

ASA Holds Initial Shotcrete Nozzleman Certification



George Yoggy stands the field orientation for the first certification course

Streetsboro, Ohio, a small town just southeast of Cleveland, recently became the site for a landmark occasion in the shotcrete industry. For six days in September, 1999, the back lot of the Master Builders' manufacturing plant and a local hotel in Streetsboro became the venues for the first shotcrete nozzleman certification held by an industry association in North America.

The first three days were comprised of intensive training, peer-review, and curriculum development by a dedicated group of acknowledged industry experts. Working day and night, and even into the wee hours of the morning, they completed the necessary documentation, test procedures, and examination questions to enable the first class of nozzleman candidates to take

a two-day instructional course and complete their certification examination on the last day. A total of 15 nozzlemen were enrolled, and all were certified in some or all of the configurations on which they were tested.

Personnel

Before the program was undertaken, an initial Certification Board was named to oversee this pilot offering. Chairing this first Board was Dr. D.R. "Rusty" Morgan of AGRA Earth and Environmental, Ltd. The other members were George Yoggy, Allentown Shotcrete Equipment Co; Lars Balck, The Crom Corporation; Marc Jolin, SEM Engineers; and Larry Totten, Johnson

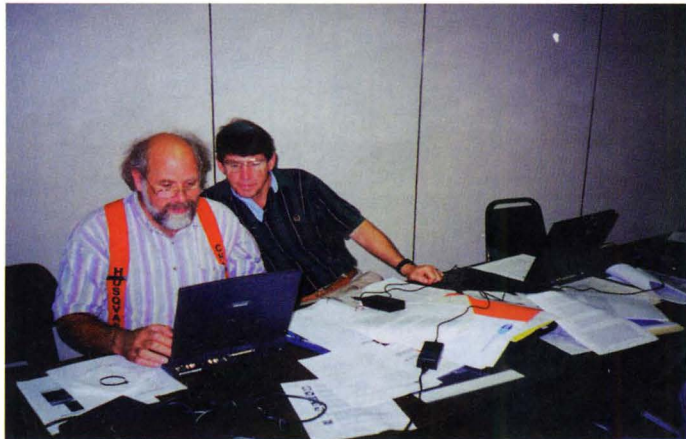
Western Gunit Company. These and several others were invited to participate in the planning sessions which were held from Sunday through Tuesday preceding the classes and certification testing. Joining Morgan, Yoggy, Balck, and Jolin were Neil McAskill, AGRA Earth and Environmental LTD; Ray Schallom, RCS Consulting and Construction, Inc.; Jean Francois Dufour, King Packaged Materials Co.; Pierre Lacombe, SEM Engineers; and Pat Bridger, Allentown Shotcrete Equipment. Observing for future program participation were Roland Heere, AGRA Earth and Enviromental LTD.; and Ray Bradshaw, BEK Inc.

Also participating in the planning sessions was Merle Isaak, Chairman of ACI Committee C 660-Shotcrete Nozzleman Certification, who acted as both contributor and observer to assure that the ASA program was developed in accordance with both current ACI documents and also with the plans for the future ACI Shotcrete Nozzleman Certification program.

Preparation

In addition to working diligently on the classroom presentation and the written exam, all these future trainers and examiners spent many hours in actual nozzling and also in observing and critiquing each other. A wide variety of equipment and materials was used in these sessions to assure that each person was familiar with all the situations on which the candidates would be tested. Both wet and dry mix shotcretes were used, as well as different combinations of nozzles and hose sizes.

Each afternoon, after the shooting sessions were over, work started again on the documentation portion of the program. The



Neil McAskill (left) and Lars Balck collaborate on one portion of the training presentation



Pierre LaCombe, Ken Bradshaw, Pat Bridger, and George Yoggy pore over slides for inclusion in the training program



Incorporation of shotcrete shear walls made it possible to include this historic structure into a modern federal courthouse complex

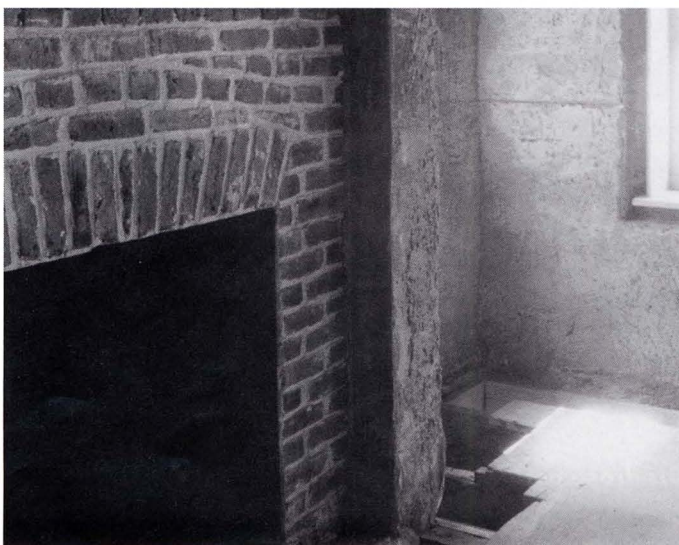
Design criteria and the extent of the shotcrete application varies from site to site. Some buildings incorporate shotcrete shear walls in conjunction with existing masonry walls to strengthen what is already there. If the mortar between the bricks is still intact and the design engineer is satisfied that the original structure still has structural value, this is often the most cost-effective route to follow. Steel reinforcement and wall thicknesses vary according to the load-carrying capacity required.

Some structures, such as the new federal court complex shown in the adjacent photographs, incorporate shotcrete as an independent load-carrying struc-

ture using the existing unreinforced masonry walls as a "form" only. Wall thicknesses varied from 18 inches (450 mm) below ground level to 6 inches (150 mm) on the third floor. Reinforcement ranged from double mats of No. 6 bars ($\text{Ø} = 19$ mm) to single mats of No. 4 bars ($\text{Ø} = 13$ mm) and several combinations of caged steel as design requirements dictated. The reason this approach was necessary was that the new courthouse incorporated and surrounded an existing two hundred year old unreinforced masonry structure in the completely new, modern complex. The old building will be subjected to live and dead loads which would have exceeded its structural capacity

when it was new. Obviously, a new structural design solution had to be established before modern loads could be applied. Due to the historic nature of the structure, and its proximity to the famous "Four Corners of the Law," demolition of the existing structure was unthinkable.

Another major structure in which shotcrete was incorporated was a portion of the Storm Eye Institute at the Medical University of South Carolina. The project was a vertical expansion of the existing building by adding three more floors and an enlarged mechanical mezzanine level to this seven story structure. Shotcrete shear walls were added



Shotcrete shear walls provide an internal support structure for this unreinforced masonry building



Seismic shear walls incorporated to add lateral support to an existing structure were critical to allow the addition of the top three floors in the vertical expansion of this medical center building



George Yoggy demonstrates proper filling of the test panel during a candidates training session



Nozzleman candidate completes wet-mix vertical test panel

materials for both the instruction and the actual certification testing were donated by Master Builders and King Packaged Materials.

Certification Testing

The final day consisted of the actual certification testing. Prior to acceptance into the program, each candidate had provided verification of at least 500 hours of shotcrete-related experience. Most candidates had considerably more than this minimum experience level.

Once the written test was completed, the candidates were again transported to the shooting site. Each then proceeded to shoot the test panels in the orientation and processes for which they desired to be certified. Their choices were dry mix vertical, dry mix overhead, wet mix vertical, and wet mix overhead. As each reinforced panel was filled, the candidates were marked on a number of aspects of their performance, such as checking and preparation of equipment, verification of the acceptability of the reinforcement and surface to be shot, safety considerations, signaling, and actual nozzling technique. In addition to the ASA examiners, Peter Steiner and John Nehasil of the ACI staff were on hand to observe the testing for coordination with the future ACI Shotcrete Nozzleman Certification.

Coring and Evaluation

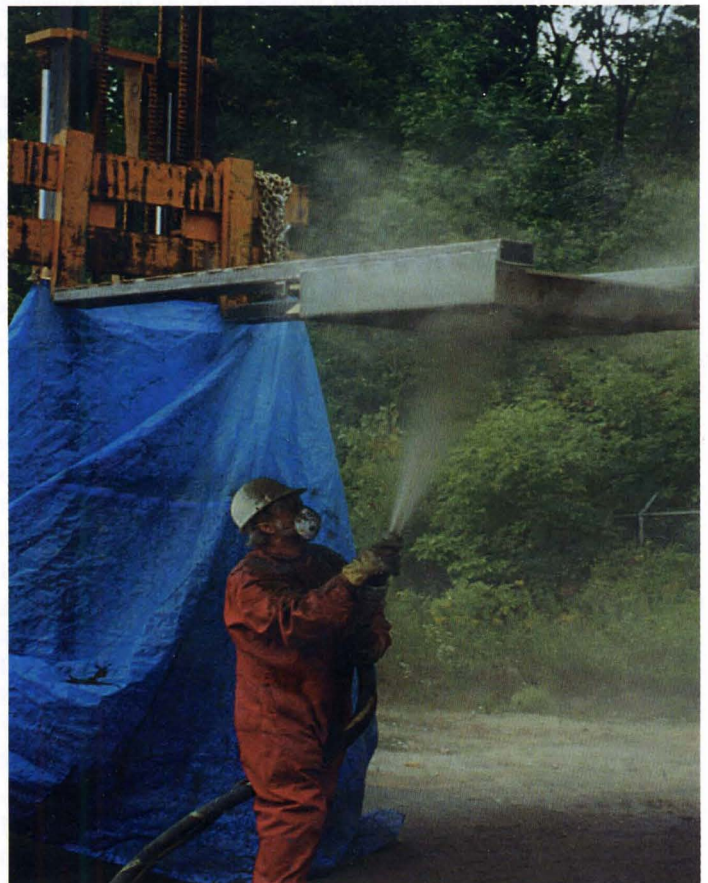
Starting ten days after shooting, four cores were extracted from each panel. Each core was positioned to include crucial locations with regard to reinforcing encasement. Large bars, intersections of bars, and bar laps were included in the cores for each candidate. Once the coring operation was complete, each core was examined and graded, using the ACI grading schedule shown in their document ACI 506.2-95 "Specification for Shotcrete. Cores with any visible deficiencies were inspected by more than a single examiner, to assure that accurate grading was given."

Summary

Although the program was not without its glitches, as might well be imagined with any first effort, it is seen as a definite success and a precursor to widespread certification of shotcrete nozzlemen. The certificates which were awarded to the successful candidates will remain in effect for a period of five years, after which recertification will be required. Based on the level of interest in the

initial program, a second one has been scheduled for Orlando, Florida on April 5-7, 2000. A formal announcement with details of this program will be distributed early in 2000.

Much credit is due to the "core" group of examiners for their extraordinary efforts in preparing the initial offering in such a timely manner. They have provided the shotcrete industry with a very valuable resource for owners and designers of shotcrete. ■



Overhead panels proved challenging to skill of candidates