PAVEMENT TECHNOLOGY ADVISORY
- GEOSYNTHETICS -
PTA-D6

WHAT ARE GEOSYNTHETICS?

The term "geosynthetics" refers to all fabricated synthetic (usually polymeric) materials used in various geotechnical applications such as drainage, reinforcement, erosion control, and lightweight fill. There are many potential uses for geosynthetics in highway projects. This document describes various geosynthetic materials that are potentially useful in highway construction applications.

GEOSYNTHETIC TYPES AND APPLICATIONS

The following is an alphabetical list of various geosynthetic types and some potential uses of each:

Geocells are designed to protect slopes against erosion, stabilize steep slope surfaces, provide protective linings for channels, support heavy construction traffic on weak subgrade soils, and provide multi-layered earth-retaining structures. Geocells are typically constructed of high-density polyethylene (HDPE). The cells in the three-dimensional panels are opened and filled with granular material, which adds weight to make the multi-layer system act as a gravity retaining wall.

Geocomposites are designed to replace aggregate and/or perforated pipe subsurface drainage systems. A geocomposite consists of a deformed, perforated, or slotted plastic core and a geotextile (filter) fabric wrap. Geocomposites include geonets, pavement edge drains (drainage mats), and sheet (wall) drains. Wick (strip) drains, used to expedite drainage of deep, compressible soil deposits, have also been included in the geocomposite category. The core material could be HDPE, polypropylene, polyvinyl chloride (PVC), high impact polystyrene, or a combination of two polymers.

Geofoam refers to low-density cellular plastic foam, either molded expanded polystyrene blocks or extruded polystyrene sheets. Geofoam is used as a super lightweight fill, with 1.5 to 3.0 pounds per cubic foot (pcf) density, compared to other lightweight materials with densities ranging from 50 to 70 pcf. Geofoam's light weight makes it a viable option for landslide repair, and for embankments on soft, compressible deposits. Geofoam is also used for thermal insulation of pavements and foundations. Geofoam, however, requires special design considerations with regards to buoyancy, fungus attack, and the presence of petroleum products (asphalt, oil, or gasoline).

Geogrids are used for soil reinforcements in embankments and walls, subgrade stabilization, and embankment base reinforcement. Geogrids are characterized by integrally connected elements, with in-plane apertures (openings) uniformly distributed between the elements. The apertures allow the soil to fill the space between the elements, thereby increasing soil interaction with the geogrid and ensuring unrestricted vertical drainage. The geogrids vary in manufacturing process, polymer type,

coating, density, aperture dimensions, and tensile strength and modulus. Depending on the brand name and material, the geogrid could be made of polypropylene, polyester, polyethylene, or fiberglass. The material coating, if needed, could be PVC, polyester, bitumen, elastomeric polymer, or latex.

Geomembranes serve as hydraulic barriers. **Geonets** are horizontal drainage mats, often used in conjunction with geomembranes in landfill applications. Geomembranes and geonets have limited uses for highway projects. They are mostly used for containment of spills, leaking under-ground storage tanks, or other hazardous materials within the right-of-way.

Geotextiles typically provide one of the following functions: separation/filtration; reinforcement; drainage; or hydraulic barrier. They can be classified as woven, nonwoven, or knitted. Woven fabrics exhibit high tensile strength, high modulus, and low strains, while nonwoven fabrics have high permeability and high strain characteristics. Geotextiles are manufactured in a variety of geometric and polymeric compositions to meet a number of different applications. Many geotextiles are made of polypropylene. Fabric formed concrete revetment mats, silt filter fences, erosion control blankets, and fabric envelopes for pipe or mat underdrains are examples of common geotextile applications.

A geotextile's long-term performance is a function of the durability and creep characteristics of the polymer structure. The effects of ground, weather, sunlight, and aging conditions must be considered when specifying a geotextile for a permanent application.

USAGE BY IDOT

The uses and types of geosynthetics are expanding rapidly. Some of the above-mentioned geosynthetic types are used by the Illinois Department of Transportation (IDOT) in various applications.

The IDOT Standard Specifications for Road and Bridge Construction addresses several geotextiles including: Fabric Envelope for Pipe Underdrains; Geotextile Fabric, for ground stabilization and silt filter fence; Filter Fabric For Use With Riprap; Fabric For Fabric Formed Concrete Revetment Mats; Geotechnical Fabric For French Drains; and Fiber Mat, for ditch lining. Additionally, the Standard Specifications address Geocomposite Wall Drains and Drainage Mat Underdrains. Acceptance of geosynthetic materials is primarily based on manufacturer's certification. Some geo-synthetic materials and manufacturers have not been approved for a variety of reasons.

If use of a geosynthetic material is warranted, and it is not covered by the Standard Specifications, a Special Provision must be developed to specify material properties, transportation, storage, construction installation method, and any required short-term or long-term protection.

Note: The State Geotechnical Engineer should be contacted for current geo-synthetic practice and for review of district special provisions to ensure uniform statewide practice.

ADDITIONAL INFORMATION

IDOT is working to update and expand its Geotechnical Manual, which contains a discussion on geosynthetics. An Order Form for those who wish to purchase the Geotechnical Manual is available in the "Doing Business" section of the IDOT website at www.dot.il.gov.

If you have any questions, or for more information, please contact:

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