

SECTION 441 EDGEDRAIN MAT (GEOCOMPOSITE DRAIN)

441-1 Description.

Construct an edgedrain mat using a geocomposite drain (prefabricated drainage unit) at locations shown in the plans or as directed by the Engineer.

441-2 Materials.

441-2.1 General: Furnish manufacturer's certification that all materials proposed for use meet the requirements as specified.

Include with the certification test results from an approved independent testing laboratory for each material property as specified. Submit the certification and test results to the Engineer at least 30 days prior to using materials on any project. Include two specimens, each 12 by 12 inches [300 by 300 mm], of the geocomposite drain with the submission. However, the Engineer may inspect, test, or reject all materials at any time.

As specified by the manufacturer, use geocomposite drains that include all necessary fittings and materials to make splices along the drain and connections from the drain to the outlet piping. Use fittings and connections that are of sufficient strength to withstand construction handling and permanent loading and that meet the approval of the Engineer in any and all cases. Ensure that the geocomposite drain is a product included on the Qualified Products List.

441-2.2 Drainage Core: The drainage core is the interior element of the geocomposite drain, which is encased in filter fabric.

Use a drainage core that is a flexible, rectangular, hollow mat fabricated from a polyolefin and is strong enough to resist the vertical and lateral pressures induced by installation and subsequent soil and traffic loadings. Use a design that allows entry of water from all sides of the core and provides open continuous channels, both horizontally and vertically, for water to flow without restriction.

Property	Test Method	Requirements
Water Absorption	ASTM D 570	0.05% Maximum at 24 hours
Fungus Resistance	ASTM G 21	No Growth

441-2.3 Filter Fabric: The filter fabric is the exterior element of the geocomposite drain, which completely encases the supporting drainage core. For cores having a waffle and/or column type structure, bond the filter fabric to the cores projections. For cores having an over-elongated tube type structure, tightly stretch the filter fabric around the core.

Use a filter fabric that is a non-woven needle punched polyolefin geotextile fabric, free of chemical treatment or coating which alters its physical properties. All fabric minimum strengths shown are minimum average roll requirements in the weakest principal direction, using sampling procedures specified in ASTM D 4354.

Non SI Units		
Property	Test Methods	Requirements
Permeability*	ASTM D 4491	K = 0.20 cm/sec. minimum
AOS (Apparent Opening Size)	ASTM D 4751 (U.S. Std. Sieve)	50-100
Grab Tensile Strength	ASTM D 4632	90 lbs., minimum
Puncture Strength	ASTM D 3787 Modified**	45 lbs., minimum
Trapezoidal Tear Strength	ASTM D 4533	45 lbs., minimum
Mullen Burst Strength	ASTM D 3786	150 psi, minimum
Elongation	ASTM D 4632	35%, minimum
Seam Strength	ASTM D 4595 (wide-width strip method)	80 lbs., minimum
Fabric Weight	ASTM D 3773	4.0 oz/yd ² minimum
Ultraviolet (UV) Resistance	ASTM D 4355 (UV exposure 500 hrs.)	80% Strength retained, minimum
Fungus Resistance	ASTM G 21	No Growth

* Any drain's filter fabric that is overlapped and glued and/or bonded on the pavement side is the critical permeability section. Test a section of filter fabric with the same characteristics, i.e., as fabricated and installed, to ensure that the overlapped section complies with the specified requirements. When the drain's filter fabric is not overlapped on the pavement side, the Contractor may test a normal thickness of the filter fabric to determine its acceptability.

** (Steel ball replaced with a 5/16" diameter solid steel cylinder with a flat tip chamfered at 1/32" x 45 degrees, centered within the ring clamp.)

SI Units		
Property	Test Method	Requirements
Permeability*	ASTM D 4491	2 mm/s, minimum
AOS	ASTM D 4751	150 - 300 μm
Grab Tensile Strength	ASTM D 4632	400 N, minimum
Puncture Strength	ASTM D 3787 Modified**	200 N, minimum
Trapezoidal Tear Strength	ASTM D 4533	200 N, minimum
Mullen Burst Strength	ASTM D 3786	1,035 kPa, minimum
Elongation	ASTM D 4632	35%, minimum
Seam Strength	ASTM D 4595 (wide width strip method)	14 kN/m, minimum
Fabric Weight	ASTM D 3773, ASTM D 3774, ASTM D 3775, ASTM D 3776, ASTM D 3882, ASTM D 3883	0.14 kg/m ² , minimum
Ultraviolet (UV) Resistance	ASTM D 4355 (UV exposure 500 hours)	80% Strength retained, minimum
Fungus Resistance	ASTM G 21	No Growth

* Any drain's filter fabric that is overlapped and glued and/or bonded on the pavement side is the critical permeability section. Test a section of filter fabric with the same characteristics, i.e., as fabricated and installed, to ensure that the overlapped section complies with the specified requirements. When the drain's filter fabric is not overlapped on the pavement side, the Contractor may test a normal thickness of the filter fabric to determine its acceptability.

** Steel ball replaced with an 8 mm diameter solid steel cylinder with a flat tip chamfered at 1 mm by 45 degrees, centered within the ring clamp.

441-2.4 Geocomposite Drain: The geocomposite drain is a prefabricated drainage unit consisting of a supporting drainage core and a filter fabric envelope which completely encases the core and itself.

Once completely fabricated, ensure that the drain's thickness is no less than 3/4 inch [19 mm] with a width or depth as shown in the plans. Sufficiently bond the filter fabric to the core as

specified in order to prevent the fabric from sagging into the core and impeding the water flow due to installation and subsequent soil and traffic loadings, to provide acceptable peel strength, and to facilitate continuous installation of the drain using an approved trenching machine.

Non SI Units		
Property	Test Method	Requirements
Compressive Strength (20% Maximum Deformation)	ASTM D 1621 (12 x 12 inch specimen)	50 psi, minimum
Peel Strength* (Bonding Fabric to Fabric, Bonding Fabric to Projection, Bonding Fabric to Core)	ASTM D 903	35 lbs/ft of width, minimum
In-Plane Flow (Cross-sectional Area; Hydraulic Transmissivity)	ASTM D 4716** (24 inch long specimen, minimum)	15 gal/minute/ft of width, minimum
* Test peel strength for all three conditions. Use test specimens that are both flexible (filter fabric) when testing bonding fabric to fabric, and flexible to rigid (filter fabric to core) when testing bonding fabric to projection or core. Bond specimens to each other using typical assembly conditions for a drain completely fabricated and installed. Thickness of the rigid (core) material is the normal core thickness, prior to the filter fabric encasement, and is an exception to the limiting 1/8 inch thickness of test materials specified in the test method.		
**Test to be conducted at a gradient of 0.1 and a normal pressure of 10 psi for not less than 100 hours.		
SI Units		
Property	Test Method	Requirements
Compressive Strength (20% Maximum Deformation)	ASTM D 1621 (300 by 300 mm specimen)	345 kPa, minimum
Peel Strength* (Bonding Fabric to Fabric, Bonding Fabric to Projection, Bonding Fabric to Core)	ASTM D 903	0.05 kg/mm of width, minimum
In-Plane Flow (Cross-sectional Area; Hydraulic Transmissivity)	ASTM D 4716** (600 mm long specimen, minimum)	0.003 m ³ /(s·m) of width, minimum
* Test peel strength for all three conditions. Use test specimens that are both flexible (filter fabric) when testing bonding fabric to fabric, and flexible to rigid (filter fabric to core) when testing bonding fabric to projection or core. Bond specimens to each other using typical assembly conditions for a drain completely fabricated and installed. Thickness of the rigid (core) material is the normal core thickness, prior to the filter fabric encasement, and is an exception to the limiting 3 mm thickness of test materials specified in the test method.		
**Test to be conducted at a gradient of 0.1 and a normal pressure of 70 kPa for not less than 100 hours.		

(a) Use waffle and/or column drains that provide at least 65% unobstructed inflow opening on the pavement side and at least 12% unobstructed inflow opening on the shoulder side. If a multi-channel core separates the flow into two sections, use only the in-plane flow rate of the pavement side facing channel in determining acceptability. The Contractor may consider a multi-channel core as a single channel if it provides at least 10% unobstructed crossing opening between channels.

(b) Use over-elongated drains that provide at least 12% unobstructed inflow opening on either the pavement or the shoulder side.

Ensure that the drain's material and manufacture are appropriate to facilitate swift, continuous machine-installation using conventional trenching equipment.

441-2.5 Outlet Pipe: For pipe materials for outlets, use any of those specified in 440-2 except that there shall be no perforations. Use outlet pipes 4 inches [100 mm] in diameter as specified on Design Standards, Index No. 287 (edgedrain requirements).

441-3 Installation Methods.

Prior to commencing installation of the geocomposite drain, submit the proposed installation method, noting any deviation from the manufacturer's recommendations to the Engineer. Propose an installation method that reflects adequate measures to safeguard the drain's filter fabric from clogging, minimizing any likely sources of contamination. Upon review of the proposed installation plan, the Engineer may request the Contractor to have a manufacturer's representative present on the project during the installation of the drain at no expense to the Department.

Install geocomposite drains with approved trenching equipment which will cause only a minimal disturbance to the pavement structure and subbase. Design a trencher installation boot to ensure that the drain maintains its flat flow plane after placement and compaction of backfill materials. Throughout each section of drain, use trenching equipment that provides an exposed edge of pavement free of any sand, clay, soil, or other foreign material which hinders inflow and/or prevents direct contact between the drain and the pavement structure. If the Contractor fails to comply with these requirements, the Engineer may restrict the installation of additional sections of drain until the Contractor has made appropriate equipment adjustments or obtained other equipment able to comply with this requirement.

Install the drain as shown in the plans, recommended by the manufacturer, specified herein, and approved by the Engineer. Place the drain in a trench immediately adjacent to the roadway pavement edge. If projections protrude from only one side of the drain, place it such that the projections are in contact with the pavement side of the trench. For over-elongated tube drains, place it such that the drain is in contact with the shoulder side of the trench. Since trench depths shown in the plans are approximate, the Engineer may adjust them. Provide a trench a minimum of 4 inches [100 mm] and a maximum of 5 inches [125 mm] in width.

For over-elongated tube drains, backfill meeting the requirements of 902-4. Otherwise, use materials generated from the trenching operation or material as required by the plans for backfill. Only use rock or coarse aggregate material passing a 3/4 inch [19.0 mm] sieve. Perform the backfilling operation in uncompacted lifts, no greater than 8 inches [200 mm].

Due to the specified trench width limitations, compact the embankment with vibratory compactors having a maximum compaction force of 5,000 pounds [22 kN] (Construction Industry Manufacturers Association rating) or to a degree acceptable to the Engineer. Achieve a minimum density of 90% of the maximum density as determined by AASHTO T 99, Method A or as estimated by the Engineer based on his experience with the backfill material used. Obtain the Engineer's approval of other compaction type equipment.

Excavate the trench, place the drain, and place the first backfill lift in a single continuous operation. Provide compaction equipment, tension in drain, and boot clearance that are compatible with the trencher speed in order to ensure adequate density of the backfill.

Install outlet fittings and outlet pipes concurrently with the installation of the geocomposite drains. Provide positive drainage within 24 to 48 hours of beginning trenching for installation of a given section of drain. If the Contractor fails to comply with this requirement, the Engineer may restrict the installation of additional sections of drains until such time as the Contractor completes appropriate outlet installations.

Install all fittings and material in such a way as to preclude soil intrusion into the drainage mat core or outlet piping, and to provide continuity of the drainage flow.

Either connect the open end of outlet pipes into a drainage structure or terminate them by the use of a concrete apron. Use geocomposite drain outlets and outlet pipe aprons meeting the same requirements used on draincrete edgedrains, which are shown on Design Standards, Index No. 287. Refer to the plans for any significant difference or exception.

Excavate, restore, and sod the disturbed areas at the outlet ends without blocking the proposed drainage. At the time of the Engineer's inspection and project acceptance, ensure that all outlet pipes and concrete aprons are clear of earth material, vegetation, and other debris.

Leave the backfilled and compacted trench in condition ready to receive a capping of Type S asphaltic concrete, or a capping meeting the requirements as shown on the plans.

Do not leave any trench greater than 2 inches [50 mm] in depth open overnight. Barricade trenches at all times.

441-4 Method of Measurement.

The quantities to be paid for will be the length, in feet [meters], completed and accepted. The quantity will be measured in place along the centerline of the edgedrain and outlet pipe.

441-5 Basis of Payment.

441-5.1 Edgedrain Mat: Price and payment will be full compensation for removal of existing shoulder pavement, trench excavation, disposal of excess materials, fittings, splices, and connections, select backfill material, and barricades necessary for edgedrain mat construction.

441-5.2 Edgedrain Mat Outlet Pipe: Price and payment will be full compensation for removal of existing shoulder pavement, trench excavation, pipe and fittings, standard aprons (for details on concrete, sodding, and other details see Design Standards, Index No. 286), galvanized hardware cloth (rodent screens), grouting around and stubbing into existing or proposed inlets and drainage structures or paved ditches; restoration of ditch pavement, backfill in place, and disposal of excess materials.

441-5.3 Separate Payment: Separate payment will be made for the following work:

(1) Non-standard concrete apron, which will be paid for at the Contract unit price per cubic yard [cubic meter] for Class I Concrete (miscellaneous);

(2) Non-standard sodding, which will be paid for at Contract unit price per square yard [square meter] for sodding;

(3) Shoulder pavement, which will be paid for at the Contract unit price per ton [metric ton] for Type S Asphaltic Concrete;

(4) Tack coat, which will be paid for at the Contract unit price per gallon [liter] for Bituminous Material (Tack Coat); and

(5) Shoulder joint seal, which will be paid for at the Contract unit price per foot [meter] for Shoulder Joint Seal.

441-5.4 Payment Items: Payment will be made under:

Item No. 441- 74-	Edgedrain Mat - per foot.
Item No. 2441- 74-	Edgedrain Mat - per meter.
Item No. 441- 75-	Edgedrain Mat Outlet Pipe - per foot.
Item No. 2441- 75-	Edgedrain Mat Outlet Pipe - per meter.