Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T125

Field density of road construction materials (Balloon densometer method)

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
		Generally Revised- Title Changed Consistent with T111 and notes revised.	G. Donald	Nov 2007
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 T125 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T125

Field density of road construction materials (Balloon densometer method)

1. Scope

This test method sets out the procedure to determine the field wet or dry density of in situ road construction materials using the balloon densometer.

2. General

(a) This is a field test of either natural or compacted material in situ

(b) The Test Method is applicable to a fine grained earthworks or pavement layer

(c) The Test Method is not applicable where the surface is irregular (i.e. with greater than 5 mm asperities) or particles are present which are capable of puncturing the balloon

3. Apparatus

(a) A densometer of at least 1.5 Litre capacity

NOTE: Refer to 0 Appendix - Suitable Form of Apparatus.

(b) A metal tray with turned up edges approximately 25 mm high, with a circular aperture and pins to suit the densometer being used. The tray is to be fitted with two adjacent lugs each with an approximately 5 mm diameter hole through which the securing pins may be driven

(c) Balloons of meteorological quality made of latex of or an equivalent material

(d) Two metal securing pins 3 mm diameter at least 50 mm long, pointed and fitted with hardened metal heads

(e) Suitable tools for excavating holes in soils, gravels and crushed rock materials (e.g. hammer or mallet, chisel, brick bolster, trowel, spoons, scoops, spatula, paint brushes, etc)

(f) A steel straightedge, about 300 mm long, about 25 mm wide and about 3 mm thick, preferably with a bevelled edge

(g) A cylindrical metal calibrating container with an internal diameter of 105 ± 0.5 mm and a volume of approximately one litre

(h) A balance of at least 5 kg capacity and with a limit of performance of 5 g

(i) Sealable airtight containers suitable for curing moist samples of at least 5 Litres capacity

NOTE: Air-tight heavy-duty plastic bags may be suitable.

(j) Metal dishes approximately 225 mm and 350 mm diameter

(k) Apparatus for moisture content determination in the field

(l) A 300 mm ruler

4. Procedure

4.1 Setting up apparatus

(a) The following procedure refers to the densometer apparatus described in the Appendix

(b) Set the densometer upright on a flat surface and press down on the top of the cylinder guard (Part C) and loosen the two knurled screws (Part 7) on the base (Part B)

(c) Remove the compression disc (Part N) and gasket (Part L) from the top of the cylinder. Remove the cylinder guard by lifting it vertically from the base, taking care not to bend the brass vent tube (Part K2) which projects to the top of the calibrated cylinder

(d) Turn the graduated cylinder upside down and fill with water to within about 25 to 30 mm from the open end

(e) Hold the open end of the cylinder (Part C) up and place the compression disk in the bottom of the guard with the sponge-gasket exposed. Lower the graduated cylinder into the guard

(f) Place the lower gasket (Part M) in position on the base (Part B). Ensure the gasket is seated in a level position

(g) Attach the density balloon (Part O) to the base around the lip. Place the base on the cylinder guard by lowering the vent tube vertically into the graduated cylinder. Press down on the base to compress the gasket and compression pad and replace the knurled screws. Close the control valve (Part 3) and turn the densometer upright

NOTE: If there is insufficient compression on the gasket seal, some leakage may occur at the junction of the graduated cylinder and base. This leakage may be stopped by tightening the socket-head set screw (Part 5) on top of the cylinder guard and locking it in position with the lock-nut (Part 6). The set screw works against the compression pad and gasket.

4.2 In situ test

(a) Expose a flat area of the material to be tested (approximately 450 mm square), and trim down to a level surface to receive the field density tray

(b) Fix the field density tray in position on the surface by means of securing pins to prevent any movement during performance of the test

(c) Set the densometer in the recessed hole in the field density tray. Connect the bulb assembly to the densometer so that it will produce pressure in the cylinder when actuated

(d) Open the control valve and pump the balloon down until the water in the graduated cylinder has reached its lowest point. The densometer must be held firmly in position during this operation

(e) Record the volume shown on the graduated cylinder as initial reading (V_1) to the nearest 5 ml

(f) Release the rubber bulb and insert the vacuum end of the bulb in the coupler. Pump the balloon back into the cylinder and close the control valve

(g) Remove the densometer from the base plate

(h) Excavate a cylindrical hole from inside the central hole in the tray and with sides essentially vertical. Place the material in an airtight container. The depth of the hole should be approximately 125 mm except where the thickness of the layer being tested is less than 125 mm

(i) Collect all excavated material from the hole (e.g. brush the final amounts into a small scoop or spoon) and place the material in the airtight container for subsequent testing

NOTE: Care is necessary to avoid loosening material in the sides of the excavated hole. Any particles which are loosened should be removed and included in the excavated material.

(j) Remove the density tray, then measure and record the depth of excavation to the nearest 5 mm

(k) Repeat Steps (b) to (d). Record the volume shown on the graduated cylinder as final reading (V_2) to the nearest 5 ml

(l) Release the rubber bulb and insert the vacuum end of the bulb in the coupler. Pump the balloon back into the cylinder and close the control valve

(m) Remove the densometer from the base plate

(n) Determine the mass of the excavated material (M_4) to the nearest 5 g

(o) If required, determine the field moisture content (w_f) of the excavated material in accordance with the procedure set out in T120, T121 or T180

5. Calculations

(a) Calculate the volume of the hole (V) as follows:

$$V = (V_2 - V_1)$$

Where:

V = Volume of hole (ml)

V_1 = Initial cylinder reading (ml)

V_2 = Final cylinder reading (ml)

(b) Calculate the wet density and/or the dry density as follows:

$$WD = \frac{M_4}{V}$$

OR

$$DD = \frac{M_4}{V} \times \frac{100}{(100 + w_f)}$$

Where:

WD = Wet Density (t/m^3)

DD = Dry Density (t/m^3)

M_4 = Mass of wet excavated material (g)

V = Volume of hole (ml)

w_f = Field moisture content (%)

6. Reporting

Include the following in the report:

(a) The depth of excavation (mm)

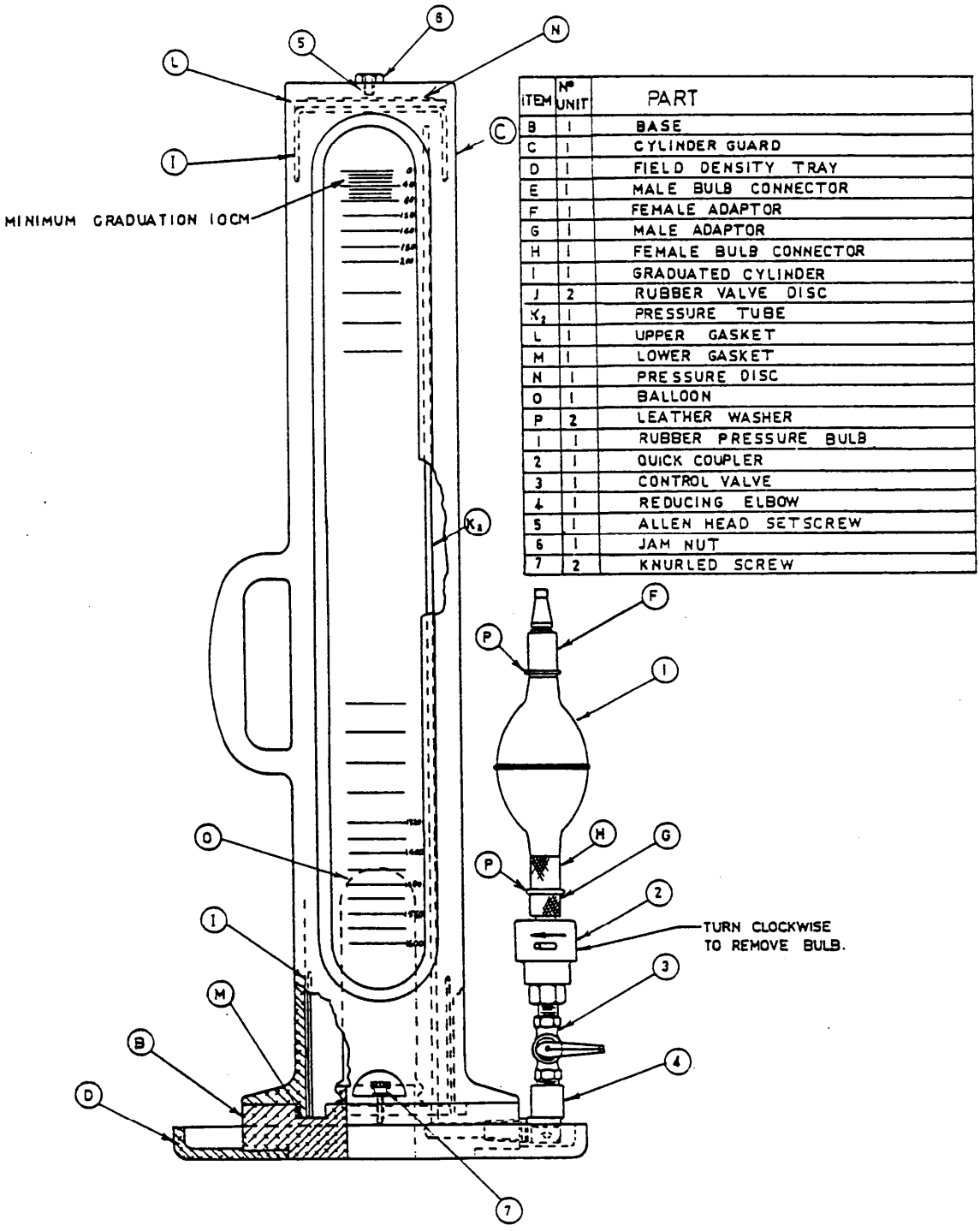
(b) The field wet density and/or dry density to the nearest 0.01 t/m^3

(c) If dry density is reported, the field moisture content to the nearest 0.5%

NOTE: Where the results are to be used for further calculations, report the values to the nearest 0.001 t/m3 for density and 0.1% for moisture content.

(d) Reference to this test method

Appendix - Suitable Form of Apparatus



ITEM	Nº UNIT	PART
B	1	BASE
C	1	CYLINDER GUARD
D	1	FIELD DENSITY TRAY
E	1	MALE BULB CONNECTOR
F	1	FEMALE ADAPTOR
G	1	MALE ADAPTOR
H	1	FEMALE BULB CONNECTOR
I	1	GRADUATED CYLINDER
J	2	RUBBER VALVE DISC
K_2	1	PRESSURE TUBE
L	1	UPPER GASKET
M	1	LOWER GASKET
N	1	PRESSURE DISC
O	1	BALLOON
P	2	LEATHER WASHER
1	1	RUBBER PRESSURE BULB
2	1	QUICK COUPLER
3	1	CONTROL VALVE
4	1	REDUCING ELBOW
5	1	ALLEN HEAD SETSCREW
6	1	JAM NUT
7	2	KNURLED SCREW

Fig.1. VOLUME METER.

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