



PDH-Pro.com

Geotextiles in Pavement, Drainage, & Embankment Applications

Course Number: GE-02-150

PDH: 4

Approved for: AK, AL, AR, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WI, WV, and WY

State Board Approvals

Florida Provider # 0009553 License #868

Indiana Continuing Education Provider #CE21800088

Maryland Approved Provider of Continuing Professional Competency

New Jersey Professional Competency Approval #24GP00025600

North Carolina Approved Sponsor #S-0695

NYSED Sponsor #274

How Our Written Courses Work

This document is the course text. You may review this material at your leisure before or after you purchase the course.

After the course has been purchased, review the technical material and then complete the quiz at your convenience.

A Certificate of Completion is available once you pass the exam (70% or greater).

If a passing grade is not obtained, you may take the quiz as many times as necessary until a passing grade is obtained).

If you have any questions or technical difficulties, please call (508) 298-4787 or email us at admin@PDH Pro.com.





Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the primary polymer materials and manufacturing processes used to produce woven and nonwoven geotextiles.
- **Evaluate** the environmental factors influencing geotextile durability and select appropriate materials for chemically sensitive or high-risk environments.
- **Select** the appropriate geotextile function—filtration, drainage, reinforcement, or separation—based on specific civil engineering site requirements.

Executive Summary: Geotextiles are permeable synthetic membranes used in conjunction with soil and rock to enhance civil engineering projects. Their performance is defined by their manufacturing process (woven vs. nonwoven) and their ability to perform one or more critical functions: filtration, drainage, separation, reinforcement, and moisture barrier protection. Successful implementation requires matching the polymer’s durability to the environmental conditions and ensuring robust installation, particularly regarding seam integrity.

Design Fundamentals

This manual describes various geotextiles, test methods for evaluating their properties, and recommended design and installation procedures.

Scope of Application

This module covers physical properties, functions, design methods, design details, and construction procedures for geotextiles as used in:

- **Pavements and Railroad Beds**
- **Retaining Walls and Earth Embankments**
- **Rip-rap and Concrete Revetment**
- **Drain Construction**

Note: This manual does not cover other geosynthetics such as geogrids, geonets, geomembranes, plastic strip drains, or natural fiber products.

Geotextile Types and Construction

Geotextiles are engineered from synthetic polymers. The physical properties are adjusted through chemical additives and processing methods.

Materials and Yarns

- **Primary Polymers:** Polypropylene and polyester are the most common. Others include polyethylene, polyamide (nylon), and polyvinylidene chloride.
- **Sewing Thread:** Typically made from **Kevlar**, polyester, polypropylene, or nylon.
- **Yarn Formation:** Fibers are bundled and twisted (spun). Yarns may consist of **continuous filaments** (long fibers) or **staple fibers** (short cut pieces).

Woven Geotextile Manufacture Woven construction involves interlacing **warp yarns** (machine direction) with **fill yarns** (cross direction).

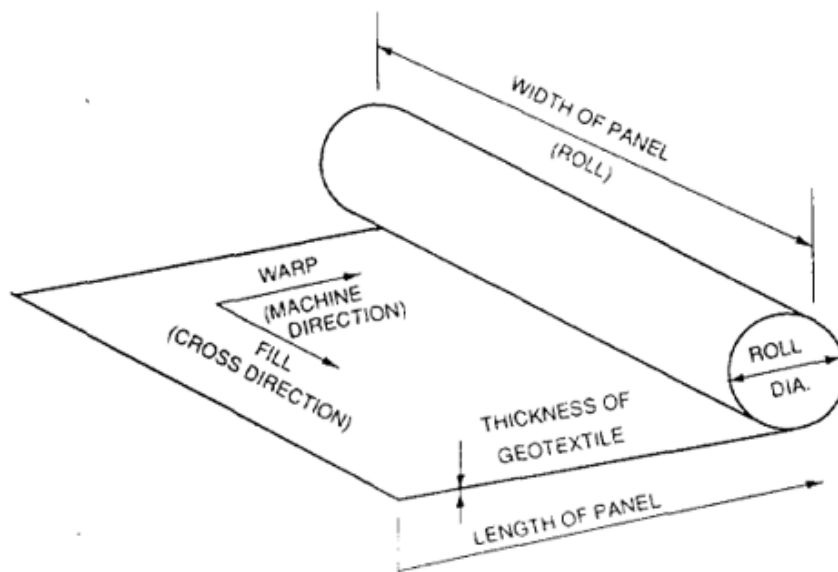


Figure 1-1: Dimensions and Directions for Woven Geotextiles.

- **Performance Characteristics:** High strength and high moduli with low elongation at rupture.
- **Pore Structure:** Simple structure with a narrow range of opening sizes.
- **Variations:** * **Monofilament:** (See Figure 1-2).
 - **Multifilament:** Highest strength and cost (See Figure 1-3).
 - **Slit-film/Ribbon:** Cost-effective for **separation** (See Figure 1-4).

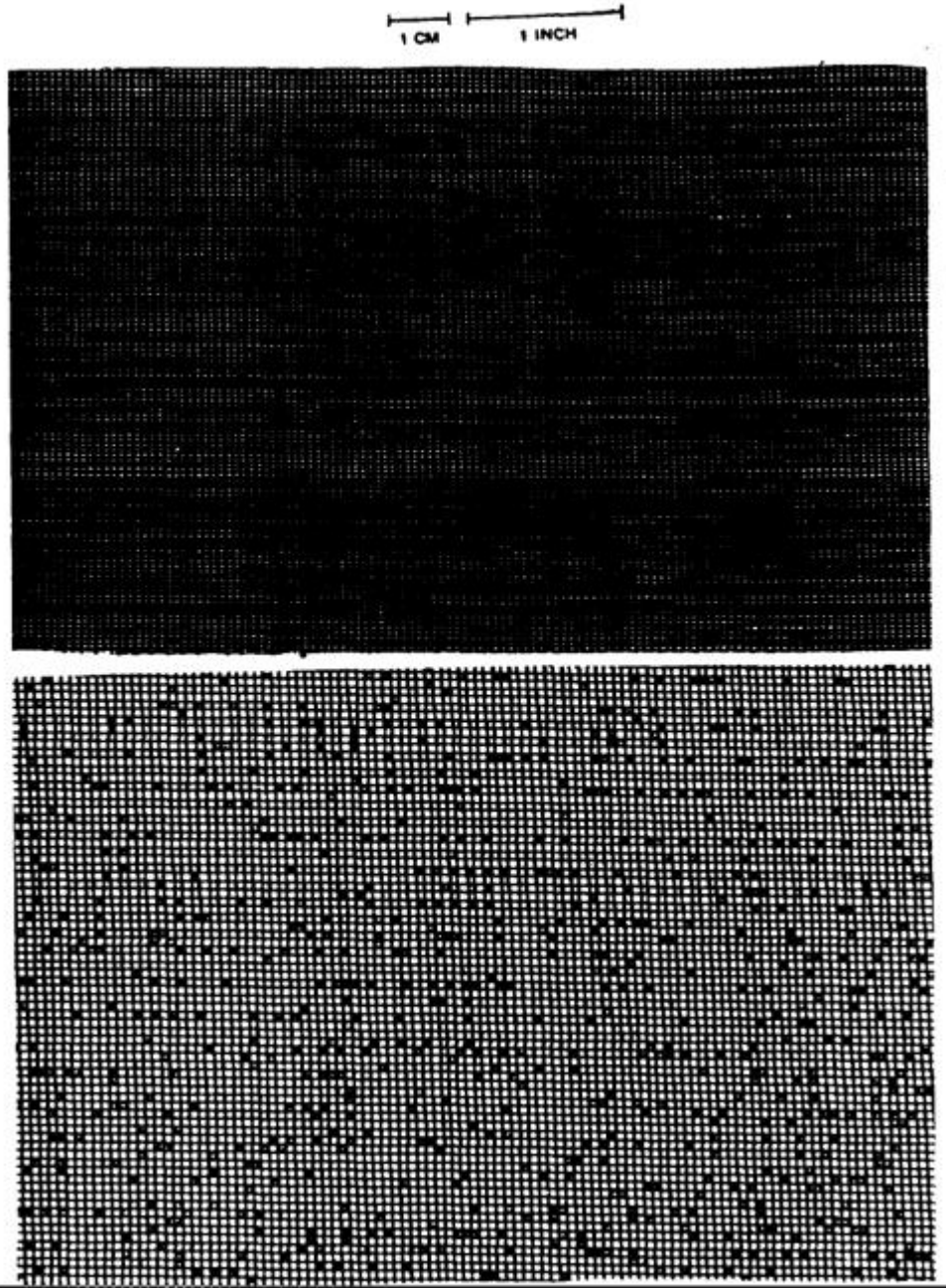


Figure 1-2: Woven Monofilament Geotextiles Having Low Percent Open Area (Top), and High Percent Open Area (Bottom).

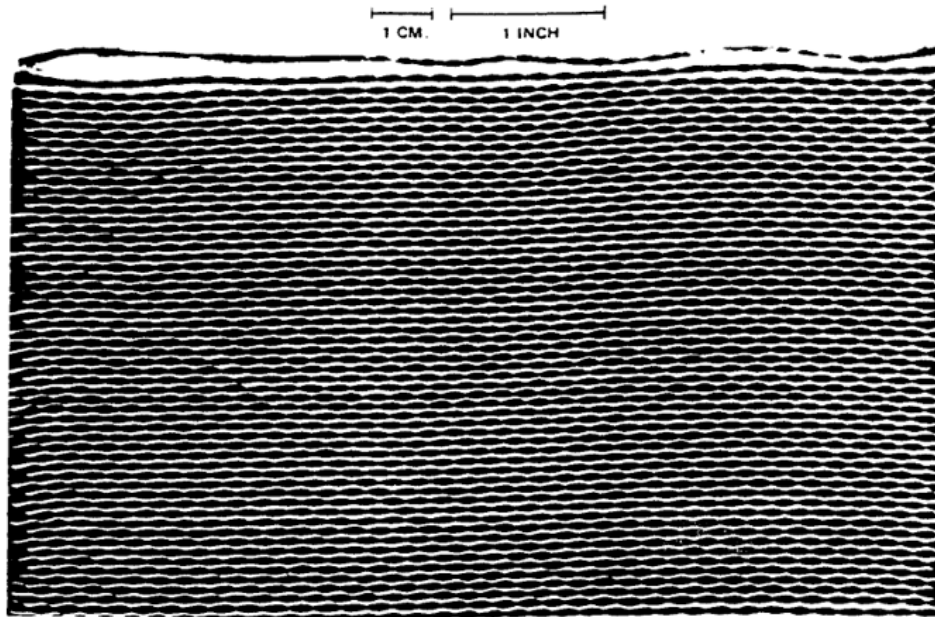


Figure 1-3: Woven Multifilament Geotextile.

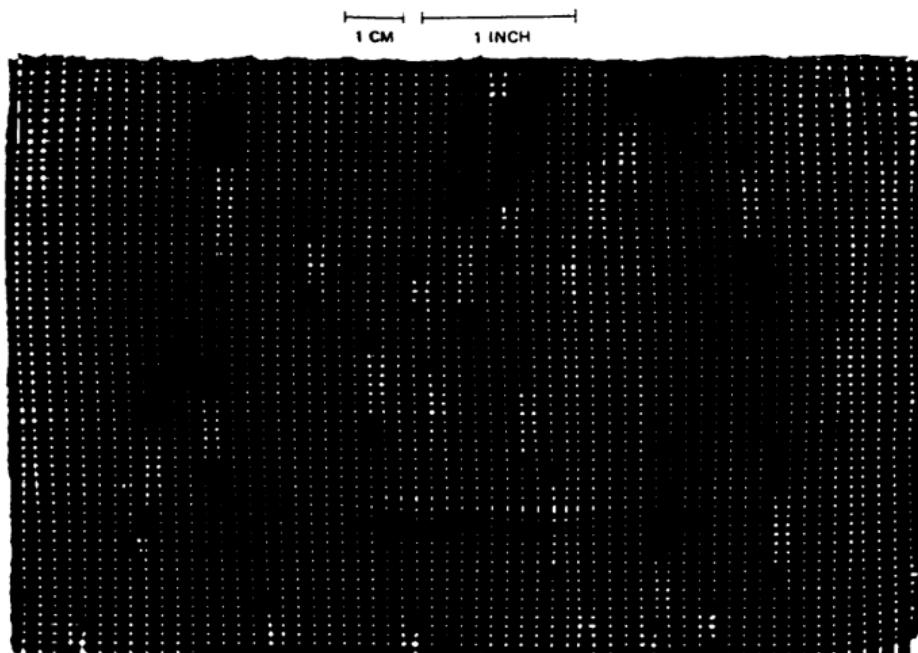


Figure 1-4: Woven Slit-Film Geotextile.

Nonwoven Geotextile Manufacture

Nonwoven products are generally thicker than woven products and are formed through mechanical or thermal bonding rather than weaving.

- **Needle Punching:** Barbed needles entangle fibers, creating a felt-like mat.
- **Heat Bonding:** Uses fibers with different melting points or heterofilaments (sheathed fibers) to fuse the mat.
- **Resin Bonding:** An introduced resin coats and bonds fiber contacts.

Figure 1-5: Needle-Punched Nonwoven Geotextile.

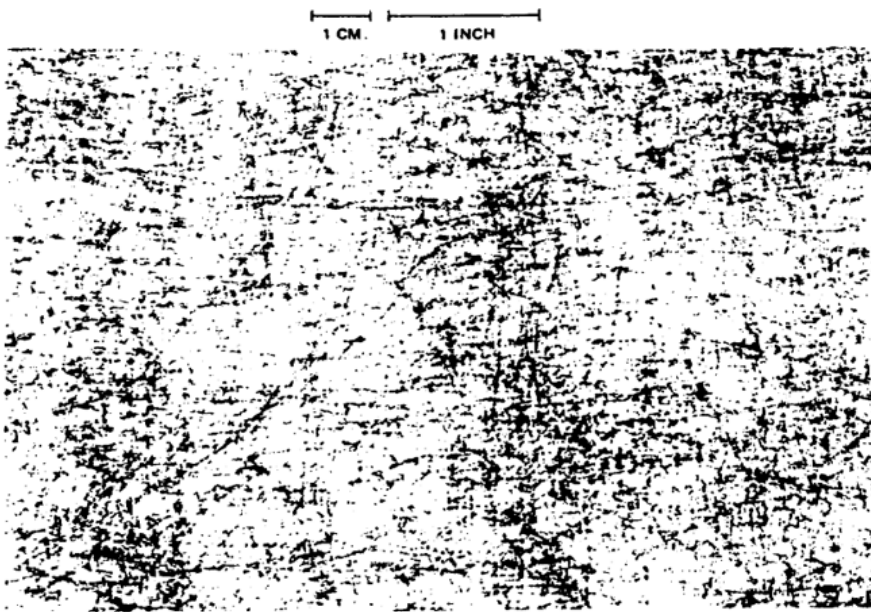


Figure 1-6: Heat-Bonded Nonwoven Geotextile.

Geotextile Durability

The long-term integrity of a geotextile is dependent on its environment and polymer composition.

- **Ultraviolet (UV) Light:** Sunlight degrades polymers; carbon black additives reduce but do not eliminate this risk.
- **Temperature:** Hot asphalt can reach polymer melting points, while extreme cold can cause brittleness.
- **Chemical Environment:** * **High pH (Alkaline):** Harsh on polyesters.
 - **Low pH (Acidic):** Harsh on polyamides.



Purchase this course to
see the remainder of
the technical materials.