

SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE FOP FOR AASHTO T 84

Scope

This procedure covers the determination of bulk, bulk (SSD), and apparent specific gravities; and the absorption of fine aggregate after a prescribed soaking period in water in accordance with AASHTO T 84-22. For materials that do not readily slump during the cone test, see AASHTO T 84.

Apparatus

- Balance: A balance of sufficient capacity, readable to 0.1 g. Meeting AASHTO M 231, class G2.
- Pycnometer: A flask or other suitable container in which the volume can be reproduced within ± 0.1 ml. The volume of the flask shall be at least 50 percent greater than required for the test sample.
- Mold: A metal mold in the form of a frustum of a cone 40 ± 3 mm in diameter at the top, 90 ± 3 mm in diameter at the bottom, and 75 ± 3 mm in height.
- Tamper: A metal tamper weighing 340 ± 15 g and having a flat circular tamping face 25 ± 3 mm in diameter
- *Oven*—An oven of appropriate size capable of maintaining a uniform temperature of $110 \pm 5^\circ\text{C}$ ($230 \pm 9^\circ\text{F}$). Oven(s) for heating and drying shall be capable of operation at the temperatures required, between 100 to 120°C (212 to 248°F), within $\pm 5^\circ\text{C}$ ($\pm 9^\circ\text{F}$).

Sample Preparation

1. Obtain sample according to the FOP for AASHTO R 90
2. Reduce according to the FOP for AASHTO R 76.
3. Sieve sample over the 4.75 mm (No. 4) sieve.
4. Split or quarter approximately 1000 g of material from the portion passing the 4.75 mm (No. 4) sieve.
5. Dry to constant mass according to the FOP for AASHTO T 255 using a controlled heat source.
6. Cool to room temperature.
7. Cover sample with water and allow to stand for 15 to 19 hours.
8. Carefully decant the water without losing fines.
9. Spread the sample on a flat smooth surface exposed to a gently moving current of warm air.
10. Stir frequently to promote uniform drying.
11. Continue until the test sample approaches a surface-dry condition.

12. To determine a surface-dry condition:

- a. Hold the mold firmly on a smooth non-absorbent surface (large diameter down).
- b. Fill the mold to overflowing with a portion of the partially dried sample.
- c. Lightly tamp the surface 25 times with the tamper (allow the tamper to fall freely from approximately 5 mm above the top of the sample).
- d. Clean excess from around the base of the mold
- e. Lift the mold vertically.
- f. If the fine aggregate slumps on the first trial, it is too dry.
 - i. Thoroughly mix a few milliliters of water with the aggregate.
 - ii. Permit the sample to stand in a covered container for 30 minutes.
 - iii. Resume the process of drying and testing for the free-flowing condition.
- g. If the material slumps slightly upon removal of the mold, the sample has reached surface-dry condition.
- h. If the material does not slump, continue drying while constantly stirring.
- i. Perform Steps 12a through 12e at frequent intervals until the material reaches a surface-dry condition.

Procedure

Record all masses to the nearest 0.1 g.

1. Obtain approximately half, 500 ± 10 g, of the surface-dry material. Designate as S .
2. Determine and record mass of S .
3. Obtain approximately the same amount of material as the mass of S , ± 0.2 g, from the remaining surface-dry material, if desired. Designate as S_1 . This portion of the sample may be used in Step 12.
4. Partially fill the pycnometer with water.
5. Introduce the sample, S , into the pycnometer.
6. Fill pycnometer with water to approximately 90 percent capacity.
7. Roll, invert, and agitate the pycnometer to eliminate all air bubbles.

Note 2: It normally takes 15 to 20 min to eliminate air bubbles by manual methods. Dipping the tip of a paper towel into the pycnometer has been found to be useful in dispersing the foam that sometimes builds up when eliminating the air bubbles.
8. Adjust the temperature of the pycnometer, sample, and water to $23 \pm 1.7^\circ\text{C}$ ($73.4 \pm 3^\circ\text{F}$). Immerse in circulating water if necessary.
9. Fill pycnometer to its calibrated capacity and dispel any foam.
10. Dry the outside of the pycnometer.

11. Determine and record the total mass of the pycnometer, sample, and water to the nearest 0.1 g. Designate as C .
12. Remove the sample from pycnometer and dry to constant mass according to the FOP for AASHTO T 255; or dry the portion of the sample from Step 3 (S_I) to constant mass according to the FOP for AASHTO T 255.
13. Cool the sample (S or S_I) to room temperature.
14. Determine and record the mass of the dry sample. Designate as A .

Calculations

Bulk Specific Gravity (G_{sb})

$$G_{sb} = \frac{A}{B + S - C}$$

Bulk Specific Gravity (Saturated Surface-dry (SSD)) (G_{sbSSD})

$$G_{sbSSD} = \frac{S}{B + S - C}$$

Apparent Specific Gravity (G_{sa})

$$G_{sa} = \frac{A}{B + A - C}$$

Percent absorption

$$\% \text{ absorption} = \frac{S \text{ or } S_1 - A}{A} \times 100$$

where:

- A = mass of oven-dry sample in air, g
- B = mass of pycnometer filled with water (see Annex), g
- C = mass of pycnometer, sample, and water, g
- S = mass of saturated surface-dry sample, g
- S_1 = mass of second saturated surface-dry sample, g

Example**Bulk Specific Gravity (G_{sb})**

$$G_{sb} = \frac{499.0 \text{ g}}{666.1 \text{ g} + 502.3 \text{ g} - 979.1 \text{ g}} = 2.636$$

Bulk Specific Gravity (Saturated Surface-dry (SSD) Basis) (G_{sbSSD})

$$G_{sbSSD} = \frac{502.3 \text{ g}}{666.1 \text{ g} + 502.3 \text{ g} - 979.1 \text{ g}} = 2.653$$

Apparent Specific Gravity (G_{sa})

$$G_{sa} = \frac{499.0 \text{ g}}{666.1 \text{ g} + 499.0 \text{ g} - 979.1 \text{ g}} = 2.683$$

Percent absorption

$$\% \text{ absorption} = \frac{502.3 \text{ g} - 499.0 \text{ g}}{499.0 \text{ g}} \times 100 = 0.661\% \text{ Report} = 0.7\%$$

where:

A	=	499.0 g
B	=	666.1 g
C	=	979.1 g
S	=	502.3 g
S ₁	=	502.1 g

Report

- Report on standard agency forms.

- Report specific gravity to the nearest 0.001
- Report absorption to the nearest 0.1 percent.

ANNEX — STANDARDIZATION OF PYCNOMETER

(Mandatory Information)

1. Fill the pycnometer to the calibrated fill line with water at $23 \pm 1.7^{\circ}\text{C}$ ($73.4 \pm 3^{\circ}\text{F}$).
2. Dry the outside of the pycnometer.
3. Determine the combined mass of pycnometer and water to the nearest 0.1 g.
Designate as B.