STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT 1031

METHOD OF TEST FOR DETERMINING SPECIFIC GRAVITY AND PERCENT ABSORPTION FOR COARSE AND FINE AGGREGATE

July 19, 2013

1031.01 FINE AGGREGATE. AASHTO T 84, Specific Gravity and Absorption of Fine Aggregate, shall be followed with the following exception to section 7.1.1.:

7.1.1. Wash the fine aggregate over a No. 200 sieve until all material passing the No. 200 sieve is removed. Dry it in a suitable pan or vessel to a constant mass at a temperature of 110+/- 5°C (230 +/- 9°F). Allow it to cool to a comfortable handling temperature. Then add at least 6 percent water to it and permit it to stand for a period of one hour (minimum).

1031.02 COARSE AGGREGATE. AASHTO T 85, Specific Gravity and Absorption of Coarse Aggregate, shall be followed except that section 8.3 shall be modified to permit the use of a centrifuge to bring the aggregate to a saturated surface dry condition.

Calculations:

Determine calculations based on appropriate formula for desired result - those formulas are again:

A. Bulk specific Gravity (Gsb): The ratio of the mass in air of a unit volume of aggregate at a stated temperature to the mass in air of an equal volume of gas-free distilled water at a stated temperature.

$$Gsb = A / (B + S - C)$$

B. Bulk SSD Specific Gravity (Gsb SSD): The ratio of the mass in air of a unit volume of aggregate, INCLUDING the mass of water within the voids filled to the extent achieved by submerging in water for approximately 15 hours, to the mass in air of an equal volume of gas-free distilled water at a stated temperature.

$$Gsb\ SSD = S / (B + S - C)$$

C. Apparent Specific Gravity (Gsa): The ratio of the mass in air of a unit volume of the IMPERMEABLE portion of aggregate (does not include the permeable pores in aggregate) to the mass in air of an equal volume of gas-free distilled water at a stated temperature

$$Gsa = A / (B + A - C)$$

D. Absorption (% Abs): The increase in mass of aggregate due to water in the pores of the material, but not including water adhering to the outside surface of the particles.

$$\%\ Abs = [(S-A) / A] \times 100$$

<u>Alternate Procedure</u>

% ABS = Mass of Saturated Surface Dry Material – Mass of Oven Dried Material / Divided by Mass of Saturated Surface Dry Material X 100

A = Mass of oven-dry specimen in air, g;
B = Mass of pyconometer filled with water, g;
C= Mass of pyconometer with specimen and water to calibration mark, g:
S= Mass of saturated surface-dry specimen, g.

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STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT 1029

METHOD OF TEST FOR DETERMINING THE PERCENTAGE OF DELETERIOUS MATERIALS IN COARSE AGGREGATE

April 17, 2009

1029.01 Scope. This method of test covers the procedure to be used for the determination of the proportion of deleterious materials (e.g., shale, shaly material, chert, limonitic concretions, soft pieces, clay lumps, or coal) in a sample of aggregate.

1029.02 Apparatus. Balance or scale accurate to within 0.1 percent of the weight of the sample to be tested.

1029.03 Portion of Sample Required for Testing. The material to be tested shall consist of that portion of the total sample retained on the No 4 (4.75 mm) sieve. The minimum mass of the test sample, after washing and oven-drying to a constant mass, shall be as indicated in the following table.

Size of Aggregate	Portion Required for Test (grams)
No. 1 and No. 2	Entire Sample
No. 357	15,000
No. 4	15,000
302	10,000
No. 57	10,000
No. 6	5,500
301	5,000
304	5,000
No. 67	3,500
No. 7	2,000
No. 8	1,000
No. 9*	500

* Note: For the #9-size, the fraction of material retained on the No. 4 (4.75 mm) sieve must be at least 5%. If not, the material is considered to be fine aggregate and this test is not required.

The test sample shall be obtained by quartering or by means of a sample splitter.

1029.04 Procedure - General.

1. Determine and record the mass of the test sample to the nearest gram.

2. Visually examine and separate the various types of deleterious materials from the remainder of the test sample and place the particles in separate containers.

3. Weigh and record the mass of each of the deleterious materials to the nearest gram.

1029.05 Deleterious Shale. The following methods shall be used in Step 2 above to determine which particles of shale are to be considered deleterious shale.

Method A (When aggregate must meet requirements of 703.02, 703.04, 703.11, 703.14, or 703.17). A particle shall be counted as deleterious shale if it 1) consists of 100 % shale, or 2) has shale adhering to it, or contains stringers within it, which visually comprise 50 % or more of the particle.

Method B (When aggregate must meet requirements of 703.05, 703.12). A particle shall be counted as deleterious shale if it consists of 100 % shale, has shale adhering to it, or contains stringers within it.

Note: In either method, particles that are stained on the surface due to being in contact with a shale seam or stringer shall not be counted as deleterious shale if there is no actual shale present.

1029.06 Calculations - General. Calculate the percentage of each type of deleterious material to the nearest 0.1 percent as follows:

$$P = \frac{D}{W} \times 100$$

Where:

P = percentage of each type of deleterious material
D = mass of the particular type of deleterious material
W = mass of entire test sample portion

1029.07 Deleterious Chert. The percent of deleterious chert is determined by multiplying the percentage of total chert obtained by the above equation (P) by the deleterious chert factor which is on file in the Office of Materials Management.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT 1024

METHOD OF TESTING COARSE AGGREGATES TO DETERMINE SUSCEPTIBILITY TO D-CRACKING

April 17, 2009

ASTM C 666 Procedure B, Rapid Freezing in Air and Thawing in Water, with the following exceptions:

Section 4.1.2 Procedure B shall apply.

Section 4.4 Perform the length change test ~~in order to determine the area under the curve of expansion versus the number of cycles.~~ Measure comparator readings to nearest 0.0001 in.

Section 5.2 The time to complete the freezing and thawing cycle shall not be less than 2 hours nor more than 2 ½ hours.

Section 7.1 Make six (6) Freeze Thaw specimens for each sample.

Section 7.2 The molds shall have nominal dimensions of 3" × 4" × 15" (75 × 100 × 381 mm) with the gage studs placed at the ends of the 15 inch (381 mm) length. The gage studs shall be stainless steel hex head bolts 1/4-20 UNC × 1 1/4" with matching washer and nut tightened to the head of the bolt. The threaded end of the bolt shall be rounded to fit the comparator. The gage length shall be 13" ±1/32" (330 ±0.8 mm).

Section 8.2 The initial length comparator reading is not optional

Section 8.3 The measure of length change is not optional. Continue each specimen in the test until it has been subjected to 350 cycles. The test shall continue to 350 cycles regardless of relative dynamic modulus or percent expansion unless the deterioration has made it impossible to measure the length change.

insert: total percent expansion

Section 10.6.2 Report the ~~area under the curve of~~ percent expansion versus the number of cycles. Of the six specimens, eliminate the high and the low ~~areas under the curve~~ and average the remaining four values. Report the ~~area under the curve~~ to ~~two~~ decimal places. Also report the durability factor and weight change.

four decimal places

average total percent expansion

Replace with: average total percent expansion

A passing result for the ~~area under the curve~~ is defined in 703.13.

~~Calculations for the area under the curve for a specimen are as follows:~~

$$L_n = \frac{(l_n - l_i)}{L_g} \times 100$$

Remove - No longer need

$$C_x = C_n - C_{n-1}$$

$$A_c = \sum L_n C_x - (L_n - L_{n-1}) C_x$$

~~where:~~

~~L_n = Length change (%) from the initial comparator reading at a given cycle (n).~~
~~l_n = Comparator reading at n cycles.~~
~~l_i = Initial comparator reading.~~
~~L_g = Gage Length (13 in.).~~
~~C_x = The cycle range from which the area will be determined for a given cycle reading.~~
~~C_n = Number of cycles.~~
~~A_c = Area under the curve.~~

Approved sources will be posted on the CMS Portal (http://www.odotonline.org/cmsportal/).

703.13 Coarse Aggregate for **Items 305, 451 and 452**. In addition to the requirements of 703.02, the following aggregate requirements apply.

When the total combined quantity of the listed items is greater than 10,000 square yards (8000 m2), provide size No. 57 or 67 from Table 703.01-1. If the total combined quantity of the listed items is less than 10,000 square yards (8000 m2), then provide one of the following sizes from Table 703.01-1: No. 7, 78, 8, 57, or 67.

If gravel or limestone No. 57 or 67 size is selected in either of the above cases, then ensure that the coarse aggregate incorporated into the concrete is tested according to ODOT Supplement 1024.

Ensure that the validity of results of freeze thaw-resistance testing is as outlined below:

Average Total Percent Expansion[1]	Status of Source Approval
0.000 to 0.010	Valid for four years from date approved[2]
0.011 to 0.020	Valid for two years from date approved[2]
0.021 to 0.030[4]	Not Approved, one retest allowed[3]
> 0.030[4]	Not Approved, no retesting allowed[3]

[1] As measured at 350 cycles.

[2] If a notable change in the properties of the aggregate originating from the affected source is determined from quality control testing, a retest of freeze-thaw resistance may be requested before the original expiration date. The Laboratory will make the determination to retest.

[3] Except as noted, the Department will not retest the material unless the producer of the material sends a written request to the Department with substantiation that significant changes in operation have been made (e.g., new processing equipment, material from a new ledge, etc.).

[4] If the average total percent expansion is greater than 0.020, but the durability is greater than or equal to 100, the Department may accept the source for two years.

The Laboratory will maintain a list of approved sources.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT 1024

METHOD OF TESTING COARSE AGGREGATES TO DETERMINE SUSCEPTIBILITY TO D-CRACKING

October 17, 2014

ASTM C 666 Procedure B, Rapid Freezing in Air and Thawing in Water, with the following exceptions:

Section 4.1.2 Procedure B shall apply.

Section 4.4 Perform the length change. Measure comparator readings to nearest 0.0001 in.

Section 5.2 The time to complete the freezing and thawing cycle shall not be less than 2 hours nor more than 2 ½ hours.

Section 7.1 Make six (6) Freeze Thaw specimens for each sample.

Section 7.2 The molds shall have nominal dimensions of 3" × 4" × 15" (75 × 100 × 381 mm) with the gage studs placed at the ends of the 15 inch (381 mm) length. The gage studs shall be stainless steel hex head bolts 1/4-20 UNC × 1 1/4" with matching washer and nut tightened to the head of the bolt. The threaded end of the bolt shall be rounded to fit the comparator. The gage length shall be 13" ±1/32" (330 ±0.8 mm).

Section 8.2 The initial length comparator reading is not optional

Section 8.3 The measure of length change is not optional. Continue each specimen in the test until it has been subjected to 350 cycles. The test shall continue to 350 cycles regardless of relative dynamic modulus or percent expansion unless the deterioration has made it impossible to measure the length change.

Section 10.6.2 Report the percent expansion versus the number of cycles. Of the six specimens, eliminate the high and the low total percent expansion and average the remaining four values. Report the average total percent expansion to three decimal places. Also report the durability factor and weight change.

A passing result for the average total percent expansion is defined in 703.13. Approved sources will be posted on the CMRS Portal (http://www.odotonline.org/cmsportal/).