Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T134

Lime or cement content of uncured stabilised soil (EDTA method)

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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 T134 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T134

Lime or cement content of uncured stabilised soil (EDTA method)

1. Scope

This test method sets out the procedure for the determination of the lime or cement content of soil-lime or soil-cement mixtures sampled from a project under construction and tested within a limited period of the completion of mixing (one hour in the case of cement and eight hours in the case of lime stabilisation). The method determines the CA^{2+} content by titration with EDTA and is suitable to field testing. Varying amounts of calcium carbonate in the soil will not affect the accuracy of the test.

This method is derived from the American Society for Testing and Materials Designations D2901-70 and D3155-73.

2. Apparatus

(a) Balance with a capacity of 5 kg and sensitive to 0.1 g

(b) Laboratory glassware including 100 mL measuring cylinders, 50 mL burette, 10 mL pipette, 250 mL Erlenmeyer flasks, medicine droppers and glass rods

(c) Plastic ware including 2.5 litre polyethylene containers with tight-sealing lids. Polyethylene bottles for ammonium chloride and distilled water

(d) Indicator paper, either narrow range paper for pH range 10-14 or universal indicator paper

(e) 4.75 mm AS sieves

(f) A thermostatically controlled oven with good air circulation, capable of maintaining a temperature within the range of 105°C to 110°C

3. Reagents

(a) Ammonium Chloride Solution (10%). Dissolve 500 g of ammonium chloride (NH_4Cl) in three litres of distilled water. Make up exactly 5 litres with distilled water and place into a plastic bottle

(b) EDTA Solution (0.1 M). Dissolve 37.22 g of ethylenediaminetetra-acetic acid disodium salt in about 800 mL of distilled water in a 1 litre volumetric flask. Make up to the mark with distilled water

(c) Patton and Reeder Indicator. Tritrate 0.5 g of indicator with 50 g KNO_3. Use approximately 0.2 g for titration

(d) Sodium Hydroxide Solution (50%). Cautiously dissolve 50 g of sodium hydroxide pellets in 60 mL of distilled water. Allow to cool. Dilute to 100 mL and store in a plastic bottle

(e) Triethenolamine Solution (20%). Dilute 100 mL of reagent grade triethanolamine to 500 mL with distilled water

4. Sample Preparation

(a) Standard Samples

(i) Take a representative sample of 3-4 kg of the material which is to be stabilised. Dry in oven to constant mass. If any material is retained on a 4.75 mm sieve, thoroughly screen it until all the material retained is free of smaller adhering particles. Discard material retained on the sieve

(ii) Prepare 3 sets of duplicate samples at the design moisture content as follows:

Set 1. Two Samples at 75% of the design lime or cement content.

Set 2. Two Samples at the design lime or cement content.

Set 3. Two Samples at 125% of the design lime or cement content.

The total mass of each prepared standard sample should be 300 g.

(iii) For each set calculate the quantities of soil, lime or cement and water to be mixed as follows:

$$M_w = 300 \times \frac{W}{100 + W}$$

$$M_L = (300 - M_w) \times \frac{L}{100}$$

$$M_s = 300 - M_w - M_L$$

Where: M_w = mass of water in grams to be mixed.

W = design moisture content, per cent of mass dry soil including lime or cement additive.

M_L = Mass in grams of lime or cement to be added

L = Design lime or cement per cent of mass of dry soil plus lime or cement.

M_s = Mass in grams of dry soil without lime or cement addition.

(iv) For each sample mix the soil and lime or cement to a uniform colour. Add the water and mix thoroughly.

(b) Stabilised Soil Samples

(i) Take representative samples of about 3 kg of the stabilised soil at the completion of mixing at the construction site. Weigh and record the mass (M_t) of each sample and number each sample. If any material is retained on a 4.75 mm sieve, thoroughly screen it until all the material retained is free of smaller adhering particles. Weigh and record the mass (M_p) of material passing the 4.75 mm sieve.

Note: The stabilised soil is assumed to be at design moisture content.

(ii) Riffle the material passing the 4.75 mm sieve to obtain two sub-samples each of 300 g ± 10 g.

5. Procedure

Carry out the following procedure on each prepared standard sample and stabilised soil sample.

(a) Place each 300 g sub-sample in a 2.5 litre polyethylene container and add 600 mL of ammonium chloride solution. Screw the lid of the container and shake the mixture for two minutes

(b) Allow the mixture to settle for four minutes and pipette a 10 mL aliquot of the supernatant liquid into a 250 mL Erlenmeyer flask containing 100 mL of distilled water

(c) While swirling to mix, add drops of 25% NaOH solution (dilute the 50% NaOH solution with an equal amount of distilled water just before use) until a pH between 13.0 and 13.5 is obtained as measured by the narrow range indicator paper using a stirring rod to transfer drops of solution to the paper. Alternatively bring the pH to 10 measuring by use of the Universal Indicator paper ad add another 2 mL 25% NaOH solution

(d) Add four drops of triethanolamine solution and then 0.2 g of the indicator powder. Titrate, whilst swirling with EDTA solution to a pure blue end point and record the quantity of EDTA solution in mL

6. Calculations

(a) If all the soil in a subsample passes the 4.75 mm sieve, proceed as follows:

(i) After titrating the six standard samples, construct the calibration curve, showing the volume (mL) of EDTA solution titrated for each sample, using average figures from sets 1, 2 and 3 against the quantity of admixture as a percentage of the dry mass of the soil plus lime or cement for the particular sample.

(ii) After titrating the stabilised soil samples, read the per cent lime or cement content (L_D) direct from the calibration curve corresponding to the titration result in mL of EDTA for the test sample.

(b) If the soil in the sample of stabilised soil contains some material which is retained on the 4.75 mm sieve, proceed as follows:

(i) After titrating the six standard samples, construct the calibration curve showing volume (mL) of EDTA solution titrated for each sample against the mass (g) of lime or cement added to the particular sample.

(ii) After titrating the stabilised soil samples, read from the calibrating curve the mass (L_S) in grams of lime or cement corresponding to the volume (mL) of EDTA titrated into the particular test sample.
Compute the lime or cement content (L_D) as a percentage of the dry mass of total sample as follows:

$$A = \frac{M_P}{300} \times L_S$$

$$B = \frac{M_t \times 100}{(100 + M)}$$

$$L_D = \frac{A}{B} \times 100$$

Where: A = mass (g) of lime or cement in the sample of stabilised soil before sieving.

M_p = mass (g) of sample of stabilised soil passing the 4.75 mm sieve.

L_s = mass (g) of lime or cement read from the calibration curve.

B = Mass (g) of dry stabilised soil (i.e. soil plus lime or cement) in the sample of stabilised soil before sieving.

M_t = mass (g) of the sample of moist stabilised soil before sieving.

M = Design moisture content per cent.

L_D = Lime or cement as percentage of the dry mass of total sample.

7. Reporting

Report the mean lime or cement content L_D as a percentage, to one decimal place, of the dry mass of the total sample for each sample of stabilised soil taken in the field.

Note: If the sample of stabilised soil is not at the design moisture content, water should be added to bring it to its design moisture content (see calculations in Sample Preparation (a)(iv). This water should be mixed thoroughly. The sample should then be reweighed, the new mass being M_t.

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