

Australian Standard®

Method for sampling and testing aggregates
Method 5: Particle density and water absorption
of fine aggregate

A1

PREFACE

This Standard incorporates Amendment No. 1 (December 2018). 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, the apparent particle density and the water absorption of fine aggregates or the fine fraction of an aggregate.

Difficulty may be experienced using this method when the test portion is substantially retained on the 1.18 mm sieve. Such a test portion is unlikely to retain its shape in the compaction cone making the determination of the saturated surface-dry condition difficult to judge. Under these circumstances the saturated surface-dry (SSD) condition is determined visually as that point where the surface of the aggregate still appears damp but there are no visible films of moisture present. The fact that the SSD condition was determined visually is noted on the test report.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1141 Methods for sampling and testing aggregates
- 1141.1 Method 1: Definitions
- 1141.2 Method 2: Basic testing equipment
- 1141.6.1 Method 6.1: Particle density and water absorption of coarse aggregate—
Weighing-in-water method
- 1141.6.2 Method 6.2: Particle density and water absorption of coarse aggregate—
Pycnometer method

A1

[Text deleted]**3 DEFINITIONS**

For the purpose of this Standard the definitions in AS 1141.1 and those below apply.

3.1 Apparent particle density

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

3.2 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.

NOTE: Impermeable voids are those inaccessible to water by 24 h soaking. Permeable voids are those accessible to water by 24 h soaking.

3.3 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.

3.4 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 | The following apparatus, conforming to the relevant provisions of AS 1141.2 and the requirements given below, is required:

- (a) *Balance*—of sufficient capacity with a limit of performance not exceeding ± 0.5 g.
- (b) *Flask*—a 500 mL volumetric flask or pycnometer with lid or stopper which has a known or calibrated volume at the temperature of test (see Note to Clause 6(h)).
- (c) *A rigid conical metal mould*—of height 73 ± 3 mm. The internal diameter of the mould at its base shall be 90 ± 3 mm and the internal diameter at the top of the mould shall be 38 ± 3 mm.
- (d) *A straight metal tamping rod*—of a mass of 350 ± 5 g and with a flat circular tamping face of approximately 25 mm diameter, square to the axis of the rod.
- (e) *Drying oven*—complying with the requirements of AS 1141.2 and capable of operating at 105 to 110°C.
- (f) *Container or dish*—for soaking and drying the sample.
- A1 | (g) *Sieve*—4.75 mm.
- (h) *Heater or blower*—capable of supplying a gentle flow of warm air.
- (i) *Potable, distilled or demineralized water*—as appropriate.
NOTE: Water used for the test should not contain minerals or other contaminants that react with the aggregate or substantially change the density of water.
- (j) *Thermometer*—covering the range 0°C to 40°C, graduated to 1°C or less, with an uncertainty not exceeding 0.5°C.

5 PREPARATION OF TEST PORTION

The test portion shall be prepared as follows:

- (a) Obtain a sample of fine aggregate or the fine fraction of an aggregate to permit the testing of a portion of at least 500 g.
- (b) Sieve the sample, if necessary, through a 4.75 mm sieve. If the amount of material retained on the sieve exceeds 10% of the total, this fraction shall be tested separately, in accordance with AS 1141.6.1 or AS 1141.6.2. If the amount of material retained on the sieve is less than 10% of the total, reject this material.
- (c) Obtain a test portion of the sample of at least 500 g by riffing the sample sieved in Step (b).

6 PROCEDURE

The procedure shall be as follows:

- (a) Immerse the test portion in water at room temperature for a period of not less than 24 h. Remove the air entrapped in the aggregate by gentle agitation with a rod until no air bubbles rise to the surface.
- (b) Drain the water off the test portion and spread the aggregate on a flat impervious surface.
- (c) Surface dry the aggregate by exposing it to a gently moving current of warm air and stirring it frequently to achieve uniform drying.
- (d) When the aggregate appears to be free flowing, fill the conical mould by loosely placing part of the test portion in it. Tamp the surface of the aggregate with the tamping tool 25 times, allowing the tamping tool to fall from about 10 mm above the surface of the aggregate.
- (e) Lift the conical mould vertically. If free moisture is present, the cone of fine aggregate will retain its shape. If the cone slumps on removal of the mould the first time, the aggregate is too dry and additional water will need to be added and the test portion allowed to stand for 30 min.
- (f) Continue drying with constant stirring and retest at frequent intervals using the procedure in Steps (d) and (e) until the cone of aggregate slumps on removal of the mould. Slumping of the aggregate cone indicates that it has reached a saturated surface-dry condition.
- (g) Immediately after the saturated surface-dry condition has been achieved, determine the mass (m_2) of the total test portion.
- (h) Place the test portion into the volumetric flask or pycnometer, as appropriate. Fill the flask to the 500 mL mark, or in such a manner that the same procedure used for determining the volume of the pycnometer has been followed (see Note). Determine the mass (m_3) of the flask and its contents.

NOTE: A pycnometer with a stopper that has a constant volume mark included in the tube or pycnometer with a flat ground top and lid has been found suitable.
- (i) Top up the pycnometer with water and slide the lid on, or insert the stopper, making sure that no air bubbles are trapped. Dry the outside of the pycnometer and lid. Determine the mass of the pycnometer plus lid, or stopper, plus aggregate plus water (m_3).

NOTE: The mass of the pycnometer filled with water may be calibrated at regular intervals at the temperatures expected for the test or it may be determined immediately after the volume of aggregate has been determined.
- (j) Remove the aggregate from the flask and place it in a dish, taking care not to lose any particles.
- (k) Dry the aggregate in an oven at 105°C to 110°C to constant mass. Determine the mass (m_1) of dry aggregate.
- (l) Fill the flask with water at the same temperature as that measured in Step (j) and determine the mass (m_4) of the filled flask.

7 CALCULATIONS

The following shall be calculated:

- (a) The apparent particle density (ρ_a) from the following equation: