



Designation: C 1077 – 00

## Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation<sup>1</sup>

This standard is issued under the fixed designation C 1077; 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 ( $\epsilon$ ) 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 practice identifies and defines the duties, responsibilities, and minimum technical requirements of testing laboratory personnel and the minimum technical requirements for laboratory equipment utilized in testing concrete and concrete aggregates for use in construction.

1.2 This practice provides criteria for the evaluation of the capability of a testing laboratory to perform designated ASTM test methods on concrete and concrete aggregates. It can be used by an accrediting agency in the accreditation of a laboratory or by other parties to determine if the laboratory is qualified to conduct the specified tests.

1.3 If the laboratory requires external technical services to conduct tests, the external agency shall be subject to separate evaluation.

1.4 *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:

- C 29/C 29M Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate<sup>2</sup>
- C 31 Practice for Making and Curing Concrete Test Specimens in the Field<sup>2</sup>
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens<sup>2</sup>
- C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete<sup>2</sup>
- C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete<sup>2</sup>
- C 70 Test Method for Surface Moisture in Fine Aggregate<sup>2</sup>
- C 78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)<sup>2</sup>

- C 87 Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar<sup>2</sup>
- C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate<sup>2</sup>
- C 116 Test Method for Compressive Strength of Concrete Using Portions of Beams Broken in Flexure<sup>2</sup>
- C 117 Test Method for Material Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing<sup>2</sup>
- C 123 Test Method for Lightweight Pieces in Aggregate<sup>2</sup>
- C 125 Terminology Relating to Concrete and Concrete Aggregates<sup>2</sup>
- C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate<sup>2</sup>
- C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate<sup>2</sup>
- C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine<sup>2</sup>
- C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates<sup>2</sup>
- C 138 Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete<sup>2</sup>
- C 142 Test Method for Clay Lumps and Friable Particles in Aggregates<sup>2</sup>
- C 143 Test Method for Slump of Hydraulic Cement Concrete<sup>2</sup>
- C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete<sup>2</sup>
- C 172 Practice for Sampling Freshly Mixed Concrete<sup>2</sup>
- C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method<sup>2</sup>
- C 174 Test Method for Measuring Length of Drilled Concrete Cores<sup>2</sup>
- C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory<sup>2</sup>
- C 215 Test Method for Fundamental Transverse, Longitudinal and Torsional Frequencies of Concrete Specimens<sup>2</sup>
- C 227 Test Method for Potential Alkali Reactivity of Cement–Aggregate Combinations (Mortar-Bar Method)<sup>2</sup>
- C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method<sup>2</sup>
- C 232 Test Methods for Bleeding of Concrete<sup>2</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.98 on Evaluation of Laboratories.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

- C 234 Test Method for Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel<sup>2</sup>
- C 289 Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)<sup>2</sup>
- C 293 Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)<sup>2</sup>
- C 295 Guide for Petrographic Examination of Aggregates for Concrete<sup>2</sup>
- C 341 Test Method for Length Change of Drilled or Sawed Specimens of Hydraulic-Cement Mortar and Concrete<sup>2</sup>
- C 403 Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance<sup>2</sup>
- C 418 Test Method for Abrasion Resistance of Concrete by Sandblasting<sup>2</sup>
- C 441 Test Method for Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction<sup>2</sup>
- C 457 Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete<sup>2</sup>
- C 469 Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression<sup>2</sup>
- C 470 Specification for Molds for Forming Concrete Test Cylinders Vertically<sup>2</sup>
- C 495 Test Method for Compressive Strength of Lightweight Insulating Concrete<sup>2</sup>
- C 496 Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens<sup>2</sup>
- C 511 Specification for Moist Cabinets, Moist Rooms and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes<sup>3</sup>
- C 512 Test Method for Creep of Concrete in Compression<sup>2</sup>
- C 535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine<sup>2</sup>
- C 566 Test Method for Total Moisture Content of Aggregate by Drying<sup>2</sup>
- C 567 Test Method for Unit Weight of Structural Lightweight Concrete<sup>2</sup>
- C 586 Test Method for Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)<sup>2</sup>
- C 597 Test Method for Pulse Velocity Through Concrete<sup>2</sup>
- C 617 Practice for Capping Cylindrical Concrete Specimens<sup>2</sup>
- C 641 Test Method for Staining Materials in Lightweight Concrete Aggregates<sup>2</sup>
- C 642 Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete<sup>2</sup>
- C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing<sup>2</sup>
- C 671 Test Method for Critical Dilation of Concrete Specimens Subjected to Freezing<sup>2</sup>
- C 672 Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals<sup>2</sup>
- C 682 Practice for Evaluation of Frost Resistance of Coarse Aggregates in Air-Entrained Concrete by Critical Dilation Procedures<sup>2</sup>
- C 684 Test Method of Making, Accelerated Curing, and Testing of Concrete Compression Test Specimens<sup>2</sup>
- C 702 Practice for Reducing Samples of Aggregate to Testing Size<sup>2</sup>
- C 779 Test Method for Abrasion Resistance of Horizontal Concrete Surfaces<sup>2</sup>
- C 801 Test Method for Determining the Mechanical Properties of Hardened Concrete Under Triaxial Loads<sup>2</sup>
- C 802 Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials<sup>2</sup>
- C 803 Test Method for Penetration Resistance of Hardened Concrete<sup>2</sup>
- C 805 Test Method for Rebound Number of Hardened Concrete<sup>2</sup>
- C 823 Practice for Examination and Sampling of Hardened Concrete in Constructions<sup>2</sup>
- C 856 Practice for Petrographic Examination of Hardened Concrete<sup>2</sup>
- C 873 Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds<sup>2</sup>
- C 876 Test Method for Half-Cell Potentials of Uncoated Reinforcing Steel in Concrete<sup>2</sup>
- C 900 Test Method for Pullout Strength of Hardened Concrete<sup>2</sup>
- C 918 Test Method for Measuring Early-Age Compressive Strength and Projecting Later-Age Strength<sup>2</sup>
- C 944 Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method<sup>2</sup>
- C 1040 Test Methods for Density of Unhardened and Hardened Concrete In Place by Nuclear Methods<sup>2</sup>
- C 1064 Test Method for Temperature of Freshly Mixed Portland Cement Concrete<sup>2</sup>
- C 1074 Practice for Estimating Concrete Strength by the Maturity Method<sup>2</sup>
- C 1084 Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete<sup>2</sup>
- C 1105 Test Method for Length Change of Concrete Due to Alkali-Carbonate Rock Reaction<sup>2</sup>
- C 1137 Test Method for Degradation of Fine Aggregate Due to Attrition<sup>2</sup>
- C 1138 Test Method for Abrasion Resistance of Concrete (Underwater Method)<sup>2</sup>
- C 1150 Test Method for the Break-Off Number of Concrete<sup>2</sup>
- C 1152 Test Method for Acid-Soluble Chloride in Mortar and Concrete<sup>2</sup>
- C 1202 Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration<sup>2</sup>
- C 1218 Test Method for Water-Soluble Chloride in Mortar and Concrete<sup>2</sup>

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.01.

C 1231 Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders<sup>2</sup>

D 75 Practice for Sampling Aggregates<sup>4</sup>

D 2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate<sup>4</sup>

E 4 Practices for Force Verification of Testing Machines<sup>5</sup>

E 11 Specification for Wire-Cloth Sieves for Testing Purposes<sup>6</sup>

### 2.2 ACI Standards:

ACI 214-77 Recommended Practice for Evaluation of Strength Test Results of Concrete<sup>7</sup>

SP-19 (116R) Cement and Concrete Terminology<sup>7</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *evaluation authority*—an independent entity, apart from the organization being evaluated, that can provide an unbiased evaluation of that organization. The entity must have the capability to assess the professional and technical activities of concrete and concrete aggregate testing laboratories.

3.1.1.1 *Discussion*—Laboratory inspection services are provided by the Cement and Concrete Reference Laboratory (CCRL).<sup>8</sup> Laboratory inspection is broadened into accreditation programs by such independent authorities as the National Voluntary Laboratory Accreditation Program (NVLAP),<sup>9</sup> American Association for Laboratory Accreditation (AALA)<sup>10</sup>, Construction Materials Engineering Council (CMEC)<sup>11</sup>, AASHTO Accreditation Program (AAP)<sup>12</sup> and other recognized agencies as may be established.

3.1.2 *external technical services*—those services required by a testing laboratory that are provided by another organization.

3.1.3 *field technician*—an employee of the laboratory who is assigned to perform sampling and testing functions outside the laboratory.

3.1.4 *laboratory technician*—an employee of the laboratory who is assigned to perform the actual testing operations primarily conducted in the laboratory.

3.1.5 *quality systems*—those internal procedures and practices that a laboratory utilizes to ensure continued compliance with applicable testing standards for concrete and concrete aggregates.

3.1.6 *testing laboratory*—an organization that measures, examines, performs tests, or otherwise determines the charac-

teristics or performance of materials or products. This may include organizations that offer commercial testing services, an in-house quality control function, an academic institution, or any other organization providing the required testing services.

3.1.7 Additional definitions can be found in Terminology C 125, Practices E 4, and ACI SP-19.

## 4. Significance and Use

4.1 The testing and inspection of concrete and concrete aggregates are important elements in obtaining quality construction. A testing laboratory specializing in these services must be selected with care.

4.2 A testing laboratory shall be deemed qualified to perform and report the results of its tests if the laboratory meets the requirements of this practice. The testing laboratory services shall be provided under the technical direction of a registered professional engineer.

4.3 This practice establishes essential characteristics pertaining to the organization, personnel, facilities, and quality systems of the laboratory. This practice may be supplemented by more specific criteria and requirements for particular projects.

## 5. Organization

5.1 The following information shall be readily available for review:

5.1.1 Description of the organization, including:

5.1.1.1 Complete legal name and address of the main office and each laboratory location,

5.1.1.2 Names and positions of the principal officers and the responsible, registered professional engineer in charge, and

5.1.1.3 Description of the organization management structure.

5.1.2 Listing of the relevant technical services offered, and

5.1.3 All external technical services normally utilized.

5.2 The laboratory shall designate an individual with access to management who has the responsibility of seeing that procedures required in this document are being carried out.

## 6. Human Resources

6.1 Information shall be made available to substantiate personnel qualifications as follows:

6.1.1 All relevant testing services are provided under the full-time technical direction of a registered professional engineer with at least 5 years experience in construction materials testing.

6.1.2 Supervising laboratory technicians shall possess a minimum of 3 years relevant experience and current technician certification. The technician certification program must include a written examination and performance evaluation of relevant tests. Relevant tests which must be covered by the certification program are: Practice C 31, Test Methods C 39, C 40, C 117, C 127, C 128, C 136, C 138, C 143, Practice C 172, Test Methods C 173, C 231 and Practice C 1064. The certification requirement is satisfied by being certified as (1) both an ACI Concrete Laboratory Testing Technician-Grade 1 and an ACI Concrete Field Testing Technician-Grade 1, or (2) a NICET Construction Materials Testing - Concrete Level 1 Engineering Technician or higher, or (3) by an equivalent certification program.

<sup>4</sup> Annual Book of ASTM Standards, Vol 04.03.

<sup>5</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>6</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>7</sup> Available from American Concrete Institute, P.O. Box 9094, Farmington Hills, MI 48333.

<sup>8</sup> CCRL, National Institute of Standards and Technology, Bldg. 226, Rm. A365, Gaithersburg, MD 20899.

<sup>9</sup> NVLAP, National Institute of Standards and Technology, Bldg. 820, Rm. 282, Gaithersburg, MD 20899.

<sup>10</sup> American Association for Laboratory Accreditation, Quince Orchard, Gaithersburg, MD 20878.

<sup>11</sup> Construction Materials Engineering Council, 649 Vassar St., Orlando, FL 32804.

<sup>12</sup> American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capital St. NW, Suite 225, Washington, DC 20001.