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Case 11-31

DATE: August 17, 2011  
TO: MAG Specifications and Details Committee Members  
FROM: Peter Kandaris, SRP Representative  
RE: **Revisions to Section 703 – Riprap; Section 220 – Riprap Construction**

Purpose: Update standard identified by Outside ROW WG

703 Revisions: The purpose of the changes is to simplify the language and include LA abrasion test requirement where deleted from revisions to Section 701 (Case 11-29).

Major changes are summarized below:

- (a) Change the term “stone” to “aggregate” to be consistent with other MAG sections.
- (b) Refer to corrected Section 701 subsections.
- (c) Include engineering review of submittals and material source as is done with other materials (recommended by MCDOT).
- (d) Place all material physical requirements in Section 703.2.
- (e) Improve definition for aggregate shape and include appropriate ASTM test method.

220 Revisions: The purpose of the changes is to make the section compatible with revisions to Section 701 (Case 11-29) and update the grout material requirements.

Major changes are summarized below:

- a) Change subsection reference to Section 701.
- b) Delete “cookbook” grout mix in favor of mix performance criteria.
- c) Provide parameters for ready-mix production of grout include use of fly ash, and specify coarse and fine aggregate gradation/distribution.
- d) Eliminating field job mixing of grout as an option.

**SECTION 703 – REVISED 8-17-11**

**RIPRAP**

**703.1 GENERAL:**

Aggregate for grouted and ungrouted riprap shall meet the requirements of Sections 701.2 and 703.2 unless otherwise stated in the project specifications.

Aggregate shall be color-matched with adjacent landscape aggregate if specified on the plans or in the special provisions.

The Contractor shall provide the Engineer, in writing, material information and the source location at least 10 days prior to use of the material unless the material is currently acceptable for use as determined by the Engineer.

**703.2 PHYSICAL PROPERTIES:**

Riprap shall have the following physical properties:

- (A) The maximum aggregate size shall be 150% of the indicated  $D_{50}$  size and the minimum aggregate size shall be 50% of the indicated  $D_{50}$  size.
- (B) Aggregate shall be angular and shall not exceed 3:1 ratio for flat and/or elongated pieces when determined by ASTM D-4791. Rounded aggregate shall only be allowed when specified or approved by the Engineer.
- (C) The loss by abrasion in the Los Angeles Abrasion Machine, determined as prescribed in ASTM C-535, shall not exceed 40 percent (by weight) after 1000 revolutions.



LA abrasion test requirements come from Section 701 for quarry stone.

SECTION 703 – REVISED 8-17-11

RIPRAP

703.1 STONEGENERAL:

~~Stone Aggregate for plain and grouted and ungrouted riprap shall meet the requirements of Sections 701.4 701.2 and 703.2 unless otherwise stated in the project specifications. Stone shall be angular, rounded stone shall only be allowed when specified. Flat or needle shapes will not be acceptable unless the thickness of the piece is more than 1/3 the length.~~

~~Stone Aggregate shall be color-matched with adjacent landscape aggregate if specified on the plans or in the special provisions.~~

~~The Contractor shall provide the Engineer, in writing, material information and the source location at least 10 days prior to use of the material unless the material is currently acceptable for use as determined by the Engineer.~~

703.2 SIZE OF STONEPHYSICAL PROPERTIES:

Riprap shall have the following physical properties:

- (A) ~~Unless otherwise indicated~~ The maximum ~~stone aggregate~~ aggregate size shall be 150% of the indicated D<sub>50</sub> size and the minimum ~~stone aggregate~~ size shall be 50% of the indicated D<sub>50</sub> size.
- (B) ~~Stone Aggregate shall be angular and shall not exceed 3:1 ratio for flat and/or needle elongated pieces when determined by ASTM D-4791. shapes will not be acceptable unless the thickness of the piece is more than 1/3 the length. Rounded stone aggregate shall only be allowed when specified or approved by the Engineer.~~
- (C) ~~The loss by abrasion in the Los Angeles Aabrasion Mmachine, determined as prescribed in ASTM C-535, shall not exceed 40 percent (by weight) after 1000 revolutions.~~



LA abrasion test requirements come from Section 701 for quarry stone.

## SECTION 220 – REVISION 8-3-11

### RIPRAP CONSTRUCTION

#### 220.1 DESCRIPTION:

Riprap construction shall consist of furnishing and placing stone, with or without grout, and underlain with filter material of granular filter blankets or erosion control geosynthetic fabric. The depth and type of riprap shall be as shown on the plans or in the special provisions.

#### 220.2 MATERIALS

Riprap shall conform to the requirements of Section 703.

Erosion control geosynthetic fabric shall conform to the requirements of Table 796-3 in Section 796.

Waste or sacked concrete shall not be permitted for use as riprap.

The Contractor, at no additional cost, shall provide mechanical equipment, a sorting site, and labor needed to assist in checking riprap gradation.

Granular filter blankets shall consist of processed natural material conforming to the requirements of Section 7012.3, with the gradation and thicknesses as specified on the plans or in the special provisions.

#### 220.3 PREPARATION OF GROUND SURFACES

The bed for placement of riprap shall be shaped and trimmed to provide even surfaces.

#### 220.4 PLACEMENT OF EROSION CONTROL GEOSYNTHETIC FABRIC:

Fabric shall be placed at the locations shown on the project plans. The Contractor shall provide a surface free of obstructions, depressions, debris, and soft yielding surfaces prior to the placement of fabric. The fabric shall be loosely laid (not in a stretched condition), aligned and placed with no fold over wrinkles.

The fabric shall be placed to provide a minimum 24-inch of overlap for each joint. On horizontal joints, the uphill fabric shall overlap the downhill fabric. On vertical joints, the upstream fabric shall overlap the downstream fabric.

Bedding material shall be placed uniformly on the fabric to the depth specified on the plans and shall be free of mounds, dips, and windrows. Bedding material shall not be compacted.

#### 220.5 RIPRAP PLACEMENT:

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Riprap shall be carefully placed on filter material consisting of a granular filter blanket or the bedding material on erosion control geosynthetic fabric. Placement shall not damage the underlying filter blanket or geosynthetic fabric. If the Engineer determines that the placement of stone has damaged or displaced the filter material to the extent that it cannot function as intended, the Contractor, at his expense, shall remove the placed riprap stone and properly correct the damage to, and/or the displacement of, the filter material. Such correction may include the removal of the filter material, re-grading the affected area, and subsequent replacement of the filter material and riprap stone as required by the Engineer.

Riprap shall be placed in a manner which will produce a dense, reasonably well-graded mass without segregation and with a minimum amount of voids. The larger stone shall be evenly distributed through the riprap mass. The individual placement of larger riprap stones may be required to obtain a uniform distribution of stone size. The riprap placement shall be supplemented by such hand methods as are required to obtain a uniform finished surface. Allowable tolerance from the slope lines and grades shown for the finished riprap surfaces shall not exceed a distance equal to 1/3 of the nominal D<sub>50</sub> size above or below the design surfaces. The final surface elevations shall be lower than any adjacent apron or pipe invert elevations and shall not obstruct the operation of adjacent structures. The flow line within riprap shall provide positive drainage with minimal ponding. Individual stones shall depress below the finished grades no lower than a distance equal to 1/2 of the nominal D<sub>50</sub> size. Special care shall be exercised in placing riprap within 3 feet of structures to avoid damage to such structures.

**220.6 GROUTED RIPRAP:**

Place riprap as specified in Section 220.5, excluding the use of filter material, ~~then grout and secure~~ in place with portland cement ~~mortar~~ grout meeting the requirements of Table 220-1. Place grout to the depth as shown on the plan but in no case less than 70 percent of the depth of riprap. Consolidate grout into place with suitable spades, trowels or other approved means to provide a dense stone and mortar layer with all voids and interstices filled. After grout has been placed, the rocks shall be thoroughly brushed so that their top surfaces are exposed. If required, use water pressure to clean stone faces after the mortar has achieved sufficient strength. The outer rocks shall project 1/3 to 1/4 their diameter above the grouted surface.

**Table 220-1 Grout for RipRap**

<b>Minimum Cementitious Material (lbs)</b>	<b>Maximum W/CM Ratio</b>	<b>Slump (in)</b>	<b>Air Content (%)</b>
<b>850</b>	<b>0.60</b>	<b>9 +/- 2</b>	<b>0 % - 8 %</b>

~~The grout shall consist of 1 part cement and 3 parts by volume of aggregate. The portland cement cementitious materials shall meet the requirements be Type II as specified in~~ of Section 725.2. Up to 25 percent by weight of the Table 220-1 minimum cementitious materials requirements may be an approved fly ash or natural pozzolan. The aggregates shall meet the applicable requirements of ASTM C-33, #8 (3/8") coarse aggregate grading and fine aggregate

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(sand) grading. All Ready Mixed Grout volume calculations shall be based on "absolute volume" with the total volume per cubic yard equal to 27 cubic feet. Coarse aggregate volume shall be a maximum of 35% of the total aggregates volume. ~~shall be 2 parts sand and 1 part gravel passing a 3/8 inch square mesh screen. The quality of the sand and gravel shall be as specified in Section 701.~~ All mixing shall be in accordance with the applicable requirements of Section 725.7.

The amount of ~~water slump~~ shall be the minimum amount needed ~~such as~~ to permit gravity flow into the interstices with limited spading and brooming. The consistency of the grout shall be as approved by the Engineer.

~~Except when hand mixing is permitted by the Engineer, grout shall be mixed in an approved machine mixer for not less than 1 1/2 minutes. Should hand mixing be permitted, the cement and aggregate shall be thoroughly mixed in a clean, tight mortar box until the mixture is of uniform color after which clean water shall be added in such quantity as to provide a grout of the required consistency.~~

### **220.7 MEASUREMENT:**

The completed, in place riprap construction within the limits of the dimensions shown on the plans shall be measured. Measurement will be in cubic yards rounded to the nearest cubic yard.

No separate measurement will be made for erosion control geosynthetic fabric, bedding material, or grout.

### **220.8 PAYMENT:**

Payment for riprap will be made for the accepted complete in-place riprap construction at the contract unit price. Riprap construction shall include excavation, ground surface preparation, erosion control geosynthetic fabric (if used for the project), bedding material, riprap stone, grout (if used for the project) and backfilling.

Payment for riprap shall be full compensation for furnishing all material, labor and equipment for riprap construction.