

EXPECTED IMPLEMENTATION JULY 2022

530 REVETMENT SYSTEMS. (REV 11-23-21) (FA 1-13-22) (7-22)

ARTICLE 530-2 is deleted and the following substituted:

530-2 Materials.

530-2.1 Riprap:

530-2.1.1 Filter Fabric: Meet the following requirements:

Type D-2 Geotextile Fabric*Section 985

*Use products listed on the Department's APL.

Schedule work so that covering the fabric with the specified material does not exceed the manufacturer's recommendations for exposure to ultraviolet light or five days, whichever is less. If the Engineer determines the exposure time was exceeded, the Contractor shall replace the fabric at no expense to the Department.

Place the filter fabric (fabric) at locations as shown in the Plans, in accordance with the manufacturer's directions. Place the fabric on areas with a uniform slope that are reasonably smooth, free from mounds, windrows, and any debris or projections which might damage the fabric.

Loosely lay the material. Do not stretch the material. Replace or repair any fabric damaged or displaced before or during placement of overlying layers. Repair in accordance with the manufacturer's instructions.

The Contractor may sew the seams to reduce overlaps as specified in 985-3. Follow the manufacturer's instructions for all seams and overlaps.

530-2.1.2 Prepackaged Sand-Cement Bags: Provide prepackaged sand-cement bags that meet the following requirements:

1. Evenly proportioned sand and cement in the ratio of five cubic feet of sand to 94 pounds of cement. Material proportioned by mass shall use a sand density of 85 pounds per cubic foot.

2. Sealed package of 80 pounds of sand-cement in a bag.

3. Bag made of scrim-reinforced paper capable of holding the sand-cement without leakage.

4. Sand meets requirements of Section 902-3.3

5. Type I/II cement meets requirements of Section 921.

Prepackaged Sand-Cement Bags shall be one of the products listed on the Department's Approved Product List. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6. Include with the submittal a product data sheet, safety data sheet, product label, and a self-certified statement the product meets the requirements of this Section.

530-2.1.3 Rubble:

530-2.1.3.1 Rubble (Bank and Shore Protection): Provide sound, hard, durable rubble, free of open or incipient cracks, soft seams, or other structural defects, consisting of broken stone with a bulk specific gravity of at least 2.20. Ensure that stones are rough and angular.

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For this application, use broken stone meeting the following gradation and thickness requirements:

Weight Maximum Pounds	Weight 50% Pounds	Weight Minimum Pounds	Minimum Blanket Thickness in Feet
670	290	60	2.5

Ensure that at least 97% of the material by weight is smaller than Weight Maximum pounds].
Ensure that at least 50% of the material by weight is greater than Weight 50% pounds].
Ensure that at least 85% of the material by weight is greater than Weight Minimum pounds].

530-2.1.3.2 Rubble (Ditch Lining): Use sound, hard, durable rubble, free of open or incipient cracks, soft seams, or other structural defects, consisting of broken stone or broken concrete with a bulk specific gravity of at least 1.90. Ensure that stones or broken concrete are rough and angular.

Use broken stone or broken concrete meeting the following gradation and thickness requirements:

Weight Maximum Pounds	Weight 50% Pounds	Weight Minimum Pounds	Minimum Blanket Thickness in Feet
75	30	4	1.5

Ensure that at least 97% of the material by weight is smaller than Weight Maximum pounds].
Ensure that at least 50% of the material by weight is greater than Weight 50% pounds].
Ensure that at least 90% of the material by weight is greater than Weight Minimum pounds].

530-2.1.3.3 Physical Requirements of Broken Stone and Broken Concrete: Use broken stone and broken concrete meeting the following physical requirements:

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Absorption (FM 1-T 85)	Maximum 5%
Los Angeles Abrasion (ASTM C535)	Maximum loss 45%*
Soundness (Sodium Sulphate) (AASHTO T 104)	Maximum loss 12%** (after five cycles)
Flat and elongated pieces	Materials with least dimension less than one third of greatest dimension not exceeding 10% by weight.
Dirt and Fines	Materials less than 1/2 inch in maximum dimension accumulated from interledge layers, blasting or handling operations not exceeding 5% by weight.
Drop Test***(EM 1110-2-2302)	No new cracks developed, or no existing crack widened additional 0.1 inch, or final largest dimension greater than or equal to 90% original largest dimension of dropped piece.
<p>* Ensure that granite does not have a loss greater than 55% and that broken concrete does not have a loss greater than 45%.</p> <p>** The Engineer may accept rubble exceeding the soundness loss limitation if performance history shows that the material will be acceptable for the intended use. The Engineer will waive the soundness specification for rubble riprap (broken stone and broken concrete) when project documents indicate it will be placed in or adjacent to water or soil with a sulfate content less than 150 parts per million and a pH greater than 5.0.</p> <p>*** The Engineer will waive the Drop Test unless required to ensure structural integrity. Provide all equipment, labor and testing at no expense to the Department. EM refers to the US Army Corps of Engineer's Specification Engineering Method.</p>	

530-2.1.3.4 Source Approval and Project Control: The Engineer will approve construction aggregate sources in accordance with 6-2.3.

1. The Engineer may perform Independent Verification tests on all materials placed on the project.
2. The Engineer will check the gradation of the riprap by visual inspection at the project site. Resolve any difference of opinion with the Engineer in accordance with the method provided in FM 5-538. Provide all equipment, labor, and the sorting site at no expense to the Department.
3. The Engineer may test components in a blend of rubble processed from different geologic formations, members, groups, units, layers or seams. The Engineer may select components based on like color, surface texture, porosity, or hardness. The Engineer will reject any blend if a component that makes up at least five percent by volume of the blend does not meet these specifications.

530-2.1.4 Bedding Stone: Use Bedding Stone of either a durable quality limestone or other quarry run stone, with a bulk specific gravity of not less than 1.90 and that is reasonably free from thin, flat and elongated pieces. Ensure that the bedding stone is also reasonably free from organic matter and soft, friable particles. Meet the following gradation limits:

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Standard Sieve Sizes - Inches	Individual Percentage by Weight Passing
12 inches	100
10 inches	70 to 100
6 inches	60 to 80
3 inches	30 to 50
1 inch	0 to 15

The Engineer will conduct source approval and project control of bedding stone as specified in 530-2.1.3.4. In lieu of limestone or other quarry run stone, the Contractor may substitute non-reinforced concrete from existing pavement that is to be removed and which meets the above requirements for commercial bedding stone.

530-2.2 Articulating Concrete Block (ACB) Revetment Systems: Obtain all precast block, cabling, anchors, and necessary incidental materials from the same manufacturer. ACB revetment systems must meet the requirements of ASTM D6684, ASTM D7276 and ASTM D7277. Submit to the Engineer certification from the manufacturer that the ACB revetment system meets the requirements of this Section.

ACB system components must meet the following requirements:

- ConcreteSection 347, ASTM D6684
- Cables and Fittings.....ASTM D6684
- Type D-2 Geotextile Fabric *Section 985
- Granular UnderlaySection 901

*Use products listed on the Department's APL.

Cables must maintain at least 85% of original tensile strength (ASTM D638) after 1,000 hours exposure to a saturated solution of calcium hydroxide (pH greater than or equal to 11) at 73°F, plus or minus three degrees. Cables must not exceed a maximum of 0.5% moisture absorption at seven days, per ASTM D570. Cable crimps must be aluminum or stainless steel Type 304 or 316.

530-2.3 Gabions:

530-2.3.1 General: Provide gabions meeting the requirements of ASTM A974 and ASTM A975 as modified herein.

Allowable Gabion Wire and Connector Material	Substructure Environmental Classification
Polymeric	Any
Metallic	Slightly Aggressive
Metallic – Galvanized and PVC coated	Slightly Aggressive Moderately Aggressive
Metallic – Type 304 Stainless Steel, Size W1.4 (MW10) or larger	Slightly Aggressive Moderately Aggressive Extremely Aggressive (< 2,000 ppm Chlorides)
Metallic – Type 316 Stainless Steel, Size W1.4 (MW10) or larger	Any

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530-2.3.2 Metallic Gabions: The components of metallic gabions must meet the following requirements:

- Wire Mesh and Fabric *ASTM A974 and A975
- Spiral Binders, Lacing Wire, Stiffeners, and Ring Wire
- FastenersASTM A974 and A975
- Stainless Steel Wire, Wire Fabric, and Lacing Wire
-ASTM A1022

*Wire mesh must be Style 1 or Style 3. Wire fabric must be Style 1 or Style 5.

530-2.3.3 Polymeric Gabions: Polymeric gabions must be constructed in general accordance with ASTM A974 using a single layer of structural geogrid instead of welded wire, and polymeric braid instead of ring wire fasteners. The structural geogrid must be Type R-1, 2, 3, 4, or 5 meeting the requirements of Section 985 and the following:

- Tensile Strength @2% strain MD*575 lb/ft
- Tensile Strength @ 2% strain XD**.....575 lb/ft
- Junction Strength (% of Tensile Strength)..... 90%
- Min UV Stability..... 85%
- Min. Carbon Black Content (by Weight)..... 2%

*MD = machine direction
 **XD = cross direction

Polymeric braid for seaming polymeric gabions or connecting metallic gabions must have a minimum tensile strength of 400 pounds for a 36 inch long specimen and contain at least 2% carbon black by weight.

530-2.3.4 Gabion Rock: Use rock meeting the requirements of ASTM D6711 to fill gabions. The rock must be reasonably free from thin, flat or elongated pieces. Rock size must be at least 1.25 times greater than the aperture size of the wire mesh or fabric. Each range of sizes may allow for a variation of 5% oversize rock by weight, 5% undersize rock by weight, or both.

Physical Property Requirements	Acceptable Range
Los Angeles Abrasion and ASTM C535	Maximum loss 40%
Bulk Specific Gravity	Minimum 2.20
Absorption, ASTM C127 and ASTM C128	Maximum 3%

530-2.3.5 Miscellaneous Components: Miscellaneous components for gabion installations must meet the following requirements:

- Type D-2 Geotextile Fabric*Section 985
- Granular UnderlaySection 901
- Anchors.....Section 451 or manufacturer’s recommendations

*Use products listed on the Department’s APL.

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SUBARTICLE 530-3.1 is deleted and the following substituted:

530-3 Construction and Installation.

530-3.1 Geotextile Fabric: Overlap adjacent strips of fabric a minimum of 24 inches, and anchor them with securing pins (as recommended by the manufacturer) inserted through both strips of fabric along a line through the midpoint of the overlap and to the extent necessary to prevent displacement of the fabric.

Place the fabric so that the upstream (upper) strip of fabric overlaps the downstream (lower) strip.

Stagger vertical laps a minimum of 5 feet. Use full rolls of fabric whenever possible in order to reduce the number of vertical laps.

Do not drop bedding stone or riprap from heights greater than 3 feet onto the fabric.

SUBARTICLE 530-5.4 is deleted and the following substituted:

530-5.4 Geotextile Fabric: Include the cost of materials and installation of the geotextile fabric, including any repairs or replacement, in the Contract unit price for riprap or ACB revetment system.

