

DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

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**METHOD OF TEST FOR SURFACE MOISTURE IN
CONCRETE AGGREGATES BY THE DISPLACEMENT METHOD
(FIELD METHOD)****A. SCOPE**

This test method describes a rapid procedure used in the field for determining the percentage of surface moisture in both fine and coarse concrete aggregates by displacement in water. Surface moisture is defined as moisture in excess of that contained by the aggregate when in a saturated surface-dried condition. This is the value desired in correcting the batch weights for portland cement concrete. The accuracy of the method depends upon accurate information on the bulk specific gravity of the material in a saturated surface-dry condition.

B. REFERENCES

ASTM C 138/C 138M - Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

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, 12 to 14 qt size.
3. A suitable container for the immersion of the pail and sample in water. A 20 in. diameter container or pail approximately 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 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).

D. PREPARATION OF SAMPLE

Select a representative sample of the fine or coarse aggregate weighing approximately 8 kg. Cover the sample to minimize evaporation.

E. TEST PROCEDURE

1. Record all weights 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. 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 hook-ended rod. Place a reference mark at this intersection of the rod with the 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" weighing. Weigh the pail and rod in water and record as weight, W_2 .

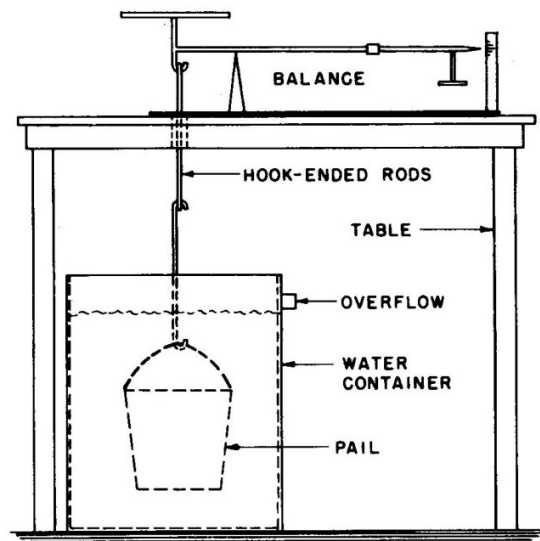


FIGURE 1. Apparatus For Immersion of The Pail in Water

4. Remove the pail from the water container, wipe off moisture, and weigh the test sample of aggregate in the pail. Weigh the aggregate as rapidly as possible to prevent the evaporation of the surface moisture. Record this weight as W_3 .
5. 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.
6. 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 was submerged when filled with water only (See 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 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 air is equal to the weight of the sample and the dry pail in air minus the tare weight of the pail.

$$W_a = W_3 - W_1$$

3. Calculate the percentage of surface moisture in terms of the saturated surface-dry aggregate from the following formula.

$$P = \left(\frac{W_a}{W_w \left(\frac{G}{G-1} \right)} - 1 \right) \times 100$$

Where:

P = Surface moisture of the aggregate in terms of saturated surface-dry aggregate, %

W_a = Weight of sample in air, g

W_w = Weight of sample in water, g; and

G = Bulk specific gravity, saturated surface-dry basis

G. NOTES

A negative value of “ P ” indicates that the moisture in the sample is less than that required for saturation and that the aggregate will absorb water from the concrete during mixing.

The complete determination requires between 2 to 3 min. to perform.

This test method is based on the premise that large samples are more representative.

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 223 contains 4 Pages)