Designation: C977 – 10

Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization[1]

This standard is issued under the fixed designation C977; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification pertains to quicklime and hydrated lime, either high calcium, dolomitic, or magnesian lime, for use in stabilization of soils (See Note 2).

NOTE 1—Quicklime and hydrated lime act upon clay soils and may render such soils suitable for highway construction and for other load-bearing applications. In most cases, lime causes finely divided clay particles to agglomerate into coarser particles which improves load-bearing properties and subsequently the lime-treated soil hardens by chemical reaction.

NOTE 2—No attempt is made to present requirements for by-product lime, commercial lime slurry, etc. Specification requirements for these materials could be better determined on a local basis.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

C50 Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products

C51 Terminology Relating to Lime and Limestone (as used by the Industry)

C110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone

D6276 Test Method for Using pH to Estimate the Soil-Lime Proportion Requirement for Soil Stabilization

3. Chemical Composition

3.1 Unless otherwise specified, for definitions of terms used in this specification, refer to Terminology C51.

3.2 Quicklime and hydrated lime for soil stabilization shall conform to the following chemical composition:

Calcium and Magnesium Oxides (on a non-volatile basis, minimum %)	90.0
Carbon Dioxide (taken at point of manufacture, maximum %)	5.0
Free Moisture (taken at point of manufacture, maximum %)	2.0

4. Physical Properties

4.1 *Hydrated Lime,* shall have not more than 3 % retained on a No. 30 (590-μm) sieve and not more than 25 % retained on a No. 200 (75-μm) sieve.

4.2 *Quicklime:*

4.2.1 *Particle Size of Quicklime*—Quicklime shall all pass a 1.0-in. (24.4-mm) sieve.

4.2.2 Quicklime for soil stabilization shall have a temperature rise of a minimum of 30°C in 20 min.

4.2.3 *Residue of Quicklime*—Quicklime for soil stabilization shall have not more than 10 % residue.

5. Field Applications

5.1 When quicklimes are used, ensure that thorough mixing of the lime and soil is accomplished and all lime pebbles have been hydrated with additional water and distributed uniformly throughout the soil. There shall be no lime pebbles present before the compaction operation starts. Check by turning soil with a spade at representative intervals and inspect for visible lime pebbles. Care should be exercised on initial dry applications to minimize environmental dusting.

5.2 For hydrated limes, additional water shall be added to the lime-soil mixture to facilitate mixing and uniform distribution of the hydrated lime in the soil layer. There shall be no lime clumps present before the compaction operation starts. Check by turning soil with a spade at representative intervals

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

and inspect for visible lime clumps. Care should be exercised on initial dry applications to minimize environmental dusting.[3]

6. Test Method

6.1 The chemical analysis of quicklime and hydrated lime shall be conducted in accordance with Test Methods C25.

6.2 The particle size of hydrated lime shall be determined in accordance with the sieve analysis of hydrated lime in Test Methods C110.

6.3 The quicklime temperature rise and residue should be determined in accordance with the Slaking Rate of Quicklime in Test Methods C110.

6.4 The appendix of this specification contains a non-mandatory test to approximate the lime-soil proportion for stabilization. A more detailed version of this test appears in Test Method D6276.

7. Sampling, Inspection, Packaging, and Marking

7.1 The sampling, inspection, rejection, retesting, packaging, and marking shall be done in accordance with Practice C50.

8. Keywords

8.1 highway construction; hydrated lime; lime treated soils; load-bearing; quicklime; soil; stabilization

[3] Further information on soil stabilization construction technique is available from National Lime Association Bulletin No. 326, 200 N. Glebe Rd., Arlington, VA, 22203–3728. This information can be accessed online at www.lime.org.

APPENDIX

(Nonmandatory Information)

X1. EADES AND GRIM TEST METHOD FOR DETERMINING THE APPROXIMATE LIME/SOIL PROPORTION FOR STABILIZATION

X1.1 This test method usually provides a lime-soil proportion for stabilization. It gives an indication whether the soil in question can be stabilized. For most stabilization work, the results of this test should be verified by performance tests in a soil laboratory.

X1.2 Air dry a sufficient quantity of the soil to be tested and screen through a No. 40 (425-µm) sieve. Store in a closed container to maintain uniform moisture. Weigh to the nearest 0.1 g a series of 20-g samples of soil and place in separate 150-mL plastic containers with water-tight lids.

X1.3 In the case of quicklime, rapidly crush the lime to pass a No. 6 (3.35-mm) sieve.

X1.4 Weigh, to the nearest 0.01 g, a series of quantities of lime equivalent to 2, 3, 4, 5, and 6 % of the soil sample.

X1.5 Add the lime quantity to the soil sample, mark the container with the appropriate percentage, and mix the dry contents thoroughly.

X1.6 Add the 100 mL of 70°F carbon dioxide-free distilled water or, if possible, 70°F actual water to be used on the job to each container of soil and lime. Seal with screw-cap lid and mix the three components by shaking the bottles. Shake each bottle for 30 s every ten min for 1 h. After 1 h, shake vigorously and transfer part of the slurry into a beaker. Measure the pH with a low-sodium error glass electrode (previously standardized to pH 12.45 with an agitated calcium hydroxide slurry). Record the pH reading for each mixture.

X1.7 If the pH readings are 12.40 or higher, the lowest percentage that gives a pH of 12.40 is the % required to stabilize the soil. If the pH readings do not go beyond pH of 12.30 and two percentages give this reading, the lowest % to give a pH of 12.30 is the % required to stabilize the soil. If the highest pH reading is a pH of 12.30 and only the highest percentage lime used gives a pH of 12.30, additional testing is required using higher percentages of lime.