

Technology in Practice

What, Why & How?



TIP 11 - Testing Concrete Cores

This TIP facilitates the understanding of core testing for acceptance of concrete, the corresponding ASTM standard and how it is used. It does not supersede these standards.

WHAT is Concrete Core Testing?

ASTM C42/C42M is the standard test method for obtaining and testing the strength of drilled cores and sawed beams of concrete. Cores are extracted from hardened in-place concrete primarily to measure in-place concrete strength. Cores can also be extracted from concrete pavements and structures to verify compliance with construction dimensional tolerances, condition evaluation of structures, forensic evaluation using petrography and chemical methods, estimating the composition of concrete, and density and voids analysis. This TIP is limited to compressive strength testing of cores which is the more common reason for taking concrete cores.

WHY is the Strength of Cores Measured?

The strength of cores is used to verify the quality and strength of concrete in structures. Most commonly, cores are extracted when there is a reported low strength test result of standard cured cylinders. Strength results from standard cured cylinders are used to judge the quality of the concrete supplied to a project. Strength of cores can also be measured to evaluate construction practices (placement and consolidation) and whether proper curing and protection was provided to a structure during construction. The compressive strength of cores is the more common test performed and related to the specified compressive strength in a project specification. Splitting tensile strength of cores can be measured to evaluate whether flexural strength of pavements is consistent with the design assumptions. Measuring splitting tensile strength of cores is considered more reliable than measuring the flexural strength of beams sawed from the pavement.

ACI 318, *Building Code for Structural Concrete*, establishes two acceptance criteria for strength test results based on standard cured cylinders from samples of concrete delivered to a project. It states that when strength test results fail one or both of these criteria, steps should be taken to increase the strength level and suggestions for this are provided in the ACI 318 commentary. The Code only requires an investigation of low strength test results when an individual strength test result (average of 2 or 3 cylinders) is more than 500 psi [3.5 MPa] less than the specified strength, f'_c (less than $0.9 f'_c$ when the specified strength is equal to or greater than 5000 psi [35 MPa]).

The Code allows for the evaluation of the curing and protection of the structure. A project specification may require strength tests of field-cured cylinders to evaluate this. The strength of field-cured cylinders should achieve 85% of companion standard cured cylinders (not the specified strength). This criterion does not apply if the average strength of field-cured cylinders is at least 500 psi above the specified strength, f'_c . Evaluation of strength of field cured specimens addresses responsibilities of the contractor and cannot be used to evaluate the quality of concrete furnished by the concrete producer.

If low strength test results or if deficiencies in protection and curing are indicated the Code says that steps shall be taken to ensure that load-carrying capacity of the structure is not jeopardized.

The Code states that the engineer should confirm the likelihood of low-strength concrete and should perform "calculations [that] indicate that load-carrying capacity is significantly reduced" before requiring core tests.