Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T272

Modified tray test for sealing aggregates

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 Summary	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 T272 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T272

Modified tray test for sealing aggregates

1. Scope

This test method sets out the procedure to determine the modified average least dimension (MALD), void content and theoretical spread rate of a single layer of sealing aggregate.

2. General

Term	Definition
Modified Average Least Dimension (MALD)	The average thickness of a hand placed single layer of sealing aggregate, with its apparent least dimension in a vertical position.
Aggregate Voids (AGGVOIDS)	The percentage of voids in a single layer of hand placed aggregate.
Bulkvoids (BULKVOIDS)	The voids contained in a unit volume of aggregate.

3. Apparatus

(a) Modified tray, consisting of a metal tray, metal ring and cloth (calico)

(b) membrane (see Fig. 1).

(c) A sand pouring container of about 4 L fitted with a sealing cap and

(d) equipped with a tapered pouring spout.

(e) A supply of clean density sand.

(f) A balance of suitable capacity with a limit of performance of 0.5

(g) A metal straight edge, 300 mm long.

(h) A tray of sufficient size, to collect excess sand.

(i) A ruler 400 mm long.

4. Preparation

4.1 Calibration of Modified Tray

4.1.1 Area of Modified tray

(a) Determine the internal area (A) of the Modified tray by taking the

(b) Average of at least 10 diameter measurements and record in mm^2

4.1.2 Mass of sand required to fill the Modified tray

(a) The mass of density sand required to fill the Modified tray shall be taken as the average of 3 individual readings. The range of readings should not exceed 1 percent. The Modified tray should be calibrated weekly when work is performed on a daily basis, before each series of tests, and with each batch of sand.

4.1.3 Procedure

(a) Insert the cloth membrane into the Modified tray by smoothing it against the side and base. Ensure that no excess gathering of the membrane is evident.

(b) Push the metal ring onto the membrane covered Modified tray, making sure that the ring is correctly seated.

(c) Place the Modified tray on the balance and determine the mass (M_t) of the tray, ring and membrane. Record to the nearest 1g

(d) Fill the Modified tray with density sand by pouring in a smooth circular motion until the Modified tray is slightly overfull [see 7(a) and Note].

(e) Remove the excess sand by striking off with the metal straight edge [see7 (b)]

(f) Weigh the sand filled Modified tray and record the mass (M_s) to the nearest 1 g.

(g) Repeat steps (a) to (f) 3 times. The range of readings should not exceed 1 percent.

(h) Average the results of (M_t)and record the mass to the nearest 1g.

(i) Average the results of (M_s) and record the mass to the nearest 1g.

(j) Subtract the average the results of (M_t) from the average of (M_s) and record mass (M_1) of sand to the nearest 1g.

4.2 Determination of the Loose Unit Mass of the Sand

(a) The Loose Unit Mass of the sand shall be the average of at least three individual density determinations, record to the nearest 0.01 t/m<P8M^>3<P255D>. The Loose Unit Mass of the sand shall be determined in the Modified tray only (without the membrane and ring). The Loose Unit Mass the sand shall be determined before each series of tests and with each batch of sand.

4.2.1 Procedure

(a) Determine the volume of the Modified tray (without ring and membrane) by measuring the mass of water required to fill the tray (use a glass plate to remove the effect of meniscus). Repeat twice and correct for water temperature. Record volume (V) to the nearest 1.0 mL

(b) Dry the Modified tray and fill with density sand by pouring in a smooth circular motion until the tray is slightly overfull (see 7(a) and Note).

(c) Remove the excess sand by striking off with the metal straight edge (see 7(b)

(d) Repeat steps (b) & (c) three times and determine the average mass of sand required to fill the tray. Record the mass (M) of the sand to the nearest 1g

(e) Calculate the Loose Unit Mass of the sand (DS) by dividing the mass of sand (M) required to fill the Modified tray by the volume (V) of the tray. Record to the nearest 0.01 t/m^3

4.3 Determination of the MALD, Aggvoids and Bulkvoids

4.3.1 Procedure

(a) Calibrate the Modified tray and determine the density of the sand as described in *4.1.3* and *4.2.1.*

(b) The sample submitted for test shall be reduced, as required by quartering or riffling to obtain a suitable test portion as listed below.

AGGREGATE	
Nominal Size (mm)	**Mass (g) (approx)**
7	400
10	500
14	600
20	900

(c) Place each aggregate particle in the Modified tray shoulder-to-shoulder in a single layer thickness, with its apparent least dimension in a vertical position.

(d) Place the cloth membrane on top of the aggregate, taking care not to disturb the aggregate. Ensure the correct placement of the membrane (see *4.1.3*).

(e) Push the metal ring onto the membrane covered Modified tray, making sure that the ring is correctly seated.

(f) Place the Modified tray on the balance and determine the mass (M_{ta}) of tray, ring, membrane and aggregate. Record to the nearest 1g

(g) Fill the Modified tray with sand (as described in *4.1.3* (d)).

(h) Remove the excess sand by striking off with the metal straight edge (see 7(b)).

(i) Weigh the sand filled Modified tray and record the mass (M_{sa}) to the nearest 1g.

(j) Repeat (d) to (h) at least three times. The range of readings should not exceed 1 percent.

(k) Average the results of (M_{ta}) and record the mass to the nearest 1g.

(l) Average the results of (M_{sa}) and record the mass to the nearest 1g.

(m) Subtract the average results of (M_{ta}) from the average of (M_{sa}) and record the mass (M_2) of sand to the nearest 1g.

(n) Weigh the aggregate and record the mass (M_3) to the nearest 1g.

(o) Determine the loose unit mass (LUM) of the aggregate using Test Method T211. Record the LUM to the nearest $0.01 t/m^3$

(p) Determine the dry bulk density (DBD) of the aggregate using Test Method T209. Record the DBD to the nearest $0.01 t/m^3$

(q) Determine the Average Least Dimension (ALD) of the aggregate using Test Method T235 or T275 as appropriate. Record the ALD to the nearest 0.1 mm

5. Calculations

(a) Calculate the volume of the layer (<MS>VLAYER<D>) as follows: (space occupied by stone plus voids in layer)

$$\text{VLAYER} = \frac{M_1 - M_2}{DS} \text{ (mL)}$$

(b) Calculate the Modified average least dimension (MALD) of the aggregate as follows:

$$\text{MALD} = \frac{VLAYER \times 1000}{A} \quad \text{(mm)}$$

(c) Calculate the aggregate spread rates as follows:

$$\text{SR1} = \frac{M_3}{A} \times 1000 \quad \text{(kg/m}^2\text{)}$$

$$\text{SR2} = \frac{SR1}{LUM \times 1000} \quad \text{(m}^3\text{/m}^2\text{)}$$

$$\text{SR3} = \frac{1}{SR2} \quad \text{(m}^2\text{/m}^3\text{)}$$

(d) Calculate the aggregate spread rate ratio (SRR) as follows:

$$\text{SRR} = \frac{ALD}{SR2}$$

(e) Calculate the aggregate voids (AGGVOIDS) as follows:

$$\text{AGGVOIDS} = \{\text{VLAYER} - \frac{M_3}{DBD}\} \times \frac{100}{VLAYER} \quad (\%)$$

(f) Calculate the BULKVOIDS (air voids in bulk aggregate)as follows:

$$\text{BULKVOIDS} = (DBD - LUM) \times (\frac{100}{DBD}) \quad (\%)$$

Where:

LAYER = Space occupied by aggregate plus voids in layer (mL)

M_1 = Mass of sand in assembled Modified tray(g)

M_2 = Mass of sand in tray with aggregate placed (g)

M_3 = Mass of aggregate in Modified tray(g)

DS = Loose Unit Mass of sand (t/m^3)

A = Area of the Modified tray (mm^2)

LUM = Loose Unit Mass of aggregate (t/m^3) (Test Method T211)

DBD = Dry Bulk Density of aggregate (t/m^3) (Test Method T209)

ALD = Average least dimension of aggregate (mm) (Test Method T235 or Test Method T275 as appropriate)

6. Reporting

(a) Report the Modified average least dimension (MALD) to 0.1mm

(b) Report the Aggregate spread rate: (SR3) to 1.0 m $m^2/m.^3$

(c) Report the Aggregate voids (AGGVOIDS) to 0.1%

(d) Report the BULKVOIDS (air voids in bulk aggregate) to 0.1%

7. Techniques

(a) The end of the sand pouring spout should be kept within 20 - 30 mm above the surface of the sand in the tray (see Fig. 2).

(b) Remove excess sand by striking off (i.e. scraping) with a metal straight. It is preferable to tilt back the straight edge to avoid compacting the sand (see Fig.3)

NOTE: Each operator should maintain a constant pouring height and motion. Sand compaction is subject to the falling height and rate of circular pouring motion of the sand.

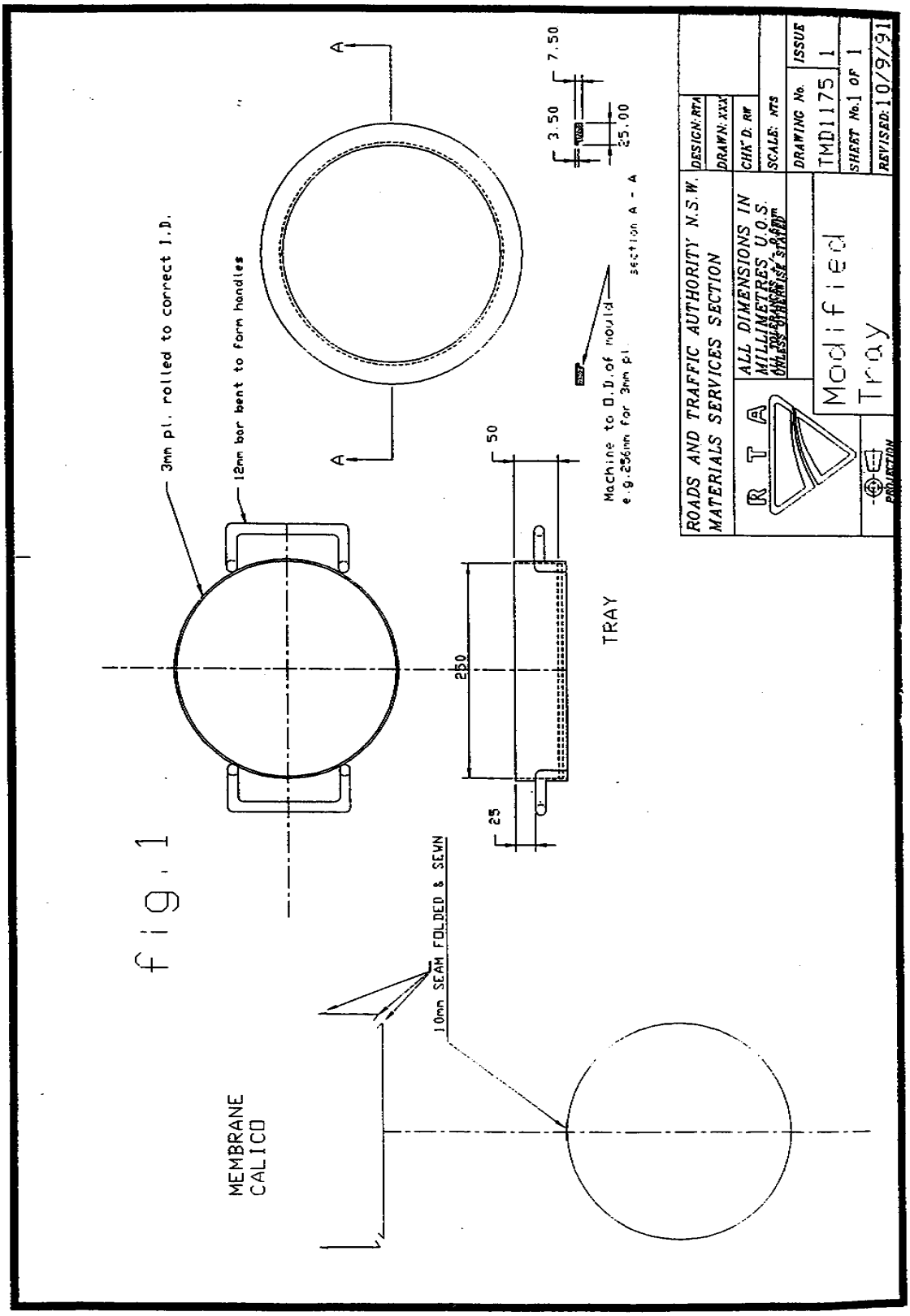
ROADS AND TRAFFIC AUTHORITY N.S.W.
MATERIALS SERVICES SECTION
RTA
ALL DIMENSIONS IN MILLIMETRES U.O.S.
DESIGN: RTA
DRAWN: XXX
CHK'D: RW
SCALE: NTS
DRAWING No. TMD1175
ISSUE 1
SHEET No. 1 OF 1
REVISED: 10/9/91
Modified Tray
PROJECTION
3mm pl. rolled to correct I.D.
12mm bar bent to form handles
Machine to O.D. of mould e.g. 256mm for 3mm pl.
section A - A
3.50
7.50
25.00
50
250
25
TRAY
10mm SEAM FOLDED & SEWN
MEMBRANE CALICO
fig. 1

Figure 1

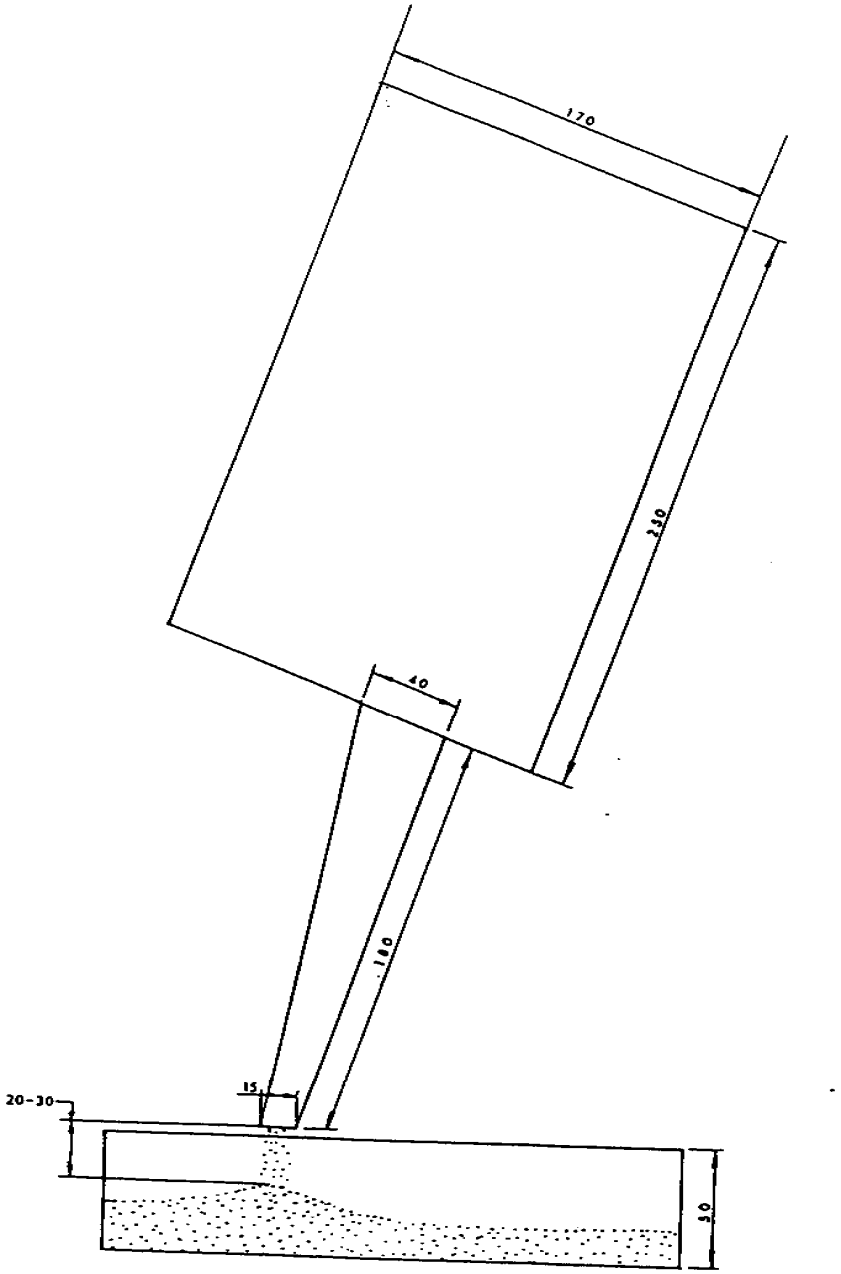

Fig. 2

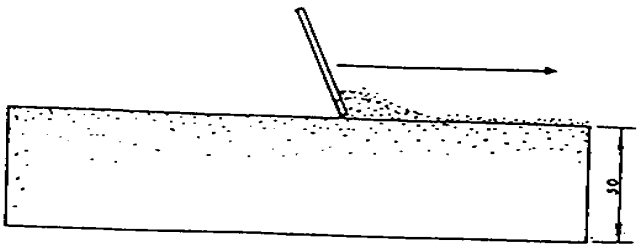

Fig 3