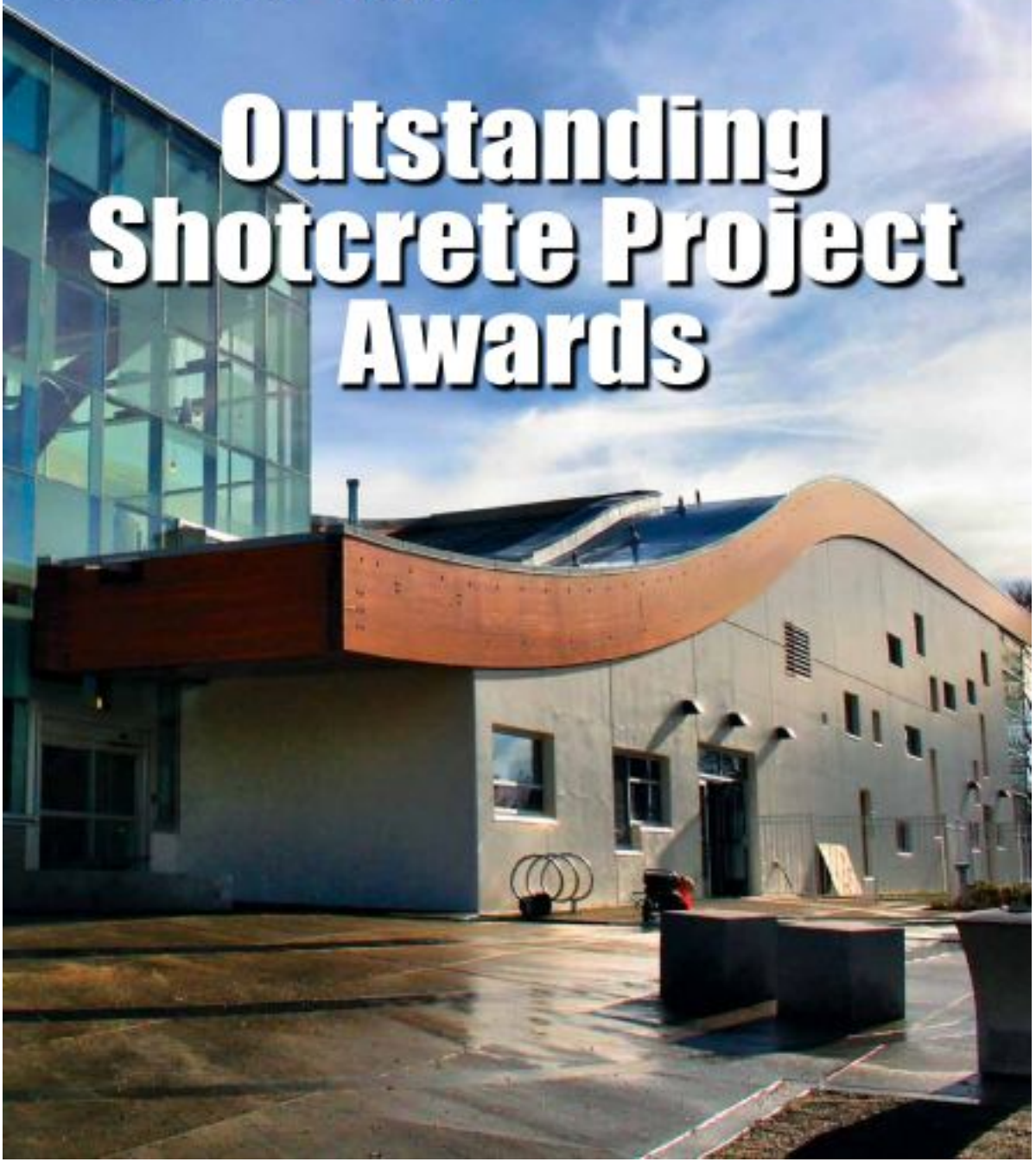
Shotcrete MAGAZINE

A quarterly publication of the American Shotcrete Association

Volume 12, Number 2 ◆ Spring 2010

Outstanding Shotcrete Project Awards



Shotcrete is a quarterly publication of the American Shotcrete Association. For information about this publication or about membership in the American Shotcrete Association, please contact ASA Headquarters at:

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AMERICAN SHOTCRETE ASSOCIATION

Shotcrete MAGAZINE

Volume 12, Number 2
Spring 2010

Features

Departments

On the cover: Surrey 2010 Olympic Games Preparation Center. Photo courtesy of Mike Bar, www.Surrey.com.

Shotcrete—A Proven Process for the New Millennium

The Vision, the Mission, and the Values

By Patrick Bridger

I have had the privilege to be a part of the American Shotcrete Association (ASA) since its inception 12 years ago. The preceding leaders have unselfishly given or shared their time, ideals, knowledge, and financial contributions to bring this organization to where we stand today. On behalf of the membership, I want to thank all of the Past Presidents for their efforts and leadership. It is an honor for me to be entrusted by the membership to be the President for the next 2 years. I am also pleased with the new Executive Committee members and Board of Directors. Working together, we will continue to serve the best interest sof our members and the shotcrete industry that we are all so passionate about. I also want to thank Chris Zynda for the new ideas he has brought to this group within the last 2 years.

The vision of ASA is "…that the shotcrete process be understood and used in every beneficial application." What long-term goals do we want to achieve from here? Continuing education is the key to the future of the shotcrete process. Who do we want to educate? Certainly, we agree it is the engineers and owners; but, more importantly, we need to educate ourselves—the supporting members, comprising equipment suppliers, material suppliers, and contractors. We also need to reach out to other groups, such as the International Concrete Repair Institute (ICRI), to gain knowledge and understand their beliefs and the methods they teach. Only then can we promote our methods to them. The mission of ICRI is very similar to ASA's vision: "…to improve the quality of repair, restoration, and protection of concrete and other structures in accordance with consensus criteria." This association is a close relative to ours with similar interests, but it has greater membership participation. There are some opposing beliefs and teachings; therefore, we must be proactive and share the ideas that we believe. We must also learn alternative methods of sprayed concrete using low-velocity spraying methods and agree that there are certain applications where these methods are acceptable.

Another important industry association we need to approach is the American Concrete Pumping Association (ACPA). Here again, there are so many similar interests to the markets we serve. The mission of ACPA is "to promote, expand, and improve the concrete pumping industry through progressive leadership, education, communication, and advocacy establishing concrete pumping as a preferred method of placing concrete." Wet shotcrete has become the primary or preferred method of shotcrete within the last 25 years. The only difference between shotcreting and pumping concrete is the addition of a nozzle on the end of the hose. The work that has been done within this association is similar to what we are doing. ACPA offers pump operator certification to educate pump operators on pump safety. There is no issue more important than the safety of the construction crew supplying wet shotcrete. ACPA's safety program, the most comprehensive in the industry, includes communication tools such as videos, posters, operator certification, and safety meeting outlines. Rather than reinventing a comprehensive safety program of our own, wouldn't it be wise for us to present the safety issues related to "spraying concrete" using concrete pumps for wet shotcrete to ACPA?

These two closely related associations have very large memberships. Sharing the information that ASA and ACI Committee 506, Shotcreting, have all worked so hard to put together with these two groups will hopefully educate them to our method of placing concrete. I think these two groups also have many things to offer our membership and target audience.

The ASA vision is to

- Create goals;
- Educate ourselves and others to build and support our methods to the highest standards;
- Emphasize safety consistency with other groups; and
- Recognize and reward the efforts and accomplishments of our industry.

The ASA mission is to

- Create an action plan;
- Motivate to guarantee success toward a common goal;
- Act in a fair manner to enhance technology available to the shotcrete market;
- Promote reliable industry standards created by industry leaders; and
- Share our values and philosophy. We are value-oriented, quality-minded, flexible, competent, innovative, technology-driven, and customer-focused.

I appreciate the opportunity given to me by the membership to listen, learn, and lead. Working together, we will continue our efforts toward a common goal to advance the shotcrete industry.

Leadership and Commitment

By Chris Darnell, ASA Executive Director

A little more than 1 year has passed since I joined the ASA staff, and it has been both an enjoyable and interesting year that has afforded me the opportunity to begin to really learn about the shotcrete industry. Having been involved in the past with ACI's Shotcrete Nozzleman Certification program as a member of ACI's staff, I was familiar with the shotcrete process and some of its more obvious principles. The last year, however, has truly been an eye-opening experience. I have been amazed at the number of advantages and benefits that shotcrete offers. I firmly believe that if the concrete world fully understood the benefits of the shotcrete process, the increase in the amount of concrete placed via shotcrete would be incredible.

Shotcrete is truly a gem of a secret waiting for the concrete world to fully discover and embrace. This potential to benefit the concrete world and significantly grow the shotcrete industry is a source of both excitement and responsibility.

To accomplish this potential growth, we as an industry must do two things. First, we have to make sure that the level of quality remains high as the concrete world begins to put our claims to the test. A commitment to education and certification is absolutely critical. The Technical Tip feature in this issue by Ted Sofis is an important read for all, but especially for anyone on the fence about certification. Ted does a great job of walking the reader through the evolution of his own feelings regarding certification. It is not unusual for an experienced, knowledgeable, quality contractor to be initially offended by a certification requirement. Those same experienced, quality contractors ultimately realize that the biggest challenge to their business is the unqualified contractor and/or nozzleman who can undo years of advancement and acceptance with one high-profile substandard project.

As with many ideas or processes working their way into the mainstream, shotcrete has often been disproportionately judged by its isolated failings in the past. Because of this, it is extremely important that the base line of shotcrete quality be continually raised. In the end, certification is not punishing the high quality contractor; rather certification, if broadly adopted in job specifications, acts as a sort of insurance policy to help preserve and expand their business. As a result, support and participation in certification is a critical investment in growing the shotcrete market and ultimately the potential of your business.

The second action item to realize this potential growth is to get the word out. This sounds simple enough, but it is in fact a tall task that requires commitment and leadership from the whole shotcrete industry. This type of effort is best achieved if primarily focused through a consensus organization representing the industry, and ASA is ready to carry the load. During the first 10 years of ASA's existence, efforts were wisely spent building a healthy association and network capable of delivering the industries' message. With the infrastructure now in place, the association is focusing more and more on the task of putting this system to work on the purpose it was designed for—to effectively and consistently inform and educate the concrete and greater construction world about the versatility, quality, and economic advantages of shotcrete.

The tools for communicating our message continue to grow under the work of ASA's volunteers and leadership. The Outstanding Shotcrete Project Awards program is a critical tool in this campaign and this 1st Annual awards issue is a natural and important next step. Nothing sells an idea like real-life success stories and this issue is a great example of this.

The awards program and the vehicles that serve to communicate its content (the awards banquet and this annual awards issue) are all made possible because of the exceptional commitment and leadership of the sponsors of the ASA 5th Annual Outstanding Shotcrete Projects Awards. This year's "Big Shooters" (American Concrete Restorations, Inc., and Spec Mix) and all of our sponsors are listed on the following page. Please make note of our sponsors, and if you know and/or work with someone at one of these organizations, take a moment to thank them for making this year's awards program, awards banquet, and this 1st Annual awards issue possible; and especially for their leadership and commitment to our industry's potential.

AMERICAN SHOTCRETE ASSOCIATION

A very special thanks to the sponsors of our Fifth Annual Outstanding Shotcrete Project Awards

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2009 Outstanding Architectural Project

Surrey 2010 Olympic Games Preparation Center

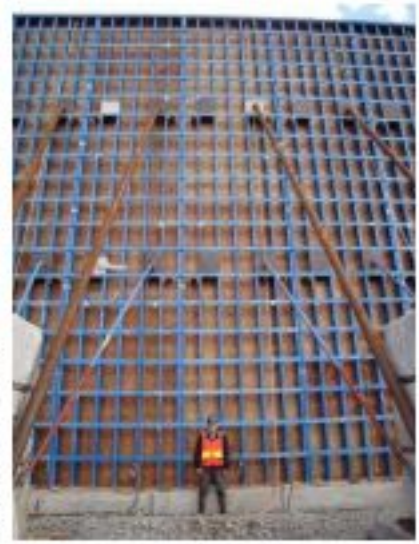
In February 2010, Vancouver hosted the Winter Olympic Games. In preparation for the quickly approaching games, new buildings were constructed all over the Vancouver area. A high-profile example of one such building is the Surrey 2010 Olympic Games Preparation Center. This center played a prominent part in the Winter Olympics as a training venue for Olympians and volunteers as well as a central location for all recruitment and logistics.

The use of architectural structural shotcrete and the schedule savings versus conventional poured concrete proved to be the crucial component that saved the day for this critically-schedule-dependant project.

Because the early phases of the Olympic Games Preparation Center project got off to such a late start, our company was approached and asked just how fast this architecturally intense design could be done. The walls ranged in size up to 40 ft (12.19 m) high with curved tops, extensive reveals, recesses, and block-outs. Also, the specified finish was a light sandblast and two coats of clear sealer, so there was no room for repair or remedial work. This project had to be done in one-quarter of the time normally allowed for conventional forming and had to be perfect—the first time around.

The project management company allowed for 24/7 production to ensure delivery of this time-sensitive project, and even then there was slim hope by the design and management team that the 6 weeks alloted to produce the structure would be enough.

The time from when the first excavator bucket went into the ground, until the milestone date of structural completion was reached was reduced to 3-1/2 weeks without the need for even a second shift! This may seem amazing in itself, without the fact that it was done during a 50-year record-breaking snowfall and freezing period. Through up to 3 ft (0.914 m) of snow and sub-zero weather conditions for the entire duration



of the project, shotcrete was the only concrete being placed. Our company worked under extreme time constraints and achieved results of the highest quality.

All of the vertical portions of this project were placed using shotcrete. From the footings up, all of the walls were formed on one side and shot against, including several sections where the walls had to run by the level of suspended slab interrupting on the inside. The need for continuity in the exterior finish was of the highest importance. All of the reinforcing steel for the suspended slabs had to be doweled out on the inside face of the walls and special care had to be taken to ensure that conditions vital to the building envelope were not compromised.

There were countless instances where the shotcrete process was used on a structural wall, building envelope, finished product, and the architectural feature. Not only were the walls architecturally challenging in a level-of-finish aspect, but they were also challenging in a logistic aspect. They ranged up to 40 ft (12.19 m) high with curving tops that were recessed, with multiple reveal lines, and an abnormally high amount of block-outs. The formwork was erected to the full height for all of the walls to ensure the continuity of reveals and to maintain the truest line of construction. To conventionally form and pour a 40 ft (12.19 m) high wall with all of these elements would have required six times the formwork material; taken at least five times longer; and there would have been no way to ensure the consolidation around all of the block-outs, which were randomly stacked in multiple layers.

The formwork panels used were a large contributing factor to the success—these high-lift-shoot panels were designed for this project and, specifically, for shotcrete. The ability to stand these 40 ft (12.19 m) high panels quickly and easily due to the decreased weight, in comparison to conventional forming, was also a major governing factor to help reduce the cost and time of the overall project.

Conventional formwork was ruled out as impossible to achieve all of the desired results—

Photo courtesy of Mikeller, www.Surrey.com

regardless of the extreme time constraints—due in part to a number of factors: cost, labor, and the challenges involved in effectively vibrating around numerous block-out recesses and reveals. Shotcrete proved to be not just the best solution, but the only solution! At the end of the day, the shotcrete process offered significant cost and time savings over conventional forming.

The significance of the shotcrete work to the 2010 Winter Olympic Games Preparation Center can only be described as the integral component to the entire structure, and a cornerstone to conquering the demanding schedule.

The Outstanding Architectural Project

Project Name
Surrey 2010 Olympic Games Preparation Center

Project Location
Surrey, British Columbia, Canada

Shotcrete Contractor
Conshot Systems Inc.*

General Contractor
Sepra Projects Ltd./
Turnbull Construction Services Ltd.

Architect/Engineer
CEI Architecture Planning Interiors

Material Supplier/Manufacturer
RMC Ready Mix Ltd.

Project Owner
City of Surrey

*Corporate Member of the American Shotcrete Association

2009 Outstanding Infrastructure Project

The Dan Ryan Expressway

The Dan Ryan Expressway runs from the Circle Interchange of downtown Chicago through the south side of the city and totals 11.5 mi(5.22 km).In 2006 and 2007, the Illinois Department of Transportation (DOT) reconstructed the entire length of the Dan Ryan Expressway, including the addition of a travel lane.The project was the most massive expressway reconstruction plan in Chicago's history.In 2008, the focus was now on the reconstruction of 120 piers that supported 2.5 mi (4.17 km) of expressway that were previously repaired in 1988 and 1989 using formed concrete.

Shotcrete Challenge

The repairs began in September of 2008 while starting at the southern end of the project. American Concrete Restorations (ACR) was contracted to repair the substructure following the Illinois DOT's Structural Repair of Concrete Specification. The specification gives the contractor the choice of formed concrete repair or shotcrete. The use of shotcrete over the form-and-pour method was chosen partly for its advantages in "green building." The use of shotcrete eliminated the use of lumber, including approximately 400 sheets of plywood: 5000 linear ft (1524 m),

Underneath view of one of the largest and busiest expressways in Chicago, IL

Use of shotcrete over form and pour was chosen for its advantages in "green building"

This elevated structure runs through the heart of the city of Chicago

120 piers approximately 60 ft (18.28 m) high above local roads, businesses and railways

2 x 4 in. (50.8 x 101.6 mm); and 5000 linear ft (1524 m), 2 x 6 in. (50.8 x 152.4 mm). It also eliminated the energy to manufacture, transport, install, and dispose of these materials at the end of the project. In addition, the use of recyclable bulk bags saved on waste and disposal of paper bags and/or excess ready mix. With the use of shotcrete, ACR was able to deliver a fresh material on a consistent basis to properly encase the reinforcing steel while touching the material only once and not having to revisit the areas to strip forms, fill holes, and grind. The bridge was elevated approximately 60 ft (18.28 m) above numerous local roads, businesses, and railways within an overpopulated area of Chicago known as Chinatown. The use of shotcrete also eliminated a safety factor of not dropping plywood, coil rods, and small tools from these heights.

A 60 ft (18.28 m) boom lift was used to access piers

Plan of Attack

The 60 ft (18.28 m) tall boom lifts were brought in to begin removal; however, as concrete removal started, it was immediately recognized that the project was going to exceed initial contract quantities. This required evaluation and authorization by the owner. Because the areas in need of repair were so extensive, the owner decided to repair only the pier caps at this time.

A quick response from the owner was received and the additional quantities were approved. The owner's decision to repair only the pier caps, however, also brought concern to remove them in their entirety. The owner suggested the use of shoring to help support the structure. ACR, on the other hand, suggested an alternative procedure that was successfully used on other state projects where the caps are completed in segments. It includes the pier cap being repaired in halves, where one area is removed and replaced and, after the shotcrete reaches 75% of its strength, the other half is completed (and so on). The owner was satisfied with the procedure as it was to be done in lieu of shoring and would provide a cost savings to the state of Illinois. After the procedure was approved, the concrete removal was set in motion at numerous piers. The concrete was removed past the first mat of steel while saw cutting the edges and sandblasting using abrasive grit, taking great care to blast the saw-cut edges that get polished with the saw cut. Black reinforcing bar was supplemented as necessary and the entire prepared area was inspected by the engineer for approval.

Over 15,000 lb (6803.8 kg) of reinforcement was supplemented

Shotcrete Solution

All of the shotcrete work was done from the ground and was pumped 60 ft (18.28 m) upward to the nozzle. ACR used prebagged materials. The water was hauled on site using 250 gal. (946.4 L) totes; the temperature was monitored. The use of

All shotcrete work was done from the ground and pumped upward to the nozzle

Completed by American Concrete Institute (ACI) Certified Nozzlemen

Cured with wet cotton mats for 7 days

11,000 ft² (311.4 m²) of removal and replacement

Zero accidents!

hot water in tote tanks in cool weather and the use of ice in warmer weather kept the material temperature consistent between 70 and 78°F (21.1 and 25.5°C). In addition, the use of canopies over the material and a shotcrete pump aided in temperature control during the summer months, whereas concrete blankets and heaters helped moderate the material temperature in autumn.

The freshly sandblasted surface (within 72 hours of shotcrete placement by specification) was prewet to a saturated surface-dry condition. The shotcrete was placed with a 0.42 water-cement ratio, along with the addition of 10% by weight of 0.375 in. (9.5 mm) river rock. All of the work was completed by ACI Certified Nozzlemen. The curing was done with cotton mats attached to the pier with 1 x 2 in. (25.4 x 50.8 mm) studs and interspersed with heavy-duty soaker hoses and were gravity fed with water for 7 days. After 7 days of wet curing, the mats were removed and the structures were sounded by the engineer for acceptance.

Phase I (South end) was completed mid-November 2008 and Phase II (North end) was completed on July 15, 2009. The scope of work resulted in over 11,000 ft² (311.4 m²) of removal and replacement with high-quality shotcrete. The General Contractor and ACR are also proud of their safety record of zero accident reports while working 60 ft (18.28 m) in the air. All of the test results exceeded the specification's requirement. The shotcrete solution resulted in a long-term, affordable repair.

The Outstanding Infrastructure Project

Project Name
Dan Ryan Expressway

Project Location
Chicago, IL

Shotcrete Contractor
American Concrete Restorations, Inc.*

General Contractor
Illinois Constructors

Architect/Engineer
Illinois Department of Transportation

Material Supplier/Manufacturer
Spec Mix, Inc.,
as manufactured by Packaged Concrete*

Project Owner
Illinois Department of Transportation

*Corporate Member of the American Shotcrete Association

ATTENTION STUDENTS

The American Shotcrete Association (ASA) is committed to its student members and their access to information, not only about shotcrete, but the entire concrete industry. As a result, we are very excited to announce that ASA has partnered with the American Concrete Institute (ACI) to expand the access and exposure for student members of both organizations to all parts of the concrete industry.

ACI has extended its offer of free Student Membership and access to its outstanding publication *Concrete International* to all ASA Student Members.

Beginning with the Winter 2010 issue, all Student Members of ACI now receive access to the electronic version of ASA's award-winning *Shotcrete* magazine.

Both organizations offer free student memberships that allow access to a wealth of information, numerous scholarship opportunities, and an important credential that demonstrates your commitment to education and an understanding of the concrete world.

ASA encourages its current student members to take advantage of the outstanding benefits of ACI's free Student Membership. You can find more information and sign up as an ACI Student Member at:

www.Concrete.org/STUDENTS/stu.htm

ASA also welcomes ACI Student Members to take advantage of ASA's free Student Membership. You can find more information and signup as an ASA Student Member at:

www.Shotcrete.org/MembershipApplication.asp

AMERICAN SHOTCRETE ASSOCIATION

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American Concrete Institute®

Advancing concrete knowledge

2009 Outstanding International Project

CEMEX Bayano Plant No. 2 Line Expansion

CEMEX is one of the world's two largest cement companies, with a production capacity of approximately 86 million tons (78 million metric tonne) of cement per year. CEMEX and its subsidiaries produce, distribute, market, and sell cement, concrete, aggregates, and clinker on four continents. CEMEX has major operations in 30 countries and maintains trade relations in 60 nations. In 1994, CEMEX purchased Cemento Bayano, S.A., in Panama.

Panama's greatest source of revenue comes from the Panama Canal. In just 4 more years, the canal will have been operating for a century. Annual traffic has increased from approximately 1000 vessels during the first years to now over 14,000. People all around the world have benefitted from this truly marvelous wonder. The canal is presently handling far more traffic than had ever been envisioned by its builders. In the 1930s, it was estimated the maximum capacity would be around 80 million tons (70 million metric tonne) per year. In 2008, however, traffic through the canal consisted of over 300 million tons (270 million metric tonne).

The largest ships able to pass through today's canal are referred to as "Panamax" vessels. As world trade continues to expand, market forces demand even larger and larger ships. It's anticipated that by next year over a third of the world's container ships will be too large to pass through the present canal. Policy makers watching this trend over the years have proposed various approaches for enlarging the canal and its locks to accommodate greater numbers of ships and larger vessels. In April 2006, Panama's President proposed a course to pursue. In accordance with Panama's constitution, a national referendum was held in October of 2006, and Panama citizens overwhelmingly approved the President's proposal with 80% of the votes being in favor. The project includes new locks and water-saving basins on both the Pacific and Atlantic ends of the canal. The canal expansion project officially started on September 3, 2007. The new locks are expected to open for traffic sometime in 2015. The project is expected to cost approximately $5.25 billion USD. The completed expansion should allow for traffic through the canal to increase to nearly 510 million tons (459 million metric tonne) expected by 2025, and it will have an estimated maximum sustainable capacity of approximately 600 million tons (600 million metric tonne) per year.

Clinker storage dome, Panama

In February 2007, just a few months after Panama's national referendum, CEMEX S.A. announced it would invest $200 million USD to construct a new kiln at its Cemento Bayano, S.A. plant in Panama to help meet the anticipated demand for additional cement. Construction of the Bayano plant expansion was targeted to be completed by 2009. The plant is now producing clinker.

The expansion of the Bayano plant increased its capacity to potentially 1.6 million tons (1.45 million metric tonne) per year—up from about 450,000 tons (408,233 metric tonne) of clinker per year previously. Using CEMEX's technology, the Bayano plant has become one of the most modern, efficient, and environmentally-friendly cement production facilities in the Americas.

As part of the Bayano plant expansion, DOMTEC® International, LLC, of Idaho Falls, ID, and Construcciones FASA of Mexico City, Mexico, were contracted to construct the 77,000 ton (70,000 metric tonne) capacity clinker storage dome facility.

DOMTEC International was organized almost 15 years ago with the mission of building higher quality domes. This is accomplished by implementing strict and effective quality assurance and by conducting thorough training. DOMTEC International has become synonymous with reliability and dependability. DOMTEC International's structural engineers are some of the most experienced dome engineers in the world, and DOMTEC's dome technicians are among the most experienced.

Construcciones FASA is a 60-year-old company specializing in civil and concrete construction. Its specialty is slip-form concrete silos. The company also contracts earthwork and other types of concrete and steel construction.

Concrete Domes

Concrete domes make efficient and economical storage structures, and they have become especially popular among major cement producers. CEMEX was familiar with concrete domes, having already purchased several other concrete domes at various plants and terminals around the world. Some of their advantages include:

- Better containment and protection of stored materials;
- Efficient use of land and space;
- Strength and durability; and
- Rapid construction.

Better Storage

DOMTEC concrete domes keep products dry, despite Panama's weather, which includes heavy rains and hurricanes. Insulated DOMTEC domes also virtually eliminate condensation. They are tightly constructed, enhancing the ability to prevent fugitive dust emissions.

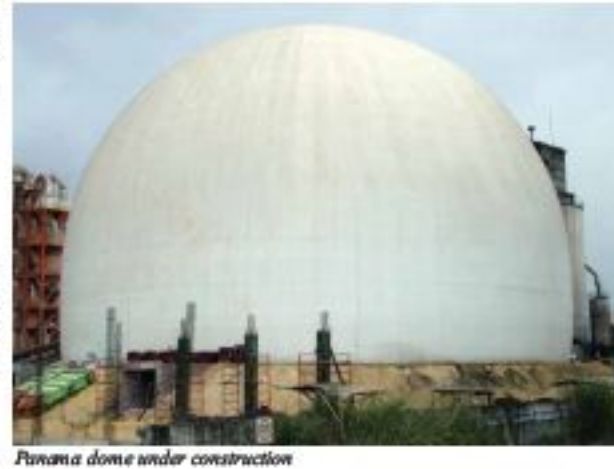
Efficiency

Large quantities of materials can be stored in a dome in a relatively small space. For example, the Bayano plant clinker dome is only 167 ft (51 m) in diameter, yet it can store up to 77,000 tons (70,000 metric tonnes) of clinker. Domes are efficiently filled by conveying to a single opening at the top. The dome's compactness also results in filling conveyors being shorter in length and simpler than those needed for silos or other types of storage warehouses.

Strength and Durability

DOMTEC concrete domes allow clinker to be piled high against the walls. They also support heavy conveyor loads. The Bayano clinker dome supports approximately 330 tons (300 metric tonnes) of conveyor equipment, head house, and dust filters. Also, concrete doesn't burn or oxidize and it isn't eaten by insects. Concrete domes are able to withstand hurricane-force winds and even earthquakes better than other structures.

Headhouse, conveying equipment installation



Panama dome under construction

Rapid Construction (regardless of the weather)

After the foundation is completed, depending on the dome's size, most domes are usually completed within 2 to 5 months. Dome construction takes place primarily on the inside of the inflated form. Working on the inside has several inherent advantages. For example, temperatures stay within a comfortable range and higher quality work can be achieved even during inclement weather.

Dome Construction

The dome construction process begins with a ring beam footing, or in Bayano's case, a ring "pile cap." A fabric form is attached to the base ring beam and inflated. This inflatable form is made of durable single-ply roofing material. (Dome construction takes place on the inside of the

Shotcrete application by experienced nozzlemen

CEMEX Cemento Bayano Plant

The Outstanding International Project

Project Name
CEMEX Bayano Plant No. 2 Line Expansion

Project Location
Bayano, Panama

Shotcrete Contractor
DOMTEC International, LLC*

General Contractor
Cemex S.A.

Architect/Engineer
ZZ Consulting P.A.

Material Supplier/Manufacturer
Cemex Bayano Plant and
The Farley Group

Project Owner
Cemex S.A.

*Corporate Member of the American Shotcrete Association

inflated form, thus upon completion of the dome, the inflatable form remains in place and functions as the dome's finished roof membrane.) Once inflated, polyurethane foam is applied against the dome's interior surface to a thickness of approximately 2 in. (50.8 mm). Initial reinforcement steel is attached using special fasteners that have been embedded in the foam. Depth gauges and hanger wires are also installed, and the first layers of shotcrete are sprayed, providing enough stiffness and strength to support the next mat of heavier structural reinforcing bars. The initial shotcrete is sprayed in thin layers. As the overall shell thickness increases, the quantity of shotcrete that can be applied per pass can also be increased, depending on where in the dome the shotcreting is taking place. Overhead shotcreting is done in thinner layers than horizontal spraying. All nozzling is performed by experienced DOMTEC nozzlemen to ensure proper reinforcing bar embedment and the designed thickness.

Building CEMEX's Bayano Plant Clinker Dome

DOMTEC International designed the storage dome and supervised its construction, including doing all the shotcrete nozzling. FASA built the dome's base ring beam foundation and two subfloor reclaim tunnels and supported DOMTEC International during dome construction.

DOMTEC's specialty equipment and the air form were shipped to Panama via ocean containers. CEMEX supplied the reinforcing bar and shotcrete locally in accordance with DOMTEC's specifications. The overall plant expansion justified an on-site batch plant, which mixed and supplied the shotcrete in typical concrete trucks. DOMTEC's crew of six experienced supervisors and technicians oversaw the complete dome construction process and personally performed all the shotcrete nozzling. Local labor was hired to install most of the reinforcing bar installation, under DOMTEC's supervision, and to help with dome shotcreting.

Approximately 897,000 lb (407,727 kg) of reinforcing steel were installed in the CEMEX Bayano clinker storage dome. This consisted primarily of reinforcing bar sizes ranging from No. 3 to No. 10. By far, the majority of the bars, both by weight and numbers of bars, were No. 10, 8, and 6. The reinforcing steel was enveloped with 2515 yd^3 (1920 m^3) of shotcrete sprayed using a pump. Shotcreting was applied at an average of about 90 yd^3 (69 m^3) per day. Dome construction took about 4 months and was completed on time and on budget.

CEMEX is now in the position to help meet the growing demand for cement as the Panama Canal Expansion Project continues.

Have YOU visited the ASA Web site Lately?

There have been significant changes and new services added!

FEATURES —

- ASA Buyers Guide
- Technical Inquiry Submission
- Shotcrete Video Demos
- *Shotcrete* Magazine Archive
- Outstanding Shotcrete Project Awards
- Products
- Education
- Certification
- And Much More

AMERICAN SHOTCRETE ASSOCIATION

WWW.SHOTCRETE.ORG

2009 Outstanding Pool & Recreational Project

Scheiner Watershape

View from house over terraces and main pool

The homeowners live and work in Manhattan with their teenage son. When they want to relax, however, they all head upstate to their home overlooking the Hudson River Valley. They recently renovated their weekend home—now in a distinct modern style—so the existing vinyl liner pool no longer related to the new look. The homeowners approached us to design and construct a watershape that would not only open up the view to the valley but also fit their modern taste.

After several drafts our final design consisted of a perimeter overflow spa and negative edge swimming pool, with a multi-level runnel system connecting the two bodies of water. Within the main pool, there was a dividing wall that created a private sitting area in the shallow end. The homeowners were excited about the unique spaces that were proposed. Now we had to focus on turning this unique watershape into a reality, which took significant thought and preparation.

We decided to employ the shotcrete process, as it would allow for the efficient creation of the repeating curves seen in the pool design as well as the creation of the multiple shapes and elevation changes within the runnel and spa complex. The dry method of shotcrete proved particularly versatile on the project, as it allowed breaks in the shooting, thereby giving the crews shaping the details time to catch up. Strategies were discussed during advance meetings with the shotcrete company, and we ultimately decided to shoot the project in four phases.

Stone-filled bags used to create floor profiles of pool and catch basin

Reinforcing steel of main pool with interior dividing wall

Main pool being shotcreted with tapered and curved negative edge

Walls formed for raised perimeter overflow spa

Large diameter plumbing to reduce water velocity and increase efficiency

Overflow spa with connecting runnel beyond

After the demolition of the existing pool, focus was put on the construction of the new pool and its catch basin. The location of the undisturbed grade was determined through site analysis, which was also of proper bearing capacity (1000 lb/ft^2 [4882 kg/m^2]) as required by the structural engineer. This information was used to calculate how far away from the house the pool could be located to give the desired effect of the negative edge. Where the negative edge pool sits on the property is a critical choice as it relates to the downhill views.

Construction began with excavation and the stacking of crushed stone bags that created the various floor profiles. Much consideration was taken with the forming, ensuring the forms were properly braced to avoid vibration during the shotcrete application. Wood forms were used in lieu of the more common "steel-tex" material to help achieve the necessary rigidity.

Reinforcing of the shotcrete was accomplished by the use of No. 4, Grade 60 deformed steel reinforcing bar. Besides the obvious addition of tensile strength, the reinforcing bar was installed within the interior elements of the pool (steps, benches, and dividing wall) to aid the nozzleman in applying the shotcrete in a timely manner.

Using a 4:1 mixture, the shotcrete company began the first phase by applying 80 yd^3 (61 m^3) of shotcrete to the pool shell. Careful to throw out rebound and trimmed material, they left a tapered, clean joint between the negative edge wall and adjacent catch basin. After stripping the forms and cleaning and saturating the shotcrete joint to a saturated surface-dry condition, the catch basin structure was shot using 23 yd^3 (18 m^3) of shotcrete. The next 7 days were spent soaking the structures to aid in hydration. The pool's structural shell was now complete.

The second half of the project focused on the perimeter overflow spa and multi-level runnel system leading into the pool. The first step was to form the bases of the spa and runnel system. Beneath the runnel, we excavated down 3.5 ft (1.1 m) and installed local 0.75 in. (19 mm)

Spa with red concrete panels overflowing to runnel into pool

Interior dividing wall just under the surface of main pool

Stone walls with piers bordering negative edge

Still surface waters of spa and pool reflecting in the late afternoon

crushed stone as engineered fill to protect against frost heave. Phase 3 occurred about 2 months later, at which time the spa base and runnel were shot using a total of 15 yd³ (11 m³) of shotcrete. The fourth and final shotcrete phase came later that month and entailed shooting the spa walls, benches, and steps, which took 12 yd³ (9 m³) of shotcrete.

The shells were now ready for the installation of fittings and masonry finishes: natural stone, ceramic and glass tile, aggregate plaster finishes, and custom precastred concrete panels on the spa. By this time, the outside temperature was dropping and the winter winds were picking up, so the remainder of the finish work was put on hold until the spring.

As we found out early on, it was relatively easy to design the structures, but building them was quite a different story. The success of this watershape relied on moving water without loss; shotcrete's abilities and characteristics enabled that success.

Although this project eventually included landscaping, masonry, and carpentry, there is no doubt that the focus of this property was to be the pool. The versatility of shotcrete allowed all phases to proceed with relative ease to create this unique poolsetting, much to the homeowner's satisfaction. We are positive that without the use of shotcrete, we would not have been able to accomplish this multi-dimensional project.

The Outstanding Pool & Recreational Project

Project Name
Scheiner Watershape Hudson River Valley

Project Location
Cold Spring, NY

Shotcrete Contractor
Shur Shot Gunite Corporation

General Contractor
Group Works LLC*

Architect/Engineer
Group Works LLC*

Material Supplier/Manufacturer
Shur Shot Gunite Corporation

Project Owner
Marcia and Richard Scheiner

*Corporate Member of the American Shotcrete Association

Circle #35 on reader response form—page 68

2009 Outstanding Repair & Rehabilitation Project

Seismic Retrofit to the University of Memphis' Cecil C. Humphreys School of Law

In January of 2006, the University of Memphis officially announced that it was moving the Cecil C. Humphreys School of Law to the historic building that housed the Memphis Customs House, the Federal Court House, and the Post Office. The United States Post Office was the last of the original occupants to leave the building when it relocated in 2005. The building was donated to the state of Tennessee for the Tennessee Board of Regents through a series of easement transfers from the United States Postal Service to the city of Memphis and then to the state of Tennessee. The classical revival-style building was placed on the National Register of Historic Places in 1980, and has a beautiful view overlooking the Mississippi River and Mud Island River Park. The architects, Askew, Nixon, Ferguson Architects, Inc. & Fleming Associates Architects, worked with the University of Memphis and the Tennessee Board of Regents to redesign the building to include auditorium classrooms, a law library, and faculty and administrative offices; and remodeled high-ceilinged courtrooms and student activity areas. Burr & Cole, CE Inc. and Rutherford & Chekene, Inc., provided the structural and seismic engineering designs that met the new requirements.

Building History

The 140,000 ft^2 (13,006 m^2) building has a core that dates back to the early 1880s, but includes additions that were built in 1903 and 1929. During the major expansion and remodeling in 1929, limestone replaced the building's previously marble exterior. The beautiful structure of limestone, granite, and marble was built to last, but it wasn't built up to earthquake building codes. Memphis sits along the New Madrid Fault Line and authorities are doing their best to prepare for possibly large earthquakes that could hit the area at any time. In this case, the new construction within the 1903 addition was designed to meet earthquake requirements of the code, but other areas of the building needed modification. In addition, the Tennessee Board of Regents allowed approximately $2.1 million to retrofit the balance of the building with seismic shear walls and other seismic restraints.

East façade of the University of Memphis' Cecil C. Humphreys School of Law during the renovation project

Seismic Retrofit

In June of 2006, Bruce Burr of Burr & Cole, CE Inc. contacted Pat Mooney of Proshot Concrete, Inc., to discuss the possibility of using shotcrete as part of the seismic retrofit. Proshot Concrete, Inc. was contacted for their shotcrete expertise to complete a seismic retrofit that would bring the building up to code. Because the building was constructed in separate phases using different building techniques, the design for the seismic retrofit wasn't the same for all parts of the structure. The original rectangular core of the building was scheduled to receive the most drastic architectural and structural design changes. It received a

Lower portion of 18 ft (5.49 m) reinforced concrete wall

complete internal shell of steel reinforcement and shotcrete from the basement to the fourth floor attic.

Building's Core

Two reinforcement walls of No. 5, No. 6, and No. 8 steel reinforcing bar were constructed on a new footer in the basement floor and then covered with 12 in. (304$ mm) of shotcrete to create the reinforced concrete shear walls. The 4 ft (1.22 m) wide footer was built with a depth of 4 or 6 ft (1.22 or 1.83 m) to meet the design specifications. During the construction of the steel-reinforced shear walls, mounting plates and dowels were carefully placed for the location of the new floors. Within the building's rectangular core, a 3 ft (1 m) area was demolished around the perimeter of the existing floors to provide access to the walls of the steel reinforcing bar that connected the separate levels of the building. The completed internal shell of reinforcement steel and shotcrete provided the structure with enough strength to allow for the removal of the preexisting flooring and support beams. The roof above the building's rectangular core was demolished to provide access to the interior levels. Large cranes used wrecking balls to demolish the old horizontal floor of arched brick and concrete around the steel support beams. The old beams were connected to the crane and then cut to be lifted away just before the new steel I-beams were installed at each level. The new floor plans included auditorium seating in the large class rooms, so they required slanted support beams at varying heights. The accurate placement of the end plates during the shotcrete process was critical to the I-beam installation. The application of shotcrete allowed for minimal forming for the 12 to 20 ft (3.66 to 6.1 m) tall shear walls and ease of access for multiple contractors working on the project.

Building's I-Shaped Wings

The north and south wings of the building received steel reinforced shotcrete corners instead of a complete perimeter lining like the building's original core. The 12 in. (304.8 mm) of reinforced shotcrete stretch 12 to 20 ft (3.66 to 6.1 m) in each direction from the building's internal corners, depending on the specifications. Similar to the shear wall shell of the building's core, the reinforcement corner walls began in the basement and created a continuous wall of steel to the building's attic. Instead of demolishing a gap for the wall of steel and shotcrete, holes were bored into the existing concrete floors for the steel reinforcement and the shotcrete was finished flush to the existing surface.

Wooden forms were built to protect the tall, arched windows during the retrofit process. Three ft (1 m) epoxy-coated angled dowels were also installed around the perimeter of each floor

Internal corner with reinforced shotcrete around arched windows

Wooden window form and reinforcement prior to receiving 12 in. (304.8 mm) of concrete

to join the exterior façade to the reinforced interior. In all 300 tons (272.2 metric tonnes) of steel and 2000 yd³ (1529.1 m³) of concrete were used throughout the building to accomplish the seismic retrofit. The specifications for the job required an average compressive strength of 5000 psi (34.5 MPa), but Proshot Concrete, Inc., was able to maintain an average compressive strength between 7000 and 8000 psi (48.3 and 55.2 MPa).

Fourth Level Renovations

The beautiful limestone exterior of the building received a cleaning and repointing of joints, but wasn't disturbed or altered for the seismic retrofit. The roof was removed from the original rectangular building to convert the attic into a useful human-occupied space. The dark attic that was once just used for storage is now a light-filled area that contains the law review suite, learning commons, and a reading room with large windows overlooking the Mississippi River.

Project Summary

Bell & Associates Construction, LP, was the general contractor on the project and they worked

with Proshot Concrete, Inc., the University of Memphis; the Tennessee Board of Regents; and A&E to preserve the historic features of the building while completing the seismic retrofit. Bell & Associates Construction, LP, did a great job coordinating the multiple contractors working on the job. Working with electrical; heating, ventilating, and air conditioning (HVAC); plumbing; fire sprinklers; telecommunications; and other contractors who needed to penetrate the steel-reinforced walls during the project was a major task for Proshot Concrete, Inc. Shotcrete's characteristics made it a key factor to the overall quality of the seismic retrofit and remodeling project. Shotcrete's minimal forming allowed large areas to be prepared with reinforcing bars in advance of the shotcrete placement. The large historical building with multiple levels and an existing floor plan created many challenges during this project, but the use of shotcrete allowed the seismic retrofit to have minimal impact to the building's appearance. The Cecil C. Humphreys School of Law will be a modern learning environment in a historical building and the use of shotcrete is helping to ensure a safe environment for many years to come.

Concrete pump at the southwest corner of the Cecil C. Humphreys School of Law

The Outstanding Repair & Rehabilitation Project

Project Name
Seismic Retrofit to the University of Memphis Cecil C. Humphreys School of Law

Project Location
Memphis, TN

Shotcrete Contractor
Proshot Concrete, Inc.*
Daniel Wallace, Superintendent
Patrick A. Mooney, Project Manager

General Contractor/ Project Management
Bell & Associates Construction LP
John Thayer, Project Manager

Architects
Aslaw, Nixon, Ferguson Architects/ Fleming Associates

Engineers
Burr & Cole /CE Inc./Rutherford & Chekene Inc.

Project Owner
Tennessee Board of Regents/ University of Memphis Law School

*Corporate Member of the American Shotcrete Association

ASA ANNOUNCES AVAILABLITY OF NEW

ONLINE BUYERS GUIDE

New online tool offers the industry free access to products and services of the leading companies in the shotcrete industry

The new American Shotcrete Association (ASA) Buyers Guide is now available free to the concrete industry at **www.shotcrete.org/BuyersGuide**.

The ASA Buyers Guide provides a new and important tool to locate those companies that continually prove their commitment to the shotcrete process and its quality by supporting ASA through Corporate Membership.

This new service enables users to search for companies based on products and/or services related to shotcrete across seven main categories:

- Admixtures
- Cement/Pozzolanic Materials
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- Contractors
- Equipment
- Fibers
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2009 Outstanding Underground Project

The Heartland Corridor Clearance Improvement Project: Vaughan, Roderfield, Laurel, and Gordon Tunnels

As part of a 3-year project, Norfolk Southern Railway, which operates 21,500 mi (34,600 km) of track in 22 eastern states, is expanding 28 tunnels along the Heartland Corridor, a vital line that connects the port of Hampton Roads, VA, and Chicago, IL, by adding up to 2 ft (609.6 m) of headroom, which will allow larger trains and thereby more cargo to use the route and cut roughly 200 mi (321 km) off their trip. The $150 million project is slated for completion in 2010.

Workers on the Heartland Corridor project

Along the Heartland Corridor, Norfolk Southern has employed a number of methods to increase the clearance, including raising the roof and lowering the track. To expand the tunnels, workers must also transform the passageways' corners from rounded to squared, which allows the taller trains to pass

Norfolk Southern hired three contractors to complete the project: Johnson Western Gunite Company, San Leandro, CA; LRL Construction Company, Tillamook, OR; and R.J. Corman Railroad Company, Nicholasville, KY. The material supplier selected for the tunnel work was The Quikrete Companies.

Along the Heartland Corridor, Norfolk Southern has employed a number of methods to increase the clearance, including raising the roof and lowering the track. To expand the tunnels, workers must also transform the passageways' corners from rounded to squared, which allows the taller trains to pass.

The railroad even removed the roof from one of the 27 under construction as part of a 174 ft (53 m) long "daylighting" of a tunnel. The tunnels, which range in length from 174 to 3302 ft (53 to 1006.4 m) long, were built with arched roofs and rounded corners.

Of the tunnels currently being worked on, eight require the liner notch work to square the edges, 18 require complete roof replacements, and one is a "daylighting" project.

The four-tunnel Vaughan, Roderfield, Laurel, and Gordon (VRLG) project involved the liner removal and notching of double-track tunnels in Roderfield, WV. The tunnels varied in length—Vaughan (1113 ft [339.2 m]), Roderfield (924 ft [281.6 m]), Laurel (803 ft [244.75 m]), and Gordon (1271 ft [387.4 m]). Crews were required to complete demolition, rock bolt, and apply shotcrete all within 10-hour shifts. Excavator-mounted road headers as well as an AM 75 Alpine Miner were used to complete demolition and notching. Shotcrete was applied using volumetric batching machines and shotcrete pumps.

In total, approximately 10,000 yd³ (7645 m³) of grout was used in the four-tunnel VRLG project,

which started in January 2008 and was completed in May 2009.

Perhaps the biggest challenge was working in four tunnels consecutively in the same location and organizing trains to go to each tunnel at the beginning of each shift, while dealing with the inability to pass equipment in each tunnel.

For the project, Norfolk Southern rerouted as many trains as possible to allow for the construction but cannot completely shutter the line during the tunnel work. Crews start their work on Saturday and must be finished on Wednesday, with scheduled work times of 2 a.m. to 12 p.m. each of these days, at which time the rail line resumes its normal operations.

The challenge with this project is that Norfolk Southern could not close the tunnels to all rail traffic because this is such an important route for freight movement, which means that workers have a limited window in which to work.

Over the last three decades, freight traffic on railroads nationwide has increased, and railroads have turned to double-stack trains—cars that allow intermodal containers to be stacked one on top of another—to boost the amount of goods each train hauls. The intermodal containers are used worldwide on ships, trucks, and trains to carry a number of products.

Modern-day stack trains require tunnels to be at least 20 ft 9 in. (6.4 m) tall. Because of the small tunnels through the Appalachian Mountains, Norfolk Southern's large intermodal trains make the trip from Hampton Roads, VA, to Chicago via Harrisburg, PA, or Knoxville, TN.

As part of the tunnel expansions that require linear notch work and roof replacements, crews bore holes every 4 ft (1.2 m), which allows them to fill any voids behind the tunnel ceiling. Workers then install 18 ft (5.5 m) long roof anchors to secure the tunnel ceiling to the mountain above; they complete the process by applying nonshrink precision grout to fill in the holes.

While expanding the tunnels to accommodate larger trains is a primary objective, it is just one of the goals of the multi-year project. The railroad wants to ensure that the tunnels are stabilized and safe for the next century.

Using shotcrete combines the process of applying cement to the tunnel walls and packing it down. Spraying the shotcrete also eliminates the need for forming and provides an extremely dense (9000 psi [62 MPa]) and high-strength concrete tunnel lining.

While modern technology has shouldered the load in bringing the corridor into twenty-first century compliance, there is no shortage of respect and admiration among today's workers for those who forged the line.

As part of a 3-year project, Norfolk Southern is expanding 27 tunnels along the Heartland Corridor by adding up to 2 ft (0.6 m) of headroom, which will allow larger trains to use the route and cut roughly 200 mi (321 km) off their trip

The Outstanding Underground Project

Project Name
The Heartland Corridor Clearance Improvement: Vaughan, Roderfield, Laurel, and Gordon Tunnels

Project Location
Roderfield, WV

Shotcrete Contractor
Johnson Western Gunite Company*

General Contractor
Johnson Western Gunite Company*

Architect/Engineer
STV Whitehead, Hatchmott McDonald, and Rick Meredith

Material Supplier/Manufacturer
The Quikrete Companies*

Project Owner
Norfolk Southern Railway

*Corporate Member of the American Shotcrete Association

2009 Carl E. Akeley Award

Carl E. Akeley

2009 Awardees

Jean-François Dufour

Simon Remy

Pierre Lacroix

Richard Morin

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, Mr. Akeley is considered the inventor of the shotcrete process.[1]

Born in Clarendon, NY, on May 19, 1864, Mr. Akeley was a noted naturalist, taxidermist, inventor, photographer, and author. He made many significant contributions to the American Museum of Natural History as well as many other museums around the United States. He invented the cement gun initially to repair the façade of the Field Columbian Museum and later used it to improve the quality of his taxidermy exhibits at the museum. Mr. 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.

The American Shotcrete Association 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 previous 12 months as determined by the Akeley Award Committee of the American Shotcrete Association.

The Fourth Annual Carl Akeley Award is presented to Jean-François Dufour and Simon Remy of King Packaged Materials Company, Pierre Lacroix of the Division of Expertise and Technical Support of the City of Montreal, and Richard Morin of the Civil Section for the Laboratories of the City of Montreal for their paper "The Effects of Liquid Corrosion Inhibitor in Air-Entrained Dry-Mix Shotcrete." This paper was published in the Winter 2009 issue of *Shotcrete* magazine and demonstrates the advances that have taken place in the repair of structures with shotcrete in the 100 years since Carl E. Akeley first developed the process.

[1] Bilchart, R., "Carl Akeley – A Tribute to the Founder of Shotcrete," *Shotcrete*, V. 4, No. 3, Summer 2002 pp. 10-12.

ASA President's Award

2009 Awardee

Merlyn Isaak

In 2005, the American Shotcrete Association established its President's Award. This award is presented to a person or organization that has made exceptional contributions to the shotcrete industry. The selection is the sole responsibility of the current ASA President.

The first award was presented in 2006 to Dr. Marc Jolin of Laval University. In 2007 the President's Award was presented to George D. Yoggy of Allentown Equipment. Last year the award was presented to Dudley R. "Rusty" Morgan.

ASA Honorary Lifetime Member Award

2009 Awardee

Dudley R. "Rusty" Morgan

The Bylaws of the American Shotcrete Association provide for Honorary Memberships bestowed at the discretion of the ASA Board of Direction. To be eligible for consideration, an individual must be at least 65 years of age, must have been an ASA member for at least 5 years, and retired from the shotcrete industry.

The Board voted unanimously to award an ASA Honorary Membership to Dudley R. "Rusty" Morgan in recognition of his extraordinary contributions to the American Shotcrete Association and the shotcrete industry.

ASA Past Presidents Award

1999
Iars Balck Jr.

2000
Peter C. Tatnall

2001
Steven Gentry

2002
Raymond Schallom III

2003
Edward Brennan

2004
Janice Fisher

2005
Larry Totten

2006
Dudley R. "Rusty" Morgan

2008
Chris Zynda

Get Your Nozzlemen Certified

By Ted W. Sofis

In 1998 we started a shotcrete project on a dam near Altoona, PA, that called for nozzleman certification. I initially resisted. After all ,our company had been in the business since 1959 and I personally had been doing shotcrete work since 1971. I felt offended. Typically, engineers would require the contractor to have at least 5 to 10 years of shotcrete experience and to have successfully completed several similar projects. In addition to this, the shotcrete superintendent and nozzleman were typically required to have a minimum of 5 years of experience. So I called the government agency for which we were doing the job and offered to submit our credentials and our employee resumes. They were firm that the project specification required certified nozzlemen. I called the American Concrete Institute (ACI) only to find out that the nozzleman certification program was not yet up and running. The ASA and ACI nozzleman certification programs have both come a long way since their beginnings in 1998. Over time, ASA has become the major resource for shotcrete-related dialogue, a forum for discussion, and the primary sponsor for ACI nozzleman certification.

Today, nozzleman certification is required on a growing number of private and public projects. It provides certification from an impartial third party that acceptable standards of education and competence have been achieved.

A shotcrete panel form with the simulated reinforcing bars

The gunning of an overhead panel during the certification

The scaffolding set up for both the overhead and vertical panels

Nozzleman shooting his overhead shotcrete panel

There is a confident self-reliance that most experienced shotcrete people have, and we take pride in our skills and our abilities. Those attributes are part of what makes a good nozzleman. Of course, this pride also makes most nozzlemen reluctant to have an outside party evaluate their level of skill. This is something we must get past—after all, it's not about ego. It's about providing assurance to the owners, engineers, and specifiers that the basic level of education and competence has been attained.

I eventually joined ASA and, despite my ego, I made arrangements for the education and testing of our shotcrete personnel. Among the individuals we had tested were nozzlemen with over 30 years and as little as 5 years of shotcrete experience and, believe it or not, they all came through the process unscathed. We had the scaffold with overhead and vertical panels set up beforehand. The classroom session, the written examination, and both the overhead and vertical gunning were all accomplished in 2 days. The shotcrete panels were then core

The core drilling of a shotcrete panel to see the encapsulation of the reinforcing bars

The core drilling of the shotcrete panels to see the encapsulation of the reinforcing bar

The gunning of a vertical panel with Examiner Ray Schallom looking on

The core drilling of the shotcrete panels the day after gunning

The gunning of a vertical panel with dry-process shotcrete

Certification classroom session conducted by Examiner Ray Schallom

drilled and the nozzlemen were able to see the quality of their work firsthand. Despite everything that you think you know, you learn a few new things. It was a positive experience for me and it was relatively painless for the session attendees.

Undertaking certification is something all of us in the industry should welcome. It lends credibility to the craftsman, the contractor, and to the process. It is not an indictment of your ability or experience, but an assurance to your customers. So if you haven't had your employees certified, consider doing it. In years past, the quality of some shotcrete projects have been inconsistent and below standard. Good practices and quality workmanship benefit all of us, and anything that improves the standard of workmanship is good for the shotcrete industry.

Nozzlemen taking the written portion of the examination

Gunning field testing, classroom testing, and core drilling of gunned samples are complete

***Ted W. Sofis** and his brother, William J. Sofis Jr., are principal owners of Sofis Company, Inc. After graduating from Muskingum College, New Concord, OH, with a BA in 1975, he began working full time as a shotcrete nozzleman and operator servicing the steel industry. He began managing Sofis Company, Inc., in 1984 and has over 34 years of experience in the shotcrete industry. He is an ASA-approved Shotcrete Nozzleman Educator, is the Treasurer for ASA, and is a member of the ASA Publications and Education Committees. Over the years, Sofis Company, Inc., has been involved in bridge, dam, and slope projects using shotcrete, as well as refractory installations in power plants and steel mills. Sofis Company, Inc., is a member of the Pittsburgh Section of the American Society of Highway Engineers (ASHE) and ASA.*

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Certification vs. Qualification of Shotcrete Nozzlemen

By Merlyn Isaak

Certify: To attest; to testify to in writing; vouch for; to endorse as meeting set standards or requirements.

Qualify: To limit or restrict, as by conditions or exceptions.

In 2000, ACI, in cooperation with ASA, established a formal certification program for certifying shotcrete nozzlemen. Prior to that date, ACI had a guideline document for certifying nozzlemen, but it was not being uniformly applied, it contained outdated features and applications, and it was not being universally accepted nor endorsed.

In the mid 1990s, ACI Committee 506, Shotcreting, started the ball rolling for a formal program and, in conjunction with ACI's Certification Programs Committee (CPC), went through the process of getting the Financial Advisory Committee (FAC) and ACI Board of Directors' approvals. CPC established Committee C660, Shotcrete Nozzleman Certification for the specific purpose of formulating a formal certification program using the established strict procedures common to all other ACI certification programs. In addition to following standard protocols, the committee solicited input from ACI membership, shotcrete industry members (even prior to ASA's existence), and design professionals. To ensure credibility of the program and also to satisfy federal guidelines regarding fair employment, a survey of knowledge, skills, and abilities ("ksa's") required to be an employable nozzleman was conducted. This information then was distilled into a job task outline that became the basis for all examination, reference, and performance material for the program. Simultaneously, the committee established minimum criteria for examiners.

The resultant program consists of a 90-min written examination (60 to 70 questions) and a two-part performance exam. Part I of the exam involves the verbal querying by an examiner (using a program's standard checklist) of the candidate to assess his or her knowledge of equipment, safety, and procedures. Part II involves the candidate shooting a test panel that contains several sizes of reinforcing. Subsequently, the panel is cored in five predetermined locations (through reinforcing) and the cores are graded per ACI 506.3.

The program covers both wet- and dry-mix processes, and two positions: vertical (as for walls) and overhead. A prototype or "beta" test of the program was sponsored by ASA at Streetsboro, OH, in September 1999. This session served to qualify a first set of examiners as well as work out the bugs and refine the program.

As with all other ACI certification programs, examination sessions (written and performance) are conducted by local sponsoring groups (LSGs). For most ACI programs, chapters typically become LSGs (ACI headquarters' approval is required in accordance with formal rules). However, for doing a shotcrete nozzleman certification session, the equipment, yard space, and manpower requirements exceed most chapters' resources. ASA chose, as part of its charter, to embrace the certification of nozzlemen. As such, they were the first LSG to be approved for administering this program. Because of their national membership base, they continue to sponsor most sessions; another organization, Laval University, in Quebec, Canada, which has a shotcrete-oriented part of its construction-related curriculum, has also qualified as an LSG. This attests to the international appeal of such a program.

Status

Since its inception, as of this writing (August 2002), approximately 270 examinations have been administered. Having acted as an examiner, I can attest that the program is largely satisfying the

basic objective—namely, to certify nozzlemen with basic knowledge, skills, and abilities. It has become obviously the failure statistics that those who do not study the reference material ("knowledge") or have inadequate experience ("skills and abilities") fail those respective parts of the examination.

CAVEAT!

The reason for the exclamation mark is that there are a lot of shotcrete applications that go way beyond "basic." I could list numerous examples, but anyone who is interested in or involved in this industry knows what I mean. For just one example, at where I work (California), shotcrete is regularly used for seismic upgrades of structures. These applications often involve very large and congested reinforcing, in multiple layers, sometimes up to ±2 ft in thickness. Needless to say, the "basic" minimally qualified nozzlemen would not be up to such a challenge. *Shotcrete* and other literature are full of other examples. This leads to the other key word in the title of this article: "**qualification**."

Qualification

As the definition at the beginning of this article states, "to limit or restrict, as by conditions or exceptions," there are conditions where the basic certified nozzleman will not be able to satisfy the project requirements. Just because a nozzleman is certified does not mean he or she is *qualified* for every project.

We must keep in mind that the certification program, as currently structured, is "baselined" at 500 h of experience. It is not intended to instantly make him or her into the shotcrete equivalent of a master craftsman. Rather, we are ensuring only that he/she has the *basic* knowledge, skills, and abilities that a group of industry representatives believe are important. The test panel consists of a 30 in. square by 3-1/2 in. deep formed box with a grid of various-sized reinforcing bars spaced 6 in. apart (except two No. 4 bars at 1-1/2 in. apart to simulate a noncontact lap splice). So when conditions are more demanding, **qualification** may be necessary.

How is this additional qualification achieved, you ask? The two most common methods I am familiar with are referral (with documentation) from another successful project of similar or higher degree of difficulty, or shooting a mockup that simulates the most difficult aspect of the project at hand. With the referral method, it is important to ensure that the nozzleman being qualified is the one who shot the referenced work, and that the referenced work is of a similar or higher degree of difficulty.

When referrals are not a possibility, about the only other alternative is a mockup. In our part of the world, we are still using the Uniform Building Code (UBC), which has a list of several conditions **requiring** a mockup.

In my practice, I have prepared a checklist of situations where I recommend a mockup (assuming referral is not possible) that goes beyond code requirements. The list includes:

- Wall or section thickness greater than 12 in.;
- Reinforcing spacing closer than 6 in. on center with two curtains of reinforcing;
- Reinforcing spacing closer than 4 in. on center with one curtain;
- Reinforcing larger than No. 8 (1 in. diameter);
- Contact lap splices for bars larger than No. 6;
- Use of rebar couplers for splices with less than 4 in. clear;
- Non-contact lap splices with less than 2 in. clear;
- Heavily reinforced boundary elements on shear walls;
- Heavily reinforced columns or pilasters being integrally combined with other elements; and
- Inside corners with heavy reinforcing.

In order for a mockup to accomplish its intended purpose, it must be large enough to allow the nozzleman to demonstrate his ability. Mockups that are too small only penalize the nozzleman, as they are more likely to trap rebound.

On large projects, or those lasting longer than 2 or 3 days of shooting, it is advisable to **qualify** two or more nozzlemen.

Evaluating the mockup can be done by coring and core grading per ACI 506.3. Note that core grading is not permitted for evaluating the in-place work of a project. So it is extraordinarily important to qualify the nozzlemen up front *before* the project starts!

Some advocate dissecting the mockup by saw-cutting at various locations to look for voids. The drawback to this method is the lack of acceptance/rejection criteria.

Conclusion

I look at certification as a necessary first step for a nozzleman to establish himself/herself as a shotcrete craftsperson. The alert reader may have deduced from the previous commentary that a nozzleman could conceivably be *qualified* for a project without being certified (unless there is a specification requirement for being certified).

Currently, this is a weak link in industry practice, because without that nozzleman having gone through the certification process, there is no way of knowing what he/she **knows** (that is, the "knowledge" element of ksa's).

Knowledge for this program includes such items as: concrete basics, the effects and consequences of hot and cold weather, admixtures, the importance of curing, the role of fibers, safety, and quality controls. Shotcrete is often expected to compete with or take the place of poured-in-place concrete; therefore, the resultant shotcrete must be of equivalent (or better) quality. This can be consistently achieved only if the nozzleman is completely "rounded out" with respect to *all* aspects of shotcrete construction. Eventually, as design professionals become aware of the certification program and specify it, the weak link will be largely eliminated, and the shotcrete industry and project owners will benefit.

*ACI Fellow **Merlyn Isaak**, P.E., is a consulting civil/materials engineer in Los Gatos, California. He is past chair of ACI's Committee C660, Shotcrete Nozzleman Certification, and is a member of ACI Committee 506, Shotcreting. His experience includes over 35 years in quality control, testing, and inspection of construction materials.*

Are You Using the Right Wet-Mix Nozzle?

By Oscar Duckworth

My first shotcrete nozzle was a lot like my first car. I thought it was the best thing ever, until I replaced it and found out how truly bad it was. Like my first car, that nozzle was the only thing available to me at the time. And like my first car, it was unreliable, required constant attention, and merely provided acceptable performance.

Today there are countless nozzle configurations available to the nozzleman, all of them superior to those early designs. But beware—unlike my first car, that first nozzle is still available on the shelf right next to all of the other choices.

Which Nozzle Is Right for Me?

There is no single wet-mix nozzle that is right for all applications. One given nozzle configuration will, however, perform a specific task better than another.

Selecting a Wet-Mix Nozzle

Nozzle choices must be made for different job requirements, such as:

- Quantity (volume) of material placement;
- Velocity of the material being placed;
- Type of placement, such as tight access or overhead;
- Mixture proportions; and
- Use of accelerators at the nozzle.

Fig 1: A few of the countless wet-mix nozzles currently available

Nozzle Sizes and Types

Wet-mix nozzles come in several sizes. The most common sizes used are 1.5, 2, and 2.5 in. (38, 51, and 64 mm). Both 1.5 and 2 in. (38 and 51 mm) are generally used for hand-nozzle work, while 2.5 in. (64 mm) or larger nozzles are primarily used in robotic operations.

The 1.5 in. (38 mm) nozzles are popular choices for small jobs and repair areas because they are much lighter and easier to handle than their larger counterparts. Their use may be limited, however, by the mixture proportions. Many shotcrete mixtures may not be pumpable through a 1.5 in. (38 mm) system without a reduction or elimination of the coarse 3/8 to 1/2 in. (10 to 13 mm) aggregates.

Two inch (51 mm) wet-mix nozzles and placement systems are the most popular hand nozzle size and work well with most mixture properties. This size will accommodate most popular mixture designs, including those with synthetic fiber below approximately 12 lb/yd^3 (7.2 kg/m^3) or steel fiber below approximately 75 lb/yd^3 (45 kg/m^3).

Nozzles that are 2.5 in. (64mm) or larger are commonly used in robotic operations and allow the use of harsher mixtures and larger amounts of fiber without plugging. They can potentially allow placing material at over twice the speed of other systems. These nozzles require a much larger compressor air volume to maintain adequate velocity.

Admixture Nozzles

These special-purpose nozzles are configured with a second set of ports within the nozzle body that allow the injection of liquid chemicals into the mixture during placement to speed up the setting time or early-strength development of the in-place material. The admixture nozzle is commonly used in tunneling, overhead, or specialty earth retention projects such as low tide work. Admixture nozzles are available in popular robotic and hand nozzle configurations.

Admixture dosage rates are critical as they can affect shootability, strength, and durability of the in-place shotcrete. Therefore, calibration of the dosing system is very important and needs to be checked regularly.

The use of "jack tanks" or other devices that lack the ability to deliver a calibrated flow of admixture should not be used. Admixture nozzles must be used in conjunction with precise metering equipment and by nozzlemen familiar with the systems in use.

How Many Nozzles Do I Need?

The definition of shotcrete, as defined by the American Concrete Institute (ACI), is "concrete or mortar placed at sufficient velocity to achieve compaction." Therefore, the primary requirement of an acceptable wet-mix nozzle is that it is able to produce and maintain adequate velocity to ensure proper compaction at the receiving surface to achieve acceptable compaction for the application at hand. The receiving surface is the point where the mixture is compacted to its highest degree. Insufficient compaction will create low-quality, in-place material.

Material velocity drops sharply as the distance increases to the receiving surface so the nozzle must be kept close, usually 1 to 4 ft (0.3 to 1.2 m) from the receiving surface; or the nozzle must be reconfigured to maintain the higher exit velocity for special placement requirements such as overhead work. This may be accomplished by choosing a nozzle tip to increase exit velocity.

A well-designed wet-mix shotcrete nozzle must do many things to achieve acceptable compaction. The nozzle must allow enough air volume uniformly into the air ring and the ports within the nozzle body to completely break up the supplied mixture into fine particles. Unfortunately, many early nozzle designs were not up to this essential task. Most modern designs use much larger air rings and valves in conjunction with bigger drilled ports within the nozzle body to deliver higher diffusion energy to the mixture. If, for any reason, the material is not completely diffused into small particles during this step, they will exit the nozzle as larger masses. These "lumps" or "slugs" will then gather at the receiving surface as loosely consolidated masses. Typically, the larger the drilled port, the better it will diffuse the mixture. Always choose a nozzle that will allow adequate air volume to completely diffuse the mixture.

Fig 2: Note second valve supplying second row of drilled ports on wet-mix admixture nozzle

Fig 3: Nozzle body above with 1/8 in. (3.2 mm) drilled ports. Nozzle body below uses 3/16 in. (5mm) ports and adds chamfer to increase air flow

The ports supplying air from the air ring through the nozzle body can plug with material during use if the air supply line is stopped or kinked for even a moment. When a nozzle is set down, always leave the air supply line open a little to maintain pressure to the air ring to prevent ports from plugging. A nozzle with partially plugged air ring holes will not be able to properly break up the material and will not provide an adequate velocity or spray pattern to the receiving surface. During placement, stop work immediately

Fig 4: Note plugged port within nozzle body

Fig 5: Nozzle tips are available in many lengths for varying placement conditions

Fig 6: After placing only 80 lb/yd³ (60 kg/m³), the worn tip on the right has become oversized and must be discarded

if you suspect a partially plugged nozzle, and clean or replace the nozzle.

The next aspect of a wet-mix nozzle is to provide the velocity required to achieve acceptable compaction at the receiving surface. Shorter nozzle tips provide less velocity for close-in work. Longer tips with tighter opening sizes create tremendous velocity. A skilled nozzleman should carry many different tips for varying job conditions.

The constricting shape of the nozzle tip is designed to control both the velocity and the spray pattern of the shotcrete material. The nozzle tip will wear rapidly through use. When the nozzle tip thins, impact energy is reduced and the tip must be replaced. Many nozzle tips begin to degrade immediately and are worn to the point that they need to be replaced in less than a few hundred yards of placement.

Using a worn nozzle tip will certainly create placement problems due to poor compaction at the receiving surface. A distinct reduction in nozzle velocity and a wider, poorly controlled spray pattern are clear indicators of a worn-out nozzle tip. Always replace worn parts. Never use cut-off tips. A cut-off tip will not generate sufficient impact energy.

Air flow requirements vary greatly depending on the type, size, and manufacturer of the nozzle. A wet-mix nozzle will only convey as much air as is allowed by its design and the size of the supply line, regardless of the size of the compressor it is connected to. Always follow the manufacturer's recommended compressor (cubic foot per minute [cfm]) requirements and use properly sized supply lines. Use 3/4 and 1 in. (19 and 25 mm) minimum for hand nozzles and much larger for robotic nozzles. A good nozzle requires plenty of air. The nozzle body at the bottom of Fig. 7 will flow nearly 180 ft³/min (5.1 m³/min).

A properly chosen wet-mix nozzle and its placement system must:

- Be able to convey the approved mixture design;
- Provide adequate volume for job conditions;
- Completely break up the mixture;
- Deliver a good spray pattern; and
- Create sufficient impact energy to the receiving surface for the intended purpose.

As noted previously, a primary component to acceptable shotcrete placement is impact energy. The wet-mix nozzle, as well as all the other components of the placement system, must be selected and maintained to provide adequate impact energy to the receiving surface.

Fig 7: Note undersized 1/2 in. (13 mm) elbow and valve on upper nozzle and properly sized 3/4 in. (19 mm) parts on nozzle below. Half-inch (13 mm) elbow and valve will not flow sufficient air for adequate shotcrete placement

*ACI Certified Nozzleman **Oscar Duckworth** is an American Shotcrete Association (ASA) and ACI member with over 15,000 hours of nozzle time. He has worked as a nozzleman on over 2000 projects. Duckworth is currently an ACI examiner for the wet-mix process and is an approved ASA wet-mix and dry-mix Educator. He continues to work as a shotcrete consultant and a certified nozzleman.*

Wet-Mix Nozzle Checklist

- Choose a nozzle with adequately sized ports, usually 3/16 in. (5 mm) minimum;
- Use the right tip for the job—a short tip for low velocity, close-in work, a medium tip for shooting 2 to 4 ft (0.6 to 1.2 m) from the surface, and a long tip for high velocity for overhead or for greater distance from the receiving surface;
- Maintain your nozzle. Inspect nozzle tips, do not use cracked or worn nozzle tips. Always replace worn items. Keep nozzle body ports clean. If the nozzle becomes plugged, stop immediately, follow proper shut down procedures, and clean and or replace the nozzle; and
- Use adequate air volume and a properly sized compressor and supply lines.

The choice of the proper nozzle configuration is an often over-looked essential element to shotcrete quality. Routine inspection and maintenance of wet-mix nozzles must become part of the nozzleman's daily routine. This is one of many steps needed to assure ultimate product quality.

Progression of Work after Shotcrete Application

By Ron Lacher

Because of its role in the concrete construction industry, the American Shotcrete Association (ASA) receives many questions, both technical and nontechnical, from those interested in the shotcrete process. As a service to those interested parties, ASA submits those questions to a technical team of members that collectively formulates replies. Some of these questions and answers may be published in *Shotcrete* magazine, as well as on the ASA Web site under "FAQs."

A couple of months ago a two-part question was submitted to ASA that asked, "How soon after shotcrete application in a swimming pool can form materials be removed?" The inquiry also included, "How soon after shotcrete application can tile installation be started?" These are questions I'm frequently asked. I want to revisit the topic, and the "Pool & Recreational Shotcrete Corner" provides the perfect venue for that discussion.

When we talk about the appropriate timing to continue work on a swimming pool after shotcrete application, be it form removal, tile installation, or any another phase, the real underlying question is, "Has the shotcrete developed all the properties necessary to permit each subsequent yet individual phase to continue?" The tried and true specification that we hear over and over is the structural designer's specified compressive strength, for example—4000 psi (27.6 MPa) usually at 28 days. Whereas a specified compressive strength may be necessary for the pool to meet the requirements as a structural element, that specified compressive strength may not be needed as a prerequisite to begin other phases. Additionally, we may be looking for the attainment of other properties in addition to compressive strength—for example, surface hardness, abrasion resistance, surface permeability, absorption, flexural strength, and drying shrinkage. As we'll see, subsequent phases may have differing requirements of shotcrete properties.

Before moving on, let me mention the importance of proper curing. The attainment of the individual properties we may be looking for to continue with the next phase comes from the maturing of the shotcrete through the hydration process. As we already know, hydration is a chemical process that results in the maturing or hardening of the shotcrete. Shotcrete does not harden by drying; in fact, drying will completely stop the hydration process and result in under-strength shotcrete. So, it is really adequate moisture after final set that is necessary for maturing or hardening of the shotcrete. Providing adequate moisture for maturing or hardening of shotcrete is called curing. ACI 308R-01, "Guide to Curing Concrete," covers the curing topic thoroughly, and I encourage anyone working with concrete to become familiar with this document.

In accordance with ACI 308R-01, the term curing is used to describe the process by which hydraulic cement concrete matures and develops hardened properties over time as a result of the continued hydration of the cement in the presence of sufficient water and heat. At this point, it's sufficient to say that proper curing is critical to the attainment of all the properties necessary to permit each subsequent yet individual phase of the pool construction to continue. But, in the swimming pool industry, this important facet is often left to the homeowner without detailed instructions provided for this critical aspect.

Let's move on to the questions at hand and first consider the timing of form work removal. To answer that question, we need to know if the forms are the simple bender board or other flexible material typically located at the outside of the pool's bond beam and used to set the elevation, shape, and dimensions of the pool. Or is the form removal being asked about complicated false work supporting a completely out of grade, pile-supported swimming pool? Form removal timing for these two scenarios would be vastly different. If we're talking about the bender board located at the outside of the pool's bond beam, quite honestly, that should be removed as soon as the shotcrete has gained sufficient strength—approximately 500 psi (3.5 MPa)—to not damage the carefully cut edges and lines establishing the pool's shape, bond beam, steps, and benches. It's typical for shotcrete waste, that is, rebound and cuttings, to be shoveled out of the pool and, in doing so, the wood forms, stakes, and kickers are often partially buried in the waste material. It's not uncommon for this type of form removal process to take place within a day or two of shooting the pool as long as care is exercised.

If the forms are supporting a structural element of the pool, the timing of form removal is a

completely different story. In this case, supervision from the pool's structural designer should always be sought before the form work or false work is removed. It may be possible to remove the form work before the full specified shotcrete strength is attained as long as the pool is not filled with water. The pool's permanent structural support system would have been designed to include the weight of water in the pool, typically substantially greater than the weight of the shotcrete shell. So as long as the pool is not filled with water, the structural designer may approve the form work removal at a lesser strength than the 28-day specified strength.

When discussing the topic of shotcrete strength attainment and the continuation of work, the timing of backfilling against a out-of-grade pool wall must be included in that discussion. Frequently, because of site conditions or other reasons, pool walls are built exposed or out of grade. Contractors need to backfill so the work around the exposed wall can continue. Also, it's unlikely that the pool wall would have been designed for the very high loads brought about by heavy compaction equipment. Consequently, this is an area where care and good judgment must be exercised. My first recommendation is that the advice of the pool's structural designer should always be sought before beginning backfilling. If that advice is not available, my recommendation would be to wait at least 7 days where, with proper curing, the shotcrete would have attained at least 50% of its 28-day strength (ACI 308R-01). Backfilling would only then be performed by hand and compaction attained with hand-operated equipment using the utmost care.

Up to now we've talked mainly about formwork removal issues, but there was a second part to the question asked, that is, how soon after shotcrete application can tile installation be started? Batter boards, attached to the pool shell with concrete nails, are frequently used in the tile or coping installation process. The concrete nail installation can cause some minor damage to the shotcrete surface if the shotcrete is either too weak or too strong. Because the repair would generally be a simple matter, shotcrete strength is usually not a major concern regarding the batter board installation. There are a couple of other important issues relating to tile installation that may be affected by time. The first is the moisture content of the shotcrete substrate. Most swimming pool tile installations would begin with the application of a scratch and float coat of cementitious mortar to provide a plumb, straight, and uniform surface for the tile application. Other than a saturated surface dry substrate, the moisture content of the shotcrete would not normally be

Typical bender board form work around a swimming pool that sets the shape, elevation, and dimensions

Pier-supported, out-of-grade swimming pool required complicated false work during construction

After shotcrete, backfilling of the pool wall will be necessary before work on the pool can continue

a concern. If specialized thinsets, waterproofers, or other coatings, however, are to be applied as a part of the tile installation process, the manufacturer of the product should be contacted for specific requirements, especially regarding substrate moisture content.

Batter board attached to the pool shell with concrete nails. Note the minor damage to the top of the pool wall

Vanishing edge weir wall where shrinkage cracks reflected through water line tile. Repair was by epoxy injection

A far more important issue relating to the timing of tile installation is the possibility of drying shrinkage cracking occurring in the shotcrete after tile installation but before filling of the pool. Shotcrete swimming pool shells are frequently left uncompleted for extended periods and may be subject to drying shrinkage cracking, especially in hot, dry climates. Drying shrinkage cracks are also observed with greater frequency in pool elements such as vanishing edge weir walls and gutter walls that are exposed to the atmosphere on both sides of the wall. If tile installation takes place shortly after shotcrete application and the pool is left unfilled for an extended period, there is a risk that drying shrinkage cracking may occur and reflect through the tile, permitting leaks. If the pool is to be left unfilled for an extended period, it is recommended that the possibility of drying shrinkage cracking be considered when scheduling the installation of the tile. If the tile installation phase must take place shortly after the shotcrete installation, an appropriate elastomeric crack isolation membrane should be incorporated into the tile installation. Also, before filling, the pool tile should be carefully inspected for shrinkage cracks that may have reflected through the setting bed from the shotcrete substrate.

Similarly, drying shrinkage cracking can reflect through nonelastomeric, cementitious waterproofing materials that may be used to waterproof pool gutters. If the gutters are hidden at the time of pool filling—for example, in a slot in the perimeter overflow pool—the drying shrinkage cracking and the potential for leaking may not be detected by visual inspection. The possibility of drying shrinkage cracking in hidden or inaccessible gutters should be considered when selecting waterproofing materials and in the construction phasing of hidden gutters and other inaccessible elements.

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

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AMERICAN SHOTCRETE ASSOCIATION

Gunite Supply and Equipment

GUNITE Supply & Equipment
www.gunitesupply.com
Since 1967

Since 1967, Gunite Supply and Equipment (originally known as the Gunite Contractors Equipment and Supplies Co.) has been a primary manufacturer and distributor of gunite and shotcrete equipment, accessories, and supplies for shotcrete and gunite construction, concrete repair, refractory applications, and mining. Gunite Supply primarily serves the dry-mix shotcrete/gunite industry by offering products ranging from full-size batch plants to the smallest parts and accessories.

Gunite Supply provides on-site material mixing solutions to gunite contractors through its line of batch plants. The company is the exclusive distributor of the AIRPLACO 914 dry-mix gunite batch plant. The AIRPLACO 914 allows contractors to mix gunite materials at the job site, eliminating the need for ready mixed deliveries. The 914 is used to mix sand (aggregate) with cement materials and deliver these materials to a gunite machine. The 914 is available as either a truck (914MB) or trailer (914MBT) unit and incorporates the AIRPLACO exclusive Hydraulic Ratio proportioning system and an efficient, low-maintenance hydraulic drive train.

The predecessor to the 914 batch plant is the Mix-Elvator® gunite batch plant. The Mix-Elvator was originally developed by AIRPLACO in 1955 to offer a self-contained gunite rig to contractors. The Mix-Elvator is sufficient for all sizes of contractors, from start-ups to established crews with a steady workload. The Mix-Elvator is available in three models: 432D, 634D, and 734LBD. Each operates on the same principle, which involves a cement bin, sand bin, series of augers, and hydraulic system working in concert to proportion and combine dry-mix shotcrete materials. Contractors can easily alter mixture proportions at any time using the machine's simplified controls. In addition to serving as a batch plant, the Mix-Elvator can be equipped with a predampening spray-bar system to reduce static electricity, dust, rebound, and wear in the machine's parts.

Corporate Member Profile

Gunite Supply offers three models of rotary gunite machines, including the classic Ridley and Cyclone™ brands. Both gunite machines are bowl-type gunite machines (as opposed to barrel-type machines). The Ridley C-10 is rooted in the early days of rotary gunite machine design dating back to the 1940s. It is available as either an air-powered or hydraulic-powered machine, one of the few gunite machines in the industry today to offer this hydraulic option. The hydraulic motor allows the gunite machine to receive power from the Mix-Elvator or 914 Mobile Batch plant. The Cyclone with its unique design, patented in 1972, is also a popular choice. It performs in open spaces and confined work areas alike, providing the mobility and power to meet the demands of many shotcrete applications.

Gunite Supply also offers a complete line of tools, parts, and accessories for the shotcrete contractor. Product categories include shotcrete hose (wet-mix), gunite hose (dry-mix), hose couplings (dry-mix), shotcrete clamps (wet-mix), gunite nozzles (dry-mix), shotcrete nozzles (wet-mix), plaster nozzles, and finishing tools.

Wet-mix shotcrete hose is available in green stripe fabric-reinforced or wire-reinforced hose with heavy duty or grooved end fittings. Dry-mix gunite hose is available in red stripe, blue stripe with enhanced flexibility, and white stripe refractory hose. Dry-mix hose couplings are offered with a choice of steel and aluminum components. Wet-mix shotcrete clamps (snap clamps) are available in all common line sizes—heavy duty or grooved.

Gunite Supply offers Ridley, Hamm, Spindet, and Double Bubble brand dry-mix gunite nozzles and parts. Nozzle bodies, tips, and liners are available for all common nozzle sizes. Wet-mix shotcrete nozzles are available with grooved or heavy-duty end fittings. Interchangeable poly-urethane or rubber nozzle tips for wet-mix shotcrete nozzles are available for specific spray patterns and applications. Stucco/plaster nozzles are also available in a variety of designs and lengths.

Gunite Supply offers a popular line of finishing tools for both wet- and dry-process shotcrete. Wood and aluminum finishing rods are offered for a range of shaping and finishing duties. A flexible finishing rod is available for smoothing over rounded surfaces after shotcrete placement. Gunite Supply features an assortment of fresnos for use on shotcreted floor or ground surfaces. Various trowels and floats are available for light finishing duties.

Other specialty accessories are available, such as water booster pumps for increasing water pressure on the job site, Jiffy-Jak scaffolding supports for creating an elevated work platform, gunite shooting wire (piano wire), J-hooks, water meters, pressure gauges, taps, cleanout accessories, air vibrators, line reducers, shotcrete additives, and primers.

Gunite Supply has launched the GUNITE STORE to offer online ordering of shotcrete tools, nozzles, and other accessories. The Web site at www.gunite.us allows shotcrete contractors to easily search through the catalog of tools and accessories. The site is set up to offer a completely secure environment for placing orders online. The GUNITE STORE is available 24 hours a day for convenience, accepts credit card payments, and calculates shipping to anywhere in the U.S.

Service and sales support are available by contacting any of Gunite Supply's three locations. Warehouses and showrooms in Monrovia, CA; Houston, TX; and Cincinnati, OH, create a regional presence throughout the U.S. and ensure a quick response to customer requests. In addition, a growing network of dealers and international reps are ready to assist in strategic distribution, logistics, and product support.

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Allentown Celebrates 100th Anniversary

Allentown Shotcrete Technology, Inc., a leading manufacturer of wet- and dry-process shotcrete equipment, is celebrating its one-hundredth anniversary in the sprayed concrete industry.

"In this day and age, very few companies are able to succeed in business for 100 years," says Patrick Bridger, president of Allentown. "We are very proud of our longevity, and see it as a testament to our reputation for quality, and the value we have brought our customers for a century."

As a pioneer in the field, Allentown's technology was first developed in the early 1900s when its originator Carl Akeley, a famous hunter and professor, devised a method for spraying plaster onto a wire frame for taxidermy purposes. Using compressed air, dry material was pushed through the nozzle of a gun-like device, where it was wet with water as it was blown onto a frame. The outcome was a strong, thick plaster coating that didn't slump from the frame or set before being fully placed.

The equipment was subsequently used to patch deteriorated concrete using a dry mixture of sand and cement. The results were excellent, and patents and trade names were applied for in 1910 for the new "cement gun" and the "gunite" material it produced.

This dry-process technique was used for the next 40 years, until a new process was developed in the 1950s that involved the use of pressure tanks to force stiff mortar through a hose. This new wet-process became known as shotcrete—and the rest is history.

Since then, the Allentown name has been synonymous with the process of spraying mortar at high velocity onto surfaces in the refractory, underground, mortar, and civil industries. The Allentown equipment line has expanded to include a wide range of gunning machines, predampeners, pumps, combination mixer-pumps, mixers, chemical additive pumps, nozzle carriers, mortar machines, concreting machines, and parts and accessories.

Throughout the years, Allentown has experienced numerous milestones, which have strengthened its position in the market:

1900s—Carl Akeley develops method for spraying plaster onto wire frames.

1910—First cement gun introduced at New York Concrete Show.

1911—Patents and trademarks issued for the cement gun and its gunite process.

1950s—Wet-process shotcrete application developed.

1960s—Dry-process rotary gun developed.

1970s—Swing-tube technology used on wet-process shotcrete equipment, making application and use more practical.

2007—Company acquired by Putzmeister America, Inc., resulting in most comprehensive line of sprayed concrete equipment. Name changed from Allentown Equipment to Allentown Shotcrete Technology, Inc.

2008—Allentown becomes exclusive U.S. distributor of the Sika/Aliva family of wet- and dry-process shotcrete equipment.

2009—Putzmeister America's Special Application Business forms partnership between Allentown, Esser Pipe Technology, and Maxon Industries, Inc., creating a comprehensive systems approach for tunnel and mining, dams and power generation, transportation, marine, and off-shore industries. MacLean Engineering develops new self-contained shotcrete spraying.

Specialty Contractor Melds 22 Separate Gunite Entities under US Gunite Brand

US Gunite of Keller, TX, a nationwide provider of pneumatically-applied concrete resources, announced the branding of all of its independently operated entities into one umbrella identity. With 22 companies, 450 employees, and more than 30 locations coast-to-coast, ownership determined that it was time to begin operating under one brand.

The various locations have been operating as separate identities under the Gunite moniker (for example, Metroplex Gunite, Southern Gunite, Tri State Gunite). "We've just rebranded so that all of the companies are now operating under the US Gunite banner," stated Jim Kinnebrew of US Gunite. "We've adopted a partnership model similar to law firms. Our CEO and Managing Partner, Leroy Hess, represents the entire company. In turn, each operating company is led by individual partners who have ownership in that particular company."

Kinnebrew explained that there are two primary advantages to this approach. "We have established local, home-grown relationships that a national centralized company typically won't have. When necessary, we have the capacity, equipment, and resources to shift resources from one location to another, or from several operations to cover an outlying area or large project."

The collective companies now operating under the US Gunite brand completed over 11,000 projects last year. The company's roots are in the residential and commercial pool business, but a number of new opportunities are opening up. Erosion control on hillsides and along seawalls, retaining walls for building foundations and civil projects, and repair of existing concrete structures are a few of the many solutions US Gunite is now providing for commercial, civil, and industrial customers.

"I want to stress that we're not moving away from our core business, we are adding to it. The same skill sets and capabilities required for blowing concrete in a commercial pool on the seventh floor of a building are equally important in any industrial or infrastructure project that requires concrete," stated Kinnebrew.

Founded in 1980, US Gunite has grown to over 30 locations and 70 crews nationwide. Specializing in both shotcrete (wet) and gunite (dry) applications, the firm serves as a highly experienced subcontractor to commercial contractors and pool construction companies.

Equipment Manufacturers Expect Slight Increase for 2010, Stronger Increases in 2011 and 2012

Construction equipment manufacturers expect overall industry business to turnaround slightly in 2010 following double-digit expected year-end 2009 declines in the minus-40-percent range for the U.S. and minus-30-percent range for Canada and other worldwide sectors, according to the annual outlook survey of the Association of Equipment Manufacturers (AEM). Survey respondents then anticipate stronger growth going into 2011, but not enough to erase the severe 2009 business and job losses.

Construction machinery business in the U.S. was predicted to end 2009 with a 43% overall drop and then increase 5% in 2010, followed by gains of 15% in 2011 and 14% in 2012.

For Canada, 2009 business was anticipated to decrease 34% overall with a 7% increase in 2010, a 14% increase in 2011, and an 11% increase in 2012. Industry business to the rest of the world was expected to close out 2009 with losses of 34%, followed by a gain of 7% in 2010 and a gain of 13% in 2011 and again in 2012.

DOT Stimulus Spending Tops $8 Billion

Payments by the U.S. Department of Transportation (DOT) to reimburse states for stimulus projects reached $8.101 billion as of January 8, 2010, up about $1.3 billion over December 2009.

The DOT, in the latest tally of federal agencies on the recovery.gov Web site, also said it has approved stimulus projects worth $32.926 billion. It is authorized to spend up to $48.1 billion under the American Recovery and Reinvestment Act.

The department ended 2009 having sent out stimulus checks totaling $7.955 billion. Most DOT spending under the stimulus measure is for road and bridge projects through the Federal Highway Administration, which has paid out $5.5 billion.

Other DOT funds go to airport repairs and transit system infrastructure or equipment needs. The DOT is also expected to soon award $8 billion for passenger rail system expansion and $1.5 billion in discretionary grants for projects deemed of national importance.

The entire stimulus package is projected to put $787 billion into the economy through construction projects, entitlement spending, and aid to states to cover some of their agency jobs and through tax reduction. Stimulus spending by all agencies as of January 8 totaled $167 billion.

Personnel News

Nick Dalis, Joseph J. Albanese, Inc., Named 2009 Keller*Online* Safety Professional of the Year

J. J. Keller & Associates, Inc., a leading national provider of risk and regulatory management solutions, has named **Nick Dalis**, Joseph J. Albanese, Inc., Santa Clara, CA, as the 2009 Keller*Online* Safety Professional of the Year (SPOTY). The SPOTY award is sponsored by Keller*Online*, a widely used safety management tool on the Web.

Dalis serves as the Director of Safety for Joseph J. (J.J) Albanese, Inc., which is a full-service, self-performing concrete contractor specializing in all aspects of site construction, including structural concrete, site concrete, masonry block work, shotcrete, grading/paving, demolition, sawcutting/coring, iron workers, trucking, and concrete pumping. When he took over as the Safety Director in 2001, the recordable injury rate at his company was 24.4. Through the efforts of himself, his growing team of field safety coordinators, and a top-down buy in to safety from the top executive to the laborer in the field, the company's recordable injury rate was reduced to 4.1 in 2009. In addition, the company's "ex-mod" rate decreased from 1.44 in 2005 to 0.83 in 2009 and their lost time accident rate went from 10.01 in 2003 to 0.41 in 2009. All of this occurred while increasing man hours worked from 861,848 in 2004 to 1,561,224 in 2008.

J.J. Albanese, Inc., is signatory to seven different unions, which can prove to be a struggle for any organization to manage. Communication, training, and accountability have been keys to the company's success in safety. In-depth and hands-on safety training for both new and existing employees ensures each employee's awareness of the safety philosophy of the company. The "three strikes, you're out" accountability system for safety violations alerts the Safety Department when more safety training is needed. The family-owned and operated business has an executive management team that truly believes in their safety culture, allowing Dalis to do his job more effectively.

Cemex Announces Senior Management Changes

CEMEX, S.A.B. de C.V. (NYSE: CX), has announced changes to its senior management team.

Fernando A. Gonzalez has been appointed Executive Vice President, Planning and Finance. Gonzalez, who has served CEMEX in a variety of executive capacities since 1989 and has been a member of the company's Executive Committee since 2003, will be responsible for all corporate strategic and developmental functions, including the company's relationships with capital markets.

In his new role, one of Gonzalez's key assignments is to execute the financial strategy that has been put in place over the past year. He has a wealth of operating, strategic, and financial experience, and will play an important role in taking full advantage of the upcoming recovery in the market.

Gonzalez, whose most recent position was Executive Vice President for Planning and Development, previously headed CEMEX's businesses in Europe, Middle East, Africa, Asia, South America, and Australia.

CEMEX also announced the retirement of **Hector Medina**, Executive Vice President of Finance and Legal, and **Armando J. Garcia**, Executive Vice President of Technology, Energy and Sustainability. Medina and Garcia each took advantage of an early retirement program for senior executives. Garcia remains a member of the Company's Board of Directors, on which he has served since 1983.

Mark Selway Appointed as Boral's Next CEO

Mark Selway

The Chair of Australian building products firm Boral Limited, **Dr. Ken Moss**, announced that the Board has appointed **Mark Selway** as the next Chief Executive Officer of Boral Limited.

Moss said Selway would replace **Rod Pearse**, who announced earlier this year that he would be retiring after 10 years at the head of Boral.

Moss said Selway has had an impressive career in the industrial sector with broad international experience and has a strong track record of world-class manufacturing excellence and growth through innovation and geographic expansion.

Selway has been the Chief Executive of the Weir Group PLC, a Scottish-headquartered, publicly listed engineering business, since 2001. Since Selway joined Weir, the business has been transformed into a highly focused industry leader in the design, supply, and service of engineered equipment for the oil and gas, mining, and power and industrial sectors.

"After a comprehensive international search, the Board is delighted to appoint Mark to the position of CEO as we feel his experience, track record, and capabilities are ideally suited to Boral's future development," Moss said.

"Boral remains a fundamentally strong company, and is well-positioned to benefit from the inevitable recovery from the current global economic downturn. Mark has proven leadership capabilities in competitive environments and a proven ability to deliver against both performance and growth imperatives."

"In his new role, Mark will be supported by a committed management team at Boral. He will work with Pearse and the rest of the team to ensure a smooth and seamless transition."

Boral Appoints New Head of U.S. Operations

Boral Limited has named **Mike Kane**, former Chief Executive of U.S. brick manufacturer Calstar Products, the new President of its U.S. operations.

"I am very pleased to welcome Mike to Boral's senior management team," said Boral Chief Executive Mike Selway. "Mike has a deep knowledge of the U.S. building and construction materials industry and he is very well placed to lead Boral's U.S. businesses as they recover from the current economic downturn."

Bekaert Announces Rodencal and Kunesh Promotions

T.R. Kunesh

Bekaert is pleased to announce that **Jeff Rodencal** has been promoted from General Manager–Building Products, for the U.S., Canada, and Mexico, to General Manager in Bekaert International Americas (BIA). Bekaert is also pleased to announce that **T.R. Kunesh** has recently been named the Dramix® Sales Manager for the U.S. and Canada. Kunesh has extensive experience in the construction industry, driving organic growth including sales and marketing positions with Oldcastle Precast, Somero Enterprises and Catalina Pacific Concrete. In his new position, Kunesh will be responsible for sales and marketing. He received his Bachelor of Arts degree from the University of California-Irvine in Southern California.

Dramix is a cold-drawn hooked-end steel wire fiber used for concrete reinforcement. Dramix reinforced concrete offers high ductility and load bearing capacity. Applications of Dramix steel fibers include industrial floors, precast elements, tunneling and mining, housing applications, and public works.

Bekaert (**www.bekaert.com**) is a European-based company headquartered in Belgium, employing 20,400 people. Bekaert is present in 120 countries and generates annual combined sales of more than $3.4 billion. Bekaert operates in advanced metal transformation and advanced materials and coatings.

Slag Cement Association Appoints Fiorato as New Executive Director

Tony Fiorato

"Tony brings a wealth of experience in the cement and concrete industries to the SCA," says **Angus Jappy**, President of the Slag Cement Association (SCA) and Vice President, Cementitious Materials, North America, Lehigh Hanson. "His depth of knowledge about sustainable construction and the role that slag cement can play in advancing green building solutions is a tremendous asset that we believe will enhance the performance and visibility of the SCA. He is a proven manager and we welcome his talents."

Tony Fiorato served as President and CEO of CTLGroup, an engineering, testing, and research firm, from 1999 until his retirement in 2007. From 1989 to 1999, he was Vice President of research and technical services for the Portland Cement Association (PCA). He joined PCA in 1973 as a Structural Engineer and served in a number of professional and management positions within the association and its subsidiary, CTLGroup.

Fiorato is a Fellow and Past President of the American Concrete Institute (ACI). He currently serves on ACI Committee 318, Structural Concrete Building Code, the ACI Standards Board, and the ACI Board Advisory Committee on ISO TC 71 on Concrete, Reinforced Concrete, and Prestressed Concrete. A Fellow of ASTM International, Fiorato currently serves on ASTM Committees C01, Cement; C09, Concrete and Concrete Aggregates; and E36, Laboratory and Inspection Agency Accreditation. He is Chair of Committee C09 and the Executive Committee of the Cement and Concrete Reference Laboratory. He served on the ASTM Board of Directors and was Chairman of the Board in 2006.

Fiorato was elected to the National Academy of Engineering in 2008. He is the recipient of a number of awards in recognition of his contributions.

ASCC Elects Officers and Directors

Clay Fischer, President, Woodland Construction Co., Jupiter, FL, has been elected first Vice President of the American Society of Concrete Contractors (ASCC), St. Louis, MO, for 2010-2011. **Scott Anderson**, Houston, TX; **Mike Poppoff**, Moxie, WA; and **Thomas Zinchiak**, Woodbine, MD, were reelected as Vice Presidents. **Harry Moats**, Douglasville, GA, was reelected as Secretary/Treasurer. **Peter Emmons**, Structural Group, Hanover, MD, and **Shawn McMahon**, McMahon Contracting L.P. Irving, TX, were elected as Directors.

The ASCC Safety and Risk Management Council (SRMC) reelected **Chris Pine**, Director of Construction, Webcor Concrete, Hayward, CA, as Council Director and **Steve Pereira**, Professional Safety Associates, Denham Springs, LA, as Secretary/Treasurer. **Keith Bauer**, Charlotte, NC; **William Bramschreiber**, Los Angeles, CA; **Michael Duncan**, Apopka, FL; **Rob Graham**, Los Angeles, CA; **Janet Greco**, West Babylon, NY; **Tony James**, Chicago, IL; **Sheri John**, Schofield, WI; **Bob Kent**, Little Ferry, NJ; **Dan Milinazzo**, Greeley, CO; **Michael J. Schneider**, Monroe, OH; **E. Byron Spencer**, Lombard, IL; **Charles K. Van Vliet**, Grand Rapids, MI; **Steve Williams**, Peoria, IL; **Scott Winkler**, Hamilton, OH; and **John Ylinen**, Tempe, AZ, were elected members of the SRMC Advisory Board. **Nick Adams**, Euclid Chemical Co., Cleveland, OH, is the new council director of the Manufacturer's Advisory Council.

ASCC is a nonprofit organization dedicated to enhancing the capabilities of those who build with concrete, and providing them a unified voice in the construction industry. Members include concrete contracting firms, manufacturers, suppliers, and others interested in the concrete industry such as architects, specifiers, and distributors. There are approximately 520 member companies across the U.S. and five foreign countries. For more information visit the Web site at **www.ascconline.org**.

Shotcrete Calendar

JUNE 6-9, 2010
ASTM International Committee C09, Concrete and Concrete Aggregates
Renaissance St. Louis Grand and Suites Hotel
St. Louis, MO
Web site: **www.astm.org**

JUNE 6-9, 2010
International Bridge Conference
Visit ASA at booth #607
David L. Lawrence Convention Center
Pittsburgh, PA
Web site: **www.eswp.com/bridge**

JULY 29- AUGUST 1, 2010
American Society of Concrete Contractors CEO Forum
Ojai Valley Inn & Spa
Ojai, CA
Web site: **www.ascconline.org**

SEPTEMBER 16-19, 2010
American Society of Concrete Contractors Annual Conference
Little America
Salt Lake City, UT
Web site: **www.ascconline.org**

OCTOBER 20-22, 2010
ICRI 2010 Fall Convention
Theme: "Transportation Structures"
Omn William Penn Hotel
Pittsburgh, PA
Web site: **www.icri.org**

OCTOBER 23, 2010
ASA Fall Committee Meetings
The Westin Convention Center
Pittsburgh, PA

OCTOBER 24-28, 2010
ACI Fall 2010 Convention
Theme: "Green Concrete in the Steel City"
The Westin Convention Center
Pittsburgh, PA
Web site: **www.concrete.org**

OCTOBER 25, 2010
ASA Fall Underground Committee Meeting
The Westin Convention Center
Pittsburgh, PA

OCTOBER 28 - NOVEMBER 2, 2010
2010 AASHTO Annual Meeting
Beau Rivage Resort & Casino
Biloxi, MS
Web site: **www.transportation.org**

OCTOBER 31 - NOVEMBER 5, 2010
International Pool, Spa, Patio Expo
Conferences: October 31-November 5
Exhibits: November 3-5
Mandalay Bay Convention Center
Las Vegas, NV
Web site: **www.poolspapatio.com**

DECEMBER 5-8, 2010
ASTM International Committee C09, Concrete and Concrete Aggregates
Sheraton New Orleans
New Orleans, LA
Web site: **www.astm.org**

JANUARY 17, 2011
ASA World of Concrete Annual Meetings
Las Vegas Convention Center
Las Vegas, NV

JANUARY 17-21, 2011
World of Concrete 2011
Seminars: January 17-21
Exhibits: January 18-21
Las Vegas Convention Center
Las Vegas, NV
Web site: **www.worldofconcrete.com**

JANUARY 18, 2011
The 2011 ASA Annual Membership Meeting & Sixth Annual Outstanding Shotcrete Project Awards Banquet
Las Vegas, NV

APRIL 2, 2011
ASA Spring Committee Meetings
Marriott Tampa Waterside & Westin Tampa Harbour Island
Tampa, FL

APRIL 4, 2011
ASA Spring Underground Committee Meeting
Marriott Tampa Waterside & Westin Tampa Harbour Island
Tampa, FL

Association News

ASA Officers Elected

With terms beginning February 2, 2010, the ASA membership has elected the following individuals to leadership roles in the association. **Patrick Bridger**, Allentown Shotcrete Technology, Inc., was elected to a 2-year term as President. **Joe Hutter**, King Packaged Materials Company, was elected to a 2-year term as Vice President. Elected to 1-year terms were Secretary **Michael Cotter**, Shotcrete Hydrodemolition Consultant, and Treasurer **Ted Sofis**, Sofis Company, Inc.

These four individuals, plus immediate Past President **Chris Zynda**, Joseph J. Albanese, Inc., will serve as ASA's Executive Committee.


Patrick Bridger


Joe Hutter


Michael Cotter


Ted Sofis


Chris Zynda

ASA Directors Elected

Four new ASA Directors were elected to terms beginning February 2, 2010. The new Directors are **William T. Drakeley Jr.**, Drakeley Industries, LLC; **Charles Hanskat**, Concrete Engineering Group, LLC; **Tom Norman**, Airplaco Equipment Company; and **Ray Schallom III**, Allentown Shotcrete Technology, Inc.

These individuals will join with five previously elected Directors (**Dan Millette**, The Euclid Chemical Company; **Ryan Poole**, DOMTEC International, LLC; **Howard Robbins**, Meadow Valley Contractors; **Marcus von der Heffen**, Johnson Western Gunite Company; and **Curt White**, Coastal Gunite Construction Company) and the ASA Executive Committee to form the 14-member ASA Board of Direction.


William T. Drakeley Jr.


Charles Hanskat


Tom Norman


Ray Schallom III

ASA Has Strong Showing at 2010 WOC

World of Concrete (WOC) 2010, held February 2-5, 2010, with seminars February 1-5, delivered another strong event with 5,108 registered professionals and 1354 exhibiting companies in more than 600,000 net ft² (55,741.8 m²) of action-packed exhibit space.

ASA premiered a new and larger 20 x 30 ft (6.1 x 9.1 m) booth at this year's show and results were very positive. Thousands of individuals visited the ASA booth gathering information and asking questions about shotcrete. In addition, ASA once again played a significant role in the show's seminar program. ASA Officers Michael Cotter, Shotcrete Hydrodemolition Consultant, and Raymond Schallom III, Allentown Shotcrete Technology, were the speakers for ASA's 3-hour seminar titled "Using the Shotcrete Process to Rehabilitate North America's Infrastructure." The seminar was very well received and the amount of interest and questions about shotcrete generated from the seminar was outstanding.

In the end, World of Concrete 2010 proved to be a significant opportunity for ASA to educate and promote the numerous benefits of the shotcrete process to an enormous crowd of interested concrete industry professionals.

ASA to Exhibit and Conduct Seminar at the 2010 IBC Show

ASA will, for the second year in a row, participate as an exhibitor at the 2010 International Bridge Conference (IBC) in Pittsburgh, PA, June 6-9, 2010. ASA will be in **Booth #607** on the main show aisle. ASA is also pleased to announce that it will be conducting a 90-minute workshop (an overview of the shotcrete process and how its versatility has lead to its growing use for the rehabilitation of bridges and other concrete structures) lead by ASA Officers Ted Sofis, Sofis Company Inc., and Joe Hutter, King Packaged Materials Company. The presentation is scheduled for Monday, June 7, 2010, at 1:30 p.m.

The IBC has proven to be a valuable tool for ASA in its efforts to communicate the exceptional advantages of shotcrete to both public officials and specifying professionals in the infrastructure industry.

For more information and/or to register for the show, visit **www.InternationalBridgeConference.org**.

2009 ASA Annual Committee Reports

At the heart of the ASA Annual Report (distributed at the Annual Meeting) are the yearly updates from each ASA committee. The ASA committees are the work horses of the association and responsible for all the advances made in educating and promoting the shotcrete process. Please take a few moments to read through the brief 2009 updates that follow. ASA also encourages you to become active in one or more of the ASA committees. Simply contact us at info@shotcrete.org for information on becoming involved.

Education Committee


Ray Schallon III

The Education Committee's original purpose was the establishment of the Shotcrete Nozzleman Education and Certification Program and the recruitment of ASA-approved Shotcrete Nozzleman Educators and ACI-approved Shotcrete Nozzleman Examiners. We currently have 31 ASA-approved trainers, 19 of which are also ACI-approved examiners, along with pending applicants to join the program.

The Shotcrete Nozzleman Education and Certification Program had another successful year in 2009, continuing its positive impact in the quality of shotcrete placed and the confidence of specifiers citing the shotcrete process.

The Education Committee is working hard on a number of initiatives including the development of a Shotcrete Inspector Training Program to support a planned ACI Shotcrete Inspector Certification Program, and the creation of a training session review/feedback form to be completed by individuals participating in ASA training sessions, with the purpose of identifying areas for improvement. The committee invites additional volunteers to help with the tasks planned in 2010.

Safety Committee


Chris Zynda

In the interest of safety within the shotcrete industry, the Safety Committee is continuing its work on a comprehensive safety manual. Numerous safety issues will be covered in the manual including job-site safety, personal protective equipment (PPE), equipment operation, scaffolding, nozzleman safety, finishing safety, lifting, environmental safety, safety training, and job-site safety meetings.

The Safety Committee is also working with OSHA on the creation of a Quick Card on shotcrete regarding soil/slope stabilization. Once finalized, the document will be added to the existing collection of free OSHA Quick Cards available to the public and distributed to all OSHA area and regional offices. OSHA Quick Cards are intended to be a simple and broad identification of safety concerns, while lending credence to the card's topic.

Marketing Committee


Joe Hutter

In an effort to grow our membership, the Marketing Committee focused most of its energy during its first 10 years on the marketing and promotion of the association. These efforts have paid dividends as the association has grown to include over 130 corporate members. Over the past couple of years, however, the committee has begun to change its marketing objectives to focus on the promotion of the shotcrete process as a preferred method of placing concrete. New marketing initiatives such as promotional PowerPoint presentations, new strategic advertisements, more industry-specific trade show participation, and a new trade show booth have been designed to promote the benefits of shotcrete, and in so doing, grow the shotcrete market.

2009 was a very busy year for the Marketing Committee. With dozens of projects and efforts in the works, a few of the highlights are as follows:

Outstanding Shotcrete Project Awards: Once again, our association began the year with its Annual Membership Meeting and Awards Banquet, giving all members of our association the opportunity to meet, socialize, and celebrate excellence in our industry. The evening was highlighted by the presentation of the Outstanding Shotcrete Project Awards in six categories, as selected by the 2009 Awards Committee. This issue of *Shotcrete* magazine features articles on each award winner. This new annual awards issue format will be a key tool for the association in its efforts to promote the shotcrete process.

ASA Web Site: Many improvements were made to this critical marketing tool, including the new Online Buyers Guide. Visits to ASA's Web site continue to grow at an amazing rate as a growing percentage of the world turns to

www.shotcrete.org as their first source for shotcrete information. Visits to the ASA Web site in 2009 totaled more than 125,000!

Online Buyers Guide: The new ASA Online Buyers Guide was launched in spring 2009. The guide has turned into the "go-to" tool for anyone in the construction world looking for shotcrete-related organizations. In 7 short months, Web traffic to the Buyers Guide grew to make it ASA's fourth most visited Web page, with 7000 views/searches.

New Products: The Marketing Committee continues to oversee the creation and release of new products aimed to help our members and to educate the concrete industry on the many benefits of the shotcrete process. New products in 2009 included *Shotcrete: A Compilation of Papers* (Rusty Morgan's papers) and the "Shotcrete for Repair and Rehabilitation of Concrete Structures" USB flashdrive product. The next USB product on mining and tunneling is due for release in 2010.

Press Releases: The Committee has also overseen the development of a new process to send press releases to the concrete industry on all significant events and actions of ASA. In 2009, 10 press releases were sent to and picked up by hundreds of concrete-related magazines and Web sites. These press releases are an important part of ASA's marketing strategy as the information in each release is eventually read by thousands of construction professionals.

Trade Show Exhibitions: In 2009, ASA added the International Bridge Conference (IBC) to the list of shows at which ASA now exhibits. The IBC offers ASA critical access to departments of transportation and other infrastructure-related organizations and professionals. The IBC, in addition to the International Pool, Spa & Patio Expo and World of Concrete, provided ASA with excellent exposure and access to critical areas for the shotcrete industry. The ASA Marketing Committee welcomes ideas from the membership and urges members wishing to influence the direction of the ASA Marketing Committee to come to a future Marketing Committee meeting.

Membership Committee

Patrick Bridger

While 2009 was a very difficult year economically for the construction industry, it has served as a testament to the outstanding commitment and support of our membership. Many associations saw double-digit percentage declines in their membership, but ASA's membership remained strong with a slight increase in total members.

The Membership Committee's commitment to increasing the value of membership continued with many new benefits added in 2009. Two of the most significant new benefits are as follows:

ASA Online Buyers Guide: As detailed in the Marketing Committee section, the creation of the ASA Online Buyers Guide has created a significant benefit for our Corporate Members. The online Guide averaged 1000 visits/searches per month of ASA Corporate Members.

Government Projects Open for Bid: ASA membership now includes access to shotcrete-related government projects open for bid. Links to these projects are sent in the twice-a-month member version of our new e-newsletter "What's In the Mix."

ASA now has members in 23 countries and we expect our international membership to continue to grow. With the creation of the new electronic version of *Shotcrete* magazine, the multiple-month-long delay in delivery of the physical magazine to members outside of the U.S. has been eliminated.

It is the membership support that has strengthened this association to what it has become today—an information center for shotcrete throughout North America and beyond. On behalf of ASA, I'd like to thank all the levels of membership for your support and contributions to the success of this association.

Pool & Recreational Shotcrete Committee

Tom Norman

The mission statement of this committee is to educate and promote the proper use and application of shotcrete to the swimming pool and recreational shotcrete industry.

The Pool & Recreational Shotcrete Committee has continued to promote and educate within the shotcrete pool industry along with other areas of shotcrete used for recreational settings, such as skateboard parks, miniature golf courses, rockscapes, water parks, zoos, and aquariums.

As we are all too aware, the pool-building industry has taken a pretty big economic hit within the past few years with the ever increasing mortgage foreclosures, rapidly declining home values, and the overall economic recession. To overcome these challenges in 2010, the pool and recreational industry are going to have to continue to work harder, smarter, and more efficiently! One of the most effective ways to accomplish these goals is to continue to support ASA with your annual membership and obtain ASA/ACI Shotcrete Nozzleman Certification for your crew. These two goals alone will give your company the networking opportunities and credentials to take your business to the next level of growth in these uncertain times.

This past year, the Pool & Recreational Shotcrete Committee has overseen continued publication of the Pool & Recreational Shotcrete Corner articles in *Shotcrete* magazine. Thank you to everyone who submitted project articles. Feedback has been positive, with a lot of interest from future contributing authors. If you have an article that you would like to submit for consideration, please do not hesitate to do so. Article submittal guidelines can be found on the ASA Web site at **www.shotcrete.org/ASA shotcrete_authors.htm**. Articles may be submitted to ASA at info@shotcrete.org.

This committee's focus and efforts in 2010 will include the committee task group, consisting of Ron Lacher and Chris Zynda, to review the education modules and text from the pool section with the goal of updating these slides.

The committee also seeks to educate the industry by increasing ASA membership through the committees' marketing efforts. Membership leads to education. ASA members have many educational resources available to them just by becoming a member, including the online Buyers Guide, FAQ section, and videos demos on the ASA Web site; *Shotcrete* magazine; and communication with other members and ASA staff.

Publications Committee

Howard Robbins

The mission statement of the Publications Committee is to "oversee publications for the promotion of association activities." We continue to successfully fulfill this mission.

The premier issue of *Shotcrete* magazine was published in February 1999 and this publication has grown to be the shotcrete industry's leading source of news and information. 2009 saw 1200 new subscriptions and our overall circulation of the physical magazine topped 10,000, with subscribers in 83 countries. The creation of the new electronic version of *Shotcrete* in 2009 opened up even greater opportunities for the magazine's reach internationally by eliminating the multiple-month-long delivery times.

The magazine's readership had a second significant jump in 2009 when an agreement was reached with ACI. ACI Student Members now receive a link to each new electronic version of *Shotcrete*. There are currently over 5000 ACI Student Members and growing. These future engineers, architects, and specifiers will now be familiar with the many advantages of shotcrete as they enter the concrete industry. The addition of the ACI students raises the combined readership of the physical and electronic versions of *Shotcrete* to over 15,000.

This issue of *Shotcrete* unveils the 1st Annual Outstanding Shotcrete Project Awards. Project descriptions serve as the feature articles. This issue also premiers a new regular department titled "Nozzleman Knowledge," containing tips and other information directed at nozzlemen.

The success of the this award-winning publication is due in part to the hardwork of the Publications Committee that meets in the fall and spring of each year to plan for the future issue themes and issue content to address current industry trends and needs. It is notable that all the content associated with each issue is generated through members of the Publications Committee.

One great feature of each issue is the Corporate Member Profile section. This is an outstanding opportunity to reach thousands of potential customers by providing information on your company and its products and services. The committee encourages every Corporate Member that has not already done so to take advantage of this by creating your company profile and submitting it for publication.

Sustainability Committee

The first meeting of the ASA Sustainability Committee took place at ASA's Fall Meetings in New Orleans, LA, in November 2009. The meeting was a great start for this new ASA endeavor.

Charles Hanskat

A number of important first steps were completed, not the least of which was the appointment of a committee chair. With strong support from the entire committee, Charles Hanskat, Concrete Engineering Group, LLC, Northbrook, IL, was appointed the committee chair.

With the committee infrastructure now established, the Sustainability Committee will begin work on a number of short- and long-term objectives. One of the first efforts will be to work with the U.S. Green Concrete Council (USGCC), a for-profit subsidiary of ACI, on the development of two chapters in an important new book for the entire construction industry. The book, with a planned release in fall 2010, is titled *The Sustainable Concrete Guide: Applications* and will serve as a reference for the architect/engineer on how best to use concrete products and systems in a sustainable manner. The ASA Sustainability Committee will be working with the USGCC to create material for planned chapters on shotcrete and concrete repair.

The Sustainability Committee will also be the focal point for ASA participation in the concrete industry's Joint Sustainability Initiative (JSI). In August, the ASA Board voted to become a full partner in the JSI coalition. JSI's mission is to present a unified industry approach and promotion of concrete and its sustainability benefits.

ASA's participation in this effort not only strengthens the overall concrete industry, but also helps further the recognition of shotcrete as a key component of the concrete world. This will be further realized as this new effort produces education materials, including the previously mentioned book *The Sustainable Concrete Guide: Applications*.

Longer-term objectives for the new Sustainability Committee will focus on identifying and quantifying the sustainability benefits of shotcrete. These benefits will be used in ASA's promotion of shotcrete and in the creation of a document listing and explaining these benefits for use by our members as they compete on projects against other construction processes and materials.

Underground Committee

Dan Millette

As 2009 drew to a close, the Underground Committee completed its work on the creation of the second in an ASA series of USB flash drive products. This USB product will focus specifically on shotcrete's role in mining and tunneling. This new and important tool will be available for sale in 2010.

The Underground Committee is also working on expanded promotion of the Underground Shotcrete Education Program to improve and ensure the quality of underground construction projects. This program provides the basics of the shotcrete process to include materials selection and testing, basic equipment requirements, skill requirements for the nozzlemen and crew, proper shotcreting techniques, and safety considerations in the underground environment. Educators are selected on the basis of their experience and knowledge of the use of shotcrete for ground support. Currently, ASA has six Underground Shotcrete Educators.

ASA Annual Meeting and Awards Banquet

The ASA Annual Meeting and Awards Banquet has grown to be a fixture at the yearly World of Concrete show. This year's event was not only a great time for those attending, but also an outstanding opportunity to show off the versatility and high quality of some of the shotcrete work completed in 2009. If you have not attended this event in the past, do yourself a favor and plan to attend in 2011. This is a must for anyone in or related to the shotcrete industry.

ASA extends a special thanks to our Big Shooter sponsors American Concrete Restorations, Inc., and Spec Mix, Inc., as well as to all of our banquet and awards sponsors (see list on page 5). Their leadership and commitment to the shotcrete industry made this event and the Outstanding Shotcrete Project Awards possible.













ASA's New Sustainability Committee Needs Your Help

ASA recently established a Board committee to help address how shotcrete can provide improved sustainability of concrete structures. The U.S. Green Concrete Council (USGCC), a division of Creative Association Management (CAM)—a wholly-owned subsidiary of the American Concrete Institute (ACI)—is developing a book to help members of the construction team, including owners, architects, engineers, and contractors, understand how concrete provides significant benefits for sustainable "green" construction. The book, *The Sustainable Concrete Guide: Applications*, will include details on how various concrete applications can be used sustainably. ASA has been asked to contribute to chapters on shotcrete and repair.

The ASA Sustainability Committee has started compiling material for the book and would like your help. **We are looking for any case studies on projects you have worked on where shotcrete provided sustainability benefits.** Specifically, the committee has identified these four areas where shotcrete seems to have a major sustainability advantage when compared to cast-in-place concrete:

1. Reduction of formwork;
2. Increased speed of construction;
3. Repair with shotcrete allowed extension of service life; and
4. Thinner, more efficient structures.

So, if you have any projects where you have documented savings in any of these four areas, please write up a short description of the project, including the benefits in cost/time/materials, and send it to us. For example, you may have had projects where:

- you bid against cast-in-place work and the shotcrete solution saved 50% of the formwork;
- more flexible sequencing with shotcrete decreased the overall time for completion by 25%;
- the more traditional form and pour methodology wouldn't have worked, but shotcrete could; and
- use of shotcrete allowed continued occupancy during rehabilitation that shoring, forming, and casting may have prevented.

Along with the short text write-up of the project, it would be very helpful to have pictures that showcase the project and the work being done. Please send your case studies to Chris Darnell at Chris.Darnell@shotcrete.org.

U.S. Green Concrete Council Unveils New Guide on Sustainable Concrete

The U.S. Green Concrete Council (USGCC) recently unveiled its new book, *The Sustainable Concrete Guide: Strategies and Examples*, during a press conference at World of Concrete in Las Vegas, NV.

The first-ever comprehensive resource on concrete and sustainability, *The Sustainable Concrete Guide: Strategies and Examples* provides insight on specific strategies for the best use of concrete in high-performance, long-lasting, green buildings. Included in the guide are case studies, technical data and references, and numerous practices that can be implemented immediately. The guide is divided into three parts.

Part 1—"Concrete Basics for Sustainability" provides information that outlines the uses of concrete as the most widely used building material in the world.

Part 2—"Considerations for Best Use of Concrete for Sustainable Structures" consists of 11 chapters on specific uses of concrete for sustainable structures:

Chapter 1—Carbon footprint
Chapter 2—Thermal transmission
Chapter 3—Thermal mass and storage
Chapter 4—Longevity and service life
Chapter 5—Stormwater management
Chapter 6—Human factors and the living/working environment
Chapter 7—Safety and security
Chapter 8—Reduce, reuse, recycle
Chapter 9—Economic impact
Chapter 10—Resilience with climate change
Chapter 11—Compatibility with other innovative sustainability strategies

Part 3—"Beyond Sustainable Rating Systems: Project Profiles" features 12 specific construction projects throughout the U.S., all of which use sustainable concrete practices and techniques. Included are profiles of three specific types of structures: parking structures and parking lots; single-family and multi-family residential structures; and commercial, institutional, and industrial structures.

The book is authored by Andrea J. Schokker, Professor and Head of the Civil Engineering Department at the University of Minnesota Duluth. Schokker is a member of the American Concrete Institute (ACI) Board of Direction and is Chair of ACI Committee 130, Sustainability of Concrete. She is also a member of many other ACI committees, including a subcommittee of 318, Structural Concrete Building Code, and Joint ACI-ASCE Committee 423, Prestressed Concrete.

"Green building practices have been in the spotlight for quite some time in the U.S. and around the world," said Schokker. "*The Sustainable Concrete Guide: Strategies and Examples* is a first-of-its-kind guide that fills the pressing need for a comprehensive source on implementing sustainable concrete building practices and techniques immediately. This book presents real-world examples that can be used to guide any engineer, architect, specifier, building owner, or contractor who is interested in learning

how to most effectively and efficiently integrate concrete in durable and sustainable structures."

The U.S. Green Concrete Council (USGCC) editorial review panel, chaired by ACI President Florian Barth, also played an integral part in the creation of the book. Other panel members include Michael Deane, Vice President and Chief Sustainability Officer at Turner Construction Company; Kevin MacDonald, Vice President of Engineering Services at Cemstone; Aris Papadopoulos, CEO of Titan America; Michael Paul, Lead Structural Engineer and Senior Consultant for Duffield Associates; Richard Stehly, Vice President of ACI and Principal of American Engineering & Testing; and Wayne Trusty, President of Athena Institute International.

USGCC was established in 2009, with the purpose of disseminating information on sustainable concrete. The organization aims to satisfy the immediate demand for resources on the role of concrete in sustainable buildings and to facilitate the development of additional sustainability-related consensus documents. USGCC is a division of Creative Association Management (CAM), a wholly-owned subsidiary of ACI. *The Sustainable Concrete Guide: Strategies and Examples* is the first in a series of sustainable concrete guides to be published by USGCC. The second is expected to be available in fall 2010.

For more information on this important new book and USGCC, visit **www.USGreenConcreteCouncil.com**.

Industry-Wide Concrete Collaboration Unveils Initiatives to Put Sustainable Messages into Action

Partnership comprises nearly 30 concrete associations including the American Shotcrete Association

The Concrete Joint Sustainability Initiative (Concrete JSI) recently unveiled its 2010 goals and initiatives to align sustainable development activities within the concrete industry.

Formed in 2009, Concrete JSI is a unified group of 26 concrete associations dedicated to promoting the sustainable attributes of concrete as a building material. Initially chartered by the American Concrete Institute (ACI), National Ready Mixed Concrete Association (NRMCA), and the Portland Cement Association (PCA), the group was formed to align advocacy, technology, and educational resources related to concrete sustainability.

"This never-before-seen collaboration of the many market segments of the concrete industry will bring together its diverse resources to convey the social value of building sustainable homes, roads, schools, and other structures," said Aris Papadopoulos, Vice Chairman of the PCA Board of Directors and Chair of the Concrete JSI.

Concrete JSI 2010 activities include the distribution to the industry of a series of nine PowerPoint presentations that communicate the purpose of the partnership and discuss each of the eight social values of concrete, as defined by Concrete JSI. Member organizations of Concrete JSI will use these

Concrete Joint Sustainability Initiative

presentations to introduce both internal and external audiences to the shared message of concrete sustainability. The presentations are available on Concrete JSI's new Web site, **www.SustainableConcrete.org**.

The Web site, in addition to being a resource center for the members of Concrete JSI, serves as the industry's primary portal for educational and outreach efforts related to the sustainability of concrete structures. Included are links to the sites of all member associations.

Concrete JSI is also mapping out the research and development programs of each of its member organizations to identify synergies, overlaps, and gaps to further develop and refine the research base related to concrete sustainability. The result will be a minimization of the duplication of activities among the member organizations and the further cooperation in areas of technical committees, educational seminars, publications, certification, marketing, and other related activities pertaining to sustainable development.

As the group moves forward with its initiatives, it also plans to maintain a presence at major sustainable building events and to magnify the industry's visibility and impact on green building practices.

"The concrete industry has reacted positively and implemented many improvements in sustainable development," said Florian Barth, ACI President and Vice Chair of Concrete JSI. "By ratifying this agreement, we not only agree to work together but also establish that we have the same vision to share this planet responsibly."

All Concrete JSI member organizations have signed the charter "Joint Declaration of Industry Vision for a Sustainable Future." The charter contains nine declarations that provide guiding principles for member organizations. At the charter's core are eight specific social values concrete structures contribute.

1. Conserve Resources: Concrete structures, throughout their life cycle, are efficient users of energy, water, land, and other resources.
2. Safer Living: Concrete structures provide a superior level of user safety, protection, and peace of mind.
3. Lower Cost: Concrete structures provide economic advantage both from a total cost of ownership perspective and from greater local content benefit to communities.
4. Protect Communities: Concrete structures offer greater disaster resistance, protecting essential community services and business continuity.
5. Durability: Concrete structures outlast the useful lives of other structures with minimal maintenance and repair.
6. Reduce Waste: Concrete structures, throughout their life cycle, produce a reduced level of by-products (including CO_2), use the by-products of other activities, and can ultimately be recycled themselves.
7. Beauty: Concrete structures can be designed to create esthetic quality for both users and their surroundings.
8. Connecting People: Concrete structures provide the essential links (for example, roads, bridges, ports, and utility infrastructure) that enable society to function safely and efficiently and to prosper financially.

NRMCA selects speakers for 2010 Concrete Sustainability Conference

The National Ready Mixed Concrete Association (NRMCA) has selected speakers for the 2010 Concrete Sustainability Conference, scheduled for April 13–15, 2010, in Tempe, AZ.

The conference, sponsored by NRMCA and the School of Sustainable Engineering and The Built Environment at Arizona State University (ASU), will feature more than 50 speakers.

Several prominent keynote speakers will present during the opening and closing general session. **Dr. Paul Johnson**, Executive Dean of the Ira A. Fulton School of Engineering, will discuss how ASU has become one of the most sustainable universities in the U.S. **Mark Wilhelm**, Principal of Green Ideas Environmental Building Consultants, will provide an update on the LEED Green Building Rating System. **Wayne Trusty**, President of Athena Institute, will present how life-cycle assessment can measure environmental performance. **Dr. Franz-Josef Ulm**, Professor in the Department of Civil and Environmental Engineering at the Massachusetts Institute of Technology (MIT), will present work being done at the MIT Concrete Sustainability Hub to improve the efficiency of cement and concrete through nanotechnology.

This fifth annual conference will provide learning and networking opportunities on the latest advances, technical knowledge, continuing research, tools, and solutions for sustainable concrete manufacturing and construction. Examples of topics include Measuring Stormwater Quality Improvement through Pervious Concrete Paving, Recycling Carbon Dioxide into Concrete, and The Influence of City Street Pavement Type on Fuel Consumption and Emissions. A complete list of topics and presenters is available at **www.SustainabilityConf.org**.

RMC Foundation Releases Sustainable Concrete Plant Guidelines

The RMC Research and Education Foundation is proud to announce the release of a new tool for the concrete industry: "Sustainable Concrete Plant Guidelines." The guidelines were developed by West Main Consultants and **William C. Twitty Jr.**, with guidance from NRMCA's **Lionel Lemay**, Senior Vice President–Sustainable Construction. The concept behind the development of the guidelines was to further the efforts underway within the concrete industry in the sustainable development field and assist producers by providing additional resources on how to make their own plants and operations more sustainable. The guidelines will be an evolving document, and we seek comments from industry representatives on this released version and the supporting materials.

"Concrete by its very nature is a very sustainable material. These guidelines are a great tool for producers to identify ways to enhance their manufacturing processes to make concrete even more sustainable," said **James Repman**, Foundation Chair. Repman also noted, "These guidelines complement the other environmental and sustainability initiatives already established within the industry and allow producers to augment those efforts." Foundation Executive Director **Julie Garbini** agreed and added, "This document gives producers performance-based metrics by which to measure and demonstrate the sustainability of their operations. It provides specific guidance on how to assess energy and resource consumption for continuous improvement. We are proud to add this new deliverable to the many other sustainable development-related research studies, reports, and tools available from the foundation."

The "Sustainable Concrete Plant Guidelines" and supporting materials are available for download from the foundation's Web site at **www.rmc-foundation.org**. Additional resources are available on the Foundation's Research to Support Sustainable Development CD. The mission of the RMC Research and Education Foundation is to support research and educational programs that will increase professionalism and quality in the concrete industry.

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REED Introduces Dust Extractor Gunite Machine Accessory

REED's new Intermediate Dust Extractor is used with REED Gunite machines on very confined job sites where dust extraction is required (tunnels, mines, and refractory jobs).

The Intermediate Dust Extractor was designed to handle very fine cementitious dust particles. As with all other REED shotcrete equipment, it was built to withstand harsh job-site conditions. The skid-mounted Intermediate Dust Extractor can be ordered as either air powered or electrically driven. The palletized transportation dimensions are 649 lb (295 kg), 63 x 47 x 67 in. (1600x 1200 x 1700 mm).

Standard features include a Turbo Series super-duty cartridge filter; cylindrical collection center; integral reuse access panel; heavy-duty quick-release hood for easy filter removal; and a high efficiency, mild pressure, curved-lip centrifugal fan with self-cleaning action. Complete specifications can be found at **www.reedpumps.com/pdf/reeddustextractor-021810.pdf.**

REED Shotcrete Equipment is an independent member of the J.F.Shea Co., a $3 billion-plus, southern California-based building and construction firm in its second century of operation. For more information on the new Intermediate Dust Extractor, contact REED at (909) 287-2100 or mike.newcomb@reedmfg.com.

Boulderscape Launches New and Enhanced Web Site

Boulderscape Inc., the nationwide leader in sculpted retaining wall finishes, is pleased to announce the launch of its newly resurfaced Web site, **www.boulderscape.com**. The new site

was designed to increase functionality for clients and is complete with comprehensive photo galleries, videos, case studies, and technical information.

"Our goal was to provide architects, designers, engineers, and DOTs with a more functional space to interact with our product online," said **Steve Jimenez**, Senior Vice President of Boulderscape's Commercial Division. "By putting photos and specs directly in their hands, we hope to empower designers and owners with more information than ever before. Ultimately, we believe this information will lead them to discover the most ideal finish for their particular situation and need."

Sculpted shotcrete finishes are extremely popular facing choices on retaining walls for their cost-saving properties. A sculpted Boulderscape finish can, for example, provide savings of as much as 30 to 40% when used instead of a cast-in-place or form-liner finish. Most Boulderscape sculpted finishes can also be installed in approximately half the time of more expensive alternatives. This combination of cost and time efficiency makes them an ideal choice for owners and general contractors alike.

"When people see the new site, I think they'll not only be surprised at the diversity of styles and breadth of options that can be achieved via the sculpting method, but also by the several types of retaining systems to which our finishes can be applied," says Jimenez.

Boulderscape offers its shotcrete sculpting services nationwide and can be contacted by phone at (949) 661-5087. For more information, visit **www.boulderscape.com**.

ACI Announces the Availability of Three Resources Designed to Educate and Inform Concrete Contractors and Craftsmen

The *Contractor's Guide to Quality Concrete Construction*, a joint publication of the American Society of Concrete Contractors (ASCC) and the American Concrete Institute (ACI), has been released. The book provides insight into proven construction practices that will produce quality concrete construction. Topics covered in the guide include

organizing for quality, concrete mixture proportioning, specifications, foundations, formwork, reinforcement and embedments in structures, joints and reinforcement for slabs-on-ground, preparing for concreting, concrete placing and finishing, common field problems, and safety.

The audio version, which is available in CD-ROM (set of six) and MP3 formats, is accompanied by a printed supplement containing figures, tables, and checklists from the hard copy document. It is perfect for contractors and engineers who want to educate themselves while in the convenience of their home, office, or vehicle.

"Specification for Ready Mixed Concrete Testing Services (ACI 311.6-09)" establishes the requirements for testing of ready mixed concrete delivered to a project site. It includes requirements for making and curing test specimens, performing field and laboratory tests, and qualifying personnel and laboratories.

"Our industry has been waiting for a specification for testing ready mixed concrete, which can easily be incorporated in contract specifications," said Mike Russell, Chair of ACI Committee 311, Inspection of Concrete. "Specifiers will appreciate the mandatory and optional requirement checklists included in this specification."

"Report on Glass Fiber-Reinforced Concrete Premix (ACI 549.3R-09)" summarizes the current knowledge of materials, manufacturing methods, engineering properties, and applications of glass fiber-reinforced concrete premix.

"Glass fiber-reinforced concrete premix technology is unique as it offers significant advantages over conventional construction technologies," said Ashish Dubey, Chair of ACI Committee 549, Thin Reinforced Cementitious Products and Ferrocement. "This state-of-the-art report, produced by international subject-matter experts, is intended to increase awareness of producers, engineers, specifiers, and users about the glass fiber-reinforced concrete premix technology and its use in a variety of applications."

This report introduces glass fiber-reinforced concrete (GFRC) premix and reviews the state of knowledge regarding selection of materials, mixture proportions, and manufacturing methods for producing premix products. Also highlighted is a diverse range of GFRC premix applications from around the world and dry-bagged premix materials that are used in surface bonding, stucco, and certain shotcrete applications. Available in hard copy or PDF format.

To learn more or to order any of these documents, visit the ACI Bookstore at **www.concrete.org**.

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: *I have reviewed ACI 506R, "Guide to Shotcrete," and 506.5R, "Guide for Specifying Underground Shotcrete," but was unable to find specific criteria pertaining to shotcrete protection for reinforcing steel. Would the clear cover then be based on ACI318 Section 7.7.1 for cast-in-place concrete? For underground structures, would 3 in. (76.2 mm) of clear cover from ground be required?*

Answer: Shotcrete is concrete, and therefore if designing structures based on the ACI 318 Code, cover for conventional reinforcing steel should be those suggested in ACI 318 for concrete against ground. If the shotcrete is a "temporary" support, with further placement of "final" support, then these requirements do not apply.

Question: *I have a question on cold weather shotcreting. I have heard that for shotcrete operations, the ambient temperature has to be 40°F (4.4°C) and rising. I am on a job, and the inspector said it only needs to be 35°F (1.67°C) and rising. The high for the day is expected to be around 45°F (7.2°C), then fall back into the high 20s F (–4 to –1.67°C). What would be your advice?*

Answer: Shotcrete is concrete and the same rules apply with respect to cold weather applications. Cold weather is defined in ACI 306R, "Cold Weather Concreting" as "a period when, for more than 3 consecutive days, the following conditions exist: 1) the average daily air temperature is less than 40°F (4.4°C) and 2) the air temperature is not greater than 50°F (10°C) for more than one-half of any 24-hour period." ACI 306R is an excellent reference that provides recommendations for cold weather concrete placement and protection. A copy of ACI 306R can be purchased online at ACI's Web site, **www.concrete.org**, from the Bookstore and Publications tab. You can also download articles regarding cold weather placement from ASA's Web site, **www.shotcrete.org**—click on "*Shotcrete* magazine," go to the article search page, and type in "cold weather."

Question: *One of our clients has a 65.6 ft (20 m) tall mechanically supported earth (MSE) wall (to dump the ore from the mine into the crushers). The wall is about 984.25 ft (300m) long and has approximately 30-degree slopes on both ends, like a pyramid. These slopes have eroded over the last 8 years of operation and some of the wall reinforcing is exposed. We want to stop the erosion and stabilize the slopes. The instructions issued to the contractor are: level the slopes; fill the voids; compact; apply shotcrete (maximum 1 in. [25mm]). The area in question is 6.6 x 65.6 x 131.2 ft (2 x 20 x 40m). Is shotcrete application in this case appropriate? Can you forward information on experts we could consult on?*

Answer: Shotcrete is well suited to the application you have described. You need to determine the characteristics that you want from the shotcrete (strength, toughness, freeze-thaw durability) and include these in the specification.

The 1 in. (25 mm) seems very thin for a long-term installation. Please be aware that the material costs (in most cases) will be a small part of the total cost of the installation. You should also make sure that you have a good specification for surface preparation. If the existing surface is not properly prepared, the added shotcrete will not bond well and the installation will not last very long.

The ASA Online Buyers Guide (**www.Shotcrete/BuyersGuide**) is an excellent source to locate members within the field of shotcrete whom are listed as shotcrete consultants.

Question: *Type CA and FA shotcrete are two classifications listed in ASTM C1480. What is the application of these two types of shotcrete?*

Answer: Type FA shotcrete uses a fine aggregate meeting the requirements of ASTM C1436 Gradation #1. Type CA shotcrete uses a combined aggregate gradation meeting the requirements of ASTM C1436 Gradation #2. The decision on which type to use depends on the application, shotcrete thickness, specification requirements, and perhaps the shotcrete equipment to be used, that is, wet- or dry-process. For example, one may want to use Type FA if using dry-process equipment and placing thin sections, or when a smooth finished surface texture is required. For thicker sections, Type CA shotcrete may provide the best properties for the application. The choice of which to use depends on the application, equipment, and experience of the contractor.

Question: *How soon after shootinga pool shell can formwork be removed? How soon can tiling begin?*

Answer: Vertical formwork can generally be removed the day following the shotcrete installation. If the formwork is supporting a load like a soffit form, the form should not be removed until the shotcrete has attained full strength such that it can support the weight of the member.

Your question regarding the installation of the tile should be directed to a professional who installs tile.

Question: *We have an approximately 9500 ft² (882.6 m²) pool that was built and finished in midsummer. Four weeks later, the pool has developed "spider web" cracking in the bottom. We need to have a compressive strength test done. Our crew is on site now and is going to pull a 4in. (1016 mm) core sample for testing. I need to know what procedure to follow and where to send the sample for testing.*

Answer: Consult with a local engineering firm that is qualified to develop a coring plan, obtain cores, and perform testing in accordance with ASTM C42/C42M or ASTM C1604/C1604M. Please refer to ASTM C42/C42M for further guidance.

AMERICAN SHOTCRETE ASSOCIATION

ASA Membership Benefits

	Corporate	Corporate - Additional Individual	Individual	Employees of Public Authorities or Agencies	Nozzleman	Student
Annual Dues	$750	$100	$250	$50	$50	Free
Subscription to quarterly *Shotcrete* magazine (Hard Copy)	X	X	X	X	X	
Electronic Subscription to quarterly *Shotcrete* magazine	X	X	X	X	X	X
Company & specialty information listed in ASA's online Buyers Guide	X					
Company & specialty information listed in *Shotcrete* magazine's annual Buyers Guide	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
Discount on ACI Nozzleman Certification program	X					
Free advance general admittance registration to World of Concrete	X	X	X	X	X	X
Complimentary ASA shotcrete brochure each year	25		1	1		
Complimentary ASA reflective hardhat sticker each year	10		1	1		
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 Member pricing on advertising in *Shotcrete* magazine	X	X	X	X		
Free logo and link advertising on ASA website homepage for duration of each issue you advertise in Shotcrete	X					
Opportunity to submit items for Industry News and New Products & Practice sections of *Shotcrete* magazine at no charge	X	X	X	X		
Voting privileges at meetings and director/officer elections	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 become a shotcrete educator	X	X	X	X	X	
All company employees have opportunity to receive discounted Corporate Additional ASA Memberships ($150 off regular membership price for each employee)	X					
Opportunity to submit entries into the annual Outstanding Shotcrete Project Awards Program	X					
Discount on ASA Underground Shotcrete Education Program	X					
ASA Promotion of nozzleman certification on a national basis in conjunction with ACI					X	
Education & promotion of your shotcrete industry to the overall concrete industry	**X**	**X**	**X**	**X**	**X**	**X**

AMERICAN SHOTCRETE ASSOCIATION

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- ❑ 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
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- ❑ Mining/Underground
- ❑ Parking Structures
- ❑ Pumping Services
- ❑ Refractory
- ❑ Repair/Rehabilitation
- ❑ Residential

Contractors, contd.
- ❑ Rock Bolts
- ❑ Rock Carving
- ❑ Seismic Retrofit
- ❑ Sewers
- ❑ Skateparks
- ❑ Slope Protection/Stabilization
- ❑ Soil Nailing
- ❑ Storage Tanks
- ❑ Structural
- ❑ Swimming Pools/Spas
- ❑ Tunnels
- ❑ Walls
- ❑ Water Features

Equipment
- ❑ Accessories
- ❑ Adaptors
- ❑ Air Vibrators
- ❑ Bowls
- ❑ Clamps
- ❑ Compressors
- ❑ Couplings
- ❑ Feeder/Dosing
- ❑ Finishing
- ❑ Grouting

Equipment, contd.
- ❑ Guide Wires
- ❑ Gunning Machines
- ❑ Hoses
- ❑ Mixers
- ❑ Nozzles
- ❑ Pipe/Elbows/Reducers
- ❑ Plastering
- ❑ Pre-Dampers
- ❑ Pumps
- ❑ Robotic
- ❑ 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

American Shotcrete Association

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Please send information on the products or services circled below:

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Spring 2010

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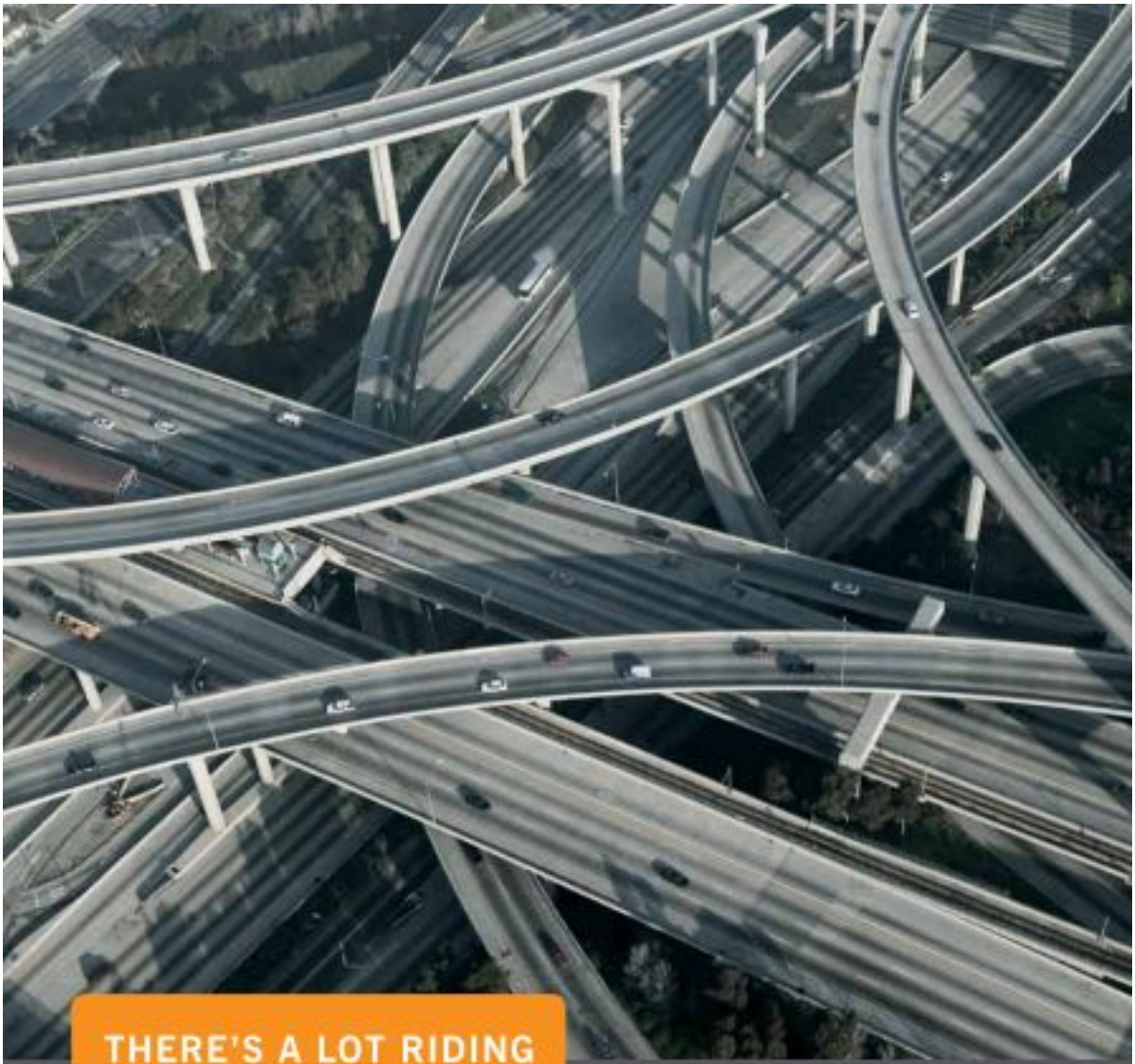

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