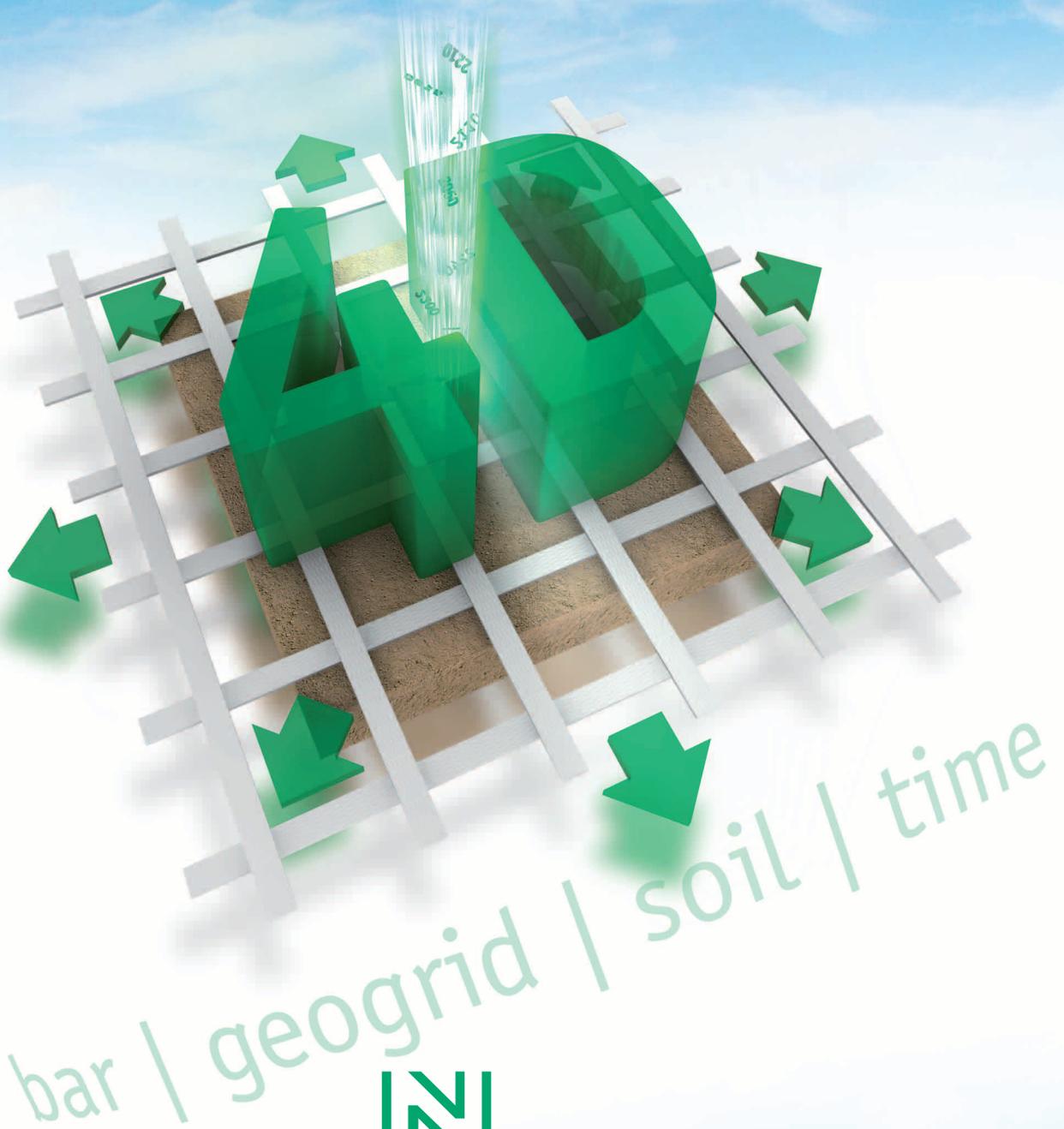


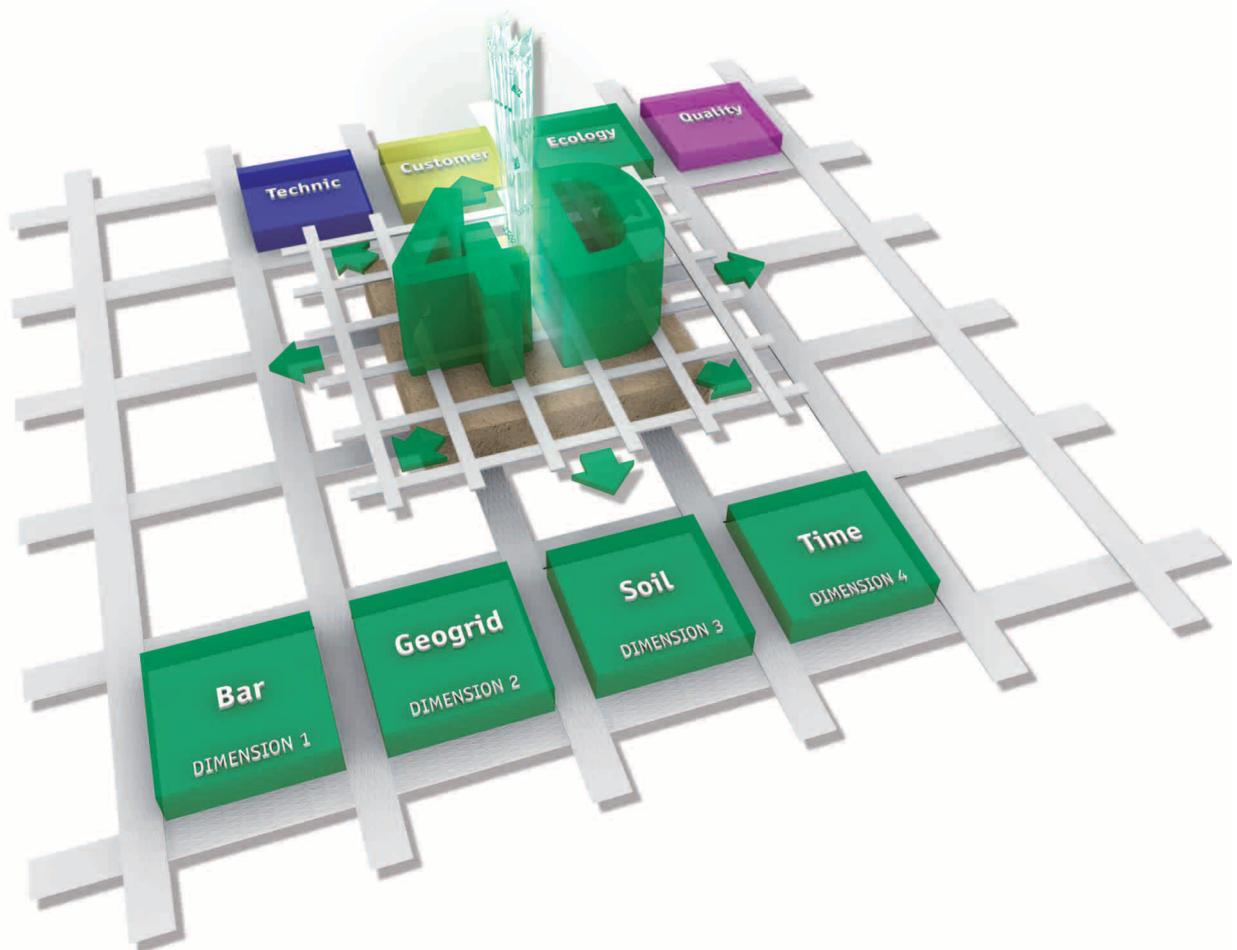
GET THE SOLUTION. TRY NAUE.

the **FOUR**DIMENSIONS of  
Secugrid®



bar | geogrid | soil | time



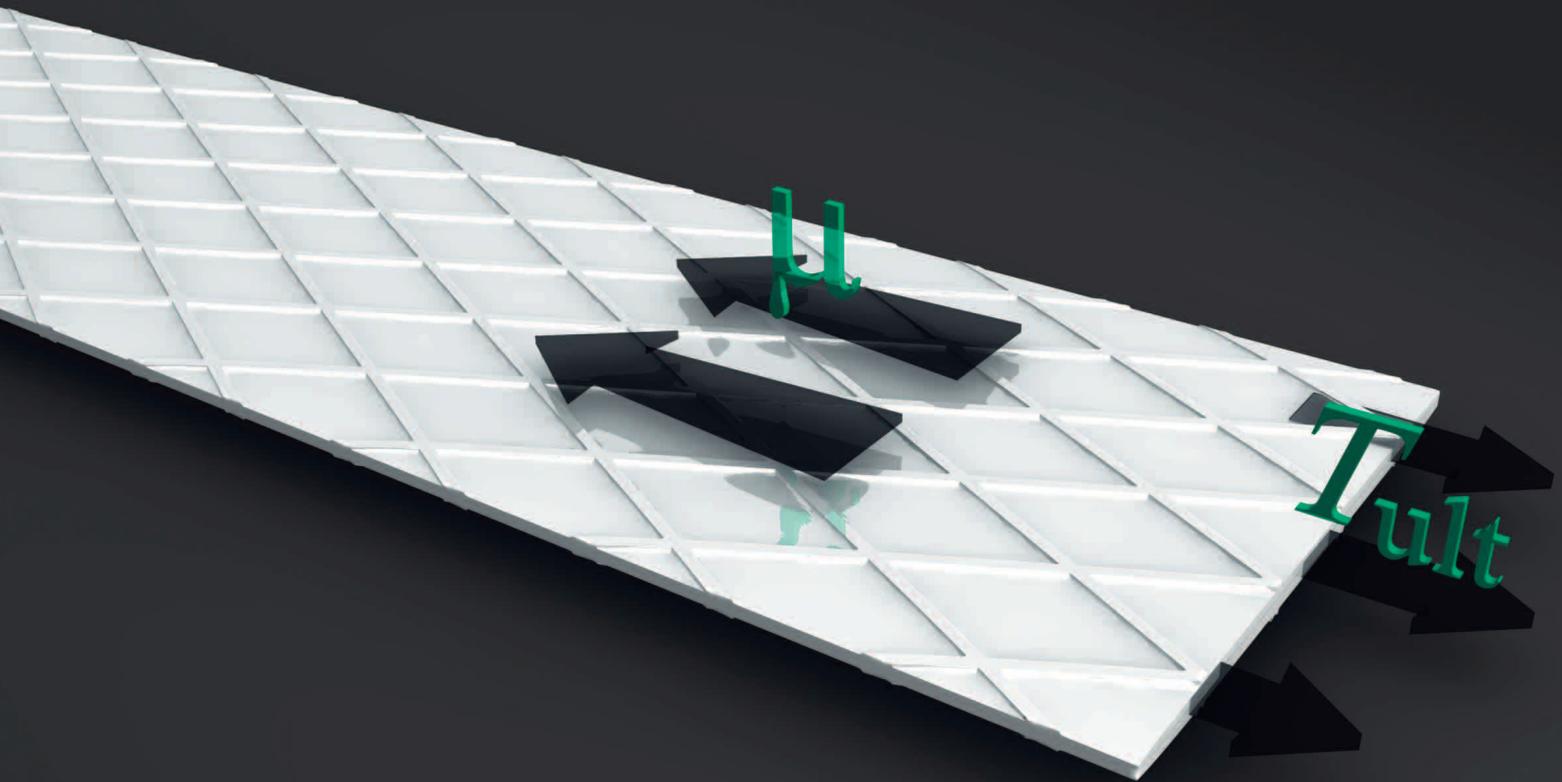


The four dimensions of length (the bar), width (the geogrid), depth (the soil) and the time (durability) greatly influence construction project scope, design, product selection and expected service life. Today, NAUE introduces you to a new four-dimensional way of understanding reinforcement applications: the Four Dimensions of Secugrid®.

# DIMENSION 1

## Length - The bar

### Strength transfer



**Technical advantages:** High-strength, high-modulus, robust geogrid bars for sustainable performance

**Customer advantages:** Safe and long-lasting stress transfer in the design

**Quality advantages:** Superior manufacturing method for ensuring reinforcement strength

**Ecological advantages:** Roads hold up better with less aggregate; steep walls can be built.

Geogrids provide vital reinforcement to roads (paved and unpaved), retaining walls and mechanically stabilised earth (MSE) structures. A reinforcement material must transfer strength appropriately to allow these constructions to survive their prolonged stresses and applied loads. When it comes to geogrid selection, because of the complexity of these polymeric materials you must consider the manufacturing method used in order to properly select a material with good strength transfer performance in the geogrid bars. That transfer strength is the key to project success.

NAUE Secugrid® is manufactured with extruded flat polyester or polypropylene bars that pass over rollers running at different speeds. The rollers uniformly stretch the bars and

uniformly orientate the polymers into high-tenacity flat bars. With this process strong, uniform strength is achieved in all Secugrid® bars.

Strength is not the only important factor for a safe reinforcement design. A very high modulus is just as important. This means that this product will pick up the stresses quickly

with little or no movement in the overlying base materials. The performance of the geogrid at a stress/strain ratio in the range of 2% is therefore important, and here Secugrid® shows its strength. Secugrid® has excellent tensile strengths

at low elongations and demonstrates its advantages in the critical elongation ranges.

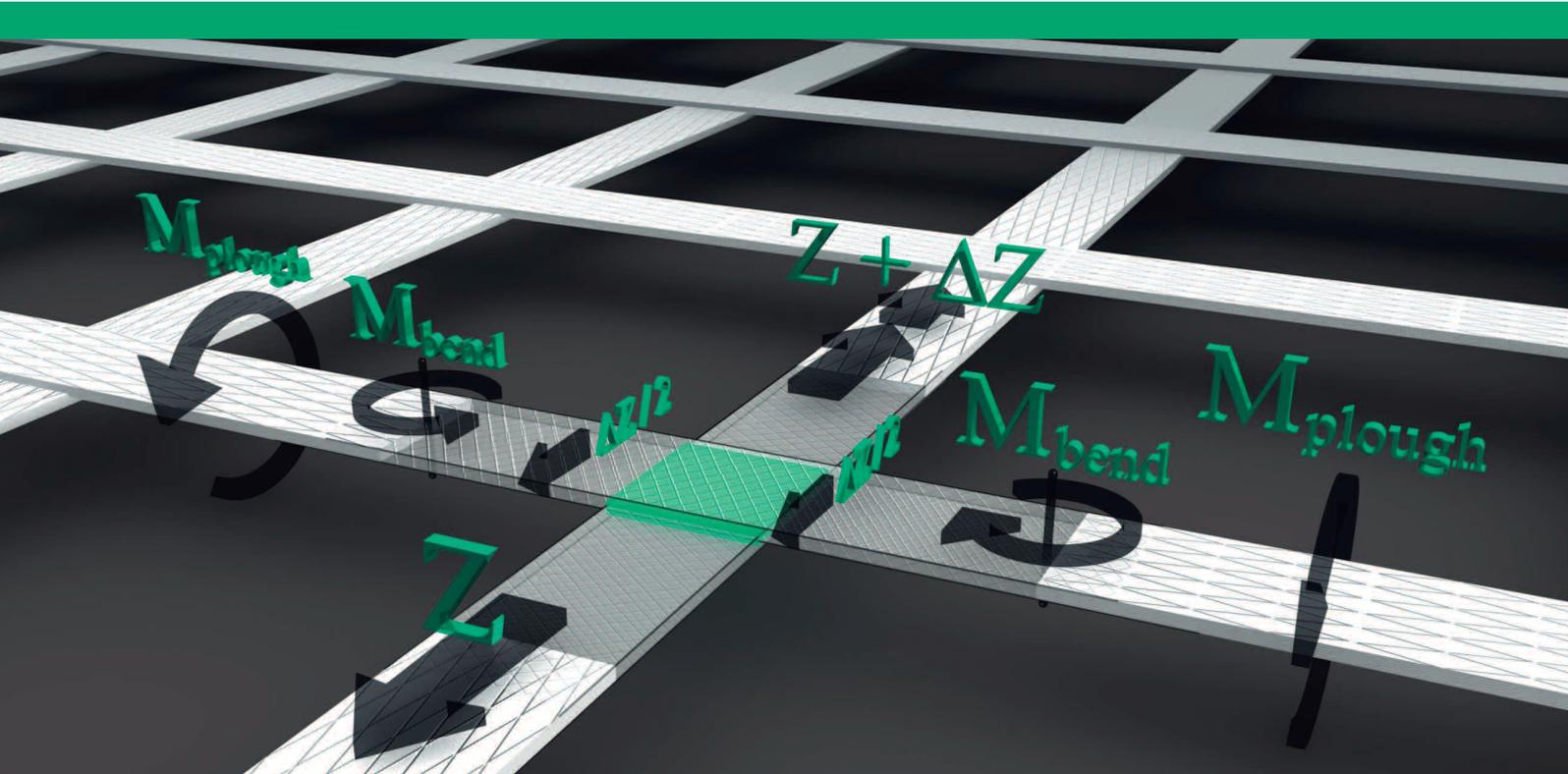
The result of this is a reinforcement bar with very strong initial modulus, stiffness and robustness. Further, the bars are uniformly structured, creating additional friction against the soil.

*»The shortest distance for strength transfer between two points is a bar.«*

# DIMENSION 2

## Width - The geogrid

### Radial Interlocking



**Technical advantages:** True biaxial strength and radial stress transfer and interlocking  
**Customer advantages:** Reduced long-term maintenance issues. Ease of installation  
**Quality advantages:** Round the clock quality control, ISO 9001 audited, CE marking  
**Ecological advantages:** Optimised Secugrid® for soil reinforcement reduces transport needs (and costs) to site

These Dimension 1 bars are fed into welding equipment in which cross-machine direction ribs are introduced and are welded together; thus, forming the two-dimensional apertures - the openings - in the geogrid.

The result of this is a reinforcement material with very strong initial modulus, stiffness and aperture size (square or rectangle) characteristics for multi-directional, bi-axial or uni-axial reinforcement applications. Further, the materials can be shipped in rolls and unrolled quickly and easily at the site. The durability of the material helps guard against installation damage.

One of the most common uses of geogrids is for the reinforcement of soft and compressible foundation soils for paved and unpaved roads. Though this application is common,

*»The circle in the square.«*

not all geogrids are appropriate for this function. Key to success is specifying a product with a true biaxial strength, the ability to improve radial interlocking in the base aggregate and stress transfer through the aggregate to prevent pumping, the mixing of fines, rutting and road erosion.

When inserted into a base course layer, the stiffness and strength of NAUE Secugrid® interlocks with the aggregate,

restraining the aggregate laterally. As loads are applied to the road (or rail) system above, the tensile forces are transmitted from the aggregate to the geogrid. These lateral stresses and strains are then reduced.

As the aggregate interlocks laterally with the geogrid and the stress is transferred to the reinforcement, the risk of vertical deformation (rut depth) at the road surface is greatly reduced. The integrity of the installation is protected in all directions.

# DIMENSION 3

## Depth - The soil

### Less aggregate or steeper walls



As noted in Dimensions 1 and 2, the strength and stress transfer characteristics of Secugrid® greatly improve the performance of aggregate base course in roads and, additionally, provide long-term creep-resistance for critical applications such as mechanically stabilised earth (MSE) wall designs. Two other benefits must be considered alongside Di-

The interaction between Secugrid® and base aggregate increases the elastic modulus. Thus, the stiffness or load distribution capacity of the base course is improved. As such, less aggregate is needed in the base course - a fact that can equate to significant savings. Aggregate is heavy and expensive to transport. Site prepara-

tion service life and reducing long-term maintenance needs through a better performing construction.

In developed areas where quality building sites and space are tough to come by or where project economy and space are an issue, steeper MSE walls may be achieved with strong geogrid reinforcement. The high-strength, low-elongation stress/strain characteristics of Secugrid® provide veneer stabilisation and enable taller

walls even on severe angles such as 1:1.5 (H:V), whether it's a mountain road, a commercial development, or a municipal solid waste (MSW) land-

fill. Steeper constructions also limit overall site disturbance, which is a well-appreciated and recognised environmental benefit.

#### Technical advantages:

High stress/strain characteristic provides multiple benefits - better distribution of tensile forces, longer service lives, improved long-term project economy, and much more

#### Customer advantages:

Reduced dependency on aggregate, less long-term maintenance, maximised site use

**Quality advantages:** The wide range of quality products made of polypropylene or polyester with strengths up to 400 kN/m

**Ecological advantages:** Maximising space use is a project characteristic that improves sustainability. Reducing material shipments (e.g., heavy aggregate) is also an important environmental benefit

*»Step over the edge and test the new dimension.«*

# DIMENSION 4

## Time - durability

### Sustainability



There are many sayings about time, and nearly all of them stress the importance of acting now what saves later. This is very much true in regards to the use of geogrid reinforcement. Not only does it make previously impossible designs possible (such as the scale on which modern MSE walls can be built), it greatly improves the longevity of standard and unique constructions.

The other three dimensions of Secugrid® underscore the vital characteristics that make this fourth dimension possible: strength transfer in the geogrid bars due to Secugrid's ma-

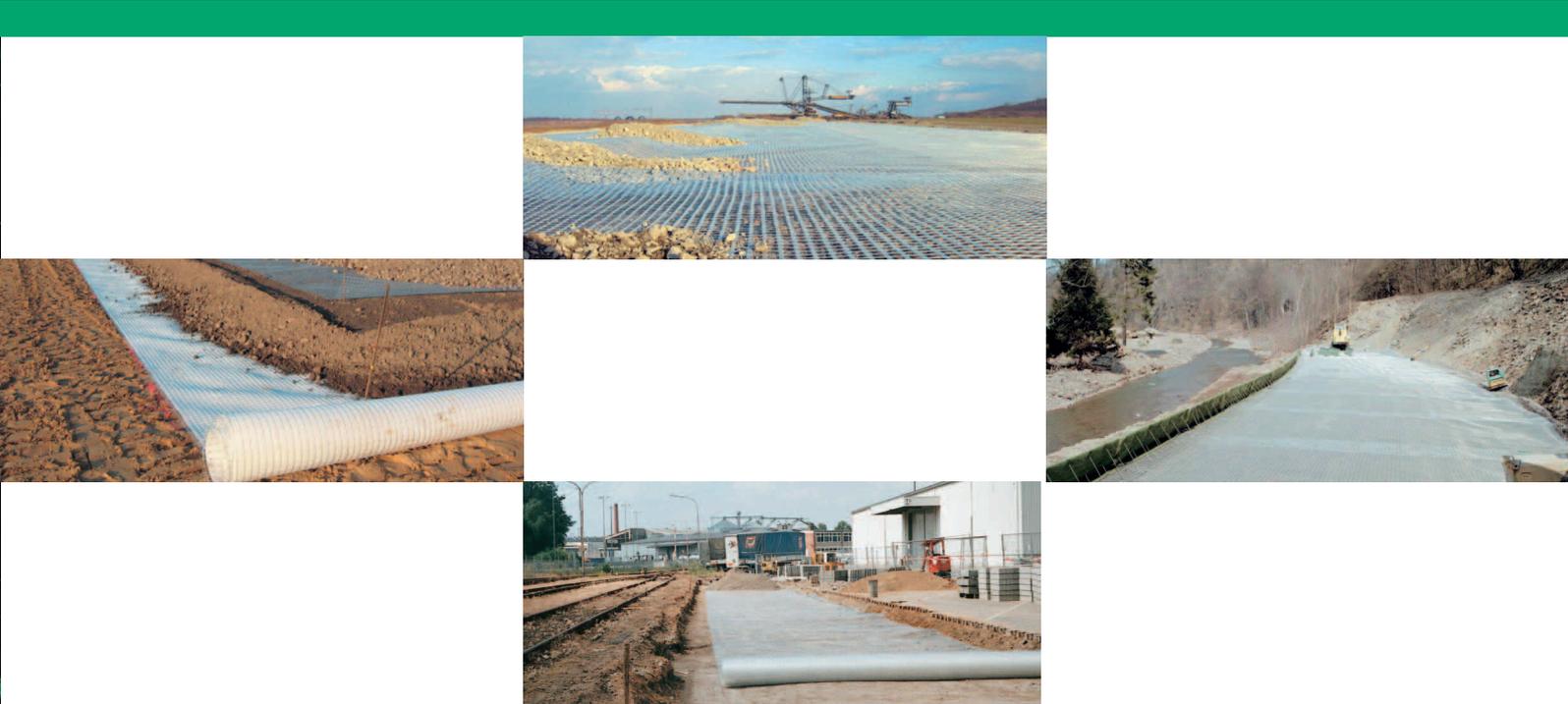
**Technical advantages:** Long-term resistance and performance of Secugrid® soil reinforcement geogrids  
**Customer advantages:** Quicker installation in the project, longer lasting design  
**Quality advantages:** Excellent and durable long-term creep performance  
**Ecological advantages:** Long-lasting designs, reducing carbon footprint and minimising use of finite resources

»Time is money.  
Time is of the essence.  
A stitch in time saves nine....«

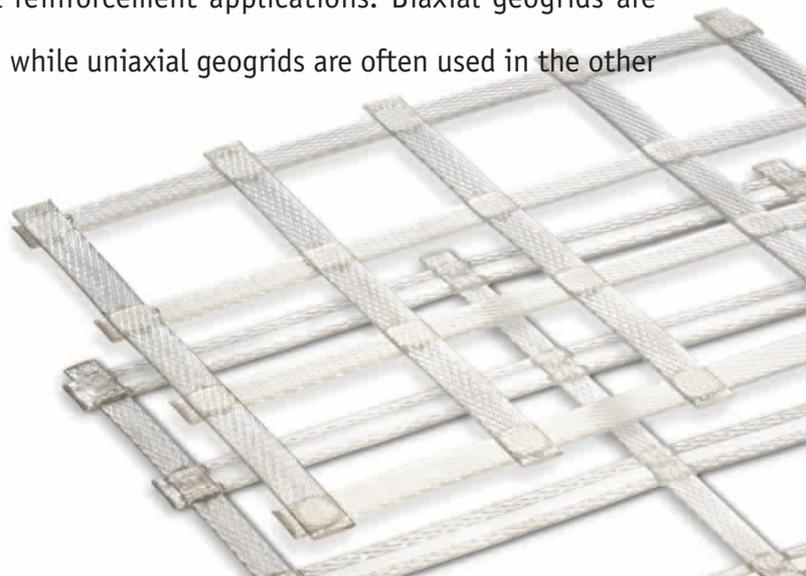
nufacturing process; the radial interlocking of aggregate and the transfer of stresses to the geogrid; and the reduced need for aggregate in base course and the strength to construct steeper walls.

These material characteristics improve both immediate and long-term issues of time: faster installations without sacrificing quality; significantly slowed degradation and reflective-cracking of roads (meaning, less maintenance over time); reduced site disturbance; and greater longevity due to the higher internal

strength of these constructions. All of the advantages of Secugrid® in this dimension lead to project cost savings and better performance, today and in the future.



Secugrid® geogrids are produced with a new dimension of manufacturing technology. The reinforcement element is a highly-oriented polypropylene or polyester bar that is uniformly extruded and drawn to achieve a high modulus and high strength at low elongations. This is combined with the NAUE-patented welding technology to provide a structurally sound and stable geogrid. Secugrid® is used mainly for base reinforcement, mechanically stabilised earth (MSE) wall construction including veneer stabilisation, the segmental retaining wall (SRW) market, embankment reinforcement, load transfer platforms over pile caps and other soil reinforcement applications. Biaxial geogrids are primarily used in base reinforcement applications, while uniaxial geogrids are often used in the other markets.





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