ASTM C143

Standard Test Method for Slump of Hydraulic-Cement Concrete

Understanding ASTM International Test Procedures for Cement and Concrete - Staying Up to Standard

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Acknowledgments

Slides Adapted from ASTM International

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Outline

- Scope
- Summary of Test Method
- Significance and Use
- Identify Necessary Equipment
- Procedure
- Understand Limitations of Procedure
- Report

Related Procedures

- ASTM C31 – Practice for Making and Curing Concrete Test Specimens in the Field
- ASTM C138 – Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- ASTM C172 – Practice for Sampling Freshly Mixed Concrete
- ASTM C173 – Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- ASTM C231 – Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- ASTM C670 – Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- ASTM D638 – Test Method for Tensile Properties of Plastics

Scope

- This test method addresses the procedures for determining the slump of hydraulic-cement concrete.
- The slump test can be conducted both in the field and laboratory.

Summary of Test Method

- A sample of concrete is placed in a mold and consolidated.
- The mold is then raised vertically and the concrete is allowed to settle.
- Slump is the vertical distance between the original and displaced center of the concrete surface.

Significance and Use

- This test is considered applicable to concrete having coarse aggregate up to 37.5 mm in size.

Significance and Use

- When the aggregate is larger than 37.5 mm,
  - wet sieve the concrete over a 37.5 mm sieve
  - test the sieved material

Note that the standard does not state whether the aggregate size is an absolute maximum or nominal maximum.

Significance and Use

- This test is NOT applicable to non-plastic, non-cohesive concrete.
  - non -plastic concrete is defined as having a slump less than 15 mm
  - non-cohesive concrete is defined as having a slump greater than about 230 mm

Significance and Use: Note 1

- The slump test was originally devised to provide a method to monitor the consistency of unhardened concrete.
- Under field conditions a relationship between slump and strength cannot be clearly and consistently shown.

Apparatus

- Mold
- Tamping Rod
- Measuring Device
- Scoop

Apparatus: Mold

- May be metal or an alternate material.

Apparatus: Mold

- Shall be in the shape of the frustum of a cone.
  - 100 mm wide top, 200 mm wide base, 300 mm height
- Dimensions shall be checked and recorded,
  - when purchased or first used
  - at least annually
- Shall have foot fins and handles.

Apparatus: Alternate Material Molds

- Non-metal molds are permissible if they,
  - meet the shape and dimensional requirements of metal molds
  - are rigid, dimensionally stable, resistant to impact, and non-absorbent
  - provide results comparable to metal molds
- Initial comparability tests are the responsibility of the manufacturer.

Apparatus: Alternate Material Molds

- If the condition of a mold is suspected of being out of tolerance from the as manufactured condition,
  - perform a single comparative test with a metal mold
  - the difference in measured slump between the metal and alternate material mold may not be more than 15 mm
  - molds that fail the test shall be removed from service

Apparatus: Tamping Rod

- Round, smooth, straight, steel.
- 16 mm diameter.
- Tamping end, or both ends, shall be rounded to a hemispherical tip.

Apparatus: Tamping Rod

- The length shall be at least 100 mm greater than the depth of the mold, but not greater than 600 mm.
  - a length of 400 to 600 mm meets these requirements

Apparatus: Measuring Device

- Ruler, roll-up tape, or similar device.
- Rigid or semi-rigid.
- Marked with increments of 5 mm or smaller.
- Minimum length of 300 mm.

Apparatus: Scoop

- Shall have a size,
  - large enough so the material taken from the sampling receptacle is representative
  - small enough so concrete is not spilled during placement of material in the mold

Procedure: Sample

- Obtain a representative sample of concrete according to ASTM Practice C 172.

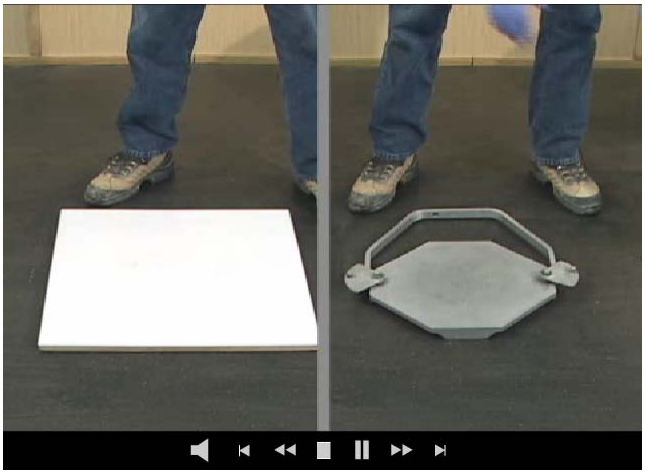
Procedure: Dampen Mold

- Dampen the mold and place on a rigid, flat, level, moist, and non-absorbent surface that is free of vibration.

Procedure: Secure Base

- Stand on the two foot fins while filling the mold and cleaning the perimeter.
  - clamping the mold to a base is also permitted

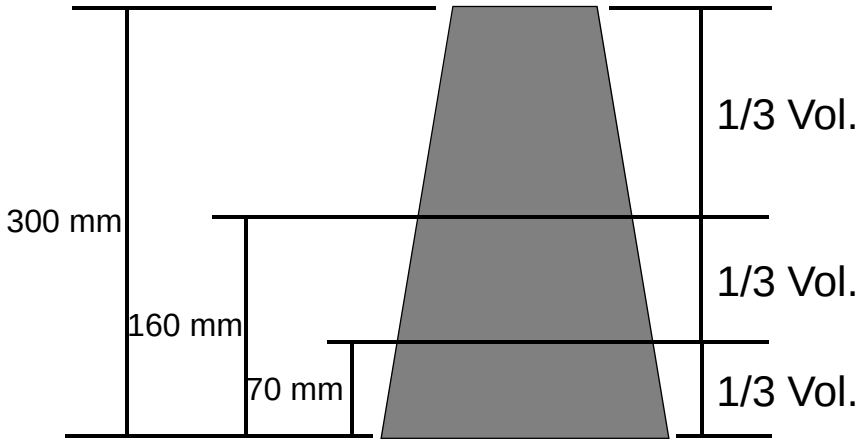
Procedure: Secure Base



Procedure: Filling Mold

- Use a scoop to place concrete in the mold.
- Move the scoop around the mold opening so material is evenly distributed and segregation is minimized.
- Fill the mold in three layers of approximately equal volume.
  - fill the mold to 70 mm, 160 mm, and then 300 mm from the base

Procedure: Filling Mold



Procedure: Rodding Concrete

- Rod each layer 25 times.
  - uniformly distribute the rodding strokes over the cross section of a layer
  - rod the bottom layer through its depth
  - rod each upper layer through its depth and into the layer below approximately 25 mm

Procedure: Rodding Concrete

- While rodding the bottom layer,
  - slightly incline the rod
  - rod around the mold perimeter using about half of the 25 strokes
  - conclude with vertical strokes near the center of the mold
- For the top layer,
  - heap concrete above the mold prior to rodding
  - add concrete as necessary to keep an excess above the top of the mold at all times

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Procedure: Rodding Concrete

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Procedure: Strike-off Concrete

- Strike-off the mold with the tamping rod in a screeding and rolling motion.

Procedure: Raising the Mold

- Holding the mold down firmly, clear away any concrete from the area surrounding the base.
  - prevent interference with the slumping concrete
- Remove the mold immediately after clearing the base of concrete.
- Raise the mold vertically in 5 ± 2 seconds.
  - there should be no lateral or torsional (twisting) motion

Procedure: Raising the Mold

Procedure: Timing Requirements

- Complete the entire test without interruption, from the start of filling to removal of the mold, within 2½ minutes.

Procedure: Measuring Slump

- When measuring the slump,
  - measure immediately after removing the mold
  - measure the vertical difference between the top of the mold and the displaced original center
  - if a falling away or shearing occurs, disregard the test and make a new test using another portion of the sample

To measure slump, it is convenient to invert the mold and place it next to the slumped concrete.

Procedure: Measurement Location

Displaced Original Center

Procedure: Measurement Procedure

Procedure: Measurement Procedure

Report

- Slump is reported to the nearest 5 mm.

Limitations and Errors

- Slump test is suitable for slumps of medium workability, slump in the range of 15 – 230 mm.
- Test fails to determine the difference in workability in stiff mixes which have zero slump, or for wet mixes that give a collapse slump.
- Limited to concrete formed of aggregates of less than 37.5 mm
- Lacks to tell you anything about water content, w/c, w/cm, strength, air, shrinkage, pump-ability, response to the vibrator and slip forms, and finishability.
- User dependent.
- Very sensitive to time from mixing and time in cone.

Factors Affecting Slump

1. Content, proportions, chemistry, fineness, particle size distribution, moisture content and temperature of cementitious;
2. Content, proportions, size, texture, combined grading, cleanliness and moisture content of the aggregates;
3. Dosage, type, combination, interaction, sequence of addition, effectiveness of chemical admixtures;
4. Air content;
5. Batching, mixing and delivery methods and equipment;
6. Temperature of the concrete;
7. Sampling, slump-testing technique and the condition of test equipment;
8. The amount of free water in the concrete; and
9. Time since batching at the time of testing.

Slump is Influenced by Everything!

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Questions & Answers