

SECTION 645 GEOTEXTILE FABRICS

645.1 Description

- (1) This section describes furnishing and installing geotextile fabrics for subgrade separation and stabilization, drainage filtration, subgrade reinforcement, and under culverts and riprap.

645.2 Materials

645.2.1 General

- (1) Furnish geotextile fabric of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest primary direction. The contractor may use nonwoven fabric that is one or a combination of the following: needle punched, heat bonded, or resin bonded.
- (2) Furnish geotextile fabric that is insect, rodent, mildew, and rot resistant.
- (3) Furnish the geotextile fabric in a wrapping that protects the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. Keep the geotextile dry until installed.
- (4) Clearly mark the geotextile fabric rolls to show the type of fabric.
- (5) The engineer may obtain samples of fabric for testing from the job site as specified below, or as the engineer determines.
- (6) If using sewn seams, furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment proposing to use on the project, before incorporating into the work.
- (7) If no minimum values are specified below, use those specified in the special provisions.

645.2.2 Geotextile Fabric, Type SAS (Subgrade Aggregate Separation)

- (1) Furnish fabric conforming to the following physical properties:

TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	170 lb. (750 N)
Minimum puncture strength	ASTM D 4833	70 lb. (300 N)
Maximum apparent opening size	ASTM D 4751	No. 70 (212 μ m)
Minimum permittivity	ASTM D 4491	0.35 s ⁻¹

^[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

- (2) For quantities over 20,000 square yards (20 000 m²), furnish to the engineer, at least 10 days before use in the work, a manufacturer's certified report of test or analysis that shows the geotextile fabric delivered conforms to the above requirements. Mark the delivered geotextile fabric to clearly identify it with the applicable test report furnished to the engineer. The engineer will obtain samples of fabric for testing from the job site for each 20,000 square yards (20 000 m²) or lesser portion used in the work.

645.2.3 Geotextile Fabric, Type MS (Marsh Stabilization)

- (1) Furnish fabric conforming to the physical properties the special provisions specify.
- (2) Deliver to the engineer a sample of the geotextile material at least 15 days before incorporating into the work. At the same time, furnish a sewn seam sample using the same geotextile fabric, thread, seam spacing, and number, and overlap distance as are intended or required for use.
- (3) Furnish to the engineer, at least 15 days before use in the work, a manufacturer's certified report of test or analysis that shows that the geotextile fabric delivered conforms to the above requirements. Mark the delivered geotextile fabric to clearly identify it with the applicable test report furnished to the engineer. The engineer will obtain samples of fabric for testing from the job site for each 10,000 square yards (10 000 m²) or lesser portion used on the contract.

645.2.4 Geotextile Fabric, Type DF (Drainage Filtration)

- (1) Furnish fabric conforming with the physical requirements of either schedule A, schedule B, or schedule C as the contract specifies.

SCHEDULE A TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	110 lb. (500 N)
Minimum puncture strength	ASTM D 4833	40 lb. (175 N)
Minimum apparent breaking elongation	ASTM D 4632	30%
Maximum apparent opening size	ASTM D 4751	300 µm
Minimum permittivity	ASTM D 4491	0.70 s ⁻¹

SCHEDULE B TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	180 lb. (800 N)
Minimum puncture strength	ASTM D 4833	70 lb. (300 N)
Minimum apparent breaking elongation	ASTM D 4632	30%
Maximum apparent opening size	ASTM D 4751	300 µm
Minimum permittivity	ASTM D 4491	1.35 s ⁻¹

SCHEDULE C TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	180 lb. (800 N)
Minimum puncture strength	ASTM D 4833	70 lb. (300 N)
Minimum apparent breaking elongation	ASTM D 4632	15%
Maximum apparent opening size	ASTM D 4751	600 µm
Minimum permittivity	ASTM D 4491	1.00 s ⁻¹

^[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

(2) Do not use slit film woven fabric for this work.

(3) For quantities over 2000 square yards (2000 m²), furnish to the engineer, at least 10 days before use in the work, a manufacturer's certified report of test or analysis that shows the geotextile fabric delivered conforms to the above requirements. Mark the delivered geotextile fabric to clearly identify it with the applicable test report furnished to the engineer. The engineer will obtain samples of fabric for testing from the job site for each 2000 square yards (2000 m²) or lesser portion used in the work.

645.2.5 Geotextile Fabric, Type SR (Subgrade Reinforcement)

(1) Furnish fabric conforming to the physical properties the special provisions specify.

(2) For quantities over 10,000 square yards (10 000 m²), furnish to the engineer, at least 10 days before use in the work, a manufacturer's certified report of test or analysis that shows the geotextile fabric delivered conforms to the above requirements. Mark the delivered geotextile fabric to clearly identify it with the applicable test report furnished to the engineer. The engineer will obtain samples of fabric for testing from the job site for each 10,000 square yards (10 000 m²) or lesser portion thereof used on this contract.

645.2.6 Geotextile Fabric, Type R (Riprap)

(1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	205 lb. (900 N)
Minimum puncture strength	ASTM D 4833	80 lb. (350 N)
Minimum apparent breaking elongation	ASTM D 4632	15%
Maximum apparent opening size	ASTM D 4751	No. 30 (600 µm)
Minimum permittivity	ASTM D 4491	0.12 s ⁻¹

^[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.7 Geotextile Fabric, Type HR (Heavy Riprap)

(1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE ^[1]
Minimum grab tensile strength, lb	ASTM D 4632	305 lb. (1350 N)
Minimum puncture strength, lb	ASTM D 4833	100 lb. (425 N)

Minimum apparent breaking elongation, %	ASTM D 4632	15%
Maximum apparent opening size	ASTM D 4751	No. 30 (600 μm)
Minimum permittivity	ASTM D 4491	0.40, s ⁻¹

^[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.8 Geotextile Fabric, Type C (Modified SAS)

- (1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE ^[1]
Grab tensile strength, lb	ASTM D 4632	205 lb. (900 N)
Puncture strength, lb	ASTM D 4833	70 lb. (300 N)
Maximum apparent opening size	ASTM D 4751	No. 50 (300 μm)
Minimum permittivity	ASTM D 4491	0.12 s ⁻¹

^[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.9 Geotextile Fabric, Type ES (Embankment Stabilization)

- (1) Furnish fabric conforming to the physical properties the special provisions specify.
- (2) Deliver to the engineer a sample of the geotextile material at least 15 days before incorporating it into the work. At the same time, furnish a sewn seam sample using the same geotextile fabric, thread, seam spacing and number, and overlap distance as are intended or required for use in the work.
- (3) Furnish to the engineer, at least 15 days before use in the work, a manufacturer's certified report of test or analysis that shows that the geotextile fabric delivered conforms to the above requirements. Mark the delivered geotextile fabric to clearly identify it with the applicable test report furnished to the engineer. The engineer will obtain samples of fabric for testing from the job site for each 10,000 square yard (10 000 m²) or lesser portion used on the contract.

645.3 Construction

645.3.1 Sewing

- (1) Sew all factory and field seams with a thread having the same or greater durability as the fabric material. Use a 401 stitch conforming to Federal Standard No. 751a for all seams. Ensure that all seams develop a tensile strength equal to or greater than 60 percent of the specified grab tensile strength of the fabric, unless specified otherwise.

645.3.2 Geotextile Fabric, Type SAS

- (1) Before placing the geotextile fabric, smooth, shape, and compact the subgrade to the required grade, section, and density. After placing the fabric on the subgrade area, the engineer will not allow traffic or construction equipment to travel directly on the fabric.
- (2) Roll the fabric out on the roadway and pull taut manually to remove wrinkles. Join separate pieces of fabric by overlapping or sewing. Place the fabric in the overlapped joints so it overlaps at least 18 inches (450 mm).
- (3) The engineer may require the use of weights or pins to prevent the wind from lifting the fabric.
- (4) After placing, do not expose the fabric longer than 48 hours before covering.
- (5) Place the base material over the fabric by back dumping with trucks and leveling with a crawler dozer. The contractor shall not use construction equipment that causes ruts deeper than 3 inches (75 mm). Fill all ruts with additional material. The engineer will not allow the contractor to smooth ruts without adding additional material. Cover damaged areas with a patch of fabric using a 3-foot (900 mm) overlap in all directions.

645.3.3 Geotextile Fabric, Type MS

- (1) Complete clearing operations before placing the fabric. Within the area being covered by fabric, cut stumps and sharp objects level with the ground surface. Do not remove sod, grass, and roots that extend beneath the ground surface. Carefully place the geotextile fabric on the ground using hand methods to avoid disturbing the existing root mat and vegetation. Roll the fabric out as smoothly as possible and pull taut manually to remove wrinkles. The engineer may require the use of weights or pins to prevent the

wind from lifting the fabric. After placement, do not expose the fabric longer than 48 hours before covering. If visible defects exist, replace the defective section of fabric with a new defect-free section of fabric.

- (2) Place the geotextile fabric with the machine direction perpendicular to the roadway alignment. Sew all seams with 2 parallel stitch lines according to plan details. Space the parallel stitching no more than one inch (25 mm) apart. Place all seams perpendicular to the roadway alignment and facing upward. Ensure that all seams develop at least 80 percent of the specified cross direction tensile strength of the fabric, as determined by the same testing methods. Do not make butt splices between individual roll ends. One stitch line may not cross another stitch line. Repair all breaks or faults in any seam as the engineer directs.
- (3) Place the initial fill layer over the fabric to a depth not less than one-foot (300 mm) but not more than 2 feet (600 mm) by carefully end dumping and pushing on to the fabric. The contractor shall not use construction equipment that causes ruts deeper than 3 inches (75 mm) and does not excessively deform the marsh surface. The contractor shall not drive vehicles on the fabric. Complete the initial lift and install all instrumentation before placing any additional material. After placing the initial lift, place all subsequent lifts no deeper than one foot (300 mm). Do not begin any lift until completing the preceding lift and obtaining the engineer's approval. Conduct spreading operations so that no damage occurs to the fabric. Unless the engineer directs otherwise, place and spread lifts by expanding outward from the centerline of the fill. If fill placement damages the fabric, remove the fill material around the damaged area and the engineer will examine the damaged area to determine if the material requires replacement.

645.3.4 Geotextile Fabric, Type DF

- (1) Before placing the geotextile fabric in trench drains, construct the trench to the grades and dimensions the plans show or as the engineer directs. Remove protruding stones and other matter that might damage the geotextile fabric from the trench walls and base before placing the fabric. Place the geotextile fabric in the trench so it conforms to the trench walls and remains in proper position during drain construction and backfilling. The contractor may join separate pieces of fabric by overlapping or sewing. If overlapping, place the fabric in overlap joints of at least 18 inches (450 mm) in the direction of drain flow. Correct misaligned fabric as the engineer directs. The engineer will direct treatment of damaged fabric areas by one of the following methods:
 1. Place an additional section of fabric extending at least 24 inches (600 mm) beyond any point of the damaged area and position between the trench walls and the damaged fabric.
 2. Remove the section of fabric containing the damaged area and replace it with a new section of fabric.
- (2) After placing, do not expose the fabric longer than 48 hours before covering.
- (3) For applications other than trench drains, construct the surface on which placing the fabric to the grades and dimensions the plans show. Prepare the surface by removing or covering all objects that might damage the fabric. Carefully place the fabric to prevent damage and secure in position. Conduct backfilling or covering operations so that no damage or misalignment occurs to the fabric. Treat all fabric damage or misalignment as specified in the previous paragraph. After placement, do not expose the fabric longer than 48 hours before covering or backfilling.

645.3.5 Geotextile Fabric, Type SR

- (1) Before placing the fabric, smooth and shape the roadway to the required grade and section, and if the engineer requires, compact to the specified density. After placing the fabric on the earth grade, the contractor shall not allow traffic or construction equipment to travel on the fabric.
- (2) Roll out the fabric on the roadway and pull taut manually to remove wrinkles. Join parallel strips of fabric by overlapping or sewing. Sew seams as specified in 645.3.1, except ensure a tensile strength equal to or greater than 60 percent of the specified directional tensile strength of the fabric develops. Overlap the fabric in joints at least 24 inches (600 mm). Overlap butt splices between fabric rolls at least 36 inches (900 mm). The engineer may require the use of weights or pins to prevent the wind from lifting the fabric.
- (3) Cover all tears, holes, or rips in the fabric with a patch of fabric overlapping the defect 36 inches (900 mm) in all directions.
- (4) Cover all fabric within 72 hours of placement.
- (5) Place the backfill material in an initial lift of 12 inches (300 mm). Do not place subsequent lifts, in layers exceeding 12 inches (300 mm) in thickness. Spread each lift with a crawler type tractor and compact with suitable compaction equipment. The contractor shall not use construction equipment that causes ruts

deeper than 4 inches (100 mm). The engineer will not allow turning movements for any hauling or spreading equipment on the fabric until at least 2 lifts of backfill, at least 18 inches (450 mm) deep, are placed and compacted. Do not begin subsequent lifts until spreading and compacting a distance of at least 1000 feet (300 m) of the previous lift. Maintain a 1000-foot (300 m) interval between subsequent lifts until completing each lift. If ruts greater than 4 inches (100 mm) develop during construction operations, the engineer may require the contractor to use lighter equipment, equipment with lower contact pressure, or smaller loads on existing equipment.

- (6) Fill all ruts in the surface of each lift of backfill with additional material. Do not smooth ruts without adding additional backfill.

645.3.6 Geotextile Fabric, Type R

- (1) Before placing the fabric, grade the area smooth and remove all stones, roots, sticks, or other matter that might prevent the fabric from completely contacting the soil.
- (2) Place the fabric loosely and lay it parallel to the direction of water movement. The engineer may require pinning or stapling to hold the geotextile in place. Join separate pieces of fabric by overlapping or sewing. Overlap the fabric in the joints at least 24 inches (600 mm) in the direction of flow. After placing, do not expose the fabric longer than 48 hours before covering.
- (3) Cover damaged areas with a patch of fabric that overlaps 3-feet (900 mm) in all directions.
- (4) Place riprap from the base of the slope upward. The engineer will determine the freefall height of riprap, but in no case should this height exceed one foot (300 mm).

645.3.7 Geotextile Fabric, Type HR

- (1) Place as specified in 645.3.6, except that the freefall height of riprap must not exceed 6 inches (150 mm).

645.3.8 Geotextile Fabric, Type C

- (1) Before placing geotextile fabric, construct and shape the grade to the required grade and section. After placing the fabric, the engineer will not allow traffic or construction equipment to travel on the fabric.
- (2) Roll out the fabric on the excavation and pull taut manually to remove wrinkles. Join separate pieces of fabric by overlapping or sewing. Overlap the fabric in joints at least 18 inches (450 mm). The engineer may require the use of weights or pins to prevent the wind lifting the fabric.
- (3) After placing, do not expose the fabric longer than 48 hours before covering.
- (4) Then place the specified backfill material over the fabric. The contractor shall not use construction equipment that causes ruts over 3 inches (75 mm) in depth. Fill all ruts with additional material and level to required grade. Do not smooth ruts without adding additional material.

645.3.9 Geotextile Fabric, Type ES

- (1) Before placing the geotextile fabric, construct the embankment to the required elevation and make the surface smooth and level. Place the fabric on the prepared surface to the limits the plans show with the machine direction of the fabric oriented in the direction the plans show. Roll out the fabric as smoothly as possible and pull taut manually to remove wrinkles. The engineer may require the use of weights or pins to prevent the wind lifting the fabric. After placing, do not expose the fabric longer than 48 hours before covering. If visible defects or damage to the fabric exists, remove the section containing the defect or damage and replace with a new section of defect-free fabric.
- (2) Sew all seams between fabric strips with 2 parallel stitch lines spaced no more than one inch (25 mm) apart according to the details the plans show. Orient all seams parallel to the roadway alignment and face upward. Sew all seams with a thread having the same or greater durability as the fabric material. Use a 401 stitch conforming to Federal Standard No. 751a for all seams. Ensure that all seams develop a tensile strength equal to or greater than 50 percent of the specified cross direction tensile strength of the fabric. Repair all sewing defects in any seam as the engineer directs. Do not use butt splices between individual roll ends.
- (3) Place the initial fill layer over any fabric layer to a depth not less than 8 inches (200 mm) or more than one foot (300 mm). Carefully end dump and push this lift on to the fabric. Perform spreading operations and use equipment in a manner that does not displace or damage the fabric. Do not make sharp turning movements while placing the initial lift over any individual fabric layer. The contractor shall not drive vehicles on the fabric. Complete the preceding lift before beginning the next lift. Place and compact additional lifts as specified in section 207.

- (4) Unless specified otherwise, use the granular fill material, specified in the plans and special provisions, from at least 8 inches (200 mm) below to at least 8 inches (200 mm) above any single or multiple layer geotextile installation.

645.4 Measurement

- (1) The department will measure the Geotextile Fabric bid items by the square yard acceptably completed.

645.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
645.0100 - 0199	Geotextile Fabric (type)	SY

- (2) Payment for Geotextile Fabric Type SAS, Geotextile Fabric Type DF, and Geotextile Fabric Type SR, and Geotextile Fabric Type C is full compensation for providing, transporting, and installing the fabric.
- (3) Payment for Geotextile Fabric Type MS, Geotextile Fabric Type ES, Geotextile Fabric Type R, and Geotextile Fabric Type HR, and Geotextile Fabric Type C is full compensation for preparing the marsh area or foundation, and for providing, transporting, and installing the fabric.