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METHOD OF TEST FOR BULK SPECIFIC GRAVITY (S.S.D.) OF FINE AGGREGATE BY THE DISPLACEMENT METHOD (FIELD METHOD)

A. SCOPE

This test method, which is a modification of AASHTO T 84, describes a rapid procedure used in the field for determining the bulk specific gravity of fine aggregate in a saturated surface dry condition. The bulk specific gravity is the value desired for calculations in connection with portland cement concrete.

B. REFERENCES

AASHTO T 84 - Specific Gravity and Absorption of Fine Aggregate

C. APPARATUS

The apparatus shall consist of the following:

1. A balance having a capacity of 20 kg and accuracy of 1 g.
2. A galvanized water pail of 12 to 14 qt size.
3. A suitable container for the immersion of the pail and sample in water. A 20 in. diameter container 24 in. high may be used.
4. A brass or galvanized rod about $\frac{3}{16}$ in. in diameter with open hooks on each end. The rod should preferably be made in two detachable sections; the upper section is attached to the center of the scale pan and becomes part of the tare weight. This upper section is of such length that its lower end remains above the surface of the water in the container, and it is in a convenient position for attaching and removing the lower section from which the pail is suspended when weighing in water.
5. A bench or table to support the balance over the water container with sufficient clearance to permit inserting the pail into the water container. Make an opening in the bench to permit suspending the hooked rod from the center of the balance pan. See Figure 1 for a suitable arrangement.
6. A spoon, rod or other suitable device for stirring and removing trapped air from the sample when it is inundated in the pail. (The hand may be used if desired.)
7. A one qt glass jar.
8. A conical metal mold $1\frac{1}{2}$ in. in diameter at top, $3\frac{1}{2}$ in. in diameter at the bottom and 3 in. in height.

9. A metal tamping rod weighing 12 oz and having a flat circular tamping face 1 in. in diameter.

D. PREPARATION OF SAMPLE

Select a representative sample of the fine aggregate weighing approximately 8 kg. If the fine aggregate is not wet, mix with 3 to 4 % of water and store overnight in a closed container.

E. TEST PROCEDURE

1. Measure weight to the nearest gram.
2. Weigh the empty pail and record as tare weight of pail, W_1 .
3. Submerge the pail, as shown in Figure 1, and exercise care when immersing to see that no air is trapped under the pail. Adjust the water level in the container to intersect the straight portion of the lower section of the hook-ended rod. Place a reference mark at this intersection of the rod with a water surface or insert an overflow spout through the side of the water container at this level. Adjust to this same water level within ± 1 in. for all future "in water" weighings. Weigh the pail and rod in water and record as weight, W_2 . Remove pail from the water container and place upside down to dry, as it will be used later as a container for the sample when weighed in air.
4. Spread the wet sample on a flat surface, expose it to a gently moving current of warm air (a porous surface and artificial air circulation are advantageous), and stir or roll the sample frequently to secure uniform drying. Continue this drying operation and make tests at frequent intervals by one of the two following methods until the tests indicate that the fine aggregate has reached a surface dry condition.
 - a. Method 1. Place a portion of the drying fine aggregate in a dry 1 qt glass jar and shake the jar. If the sand grains adhere to the dry surface of the jar, pour out the sample, and renew drying operations. Make jar shaking tests at frequent intervals. When the grains of a sample of the drying fine aggregate just cease to adhere to the dry surface of the jar, the sample has reached the saturated surface dry condition.
 - b. Method 2. Place the drying fine aggregate loosely to overflowing in the conical mold and lightly tamp the surface of the aggregate 25 times with the metal tamping rod. Do not add additional aggregate after the rodding is completed. Lift the mold vertically. If free moisture is present, the cone of fine aggregate will retain its shape. Continue drying with constant stirring and make tests at frequent intervals until the cone of fine aggregate slumps upon the removal of the mold. This indicates that the fine aggregate has reached the saturated surface dry condition.
5. Place the fine aggregate in the dry pail immediately after it has reached a saturated surface dry condition and record this weight as W_3 .
6. Remove the pail and sample from the balance and add enough water to the pail to completely inundate the sample. Stir the inundated sample with the spoon, rod or hand in order to remove any entrapped air.

7. Add enough water to almost fill the pail and attach the pail to the balance by means of the hook-ended rod. Lower and immerse the pail and sample to within ± 1 in. of the same level where the pail submerged when filled with water only (see paragraph E.3.). Exercise care when immersing to see that no air is trapped under the pail. Weigh the pail, rod and sample in water and record as weight, W_4 .

F. CALCULATIONS

1. The weight of the sample in water, W_w , is equal to the weight of the pail, rod and sample in water minus the weight of the pail and rod in water.

$$W_w = W_4 - W_2$$

2. The weight of the sample in a saturated surface dry (SSD) condition in air, W_a , is equal to the weight of the SSD sample and the dry pail minus the weight of the dry empty pail.

$$W_a = W_3 - W_1$$

3. Calculate the bulk specific gravity (SSD basis) from the following formula:

$$\text{Bulk Sp. Gr. (SSD)} = W_a / (W_a - W_w)$$

4. Duplicate determinations should check to within ± 0.02 .

G. NOTES

Although Method 2 (under Test Procedure paragraph E.4.b.) is an AASHTO standard method for determining the end point in drying to a SSD condition, it tends to result in over drying rough-textured or angular aggregates. Method 1 is preferred for aggregates of such characteristics. Judgment is required in determining the end point by either method. The sand should be free flowing when the end point is reached. A small part of the grains should have turned from dark to light color with the remainder apparently at the turning point. If the end point has not been exceeded, a few drops of water mixed into the sample should destroy the free-flowing characteristics.

H. HEALTH AND SAFETY

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

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(California Test 225 contains 4 pages)

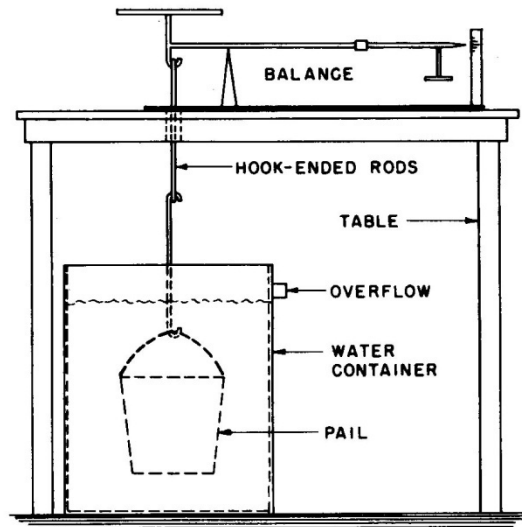


FIGURE 1. Apparatus For Immersion Of The Pail In Water