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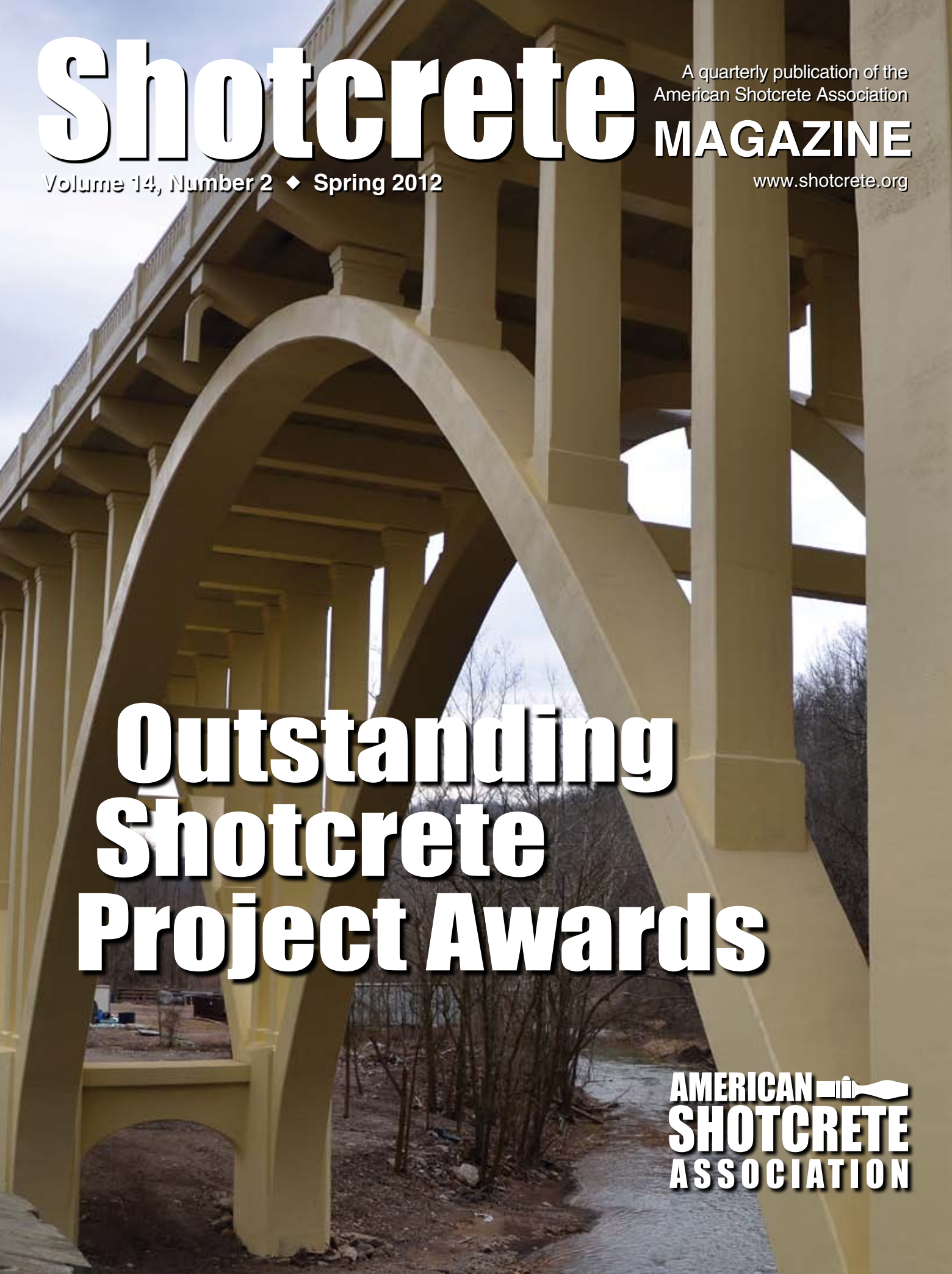

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Shotcrete MAGAZINE
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Features

Departments

On the cover: Blaine Hill Viaduct—Route 40 ODOT 248-10
Photo courtesy of Jason Pinney

The ASA Outstanding Shotcrete Project Awards

By Joe Hutter

Optimism about the North American construction industry is higher than it has been since the start of the recent economic downturn. Industry forecasts indicate that the worst is behind us, which can only mean good things for members of ASA.

Much of this optimism was evident during the cocktail hour of our recent ASA Awards Banquet, held during World of Concrete 2012. The results of an unofficial poll of the ASA members who were present at the banquet indicated that many of us believe that opportunities from increased infrastructure spending and strong commodity pricing will continue making their way down to the members of our industry over the next several years.

This year's banquet was held for the first time at the Paris Las Vegas Hotel & Casino and judging by the reaction of our members, it was by far the best venue since the inaugural ASA Awards Banquet in 2005. A record number of members attended the event, and a record number of projects were submitted by members of the shotcrete industry. Although the majority of projects were North America-based, some were submitted from markets as far away as Sweden and the United Arab Emirates—an indication that ASA's reach is expanding.

From the perspective of the ASA Board, the most satisfying aspect of the banquet was the willingness of so many of our corporate members to participate. This participation was evident not only through the high attendance numbers but also through the outstanding response to ASA's request for corporate sponsors. Over 30 ASA member companies came forward with $30,000 in sponsorship commitments to help make this year's program a resounding success.

It is our hope that the positive response from the sponsors of the ASA Outstanding Shotcrete Project Awards program will continue in future years, and we have taken several steps to ensure that our sponsors receive the recognition they deserve. Some of these steps are:

1. Increased prominence of our sponsors' logos throughout the evening of the Awards Banquet;
2. Visibility of our sponsors' logos in the ASA booth at World of Concrete;
3. Live links to sponsors' Web sites in the section of ASA's Web site that covers the awards program (over 4000 visits in 2011);
4. Prominence of sponsor logos in the Outstanding Shotcrete Project Awards issue of *Shotcrete* magazine (the most widely distributed issue);
5. Live links to sponsors' Web sites in the electronic version of *Shotcrete* magazine; and
6. Live links to sponsors' Web sites in ASA's e-newsletter announcement.

In addition to the aforementioned benefits, all sponsors receive a number of complimentary tickets to the ASA Awards Banquet—the number of tickets increasing with the increased level of sponsorship commitment.

Year after year, the exposure that the ASA Outstanding Shotcrete Project Awards program receives continues to increase. Publications throughout the North American construction industry continue to pick up ASA press releases and run the story of the ASA Outstanding Shotcrete Project Awards in their publications. This exposure can only help members of ASA grow our industry, which is acknowledged to have some of the construction industry's most innovative contractors, designers, manufacturers, and suppliers.

As we head into what we hope will be a prosperous 2012, we urge all ASA members to begin thinking now about current and upcoming shotcrete projects that may be worthy of consideration for next year's ASA Outstanding Shotcrete Project Awards. We also thank all of the members who generously sponsored this year's Awards Banquet and welcome participation from new sponsors when we meet again in Las Vegas in 2013!

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Membership/Marketing Committee Update

By Joe Hutter, Marketing Chair

The mission statement of ASA's Membership/Marketing Committee is "to broaden the ASA membership base and ensure that shotcrete has its 'market share' in a national arena." Simply put, our goal is to convince more shotcrete industry members to become members of ASA and to increase the size of the shotcrete pie so our members will in turn have more opportunities to grow their businesses.

Ironically, these two mandates are very much related. When we step back and take a close look at what ASA is trying to accomplish, we can be proud of the initiatives that have been taken to get the word out to the construction industry that shotcrete can be the preferred option of placing concrete in many applications. The challenge we face, however, is that these initiatives often cost money, and the biggest source of revenue that our association has is membership fees. So, without the loyalty of the many ASA members who renew their memberships year after year, there would be little revenue available to promote shotcrete through participation in trade shows, advertisements in industry publications, development of marketing tools, and the education of specifiers through seminars and presentations.

To date, the membership of ASA has remained strong despite the economic slowdown that has plagued the majority of the construction industry over the past few years. We have managed to maintain a membership total of almost 600 members, over 140 of which are corporate members. The association has funneled much of this revenue through the Marketing Committee which, in turn, has invested the funds in programs that promote the shotcrete process to markets throughout North America. Some of the key marketing initiatives that have impacted our industry include:

1. The development and maintenance of ASA's Web site, which has become a "go-to source" for many consultants, DOT personnel, and other industry specifiers. At this time, ASA is investing funds to update the Web site to expand functionality (including the introduction of an online bookstore);
2. Participation in industry trade shows, such as World of Concrete, the Pool and Spa Show, the International Bridge Conference, and Transportation System Preservation Technical Services Program (TSP•2) conferences across the U.S.;
3. The development of additional content for inclusion on the ASA Shotcrete Specifiers Education Tool/USB. Presentations completed to date include *Shotcrete for Repair and Rehabilitation of Concrete Structures*, *Shotcrete for Underground Structures*, and *Structural Shotcrete*);
4. Lunch & Learn Seminars: This recent initiative has led to the development of a speakers' roster of ASA members, from which presenters will be chosen to conduct Lunch & Learn Seminars for specifiers across North America;
5. The development of advertisements in industry magazines promoting ASA as a sponsoring group for American Concrete Institute (ACI) nozzleman certifications;
6. The publication of documents such as "Sustainability of Shotcrete"; and
7. Funding of the annual Outstanding Shotcrete Projects Awards Program.

Membership revenue has also allowed ASA to fund other important initiatives. Funding of the annual ASA Graduate Scholarship Program, for example, has allowed ASA to give back to our industry by providing financial assistance to some of the bright young minds that have targeted our industry as a potential career. ASA has made two $3000 (USD) awards available each year to applicants who have been accepted into a graduate program in the field of concrete at an accredited college or university within the U.S. or Canada.

In addition to assisting with all of the preparation required for the annual World of Concrete show, ASA's Marketing

Committee Chair Memo

Committee is also responsible for submitting proposed sessions for World of Concrete seminars. This year (2012), two ASA members (Marc Jolin and Scott Rand) presented a 90-minute seminar titled "The Diversity of Shotcrete as a Method of Concrete Placement" to an audience of over 80 World of Concrete attendees. Next year, ASA plans to provide a 6-hour nozzleman education session, giving even more exposure to ASA and the shotcrete industry.

There are several ASA membership categories available, ranging from a full corporate membership costing $750, to individual memberships for $250, to a no-charge membership offered to employees of public agencies and students. In addition to helping fund so many ASA activities, membership benefits also include: a company listing in the ASA Buyers Guide, discounts on ASA Nozzleman Certification and Education, access to ASA's new Online Project Bid Submittal Tool, a subscription to the quarterly *Shotcrete* magazine (print and electronic copies), networking and participation opportunities at all membership and committee meetings, and a host of other benefits enjoyed by all ASA members.

So, if you are reading this magazine because you have been lucky enough to be provided a free subscription, please consider filling out the membership application on the ASA Web site and the next time you are speaking with a colleague—whether it be a competitor, supplier, or consultant—ask them if they are ASA members. If they are not, invite them to join ASA. The more members we have, the stronger our organization will become.

ASA Membership/Marketing Committee

Joe Hutter, Chair

Patrick Bridger, Co-Chair

Michael Cotter	Ryan Poole
Oscar Duckworth	Raymond Schallom III
Dan Millette	Ted Sofis
Tom Norman	Marcus von der Hofen

ASA and TSP·2

By Chris Darnell, ASA Executive Director

ASA continues to pursue its core mission "to encourage and promote the safe and beneficial use of the shotcrete process" in a number of tangible ways. One of the most effective ways is through direct interaction with other industry groups.

Last year, ASA created a new focus on public authorities. Past President Patrick Bridger discussed ASA's plans for this effort in his President's Message in the Fall 2011 issue of *Shotcrete* magazine. The plan includes a number of points, such as free ASA membership to employees of public authorities as a way to distribute a collection of important informational sources on shotcrete directly to these individuals. The plan also includes direct interaction with shows, conferences, and organizations that focus on public authorities. The bridge preservation arm of the Transportation System Preservation Technical Services Program (TSP·2) is one of ASA's primary groups for interaction.

TSP·2 was formed by the American Association of State Highway and Transportation Officials (AASHTO) to provide state highway agencies, provincial departments of transportation, and other pavement and bridge preservation practitioners with a source for news and technical information. In late 2011, ASA became a National Industry Member of TSP·2. Membership affords us the opportunity to have ASA Board representation at each of the four regional—Midwest, Northeast, Southeast, and Rocky Mountain/Western—annual meetings. In addition, ASA plans to have a manned exhibit booth at one of the four regional meetings every year on a rotating basis. For 2012, ASA is targeting an exhibit booth at the Northeast Regional Meeting.

Following is a more in-depth description of TSP·2. I hope after reading it, you will share our excitement about the opportunity for ASA to be an educational resource on the numerous advantages and benefits of the shotcrete process for this group.

Also, please remember to promote ASA's free membership for employees of public authorities to your local- and state-level contacts.

TSP·2

By Patte Hahn, TSP·2 staff

In May 2006, AASHTO took a significant step to further the preservation and maintenance of the nation's highway and bridge assets by contracting with the National Center for Pavement Preservation (NCPP) to develop and administer TSP·2. The program was initiated as an efficient means to disseminate information to help AASHTO member agencies and other public highway and street agencies preserve their highway infrastructure and equipment, especially pavements and bridges. The principal mission of TSP·2 is to serve as a clearinghouse with comprehensive, up-to-date information on efficient, effective preservation measures that enhance highway performance and extend useful life.

Since its founding, TSP·2 has expanded to include eight regional partnerships and a comprehensive, one-stop Web page maintained by NCPP (**www.tsp2.org**). TSP·2 has established pavement and bridge partnerships in the nation's Midwest, Northeast, Southeast, and Rocky Mountain/Western regions.

Membership in the partnerships is open to organizations and individuals active or interested in the preservation of the highway infrastructure. Partnerships are managed by elected Boards of Directors with logistical and other support provided by NCPP. Each partnership has an annual meeting at which there is a technical agenda and action on administrative issues. Most of the technical activities of the partnerships are conducted throughout the year by various appointed task forces and committees.

The pavement partnerships are concerned with extending the service lives of the nation's roadways by promoting the application of timely and effective preservation treatments as part of cost-effective long-term network asset management.

The bridge partnerships are concerned with the nation's large population of highway bridges. In the U.S., there are approximately 600,000 bridges, with a mean age of 41 years. In 2011, approximately 10% of these bridges were rated structurally deficient. These bridges are not unsafe; but, in many cases, the condition of the deck, superstructure, and/or the substructure is such that costly rehabilitation or even replacement is the best or only option. These structurally deficient bridges put severe pressure on agency budgets and sometimes necessitate a "worst-first" program of work on bridges. Across the country, states are making some progress on eliminating the current backlog of structurally deficient bridges. In 2011, however, an additional 10% of the bridge population was rated in fair condition. Experience has shown that the condition of these bridges will continue to decline if nothing is done to intervene at an early stage. Partnership members are concerned that the attention given to currently deficient bridges may doom other bridges in the next higher condition stratum to deteriorate to a condition of structural deficiency, thereby perpetuating the problem. Therefore, the overarching concern of the bridge partnerships is extending the service life of existing bridges by supporting the application of effective preservation treatments to bridges in a timely, cost-effective manner. The partnerships are working cooperatively to identify successful preservation treatments, document these successes, and encourage application of "the right treatment(s) to the right bridge(s) at the right time and at the right cost."

TSP·2 Web pages are maintained by NCPP and feature proceedings of each annual meeting, including presentation videos; posts of news items with links for further information; event listings with information and relevant registration links; and links to the Web sites of AASHTO (and its committees, associations, and foundations), the FHWA, other preservation centers, national highway specifications, and various related committees of the Highway Research Board (TRB). Other areas of interest featured on the TSP·2 Web pages include research, tools/techniques, and training opportunities.

ANNOUNCING THE 2012-2013 American Shotcrete Association Graduate Scholarship PROGRAM

The purpose of the **ASA Graduate Scholarship Program** is to attract, identify, and assist outstanding graduate students pursuing careers within the field of concrete with a significant interest in the shotcrete process.

Two $3000 (USD) awards are available for the 2012-2013 academic year. One scholarship will be awarded to a graduate student within the United States and the second scholarship will be awarded to a graduate student in Canada.

All applications and required documents must be received by **5:00 p.m. EDT** on **Friday, November 2, 2012**.

Obtain an application and requirements at: **www.shotcrete.org/ASAscholarships.htm**.

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ASA welcomes all students to take advantage of the outstanding benefits of a free Student Membership with both ASA and the American Concrete Institute (ACI).

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2011 Outstanding International Project

Al Ain Wildlife Park & Resort Retaining Wall and Artificial Rocks

By Huiqing He, Jolly Miller, Denis Beaupre, and Jean-François Dufour

The Al Ain Wildlife Park & Resort is a multi-faceted development spread over 2220 acres (900 ha) at the foothills of Jebel Hafeet. This project is a symbol of the United Arab Emirates' (UAE) commitment to wildlife conservation, and it deeply reflects the local culture and values of the UAE by building a world-leading commercially and environmentally sustainable resort. "Deserts of the World" is the theme of the entire development, featuring many species of animals from around the globe, ranging in size from termites to elephants. It is an excellent project to showcase biodiversity and provide a vibrant, fascinating demonstration of sustainable desert living.

The Scope of Work

The scope of shotcrete work included three parts: 1) the structural retaining wall at Nok Safari; 2) artificial rocks; and 3) the ha-ha retaining wall. The total concrete quantity was about 4480 yd^3 (3500 m^3). The project started on August 26, 2010, and was completed on July 6, 2011.

In general, the work included extensive structural work for placement of shotcrete and various artifacts. Coloring, dying, and tinting of shotcrete rockwork surfaces was required to achieve the desired finish.

The scope of work for the structural retaining wall at Nok Safari included building a retaining wall over 1.86 miles (3000 m) in total length. The work included the ground excavation, concrete blinding (often called mud slabs in the U.S.), cast-in-place concrete foundation and core wall, steel reinforcement, shotcrete placement (core and surface work), final texture finish, and concrete paint.

The scope of work for the artificial rocks included building a rockscape imitation of the surrounding mountain area for over 21,500 ft^2 (2000 m^2), divided into 10 different zones throughout the project. The size and shape of the rockscape included many significant color ranges and texture types designed to complement the local geographical rock environment. The surface texture was made by hand-carving and embossing.

The ha-ha wall was also a retaining wall where shotcrete was used to place concrete over 1480 ft (450 m) in total length.

The project owner was Al Ain Wildlife Park & Resort, the architect was EDSA, the general contractor was Hilalco, the shotcrete contractor was Imagineering, and the wet-mix shotcrete material supplier was UNIBETON Ready Mix. The parties involved were all from the UAE, with the exception of Imagineering, which was from the U.S. Figures 1 and 2 demonstrate the shotcrete equipment and placement.

Shotcrete Challenges and Solutions

The selection of shotcrete over cast-in-place concrete was an obvious choice due to its versatility, natural appearance, ease of free form shaping, artistic transforming, and sustainability advantages.

The challenges faced for the design, supply,

Fig. 1: Concrete supply by UNIBETON Ready Mix

Fig. 2: Shotcreting by Imagineering

Fig. 3: Shading for hot summer operation

Fig. 4: Artificial rocks blended with the mountains of Jebel Hafeet

and placement of shotcrete were to meet the project's specific requirements with consistent workability, strength and durability, artistic appearance, shotcrete temperature control, and extremely hot weather conditions.

The wet-mix shotcrete mixtures were supplied by UNIBETON Ready Mix, a well-established leader in the ready mix concrete industry in the UAE, specializing in the design and supply of a wide range of concrete products using customer-focused concrete technologies and solutions.

Two shotcrete mixtures were supplied to the project. The mixture designs were composed of locally produced portland cement and imported silica fume with a maximum aggregate size of 0.20 in. (5 mm), which was also locally supplied.

High-range water-reducing and retarding admixtures were specifically selected and formulated to ensure that concrete remained workable for 2 to 4 hours despite the extremely hot climate. The shotcrete was placed with a 0.40 water-cement ratio (*w*/*c*) along with the addition of polypropylene fibers on site. The fibers were added for crack control purposes and increased durability.

To closely represent local geologic features along with a more sustainable approach, regional materials were carefully selected, such as the Al Ain dune sand, which is a typical colored fine sand contributing to a regional natural look.

The placement of shotcrete was performed in extremely hot weather conditions, typical of this region throughout the majority of the year, where the highest temperature can easily reach up to 113 to 122°F (45 to 50°C). This significantly increased the overall challenge. The shotcrete was produced using combined cooling controlled techniques, including a skillful use of shading, ice-making at the batch plant, and temperature control considered in the concrete mixture design. It also included controlled admixture dosages for proper hydration retardation, which enabled the artwork shaping of the fresh shotcrete to be performed by the shotcrete contractor, as initially designed (Fig. 3 and 4).

These hot weather shotcreting challenges required a high level of cooperation, communication, and mutual support between the shotcrete material supplier and the shotcrete contractor's on-site team. This allowed for maintaining the shotcrete's required workability and pumpability to ensure that the designed artworks were created and artistically blended into the surrounding area—the mountains of Jebel Hafeet.

Artistic Design and Transformation

Creating naturalistic habitats and living environments required the use of specialized

Fig. 5: Gateway blended with surrounding nature

Fig. 6: Artificial rock with designed shape and texture and blending effect with the mountains

Fig. 7: Retaining wall design and surface details

Fig. 8: Gateway at the entrance

construction methods that combined artistic ability with traditional construction techniques.

The artistic creation of the shotcrete works and their natural blending with the surrounding area required talented artistic design to bring the vision to completion. The architectural vision that went into the retaining walls and the artificial rockscapes came from the project landscape designer's rich imagination and experience to replicate realistic sandstone and rocks' natural visual structures, which blend naturally with the mountains of Jebel Hafeet in the background (Fig. 5 and 6).

Fig. 9: Artificial rocks with designed shape and texture

Fig. 10: Artificial rocks with designed shape and surface details

To ensure that a natural-looking retaining wall and artificial rocks were created, various shotcrete surface textures and finishes were used for a better appearance of the wall and better blending of artificial rocks within the surrounding natural environment. The finishes used were natural as shot, scratched, smoothed, troweled, carved, aggregate-exposed, and painted. Each of these required different skills and required more than one step to complete, as illustrated in Fig. 7 through 10.

2011 Outstanding International Project

Project Name
Al Ain Wildlife Park & Resort

Project Location
Al Ain, UAE

Shotcrete Contractor
Imagineering

General Contractor
HILALCO

Architect/Engineer
EDSA

Material Supplier/Manufacturer
UNIBETON Ready Mix

Project Owner
The Zoo and Aquarium Public Institute in Al Ain

Immediate concrete surface curing was also a key element after shotcrete placement and finishing to minimize plastic shrinkage cracking under these hot temperatures.

Concluding Remarks

Overall, the Al Ain Wildlife Park & Resort development is one of the few shotcrete projects to take place in the UAE using sustainability and the existing surrounding natural environment as guiding principles for the design and completion of the work. The project was delivered to the client on time and met all the technical and environmental requirements. Throughout the course of the project, shotcrete proved its versatility and flexibility as a method of placing concrete once again despite the extremely hot working conditions, technical challenges, and demanding requirements of the project's design.

Huiqing He *is a Deputy Operations Director for UNIBETON Ready Mix. She received her PhD in material engineering from the University of Montreal, Montreal, QC, Canada and has professional expertise in operations, technical and project management, green and sustainability solutions, and research and development as a director, project manager, consultant, application specialist, and researcher in the fields of civil engineering and material engineering in the UAE, Canada, and China. She has received five awards for "Advances in Science & Technology" and three awards for "Green and Sustainability" and has published 28 papers.*

Jolly Miller *has been a leader in the shotcrete and exhibit industry for over 30 years, winning seven Association of Zoos & Aquariums (AZA) Best Exhibit Awards; five Significant Achievement Awards; and many other awards for using shotcrete to build top-down parking garages, buildings, soil-anchored retaining systems and—most notably—naturalistic zoo exhibits, aquariums, and larger savannas. After selling Jolly Miller Construction in 2002, Miller continued as a Consultant with Cemrock Landscapes, winning the Best Exhibit Awards for the Australia Exhibit at the Baltimore Aquarium and the Russian Grizzly Exhibit at the Minnesota Zoo. Following Cemrock, Miller continued to work with architects and owners designing new projects and then mobilizing build crews. The crews that Miller assembles are generally made up of artists, craftsmen, and construction workers who enjoy the challenges of using the latest concrete mixtures, hydraulic concrete pumps, and innovative design to raise the industry standards to higher levels.*

Denis Beaupre *received his PhD in civil engineering from the University of British Columbia, Vancouver, BC, Canada, in the rheology of high-performance shotcrete. He was a Professor and Researcher in Concrete Technology at Laval University for 9 years before his current position for 9 years as Operations Director for UNIBETON Ready Mix–UAE. He is the inventor of the IBB rheometer and the IBB workability probe. He has authored many papers in the fields of shotcrete, concrete rheology, pumping, repair, and durability of concrete.*

Jean-Francois Dufour*, MSc, PEng, is the General Manager for UNIBETON Ready Mix–UAE, a leading ready mix concrete producer in the UAE and the Middle East. He is a Graduate Civil Engineer with a master's degree in civil engineering from Laval University, Quebec, QC, Canada, and has been practicing as a Civil Engineer in the field of concrete since 1995. Dufour is the Canadian Representative of the International Tunneling Association in the Working Group 12 (Shotcrete Technology) and has chaired technical committees for the American Concrete Institute (ACI) and ASA.*

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2011 Outstanding Infrastructure Project

Portage Bridge 2010 Structure Rehabilitation

By Kevin Robertson

The Portage Bridge is a busy six-lane interprovincial road crossing the Ottawa River, joining downtown Ottawa, ON, Canada, to Gatineau, QC, Canada. Built by the National Capital Commission (NCC) and opened in 1973, it is now a crucial passageway for many commuters between the two provinces. The bridge consists of six traffic lanes, two bicycle lanes, and a pedestrian walkway.

Genivar, a leading Canadian consulting services firm, was hired to determine the extent of the damage the bridge experienced from years of exposure to deicing salts and freezing-and-thawing cycles and design a method of repairing and restoring the structure. Minor repairs were completed in the past from below the bridge, as the bridge is too busy to shut down.

The project was released for tender in May 2010 and awarded in June 2010 to David S. Laflamme Construction, a contractor in the greater Ottawa area who has many years of experience in bridge rehabilitation.

The original specifications called for pressure grouting the small patches from below, but as the removal process began, it became evident that the extent of the deteriorated concrete was much larger than previously anticipated. Through discussions between personnel from Genivar, David S. Laflamme Construction, and King Packaged Materials Company, it was determined that improved compatibility between the parent concrete and the repair material could be achieved if concrete was placed in the repaired areas as opposed to pressure grouting.

After examining the site conditions, logistics, and allowable time frame, it was determined that the best option for placing the replacement concrete was through the shotcrete process. All work had to be completed from below the bridge, using special platforms built between the steel girders. The platform allowed the shotcrete and chipping crews to access the damaged areas and prevented concrete debris and shotcrete rebound from entering the river flowing below. Time constraints due to eventual cold weather concerns meant that the crews had only a few months to complete the work. The shotcrete work was subcontracted to Coaster Concrete of Gatineau, QC, Canada, who employed ACI Certified Nozzlemen to complete the shotcrete work.

Portage Bridge (Ottawa, ON, Canada, to Gatineau, QC, Canada)

The flexibility of the shotcrete process offered a number of other advantages over traditional form-and-pump applications. Coaster Concrete crews were able to set up the shotcrete machine on either approach to the bridge, which allowed the material to be conveyed over long distances (up to 400 ft [122 m]) to the nozzleman below. The accelerated set times and rapid strength gain offered by King Packaged Materials' MS-D1 Accelerated Shotcrete allowed NCC to keep the bridge open even during the shooting process and allowed the contractors to accelerate their production schedule.

Other key properties offered by the shotcrete mixture included:

1. Air entrainment, which ensured improved salt-scaling resistance and resistance to freezing-and-thawing cycling; and
2. Silica fume, which reduced permeability values and provided further protection against future corrosion of the reinforcing steel.

The repair process started with the removal of any unsound concrete using pneumatic hammers. A minimum of 1 in. (25 mm) of space was left behind the reinforcement steel to ensure full encapsulation and provide sufficient mechanical bond. The perimeters of all repair areas were saw cut to eliminate any feather edges.

The area to be repaired totaled approximately 9730 ft^2 (904 m^2) and, with an average thickness of 4.75 in. (120 mm), required approximately 410 bags weighing 2200 lb (1000 kg) each of preblended shotcrete mixture. Steel reinforcing anchors were placed at 24 in. (600 mm) center-to-center each way. Any significantly deteriorated reinforcing steel was removed and replaced. A mat of 4 x 4 W2.9/2.9 (102 x 102 MW18.7/18.7) galvanized wire mesh was installed before any shotcrete was applied.

An offroad telescoping boom forklift was used to lift the bags over the hopper of the shotcrete machine and provide a continuous feed of material to the nozzling crews, who had only 6 ft (1.8 m) of head room when shooting. The nozzleman designed a small movable chair that could be rolled into position, providing a distance of 3 to 5 ft (0.9 to 1.5 m) from the end of the nozzle to the concrete surface. A standard gun finish was accepted because the area under the bridge was not accessible to foot or vehicular traffic.

Shotcrete encapsulating the reinforcing bar

Core testing for bond and compressive strength was taken from these locations

Underside of deck ready for shotcrete placement

Equipment setup. Bulk bags were used

This shotcrete project is the first of its kind in the Ottawa market on a major concrete infrastructure. With the great success of shotcrete on this project, there should be many more opportunities for shotcrete to come.

2011 Outstanding Infrastructure Project

Project Name
Portage Bridge 2010 Structure Rehabilitation

Project Location
Ottawa, ON, Canada

Shotcrete Contractor
Coaster Concrete

General Contractor
David S. Laflamme Construction

Architects/Engineers
Genivar and National Capital Commission

Material Supplier/Manufacturer
King Packaged Materials Company*

Project Owner
Ministry of Transportation Ontario

*Corporate Member of the American Shotcrete Association

Nozzleman in cramped quarters

Kevin Robertson *is a Technical Representative for King Packaged Materials Company, Boisbriand, QC, Canada. His areas of expertise include shotcrete materials, application, and equipment, focused mainly on concrete rehabilitation applications. Robertson is a member of ASA, the American Concrete Institute (ACI), and is on the Board of Directors of the Quebec Province Chapter of the International Concrete Repair Institute (ICRI).*

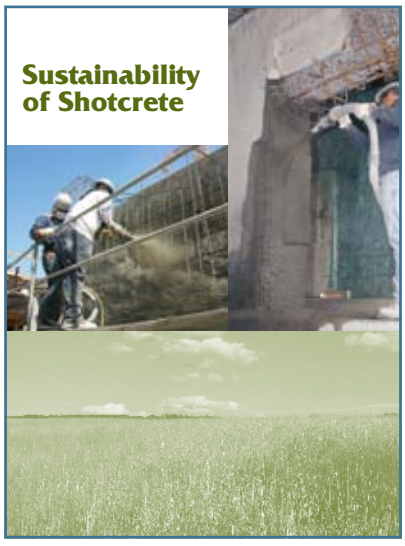
Sustainability of Shotcrete

Sustainability continues to grow as a driving force in the decision making of Owners and Specifiers regarding construction materials and placement strategies. "Sustainability of Shotcrete" is a timely and valuable resource to promote the shotcrete process and educate potential clients and owners. The document can also be submitted with project bids to identify and substantiate the sustainability advantages of the shotcrete process.

This 10-page, full-color brochure identifies and discusses the numerous shotcrete sustainability advantages and also includes case studies demonstrating these advantages in both new construction and repair.

The brochure's content was originally developed by the ASA Sustainability Committee for use in the United States Green Concrete Council (USGCC) book titled *The Sustainable Concrete Guide—Applications*. The full book can be ordered from **www.concrete.org**.

Copies of "Sustainability of Shotcrete" can be ordered from the ASA Web site at **www.shotcrete.org** or by calling 248-848-3780. For orders outside of North America, please contact ASA directly.



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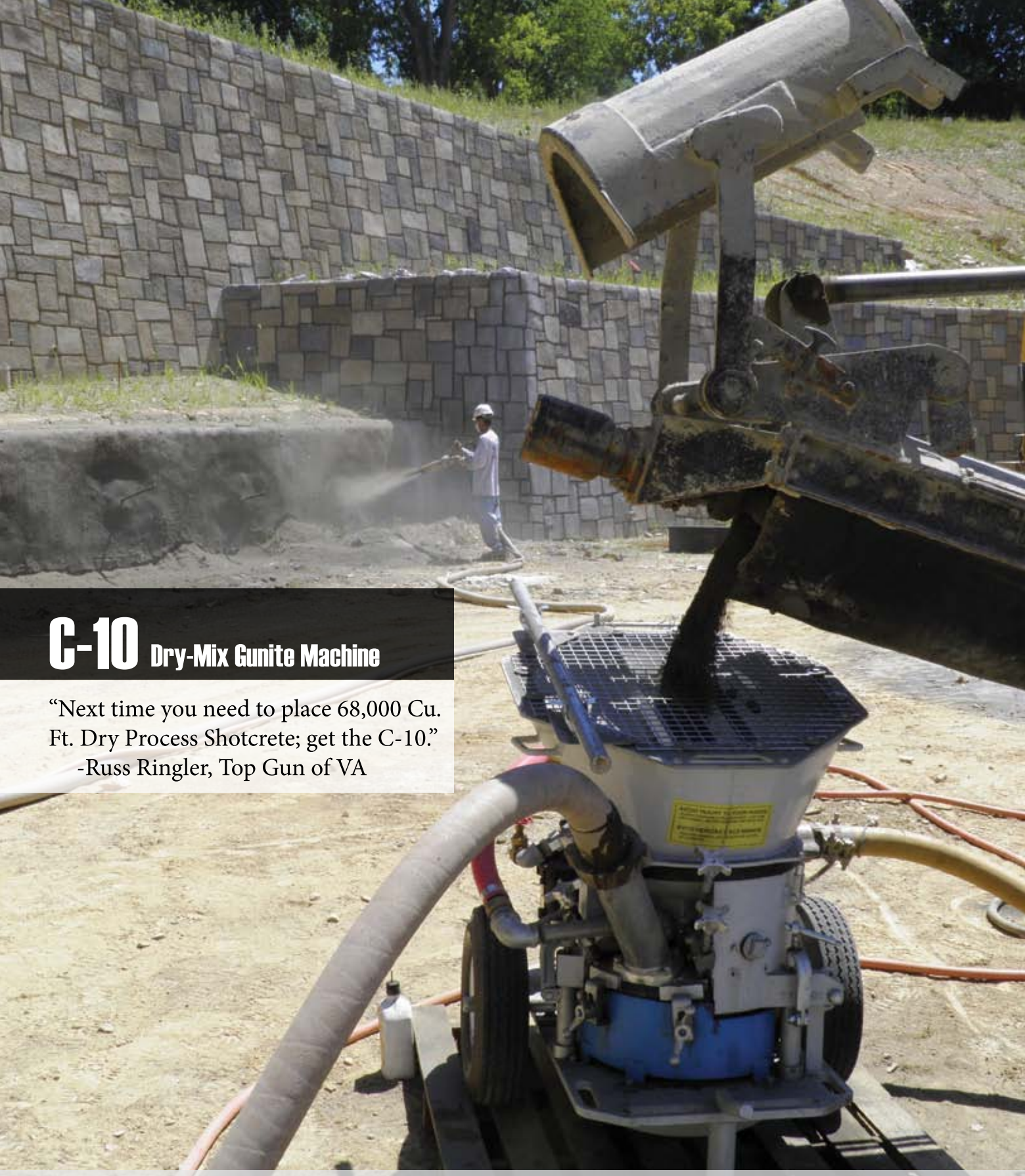

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2011 Outstanding Repair & Rehabilitation Project

ODOT U.S. Highway 26 Dennis L. Edwards Tunnel Project

By Larry Totten and Reg Ryan

In early 2010, the Oregon Department of Transportation (ODOT) determined that, for safety reasons, a series of basic repairs, including relining and lighting improvements, had to be commenced on the 70-year-old Dennis L. Edwards Tunnel, located 34 miles (55 km) west of Portland.

After the constructibility review of the project in early 2010, ODOT held a series of public meetings asking the public whether the vertical clearance of the tunnel should also be addressed as part of the project to improve freight mobility to and from the Oregon Coast. Public input was especially important to this project because the tunnel is regularly used by inland commuters to access the Oregon Coast communities that rely heavily on tourism. The daily average of 6700 motorists increases dramatically through the spring and summer months, with a seasonal peak in August of 15,000. A strong, consistent outpouring of citizen input against this proposal determined that the vertical clearance improvements would no longer be an option; the coastal residents were concerned that a lengthy repair to the tunnel would stifle already-lagging coastal tourism. ODOT estimated that the project would originally take 12 to 13 weeks and that the tunnel would reopen by the end of May, just before the high season for coastal tourism would commence.

Johnson Western Gunite Company (JWG) began work on the tunnel in January 2011. The shotcrete work consisted of relining the existing 800 ft (244 m) long tunnel, improving drainage, lighting, and long-term stability of the tunnel. The existing tunnel liner was a combination of much of the original timber arch ribs and various previous repairs using steel set and reinforcing bar reinforcement and shotcrete. JWG initially started work on the project using shotcrete and rock bolts to support the tunnel during removal of the aging timber sets. Almost immediately, it was apparent that these means and methods would not work due to poor and unstable ground conditions. The weather was colder and wetter than anticipated, and unexpected soft, damp, and unconsolidated tunnel rock conditions complicated the application of shotcrete to the tunnel lining.

Due to these unstable conditions, the original end-of-May completion date was at risk, thus jeopardizing completion before the much-anticipated beginning of the coastal tourism season. Because ODOT recognize their commitment to the communities that use the tunnel, it was critical that the design be modified to accelerate the construction process in a safe and timely manner. It was important to all concerned that the tunnel reopen as soon as possible, so ODOT and JWG immediately started discussions to review and consider alternative repair methods.

JWG submitted a value engineering proposal to leave in the existing lagging, shoot between the existing sets, and then remove the sets after the shotcrete had reached the required strength. After discussion and negotiation, this method was accepted and JWG continued with the new removal and relining plan. As these sets were removed, reinforcing bar was installed and steel fiber-reinforced shotcrete was applied as the final support and liner. Shotcrete was placed up to 18 in. (460 mm) in thickness with two mats of steel reinforcement and 80 lb/yd^3 (36 kg/m^3) of steel fiber.

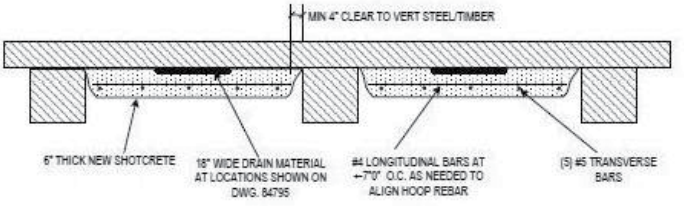
Shotcrete was a significant benefit in this project, as no formwork was required. Shotcrete was applied in the tunnel at night and because formwork was not needed, there was no blockage of the roadway, thus allowing the tunnel to be

reopened every morning to the motoring public. Using shotcrete for this critical tunnel repair not only saved ODOT time and money but also maintained a good relationship with the coastal residents who used the tunnel to commute through on a daily basis.

Larry Totten *is the current President of Johnson Western Gunite Company. He has also served as a Project Manager and Chief Estimator during almost 30 years with the company. He received his MS and BS in civil engineering and is a member of ASA, the American Society of Civil Engineers, the American Concrete Institute (ACI), and the Associated General Contractors of America. He holds contractors licenses in six states and is a licensed professional engineer in California. He is the Chairman of the Laborers Craft Committee of the Associated General Contractors of California. His industry leadership includes membership in ACI Committee 506, Shotcreting; Chairman of the Northern California Laborers Trust Fund; and Past President of ASA.*

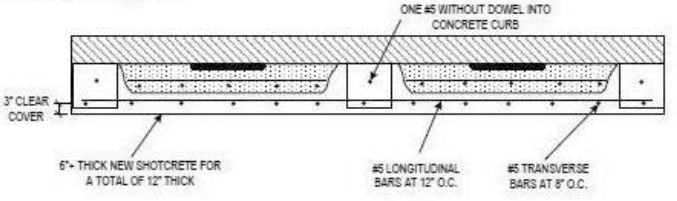
Reg Ryan *has dedicated his entire career to the construction industry, specializing in mining, shotcrete, slope stabilization, tunnels, and difficult access projects. From Iqaluit in the Arctic Circle to Belize in Central America, Ryan has stepped up to numerous challenges with innovative ideas and designs. With over 30 years of experience in the industry, when Ryan hears "it can't be done," he draws on his depth of knowledge and unwavering determination to figure out a creative solution to make it happen. Ryan served as Vice President with Johnson Western Gunite from 1999 to 2012. He now continues with Superior Gunite as Senior Project Manager/Estimator after Johnson Western Gunite merged with Superior Gunite.*

SHOTCRETE LAYER # 1



Note: 1. For Mat #1, center (3) #5 polyester resin bonded dowels to be embedded into the concrete curb between each set of timbers. [Depth of Embedment = 6" Length of Bar = 36" total]
2. No rebar dowels into concrete curb for mat #2.

SHOTCRETE LAYER # 2



2011 Outstanding Repair & Rehabilitation Project

Project Name
Dennis L. Edwards Tunnel, U.S. Highway 26

Project Location
Manning, OR

Shotcrete Contractor
Johnson Western Gunite Company*

General Contractor
Johnson Western Gunite Company*

Architect/Engineer
Shannon & Wilson, Lochner Consulting Engineers

Material Suppliers/Manufacturers
The Quikrete Companies* and Cemex

Project Owner
Oregon Department of Transportation (ODOT)

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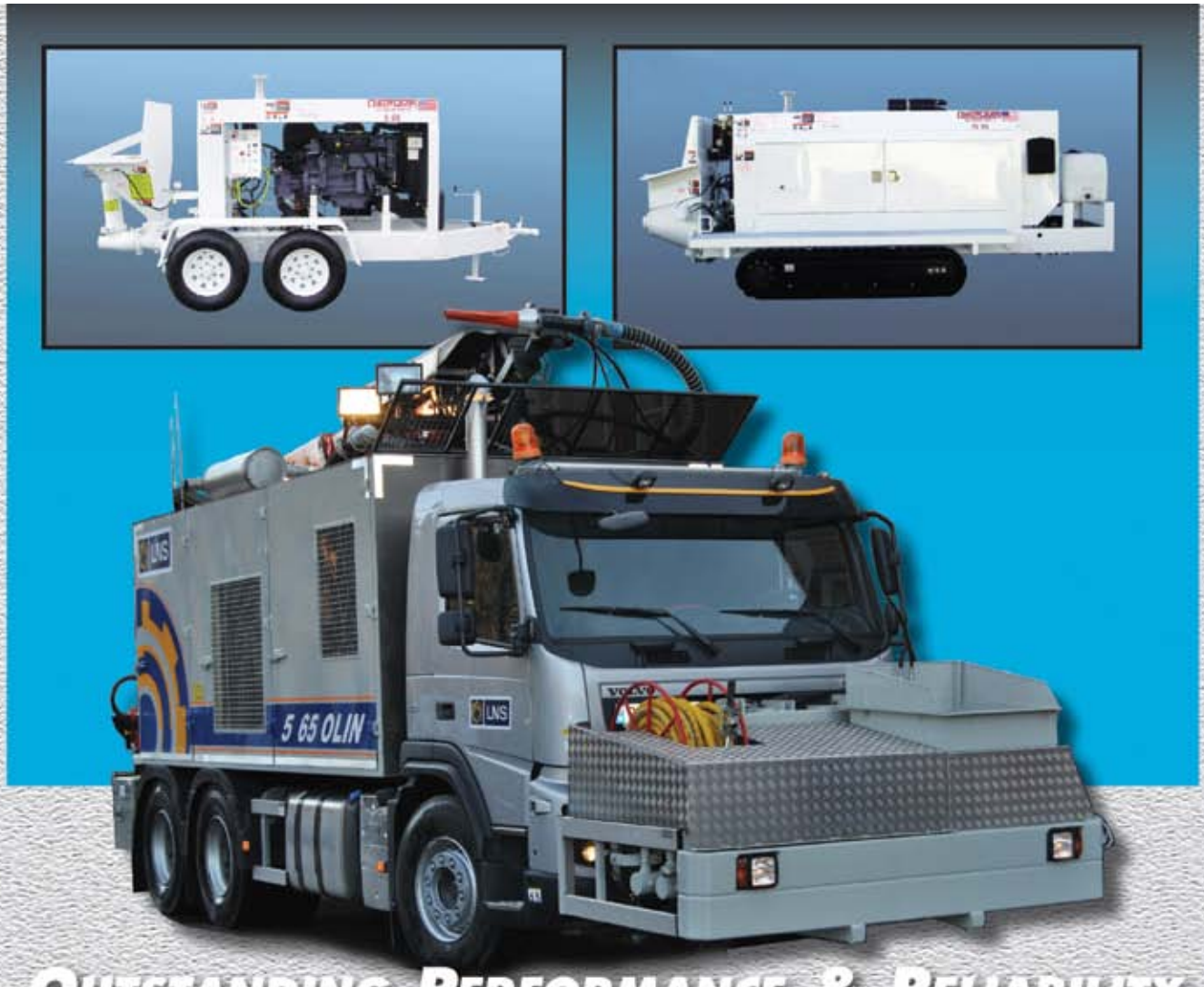

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2011 Outstanding Underground Project

Incline Tunnel—S&S Quarries, Inc.

By Edwin Brady

The Incline Tunnel, S&S Quarries, Inc., is the access to an underground rock mine in Knoxville, IA, owned by Bruening Rock Products. This access tunnel is 1950 ft (594 m) in length on a 12% grade with a depth at the bottom of the incline of 210 ft (64 m). A section approximately 250 ft (76 m) long and 1300 ft (400 m) down the incline passes through a fault zone. Earth pressure had caused extensive distortion of the tunnel cross section, with the base of the horseshoe-shaped arch moving approximately 2 ft (0.6 m) inward on both sides. Distortion of the section profile had created longitudinal and transverse cracking in the original shotcrete lining, along with movements of several feet. Inspection by Roberto Guardia, PE, Vice President of Shannon & Wilson, Inc., Geotechnical and Environmental Consultants in Jacksonville, FL, detailed the condition of the tunnel and made recommendations to reinforce this 250 ft (76 m) section by adding steel lattice trusses encapsulated with a new lining of steel fiber-reinforced, microsilica-enhanced shotcrete. A joint effort by the owner and Richie Benninghoven of USC Technologies, LLC as general contractor undertook the task of performing repairs. Edwin Brady Construction Co., Inc. was employed as the shotcrete contractor.

Prequalification and Startup

It was critical that operations at the mine remain fully operational during the repairs. Work was scheduled to start in early March 2009. Preconstruction testing revealed problems with the shotcrete mixture. Local aggregates were not very well-graded, pea gravel was not available, and 80 lb/yd^3 (47 kg/m^3) of steel fibers produced a very difficult-to-pump concrete mixture. This problem was solved by adding fly ash to the mixture, along with water reducers, plasticizers, and strict quality control to regulate slump. An Allentown RP20 Refractory Pump with an integral peristaltic accelerator pump was obtained from Gary Carlson Equipment, and a successful preconstruction qualification test/mockup was accomplished with authorization to commence the work with Edwin Brady, an ACI-Certified nozzleman and ACI examiner, of Edwin Brady Construction Co., Inc., as the approved nozzleman. With shotcrete thicknesses of as much as 6 ft (1.8 m) in vertical sections and 2 ft (0.6 m) in overhead portions, a set accelerator was required. Eucon Sureshot AF, a high-performance alkali-free shotcrete accelerator

Fig. 1: (a) and (b) Steel lattice trusses in place and ready for shotcrete

Fig. 2: Surface preparation by high-pressure water blasting

Fig. 3: Shotcrete placement

manufactured by The Euclid Chemical Company was the perfect solution. With this accelerator, we were able to place approximately 4 in. (100 mm) of shotcrete overhead, allow it to set for approximately 1 hour, and then place another 4 in. (100 mm). This allowed us to place upward of 12 in. (300 mm) of shotcrete thickness in an overhead application in a single shift.

Project Schedule

We quickly settled into a routine of mobilizing equipment to the work area, shooting a 24 x 24 x 4 in. (600 x 600 x 100 mm) test panel, shooting 4 to 7 yd^3 (3 to 5 m^3) loads of shotcrete, flushing hoses and cleaning up the pump, taking a lunch break, shooting three additional 7 yd^3 (5 m^3) loads of shotcrete, flushing hoses and cleaning up the shotcrete pump, and demobilizing equipment to allow trucks to carry ore from the mine to the surface through the repair area during the night shift. This routine resulted in the placement of a total of 49 yd^3 (37 m^3) of shotcrete in a 10-hour shift. This all required very precise coordination with the ready mix concrete supplier (Bruening Rock Products, project owner) and a quick turnaround between trucks because they had to back down a 12% slope (1300 ft [400 m]) in an unlit, dark tunnel to get to our Allentown shotcrete pump. Our four-man crew consisted of a pump operator, man-lift operator, nozzleman, and general laborer. A typical week consisted of 2 to 3 days of placing shotcrete, 1 to 2 days for surface preparation with high-pressure water blasting, and 1 day for equipment cleaning and maintenance. With this schedule, we placed about 1050 yd^3 (800 m^3) of shotcrete to complete the work in the tunnel in approximately 8 weeks.

Additional Work

Upon completion of work in the tunnel, the owner directed us to perform the additional work

Fig. 4: Completed section

Fig. 5: The light at the end of the tunnel

Fig. 6: Scaling loose rock from high wall

Fig. 7: High-pressure water blasting to prepare high wall for shotcrete

Fig. 8: High wall and portal completed

2011 Outstanding Underground Project

Project Name
Incline Tunnel—S&S Quarries, Inc.

Project Location
Knoxville, IA

Shotcrete Contractor
Edwin Brady Construction Co., Inc.

General Contractor
USC Technologies, LLC

Architect/Engineer
Shannon & Wilson, Inc.

Material Supplier/Manufacturer
The Euclid Chemical Company*

Project Owner
Bruening Rock Products, S&S Quarries, Inc.

*Corporate Member of the American Shotcrete Association

of applying new shotcrete to the tunnel portal and high wall to provide stabilization to the friable and unstable exposed rock faces. After scaling these surfaces and cleaning them with high-pressure washing, we placed about 150 yd^3 (115 m^3) of shotcrete in 1 week to complete the extra work.

Project Summary

Total shotcrete placed: 1200 yd^3 (920 m^3)
Total Eucon Sureshot AF accelerator used: 275 gal. totes × 18 = 4950 gal. (18.7 m^3)

Total Time on Project

Mobilization and preconstruction: 1 week
Shotcrete placement: 9 weeks
Cleanup and demobilization: 3 days

Conclusions

This project demonstrated how effective shotcrete is as a repair method for ground support. Through the use of admixtures, you can produce a very high-performance concrete and control its setting characteristics to allow high-build applications, even in overhead conditions. A properly designed mixture, along with a good nozzling technique, allowed for full encapsulation of the steel lattice trusses equal to the quality of a form-and-pour repair. Highly mobile equipment allowed for efficient setup and knockdown each day. This, coupled with high production rates, allowed for a very tight completion schedule with few or no interruptions to normal mining operations for the owner. Nearly 2 years after completion of this work, the owner reports no problems with the work and reiterates satisfaction with the overall success of the project.

***Edwin Brady**, PE, President of Edwin Brady Construction Co., Inc, has over 20 years of experience in wet- and dry-process shotcrete, including over 3000 hours of nozzleman experience, concrete repair, and specialty grouting projects on four continents and throughout the U.S. Brady received his BSCE from the University of Kentucky, Lexington, KY, in 1980 and has done extensive graduate work toward his MSCE from the University of Houston, Houston, TX. He is an ACI Certified Nozzleman (wet- and dry-process, vertical and overhead); an ACI Certified Examiner (wet- and dry-Process); and a licensed professional engineer in Kentucky and Colorado.*

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AMERICAN SHOTCRETE ASSOCIATION

2011 Outstanding Pool & Recreational Project

The Garrison Inn Project

By Jamie Scott

This project was part of a larger reconstruction of a historic residential property on the Hudson River. The property, which was originally a private residence, became an historic inn and then was returned to a private home. Modern additions were added over the years, somewhat inappropriately. The goal was to restore the home and outdoor gardens to resemble the original design. This task was greatly simplified when original photographs were discovered in the house during the renovation.

The property is across the river from the United States Military Academy at West Point. We often saw helicopters buzzing about and heard booms, which we initially thought were thunder but then realized were military artillery practice.

Group Works LLC was contracted to create a series of retaining walls to establish a lower plateau that would sit on a bluff high above the Hudson River. This plateau would hold a new swimming pool complex and great lawn area. Due to the heavily sloping land and restricted access, creating staging areas for construction proved to be difficult. The shotcrete process was selected as the best solution for the retaining walls because less forming material needed to be moved into the area. In addition, shotcrete trucks have the ability to pump farther from the placement area.

The wall portion of the project started with clearing the land down to bedrock. The engineer called for wrapping the reinforced footings over and around the bedrock to eliminate the possibility of the walls sliding on the bedrock over time. The reinforcement for footings and walls was 0.5 in. (13 mm) deformed steel reinforcing bars placed 12 in. (305 mm) on center. The reinforcement extended into the vertical walls on the same spacing. Numerous weep holes were required to help alleviate hydraulic pressure from groundwater that might build up behind the walls. The wall behind the pool was designed to have water level with the top, with the bottom stepping up and down over the exposed bedrock. The sister wall

Property before pool and wall construction began

Wall footings with wall forms beginning to be installed

Wall footings with wall forming and steeling completed

Shotcrete walls in place before being backfilled

Pool being formed and steeled with one wall as a backdrop

at the great lawn was built at an angle to work with the gently sloping grade of the lawn. A total of 150 yd^3 (116 m^3) was used in the footings and walls and water-cured with soaker hoses and tarps for 7 days.

The swimming pool phase was next. The total area required hammering out the bedrock, which took a month. The ledge rock was quite soft at the very top, but it quickly became extremely dense just below the surface. A rock drill was brought in to create relief holes in the rock to assist the hydraulic machine-mounted hammer. The pool was formed with plywood to reduce form vibration during shotcreting. (Steel-tex paper is another forming material used by the pool industry, but it is not easily braced and prone to vibration and movement during shotcreting.) Again, 0.5 in. (13 mm) deformed steel reinforcing bars were used for reinforcement, placed 12 and 6 in. (300 and 150 mm) on center. We used dry-mix shotcrete that enabled starting and stopping the shooting as necessary to allow the nozzleman and finishers to stay coordinated. The pool, which was shot over 2 consecutive

Pool shotcreted, waiting for forms to be stripped

Finished pool and walls looking northwest across the Hudson River

days, used a total of 95 yd^3 (73 m^3) and was water-cured with soaker hoses for 7 days.

The entire property is now nearing completion after 2 years of work, with the outdoor environment a key element of the restoration. The pool was put into use as soon as it was finished, keeping the owners entertained during the rest of the reconstruction process.

Jamie Scott *is a third-generation Watershape Designer and Builder who has worked in the swimming pool and landscape industries for 39 years. He received his BS in business and accounting from Southern Methodist University, Dallas, TX. Scott co-owned a high-end pool and landscape firm until 1998, when he divested to found a new firm, Group Works LLC, based in Wilton, CT. Through Group Works LLC, Scott has aligned himself with Genesis 3 and other organizations that focus on continuing education and increasingly higher standards in the watershape industry. He is a Platinum Member of Genesis 3 and a certified member of the Society of Watershape Designers. Scott is also an APSP-Certified Professional Builder and an ASA member and has trained with the Portland Cement Association. Additionally, he is on track to become a registered landscape architect. Scott and Group Works LLC have been featured in regional and national publications.*

2011 Outstanding Pool & Recreational Project

Project Name
The Garrison Inn Project

Project Location
Garrison, NY

Shotcrete Contractor
Shur Shot Gunite

General Contractor
Group Works LLC*

Architect/Engineer
Rader + Crews

Material Supplier/Manufacturer
Shur Shot Gunite

Project Owner
Name withheld

*Corporate Member of the American Shotcrete Association

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AMERICAN SHOTCRETE ASSOCIATION

2011 Outstanding Architecture Project

Soleri Bridge and Plaza

By Donna Isaac and Laurel Mellett

Fisher Shotcrete, Inc., is very excited to receive the 2011 ASA Outstanding Architecture Project Award for the Soleri Bridge and Plaza project. This project was very interesting from the start and is a great example of the flexibility of shotcrete in so many applications.

The Soleri Bridge and Plaza was commissioned by Scottsdale Public Art and is owned by the city of Scottsdale, AZ. The plaza, which is managed by the Salt River Project (SRP), is a 2 acre (0.81 ha) parcel that runs along the Arizona Canal—a major canal—and is the heart of the city's downtown underground utilities. The bridge spans the 130 ft (40 m) canal and forms a new pedestrian link between downtown Scottsdale retail shops and restaurants and the residents on the north side of the canal. Constructing this project and anchoring two 64 ft (20 m) pylons and two 22 ft (6.7 m) pylons for the bell assembly took extraordinary teamwork between Scottsdale Public Art, Paolo Soleri, the city of Scottsdale, SRP, and the entire contracting team.

The Soleri Bridge commission began nearly 20 years ago. Paolo Soleri, the internationally recognized architect, artist, and philosopher, is the man behind the design and commission of this bridge. In the 1940s, Soleri came to Arizona and studied with Frank Lloyd Wright at Taliesin West. By the 1950s, he was gaining international recognition for his design work, most notably for a bridge design that was published by the Museum of Modern Art. Soleri settled in the Paradise Valley

Final project

community in Arizona adjacent to Scottsdale. His residence, Cosanti, encompasses a gallery and studio, where Soleri lives and works on his urban planning ideas, specifically what he terms "arcology"—a blend of architecture and ecology. Located just north of the Phoenix metropolitan area, Arcosanti is a self-designed and enclosed community. It has been under construction for 40 years and is the heart of the Cosanti Foundation.

Arcosanti also houses the Soleri Archives, an impressive overview of the architect/artist's life's work. Whereas building communities has been Soleri's key focus, his bridges have allowed him to experiment with space, materials, and design. Soleri's bridge designs span 60 years, yet Scottsdale's bridge is the first to be commissioned and completed by Paolo Soleri.

Fisher Shotcrete, Inc., was engaged by Howard S. Wright and Hunter Contracting to complete the smaller, 22 ft (6.7 m) pylons that display Paolo Soleri's famous bells, which were cast in 1969. Shotcrete was also used for the structural walls on the canal bank, the decorative structural walls that surround the plaza as retaining walls, and the monument wall at the main entry point. These walls display an artistic drip method that is characteristic of Soleri and one that he devised for his early structural buildings at Cosanti.

This bridge was designed as a sundial and is meant to showcase solar events by allowing the sun's shadow to be viewed as a shaft of light. The bridge is laid on a true north axis, so the accompanying pylons, with their 6 in. (150 mm) gap, allow the shadow of the sun at precisely solar noon to become a shaft of light, illuminating a red line that leads the pedestrian's eye across the bridge. At the summer solstice, when the sun is highest in the sky, no shadow is seen. At the winter solstice, when the sun is lowest, the shaft of light reaches the bridge deck and the shadow is longest. This shaft of light can be seen each solar noon, but the length and skew of the shadow along the red line depend on the time of year. Spring and autumnal equinox celebrations also take place at this open public space. The precise alignment of the bridge was crucial, as the pylon placements were keyed from it.

Initially, the smaller 22 ft (6.7 m) pylons were intended to be closed like the larger pylons. Soleri, however, decided to open the smaller set of pylons on the southern side, enclosing the Goldwater Bell Assembly to mimick a bell cloister. The special red paint forms a unique and dramatic backdrop to the cast bell assembly by day and night. The small pylons serve as anchors and are the weight-bearing source for the bridge cabling. The formwork for these pylons was produced on site. It was a one-sided template that required the exposed surface to have a smooth

Anchor pylons shot using a template

Anchor pylons with orbital sheath and paint

trowel finish. The interior side is painted with a natural material to allow for bonding with the shotcrete and is highly resistant to the strong light from its southern exposure. The exterior of the pylons matches the orbital finish of the steel with both the larger pylons and the bridge. The outer orbital steel for the smaller pylons, however, was fabricated off site in Tucson and then shipped to Scottsdale. Engineers fabricated this outer surface as a cover so precisely that it could be slipped over the 22 ft (6.7 m) pylons effortlessly and anchored in place. Shotcrete, inherently a flexible material that requires less curing time, proved advantageous for this project and helped reduce the overall budget by needing only the one-sided form.

Drip method

The plaza's surrounding retaining walls reflect the characteristic Soleri drip method. Soleri developed this concept of the drip walls during his early building years at Cosanti in the late 1950s. Not wanting to waste any material, Soleri used the last bit of material or slurry left in the concrete mixer for finish texturing of cast walls or panels. He did this by mixing the leftover concrete with sand, water, and some indigenous earth. This slurry mixture is then dripped on the sloped retaining wall or panel for an appealing, unique look. Soleri has joked that the motivating factor behind the development of this process is that he is a child of the Depression and therefore does not want to waste anything. Although the strength of the concrete is decreased by the additives, it remains more of a structural accent than the use of the silt or dirt alone. The walls of this plaza have thicknesses varying from 6 to 12 in. (150 to 300 mm). Soleri was on site while these walls were constructed and during the finishing process, and he often directed the crew to angle the walls in a certain way or degree. This resulted in the diamond-facet aesthetic. While Soleri did allow the crew carte blanche in cutting several of the angles, for


Drip method and earth-cast wall

the most part, he directed how the angles were cut and faceted.

Although this method does not involve shotcrete, the earth-cast panels, another signature method Soleri perfected, are displayed in the plaza. When first experimenting decades ago, Soleri realized that by just digging a hole in the earth, you could actually use a casting method that allows finished pieces to stay connected to the earth. It was through this realization that his method was honed. By creating a silt and clay form on the ground using those materials and the right balance of water, a mold is created. For the most part, the colors added to the concrete used in his pieces are earth tones, as they incorporate the colors and textures from the soil itself. The earth-cast panels displayed in this plaza are crucial to the design. Their totemic forms and size provide an almost intimate gallery setting as they rim the south edge of the plaza.

This project is a fantastic example of why shotcrete is such a great option for artistic ventures. The general construction team looked at different options to bring Soleri's vision for the bridge, pylons, and art elements to realization. Because shotcrete can structurally anchor and aesthetically please, it was selected over precast options.

Since starting out in the swimming pool segment of shotcrete over 25 years ago, Fisher Shotcrete, Inc., has been very aware of the intrinsic artistic nature of the material. The ability to have curved or skewed lines in the same space as straight lines allows a multitude of options in many types of applications. Whereas commercial applications typically don't demand such renditions, an architectural application such as this open-air plaza is where the use of shotcrete really shines.

Over a 6-month period, 203 yd^3 (155 m^3) of shotcrete was placed for all elements of the project. The Soleri Bridge and Plaza was dedicated on December 11, 2010—just in time for the winter solstice!

2011 Outstanding Architecture Project

Project Name
Soleri Bridge & Plaza

Project Location
Scottsdale, AZ

Shotcrete Contractor
Fisher Shotcrete, Inc.*

General Contractor
Howard S. Wright

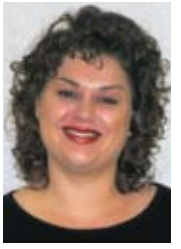
Architects/Engineers
Douglas Architecture & Planning and Steve Martino & Associates/Gookin Engineers

Material Supplier/Manufacturer
Arizona Materials

Project Owner
City of Scottsdale

*Corporate Member of the American Shotcrete Association

Donna Isaac *is a Senior Project Manager with Scottsdale Public Art. From 2005 to 2008, she worked as a Public Art Project Manager with the city of Phoenix Office of Arts and Culture. She also served as Public Art Manager for the Arizona 9/11 Memorial. Isaac has been an independent art critic and journalist for newspapers and magazines in France, the U.S., and Canada. She has worked in public process and public participation internationally with the European Union and the Norwegian Ministry of Foreign Affairs, with projects in Hungary, Kosovo, and Macedonia. She has also worked with tribal communities as a Facilitator and Cultural Consultant for cultural resources and facilities. Isaac received her MA in art history and her museum training at the École du Louvre in Paris, France. She has consulted with various communities, Maricopa County, the Maricopa Association of Governments, and the state of Arizona on a variety of public art and community engagement projects.*



Laurel Mellett *is the Operations Director for Fisher Shotcrete, Inc., which includes the Industrial Coatings Division of Fisher Epoxy Solutions in Gilbert, AZ. She grew up in the shotcrete industry, starting her career by helping with the day-to-day operations of the family shotcrete business. She worked in the shotcrete business while attending Arizona State University, where she received her bachelor's degree in both marketing and management and her International Business Certificate. While participating in a university exchange program, Mellett received her Diploma of Management Studies from the University of Bradford in West Yorkshire, England. Her research interests include internal consulting and operations management. Mellett has served on many ASA committees and is a member of the American Concrete Institute (ACI) Committee 506, Shotcreting.*

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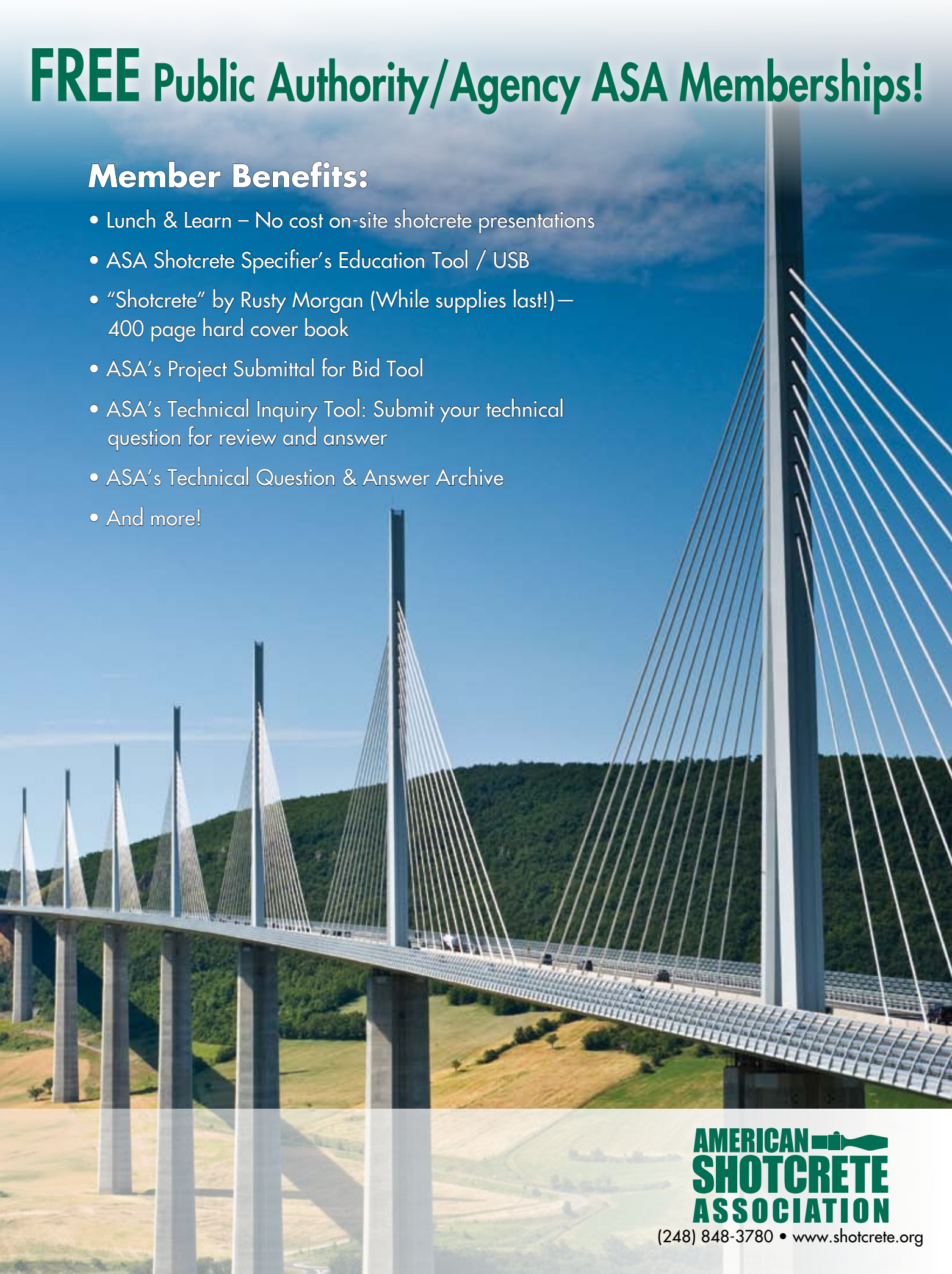

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2011 Honorable Mention

Shotcrete Saves the Day—Restoring a Crumbling Rock Face

By Mark K. Seel

An exposed section of bedrock that supports a playground adjacent to a city school was in desperate need of intervention. Upon arrival at the site, the adjacent sidewalk had been blocked off with a cyclone fence to keep pedestrians away from the rock mass, which showed signs of movement as evidenced by individual blocks of fallen rock (refer to Fig. 1). Subsequent investigation and analyses were initiated by Langan Engineering and Environmental Services, Inc. (Langan); and recommendations were made that included using a combination of steel rock anchors and high-strength steel netting to restrain the rock mass. Shotcrete was suggested to provide cohesion to the blocky rock mass. Supplemental sculpted and tinted shotcrete would provide the rock mass with the appearance of being restored to a near-original visual condition.

Investigation and Design Intent

Langan investigated the rock exposure using: 1) a combination of shallow test pits to verify foundation conditions; and 2) discontinuity mapping to verify observed potential modes of block failure along joints in the rock mass. All available information and measurements were then used to characterize the rock mass and determine block stability. The observed conditions indicated that the adjacent roadway and sidewalks were cut into the rock mass during initial site development. It is believed that to achieve the desired site and road grades, the rock cut was made as steep as possible. This condition left no space for rock-fall catchment. As with any rock exposure, time and the elements took their toll on the rock mass. Our analyses indicated that plane sliding and general ravel-type failures had recently occurred and were likely to continue without intervention. Because of the adverse orientation of select discontinuities in the exposure and the lack of adequate space for rock-fall catchment, significant active restraint and rock-fall protection were required.

Fig. 1: Initial condition—fallen rock

A combination of steel rock anchors and high-strength steel netting was needed to provide the required restraint and rock-fall protection; however, steel fiber-reinforced shotcrete was also needed to provide supplemental durable structural support of the rock. In addition, shotcrete was also expected to architecturally conceal the stabilizing elements from view. Langan subsequently designed a four-part system for the rehabilitation of the rock mass that included installation of rock anchors; base/dental shotcrete; and high-strength steel netting and a drainage mat integrated into a strong, cohesive decorative shotcrete façade.

The base shotcrete was an important element that would provide supplemental structural support to the rock mass. In addition, the base/dental shotcrete would mitigate the potential to leave voids in the stabilized mass. Primary structural support was provided by the high-strength steel netting and steel rock bolts. The base shotcrete was also expected to facilitate the rock bolt installation through potentially unstable rock blocks (refer to Fig. 2). Shotcrete also insulates the rock mass from the effects of seasonal weathering. The decorative shotcrete façade provided a new durable face with several decades of reliable service life.

Fig. 2: Unstable rock

Construction

All work had to be performed at the site, which essentially consisted of a 15 ft (5 m) wide sidewalk approximately 300 ft (91 m) long. All work was coordinated through the project architect and the school's administration. The hours of operation had to be controlled to prevent impacting normal school activities. Occasional night work was required to accommodate the schedule. Quality control and quality assurance were performed on all aspects of the work. The work was supervised by a licensed professional engineer. Shotcrete test panels were made and cores were removed from them. Grout cubes were cast during the rock anchor testing. Samples of the shotcrete and grout were tested to verify that their unconfined compressive strengths exceeded the 28-day design strengths required in the contract documents.

The contractor cleared the site of debris, soil cover, and vegetation. The rock face was cleaned with a high-pressure water blast. The stabilization work then proceeded in two parallel paths. Three inch (75 mm) diameter holes were drilled in stable sections of the rock mass using a track-mounted hydraulic drill equipped with a carbide-tipped

Fig. 3: Drilling rock anchor borehole

Fig. 4: Applying and sculpting shotcrete

Fig. 5: Sculpting shotcrete

hammer drill (refer to Fig. 3). Cuttings were blown out and the borehole was flushed with fresh water. Concurrently, but in areas where the rock was potentially unstable, the first 3 to 4 in. (75 to 100 mm) of base wet-mix shotcrete (steel fiber-reinforced) was applied in "dental" fashion to secure blocks of rock and create a stable smooth substrate. This base shotcrete layer was applied to deep crevasses and joints to provide structural support to the generally weakened rock mass. Additionally, shotcrete was applied in greater thickness to areas where deep and/or steep transitions occurred. The idea here was to "soften" edges so the overlying steel netting would make full contact with the substrate when placed. This provides uniform stress distribution and eliminates the formation of cavities behind the netting, thus ensuring full continuity of the section within the shotcrete. Once the rock mass was sufficiently stable, holes for the remaining rock anchors were drilled and cleaned. Steel dowels were drilled and grouted locally into the rock where greater thicknesses of shotcrete were required to achieve the project objective. Weep holes were then drilled into the rock mass to facilitate drainage, and a drainage mat was affixed to the rock and base shotcrete surface to drain water away from the rock mass.

One inch (25 mm) diameter Grade 97 (670 MPa) corrosion-protected rock anchors were placed in the clean boreholes, and a neat cement grout with a 28-day design compressive strength of 5000 psi (37 MPa) was tremied into the boreholes and allowed to cure. Ten percent of the anchors were performance-tested. High-strength steel netting was then stretched over the rock mass and pulled tight over the anchors. Plates and nuts were secured on the anchors, which were restressed and locked off. The remaining anchors were tightened with a calibrated torque wrench and locked off. The anchor head assemblies were fabricated with protruding pins to engage the overlying shotcrete cover.

After installing the high-strength steel netting, one to two layers of wet-mix shotcrete with a total thickness of 6 to 8 in. (150 to 200 mm) was applied and finished (refer to Fig. 4 and 5). The final face surface was sculpted and tinted to match the rock's original appearance. "Jointing" was carved in the final surface to replicate the natural appearance of the rock. After an initial curing period of 24 hours, the shotcrete was stained to match the original rock surface (refer to Fig. 6). Final site work consisted of removing and replacing the site sidewalk and curb.

The entire project took approximately a) 3 weeks to complete; b) 1 week to mobilize, clear, and restore the site; c) 6 days to install the rock anchors and netting; and d) 4 days to

Fig. 6: Final stabilized rock mass

complete the shotcrete work. Roughly 95 yd^3 (73 m^3) of shotcrete was used in this project.

Benefits

Stabilizing the rock mass eliminated the public safety concern of pedestrian traffic in the vicinity of a potentially unstable rock exposure. The use of shotcrete virtually eliminates the need for future maintenance that would involve the use of trucks and heavy construction equipment, which congests roads and creates noise and air pollution. In addition, there will be no further need for additional material, processing, or rock, which can cause dust nuisance and would use additional energy resources. The result is a sustainable, safe, aesthetically pleasing, durable façade.

2011 Honorable Mention

Project Name
PS #6 - Rock Stabilization

Project Location
Bronx, NY

Shotcrete Contractor
Moretrench American Corporation &
Boulderscape Incorporation*

General Contractor
CM&E Con Inc.

Architect/Engineer
Langan Engineering and Environmental Services

Material Supplier/Manufacturer
Jenna Concrete

Project Owner
New York City School Construction Authority

*Corporate Member of the
American Shotcrete Association

Mark K. Seel *is Vice President of Langan Engineering and Environmental Services, Inc., a full-service engineering, environmental, and construction services firm headquartered in Elmwood Park, NJ. He is a Senior Geotechnical Engineer involved in the assessment and stabilization of rock exposures. Seel is a member of several associations, including the Transportation Research Board, the American Rock Mechanics Association, the Deep Foundations Institute, and the American Society of Civil Engineers. His research interests include the advancement of technical excellence within the geotechnical and rock mechanics fields. Seel received his BS in geological engineering from the Colorado School of Mines, Golden, CO, and his MS in civil/environmental engineering from the Stevens Institute of Technology, Hoboken, NJ. He is both a licensed professional engineer and geologist in several states.*

2011 Honorable Mention

Blaine Hill Viaduct Bridge—Route 40 Ohio Department of Transportation 248-10

By Jason Pinney

Located in Belmont County, OH, the Blaine Hill Viaduct Bridge was constructed in 1933. It is on U.S. Route 40 between St. Clairsville and Bridgeport, OH. The bridge is a concrete structure with a total length of 1008 ft (307 m). The bridge has 11 spans: the four main spans are concrete open spandrel arches, five of the approach spans are prestressed concrete box beams, and the remaining two approach spans are prestressed slabs. It eventually replaced and sits adjacent to the Blaine Hill South Bridge, built in 1828 as a part of the National Road Project.

The Blaine Hill Viaduct Bridge was last rehabilitated in the early 1980s. Since that time, more repair work was necessary to keep the structure operational. The Ohio Department of Transportation (ODOT) put the repairs out to bid, and the successful bidder was Suburban Maintenance Construction Inc. (SMCI). The contract included the removal and replacement of 14,000 ft^2 (1300 m^2) of concrete at various depths. The project cost was slightly less than $2.3 million and took two construction seasons to complete.

This project (ODOT 248-10) was specified to be repaired using the form-and-pump method of repair, along with hand-applied trowelable mortars. SMCI requested that ODOT, District 11, consider the shotcrete method as an alternative

Fig. 1: Deteriorated concrete being removed during demolition

Fig. 2: Wire mesh and anodes installed prior to material installation

method of repair. SMCI felt the shotcrete method would be ideal for this project due to the nature of repairs that included many start-and-stop repairs on the structure. SMCI also saw the benefit of saved forming time and the significantly reduced use of forming materials. ODOT almost exclusively specifies "form and pump" or "hand-applied trowelable mortars" as their preferred repair method on bridge structures throughout Ohio. Multiple meetings were needed with District 11 to demonstrate and discuss the benefits of the shotcrete method. SMCI placed test patches and shot test panels to help make ODOT comfortable with the proposed shotcrete method of repair. Eventually, ODOT, District 11, signed off on the dry-process shotcrete method for repairs, where SMCI proved it was beneficial and made sense to the project.

As the demolition process began, deteriorated and unsound concrete was saw cut and removed using 15 lb (6.8 kg) chipping hammers. Existing exposed reinforcing steel was sandblasted to bare steel. This removed all corrosion from the reinforcing steel. Where existing reinforcement was deficient, it was replaced with either reinforcement steel or wire mesh, depending on the size, shape, and condition of the patch area. Before shotcreting started, approximately 5300 embedded sacrificial galvanic anodes (Galvashield® XP2 anodes) were installed on the reinforcing steel.

SMCI used ACI-certified nozzlemen to perform the shotcrete work on the bridge rehabilitation. Prior to the placement of the material, patch areas were saturated-surface-dry (SSD) to ensure proper bonding and hydration of the applied shotcrete. Areas patched on the structure included wing walls, piers, spandrel columns, arches, and abutments. Patches were "gunned" at varying depths from 2 to 6 in. (50 to 150 mm) in depth and a hand-trowel finish was used on the material. The patches were then sprayed with a white-to-clear ODOT-approved curing compound. The curing compound helped to ensure proper hydration and minimized shrinkage cracking. Ultimately, a final tinted epoxy urethane

Fig. 3: Rehabilitated columns with tintable epoxy urethane sealer

Fig. 4: Open spandrel arch and spandrel column rehabilitation

Fig. 5: Rehabilitation of Blaine Hill Viaduct Bridge near completion

sealer was applied to the entire concrete structure for added durability, protection, and overall aesthetics. In addition to the substructure rehabilitation, the bridge deck received a microsilica concrete overlay.

The Quikrete® Companies supplied preblended 3000 lb (1360 kg) bulk bags to ODOT specifications for pneumatically placed mortars—283 of the 3000 lb (1360 kg) bulk bags were used to complete this project. Preblended shotcrete materials assured the contractor and project owner that materials were mixed in accordance to job specifications. Bulk bags were chosen on this project for their ease of use, maneuverability on the job site, and overall cost effectiveness. The dry-process shotcrete material was placed using an AIRPLACO Cyclone® CY-61 Dry Bowl Rotary Gun.

At the 2011 Ohio Transportation Engineering Conference in October, Tran Systems presented a session on "The Rehabilitation of an Open Spandrel Arch Bridge." This presentation was based on the entire rehabilitation project for the Blaine Hill Viaduct Bridge. After the presentation, SMCI, the shotcrete contractor, was acknowledged for the craftsmanship performed on the job. Looking to the future, we trust that successful bridge rehabilitation projects, such as the Blaine Hill Viaduct Bridge, will open many more opportunities for dry-process shotcrete work in Ohio for cost-effective and durable infrastructure repairs.

2011 Honorable Mention

Project Name
Blaine Hill Viaduct Bridge—Route 40
Ohio Department of Transportation 248-10

Project Location
St. Clairsville, OH

Shotcrete Contractor
Suburban Maintenance & Construction Inc.

General Contractor
Suburban Maintenance & Construction Inc.

Architect/Engineer
Tran Systems—
Ohio Department of Transportation

Material Supplier/Manufacturer
The Quikrete Companies*

Project Owner
Ohio Department of Transportation

*Corporate Member of the
American Shotcrete Association

***Jason Pinney**, the Construction Products Sales Manager for The Quikrete Companies in Columbus, OH, is directly responsible for construction product sales in Ohio and Kentucky. He has more than 12 years of industry experience. His research interests include heavy high construction and rehabilitation. Pinney has been directly involved in multiple State DOT material approvals. Quikrete is a Corporate Member of ASA.*

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2011 Carl E. Akeley Award

The sixth annual Carl E. Akeley Award was presented to Charles S. Hanskat of Concrete Engineering Group LLC for his paper "Shotcrete Testing—Who, Why, When and How." This paper, published in the Summer 2011 issue of *Shotcrete* magazine, provided an informative overview of shotcrete testing for construction team professionals. The award was presented to Hanskat by Ted Sofis, ASA Publications Committee Chair.

ASA established the Carl E. Akeley Award to honor his founding of what today is referred to as the shotcrete process. This award is presented to the author(s) of the best technical article appearing in *Shotcrete* magazine in the past 12 months, as determined by the Akeley Award Committee of ASA.

Carl E. Akeley invented the cement gun in 1907 and introduced a commercial version of it at the Cement Show in New York in December 1910. For this reason, Akeley is considered the inventor of the shotcrete process.[1]

The sixth annual Carl E. Akeley Award, 2011

Born in Clarendon, NY, on May 19, 1864, Akeley was a noted naturalist, taxidermist, inventor, photographer, and author. He made many significant contributions to the American Museum of Natural History and many other museums around the U.S. He initially invented the cement gun to repair the façade of the Field Columbian Museum and later used it to improve the quality of his taxidermy exhibits at the museum. Akeley made five expeditions to Africa, during which time he procured many animals for museum exhibits. President Theodore Roosevelt accompanied him on one of those expeditions and encouraged him in his development of the cement gun. During his fifth expedition to Africa, he contracted a virus and died on November 17, 1926.

References

1. Teichert, P., "Carl Akeley—A Tribute to the Founder of Shotcrete," *Shotcrete*, V. 4, No. 3, Summer 2002, pp. 10-12.

Past Akeley Award recipients were:

- 2006 – Jean François Dufour, "State-of-the-Art Specification for Shotcrete Rehabilitation Projects"
- 2007 – Knut F. Garshol, "Watertight Permanent Shotcrete Linings in Tunneling and Underground Construction"
- 2008 – E. Stefan Bernard, "Embrittlement of Fiber-Reinforced Shotcrete"
- 2009 – Dufour, Lacroix, Morin, and Reny, "The Effects of Liquid Corrosion Inhibitor in Air-Entrained Dry-Mix Shotcrete"
- 2010 – Lihe (John) Zhang, "Is Shotcrete Sustainable?"

Carl E. Akeley

Patrick Bridger, Joe Hutter, Charles S. Hanskat, and Ted Sofis

2011 ASA President's Award

The recipient of the 2011 ASA President's Award goes to a well-respected East Coast contractor. In 1983, he left his job with Indiana Gunite and moved his family from Florence, AL, to Oxford, MD, to live with his in-laws while he started his own business working out of their attic. He spent years on the road building his business, leaving his wife at home taking care of the family. After building a successful business, he chose to relocate his family with one requirement in mind: it had to be far enough south that no road sign says "Bridge Freezes before Roadway."

His greatest passion is sailing/boating with his family and friends around Canada, up and down the inner-coastal waterway, around the Chesapeake Bay and its tributaries, and across the Gulf of Mexico, and is currently planning a trip this spring to the Bahamas. If he is not boating, he would prefer to be on the golf course. He is also an avid reader—from the *Wall Street Journal* to history novels and seaside adventures.

Some of you may have heard one of his favorite business sayings: "I am just a country contractor trying to get by."

"One of the kindest and most generous persons I've ever met, Curt White is the rock behind Coastal Gunite, his family and friends, and his employees. It gives me great pleasure to recognize Curt White as this year's recipient of the ASA President's Award," stated ASA President Patrick Bridger in his presentation to a surprised R. Curtis White Jr.

The ASA President's Award was established in 2005 to recognize the person or organization that has made exceptional contributions to the shotcrete industry. It is the sole responsibility of the current ASA President to select the recipient of this award.

The 2011 ASA President's Award

Past President Award winners were:

2006 – Dr. Marc Jolin
2007 – George D. Yoggy
2008 – Dudley R. "Rusty" Morgan
2009 – Merlyn Isaak
2010 – Larry Totten


Patrick Bridger and the Whites


Curt and Bain White

Top Ten Sustainability Benefits of Shotcrete

The United States Green Concrete Council's (USGCC) book, *The Sustainable Concrete Guide—Applications*, includes a list of the top 10 sustainability benefits of shotcrete in its chapter on shotcrete. Over the next 10 issues of *Shotcrete* magazine, this Sustainability column will elaborate on each one of the listed advantages. Previous discussion of advantages from past issues can be viewed on the ASA Web site at **www.shotcrete.org/sustainability**.

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1. Formwork savings of 50 to 100% over conventional cast-in-place construction.
2. Formwork does not have to be designed for internal pressures.
3. Complex shapes require very little—if any—formwork.
4. Crane and other equipment savings or elimination.
5. **Labor savings of at least 50% in repair applications** (see below).
6. New construction speed savings of 33 to 50%.
7. Speed of repair reduces or eliminates downtime.
8. Better bonding to the substrate, which enhances durability.
9. Adaptability to repair surfaces that are not cost-effective with other processes.
10. Ability to access restricted space and difficult-to-reach areas, including overhead and underground.

Labor Savings of at Least 50% in Repair Applications

Shotcrete has substantial benefits for enhanced sustainability in the repair industry. Shotcrete is an efficient repair method that offers—in addition to significant material savings—exceptional labor and speed advantages in many repair applications, all of which are critical sustainability advantages.

Using shotcrete allows the repair contractor to economically and efficiently address a wide range of concrete repairs with these labor-saving benefits:

- The use of minimal, if any, formwork;
- The allowance of unique overhead placement quality and efficiency;
- Increased speed of placement;
- The ability to provide the precise shape and thickness required for the structural or aesthetic functionality of the repaired concrete members in a significantly more efficient manner than form-and-pour;
- The possible elimination—or at least reduction—of shoring and scaffolding that would be needed for form-and-pour repair methods; and
- The possible elimination of the need for labor to operate heavy lifting equipment or forklifts on the site that would be needed for form-and-pour methods to build, set, and strip formwork.

In addition to significant sustainability benefits from material resource savings by eliminating formwork, the use of shotcrete can result in a labor savings of up to 50% on a repair project. The shotcrete process offers all the sustainability advantages of concrete as a repair material, plus a significant number of sustainability advantages inherent in the placement process.

In small repair areas, forming is labor-intensive. With shotcrete, the repair material can be gunned in from the open side against a prepared substrate, completely eliminating the need for forming. This not only saves the costs of the forming materials but also the costs of the labor involved in making the forms, securing them in place, the time-consuming procedure of conveying the concrete to the scattered repair areas, and stripping the forms. Additional labor costs are saved by eliminating the need to pour concrete through chutes to adequately fill the small formed repair areas without leaving voids, honeycombs, and air pockets. The ability to transport the shotcrete material through hoses directly to the repair areas eliminates the need for hoists, cranes, buckets, and the additional handwork that is involved in physical concrete placement. Thus, shotcrete placement provides a more efficient and cost-effective method of conveying the repair material.

In overhead areas, shotcrete can be gunned in place from the underside of the repair area and quickly and efficiently placed. On overhead forming and pouring installations, the concrete flows along the bottom side of the form, often leaving a gap or air pockets between the existing overhead concrete substrate and newly placed repair. With shotcrete, the receiving surface is fully visible and the repair material is shot in place from the top down, ensuring an excellent bond to the existing overhead concrete substrate. Additionally, overhead forming requires a

Shotcrete can easily conform to rounded or irregular shapes and varying depths, as illustrated by this freshly gunned circular-shaped bridge pier

On this pier hammer head, the shotcrete is easily gunned in place without the need for forming

great deal of time and labor to secure and often support scaffolding and bracing to hold the formwork in place. This step becomes completely unnecessary with a shotcrete installation.

Shotcrete can easily conform to complex shapes or rounded shapes where forming becomes difficult and expensive. Forming the underside of a dome or arch or building forms for repair areas on a cone or cylinder shape becomes a time-consuming and labor-intensive operation. The shotcrete, when shot in place, will fill in and conform to irregular depths and shapes easily and efficiently, taking the shape of the receiving surface.

In summary, for the rehabilitation of concrete structures, there is no more efficient repair method than using shotcrete. In most repair applications, shotcrete can be gunned directly onto the receiving surface, completely eliminating the need for forming. This yields big savings in time, labor, and material. Additional benefits include: 1) the speed and efficiency of placement; 2) the ease in overhead placement; 3) the elimination of bracing and support scaffolding for the formwork; 4) the reduction or elimination of hoists and handwork; 5) the advantages in material transport and handling; and 6) the unique feature of being able to conform to irregular shapes. In light of all these advantages, it is plainly evident that a 50% reduction in labor costs is easily realized using the shotcrete process for concrete repairs.

In this dry-process shotcrete repair of an industrial sump, the repair mortar is gunned in place without the need to make or install forms

The deteriorated concrete on this bridge pier has been removed, the reinforcing bar exposed, and the surface prepared prior to the shotcrete placement. The use of shotcrete eliminates the need for forming and labor costs involved

Shotcrete can be efficiently gunned overhead in concrete repair applications, where forming and material placement can be difficult and expensive, as evidenced by this dry-process shotcrete repair

Shotcrete FAQs

As a service to our readers, each issue of *Shotcrete* will include selected questions and provide answers by the American Shotcrete Association (ASA). Questions can be submitted to info@shotcrete.org. Selected FAQs can also be found on the ASA Web site, **www.shotcrete.org/ASAfaqs.htm**.

Question: *When replacing welded-wire reinforcement with micro- or macro-synthetic or steel fibers, how is the "equivalent dosage" of fibers determined?*

Answer: The equivalent dosage of fibers to replace embedded steel reinforcement needs to be evaluated by the design engineer for the specific project or application. Guidance for the designer is available in ACI 506R-05, "Guide to Shotcrete," and ACI 506.1R-08, "Guide to Fiber-Reinforced Shotcrete."

Question: *Is there a recognized standard addressing pass/fail criteria for abrasion testing of cement mortar shotcrete-lined corrugated steel pipe?*

Answer: We are not aware of any recognized standard for abrasion testing or acceptance specifically for this application. ASTM International has several abrasion tests for concrete and mortar that include:

- ASTM C418-05, "Standard Test Method for Abrasion Resistance of Concrete by Sandblasting";
- ASTM C779/C779M-05(2010), "Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces";
- ASTM C944/C944M-99(2005)e1, "Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method"; and
- ASTM C1138M-05(2010)e1, "Standard Test Method for Abrasion Resistance of Concrete (Underwater Method)."

Also, ACI 350-06, "Code Requirements for Environmental Concrete Structures," Section 4.6, has requirements for protection against erosion.

Question: *We are considering a shotcrete application over a weathered rock outcrop (consisting of sandstone, siltstone, and clay stone) in our backyard to prevent further erosion and unstable conditions. Does the outcrop need to be prepared as described in your previous Shotcrete FAQs (loose material removed, saturated surface-dry [SSD]) if a mesh that is anchored to the outcrop will be used? Also, will the shotcrete need to have fibers in the mixture? Do we need joints?*

Answer: It is always a good practice to scale off the loose material from the rock face, particularly when dealing with shale or clay stone, as they degrade when exposed to the air. In addition to scaling the rock face, it should be washed down with air and water prior to gunning. As for expansion joints, they are not normally used when gunning over natural rock. The shotcrete is typically gunned continuously across the hillside without any expansion joints, with a natural gun finish following the natural contours of the rock face. With an anchored mesh in place, the use of fibers is not necessary. In many applications, fibers can be used in place of or in addition to mesh.

Question: *I am considering the use of shotcrete as an alternative to grouted riprap for slope stabilization. The project involves a basin with varying slopes and easily erodible soils. Water will cascade down the side slopes.*

I was going to specify shotcrete with welded-wire reinforcement but am now considering fiber-reinforced shotcrete. Is fiber-reinforced shotcrete the better choice and, if so, is 3 in. (76 mm) thickness sufficient?

Answer: Structurally, using proper quantities of either welded wire or fibers should work well. If fibers are used, they should be specified by an engineer who has the experience to specify the type of fiber and either performance requirements or dosage levels. The advantage of fibers is that they are uniformly distributed through the section, whereas the welded-wire reinforcement can be difficult to maintain in the proper location within the pavement section. The proper thickness should also be determined by a qualified engineer, as soil and groundwater pressures can impact the required thickness.

Question: *Can shotcrete be used to repair a wall made of cement and fly ash? If so, should the wall be prepared for the shotcrete application?*

Answer: Structurally sound concrete that contains up to 20% fly ash in the total cementitious materials should not present any problems for subsequent bonding of shotcrete. Concrete with fly ash contents up to 30% have been used in recent years without any reported problems with strength and bond. Although concrete mixtures with higher levels of fly ash (up to 55%) have been proposed, we don't have direct experience with their bonding characteristics. We suspect it would be fine as long as the base concrete develops adequate compressive and tensile strength. This could be confirmed by a simple bond strength test of shotcrete on the concrete substrate in question.

The existing surface needs to be properly prepared, removing all soft or deteriorated material back to sound concrete. For extensive defects in the existing concrete, chipping hammers may be required. For removal of light surface carbonation or laitance, a strong, high-pressure water blast or sand/bead blasting may be adequate. Depending on the thickness of the shotcrete, reinforcing may be required in the overlay. Specific details of the repair are best developed by an engineer experienced in shotcrete repair.

The Danger of Fallouts in Overhead Shooting

By William Clements

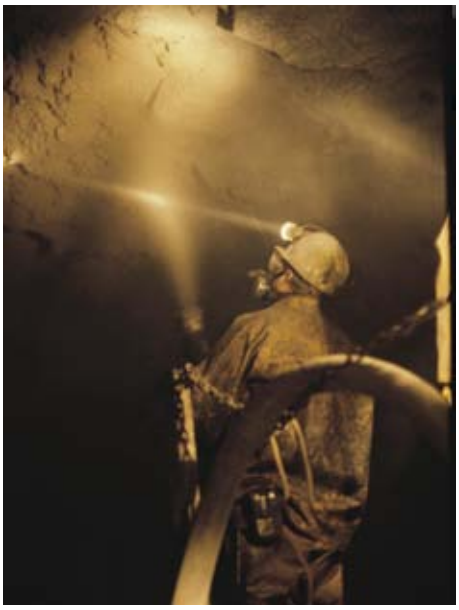
The volume of shotcrete required to cover an area of only 3 ft^2 (0.3 m^2) with a 4 in. (100 mm) thickness would typically weigh approximately 140 lb (64 kg), a weight that—if dropped from a height of 10 ft (3 m)—would seriously endanger the life of any individual standing below it. This fact should serve as a reminder to all of how dangerous it can be to work under freshly applied shotcrete. Up to several hours after applying shotcrete, it is possible to experience fallouts (the sudden collapse of shotcrete after placement) for a variety of different reasons inherent to shotcrete materials and applications.

Fallouts can be caused by poor quality or inconsistent material; application inconsistencies; cold temperatures; improper dosage of admixtures; or failure of the application equipment, which can lead to increased set times and reduced adhesion to the receiving surface. Vibrations in the rock or on a concrete structure can also cause shotcrete fallouts; these can be especially dangerous because the occurrence can be unexpected and unpredictable.

For underground applications, it is also possible to experience fallouts when the rock-bolted screen is either too close to or too far from the rock face or has not been bolted properly, causing it to loosen. It should also be noted that shotcrete does not always have an anchorage system that is stable enough to hold the freshly applied shotcrete in place. This can happen when there are inconsistencies in the profile of the receiving surface. In these cases, it is very difficult to detect how thick the shotcrete has been applied and, therefore, which sections may be more likely to fall if a section was shot too thick.

The best practice when applying overhead shotcrete is to eliminate any situation where a member of the shotcrete crew will be working under fresh, plastic shotcrete. The optimum way to achieve this is through planning, roping off any areas where shotcrete has been recently applied, and opening the area for access only when the shotcrete has reached final set.

Nozzleman applying shotcrete overhead to repair concrete soffit in tunnel



Nozzleman applying shotcrete to back in order to provide ground support during the mining process

***William Clements**, MASc, EIT, is a Technical Services Representative for King Packaged Materials Company. He received his bachelor's and master's degrees in civil engineering from the University of Windsor, Windsor, ON, Canada. His research interests include cementitious material mixture design development, structural rehabilitation, and shotcrete technology.*

Putzmeister and Sany Merge

Putzmeister Holding GmbH (Putzmeister) and SANY Heavy Industry Co., Ltd (Sany) have announced the signing of an agreement on the merger of both companies. Sany, together with the Chinese private equity company CITIC PE Advisors (Hong Kong) Limited as a minority shareholder, thereby acquires 100% of Putzmeister. The final closing of the deal is subject to approval by the relevant authorities and the customary closing conditions. Both parties agreed not to disclose the financial terms of the transaction.

Putzmeister develops, produces, and sells construction machinery worldwide—especially concrete pumps—for the building and mining industries, tunnel construction, and large-scale industrial projects. Sany, based in Changsha, China, is a large Chinese producer of construction machinery and market leader for concrete pumps in China, which is the largest and fastest-growing market for concrete pumps and other industrial equipment worldwide. The business activities of Putzmeister and Sany are highly complementary geographically. Therefore, the merger of the Chinese market leader in concrete pumps with the leading provider in most markets outside of China follows a clear strategic and industrial rationale: the creation of the global market leader for concrete pumps.

Both partners benefit substantially from the combination. Sany's financial strength secures Putzmeister's growth prospects and provides a significant competitive advantage. Sany adds "made in Germany" technologically cutting-edge products and innovations to its portfolio and acquires a strong distribution and service network outside China.

This transaction marks the first merger between a large well-known German Mittelstand company and a Chinese partner. Karl Schlecht, founder of Putzmeister, said, "This merger is a global showcase transaction. Sany is one of the few large Chinese conglomerates which is personally operated by the founder, who is also the majority shareholder. In fact, Liang Wengen is one of China's most successful entrepreneurs. He not only shares our entrepreneurial spirit but also Putzmeister's visions and corporate values."

Aichtal, Germany, will become Sany's new headquarters for concrete machinery in the world outside China. Putzmeister will continue to operate with a high degree of independence in day-to-day management. Sany will focus on operations in China, where Putzmeister will continue to be the premium brand. Norbert Scheuch will remain in his position as CEO of Putzmeister within Sany and will join the Sany Executive Board. The entire proceeds of the transaction will be transferred to the benefit of the Karl Schlecht Charitable Foundation (KSG) and the Karl Schlecht Family Foundation (KSF).

Liang Wengen, Chairman and Founder of Sany, said, "With this merger, Putzmeister and Sany will create a new and global market leader for concrete pumps. Putzmeister will remain as an independent brand with its own management within the Sany group. We are looking forward to working with the Putzmeister management which made this business so successful."

Sika Expanding in Sweden, Russia, and Saudi Arabia

To satisfy customers' needs, Sika Corporation is strengthening its position worldwide and building new production facilities in all mature and emerging markets.

In Scandinavia, in the far north of Sweden in the iron ore mines of Kiruna, where Sika provides a wide range of products for shotcrete applications, a sharp, rapid increase in the volume of accelerators sold brought the old production facilities to the brink of their capacity. To address this situation, Sika Sweden established new production plants with more effective powder dosing and mixing systems, enabling the manufacture of larger volumes. A new management and administrative headquarters was also built next to the facilities, just 30 minutes from the center of Stockholm.

To meet the country's fast-growing economic demands, Sika Russia has opened its first major production facility and new headquarters—both essential milestones. The new plants in Lobnya, located north of Moscow, comprise innovative production facilities, new office buildings, warehouses, technical service facilities, concrete and chemical laboratories, and water clarification plants. Now, 120 Sika employees have new workspaces in this modern complex.

Situated on the Arabian Peninsula and Rabigh—on the coast of the Red Sea near the city of Jeddah (population 3 million)—Sika Saudi Arabia has opened a new production plant for concrete admixtures and dry mortar. Sika had been a regional market leader in the 1970s and 1980s but had long since relocated to Bahrain. The new plant makes Sika's position in Saudi Arabia even stronger and offers customers even more competitive solutions to overcome challenges.

Sandvik Reduces Workforce in Mining and Construction

Actions to achieve the goals in Sandvik's new group strategy for the Sandvik Mining and Sandvik Construction business areas have been identified and approved. This will result in the workforce being reduced by 400 employees.

In most cases, the global workforce reduction of 400 employees in Sandvik Mining and Sandvik Construction will only affect a small number of people per country and production unit. Local negotiations will be concluded in the first and second quarters of 2012. The total includes already implemented, ongoing, and planned restructuring activities, such as the workforce reduction announced on November 3, 2011, in Sandvik Mining and Sandvik Construction's operations in Sandviken, Sweden, as a result of the separation of the business area and the relocation of the head offices of the new business areas.

As part of the review, the two business areas have decided to focus more on the core operations. For some smaller products in certain geographical areas, the sales channels will be adjusted, resulting in more sales via distributors to achieve better coverage of the regions where market penetration was previously weaker.

In addition, Sandvik's legal entity in Algeria will be closed. Also, as of 2012, sales will be conducted via distributors in line with the updated strategy.

At the same time, production and sales will be discontinued for a small number of products that will not form part of the company's long-term offerings. Sales of these products represented less than 5% of the joint sales of the two new business areas in 2011. An adjustment of the inventory value related to products to be discontinued for the recently acquired Shanghai Jianshi Luqiao and an adaptation to Sandvik's stricter depreciation policy for slow-moving inventory are also included in the review.

LZhang Consulting & Testing Ltd. Establishes New Research Laboratory

Dr. Lihe Zhang

Dr. Lihe (John) Zhang has established LZhang Consulting & Testing Ltd., setting up an advanced research laboratory for fiber-reinforced shotcrete/concrete in Vancouver, BC, Canada. The laboratory teams up with universities, governmental research institutes, and some of the world's most experienced and talented minds in shotcrete to conduct advanced research work on shotcrete. The goal is to provide advanced research and high-quality consulting and testing services to the shotcrete industry.

The laboratory is fully equipped for testing of flexural toughness of fiber-reinforced shotcrete/concrete to ASTM C1609, ASTM C1550, and EFNARC standards and conducting trial shooting and testing for rebound, early-age strength, compressive strength, boiled absorption and volume of permeable voids, and rapid chloride penetration tests. At this independent industrial research laboratory, research on new fiber products, new application methods for shotcrete, innovative technology, new shotcrete materials, and durability of shotcrete (including impact resistance for fiber-reinforced shotcrete) can be conducted. As a voting member of ASTM C09.46, Shotcrete and Fiber-Reinforced Concrete, Zhang will provide technical support for the ASTM International standards based on the testing and research projects.

The use of fiber-reinforced shotcrete has increased in ground and underground support, particularly in tunnels and mines. The design of fiber-reinforced shotcrete/concrete for construction requires flexural toughness testing to ASTM C1609 and ASTM C1550. One of the challenges is to provide reliable testing results with a closed-loop testing system as specified in ASTM International standards. With the laboratory's newly assembled INSTRON closed-loop testing system, the shotcrete industry now has an independent testing and research laboratory for fiber-reinforced shotcrete/concrete. Zhang is currently working on a fiber-reinforced shotcrete research project for a mine application.

Zhang is also on the ASA Board of Direction.

For further information, please contact Dr. Lihe (John) Zhang at zhanglihe@gmail.com.

Industry Personnel

Hanskat Elected to SDC Board

Charles Hansksat

Charles Hanskat, ASA Secretary and Chair of the ASA Sustainability Committee, is one of four newly elected members of the Strategic Development Council (SDC), a council of the ACI Foundation.

An ACI Fellow, Hanskat is a founding and current member of ACI Committees 371, Elevated Tanks with Concrete Pedestals; 372, Circular Concrete Structures Prestressed by Wrapping with Wire or Strand; 373, Circular Concrete Structures Prestressed with Circumferential Tendons; and 376, Concrete Structures for Refrigerated Liquefied Gas Containment; and a member of several ACI Board committees and ACI Committees 301, Specifications for Concrete; 350, Environmental Engineering Concrete Structures; and 506, Shotcreting; and Joint ACI-ASCE Committee 334, Concrete Shell Design and Construction.

Hanskat has been active in professional and technical engineering societies since engineering school. His 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 local, state, and national levels was highlighted when he served as State President of FES and then as a National Director of NSPE. He served as a District Director for Tau Beta Pi for 25 years from 1977 to 2002.

Joining Hanskat as new members on the SDC Board are:

- Kevin Cail, Director of Sustainability and Innovation for Lafarge North America, Washington, DC;
- Brian Green, a Research Geologist specializing in grout and concrete materials research in the Concrete and Materials Branch of the Geotechnical and Structures Laboratory at the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS; and
- Claudio E. Manissero, President of Premier Construction Products Group, Huntersville, NC.

SDC provides the concrete industry with a forum that includes government and academia for companies and entrepreneurs to share new technologies at a senior level and discuss strategic issues and tactics, including the support of practical research to the benefit of all. For entrepreneurs, SDC provides a showcase for their technologies and an opportunity to work with concrete industry leaders to find pathways to accelerate technology acceptance. Visit **www.concretesdc.org** for more information.

Blastcrete Equipment Company Names Bagwell General Manager

Maury Bagwell

Blastcrete Equipment Company has announced the appointment of Maury Bagwell as General Manager. In his new position, Bagwell's primary responsibilities are product development and engineering, management of employees, and quality control.

A veteran of the equipment industry, Bagwell has more than 20 years of experience in manufacturing, sales, product design, and engineering. Prior to joining Blastcrete, he was involved in both engineering and sales for Engine Power Source as an OEM Sales Manager.

Bagwell feels that his strong background in mechanical engineering and expertise in power transmission and hydraulic component design will help elevate the Blastcrete mission of providing high-quality custom equipment solutions for a variety of industries.

"I'm eager to build on the reputation Blastcrete has established as a trusted partner, delivering safe, dependable, and effective equipment," he said. "It's my goal now to raise the bar even further by streamlining our processes, from the initial design and CAD drawing phase up to final production. Ultimately, it's going to result in greater efficiency and allow us to provide the best products and service for our customers."

For 60 years, Blastcrete Equipment Company has been manufacturing safe, reliable, and user-friendly solutions for a variety of industries worldwide. With a complete product line consisting of concrete mixers, pumps, and related products, Blastcrete Equipment Company is poised to meet the needs of the commercial and residential construction, ICF and SCIP building systems, and refractory and underground markets. For more information, visit **www.blastcrete.com**.

Von der Hofen Joins Coastal Gunite

Marcus H. von der Hofen

Coastal Gunite Construction would like to announce Marcus H. von der Hofen as its new Vice President and COO as of January 1, 2012. He has 16 years of shotcrete and 25-plus years of commercial construction experience. In addition, he is a Director on the ASA Board of Direction.

Coastal Gunite, an ASA Corporate Member, has been a long-time leader in the shotcrete industry. With the addition of von der Hofen, the company looks forward to continued success. For more information, visit **www.coastalgunite.com**.

Lauper Joins Shotcrete Technologies

Thomas Lauper

Worldwide shotcrete expert Thomas Lauper, Civil Engineer, has joined the Shotcrete Technologies, Inc., team. Lauper has provided in-depth shotcrete solutions to contractors and owners worldwide for over 30 years. His knowledge and hands-on experience with projects from the Xiaolangdi Multipupose Dam in China to the Lotschberg Tunnel in Switzerland complements Shotcrete Technologies' already cutting-edge position in the shotcrete market.

Shotcrete Technologies has been supplying mining, tunneling, and infrastructure projects with quality shotcrete products and services for over 30 years. For more information, visit **www.shotcretetechnologies.com**.

Dufour Named UNIBETON Ready Mix UAE General Manager

Jean-François Dufour

UNIBETON Ready Mix, a leading ready mixed concrete producer in the Gulf Cooperation Council (GCC) of the Middle East and a subsidiary of the Al Faraa Group of Companies since 1980, has recently appointed Jean-François Dufour as the new General Manager in the United Arab Emirates (UAE). Dufour, a Civil Engineer from Quebec (QC), Canada, received his master's degree in concrete technology. He moved from Montreal, QC, Canada, to Abu Dhabi, UAE, in February 2010.

Dufour is a former ASA Board member; a member of ACI; and is the Canadian member of Group 12, Shotcrete, in the International Tunnel Association (ITA).

UNIBETON received the 2011 ASA Outstanding Shotcrete Project Award in the International Category for the Al Ain Wildlife Park and Resort's extension project at the Al Ain Zoo, UAE.

Passing of Kathleen R. Schallom

Kathleen R. Schallom

After battling injuries and a long illness, Kathleen R. Schallom, President of RCS Consulting & Construction Co., Inc., and wife of ASA Past President and current ASA Board member Ray Schallom III, passed away Christmas Day 2011.

Schallom enjoyed attending ASA annual meetings, ACI conventions, and World of Concrete, where she met and socialized with many ASA and ACI members. She was always cheerful and witty, never letting her medical issues get the best of her. Over the years, Schallom left many of us with wonderful memories. We will forever miss her but will hold her in our hearts and keep her in our prayers.

The following poem was written and dedicated by Beverly Stock, Ray's cousin, at Schallom's memorial service on January 7, 2012.

Dear Kathleen—

God saw you holding on,
When recuperation was not to be.
I believed He wrapped His arms around you,
And whispered, "Come to me."

He knew you as a mother, in the classroom,
As a wife and friend,
One who cared very much for your family,
Until the end.

You did not deserve what you went through,
So He gave to you His rest.
God's garden must be beautiful,
He only takes the best.

So when He saw you sleeping,
So peaceful and free from pain
He could not wish you back
To suffer that again.

Rest in peace and out of pain.

ASA Corporate Member BASF Scientist Fred Goodwin Named Top Thinker

Fred Goodwin

Fred Goodwin, Fellow Scientist for BASF Corporation's Construction Chemicals business, was recently named one of the Top 24 Thinkers by the *Journal of Protective Coatings & Linings* (JPCL).

Goodwin has more than 30 years of industry experience. His diverse background in construction includes cement manufacturing; research and development; and technical support of grouts, adhesives, coatings, shotcrete, stucco, flooring, and concrete repair materials. An active member of The Society for Protective Coatings (SSPC) and NACE International, Goodwin is also the Chair of various ASTM International, International Concrete Repair Institute (ICRI), and ACI committees. In addition, he has been an author for ASTM International, ICRI, and ACI and a contributing author for several industry publications. Goodwin is listed as Inventor on several U.S. patents and frequently serves as a Guest Lecturer at trade and professional association events. He was named an ICRI Fellow in 2009 and an ACI Fellow in 2011.

ASA Officers Elected

With terms beginning January 23, 2012, the ASA membership has elected the following individuals to leadership roles in the association. President **Joe Hutter**, King Packaged Materials Company; Vice President **Michael Cotter**, Consultant; Secretary **Charles Hanskat**, Concrete Engineering Group, LLC; and Treasurer **Ted Sofis**, Sofis Company, Inc., were all elected to 1-year terms.

These four individuals will join with immediate Past President **Patrick Bridger**, Allentown Shotcrete Technology, Inc., to form the 2012 ASA Executive Committee.

Joe Hutter

Michael Cotter

Charles Hanskat

Ted Sofis

Patrick Bridger

ASA Approved as an AIA CES Provider

ASA was recently approved by the American Institute of Architects (AIA) as a Continuing Education System (CES) provider. Three lunch and learn format presentations have been approved for presentation to engineers, project owners, architects, and any other specifiers. Topics include "Introduction to the Shotcrete Process," "Shotcrete for the Repair and Rehabilitation of Concrete Structures," and "Shotcrete Underground Construction." ASA Lunch and Learn presentations are available free to groups of five or more attendees.

For more information or to arrange for a free presentation, visit **www.shotcrete.org/pdf_files/Lunch_Learn_info.pdf** or see the ad on page 24.

ASA Board Appoints Duckworth to Director Position

Oscar Duckworth

With the election of Charles Hanskat to the Officer position of Secretary and resulting midterm move from his position as a Director, a vacancy in one of the nine Director positions on the Board occurred. Following protocol established in the ASA Bylaws, the Board received and unanimously approved the nomination of Oscar Duckworth, Valley Concrete Services, to complete the remaining 1 year on the open Director term.

ASA Directors Elected

Three ASA Directors were elected/reelected to 3-year terms beginning January 23, 2012. The Directors reelected to a second term are **Marcus von der Hofen**, Coastal Gunite, and **Dr. Lihe (John) Zhang**, LZhang Consulting & Testing Ltd. **Scott Rand**, King Packaged Materials Company, was elected to his first term.

The three newly elected Directors will join the previously elected Directors (**William T. Drakeley Jr.**, Drakeley Industries, LLC; **Tom Norman**, Airplaco Equipment Company; **Ray Schallom III**, RCS Consulting & Construction Company, Inc.; **Ryan Poole**, DOMTEC International LLC; and **Dan Millette**, The Euclid Chemical Company), and the ASA Executive Committee to form the 14-member ASA Board of Direction.

Marcus von der Hofen

Dr. Lihe (John) Zhang

Scott Rand

New 2011 Nozzleman Compilation

ASA has introduced what will be an annual publication: the Nozzleman Compilation. The document is a collection of articles from the previous year's issues of Shotcrete magazine that are aimed specifically at the nozzleman. Sources include Technical Tips, Nozzleman Knowledge, Safety Shooter, and other relevant material.

The Nozzleman Compilation will be sent free of charge to all current ASA Nozzleman Members as part of their overall membership benefits. Copies of the document can be purchased at **www.shotcrete.org/pdf_files/ANC_order_form.pdf**.

2011-2012 ASA Graduate Scholarships Awarded

The 2011-2012 ASA Graduate Scholarships have been awarded to **Jessica Benaglio** and **Patrick Power**.

Jessica Benaglio

Jessica L. Benaglio received her BSE from the University of Michigan, Ann Arbor, MI, in civil and environmental engineering in 2011. She is currently pursuing her MSE in structural civil engineering from the same institution. During this time, she interned with the Michigan Department of Transportation, performing duties as a highway bridge inspector; surveyor of bridges, roads, entrance/exit ramps, and vegetation; designed traffic flow for intersections with MicroStation, and obtained her Concrete Field Technician Certification. Her ultimate goal is to design energy sustainable buildings for which she sees the use of shotcrete as a fitting application.

Patrick O. Power

Patrick O. Power received his BEng degree in civil engineering from Laval University, Quebec City, ON, Canada, in 2011, and is currently pursuing his MSc degree in civil engineering from the same university. His research at Laval is on the durability of North American shotcrete mixtures encompassing mixtures from coast to coast. The study aims to provide a wide array of information on mixtures ranging from standard coastal Gunite to ternary binder shotcrete. Power plans to pursue a career in concrete repair and sees that additional research in shotcrete would increase the options available to extend the service life of infrastructure repairs.

World of Concrete 2012

ASA's booth at this year's WOC saw a fair amount of traffic as visitors came by to pick up a variety of information and chat with Board members and ASA staff regarding their certification and shotcrete needs and concerns. The booth featured posters with this year's Outstanding Shotcrete Project Award winners, Banquet Sponsors, and a video demonstrating a variety of shotcrete applications.

2012-2013 ASA Graduate Scholarship Program Now Open

ASA is now accepting applications for Graduate Scholarships for the 2011-2012 academic year. The purpose of the ASA Graduate Scholarship Program is to attract, identify, and assist outstanding graduate students pursuing careers within the field of concrete with a significant interest in the shotcrete process.

One scholarship will be awarded to a graduate student attending an accredited college or university in the U.S. and a second scholarship will be awarded to a graduate student attending an accredited college or university in Canada.

Based on essays, submitted data, and references, the ASA Scholarship Committee will select scholarship recipients who appear to have the strongest combination of interest and potential for professional success in the shotcrete industry. Each ASA Graduate Scholarship award consists of a stipend of $3000 (USD) and is paid in one (1) installment of $3000 (USD) directly to the student's educational institution.

Applications and all required documents must be received by 5:00 p.m. EST on November 2, 2012.

All application information and requirements can be found at: **www.shotcrete.org/ASAscholarships.htm**.

ASA Annual Outstanding Shotcrete Project Awards Banquet

The Paris Las Vegas Hotel & Casino provided a new venue for ASA's Seventh Annual Outstanding Shotcrete Projects Awards Banquet on January 24, 2012. Not only did our attendees enjoy a wonderful cocktail reception and delicious meal at the Paris Las Vegas, but they also got to see the versatility and high quality of the exceptional shotcrete projects awarded this year.

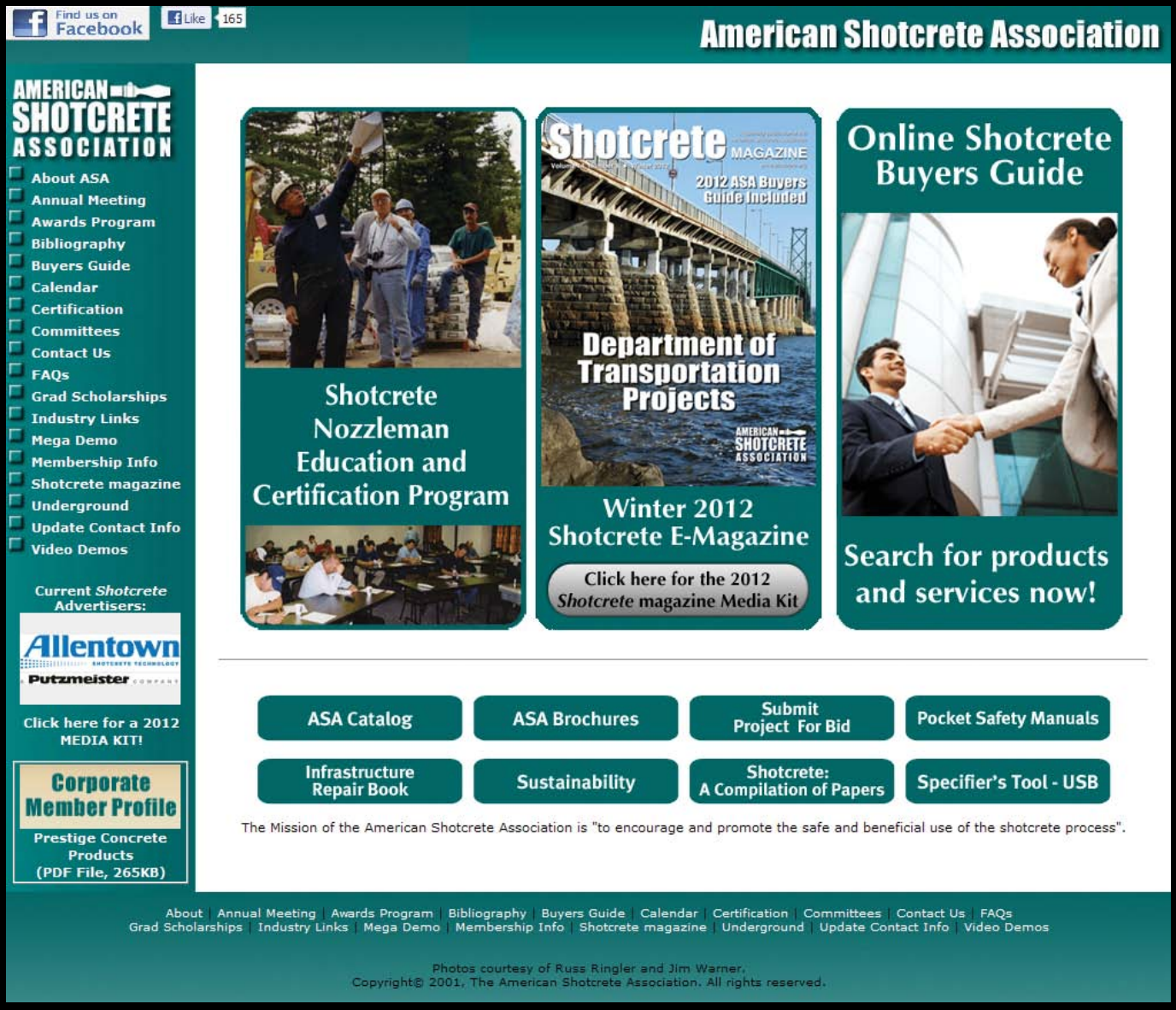
As mentioned in the President's Message on page 2 of this issue, ASA extends a big "thank you" to the Award Banquet Sponsors who made this event and the overall awards program possible.

ASA Annual Outstanding Shotcrete Project Awards Banquet, cont.

ASA Annual Outstanding Shotcrete Project Awards Banquet, cont.

Have YOU Visited the ASA Web site Lately?

There have been significant changes and new services added!



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- *Shotcrete* magazine Archive
- Outstanding Shotcrete Project Awards
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AMERICAN SHOTCRETE ASSOCIATION

WWW.SHOTCRETE.ORG

P & M Service Specialists, Inc.

P & M Service Specialists, Inc., is one of the few shotcrete and gunite equipment repair/refurbish companies that provide service throughout the U.S. and internationally. P & M Service Specialists, Inc., has fully trained mechanics and technicians on site that specialize in refurbishing, restoration, and servicing of all shotcrete, gunite, and refractory equipment and pumps. Only top-of-the-line parts directly from the original manufacturer are used. Their goal is to assist clients in meeting their deadlines.

Parts and services are provided for a variety of equipment from Meyco, Allentown, Reed, Putzmeister, Schwing, Transcrete America, and others.

P & M Service Specialists, Inc., also provides new and refurbished shotcrete and gunite equipment for purchase. Customer equipment needs are met by researching equipment throughout the industry to ensure that it is the right fit for the client's project/need.

P & M Service Specialists, Inc.'s customer service commitment does not stop with the repair or purchase of equipment. Service above and beyond clients' expectations is also provided by keeping customers up to date on industry changes and standards, supporting and promoting their existing business while researching and providing necessary information for growth, and providing ongoing technical support.

Contact P & M Service Specialists, Inc., today for assistance in maximizing and growing your business.

P & M Service Specialists, Inc.
4225 Park Avenue
Slatington, PA 18080
Phone: (610) 767-2100
Web site: www.pm-ss.com
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Brian Gawlik | Parts | bgawlik@pm-ss.com

Putzmeister PM500 refurbish (before)

Putzmeister PM500 refurbish (after)

Meyco Oruga refurbish (before)

Meyco Oruga refurbish (after)

Allentown R900 Batch Rig refurbish before conversion from air motor to diesel motor

Allentown R900 Batch Rig refurbish with a conversion from air motor to diesel motor

Multicrete Introduces New Hybrid Wet® Shotcrete Carrier

Multicrete's new Hybrid Wet® shotcrete carrier is a self-contained shotcrete machine complete with both wet- and dry-spraying capabilities. It converts dry, premixed shotcrete into wet shotcrete and pumps it to the front-mounted spray boom—all on a single carrier.

This shotcrete carrier is based on simplicity. It enables loading and hauling dry, premixed material to the shooting site. Water is added to the mixing auger just before the shotcrete pump. It is sprayed wet at a low slump for reduced accelerator needs and high strength and adhesion. This unit can also spray predampened, dry shotcrete.

The benefits of shooting wet material include dust mitigation, low rebound, minimal operating labor, rapid and easy cleanup, less cost in admixtures, no waste, and easy application technique. There is no wasted product because the premixed, dry shotcrete is able to be used as needed. Unused product is simply stored in the hopper until required; therefore, the sprayed material is always fresh. Efficiency guarantees increased profitability!

Features of the Hybrid Wet shotcrete carrier include:

- Spray boom with umbilical cord controller (radio control available);
- Hopper with 7 yd^3 (5 m^3) total volume;
- Shooting rate up to 9 yd^3/h (7 m^3/h);
- Onboard liquid accelerator system, synchronized to the shotcrete pump;
- Fully self-propelled—just hook up air and water hoses;
- Robust, onboard programmable logic controller (PLC) system designed for vehicles to provide consistent feed rate and synchronized accelerator dosing; and
- Onboard form release tank and pressure washer.

Multicrete Systems Inc. is the Western Canadian leader in the supply of shotcrete equipment, offering lease and purchase options from the broadest line of bulk mixtures and bulk handling systems—solutions to meet its customer's needs.

For more information, please visit Multicrete's Web site at **www.multicretesystems.com**.

King/Minequip Offers Aliva AL-257 Wet-Dry Process Shotcrete Machine

The Aliva AL-257 is a compact rotor-type shotcrete machine that is able to convey either wet- or dry-mix shotcrete without altering the machine. This is achieved by the addition of an exhaust on the side of the hopper that allows the air from the rotor port to be vented as it is being charged with material. This port is not required in the dry-mix process due to the fluid nature of dry shotcrete. Wet-mix shotcrete, however, requires that the air in the port be displaced as it is being filled. This port enables the rotor-style machine to convey wet-mix shotcrete using the thin stream method. The port also allows the rotor to fill closer to capacity, which reduces pulsation in the conveyance hoses.

Another advantage of the AL-257 is the introduction of steel-on-steel gasket and rotor plates that have proven to last up to five times longer than traditional rubber pads with steel rotor discs. This allows for increased productivity due to the decrease in machine maintenance. The rotors for the AL-257 are constructed of High-Tec aluminum and vary in sizes from 0.7 to 3.2 gal. (2.5 to 12 L). This translates into a material output of 0.91 to 12.5 yd^3/h (0.7 to 9.6 m^3/h). The output is determined by a combination of the rotor size and the rpm of the rotor. The rpm is controlled by either an air or electric motor with variable speed controls. Air-operated machines require nothing but a large air compressor to function.

Along with the advantages listed previously, safety features have also evolved. The rotor on the AL-257 is protected by a guard so that the operator cannot be exposed to moving parts. There is also an emergency stop that not only stops the rotor but also cuts off the air supply to the conveyance hoses, allowing the pressure in the hose to dissipate.

With its variable output, robust design, and compact size, the Aliva AL-257 is a shotcrete machine that can adapt to any job site. For more information, visit **www.kpmindustries.com**.

Blindside Waterproofing System for Shotcrete Foundation Walls from Grace

Preprufe® SCS is a unique blindside waterproofing system specifically developed to provide a high-performance waterproofing solution for shotcrete foundation walls. The waterproofing system consists of the following:

- Preprufe SCS Membrane consisting of a polymer-mesh-reinforced cavity backed by a plastic film facing the soil retention system, and faced with a nonwoven, semi-permeable geotextile acting as a shotcrete barrier while allowing grout to bond to the shotcrete;
- Preprufe SCS Grout Injection Ports installed prior to shotcrete placement to facilitate hydrophilic grout injection; and
- Preprufe SCS Hydrophilic Grout post-injected under pressure into composite sheet through injection ports left protruding through the shotcrete. The shotcrete side of the membrane enables grout to bond with shotcrete across the permeable geotextile.

The Preprufe SCS Composite Sheet Membrane is applied vertically to timber lagging or other soil retention systems. Shotcrete is then placed directly against the geotextile side of the membrane. Unlike conventional waterproofing systems, Preprufe SCS has injection ports to facilitate grout injection into a precreated cavity space, forming an in-place monolithic grout membrane with uniform thickness.

After shotcrete placement, injection of the specially formulated Preprufe SCS Hydrophilic Grout fills and seals the system, thus providing ultimate waterproofing protection. All components of the specially developed Preprufe SCS System work together to form a continuous and integral bond to the structure, eliminating lateral water migration between the membrane and the shotcrete. When properly installed and grouted, the Preprufe SCS System will protect against water ingression.

For more information, visit **www.na.graceconstruction.com**.

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AMERICAN SHOTCRETE ASSOCIATION

INTERESTED IN BECOMING A MEMBER OF ASA?
Read about the benefits of being a member of ASA on page 70 and find a Membership Application on page 71.

AMERICAN SHOTCRETE ASSOCIATION

ASA Membership Benefits

	Corporate	Corporate - *Additional Individual*	Individual	Nozzleman	Employees of Public Authorities / Agencies	Student
Annual Dues	$750	$100	$250	$50	Free	Free
Company & specialty information listed in ASA's online Buyers Guide & in Hard copy via *Shotcrete's* annual Buyers Guide	X					
Discount on ACI Nozzleman Certification and Education	X					
Opportunity to submit items for Industry News and New Products & Processes sections of *Shotcrete* magazine at no charge	X	X	X		X	
Discounted ASA Member prices on all ASA products	X	X	X	X	X	X
Networking and participation opportunities at Annual Membership Meeting and committee meetings	X	X	X	X	X	X
Opportunity to respond to bids from our Online Project Bid Submittal Tool	X	X				
Subscription to quarterly *Shotcrete* magazine (Hard & Electronic Copies)	X	X	X	X	X	X*
Links to shotcrete related government projects open for bid (*sent twice a month in the member edition of the ASA e-newsletter*)	X	X	X	X	X	X
Permission to include ASA logo on corporate letterhead and business cards	X	X	X		X	
Permission to display ASA logo on company web site	X					
Discounted pricing on advertising in *Shotcrete* magazine, including free linked logo advertising from the ASA homepage during your advertising quarter	X	X	X		X	
Voting privileges at meetings and director/officer elections	X	X	X			
Free advance general admittance registration to World of Concrete	X	X	X	X	X	X
Opportunity to submit entries for the annual Outstanding Shotcrete Project Awards Program	X					
Free Lunch & Learn Seminars upon request					X	
Complimentary copy of ASA's Shotcrete Specifiers Education Tool - a 4GB USB flashdrive					X	
Complimentary copy of "Sustainability of Shotcrete" each year	1				1	
Discounted Corporate Additional ASA Memberships are available for all company employees ($150 savings per employee)	X					
Discount on ASA Underground Shotcrete Education Program	X					
Complimentary copy of ASA's Annual Nozzlemen Compilation each year				1		
Complimentary ASA shotcrete brochure each year	25	1	1		1	
Complimentary ASA reflective hardhat sticker each year	10	1	1	1		
Education & promotion of your shotcrete industry to the overall concrete industry	**X**	**X**	**X**	**X**	**X**	**X**

* Student members outside North America will only receive electronic copies

AMERICAN SHOTCRETE ASSOCIATION

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Phone: (248) 848-3780 Fax: (248) 848-3740
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Please indicate your category of membership:

❑ Corporate	$750	
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❑ Additional Individual from Corporate Member	$100	
❑ Employees of Public Authorities and Agencies	Free	
❑ Nozzleman	$50	
❑ Retired	$50	(For individuals 65 years or older)
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Company Specialties are searchable in the printed and online Buyers Guide.

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❑ Foaming
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❑ Special Application
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❑ Water Proofing
❑ Water Reducing-Accelerate
❑ Water Reducing-High Range
❑ Water Reducing-Mid Range
❑ Water Reducing-Normal
❑ Water Reducing-Retarding
❑ Water Repellent

Cement/Pozzolanic Materials
❑ Cement-Blended
❑ Cement-Portland
❑ Cement-White
❑ Fly Ash
❑ Ground/Granulated Slag
❑ Metakaolin
❑ Pozzolan
❑ Silica Fume-Dry
❑ Silica Fume-Slurry

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❑ Safety/Protection
❑ Silo Systems
❑ Valves
❑ Wear Plates

Fibers
❑ Carbon
❑ Glass
❑ Steel
❑ Synthetic

Shotcrete Materials/Mixtures
❑ Dry Mix
❑ Steel-Fiber Reinforced
❑ Synthetic-Fiber Reinforced
❑ Wet Mix

Shotcrete Calendar

APRIL 18-20, 2012
ICRI 2012 Spring Convention
Theme: "Preservation Engineering—Masonry/Stone/Concrete"
Hilton Quebec
Quebec City, QC, Canada
Web site: **www.icri.org**

APRIL 23-25, 2012
Southeast Bridge Preservation Partnership 2012 Meeting
Sheraton Gateway Hotel
Atlanta, GA
Web site: **www.tsp2.org/bridge/sebpp/annual-meetings/2012-2**

MAY 8-10, 2012
2012 Western Bridge Preservation Partnership Annual Meeting
Vancouver, WA

JUNE 24-27, 2012
ASTM International Committee C09, Concrete and Concrete Aggregates
Sheraton San Diego Hotel & Marina
San Diego, CA
Web site: **www.astm.org**

OCTOBER 20, 2012
ASA Fall Committee Meetings
Sheraton Centre
Toronto, ON, Canada

OCTOBER 21-25, 2012
ACI Fall 2012 Convention
Theme: "Forming Our Future"
Sheraton Centre
Toronto, ON, Canada
Web site: **www.concrete.org**

NOVEMBER 7-9, 2012
ICRI 2012 Fall Convention
Theme: "Life Cycle Repair—Sustainability"
Rancho Las Palmas Resort & Spa
Ranchero Mirage, CA
Web site: **www.icri.org**

DECEMBER 2-5, 2012
ASTM International Committee C09, Concrete and Concrete Aggregates
Hyatt Regency Atlanta
Atlanta, GA
Web site: **www.astm.org**

All ASA members and subscribers have access to the electronic version of *Shotcrete* magazine. A link to this e-magazine is sent as an item in the "What's in the Mix" e-newsletter. To ensure access to all future issues of the electronic version of the magazine, send your e-mail information to info@shotcrete.org.

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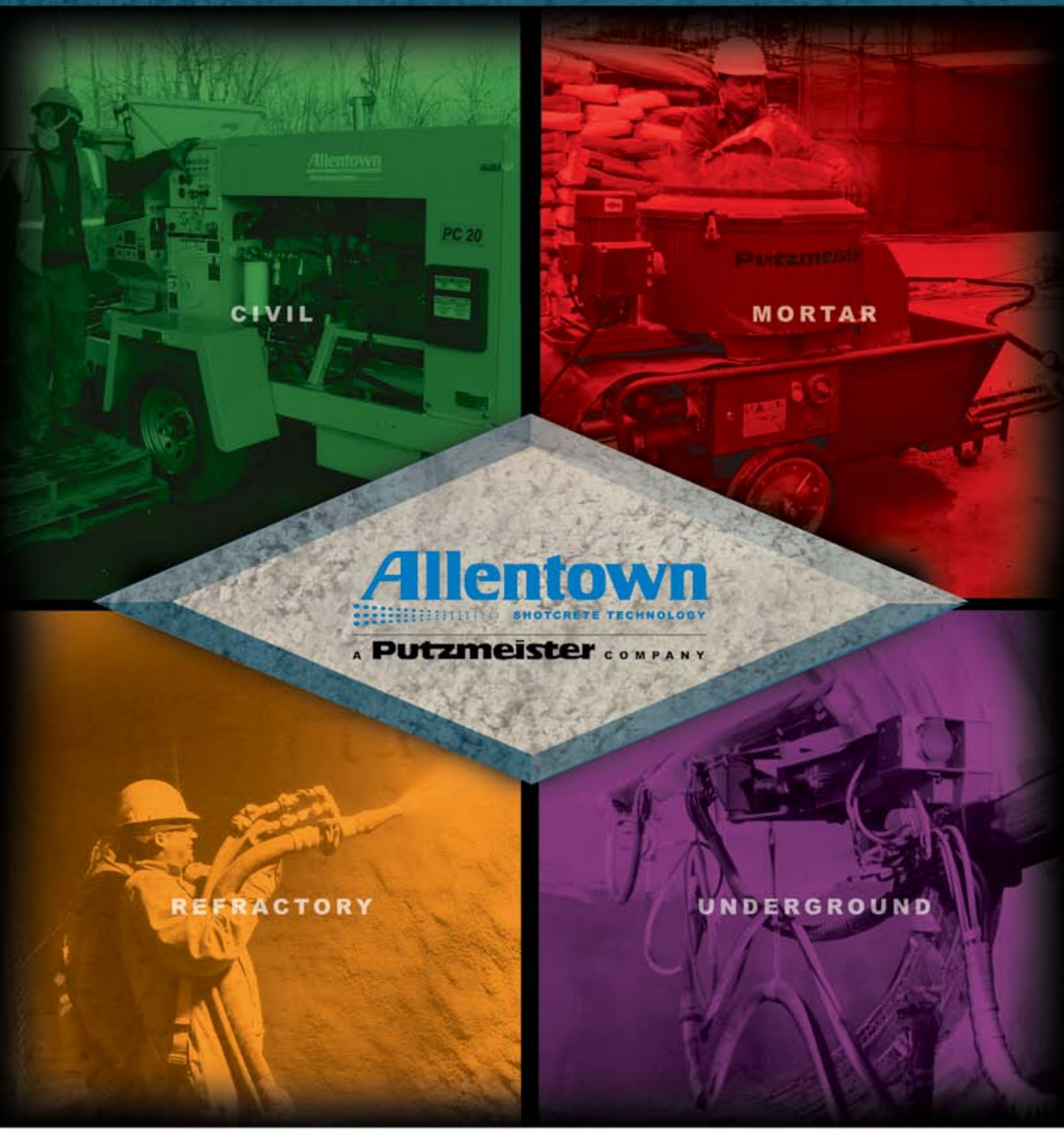

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