

## CONSTRUCTION SPECIFICATION

### MI-165. GEOTEXTILES

1. SCOPE

This work shall consist of furnishing all materials, equipment and labor necessary for the installation of geotextiles for slope protection, subsurface drains and road stabilization.

2. MATERIALS

Geotextiles shall be manufactured from synthetic long chain or continuous polymeric filaments or yarns, having a composition of at least 95 percent, by weight, of polypropylene, polyester or polyvinylidene-chloride. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other, are inert to commonly encountered chemicals and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. The geotextile shall be free of any chemical treatment or coating that might significantly reduce its permeability and shall have no flaws or defects that significantly alter its physical properties. Unless otherwise specified, the class and type of geotextile shall be as shown on the drawings and shall meet the requirements for materials that follow:

a. Woven Geotextile

The woven geotextile shall conform to the physical properties listed in Table 1. The woven geotextile shall be manufactured from monofilament yarns that are woven into a uniform pattern with distinct and measurable openings. The geotextile shall be manufactured so that the yarns will retain their relative position with regard to each other. The yarns shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure. The edges of the material shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.

b. Nonwoven Geotextile

Nonwoven geotextiles shall conform to the physical properties listed in Table 2. Nonwoven geotextiles shall be manufactured from randomly oriented fibers that have been mechanically bonded together by the needle-punched process. In addition, one side may be slightly heat bonded. Thermally bonded, nonwoven geotextiles, in addition to mechanically bonded, nonwoven geotextiles, may be used for Road Stabilization. The filaments shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure.

c. Shipping, Product Identification, Certification and Test Data

The geotextile shall be shipped in rolls wrapped with a protective covering to keep out mud, dirt, dust, debris and direct sunlight. Each roll of geotextile shall be clearly marked to identify the brand, type and production run.

The geotextile shall meet the specified requirements (Table 1 or 2) for the product style or type shown on the label. The manufacturer or distributor will provide a letter of certification to the Engineer stating the compliance of the delivered product to the requirements of Table 1 or Table 2, whichever is applicable. Test data pertaining to the production run of the product must be submitted to the Engineer if requested to do so, in writing, by the Engineer.

All geotextile materials will be subject to sampling and testing by an independent testing laboratory at any time until final inspection and acceptance.

3. STORAGE

Prior to use, the geotextile shall be stored in a clean, dry place, out of direct sunlight, not subject to extremes of either hot or cold, and with the manufacturer's protective cover in place.

4. SURFACE PREPARATION

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of holes, sharp objects and projections. The surface preparation will be inspected and approved by the Engineer prior to placing the geotextile.

5. PLACEMENT

a. General

The geotextile shall be placed on the approved, prepared surface at the locations and in accordance with the details shown on the drawings. The geotextile shall be unrolled along the placement area and loosely laid (not stretched) in such a manner that it will conform to the surface irregularities when stone or other material is placed on or against it. No cuts or punctures will be permitted in the geotextile. The geotextile may be folded and overlapped to permit proper placement in the designated area.

Where seaming is required or desired, the seam shall be composed of a sewing thread having a composition of at least 95 percent polypropylene, polyester or polyarimid. The sewing thread shall have a minimum breaking strength of 28 pounds (125 N) when tested in accordance to ASTM D 2256-80 and shall be highly contrasting in color to the geotextile. The seam shall conform to Federal Standard SSa-2, SSn-2 or SSd-2, using a minimum of 4 stitches per inch per stitch line. The stitch lines shall be parallel, a maximum of 0.75 inches (20 mm) apart and parallel to the geotextile edge (SSa) or fold (SSn or SSd). The stitch line closest to the edge or fold shall be no more than 2 inches (50 mm) and no less than 0.75 inches (20 mm) from the edge or fold. Federal Standard 401 or 301 stitches shall be used. Federal Standard 101 stitches will not be accepted.

b. Slope Protection

The roll or panel length shall be placed parallel to the direction of water flow unless otherwise indicated on the drawings. The geotextile's terminal end details shall be as shown on the drawings. The minimum overlap shall be 18 inches (45 cm), in any direction, unless adjacent panels are sewn together.

The geotextile shall not be placed until it can be anchored and protected with the intended covering within 48 hours. If the geotextile will not be covered within 48 hours, a temporary covering will be used for protection from ultraviolet light.

Securing pins, approved by the Engineer and provided by the geotextile manufacturer, shall be placed along the edge of the panel to adequately secure it during placement, except as noted under item d. below. At vertical laps, securing pins shall be inserted through both layers along a line through the approximate midpoint of the overlap. At horizontal laps and laps across slopes, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches (50 mm) in from the edge of the outer limits of the placed geotextile at intervals not greater than 12 feet (3.6 m), unless otherwise specified. Additional pins shall be installed as necessary to prevent any slippage of the fabric, regardless of locations. The use of securing pins will be held to the minimum necessary. The fabric may be secured with other methods when specified or directed by the Engineer. Pins shall be steel or fiberglass, formed as a "U", "L", or "T" shape or with "ears" to prevent total penetration. Steel washers shall be provided on all but the "U"-shaped pins.

c. Subsurface Drains

The geotextile shall be covered by drainfill or other material within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case will material be dropped on uncovered fabric from a height greater than 5 feet (1.5 m). The minimum overlap of adjacent geotextile panels for unsewn fabric shall be as follows:

- 1) Trench drain - 12 inches (30 cm)
- 2) Blanket drain - 18 inches (45 cm)

d. Road Stabilization

The geotextile shall be unrolled parallel to the roadway centerline. The minimum overlap of adjacent geotextile panels shall be 24 inches (60 cm) for unsewn fabric. Alternately, adjacent panels may be sewn together per item 5a. above.

Securing pins, approved by the Engineer and provided by the geotextile manufacturer, may be used when necessary to ensure temporary anchoring of the geotextile during the installation process. The pins shall be removed prior to permanent backfilling.

Backfill will be dumped and spread in a uniform thickness generally not to exceed 9 inches after compaction. The first 2 or 3 lifts may be used to seal and consolidate with only light compaction. Over-stressing the soil and severe rutting should be avoided by utilizing spreading and dumping equipment that exerts only moderate pressures on the soil. Granular backfill depths may have to be increased and equipment loads reduced to control soil stress if determined necessary by the Engineer. Ruts developed during spreading and compacting will be filled with additional backfill material so that backfill thickness can be maintained. In no case will blading or backblading of a rutted surface be allowed to reduce rut depth.

Gravel and other coarse-grained backfill will be compacted with vibratory rollers. Vibration will not be used for coarse-grained backfill when the resulting dynamic forces will cause a loss in subgrade or backfill soil strength; e.g., fine sand backfill over a sand or silt subgrade having a high water table. If such conditions exist, moderate to heavy static rollers (steel drum or rubber tired) will be used. Fine-grained backfill will be compacted with sheepsfoot or rubber tired rollers.

TABLE 1 - REQUIREMENTS FOR WOVEN GEOTEXTILES BY USE

| Property  | Test Method                         | <u>Slope Protection</u>                     | <u>Road Stabilization</u>                   |
|---|-------------------------------------|---|---|
|   |                                     | Unprotected Class I and Protected Class II  | Class IV                                    |
| Tensile Strength - Lbs (kN) <u>1/</u>                   | ASTM D 4632                         | 250 (1.11) min.                             | 200 (0.89) min.                             |
| Bursting Strength - psi (kg/cm <sup>2</sup> ) <u>1/</u> | ASTM D 3786                         | 450 (31) min.                               | 450 (31) min.                               |
| Elongation - % <u>1/</u>                                | ASTM D 4632                         | 35 max.                                     | 35 max.                                     |
| Puncture - lbs. (kN) <u>1/</u>                          | ASTM D 4833                         | 100 (0.445) min.                            | 100 (0.445) min.                            |
| Ultraviolet Light Resistance - % <u>1/</u>              | ASTM D 4355<br>150 hrs.<br>exposure | 70% min. tensile strength retained          | 70% min. tensile strength retained          |
| Apparent Opening Size (AOS) - mm                        | ASTM D 4751                         | Less than or equal to 0.212 (#70) <u>2/</u> | Less than or equal to 0.600 (#30) <u>2/</u> |
| Percent Open Area                                       | CORPS AD-745-085 <u>3/</u>          | 4.0% min.                                   | 1.0% min.                                   |

1/ Minimum roll value (weakest principal direction): average minus two standard deviations (only 2-1/2 percent will be lower).

2/ U.S. standard sieve size.

3/ Test methods prepared by U.S. Army Corps of Engineers.

TABLE 2 - REQUIREMENTS FOR NONWOVEN GEOTEXTILES BY USE

| Property  | Test Method                         | Slope Protection                            |   | Subsurface Drainage                         | Road Stabilization                          |
|---|-------------------------------------|---|---|---|---|
|   |                                     | Unprotected Class I                         | Protected/Bedding Class II                  | Class III                                   | Class IV                                    |
| Tensile Strength - lbs (kN) <u>1/</u>                   | ASTM D 4632                         | 200 (0.89) min.                             | 100 (0.44) min.                             | 100 (0.44)min.                              | 150 (0.66) min.                             |
| Bursting Strength - psi (kg/cm <sup>2</sup> ) <u>1/</u> | ASTM D 3786                         | 350 (1.55) min.                             | 210 (0.93)min.                              | 210 (0.93) min.                             | 300 (1.33)min.                              |
| Elongation - % <u>1/</u>                                | ASTM D 4632                         | 100 max.                                    | 100 max.                                    | 100 max.                                    | 100 max.                                    |
| Puncture - lbs. (kN) <u>1/</u>                          | ASTM D 4833                         | 90 (0.40) min.                              | 50 (0.22)min.                               | 50 (0.22) min.                              | 80 (0.35) min.                              |
| Ultraviolet Light Resistance-% <u>1/</u>                | ASTM D 4355<br>150 hrs.<br>exposure | 70% min. tensile strength retained          | 70% min tensile strength retained           | 70% min. tensile strength retained          | 70% tensile strength retained               |
| Apparent Opening Size (AOS) - mm                        | ASTM D 4751                         | Less than or equal to 0.212 (70#) <u>2/</u> | Less than or equal to 0.212 (70#) <u>2/</u> | Less than or equal to 0.212 (70#) <u>2/</u> | Less than or equal to 0.212 (70#) <u>2/</u> |
| Permittivity - sec.-1 <u>1/</u>                         | ASTM D 4491                         | 0.70  | 0.70  | 0.70  | 0.70  |

1/ Minimum roll value (weakest principal direction): average minus two standard deviations (only 2-1/2 percent will be lower).

2/ U.S. standard sieve size.