

The Growing Use Of Geotextiles

A relatively new concept in materials has emerged for the civil engineering community involved in soil and rock-related activities. Known as "geosynthetics", because they are used in soil and are synthetic, these materials include geotextiles (the largest group), geogrids, geomembranes, and geocomposites.

Geotextiles

The term geotextile refers to a fabric used in geotechnical engineering to improve performance or cost effectiveness of a human-made structure. These materials were introduced in the 1950's and their use has grown very rapidly in the last decade.

Also called filter fabric, filter cloth, geotechnical fabric, engineering fabric, and geofabric; geotextiles are currently being made from fibers of polypropylene, polyester, polyethylene, nylon, polyvinylidene chloride, and fiberglass. Polypropylene and polyester seem to be the most popular. Generally, the synthetic fibers are made into a flexible porous fabric by standard weaving machinery or they are matted together in a random "nonwoven" manner. However, some fibers are also knitted.

The physical properties of geotextiles can vary considerably depending upon the additives used in the composition of the material and upon the methods of processing the molten material into filaments. "Wovens" may be monofilament or multifilament. The woven construction is the most expensive and tends to produce fabrics having relatively high strengths and moduli. Due to their high cost, wovens are used primarily for filtration and for special reinforcement applications. Nonwoven fabrics are less expensively produced by a bonding process or interlocking the fibers by mechanical, chemical, or solvent means. Although the knitting process is least expensive, knit fabrics are seldom used in geotextiles. Only two fabrics are currently manufactured this way--one is designed for unidirectional soil reinforcement and the other for temporary surface erosion protection.

Functions and Applications

There are at least 100 specific engineering applications for geotextiles. In any one application, the fabric may be performing one or more of six basic functions: filtration, drainage, screening, erosion control, reinforcement, or separation. These functions are explained below:

Filtration

This function involves the movement of water through the fabric. The geotextile substitutes for and serves the same function as the traditionally graded granular sand-and-gravel filter. This filter must allow the water to pass without significant build-up of hydrostatic pressure. A geotextile-lined drainage trench along the edge of a pavement is an example of an application using geotextile material as a filter.

Drainage

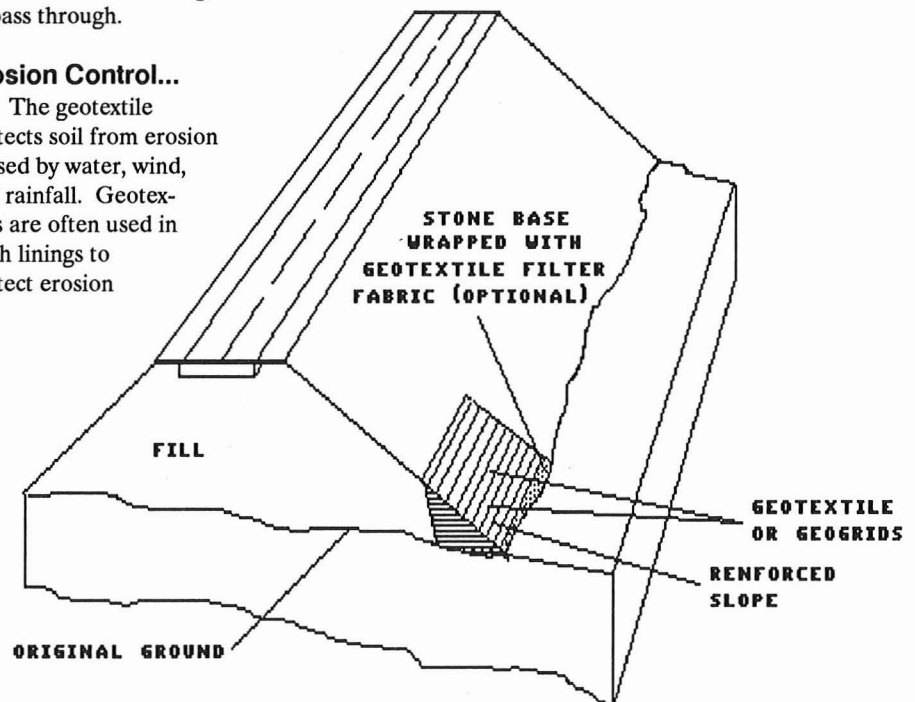
Basically, all fabrics can work as drainage material, but to widely varying degrees. Geotextiles may be used in trench drains, blanket drains, and drainage columns next to structures as a substitute for granular material. Strip drains substitute for sand drains to accelerate the consolidation of fine-grained soils.

Screening...

A geotextile can function as a screen by impounding particles suspended in surface fluid flow while allowing the fluid to pass through.

Erosion Control...

The geotextile protects soil from erosion caused by water, wind, and rainfall. Geotextiles are often used in ditch linings to protect erosion



Small slope failures can be repaired successfully by reinforcing the slope with geotextiles, as illustrated above.

of fine sands and cohesionless silts.

Reinforcement ...

The geotextile can act as reinforcement by strengthening the performance of weak materials or structures. Geotextile-reinforced embankments and earth retaining walls are examples of this use of fabrics.

Separation...

Separation is the concept of preventing two dissimilar materials from mixing so that the integrity and function of both materials can remain intact or be improved. The geotextile is most often used to prevent the mixing of fine soils and gravel. In construction of expedient haul roads over soft soil, fabric is placed over the soft subgrade and then gravel or crushed stone is placed on the fabric.

Sources of Information

A very good reference is "Designing with Geosynthetics," by Robert M. Koerner, Prentice-Hall, 1985. Also, a new technical manual, TM5-8000-08, "Engineering Use of Geotextiles," is soon to be published by the U.S. Corps of Engineers.

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