

GEOSYNTHETICS

 TENCATE
Geolon®

Windfarm haul roads – all in one go
with high performance TenCate Geolon® woven geosynthetics



Protective Fabrics
Outdoor Fabrics
Advanced Composites
Advanced Armour

Geosynthetics
Grass

 **TENCATE**
materials that make a difference

WINDFARM HAUL ROADS - ALL IN ONE GO

Separation, reinforcement and filtration in one product

The smartest, quickest and easiest way to establish haul roads

The difficulties in establishing wind farm haul roads

Windfarms, almost by definition, are sited in remote open areas often across poorly drained bogland. Soil types vary from bare rock to very soft peat with virtually no bearing strength and the challenge initially is to transport site construction traffic followed by large prefabricated wind tower components and then service vehicles throughout the life of the wind park. This may include decommissioning site traffic with equally heavy loading conditions and the requirement to remove all imported mineral materials at the end of the project. The ideal goal in the areas of soft subsoils such as centuries old, ecologically sensitive, peat bogs is to construct a road which "floats" on the surface of the soil causing the least disturbance possible. A geosynthetic provides the necessary reinforcement and separation needed to prevent spread and dispersion of the road aggregate.

Back to basics

TenCate, based in Holland, has manufactured and supplied high strength woven geotextiles for road construction since 1975 for all types of road construction. The practical experience gained first from Holland's silty soils with high water tables to worldwide applications along with laboratory and field tests carried out by Delft University Hydraulics and Soil Mechanics laboratories in Holland showed the load bearing capabilities of these geotextiles in the construction of haul roads. Through continuous improvement of yarn and weaving technology TenCate have now created high performance, low strain polypropylene woven geotextiles which match or exceeds all geogrids commonly used in windfarm haul road construction.

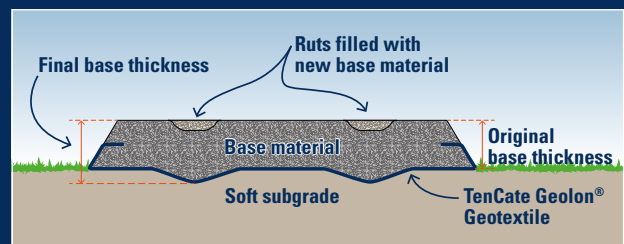
Designing haul roads

In recent years focus has been on the use of geogrids supplied by TenCate and others. However with recent improvements and the development of sites in even more difficult soil conditions the need for geosynthetics which are tough separators as well as reinforcement layers has become essential.



TenCate Geolon® separation, reinforcement and filtration - all in one go

Site surveys have shown that when spreading and compacting a well graded crushed aggregate, typically 75mm down, the subsoil will move till an equilibrium state is reached where the composite of aggregate and geosynthetic acts as a stable platform for the road traffic. Initially all vehicles using the haul road load the surface along the wheel tracks causing the subsoil to move forming a characteristic "w" shape (see Ground Penetrating Radar plot of "rigid" geogrid)

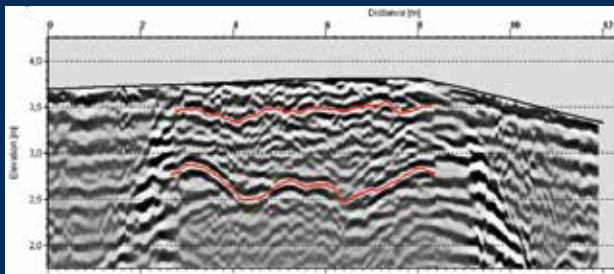


Cross section of an haul road with TenCate Geolon® PP (w-shape)



This model dictates the required essential functions of the geosynthetic. The critical load mechanisms on the geotextile are:

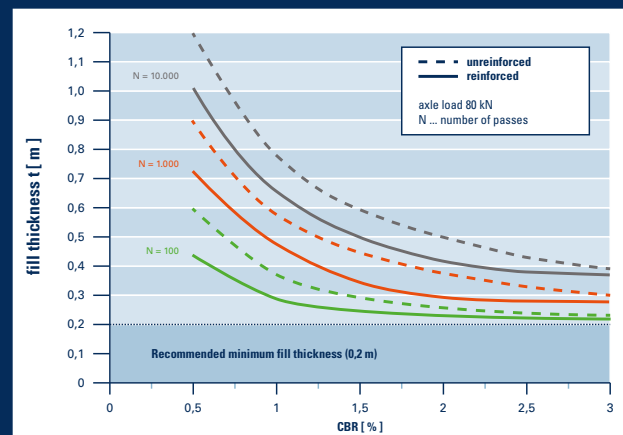
- Tensile forces induced through load transfer by friction from overlying aggregate and upthrust from underlying subsoil
- Shearing loads from rutting and differential settlement through varying subsoil shear strengths
- Surface abrasion and puncture forces due to relative large movements of sharp aggregate across geosynthetic surface when spread and rolled.



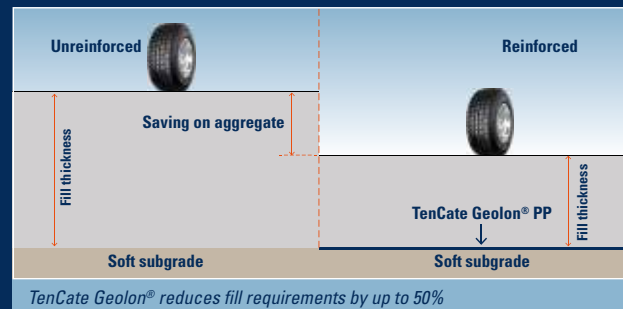
All these loads are dependent on soil types and traffic loading and geotextile selection is derived from the laboratory and site experience summarised by the following design curves.

	Subgrade Bearing Capacity		
Ev₁ [MN/m²]	0,5 - 1,5	1,5 - 2,5	2,5 - 5,0
CBR [%]	0,5 - 1,0	1,0 - 1,5	1,5 - 3,0
Consistency	liquid	viscous	soft
visual appearance	standing person sinks > 75 mm	Walking person sinks 40 - 75 mm	Walking person sinks < 40 mm

These cost saving design curves give a quick indication of the likely minimum depth of aggregate required to give adequate bearing capacity based on soil CBR strength; vehicle axle loads and number of vehicle passes. Often different parts of the windfarm receive differing amounts of traffic offering further savings for less loaded areas of the site, like the secondary access roads to individual towers.



Design of unpaved roads, with or without reinforcement, rut depth ≤ 50 mm



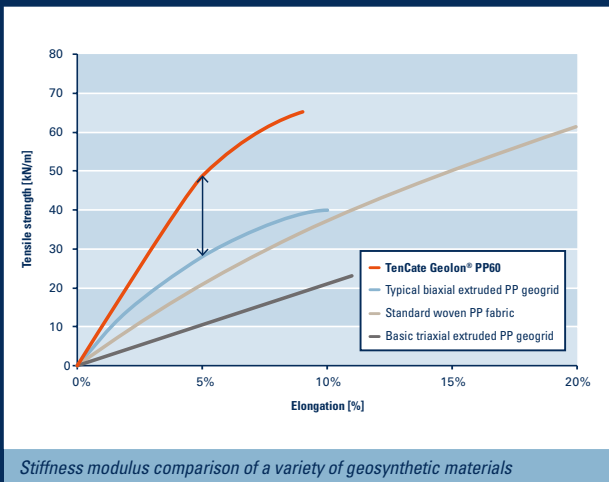
Stiffness of TenCate Geolon® PP

TenCate Geosynthetics' medium strength Geolon PP series is characterized by an extremely high stiffness. Compared to other materials available in the market, Geolon PP60 for instance offers almost twice the tensile strength of typical extruded PP geogrids at 5% elongation. The difference with standard woven PP geotextiles is even bigger; in both

directions. High strength at low elongation – the so called Young's modulus of geosynthetic materials – is of extreme importance for less rutting, deformation and settlement.

The load transfer mechanism

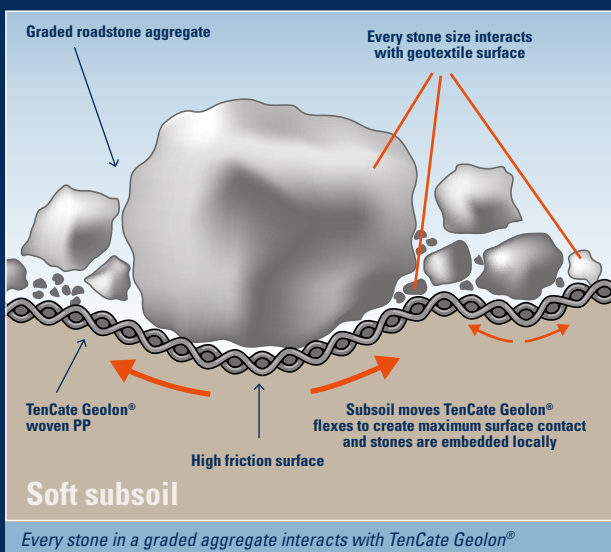
Friction transfer is dependent on the roughness of the surface of the geotextile and the surface contact with the individual stones.



TenCate Geolon® - stiff and flexible



With a typical 75mm down road stone the larger stones will cause a flexible geotextile to deform and shear locally, without damage, bedding into the subsoil and partially moulding the geotextile to the low stone profile. This increases the surface contact area and creates embedment into the subsoil which in turn resists "spread" of the stone.



Quick and easy to install

TenCate weaving technology results in materials which have other key characteristics:

- Wide rolls at 5.2m for average loading and shallower construction means a single roll can be used to create the road in "one go" avoiding the waste of an overlap down the middle of the road
- Prefabricated sheets to any size to allow for wide roads; passing places; loading platforms; turning circles. Which save on overlaps and laid in "one go"
- Flexible even weave means TenCate Geolon® is easy to lay maintaining surface contact avoiding recoil and waving commonly found with rigid geogrids which suffer from manufacturing "memory"
- Safe to use with no sharp edges laying flat, unlike rigid geogrids which recoil requiring preloading to keep in place before being backfilled with heavy loading equipment



Impact to the environment – as if you had never been there!

TenCate Geolon® protects the underlying soils such as valuable peat allowing it to freely drain and remain uncontaminated by aggregate fill and dust. TenCate Geolon® enables the complete removal, in the short term, of unnecessary passing places and turning circles and in the long term the entire road system leaving the subsoil undisturbed and able to recover. The robust and inert nature of TenCate Geolon® means that the road can be recovered first by the scraping off the upper layers and then using the fabric itself to “peel” the road away from the subsoil mounding aggregate into piles for easy removal by shovel. You would never know anyone had even been there.



Ten reasons why TenCate Geolon® gets the job done

Separation, reinforcement and filtration in one product

Why use TenCate Geolon® PP woven geotextiles in windfarm haul roads?

	FEATURES	ADVANTAGES	BENEFITS
1	High modulus – Stiffness – low strain	<ul style="list-style-type: none"> • Takes up load immediately, minimise settlement • Increase bearing capacity of stone 	<ul style="list-style-type: none"> • Cost saving in amount of stone used • Cost saving in delivery, labour and plant • Saving to environment minimal use of mineral material
2	Good friction and embedment. Large stones embed into fabric locally and small stones create high friction	<ul style="list-style-type: none"> • Transfer of load into geotextile utilising strength of soil immediately creating “confinement” • No need for special stone sizes dictated by geogrid aperture sizes 	<ul style="list-style-type: none"> • Cost saving through minimum stone usage • Less likely to fail due to localised stress • Use the most cost effective aggregate source available
3	Multi function separation/reinforcement	<ul style="list-style-type: none"> • Single product • Optimum cost 	<ul style="list-style-type: none"> • Cost saving on basic material
4	Flexible and robust	<ul style="list-style-type: none"> • Can rollout simply and takes up profile of soil • Works with soil especially subsoil movement to find optimum loading shape (w-shape) 	<ul style="list-style-type: none"> • Won't shear due to reverse loading from wheel loads and upthrust of soil
5	Wide width 5.2m	<ul style="list-style-type: none"> • Can be laid in one operation with no or minimal overlaps 	<ul style="list-style-type: none"> • Less wastage
6	Easy to install , convenient roll size	<ul style="list-style-type: none"> • 100m roll can be lifted by hand over peat bog safely 	<ul style="list-style-type: none"> • Safe load handling by hand over rough terrain where vehicles cannot reach
7	Safe to handle	<ul style="list-style-type: none"> • Lays flat when you roll it, safe to handle, no sharp edges to cut you 	<ul style="list-style-type: none"> • No safety book entries from cuts
8	Prefabricated, can be sewn into panels	<ul style="list-style-type: none"> • Can be laid out in one piece for wide roads passing places and loading platforms 	<ul style="list-style-type: none"> • Cost saving for easy and quick handling • No overlap issues eg in difficult working conditions such as bad weather
9	Easily recoverable	<ul style="list-style-type: none"> • Geotextile and aggregate can be removed completely, leaving valuable peat untouched to recover naturally 	<ul style="list-style-type: none"> • Environmental impact reduced to a minimum
10	TenCate design service	<ul style="list-style-type: none"> • Predesign for estimating and/or Professionally Indemnified design for added confidence 	<ul style="list-style-type: none"> • Gives you and your client security of design

GEOSYNTHETICS

For further information on pre-design, installations and cost savings contact:

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503015 – EN – PDF-SH – 29.11.2017 – GraphID



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