Designation: D5102 – 09

Standard Test Methods for Unconfined Compressive Strength of Compacted Soil-Lime Mixtures[1]

This standard is issued under the fixed designation D5102; 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.

1. Scope*

1.1 This test method covers procedures for preparing, curing, and testing laboratory-compacted specimens of soil-lime and other lime-treated materials (Note 1) for determining unconfined compressive strength. This test method can be used for specimens prepared at the maximum unit weight and optimum water content, or for specimens prepared at other target unit weight and water content levels. Other applications are given in Section 5 on Significance and Use.

NOTE 1—Lime-based products other than commercial quicklime and hydrated lime are also used in the lime treatment of fine-grained cohesive soils. Lime kiln dust (LKD) is collected from the kiln exhaust gases by cyclone, electrostatic, or baghouse-type collection systems. Some lime producers hydrate various blends of LKD plus quicklime to produce a lime-based product.

1.2 Cored specimens of soil-lime should be tested in accordance with Test Methods D2166.

1.3 Two alternative procedures are provided:

1.3.1 Procedure A describes procedures for preparing and testing compacted soil-lime specimens having height-to-diameter ratios between 2.00 and 2.50. This test method provides the standard measure of compressive strength.

1.3.2 Procedure B describes procedures for preparing and testing compacted soil-lime specimens using Test Methods D698 compaction equipment and molds commonly available in most soil testing laboratories. Procedure B is considered to provide relative measures of individual specimens in a suite of test specimens rather than standard compressive strength values. Because of the lesser height-to-diameter ratio (1.15) of the cylinders, compressive strength determined by Procedure B will normally be greater than that by Procedure A.

1.3.3 Results of unconfined compressive strength tests using Procedure B should not be directly compared to those obtained using Procedure A.

1.4 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.4.1 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.

1.5 Lime is not an effective stabilizing agent for all soils. Some soil components such as sulfates, phosphates, organics, etc. can adversely affect soil-lime reactions and may affect the test results using this method.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.6.1 The gravitational system of inch-pound units is used when dealing with inch-pound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass is slugs. The rationalized slug unit is not given, unless dynamic (F = ma) calculations are involved.

1.6.2 It is common practice in the engineering/construction profession to concurrently use pounds to represent both a unit of mass (lbm) and of force (lbf). This implicitly combines two separate systems of units; that is, the absolute system and the gravitational system. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. As stated, this standard includes the gravitational system of inch-pound units and does not use/present the slug unit for mass. However, the use of balances or scales recording pounds of mass (lbm) or recording density in lbm/ft^3 shall not be regarded as non-conformance with this standard.

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[1] These test methods are under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.15 on Stabilization With Admixtures.

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***A Summary of Changes section appears at the end of this standard**

1.7 *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 requirements prior to use.* For specific precautionary statements, see Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

C977 Specification for Quicklime and Hydrated Lime for Soil Stabilization

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

D2166 Test Method for Unconfined Compressive Strength of Cohesive Soil

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)

D3551 Practice for Laboratory Preparation of Soil-Lime Mixtures Using Mechanical Mixer

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing

D6026 Practice for Using Significant Digits in Geotechnical Data

3. Terminology

3.1 *Definitions:*

3.1.1 Refer to Terminology D653 for terms relating to soil and Definitions C51 for terms relating to lime and limestone.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lime content*—the ratio, expressed as a percentage, of (*a*) the dry (as received/packaged) mass of lime to (*b*) the dry mass of soil.

3.2.2 *unconfined compressive strength of soil-lime* (q_u)—the compressive stress at which an unconfined cylindrical specimen of soil-lime will fail in an axial compression test. In this test method, unconfined compressive strength is either the maximum axial load/force attained per unit area or the load/force per unit area at 5 % axial strain, whichever occurs first during performance of a test.

3.2.3 *carbonation*—partial or complete transformation of calcium hydroxide or magnesium hydroxide (or both) to carbonate phases due to reaction with carbon dioxide. Carbonation may take place during manufacture and storage of lime, laboratory mixing, curing and testing of soil-lime mixtures, construction, and service. Carbonation will reduce the effectiveness of the lime in producing desired soil-lime reactions.

3.2.4 See Section 7 on Reagents and Materials.

4. Summary of Test Method

4.1 Dependent on design criteria, a predetermined number of compacted soil-lime specimens are prepared for each specified lime content, unit weight, and water content so unconfined compression testing can be performed on laboratory cured specimens of specified ages. In many instances, single or preferably duplicate specimens are tested following a 28 and 90-day curing period at room temperature. In some cases, however, a curing period of 7 days at room temperature or accelerated curing conditions may be necessary.

4.2 The amount of soil, lime, and water required for the specimen is determined. The soil-lime-water mixture is compacted in a mold to the desired initial specimen conditions (moist/dry unit weight and molding water content).

4.3 After removal from the mold, specimens are cured for a specified number of days.

4.4 Following the curing period, the soil-lime specimens are loaded in compression to failure. Maximum load or load at 5 % axial strain is used to calculate unconfined compressive strength.

5. Significance and Use

5.1 Compression testing of soil-lime specimens is performed to determine unconfined compressive strength of the cured soil-lime-water mixture to determine the suitability of the mixture for uses such as in pavement bases and subbases, stabilized subgrades, and structural fills.

5.2 Compressive strength data are used in soil-lime mix design procedures: (*a*) to determine if a soil will achieve a significant strength increase with the addition of lime; (*b*) to group soil-lime mixtures into strength classes; (*c*) to study the effects of variables such as lime percentage, unit weight, water content, curing time, curing temperature, etc.; and (*d*) to estimate other engineering properties of soil-lime mixtures.

5.3 Lime is generally classified as calcitic or dolomitic. Usually in soil stabilization, high-calcium lime [CaO] or dolomitic lime [$CaO + MgO$] are used. The lime is transformed from oxide to hydroxide form [[$Ca(OH)_2$ or [$Ca(OH)_2$ + $Mg(OH)_2$]] by the addition of water in the soil, a slurry tank, or at a manufacturing facility. Lime may increase the strength of cohesive soil. The type of lime in combination with soil type influences the resulting compressive strength.

NOTE 2—The agency performing this test method can be evaluated in accordance with Practice D3740. Not withstanding statements on precision and bias contained in this method: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facility used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing. Users of this test method are cautioned that compliance with Practice D3740 does not, in itself, ensure reliable testing. Reliable testing depends on many factors; Practice D3740 provides a

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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.

means of evaluating some of these factors.

6. Apparatus

6.1 *Balance or Scale:*

6.1.1 *Specimen Masses*—A balance or scale which will measure masses to four significant digits and conforming to the requirements of either Class GP2 or GP5 in Guide D4753.

6.1.1.1 The minimum capacity requirement for Procedure A is typically 1000 g; while for Procedure B it is typically 20 000 g.

6.1.2 *Water Content Masses*—A balance or scale which will enable water content determinations to be determined to the nearest 0.1 % and conforming to the requirements of either Class GP1, GP2 or GP5 in Guide D4753. The type of class required depends upon the size of the water content specimen and its water content.

6.1.2.1 To meet this requirement, masses less than about 400 g have to be measured to 4 significant digits; while larger masses to three significant digits.

6.2 *Specimen Dimension Measurement Devices,* dial comparators, calipers, circumferential tape or other suitable devices for measuring the height and diameter of the specimen to three significant digits.

6.2.1 If densities/unit weights are required to four significant digits (density to nearest 0.001 Mg/m^3 or unit weight to nearest 0.1 lbf/ft^3), then the specimen dimensions have to be measured to four significant digits.

6.3 *Specimen Molds:*

6.3.1 *Procedure A,* molds having sufficient capacity to provide specimens with length-to-diameter ratios between 2.00 and 2.50. Molds shall have a minimum inside diameter (ID) of 50 mm or 2.0 in. Split molds may be used. The mold shall have an extension collar assembly made of rigid metal and constructed so it can be securely attached to and detached from the mold.

6.3.2 *Procedure B,* molds with extension collars conforming to the requirements of Test Methods D698.

6.4 *Tamping Rod or Compaction Hammer,* tamping rod or compaction hammer suitable for mold size and preparation of specimen at desired unit weight.

6.5 *Test Specimen Extruder,* An extruder is required if split molds are not used. The device shall consist of a piston, jack, and frame or similar equipment suitable for extruding specimens from the mold.

6.6 *Containers,* suitable plastic airtight, moisture proof containers for sealing and storing specimens after compaction. The containers should be rigid to protect the specimens from disturbance during handling.

6.7 *Miscellaneous Equipment,* tools such as spatulas, knives, straightedge, trowels, scoops, etc., for use in preparing specimens.

6.8 *Temperature Controlled Room or Cabinet,* a room or cabinet capable of maintaining a temperature of 23 ± 2°C (73 ± 4°F) for curing soil-lime specimens. A moist room can be used but is not required.

6.9 *Timer,* a timing device to indicate the elapsed testing time to the nearest second for establishing the rate of strain application prescribed in 13.2.

6.10 *Compression Device and Load/Force Indicator,* The compression device may be any device with sufficient capacity and control to provide a constant rate of deformation to meet the requirements of 13.2. The device shall be equipped so the compressive load is applied to the specimen without producing eccentric loading conditions. When the compression device is set to advance at a specified rate, the actual rate shall not deviate from the required value by more than ±20 %, with the change in rate being gradual, not stick-slip (Note 3).

NOTE 3—The loading conditions of most loading frames with multiple gear-drive settings vary more than expected; that is, more than about ±10 %.

6.10.1 The load/force indicator shall have a direct readability of at least three significant digits at failure, with a minimum full range accuracy of 0.25 %.

6.11 *Deformation Indicator,* The deformation indicator (mechanical or electronic) shall have a minimum readability (without interpolation) of 0.02 mm or 0.001 in. and have a travel range sufficient to measure 6 % axial strain (see 14.1).

7. Reagents and Materials

7.1 *Hydrated Lime*—Lime that is predominantly calcium hydroxide [$Ca(OH)_2$] or a mixture of $Ca(OH)_2$ and magnesium oxide (MgO) or magnesium hydroxide [$Mg(OH)_2$], or both. Only fresh lime meeting the requirements of Specification C977 may be used. Bagged lime must be kept sealed because of the tendency for the lime to undergo carbonation.

7.2 *Quicklime*—Lime which is predominantly calcium oxide (CaO) or CaO in association with MgO. Only fresh lime meeting the requirements of Specification C977 may be used. Bagged lime must be kept sealed because of the tendency for the lime to combine with CO_2 in air.

7.3 *Tapwater*—Tapwater that is free of acids, alkalies, and oils and is suitable for drinking shall be used for wetting the soil.

8. Safety Hazards

8.1 Lime chemically reacts with water and can become hot. Appropriate safety equipment, such as gloves, protective eyewear, respirator, and plastic apron should be worn when handling lime.

9. Technical Hazards

9.1 Perform compaction as quickly as possible after the curing period to minimize additional lime carbonation and unrecorded moisture loss.

9.2 When compacting specimens, tamping should be uniform and consistent over the surface of each layer, and scarify between layers.

9.3 Handle compacted soil-lime specimens so as to prevent disturbance or changes in cross section or loss of moisture.

9.4 Lime can react with some metals such as aluminum and zinc. Therefore, aluminum foil and metal pans and containers consisting of aluminum and zinc shall not be used for storing lime, curing a soil-lime mixture(s), or curing a soil-lime compacted specimen(s).

10. Test Specimens

10.1 *Specimen Size*—Specimens shall have a minimum diameter of 50 mm (2.0 in.), and the largest particle contained within the test specimen shall be smaller than 1⁄10 of the specimen diameter. For specimens having a diameter of 72 mm (2.8 in.) or larger, the largest particle size shall be smaller than 1⁄6 of the specimen diameter.

10.2 Calculate the quantity of soil, lime, and water required for one specimen and the total quantities of each needed to prepare the required number of test specimens at each prescribed lime content, percent of maximum dry unit weight, and water content. The values of maximum dry unit weight and optimum water content are determined in accordance with Test Methods D698. The initial water content of soil, as determined using Test Method D2216, is used to calculate the additional water required to bring the soil-lime mixture to the desired water contents. Approximately 10 % more material than calculated should be prepared to ensure that enough material is available.

10.3 Mix the soil-lime mixtures in accordance with Practice D3551. See Section 11 before compaction.

10.4 Select the proper compaction mold in accordance with the procedure to be used.

10.4.1 *Procedure A, (Specimens Having Height-to-Diameter Ratios Between 2.0 and 2.5)*—Prepare specimens by compacting material in at least three layers into a mold meeting the requirements of 6.3.1. Specimens may be compacted to the desired unit weight by either: *(1)* kneading, tamping, or impacting (Test Methods D698) each layer until the accumulative mass of the soil placed in the mold is compacted to a known volume, or *(2)* adjusting the number of layers, the number of tamps/blows per layer, and the force per tamp/blow (Note 4). The ends of the specimen should be perpendicular to the longitudinal axis. Scarify the top of each layer prior to the addition of material for the next layer. After the specimen is formed, remove the mold. Determine and record the mass of the specimen, length of the specimen, and diameter of the specimen at midheight to the number of significant digits prescribed in Section 6 (6.1 and 6.2).

NOTE 4—When comparing strength data between laboratories, the details on specimen preparation should be known, as the preparation method affects unit weight as strength is affected by the method of compaction, the compacted unit weight and the molding water content.

10.4.2 *Procedure B*—Compact specimens in accordance with the procedure given in Test Methods D698. Scarify the surfaces of the first two layers prior to adding material for the next layer. Take steps to ensure layer heights are approximately equal. After a specimen is formed and its moist/dry unit weights are determined (Test Methods D698), extrude the specimen from the mold and determine and record the mass of the specimen, length of the specimen, and diameter of the specimen at midheight. The significant digits in these measurements shall be in accordance with that prescribed in Section 6.

10.5 After the mass and dimensions of the specimen have been determined, place the specimen in an airtight, moisture proof container and allow the specimen to cure in accordance with Section 12 on curing test specimens.

11. Conditioning

11.1 Store lime in a plastic, airtight, moisture proof container to keep it dry and free from carbonation.

11.2 Store the soil in an airtight, moisture proof container to preserve the water content.

11.3 Allow the soil-water-lime mixture to mellow in an airtight, moisture-proof container as specified, before compacting (Note 5).

NOTE 5—A 24-h mellowing period is typical, although periods exceeding 48 h have been used for high plasticity soils.

12. Curing Test Specimens

12.1 Randomize the specimens for testing to ensure representative test results.

12.2 Cure compacted test specimens in an airtight, moisture proof container at a temperature of 23 ± 2°C (73 ± 4°F) for the specified curing period (Note 6).

NOTE 6—Any curing period may be specified, however, most commonly used curing periods are 7, 28, and 90 days.

12.2.1 The container cannot contain aluminum or zinc, see 9.4.

12.3 The test specimens should be wrapped and sealed in plastic or placed in rubber sleeves to reduce carbonation. Curing conditions different from those specified should be noted on the test data sheet/form, see Section 15 (Note 7).

NOTE 7—When accelerated curing conditions are necessary to expedite the curing process for simulating long-term field conditions, curing temperatures in excess of 49°C (120°F) should be avoided. Research indicates that a temperature of 40°C (105°F) at various curing times is appropriate for accelerated curing without introducing pozzolanic reactive products that significantly differ from those expected during field curing.[3]

12.3.1 A damp cloth placed within the curing container, but not in contact with the soil-lime specimen, will maintain humid conditions for curing and will prevent drying.

13. Procedure

13.1 Determine and record the mass of the specimen, see 10.4.1 or 10.4.2. If the change in mass is greater than about 2 %, re-measure and record the dimensions of the specimen, see 10.4.1 and 10.4.2.

13.2 Place the specimen in the loading device so it is centered on the bottom platen. Carefully adjust the loading device so the upper platen just makes contact with the specimen. Zero the deformation indicator. Apply the load continuously and without shock so as to produce an axial deformation rate of approximately 0.5 to 2.0 % per min. The lower rate should be selected for brittle specimens, while the higher rate for non-brittle specimens.

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[3] "Lime Stabilization," *State of the Art Report No. 5*, ISBN #0-309-04118-X, Transportation Research Board, National Research Council, Washington, DC, 1987.

13.3 Record load (axial force), deformation, and time values at intervals sufficient to define the shape of the stress-strain curve (usually 10 to 15 points are sufficient). Record the maximum axial force applied to the specimen, along with its deformation.

13.3.1 The axial force and deformation shall be determined and recorded in accordance with that specified in Section 6 (6.10 and 6.11).

13.4 Continue loading the specimen until load values decrease with increasing strain or until 5 % strain is exceeded.

13.5 Make a sketch or take a photograph of the test specimen after the test showing the mode of failure.

13.6 Measure and record the diameter of the failed specimen to three significant digits in three directions at its midheight, unless a brittle failure occurs.

13.7 The example data sheet shown in Test Methods D2166 can be used. If this example data sheet is used, the corrected area shall be calculated using the appropriate method given in 14.2. Other data sheets may be used, provided the form contains all required data.

13.8 Measure water content using whole specimen or representative portion to nearest 0.1 %.

14. Calculation

14.1 Calculate axial strain to the nearest 0.1 %, for each applied load, as follows:

$$\varepsilon = \frac{\Delta L}{L_o} \times 100 \qquad (1)$$

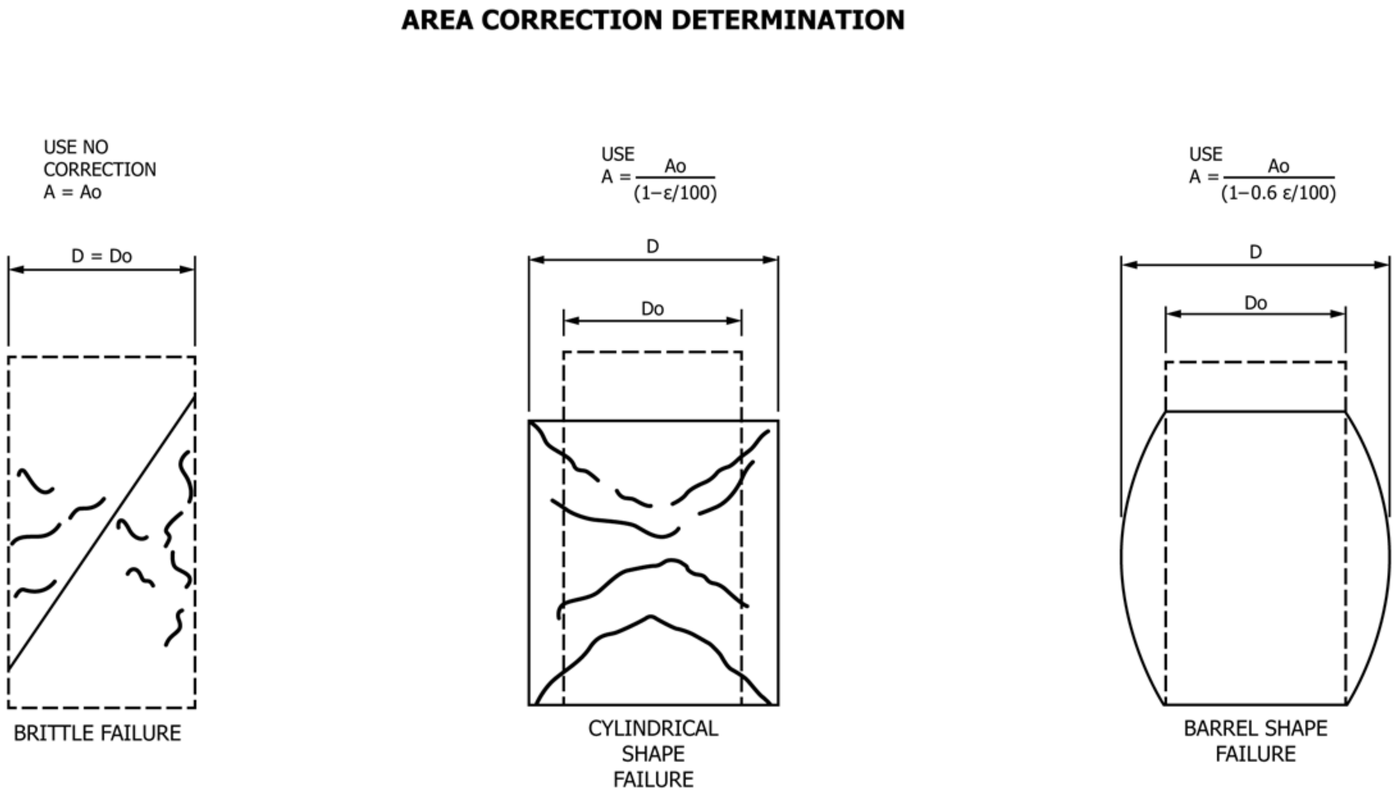
where:

ε = axial strain, %
ΔL = length change of specimen as read from deformation indicator, mm (in.),
L_o = initial length of specimen, mm (in.), and
100 = convert from decimal to percent.

14.2 Calculate the average cross-sectional area for a given applied axial force (see Fig. 1), as follows:

14.2.1 If the post test measurement of the specimen diameter indicates the specimen diameter did not change during testing, or a brittle failure occurred, use the original cross-sectional area of the specimen.

14.2.2 If radial deformation occurred during the test, but the specimen maintained a cylindrical shape failure the corrected average cross-sectional area of the specimen shall be calculated as follows:



where:
A = average corrected cross-sectional area of specimen, mm^2 (in.^{2}),
A_o = initial average cross-sectional area of specimen, mm^2 (in.^{2}), and
ε = axial strain for a given load, %

FIG. 1 Area Correction Determination

$$A = \frac{A_o}{(1 - \varepsilon/100)} \quad (2)$$

where:

A = corrected cross-sectional area of specimen, for a given axial force, m^2 ($in.^2$),
A_o = initial cross-sectional area of specimen, m^2 ($in.^2$), and
ε = axial strain for a given axial force, %.

NOTE 8—$m^2 = mm^2 \times 10^{-6}$

14.2.3 If radial deformation increased during the test and the specimen assumed a barrel shape, the corrected cross-sectional area for a given axial force shall be calculated as follows:

$$A = \frac{A_o}{(1 - 0.6\varepsilon/100)} \quad (3)$$

where:

A = corrected cross-sectional area of specimen, for a given axial force, m^2 ($in.^2$),
A_o = initial cross-sectional area of specimen, m^2 ($in.^2$),
0.6 = area correction constant, and
ε = axial strain for a given axial force, %.

14.3 Calculate the compressive stress for a given applied axial force to three significant digits, as follows:

$$\sigma = \frac{P}{A} \quad (4)$$

where:

σ = compressive stress, kPa ($lbf/in.^2$),
P = axial force applied to specimen, kN (lbf), and
A = corresponding cross-sectional area, m^2 ($in.^2$).

14.4 *Graph*—If desired, a graph showing the relationship between axial strain (abscissa) and compressive stress (ordinate) may be plotted. Select the maximum value of compressive stress or the compressive stress at 5 % axial strain, whichever occurs first; and report as the unconfined compressive strength q_u. Whenever it is considered necessary for proper interpretation, include the stress-strain graph as part of the data reported.

14.4.1 The compressive stress at 5 % axial strain may be calculated assuming a linear relationship between the two measurements bounding the 5 % axial strain measurement.

15. Report: Data Sheet/Form

15.1 Record the following information:

15.1.1 Soil-lime mixture identification (percent lime, soil sample identification, lime identification, and type of lime).

15.1.2 Classification test data or visual classification (as a minimum the color, group names and symbol, see Practice D2488), or both, of soil sample.

15.1.3 Length of curing period used to prepare soil-lime mixture in accordance with Practice D3551.

15.1.4 Specimen identification number.

15.1.5 Specimen preparation procedure (A or B) and details of preparation procedure.

15.1.6 Average specimen diameter and height to 3 or 4 significant digits.

15.1.7 Height-to-diameter ratio, as height-to-diameter ratio directly affects strength, as described in 1.3.2.

15.1.8 Specimen cross-sectional area, m^2 ($in.^2$) to minimum 3 significant digits.

15.1.9 Strain rate setting, percent per minute.

15.1.10 Stress-strain data (readings and calculated values).

15.1.11 Compressive strength, kPa ($lbf/in.^2$).

15.1.12 Strain at failure, percent.

15.1.13 Age of specimen (curing duration), days.

15.1.14 Details of curing conditions.

15.1.15 Stress-strain graph, if prepared.

15.1.16 Failure sketch or photograph.

15.1.17 Remarks. Note any unusual conditions or other data considered necessary to properly interpret test results.

15.1.18 Water content and moist/dry unit weight of specimen, before and after cure.

16. Precision and Bias

16.1 *Repeatability:*

16.1.1 *Single-Laboratory Precision*—The standard deviation for identical laboratory-prepared specimens increases with average strength.[4]

16.1.2 *Single-Operator and Multi-Laboratory Precision*—Test data on single operator and multi-laboratory precision is not presented due to the nature of the soil-lime materials tested by this test method. It is either not feasible or too costly at this time to have ten or more laboratories participate in a round-robin testing program. Also, it is either not feasible or too costly to produce multiple specimens that have uniform physical properties. Any variation observed in the data is just as likely to be due to specimen variation as to operator or laboratory testing variation.

16.1.2.1 The Subcommittee D18.15 is seeking any data from the users of this test method that might be used to make a limited statement on precision.

16.2 *Bias*—There is no accepted reference value for this test method, therefore, bias cannot be determined.

17. Keywords

17.1 lime content; soil-lime; soil-stabilization; specimen preparation; unconfined compressive strength

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[4] Liu, T. K., and Thompson, M. R., "Variability of Some Selected Laboratory Soil Test," *Proceedings, National Conference on Statistical Quality Control Methodology in Highway and Airfield Construction*, Charlottesville, VA, 1966.

SUMMARY OF CHANGES

Committee D18 has identified the location of selected changes to this standard since the last issue (D5102 – 04) that may impact the use of this standard. (Approved October 1, 2009.)

(1) Clarified the definition of carbonation in 3.2.3 to more clearly describe the chemical transformation of hydroxide phases of lime to carbonate phases by contact with carbon dioxide.
(2) Clarified the classifications of lime in 5.3 including their transformation from oxide to hydroxide forms.
(3) Revised Note 3 to improve its readability.
(4) Revised 9.1 to remove reference incorrect reference to 1-h curing time and to hydration rather than carbonation.
(5) Removed incorrect reference to 1-h curing time from 11.3.
(6) Replaced "curing" with "mellowing" in 11.3 and Note 5.
(7) Clarified commonly used curing periods in Note 5.
(8) Removed the requirement for rigid containers from 12.2.

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