

SECTION 31 37 00
RIPRAP

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - b. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.
 - c. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - d. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - e. D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
 - f. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
 - g. D6241, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50 mm Probe.

1.02 DEFINITIONS

A. Refer to applicable definitions in Section 31 23 23, Fill and Backfill.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Description and location of proposed sources of riprap bedding and riprap.

B. Informational Submittals:

1. Quarry Certificate of Conformance and supporting documentation showing proposed riprap bedding or riprap meet Standard Specification gradation and materials requirements for the Class or Type specified.
2. Trip tickets showing source, type, and weight of each load of material delivered to Site.

1.04 QUALITY ASSURANCE

- A. Riprap Source: Quarry that has produced riprap and has performed satisfactorily on other projects for at least 5 years.
- B. Site Visit: Arrange for Contracting Officer to visit quarry site to observe materials proposed for riprap and riprap bedding.

1.05 SCHEDULING AND SEQUENCING

- A. Complete subgrade preparation as specified in Section 31 23 13, Subgrade Preparation, and geotextile installation prior to placing riprap.

PART 2 PRODUCTS

2.01 RIPRAP GEOTEXTILE

- A. Physical Characteristics:

- 1. Conform to Table 1.

Table 1 – Strength and Durability Properties						
Property	Test Method ASTM	Units	Class 1		Class 2	
Type of Geotextile			Woven	Nonwoven	Woven	Nonwoven
Elongation at break	D4632	%	< 50	≥ 50	< 50	≥ 50
Minimum grab strength	D4632	lb (N)	320 (1420)	200 (890)	250 (1110)	160 (710)
Minimum sewn seam strength	D4632	lb (N)	290 (1290)	180 (800)	220 (980)	140 (620)
Minimum tear strength	D4533	lb (N)	110 (490)	80 (360)	90 (400)	55 (240)
Minimum puncture strength	D6241	lb (N)	620 (2760)	430 (1910)	500 (2220)	310 (1380)
Minimum ultraviolet strength	D4355	%	50% retained strength after 500 hours of exposure			

Table 1 – Strength and Durability Properties							
Property	Test Method ASTM	Units	Class 1			Class 2	
Hydraulic Properties							
Property	Test Method ASTM	Units	Type A	Type B	Type C	Type D	Type E
Minimum permittivity	D4491	S ⁻¹	0.7	0.5	0.2	0.1	0.1
Maximum apparent opening size (AOS)	D4751	Sieve size U.S. (mm)	No. 40 (0.425)	No. 40 (0.425)	No. 60 (0.250)	No. 40 (0.425)	No. 70 (0.212)

2. Use long-chain synthetic polymers composed of at least 95 percent by mass of polyolefins or polyesters to manufacture geotextile and the threads used in joining geotextile by sewing. Form the geotextile, including selvages, into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.
3. Do not use woven slit film geotextile.

- B. Functional Characteristics: Identify, store, and handle geosynthetics according to ASTM D4873 and the manufacturer's recommendations. Elevate and protect geosynthetic rolls with a waterproof cover if stored outdoors. Limit geosynthetics exposure to less than 10 days of ultraviolet radiation.
- C. Performance Characteristics: Property values, with the exception of apparent opening size (AOS), in these Specifications represent minimum average roll value (MARV) in the weakest principal direction (that is average test results of any roll in a lot sampled for conformance or quality assurance testing must meet or exceed the specified values). Values for AOS represent maximum average roll values.

2.02 RIPRAP

A. Physical Characteristics:

1. Hard and durable quarry stone free from fractures, bedding planes, pronounced weathering, and earth or other adherent coatings.
2. Minimum Dimension of Individual Pieces: Not less than 1/3 maximum dimension.
3. Abrasion Resistance: Maximum 35 percent wear as determined in accordance with ASTM C535.
4. Bulk Density: Minimum 160 pounds per dry cubic foot.

5. Gradation: Smaller pieces shall generally fill voids between larger pieces without either excess or deficiency of one or more sizes of stone.

Class	Maximum Rock Thickness (inches)	Weight (pounds)	% Greater Than
I	12	150 100 50 25	0 to 5 30 75 90
II	18	250 150 50 25	0 to 5 30 75 90
III	24	800 400 200 25	0 to 5 30 75 90
IV	30	1,600 800 400 50	0 to 5 30 75 90
V	36	2,700 1,600 800 100	0 to 5 30 75 90

- B. Functional Characteristics: None.
- C. Performance Characteristics: None.

2.03 CONCRETE GROUT

- A. Physical Characteristics: Portland cement concrete.
- B. Functional Characteristics: As specified in Section 03 30 00, Cast-in-Place Concrete.
- C. Performance Characteristics: 28-day compressive strength of 3,000 psi.

PART 3 EXECUTION

3.01 GEOTEXTILE

- A. Before placing the geotextile prepare the surface as follows:
 - 1. Existing Ground: Cut trees and shrubs flush with the ground surface. Do not remove the topsoil and vegetation mat. Clear the area of vegetation and obstructions according to Section 31 10 00, Site Clearing. Remove sharp objects and large rocks. Fill depressions or holes with suitable material to provide a smooth surface.
 - 2. Subgrade: Prepare the subgrade according to Section 31 23 13, Subgrade Preparation.
- B. Replace or repair geosynthetic that is torn or punctured. Remove the damaged area and place a patch of the same type of geosynthetic overlapping 36 inches beyond the damaged area or sew a seam around the damaged area.

3.02 PLACING RIPRAP

- A. Place riprap over geotextile to uniform depth shown. Place riprap on geotextile without puncturing or damaging geotextile. If accidentally damaged, repair geotextile prior to proceeding.
- B. No mechanical compaction of riprap is required; however, work riprap bedding as necessary to distribute it and to eliminate detrimental voids. Avoid overworking or long pushes that result in segregation of particle sizes.
- C. Grade surface of riprap bedding free from irregularities and to tolerances of 0.2 foot from established grade.
- D. Place and grade riprap in a manner that avoids subgrade disturbance and displacement or damage to geotextile. Do not push riprap bedding down slope. If wrinkles form in geotextile as riprap bedding is placed, correct them as directed by the Contracting Officer.

END OF SECTION

