



Designation: C 1480 – 00 (Reapproved 2005)

## Standard Specification for Packaged, Pre-Blended, Dry, Combined Materials for Use in Wet or Dry Shotcrete Application<sup>1</sup>

This standard is issued under the fixed designation C 1480; 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 specification covers laboratory performance standards for pre-blended, dry, packaged, combined materials for use in wet or dry shotcrete applications that are delivered to a purchaser with the ingredients uniformly mixed. The use of supplemental materials, placement, curing, or protection of the shotcrete after delivery to the purchaser is not addressed by this specification.

1.2 The values stated in SI units shall be regarded as the standard. The inch-pound values in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test method portion of this specification: *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:*<sup>2</sup>

- C 78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- C 150 Specification for Portland Cement
- C 387 Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
- C 595 Specification for Blended Hydraulic Cements
- C 1012 Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
- C 1140 Practice for Preparing and Testing Specimens from Shotcrete Test Panels
- C 1157 Performance Specification for Blended Hydraulic Cement
- C 1202 Test Method for Electrical Indication of Concrete's

<sup>1</sup> This specification is under the jurisdiction of ASTM committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.46 on Shotcrete.

Current edition approved May 1, 2005. Published June 2005. Originally approved in 2000. Last previous edition approved in 2000 as C 1480 – 00.

<sup>2</sup> 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.

### Ability to Resist Chloride Ion Penetration

C 1385/C 1385M Practice for Sampling Materials for Shotcrete

C 1399 Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete

C 1436 Specification for Materials for Shotcrete

E 96 Test Methods for Water Vapor Transmission of Materials

2.2 *ACI Documents:*

506.2 Specification for Shotcrete<sup>3</sup>

506R Guide to Shotcrete<sup>3</sup>

CP-60 Craftsman Workbook, ACI Certification Program for Shotcrete Nozzleman<sup>3</sup>

2.3 *National Institute of Standards and Technology: Handbook 44* Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing Devices<sup>4</sup>

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Packaged, pre-blended, dry, combined materials*—for use in wet or dry shotcrete applications consist primarily of hydraulic cement and concrete aggregates blended, in a dry state, with other ingredients to enhance one or more properties of the mixture.

### 4. Classification

4.1 Dry packaged shotcrete materials are categorized as to type and grade.

4.1.1 Shotcrete type is based on aggregate size.

4.1.2 Type FA shotcrete shall contain aggregate in accordance with the requirements of Specification C 1436C 1436 Grading #1. Aggregates failing to comply with Grading #1 can be used only if preconstruction testing proves that they give satisfactory results or if acceptable service records are available.

4.1.3 Type CA shotcrete shall contain coarse and fine aggregates in accordance with the requirements of Specification C 1436C 1436, Grading No. 2. Aggregates failing to

<sup>3</sup> Available from American Concrete Institute, P.O. Box 9094, Farmington Hills, Michigan 48333

<sup>4</sup> Available from National Institute of Standards and Technology (NIST), Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

comply with Grading #2 can be used only if preconstruction testing proves that they give satisfactory results or if acceptable service records are available.

4.2 Shotcrete grade is based on the desired physical properties of the material.

4.2.1 Grade GU shotcrete is a general use product.

4.2.2 Grade SR shotcrete has sulfate resistance in accordance with the requirements of 7.4

4.2.3 Grade LP shotcrete has permeability values in accordance with the requirements of 7.5

4.2.4 Grade FR shotcrete has average residual strength values in accordance with the requirements of 7.6, Type I or II.

4.2.4.1 Class I shotcrete has average residual strength values in accordance with the requirements of 7.6.1.

4.2.4.2 Class II shotcrete has flexural strength and average residual strength values in accordance with the requirements of 7.6.2.

NOTE 1—Grade FR Class I shotcrete is intended to minimize plastic shrinkage cracking. Grade FR Class 2 shotcrete is intended to provide a minimum level of post-crack flexural load capacity for hardened shotcrete.

## 5. Ordering Information

5.1 The purchaser shall specify the type, grade, and class (if applicable) of shotcrete required.

NOTE 2—A single material may meet more than one grade. Other properties may be specified by the purchaser, but are beyond the scope of this specification.

5.2 At the request of the purchaser, the producer shall, prior to delivery, furnish laboratory performance data satisfactory to the purchaser that the product meets the specified type and grades.

## 6. Materials and Manufacture

6.1 Basic materials shall meet the requirements of Specification C 1436C 1436.

6.2 Additional materials shall be permitted only if adequate test data are available to insure that the ingredient has no deleterious effects on the specified properties.

6.3 Aggregates shall be dried, without disintegration, to a moisture content of less than 0.2 mass percent, computed on material dried substantially to constant mass at 105 to 110 °C (210 to 230 °F).

6.4 *Measurement of Materials*—Measure materials in accordance with 6.4.1-6.4.4.

6.4.1 Cementitious materials and aggregates shall be measured by mass (or by volume). Volumetric measurement shall be calibrated by mass.

6.4.2 Scales for batching ingredients shall conform to the applicable section of the current edition of the National Institute of Standards and Technology Handbook 44 Specifications, Tolerance, and Other Technical Requirements for Commercial Weighing Devices.

6.4.3 Measure fibers by mass.

6.4.4 Measure admixtures by mass or volume.

6.5 Shotcrete ingredients shall be thoroughly blended at a central location. Mixer performance tests shall be performed to establish the mixing time suitable for uniformity of mixing.

Representative samples shall be obtained in accordance with Practice C 1385/C 1385M C 1385/C 1385M.

6.6 *Delivery*—Unless otherwise specified, delivery of the shotcrete materials shall conform to 6.6.1-6.6.3.

6.6.1 Thoroughly mix and deliver to the construction site materials without segregation or lumps of ingredients.

6.6.2 Temperature of pre-blended, dry, combined materials for shotcrete at time of delivery shall not exceed 65 °C (149 °F).

6.6.3 Delivery shall be in any size package as agreed between the purchaser and producer.

## 7. Physical Requirements

7.1 Type FA shotcrete shall meet the requirements of Table 1 when mixed and tested in accordance with the procedure for mixing and testing high strength mortar in accordance with Specification C 387C 387.

7.2 Type CA shotcrete shall meet the requirements of Table 1 when mixed and tested in accordance with the procedures for mixing and testing normal strength concrete in accordance with Specification C 387C 387.

7.3 Grade GU shotcrete shall meet the general requirements for type FA or type CA shotcrete.

7.4 Grade SR shotcrete shall have sulfate resistance as determined in one of the following ways:

7.4.1 Product shall be prepared with a cement meeting Specification C 150C 150 types II or V, Specification C 595C 595 cements with an MS designation or Performance Specification C 1157C 1157 types MS or HS

7.4.2 Product shall exhibit an expansion of less than 0.1 % at 180 days when tested in accordance with applicable portions of Test Method C 1012C 1012. Samples for testing shall be mixed and placed in accordance with this specification.

7.4.3 In Test Method C 1012C 1012 the samples are normally prepared at a fixed water content using standard sand. Those portions of the method will not apply in this case

7.5 Grade LP shotcrete shall have a chloride penetrability rating of “very low” (< 1000 coulombs) when tested at an age of 28 days in accordance with Test Method C 1202C 1202. Specimens for the test shall be either from laboratory prepared samples mixed and placed in accordance with this specification or from field samples obtained in accordance with method Practice C 1140C 1140 and Test Method C 1202C 1202.

NOTE 3—Due to the potential differences between laboratory and field conditions it may be necessary to test field samples in order to verify performance with the applied material specifications. See appendix for a discussion of expected field performance vs. laboratory performance for wet mix vs. dry mix shotcrete.

**TABLE 1 Physical Requirements**

| Property                          | Requirement for Type FA | Requirement for Type CA  |
|-----------------------------------|-------------------------|--------------------------|
| Flow                              | 105 to 115              | - - -                    |
| Slump                             | - - -                   | 50 to 75 mm (2 to 3 in.) |
| 7 day Compressive strength (min)  | 21.0 MPa (3050 psi)     | 21.0 MPa (3050 psi)      |
| 28 day Compressive Strength (min) | 35.0 MPa (5075 psi)     | 35.0 MPa (5075 psi)      |