



Designation: D4832/D4832M – 23

Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Cylindrical Test Specimens¹

This standard is issued under the fixed designation D4832/D4832M; 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 the preparation, curing, transporting and testing of cylindrical test specimens of controlled low strength material (CLSM) for the determination of compressive strength.

1.2 This test method covers CLSM materials that have a higher strength than the soil but less than 8400 kPa [1200 psi]. Typical strengths for most applications fall between 350 to 700 kPa [50 to 100 psi].

1.3 The CLSM used to make the molded specimens shall be sampled after all on-site adjustments have been made to the mixture proportions, including the addition of mix water and any admixtures.

1.4 This test method may be used to prepare and test cylindrical specimens of other mixtures of soil and cementitious materials, such as self-cementing fly ashes.

1.5 CLSM is also known as flowable fill, controlled density fill, soil-cement slurry, soil-cement grout, unshrinkable fill, and other similar names.

1.6 *Units*—The values stated in 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 nonconformance with the standard.

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

1.7 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

¹ This test method is 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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1.7.1 For purposes of comparing, a measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

1.7.2 The procedures used to specify how data are collected/recorded and calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that should generally be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.8 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. See Section 7.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C125 Terminology Relating to Concrete and Concrete Aggregates

C192/C192M Practice for Making and Curing Concrete Test

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.

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



Specimens in the Laboratory

- C470/C470M** Specification for Molds for Forming Concrete Test Cylinders Vertically
- C617/C617M** Practice for Capping Cylindrical Concrete Specimens
- C1231/C1231M** Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens
- D653** Terminology Relating to Soil, Rock, and Contained Fluids
- D2166/D2166M** Test Method for Unconfined Compressive Strength of Cohesive Soil
- D3740** Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D5971/D5971M** Practice for Sampling Freshly Mixed Controlled Low-Strength Material
- D6023** Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM)
- D6024/D6024M** Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application
- D6026** Practice for Using Significant Digits and Data Records in Geotechnical Data
- D6103/D6103M** Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

3. Terminology

3.1 Definitions:

3.1.1 For definitions of common technical terms in this standard, refer to Terminology **C125** and **D653**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *Controlled Low Strength Material (CLSM), n*—a mixture of soil, aggregates (sand, gravel, or both), cementitious materials, water, and sometimes admixtures, that hardens into a material with a higher strength than the soil but less than about 8400 kPa [1200 psi].

3.2.1.1 *Discussion*—CLSM can be placed as a slurry, a mortar, or a compacted material and typically has strengths of 350 to 700 kPa [50 to 100 psi] for most applications.

4. Summary of Test Method

4.1 CLSM cylindrical specimens are tested to determine the compressive strength. The specimens are prepared by pouring a representative CLSM sample into molds, then depending on the strength development, either curing the specimens then removing them from the molds or removing the molds prior to curing the specimens, and preparing the specimens for compression testing. The specimens are then tested to obtain compressive strengths. Duplicate specimens are required for each test age specified.

5. Significance and Use

5.1 This test method provides standardized requirements for the preparation, curing, transporting and testing of test specimens of CLSM under field conditions by replicating a “field cure” of the material.

5.1.1 If the specimens are field cured, as stipulated herein, the resulting compressive strength test data may be used for the following purposes:

5.1.1.1 Acceptance testing for specified strength,

5.1.1.2 Checking the adequacy of mixture proportions for strength,

5.1.1.3 Quality control,

5.1.1.4 Determining if the material can be put in service,

5.1.1.5 Adequacy of curing.

5.2 Compressive strength testing is performed to assist in the design of the mix and to serve as a quality control technique during construction. Mix design is typically based on 28-day strengths and construction control tests performed 7 days after placement. The compressive strength(s) and other test age(s) will vary according to the requirements for the end product. Additional information on the use and history of CLSM is contained in **Appendix X1**.

5.3 This test is one of a series of quality control tests that can be performed on CLSM during construction to monitor compliance with specification requirements. The other tests that can be used during construction control of CLSM are Practice **D5971/D5971M** and Test Methods **D6023**, **D6024/D6024M**, and **D6103/D6103M**.

5.4 There are many other combinations of soil, cement, fly ash (cementitious or not), admixtures, water or other materials that could be tested using this method. The mixtures will vary depending on the intended use, availability of materials, and placement requirements.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice **D3740** are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice **D3740** does not in itself assure reliable results. Reliable results depend on many factors; Practice **D3740** provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Single-Use Cylindrical Molds*—Plastic single-use 150 × 300 mm [6 × 12 in.] or 100 × 200 mm [4 × 8 in.] cylindrical molds with tight-fitting lids (see **Note 4** regarding cautionary statement for “air-tight” lids), conforming to Specification **C470/C470M**. Other sizes and types of molds may be used as long as the length to diameter ratio is at least 2.0 to 1.0 and no greater than 2.5 to 1.0. The 150 × 300 mm [6 × 12 in.] molds are sometimes preferred because of the low strength of the material and the larger surface area of the ends of the specimens.

6.1.1 Mold removal can be accomplished using one or a combination of the following procedures. Select a procedure that avoids disturbance and damage to the specific mix being tested.

6.1.1.1 Apply air pressure to the bottom of the specimen through a small hole in the bottom of the mold. The pressure shall be low enough to avoid damage to the test specimen. Drilling the hole in the mold shall be accomplished in a manner that avoids damage to the specimen.