STANDARD SPECIFICATIONS
SECTION 02070
GEOSYNTHETICS

PART 1 GENERAL

1.1 DESCRIPTION

A. Section includes requirements for providing geosynthetics for drainage, filtration, erosion control, sediment control, roadways, and slope stabilization.

1.2 DEFINITION: Geosynthetics refer to group of materials made from polymeric fibers.

A. Geotextiles: Permeable textile material used with soil, rock, or other geotechnical engineering related materials as integral part of human-made project, structure, or system.

B. Geogrids: Deformed or non-deformed grid-like polymeric material formed by intersecting ribs joined at junctions used for reinforcement with soil, rock, or any other geotechnical engineering related materials as integral part of human-made project, structure or system.

C. Geonets: Netlike polymeric material formed from intersecting ribs integrally joined at junctions used for drainage with soil, rock, or other geotechnical engineering related materials as integral part of human-made project, structure or system.

D. Geomembranes: Essentially impermeable membrane used as liquid or vapor barrier with soil, rock, or other geotechnical engineering related materials as integral part of human-made project, structure, or system.

E. Geocomposites: Manufactured material using geotextiles, geogrids, geonets, and/or geomembranes in laminated or composite form.

1.3 SUBMITTALS

A. Submit following Section 01330.
   1. List of geosynthetics used on project to include manufacturer's name, address, material's properties, identification number, and intended application.
   2. Submit manufacturer's recommended joining and repair methods for geosynthetics used on project.

B. Submit following Section 01450.
   1. Certificates of Compliance of test results for specified properties.
      a. Present test methods used for specific properties of geotextiles.

Property	Current Method
Grab Tensile Strength	ASTM-D-4632
Grab Elongation	ASTM-D-4632
Mullen Burst	ASTM-D-3786
Puncture Resistance	ASTM-D-4833
Trapezoidal Tear	ASTM-D-4533
Apparent Opening Size (AOS)	ASTM-D-4751
Permittivity	ASTM-D-4491

1.4 DELIVERY, STORAGE AND HANDLING

A. Furnish geosynthetic rolls with suitable wrapping for protection against moisture, and extended ultraviolet exposure before placement.

B. Label or tag each roll with sufficient identification for inventory and quality control purposes.

C. Store rolls in manner that protects them from elements mentioned above.
   1. If stored outdoors, elevate and protect with waterproof cover.

1.5 REFERENCE

A. Task Force 25 refers to joint committee formed from AASHTO, American Building Contractors (ABC), and American Road Builders and Transportation Association (ARBTA).

PART 2 PRODUCTS

2.1 MATERIALS

A. Fibers used in manufacture of geosynthetics, and threads used in joining geosynthetics by sewing:
   1. Long-chain synthetic polymers composed of at least 85 percent by weight polyolefins, polyesters, or polyamides.
   2. Formed in network so that filaments or yarns retain dimensional stability relative to each other, including selvedges.

B. Minimum values for geosynthetic properties represent numerical values with minimum average roll value from test results on any sampled roll in a lot and meeting or exceeding minimum values in the tables.
   1. Use value in weaker principal direction.

C. Drainage and Filtration.

1. Use geotextile to allow passage of water while retaining in-situ soil without clogging.
2. Use drainage composite for wall drains to conduct fluid in its manufactured plane.
3. Filter Geotextile.
    a. Use nonwoven geotextile meeting geotextile properties for "moderate" degree of survivability following Task Force 25.

Property (unit)	Value
Grab Tensile Strength (lbs.)	130 min
Grab Tensile Elongation (percent)	25 min
Puncture Resistance (lbs.)	40 min
Burst Resistance (psi)	210 min
Trapezoidal Tear (lbs.)	40 min
Permittivity (sec-1)	1 min
AOS (sieve No.)	sands No.50 - No.70 silts/clays No.70 - No.100

4. Drainage Composite, Type A.
    a. Use for retaining walls or structures less than 25 feet in height with sand, silt, or clay backfill soil.
    b. Heat bond or glue to plastic or nylon geomat drainage core filter geotextile.
    c. Minimum hydraulic transmissivity: 2 gpm/ft following ASTM D4716.
    d. Use crush resistance in range of 2500 to 4500 psf, depending on height of wall or structure.
    e. Apply lower range to heights up to 15 feet following ASTM D1621.
5. Drainage Composite, Type B.
    a. Use for retaining walls or structures less than 25 feet in height with gravel or aggregate backfill.
    b. Heat bond or glue to core filter geotextile.
    c. The minimum hydraulic transmissivity: 10 gpm/ft.
    d. Use crush resistance in range of 2500 to 4500 psf, depending on height of wall or structure.
    e. Apply lower range to heights up to 15 feet.

D. Erosion Control.
1. Use geotextile to minimize soil erosion due to construction activity and/or natural forces and to allow free passage of water while retaining in-situ soil without clogging.
    a. Combine with select stone, soil material, and/or vegetation to achieve this goal.
2. Use for slope and scour protection for bridge piers and abutments, drainage channel/swales and stream crossings.
3. Temporary erosion control products that include natural fibers following Section 01570.
4. Erosion Control Geotextile.
    a. Place stone from height of less than 3 feet and not exceeding 250 lbs.

Property (unit)	Value
Grab Tensile Strength (lbs.)	200 min
Grab Tensile Elongation (percent)	20 min
Seam Strength (lbs.) ASTM D4884	180 min
Puncture Resistance (lbs.)	80 min
Burst Resistance (psi)	320 min
Trapezoidal Tear (lbs.)	50 min
Permeability (cm/sec) ASTM D4491-99a	$k_{fabric} > k_{soil}$
Ultraviolet degradation at 150 hours ASTM D4355	70 percent strength retained.
AOS (sieve no.)	Greater than No 30 sieve on soil with 50 percent or less particles by weight passing No. 200 sieve. Less than No. 50 sieve on soil with more than 50 percent particles by weight passing No. 200 sieve.

E. Sediment Control.
   1. Use geosynthetic as barrier to remove suspended particles from passing water.
   2. Use geotextile as silt fence or sediment trapping device.
      a. Quantities of silt fence shown on plans may be increased or decreased at Engineer's direction based on weather, construction procedures, and actual site conditions that occur during construction of project.

Property (unit)	Value
Grab Tensile Strength (lbs.)	90 min
Grab Tensile Elongation (percent)	50 max
Puncture Resistance (lbs.)	40 min
Burst Resistance (psi)	190 min
Permittivity (sec-1)	0.01 min
AOS (sieve No.)	No. 30 - No. 50

F. Roadways.
   1. Use geosynthetic between pavement aggregates and soil subgrade as separating or reinforcing membrane and for unpaved roadways and temporary access roads.
   2. Geotextile Separator:

Property (unit)	Value
Grab Tensile Strength (lbs.)	200 min
Grab Tensile Elongation (percent)	40 max
Puncture Resistance (lbs.)	75 min
Burst Resistance (psi)	400 min

G. Slope Stabilization.

1. Use geotextile to construct soil reinforced embankments and retaining walls.
2. Woven Geotextile or Geogrid Reinforcement: Use wide-width strip, minimum tensile strength of 150 lbs. per inch following ASTM D4595.

H. Barriers or Liners: Geomembrane with geotechnical engineering related material to control fluid migration in man made project, structure, or system.

PART 3 EXECUTION

3.1 GENERAL

A. To minimize potential damage of geosynthetics to elements, limit exposure, such as ultraviolet light and moisture, between lay down and cover to 14 days.

B. Join geosynthetic by either sewing or overlapping, and make seams following manufacturer's recommendations.

C. Repair geosynthetic with geosynthetic patch placed over damaged area and extend 3 feet beyond perimeter of tear or damage or following manufacturer's recommendations.

D. Place riprap and stone on erosion control geotextile.

E. For other applications.
1. Do not drop riprap and heavy stone that is to be placed on top of geosynthetics from height exceeding 1 foot.
2. Do not drop stones for slope protection and smaller size of stone filling onto geosynthetic from height exceeding 3 feet.

3.2 FILTRATION

A. Install filtration geotextiles for applications including, but not limited to, wrapping aggregate drain, or as part of drainage composite.
1. Soil in contact with filter geotextile to be smooth and free of large or sharp objects, which may puncture or tear geotextile.
2. Place filter geotextile in direct contact with aggregates from base of wall or deeper when aggregate drain is used behind concrete retaining wall.
    a. Place aggregates in lifts and roll geotextile up to height of each lift.
    b. For each lift of aggregates place lift of backfill material on other side of filter geotextile.
    c. Follow this sequence until height of wall is reached.
3. For gabion retaining walls, place filter geotextile next to gabion wall.
    a. Roll geotextile upward along the wall as each specified lift of backfill material is placed.
4. Place filter geotextile against trench to specified height when it is used for pipeline surrounded with uniform coarse aggregates or for underdrain system.

a. Prepare trench to be smooth and free of large, sharp objects that may puncture or tear geotextile.
b. Compact aggregates inside geotextile as previously specified herein.
c. Fold geotextile over the top of aggregates with 12-inch overlap.
d. Place general backfill above geotextile to top of trench.

3.3 DRAINAGE

A. Install specified drainage composites for applications including, but not limited to, pore water dissipaters behind retaining walls.
   1. Place drainage composite behind and in direct contact with retaining walls.
      a. As each lift of backfill material is placed, roll drainage composite upward along the wall unless otherwise specified by manufacturer.
      b. Follow manufacturer's recommendations for anchorage and seals.

3.4 ROADWAYS

A. Strip topsoil, clear and grub site, excavate or fill to grade; and remove soft areas detected during proof rolling and replace with compacted fill.

B. Place geotextile or geogrid on prepared subgrade without wrinkles or folds; and overlap adjacent rolls using manufacturers overlap requirements.

C. Check for damaged geotextile or geogrid before placing aggregate. Repair following manufacturer’s recommendations.

D. Place aggregate by end dumping onto geotextile or geogrid from the edge or previously placed aggregate.
   1. Keep construction equipment off geotextile or geogrid.
   2. Place aggregate so that minimum specified lift thickness is maintained between construction equipment and geotextile or geogrid at all times.

E. Fill ruts with aggregate compacted to specified density.

F. Repair any damage to geotextile or geogrid that occurs during placement of aggregate following manufacturer’s recommendation.
   1. Modify placement procedures to prevent further damage from occurring.

3.5 TEMPORARY CONSTRUCTION ROADWAYS

A. Before installing geotextile or geogrid, remove boulders, debris, stumps, and large logs.
   1. Do not remove low vegetation, root mat, and desiccated crust overlaying some soft organic soils.

B. Extend geotextile or geogrid entire width of the roadway and follow manufacturer's recommended overlaps with 12 inches as minimum.

C. Keep construction equipment off geotextile or geogrid until minimum 12 inches of aggregate is placed over fabric.
   1. For very soft soils, place minimum 18 inches of aggregate before construction equipment is allowed over geotextile or geogrid.

D. Rut entire road surface with loaded rubber tire dump trucks after placing and leveling initial aggregate lift.
   1. Add next level of aggregate after uniform rutting of 2 to 4 inches is achieved.

E. During roadway operations, repair rutting by additional aggregate and not by leveling of existing aggregate.

3.6 SLOPE STABILIZATION

A. Wrapped facing and structural facing are allowed.
   1. Unroll wrapped facing of geosynthetic perpendicular to wall face with at least 3 feet of geosynthetic draping over wall facing or used to form facing itself.
   2. Overlap adjoining rolls, perpendicular to wall facing, a minimum of 6 inches.
   3. Install structural facing using geosynthetic placed in alternating layers with soil to form a slope, with facing material following Drawings.
   4. If indicated on the Drawings, provide erosion mat to assist in vegetative growth on slope surface.

B. Protection of Geosynthetic wall facing from vandalism and ultraviolet: Spray coated layer of compatible bituminous materials directly on geosynthetic with sand broadcast over surface.

C. Placement and Compaction: Started with soil from area away from wall face and progress toward wall face.

3.7 EROSION AND SEDIMENT CONTROL

A. Execute applications of geosynthetic for erosion and sediment control following Section 01570 and specified herein.

B. Erosion Control Geotextile.
   1. Placement.
      a. Place erosion control geotextile as shown on Standard Details without folds or wrinkles.
      b. Where erosion control geotextile is shown on Drawings, proceed to
         1) Form to lines and grades shown on Drawings.
         2) Place erosion control geotextile on prepared subgrade.
         3) Place sheets parallel to flow and slope.

4) Overlap upstream sheet over downstream sheet and/or upslope sheet over downslope sheet with minimum overlap of 12 inches and stagger vertical overlaps minimum of 5 feet.
5) Anchor sheets with securing pins inserted through geotextile along but not closer than 2 inches to each edge and at laps to prevent displacement before or during construction.
6) Where erosion control geotextile is required below water line, alternate methods of anchorage will be considered upon submittal to Engineer.
7) Replace geotextile damaged or displaced before, during, or after placement and repair at no cost to the Commission.

c. Gravel blanket material (ASTM C33 No. 57 aggregate): Placed to depths and where shown on Drawings.
1) Begin blanket material placement at toe and proceed up slope.
2) In underwater applications, place geotextile and required thickness of blanket material the same day.
3) Do not drop riprap and heavy stone onto geotextile from height of more than 1 foot.
4) Do not drop slope protection and smaller size of stone filling onto geotextile from a height exceeding 3 feet.

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