

# CALIFORNIA COUNCIL OF TESTING & INSPECTION AGENCIES

## Laboratory Internal Auditing ASTM C42-04

### Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

Company Name	Company Address
Telephone No.	
Completed By:	Signature

- This test method covers obtaining, preparing, and testing (1) cores drilled from concrete for length or compressive strength or splitting tensile strength determinations and (2) beams sawed from concrete for flexural strength determinations.
- This test method provides standardized procedures for obtaining and testing specimens to determine the compressive, splitting tensile, and flexural strength of in-place concrete.
- Generally, test specimens are obtained when doubt exists about the in-place concrete quality due either to low strength test results during construction or signs of distress in the structure. Another use of this method is to provide strength information on older structures.
- 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. These factors shall be considered in planning the locations for obtaining concrete samples and in comparing strength test results.
- The strength of concrete measured by tests of cores and beams 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.
- There is no universal relationship between the compressive strength of a core and the corresponding compressive strength of standard-cured molded cylinders. The relationship is affected by many factors such as the strength level of the concrete, the in-place temperature and moisture history, and the strength gain characteristics of the concrete. Historically, it has been assumed that core strengths are generally 85 % of the corresponding standard-cured cylinder strengths, but this is not applicable to all situations. The acceptance criteria for core strength are to be established by the specifier of the tests. ACI 318 provides core strength acceptance criteria for new construction.

This Internal Audit deals only with the removal and testing of core samples for compressive strength.

1.00 Apparatus	Ref	Yes	No	N/A	Comments
1.1 Does the core barrel have adequate cutting impregnated diamonds?					

2.00 Sampling	Ref	Yes	No	N/A	Comments
2.1 Was the concrete strong enough to permit removal without disturbing the bond between the mortar and the course aggregate?					
2.2 Have the damaged portion(s) been removed and the resulting test specimen of suitable length?					
2.3 Has defective or damaged concrete that cannot be tested been reported along with the reason that prohibits use of the sample for preparing strength test specimens?					
2.4 Does the specimens contain embedded reinforcement?					
2.5 Has the core specimen been drilled perpendicular to the surface and not near formed joints or obvious edges of a unit of deposit?					

2.6 Has the approximate angle between the longitudinal axis of the drilled core and the horizontal plane of the concrete as placed been recorded and reported?					
2.7 When drilling perpendicular to a vertical surface, or perpendicular to a surface with a batter, has the specimen been taken from near the middle of a unit of deposit?					

3.00 Drilled Cores	Ref	Yes	No	N/A	Comments
3.1 When determining the thickness of pavements, slabs, walls or other structural elements and its stipulated to be measured in accordance with Test Method C 174/C 174M is the core diameter of at least 3.75 in. [95 mm]?					
3.2 For cores that are not intended for determining structural dimensions, has the longest and shortest lengths on the cut surface along lines parallel to the core axis been measured and recorded?					
3.3 Has the average of the above lengths been reported to the nearest 1/4 in. [5 mm]?					
3.4 When determining compressive strength in load bearing structural members is the diameter of core specimens at least 3.70 in. [94 mm]?					
NOTE 1: For non-load bearing structural members or when it is impossible to obtain cores with length-diameter ratio (L/D) greater than or equal to 1, core diameters less than 3.70 in. [94 mm] are not prohibited. The compressive strengths of nominal 2-in. [50-mm] diameter cores are known to be somewhat lower and more variable than those of nominal 4-in. [100-mm] diameter cores. In addition, smaller diameter cores appear to be more sensitive to the effect of the length-diameter ratio.					
NOTE 2: For concrete with nominal maximum aggregate size greater than or equal to 1 1/2 in. [37.5 mm], the core diameters shall be as directed by the specifier of the tests. The preferred minimum core diameter is three times the nominal maximum size of the coarse aggregate, but it should be at least two times the nominal maximum size of the coarse aggregate.					
3.5 If the ratio of the length to the diameter (L/D) of the core exceeds 2.1, has the length of the core been reduced so that the ratio of the capped or ground specimen is between 1.9 and 2.1?					
NOTE 3: The moisture conditioning procedures specified in this test method are intended to preserve the moisture of the drilled core and to provide a reproducible moisture condition that minimizes the effects of moisture gradients introduced by wetting during drilling and specimen preparation.					
3.6 After drilling has the surface drill water been wiped off and the remaining surface moisture allowed to evaporate?					
3.7 When surfaces appear dry, but not later than 1 h after drilling, have the cores been placed in separate plastic bags or nonabsorbent containers and sealed to prevent moisture loss?					
3.8 Have the cores been protected from exposure to direct sunlight and maintained at ambient temperature?					
3.9 Have the cores been transported to the testing laboratory as soon as possible?					
NOTE 4: Keep cores in the sealed plastic bags or nonabsorbent containers at all times except during end preparation and for a maximum time of 2 h to permit capping before testing.					
3.10 If water is used during sawing or grinding of core ends, have these operations been completed as soon as possible, but no later than 2 days after drilling of cores?					
3.11 After completing end preparation, has surface moisture been wiped off, allowed the surfaces to dry, and placed sealed plastic bags or nonabsorbent containers?					

3.12 Has the duration of exposure to water during end preparation been minimized?					
3.13 Have the cores been allowed to remain in the sealed plastic bags or nonabsorbent containers for at least 5 days after last being wetted and before testing?					
NOTE 5: The waiting period of at least 5 days is intended to reduce moisture gradients introduced when the core is drilled or wetted during sawing or grinding.					
3.14 When direction is given to test cores in a moisture condition other than achieved by conditioning according to 7.3.1, 7.3.2, and 7.3.3, has the alternative procedure been reported?					

4.00 Sawing of Ends	Ref	Yes	No	N/A	Comments
4.1 Are the ends of core specimens to be tested in compression flat, and perpendicular to the longitudinal axis in accordance with Test Method C 39/C 39M?					
4.2 Have all projections extending more than 0.2 in. [5 mm] above the end surfaces been removed?					
4.3 Does the slope of the end surfaces depart from perpendicularity to the longitudinal axis by more than 1:8 <i>d</i> or [1:0.3 <i>d</i> ] where <i>d</i> is the average core diameter in inches [or mm]?					

5.00 Density	Ref	Yes	No	N/A	Comments
When required by the specifier of the tests, determine the density by weighing the core before capping and dividing the mass by the volume of the core calculated from the average diameter and length.					

6.00 Capping	Ref	Yes	No	N/A	Comments
6.1 If the ends of the cores do not conform to the perpendicularity and planeness requirements of Test Method C 39/C 39M, are the cores sawed or ground to meet those requirements or capped in accordance with Practice C 617?					
6.2 If cores are capped in accordance with Practice C 617, the capping device shall accommodate actual core diameters, are the caps concentric with the core ends?					
6.3 Have the core lengths been measured to the nearest 0.1 in. [2 mm] before capping?					
Note: Unbonded caps in accordance with Practice C 1231/C 1231M are <i>not</i> permitted.					

7.00 Measurement	Ref	Yes	No	N/A	Comments
7.1 Before testing, has the length of the capped or ground specimen been measured to the nearest 0.1 in. [2 mm]?					
7.2 Has the average diameter been determined by averaging two measurements taken at right angles to each other at the mid-height of the specimen?					

7.3 Has the core diameters been measured to the nearest 0.01 in. [0.2 mm] when the difference in core diameters does not exceed 2 % of their average, otherwise measure to the nearest 0.1 in. [2 mm]?					
7.4 When the difference between the largest and smallest diameter exceeds 5 % of their average has the core been tested?					

8.00 Testing	Ref	Yes	No	N/A	Comments
8.1 Have the specimens been tested in accordance with Test Method C 39/C 39M?					
8.2 Have the specimens been tested within 7 days after coring, unless specified otherwise?					

9.00 Calculations	Ref	Yes	No	N/A	Comments
9.1 Has the compressive strength of each specimen been calculated using the computed cross-sectional area based on the average diameter of the specimen?					
9.2 If the ratio of length to diameter (L/D) of the specimen is 1.75 or less, have the results been corrected by multiplying by the appropriate correction factor?					

NOTE : Use interpolation to determine correction factors for L/D values not given in the table.

NOTE : Correction factors depend on various conditions such as moisture condition, strength level, and elastic modulus. These correction factors apply to low-density concrete having a density between 100 and 120 lb/ft<sup>3</sup> [1600 and 1920 kg/m<sup>3</sup>] and to normal density concrete.

They are applicable to both dry and wet concrete for strengths between 2000 psi and 6000 psi [14 MPa to 42 MPa]. For strengths above 10 000 psi [70 MPa], test data on cores show that the correction factors may be larger than the values listed above.6

10.00 Compression Report	Ref	Yes	No	N/A	Comments
10.1 Does the report contain the following information, as required by C39?					
10.1.1 Identification number,					
10.1.2 Diameter (and length) if outside the range of 1.8D to 2.2D,					
10.1.3 Cross-sectional area,					
10.1.4 Maximum load,					
10.1.5 Compressive strength calculated to the nearest 10 psi,					
10.1.6 Type of fracture, if other than the usual cone,					
10.1.7 Age of specimen.					
10.2 In addition to the requirements of C39 have the following results been reported?					
10.2.1 Length of core as drilled to the nearest 1/4 in. [5 mm],					
10.2.2 Length of test specimen before and after capping or end grinding to the nearest 0.1 in. [2 mm], and average diameter of core to the nearest 0.01 in. [0.2 mm] or 0.1 in. [2 mm],					

10.2.3 Compressive strength to the nearest 10 psi [0.1 MPa] when the diameter is measured to the nearest 0.01 in. [0.2 mm] and to the nearest 50 psi [0.5 MPa] when the diameter is measured to the nearest 0.1 in. [2 mm], after correction for length-diameter ratio when required,					
10.2.4 Direction of application of the load on the specimen with respect to the horizontal plane of the concrete as placed,					
10.2.5 The moisture conditioning history,					
10.2.6 The date and time core was obtained and first placed in sealed bag or nonabsorbent container,					
10.2.7 If water was used during end preparation, the date and time end preparation was completed and core placed in sealed bag or nonabsorbent container,					
10.2.8 The date and time when tested,					
10.2.9 Nominal maximum size of concrete aggregate.					
10.2.10 If determined, the density,					
10.2.11 If applicable, description of defects in cores that could not be tested, and					
10.2.12 If any deviation from this test method was required, describe the deviation and explain why it was necessary.					

.00	Ref	Yes	No	N/A	Comments

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