

At the ACI Fall 2011 Convention in Cincinnati, OH, the governing policy for the ACI Shotcrete Nozzleman Certification Program was updated and revised. It is reprinted here in its entirety. You can also download and view a copy from www.concrete.org/Certification/pdf/scn.pdf.

ACI Certification Policies for Shotcrete Nozzlemen

The statements contained herein are a consolidation of approved policies and procedures. This policy statement supersedes all previous action of the American Concrete Institute (ACI) Board of Direction with respect to Shotcrete Nozzlemen certification and is effective October 18, 2011.

The certification program policies are broken down into eight sections as follows:

Section 1: Certification Criteria

Section 2: Examination Criteria

Section 3: Re-examination Criteria

Section 4: Appeals

Section 5: Sponsoring Group Criteria

Section 6: Examiner/Supplemental Examiner Criteria

Section 7: ACI Responsibilities

Section 8: Recertification Criteria

Section 1.0—Certification Criteria

- 1.01 The American Concrete Institute (ACI) certification program for Shotcrete Nozzlemen shall require successful completion of both a written examination and a two-part performance examination, all to be completed within a 1-year period.
- 1.02 No specific education is required as a prerequisite for Shotcrete Nozzleman certification.
- 1.03 500 hours of verified work experience as a nozzleman is a prerequisite to participate in the performance examination, with at least 100 hours in the process for which certification is sought. Required work experience must be documented on an ACI Work Experience Form and submitted to the Sponsoring Group conducting the certification session prior to the scheduled testing date. The required 500 hours of work experience must be reviewed and verified by the Sponsoring Group and the scheduled examiner prior to certification session.

If an applicant has tested in a past ACI Certification of Shotcrete Nozzleman session, demonstration of the 500 hours of work experience prerequisite is not required, as this has already been met in their original ACI session.
- 1.04 ACI Certification of Shotcrete Nozzlemen shall be valid for a period of 5 years from the date of completion of all certification requirements.
- 1.05 Certification may be renewed by satisfying the recertification requirements.

Section 2.0—Examination Criteria

General Requirements

- 2.01 The content of the written and performance examinations for certification as a Shotcrete Nozzleman is derived from:
 - “Craftsman Workbook for ACI Certification of Shotcrete Nozzleman CP-60(09)”
- 2.02 All written and performance examinations are closed book. Notes or other technical materials shall not be permitted in the examination area.
- 2.03 The examinations shall be conducted by the examiner, proctors, and/or supplemental examiners as applicable (refer to Section 6).
- 2.04 The examiners, proctors, supplemental examiners, and/or sponsoring groups do not have any jurisdiction over the content of any examination, or over the grading of the written examination.

Written Examination

- 2.05 The examinee will be required to pass a written examination for each type of process in which he/she wishes to be certified (wet- and/or dry-mix).
- 2.06 The entire written examination for either wet- or dry-mix will consist of 60 to 90 questions. The questions may be either true-false or multiple choice.
- 2.07 A maximum of 90 minutes shall be permitted for completion of either the wet- or dry-mix examination. The examiner may allow additional time for an oral examination.
- 2.08 Oral administration of the written exam shall be permitted in special cases when conducted in accordance with ACI guidelines.
- 2.09 A score of 75% or higher constitutes a passing grade on each written exam.

Performance Examination

- 2.10 The performance examination shall require the examinee to demonstrate all the essential steps involved in proper shotcrete technique, from initial preparation through placing and curing.
- 2.11 All examinees are required to certify with a test panel in the vertical position. The examinee may choose to also certify in the overhead position. Each shooting position in each process requires a separate performance demonstration test panel.

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- 2.12 The test panel to be shot shall be of the minimum dimensions and edge configuration shown in drawing Sketch A, Appendix I (www.concrete.org/Certification/pdf/scn.pdf, page 13). The vertical test panel shall be positioned within ten (10) degrees of vertical and the overhead panel shall be positioned horizontally at approximately 2.5 m (8 ft) from grade.
- 2.13 Reinforcement shall be incorporated in the test panel per drawing Sketch A, Appendix I (www.concrete.org/Certification/pdf/scn.pdf, page 13).
- 2.14 The shotcrete mixture design used shall be a mixture in common use in the geographic area of the test site. The mixture for the wet-mix process may be a locally supplied ready mix or dry materials wet-mixed at the test site.

Dry mix may be prepackaged materials or bulk materials dry-batched at the test site.

Mixtures may contain accelerators. The Local Sponsoring Group shall make information available to the applicant regarding mixture design/methods and type of equipment to be used at least 1 week before conducting the performance examination.
- 2.15 The nozzleman is expected to verify the adequacy of the test panel form, reinforcing placement, panel support/bracing, etc., as part of the performance examination.
- 2.16 The nozzleman shall be supported by an adequate crew consisting of an experienced gunman or pump operator, and a nozzle helper/airline-blowpipe operator.
- 2.17 All work shall be done in the direct presence of the examiner or supplemental examiner(s) as applicable in Section 6.07.

Performance Evaluation

- 2.18 The examinee's performance will be evaluated based on a two-part performance examination: Part I, demonstrating to the examiner or supplemental examiner the examinee's knowledge of all the items covered on the Performance Checklist; and Part II, five (5) cores will be cut from the performance demonstration test panel to evaluate soundness of shotcrete.
- 2.19 Grading of the Part I performance workmanship will be based on a point system as set forth on the performance checklist, with points deducted for failure to perform, or incorrect performance of various required elements.
- 2.20 The minimum passing grade for the Part I performance evaluation shall be 75%.
- 2.21 For Part II, grading of the cores is based on visually examining, measuring defects, and grading each of five (5) cores located, as shown on Sketch A, Appendix I (www.concrete.org/Certification/pdf/scn.pdf, page 13); grading considers various defects, such as (but not limited to) sand lenses, porosity pockets, random voids, and especially voids around reinforcing bars.
- 2.22 A test panel with any single core grade exceeding grade 3, or with more than two (2) of the five (5) cores having a core grade 3 will be declared a failure. Core grades shall not be averaged.

Section 3.0—Reexamination Criteria

- 3.01 Failure of the written examination by the criteria cited in Section 2.09 shall require reexamination.
- 3.02 Failure of either Part I or Part II of the performance examination shall require reexamination on the entire performance examination.
- 3.03 Reexamination of a performance examination on the same day as original examination will only be permitted at the examiner's option and on a time-and-materials-available basis, subject to processing all other scheduled examinees.

In the event of equipment malfunction during shooting of a test panel, the examinee is permitted to wash out said panel and start over.
- 3.04 The performance exam for the vertical test panel must be passed for certification to be issued (refer to Section 2.11). If an examinee pursues certification in the overhead position as well and fails the performance exam for the vertical test panel, the entire performance exam must be retaken, including (if still desired) the performance exam for the overhead panel.
- 3.05 Reexamination on the written or the performance examination must be taken within 1 year of the initial examination. Otherwise, both the written and the performance examinations must be retaken in their entirety.

Section 4.0—Appeals Criteria

- 4.01 All appeals shall be directed initially to the examiner.
- 4.02 In the event that the examinee is not satisfied with the decision of the examiner regarding an appeal, the examinee may pursue an appeal with ACI according to the following order:
 1. Local Sponsoring Group;
 2. ACI Director of Certification;
 3. The Certification Appeals Committee (consisting of the Director of Certification, the Chair of the Certification Programs Committee, and the Chair of Committee C660);
 4. Committee C660, Shotcrete Nozzleman Certification; and
 5. The Certification Programs Committee.
- 4.03 Appeals submitted to ACI for consideration must be received, in writing, within sixty (60) days of the receipt of the examination at ACI Headquarters.

Section 5.0—Sponsoring Group Criteria

Groups desiring to conduct ACI Certification program(s) shall adhere to the current policy on **Sponsoring Groups for Certification**.

Note: The Sponsoring Group Policy was approved by the ACI Board of Direction on March 21, 1991, and revised by the ACI Certification Programs Committee October 18, 2011.

Because of specialized venue and equipment requirements, Shotcrete Nozzleman Certification examination sessions are typically conducted as "in-house" sessions. The business,

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organization, or individual providing the venue (and equipment) for the session is known as the “host” for the purposes of this Policy.

For the Shotcrete Nozzleman Certification program (both wet and dry processes), Sponsoring Groups shall also be responsible for the following:

5.01 Ensure that the ACI Host Relationship Disclosure form is signed and completed by the scheduled examiner, and that the relationship between the host and examiner does not constitute a conflict of interest.

5.02 Ensure that the required work experience for each applicant is documented on an ACI work experience form, that the examiner has verified the experience, and that all required signatures are present on the form prior to ordering session materials from ACI.

Note: The 500 hours of work experience prerequisite documentation is not required if proof of participation in a previous ACI Shotcrete Nozzleman Certification session is demonstrated.

5.03 Ensure that a copy of all applicants’ work experience forms and the ACI Host Relationship Disclosure form is provided to ACI.

Section 6.0—Examiner/Supplemental Examiner Criteria

6.01 The examiner shall be approved by ACI with the assistance of a Task Group under Committee C660 for dry-and/or wet-mix shotcrete. Qualifications shall be submitted on Form D3 for each process.

6.02 The examiner shall be authorized by ACI to conduct Nozzleman Certification examinations for only the shotcrete process for which the examiner is approved.

6.03 In order to be considered for approval as an examiner, the applicant shall meet the following requirements:

- a) Be knowledgeable about shotcrete and thoroughly familiar with the current applicable reference documents.
- b) Have a total of at least 5 years of documented experience in at least two of the following four categories:
 1. Testing, inspection, and quality control of shotcrete;
 2. Supervision of shotcrete construction work;
 3. Design of shotcrete structures; or
 4. Shotcrete nozzling.
- c) Have sufficient experience to evaluate and judge the qualifications of shotcrete nozzleman applicants and conduct written and performance examinations. For each process, this experience must be, but is not limited to:
 - Knowledge of both vertical and overhead spraying; and
 - Knowledge and experience on more than one type of equipment (gun, pump, nozzle).

d) Have, to the satisfaction of the examiners of record, participated in all phases of at least two (2) ACI-sanctioned Nozzleman Certification programs for each process for which approval is sought, with different

examiners of record for each session. For the first session, the applicant must serve as proctor and supplemental examiner. For the second session, the applicant shall serve as a proctor and supplemental examiner and conduct all phases of the session, including written examination, performance examination, and core grading, under direct supervision of the examiner of record for both vertical and overhead.

e) Have attained a passing grade on the written exam for each process sought.

6.04 In order to maintain examiner status, an examiner shall meet the following requirements:

a) Have conducted or assisted in at least (3) ACI-sanctioned Nozzleman Certification programs in five (5) years, if not actively participating in Committee C660 activities.

6.05 Examiners, Supplemental Examiners, and Proctors must recuse themselves from any conflict-of-interest situation while acting as agents of ACI in conducting exam sessions. This includes but is not limited to meeting the following conditions:

a) Examiners, supplemental examiners, and proctors shall not be professionally or personally related to the Host, its parent or subsidiaries, or examinees at the time of the exam session.

b) Examiners and supplemental examiners shall not be employed by the same organization (including parent or subsidiaries) as any of the examinees at the time of the exam session.

c) Examiners, supplemental examiners, and their employers shall not be in a business relationship with the Host, its parent, or any subsidiaries at the time of the exam session.

d) Examiners, supplemental examiners, and their employers shall not be in a business relationship on any project that the Host, its parent, or any subsidiaries have a business relationship at the time of, and six (6) months prior to, the exam session.

Note: ACI policies are intended to aid in the identification and remediation of any aspect of the examination process that could result in invalidation of an exam session and sanction of an Examiner. It is not possible to enumerate or even identify all conflict-of-interest situations for listing in this policy; therefore, ACI urges Examiners and Sponsoring Groups to communicate with ACI during the session planning stages and obtain guidance from ACI, leaving enough time for adjustments prior to the exam session if needed to assure policy compliance.

6.06 Supplemental examiners shall have experience in shotcrete work per Paragraph 6.03B, and shall be approved by and perform at the direction of the examiner.

6.07 Supplemental examiners shall be permitted to assist in conducting Part I of the performance examination.

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- 6.08 Proctors shall be permitted to assist the examiner in conducting the written examination.
- 6.09 Proctors shall satisfy the following requirements:
- Be selected by the examiner; and
 - Be considered trustworthy and conscientious by the examiner.
- 6.10 The examiner shall be directly responsible to:
- Complete and submit to the Sponsoring Group prior to the session a signed and completed ACI Host Relationship Disclosure form.
 - Review and verify each applicant's work experience. Verification requires the completion of two steps:
 - Review each applicant's work experience submitted on an ACI form for completeness and feasibility (that is, it is possible for the applicant to have accumulated the required experience within the time frame reflected on the Work Experience Form).
 - Contact and speak directly with the applicant prior to approving/signing the applicant's Work Experience Form; this may be by phone if the applicant's identity can be verified, or in person. The complete content and length of the Examiner's interview with the applicant is left to the Examiner's judgment and discretion in deciding if, in their opinion, the applicant possesses the required minimum amount of work experience. Every applicant interview must include the following:
 - Verification of the applicant's identity;
 - Discussion of any items on the applicant's Work Experience Form that seems incomplete, questionable, or require clarification; and
 - Discussion of the applicant's nozzleman experience, including how long they have been a nozzleman, the type of work they have been involved in, and the type of equipment they have used.
- Once assured of the accuracy of the information on the applicant's Work Experience submission and that a minimum of hours (as per Section 1.03) as a nozzleman has been demonstrated, the Examiner must sign and date the applicant's ACI-approved work experience form and return a signed copy to the Sponsoring Group prior to the certification session.
- Select the supplemental examiners and proctors.
 - Verify the qualifications of the supplemental examiners and proctors according to the criteria outlined in Sections 6.07 through 6.10.
 - Communicate examination needs to the Sponsoring Group.
 - Verify the identity of each examinee at the session (photo ID), and assure that the examinees are aware of the certification criteria. In addition, a photo must be secured of each participant (face shot) at the session.
 - Verify that the examinees have signed the release statement on the written and performance examinations at the session prior to testing.
- Verify that materials, mixture designs, and equipment are suitable for the program.
 - Verify that the test panel conforms to Appendix I, Sketch A (www.concrete.org/Certification/pdf/scn.pdf, page 13), and verify the reinforcing bar location (to ensure accurate locations for later coring).
 - Verify that test panels are secured to minimize vibration and prevent tipping or collapse.

Note: Appendix III (www.concrete.org/Certification/pdf/scn.pdf, page 15) of this Policy contains approximate weight and force parameters and an example of a configuration that has been used successfully. Overhead applications deserve particular attention due to the weights involved and the potential for "dropouts" (in-place shotcrete falling out during or immediately after shooting). All ACI Shotcrete Nozzleman certification sessions shall comply with all applicable Federal, Regional, and Local safety regulations.
 - Be present and in full supervision during the examination sessions (written and performance).

Note: Historical administrative experience indicates that a ratio of 1:5 Examiners/Supplemental Examiners to Examinees is advised to facilitate Examiner control of sessions. Examiners may exceed this ratio if the program policies are maintained throughout the duration of the examination session, and the order, fairness, objectivity, and thoroughness of the process intended by the policies are preserved.
 - Ensure that neither they nor their examiner candidates and/or supplemental examiners individually observe more than one examinee conducting tests at any one time during the performance examination.
 - Verify that the performance evaluations were conducted by examiners or by approved supplemental examiners, review and co-sign the performance checklists where appropriate.
 - Arrange for removal and positive identification of cores from test panels.

Note: All panels are to be cored, even if the examinee fails other parts of the performance exam.
 - Perform or direct the layout of core locations.
 - Be present and in full supervision of panel stripping and coring. Photograph the back of the stripped panel prior to coring.
 - Visually examine and grade cores. Photograph all extracted cores that reflect the performance of the examinee and take individual photos of cores with failing core grades.
 - Collect and summarize all test data (complete and sign the Performance Checklist - Part II, Grading Summary, and Checklist Report for each examinee) and collate with written examinations.
 - Forward all test data to the Sponsoring Group for preparation and shipment to ACI Headquarters, Certification Department.

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- t) Conduct detailed interviews of examiner applicants assisting in administering sessions, evaluating their abilities in administering examinations, and forwarding the results of their evaluation to ACI Headquarters with the session materials.

Section 7.0—ACI Duties and Responsibilities

- 7.01 ACI shall approve the local sponsoring group.
- 7.02 ACI shall approve the examiner. Examiner reapproval is required every five (5) years.
- 7.03 Examiner approval may be suspended or revoked by ACI at any time.
- 7.04 ACI shall authorize the sponsoring group to conduct examination sessions for Shotcrete Nozzleman Certification.
- 7.05 ACI shall grade the written examinations and review the results of the performance examination/evaluations, and notify the examinee and examiner of the final results in writing.
- 7.06 ACI shall certify the examinees that have satisfied the certification requirements.
- 7.07 ACI shall issue a certificate, wallet card, and hard-hat decal to successful examinees.

Section 8.0—Recertification

Shotcrete Nozzlemen may recertify for an additional five (5)-year period by successful completion of all the certification requirements outlined in Sections 1.0, 2.0, and 3.0 of this policy or, if eligible, by participating in the alternative recertification process as follows:

- 8.01 The recertification process described in Sections 8.02 to 8.03 is available only to candidates who meet the following criteria:
 - a) Nozzlemen previously certified by ACI who are seeking recertification in the same process (wet- or dry-mix) as their previous ACI-issued certification; and
- 8.02 Information described in Sections 8.01a through 8.01c required for determination of candidate eligibility for recertification shall be gathered, evaluated, and verified by the examiner prior to administration of any recertification examination, as described in Sections 8.03a and 8.03b.
- 8.03 Candidates who meet the criteria listed in Section 8.01 as determined by the Examiner may renew their certification (recertify) by successfully completing:
 - a) A structured interview with the Examiner. The interview is in lieu of the written exam requirement imposed for initial certification and is designed to substantiate that the candidate has retained his knowledge of the safe and competent application of shotcrete and is made aware of any new developments in this area of concrete construction; and
 - b) A performance examination per the policies described in Sections 2.01 through 2.04, Sections 2.10 through 2.22, and Sections 3.02 through 3.04.
- 8.04 The oral interview must be conducted within the time frame described in Section 8.01b. If the interview is not conducted within this time frame, the candidate seeking recertification shall be required to take the written examination per the policies described in Sections 2.05 through 2.09, and Sections 3.01 and 3.05.

CALL FOR TOPICS

Shotcrete magazine welcomes topic suggestions for the “Nozzleman Knowledge,” “Technical Tip,” and “Safety Shooter” columns, especially from our **nozzlemen** readers. These columns, in particular, are designed to serve ASA’s nozzlemen members and bring helpful information not readily available in the industry. If you would like to submit a topic or question for an article, please send an e-mail to info@shotcrete.org or call (248) 848-3780. ASA staff and the Publications Committee will do their best to secure an author to address your concerns. Annual compilations of these columns are available as a member benefit for ASA’s nozzlemen members.