

Special Shotcrete Inspection in Swimming Pool Construction

By Ron Lacher

I am writing this article just having returned from 4 very busy days at the ACI Fall 2009 Convention in New Orleans, LA. During those 4 days, I attended all of the American Shotcrete Association (ASA) committee meetings as well as the committee meetings for ACI Committees 506, Shotcrete, and C660, Shotcrete Nozzleman Certification. The experience was more than worthwhile. The new people I met and contacts I made were invaluable, some when least expected. I struck up a conversation with the gentleman in front of me in the cab line at the New Orleans airport. It turned out that he was a materials engineer involved in a case I was researching for an issue I'd run into. What a coincidence! I plan on writing about this important issue in a future article for *Shotcrete* magazine. Especially beneficial was hearing first-hand about all the projects and activities in progress by the committees

and subcommittees dealing with shotcrete. Plus, I thoroughly enjoyed visiting New Orleans and experiencing its unique history, architecture, and culture. Did I mention the food? I had more than my share of gumbo, red beans and rice, and poboys. If you are in the swimming pool industry and have an interest in shotcrete, I encourage you to attend the ASA committee meetings at the ACI Spring 2010 Convention in Chicago, IL, March 20 to 25. The swimming pool industry is one of the most visible users of shotcrete and more representation is needed in both ASA and ACI.

Of the various committee meetings I attended while in New Orleans, I found that ACI Committee C660 was working on what I believe to be one of the most important topics in shotcrete today—Shotcrete Inspector Certification. As readers of *Shotcrete* magazine, we already know that shotcrete is a very versatile and economical method of concrete placement. As with any construction method, we also know that there are a number of important aspects necessary to obtain quality results. Many articles have been written about most of those aspects, for example, the knowledge, skill, and experience of the nozzleman. There are other aspects of shotcrete application that, in my opinion, are almost as important as the skill of the nozzleman. Those are the knowledge and training of the shotcrete inspector. Today, most areas of the country have adopted the International Building Code (IBC) published by the International Code Council (ICC). In Chapter 17, Table 1704.4, of the IBC, continuous shotcrete inspection for proper application techniques during shotcrete placement is required. Many swimming pool contractors are not familiar with the code requirement for shotcrete special inspection because the Code makes an exception for most residential pools (Group R-3 and U occupancies). Even so, it is not uncommon for the local building official to require continuous special inspection during shotcrete placement in swimming pools.



Shotcrete inspection would help eliminate many unacceptable practices such as making steps and benches with rebound

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These types of requirements tend to proliferate so, as time goes on, more and more building departments will likely require continuous special inspection during shotcrete placement in swimming pools.

When continuous shotcrete inspection is required in swimming pool construction, what category of inspectors performs the inspection and where do the inspectors get their knowledge and training about shotcrete placement? Continuous shotcrete inspection is usually provided by an independent special inspector who typically possesses some form of certification in concrete inspection either from ACI or perhaps ICC. Holding an ICC or ACI certification, however, doesn't guarantee that the inspector is familiar with the code inspection requirements for shotcrete placement.

Let's take a quick look at the two ACI certification programs that would be relevant to structural concrete testing and inspection. The first is called *Concrete Field Testing Technician—Grade I*. According to ACI, this is an individual who has demonstrated the knowledge and ability to properly perform and record the results of seven basic field tests on freshly mixed concrete. The seven basic field tests are: 1) the temperature of freshly mixed portland cement concrete; 2) sampling freshly mixed concrete; 3) slump of hydraulic cement concrete; 4) unit weight, yield, and air content of concrete; 5) air content of freshly mixed concrete by the pressure method; 6) air content of freshly mixed concrete by the volumetric method; and 7) making and curing concrete test specimens in the field. Of course, these are important tests and one or more may be performed as a part of the placement of wet-mix shotcrete materials. But these tests do not relate in any way to proper shotcrete application techniques nor are they applicable to dry-mix shotcrete. The second ACI certification program is called *Concrete Construction Special Inspector*. This is a person qualified to inspect and record the results of concrete construction inspection based on codes and job specifications and includes pre-placement, placement, and post-placement operations. ACI's knowledge requirements for this certification include a long list of resource materials, but it's noteworthy that this list does not include any resource materials about shotcrete. The ICC *Reinforced Concrete Special Inspector* is an individual who possesses one of the two aforementioned ACI certifications and has also passed the ICC special inspector exam that tests for knowledge of concrete quality, reinforcement,

formwork, joints and embeds, concrete placement, protection, and curing. Similarly to ACI's required knowledge base, ICC did not list shotcrete as a content area for the ICC exam. Based on this and as previously stated, holding an ICC or ACI certification does not guarantee that the inspector is familiar with the code inspection requirements for shotcrete placement.

My experience with shotcrete special inspection is primarily related to swimming pool construction, and my comments are not intended to reflect on special shotcrete inspectors outside of swimming pool construction. Also, I'm sure that there are many capable and knowledgeable special inspectors in swimming pool construction. I've had personal experience, however, with many inspectors who did not have a clear understanding of the proper methods of shotcrete application and testing. One area where there is considerable confusion is the obtaining of shotcrete samples for compression testing. The IBC requires, under Paragraph 1913.10.1, Sampling, that shotcrete specimens be taken from the in-place work or from test panels. Variations actually used include shooting into a homemade welded wire basket formed into a cylinder, taking wet-mix shotcrete samples directly from the ready-mix chute and rodding into a standard test cylinder, and taking either shot or unshot dry-mix material and rodding into a standard test cylinder. Clearly, these alternate methods of obtaining samples for testing do not meet the intent of the IBC. Other areas where proper shotcrete application does not appear to be well understood by some shotcrete special



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inspectors include the proper angle of the nozzle to the receiving surface; the removal of rebound and overspray on the receiving surface; the improper reuse of rebound; and the improper phasing of the work, especially in wet-mix applications where walls are often shot before the floor at the base of the wall.

Based on my experience and observations in the swimming pool industry, it is my opinion that independent special shotcrete inspection is an area where improvement in knowledge and training is needed. Are these examples isolated instances of special inspectors not providing the oversight that was expected of them? Sadly, many shotcrete applicators in swimming pool construction have, “off the record,” voiced similar experiences.

I’m not one who believes in establishing rules and procedures to solve potential problems when those potential problems have never occurred, but that is not the case with training and certification of shotcrete inspectors. As previously mentioned, ACI Committee C660, Shotcrete Nozzleman Certification, is currently developing a certification program for special shotcrete inspectors. Based on my experiences, a couple of which I’ve outlined herein, I’m strongly in favor of certification for

shotcrete inspectors based on a training and certification program developed by ACI Committee C660. I hope to become involved in that process.



Ron Lacher, PE, CBP, President of Pool Engineering, Inc., received his bachelor's degree in civil engineering. Lacher is a nationally recognized expert in swimming pool construction and swimming pool structural design. He is a Certified Building Professional (CBP) by The Association of Pool & Spa Professionals (APSP). His firm, Pool Engineering, Inc., has provided the structural designs for over 100,000 pools. Lacher's affiliations include the Advisory Board of the National Pool Industry Research Center, California Polytechnic State University, San Luis Obispo, CA; the APSP Builders Council and Education Committee; the ASA Pool Recreational Shotcrete Committee, where he is an approved educator for wet- and dry-mix shotcrete; the International Association of Plumbing & Mechanical Officials technical committee for the Uniform Swimming Pool, Spa & Hot Tub Code; and The Ceramic Tile Institute of America Swimming Pool technical subcommittee for the preparation of ANSI installation standards for tile and glass tile in swimming pools. Lacher has authored numerous articles on proper trade practices and structural engineering in swimming pool construction and is a well-known seminar presenter at national and regional trade conferences. He is a licensed professional engineer in California.

Tom Norman, ASA member and Chair of ASA's Pool & Recreational Shotcrete Committee, wants your input. Your comments, suggestions, and the topics you'd like to see covered are welcome. Perhaps you'd like to become a contributing author to Pool & Recreational Shotcrete Corner. Norman and the ASA staff encourage you to contact ASA with your questions and comments at: info@shotcrete.org.