

Australian Standard®

AS 1141.6.1

Methods for sampling and testing aggregates**Method 6.1: Particle density and water absorption of coarse aggregate—
Weighing-in-water method**

This Standard incorporates Amendment No. 1 (October 2020). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

1 SCOPE

This Standard sets out the method for determining the particle density, apparent particle density and water absorption of aggregates substantially retained on a 4.75 mm sieve, by weighing in water.

NOTE: An aggregate containing more than 10% of material passing a 4.75 mm test sieve is regarded as a mixed aggregate. A mixed aggregate is separated into two fractions consisting of material retained on and material passing a 4.75 mm sieve. The density of the fine fractions is determined separately by the method of AS 1141.5. The density of the mixed aggregate is calculated as a weighted average as determined in Clause 7(e).

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2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1141 Methods for sampling and testing aggregates

1141.2 Method 2: Basic testing equipment

1141.5 Method 5: Particle density and water absorption of fine aggregate

3 DEFINITIONS**3.1 Particle density on a dry basis**

The dry mass per unit volume of particles, the volume including both the permeable and impermeable voids inherent in the particles. In the context of this definition, impermeable voids are defined as voids inaccessible to water by 24 h soaking and permeable voids as those accessible to water by 24 h soaking.

3.2 Particle density on a saturated-surface-dry basis

The saturated-surface-dry mass per unit volume of particles, the volume including both the permeable and impermeable voids inherent in the particles.

3.3 Apparent particle density

The dry mass per unit volume of particles, the volume including only impermeable voids inherent in the particles.

3.4 Water absorption

The ratio, expressed as a percentage, of the mass of water held in the permeable voids of the particles brought to the saturated surface-dry condition following soaking under water for 24 h, to the oven-dry mass of the material.

4 APPARATUS

A1 | Apparatus conforming to the relevant provisions of AS 1141.2 and the following shall be used:

- (a) *Wire basket*—of appropriate mesh and size, or a perforated container, with wire hangers for suspending it from the balance.
- (b) *Water bath*—of appropriate size and shape to accommodate the basket and provide a cover of at least 50 mm of water above the top of the immersed basket.
- (c) *Thermometer*—graduated in 1°C with an uncertainty not exceeding 0.5°C.
- (d) *Balance*—of sufficient capacity with a limit of performance not exceeding ± 5 g, and of a type that will permit a basket containing the sample to be suspended from it and weighed in water.
- (e) *Oven*—thermostatically controlled to operate at a temperature of 105°C to 110°C.
- (f) *Container*—suitable for use in the procedure described in Clause 6(b).
- (g) *Towels and dry cloths*—for drying the stone.
- (h) *Dishes*—of suitable sizes.

5 PREPARATION OF TEST PORTIONS

Test portions shall be prepared as follows:

- (a) Obtain a sample of sufficient mass to permit the preparation of a test portion retained on the 4.75 mm sieve of at least 2 kg for sizes up to and including 20 mm aggregate and at least 5 kg for larger sizes.
- (b) Sieve the sample over a 4.75 mm sieve. Reject the undersize material if it amounts to less than 10% of the total. If the amount of undersize material amounts to more than 10%, test it separately by the method of AS 1141.5. Wash the sample thoroughly to remove dust or other coatings from the surface of the particles.
- (c) Quarter or divide the washed material to obtain a test portion of at least 2 kg for sizes up to and including 20 mm aggregate, or 5 kg for larger sizes.

6 PROCEDURE

The procedure shall be as follows:

- (a) Immerse the material in water at room temperature, with a cover of at least 20 mm of water above the top of the material, for a period of at least 24 h. Stir the material occasionally to dislodge air bubbles. The material shall remain completely immersed during the soaking period.

NOTE: For materials with water absorption greater than 5% the time of soaking should be between 24 and 26 hours.

- (b) Following immersion, transfer the material into the basket. Immerse the basket immediately in water contained in a bath below the balance. Jiggle the basket to dislodge air bubbles, then attach the basket hanger to the balance. Weigh the basket and material in water and record (w_1).
- (c) Measure and record the temperature of the water in the bath.
- (d) Remove the basket and material from the water bath and allow them to drain. Transfer all of the material to a dish. Do not allow the material to dry out if the particle density, water absorption or both are to be determined.
- (e) Return the empty basket to the water bath and jiggle the basket to dislodge air bubbles. Weigh the basket in water to the nearest 1 g and record (w_2). Alternatively, the empty basket in water may have been tared to zero prior to the procedure in Step (b) above.

NOTE: The head of water above the basket should be the same as that used when weighing the basket and material in the water.

- (f) If the particle density or water absorption, or both, are required, surface dry the material. Large stones can be dried individually while the finer material may be rolled on a dry cloth. Spread the material one stone deep over a dry cloth and allow it to surface dry, turning the stone at least once during this period. A gentle current of air may be used to accelerate the drying. Drying shall continue until all visible films of water have been removed but the surfaces of particles still appear damp.

Determine the mass of the surface dry material and record (m_2).

- (g) Dry the material in the oven at 105°C to 110°C to constant mass and determine and record its mass (m_1).

7 CALCULATIONS

The following calculations shall be made as required:

- (a) Calculate the apparent particle density (ρ_A) using the following equation:

$$\rho_A = \frac{m_1 \times \rho_w}{m_1 - (w_1 - w_2)} \quad \dots 1$$

where

- ρ_A = apparent particle density, in t/m³
- m_1 = mass of dry material, in grams
- w_1 = weight of basket and material under water, in grams
- w_2 = weight of basket under water, in grams
- ρ_w = density of water at test temperature (g/cm³) (see Table 1)