

SECTION 02740, Rev. 1
GEOCOMPOSITES

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PART 1 GENERAL

1.01 SCOPE

- A. This Section includes requirements for liner system geocomposite drainage layer products and installation.

1.02 RELATED SECTIONS AND PLANS

- A. Section 01025 – Measurement and Payment
- B. Section 02240 – Liner Protective Soil
- C. Section 02770 – Geomembrane
- D. Section 02780 – Geosynthetic Clay Liner
- E. Section 02790 – Interface Friction Conformance Testing
- F. Section 13005 – Liner Penetration Boxes
- G. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM D 1505. Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 - 2. ASTM D 1603. Standard Test Method for Carbon Black Content in Olefin Plastics.
 - 3. ASTM D 1777. Standard Method for Measuring Thickness of Textile Materials.
 - 4. ASTM D 3786. Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric -Diaphragm Bursting Strength Tester Method.
 - 5. ASTM D 4491. Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.

6. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 7. ASTM D 4632. Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
 8. ASTM D 4716. Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 9. ASTM D 4751. Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 10. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 11. ASTM D 5199. Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
 12. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
 13. ASTM F 904. Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.
- B. Federal Standard No. 751a - Stitches, Seams, and Stitching.
- C. Latest version of the Geosynthetic Research Institute (GRI) test method:
1. GRI GN2 and GRI GC13. Joining and Attaching Geonets and Drainage Composites.
 2. GRI GN4. Test Methods, Required Properties and Testing Frequency for Biplanar Geonets and Biplanar Geonet Composites.

1.04 SUBMITTALS

- A. Submit the following to the Engineer for review at least 21 calendar days prior to use:
1. geocomposite Manufacturer and product names;

2. certification of minimum average roll values and the corresponding test procedures for all geocomposite properties listed in Table 02740-1; and
 3. projected geocomposite delivery dates.
- B. Submit to the Engineer for review at least 14 calendar days prior to geocomposite placement, manufacturing quality control certificates for each roll of geocomposite as specified in this section.
- C. For each proposed geocomposite material, the Contractor shall submit to the Engineer for review at least 14 calendar days prior to transporting the geocomposite to site the results of manufacturing quality control testing and certification that the geocomposite is manufactured to meet the minimum interface shear strength criteria when tested in compliance with requirements of Section 02790.

1.05 CONSTRUCTION QUALITY ASSURANCE

- A. The installation of the geocomposite drainage layers will be monitored by the CQA Consultant as required by the CQA Plan.
- B. The CQA Consultant will perform material conformance testing of the geocomposites as required by the CQA Plan.
- C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the installation schedule.
- D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 PRODUCT

2.01 GEOCOMPOSITES

- A. Furnish geocomposite drainage layer materials consisting of a polyethylene geonet core with a needle-punched nonwoven geotextile heat laminated to both sides of the geonet core.
- B. Furnish geocomposite for the primary and secondary leachate collection drainage layers having properties meeting the required property values shown in Table 02740-1. Required geocomposites properties shall be considered minimum average roll values (95 percent lower confidence limit).
- C. Furnish geocomposites that are stock products.

- D. In addition to the property values listed in Table 02740-1, the geocomposites shall:
1. retain their structure during handling, placement, and long-term service (provide manufacturer’s data for long-term compression creep testing); and
 2. be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.
- E. Furnish geocomposite that meets the interface shear strength requirements of Section 02790 as tested by an approved testing laboratory.
- F. Furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Furnish polyester or polypropylene threads that have a minimum size of 2,000 denier.
- G. Furnish geocomposite meeting the transmissivity requirements in Table 02740-1 as tested by an approved testing laboratory. The transmissivity of the geocomposites for liner system construction shall be tested in accordance with ASTM D 4716 to demonstrate that the design transmissivity will be maintained for the design period of the facility. The primary and secondary geocomposites used in the bottom liner system shall be tested using the actual boundary materials intended for each geocomposite at the normal loads of 1,000, 6,000 and 13,000 pounds per square foot (psf). At the proposed normal loads, testing shall be conducted for a minimum period of 100 hours unless project-specific data equivalent to the 100-hour period is provided in which case the test shall be conducted for a minimum period of 24 hours.

2.02 MANUFACTURING QUALITY CONTROL

- A. Sample and test the geotextile and geonet components of the geocomposite to demonstrate that these materials conform to the requirements of this section.
- B. Perform manufacturing quality control tests to demonstrate that the geotextile properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of one per lot or as per GRI-GN4, Table 1a, whichever is more frequent. A lot is defined by ASTM D 4354:

<u>Test</u>	<u>Procedure</u>
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Static Puncture strength	ASTM D 6241

- C. Perform additional manufacturing quality control tests on the geotextile, at a minimum frequency of one per lot or as per GRI-GN4, Table 1a, whichever is more frequent, to demonstrate that the apparent opening size (per ASTM D 4751) and permittivity (per ASTM D 4491) of the geotextile conform to the values specified in Table 02740-1.
- D. Perform manufacturing quality control tests to demonstrate that the geonet drainage core properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of one per lot or as per GRI-GN4, Table 1a, whichever is more frequent. A lot is defined by ASTM D 4354:

<u>Test</u>	<u>Procedure</u>
Polymer density	ASTM D 792 or 1505
Carbon black	ASTM D 1603 or 4218
Thickness	ASTM D 5199

- E. Perform additional manufacturing quality control tests, at a minimum frequency of one per lot or as per GRI-GN4, Table 1a, whichever is more frequent, with a lot defined by ASTM 4354, to demonstrate that the geocomposite drainage layers conform to the hydraulic transmissivity (per ASTM D 4716) and ply adhesion (per ASTM F 904) requirements of Table 02740-1.
- F. Submit quality control test certificates signed by the geotextile, geonet, and geocomposite manufacturer quality control manager. The quality control certificates shall include:
1. lot, batch, and roll number and identification; and
 2. results of manufacturing quality control tests including description of test methods used.
- G. Do not supply any geocomposite roll that does not comply with the manufacturing quality control requirements.
- H. If a geotextile, geonet, or geocomposite sample fails to meet the quality control requirements of this section, sample and test rolls manufactured at the same time or in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKING AND LABELING

- A. The geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
- B. Geocomposite rolls shall be labeled with the following information:
 - 1. fabricator’s name;
 - 2. product identification;
 - 3. lot or batch number;
 - 4. roll number; and
 - 5. roll dimensions.
- C. Geocomposite rolls not labeled in accordance with this section or on which labels are illegible upon delivery to the site shall be rejected and replaced with properly labeled rolls at no additional cost to the Owner.
- D. If any special handling is required, it shall be so marked on the geotextile component e.g., “This Side Up” or “This Side Against Soil To Be Retained”.

2.04 TRANSPORTATION

- A. Geocomposites shall be delivered to the site at least 21 days prior to the planned deployment date to allow the CQA CONSULTANT adequate time to perform conformance testing on the geocomposite samples as required by the CQA Plan.

2.05 HANDLING AND STORAGE

- A. The CONTRACTOR shall be responsible for storage of the geocomposite at the site.
- B. Handling and care of the geocomposite prior to and following installation at the site, is the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to the materials incurred prior to final acceptance by the OWNER.
- C. The geocomposite shall be stored off the ground and out of direct sunlight, and shall be protected from excessive heat or cold, mud, dirt, and dust. Any additional storage procedures required by the manufacturer shall be the CONTRACTOR’S responsibility.

PART 3 EXECUTION

3.01 PLACEMENT

- A. The CONTRACTOR shall not commence geocomposite installation until the CQA CONSULTANT completes conformance evaluation of the geocomposite and quality assurance evaluation of previous work, including evaluation of CONTRACTOR'S survey results for previous work.
- B. For geocomposite with directional hydraulic transmissivity, the CONTRACTOR shall install the geocomposite with the high transmissivity direction (usually the roll direction) in the downgradient direction and perpendicular to elevation contours.
- C. The CONTRACTOR shall handle the geocomposite in such a manner as to ensure the geocomposite is not damaged in any way.
- D. The CONTRACTOR shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.
- E. The geocomposite shall only be cut using manufacturer's recommended procedures.
- F. In the presence of wind, all geocomposite panels shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.
- G. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. Care shall be exercised when handling sandbags, to prevent rupture or damage of the sandbags.
- H. If necessary, the geocomposite shall be positioned by hand after being unrolled over a smooth rub sheet.
- I. Tools shall not be left on, in, or under the geocomposite.
- J. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 30 days.

- K. If white colored geotextile is used in the geocomposite, precautions shall be taken against “snowblindness” of personnel.

3.02 SEAMS AND OVERLAPS

- A. The components of the geocomposite (i.e., geotextile, geonet, and geotextile) are not bonded together at the ends and edges of the rolls. Each component will be secured or seamed to the like component of adjoining panels.
- B. Geotextile Components:
 - 1. The bottom layers of geotextile shall be overlapped. The top layers of geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 6 inches prior to seaming.
 - 2. No horizontal seams shall be allowed higher than one-third the slope height on slopes steeper than 10 horizontal to 1 vertical.
 - 3. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn using Stitch Type 401 per Federal Standard No. 751a. The seam type shall be Federal Standard Type SSN-1.

3.03 REPAIR

- A. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 2 ft beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the top geotextile and geonet on the slope. The patch shall be secured every 6 inches with approved tying devices. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or tear width across the panel is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with this section.
- B. All repairs shall be performed at no additional cost to the OWNER.

3.04 PLACEMENT OF SOIL MATERIALS

- A. The CONTRACTOR shall place all soil materials in such a manner as to ensure that:
 - 1. the geocomposite and underlying geosynthetic materials are not damaged;

2. minimal slippage occurs between the geocomposite and underlying layers;
and
 3. excess tensile stresses are not produced in the geocomposite.
- B. Spread soil on top of the geocomposite from the bottom of slopes upward to cause the soil to cascade over the geocomposite rather than be shoved across the geocomposite.
- C. For geocomposites overlying the geomembrane, do not place overlying soil material at ambient temperatures below 40 °F or above 104 °F, unless authorized in writing by the Engineer.
- D. Do not drive equipment directly on the geocomposite. Only use equipment above a geocomposite overlying a geomembrane that meets the following ground pressure requirements above the geomembrane:

Maximum Allowable Equipment Ground Pressure (pounds per square inch)	Minimum Thickness of Overlying Soil (inches)
<5	12
<10	18
<20	24
>20	36

TABLE 02740-1
GEOCOMPOSITE PROPERTY VALUES

PROPERTIES ⁽⁶⁾	QUALIFIER	UNITS	SPECIFIED VALUES ⁽¹⁾	TEST METHOD
<u>Geonet Component:</u>				
Polymer composition	Minimum	%	95 polyethylene by wt	--
Polymer density	Minimum	g/cm ³	0.93	ASTM D 792 (Md B) or 1505
Carbon black content	Range	%	1.5 - 3	ASTM D 1603 or 4218
Nominal thickness	Minimum	mil	200	ASTM D 5199
<u>Geotextile Component</u>				
Type	None	none	Needle punched nonwoven	--
Polymer composition	Minimum	%	95 polyester or polypropylene	
Mass per unit area	Minimum	oz/yd ²	8	ASTM D 5261
Apparent opening size	Maximum	mm	O ₉₅ ≤ 0.21 mm	ASTM D 4751
Permittivity	Minimum	sec ⁻¹	0.5	ASTM D 4491
Grab strength	Minimum	lb	200	ASTM D 4632 ⁽²⁾
Tear strength	Minimum	lb	80	ASTM D 4533 ⁽²⁾
Static puncture strength	Minimum	psi	430	ASTM D 6241
<u>Geocomposite:</u>				
Transmissivity ^(4,5)	Minimum	m ² /s	See Note 4	ASTM D 4716
Ply Adhesion	Minimum	lb/in	1.0	ASTM D 7005

Notes:

- All values represent minimum average roll values.
- Minimum value measured in machine and cross-machine direction.
- Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- The design transmissivity of the primary and secondary geocomposite drainage layers is measured using water at a gradient of 0.02 under compressive stresses of 1,000 psf, 6,000 psf, and 13,000 psf for a period of 100 hours. For the primary geocomposite drainage layer, the minimum required transmissivities are 5.0×10^{-3} m²/s, 4.0×10^{-3} m²/s, and 1.8×10^{-3} m²/s under the compressive stresses of 1,000 psf, 6,000 psf, and 13,000 psf, respectively. For testing of the primary geocomposite drainage layer, the geocomposite shall be sandwiched between 60-mil textured HDPE geomembrane and soil actually used for the liner protective layer. For the secondary geocomposite drainage layer, the minimum required transmissivities are 7.5×10^{-3} m²/s, 5.0×10^{-3} m²/s, and 2.5×10^{-3} m²/s under the compressive stresses of 1,000 psf, 6,000 psf, and 13,000 psf, respectively. For testing of the secondary geocomposite drainage layer, the geocomposite shall be sandwiched between two 60-mil textured HDPE geomembranes.
- See Paragraph 2.02 for required MQC test frequencies.

[END OF SECTION]