
Standard Method of Test for

Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

AASHTO Designation: T 24M/T 24-22

Technically Revised: 2022

Technical Subcommittee: 3c, Hardened Concrete

ASTM Designation: [C42/C42M-13](#)



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1. SCOPE

- 1.1. This test method covers obtaining, preparing, and testing cores drilled from concrete for length or compressive or splitting tensile strength determinations. This test method is not applicable to cores from shotcrete.
- Note 1**—ASTM Test Method [C1604/C1604M](#) is applicable for obtaining, preparing, and testing cores from shotcrete.
- Note 2**—Appendix X1 provides recommendations for obtaining and testing sawed beams for flexural performance.
- 1.2. The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.3. The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.
- 1.4. *This standard does not purport to address safety concerns 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.*
- 1.5. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of [R 18](#) are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with [R 18](#) alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of [R 18](#) or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

- 2.1. AASHTO Standards:
- [M 339M/M 339](#), Thermometers Used in the Testing of Construction Materials

- < [R 18](#), Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- < [R 39](#), Making and Curing Concrete Test Specimens in the Laboratory
- < [T 22M/T 22](#), Compressive Strength of Cylindrical Concrete Specimens
- < [T 97](#), Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- < [T 140](#), Compressive Strength of Concrete Using Portions of Beams Broken in Flexure
- < [T 148](#), Measuring Length of Drilled Concrete Cores
- < [T 198](#), Splitting Tensile Strength of Cylindrical Concrete Specimens
- < [T 231](#), Capping Cylindrical Concrete Specimens

2.2. *ASTM Standards:*

- < [C642](#), Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
- < [C670](#), Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- < [C823/C823M](#), Standard Practice for Examination and Sampling of Hardened Concrete in Constructions
- < [C1231/C1231M](#), Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens
- < [C1542/C1542M](#), Standard Test Method for Measuring Length of Concrete Cores
- < [C1604/C1604M](#), Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete
- < [E1](#), Standard Specification for ASTM Liquid in Glass Thermometers
- < [E230/E230M](#), Standard Specification for Temperature Electromotive Force (emf) Tables for Standardized Thermocouples
- < [ASTM E2877](#), Standard Guide for Digital Contact Thermometers

2.3. *Other Standards:*

- < ACI 318, Building Code Requirements for Structural Concrete
- < IEC 60584 1:2013 Thermocouples Part 1: EMF Specifications and Tolerances

3. SIGNIFICANCE AND USE

- 3.1. This test method provides standardized procedures for obtaining and testing specimens to determine the compressive, splitting tensile, and flexural strength of in-place concrete. Sampling and sample preparation requirements are given to ensure that dimensional requirements are met and that the specimens are made of intact, sound concrete, and are as free of flaws as the particular structure will allow.
- 3.2. Generally, test specimens are obtained when doubt exists about the in-place concrete quality due either to too-low strength test results during construction or to signs of distress in the structure. Additionally, this method is used to provide strength information on older structures.
- 3.3. Concrete strength is affected by the location of the concrete in a structural element, with the concrete at the bottom tending to be stronger than the concrete at the top. Core strength is also affected by core orientation relative to the horizontal plane of the concrete as placed, with strength tending to be lower when measured parallel to the horizontal plane.¹ These factors shall be considered in planning the locations for obtaining concrete samples and in comparing strength test results.
- 3.4. The strength of concrete measured by tests of cores is affected by the amount and distribution of moisture in the specimen at the time of test. There is no standard procedure to condition a

specimen that will ensure that, at the time of test, it will be in the identical moisture condition as concrete in the structure. The moisture conditioning procedures in this test method are intended to provide reproducible moisture conditions that minimize within-laboratory and between-laboratory variations and to reduce the effects of moisture introduced during specimen preparation.

- 3.5. The measured compressive strength of a core will generally be less than that of a corresponding properly molded and cured standard cylinder tested at the same age. For a given concrete, however, there is no unique relationship between the strength of these two types of specimens (see Note 3). The relationship is affected by many factors such as the strength level of the concrete, the in-place temperature and moisture histories, the degree of consolidation, batch-to-batch variability, the strength-gain characteristics of the concrete, the condition of the coring apparatus, and the care used in removing cores.

Note 3—A procedure is available for estimating the equivalent cylinder strength from a measured core strength.

Note 4—In the absence of core strength requirements of an applicable building code or of the other contractual or legal documents that may govern the project, the specifier of the test should establish in the project specifications the acceptance criteria for core strength. An example of acceptance criteria core strength is provided in ACI 318, which are used to evaluate cores taken to investigate low strength test results of standard-cured cylinder during construction. According to ACI 318, the concrete represented by the cores is at least 85 percent of the specified strength and no single core strength is less than 75 percent of the specified strength.

- 3.6. The “specifier” of the tests referenced in this test method is the individual responsible for analysis or review and acceptance of the core test results.

Note 5—For investigation of low strength test results, ACI 318 defines the specifier of the test as the licensed design professional.

- 3.7. The apparent compressive strength of concrete as measured by a core is affected by the length-diameter ratio (L/D) of the core as tested and this must be considered in preparing core specimens and evaluating test results.

4. APPARATUS

- 4.1. *Core Drill*—For obtaining cylindrical core specimens with diamond impregnated bits attached to a core barrel.
- 4.2. *Saw*—For trimming ends of cores. The saw shall have a diamond or silicon-carbide cutting edge and shall be capable of cutting cores without introducing cracks or dislodging aggregate particles.
- 4.3. *Balance*—Accurate to at least 5 g [0.01 lb].

5. SAMPLING

- 5.1. *General:*
- 5.1.1. Samples of hardened concrete for use in the preparation of strength test specimens shall not be taken until the concrete is strong enough to permit sample removal without disturbing the bond between the mortar and the coarse aggregate (see Note 5 and Note 6). When preparing strength test specimens from samples of hardened concrete, samples that have been damaged during removal shall not be used unless the damaged portion(s) are removed and the length of the resulting satisfy the minimum length-diameter ratio requirement in Section 7.2. Samples of defective or damaged concrete that cannot be tested shall be reported along with the reason that prohibits use of the sample for preparing strength test specimen.