

DATE: August 23, 2012

TO: MAG Specification and Details Committee Members

FROM: Brian Gallimore, Materials Working Group/AGC
Jeff Benedict, Asphalt Working Group/ARPA
Jeff Hearne, Concrete Working Group/ARPA

RE: Reclaimed Materials – Aggregates and Base

PURPOSE: Addresses the use of reclaimed and or recycled materials along with proper reference adjustments to their respective corresponding sections

REVISIONS:

Section 701

- 1) Added section 701.4 and correctly adjusted sequential numbering, 701.4 "RECLAIMED CONCRETE MATERIAL (RCM); a definition and general statement to describe the product – with reference to AASHTO M 319. The exclusion of RCM in the use of Portland Cement Concrete without approval of the Engineer was also included.
- 2) Added section 701.5 and correctly adjusted sequential numbering, 701.5 "RECLAIMED ASPHALT PAVEMENT (RAP); a definition and general statement to describe the product. The exclusion RAP in the use of Portland Cement Concrete without approval of the Engineer was also included.
- 3) Re-numbered section 701.4 to 701.6

Section 702

- 1) Added additional material descriptions to include reclaimed materials to Section 702.1 "GENERAL".
- 2) Revised primary applications for Select material in 701.2

Section 725

- 1) Added exclusion of RCM and RAP in the use of Portland Cement Concrete without approval of the Engineer to Section 725.3.

Section 310

- 1) In Section 310.3 "COMPACTION" - add the note to AASHTO T-99 regarding the proper use of method "C" or "D" as required based upon the gradation of the material.

SECTION 701 – REVISED 8-23-12

AGGREGATE

701.1 GENERAL:

Coarse and fine aggregates are defined in accordance with ASTM D-2487. Material property requirements for specific uses are provided in applicable MAG sections.

701.2 COARSE AGGREGATE:

Rock and gravel 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, quarry stone, or other suitable sources including recycled products that meet all material test requirements as approved by the Engineer. Aggregate classification shall be made by size as noted herein.

Apparent specific gravity shall be at least 2.50, when tested in accordance with ASTM C-127.

701.2.1 Boulders: Particles of rock that will not pass a 12-inch square opening.

701.2.2 Cobbles: Particles of rock that will pass a 12-inch square opening, but are retained on a 3-inch square opening.

701.2.3 Coarse Gravel: Particles of rock that will pass a 3-inch U.S. standard sieve, but are retained on a 3/4-inch U.S. standard sieve.

701.2.4 Fine Gravel: Particles of rock that will pass a 3/4-inch U.S. standard sieve, but are 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. Fine aggregates particles shall pass a No. 4 U.S. standard sieve, but are retained on a No. 200 U.S. standard sieve.

701.4 RECLAIMED CONCRETE MATERIAL (RCM)

Reclaimed concrete material (RCM) is defined as an aggregate material that is derived from the crushing, processing and classification of Portland cement concrete construction materials recovered, salvaged, or recycled from roadways, sidewalks, buildings, bridges, and other sources.

In accordance with Section 7 of AASHTO M319, RCM shall not contain more than five percent by mass of brick or concrete block and shall be substantially free of wood, metal, plaster, and gypsum board. RCM shall be free of all materials that fall under the category of solid waste or hazardous materials as defined by the state or local jurisdiction. With the approval of the Engineer, these respective quantities may be adjusted if the performance of the RCM is not adversely impacted. RCM may be used alone or uniformly blended with other approved aggregate materials to obtain the applicable performance criteria. RCM shall not be used in Portland Cement Concrete without the prior approval of the Engineer.

701.5 RECLAIMED ASPHALT PAVEMENT (RAP):

Reclaimed asphalt pavement (RAP) is defined as all recovered, salvaged or recycled asphalt road waste, large particles or milled material that has been size-reduced, crushed and or screened appropriately, making it reusable. This material shall be of a consistent and relatively clean manner as to not adversely affect the final material usage. RAP may be used alone or uniformly

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blended with other approved aggregate materials to obtain the applicable performance criteria. RAP shall not be used in Portland Cement Concrete without the prior approval of the Engineer.

701.4.6 SAMPLING:

Sampling of aggregates shall be performed in accordance with ASTM D-75.

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SECTION 702 – REVISED 8-29-12

BASE MATERIALS

702.1 GENERAL:

Base materials shall be as defined in Section 701, consisting of appropriately sized coarse and fine aggregates, Reclaimed Concrete Material (RCM) or Reclaimed Asphalt Pavement (RAP), other inert materials, and/or aggregates that have been treated for plasticity index mitigation, as approved by the Engineer. These materials, whether virgin or reclaimed or a uniform blend of both, shall conform to the end result quality requirements of this section.

When base material without further qualification is specified, the Contractor shall supply materials that meet the gradation and other quality requirements for Aggregate Base Course as defined in Table 702-1. When a particular classification of base material is specified, the Contractor may substitute materials meeting the gradation and other quality requirements for Aggregate Base Course for Select material, when approved by the Engineer.

The Contractor shall provide the Engineer, laboratory testing documentation on the source of the base material showing compliance to Table 702-1 in writing, material information and the source location at least 10 business days prior to placement except where the base materials are being obtained from a currently approved source from a list maintained by the appropriate Agency or use of the material unless the material is currently accepted for use, as determined by the Engineer. Included in the documentation shall be the percentage of RCM or RAP, if applicable.

RCM meeting the requirements of Section 701.4 can be utilized in base material at a maximum quantity of 50% and shall be used in roadway applications or where otherwise specified by Project plans or special provisions.

RAP meeting the requirements of Section 701.5 can be utilized in base material up to 100% and shall be used in roadway applications or where otherwise specified by Project plans or special provisions.

702.1.1 Aggregate Base Course shall be used ~~primarily~~ in roadway applications or where otherwise specified by project plans or special provisions.

702.1.2 Select Material shall be primarily used, ~~but not limited to applicable structure and pipe backfill installations, shoulders, turnouts, driveways, and tapers as a sub base in roadways or deep lifts for backfill and embankment applications~~ or where otherwise specified by project special provisions.

702.2 PHYSICAL PROPERTIES:

702.2.1 Base material shall meet the physical properties listed in Table 702-1.

Table 702-1			
Sieve Analysis			
Test Methods AASHTO T-27, T-11			
Sieve Size	Accumulative Percentage Passing Sieve, by Weight		
	Select Material		Aggregate Base Course
	Type A	Type B	
3 in.	100	--	--
1-1/2 in.	--	100	100
1 in.	--	--	90 – 100
No. 4	30 - 75	30 - 70	38 - 65
No. 8	20 - 60	20 - 60	25 – 60
No. 30	10 - 40	10 - 40	10 – 40
No. 200	0 - 12	0 - 12	3 – 12
Plasticity Index			
Test Methods AASHTO T-89 Method A, T-90, T146 Method A			
Maximum allowable value	5	5	5
Fractured Face, One Face			
Test Method ARIZ 212, Percent by Weight of the Material Retained on a #4 Sieve			
Minimum required value	50	50	50
Resistance to Degradation and Abrasion by the Los Angeles Abrasion Machine			
Test Method AASHTO T-96, Percent Loss by Weight			
Maximum allowable value at 100 revolutions	10	10	10

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Maximum allowable value at 500 revolutions	40	40	40
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702.2.2: When tested for acceptance, Base material that does not meet Table 702-1 properties for gradation or PI may be approved at the Engineer’s discretion if the R-Value is at least 70, when determined by test method AASHTO T-190 (see Table 310-1).

End of Section

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SECTION 725 – REVISED 8-23-12

PORTLAND CEMENT CONCRETE

725.3 AGGREGATES:

Coarse and fine aggregate shall conform to the applicable requirements of ASTM C33. Coarse aggregate grading requirements shall conform to the appropriate rock size designation in the Grading Requirements for Coarse Aggregate, Table 2. 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 ASTM D2419. 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 C131, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

Prior to the delivery of the aggregates and whenever required during concrete production, the Contractor shall make stockpiles available to the Engineer for testing. All required samples shall be furnished at the expense of the Contractor, and the cost of sampling and testing shall be at the expense of the Contracting Agency.

Reclaimed Concrete Materials (RCM) and Reclaimed Asphalt Pavement (RAP) as defined in Section 701 shall not be used in Portland Cement Concrete without the prior approval of the Engineer.

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SECTION 310 – REVISED 7-30-12

PLACEMENT AND CONSTRUCTION OF AGGREGATE BASE COURSE

310.1 DESCRIPTION:

Aggregate base course shall comply with Subsection 702 unless the use of a different type of material is specifically authorized in the special provisions.

310.2 PLACEMENT AND CONSTRUCTION:

The compacted lift thickness shall not exceed 6 inches, unless approved by the Engineer. Based on the type of material, type of equipment and compaction methods used, the Contractor may propose a greater lift thickness.

After distributing, the aggregate base course material shall first be watered and then graded to a uniform layer that will net, after compacting, the required thickness. The grading operation shall be continued to such extent as may be necessary to minimize segregation. The quantity of water applied shall be that amount which will assure proper compaction resulting in the density required by Section 310.3.

After placement, the aggregate base course surface shall be true, even and uniform conforming to the grade and cross-section specified. In no case shall the aggregate base course vary by more than ½ inch above or below required grade.

310.3 COMPACTION

The contractor is responsible for providing appropriate equipment and techniques to achieve the compaction results required by this specification. The aggregate base course shall be compacted in lift thicknesses as allowed by Section 310.2.

The laboratory maximum dry density and optimum moisture content for the aggregate base course material shall be determined in accordance with AASHTO T-99. (Note: when testing base materials - use method "C" or "D" as required based upon the gradation of the material.) Field 'one-point' maximum dry density and optimum moisture procedures shall only be allowed upon approval of the Engineer.

The in-place density shall be determined in the field by nuclear density testing in accordance with AASHTO T-310 or sandcone density testing in accordance with AASHTO T-191. In the event nuclear density testing is selected, a minimum of one sandcone correlation shall be performed for each 10 nuclear density tests.

A rock correction, to compensate for rock content larger than the #4 or ¾ inch sieves (as required by the laboratory maximum dry density and optimum moisture procedure selected), shall be performed in accordance with AASHTO T-224. Care should be taken to account for the specific gravity of the oversize particles particularly if recycled materials are utilized for aggregate base course. The specific gravity shall be determined in accordance with AASHTO T-85, as applicable.

For roadway construction, one field density test shall be performed per lift per 660 feet per lane. For other aggregate base course applications, a minimum of 1 field density test shall be performed for each 800 square yards.

Unless otherwise noted in the project plans or project specifications, the moisture content of the aggregate base course at the time of compaction shall be the optimum moisture content +/- 3%.