Designation: C1611/C1611M – 21

Standard Test Method for Slump Flow of Self-Consolidating Concrete[1]

This standard is issued under the fixed designation C1611/C1611M; 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 slump flow of self-consolidating concrete (SCC).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. 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 non-conformance 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. (**Warning**—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[2])

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* (**Warning**—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[3])

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

C125 Terminology Relating to Concrete and Concrete Aggregates

C143/C143M Test Method for Slump of Hydraulic-Cement Concrete

C172/C172M Practice for Sampling Freshly Mixed Concrete

C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory

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

C1758/C1758M Practice for Fabricating Test Specimens with Self-Consolidating Concrete

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *halo, n*—an observed cement paste or mortar ring that has clearly separated from the coarse aggregate, around the outside circumference of concrete after flowing from the mold.

3.2.2 *spread, n*—the distance of lateral flow of concrete during the slump-flow test.

3.2.3 *stability, n*—the ability of a concrete mixture to resist segregation of the paste from the aggregates.

3.2.4 *viscosity, n*—resistance of a material to flow under an applied shearing stress.

4. Summary of Test Method

4.1 A sample of freshly mixed concrete is placed in a mold either in the upright or inverted position. The concrete is placed

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[2] Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

[3] Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

[4] 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.

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

in one lift without tamping or vibration. The mold is raised, and the concrete is allowed to spread. After spreading ceases, two diameters of the concrete mass are measured in approximately orthogonal directions. Slump flow is the average of the two diameters.

5. Significance and Use

5.1 This test method provides a procedure to determine the slump flow of self-consolidating concrete in the laboratory or the field.

5.2 This test method is used to monitor the consistency of fresh, unhardened self-consolidating concrete and its unconfined flow potential.

5.3 It is difficult to produce self-consolidating concrete that is both flowable and nonsegregating using coarse aggregates larger than 25 mm [1 in.]. Therefore, this test method is considered applicable to self-consolidating concrete having coarse aggregate up to 25 mm [1 in.] in size. Appendix X1 provides non-mandatory visual rating criteria that may be used to classify the ability of a self-consolidating concrete mixture to resist segregation (stability).

5.4 The rate at which the concrete spreads is related to its viscosity. Appendix X1 provides a non-mandatory procedure that may be used to provide an indication of relative viscosity of self-consolidating concrete mixtures.

6. Apparatus

6.1 *Mold*—The mold used in this test method shall conform to that described in Test Method C143/C143M.

6.2 *Base Plate*—A nonabsorbent, smooth, rigid plate having a minimum diameter of 915 mm [36 in.] (see Note 1).

NOTE 1—*Field experience and results from the round robin test program have shown that base plates made from sealed/laminated plywood, acrylic plastic, or steel are suitable for performing this test.*

6.3 *Strike-off Bar*—As described in Test Method C173/C173M.

6.4 *Measuring Device*—A ruler, metal roll-up measuring tape, or similar rigid or semi-rigid measuring instrument marked in increments of 5 mm [¼ in.] or less.

6.5 *Sample Receptacle*—A pan or wheelbarrow that is water-tight, has a nonabsorbent surface, and is large enough to allow both remixing of the entire sample and retain a volume of concrete sufficient to fill the mold.

6.6 *Other Tools*—Items such as shovels and scoops capable of remixing the concrete in the sample receptacle, filling the pouring vessel, or both.

7. Sample

7.1 Obtain a sample of freshly-mixed self-consolidating concrete in accordance with Practice C172/C172M in the field, or Practice C192/C192M in the laboratory, and place it in the sample receptacle.

8. Procedure

8.1 Perform this test on a flat, level, nonabsorbent work surface such as a concrete floor or base plate. Use a base plate in conditions where a flat, level surface is not available, such as on a construction site. When the base plate is used, position and shim the base plate so that it is fully supported. Dampen the work surface, removing any standing water. Do not subject the work surface or mold to vibration or disturbance.

8.1.1 When performing the slump flow test for a given study or project, do not change the base plate surface type for the duration of the study or project.

8.2 *Remixing of Sample*—Remix the sample, obtained in accordance with 7.1, in the sample receptacle using a shovel or scoop so that the concrete is homogeneous.

8.3 *Filling the Mold*—Fill the mold by following either Procedure A or Procedure B (see Note 2).

8.3.1 Fill the mold with SCC following the procedure in Practice C1758/C1758M.

8.3.2 *Filling Procedure A (Upright Mold)*—Dampen the interior of the mold and place it on the work surface, or centered on the base plate, with the larger opening facing down. Hold the mold firmly in place during filling by standing on the two foot pieces.

8.3.3 *Filling Procedure B (Inverted Mold)*—Dampen the interior of the mold and place it on the work surface, or centered on the base plate, with the smaller opening facing down (see Note 3).

NOTE 2—*During the development of this test method, it was found that some of the users preferred to perform the test with the large opening of the mold facing down as is performed in Test Method C143/C143M. The provision of a collar to the top of the mold is useful to reduce the probability of concrete spilling over the mold and on to the base plate. Other users preferred to place the mold with the smaller opening face down, which facilitates the ease of filling. Both filling procedures have been found to be suitable when performing this test. The precision statement in Section 10 reflects the use of both procedures. Test data using the two filling procedures can be obtained in the round robin test report available from ASTM headquarters.*

NOTE 3—*As a precaution, when filling the mold in the inverted position, the mold may be supported to prevent accidental movement or tipping. Experienced users of this test method have found that it is not necessary to support the mold.*

8.4 Strike off the surface of the concrete level with the top of the mold by a sawing motion of the strike-off bar. Remove concrete from the area surrounding the base of the mold to preclude interference with the movement of the flowing concrete. Remove the mold from the concrete by raising it vertically. Raise the mold a distance of 225 ± 75 mm [9 ± 3 in.] in 3 ± 1 s by a steady upward lift with no lateral or torsional motion. Complete the entire test from the start of filling through removal of the mold without interruption within an elapsed time of 2½ min.

8.5 Wait for the concrete to stop flowing and then measure the largest diameter (d_1) of the resulting circular spread of concrete. When a halo is observed in the resulting circular spread of concrete, it shall be included as part of the diameter of the concrete. Measure a second diameter (d_2) of the circular spread at an angle approximately perpendicular to the first measured diameter (d_1). Measure the diameters to the nearest 5 mm [¼ in.]. Determine the Slump flow in accordance with Section 9.