

SECTION 606 RIPRAP

606.1 Description

- (1) This section describes furnishing and placing riprap.

606.2 Materials

- (1) Furnish durable field or quarry stone that is sound, hard, dense, resistant to the action of air and water, and free of seams, cracks, or other structural defects. Use stone pieces with a length and width no more than twice the thickness. Do not place material without the engineer's approval of the stone quality, size, and shape.
- (2) The department will determine the average dimension of stone pieces by averaging measurements of thickness, width, and length. Furnish stones conforming to the size requirements for the riprap grade the plans show. Size requirements are expressed as the percent of the gross in-place riprap volume occupied by stones within average dimension size ranges for each riprap grade as follows:

AVERAGE DIMENSION RANGES FOR EACH RIPRAP GRADE				FRACTION OF GROSS
LIGHT	MEDIUM	HEAVY	EXTRA-HEAVY	IN-PLACE RIPRAP
RIPRAP	RIPRAP	RIPRAP	RIPRAP	VOLUME OCCUPIED
inches (mm)	inches (mm)	inches (mm)	inches (mm)	BY STONES
>16 (406)	>20 (508)	>25 (635)	>30 (762)	0%
11 - 13 (279-330)	14 - 16 (356-406)	18 - 20 (457-508)	22 - 25 (559-635)	10% - 14%
9 - 11 (229-279)	11 - 14 (279-356)	14 - 18 (356-457)	18 - 22 (457-559)	15% - 21%
4 - 9 (102-229)	5 - 11 (127-279)	6.5 - 14 (165-356)	8 - 18 (203-457)	20% - 28%
<4 (102)	<5 (127)	<6.5 (165)	<8 (203)	5% - 7%
<1 (25)	<1 (25)	<1 (25)	<1 (25)	2% or less

- (3) The contractor may substitute waste concrete slabs for stone. Furnish sound concrete, free of protruding reinforcement, and conforming to the size requirements specified for stone.
- (4) Conform to section 518 for mortar rubble masonry if using mortar for grouted riprap.

606.3 Construction

606.3.1 General

- (1) Prepare the bed for the riprap by excavating, shaping the slopes, and constructing the toe for riprap installation. After placing the riprap, restore the surface of adjacent work and dispose of surplus material.

606.3.2 Placing Light Riprap

- (1) If laying stone above the waterline, place it by hand. Lay it with close, broken joints and firmly bed it in the slope and against the adjoining stones. Lay the stones perpendicular to the slope with ends in contact. Compact the riprap thoroughly as construction progresses. Make the finished surface even and tight. Place larger stone in lower courses. Chink spaces between stones by firmly ramming spalls into place. If placing riprap over geotextile fabric, conform to 645.3.6 for geotextile fabric, type R.
- (2) Unless specified otherwise, make riprap at least one foot (300 mm) thick, measured perpendicular to the slope.
- (3) Do not place riprap against, or in contact with, concrete surface before the end of the concrete's curing and protection period.

606.3.3 Placing Medium, Heavy, and Extra-Heavy Riprap

- (1) The contractor may place medium, heavy, and extra-heavy riprap by any mechanical means that produce a completed job within reasonable tolerances of the typical section the plans show. Limit handwork to the amount necessary to fill large voids or to correct segregated areas. If placing riprap over geotextile fabric, conform to 645.3.7 for geotextile fabric, type HR.
- (2) Unless specified otherwise, make medium riprap at least 18 inches (450 mm) thick, heavy riprap at least 24 inches (600 mm) thick, and extra-heavy riprap at least 30 inches (750 mm) thick.

606.3.4 Placing Grouted Riprap

- (1) If the plans specify using grouted riprap, lay the stone as specified above under 606.3.2 or 606.3.3. Fill the spaces between the stones with cement mortar. Use sufficient mortar to completely fill all voids, except leave the face surface of the stone exposed.
- (2) Place grout from the bottom to the top and then sweep the surface with a stiff broom. After completing the grouting, cure the surface as specified for concrete pavement in 415.3.12. If using the impervious coating method, provide for translucent membrane curing material as specified for curing concrete in structures in 502.2.3. During cold weather, protect the concrete as specified in 415.3.15 for concrete pavement.

606.4 Measurement

- (1) The department will measure all the bid items under this section by the cubic yard acceptably completed, measured as the volume within the limiting dimensions the contract designates or the engineer establishes in the field.

606.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
606.0100	Riprap Light	CY
606.0200	Riprap Medium	CY
606.0300	Riprap Heavy	CY
606.0400	Riprap Extra-Heavy	CY
606.0500	Grouted Riprap Light	CY
606.0600	Grouted Riprap Medium	CY
606.0700	Grouted Riprap Heavy	CY
606.0800	Grouted Riprap Extra-Heavy	CY

- (2) Payment for all the bid items under this section is full compensation for preparing the bed, providing and placing riprap, restoring adjacent work, and disposing of surplus material. The department will pay for excavation in excess of the approximate volume of earth occupied by the riprap under the Excavation Common bid item as specified under 205.5, or absent that bid item, as extra work.
- (3) Payment for the Grouted Riprap bid items also includes placing and curing mortar.