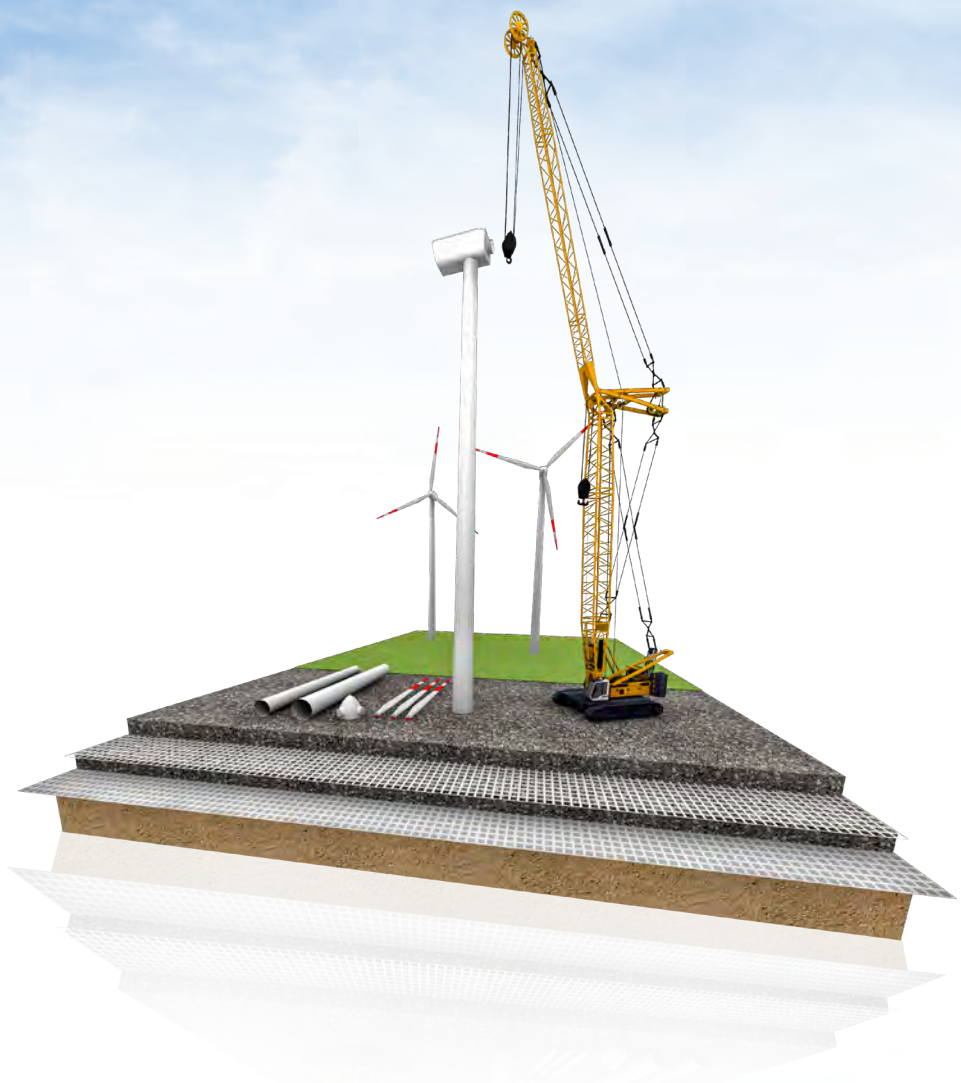
# THE WORKING PLATFORM SOLUTION



NAUE

Every year, cranes, piling rigs and rotary drill rigs fall over or become unstable due to inadequately prepared or maintained onsite ground conditions. These types of events can cause potential fatalities, serious injuries and cause extensive damage to equipment.

Therefore temporary granular platforms are now becoming a requirement for almost all construction sites. Unfortunately, the need to ensure that they are designed correctly and are fit for purpose has often been overlooked.

Modern equipment is becoming increasingly heavier and with the demands for deeper and larger diameter foundations, this has resulted in equipment with a higher centre of gravity.

Figure 1: Max. load condition 250t counterweight above test field, Salbatica II Wind Farm Romania

To promote safety in the design, installation and operation of these platforms the UK Centre of building science (Building Research Establishment Ltd (BRE)) has published a good practice guide. BRE BR470 [1] provides an overall framework reference for the design, installation and maintenance of granular platforms. It covers unreinforced and reinforced granular platforms on both cohesive and non-cohesive subgrades. It also provides, possibly, the most widely used analytical methods currently used for granular platforms.

The analytical method is based on classical bearing capacity methods but uses the concept of punching shear capacity within the platform. Instead of assuming load distribution through the platform, it is assumed that punching shear resistance develops within the platform thus partially supporting the applied load and reducing bearing pressures on the formation, as shown in figure 2.

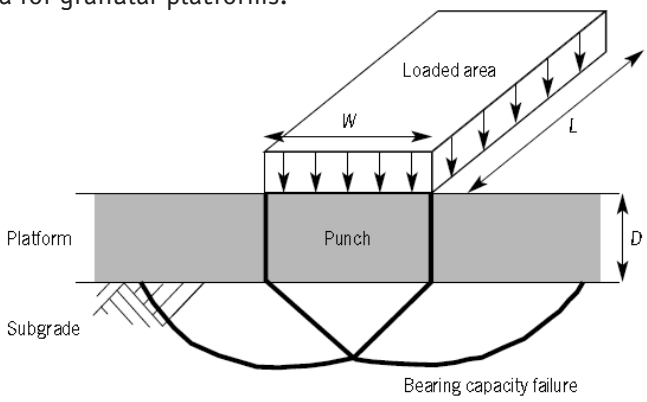



Figure 2: Punching Failure Mechanism

It is stated in BR470 that alternative methods may be adopted and the use of geosynthetic manufacturer's design methods was expanded on in a supplement, "Use of 'structural geosynthetic reinforcement' – a BRE review seven years on" (issued by the BRE in 2011) [2].

**The methods and the assumptions used can include:**

- Increased angle of load distribution
- Enhancement of formation bearing capacity
- Experimental determination of load distribution improvement factor (for reinforced vs unreinforced platforms)
- Use of bespoke partial factors

**When using the advice and design methods provided by geosynthetic manufacturers it is also recommended that:**

- Experimental testing and theoretical design is representative of actual installation and use conditions.
- Experimental testing and theoretical design are validated by representative case studies.
- Products are certified by an independent accreditation body, e.g. CE Marking or equivalent.
- Design responsibility is clearly defined and the manufacturer carries suitable professional indemnity insurance.
- The design methods and/or software developed for an individual manufacturer or product is bespoke and must not be used for other manufacturers or products.

NAUE's wholly owned subsidiary BBG, geosynthetic consultant in Germany can undertake all such design work. It is our belief and requirement that all work should be transparent, allowing for third party independent checks should they be required.

Over the years NAUE has done considerable research into the performance of our Secugrid® and Combigrid® geogrid range of products in working platforms. This has involved both laboratory and full scale trials such as the ones carried out on the Salbatica II Wind Farm in Romania. Pressure and settlement gauges were installed along with strain gauges applied on the Combigrid® to analyse the effects on the geogrid.

Figure 3: Measurement of settlements, stresses and strains, Salbatica II Wind Farm Romania

Figure 4: Installation of geogrid sample, Salbatica II Wind Farm Romania

## Advantages of Secugrid® and Combigrid®

- Very high strength at low strains
- Immediate interlocking effect
- High angles of friction due to textured geogrid surfaces
- High aperture stability
- High radial stiffness
- Uniaxial geogrid strengths up to 500kN/m
- Available with bonded Secutex® nonwoven (Combigrid®)
- Quick and easy to install
- High resistance to installation damage
- Made from uniformly extruded solid PET or PP bars
- High resistance against biological and chemical attack

## Secugrid® Soil Reinforcement - Technical Back-up

Secugrid® geogrids are manufactured from high-quality polypropylene (PP) or polyester (PET) bars which are welded firmly together, providing a structurally sound and stable geogrid.

Highly orientated bars of Secugrid® that are uniformly extruded and drawn, enable high tensile strength at low strains. The roughened surface of these individual bars increases frictional properties, which allows especially fine-grained materials to transfer loads to the Secugrid® reinforcement.

The exceptional stress/strain behavior at low elongation is vital to reinforcement success and long-term performance, such as in roadway subgrades (figure 4).

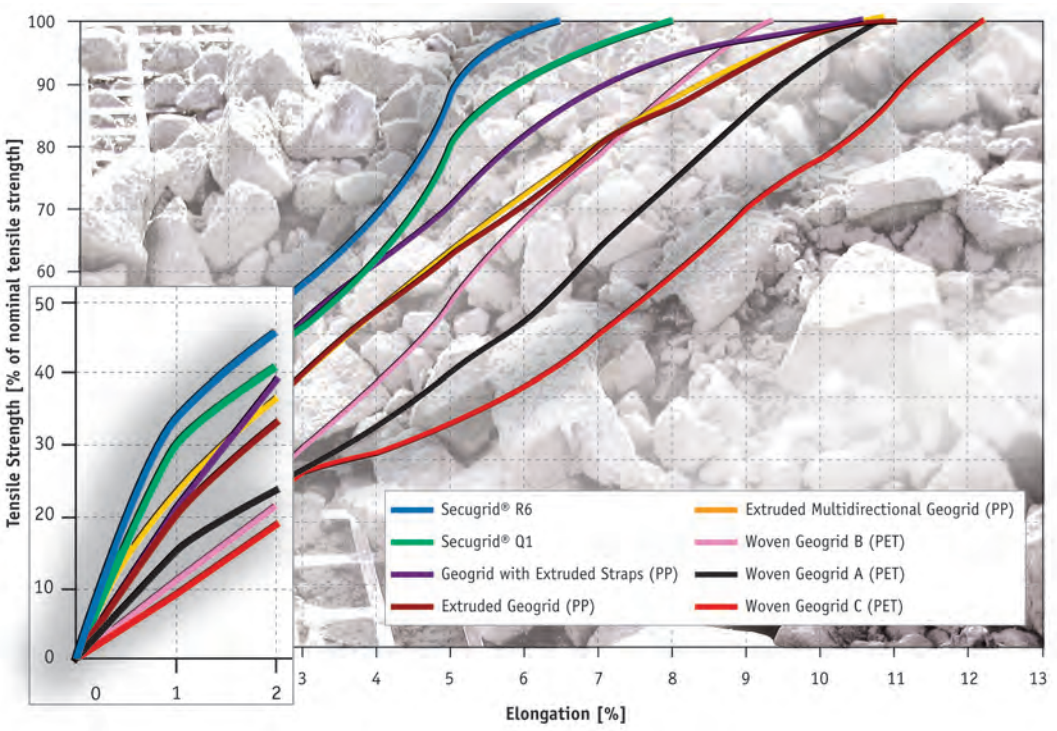



Figure 4: Typical tensile strength/elongation curves for Secugrid® and market available geogrids

As loads are applied, the aggregate interlocks with the Secugrid® geogrid layer. The superior junction strength of Secugrid® creates excellent aperture stability to support an aggregate layer with high lateral restraint.

The high torsional stiffness of Secugrid® provides greater resistance against twisting stresses and pullout, so the interlocked aggregate layer remains confined not only laterally but vertically. The radial strength at

low elongations reduces deformations in the subgrade and preserves the reinforced surface. The bearing capacity of the reinforced aggregate layer is increased. The maintenance needs are greatly reduced and the service life is extended.

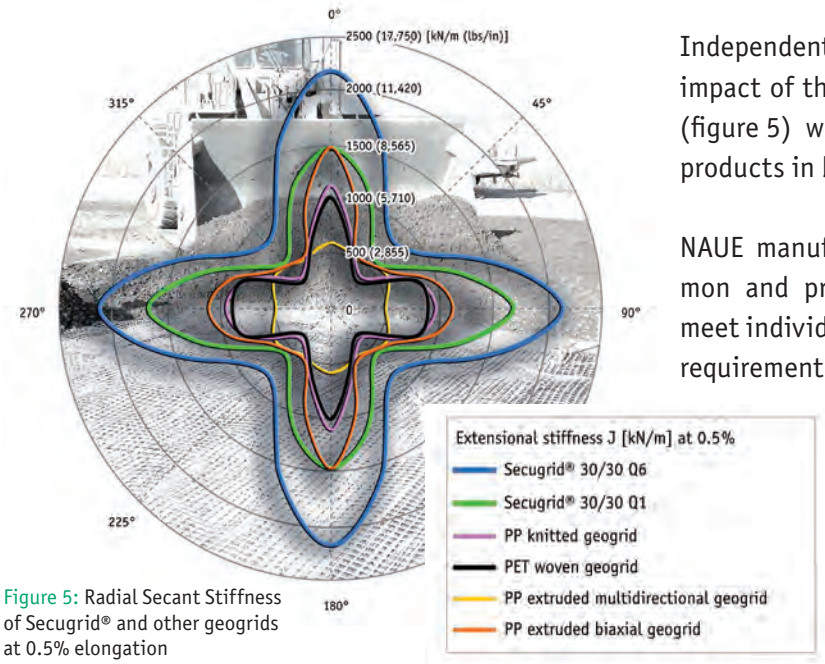



Figure 5: Radial Secant Stiffness of Secugrid® and other geogrids at 0.5% elongation

Independent testing has shown the beneficial impact of the high radial stiffness of Secugrid® (figure 5) when compared to similar available products in base course structures.

NAUE manufactures Secugrid® in various common and project-specific tensile strengths to meet individual project design and specification requirements. Easy installation on the jobsite and a high resistance to installation damage complete the high performance quality of Secugrid® geogrids.

## Combigrid® - The solution on soft soils

Reinforcement alone is not always enough. Additional engineering functions may be required in the reinforcement layer, such as separation, filtration and drainage. Combigrid® combines all of these requirements in a single product. This composite product combines a Secugrid® geogrid with a needle-punched Secutex® nonwoven geotextile.

The geotextile is firmly welded between the reinforcement bars, providing exceptional support for soil stabilisation, separation and filtration applications in addition to the geogrid's reinforcement strength.

The unique manufacturing process leads to an interlocking behaviour equal to Secugrid®. The unique addition of separation, filtration and drainage characteristics means that, in general, Combigrid® is used in subsoils with a CBR value of less than 3%. Typical areas of application include reinforcement of base courses, foundations, access roads, pipeline trenches and roads.

**Sources:**


[1] Building Research Establishment (2004): Working platforms for tracked plant: Good practice guide to the design, installation, maintenance and repair of ground-supported working platforms (BR470), UK

[2] Building Research Establishment (2011): BR 470 working platforms for tracked plant – Use of "structural geosynthetic reinforcement". BRE review seven years on, UK



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Approvals for the NAUE Group

Bentofix® BFG 5000
Bentofix® X2 BFG 5300

Secugrid® Q6, R6 and HS R6