Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T137

Cement content of cement stabilised material (heat of neutralisation)

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 T137 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T137

Cement content of cement stabilised material (heat of neutralisation)

1. Scope

This test method sets out the procedure for the quick determination of the cement content of freshly mixed cement and fine crushed rock. It is based on the measurement of the heat of neutralisation of the cement.

The method is suitable for on site field determinations.

2. Apparatus

(a) Balance accurate to 10 g in 5000 g

(b) Sample splitter

(c) Scoop

(d) Shovel

(e) Plastic jar, approximately 4.5 L capacity, with 100 mm opening and screw-on water-tight lid

(f) Large plastic container of approximately 20 litre capacity for buffer solution

(g) Thermometer 0°C-50°C with graduations 0.2°C

(h) Plastic Measuring Cylinder 1500 mL capacity

(i) Beakers

  (i) 1 × 250 mL capacity for weighing cement

  (ii) 1 × 500 mL capacity for weighing water

  (iii) 1 × 5 litre capacity for mixing buffer

(j) Buffered Acetic Acid Solution. 240 g glacial acetic acid (technical grade) and 250 g sodium acetate (technical grade-anhydrous) or 415 g Sodium acetate tri-hydrate (technical grade) dissolved in 500 mL potable water and then made up to one litre with potable water.

3. Samples

(a) Forty (40) kilograms of material representative of that to be stabilised

(b) A sample of approximately 1.5 kg of the cement to be used

4. Preparation of Calibration Curve

Two cement contents one either side of the target percentage cement should be selected. For example if the target is x percent then the three samples chosen would be x-1%, x% and x+1%.
For each of these percentages the following procedure shall be carried out in duplicate.

(a) The mass of dry crushed rock, cement and water shall be calculated so that the total mass is 5,000 g (*Notes 1*).

(b) The calculated mass of crushed rock shall be weighed into the plastic jar, and the cement and water weighed into separate beakers.

(c) The cement shall then be added to the crushed rock and the mix shaken.

(d) The water shall then be added and the mix shaken for exactly two minutes.

(e) The thermometer shall be pushed carefully into the mixture and the temperature (A)°C shall be read after 60 seconds.

(f) The measuring cylinder shall be filled to the 1,000 mL mark with the buffer solution. (See *Notes 3*).

(g) The thermometer shall be placed in the solution and the temperature (B)°C shall be read after 60 seconds.

(h) The buffer shall be poured into the mix in the plastic jar and the mixture shaken for exactly four minutes.

(i) The thermometer shall be pushed carefully into the mixture and the temperature (C)°C shall be read after 60 seconds.

(j) The temperature change (ΔT) shall be calculated using the following equation:

$$\Delta T = C - \frac{A + B}{2}$$

Where ΔT = temperature rise °C.

A = initial temperature of mix °C.

B = initial temperature of buffer °C.

C = final temperature of buffer and mix °C.

(k) The temperature rise shall be plotted against the cement content (percent mass per mass of dry crushed rock).

5. Test Procedure

(a) A sample of the stabilised material shall be obtained as soon as possible after mixing.
E.g. A shovel may be held under the pugmill where the mix pours into the truck or storage hopper.
The quality of sample should be approximately 20 kg.

(b) The sample shall be split through the sample splitter until a 5 kg sub-sample is obtained.

(c) The subsample of 5 kg shall be weighed into the plastic jar, and the temperature (A)°C recorded after 60 seconds.

(d) The measuring cylinder shall be filled to the 1,000 mL mark with buffer solution and the temperature (B)°C recorded after 60 seconds.

(e) The buffer shall be added to the mix in the plastic jar, and the mixture shaken for exactly four minutes.

(f) The thermometer shall be carefully pushed into the mix and the temperature (C)°C recorded after 60 seconds.

(g) The temperature rise (ΔT) shall be calculated as in *Preparation of calibration curve (j)*.

6. Reporting

The cement content corresponding to the temperature rise shall be read from the calibration graph and reported as a percentage, by mass of dry crushed rock to the nearest 0.1%.

7. Notes

(a) Example of calculation of mass of crushed rock cement and water

For cement content 2% and moisture content 8%.

Let mass of dry crushed rock = y grams.

Then mass of water $= \frac{8}{100}(y + \frac{2}{100}y)$ = 0.0816y grams

And mass of cement $= \frac{2}{100}y$ grams

i.e. total mass $= y + 0.08y + 0.02y$ grams

And therefore 5,000 grams = 1.1016y grams

i.e. mass of crushed rock $= \dfrac{5000}{1.1016} = 4539$ grams

And mass of water = $0.0816y$ = 0.0816 × 4539 grams

= 370 grams

And mass of cement = $0.02y$ = 0.02 × 4539 grams

= 90 grams

(b) For high percentages of cement (about 3.5%) the rock, cement and buffer mixture may gel into a solid mass thus preventing proper mixing. If percentages above 3.5% are expected, then 1,500 mL of buffer should be used instead of 1,000 mL for all calibration points and tests.

RMS 12.396