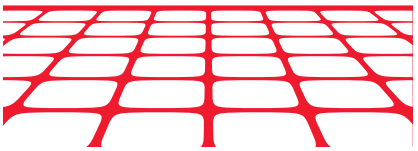
Tensar® Biaxial (BX) Geogrids For Construction Over Soft Soils



Tensar Earth Technologies, Inc.

Reinforcement, Separation, and Filtration

Tensar® Biaxial (BX) Geogrids Perform Better Under Real-World Conditions

The Spectra System consists of three primary components:

- Tensar BX Geogrids — stiff geosynthetic reinforcement
- Design — developed using SpectraPave2 Software or Tensar engineering services that include conceptual designs and design assistance
- Site Assistance — maximizes time efficiency and minimizes costs of project construction

Setting the Record Straight — Why Tensar BX Geogrids are superior to fabrics (geotextiles) when constructing over soft soils.

Common sense might suggest that fabrics are needed to separate aggregate fill from soft subgrade. Not necessarily! That is because the real challenge of building over soft soils is pressure — pressure that is mostly induced by heavy concentrated loads.

Unlike geotextiles, Tensar® Biaxial (BX) Geogrids provide a highly effective means for reducing pressure below the trafficked surface. BX Geogrid stiffness and open apertures create a "snowshoe effect" that evenly and broadly distributes load while inhibiting particle movement at the interface between interlocked fill and subgrade. Contrast this with the less efficient "hammock effect" and frictional resistance provided by fabrics.

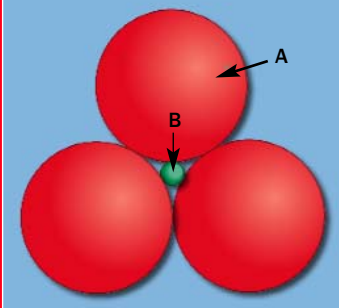
Even so, you might ask, "Isn't it important to keep erodible fines in the subgrade from moving up into the aggregate fill through open apertures?" In a word, "Yes". The phenomenon is called piping, and a simple calculation called "piping ratio" quantifies this potential under worst-case saturated conditions.*

Snowshoe Effect — Tensar BX Geogrids distribute heavy loads over soft soils just like a snowshoe supports the weight of a man over soft snow.

The figures (shown below) describe the mechanics, and the analysis (shown graphically on the following pages) illustrate the calculation. Basically, if the piping ratio is less than 5, the pore spaces (passageways) of the aggregate fill will be sufficiently small enough to hold the fine soil particles of the subgrade in place.* The two cases highlighted in this brochure illustrate the application of this principle.

**Note: For silty subgrades (P.I. < 7), "average size ratio" (D_{50f}/D_{50s}) must also be checked. This value should be less than 25.*

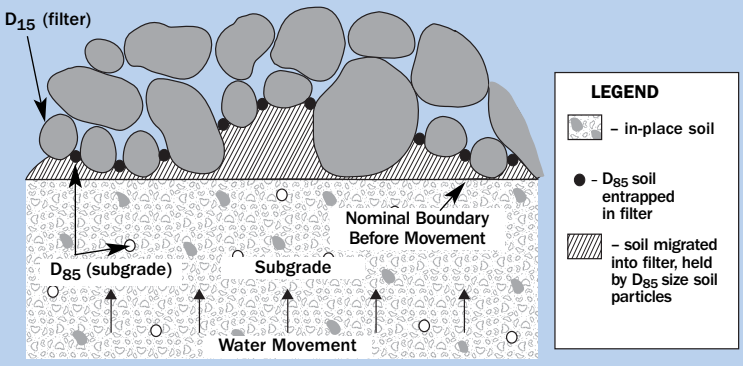
Particle Size Ratio Fundamental to Piping Concept



Spherical particle "B" will just pass through pore space between three spheres "A" 6 ½ times the diameter of "B".

This size ratio is approximately that of a pea to billard balls.

Preventing Piping with Graded (Natural) Filters



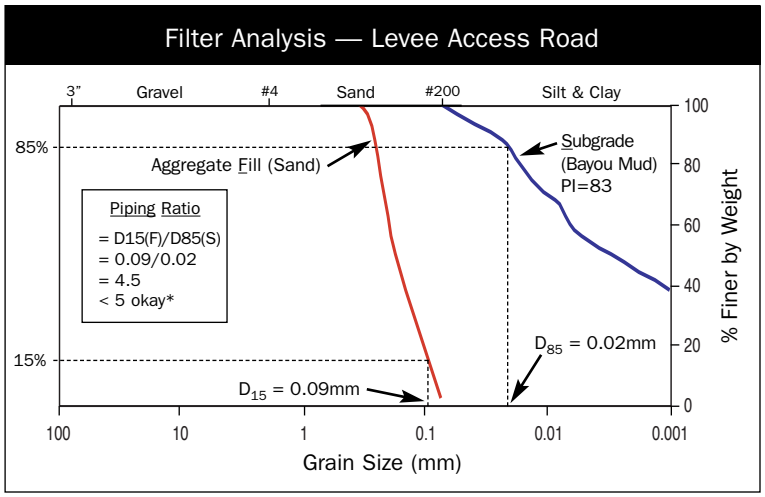
Reference: Cedergen, Harry R., "Seepage, Drainage, and Flow Nets," Third Edition. John Wiley & Sons, New York, 1989. pgs. 153 - 156.

Levee Access Road — Westminster, Louisiana

Tensar BX Geogrid in Action

How well does geogrid perform? The levee foundation and access road for this site in Louisiana were completed in 1988. Both structures were built with BX Geogrid. Because of the extremely soft soil conditions, an initial lift of fine sand was installed over the geogrid and Bayou mud subgrade. By applying piping principals, Tensar Earth Technologies engineers ensured that the distributed pore spaces within the sand fill would be small enough to hold the subsoil particles in place (see "Filter Analysis – Levee Access Road").

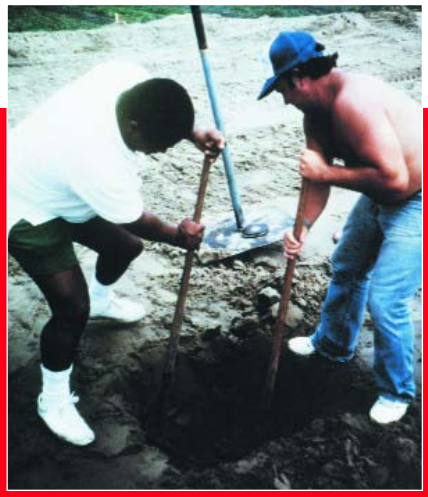
A test pit excavated in 2001, again showed no evidence of subsoil contamination. After more than 13 years of service, the Tensar BX Geogrid was still providing effective separation at the soil interface. In fact, representatives of the West Jefferson Levee District noted that the site was continuing to outperform all other comparable levee structures within the district.



Bayou mud subgrade at this site is a highly plastic, saturated clay (Plasticity Index (PI) = 83). Virtually 100% of the soil particles are finer than the No. 200 sieve (0.075 mm). That's finer than a person can discern by the naked eye. Aggregate fill is unprocessed dredge sand from the Mississippi Delta; virtually 0% of its particles are finer than the No. 200 sieve. Yet the fine sand is an effective filter for the clay, as evidenced by the piping ratio calculation and 14 years of successful performance.

* Subgrade PI > 7; therefore, there is no need to check Average Size Ratio (D_{50f}/D_{50s}).

The initial lift of sand received repeated trafficking by fully loaded dump trucks.

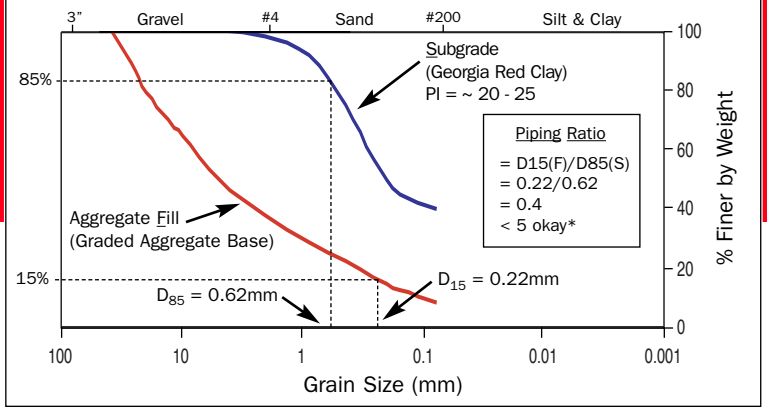


After completion of the sand construction, for both the access road and the mainline levee, excavations were made to install monitoring devices.

The excavation(s) at Westminster Levee revealed no contamination of black bayou mud within the light brown sand, all the way down to the Tensar BX Geogrid.

Manufacturing Plant — Morrow, Georgia

Filter Analysis — Industrial Plant Site



"Georgia Red Clay", like most naturally occurring subgrades, is not 100% clay sized. In many instances, like this one, there are as many or more sand-sized particles as clay-sized particles. As such, a DOT-grade base is a very effective filter, as evidenced by the piping ratio calculation.

* Subgrade PI > 7; therefore, there is no need to check Average Size Ratio (D_{50f}/D_{50s}).

Tensar BX Geogrid in Action

BX Geogrid performs equally well in more routine conditions. The storage yard for this manufacturing plant rests on "Georgia Red Clay" topped by Tensar BX Geogrid and standard, well graded DOT-type aggregate base.

Despite its color, the clay soil at this site is quite similar in terms of particle size (see analysis above) to soils in many other geographic locations. The pad supports a high volume of heavy equipment traffic, which in turn generates significant subsurface pressures. Examination of several test pits excavated at the site revealed that the aggregate fill was continuing to function as a "natural" filter, and that the geogrid reinforcement was maintaining a clear separation between the aggregate and subsoil.

A storage yard for the plant is created by applying a single lift of GAB atop Tensar BX Geogrid laid over "Georgia Red Clay".

The unpaved Graded Aggregate Base (GAB) surface receives repeated forklift traffic during dry as well as wet weather.

An excavation through the BX Geogrid interface shows that underlying red clay particles do not exist within the overlying well-graded aggregate base.

Tensar BX Geogrids are provided by:

To find out how we can help you on your next project, call 800-TENSAR-1, send an e-mail to info@tensarcorp.com, or visit www.tensarcorp.com

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