

Batch Plant Inspection and Field Testing of Ready-Mixed Concrete

This report provides recommended minimum requirements when specifications require batch plant inspection of ready-mixed concrete production and field testing of ready-mixed concrete at the project site. It is intended to be used by specifiers, architects, engineers, owners, or other groups who are interested in monitoring the ready-mixed concrete producer's or contractor's activities through the use of an independent inspection agency.

The user is cautioned that this report is intended for use in establishing the basic duties and reports required of inspection personnel. It can be used for all types and sizes of projects but should be supplemented with additional inspection requirements when the complexity of the project so dictates. Refer to "Guide for Concrete Inspection Programs (ACI 311. 4R)" for guidance on additional requirements.

Keywords : field tests ; inspection ; laboratories ; mixing plants ; quality control ; ready-mixed concrete ; tests.

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Chapter 1—Batch plant inspection of ready-mixed concrete

1. 1—Introduction and scope

This reprot provides recommended minimum requirements for inspection at the batch plant when required by specifications. It is intended for use by specifiers, architects, engineers, owners or other groups interested in monitoring the ready-mixed concrete producers' activites at the batch plant through the use of an independent inspection agency. This report also establishes recommended minmum inspector qualifications, duties and reports.

1. 2—Inspector

The inspector should be qualified by education, training, and experience to perform the minimum duties set forth in this report. The inspector should have a technical understanding of the princi-

ples involved in concrete batching and should know the basic operating sequence of the concrete batch plant. The inspector should be able to provide evidence of such training and experience. The inspector should also be furnished with and become familiar with published standards set forth by this guide and with project specification requirements.

1.3—Duties

1.3.1 The inspector should observe that the facilities, scales, and truck mixers meet the specified project requirements. The provisions of at least one of the following documents are normally incorporated in the project specification:

1.3.1.1 ACI 304R, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."

1.3.1.2 ASTM C 94, "Standard Specification for Ready-Mixed Concrete"

1.3.1.3 Plant qualification in accordance with the National Ready Mixed Concrete Association (NRMCA) plant certification checklist for certification of ready-mixed concrete production facilities

1.3.1.4 Various state or federal department of transportation requirements.

1.3.2 The inspector should be physically present at the batching console during the first batch and should periodically (at least once per hour) observe that the specified type and amount of materials conforming to the design mixture proportions are batched. Batch weights should fall within the allowable tolerances set forth by the project specifications.

1.3.3 The inspector should, when not witnessing operation, conduct or witness

the performance by the concrete producer of the following tests at least once daily :

1.3.3.1 Moisture content determination on fine and coarse aggregates in accordance with ASTM C 566

1.3.3.2 Aggregate gradations, fine and coarse, in accordance with ASTM C 136

1.3.4 Aggregate test results should then be compared to the project specifications for compliance. Usually ASTM C 33 is specified as the gradation requirement for both fine and coarse aggregates.

1.3.5 The inspector should observe that the concrete producer is making adjustments to the approved mixture proportion batch quantities allowing for free moisture contained in the fine and coarse aggregates.

1.3.6 The inspector should determine that the trucks are in good operating condition and not loaded beyond their mixer/agitator plate capacities.

1.3.7 The inspector should determine that the batch plant is furnishing to the purchaser with each batch of concrete, a delivery ticket with the following information :

1.3.7.1 Name of batch plant

1.3.7.2 Serial number of ticket

1.3.7.3 Date

1.3.7.4 Truck number

1.3.7.5 Name of purchaser

1.3.7.6 Project designation

1.3.7.7 Class or designation of concrete

1.3.7.8 Amount of concrete batched

1.3.7.9 Time batched

1.4—Reports

1.4.1 The inspector should sign the.

delivery ticket or supply other evidence that the concrete batching has been inspected.

1. 4. 2 The inspector should issue a daily inspection report showing all test results and documenting observations made during the day.

Chapter 2—Guide for field testing of ready-mixed concrete

2. 1—Introduction and scope

This report provides recommended minimum requirements for testing of ready-mixed concrete at the project site when required specifications. It includes follow up curing and testing of strength specimens and testing laboratory qualifications. This document is intended for use by specifiers, architects, engineers, owners or other groups interested in monitoring the contractors' concreting activities at the project site through the use of an independent inspection agency.

2. 2—Qualifications

The field testing technician should be qualified by education, training, and experience to perform the minimum duties set forth in this report. The technician should have a technical understanding of the principles involved in ready-mixed concrete and should know how to conduct the basic quality tests required. The technician should be able to provide evidence of such training and experience. ACI certification as a Concrete Field Testing Technician—Grade I meets this requirement. The technician should also be furnished with and become familiar with published standards as set forth in this report and with project specification requirement.

2. 3 Testing laboratory

All required laboratory acceptance

tests(i. e. laboratory curing and compressive strength of concrete cylinders) should be performed by an independent testing laboratory. The laboratory selected should meet the concrete inspection and testing section requirement of ACTM C 1077. The laboratory should provide evidence to the architect/engineer that its facilities have been inspected by an independent agency within the last three years, and show that any deficiencies mentioned in the report of that inspection have been corrected.

2. 4—Duties

2. 4. 1 If batch plant inspection is required by the project specifications, the field technician should note in a daily written report if the arriving concrete has or has not been inspected at the batch plant. Immediate verbal notification should be given in the case of a deficient item.

2. 4. 2 If batch plant inspection is not required by the project specifications, the field technician should determine that truck mixers are not loaded in excess of mixer plate capacity, that concrete is adequately mixed prior to discharge at the project site, that concrete delivery falls within the time constraints of the project specifications, and that all data required by ASTM C 94 is included on the delivery ticket.

2. 4. 3 The technician should make at least one series of control tests(slump, air content, unit weight, temperature and cast compressive strength specimens) for each 100yd³(76m³), or fraction thereof, of each mixture class of concrete placed in any one day or as directed by the project specifications. Care should be taken when sampling to obtain a

random sample reflecting true project conditions. The time and truck number should be reported when the samples are secured.

2.4.4 It is usually desirable to test the first truck load of concrete for slump, temperature, and air content so appropriate adjustments can be made at the batch plant to bring concrete within specifications.

2.4.5 The technician shall secure composite samples of concrete delivered to the project site in accordance with ASTM C 172, "Sampling Freshly Mixed Concrete."

2.4.6 The technician should determine slump of the composite concrete sample for each strength test, and whenever consistency of concrete appears to vary, in accordance with ASTM C 143, "Slump of Portland Cement Concrete."

2.4.7 The technician should determine air content and unit weight of the normal weight composite concrete samples for each strength test in accordance with one of the following test methods:

2.4.7.1 ASTM C173, "Air Content of Freshly Mixed Concrete by the Volumetric Method," or

2.4.7.2 ASTM C 231, "Air Content of Freshly mixed Concrete by the pressure Method," and

2.4.7.3 ASTM C 138, "Unit Weight, Yield, and Air Content(Gravimetric) of Concrete"

2.4.8 The technician should determine air content and unit weight of structural lightweight composite concrete samples for each strength test in accordance with the following test methods:

2.4.8.1 ASTM C 173, "Air Content of Freshly Mixed Concrete by the volumetric Method"

2.4.8.2 ASTM C 567, "Unit Weight of Structural Lightweight Concrete"]

2.4.9 The technician should determine the ambient air temperature and the composite concrete sample temperature at the time of sampling for each strength test in accordance with ASTM C 1064.

2.4.10 The technician should make four compressive strength specimens from each composite concrete sample in accordance with ASTM C 31, "Making and Curing Concrete Test Specimens in the Field."]

2.4.11 The contractor should provide an area or container for storage of the concrete compression test specimens during the initial curing period(the first 16 to 48 hours after molding). Specimens should be stored under conditions that maintain the temperature immediately adjacent to the specimens in the range of 60 to 80 F(16 to 27 C) and prevent loss of moisture from the specimens. Initial curing should meet the requirement of ASTM C 31, "Making and Curing of Concrete Test Specimens in the Field."

2.4.12 The testing laboratory should pick up compressive strength test specimens from the project site within 16 to 48 hour and store in a moist condition at 73.4 ± 3 F(23 ± 1.7 C) until the moment of test in accordance with ASTM C 31, "Making and Curing of Concrete Test Specimens in the Field."

2.4.13 The testing laboratory should test compressive strength specimens in accordance with ASTM C 39, "Compressive Strength of Cylindrical Concrete Specimens." Two specimens should be tested at 128 days for acceptance and two should be tested at 7 days for information. The acceptance test results

should be the average of the strengths of the two specimens tested at 28 days.

2.5—Reports

2.5.1 The technician should issue a daily inspection report of all field test results and document observations made during the day. Items not conforming to specifications should be reported immediately to the technician's supervisor.

2.5.2 The technician should complete a concrete data report for each set of concrete compressive strength specimen results to be reported by the testing laboratory, showing all related quality test results.

2.5.3 The testing laboratory should issue timely reports with the following information:

2.5.3.1 Project name

2.5.3.2 Client

2.5.3.3 Concrete supplier

2.5.3.4 Date sampled

2.5.3.5 Sampled by (with certification number, if applicable)

2.5.3.6 Truck number and/or ticket number

2.5.3.7 Time batched and time sampled

2.5.3.8 Air temperature and concrete temperature at time of sampling

2.5.3.9 Slump and air content

2.5.3.10 28-day compressive strength requirement f_c

2.5.3.12 Location of placement and location of sample batch

2.5.3.13 Date tested, concrete age, and compressive strength results

2.5.3.14 Any remarks that may affect concrete quality, such as water added at the project site, elapsed time between start of mixing to completion of placement, and any variation in curing requirements.

Chapter 3—References

3.1—Specified references

The documents of the various standards-producing organizations referred to in this document are listed below with their serial designation, including year of adoption or revision. The documents listed were the latest effort at the time this document was written (revised). Since some of these documents are revised frequently, generally in minor detail only, the user of this document should check directly with the sponsoring group if it is desired to refer to the latest revision.

American Concrete Institute

30AR-85 Guide for Measuring, Mixing, Transporting and Placing Concrete

311.4R-88 Guide for Concrete Inspection Programs

ASTM

C31-87a Standard Practice for Making Curing Concrete Test Specimens in the Field

C33-86 Standard Specification for Concrete Aggregates

C39-86 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C94-86a Standard Specification for Ready-Mixed Concrete

C136-84a Standard Method for Sieve Analysis of Fine and Coarse Aggregates

C138-81 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric, of Concrete

C143-78 Standard Test Method for Slump of Portland Cement Concrete

C173-78 Standard Test Method for Air Content of Freshly Mixed

Concrete by the Volumetric Method

C231-82 Standard Test Method for Air Content of Concrete by the Pressure Method

C566-84 Standard Test Method for Total Moisture Content of Aggregate by Drying

C567-85 Standard Test Method for Unit Weight of Structural Lightweight Concrete

C1064-86 Standard Test Method for Temperature of Freshly Mixed Portland-Cement Concrete

C1077-87 Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

The above Publications may be obtained from the following organizations:

American Concrete Institute
P.O. Box 19150
Detroit, MI 48219-0150

ASTM

1916 Race Street
Philadelphia, PA 19103

3. 2—Additional references

American Concrete Institute

SP-2 ACI Manual of Concrete Inspection (7th Edition) 1981

116R-85 Cement and Concrete Terminology

301-84 Specifications for Structural Concrete for Buildings (Revised 1987)

304. 5R-82 Batching, Mixing and Job Control of Lightweight Concrete

305R-77 Hot Weather Concreting (Revised 1982)

306R-78 Cold Weather Concreting (Revised 1983)

318-83 Building Code Requirements (Revised 1986) for Reinforced Concrete

318.1-83 Building Code Requirements (Revised 1987) for Structural Plain Concrete

ASTM

C70-79 Standard Test Method for (Reapproved 1985) Surface Moisture in Fine Aggregate

C125-86 Standard Definitions of Terms Relating to Concrete and Concrete Aggregates

C127-84 Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate

C128-84 Standard Test Method for Specific Gravity and Absorption of Fine Aggregate

C150-86 Standard Specification for Portland Cement

172-82 Standard Method of Sampling Freshly Mixed Concrete

C494-86 Standard Specifications for Chemical Admixtures for Concrete

D75-82 Standard Practice for Sampling Aggregates

National Ready Mixed Concrete Association

Quality Control Manual, Section 1—
Ready-Mixed Concrete Quality Control Guide

Quality Control Manual, Section 2—
Ready-Mixed Concrete Quality Control Checklist

Quality Control Manual, Section 3—
Certification of Ready-Mixed Concrete Production Facilities