

FABRIC FORMED REVETMENT SYSTEMS
(REV 9-29-20)

The following new section is added after Section 530:

SECTION 531
FABRIC FORMED REVETMENT SYSTEMS

531-1 Description.

Furnish and install a fabric formed revetment system in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Plans. Prepare and grade the slopes or surfaces to be protected to such an extent that they are normally stable in the absence of erosive forces. Position a double-layer synthetic fabric envelope in a mat configuration over the surface and fill with a pumpable sand/cement grout in a way that forms a stable mat of suitable weight and configuration.

531-2 Materials.

531-2.1 Grout: Furnish structural grout consisting of a mixture of Portland cement, fine aggregate, and water proportioned and mixed as to provide a pumpable slurry, with an efflux time between 9-12 seconds when tested using ASTM C939, Flow Cone Method. Pozzolan and grout fluidifier conforming to this Section may be used. Submit the proposed mix design for approval with substantiating tests as follows:

Portland Cement	Section 921
Fine Aggregate	Section 902
Water	Section 923
Pozzolan.....	Section 929
Grout Fluidifier.....	Section 924
Air-Entraining Admixtures.....	Section 924

*Portland Cement: Use Type I and Type II.

*Fine Aggregate: Use an aggregate gradation reasonably consistent and well graded from the maximum size which can be conveniently handled with available pumping equipment.

*Pozzolan: Use in amounts up to 30% by weight of total cementitious content.

*Grout Fluidifier: Use for water reducing and retarding admixtures. The admixtures may be used to reduce segregation, increase workability and pumpability, improve strength and water-tightness.

*Air-Entraining Admixtures: Provide an air content of 5-8% of the grout volume.

531-2.2 Fabric Form: Furnish fabric forming material consisting of specifically woven, double layer, open selvage fabric joined in mat configuration with a minimum of 50% textured yarns by weight. Use fabric consisting of uncoated synthetic yarns with sufficient tensile strength and porosity to withstand the pressure of the grout injection pump without breaking the layers of fabric. Provide fabric form meeting or exceeding property values shown in the table below.

Table 531-1			
Minimum Property Requirements for Fabric Form			
Property	Test Method	Units	Value
Composition			Nylon or polyester
Mass per unit area (double layer)	ASTM D 5261	oz/yd ²	12
Thickness (single layer)	ASTM D 5199	mils	15
Mill width (woven)		in	72
Wide-width strip tensile strength (Machine direction)	ASTM D 4595	lbf/in	200
(Cross direction)	ASTM D 4595	lbf/in	200
Elongation at break (Machine direction)	ASTM D 4595	%	20 (max)
(Cross direction)	ASTM D 4595	%	30 (max)
Trapezoidal tear strength (Machine direction)	ASTM D 4533	lbf	150
(Cross direction)	ASTM D 4533	lbf	100
Apparent Opening Size	ASTM D 4751	mm, (US Std Sieve)	0.425 max (40)
Flow Rate	ASTM D 4491	gal/min/ft ²	30
Conformance of fabric to specification property requirements per ASTM D 4759 Numerical values represent minimum average roll values (MARV) unless otherwise noted. Sample lots per ASTM D 4354.			

Fabric containing film type polypropylene, partially-oriented, draw-textured, and/or staple fiber will not be considered as an acceptable alternate.

Cut individual mill width panels to suitable length and separately join the two layers of fabric edge to edge using nylon or polyester thread or zippers. The tensile strength of stitched joints must be greater than 100 lb/inch when tested in accordance with ASTM D-4884.

531-2.3 Filter Points: When called for in the Plans, provide hydrostatic uplift relief by installing filter points woven in a way that permits passage of water through the filter points spaced at approximately 8 inch centers, or as indicated on the plans.

531-2.4 Geotextile Fabric: Use Type D-3 Geotextile Fabric meeting Section 985 and listed on the Department's APL as an underlayment.

531-2.5 Cables: When called for in the Plans, use cables constructed of high tenacity, low elongation, continuous filament polyester fibers. Furnish cables with a core construction consisting of parallel fibers contained within an outer jacket or cover, with a weight of the parallel core between 65% to 75% of the total weight of the cable. Use cable with a minimum 0.25 inch diameter and 3,300 lbf breaking strength for 3- and 4-inch mats. Use cable with a minimum 0.312 inch diameter and 4,500 lbf breaking strength for 6- and 8- inch mats. Splice cables using aluminum compression fittings selected so that the resultant cable splice from use of a single fitting provides a minimum of 80% of the rated breaking strength of the cable. At each splice, use a minimum of two fittings separated by a minimum of 6 inches of cable overlap. Upon completion of the revetment, encase all fittings in grout within the fabric form.

531-3 Equipment.

Submit a list of mixing and pumping equipment used in preparation and handling of the grout for approval by the Engineer. Remove all oil or other rust inhibitors from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used. Provide pumping equipment with a variable flow rate to provide enough pressure for pumping without breaking the fabric. Provide a screen over the concrete hopper to prevent oversize particles from being pumped into the mat.

531-4 Construction Methods.

531-4.1 General:

Before injecting grout, position the fabric at its design location over a geotextile filter fabric placed in accordance with Section 514. Each panel must be a continuous or monolithic unit for its full width, including the trench portion.

Each panel must consist of two or more mill widths of open selvage construction; join the two upper layers together by field sewing or by means of zipper closures attached to the upper and lower layers of fabric. Lap adjacent panels a minimum of 2 feet when they cannot be joined in this manner. Simple butt joint, either sewn or unsewn, will not be allowed. Place the ends and upper limits of the fabric mat in a trench of suitable depth and width as shown on the plans.

Make small cuts in the fabric to allow for the insertion of the grout hose or grout nozzle. Introduce grout into the space between the layers of fabric and inject in a way that excessive pressure on the fabric envelope is avoided. Backfill the void between trench wall and filled fabric after grouting has been completed.

Temporarily close holes in the fabric left by the removal of the grout hose or inserts by inserting a piece of burlap or similar material. Remove the burlap when the mortar is no longer fluid and the surface is firm to hand pressure. Hand fill with grout any depression left by removing the burlap. Limit foot traffic on the filled fabric formed revetment to an absolute minimum for 1 hour after pumping in order to reduce indentation. Longer times may be required due to factors such as fly ash content, air temperature, humidity, etc. which can extend curing time.

531-4.2 Acceptance Sampling and Testing.

Acceptance tests will be by compressive strength. For each 500 square yards, or less, of placement, the Engineer will cast two 4" x 8" test cylinders according to ASTM C31, except pour grout in a single lift into cylinder molds without rodding. Cylinders will be tested at 28 days according to ASTM C39. Grout must meet a minimum compressive strength of 2,500 psi at 28 days.

531-5 Method of Measurement.

The quantity to be paid for under the Section will be the area, in square yards, completed and accepted. Measurements will include the entire surface area of the installed riprap along the slopes and berm, including trenches, and no allowance will be made for overlaps.

531-6 Basis of Payment.

Price and payment will be full compensation for all work, labor, equipment, and materials specified in this Section, including grout, mat and geotextile fabric.

Payment will be made under:

Item No. 920-530- Fabric Formed Concrete Riprap, SY