Tensar®

TriAx®

Tensar® TriAx® Geogrids, as a Free-Draining Separation Barrier Between Aggregate Fills and Subgrades

The use of geogrids for stabilizing aggregate fill materials is well documented. But geosynthetics may also provide a separation barrier between aggregate fills and subgrade materials. The following is a brief overview of laboratory and field examinations of the use of stiff Tensar® TriAx® Geogrids functioning as separators.

Testing and experience have shown that TriAx Geogrids support the function of separation when properly graded aggregate fill is used. *TriAx Geogrids are not prone to "blinding out" or clogging which may occur with a geotextile used as a separation layer.*

FULL-SCALE LABORATORY TESTS

Tensar Geogrids have been used for subgrade stabilization for over 30 years. During this period of time, they have been subjected to extensive testing by a variety of independent agencies. The tests have proven that geogrids provide a stabilized composite structure that is more effective than an unbound aggregate layer.

In most tests, geogrids have been installed at the base-subgrade interface with a well-graded aggregate fill material used as the base. In some cases, test sections have been exhumed at the conclusion of the testing phase, and the base-subgrade interface examined.

- Identical pavement sections using two different Tensar Geogrids and a geotextile were tested in FHWA/MT-99-001/8138, conducted by the Department of Civil Engineering at Montana State University for the FHWA and the Montana Department of Transportation. This study concluded that, *"For all test sections, mixing of the subgrade and base course aggregate was not observed, ..."*
- In DOT/FAA/RD-92/25, performed at the U.S. Army Corps Engineers Waterways Experiment Station Geotechnical Laboratory, a similar finding was reported, *"Geogrid confines the subgrade material below the base, preventing or limiting the amount of subgrade rutting upheaval from penetrating into or through the base material. Without geogrid confinement, rutting upheaval can penetrate through the base layer..."*

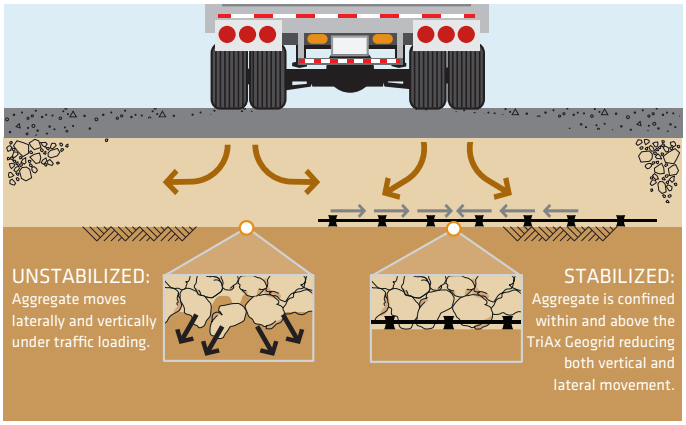
FIELD DEMONSTRATIONS

The ability of geogrid to separate aggregate fill and subgrade soil has also been demonstrated in the field. In these cases, the geogrid was placed over the subgrade and the base course installed. After years of use beneath heavy equipment and fully-loaded trucks, the base course was exhumed to observe if there was significant intermixing of the subgrade and aggregate fill material. The photos below show that geogrid effectively maintains separation.

Referencing this project, Morten Vanggaard of Franck Geoteknik AS, Denmark, stated: "The separation function of the long-established geogrids has been observed on several occasions. It was recorded on a Lorry Park project in the UK in 1995 after an installation period of eleven years. The following observations were made at the time of inspection: 1) The interface is distinct. There is no evidence of upward pumping of the cohesive subgrade or downward migration of the sub-base. 2) The geogrid is flat and level."

***NOTE:** Before beginning any project, please consult Tensar Pavement Optimization literature to assure optimum performance and verify fill specifications. Please see the reverse side for information on proper fill gradation to assure adequate filtration.*

After 11 years of traffic in a truck parking area, the boundary between the base and subgrade remains distinct. Tensar Geogrid is the only material used to separate the base and the subgrade.



Using TriAx Geogrids for subgrade stabilization changes the dynamics of the load interaction with the subgrade. By confining the fill and distributing the load, these stiff geogrids reduce pressure on the subgrade and increase its performance.

MECHANISM OF SEPARATION

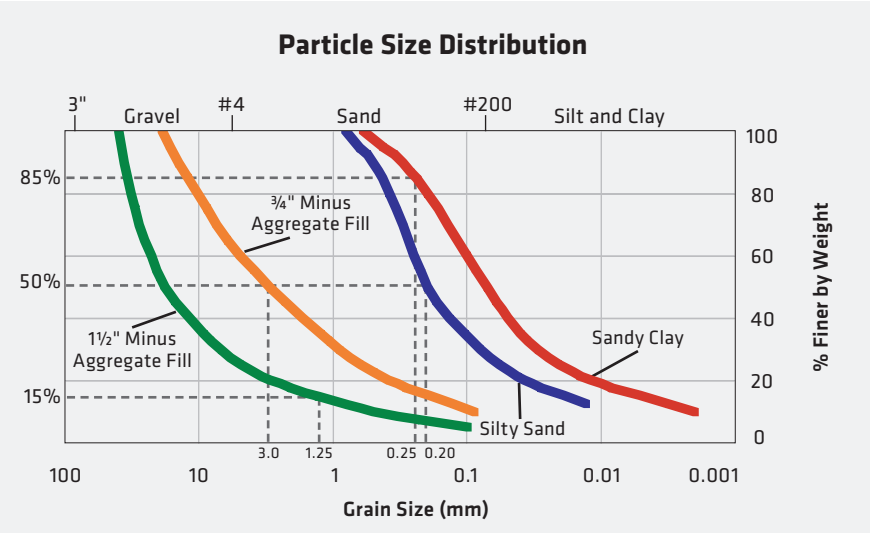
While it is not intuitive that a geogrid with open apertures could provide separation, the underlying science is relatively simple. The geogrid acts with the well-graded aggregate fill to create a filter that effectively stops the migration of fine subgrade soil particles. Consider the following:

1) A closed planar surface material, e.g. a geotextile, is not necessarily required to prevent intermixing. The mechanism is similar to that of a snowshoe which has open apertures, yet the snow does not seep through them. The snowshoe distributes a man's weight over a wide area, allowing him to walk on material that would not otherwise support him. TriAx® Geogrids work much the same way over a weak subgrade. The load is distributed over a wider area of the subgrade, reducing pressure on the subgrade, and therefore, reducing the tendency for intermixing at the boundary.

2) Consider how a sieve functions. A ½-in. sieve does not allow all of the particles smaller than ½-in. to go through unless the sieve is vibrated. TriAx Geogrids interlock with fill and inhibit movement at the base-subgrade interface. Movement is what causes the subgrade to "pump" up into the base course. Without movement, typical well-graded aggregate base material forms a filter (see chart above) and pumping does not occur. Thus, the base aggregate will not be contaminated.

3) Also consider the stabilization effect of a stiff geogrid. TriAx Geogrids act to inhibit movement within the aggregate fill, preventing lateral movement of the base away from the load. The aggregate interlocks with the grid, and the grid resists fill movement. This stabilization of the base layer also occurs in the vertical direction and in the plane of the grid itself. The internal friction of the aggregate and arching of the fill over the ribs of the grid results in vertical movement restriction. The base course material therefore acts in a more "monolithic" manner, resisting vertical and lateral displacement.

4) Finally, consider the durability of structures built with TriAx Geogrid. The failure mechanism of a base course is often related to the contamination of the base aggregate. Even 10% contamination can cause a significant loss of friction between the base particles. Without this friction, the aggregate will move away from the load, leading to rutting and pavement failure. TriAx Geogrid provides more durable base layers. If it did not separate the subgrade from the base, then it could not effectively stabilize the aggregate. The contamination of the base aggregate by subgrade pumping would weaken the base layer. Base layers become stronger when using TriAx Geogrids, as they remain unfouled by subgrade fines.



Proper gradation of aggregate fill to assure a free draining structural base, or subbase

Naturally occurring subgrades are virtually never uniformly fine; rather, they are comprised of a range of particle sizes. So are aggregate fills. Most aggregate bases are purposely graded to have particle size distributions such as the two left-most plots in the diagram above (green and orange lines). In addition to enhancing stability and constructability, graded aggregate fills are usually quite effective filters above fine-grained subgrades such as the two right-most plots above. If moisture is present in sufficient flow quantities to induce upward movement of subgrade fines, the pore spaces of the aggregate fill (f) must be small enough to hold in place the 85 percent size of the subgrade (s). The filter criteria, D15f/D85s, is called the piping ratio. If the piping ratio is less than 5 (10 for high plasticity subgrades), clay fines will not contaminate the fill. Notice for example how the piping ratio criterion is borderline on the chart above (1.25 mm / 0.25 mm = 5). Low plasticity subgrades of silt and very fine sand are inherently more mobile than clays and an additional filter criterion applies: D50f/D50s < 25. This criterion is met on the above chart (3.0 mm/0.20 mm = 15 < 25). Clearly, well-graded aggregate base is an effective natural filter for these subgrades when confined by a geogrid.

TriAx Geogrids support the function of separation when a properly graded fill is used for the site and subgrade conditions. Guidance on natural filtration has been outlined above. Seeing is believing – exhume your own section and examine the interface.

Distributed by:

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