

## U.S. Shotcrete Standards Update

By Charles Hanskat

**T**his article is dedicated to Pete Tatnall, a founding member, Past President, and Board member of ASA; a past Chairman and active member of various ASTM International committees dealing with fiber and shotcrete; and a longtime active member of American Concrete Institute (ACI) Committee 506, Shotcreting. He was a regular contributor to *Shotcrete* magazine and provided regular updates to Shotcrete Corner with articles on U.S. shotcrete standards. With great sorrow, we note that Pete passed away April 26 of this year after a long, valiant 18-month battle with illness. Pete was a great contributor to the shotcrete industry who readily shared his knowledge and experience with members and committees of ACI, ASTM International, and ASA. He will be greatly missed.

It's been over 5 years since we last updated our reference list of shotcrete-related standards and specifications. In that time, we've seen a significant increase in activity by various standards developing organizations in creating new documents incorporating shotcrete and updating their existing documents. Readers are requested to contact the editor and author if inaccuracies are found in the following report, if additional activities should be reported, or if new activities should be initiated.

### ACI ([www.concrete.org](http://www.concrete.org))

ACI Committee 506, Shotcreting, is currently chaired by Larry Totten; and Marc Jolin serves as Secretary. The committee is divided into subcommittees and task groups, each concerned with a specific document or issue. The subcommittees are working on:

- ACI 506.2-95, "Specification for Shotcrete": The specification has been completely revised and balloted through the subcommittee (506-E) and the main committee, passed Technical Activities Committee (TAC) review, and undergone a public review period of 45 days. The main committee has balloted the responses to public comments. It is anticipated that the new version, ACI 506.2-13, will be available for purchase later this year.
- ACI 506R-05, "Guide to Shotcrete": The subcommittee (506-C) is working on revisions to this document. The development of revised text is completed in the subcommittee and will be balloted to the main committee before the ACI Fall 2013 Convention. As the Guide is a non-mandatory document and serves as a "primer" on shotcrete for the industry, good photos are an important component of the document. Watch your e-mail, as ACI Committee 506 may request photos from members of ASA for specific aspects of shotcreting for the Guide.
- ACI 506.1R-08, "Committee Report on Fiber-Reinforced Shotcrete": Pete Tatnall was Chair of this subcommittee (506-B) and completed revisions to the 1998 version of the document. The current Chair, Jeff Novak, is working with the subcommittee on revisions to the document.
- ACI 506.4R-94 (Reapproved 2004), "Guide for Evaluation of Shotcrete": Marc Jolin, Chair of the subcommittee (506-A), has revised the document within the subcommittee and is planning a ballot on proposed revisions for the main committee before the ACI Fall 2013 Convention. A new section on "Acceptance of Shotcrete" is concurrently being developed by Jim Ragland.
- ACI 506.5R-09, "Guide for Specifying Underground Shotcrete": Pete Tatnall also chaired this subcommittee (506-F), which prepared ACI Committee 506's newest document. This document serves as a guide for engineers and owners who are specifying shotcrete for underground applications. It is not a construction specification geared toward the contractor that can be directly incorporated into contract documents for a specific project (such as ACI 506.2-95) but serves to provide specifiers guidance on what is needed in their particular project specification.
- ACI Committee 506 new document, "Guide for Contractor Qualifications for Specific Projects": Chaired by Marcus von der Hofen, this subcommittee (506-G) is close to finishing the document within the subcommittee. The

next step for the document will be balloting to the main ACI 506 committee. The ACI Committee 506 leadership is also considering incorporating the material into the revised "Guide for Evaluation of Shotcrete" rather than publishing it as a stand-alone document.

- ACI Committee 506 new document, "Tech Note for Visual Evaluation of Shotcrete Core Quality": Chaired by John Zhang, this task group is developing a Tech Note to provide a reference for visual evaluation of shotcrete quality using cores. As with the "Guide to Shotcrete," good-quality images are key to the usefulness of the document. Watch your e-mail, as ACI Committee 506 may request photos from members of ASA of specific examples of cores.
- ACI 506 new document, "Tech Note on Acceptance of Shotcrete": Chaired by Jim Ragland, this task group is working on a document to address acceptance criteria of shotcrete. Because the scope and complexity of shotcrete projects can vary widely, the task group is developing the concept of "Application Difficulty Level" and establishing corresponding acceptance criteria that can vary with the application. The ACI Committee 506 leadership is also considering incorporating the material into the revised "Guide for Evaluation of Shotcrete" rather than publishing it as a stand-alone document.
- ACI C660: Both English and Spanish versions of CP-60(09), "Craftsman Workbook for ACI Certification of Shotcrete Nozzleman," are available from ACI and were updated by ACI Committee C660, which is chaired by Marc Jolin.
- ACI 350.5-12, "Specifications for Environmental Concrete Structures": This is a new

document produced by ACI Committee 350, Environmental Engineering Concrete Structures. It is a construction specification similar to ACI 301 but intended for liquid-containing structures rather than buildings. Because shotcrete is widely used in environmental structures, it addresses both concrete and shotcrete.

ASA members continue to play a significant role in the leadership of ACI Committee 506 and contribute to the efforts of the subcommittees. Readers should contact the subcommittee Chairs if they have contributions.

It should be noted that the only ACI Committee 506 document mentioned that can be directly incorporated by reference into project specifications is ACI 506.2R-95 (hopefully soon to be replaced by ACI 506.2-13). If portions of any of the other documents are appropriate for the project specification, the applicable language should be put into mandatory language and inserted by the specifier into the project specification. ACI Committees 506 and C660 and subcommittees will meet in Phoenix, AZ, during the ACI Fall 2013 Convention.

## **ASTM International ([www.astm.org](http://www.astm.org))**

ASTM International Committee C09, Concrete and Aggregates, continues its work on specifications and test methods for shotcrete. The C09 committee and most subcommittees met in Indianapolis, IN, June 10-12, 2013, to work on the latest ballot activities for revising documents and developing new ones. The author is a voting member of ASTM Committees C09, Concrete and Concrete Aggregates, and ASTM Subcommittees C09.46, Shotcrete; C09.64, Nondestructive

and In-Place Testing; and C09.66, Concrete's Resistance to Fluid Penetration. The author also attended the committee meetings. The current status of these committees is reported as follows.

The C09.46 subcommittee outgoing Chair is Mark Lukkarila and the incoming Chair is Richard Schwartz. The C09.46 subcommittee is responsible for the following standards:

- ASTM C1140/C1140M-11, "Practice for Preparing and Testing Specimens from Shotcrete Test Panels": The document is current and not under active revision.
- ASTM C1141/C1141M-08, "Specification for Admixtures for Shotcrete": The document is currently being considered by the committee for revision.
- ASTM C1385/C1385M-10, "Practice for Sampling Materials for Shotcrete": The document is current.
- ASTM C1398-07, "Standard Test Method for The Laboratory Determination of the Time of Setting of Hydraulic Cement Mortars Containing Additives for Shotcrete by the Use of Gillmore Needles (Withdrawn 2010)": The document was not updated and due to limited use has been withdrawn by ASTM International.
- ASTM C1436-08, "Specification for Materials for Shotcrete": The current document is being revised and will be in balloting.
- ASTM C1480/C1480M-07(2012), "Specification for Packaged, Pre-Blended, Dry, Combined Materials for Use in Wet or Dry Shotcrete Application": The document was recently reapproved by the committee.
- ASTM C1604/C1604M-05(2012), "Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete": This document was recently reapproved by the committee. It is currently being evaluated for revisions by the task group of Curt White and the author.

Many members of the shotcrete subcommittee are also members of ASTM Subcommittee C09.42, Fiber-Reinforced Concrete. Documents from this subcommittee that are useful for shotcrete include:

- ASTM C1550-12a, "Test Method for Flexural Toughness of Fiber-Reinforced Concrete (Using Centrally Loaded Round Panel)": Because this test method has been used primarily to characterize fiber-reinforced shotcrete to date, there is continuing interest by ASTM Subcommittee C09.46, ACI Committee 506, and ASA members. This test method is current.
- ASTM C1609/C1609M-12, "Standard Test Method for Flexural Performance of Fiber-

Reinforced Concrete (Using Beam with Third-Point Loading)": This is another fiber-reinforced test standard used in the shotcrete industry. It is current with ASTM.

ASTM Subcommittee C09.66 also met at the June 2013 ASTM Committee Week. In discussions there, the subject arose of the pertinence of ASTM C642-13, "Standard Test Method for Density, Absorption, and Voids in Hardened Concrete." The document status is current, but there was discussion that the description and purpose of the test need revision. This will be considered by the subcommittee as new business. The outgoing Chair is Toy Poole and the incoming Chair of C09.66 is Ken Snyder.

Readers are encouraged to contact the aforementioned Chairs or the author if you have questions or if you are interested in participating in the development of documents concerning the use of shotcrete.



**Charles Hanskat, PE**, is Managing Principal at Hanskat Consulting Group, LLC, a firm he founded in 2012 located in Northbrook, IL. He received his BS and MS in civil engineering from the University of Florida. Hanskat is a licensed professional engineer in 23 states. He has been involved in the design, construction, and evaluation of environmental concrete and shotcrete structures for over 35 years. Hanskat is an ASA Vice President, Board member, and Chair of the ASA Sustainability Committee. He is also a member of ACI Committees 301, Specifications for Concrete; 350, Environmental Engineering Concrete Structures; 371, Elevated Tanks with Concrete Pedestals; 372, Tanks Wrapped with Wire or Strand; 376, Concrete Structures for Refrigerated Liquefied Gas Containment; and 506, Shotcreting; and Joint ACI-ASCE Committee 334, Concrete Shell Design and Construction. Hanskat's service to the American Society of Civil Engineers (ASCE), the National Society of Professional Engineers (NSPE), and the Florida Engineering Society (FES) in over 50 committee and officer positions at the national, state, and local levels was highlighted when he served as State President of FES and then as National Director of NSPE. He served as a District Director of Tau Beta Pi for 25 years from 1977 to 2002. He is a Fellow of ACI, ASCE, and FES and a member of ASA, NSPE, ASTM International, AWWA, NFPA, and ASCC.