Designation: C 341 – 96

Standard Test Method for Length Change of Drilled or Sawed Specimens of Hydraulic-Cement Mortar and Concrete[1]

This standard is issued under the fixed designation C 341; 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 covers the determination of the length changes of drilled or sawed specimens of hydraulic-cement mortar and concrete due to causes other than externally applied forces and temperature changes. It can be readily adapted, if desired, to studies of length change involving different schedules or environmental treatment than the standard procedures prescribed by this test method.

1.2 The values stated in inch-pound units are to be regarded as the standard.

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:*

A 276 Specification for Stainless Steel Bars and Shapes[2]

C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete[3]

C 157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete[3]

C 490 Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete[4]

3. Terminology

3.1 *Definition of Term*—The term "length change," as used here, is defined as an increase or decrease in a linear dimension of a test specimen which has been caused to change by any factor other than externally applied forces and temperature changes.

4. Significance and Use

4.1 Measurements of length change permit assessment of the potential for volumetric expansion or contraction of drilled or sawed specimens of hydraulic-cement mortar, and concrete due to various causes other than externally applied forces and temperature changes. This test method is particularly useful for comparative evaluation of this potential in different mortar or concrete specimens.

5. Apparatus

5.1 *Length Comparator*—The length comparator shall generally conform to the requirements of Specification C 490, except that it should be constructed to accommodate the specimens to be tested under this test method, which may have gage lengths of 3 in. (75 mm) or more.

5.1.1 *Gage Studs in Ends of Specimens*—When the comparator is to be used to measure between gage studs in the ends of specimens, the gage length for computing percentage length change shall be considered to be the distance between the innermost ends of the gage studs, and the contact terminals of the comparator shall be plane, polished, heat-treated surfaces as described in Specification C 490. Fig. 3 of Specification C 490 shows one type of comparator which has been found suitable for such specimens. A horizontal comparator may be desirable for specimens that are considered too large to be handled by the type of comparator illustrated in Fig. 3 of Specification C 490.

5.1.2 *Gage Studs on Sides of Specimen*—When the comparator is to be used to measure between gage studs on the sides of specimens, the contact terminals shall be conical, heat-treated surfaces as shown in Fig. 1, which illustrates a type of comparator that has been found satisfactory for this type of specimen. In this case, the gage length shall be the distance between the reference points located in the exposed ends of the gage studs (see 5.2).

5.2 *Gage Studs*—Gage studs shall be Type 316 stainless steel, meeting Specification A 276.

5.2.1 *For Ends of Specimens*—Gage studs that are to be located in the ends of specimens shall have a rounded surface to provide point contact with the terminals of the comparator. The types of studs described in Specification C 490 are suitable

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[2] *Annual Book of ASTM Standards*, Vol 01.05.

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

[4] *Annual Book of ASTM Standards*, Vol 04.01.

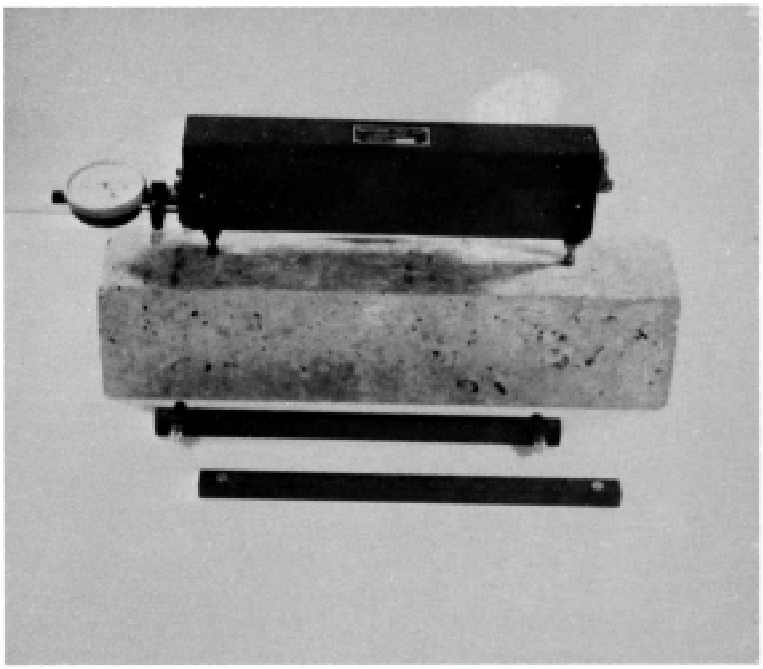

FIG. 1 Type of Suitable Extensometer for Measurement of Length Change of Specimens Having Gage Studs on Sides

for insertion in drilled holes. Spherical studs having a diameter of ¼ to ⅜ in. (6 to 10 mm), or studs that are sections of spheres of similar diameter, are suitable for cementing to the ends of specimens.

5.2.2 *For Sides of Specimens*—The exposed end of gage studs that are to be located on the sides of specimens shall have a plane surface with a diameter or diagonal of ⅜ to ½ in. (10 to 13 mm). For dry setting, the length of the stud shall be ½ to ⅝ in. (13 to 16 mm). Shorter lengths of stud, including plane disks, may be satisfactory for studs that are to be cemented.

5.3 *Drying Room and Controls*—A drying room and controls as described in Test Method C 157 shall be used for storing specimens in air.

6. Sampling

6.1 Samples shall be obtained in accordance with the section on Sampling of Test Method C 42.

7. Test Specimens

7.1 Test specimens shall be either cores or rectangular prisms that have been drilled or sawed from existing concrete or mortar structures and are free from reinforcing steel, visible cracks, or other structural defects. They may be of any size but specimens that are to be compared should not differ in their cross-sectional dimensions by more than 10 % or in length by more than 20 %. The gage length shall be at least six times the maximum nominal size of the coarse aggregate but not less than 3 in. (75 mm), and that the minimum cross-sectional dimension be at least three times the maximum nominal size of the coarse aggregate but not less than 2 in. (50 mm). When the gage studs are to be located on the sides of the specimen, the over-all length of the specimen shall exceed the gage length by at least 2 in. (50 mm).

8. Setting Gage Studs

8.1 Gage studs may either be dry-set or cemented in drilled holes, or cemented directly to the surface of the specimen.

8.2 *Drilling Holes*—For gage studs that are to be cemented, holes should be drilled (Note 1) only slightly larger than the studs. For gage studs that are to be dry-set, holes should be drilled about 0.005 in. (0.1 mm) smaller in diameter than the studs. In the case of small specimens, take care that the specimens are not damaged by the drilling operation. The location and depth of holes shall be as given in 8.2.1 and 8.2.2.

NOTE 1—Carbide-tipped masonry drills have been found most suitable for this purpose.

8.2.1 *For Gage Studs in Ends of Specimen*—Drill holes in the ends of a specimen so that their longitudinal axes coincide with the longitudinal axis of the specimen. The depth of the holes should be such that the gage studs will project from ⅛ in. to 3⁄16 in. (3 to 5 mm) beyond the ends of the specimen.

8.2.2 *For Gage Studs in Sides of Specimen*—Drill a pair of holes in each of two opposite sides of the specimen to compensate for warping and to provide a better average for length change. Position both pairs of holes in a plane containing the longitudinal axis of the specimen and space to conform to the length of the comparator. The center of each hole should be at least 1 in. (approximately 25 mm) from the end of the specimen. The depth of the holes should preferably be such that the top surfaces of the gage studs can be set about 0.1 in. (3 mm) below the surface of the specimen.

8.3 *Cementing Methods*:

8.3.1 *Studs Set in Holes*—Position gage studs in holes at the depth specified in 8.2.1 or 8.2.2, as appropriate, with the exposed end parallel to the surface of the specimen in the case of studs having plane end surfaces. The cementing material