DEPARTMENT OF TRANSPORTATION
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THIS TEST METHOD IS **ONLY VALID** FOR PROJECTS ADVERTISED

DURING THE PERIOD **SEPTEMBER 2011 THROUGH FEBRUARY 2012**

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

A. SCOPE

This test method describes a procedure for determining bulk specific gravity (oven-dry), bulk specific gravity (saturated surface-dry), apparent specific gravity, and absorption of fine aggregate.

B. REFERENCES

California Test 202 – Sieve Analysis of Fine and Coarse Aggregates
California Test 226 – Determination of Moisture Content by Oven Drying
AASHTO T 84 – Specific Gravity and Absorption of Fine Aggregate
ASTM C 128 – Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

C. APPARATUS

1. Balance: a balance or scale with capacity of 2000 g or more and sensitive to 0.1 g.

3. Flask: a volumetric flask with a mark to indicate a volume of approximately 500 mL.

4. Metal Mold: a conical metal mold in the form of a frustum of a cone with dimensions as follows:

   - 40 mm ± 3 mm inside diameter at the top,
   - 90 mm ± 3 mm inside diameter at the bottom, and
   - 75 mm ± 3 mm in height,
   - with the metal having a minimum thickness of 0.8 mm.

5. Tamping Rod: a metal tamping rod weighing 12 oz ± 0.5 oz and having a flat circular tamping face 1 in. ± ⅛ in. in diameter.

6. Water Tank: a constant temperature (73°F ± 3°F) water bath of sufficient depth to maintain the water level at or slightly above the 500 mL calibration mark of the immersed flask.

D. PREPARATION OF SAMPLE

1. Split or quarter a representative sample of approximately 1000 g from the fine aggregate to be tested.

2. Before determining the specific gravity of fine aggregate for use in hot mix asphalt (HMA), wash the material over a No. 200 sieve in accordance with California Test 202.

   NOTE: It is important that the fine aggregate be completely clean. There can be significant differences in bulk specific gravity and absorption between fine aggregate samples tested with material finer than No. 200 present vs. a sample where passing No. 200 material is not present.

3. Dry to a constant weight at 230°F ± 9°F in accordance with California Test 226, and cool to comfortable handling temperature.

4. Cover with water for 24 hr ± 4 hr.

5. Dry the test sample to saturated surface-dry (SSD) condition using the following procedures.

   NOTE: A material is in SSD condition when it retains its capacity of absorbed water and no excess free water is present on the surface of the particles.

   a. Decant excess water with care to avoid loss of fines. Spread the sample on a flat nonabsorbent surface exposed to a gently moving current of warm air, and stir frequently to insure homogeneous drying.

   b. Mechanical aids such as tumbling or stirring should be implemented to help break up any conglomerations or lumps.

      NOTE: As the SSD condition is approached, the sample must be constantly stirred and tested at frequent intervals.

   c. When the sample approaches a free-flowing condition, place the conical mold on a flat surface with the small opening up.

   d. Fill the mold loosely to overflowing with a portion of the sample.

   e. Lightly tamp the surface of the aggregate 25 times with the metal tamping rod. Each drop should start about 0.2 in. above the top surface of the fine aggregate. Permit the tamper to fall freely under gravitational attraction on each drop. Adjust the starting height to the new surface elevation after each drop and distribute the drops over the surface. Remove excess material from around the base of the cone. Do not add additional aggregate to the mold while tamping or after tamping is completed.

   f. Lift the mold vertically from the formed cone of fine aggregate and check sample (Table 1).

   g. If the sand retains its conical shape, free moisture is still present in the sample and drying must be continued.

   h. Slight slumping of the sand (less than half) as the mold is removed indicates that the sand is in the SSD condition.

   i. If the cone of sand slumps upon removal of the cone on the first trial or at anytime if more than half of the cone of sand slumps, the sand may have been dried past the SSD condition before the first test was made. In this

case, add a few milliliters of water to the sample. Thoroughly mix and allow the sample to stand in a covered container for 30 min, and then proceed with the process of drying and testing (Section D.5.b through D.5.f.).

TABLE 1

Summary of SSD Condition for Fine Aggregate

Condition	Picture	Description	Action
Too wet		• The fine aggregate retains its conical shape. • Less than half of the cone slumps and fine aggregate shows minor dampness (no visible free moisture) but the pan shows excessive dampness.	Continue with the process of drying and repeat Section D.5.b through D.5.f.
Too dry		• The cone of fine aggregate slumps upon removal of the cone. • At any point more than half of the fine aggregate slumps.	• Add a few milliliters of water to the sample and let the sample stand in a covered container for 30 min. • Repeat Section D.5.b through D.5.f.
At SSD		The fine aggregate slumps slightly (<50 %) without free moisture on the sample or in the pan, and the pan may show a slight dampness but without any free moisture.	Proceed to Section E for testing.

E. TEST PROCEDURE

1. When fine aggregate reaches the SSD condition, immediately weigh out a 500 g ± 10 g portion of the SSD fine aggregate and record the weight to the nearest 0.1 g as "S".

   NOTE: Weigh the sample immediately after it reaches the SSD condition to avoid undue moisture loss due to evaporation.

2. Introduce the SSD fine aggregate into the flask and fill the flask with water to approximately 90 % of capacity. Manually roll the flask in an inclined position, agitating the contents of the flask to eliminate visible air bubbles.

   NOTE: It may take as much as 15 to 20 min to eliminate air bubbles by manual methods.

3. After eliminating all air bubbles, adjust the temperature of the flask and its contents to 73°F ± 3°F by partial immersion in circulating water. After approximately 1 hr, remove the flask from the water bath and again roll it to eliminate any remaining air bubbles.

4. Wipe any moisture from the outside of the flask. Bring the water level in the flask to its calibrated capacity, measured to the bottom of the meniscus. Determine the total weight of the flask, specimen, and water, and record the weight to the nearest 0.1 g as "C".

   NOTE: Exercise care to eliminate all air bubbles from the sample in the flask before making the final weighing.

5. Remove the fine aggregate from the flask by emptying contents of the flask into a suitable pan or vessel and dry to a constant weight at a temperature of 230°F ± 9°F. Cool in air at room temperature for 1 hr ± ½ hr, and record the weight of the fine aggregate to the nearest 0.1 g as "A".

6. Determine the weight of the flask filled with water at a temperature of 73°F ± 3°F to the calibration mark measured to the bottom of the meniscus. Record this weight to the nearest 0.1 g as "B".

F. CALCULATIONS

Knowing: A = Weight of the oven-dry specimen, g.
B = Weight of the flask, filled with water to the calibration mark, g.
C = Weight of the flask plus specimen, filled with water to the calibration mark, g.
S = Weight of the saturated surface-dry (SSD) specimen, g.

Calculate the specific gravity to the nearest 0.001 using the following formula:

1. Bulk Specific Gravity (Oven-Dry), G_f:

$$\text{Bulk Specific Gravity, } G_f = \frac{A}{(B + S - C)}$$

2. Bulk Specific Gravity (SSD):

$$\text{Bulk Specific Gravity}_{SSD} = \frac{S}{(B + S - C)}$$

3. Apparent Specific Gravity:

$$\text{Apparent Specific Gravity} = \frac{A}{(B + A - C)}$$

4. Calculate the absorption of fine aggregate to the nearest 0.1 % using the following formula:

$$\text{Percent Absorption} = \frac{(S - A)}{A} \times 100$$

G. PRECAUTIONS

When drying the wet fine aggregate to a saturated surface-dry (SSD) condition, frequent stirring of the sample is required to ensure uniform drying throughout the sample. If non-uniform drying is allowed, the specific gravity obtained may be in error because the oven-dried portions of the sample may not be at SSD condition.

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

End of Text
(California Test 207 contains 6 pages)

California Test 207
Test Results Summary

Tester: ______________

					S	C	A	B				
Project Number	Date Tested	Test #	Flask ID #	Empty Flask Weight	Sample SSD Weights	Flask + SSD Sample + Water to Mark	Sample Oven Dry Weight	Flask + Water to Mark	Bulk Specific Gravity G_f	Bulk Specific Gravity (SSD)	Apparent Specific Gravity	Percent Absorption

Knowing:

A = Weight of the oven-dry specimen, g.
B = Weight of the flask, filled with water to the calibration mark, g.
C = Weight of the flask plus specimen, filled with water to the calibration mark, g.
S = Weight of the saturated surface-dry (SSD) specimen, g.

Bulk Specific Gravity, $G_f = \frac{A}{(B+S-C)}$

Bulk Specific Gravity$_{SSD} = \frac{S}{(B+S-C)}$

Apparent Specific Gravity$_{SSD} = \frac{A}{(B+A-C)}$

Percent Absorption $= \frac{(S-A)}{A} \times 100$