

**RIPRAP AND GRANULAR FILL**



**PART 1 -GENERAL**

**1 .1 SUMMARY**

- A. Section includes requirements for furnishing concrete or stone riprap and granular fill.

**1.2 MEASUREMENT AND PAYMENT**

- A. Where there is not a separate item listed for work of this Section, no separate measurement and payment is made. Include cost for work under this Section in the related item listed on the Unit Price Schedule.
- B. Measurement and payment is as noted on the Unit Price Schedule.
- C. Refer to Section 01270 – Measurement and Payment for unit price procedures.

**1.3 DELIVERY, STORAGE AND HANDLING**

- A. Keep the storage area clean, firm, smooth and well drained in order that the product can be placed with a minimum of foreign matter.
- B. Stockpile and handle material so as to not cause undue segregation of particle sizes either in the stockpile, or while loading, hauling and handling.

**PART 2 – PRODUCTS**

**2 . 1 RIPRAP**

- A. Provide riprap consisting of broken concrete or stone. Provide riprap that is dense, durable and hard material free from cracks, seams and other defects which would increase deterioration from handling and natural causes.
- B. Shape and Dimensions.
  - 1. Provide riprap in cubic form, rather than elongated (flat) shapes.
  - 2. Provide riprap with a minimum thickness of 6 inches.
  - 3. No more than 25 percent may have a length greater than 242 times the width or thickness. No length shall exceed 3 times the width or thickness.
- C. Do not provide spalls, fragments and chips exceeding 5 percent by weight. The dimension and shape limitations do not apply to this portion of the riprap.
- D. Where broken concrete is used, cut exposed metal, including rebar and wire mesh, flush with the surface prior to placing the riprap.

E. Provide riprap conforming to the following tables:

**TABLE 1**  
**RIPRAP GRADATION NO. 1**

Percent Lighter <u>by Weight</u>	Stone Weight <u>Lbs.</u>		Volume <u>Cubic Ft (2)</u>		Cubical Shape <u>Ft (Each Side)</u>		Spherical Shape <u>Ft (Dia.)</u>	
	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>
100	180	265	1.20	1.77	1.06	1.21	1.31	1.50
50	80	110	0.53	0.73	0.81	0.90	1.01	1.12
15	40	60	0.27	0.40	0.64	0.74	0.80	0.91

**Notes:**

1. The theoretical cube and sphere size is presented for guidance only. Paragraph 2.1 shall control riprap shape and dimensions.
2. Volume is based on 150 pcf, unit weight.
3. Riprap Gradation No. 1 is to be used where an 18 inch thick riprap mat is noted on the Plans.

**TABLE 2**  
**RIPRAP GRADATION NO. 2**

Percent Lighter <u>by Weight</u>	Stone Weight <u>Lbs.</u>		Volume <u>Cubic Ft (2)</u>		Cubical Shape <u>Ft (Each Side)</u>		Spherical Shape <u>Ft (Dia.)</u>	
	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Lower Limit</u>	<u>Upper Limit</u>
100	260	640	1.73	4.27	1.20	1.62	1.49	2.01
50	130	200	0.87	1.33	0.95	1.10	1.18	1.37
15	40	150	0.27	1.00	0.64	1.00	0.80	1.24

**Notes:**

1. The theoretical cube and sphere size is presented for guidance only. Paragraph 2.1 shall control riprap shape and dimensions.
2. Volume is based on 150 pcf, unit weight.
3. Provide a 24 inch thick mat, minimum, for Riprap Gradation No. 2.

**2.2 GRANULAR FILL**

- A. Provide granular fill consisting of crushed concrete or stone. Provide granular fill that is dense, durable and hard material.
- B. Provide granular fill, as shown on the Plans, to the following dimensions:
  1. Provide 3 inch to 5 inch granular fill with no material diameter less than 3 inches and no material diameter greater than 5 inches.
  2. Provide 4 inch to 8 inch granular fill with no material diameter less than 4 inches and no material diameter greater than 8 inches.
- C. Do not provide spalls, fragments and chips exceeding 5 percent by weight.
- D. Where crushed concrete is used, cut exposed metal, including rebar and wire mesh, flush with the surface prior to placing granular fill.

**2.3 GEOTEXTILE**

- A. Refer to Section 02379 – Geotextiles for Erosion Control Systems.

## **PART 3 – EXECUTION**

### **3.1 GRADE PREPARATION**

- A. Refer to Section 02241 – Care and Control of Water
- B. Trim and dress the channel bottom and side slopes to proper lines and grade prior to placing riprap or granular fill. Where shown on the Plans, place geotextile in accordance with Section 02379 – Geotextiles for Erosion Control Systems.
- C. The Engineer will inspect prepared section prior to placing geotextile, where required, and riprap or granular fill.

### **3.2 EXCAVATION AND FILL**

- A. Excavate the channel. Refer to Section 02315 – Excavating and Backfill.
- B. Excavate for structures. Refer to Section 02316 – Structural Excavating and Backfilling.

### **3.3 RIPRAP PLACEMENT**

- A. Riprap shall meet the gradation and quality requirements prior to placement.
- B. Place the riprap to the slopes, lines and grades as shown on the Plans, to establish a well-graded mass of riprap with minimal voids. Fill voids between larger riprap blocks with spalls and smaller blocks of the largest feasible size to form a compact mass. Do not place spalls and small blocks in place of larger size riprap.
- C. Install riprap mat to thickness as shown on the Plans, with a minimum mat thickness as shown on the gradation tables.
- D. Place the riprap to avoid displacement or damage to the prepared surface or geotextile. Place riprap in a manner to avoid segregation of particle sizes.
- E. Distribute elongated riprap throughout the mat.
- F. Avoid dropping riprap from such a height to cause breakage or damage to the geotextile (if used).
- G. Prevent mixture or incorporation of dirt or other materials with the riprap during placement.

### **3.4 GRANULAR FILL PLACEMENT**

- A. Place granular fill to the slopes, lines and grades as shown on the Plans or as directed by the Engineer.

**END OF SECTION**