



Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores¹

This standard is issued under the fixed designation C174/C174M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This test method covers the determination of the thickness of a concrete pavement, slab, or structural element using drilling cores.

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 are not exact equivalents; therefore, each system shall be used independently of the other.

1.3 *This standard does not purport to address all of the safety concerns, if any, 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.*

2. Referenced Documents

2.1 ASTM Standards:²

C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C125 Terminology Relating to Concrete and Concrete Aggregates

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

2.2 AASHTO Standards:³

AASHTO T148 Method of Test for Measuring Length of Drilled Concrete Cores

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.61 on Testing for Strength.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology C125.

4. Significance and Use

4.1 This test method is used to determine the compliance of concrete construction with design specifications and is commonly used in determining the thickness of pavements and other slab construction. This test method requires that at least one end of the core be a finished or formed surface.

5. Apparatus

5.1 The apparatus shall consist of a base plate with three posts to support the core in a vertical direction, and top plate or other means of establishing a plane that is parallel to and a measured distance from the plane defined by the supporting posts. The apparatus includes a measuring rod as described in 5.5 or other means to determine the length of axial elements of the core. While the details of the mechanical design are not prescribed, the apparatus shall conform to the requirements of 5.2 – 5.6. An example of an apparatus is illustrated in Fig. 1.

5.2 The base of the apparatus shall be so designed that the core will be held with its axis in a vertical position by three symmetrically placed supports bearing against the lower end of the core. These supports shall be short posts or studs of hardened steel, and the ends that bear against the surface of the core shall be rounded to a radius of not less than 6 mm [$\frac{1}{4}$ in.] and not more than 13 mm [$\frac{1}{2}$ in.].

5.3 The apparatus shall provide for the accommodation of cores of different nominal lengths over a range of at least 100 to 250 mm [4 to 10 in.].

5.4 The top plate or other means of measuring shall be so designed that it will be possible to make a length measurement at the center of the upper end of the core, and at eight additional points spaced at equal intervals along the circumference of a circle whose center point coincides with that of the end area of the core and whose radius is not less than one half nor more than three fourths of the radius of the core.

*A Summary of Changes section appears at the end of this standard

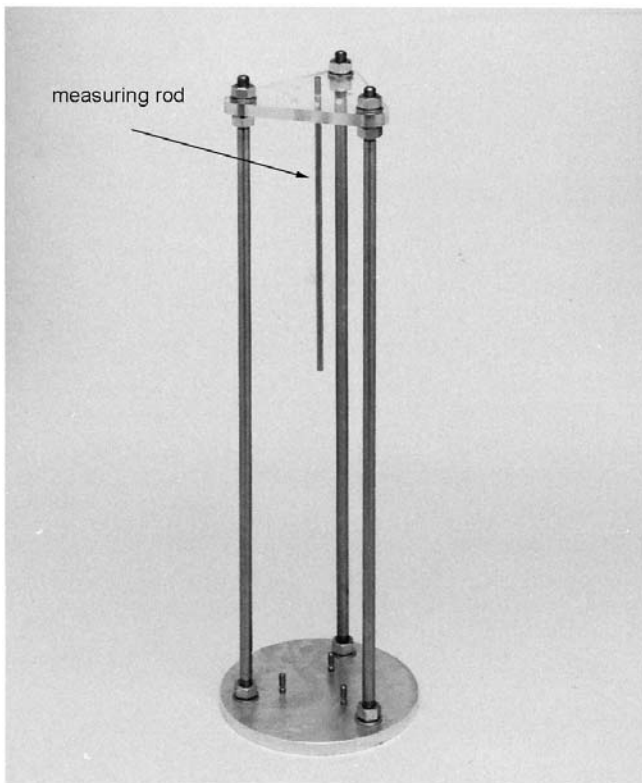


FIG. 1 An Example of Suitable Measuring Apparatus

5.5 The measuring rod or other device that makes contact with the end surface of the core for measurement shall be rounded to a radius of 3 mm [$\frac{1}{8}$ in.]. The scale on the measuring rod shall be marked with clear, definite, accurately spaced graduations. The spacing of the graduations shall be 1.0 mm [0.10 in.] or a decimal part thereof. The measuring rod shall be used to measure the distance from the bottom of the top plate to the top of the core (see Fig. 1).

5.6 The apparatus shall be stable and sufficiently rigid to maintain its shape and alignment without a distortion or deflection of more than 0.25 mm [0.01 in.] during all normal measuring operations.

5.7 *Verification Gages*—Suitable gauges for verification are right circular cylinders with flat ends and a diameter approximately equal to the diameter of cores intending to be measured and a length in the range of the required measurements. To accommodate various core lengths, gauges are available in several lengths. To minimize uncertainty of measurement, the length of the cylinder at the perimeter shall be determined accurately to 0.05 mm [0.002 in.] using calibrated measuring instruments. The flatness of the ends shall not depart from a plane by more than 0.02 mm [0.001 in.] in any 150 mm [6 in.] of cylinders 150 mm [6 in.] in diameter or larger, or by more than 0.02 mm [0.001 in.] in the diameter of any smaller cylinder.

6. Test Specimens

6.1 Cores used for length measurement shall be obtained in accordance with Test Method C42/C42M. The core shall be drilled with the axis normal to the surface of the structure.

6.2 If a core drilled from a pavement or structure placed on aggregate base course includes particles of the aggregate base bonded to the bottom surface of the concrete, the bonded particles shall be removed to expose the lower surface of the concrete. If during the removal of bonded aggregate, the concrete is broken so that the measurements obtained in 7.3 are not representative of the original core length, the core shall not be used for length measurement.

6.3 If the concrete is placed on an open-graded aggregate base course, the mortar in the concrete may penetrate into the base and surround some particles. Use sufficient force to remove bonded particles but not such force as to fracture particles substantially surrounded by mortar. If during the removal of bonded aggregate the concrete is broken so that the measurements obtained in 7.3 are not representative of the original core length, the core shall not be used for length measurement.

7. Procedure

7.1 Before any measurements of the core length are made, verify the apparatus with suitable gauges, as defined in 5.7, so that errors caused by mechanical imperfections in the apparatus are known. If the difference between the length measured with the apparatus and the known length of the verification gauge exceeds 0.25 mm [0.01 in.], apply suitable corrections to the core length measurements.

7.2 Place the core in the measuring apparatus with the flat end of the core, that is, the end that represents the upper surface of a pavement slab or a formed surface in the case of other structures, placed down so as to bear against the three hardened-steel supports. Place the core on the supports so that the central measuring position of the measuring apparatus is directly over the center of the upper end of the core.

7.3 Make nine measurements from the bottom of the top plate or other established plane to the top of the core, one at the central position and one each at eight additional positions spaced at equal intervals along the circumference of the circle of measurement. Read each of these nine measurements to the nearest 1.0 mm [0.05 in.]. Average the nine measurements and calculate the length of the core using this average and the known distance between the two established planes.

7.4 If, in the course of the measuring operation, it is discovered that at one or more of the measuring points the surface of the core is not representative of the general plane of the core end because of a small projection or depression, the core shall be rotated slightly about its axis and a complete set of nine measurements made with the core in the new position. With cores from pavements placed over open-graded aggregate bases the foregoing provisions frequently cannot be met because of the great number of projections or voids on the bottom surface.

8. Report

8.1 Report the length of the core to the nearest 1.0 mm [0.05 in.].



9. Precision and Bias

9.1 *Precision*—Single-operator and multilaboratory precision indexes are based on the results of an interlaboratory study conducted by the NCHRP.⁴ Cores, representative of different concrete pavement test sections, either 100 mm [4 in.] or 150 mm [6 in.] in nominal diameter with lengths ranging from 100 mm [4 in.] to 300 mm [12 in.] were used for the study. Testing was performed in accordance with AASHTO T148 which uses the same apparatus and measurement procedures as Test Method C174/C174M. Measurements were made to the nearest 0.1 mm. The inch-pound values in **Table 1** were obtained by mathematical conversion of the reported SI values and rounded to two decimal places.

9.2 *Bias*—Because there are no reference cores suitable for determining the bias of these procedures, no statement on bias is being made.

⁴ Azari, H., 2010, “Precision Estimates of AASHTO T148: Measuring Length of Drilled Concrete Cores”; NCHRP Web-Only Document 165, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w165.pdf

TABLE 1 Indexes of Precision

Nominal Specimen Diameter	Standard Deviation	Acceptable Difference Between Two Results ^A
Single-operator Precision:		
100 mm [4 in.]	0.4 mm [0.02 in.]	1.0 mm [0.04 in.]
150 mm [6 in.]	0.7 mm [0.03 in.]	1.9 mm [0.07 in.]
Mult-laboratory Precision:		
100 mm [4 in.]	0.9 mm [0.04 in.]	2.4 mm [0.09 in.]
150 mm [6 in.]	1.8 mm [0.07 in.]	4.9 mm [0.19 in.]

^A These values represent the d2s limits described in Practice C670.

NOTE 1—An interlaboratory test program for determining the precision of core length by this test method for various end conditions is being studied by Subcommittee C09.61 and the results will be included in a later revision of this test method.

10. Keywords

10.1 concrete; core length measuring apparatus; cores; length measurement; thickness measurement

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this standard since the last issue (C174/C174M – 13) that may impact the use of this standard. (Approved June 1, 2016.)

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| (1) Corrected wording and removed arbitrary wording. | (3) Revised and renamed Fig. 1 . |
| (2) Added Section 2, Referenced Documents, and Section 3, Terminology. | (4) Added precision statement, 9.1 . |

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