

# Technology in Practice

## What, Why & How?



### TIP 16 - Evaluating Strength Test Results

*This TIP provides guidance on evaluating strength test results used for acceptance of concrete to determine whether the testing procedures and test results indicate deficiencies in testing practices.*

#### **WHAT is the Purpose of Strength Testing?**

One of the primary specified requirements for concrete is the compressive strength. Strength tests are typically performed by a third-party testing agency. It is imperative that the procedures for making and testing strength specimens conform to the standards. Improper testing can result in acceptable concrete being rejected, considerable cost for evaluation, and delay project schedules.

Strength tests are primarily performed to evaluate the quality of concrete supplied by a ready mixed concrete producer when strength requirements are stated in orders or specifications for ready mixed concrete. The strength test results are evaluated for compliance with the strength acceptance criteria. For this purpose cylindrical test specimens are cast from representative samples of concrete as delivered. The standard size of cylindrical strength test specimens is either 4 x 8 in. or 6 x 12 in. (100 x 200 mm or 150 x 300 mm). Strength test specimens for acceptance of concrete are subjected to standard curing, as defined in ASTM C31.

A common concern is whether strength of standard-cured cylinders represent the strength of concrete in the structure. This is not the purpose of these strength tests. Concrete structural design procedures are based on strength of standard-cured specimens with appropriate safety factors for structural capacity. Field-cured cylinders are sometimes used to estimate the in-place strength of concrete in the structure for post tensioning, formwork removal, determining adequacy of curing and protection, and for other reasons during construction. This TIP does not address results of field-cured cylinders.

#### **WHAT are the Requirements for Testing Agencies (Laboratories)?**

A testing agency for quality assurance testing is hired by the owner of the structure or by the contractor when required in the contract. The testing agency should conform to the requirements of ASTM C1077, *Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation*. This standard establishes a quality system for testing agencies and requires that technicians performing tests maintain certification for the tests that they perform. Certification requirements apply to field and laboratory technicians. The laboratory should be third-party inspected periodically and participate in proficiency sample testing programs. In some cases testing agencies maintain accreditation that assures compliance with this standard. The entity contracting for testing services should ensure that the agency selected has the required credentials and that they will provide reliable testing services. ACI 311.6, *Specification for Ready Mixed Concrete Testing Services*, is a good basis for this contract.

#### **WHAT are the Requirements for Strength Testing?**

Concrete samples should be obtained in accordance with ASTM C172. The sample should be obtained after all adjustments are made to the load. The sample should not be obtained from the initial discharge. From a truck mixer, ASTM C172 requires obtaining the sample from at least two portions of the discharge stream from the middle portion of the load. The sample should be thoroughly mixed and tests should be started within specific time limits. Molding cylinders should start within 15 minutes of obtaining the sample. ASTM C94 and ACI 301