

Purpose – Why Do This Test?

The standard slump test should be considered as a pseudo-measure of workability. It does not necessarily reflect workability properties that correlate to the ability to place concrete with a slipform paver. However, slump can be used as an indicator of between-batch variability (uniformity). Changes in slump indicate variability in the materials and/or the batching process. Thus, slump is a process control test procedure and should not be considered as an acceptance criteria. Slump can also be used as an indicator of early stiffening. Performing slump tests at 5 minutes and 20 minutes after batching is a practice that is encouraged. Monitoring the slump loss over time can identify early stiffening issues associated with material changes, incompatibilities, or changes in the concrete temperature.

Principle – What is the Theory?

Water content, combined gradation, cementitious chemistry, mixing time, air content, and concrete temperature all interact to affect slump. A slump test cannot identify which of these factors is changing—it simply measures the slump. Uniformity of the concrete slump and slump loss is of primary concern. Concrete uniformity and early stiffening can be monitored by performing slump tests randomly 5 minutes after batching and again 20 minutes after batching (at the point of delivery).

Test Procedure – How is the Test Run?

ASTM C 143, the Standard Test Method for Slump of Hydraulic-Cement Concrete, determines how much a concrete sample settles (slumps) when it is unconfined. Concrete is consolidated inside of a 12-in. tall cone-shaped form. When the form is removed, the concrete is unconfined and it “slumps.” The difference between its original 12-in. height and its height immediately after the form is removed is the slump.

Test Apparatus (figure 1)

- Slump mold.
- Tamping rod.
- Flat and nonabsorbent base.

Test Method – Refer to ASTM C 143 for Comprehensive Guidance

The following steps summarize the sampling and testing procedures for concrete produced at a central mix plant and transported in nonagitating trucks:

1. Sample concrete at the central mix plant.
2. Perform the first slump test 5 minutes after the concrete batch is discharged from the mixing drum.
3. Sample concrete at the placement location and test. Perform the second slump test 20 minutes after the concrete batch is discharged from the mixing drum.
4. Measure and record the following for each test:
 - a. Concrete temperature.
 - b. Ambient temperature.
 - c. Time.
 - d. Slump.
5. Graph the test results.

[continued on next page](#)



Figure 1. Slump testing equipment

Output – How Do I Interpret the Results?

Graphing the slump test data as shown in Figure 2 will be helpful in monitoring material and process uniformity. Slump loss results can also be graphed similar to Figure 3 as a means to identify a change in the early stiffening characteristics of a mixture.

Construction Issues – What Should I Look For?

Test results that vary by more than 2 in. from sample to sample may indicate material and/or process control deficiencies. Contributing factors that should be investigated as a cause of the slump variability include the following:

- Aggregate moisture(s).
- Stockpile segregation.

- Mixing time.
- Air content.
- Concrete temperature.
- Material incompatibilities.
- Batching proportions and/or scale tolerances.

Changes in the slump loss after 15 minutes that affect the early stiffening characteristics may be addressed by lowering the initial concrete temperature.

Note: A common—but generally inappropriate—field response is to add water, increasing the initial slump to compensate for early stiffening. But adding water above the approved mixture design content to overcome early stiffening is detrimental to shrinkage, permeability, and strength; thus, it should be avoided whenever possible.

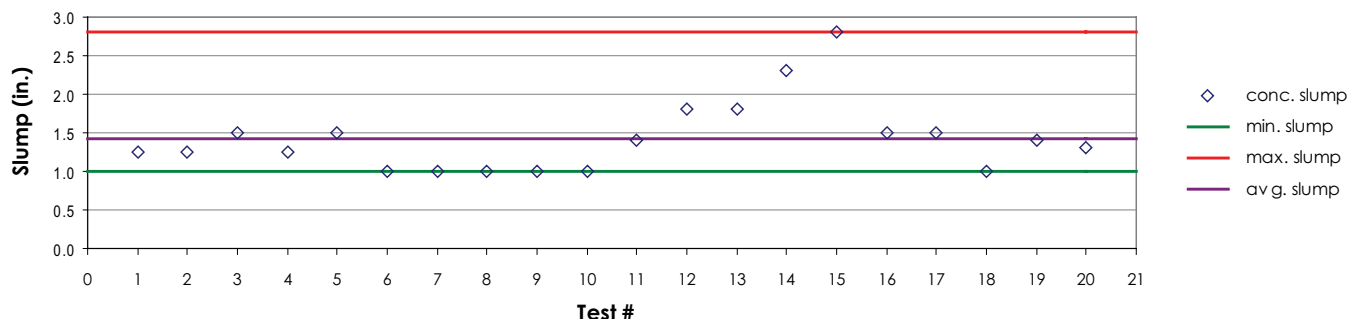


Figure 2. Slump test chart measured at placement

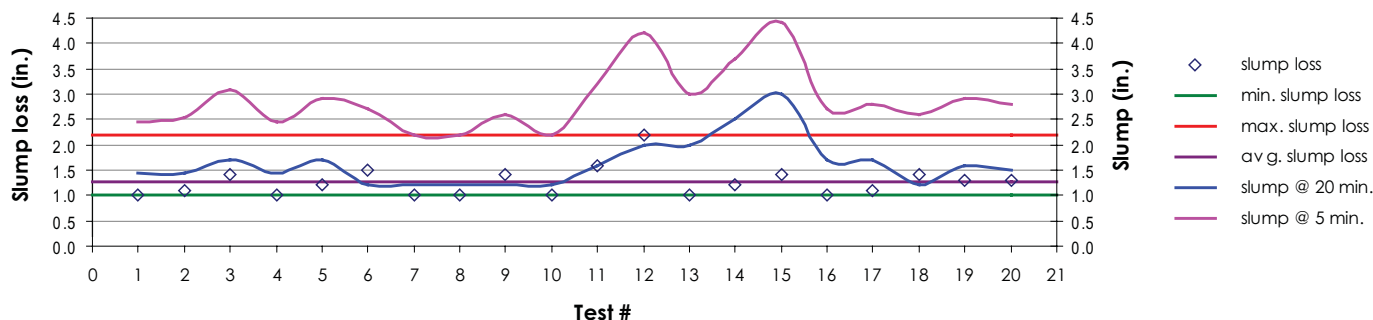


Figure 3. Slump loss chart measured at plant

APRIL 2008



IOWA STATE UNIVERSITY

This test summary is one of a set of summaries originally published in chapter 7 of the *Testing Guide for Implementing Concrete Paving Quality Control Procedures* (Fick, G., Iowa State University, Ames, Iowa, 2008). The testing guide is a product of a 17-state, Federal Highway Administration pooled-fund project, Material and Construction Optimization for Prevention of Premature Pavement Distress in PCC Pavements, TPF-5(066). The project was managed by the National Concrete Pavement Technology Center at Iowa State University.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the view of Federal Highway Administration or Iowa State University.

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, Iowa State University, 3680 Beardshear Hall, 515-294-7612.