

# Shotcrete Contractor Qualification

By Marcus H. von der Hofen

It's been over a decade since the inception of the ACI Shotcrete Nozzleman certification programs, which many individuals within the American Shotcrete Association (ASA) and the American Concrete Institute (ACI) worked extremely hard to create. Many thought that certification should have been done at the contractor level. Through hours of debate and consensus building, however, ASA moved forward in formalizing the shotcrete nozzleman programs.

The ACI Shotcrete Nozzleman certification programs were designed to be at a “baseline” level. The nozzleman receives a certificate for each shotcrete process (dry- and/or wet-mix) and orientation (vertical with or without overhead) if successful in both the written and the performance exam(s). They were not intended to be the most rigorous exams possible. The shotcrete industry has a wide spectrum of applications, practices, shotcrete processes, performance requirements, site constraints, and geographic differences. Correspondingly, a wide range of project needs exists, from lightly reinforced basic shotcrete to heavily reinforced concrete sections with complex geometry and limited access requiring much more sophisticated workmanship. No single shotcrete certification program can address all the variables one may encounter on a project.

The ACI certification programs focus on certain and specific key elements (knowledge, skills, and abilities) deemed by knowledgeable committee and industry members to be the most essential for general applications. They consist of a general-knowledge written examination and a performance examination that includes shooting an actual test panel containing reinforcing steel. The test panel is 30 x 30 x 3.5 in. (800 x 800 x 90 mm) deep and contains a single layer of reinforcing steel of different sizes and spacing. Thus, they are basic—they neither simulate deep sections, multiple layers of reinforcing, or obstructions, nor do they address bonding and surface preparation. After hardening, the panel is cored for evaluation in accordance with prescribed procedures. Evaluation is primarily based on the degree of encapsulation of the reinforcing steel. The certification programs verify the certified nozzleman knows the basics of both general knowledge and performance technique and has the **potential** for satisfactorily placing shotcrete. Again, this certification alone

is not a guarantee that this nozzleman is then able to place shotcrete in all applications and degrees of difficulty as exists in the field. There is no substitute for documented experience in the shotcrete application at hand.

What has been left out of the ACI Shotcrete Nozzleman certification programs is the fact that the nozzleman did not gain shotcrete nozzling experience and get certified *on his or her own*. The fact is that much of the field operation needed for nozzling success is not necessarily under the nozzleman's direct control. The diligent work of a qualified shotcrete contractor, who provides the right mixture design, properly sized and maintained equipment, the guidance of an experienced nozzleman, and additional shotcrete crew members (for example, gunman, pump operators, finishers, and hose tenders), is essential because it gives the nozzleman trainee the opportunity to learn quality shotcrete placement before being certified. **Specific project qualifications** are achieved if the **contractor, key personnel, material, equipment, and placement methods** are either known to meet the requirements (that is, previous successful work experience/contractor prequalification) of the project or proven through preconstruction testing. It cannot be stressed enough that satisfactorily meeting any one of the elements alone cannot guarantee success; however, failing any one of them can cause a substandard finished product.

Currently, the owner or specifier of a specific project must consider the experience of the shotcrete contractor, nozzlemen, and field shotcrete crew before deciding when to require a comprehensive preconstruction qualification program. When considering prequalifying the shotcrete contractor, it is vital that sufficiently documented projects that involved similar challenging applications using the proposed nozzlemen, crew, and procedures be provided and verified. The criteria for waiving preconstruction testing procedures for highly experienced shotcrete contractors should be detailed in the project specifications and should clearly establish the highest level of previous experience required. When contractor prequalification is not used, applicable, or available, project preconstruction testing with mockups should be considered. There is a significant cost associated with a preconstruction testing program, and this should be considered in developing the contract requirements (refer to Fig. 1).

A program to provide shotcrete contractor qualification is the next step in assuring that the shotcrete industry remains credible and has integrity in the years to come. Nozzleman certification is one part of the equation. An even more important variable is shotcrete contractor qualification. For example, if a certified nozzleman completes a project today and it fails a year from now, who is going to be held responsible for the failure? The contractor. The contractor will have to return to the site and remedy the problem with or without the certified nozzleman who completed the project. This is why shotcrete contractor qualification is as, if not more, important than nozzleman qualification; it takes an entire team to have a successful project, not just a nozzleman with credentials.

An increase in funding allocated for the rehabilitation and repair of the country's infrastructure has resulted in an increased number of fly-by-night shotcrete contractors. While competition is healthy and encouraged, these fledgling contractors with no shotcrete experience should not be allowed to simply hire a certified nozzleman and have equal bidding capability with a well-established, experienced contractor who has successfully completed similar projects over the past several years.

There is a difference between the two contractors. A qualified contractor not only has certified nozzlemen but also has the equipment, crew, management, bonding capacity, and references, which set him or her apart from the contractor with a pump and a certified nozzleman. It is important to make this distinction to private and public owners in the project specifications to avoid confusion regarding the class of contractor bidding on their project (refer to Fig. 2).

**The vision statement of ASA in 1998:**  
*To have the shotcrete process understood and used in every beneficial application.*

**The ASA Mission Statement:**  
*To encourage and promote the safe and beneficial use of the shotcrete method.*

As a charter member of ASA, I believe it is our duty to follow these statements, and who better to help the specifiers, owners, and municipalities than ASA with a Shotcrete Contractor Qualification program—a program that is maintained and can adapt as required to meet the needs of our mission. Our educational goal is not to create or train new contractors/nozzlemen but to encourage the safe and proper use of this unique method of concrete placement. Encouraging shotcrete use by providing a qualification standard will help meet this goal. This will not be an easy task, but it is one that has to be undertaken.



*Fig. 1: A typical preconstruction test panel with congested reinforcement*



*Fig. 2: Properly placed shotcrete is a team effort: the pump, mixer, and nozzlemen are pictured here*



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