

Lime Saturation Point of Soil (pH Method)

1. Scope

This test method covers the procedure for the determination of the percentage of hydrated lime required to saturate a soil.

2. Apparatus

- (a) pH meter covering the range of at least pH 3 to pH 13 and a scale readable and accurate to 0.05 pH units.
The manufacturer's instructions shall be followed for the operation of the meter.
- (b) Thermostatically controlled oven with good air circulation, capable of maintaining a temperature not exceeding 50°C.
- (c) Sieves, with 9.50, and 2.36 mm apertures, as designated in the ISO 3310 series.
- (d) Balance of at least 1 kg capacity with a limit of performance not exceeding ± 0.05 g.
- (e) Sample dividers (rifle boxes) with appropriate size openings (optional).
- (f) Mixing and quartering tray.
- (g) Mortar and rubber pestle (a rubber hardness of approximately Shore 87), or a mechanical device suitable for breaking up soil aggregations without reducing the size of individual particles.
- (h) Beakers 250 ml.
- (i) Rubber-tipped glass stirring rods.
- (j) Metal dishes, sieve brushes.

3. Reagents

- (a) A quantity of fresh hydrated lime.
- (b) Freshly boiled distilled or de-ionised water.

4. Preparation of Sample

- (a) Prepare the sample of soil in accordance with AS 1289.1.1, Clause 5.1. Discard material retained on the 10 mm sieve.
- (b) Allow the sample to dry sufficiently to enable it to be crumbled. If necessary dry the sample in an oven at a temperature not exceeding 50°C.

- (c) Break up any aggregations of particles in such a way as to avoid crushing any discrete particles. Brush adhering material from coarse particles. Break down all aggregations so that only discrete uncrushed particles remain. Use a rubber pestle to avoid breaking down sound pieces of mineral matter.

Note: When in doubt as to whether lumps are to be broken, place some in water and boil. If slaking occurs, the material should be broken further with the rubber pestle or mechanical device.

- (d) Subdivide the prepared sample by quartering or riffing to provide an amount sufficient to yield not less than 500 g of material passing a 2.36 mm sieve at step (f).
- (e) Determine the mass of the sample (m_1).
- (f) Sieve the sample over 2.36 mm sieve, and determine the mass of material passing the 2.36 mm sieve (m_2). Keep the material passing that sieve.

5. Procedure

- (a) Determine the available lime index (ALI) of the lime to be used in the laboratory investigation either in accordance with AS 4489.6.1, or from the manufacturer's Product Data Sheet.
- (b) Subdivide the sample of soil obtained in Clause 4(f) by riffing, to provide at least eight sub-samples of approximately 50 g each.
- (c) Weigh each sub-sample and record its mass.
- (d) Place one sub-sample in a 250 ml beaker.
- (e) Add a quantity of hydrated lime to each of the other sub-samples so that the proportion of hydrated lime varies from sub-sample to sub-sample by 0.5% by mass.
- (f) Thoroughly mix the lime into the soil in each of the sub-samples and transfer the soil-lime mixture for each lime content to 250 mL beakers.
- (g) Add 100 ml freshly boiled distilled or de-ionised water to each beaker, including that containing soil only.
- (h) Stir the contents in each beaker vigorously for 1 minute. Ensure that the materials in each beaker is uniformly mixed and thoroughly wetted.
- (i) After 10 minutes, remix each beaker for a further one minute and repeat this step six times for each beaker.

- (j) Place 4 g of hydrated lime in a 250 ml beaker and add 100 mL freshly boiled distilled or de-ionised water (to create the lime-water mixture). Mix vigorously for two minutes. Remix as in step (i) keeping the beaker covered between mixes.
- (k) Determine the pH of each of the soil-lime-water suspensions and the lime-water mixture after completion of the last mixing in steps (i) and (j). Use the pH meter in accordance with the manufacturer’s instructions, including checking of the calibration. Take three readings of the pH of each soil-lime-water suspension with brief stirring and settling between each reading. The readings should not differ by more than 0.05 pH units. When not in use, stand the electrodes in a beaker of de-ionised or distilled water.
- (l) If the pH of the sub-sample with the highest percentage of added lime does not equal the pH of the lime-water mixture make up a further mixture of soil plus lime, varying the lime content so that the final pH is at least equal to that of the lime-water mixture.
- (m) Plot pH versus percentage by mass of lime added to the soil. Draw the line of pH corresponding to the pH of the lime-water mixture (see Figure 1).

6. Calculations

- (a) From the graph, determine the percentage of lime (L_1) required to saturate the sample, i.e. the point of intersection of the pH versus added lime graph and the line of pH of the lime-water mixture.

In cases where the pH of the lime-soil mixes will not attain the pH of the lime-water mixture, take L_1 to be equal to the percentage of lime where the graph of pH versus lime-content reaches a plateau.

- (b) Calculate the percentage of material (P) passing the 2.36 mm sieve from the following equation:

$$P = \frac{100 \times m_2}{m_1} \quad \text{where}$$

m_1 = mass of subdivided material passing 10 mm sieve at Step 4(d)

m_2 = mass of material passing 2.36 mm sieve, at Step 4(f)

- (c) Calculate the optimum percentage of lime (L_2) needed to saturate the whole soil as follows:

$$L_2 = \frac{L_1 \times P}{100}$$

7. Report

Report the following:

- (a) The type and brand of lime used:
- (b) The available lime index (ALI) (expressed as calcium hydroxide) of the lime used in the laboratory investigation, to the nearest 1%.
- (c) The optimum percentage of lime (L_2), by mass, needed to saturate the whole soil, to the nearest 0.5%.
- (d) Reference to this test method (RC 131.01).

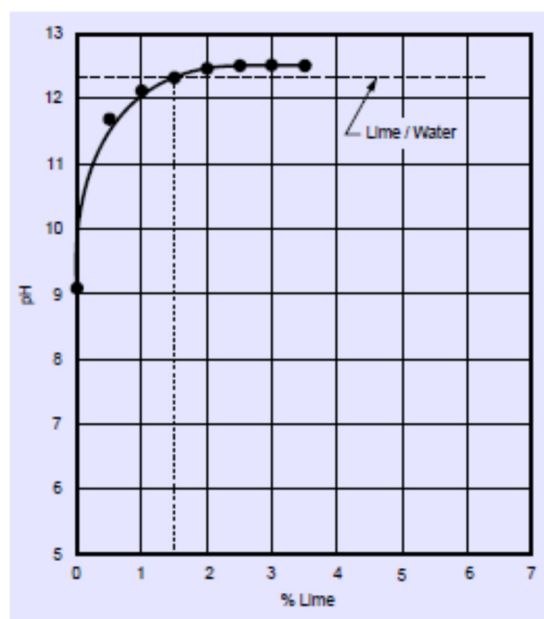


Figure 1: Plot of pH vs Percentage Lime

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VicRoads Test Method - Revision Summary

RC 131.01 – Lime Saturation Point of Soil (pH Method)

Date	Clause	Description of Revision	Authorised by
March 2018	2(c) 4(a) 4(d) & (f) 5(a) 5(k) 5 & 6 6 & 7 7(b) 7(c)	Sieves to ISO 3310 series Discard material retained on 10 mm sieve 2.36 mm sieve, consistent with AS 1289.4.3.1 Use ALI, add AS 4489.6.1, add PDS (delete RC 102.05) Re-written Consistent on lime-water mix <u>optimum</u> percentage of lime (as for RC 301.03) Use ALI, reporting consistent with AS 4489.6.1 reporting consistent with RC 301.04	Manager – Construction Materials