

Australian Standard®

AS 1141.4—2000

Methods for sampling and testing aggregates

Method 4: Bulk density of aggregate

This Standard incorporates Amendment No. 1 (April 2016). 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 bulk density of fine, coarse, or mixed aggregates. The bulk density is determined in the uncompacted, compacted, or uncompacted and compacted states.

The test is normally performed on material dried to constant mass, but may be performed at other moisture conditions if specifically required. The values obtained for bulk density of fine aggregates at different moisture conditions will differ significantly.

This method is only applicable to samples with a maximum nominal size of 63 mm.

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
- 1141.3.1 Method 3.1: Sampling—Aggregates

3 DEFINITIONS

A1 | For the purposes of this Standard the definitions of AS 1141.1 apply.

3.1 'Text deleted'

3.2 'Text deleted'

4 APPARATUS

The following apparatus is required:

- (a) *Balance or scale*—of sufficient capacity to weigh the filled measure with a limit of performance not exceeding ± 5 g.
- (b) *Cylindrical, watertight measure*—with a smooth internal surface and made of metal sufficiently thick to ensure that its form is retained during usage. It shall be free from corrosion and fitted with handles of a convenient form. The measure shall conform to the dimensions given in Table 1.

- (c) *Metal tamping rod*—approximately 16 mm in diameter, about 600 mm long with at least one end tapered for a distance of approximately 25 mm to a spherical shape having a radius of approximately 5 mm.
- (d) *Drying oven*—complying with requirements of AS 1141.2 and capable of operating at 105°C to 110°C (see Note).

NOTE: Material may be dried to constant mass using other methods such as microwave ovens, infra-red lights or hot plates, provided tests have shown that these techniques do not disrupt or weaken particles to the extent that the property being measured changes. The determination of constant mass should be such that after further periods of drying using the selected method the loss in mass does not exceed 1 percent of the total losses of moisture.

- (e) *Sample divider*—complying with the requirements of AS 1141.2.
- (f) *Flat glass plate*—to cover the measure.
- (g) *Thermometer*—covering the range 0°C to 40°C, graduated to 1°C or less, with an uncertainty not exceeding 0.5°C.
- (h) *Scoop or shovel*.

TABLE 1
SIZE OF MEASURE

For aggregate of nominal size mm	Nominal capacity L	Minimum internal diameter mm	Minimum internal depth mm
Over 20 to 63	25	350	250
5 to 20	10	250	220
Under 5	5	200	170

5 VOLUME OF MEASURE

The volume of the measure shall be determined as follows:

- (a) Clean and dry the measure and determine the mass of the measure and the glass plate.
- (b) Fill the measure with water and slide on the glass plate, ensuring that no air bubbles are trapped. Dry the outside of the measure and glass plate and determine the mass (m_f) of the measure filled with water and the glass plate.

NOTE: The mass of a 25 L measure will exceed 25 kg when filled. Care should be taken when lifting and weighting.

- (c) Calculate the volume (V_c) of the measure from the following equation:

$$V_c = (m_f - m_m) / \rho_w \quad \dots 1$$

where

- V_c = the volume of the measure, in cubic centimetres
- m_f = the mass of the water filled measure and glass plate, in grams
- m_m = the mass of the empty measure and glass plate, in grams
- ρ_w = density of water at test temperature, in grams per cubic centimetre (see Table 2)

TABLE 2
DENSITY OF WATER

Density of water (ρ_w)							
Degrees C	g/cm ³	Degrees C	g/cm ³	Degrees C	g/cm ³	Degrees C	g/cm ³
—	—	8	0.999 849	16	0.998 943	24	0.997 296
—	—	9	0.999 781	17	0.998 774	25	0.997 044
—	—	10	0.999 700	18	0.998 595	26	0.996 783
—	—	11	0.999 605	19	0.998 405	27	0.996 512
—	—	12	0.999 498	20	0.998 203	28	0.996 232
5	0.999 965	13	0.999 377	21	0.997 992	29	0.995 944
6	0.999 941	14	0.999 244	22	0.997 770	30	0.995 646
7	0.999 902	15	0.999 099	23	0.997 538	—	—

NOTE: This procedure need only be performed as a calibration every two years or if the measure has been damaged or corroded.

6 TEST PORTIONS

A sample of aggregate shall be obtained in accordance with AS 1141.3.1. A measure appropriate to the nominal size of aggregate as detailed in Table 1 shall be selected. A representative test portion of sufficient quantity to overfill the measure by about 10 percent shall be obtained by riffing or quartering the sample. Portions used for determination of compacted bulk density shall not be used for uncompacted bulk density determinations.

Unless otherwise required, the sample shall be dried to constant mass.

7 PROCEDURE

7.1 Uncompacted bulk density

The test portion shall be tested in accordance with the following procedure:

- (a) Determine the mass (m_c) of the empty measure.
- (b) Fill the measure by allowing the aggregate to drop from a shovel or scoop held at a height approximately 50 mm above the top of the measure, taking care to minimize segregation of the aggregate as the measure is filled.
- (c) Strike off the surface aggregate using the tamping rod as a straightedge and level the surface of the aggregate in such a way that any slight projections of the larger pieces of the coarse aggregate approximately balance the larger voids in the surface below the top of the measure.
- (d) Determine the mass (m_L) of the measure filled with aggregate.

7.2 Compacted bulk density

The test portion shall be tested in accordance with the following procedure:

- (a) Determine the mass (m_c) of the empty measure.
- (b) Fill the measure to about one-third of its capacity with aggregate and roughly level the surface.
- (c) Tamp the aggregate in the measure with 25 blows of the tamping rod evenly distributed across the surface to penetrate the layer as far as possible. Avoid striking the bottom of the measure.