Australian Standard®

Methods of testing soils for engineering purposes

Method 5.1.1: Soil compaction and density tests—Determination of the dry density/moisture content relation of a soil using standard compactive effort

METHOD

1 SCOPE This Standard sets out a method for the determination of the relationship between the moisture content and the dry density of a soil, when compacted, using standard compactive effort (596 kJ/m^3). Compaction is conducted over a range of moisture contents so as to establish the maximum mass of dry soil per unit volume achievable for this compactive effort and its corresponding moisture content. The procedure is applicable to that portion of a soil which passes the 37.5 mm sieve. Soil which all passes the 19.0 mm sieve is compacted in a 105 mm diameter mould. Soil which contains more than 20% of material retained on the 19.0 mm sieve is compacted in a 152 mm diameter mould. Corrections for oversize material are not made in this method but may be made using Method AS 1289.5.4.1 when required for compaction control.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS		
1152	Test sieves	
1289	Methods of testing soils for engineering purposes	
1289.0	Method 0:	General requirements and list of methods
1289.1	Method 1:	Preparation of disturbed soil samples for testing
1289.2.1.1	Method 2.1.1:	Soil moisture content tests—Determination of the moisture content of a soil—Oven drying method (standard method)
1289.2.1.2	Method 2.1.2:	Soil moisture content tests—Determination of the moisture content of a soil—Sand bath method (subsidiary method)
1289.2.1.4	Method 2.1.4:	Soil moisture content tests—Determination of the moisture content of a soil—Microwave-oven drying method (subsidiary method)
1289.2.1.5	Method 2.1.5:	Soil moisture content tests—Determination of the moisture content of a soil—Infrared lights method (subsidiary method)
1289.B3.1	Method B3.1:	Soil moisture content tests—Establishment of correlation between a subsidiary method of moisture content determination and the standard method (AS 1289.2.1.1)
1289.C5.1	Method C5.1:	Soil classification tests—Determination of the soil particle density of a soil (standard method)
1289.5.4.1	Method 5.4.1:	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
1289.F1.1	Method F1.1:	Soil strength and consolidation tests—Determination of the California bearing ratio of a soil—Standard laboratory method for a remoulded specimen

3 APPARATUS The following apparatus is required:

(a) Steel moulds, of a size dependent on the maximum size of material being tested, as follows:

(i) *For compaction of material passing a 19.0 mm sieve*

Mould A: A cylindrical metal mould having an internal diameter of 105 mm and effective height of 115.5 mm fitted with a detachable baseplate and a removable collar assembly about 60 mm high, both of which can be firmly attached to the mould. A suitable design is shown in Figure 1 (see Table 1 for tolerances).

(ii) *For compaction of that fraction of the soil material which all passes a 37.5 mm sieve but contains more than 20% of material which would be retained on a 19.0 mm sieve*

Mould B: A cylindrical metal mould having an internal diameter of 152 mm and effective height of 132.5 mm fitted with a detachable baseplate and a removable collar assembly about 60 mm high, both of which can be firmly attached to the mould (see Note 1). A suitable design is shown in Figure 1 (see Note 1, and Table 1 for tolerances).

(b) A steel rammer as shown in Figure 2 and of dimensions as shown in Table 1. Alternatively, a mechanical compactor may be used provided that it meets the essential requirements of drop height, mass and energy input (see Note 2).

(c) A level rigid foundation on which to compact the specimen, e.g. a sound concrete floor about 100 mm or more in thickness or a concrete block of at least 100 kg mass.

(d) A balance of suitable capacity with a limit of performance not greater than ±5 g.

(e) Sieves, 37.5 mm and 19.0 mm complying with AS 1152.

(f) A strong spatula or a suitable knife.

(g) A steel straightedge, about 250 mm long, 25 mm wide and 3 mm, preferably with one bevelled edge.

(h) Miscellaneous mixing apparatus, such as a pan or bowl, a spoon, trowels and water spray, suitable for thoroughly mixing increments of water with the soil.

(i) A rule graduated in millimetres or a layer depth gauge.

(j) Sealable containers, suitable for curing soil samples.

(k) A sample extractor such as a jack, lever, frame or other device suitable for extruding compacted soil specimens from the mould (optional).

(l) A soil grater for fine-grained soil (optional).

TABLE 1

DIMENSIONS AND TOLERANCES FOR SUITABLE MOULDS AND RAMMER

Apparatus	Dimension	Tolerance
MOULDS		
Mould A: 105 mm diameter		
Internal diameter, mm	105.0	±0.5*
Height, mm	115.5	±0.5*
Nominal volume, cm^3	1 000	±15
Mould B: 152 mm diameter		
Internal diameter, mm	152.0	±1.0*
Effective height, mm	132.5	±0.5*
Nominal volume, cm^3	2 400	±35
RAMMER		
Diameter (round foot), mm	50	±0.4
Radius (sector foot), mm	74	±0.5†
Arc of segment (sector foot), degrees	41	±0.5†
Area of rammer, mm^2	1 964	±31
Drop, mm	300	±2.0‡
Mass, kg	2.7	±0.01‡
Energy delivered per blow, J	7.94	±0.08
Number of layers	3	
Number of blows/layer: Mould A	25	
Mould B	60	
Energy input, kJ/m^3	596	±14

* Either but not both of the tolerances may be exceeded provided that the specified tolerance of volume is not exceeded.

† Either but not both of the tolerances may be exceeded provided that the tolerances of area is not exceeded. Diameter and radius of arc of segment are measured 3 mm behind the face of the rammer.

‡ Either but not both of the tolerances may be exceeded provided that the appropriate tolerance of energy delivered per blow is not exceeded.