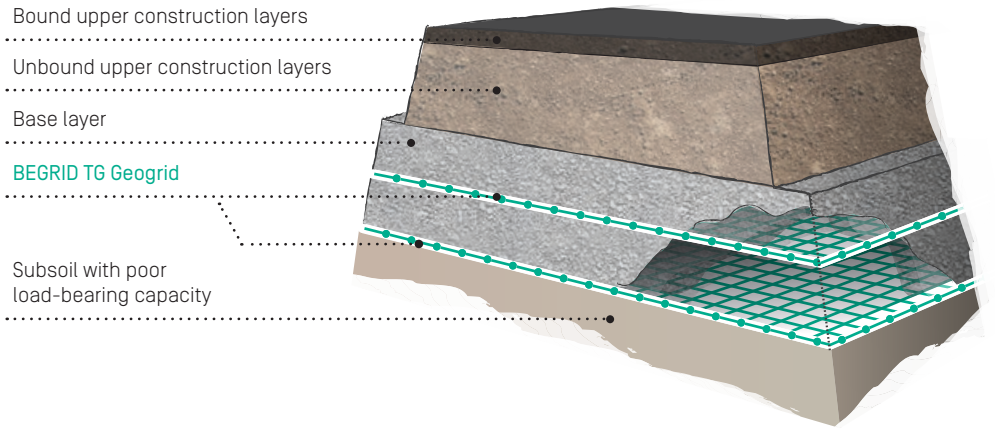
Reinforcing layer under a dam



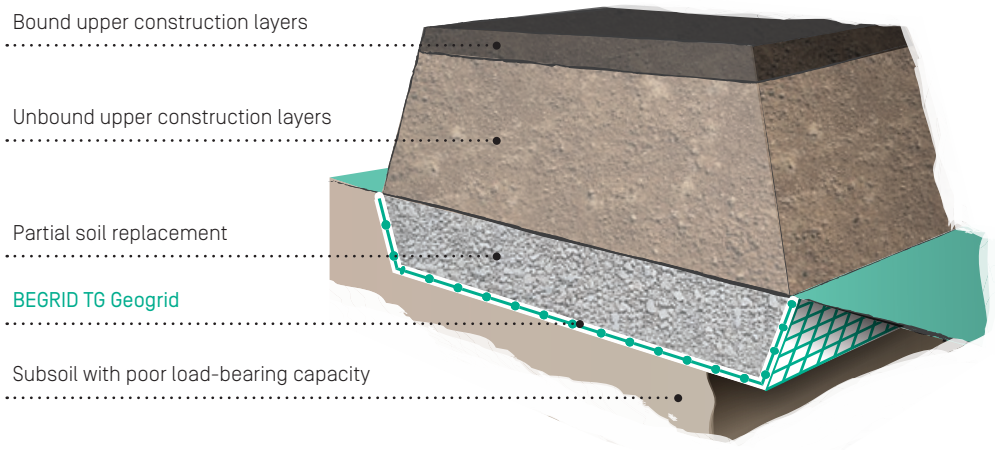
Several reinforcement layers

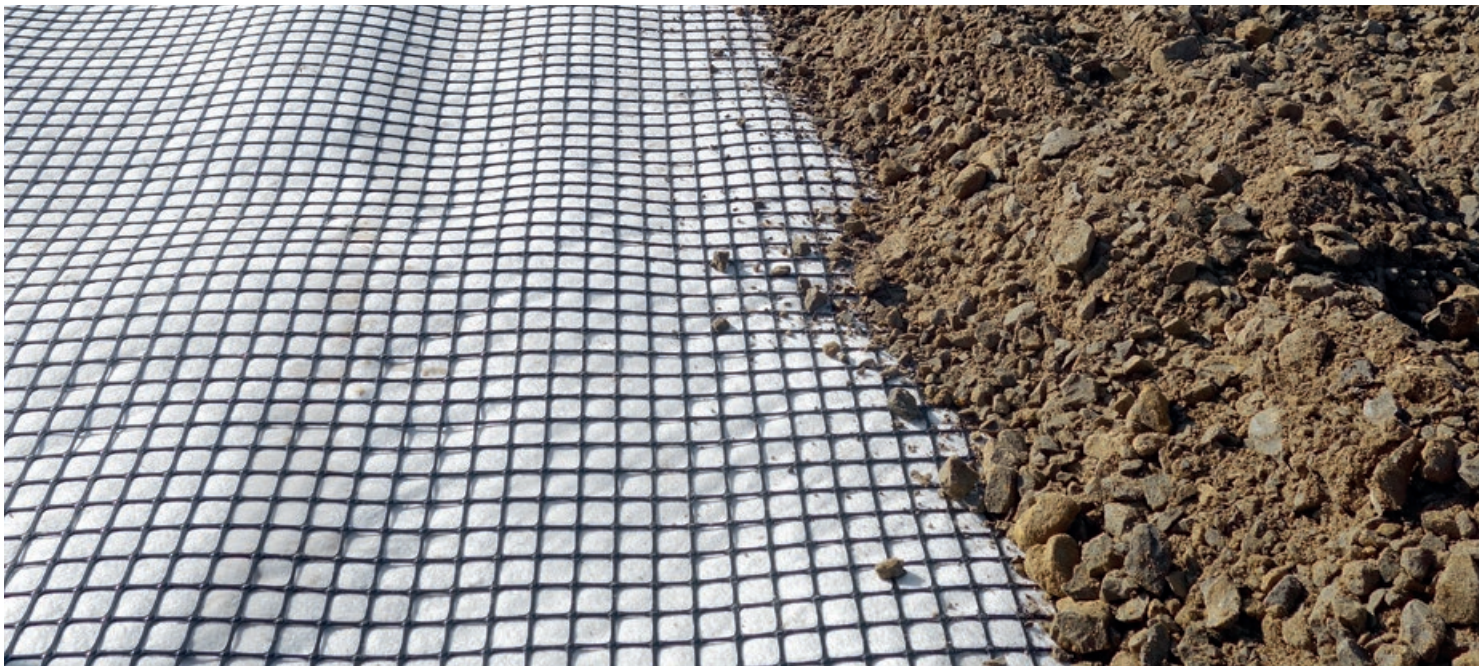


Overlaying slurry ponds and organic soils

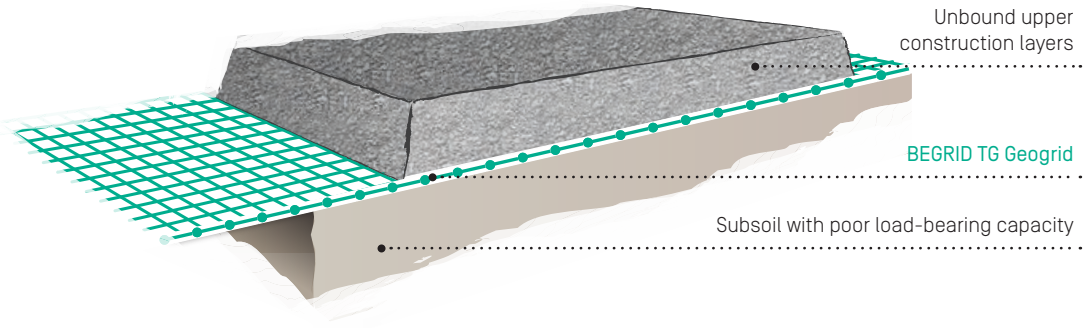


Reinforced layer as soil replacement

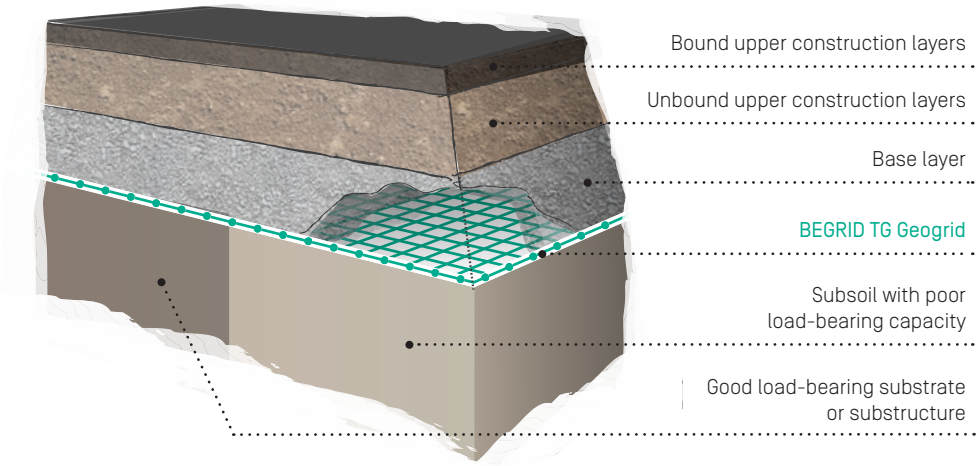




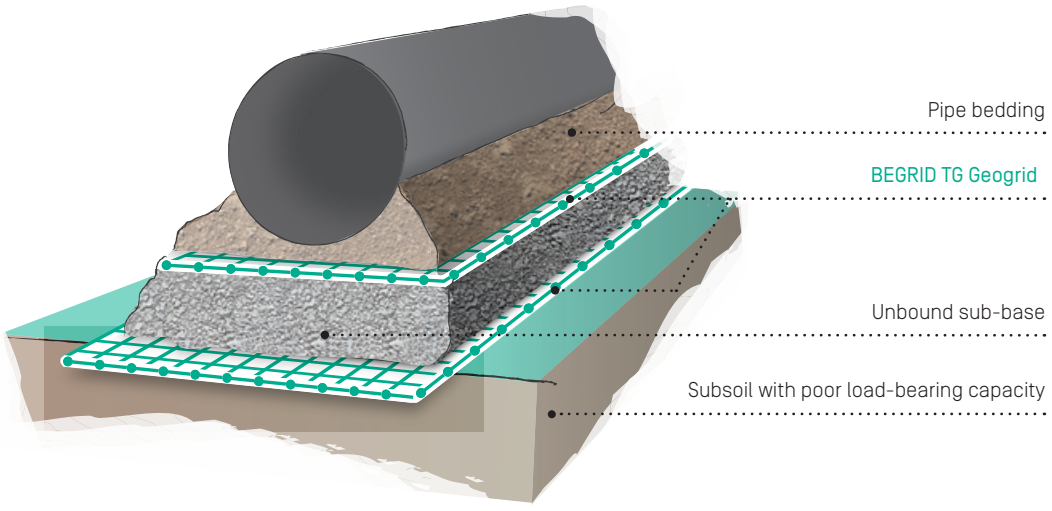
Reinforcing layer under roads with unbound surfaces (construction site access roads, service roads and access roads for site development)



Reinforcement layer to even out settlement



Reinforced foundation bed as a bearing layer for pipelines



Applications matrix at a glance

We are happy to supply current data sheets, specifications, certificates and technical verifications on request.

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Properties	TG 20 20 S	TG 30 30 S/L	TG 40 40 S	TGV 20 20 S	TGV 30 30 S
Product type	Extruded geogrid				
Raw material	Polypropylene (PP)				
Non-woven	without			GRK 3 – 170 g/m²	
Maximum tensile strength longitudinal / transverse (kN/m) Standard: EN ISO 10319	20	30	40	20	30
Mass per unit area (g/m²) Standard: EN ISO 9864	250	350/365	535	420	530
Junction strength (kN/m) Standard: GRI GG2	18	27/25	38	18	27
Secant stiffness (kN/m) at 0,5 % Elongation	759	989/713	1,499	759	989
Main fields of application					
Earthworks and foundations	●	●	●	●	●
Road and traffic areas	●	●	●	●	●
Further fields of application					
Road construction	●	●	●	●	●
Mud ponds and organic soils	○	●	●	○	●
Canal structures	○	○	○	●	●
Settlement equalisation		○	●		○

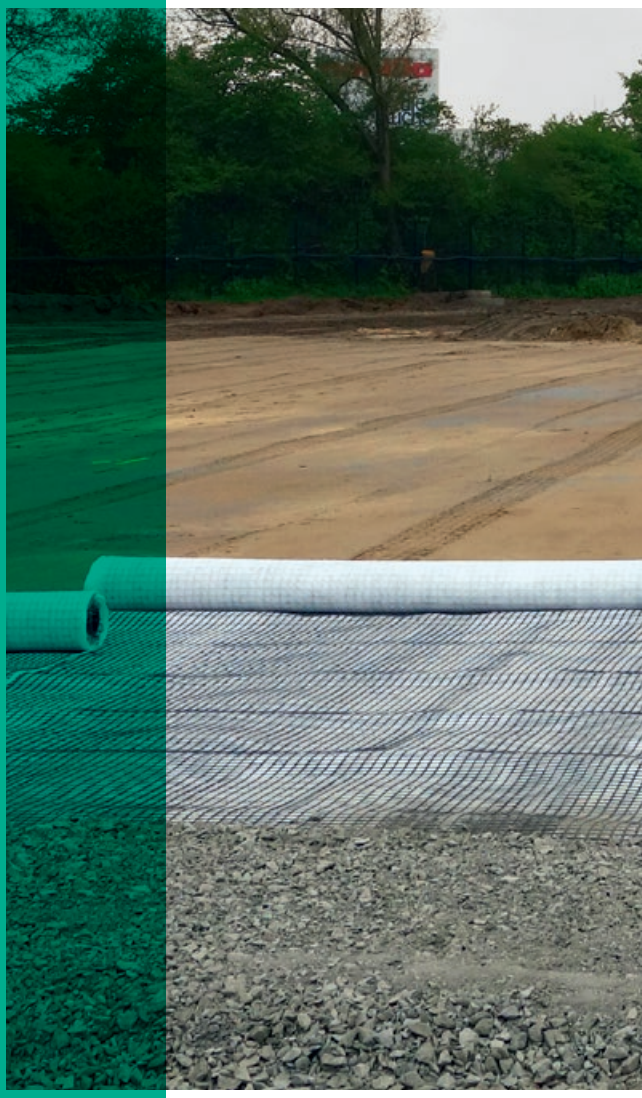
● suitable ○ partly suitable (project-related assessment necessary)

Special types available on request.

APPLICATION
in practice

Extension of the Sürenheide (Gütersloh) A2 motorway rest area

Construction period:	**May – September 2017**
Location:	**33415 Verl, A2 motorway in the Hanover direction**
System:	**BEGRID TGV 30/30 S Geogrid with non-woven geotextile**
Quantity:	**5,000 square metres**
Comment:	**The need for costly and extensive soil replacement was eliminated**



By using BEGRID TGV Geogrids, it was possible to achieve an optimal overall structure that absorbs and evens out the effects of any subsequent settlement of the subsoil.

Top image: quick installation of the BEGRID TGV Geogrids; left: the inhomogeneous conditions of the subgrade soil; right: placing fill material on the geogrids

Extension of the Sürenheide (Gütersloh) A2 motorway rest area

Due to the increased traffic volume on the A2 motorway in North Rhine-Westphalia, additional parking spaces were required at the Sürenheide (Gütersloh) rest area. The extension of the motorway rest area was to increase the number of lorry parking spaces from 17 to 78 and the number of car parking bays by 28 in each case.

The advantages of BEGRID TGV:

- Evens out any settlement
- Increases the load-bearing capacity of the base layer
- Rapid progress of construction work
- Can be driven over immediately after covering with fill material
- High design reliability for the project participants
- Inexpensive and economical system solution
- No costly and extensive replacement of soil is necessary
- Very safe and proven construction method

The requirements

In May 2017, BECO BERMÜLLER's applications engineering department was called in by the project participants for advice, since the existing soil on parts of the site was found to be inhomogeneous fill material.

The load-bearing capacity of the subsoil was found to vary considerably – and in all cases fell below the required E_{V2} value of 45 MPa. Extensive soil replacement measures were neither desired by the project participants nor feasible within the time schedule.

In order to minimise the differences in settlement and to achieve the required load-bearing capacity, BECO BERMÜLLER worked out a proposed solution aimed at completing the works on time and reopening the area to traffic as planned.

Image on the left: delivery of the sub-base material; right: Sürenheide motorway rest area after completion

The solution

After an expert assessment by the application engineers, a proposal based on base layer stabilisation with geosynthetics was presented to the project participants.

The solution involved the construction of an improved pavement structure incorporating the stretched, rigid-node BEGRID TGV Geogrid, which is a biaxial geogrid with an additional non-woven fabric of geotextile robustness class GRK 3. The grid acts in combination with the sub-base material, a crushed rock mixture 0/45, whereby the grains of the sub-base layer interlock with the grid structure. The combined action of the BEGRID TGV and the sub-base material results in a plate effect, which causes the loads to be distributed and transferred across an extended area.

In order to offer the customer the greatest possible assurance, the proposed solution was confirmed by an independent expert report. This gave the project managers maximum planning security with regard to the selected geosynthetic system.

The result

By using BEGRID Geogrid, it was possible to achieve an optimal overall structure that absorbs and evens out the effects of any subsequent settlement of the subsoil. Furthermore, it was possible to achieve very good E_{V2} values of up to 176.5 MN/m² at the surface of the unbound sub-base layer, with a sub-base layer thickness of just 40 cm. Because BEGRID TGV is so easy to lay, construction work progressed rapidly and on schedule.

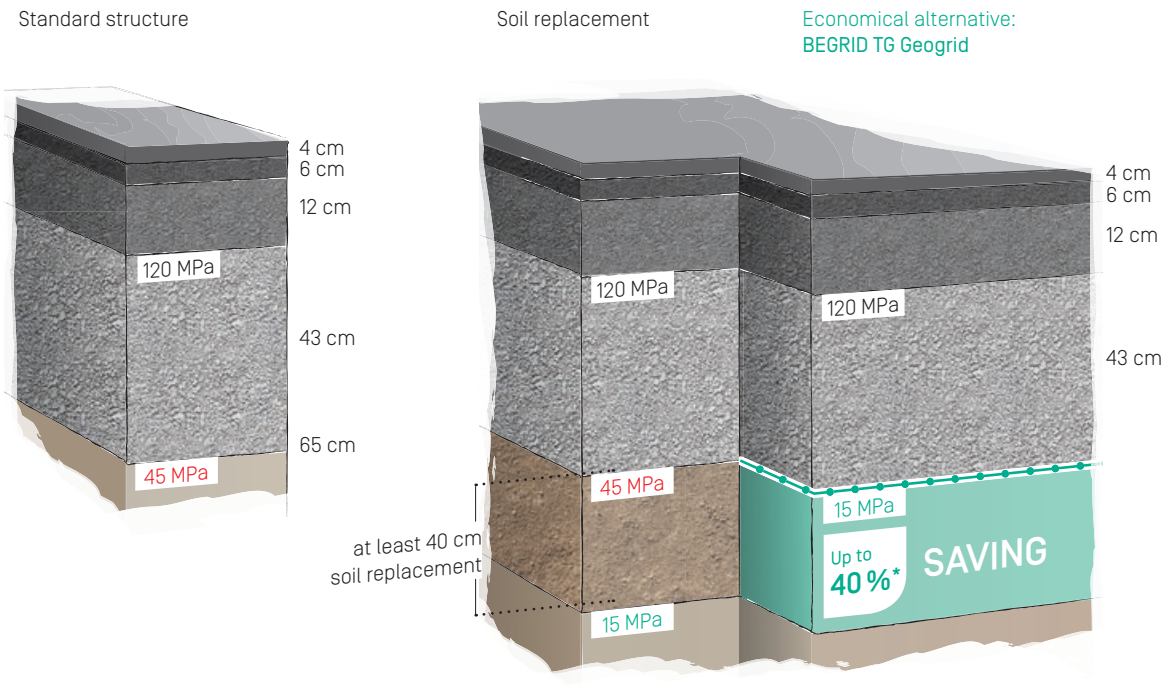
Due to the inherent rigidity of the geogrid, no frequent tensioning of the grid layers during installation is necessary. No folding of the BEGRID TGV at the edges is necessary either.

POTENTIAL SAVINGS
and base layer dimensioning

The economical use of resources in road and traffic route construction no longer refers only to economic and ecological criteria in the deployment of construction equipment and personnel. Today, construction projects are subject to an overall sustainability assessment.

In a comprehensive study conducted by EAGM, the life cycle analysis of construction methods using geosynthetics revealed the ecological and economic advantages of geosynthetics in comparison to conventional construction methods. In the case of geogrids, in particular, enormous potential savings were identified. By using geogrids it is possible to largely or completely avoid conventional soil replacement.

Example: Road construction class Bk3.2, row 1, Table 1 RStO
(Guidelines for the standardisation of traffic area pavements), published 2012
Soft - semi-solid, clayey, silty subsoil; E_{V2} = 15 MPa



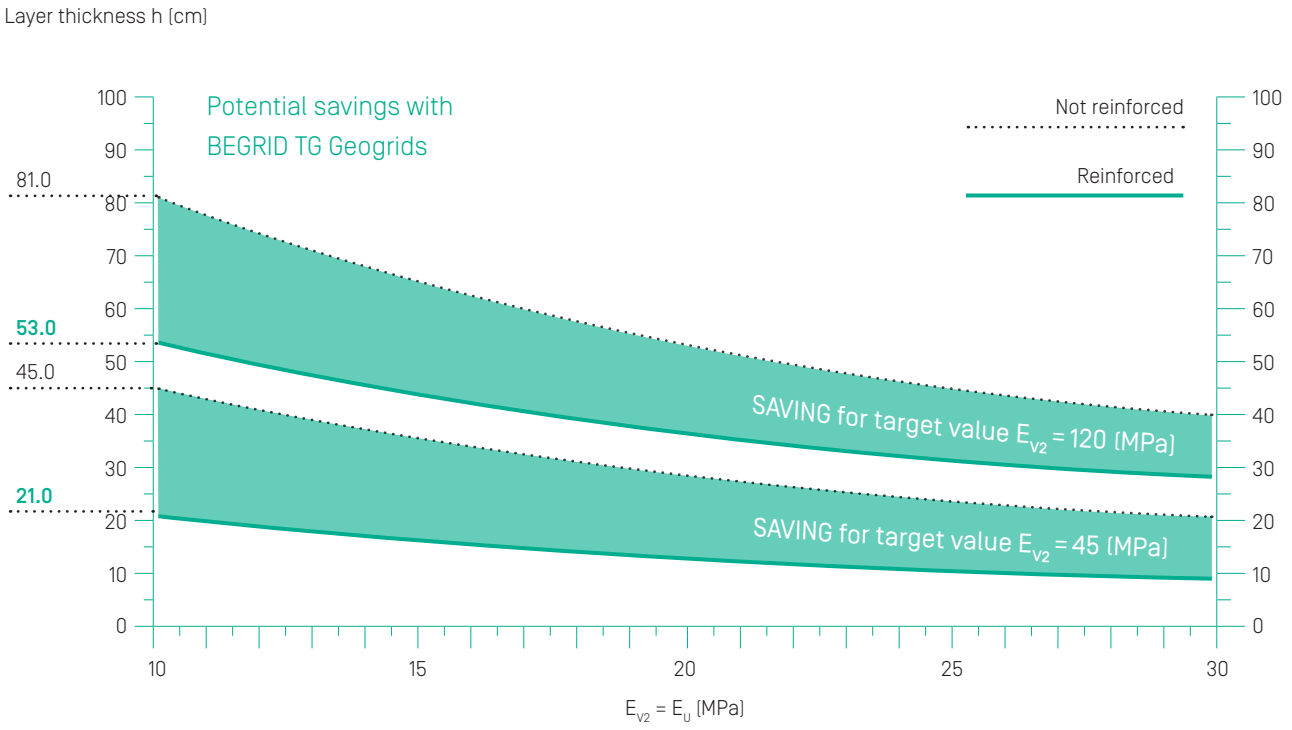
With BEGRID TG Geogrids, the costs of at least 40 cm of excavation and disposal and of the delivery and installation of replacement material are saved.

POTENTIAL SAVING
of up to
40 %*

The potential savings made, in comparison to soil replacement for example, can be up to 40 %, depending on the project. Added to this are the cost and time savings for excavation and disposal of the unsuitable soil and the provision, delivery and installation of replacement material. At the same time, all these savings also benefit our environment.

*The actual potential savings may vary depending on the boundary conditions of the specific project and on the frost resistance of the road pavement and the load-bearing capacity of the substrate.

Improvement in load-bearing capacity due to BEGRID TG Geogrids



Example, based on a modulus of deformation
E_U = 10 MPa

INSTALLATION
BEGRID TG Geogrids

To be considered:

1. BEGRID TG Geogrids must always be laid without any wrinkles or folds.
2. After the BEGRID TG Geogrid has been laid, suitable fill material must be placed on top of it.
   – BEGRID TG S: 0/22 – 0/56 mm
   – BEGRID TG L: 0/63 – 0/150 mm
3. After the geogrid has been laid, vehicles must not be allowed to drive directly on it (before fill material has been laid on top). The geogrid must be covered with a layer of soil at least 15 cm thick before vehicles may drive on it. If the soil is particularly soft (with an E_{V2} value of less than 5 MPa), the layer thickness must be increased to at least 30 cm.
4. If the geogrids are laid on soil that has an E_{V2} value of 15 MPa, the geogrids must overlap by at least 30 cm and if the E_{V2} value lies between 5 and 15 MPa, the overlap must be at least 50 cm. For values of 5 MPa or less, please contact us for advice.
5. If the subsurface is particularly uneven, the overlap width must be increased sufficiently to ensure that the minimum overlap is still assured after the fill material has been installed.
6. In order to ensure good interlocking with the geogrid, the fill material should be a mixture of non-cohesive mineral aggregates with a defined grain size distribution.

ADVANTAGES
BEGRID TG / TGV

- → Reinforcing effect in unbound upper construction layers
- → Increased load-bearing capacity due to plate effect
- → Immediately resilient and load-bearing subgrade
- → Reduction in thickness of sub-base layer for traffic routes
- → Evens out settlement
- → Reduces rutting
- → Prevention or reduction of costly soil replacement
- → Effective friction/form fit connection with the fill material
- → High tensile strength with low elongation
- → Quick and simple installation
- → Robust, to cope with installation conditions on site
- → Excellent chemical and microbiological resistance
- → Higher degree of safety and a long service life
- → Easy and cost-effective construction method
- → Potential cost savings compared to conventional construction methods
- → Low transport and storage costs

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