

Section 711 Riprap

711.01 DESCRIPTION. This work consists of furnishing and placing riprap in accordance with these specifications and in conformity to lines, grades and thickness shown on the plans or as directed.

711.02 MATERIALS. Stone riprap shall be from an approved source listed in QPL 2. Stone riprap shall not disintegrate upon exposure to the elements or be easily broken from handling, and shall be reasonably free from earth and other foreign materials. When tested in accordance with AASHTO T 85, the solid weight of stone shall be at least 155 pounds per cubic foot (2490 kg/cu m) (based on bulk specific gravity). The least dimension of any individual stone shall be at least 1/3 its maximum dimension. Each shipment of stone shall be reasonably well graded within the specified limits.

Recycled concrete may be used as riprap unless otherwise indicated in Heading (a), provided its solid weight is at least 155 pounds per cubic foot (2490 kg/cu m) (based on bulk specific gravity) and it is free of protruding reinforcement.

Stockpiles of recycled concrete shall be source approved prior to use and kept separate from other materials. Stockpiles shall be uniform and free of soil, debris, excessive amounts of asphaltic materials, and foreign matter. Once a stockpile has been approved as an acceptable source of material, no material shall be added without prior approval.

Control of gradation will be by visual inspection at the source, project site or both.

Any difference of opinion between the engineer and contractor will be resolved by checking the gradation of two random truckloads (or equivalent size samples). Equipment, labor and sorting site shall be furnished by the contractor at no direct pay.

(a) Riprap: Riprap shall be reasonably well graded and shall comply with Table 711-1.

**Table 711-1
Riprap**

Riprap Class ¹	Stone Size lb (kg)	Spherical Diameter, ft (mm) ²	Percent of Stone Smaller Than
2 lb (1 kg)	10 (4.5)	0.51 (155)	100
	4 (2)	0.38 (115)	40-100
	2 (1)	0.30 (90)	15-50
	0.75 (0.30)	0.22 (65)	0-15
10 lb (5 kg)	50 (23)	0.88 (270)	100
	20 (9)	0.65 (200)	50-100
	10 (5)	0.51 (155)	15-50
	5 (2.5)	0.41 (125)	0-15
30 lb (15 kg)	140 (64)	1.24 (375)	100
	60 (27)	0.94 (285)	42-100
	30 (15)	0.74 (225)	15-50
	10 (4.5)	0.51 (155)	0-15
55 lb (25 kg) ³	275 (125)	1.50 (460)	100
	110 (50)	1.11 (335)	42-100
	55 (25)	0.88 (270)	15-50
	20 (9)	0.63 (190)	0-15
130 lb (60 kg) ³	650 (295)	2.00 (610)	100
	260 (120)	1.46 (450)	45-100
	130 (60)	1.17 (360)	15-50
	40 (18)	0.79 (240)	0-15
250 lb (115 kg) ³	1250 (570)	2.50 (760)	100
	500 (225)	1.83 (560)	45-100
	250 (115)	1.46 (445)	15-50
	80 (35)	1.00 (300)	0-15
440 lb (200 kg) ³	2200 (1000)	3.00 (915)	100
	900 (410)	2.23 (680)	40-100
	440 (200)	1.76 (535)	14-50
	130 (60)	1.17 (360)	0-15
1000 lb (455 kg) ³	5000 (2270)	4.00 (1205)	100
	2000 (910)	2.91 (885)	45-100
	1000 (455)	2.31 (705)	10-50
	300 (135)	1.55 (470)	0-15

¹The stone size used to define the Riprap Class is the minimum median stone size for the stone class. The minimum thickness of a riprap layer shall be no less than the spherical diameter of the maximum stone size in the Riprap Class.

²Spherical diameters of riprap classes up to 30 lb (15 kg) are based on a solid weight of 140 lb/cu ft (2240 kg/cu m). Spherical diameters of riprap classes above 30 lb (15 kg) are based on a solid weight of 155 lb/cu ft (2480 kg/cu m).

³Recycled portland cement concrete may not be used in these riprap classes.

(b) Geotextile Fabric: Geotextile Fabric shall comply with Section 1019.01.

711.03 CONSTRUCTION REQUIREMENTS.

(a) Riprap: Areas on which riprap is to be placed shall be graded to the required section. Riprap shall be placed on the prepared slope or area in a manner which will produce a reasonably well-graded mass of stone with a minimum practicable percentage of voids. The entire mass of stone will be placed to be in conformance with the lines, grades, and thickness at one operation and to avoid displacing underlying material. Placing of riprap in layers, or dumping into chutes, or by similar methods likely to cause segregation, will not be permitted.

When placement in water currents is required, the contractor shall make drift checks and place riprap in such manner as to compensate for drift. The contractor shall furnish necessary facilities and personnel for checking riprap depth and distribution.

(b) Filter Stone: When specified, filter stone shall be placed on the prepared slope or area before placement of riprap. When filter stone is placed under water, free dumping will not be permitted. Underwater placement shall be by controlled methods using bottom dump buckets or wire rope baskets lowered through the water to the point of placement. If placement in strong water currents is required, placement of riprap will follow soon after placement of filter stone. Unless shown otherwise on the plans or directed, filter stone shall be Riprap Class 10 lb (5 kg) or less.

(c) Geotextile Fabric: When specified, geotextile fabric shall be placed on the prepared slope or area in accordance with Subsection 203.11(c) before placement of riprap. Care shall be taken not to damage the geotextile fabric when placing riprap. Placing riprap by rolling riprap down slope, or dropping riprap from extreme heights, or by similar methods likely to damage geotextile fabric, will not be permitted. Damaged geotextile fabric shall be repaired in accordance with Subsection 203.11(c) or replaced as directed.

711.04 MEASUREMENT. Riprap and filter stone may be measured on either a square yard (sq m), cubic yard (cu m), or weight (mass) basis as specified.

When measured on a square yard (sq m) basis, the quantity measured will be that actually placed to the limiting dimensions shown on the plans or as directed by the engineer.

711.04

When measured on a cubic yard (cu m) basis, measurement will be made in vehicles at the point of delivery on the project in accordance with Subsection 109.01.

When measured on a weight (mass) basis the pay unit will be per ton (2000 pounds) [Mg (1000 kg)]. When riprap is delivered by vehicles or railroad cars, measurement will be based on certified weight (mass) tickets furnished by the contractor. When riprap is delivered by barge, measurement will be made by calculation from barge displacement, based on water weighing 62.4 pounds per cubic foot (1000 kg/cu m).

Geotextile fabric will be measured by the square yard (sq m) of covered area in place.

No measurement will be made for excavation or backfilling.

711.05 PAYMENT. Payment for riprap and geotextile fabric will be made at the contract unit prices. Filter stone will be paid for as riprap.

Payment will be made under:

Item No.	Pay Item	Pay Unit
711-01	Riprap (class & thickness)	Square Yard (Sq m)
711-02	Riprap (class)	Cubic Yard (Cu m)
711-03	Riprap (class)	Ton (Mg)
711-04	Geotextile Fabric	Square Yard (Sq m)