TENCATE

TenCate Solutions for Subgrade Stabilization

TENCATE GEOSYNTHETICS

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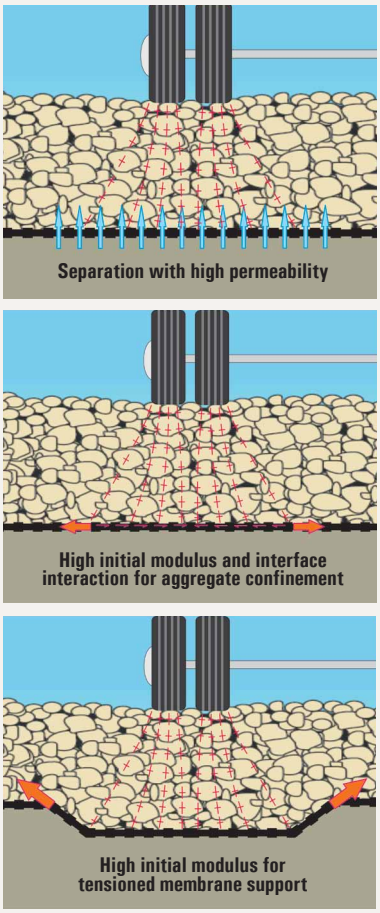


Pavement technology has demonstrated the following:

- An effective separation geotextile requires high permeability to allow rapid dissipation of excess pore pressures built up during transient wheel load passes.
- The initial tensile stiffness modulus (typically at 2% strain) in the geotextile inclusion is the key performance property for the reinforcement function and effectiveness.
- Good interaction properties between the geotextile and aggregate at the interface is responsible for effective lateral restraint of the aggregate layer.

The degree of improvement differs from product to product. For example, woven slit tape geotextiles offer the separation function but have low permeability. Nonwoven geotextiles offer the separation function with high permeability but they lack tensile modulus necessary for the reinforcement function. While geogrids provide lateral restraint of aggregates and tensile modulus for the reinforcement function, they do not have the separation capability.

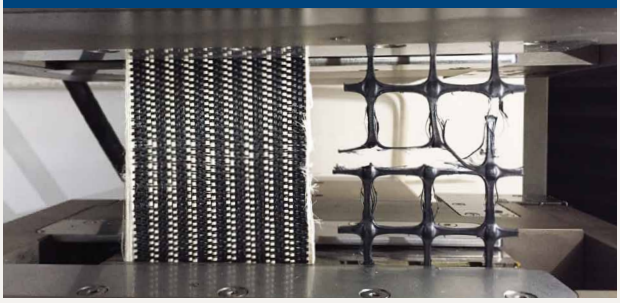
All roadway systems, be it temporary or permanent, derive their support from the underlying subgrade soils. They are serviceability controlled in design. The performance and design failure criteria are governed by limiting surface rut depths. The subgrade soils are therefore working at very low soil strains or within the elastic phase. For any geotextile or geogrid to be able to contribute basecourse reinforcement benefits, it must have the necessary tensile modulus at equally compatible low strains. Studies have found that the geotextile or geogrid tensile stiffness modulus at 2% strain is representative of the working strain levels at the aggregate and subgrade interface. When designing and specifying for basecourse reinforcement, the tensile stiffness modulus at 2% strain is therefore used.

Mirafi® HPa Subgrade Stabilization Performance

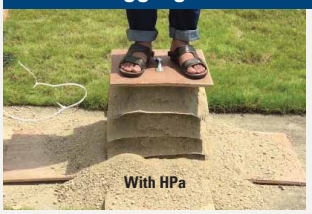
Mirafi® HPa is a specially developed class of geotextiles that combines all the critical performance functions for optimum subgrade stabilization design of roadway systems:

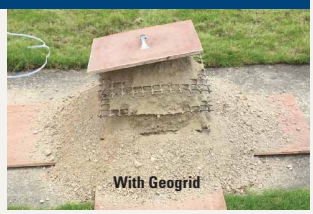
- **Separation performance** - the small opening size of Mirafi® HPa geotextiles helps prevent intrusion of aggregates into the soft subgrade as well as prevent pumping of fines from the subgrade upwards into the aggregate layer over time; geogrids with large apertures have poor separation performance.
- **Reinforcement performance** - the high initial modulus of Mirafi® HPa geotextiles makes it ideal as basecourse reinforcement. This reinforcement performance is effective at all angles of stressing.
- **Aggregate confinement performance** - the high interface interaction coefficient of Mirafi® HPa geotextiles with granular material restrains outward shear at the interface of aggregate layer and subgrade, thereby contributing to bearing capacity improvement of the subgrade.
- **Permeability performance** - the high permeability of Mirafi® HPa geotextiles allows rapid dissipation of excess pore water pressure that usually develops in the subgrade when wheel loads are induced, thereby helping to minimise undrained conditions and reduce plastic deformations in the subgrade.

Reinforcement Performance



Aggregate Confinement Performance





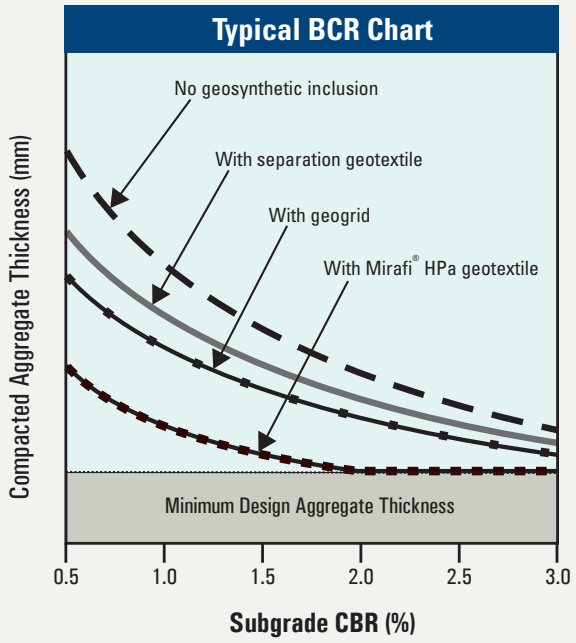
Permeability Performance

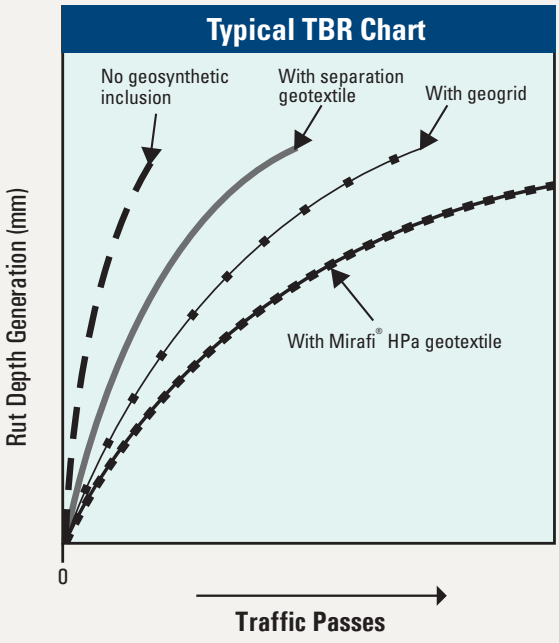
Separation Performance

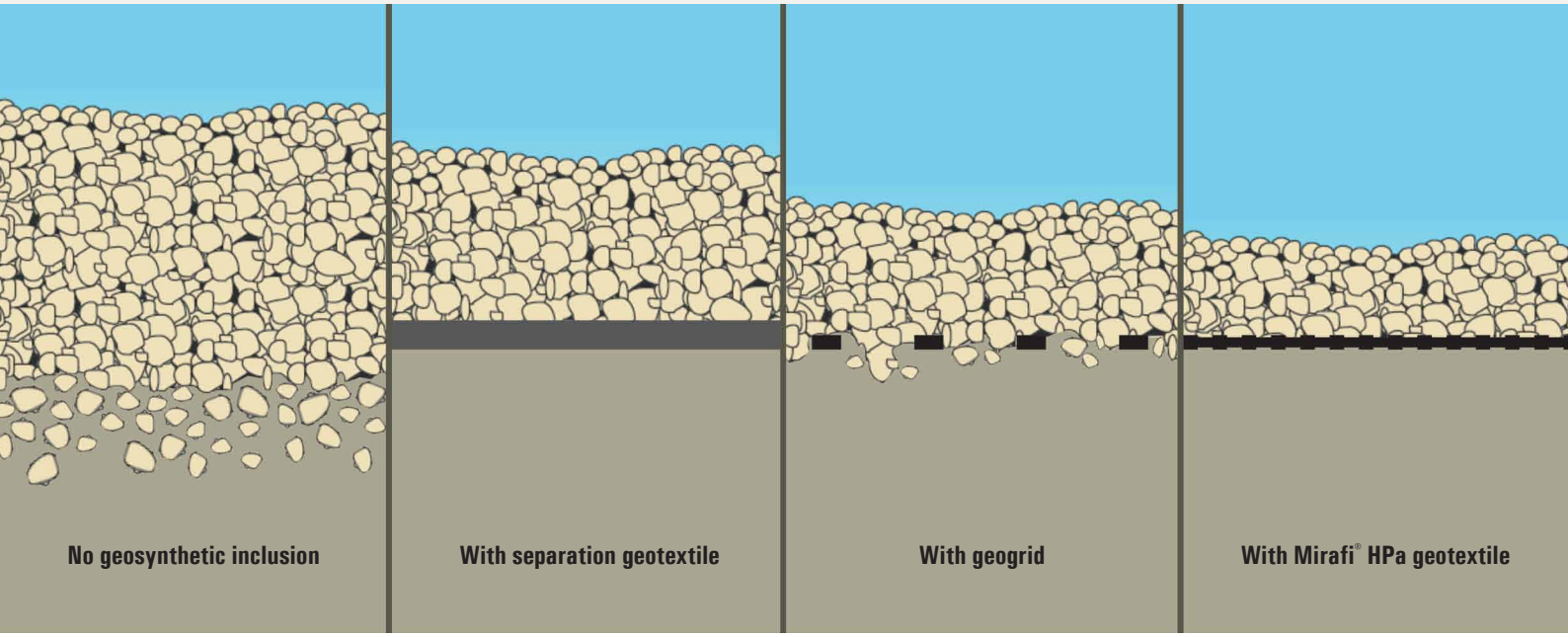
Mirafi® HPa Subgrade Stabilization Performance

Base course reduction ratio (BCR) is defined as the savings in aggregate thickness between a road section without geosynthetic inclusion and that of a section with geosynthetic inclusion of the same performance, calculated in terms of a ratio to the aggregate thickness for the road section without geosynthetic inclusion. Put in simple terms, higher BCR results in greater cost savings due to reduction in aggregate thickness in design.

Traffic benefit ratio (TBR) is defined as the multiple increase in traffic passes of a road section with geosynthetic inclusion to that of a road section of the same aggregate thickness but without geosynthetic inclusion. Put in simple terms, higher TBR results in a longer service life for the road section with geosynthetic inclusion.







Unpaved Roads and Load Support Platforms

Construction works often begin with the logistics of getting trucks and machinery to and within those construction sites. Unpaved roads have to be constructed to gain access to the construction sites. Construction platforms need to be constructed to carry out ground improvement works like piling and installation of vertical drains. Such ground improvement works usually employ heavy machinery in the process.

Many other industries also require construction of unpaved roads and load supporting platforms. Some examples are the mining, logging and energy industries where the production areas are remote and passes through soft ground conditions. Often, the trucks and machinery involved are huge and heavy.

Unpaved roads to gain access and load supporting platforms to support construction equipment need to be designed adequately. This is especially important when the subgrade is soft and saturated. Without geosynthetics the aggregates will punch into the soft subgrade and compaction of the aggregates to achieve a target CBR value may not be achieved. With the inclusion of **Mirafi® HPa** geotextile the aggregates are confined and the compaction machinery loads are supported to allow the target CBR value to be achieved easily.

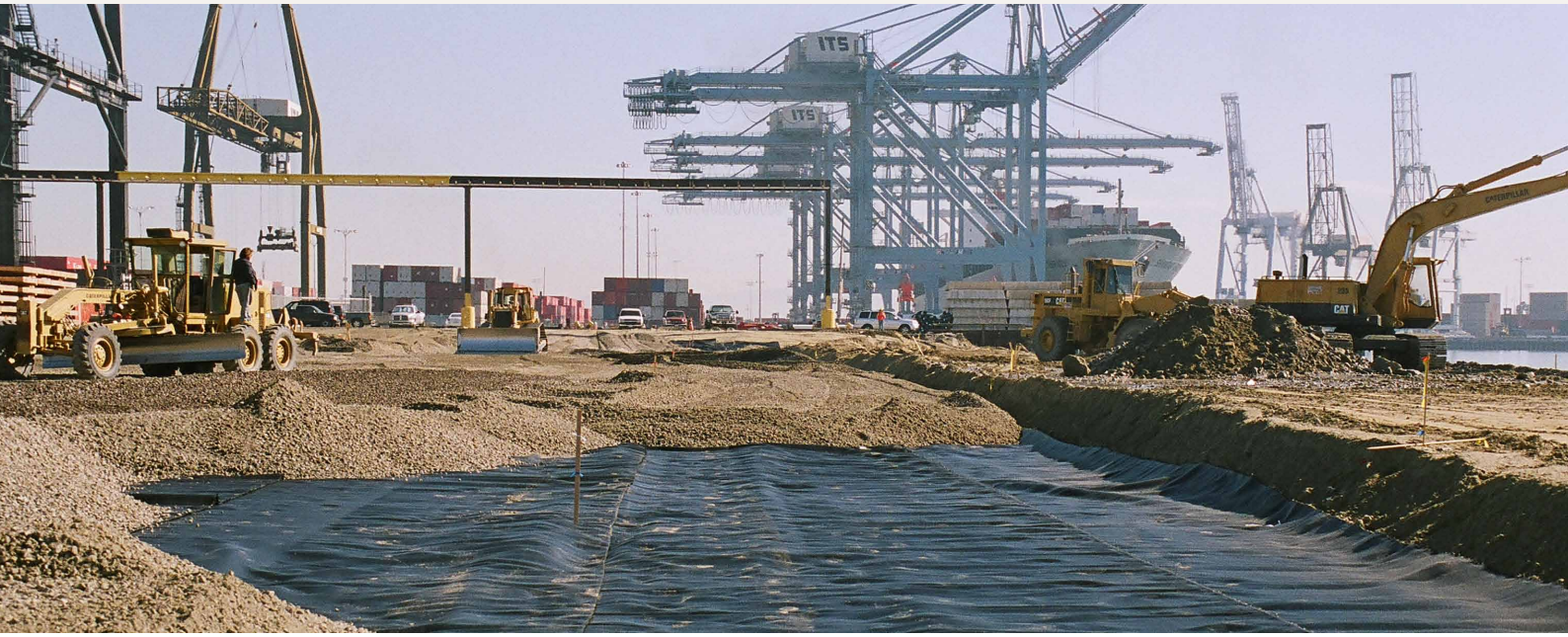
The haul roads and load bearing platforms also need to be operational under all weather conditions. Valuable cost and time may be lost if such haul roads and load bearing platforms are structurally inadequate. **Mirafi® HPa** geotextile is the ideal product for unpaved roads and load supporting platforms, combining all the critical functions that contribute towards subgrade stabilization. **Mirafi® HPa** geotextiles solve problems in the most demanding of construction conditions. **Mirafi® HPa** geotextiles also save construction costs.

Highways, Railroads, Runways and Other Permanent Pavements

We live in a connected world. Roads are required within cities. Roads and highways are required to connect cities to cities and cities to ports and airports. Roads and highways today not only have to support increasing traffic volume but also increased axle loads with transportation vehicles getting larger and more sophisticated in design. Ports require paved load supporting platforms for the handling and storage of containers. Airports need paved runways as well as airplane parking bays and platforms. As the world that we live in get more interconnected and developed, it is getting more and more difficult to avoid soft subgrade conditions. Increasingly we have to deal with issues associated with construction of such structures over soft subgrade conditions.

Pavement structures tolerate little surface deformations. The reinforcement benefit through tensioned membrane support mechanism cannot be realised under such circumstances. Thus it is very important that the geosynthetic inclusion needs to be a robust separator with high permeability. It also needs high initial tensile stiffness modulus (at typically 2% strain) coupled with good interaction properties with the aggregates to offer the optimum benefits.

Mirafi® HPa is an excellent product for pavement structures, combining all the critical functions that contribute towards subgrade stabilization. The use of **Mirafi® HPa** geotextile in a pavement design can save cost by allowing a reduced base course thickness to be adopted or alternatively extending the service life of the pavement. **Mirafi® HPa** is also a green solution. By allowing a thinner base course layer to be constructed, a pavement designed with **Mirafi® HPa** geotextile has a lower carbon footprint when compared with one designed with no inclusion.



Subgrade Stabilization of Very Soft Soils

When subgrades are supersoft, they can undergo large deformations even under the self weight of the fill material that are placed on top of such subgrades. This is often encountered when subgrades have undrained shear strength of 5 kPa or lower. Examples of such conditions are sludge ponds, fish ponds, estuarial mud flats, etc. Often establishing an initial support platform to allow vehicles and machinery to traverse for normal earthworks and other operations to proceed can be challenging. Significant settlement of the placed fill and adjacent ground heaving will occur under such circumstances. Often special earthwork construction methodology and use of geotextile reinforcement is necessary. The edges of such earthworks also require special detailing for proper anchoring of the geotextile reinforcement. Sometimes it can be in the form of a wide counter weight berm. In extreme cases it may have to extend onto firm ground and trenched in for proper anchoring of the geotextile reinforcement.

Mirafi® HPa geotextile functions as a separator and reinforcing layer to reduce the sinking in of fill material and controlling adjacent mud heaving. The high permeability of **Mirafi® HPa** allows rapid dissipation of excess pore water pressure that develops under loading of the placed fill. **Mirafi® HPa** geotextile is the ideal reinforcement because it has high initial tensile stiffness modulus and high seaming efficiency.

Geogrids are generally not suitable under such supersoft ground conditions for two reasons. Firstly the mud will just squeeze through the large appertures of the geogrid. Secondly, geogrids cannot be sewn together effectively to provide continuity of reinforcement. Overlapping of material, a practice often adopted in normal subgrade stabilisation works, is inadequate under such supersoft ground conditions.

TenCate develops and produces quality products that increase performance, reduce cost, and deliver measurable results by working with our customers to provide advanced solutions.

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