Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T163

Compaction factor of soils and gravels

OCTOBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	May 1999
		Date on Test Method Revised to Agree with Date on Revision	D.Dash	Feb 2001
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T163 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T163

Compaction factor of soils and gravels

1. Scope

This method sets out the procedure for the determination of the Compaction Factor of soils and gravels compacted by standard and modified compactive effort.

2. Apparatus

(a) A cylindrical metal mould having an internal diameter of 105 ± 0.5 mm and having a volume of 1000 ± 10 mL, fitted with a detachable base plate and a removable collar assembly approximately 60 mm high, both of which can be firmly attached to the mould. a suitable design is shown in AS 1289.E1.1.

(b) A cylindrical metal mould having an internal diameter of 148 ± 0.5 mm and having a volume of 2000 ± 20 mL, fitted with a detachable base plate and a removable collar assembly approximately 60 mm high, both of which can be firmly attached to the mould.

(c)

(i) A metal rammer with a 50 ± 0.5 mm diameter face and a drop mass of 2.7 kg + 10 g - 25 g equipped with a suitable device to control the height of drop to a free fall of 300 ± 2 mm.

(ii) A metal rammer with a 50 ± 0.5 mm diameter face and a drop mass of 4.9 kg + 10 g - 30 g equipped with a suitable device to control the height of drop to a free fall of 450 ± 2 mm. Suitable forms of hand held apparatus are shown in As 1289.E1.1.
Mechanical forms of the apparatus may be used provided the essential dimensions are adhered to, and the rammer has a free vertical fall of 300 mm or 450 mm respectively.

(d) A rigid foundation on which to compact the specimen, e.g. a concrete floor or a concrete block

(e) A metal mixing and quartering tray

(f) Mixing apparatus such as a trowel, and quartering apparatus such as metal plates approximately 400 mm by 120 mm and 200 mm by 120 mm

(g) A jack, lever and frame or other device suitable for extruding compacted soil specimens form the moulds. A suitable form of apparatus is shown in AS 1289.E1.1.

(h) A measuring cylinder, 100 mL

(i) a steel straight edge about 300 mm long, 25 mm wide and 3 mm thick, preferably with a bevelled edge.

(j) A 300 mm rule

(k) A porcelain mortar and pestle

(l) Metal dishes approximately 350 mm diameter

(m) Suitable brush for brushing sieves

(n) 19.0 mm and 37.5 mm AS sieves

(o) Apparatus for moisture content determinations

(p) A balance of at least 500 g capacity with a limit of performance of 0.05 g

(q) Depth gauges. A suitable form is shown in Figs 1 and 2.

3. Preparation of Samples

(a) The sample is tested at the moisture content at which it is received. Determine the moisture content by a method such as Test Methods T120, T121, T122 or T180.

(b) Break up any aggregations or particles in such a way as to avoid crushing any discrete particles. All aggregations are to be broken down so that if the sample were screened on a 9.50 mm sieve, only

discrete, uncrushed particles would be retained. A rubber pestle should be use to avoid breaking down sound pieces of mineral matter.
Adhering material should be brushed from the coarse pieces. When in doubt as to whether lumps are to be broken down, place some in water and boil. If slaking occurs, the material should be broken further with the rubber pestle.

(c) Thoroughly mix the sample and riffle or quarter to obtain a portion of sufficient size as to completely fill the mould (See Techniques (a)).

(i) For samples having all of the material passing the 19.0 mm sieve, use a 1 litre mould.

(ii) For samples having material retained on the 19.0 mm sieve and approximately 5% or less of the coarse fraction is retained on the 37.5 mm sieve, use a 2 litre mould.

4. Procedure

(a) Assemble the mould and collar and place in a flat bottomed dish.

(b) Measure the height (h_1) of the mould plus collar to the nearest 1 mm on the inside of the assembly.

(c) Carefully fill the mould including collar, in three layers, by allowing the material to fall freely from a scoop held at a height of approximately 50 mm above the top of the collar.

(d) Screed the top surface of the collar with a straight edge. Discard the excess material.

(e) Remove the collar and mould and collect all the contents in the dish.

(f) Add sufficient water to bring the material up to or slightly below the optimum moisture content as determined in accordance with the procedure set out in Test Method T111 or T112 for the compactive effort to be applied.

(g) Assemble the mould, collar and base plate, and place the assembly on the rigid foundation.

(h) Mix the material thoroughly and compact all of the material from (e) into the mould by the specific compactive effort. Unless otherwise specified, use Standard Compaction.

Standard Compaction

Compact the material into the mould in three layers not varying in compacted thickness by more than 5 mm.

Use a depth gauge to control the layer thickness which should not vary by more than 10 mm between layers. A suggested form of depth gauge is described in Fig. 1. Level the surface of a layer by rotating the gauge inside the mould and adding or removing excess material. Subject each layer to 25 uniformly distributed blows of a 2.7 kg rammer falling freely from a height of 300 mm in the case of the one litre mould and 50 uniformly distributed blows in the case of the two litre mould.

Modified Compaction

Compact the material into the mould in five layers not varying in compaction thickness by more than 3 mm.

Use a depth gauge to control the layer thickness which should not vary by more than 10 mm between layers. A suggested form of depth gauge is described in Fig. 2. Level the surface of a layer by rotating the gauge inside the mould and adding or removing excess material.

Subject each layer to 25 uniformly distributed blows of a 4.9 kg rammer falling freely from a height of 450 mm in the case of the one litre mould and 50 uniformly distributed blows in the case of the two litre mould.

The material may overfill or under fill the mould.

(i) Do not remove the collar. Determine the depth (h_2) of the sample below the upper lip of the collar, as the average of the measurements taken near the centre of the top surface, to the nearest 1 mm.

(j) Remove the sample and discard.

5. Calculations

Calculate the Compaction Factor (C) as follows:

$$C = \frac{\textit{Height of Loose Material}}{\textit{Height of Compacted Material}}$$

$$C = \frac{h_1}{h_1 - h_2}$$

6. Reporting

(a) Report the moisture content of the material as received to the nearest 0.5%.

(b) Report the compactive effort applied and the moisture content for compaction.

(c) Report the Compaction Factor to the nearest 0.1.

7. Techniques

(a) For samples having substantially more than 5% material retained on the 37.5 mm sieve a larger mould of suitable size should be used. In such cases the number of layers and number of blows per layer should be recorded.

(b) It is desirable to carry out the above procedure over a range of material from the one deposit to obtain an average figure for the Compaction Factor. It should be noted that different moisture contents of the material as received may lead to different Compaction Factors.

Note: The field Compaction Factor will be dependant on condition of material on delivery and method of spreading and compacting.

(c) The two depth gauges described in Figs 1 and 2 were designed to allow easy determination of the depth of each layer of material.

(i) A two sided gauge in Figure 1 is suitable when material is required to be filled in three layers. For the first layer place the longer side of the gauge into the mould and rotate gently until the material is levelled. Remove any excess.
Invert the gauge to determine the depth of the second layer. Repeat levelling procedure. The third layer is the top of the mould.

(ii) Figure 2 shows a gauge for filling the mould in five layers.
Set the required depth by releasing the two locking pins and moving depth plate to appropriate layer. Lock the pins into notches on both sides of the plate.
Repeat levelling procedure as in (c)(i).

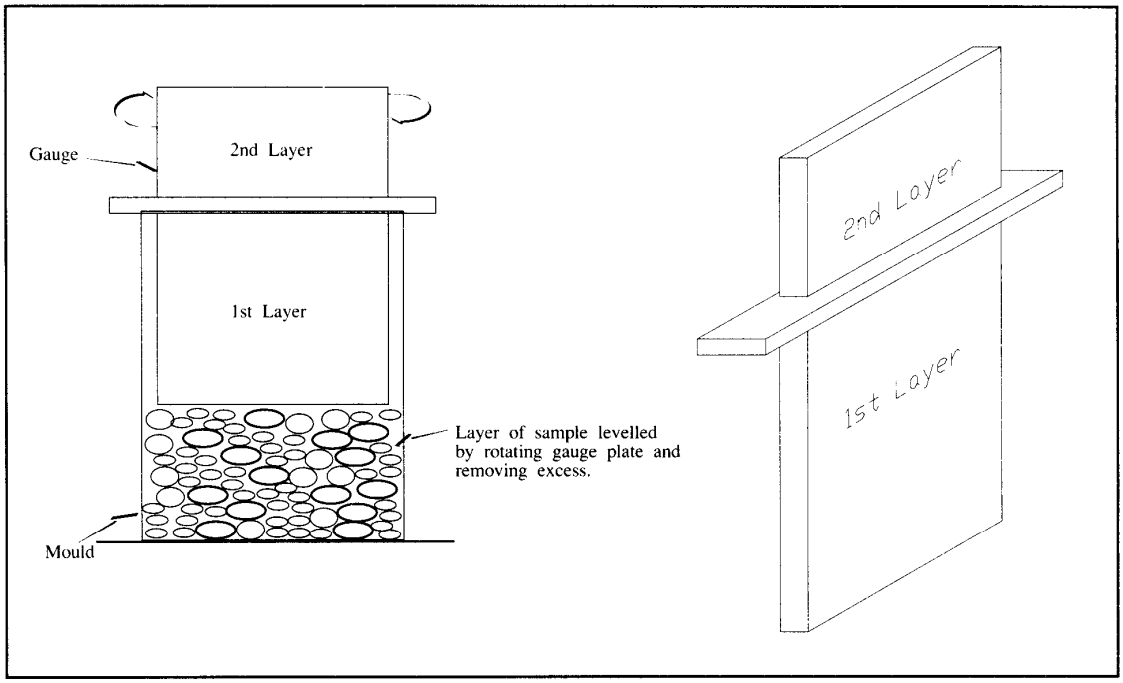

FIG 1. Gauge for 3 layer Compaction (standard)
(Different sizes for 1 and 2 litre moulds)

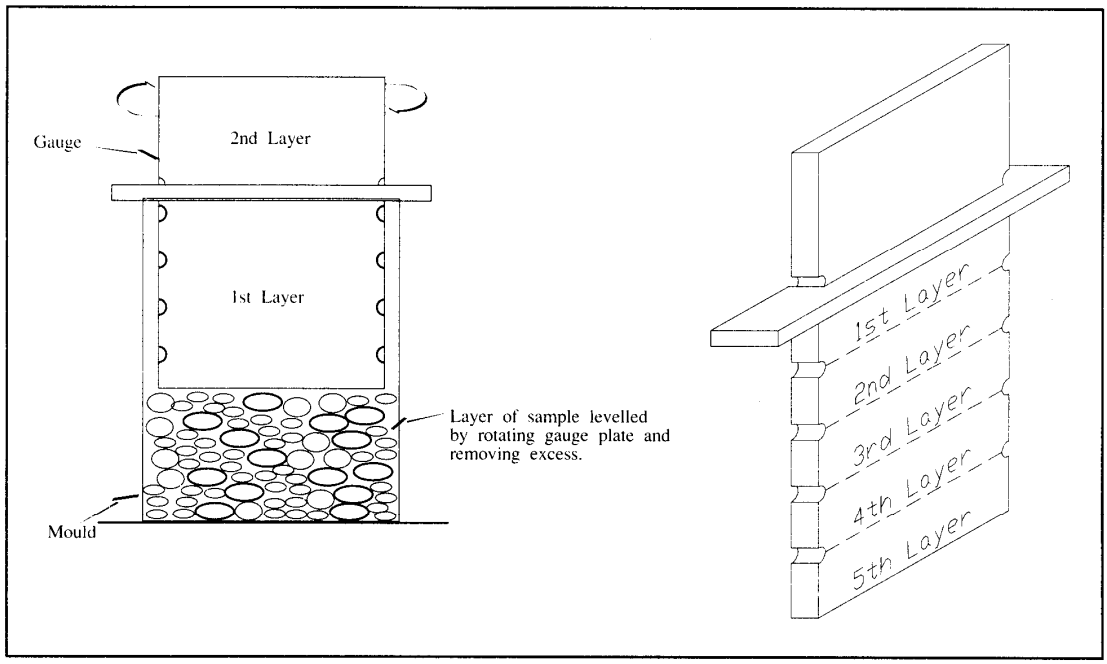

FIG 2 . Gauge for 5 layer Compaction (modified)
(Different sizes for 1 and 2 litre moulds)