

# **GEOSYNTHETIC REINFORCED STEEPENED SLOPES**

Prepared by:

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## **General**

This document is prepared to help ensure that the geosynthetic reinforced soil slope, once installed, will perform its intended design function. To do so, the geosynthetic must be identified, handled, stored, and installed in such a way that its physical property values are not affected and that the design conditions are ultimately met as intended. This document contains information consistent with generally accepted methods of identifying, handling, storing and installing geosynthetic materials. Failure to follow these guidelines may result in the unnecessary failure of the geosynthetic in a properly designed application.

## **Material Identification, Storage and Handling**

The geotextile shall be rolled on cores having strength sufficient to avoid collapse or other damage from normal use. Each roll shall be wrapped with a plastic covering to protect the geosynthetic from damage during shipping and handling, and shall be identified with a durable gummed label or the equivalent, clearly readable on the outside of the wrapping for the roll. The label shall show the manufacturer's name, the style number, and the roll number. Roll identification corresponding to the proposed location of the roll as shown on the construction drawings and as approved by the Engineer, Owner and Contractor can be provided.

While unloading or transferring the geosynthetic from one location to another, prevent damage to the wrapping, core, label, or to the geosynthetic itself. If the geosynthetic is to be stored for an extended period of time, the geosynthetic shall be located and placed in a manner that ensures the integrity of the wrapping, core, and label as well as the physical properties of geosynthetic. This can be accomplished by elevating the geosynthetic off the ground on dunnage and ensuring that it is adequately covered and protected from ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, fire or flames including welding sparks, temperatures in excess of 60°C (140°F), and human or animal destruction.

## **Foundation Soil/Subgrade Preparation**

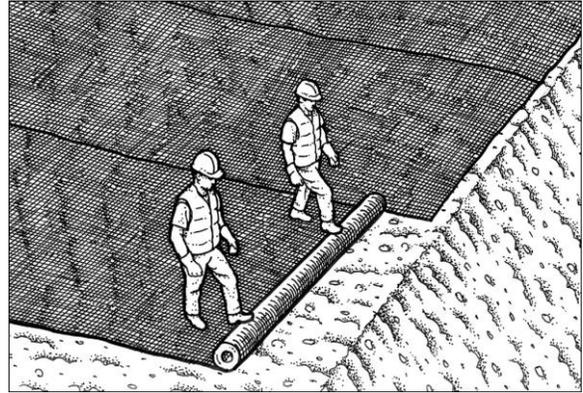
Prepare the surface on which the geosynthetic is to be placed so that no damage to the geosynthetic will occur. Foundation/sub grade soil should be excavated to the lines and grades as shown on the construction drawings or as directed by the Engineer. Over excavated areas should be filled with compacted backfill material as directed by the Engineer. The foundation/sub grade soil should be cleared of all deleterious materials and the surface should be smooth and level such that any shallow depressions and humps do not exceed 6 in (15 cm) in depth and height. The foundation/sub grade soils should be proof rolled prior to geosynthetic and backfill placement. This exercise should be performed prior to each successive geosynthetic layer that is installed.

The foundation soils shall be compacted to 95 percent of optimum dry density and plus or minus three (3) percentage points of the optimum moisture content, according to test method ASTM D698 or as specified by the Engineer. It is recommended that cohesive soils be compacted in maximum lifts of 6 in (15 cm) to 8 in (20 cm) and granular soils in lifts of 9 in (23 cm) to 12 in (30 cm) compacted thickness.

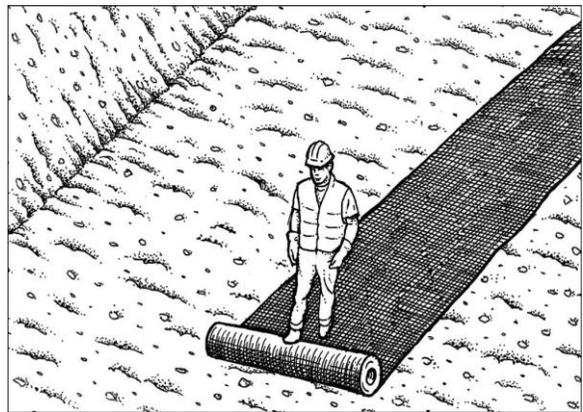
### Geosynthetic Installation

Before unrolling the geosynthetic, verify the roll identification, length, installation orientation (strength direction) and the installation location using the construction drawings. While unrolling the geosynthetic, inspect it for damage or defects. Damage that occurred during storage, handling or installation shall be repaired as directed by the Engineer.

The geosynthetic should be placed at the correct elevation and orientation as shown on the construction drawings or as directed by Engineer. Correct orientation of the geosynthetic is of utmost importance and shall be verified by the Contractor. The geosynthetic shall be cut to length as shown on the construction drawings using a razor knife, scissors, sharp knife, or other Engineer approved cutting tool.



After the geosynthetic has been situated in place it should be tensioned by hand until taut, (i.e. free of wrinkles and lying flat). Adjacent geosynthetic panels, in the case of 100 percent coverage in plan view, should be overlapped as necessary to ensure 100 percent coverage, unless otherwise specified in the construction documents. Geosynthetic panels may be secured in-place with staples, pins, sand bags, or backfill as required by fill properties, fill placement procedures, or weather conditions, or as directed by the Engineer.

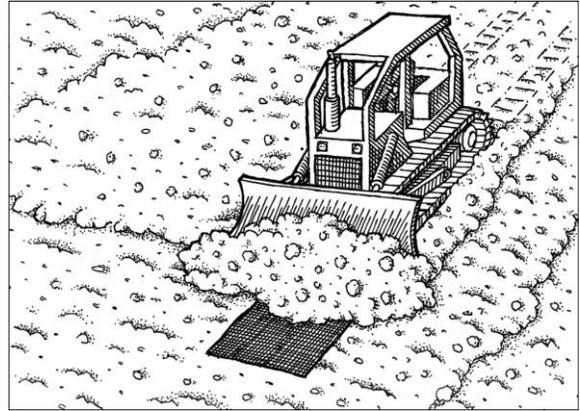


The geosynthetic may not be spliced in the primary strength direction through overlap, sewing, or other mechanical connection unless otherwise directed by the Engineer. Therefore, the geosynthetic should be installed in one continuous piece with the primary strength direction extending the full length of the reinforced area.

Place only the amount of geosynthetic needed to complete immediately pending work in order to minimize unnecessary exposure to the reinforcement. After a layer of geosynthetic has been placed, the succeeding layer of soil shall be prepared, placed and compacted as indicated in the construction documents. After installation of the soil layer has been completed, the next geosynthetic layer can be installed. The process is repeated for each subsequent layer of geosynthetic and compacted soil.

### **Backfill Placement**

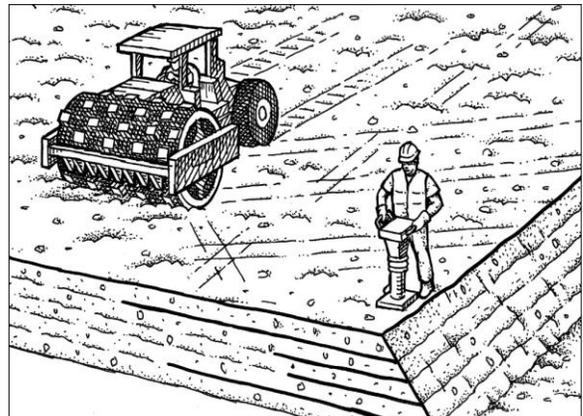
The geosynthetic is laid directly on the horizontal surface of a layer of compacted fill and covered with the next layer of fill. Deployment of fill should be performed as directed by the Engineer in charge of construction quality assurance. Soil fill shall be 95 percent of optimum dry density and plus or minus three (3) percentage points of the optimum moisture content, according to test method ASTM D698 or as specified by the Engineer. It is recommended that cohesive soils be compacted in maximum lifts of 6 in (15 cm) to 8 in (20 cm) and granular soils in lifts of 9 in (23 cm) to 12 in (30 cm) compacted thickness. The minimum compacted fill thickness between adjacent layers of geosynthetic should not be less than 6 in (15 cm) or twice the size of the larger fill particles, whichever is larger. Fill should be compacted as defined by the project specifications or as directed by the Engineer.



The minimum compacted fill thickness between adjacent layers of geosynthetic should not be less than 6 in (15 cm) or twice the size of the larger fill particles, whichever is larger. Fill should be compacted as defined by the project specifications or as directed by the Engineer.

Backfill should be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in and/or movement of the geosynthetic. Care should be taken to control the timing and rate of placement of fill material to ensure that construction activities or site vehicles traveling on any exposed geosynthetic do not damage the material.

Backfill within 3 feet (1 m) of the slope face should be compacted with hand compaction equipment. Soil compaction tests shall be performed on every soil lift or as otherwise directed by the Engineer. Backfill shall be graded away from the slope crest and rolled at the end of each workday to prevent ponding of water on the surface of the reinforced soil mass. The site shall be maintained to prevent the flow of water from overtopping the slope crest during construction and after the completion of the slope.



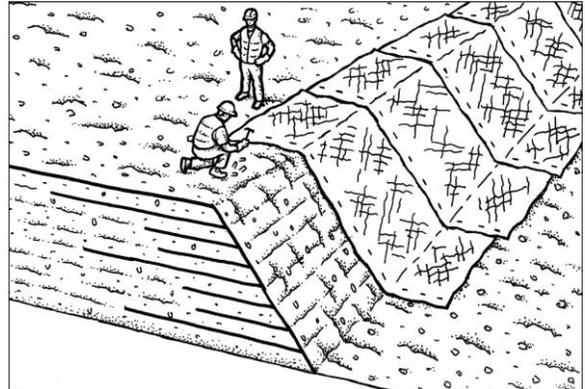
Most rubber-tired vehicles can be driven at slow speeds, less than 10 mph and in straight paths over the exposed geosynthetic without causing damage to the geosynthetic. Sudden braking and sharp turning should be avoided. Tracked construction equipment may not be operated directly upon the geosynthetic. A minimum fill soil thickness of six 6 in (15 cm) is required prior to operation of tracked vehicles over the geosynthetic. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geosynthetic.

### Drainage

Groundwater infiltration and/or surface water runoff can cause saturation of the reinforced fill soil that will significantly reduce soil strength and reduce the stability of the reinforced mass. If the slope was not designed with extra reinforcement to handle these reduced soil strengths, then an engineered drainage system should be provided to prevent the fill from becoming saturated.

### Protection of the Slope Face

For reinforced slopes, 1:1 V or flatter, the slope face is hydro seeded and covered with a material that will retain soil particles and promote vegetative growth. For slopes steeper than 1:1 V or in areas where vegetation is difficult to establish, the slope can be treated with durable facing (i.e. wire L-baskets, shotcrete, landscaping timbers, gabions, etc.).



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