CONCRETE IN PRACTICE

CIP 22

What, Why & How?
Grout

WHAT is Grout?

ACI[1] defines grout as "a mixture of cementitious material and water, with or without aggregate, proportioned to produce a pourable consistency without segregation of the constituents."

The terms grout and mortar are frequently used interchangeably but there are clear distinctions. *Grout* need not contain aggregate whereas *mortar* contains fine aggregate. *Grout* is supplied in a pourable consistency whereas *mortar* is not. *Grout* fills space whereas *mortar* bonds elements together, as in masonry construction.

Grout is often identified by its application. Some examples are: bonded prestressed tendon grout, auger cast pile grout, masonry grout, and pre-placed aggregate grout. Controlled low strength material (flowable fill) is a type of grout.

WHY is Grout Used?

Grout is used to fill space or cavities and provide continuity between building elements. In some applications, grout will act in a structural capacity. In projects where small quantities of grout are required, it is proportioned and mixed on site. The ready mixed concrete producer is generally called upon when large quantities are needed.

Flow Cone

Flow Table

HOW to Specify Grout

ASTM C 476 for masonry grout dictates proportions by loose volumes and is convenient for small quantities of grout mixed on site. These grout mixtures have high cement contents and tend to produce much higher strengths[4] than specified in ACI 530[5] or Model Codes.

When grout is ordered from a ready mixed concrete producer, the specifications should be based on consistency and compressive strength. Converting loose volume proportions into batch

weights per cubic yard is subject to errors and can lead to controversies on the job.

Specifications should address the addition of any required admixtures for grout. Conditions of delivery, such as temperature, time limits, and policies on job site addition of water, should be specified. Testing frequency and methods of acceptance must be covered in specifications.

HOW to Test Grout

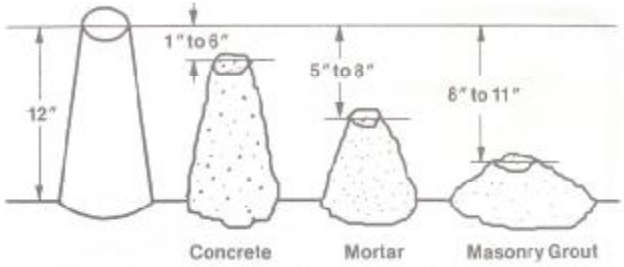
The consistency of grout affects its strength and other properties. It is critical that grout consistency permit the complete filling of void space without segregation of ingredients.

Consistency of masonry grout may be measured with a slump cone (ASTM C 143), and slumps of 8-11 in. are suggested. This is particularly applicable for grouts containing ½ in. or smaller coarse aggregate.

For grouts without aggregate, or only fine aggregate passing a No. 8 sieve, consistency is best determined with a flow cone (ASTM C 939). For flow values exceeding 35 seconds, use the flow table in ASTM C 109, so modified to use 5 drops in 3 seconds.

Masonry grout ("blockfill") for strength tests specimens should be cast in molds formed by masonry units having the same absorption characteristics and moisture content as the units used in construction (ASTM C 1019). Never use non-absorbent cube or cylinder molds for this purpose.

Strength of other types of grout is determined using 2 in. cubes per ASTM C 942. Method C 942 allows for field preparation, recognizes fluid consistency, and also affords a means for determining compressive strength of grouts that contain expansive agents or grout fluidifiers. This is extremely important since "expansive" grouts can lose substantial compressive strengths if cubes are not confined. However, cylindrical specimens (6 x 12 in. or 4 x 8 in.), may give more reliable results for grouts containing coarse aggregate.



Comparison of typical slumps

Special application grouts often require modification of standard test procedures. All such modifications should be noted in the specifications and discussed prior to the start of the job.

References

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2. *Cementitious Grouts and Grouting*, S. H. Kosmatka, Portland Cement Association, 1990.
3. ASTM C 476, "Standard Specification for Grout for Masonry," *Annual Book of ASTM Standards*, Vol. 04.05.
4. Hedstrom, E. G., and Hogan, M. B., "The Properties of Masonry Grout in Concrete Masonry," *Masonry: Components to Assemblages, ASTM STP 1063*, ed. John H. Matthys, 1990, pp. 47-62.
5. "Building Code Requirements for Masonry Structures (ACI 530-88/ASCE 5-88) and Specifications for Masonry Structures (ACI 530.1-88/ASCE 6-88)," *ACI-ASCE Standards*, American Concrete Institute/American Society of Civil Engineers, 1988.
6. ASTM C 143, "Test Method for Slump of Hydraulic Cement Concrete," *Annual Book of ASTM Standards*, Vol. 04.02.
7. ASTM C 939, "Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)," *Annual Book of ASTM Standards*, Vol. 04.02.
8. ASTM C 1019, "Standard Method of Sampling and Testing Grout," *Annual Book of ASTM Standards*, Vol. 04.05.
9. ASTM C 942, "Standard Test Method for Compressive Strengths of Grouts for Preplaced-Aggregate Concrete in the Laboratory," *Annual Book of ASTM Standards*, Vol. 04.02.
10. ASTM C 109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars," *Annual Book of ASTM Standards*, Vol. 04.01.

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