Shotcrete Specification And Testing

by I. Leon Glassgold

Shotcrete has been an important part of the construction industry for more than 90 years. As a specialty concrete technique, it is basically another means for the placement of concrete with its own peculiarities and characteristics. In the early years after its introduction by the Cement Gun Company of Allentown, Pa., in 1910, relatively little testing was done, primarily because the technique had limited use. What testing was performed was done to promote the technique—to show its efficacy for specific applications or to exhibit its superiority over other existing concrete technologies. The tests included were for material and design criteria and properties such as compressive, tensile, and flexural strengths, bond, permeability, shrinkage, and soundness. These tests were based on American Society for Testing and Materials (ASTM) concrete tests adapted for the shotcrete process. When interest in concrete durability began to heighten after World War II, freeze-thaw tests were also introduced. As in conventional concrete, compressive strength has been the defining property of shotcrete testing. However, if other properties are required for a particular application, they can be arranged at the time of specification. The main difference in the tests is in the preparation of samples, which is usually different because of the unique nature of the shotcrete process.

While interest in shotcrete was limited prior to the 1940s, an upsurge developed, especially in the wet-mix process, in the 1950s. In 1990, ASTM decided that the technology had grown sufficiently enough that a new ASTM subcommittee on shotcrete, ASTM C09.46, should be organized. This would complement the existing American Concrete Institute Committee 506 on Shotcreting. ASTM Subcommittee C09.46, Shotcreting, would absorb the

existing ASTM shotcrete standards and, in the future, develop the necessary, new standards for shotcrete.

ASTM Subcommittee C09.46 has developed and maintained jurisdiction over the following standards during the last 10 years:

1. C 1102 Standard Test Method for Time of Setting of Portland-Cement Pastes Containing Quick-Setting Accelerating Admixtures for Shotcrete by the Use of Gillmore Needles;
2. C 1117 Standard Test Method for Time of Setting of Shotcrete Mixtures by Penetration Resistance;
3. C 1140 Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels;
4. C 1141 Standard Specification for Admixtures for Shotcrete;
5. C 1385 Standard Practice for Sampling Materials for Shotcrete;
6. C 1398 Standard Test Method for Laboratory Determination of the Time of Setting of Hydraulic Cement Mortars Containing Additives for Shotcrete by the Use of Gillmore Needles;
7. C 1436 Standard Specification for Materials for Shotcrete; and
8. C 1480 Standard Specification for Packaged Pre-blended, Dry, Combined Materials for Use in Wet or Dry Shotcrete Application.

Setting standards for the use of fibers in shotcrete comes under the jurisdiction of ASTM Subcommittee C09.42 on Fiber Reinforced Concrete.

They have produced the following standard:

C 1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete.

Since compressive strength has traditionally been the qualifying property for shotcrete, the subcommittee is currently preparing a standard test method for determining the strength of hardened shotcrete. The test method will cover obtaining and testing drilled cores or cubes of hardened shotcrete.

They are also updating the older standards as they reach the 5-year mark or if they lag too far behind the technology.

In the future, the ASTM shotcrete subcommittee plans to monitor the technology carefully in conjunction with ACI Committee 506, and prepare those standards that the shotcrete industry needs or are required by the growth of the industry.

References

ASTM, *Annual Book of ASTM Standards*, V. 4.02, West Conshohocken, Pa., 2000.

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