ACI 311.6M-09

Specification for Ready Mixed Concrete Testing Services

An ACI Standard

Reported by ACI Committee 311

American Concrete Institute®

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Advancing concrete knowledge

Specification for Ready Mixed Concrete Testing Services

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This Reference Specification covers Testing Agency requirements for field and laboratory testing of ready mixed concrete delivered to the project. It is intended for use by specifiers, architects, engineers, owners, contractors, and other groups interested in monitoring the quality of concrete used in project construction. This Reference Specification can be made applicable to any construction project by citing it in a Contract. The Specifier supplements the provisions of this Reference Specification as needed by specifying individual project requirements in the Contract.

Keywords: air content; laboratory; ready mixed concrete; sampling; slump; specification; technician; temperature; testing; unit weight.

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(mandatory portion follows)

ACI 311.6M-09 was adopted October 6, 2009 and published December 2009.

(mandatory portion follows)

SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 *Work specified*—This specification sets the minimum requirements for testing of ready mixed concrete at the project site when specific field-measured properties and laboratory-measured compressive strength are used as a basis for acceptance of concrete as delivered to the site. It includes requirements for making and curing test specimens, performing field and laboratory tests, and qualifying personnel and laboratories performing these tests. Testing services required in this specification shall be completed by a Testing Agency engaged by the Owner. The Testing Agency must be independent from conflicts of interest that may affect objective reporting of the testing services.

1.1.2 *Work not specified*—This specification does not apply to testing requirements and responsibilities required of the construction Contractor.

1.1.3 *Project Documents*—The Testing Agency shall provide the tests and reports defined by the Project Specifications supplied by the Owner or Owner's representative.

1.2—Qualifications

1.2.1 The Testing Agency shall submit qualifications of field technicians and laboratory testing technicians, as defined in Sections 1.2.1.1 to 1.2.1.2, to Owner or Owner's representative.

1.2.1.1 *Field technician*—Technicians conducting field tests of concrete shall be certified as ACI Concrete Field Testing Technician – Grade I, unless otherwise specified.

1.2.1.2 *Laboratory technician*—Technicians conducting laboratory testing shall be certified as ACI Concrete Laboratory Testing Technician – Level 1 or ACI Concrete Strength Testing Technician, unless otherwise specified.

1.2.2 *Testing Agency*—The Owner or the Owner's representative shall not delegate these services to the Construction Contractor. The Testing Agency shall meet the requirements of ASTM E329 and be accredited in accordance with the requirements of ASTM C1077. Unless otherwise specified, the Testing Agency shall be accredited by one or more of the following: the AASHTO Accreditation Program (AAP), the National Voluntary Laboratory Accreditation Program (NVLAP), the American Association for Laboratory Accreditation (A2LA), the International Accreditation Service (IAS), the Construction Materials Engineering Council (CMEC), or the Washington Area Council of Engineering Laboratories (WACEL).

1.3—Definitions

accreditation—the act or result of having a Testing Agency's quality procedures, equipment calibration, and personnel reviewed and approved by an independent third-party agency.

certification—the act of having an individual's skills and knowledge of a certain subject tested and verified by an independent third-party agency.

Contract—the professional agreement between the Owner and Testing Agency for provisions of testing services.

Contract Documents—a set of documents supplied by Owner to Contractor as the basis for testing; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.

Contractor—as used in this document, the person, firm, or entity under contract for testing services.

Owner—the corporation, association, partnership, individual, public body, or authority for whom the testing services are performed.

Project Specification—the written document that details requirements for the Work in accordance with service parameters and other prescriptive or performance criteria.

Testing Agency—the firm or entity under contract for providing testing services.

Work—the entire construction or separately identifiable parts thereof required to be furnished as described in the Contract Documents.

1.4—Referenced standards

Standards of ASTM referred to in this specification are listed with serial designation and are part of this specification. The latest edition of the ASTM standard shall be used unless otherwise specified in Contract Documents.

C31M	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C138M	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C143M	Standard Test Method for Slump of Hydraulic-Cement Concrete
C172	Standard Practice for Sampling Freshly Mixed Concrete
C173M	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C511	Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
C1064M	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
C1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

These publications may be obtained from:

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428
www.astm.org

1.5—Certification and accreditation organizations

1.5.1 *Certification organization*—The following certification organization referred to in this specification is listed with contact information.

American Concrete Institute
PO Box 9094
Farmington Hills, MI 48843-9094
www.concrete.org

1.5.2 *Accreditation organizations*—The following accreditation organizations referred to in this specification are listed with contact information.

AASHTO Accreditation Program (AAP)
AASHTO Materials Reference Laboratory (AMRL)
National Institute of Standards and Technology
100 Bureau Drive, Stop 8619
Gaithersburg, MD 20899-8619
http://www.amrl.net

The American Association for Laboratory Accreditation (A2LA)
5301 Buckeystown Pike, Suite 350
Frederick, MD 21704
www.a2la.org

Construction Materials Engineering Council (CMEC)
850 Courtland St. Suite B
Orlando, FL 32804
www.cmec.org

International Accreditation Service (IAS)
5360 Workman Mill Road
Whittier, CA 90601
www.iasonline.org

National Voluntary Laboratory Accreditation Program (NVLAP)
Standards Services Division
National Institute of Standards and Technology
100 Bureau Drive, Stop 2140
Gaithersburg, MD 20899-2140
http://ts.nist.gov/Standards/accreditation/index.cfm

Washington Area Council of Engineering Laboratories, Inc.
7508 Wisconsin Avenue, 4th Floor
Bethesda, MD 20814
www.wacel.org

1.6—Units of measurement

Values in this specification are stated in SI units. A companion specification in inch-pound units is also available.

SECTION 2—TESTING OF READY MIXED CONCRETE

2.1—Sampling

Sample the ready mixed concrete for testing required in this specification in accordance with ASTM C172 unless otherwise specified.

2.2—Frequency of sampling and testing

2.2.1 Tests found in 2.3.1 through 2.3.4 shall be performed and strength test specimens shall be obtained per requirements of 2.3.6 and tested according to requirements of 2.3.5, at least once for each 76 m^3, or fraction thereof, for each class of concrete placed in any one day.

2.2.2 Tests 2.3.1 through 2.3.4 shall be performed on the initial delivery of each class of concrete delivered to the project each day, and if a concrete mixture is adjusted, on the first adjusted delivery, unless otherwise specified.

2.3—Tests

2.3.1 *Slump test*—ASTM C143M
2.3.2 *Temperature test*—ASTM C1064M
2.3.3 *Air content test*—ASTM C173M or C231
2.3.4 *Density (unit weight) test*—ASTM C138M
2.3.5 *Compressive strength test*—ASTM C39M
2.3.6 *Making compressive strength specimens*—ASTM C31M

2.4—Number of strength test specimens

An acceptance strength test set consists of a minimum of two 150 x 300 mm specimens or three 100 x 200 mm specimens to be tested at the age of 28 days, unless otherwise specified.

2.5—Curing of strength test specimens

2.5.1 *Initial curing*—Owner or Owner's representative will provide and maintain adequate facilities on the project site for initial storage and curing of the concrete specimens, unless otherwise specified. Specimens shall be stored under conditions that meet the requirements of ASTM C31M and shall be verified by Testing Agency. Such storage shall have temperature controls to maintain ASTM C31M temperature requirements. Calibrated temperature recording devices shall be used to record daily maximum and minimum temperatures of the initial curing environment.

2.5.2 *Transportation*—Testing Agency will recover and transport concrete specimens in accordance with ASTM C31M.

2.5.3 *Final curing*—Final curing of strength test specimens shall be done in accordance with ASTM C31M and C511 until time of test.

2.6—Testing for strength

Determine compressive strengths of cylinders in accordance with 2.3.5.

SECTION 3—SUBMITTALS

3.1—Scope

The Testing Agency's scope of authority, the requirements for submittal of reports (timelines, methods of delivery and distribution list), and the procedure for notification of deficiencies (methods of delivery, timelines and distribution list), and required observations shall be defined in the Contract with the Owner before the start of the project.

3.2—Reports

3.2.1 *Daily report*—The Testing Agency shall submit daily reports that document the results of field concrete tests performed in accordance with Section 2.2 and distributed in accordance with Section 3.1, unless otherwise specified.

3.2.2 *Nonconformance report*—Deficient items shall be communicated in a nonconformance report to the distribution list established in accordance with Section 3.1. Unless otherwise

stated in the Contract Documents, a nonconformance report shall be issued within 24 hours for any concrete found deficient.

3.2.3 *Final report*—A final field report and a laboratory report per ASTM test standards shall be provided to the distribution list within a time established in accordance with Section 3.1.

3.3—Report information

Reports shall include accepted portions of 3.3.1 through 3.3.12, and information required by ASTM test methods referenced in Section 2.3:

3.3.1 Project name

3.3.2 Client name

3.3.3 Concrete supplier

3.3.4 Date and time of sampling and field testing

3.3.5 Dates that strength test specimens will be tested

3.3.6 Name of field and laboratory technicians and certification numbers

3.3.7 Delivery truck number, ticket, mixture designation, and locations of sampling

3.3.8 Results of air content, temperature, slump, and density (unit weight) tests

3.3.9 Specified compressive strength of concrete and the designated test age

3.3.10 Location of placement represented by the strength test specimens

3.3.11 Location of sampled concrete within the placement

3.3.12 Report maximum and minimum temperatures of the curing environment during the initial curing period

(nonmandatory portion follows)

NOTES TO SPECIFIER

General notes

G1. ACI Specification 311.6M-09 is to be used by reference or incorporation in its entirety in the Contract for testing services. Do not copy individual Sections, Parts, Articles, or Paragraphs into a Contract, because taking them out of context may change their meaning.

G2. If Sections or Parts of ACI Specification 311.6M-09 are copied into a Contract or any other document, do not refer to them as an ACI Specification, because the specification has been altered.

G3. A statement such as the following will serve to make ACI Specification 311.6M-09 a part of a Contract:

"Testing services for (this Contract) shall conform to all requirements of ACI 311.6M-09 published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by this Contract."

G4. Each technical Section of ACI Specification 311.6M-09 is written in the three-part Section format of the Construction Specifications Institute, as adapted for ACI requirements. The language is imperative and terse.

G5. ACI Specification 311.6M-09 is written to the Testing Agency and is to be used by the Owner or the Owner's representative to specify the concrete testing on a project. When a provision of this specification requires action on the Testing Agency's part, the verb "shall" is used. If the Testing Agency is allowed to exercise an option when limited alternatives are available, the phrasing "either... or..." is used. Statements provided in the specification as information to the Testing Agency use the verbs "may" or "will." Informational statements typically identify activities or options that "will be taken" or "may be taken" by the Owner or Owner's representative.

FOREWORD TO CHECKLISTS

F1. This Foreword is included for explanatory purposes only; it does not form a part of ACI Specification 311.6M-09.

F2. ACI Specification 311.6M-09 may be referenced by the Specifier in the Contract for any building project, together with supplementary requirements for the specific project. Responsibilities for project participants must be defined in the Contract. ACI Specification 311.6M-09 cannot and does not address responsibilities for any project participant other than the Testing Agency.

F3. Checklists do not form a part of ACI Specification 311.6M-09. Checklists assist the Specifier in selecting and specifying project requirements in the Contract.

F4. The Mandatory Requirements Checklist indicates work requirements regarding specific qualities, procedures, materials, and performance criteria that are not defined in ACI Specification 311.6M-09. The Specifier must include these requirements in the Contract.

F5. The Optional Requirements Checklist identifies Specifier choices and alternatives. The Checklist identifies the Sections, Parts, and Articles of the ACI Reference Specification 311.6M-09 and the action required or available to the Specifier. The Specifier should review each of the items in the Checklist and make adjustments to the needs of a particular project by including those selected alternatives as mandatory requirements in the Contract.

F6. The Submittals Checklist identifies information or data to be provided by the Testing Agency before, during, or after construction.

F7. *Recommended references*—Documents and publications that are referenced in the Checklists of ACI Specification 311.6M-09 are listed below. These references provide guidance to the Specifier and are not considered to be part of ACI Specification 311.6M-09.

American Concrete Institute

CP-1	Technician Workbook for ACI Certification of Concrete Field Testing Technician – Grade I
CP-16	Technician Workbook for ACI Certification of Concrete Laboratory Testing Technician – Grade I
CP-19	Technician Workbook for ACI Certification of Concrete Strength Testing Technician
CP-44	Technician Workbook for ACI Certification of Aggregate Testing Technician – Level 1

The above publications may be obtained from:

American Concrete Institute
PO Box 9094
Farmington Hills, MI 48333-9094
www.concrete.org

MANDATORY REQUIREMENTS CHECKLIST

Section/Part/Article	Notes to Specifier
2.4	Specify cylinder specimen size.
3.1	Specify Testing Agency's scope of authority, the requirements for submittal of reports (timeliness, methods of delivery, and distribution list), procedures for notification of deficiencies, and required observations.
3.2.1	Specify if daily reports are not required and if summaries are required and their frequencies.

OPTIONAL REQUIREMENTS CHECKLIST

Section/Part/Article	Notes to Specifier
1.2.1.1	Other field technician certifications equivalent to ACI Concrete Field Testing Technician – Grade I (ACI CP-1) may be specified. Equivalent certification should include written and performance examinations to relevant standards as accepted by the accreditation agency.
1.2.1.2	Other laboratory technician certifications equivalent to ACI Concrete Laboratory Technician – Grade I (ACI CP-16) or Level 1 (ACI CP-44) or ACI Concrete Strength Testing Technician (ACI CP-19) may be specified. Equivalent certification should include written and performance examinations to relevant standards as accepted by the accreditation agency.
1.2.2	Laboratory accreditations equivalent may be specified.
2.1	Specify when ASTM C172 is not applicable and job conditions allow only one portion to be taken as a sample. When concrete is delivered to the project in any method other than as specified by ASTM C172, specify the sample points and locations. For concrete delivered by mechanical conveyance such as pump systems, take samples at the point of discharge from the final conveyance unless correlation tests indicate that the concrete properties do not significantly change from those tested at the truck discharge. Specify parameters for correlation tests.
2.2.1	Specify when sampling frequency must be increased or decreased due to the specific scope of the project.
2.2.2	Specify if these tests will only be taken during acceptance cylinder sampling or on each delivery.
2.4	Specify number and age of test for acceptance cylinders. Specify what additional test cylinders and ages of tests are needed for early strength indication, formwork removal, field curing, or others.
2.5.1	Specify when the construction Contractor will be responsible for the facilities construction and maintenance. The Testing Agency is responsible only for verification of proper facilities and temperatures.

SUBMITTALS CHECKLIST

Section/Part/Article	Submittal items and notes to Specifier
1.2.1.1	Documentation of current field technician certification for required testing.
1.2.1.2	Documentation of current laboratory technician certification for required testing.
1.2.2	Documentation of current Inspection Agency/Laboratories Accreditation Certifications.
3.2.1	Daily field reports.
3.2.2	Nonconformance reports.
3.2.3	Final reports.

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Advancing concrete knowledge

As ACI begins its second century of advancing concrete knowledge, its original chartered purpose remains "to provide a comradeship in finding the best ways to do concrete work of all kinds and in spreading knowledge." In keeping with this purpose, ACI supports the following activities:

- Technical committees that produce consensus reports, guides, specifications, and codes.
- Spring and fall conventions to facilitate the work of its committees.
- Educational seminars that disseminate reliable information on concrete.
- Certification programs for personnel employed within the concrete industry.
- Student programs such as scholarships, internships, and competitions.
- Sponsoring and co-sponsoring international conferences and symposia.
- Formal coordination with several international concrete related societies.
- Periodicals: the *ACI Structural Journal* and the *ACI Materials Journal*, and *Concrete International*.

Benefits of membership include a subscription to *Concrete International* and to an ACI Journal. ACI members receive discounts of up to 40% on all ACI products and services, including documents, seminars and convention registration fees.

As a member of ACI, you join thousands of practitioners and professionals worldwide who share a commitment to maintain the highest industry standards for concrete technology, construction, and practices. In addition, ACI chapters provide opportunities for interaction of professionals and practitioners at a local level.

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The AMERICAN CONCRETE INSTITUTE

was founded in 1904 as a nonprofit membership organization dedicated to public service and representing the user interest in the field of concrete. ACI gathers and distributes information on the improvement of design, construction and maintenance of concrete products and structures. The work of ACI is conducted by individual ACI members and through volunteer committees composed of both members and non-members.

The committees, as well as ACI as a whole, operate under a consensus format, which assures all participants the right to have their views considered. Committee activities include the development of building codes and specifications; analysis of research and development results; presentation of construction and repair techniques; and education.

Individuals interested in the activities of ACI are encouraged to become a member. There are no educational or employment requirements. ACI's membership is composed of engineers, architects, scientists, contractors, educators, and representatives from a variety of companies and organizations.

Members are encouraged to participate in committee activities that relate to their specific areas of interest. For more information, contact ACI.

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