

## USING GEOSYNTHETICS In Building Roads, Alleyways, Stream Accesses

This Factsheet describes typical uses of geosynthetic materials in constructing roads, alleyways, and stream accesses in soft soil conditions. Other information and case examples are referenced.

### Introduction

Soft soil; muddy soil; poor livestock footing; vehicles getting stuck; these are all preventable if soil conditions can be improved. But sometimes the standard methods, such as gravelling the area, only last for a year or two and need re-doing. Geosynthetic materials offer a long-term solution for these soft soil conditions.

The following examples use geotextiles, sometimes on slopes with the addition of geocells over the geotextile. They utilize the ability of geotextiles to separate and stabilize soil layers, provide good drainage, and one design uses the principle of reinforced soil structures to further enhance load carrying ability.

In all cases, the specific geosynthetic material chosen will depend on site conditions and should be chosen in discussion with the supplier. Refer to Factsheet #644.000-1 *Geosynthetic Materials*, for details of various geosynthetic materials.

Note that any work around a watercourse requires approval from Provincial and Federal agencies (refer to Factsheet 810.210-12 *Changes In And About A Stream*).

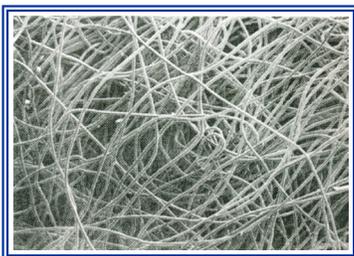
### Improving Soil Conditions with a Geotextile

Often the remedy for soft or wet soil conditions is to upgrade the soil surface with the addition of gravel. However, unless the underlying soil can support the livestock or vehicle loads, the gravel is eventually (soon?) mixed with the underlying soil and most of the benefits of the gravel are lost.

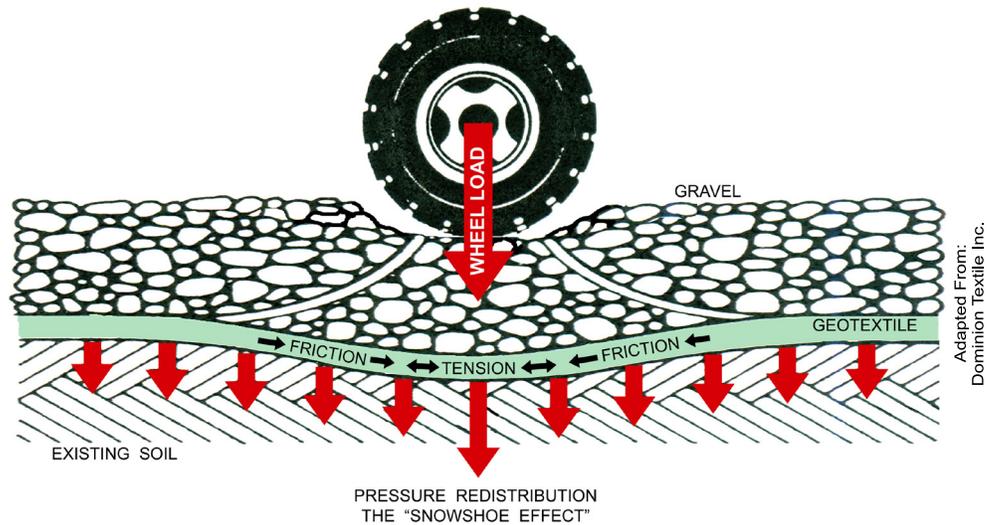
A geotextile material can be used on the soil, before the gravel is spread, to separate the soil and gravel. In this case two of the functions of a geotextile are being used:

- separating soil layers (the gravel from the underlying soft soil)
- stabilizing soil sub grade (ensures the load on the gravel surface is supported)

The improved load carrying capacity achieved by a single layer of a geotextile is comparable to how a snowshoe supports a person on loose snow – it spreads out the load over a wider area and confines the underlying soft ground, as shown in Figure 1, next page. A greater depth of gravel alone may achieve the same results, but using a geotextile, less gravel is required. In most cases the cost savings associated with the decrease in gravel thickness will match or exceed the cost of the geotextile. As well, the useful life of the graveled surface should be significantly increased.



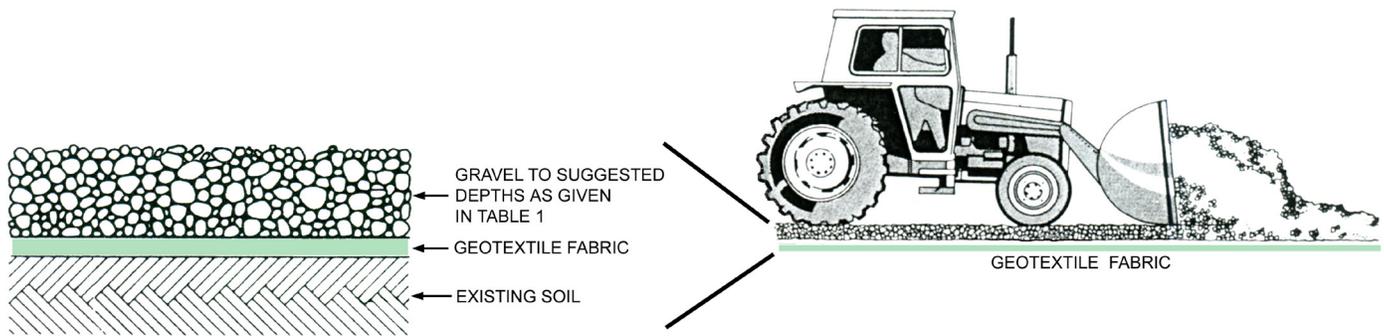
Source:  
Nilex Inc.



**Figure 1** How a Geotextile Acts To Separate and Stabilize Soil on a Roadway

**Single Layer – Non-Woven.** The common method when improving soil conditions with a geotextile is to place a single **non-woven geotextile** on top of the soil and add a layer of gravel on top, as shown in Figure 1, above. This produces a *soft soil / non-woven geotextile / top gravel* layering pattern.

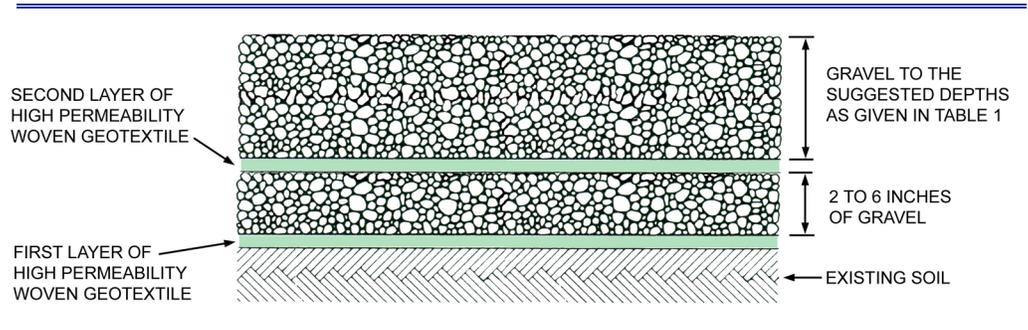
Although much better than gravel alone, some “rutting” may still occur from heavy vehicle tire loads or livestock trailing as the non-woven material does stretch (a design benefit in many cases). This method will be sufficient for low loads and/or soil conditions that are not too soft. Ruts may be corrected by grading after use as long as care is taken not to reduce the gravel coverage over the geotextile.



**Figure 2** A Single Non-Woven Geotextile Layer and Gravel on Soft Soil Surface

**Two Layers – Woven.** An alternative method that offers added load carrying benefits incorporates the principle of a reinforced soil structure. With this method, as shown in Figure 3, below, one layer of **high-permeability woven geotextile** is covered with a 50 to 150 mm (2 to 6 inch) layer of gravel, a second layer of the same geotextile is laid, and lastly the top layer of gravel is laid.

The improved load carrying capacity achieved by this two-geotextile-layer method is outlined in Factsheet 644.000-3 **Building with Reinforced Soil**. It is based on the strength achieved by confining a soil layer between the geotextile layers (reinforced soil), as well as the lower stretching property of the woven geotextile. The *soft soil / woven geotextile / gravel / woven geotextile / top gravel* layering pattern adds strength exceeding the more common single non-woven geotextile method.



**Figure 3 Two High-Permeability Woven Geotextile Layers and Gravel on Soft Soil Surface**

## Level Grade Situations

A geotextile (the one or two layering methods) plus gravel can be used at:

- roads, alleys, driveways, gateways or any surface used by vehicles where the soil is too soft to withstand the use and is rutted
- feeders, waterers, handling areas, low-gradient water access ramps, or any area used by livestock where the soil is too soft for the intensity or duration of use

The depth of the top layer of gravel placed over the geotextile will depend on the soil conditions as shown by the suggested depths in Table 1, below.

Table 1 Suggested Gravel Depths Over Geotextile <sup>1</sup>						
Traffic	Ground Conditions					
	firm penetrated by thumb with effort		soft easily penetrated by thumb		very soft easily penetrated by fist	
	mm	in	mm	in	mm	in
<b>light duty</b> small tractors, sheep	100	4	150	6	200	8
<b>medium duty</b> light vehicles, cattle	150	6	200	8	250	10
<b>heavy duty</b> milk tankers, tractors	150	6	200	8	375	15

<sup>1</sup> over top geotextile layer, such as for farm roads, alleyways, stream accesses

Source: Tensar Corporation

## Sloped Grade Situations

A geotextile overlaid with geocells (refer to Figure 4, below) plus gravel may be used on significant slopes where the gravel (although prevented from moving into the soil with the geotextile) may migrate down the slope. Although more costly, this combination is likely most useful for steep slopes with concentrated loads, such as:

- a livestock access to a stream or dugout may benefit from this to keep the gravel in place reducing the maintenance of the site (refer to Factsheet 590.302-1 *Watering Livestock Directly From Watercourses* for direct access issues)
- sloped livestock alleyways
- in-stream crossings for livestock or machinery (refer to Factsheet 810.210-11 *Agricultural Stream Crossings* for stream crossing issues) as shown in Figure 5, below

The use of a geocell to a project will add considerably to the cost as they are two to five times the cost of a geotextile, but should be considered for some sloped sites.



Figure 4 Geocells .....as shipped



.....as expanded ready to use



Geotextile Laid



Geocell Laid On Top



Material From Bank-To-Bank



Gravel Added

Photo Source:  
grassfarmer.com

Figure 5 Using A Geotextile + Geocell on a Sloped Stream Crossing  
(pictures from grassfarmer.com)

### FOR FURTHER INFORMATION CONTACT

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