Base Reinforcement

Geosynthetics for Roads and Pavements

HUESKER
Ideas. Engineers. Innovations.

Geogrids for base reinforcement

The unbound layers of roads and other pavements are subject to stringent requirements in terms of bearing capacity. Where the subgrade exhibits insufficient strength, additional measures often need to be taken to achieve the required bearing capacity.

Here, geosynthetics-based systems are becoming an increasingly popular alternative to standard techniques such as soil replacement or cement/lime stabilization. HUESKER's geogrid products for base reinforcement are a case in point: their application saves valuable resources and frequently delivers a more cost-effective, eco-efficient substainable solution than conventional methods.

Our geogrids for the reinforcement of base courses (i.e. roadbases and subbases) are flexible and offer a high tensile strength in conjunction with low strain. They are manufactured, as standard, in a range of different raw materials (PP, PET) widths and tensile strengths.

Design goals met by HUESKER's base reinforcement geogrids:

- Increase in bearing capacity or reduction in required base course thickness, particularly for weak subgrades. Indeed, in exceptionally poor ground conditions, the installation of a base course only becomes possible through the use of HUESKER geogrids.
- Decrease in rutting on unbound pavement structures exposed to track-making vehicles (e.g. heavy construction site traffic). Not only does reduced rut formation cut the cost of reprofiling, it also ensures the steady flow of site traffic.
- Bridging and evening out of non-uniform subgradesand weak points (e.g. peat lenses). Differential settlement is particularly likely to occur where inhomogeneous subgrades are exposed to regular loads. By bridging these weak points, our geogrids guarantee durable and permanently level surfaces.

In the geocomposite product DuoGrid®, our geogrids are combined with a nonwoven geotextile, which serves as a separation and filter layer. By preventing the migration of fine particles into the base course, the nonwoven ensures the long-term retention of bearing capacity. The use of DuoGrid® also saves time as it eliminates the need for multiple deployments. Moreover, our woven grids do not exhibit any "memory effect", i.e. they do not roll up or spring back after laying, thus allowing fast and simple installation without additional fixing.

Functions and mechanisms

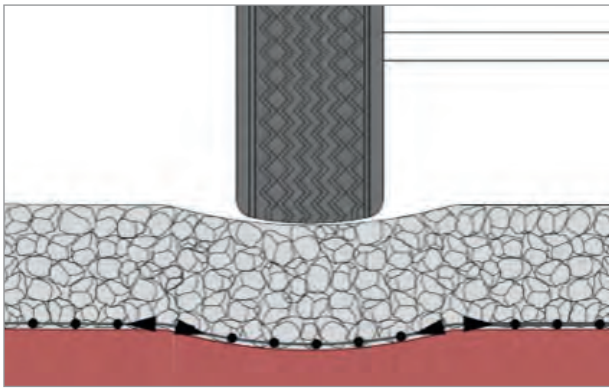
Thanks to their flexibility, HUESKER geogrids adapt perfectly to the shape of the granular base material. The resulting prestress in the grid allows the direct accommodation of loads through friction at the contact surface between the geogrid and the fractured faces of the stone material. The interlock between the granular base material and the apertures of the grid is such as to ensure the immediate mobilization of sufficient tensile strength at the required location.

The resulting "rigid" base course increases the bearing capacity of the overall system while efficiently offsetting any inhomogeneities and counteracting rut formation or single-point failures.

As part of the overall pavement system, flexible HUESKER geogrids – available in a variety of strengths – ensure the structural integrity of the base course and strengthens this against dynamic loads.

A distinction can be drawn between the various mechanisms that operate when HUESKER's geogrids are used for base reinforcement.

A. Membrane effect

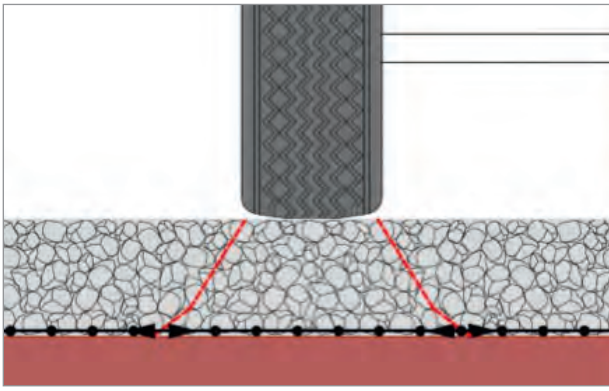


The membrane effect ensures the accommodation of loads, among other things, through optimum interlock between the reinforcement grid and surrounding soil or base material and through friction at the contact surface between the geogrid and the fractured faces of the stone material.

As a rule, the forces acting on the ground take the form of vertical wheel loads. In weak subgrades, this action results in vertical deformation. Ideally, the geogrid will adapt to this deformation, with its tensile strength mobilized in the direction of tension at the edge zones. For this mechanism to operate, it is essential to create a strong interlock between ground and geogrid so as to prevent the geosynthetic from "slipping". This is where our flexible geogrids come into their own: their high flexibility and adaptability to the surrounding ground and the accordingly strong anchorage allows the mobilization of high tensile forces.

Laboratory investigations – mainly in the form of "pull-out tests" – have confirmed the excellent interlock achieved by our geogrids in the geogrid/soil composite system.

B. Load-spreading effect

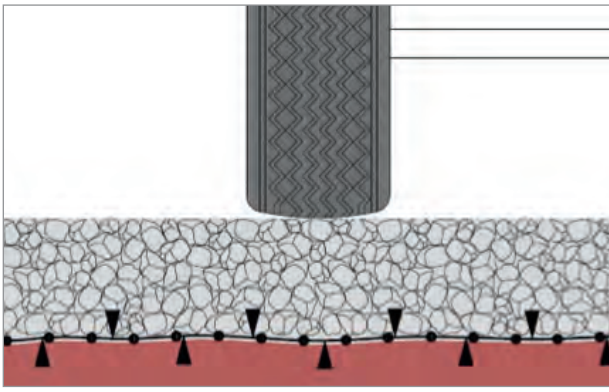


In areas subject to concentrated load application (e.g. wheel loads), HUESKER geogrids are able to accommodate the resulting tensile forces and spread these over a wider area. This load-spreading effect stems from the lateral support of the granular base material provided by its interlocking action with the grid.

By engaging with the grid apertures, the granular material is supported and held firmly in position. This, in turn, increases the internal angle of friction of the base course and improves the lateral distribution of vertical loads over the subgrade. The weak subgrade is consequently subjected to lower vertical stresses and the overall settlement of the ground is reduced.

The interlock between the granular base material and the reinforcement also serves to limit the lateral deformation of the base course. This facilitates the initial compaction of base courses on weaker subgrades, with the concentration of compaction energy brought about by the inclusion of geogrids resulting in significantly higher compaction levels.

C. Separating function



HUESKER geogrids, in particular the geocomposite products, ensure that the high-grade granular base material remains separate from the weak subgrade. This separating action prevents the base material from being pressed into the subgrade. Our geocomposite products are also stopping fine particles from the subgrade from infiltrating the base course (so-called "pumping effect").

The use of HUESKER geogrids thereby prevents any loss in the shear strength, and thus retains the soil-mechanical properties, of the granular base material.

Construction installation damage

Most instances of damage to geogrids occur during installation and compaction of the granular base material. During manufacture, HUESKER geogrids are finished with a polymer coating to protect them against both installation damage and UV exposure radiation. The inherent flexibility of our geogrids enables them to wrap easily around the granular material, thus avoiding or reducing stress concentrations on the ribs of the grid.

This helps to minimize damage to the grids, especially during compaction. Additional benefits result from the use of multifilament yarn in the manufacture of HUESKER geogrids. Unlike with monofilament geogrids, any failures do not affect the entire rib, but only part of this, which means that a high residual strength is still maintained.

Example:
If an incision is made to half the thickness of a multifilament rib with a tensile strength of 10 kN, it will still exhibit a tensile strength of 5 kN. By contrast, a notch cut to half the diameter of a monolithic member (e.g. rod) will lead to a steady loss of strength, if not complete failure, as the damage propagates. This is one of the reasons why safety ropes are made from multifilament products.

Maximum resistance to mechanical loads

Advantages at a glance

To summarize, HUESKER geogrids offer the following benefits over standard solutions:

- The use of geogrids serves to increase bearing capacity and allows base course thicknesses to be reduced. This, in turn, cuts the cost of installing base courses due to the smaller layer thicknesses and accordingly lower quantities of fill to be placed.
- Separation of the layers prevents the high-grade base material from being pressed into the soft subgrade, thereby eliminating the need to place additional material.
- The compaction level and thus the quality of the base course are enhanced.
- Construction times are shortened, thus ensuring the prompt and cost-effective completion of projects.
- The use of HUESKER geogrids allows the installation of long-lasting, high-quality base courses on weak or inhomogeneous subgrades.

Applications

HUESKER geogrids essentially lend themselves to use wherever base courses need to be installed on weak subgrades. A distinction can be drawn between temporary and permanent applications. HUESKER's Fornit®, Fortrac®, Comtrac® and Base geogrids offer useful additional alternatives in response to special, project-specific requirements. The main applications are as follows:

Installation of reinforced base courses for highways

Installation of base courses in airport engineering and runway shoulders

Construction of roads with unbound surface courses

Installation of reinforced base courses in railway engineering

Reinforcement of working platforms and access routes, e.g. for the construction of wind farms

Construction of car parks and storage areas

HUESKER inc.

10701-W South Commerce Boulevard
Charlotte, NC 28273
Phone: (704) 588-5500, (800) 942-9418
Fax: (704) 588-5988
E-mail: marketing@hueskerinc.com
Internet: www.huesker.com

Link to
image film:

HUESKER
Ideas. Engineers. Innovations.