INTERNATIONAL

Designation: C 1245 – 93

Standard Test Method for Determining Bond Strength Between Hardened Roller Compacted Concrete and Other Hardened Cementitious Mixtures (Point Load Test)[1]

This standard is issued under the fixed designation C 1245; 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.

1. Scope

1.1 This test method is intended for testing roller-compacted concrete specimens and covers determination of the relative bond between layers of hardened concrete in multiple-lift forms of construction. It is applicable to all types of layered concrete construction involving an upper layer of concrete or mortar bonded to an underlying layer of concrete or mortar where the total depth is sufficient to meet the minimum specimen length and diameter requirements of this test method.

NOTE 1—This test method does not provide tensile strength results of the material tested.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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:*

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens[2]

C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete[2]

C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory[2]

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

C 1042 Test Method for Comparing Concrete on the Basis of the Bond Developed with Reinforcing Steel[2]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[3]

3. Significance and Use

3.1 Bond strength is determined using drilled cores or cast cylindrical specimens in which the bond surface is essentially normal to the longitudinal axis at approximately the mid-length of the specimen. A splitting tensile stress normal to the bond surface is produced by point-loading the specimen across a diameter at that surface.

NOTE 2—Test results are not affected significantly by specimen surfaces obtained with normal coring operations. The ends of cores need not be trimmed.

3.2 This test method may be used either for laboratory investigation by casting individual composite cylinders or by coring prototype structures or assemblies (Test Method C 42).

4. Apparatus

4.1 *Testing Machine*—The testing machine shall conform to the requirements of Test Method C 39 and may be of any type of sufficient capacity to provide the rate of loading prescribed in 6.3.

4.2 *Testing Apparatus*—The testing apparatus shall be constructed of steel and allow the testing of both 4 and 6-in. (101 and 152-mm) diameter specimens. The test schematic is given in Fig. 1. The testing apparatus shall permit the positioning of a specimen such that the joint of the bonded surfaces is oriented as closely as possible parallel to the direction of loading. A photograph of the test configuration is given in Fig. 2. Figures 3 through 10Figs. 3-10 provide the information necessary to construct alignment devices for 4 and 6-in. (101 and 152-mm) diameter specimens. Anvil rods (Fig. 4 and Fig. 6) shall have a hardness of not less than 55 HRC (Rockwell hardness number of 64 on the C scale) and shall be plane on the bearing surfaces to within ± 0.001 in. (0.025 mm). The alignment post shall ensure that the anvil rods are kept parallel to each other in the vertical plane. The system is easily adaptable to most testing machines.

[1] This test method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.45 on Roller Compacted Concrete.

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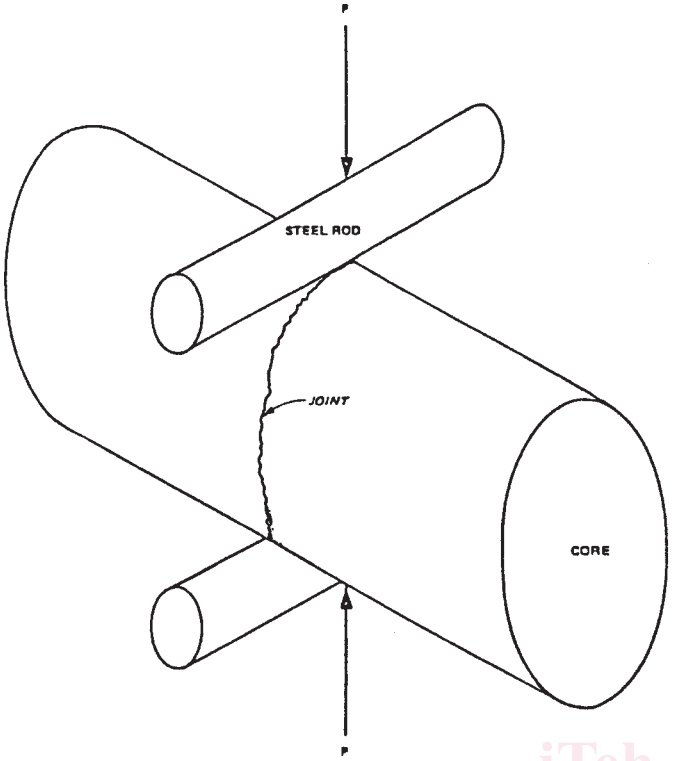
[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 03.01.



NOTE 1—Test of parent concrete conducted with identical configuration,

where:
f_{tb} = tensile bond strength, psi (MPa),
P = maximum applied load, lbf (N), and
D = average specimen diameter at bond surface, in. (mm).

FIG. 1 Test Schematic

5. Test Specimens

5.1 Test specimens shall be cores or cast cylinders 4 or 6 ± 0.25 in. (101 or 152 ± 6 mm) in diameter. Each core shall be cut, and each cylinder shall be cast to ensure that the plane best describing the bond surface is oriented at 90 ± 15° to the long axes of the specimens.

NOTE 3—Where the bond surface undulates grossly, that is, the surface has a local texture exceeding 0.5 in. (12.7 mm) in amplitude, 6-in. (152-mm) diameter cores are preferable. No information is available on the relative results of 6-in. (152-mm) versus 4-in. (101-mm) diameter specimens.

6. Procedure

6.1 *Measurements*—Determine the diameter of the test specimens by averaging three diameters measured on the bond surface. The bond surface should be established visually by color, texture, or material contrasts. Measure diameters to the nearest 0.01 in. (0.25 mm) with calipers, whenever possible, but at least to the nearest 0.1 in. (2.5 mm).

NOTE 4—Many drilled cores will not be smooth enough to justify the measurement of diameters closer than to the nearest 0.1 in. (2.5 mm).

Determine the length of each section of the bonded specimens to the nearest 0.1 in. (2.5 mm), and use these lengths to determine the section length-to-diameter ratios. Specimens must have a minimum length-to-diameter ratio of 1.2 if the bond plane is at mid-height (within ± 0.25 in. (6.35 mm)) of the specimen. If the bond plane is not at mid-length of the specimen, the section on each side of the bond plane shall be of a length at least 0.6 the diameter. Where the bond surface is irregular or undulating, a plane extending through and along the approximate average bearing of the bond surface shall be marked on the specimen, and length measurements shall be made from the line.

6.2 *Positioning*—Assemble and position the apparatus in the testing machine. Place the specimen on the bottom platen with the joint in contact with the anvil rods (see Fig. 2). The longer anvil rods (Fig. 4a and Fig. 6b) and the longer alignment post (Fig. 10) are used to test 6-in. (152-mm) diameter specimens. The shorter anvil rods (Fig. 4 b and Fig. 6a) and the shorter alignment post (Fig. 9) are used to test 4-in. (101-mm) diameter specimens.

6.2.1 Then zero the load-indicating mechanism. Position the specimen so that the bond surface is parallel to the upper and lower anvil rods (see Fig. 2). This is best accomplished by positioning the specimen by hand while gently bringing the top anvil into contact with the specimen. Alternatively, the specimen may be supported with modeling clay or pieces of polystyrene. Where the bond surface is irregular or undulating, the line drawn to describe the average bearing of the bond surface shall be used for orientation. The anvil rods shall contact the bond surface at the contact point on the circumference of the specimen.

6.3 *Loading*—Do not preload the specimen. Apply the load at a uniform rate of 150 to 200 psi/min (1 to 1.4 MPa/min) until the specimen fails. Record the maximum load applied.

7. Calculation

7.1 Calculate the strength of the bond as follows:

$$f_{tb} = \frac{P}{D^2} \quad (1)$$

where:
f_{tb} = tensile bond strength, psi (MPa),
P = maximum applied load, lbf (N), and
D = average specimen diameter at bond surface, in. (mm).

8. Report

8.1 Report the following information:
8.1.1 Date of testing.
8.1.2 Specimen identification.
8.1.3 Details of the materials comprising the specimens, such as the following:
8.1.3.1 Mixture proportions of the concretes and mortars;
8.1.3.2 Details of fabrication and bonding techniques;
8.1.3.3 Age, when tested; and
8.1.3.4 Specimen size and whether a cast cylinder or drilled core was used, and any other information necessary to describe the production or features of the specimens.
8.1.4 Record of curing and moisture condition of the specimens at the time of test.
8.1.5 Any special treatment or prior testing performed on the specimens.
8.1.6 Strength of the bond to the nearest 10 psi (0.1 MPa).
8.1.7 Mode of failure:

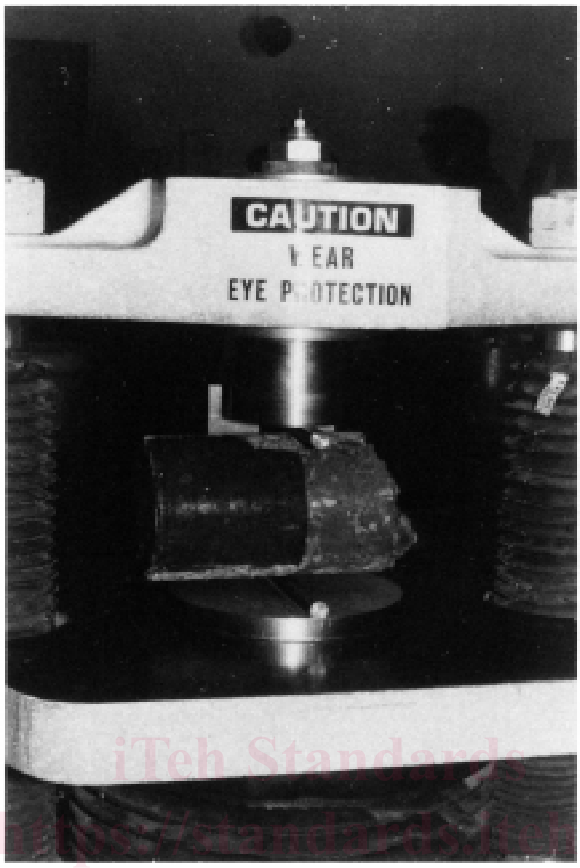


FIG. 2 Test Specimen in Testing Machine

8.1.7.1 Whether bond failure or aggregate failure, or both, were observed in the plane of failure;

8.1.7.2 Should the fracture occur along the original bond surface, the nature of the surface such as texture (smooth or rough), appearance (glossy or dull, undulating or flat), and detailed descriptions of discoloration, foreign objects or materials, loose or dusty material in voids, and the suspected presence and condition, or absence, of any bonding improvement agent;

8.1.7.3 Alternatively, should the plane of fracture occur partially or totally within the concrete layers adjacent to the bond surface, the percentage of the total area subjected to this type of failure versus the percentage area where failure occurred at the bond surface; and

8.1.7.4 Any unexpected features.

9. Precision and Bias

9.1 *Precision*—There are as yet insufficient data to support a statement of precision for this test method. A statement will be published when sufficient data are available (from Test Method C 1042).

9.2 *Bias*—This test method has no bias because the values determined can be defined only in terms of the test method (from 7.4.1 of Practice C 670).