

Method of Test for Specific Gravity and Absorption of Coarse Aggregate

1. Scope:

This test is for determining the bulk specific gravity and the absorption of coarse aggregate.

The bulk specific gravity, saturated surface dry test is the method used for the determination of the weight per ft³ of riprap.

2. Apparatus:

2.1 Scale or balance having the capacity to weigh any sample which may be tested utilizing this procedure and readable to the nearest 0.1 gram.

2.2 Wire basket. A wire basket, large enough to hold the coarse aggregate sample, with #6 mesh or smaller openings.

2.3 Water tank. A pail or tank into which the sample is suspended in water at $73.4^{\circ} \pm 3^{\circ}\text{F}$ for weighing.

2.4 Sieves. A #4 sieve conforming to ASTM E11.

2.5 Drying oven capable of maintaining a temperature of $230^{\circ} \pm 9^{\circ}\text{F}$.

3. Procedure:

3.1 Coarse aggregate.

A. Obtain a sample in accordance with SD 201. The minimum sample specimen weight shall be as shown in the following table.

Nominal maximum size, in	Minimum mass of test sample, lb.
1/2	4.4
3/4	6.6
1	8.8
1 1/2	11
2	18
2 1/2	26
3	40
3 1/2	55
4	88
4 1/2	110
5	165
6	276

B. Screen and wash the sample on the #4 sieve.

- C. Immerse the + #4 sieve material in water for 15 to 19 hours.
- D. Remove the specimen from the water and roll in an absorbent cloth until all visible films of water are removed from the particles.
- E. Weigh and record the weight of the material to the nearest 0.1 gram.
- F. Place the specimen in the wire basket and weigh and record the weight to the nearest 0.1 g of the material suspended in water at $73.4^{\circ}\text{F} \pm 3^{\circ}\text{F}$.
- G. Dry the material to a constant weight and weigh to the nearest 0.1 gram.

3.2 Riprap.

- A. Select a representative sample in accordance with the table shown in 3.1 A. (If small pieces are not available, select a larger piece that can be broken down in the laboratory).
- B. Wash the specimen to remove dust and then immerse it in water for 15 to 19 hours.
- C. Continue with paragraph 3.1. D. thru 3.1 G.

4. Report:

4.1 Bulk specific gravity.

Calculate the bulk specific gravity, $73.4/73.4^{\circ}\text{F}$ as follows:

$$\text{Bulk Sp. Gr.} = A/(B-C)$$

Where:

A = Mass of oven-dry test sample in air, g,

B = Mass of saturated-surface-dry test sample in air, g, and

C = Mass of saturated test sample in water, g.

4.2 Bulk specific gravity (Saturated-surface-dry).

Calculate the bulk specific gravity, $73.4/73.4^{\circ}\text{F}$, on the basis of mass of saturated-surface-dry aggregate as follows:

$$\text{Bulk sp. gr. (Saturated-surface-dry)} = B / (B - C).$$

4.3 Apparent specific gravity.

Calculate the apparent specific gravity, 73.4/73.4°F, as follows:

$$\text{Apparent sp. gr.} = A / (A - C)$$

4.4 Average specific gravity values.

When the sample is tested in separate size fractions, the average value for bulk specific gravity, bulk specific gravity (SSD), or apparent specific gravity can be computed as the weighted average of the values as computed using the following equation:

$$G = \frac{1}{\frac{P_1}{100 G_1} + \frac{P_2}{100 G_2} + \frac{P_n}{100 G_n}}$$

Where:

- G = Average specific gravity. All forms of expression of specific gravity can be averaged in this manner.
- G₁, G₂ ... G₃ = Appropriate specific gravity values for each size fraction depending on the type of specific gravity being averaged.
- P₁, P₂ ... P_n = Mass percentages of each size fraction present in the original sample.

4.5 Absorption.

Calculate the percentage of absorption, as follows:

$$\text{Absorption, percent} = ((B - A) / A) \times 100$$

4.6 Average absorption value.

When the sample is tested in separate size fractions, the average absorption value is the average of the values as computed in section 9.3, weighted in proportion to the mass percentages of the size fractions in the original sample as follows:

$$A = (P_1 A_1 / 100) + (P_2 A_2 / 100) + \dots (P_n A_n / 100)$$

Where:

- A = Average absorption, percent,
- A₁, A₂ ... A_n = Absorption percentages for each size fraction, and
- P₁, P₂ ... P_n = Mass percentages of each size fraction present in the original sample.

4.7 Report the specific gravity of coarse aggregate to the nearest 0.01 for concrete, nearest 0.001 for asphalt, and the absorption to the nearest 0.1% for both.

4.8 Report the unit weight of riprap to the nearest whole lb./ft³.

Unit weight of riprap = Use formula shown in paragraph 4.2 above.

5. References:

AASHTO T 85

ASTM E11

SD 201