

DATE: July 13, 2011

TO: MAG Specification and Details Committee Members

FROM: Brian Gallimore, Materials Working Group/AGC

RE: Section 701 – Rock, gravel and sand

PURPOSE: Moved material to their respective corresponding sections

REVISIONS: a) Clarify coarse aggregate, boulders and cobbles  
b) Removed quarry stone

## SECTION 701

### AGGREGATE

#### 701.1 GENERAL:

The definitions for coarse and fine aggregates are per ASTM D2487. Material property requirements for specific uses are listed in the applicable MAG section.

#### 701.2 COARSE AGGREGATE:

Coarse Aggregate shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance. Aggregate sources shall include but not be limited to alluvial deposits, terrace aggregates, quarried stone, or other suitable sources including recycled products as approved by the Engineer. Classification shall be made by size as noted below.

**701.2.1 Boulders:** Particles of rock as defined above that will not pass a 12-in. square opening.

**701.2.2 Cobbles:** Particles of rock as defined above that will pass a 12-in. square opening, but will be retained on a 3-in. square opening.

**701.2.3 Coarse Gravel:** Particles of rock as defined above that will pass a 3-in. U.S. standard sieve, but will be retained on a 3/4-in. U.S. standard sieve.

**701.2.4 Fine Gravel:** Particles of rock as defined above that will pass a 3/4-in. U.S. standard sieve, but will be retained on a No. 4 U.S. standard sieve.

#### 701.3 FINE AGGREGATE (SAND):

Fine Aggregate (Sand) shall be fine granular material produced by the crushing of rock or gravel or naturally produced by disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay, and other deleterious substances to be thoroughly suitable for the purpose for which it is intended. Sand particles are defined as passing a No. 4 U.S. standard sieve and retained on a No. 200 U.S. standard sieve.

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End of Section

## SECTION 701

### **ROCK, GRAVEL, AND SAND AGGREGATE**

#### **701.1 GENERAL:**

The following specifications set forth the definitions and requirements for coarse and fine aggregates acceptable for use as defined below. These definitions are per ASTM D-2487, crushed rock, gravel, sand, and quarry stone. Samplings and sieve analysis shall be performed in accordance with ASTM D-75 and ASTM C-136. Sand equivalents shall be determined in accordance with AASHTO T-176. The liquid limit and plasticity index shall be determined in accordance with AASHTO T-89 and T-90. Material property requirements for specific uses are listed in the applicable MAG section.

#### **701.2 CRUSHED ROCK AND GRAVEL COARSE AGGREGATE:**

Rock and gravel Coarse Aggregate shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance. Aggregate sources shall include but not be limited to alluvial deposits, terrace aggregates, quarried stone, or other suitable sources including recycled products as approved by the Engineer. Further Classification shall be made by size as noted below.

The loss by abrasion in the Los Angeles abrasion machine, determined as prescribed in ASTM C-131, Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

**701.2.1 - Crushed Rock Boulders:** Particles of rock as defined above that will not pass a 12-in. square opening. Crushed rock shall consist of the product obtained by crushing rock, stone, or gravel so that at least 50 percent by weight of aggregate retained on the No. 4 sieve for 3/4 inch or larger maximum sizes, and 50 percent retained on the No. 8 sieve for maximum sizes less than 3/4 inch shall consist of particles which have at least one rough, angular surface produced by crushing. All material that will pass a grizzly with bars spaced 15 inches apart, clear opening, shall be crushed when producing from the Contracting Agency's source.

The gradation of crushed rock shall comply with ASTM D-448.

**701.2.2 Gravel Cobbles:** Particles of rock as defined above that will pass a 12-in. square opening, but will be retained on a 3-in. square opening. Material designated herein as gravel shall be composed entirely of particles that are either fully or partially rounded and water worn. Crushed rock obtained by crushing rock which exceeds ASTM D-448 maximum gradation sizes may be combined provided it is uniformly distributed throughout and blended with the gravel. The quality and gradation requirements shall be as stated in this specification.

**701.2.3 Coarse Gravel:** Particles of rock as defined above that will pass a 3-in. U.S. standard sieve, but will be retained on a 3/4-in. U.S. standard sieve.

**701.2.4 Fine Gravel:** Particles of rock as defined above that will pass a 3/4-in. U.S. standard sieve, but will be retained on a No. 4 U.S. standard sieve.

#### **701.3 FINE AGGREGATE (SAND):**

Fine Aggregate (Sand) Sand shall be fine granular material produced by the crushing of rock or gravel or naturally produced by disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay, and other deleterious substances to be thoroughly suitable for the purpose for which it is intended. Sand particles are defined as with passing a No. 4 U.S. standard sieve and be retained on a No. 200 U.S. standard sieve.

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~~701.3.1 Sand for Asphalt Concrete Pavement:~~ Sand for asphalt concrete pavement shall comply with AASHTO M-29 except that grading requirements shall be deleted and have a minimum sand equivalent of not less than 50 and shall be non-plastic when tested in accordance with AASHTO T-89 and T-90.

Comment [DR1]: Is taken care of in 710

~~701.3.2 Sand for Mortar and Plaster:~~ It shall be thoroughly and uniformly washed and shall be entirely free from oil and deleterious substances.

~~The average value of sand equivalent determined on 3 successive samples shall not be less than 70. No individual sample shall have a sand equivalent less than 65.~~

~~The size and grading of sand to be used in mortar, and plaster shall be such as to conform with the requirements specified as follows:~~

~~Mortar: ASTM C-144~~

~~Plaster: ASTM C-35~~

Comment [DR2]: Would have to be included in section 776 if deleted.

~~701.3.3 Aggregate for Portland Cement Concrete:~~ Coarse and fine aggregate shall conform to the applicable requirements of ASTM C-33.

~~Coarse aggregate grading requirements shall conform to the appropriate rock size designation in the Grading Requirements for Coarse Aggregate Table. Fine aggregate grading requirements shall conform to the Fine Aggregate Grading section.~~

~~The average value of 3 successive sand equivalent samples shall not be less than 70 when tested in accordance with AASHTO T-176. No individual sample shall have a sand equivalent less than 65.~~

~~The loss by abrasion in the Los Angeles abrasion machine, determined as prescribed in ASTM C-131, Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.~~

Comment [DR3]: Would have to be included in section 725.3 if deleted.

~~701.3.4 Aggregate for Masonry Grout:~~ The size and grading of the fine or coarse aggregate to be used in masonry grout shall conform to ASTM C-404.

Comment [DR4]: Would have to be included in section 776 if deleted.

~~701.3.5 Aggregate for Controlled Low Strength Material:~~ Coarse aggregate shall conform to ASTM C-33 grading size No. 57. The size and gradation of fine aggregates (sand) shall conform to ASTM C-33.

Comment [DR5]: Would have to be included in section 728 if deleted.

### 701.4 QUARRY STONE:

~~701.4.1 General:~~ Quarry stone shall be angular, sound, durable, hard, resistant to abrasion; free from laminations, weak cleavages, and undesirable weathering, leaching, exfoliation tendencies, and slaking; and of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. Stone shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings. Suitable tests and/or service records will be used to determine the acceptability of the stone. Tests to which the material may be subjected include petrographic analysis, X-ray diffraction, specific gravity, absorption, abrasion, rock drop, soundness, wetting and drying, and such other tests as may be considered necessary to demonstrate to the Engineer that the materials are acceptable for use in the work. In connection therewith, the Contractor shall notify the Engineer in writing at least 60 days prior to use of the intended sources of quarry stone.

~~701.4.2 Test Requirements:~~ Quarry stone shall meet the following requirements except as may be otherwise provided on the plans and in the special provisions:

~~(A) Apparent specific gravity: 2.65 minimum.~~

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(B) Breakdown:

- Rock drop breakdown: \_\_\_\_\_ 5 percent maximum
- Abrasion breakdown at 1000 revolutions: \_\_\_\_\_ 40 percent maximum
- Breakdown after 10 cycles of wetting and drying: \_\_\_\_\_ 5 percent maximum
- Solubility in water, breakdown, or softening: \_\_\_\_\_ None

**701.4.3 Test Methods:** Unless otherwise specified in the special provisions or indicated on the plans, test methods for quarry stone shall be as follows:

(A) Apparent specific gravity per ASTM C 127.

(B) Abrasion characteristics to be determined by either Rock Drop Test or Los Angeles Rattler, ASTM C-131, as required on the plans or the special provisions:

(1) Standard Rock Drop Test. Tests shall be made on groups of 5 accurately weighed sizes of rocks: No. 1, ranging from 75 to 100 lbs.; No. 2, 100 to 125 lbs.; No. 3, 125 to 150 lbs.; No. 4, 150 to 175 lbs.; No. 5, 175 to 225 lbs.

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Each rock of the 5 sizes shall be dropped 3 times on the group of the other 4, in an enclosure, from successive heights of 10, 15, and 18 feet. The enclosure shall have a flexible medium weight galvanized iron floor or equivalent, set on a solid foundation.

Order of dropping shall be Nos. 3, 2, 4, 1, 5. All rock passing a 3 inch square mesh screen after test shall be weighed and recorded as a percentage of the total initial weight of the 5 rocks.

—(2) Los Angeles abrasion machine, per ASTM C 131, Grading B.

(C) Wetting and drying. The stone shall be crushed, screened, and 1000 or 1500 grams of the 3/4 inch to 3/8 inch fraction taken for the test.

The crushed and graded stone shall be submerged in water for 18 hours at room temperature, after which the sample shall be drained and oven dried at 140°F. When dry, the sample shall be cooled to room temperature. This would complete one cycle.

The percent loss shall be determined by screening the tested sample on a No. 4 sieve and shall be computed as follows:

$$\frac{100 \times \text{Weight of Materials Passing No. 4 Sieve}}{\text{Total Weight of Sample}} = \% \text{ Loss}$$

(D) Accelerated water breakdown and solubility test. Air dry samples of representative stone weighing approximately 1 lb. each shall be immersed for 8 hours at 140°F., in distilled water, local tap water, or 3.5 percent sodium chloride solution.

End of Section