

ROCK RIPRAP

1. APPLICABILITY

Construction Specification 61 is applicable to equipment placed or hand-placed rock riprap, granular filter and granular bedding. It is also applicable for riprap placed over geotextile fabrics installed in accordance with Construction Specification 95.

2. MATERIAL SPECIFICATIONS

Material Specifications 521, 523, and 592 are complementary to Construction Specification 61. Select Rock Type 1, 2, or 3 of Specification 523, Section 2, as appropriate and specify in Section 8.

- a. Rock Type 1 - For exposure conditions that will require sound and very durable material due to aggressive environment and demanding requirements, or in locations where replacement or repair would be very difficult if breakdown or other failure were to occur.
- b. Rock Type 2 - A lesser degree of durability is required while meeting a good standard of performance. The hazard is not a major consideration and accessibility for repair or replacement is practical. No design changes are necessary for utilization of this rock type.
- c. Rock Type 3 - Does not meet our normal requirements for quality, but due to the lack of on-site availability or availability of better materials, it is advantageous to use. Design changes, such as greater rock thickness and/or flatter slopes, may be required to compensate for the lack of long-term durability. More frequent repair and replacement should be anticipated.

3. ITEMS TO BE INCLUDED IN CONTRACT SPECIFICATIONS AND DRAWINGS

- a. Complete plans and cross-sections of the required riprap.
- b. Type of placement (equipment or hand-placed).
- c. Pay limits, where applicable.
- d. Foundation preparation requirements, if any.
- e. Gradation requirements for materials.
- f. Screening, selection or other processing requirements, to insure obtaining rock of the required quality and grading. For example, if angular to sub-angular rock is preferred over sub-rounded to rounded rock, specify this requirement in Section 8.
- g. Sources of materials, if the sources are to be specified. When sources are designated in the contract, the adequacy of quantity and quality of usable

material at each source must be determined in advance by: (1) geologic investigations with adequate sampling and testing, (2) specific case history which establishes the quality by satisfactory performance under comparable conditions of use and exposure or acceptable pre-qualification by other agencies.

- h. ASTM D 5240 should be specified to check for rock resistance to freeze-thaw damage on sites with large volumes of riprap, at highly hazardous locations, or on sites that would be very difficult to repair if rock breakdown occurs. Acceptance limits in the specification must be evaluated and strengthened, if needed, to ensure the use of the appropriate rock type and quality.
- i. Method(s) of measurement and payment.
- j. When geotextile filters are specified, Construction Specification 95 should be used.

4. DISCUSSION OF METHODS

a. Section 8, Measurement and Payment

The methods listed below provide two basic options for measuring and paying for rock riprap using either weight (ton) or volume (cubic yard) methods. Advantages of each option are as follows:

Weight - Ton methods would be more appropriate for quarried rock imported to a site. Contractors usually pay their supplier for quarried rock by the ton. Payment by the ton provides for direct pricing without the need to convert from a ton basis to cubic yards. Variations in riprap characteristics such as rock specific gravity, transportation and placement losses, denseness of placement, etc., make it necessary for the contractor to add contingencies that include these variations.

Volume - Cubic yard methods would be more appropriate for riprap that is produced from on-site locations, for gathered field stone, quarried rock sold by the truck load, and other situations where a certified scale is not readily available. It would also be appropriate for small quantities of rock where quantity measurement is not complex or a major task. Cubic yard methods can also be an advantage where the riprap end section is uniform for long reaches on larger projects. The elimination of the need to keep track of delivery tickets may be a considerable time saving.

Cubic yard methods can be expected to impose some contingency considerations from the contractor due to the necessity to convert from tons to cubic yards in quantity estimation.

(1) Methods 1, 2, and 3 provide various means of measurement and are intended for use where filter or bedding aggregate, if any, is to be paid for as a separate item.

- (2) Method 4 is intended for use where filter or bedding aggregate is a minor item and payment for it is to be included in the payment for rock riprap.
- (3) Methods 5 and 6 are intended for use when geotextile filters are specified, or when no filter, bedding aggregate, or geotextile are specified.

When specifications are prepared using electronic procedures and all but one method are deleted for use in the contract specification, delete "All Methods The following provisions apply to all methods of measurement and payment." and left justify the remaining text.