

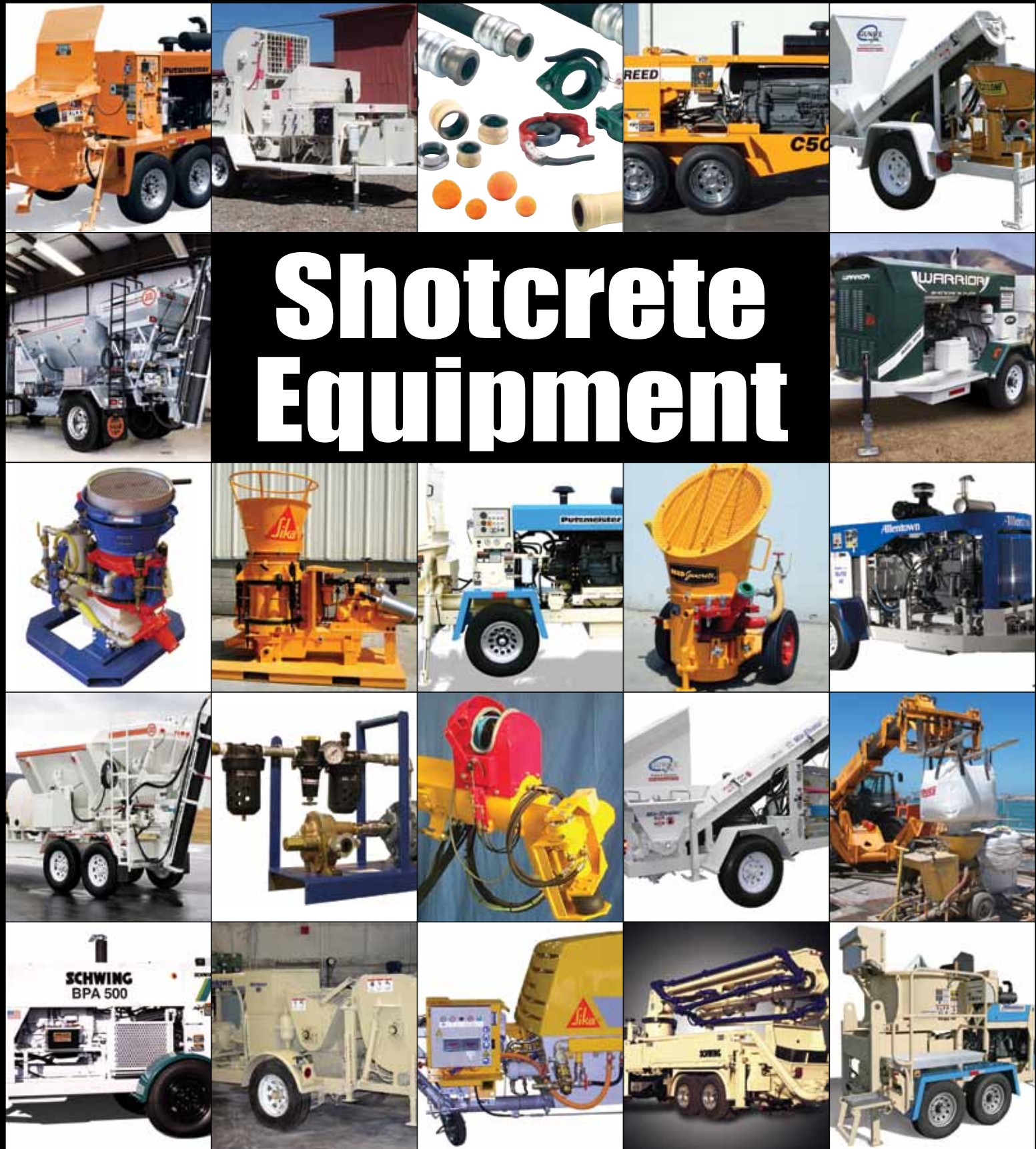
# Shotcrete

A quarterly publication of the  
American Shotcrete Association

# MAGAZINE

Volume 11, Number 3 ♦ Summer 2009

## Shotcrete Equipment





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**American Shotcrete Association**

38800 Country Club Dr.

Farmington Hills, MI 48331

Phone: (248) 848-3780 • Fax: (248) 848-3740

E-mail: [info@shotcrete.org](mailto:info@shotcrete.org)

Web site: [www.shotcrete.org](http://www.shotcrete.org)

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Graphic Design Susan K. Esper, Colleen E. Hunt,  
Ryan M. Jay, Gail L. Tatum

Editing Carl R. Bischof, Emily H. Bush,  
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# Shotcrete

Volume 11, Number 3  
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**MAGAZINE**

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*Shotcrete equipment photos provided by equipment suppliers and/or Corporate Members of ASA.*



*Shotcrete—A Proven Process for the New Millennium*

## A Race Car with No Name

By Chris Zynda



As some of you know, I have a few out-of-the-ordinary hobbies. At the top of that list is my love of drag racing.

Armed with a pure, all-white '49 Chevy race truck, we started out as the new guys in town. We had limited experience, no track record, a truck with no name, and no sponsors.

The first year was tough. We kept breaking down and the driver (me), had no idea what he was doing. Throughout that year, I couldn't help but notice that all the other race cars had the logos of their sponsors proudly displayed. This was a sign of credibility to me. These teams were immediately recognized as legitimate and reliable as a result of their sponsors.



The second year we started winning and getting noticed, but there was still something lacking. One day I went down to the local GMC dealer and made a pitch for them to sponsor our drag racer. This was a hard sale, as we didn't have much of a reputation in the drag racing world, but I finally talked them into a \$1500 sponsorship (I also promised I would buy a new truck).

With the GMC logo on the side of the race truck, we began doing shows and races all over California. They were now paying us to race the truck and use it for promotional efforts at different events.


In no time, other potential sponsors were beginning to call us, but the GMC dealer wanted sole sponsorship. We eventually made that old truck into the world's fastest 4x4 on asphalt.

You may be asking yourself, "What in the heck does this have to do with concrete that is sprayed through a hose?"

I look at my ASA membership as the credibility and indication of reliability needed in today's market to compete with the other guy. I always display the ASA MEMBER logo on all our companies' documents and presentations.

Our association is on the move, promoting the use of shotcrete on a national and international level, and many new products and services are being developed and introduced (some of which you can read about in this issue). All of this and much more are coordinated parts of our continued effort to increase the quality and quantity of specified shotcrete.

Are you ready to join this dynamic team and display your shotcrete association's logo? I encourage all of you reading this who are not already members of ASA to strongly consider membership and its many benefits.



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Circle #2 on reader response form—page 56



## Not Another E-mail!

By Chris Darnell, ASA Executive Director



We have all been there—we make one simple inquiry or purchase one small item and bam! 50 new e-mails are added to your daily load of messages, clogging up your inbox. It is both annoying and problematic as legitimate and important e-mails get lost in the pile.

At the American Shotcrete Association (ASA), we value the privilege of having access to your e-mail address and we are pledging here and now to prove it.

First of all, ASA will never sell your e-mail address to another organization.

ASA is replacing all mass e-mails with a new twice-a-month e-newsletter. The newsletter is titled, "What's in the Mix" and will contain a handful of hot-linked headlines which will allow you to view more details, should you wish.

We are doing this to reduce the number of e-mails our members and subscribers receive, while still keeping you informed of your association's new products, services, events, and other initiatives.

### New Electronic Version of Shotcrete Magazine

"What's in the Mix" will also be the delivery mechanism for an exciting new product from ASA. Beginning with this issue of *Shotcrete* magazine, all members and subscribers now have access to an electronic version of this magazine in addition to the physical copy.

There are a number of exciting features to this new product. Make sure you check out the "Association News" section of this issue for more details. I also recommend that you take a test drive of this issue by visiting [www.Shotcrete.org/FirstEMag](http://www.Shotcrete.org/FirstEMag).

Beginning with the Fall 2009 issue of *Shotcrete*, you will need a special link to access the electronic version of the magazine. This link will be sent as an item in the "What's in the Mix" e-newsletter.

Also beginning with the Fall 2009 issue, nonmembers residing outside the U.S. and Canada will no longer receive a physical copy of the magazine. Instead, the electronic version will be sent to eliminate the weeks- and sometimes months-long delivery delay.

*If you want to ensure that you receive access to all future issues of the electronic version of the magazine, you need to do two things:*

1) Make sure ASA has your e-mail address.

The easiest way to figure this out is to check if you have received your copy of "What's in the Mix". If you have, then

you are all set. If you have not, then we don't have your e-mail address and you should send an e-mail to [info@shotcrete.org](mailto:info@shotcrete.org) with your name and the e-mail address you would like us to use.

2) Add [info@shotcrete.org](mailto:info@shotcrete.org) to your system/address book as a safe sender.

It is our intent to gain your trust and prove that we will responsibly use and not abuse your e-mail address. Again, ASA will never sell your e-mail address and we will send you a maximum of two general e-mails a month via the new "What's in the Mix" e-newsletter.

Let me know what you think, and send me a note at [Chris.Darnell@Shotcrete.org](mailto:Chris.Darnell@Shotcrete.org).



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Circle #12 on reader response form—page 56

# Shotcrete Equipment: Wet or Dry?

By Paul Sulman

**W**hen I was first asked to write an article with “Wet or Dry” in the title, I was sure this topic had been beaten to death. In fact, I cannot think of a more talked-about topic when discussing shotcrete.

Because most of us have read more than one article on the benefits and disadvantages to both methods, I thought “what can I possibly write about that hasn’t already been covered?” Nevertheless, before we go there, this reminds me of when I first started in the industry almost 20 years ago. Someone asked me “which is better, gunitite or shotcrete?” After figuring out that gunitite is simply a term used to describe the dry-mix shotcrete process, I was on a mission to get the answer once and for all.

I was fortunate back then to be traveling all across the U.S., Canada, and even Australia. Who better to answer this question than the many contacts I would meet in the industry. Little did I know what I was in for! I received so much contradictory information that I thought I would never get a straight answer. It turns out that no single method is clearly better than the other. The decision to use dry-mix shotcrete (gunitite) or wet-mix shotcrete depends on the variables of each project. Every job is different. The following factors must be considered before choosing either the wet- or dry-mix process:

- project size (quantity of shotcrete required);
- accessibility;
- application rate required (cubic yards or cubic meters per hour or shift);
- availability of an air compressor;

- material availability (distance from job site and [sand/cement] transport method);
- availability of water;
- storage space;
- dust—are you going to be doing work in a confined space where the production of dust could be an issue? (less dust is generated in wet mix);
- nozzleman skill;
- rebound (generally, wet-mix shotcrete will generate less rebound);

## Equipment Costs

This is how an accountant would look at the question:

### Dry-Mix (Gunitite)

- Machine, hoses, nozzle—\$12k to 16k
- Air compressor—\$33k to 70k (dry process requires a much larger air compressor than wet process, so if a large air compressor is already on the job site—major bonus!)

Total equipment cost: \$45k to 86k (if you need to purchase an air compressor)

Shotcreting capacity range is 8 to 15 yd<sup>3</sup>/h (6.1 to 11.5 m<sup>3</sup>/h)

- \$45k for 8 yd<sup>3</sup>/h (6.1 m<sup>3</sup>/h [assuming you need to purchase an air compressor])
- \$86k for 15 yd<sup>3</sup>/h (11.5 m<sup>3</sup>/h [assuming you need to purchase an air compressor])

### Wet-Mix

- Machine, hoses, nozzle—\$45k to 95k
- Air compressor—\$15k to 20k (wet process requires a smaller air compressor (185 ft<sup>3</sup>/min [5.24 m<sup>3</sup>/min]))

Total equipment cost: \$60k to 115k (if you need to purchase an air compressor)

Shotcreting capacity range is 12 to 20 yd<sup>3</sup>/h (9.2 to 15.3 m<sup>3</sup>/h)

- \$60k for 12 yd<sup>3</sup>/h (9.2 m<sup>3</sup>/h [assuming you need to purchase an air compressor])
- \$115k for 20 yd<sup>3</sup>/h (15.3 m<sup>3</sup>/h [assuming you need to purchase an air compressor])

The aforementioned examples illustrate that the initial costs for both wet- and dry-mix shotcrete equipment are not that different (except if you already have a large air compressor on the site, in which case the dry-process wins the “equipment cost per applied cubic yard capacity” competition hands-down). If you consider the production rate per dollar and include the purchase of an air compressor, the two methods are very similar.



Wet-mix B50HP shotcrete pump (left) and dry-mix Lova shotcrete (gunitite) gun (right)

## Material Availability

While considering the differences and similarities, along with the plusses and minuses, material availability kept showing up as the common denominator. One area of the country would predominantly use the dry-mix process while another area would predominantly use the wet-mix process. Historically, only one shotcrete method would be introduced into particular areas. This method took hold and became accepted by engineers, pool builders, and contractors. With this in mind, the material suppliers got the product dialed in.

For example, some isolated areas in California have only dry-mix shotcrete contractors available while some areas have only wet-mix shotcrete applicators. Consequently, ready-mix suppliers are comfortable shipping mixer trucks with dry-mix shotcrete mixtures in some areas and may refuse to quote dry-mix materials in others.

Often, ready mixed concrete is simply not available. Tunnels, mines, and many projects in undeveloped parts of the world sometimes do not have a ready mixed concrete facility nearby. To get around this, mining and tunneling companies often use “super-sacks” of dry, preblended shotcrete mixtures that are positioned above the dry-mix gun.

Small repair or architectural projects sometimes require a lot of starting and stopping, usually with a very small amount of shotcrete applied between breaks. In these cases, the dry-mix shotcrete (guniting) method is advantageous because the material won't set up in the hoses. It will remain in the powder form because the water is applied at the nozzle. The workers can take a break any time.

A contractor may decide to, in the wet-mix situation, buy mixer trucks, and perhaps a batch plant to have control over the material supply. In the dry-mix scenario, the contractor could do the same. He may invest in a mobile volumetric concrete mixer. This could be brought to the job site and fed with sand using a dump truck and loader. The cement can be stored in the mobile concrete mixer unit. In either case, the shotcrete contractor could gain control of the entire shotcrete process. This can allow for better scheduling and less down time. It may even reduce the overall cost of the process.

## Maintenance

The equipment maintenance costs should also be considered when choosing dry- or wet-mix shotcrete equipment. Let's look at only the equipment in contact with the concrete. First, we'll look at the dry-mix shotcrete (guniting) machine. This unit is used to convey the dry shotcrete mixture, which produces considerable wear on all items in contact with the dry-mix shotcrete

material. This includes wear pads, gooseneck liners, bowls, plates, hoses, and nozzles.

Shotcrete pumps convey the shotcrete material in a wet state, which is less abrasive. Thus, it saves money and time from less part wear. The wet shotcrete pump has the following wear items: wear plate, cutting ring, piston cups, hoses, pipes, and nozzles.

## Conclusion

We all know that both wet- and dry-mix methods are viable shotcrete processes that produce a sound final product. The decision to use either dry- or wet-mix shotcrete is dependent on the factors previously identified.

There are many variables to consider when choosing to use either a wet-mix shotcrete pump or a dry-mix shotcrete gun. As in most equipment decisions, you will need to consider the requirements for most of your projects. It would be wise to choose the equipment that will get you the most work. You may even conclude that you need to purchase equipment for both dry- and wet-mix shotcrete processes to give you maximum flexibility. I would encourage you to contact the many suppliers who have experience and knowledge for help in your selection. Let's face it, in this economy, purchasing equipment is a big step and needs to be well thought out prior to issuing the purchase order.



*REED C50HP set up and wet-mix shotcrete being pumped for pool construction in Southern California*



**Paul Sulman** is West Coast Sales Manager for REED Concrete Placing Equipment in Southern California. Sulman has worked in the concrete/shotcrete industry for 20 years and is a graduate of the Mechanical Engineering Technicians program at Seneca College, Toronto, ON, Canada. Since 1957, REED has been one of the leading manufacturers of wet- and dry-mix shotcrete equipment.

# What You Need to Know Before Selecting a Wet-Mix Shotcrete Pump

By Ray Schallom III

**W**et-mix shotcrete is a method of placing concrete. The concrete material is metered into the delivery hose and moved by positive displacement or compressed air to the nozzle. Compressed air is injected (minimum of 185 ft<sup>3</sup>/min. [5.2 m<sup>3</sup>/min.]) at the nozzle to increase the velocity for placement and consolidation onto the receiving surface. The purpose for this article is to identify factors to consider when selecting a wet-mix pump for low-, medium-, and high-volume wet-mix process shotcrete applications. There are several factors that dictate the proper selection of a concrete pump: type of project; pumping distance; hose size; type of application; quantity of material to be pumped; and use for the multiple applications other than shotcrete, such as grouting or placing conventional concrete.

## Choosing the Right Wet-Mix Shotcrete Pump Manufacturer or Distributor

Contractors often purchase one type of concrete pump based on the assumption that it will be suitable for several different types of wet-mix shotcrete applications. Most concrete pumps are designed to pump coarse aggregate concrete mixtures. The concrete output range is usually from 20 to 60 yd<sup>3</sup>/h (15 to 46 m<sup>3</sup>/h). These pumps are suitable for medium- to high-volume concrete pumping applications. Concrete repair jobs are considered low-volume shotcrete applications that typically use fine-aggregate mixtures. A 1.5 in. (38 mm) hose and smaller-diameter, high-velocity nozzle setup are used for fine-aggregate shotcrete mixtures. One needs to keep in mind that only about 18 yd<sup>3</sup>/h (13.8 m<sup>3</sup>/h) can be pumped through a 2 in. (50 mm) hose unless you are pumping cement grouts.

An average manually applied shotcrete application produces between 6 and 15 yd<sup>3</sup>/h (4.6 and 11.5 m<sup>3</sup>/h) of pneumatically applied concrete. Hose sizes of 2, 2.5, and 3 in. (50, 65, and 75 mm) are typically used for robotic applications. The outputs for robotic applications range from 20 to 30 yd<sup>3</sup>/h (15 to 23 m<sup>3</sup>/h).

In the 32 years I have been in the shotcrete industry, I have found several good hydraulic swing-tube piston pumps that can be used for low-, medium-, and high-volume wet-mix shotcrete applications. There are a few important things to keep in mind when choosing a wet-mix shotcrete pump. The total cost for purchasing a wet-mix shotcrete pump is substantially greater than a dry-mix shotcrete system. Wet-mix shotcrete equipment can also be more complicated to maintain. Over the years I have developed a checklist to help me choose the right manufacturer of wet-mix pumps and systems:

- Check the years of shotcrete knowledge and experience of the manufacturer's or dealer's sales staff.
- Research the equipment's track record from a production standpoint.
- Evaluate the manufacturer's or dealer's customer service. This is helpful for troubleshooting pump-related problems or other shotcrete-related issues.
- Check on the availability of repair parts and the sales staff's knowledge of the inner workings of the concrete pump (for troubleshooting problems). The manufacturer or dealer should offer on-site setup and testing prior to startup (to make sure there are no pumping problems with the mixture proportions selected for the job).
- The manufacturer or dealer should be able to offer hands-on shotcrete training as an option (check to see how many years of hands-on training experience the trainers have).
- Identify accessories the seller offers (hoses, clamps, reducers, concrete pipe, shotcrete nozzles, or fittings and accessories needed to equip the pump for a robotic arm or robotic unit if needed).

Once you have selected the right manufacturer or distributor, the next step is to choose the right pump to meet your job requirements. The price of the wet-mix pump will likely play a key role in your selection. It is important to research the performance and maintenance history of the wet-mix pumps under consideration. More time and money may be spent on repair and maintenance for a less expensive model than one that is more rugged with a good track record.





*Fig. 1: An S 5 electric version rotor/stator unit with an M-Tec continuous mixer feeding it. This electric mixer comes with an adjustable water meter and low water-pressure cutoff that maintains a steady, consistently blended material flow*



*Fig. 2: The SP 13 high-pressure piston pump. The low profile gives the operator an unobstructed view of the work area and shooting area while making a batch of wet-mix concrete*



*Fig. 3: An Allentown Powercreter 20 is shown with a hydraulic mixer attachment. The attachment is being used as a remixer for concrete supplied by a mobile, volumetric mixer to achieve a consistent mixture for pumping operations. A vibrating screen was installed to reduce the risk of plugging the 1.5 in. (38 mm) hose due to randomly occurring large aggregate particles. The new electronic technology produced a continuous flow of concrete material that allowed the nozzleman to apply a uniform shotcrete layer to the walls with very little line surge*

## Choosing the Right Wet-Mix Shotcrete Pump

Consider a wet-mix pump designed to handle a lower-volume output for repair and grouting applications. Low-volume wet-mix pumps can have a batch mixer attachment for mixing dry, preblended products, a stand-alone mixer, or the same pump without the batch mixer that is capable of pumping fine-aggregate ready mixed mortar. The pump should be capable of reducing the material outlet to a 1.5 in. (38 mm) diameter hose for repair and grout work.

For medium and large volume projects, consider using a piston-type pump with outputs of 20 to 60 yd<sup>3</sup>/h (15 to 46 m<sup>3</sup>/h), a remixer in the hopper (to help agitate and push low-slump mixtures toward the cylinders), and a vibrator on the grate to help with low-slump mixtures or mixtures with fibers (special grates are available that have vibrators attached and smaller openings to help keep larger rocks out of the mixture while letting stiff mixtures or mixtures with fibers pass through). An accelerator dosing

system can be connected to the concrete pump which can be designed to inject the proper accelerator dosage per cylinder stroke or as a stand-alone unit with flow control devices.

## Safety Issues to Consider with Wet-Mix Shotcrete

Concrete line pressures can reach as high as 4000 psi (27.6 MPa) when a plug occurs. It is extremely important to follow the manufacturer's

operation and safety manuals to prevent injury or even death. A safety checklist is usually provided in the equipment manual for the contractor and crew to follow daily. Depending on what type of job you are on, some governing agencies may require even tighter safety controls in addition to the manufacturer's list.

## Summary

The purpose of this article is to inform contractors about choosing the right wet-mix equipment for the project size. It is intended to be a selection guide for those who are looking to purchase wet-mix pumps for the first time or seasoned contractors looking to purchase new equipment. The application of wet-mix shotcrete is a proven method of placing concrete at an economical price.

## References

- Bridger, P., "The Value of Shotcrete Accessories," *Shotcrete*, V. 7, No. 3, Summer 2005, pp. 10-12.
- Schallom, R., and Ballou, M., "What You Need to Know About Wet Shotcrete," *Shotcrete*, V. 5, No.1, Winter 2003, pp. 22-27.
- Sulman, P., "What You Should Consider When Choosing a Wet-Mix Shotcrete," *Shotcrete*, V. 7, No. 3, Summer 2005, pp. 14-16.



Fig. 4: A REED C50HP concrete pump



Fig. 5: A Schwing 750 trailer pump that was set up for easy maneuvering in and around the job site



Fig. 6: An Allentown Powercreter 40 pump with hydraulic outriggers

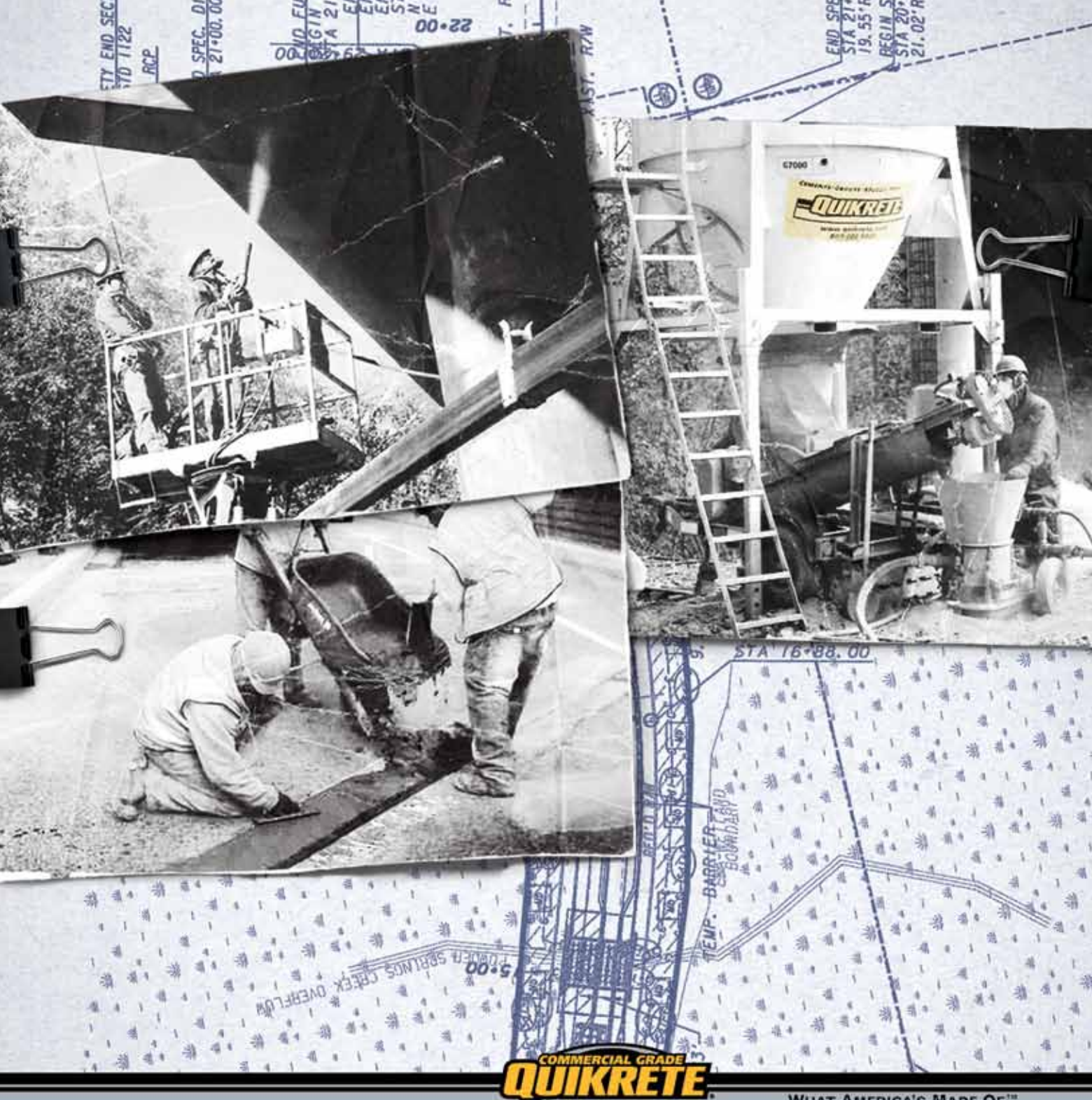


**Ray Schallom III** is an underground shotcrete application specialist and equipment salesman for Allentown Shotcrete Technology, Inc. He has 35 years of experience as a Project Manager,

Owner, and Superintendent. He is a Past President of ASA, serves as Chair of the ASA Education Committee, is a member of the Publications, Underground, and Pool & Recreational Shotcrete committees, and is on the ASA Board of Direction. He is also a member of ACI Committees 506, Shotcreting, and C660, Shotcrete Nozzleman Certification. With over 31 years of shotcrete nozzling experience in wet- and dry-mix handheld and robotic applications, Schallom is an ACI Certified Nozzleman in the wet- and dry-mix processes, as well as an ASA-approved shotcrete educator, an ASA-approved shotcrete underground educator, and an ACI-approved shotcrete examiner. He is also a member of ASTM Committee C09, Concrete and Concrete Aggregates, and Subcommittee C09.46, Shotcrete.

Photo courtesy of Oscar Ductworth.





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# Dry-Mix Shotcrete Equipment

## A Nontechnical Description of Equipment Used in the Industry Today

By Tom Norman

In the beginning, man created the dry-mix process...and it was good. Today, both the dry- and the wet-mix processes are in use. The choice of either the wet- or dry-mix process is a decision based on preference, familiarity, application, and equipment. First, you may have a preference based on what you have been told or your personal experience. Second, you may be more familiar with either the wet-mix or dry-mix process based on your exposure from coworkers, mentors, or family. The most important factor in choosing the dry- or wet-mix process is the application involved. Are you placing material in the Arizona desert where high temperatures and setup time are concerns? Are you in a confined area where dust could be a concern? The project requirements could even vary enough to create the need to use both processes. Lastly, available equipment is a factor in the decision to use one process over the other. Maybe you already have access to a perfect air compressor for a dry-mix setup or you have a good used swing tube pump just waiting to be put to use.

### Dry-Mix Shotcrete Equipment

The main categories of dry-mix shotcrete equipment are as follows:

- Pressure vessels;
- Dry-mix shotcrete guns;
- Batch plants; and
- Predampeners.

### Pressure Vessels and Dry-Mix Shotcrete Guns

The key piece of equipment for any dry-mix shotcrete application is the machine, primarily a dry-mix shotcrete gun. The first dry-mix shotcrete machine (known as the “Cement Gun”) was a single-chamber pressure vessel, basically a steel tank affixed with plumbing for air to flow throughout. Dry materials were fed into this steel vessel, which was then sealed and pressurized by feeding air into the vessel from a valve connection. A material hose was connected to an outlet valve and, when opened, material was projected into a hose and conveyed to the nozzle. The double-chamber gun was also developed for increased versatility. The addition of water at the nozzle—the

most distinguishing feature of the dry-mix process—was key to this equipment use and technique. Modern rotary guns work on an entirely different principle, yet the fact that water is added at the nozzle still remains the same. The rotary gun includes a hopper where dry or predampened material can be added. These machines are typically powered by an air motor, although hydraulic-powered machines are also available. The motor serves to rotate the gun’s material feed system. Feed systems are designed to continuously direct material from the hopper to the outlet where the material is conveyed by air to the hose and nozzle. Material drops into cavities or cylinders, which are then injected with compressed air. Feed system designs for rotary guns include the “bowl” type system and the “barrel” type system (refer to photos of each).

A note on terminology: Contractors and project teams use many variations of terms to describe dry-mix shotcrete equipment. You may hear gun, dry gun, shotcrete or gunite pump, bowl gun, rotary gun, cement gun, concrete sprayer, bowl type, rotary type, and so on. The next time you don’t agree with the names that a contractor or purchasing agent uses to describe a piece of machinery, you might want to just play along even though they might not be technically correct. Of course, a gunite machine is not a “pump.” Language has a life of its own and cannot be controlled.

### Batch Plants and Predampeners

Materials used in the dry-mix process can be dry, preblended products, or mixed on site. Dry, preblended, or “prebagged” materials are available from several suppliers (please visit [www.shotcrete.org/buyersguide](http://www.shotcrete.org/buyersguide)). Dry, preblended products can be designed to meet virtually any job requirement. Prebagged materials may offer proprietary mixture designs that could provide an advantage for a particular application. To manage the costs, delivery, and control of your mixture proportions, use a batch plant or combination batch plant/predampener. Batch plants are essentially mixers that combine cement and aggregate used in the dry-mix process. Batch plants are available for any job size, from low-volume units to high-volume batch plant truck, trailer, or stationary units. The addition of a spray



*Combination batch plant/  
predampener with  
bowl-type rotary gun*



*Rotor-type or  
barrel-type  
dry-mix  
shotcrete  
machine*



*Water-pressure  
booster pump*

bar system to the batch plant gives the ability to predampen materials before they are fed into the dry-mix shotcrete/gunite machine. Predampening can reduce static electricity, dust, and rebound that are common when conveying completely “bone-dry” materials.

## Other Equipment

Another popular piece of equipment for the dry-mix shotcrete contractor is a water-pressure booster pump. This pump, fairly small and portable, is used to increase the pressure of the water being delivered to the nozzle.

A variety of hoses and nozzles for the dry-mix process are readily available to meet the needs of low- to high-volume project requirements. The most common setups in the dry-mix process are 1.5 or 2 in. (38 or 51 mm) material hose and nozzle designs. Various nozzle tips can be used to control the spread of material as it is placed on the surface by an American Concrete Institute (ACI) certified nozzleman.

A fully self-contained dry-mix shotcrete operation consists of a batch plant with a built-in predampening system; heavy-duty air compressor; a reliable source for dry, bulk materials; material hose; air and water hose; nozzle; water-pressure booster pump; and an ACI certified nozzleman.



**Tom Norman** is a Product Manager for Airplaco Equipment Co. and Gunit Supply & Equipment, two divisions of Mesa Industries. For over a decade, he has represented the company's Northeastern region based in Cincinnati, OH. Airplaco and Gunit's shotcrete equipment, including dry-mix gunite machines, batch plants, and shotcrete pumps, is manufactured at this Northeast location and also distributed through Houston, TX, and Monrovia, CA, sales locations. Norman is involved in product development for Airplaco's line of shotcrete equipment, which has been produced since 1946. He served 6 years in the U.S. Army and earned an associate degree in business from the University of Wisconsin, Milwaukee, WI. In addition to being a member of ASA and Chair of ASA's Pool and Recreational Shotcrete Committee, Norman is a member of the International Concrete Repair Institute (ICRI) and the Association of Pool and Spa Professionals (APSP).

# Dry-Mix Guns

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Winter 2003 issue of Shotcrete magazine

By Pietro Teichert

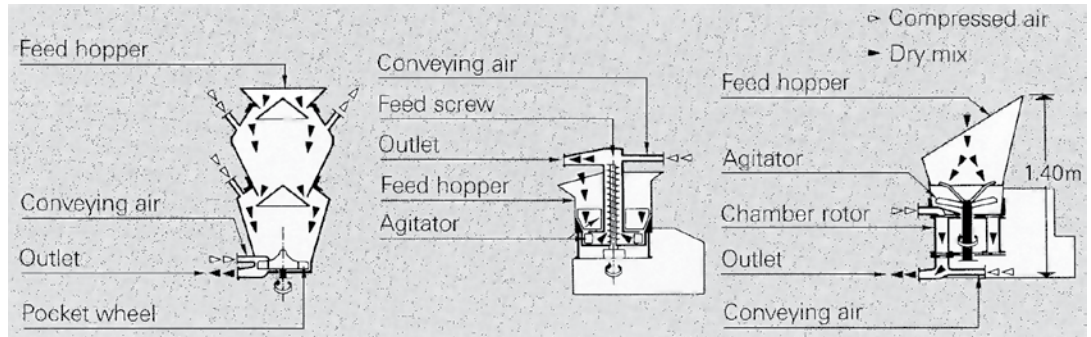


Fig. 1: Operating principle of the double-chamber gun, the screw-type gun, and the rotating-barrel gun

**B**asically, three different types of shotcrete guns exist for the dry-mix process, all of which work on the suspension-conveying principle. In order of their invention, they are (Fig. 1):

- double-chamber system;
- screw system; and
- rotating-barrel system.

The double-chamber system, which is still used occasionally today, was invented by Carl E. Akeley in 1907.<sup>1</sup> It employs two connected chambers arranged one above the other, with the discharge outlet at the bottom of the lower one. The feed opening of the upper chamber and the connection between the two chambers can be closed off hermetically with bell-shaped valves independently of one another. The bottom chamber is subjected to the same air pressure as the discharge line. The procedure starts with dry mix being filled into the upper chamber with the bell valve between the two chambers closed. Next, the feed opening is closed hermetically and the upper chamber is pressurized just like the lower one. Now the valve between the two chambers can be opened, allowing the mixture to slide from the upper into the lower chamber. After this has happened, the valve between the two chambers can be reclosed and the pressure released in the upper chamber to permit reopening of the inlet valve. In the meantime, the dry mix is discharged from the lower chamber by a pneumatically driven feed wheel and is picked up by the air stream in the discharge line. The upper chamber is refilled at the same time, and the cycle is repeated.

Up until the end of the 1940s, double-chamber machines, and above all the various models of the American Cement-Gun (Fig. 2), were the only machines available for guniting. They are still being built and used. Because of the need to manipulate valves and levers alternately, the

gunman needs considerable skill and muscle. If he fails to fill either of the two chambers with dry mix promptly, the flow of material in the hose or pipe may be interrupted. The aggregates have to be dry and relatively small in gradation. These constraints made the application of shotcrete with double-chamber guns uneconomical on certain types of jobs and under certain conditions.

The screw-type gun was invented by Georg Senn and built by Spribag AG at Widen, Switzerland, in the early postwar years (Fig. 3). The machine raised the dry mixture from the open filling container with a screw in the form of an Archimedeian screw (Fig. 1). Driven by an electric or pneumatic motor and rotating in a vertical pipe, the screw lifted the mixture up to the blow chamber from which compressed air carried it to the nozzle. The BS-12 screw-type gun handled naturally damp aggregates up to gradations of 25 mm at rates of about 3 m<sup>3</sup> of



Fig. 2: Double-chamber gun (Cement-Gun, 1914)



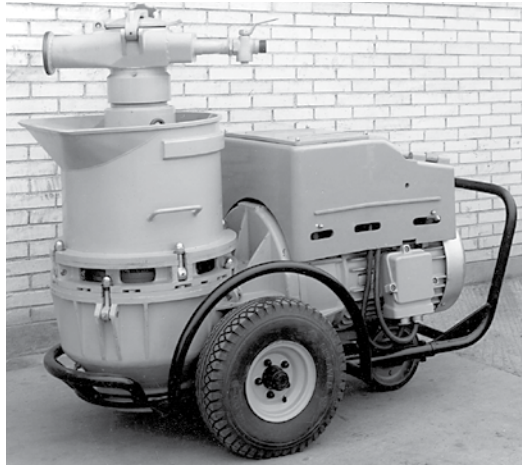
# Shotcrete Corner

dry mix per h. This made it possible to produce genuine concrete with the normal gunning process for the first time. In effect then, one could really not speak of shotcrete before the invention of the screw-type gun because the double-chamber machines were suitable only for producing mortar or gunitite. The new shotcrete, the ruggedness of Senn's screw-type gun, and the techniques for underground work that came to be developed with it all constituted the foundation for the ultimate worldwide success of the shotcrete process.

When the rotating-barrel system appeared, however, the screw-type gun disappeared from the market without trace. Developed in the postwar years in the United States on the basis of a Dutch patent, the rotating-barrel (rotor) system works on an entirely new type of principle (Fig. 1). The dry mixture passes from an open feed hopper into a rotor with a vertical axis of rotation and from the rotor into the discharge line. The rotor (or barrel) is equipped with vertical chambers of cylindrical or circular-sector chambers. As the rotor revolves, each chamber in turn comes underneath a feed opening, and the dry mixture—which is kept moving in the hopper by an agitator—drops in. The filled rotor chambers proceed to the outlet opening on the opposite side where downward-flowing compressed air blasts them into the discharge line.

The American gun, called Jetcreter (Fig. 4), was a heavy, awkward device that was hardly suitable for use underground. Meynadier & Cie AG in Zurich, Switzerland, proceeded to improve upon it with the sturdy Meyco GM 57 gun (Meyco for Meynadier, GM as an abbreviation for gunitite machine, and 57 for 1957, the year the first machine was built). The Meyco GM 57 is suitable for use in tunnels. This 1957 model has been improved repeatedly in the meantime. Its clear superiority, in many respects, over the double-chamber system and the screw principle made it very successful right from the start.

The name Meyco GM 57 evokes some personal memories. The very first machine, Serial No. 1 (Fig. 5), was tried out for several months starting in October 1957 by Ernst Laich in Locarno, Switzerland, then a sole proprietorship (today Laich SA in Avegno), in Allotment 4 of the Fionnay-Nendaz pressure tunnel of the Grande Dixence hydroelectric power plant in Valais, Switzerland. Laich was satisfied and purchased the gun. The Laich company was working on this job as a subcontractor of the main contractor, for which I was working as an intern at the time to earn money for my education. One of my assignments was to record the performance figures for the new shotcrete gun. As a matter of fact, the Meyco GM 57 No. 1 is



*Fig. 3: Screw-type gun (Spribag BS-12, around 1950)*



*Fig. 4: American rotating-barrel gun (Jetcreter)*



*Fig. 5: Rotating-barrel gun (Meyco GM 57, No. 1)*

# Shotcrete Corner

still parked in our equipment lot, now out of service but operable and ready to go after all these years.

Soon, other machine manufacturers had also switched to the new system. The screw-type gun has disappeared, while the double-chamber unit still has its advantages for special applications. With the rotating-barrel system, the dry-mix process seems to have reached a progress plateau that will be difficult to improve upon in any revolutionary way. On the other hand, there is still room for improvement in today's rotating-barrel guns. Users would like to see the expense of wear cut down, maintenance simplified, and the incidence of rebound and dust reduced.

Modern rotating-barrel machines, such as the Aliva-246.5 of Sika Schweiz AG at Widen (Fig. 6)



Fig. 6: Rotating-barrel gun  
(Aliva 246.5, 2002)



Fig. 7: Rotating-barrel gun  
(Meyco GM 090, 2002)



Fig. 8: Double  
pressure cylinder on  
truck, with bottom-  
mounted batching  
screws (Rombold-  
Spritzmobil, 2002)

or the Meyco GM 090 built by Meyco Equipment at Winterthur (Fig. 7), weigh about 450 to 1400 kg, require floor space of 1.0 x 2.0 m, and are about 1.5 m high. In 2002, a gun of this type with standard equipment was priced at about 15,000 to 30,000 Swiss francs. The guns, which are driven either by electric or pneumatic motors or by internal combustion engines, handle aggregate gradations up to 20 mm. Throughput is on the order of 1 to 15 m<sup>3</sup> of dry mix per h. The compressed air requirement for conveying is 3 to 20 m<sup>3</sup> per min.

A number of dry-mix guns are available on the international market, all of them essentially variations or combinations of the aforementioned systems, that is, double-chamber system, screw system, or rotating-barrel system. Most of these machines are suitable for handling both dry mix from naturally moist aggregates and factory-produced mixtures with oven-dried aggregates.

More recently, special spraying devices have been developed exclusively for factory-produced mixtures. These are not machines as such but merely so-called metering or batching devices that feed the dry mix from a pressure container into the air stream of the spraying hose (Fig. 7). "The system consists essentially of a pressure tank holding the material (either a vertical silo or pressure cylinder mounted on a vehicle). At the outlet of the tank, dust-free encapsulated batching screws are installed, to which the spraying hose is connected. To convey the material, compressed air is admitted to the pressure tank (silo) and the material is blown continuously via the batching screw into the air stream and conveyed to the nozzle. The conveying rate is infinitely variable between 1.5 and 12 m<sup>3</sup>/h."<sup>2</sup> These devices exhibit relatively low wear-and-tear-related costs.

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**Pietro Teichert** is the Managing Director of Laich SA, Avegno, Switzerland. He received his civil engineering degree in 1961 from Winterthur Polytechnic and has worked exclusively in the shotcrete field ever since.



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## Matching Equipment to Process: The Predampener

By David Jamieson

**A**s one who promotes choosing process before product, I believe that the success of any project also depends on matching the appropriate equipment to the process/product chosen. Specialty equipment offers several opportunities to achieve effective results. This article will discuss the predampener, a machine used in dry-mix shotcrete application.

In wet-mix shotcrete application, the water-cement ratio ( $w/c$ ) is controlled prior to discharge into the mixer-pump apparatus. High-velocity air pressure propels the mixture to the receiving surface. In a dry-mix shotcrete application, the  $w/c$  is controlled by the nozzleman. Because it is not desirable for the nozzleman to introduce all the water at the water ring, a predampener must be used to ensure proper hydration of the cement.

The predampener facilitates the process as follows: the bagged product, or “super sack” material, is dropped into the predampener’s front hopper and moved by an auger system through a fine mist of water that dampens the product prior to it being dropped into the shotcrete gun and propelled by compressed air up to the nozzle, where the appropriate amount of additional water is then added.

When shotcrete is delivered by a ready-mix concrete truck, the mixture is already predampened from the moisture in the sand. Avoid the use of

excessively aged ready-mix supplied dry-mix shotcrete, however, as prehydration can cause pellets to form, increasing rebound and reducing shotcrete quality. (Note: ACI 506R requires dry-mix shotcrete to be used within 45 min of batching.) With either ready-mix supply or predampening, the correct amount of water is indicated by the shotcrete material just staying in a loose ball when squeezed in the hand and then released. If the ball collapses, the mixture is too dry. If paste squeezes out between your fingers, the mixture is too wet.

It is unreasonable to put a dry-mix into a shotcrete gun and expect the nozzleman to have optimum control over the  $w/c$ . Reducing the variability of the  $w/c$  provides better performance in the structure. Control of the  $w/c$  is greatly enhanced with the use of a predampener. Predampeners are just one example of equipment innovation that makes shotcrete the process to match the challenges of the new millennium. Matching the proper equipment and process goes a long way toward a successful shotcrete project.




*Predampener used in dry-mix shotcrete application*



**David Jamieson** is Vice President of Concrete Repair and Restoration for The Aulson Company, a full-service specialty environmental and industrial contracting company based in

Methuen, MA. Jamieson has over 30 years of industry experience with the products, processes, and techniques of concrete repair—both as owner/operator of a contracting company and as a senior project manager for manufacturers and contractors. He is an ACI-certified Shotcrete Nozzleman. Jamieson also is an active member of the ASA and serves as Co-Chair on the ASA Publications Committee. He may be reached at [djamieson@aulson.com](mailto:djamieson@aulson.com).

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## Homegrown Innovation in Swimming Pool Dry-Mix Shotcrete Equipment

By Ron Lacher

I have always enjoyed our ASA President Chris Zynda's articles, where he's mentioned his past experiences working on a gunite crew in the swimming pool industry. Chris had many notable experiences that he has talked about, such as regularly heading for the yard well before dawn, long days, no lights or breaks on the equipment trailer, tie-wire holding things together, and much more. Chris got into the swimming pool industry in the late 1960s, while my swimming pool construction experience started a few years later in the mid 1970s. In those days, I was a pool contractor overseeing the project, so I didn't have Chris's notable experiences or his knowledge of the gunite process.

Like Chris, when I first started in this industry, I saw a lot of tie-wire holding equipment together. But I also saw a lot of inventiveness and resourcefulness on the part of a number of gunite contractors and pool construction companies. That inventiveness was usually because someone had a new idea that could hopefully produce a better mixture or perhaps increase production or improve economy.

Several months ago, I assisted Chris Zynda with an ACI Nozzleman Certification session at Woody Douglas Gunite in Ontario, CA. I've known Woody since my first days in pool construction when he was a foreman shooting my pools for another gunite company. The nozzleman certification was done at Woody's yard in San Bernardino, CA, where he stores both his running and nonrunning equipment. Woody has acquired a wide range of dry-mix equipment over the years. The nozzleman certification gave me a chance to have a close look at three or four different gunite machines. Today, most of the shotcrete companies I've observed are running equipment that was built by an equipment manufacturer. What was so interesting to me was that all but one of the gunite machines in Woody's yard were designed and built by the companies that actually use the equipment and not from an equipment manufacturer.

The popularity of these homegrown gunite machines (Fig. 1) in past years was likely due to the prevalence in some areas of street mixing gunite materials for swimming pool construction. Street mixing is the dumping of bulk sand in the street, which is then loaded into the gunite machine along with the correct proportion of either bulk or bagged cement. Today, because of environmental protection regulations in many areas, it is very difficult to legally dump sand onto the street. Because of these environmental laws, as well as equipment weight restrictions, street mixing is becoming more difficult and out of favor.

Woody Douglas entered the swimming pool gunite industry around 1963 and formed his own company in the early 1980s. Because of his prior history with gunite before forming his company, he was able to tell me a little about the history of some of his acquired pieces of equipment, which were built after the late 1960s. The dates or other information in this article may not be 100% accurate. The intent of this article is to show some examples of the creativity of several of the early gunite equipment innovators rather than be



Fig. 1: Homegrown paddle mixer from the 1970s



# Pool & Recreational Shotcrete Corner

concerned about the accuracy of the dates. I'm sure there were similar innovations in the old hopper-fed barrel mixers used in the 1950s and early 1960s; however, I haven't run across any equipment from that era sitting in bone yards or anyone able to tell me about the equipment used prior to the mid-1960s.

Woody first gave me a quick tour of a couple of old paddle mixer rigs that were built by Don Nourse of Enterprise Gunitex Corporation. These gunitex machines were likely built in the early to mid-1970s and acquired by Woody Douglas when Enterprise closed its doors. These rigs were in use and producing material primarily for swimming pool construction until they were retired a couple of years ago.

Gunitex paddle mixers have large rotating paddles within one or more drums, much like a plaster mixer (refer to Fig. 2). These are believed to do a better job than augers for mixing the cement and sand. These paddle mixer gunitex machines built by Don Nourse had both a lower mixing drum and an upper mixing drum fed by an elevator from the lower mixer. These rigs were driven by very heavy-duty hydraulic motors; because of that, they were very reliable and able to produce a quality mixture. Because of the weight of the mixer drums and the heavy-duty hydraulics, however, these rigs were overweight and became problematic as truck weight restrictions became more prevalent. It got to the point where hoses, planks, and all materials had to be removed from the drums and hopper to maintain these rigs within the legal weight restrictions. Because of the weight restriction issues, these rigs are now used for spare parts but could be put back in service if the need ever arises.

Woody also had another unique gunitex machine sitting in his yard that was built by Anthony Pools in the late 1960s. This rig is also a paddle mixer, but it is unique in that it is an all-electric gunitex machine (refer to Fig. 3 and 4). All of the paddles, elevators, and other equipment are operated by heavy-duty electric motors rather than hydraulics. Along with a compressor, a 45KVA generator was also mounted on the truck that towed the rig. The electrical control systems all appeared to be very sophisticated and reliable considering their late 1960s origin. As an example, for safety, all of the operator controls were low-voltage micro-switches that operated high-voltage relays, which switched the electric drive motors on and off. According to Woody, most of the electric motors on the rig are original, which is a testament to the planning and design that went into building the rig. Although the rig hasn't been out of the yard in 6 months due



*Fig. 2: View of the paddle mixer showing the double chamber gun*



*Fig. 3: All-electric paddle mixer from the late 1960s*



*Fig. 4: Electrical control panel on rig shown in Fig. 3*

# Pool & Recreational Shotcrete Corner



*Fig. 5: Contractor-built gunite rig using auger mixing*



*Fig. 6: Self-contained gunite rig*



*Fig. 7: Custom-built mobile mixer can deliver 17 tons (15.4 metric tons) of dry-mix material*



*Fig. 8: Rig with mobile mixer has over 40 ft (12.2 m) of auger mixing*



# Pool & Recreational Shotcrete Corner

to the slow economy, its systems are started regularly to keep batteries charged and its systems operational.

In addition to the paddle mixer gunite machines, Woody had also acquired another homegrown gunite rig that was built in the mid-1980s. This rig looked somewhat similar to more contemporary gunite machines built by an equipment manufacturer (Fig. 5). Mixing is done by an auger rather than paddles within a drum.

When we talk about gunite equipment innovators, at the top of the list would be Dean Norton of Arco Gunite in Orange, CA. Although I've also known Dean since the late 1970s when Arco Gunite was one of my regular subcontractors, Dean's career in gunite goes back to 1955. In the mid-1970s, Dean recognized the shortcomings of the existing gunite machines he had used and set out to design and build his own rig based on what he believed to be the needs of the Southern California market place. The end result was a self-contained rig shown in Fig. 6.

I've already mentioned the environmental and weight restriction regulations that will soon make street mixing an operation from the past. Dean has anticipated these changes and is now using mobile mixers he has designed and built that can transport material for up to 17 tons (15.4 metric tons) of gunite to the job site without dumping sand in the street (Fig. 7). Dean's fleet of mobile mixers is designed to feed material directly into his next generation, custom-built gunite machine. Dean proudly talks about the nearly 40 ft (12.2 m) of augers that can provide a mixture of the highest possible strength (Fig. 8).



**Ron Lacher, PE, CBP, President of Pool Engineering, Inc., holds a bachelor's degree in civil engineering and is a registered professional engineer in California. 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). Lacher's firm, Pool Engineering, Inc., has provided the 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 Pool & Recreational Shotcrete Committee of the American Shotcrete Association where he is an approved educator for wet-and-dry-mix shotcrete; the Technical Committee of the International Association of Plumbing & Mechanical Officials for the Uniform Swimming Pool, Spa & Hot Tub Code; and the Swimming Pool Technical Subcommittee of The Ceramic Tile Institute of America 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.*

**Tom Norman**, ASA member and Chair of ASA's Pool & Recreational Shotcrete Committee, wants your input. Your comments, suggestions, and the topics you'd like to see covered are welcome. Perhaps you'd like to become a contributing author to Pool & Recreational Shotcrete Corner. Norman and the ASA staff encourage you to contact ASA with your questions and comments at: [info@shotcrete.org](mailto:info@shotcrete.org).



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From the library of Chris Zynda

*Chris Zynda is President of ASA and Safety Committee Chair. He is a member of ACI Committees 506, Shotcreting, and C660, Shotcrete Nozzleman Certification; an ASTM International member; and a certified ACI Examiner.*

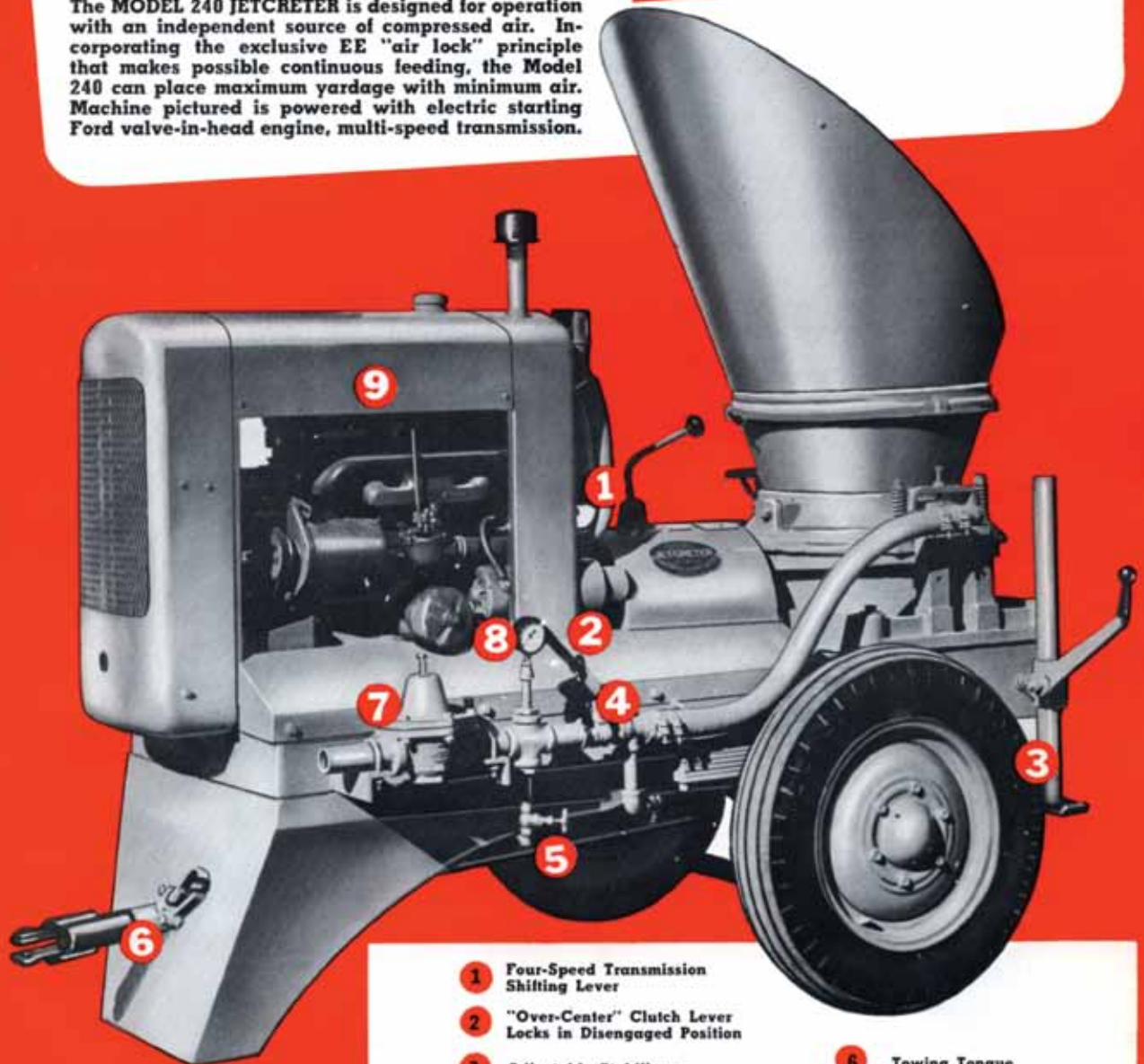


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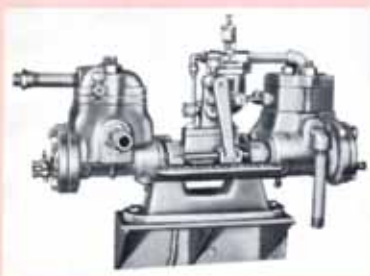
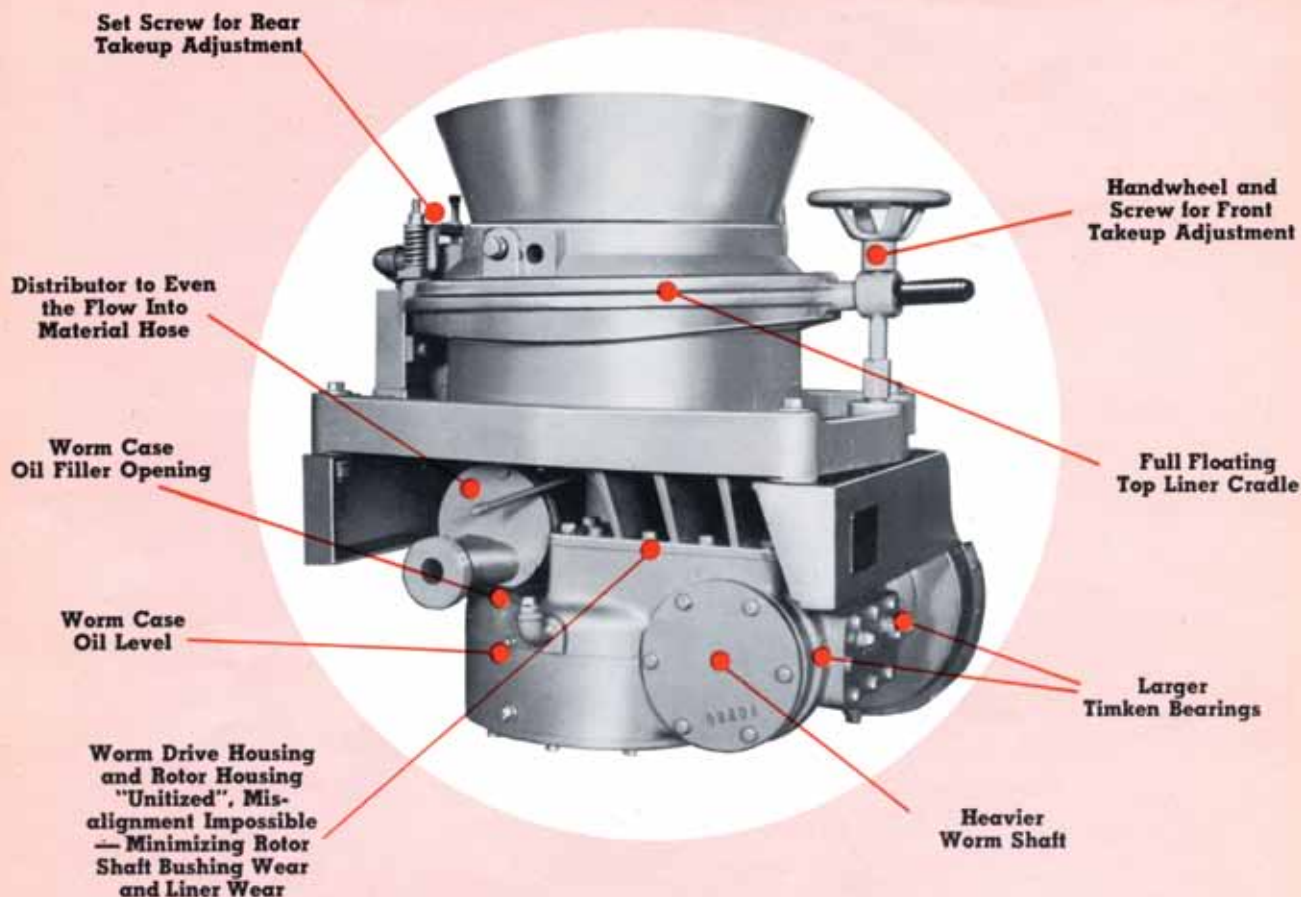


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Wisconsin w/Transmission	76"	55"	71"	2740	6.00x16	240	5	25-30	1 1/2"	150
Wisconsin w/Single Range	76"	55"	70"	2710	6.00x16	240	5	25-30	1 1/2"	150
Electric Motor w/Transmission	76"	55"	93"	3000	6.00x16	240	5	25-30	1 1/2"	150
Modified	79"	55"	As Above	Add 100 lbs.	6.00x16	400	6 1/2	35-40	2"	150

## 2008 Outstanding International Project

# Garden Valley (Jardines del Valle) Housing

**T**he Garden Valley (“Jardines del Valle” in Spanish) housing project is an ongoing residential housing project in the suburbs of Santiago, Chile. During 2007 and the first half of 2008, the first three phases of the project consisted of single-family homes ranging in size from approximately 600 to 1100 ft<sup>2</sup> (56 to 102 m<sup>2</sup>). The homes were produced on a modular basis in a factory. The housing modules are fully finished in the factory and then trucked to the project site where they are assembled, or stacked, into finished homes. The in-factory portion of the entire production process requires approximately 9 days. The on-site stacking is accomplished in a matter of only hours.

Shotcrete was used in the patented Uni-Crete Cell™ system of molds to create the five-sided monolithic housing modules that form the structure of the houses. These modules, which represent the entire structure of the house, are created in a single day at the beginning of the overall process cycle. Each Uni-Crete Cell module yields approximately 160 ft<sup>2</sup> (15 m<sup>2</sup>) of housing. An individual Tekrete™ home comprises two to seven such modules and one to three roof modules.

Before shotcrete is applied onto the five-sided mold, reinforcing bar and welded wire mesh are

placed. At the same time, electrical conduit and junction boxes are installed onto the mold so that these features are built directly into the walls. Before shotcreting, frames for the doors, windows, and other required openings are installed so that once shotcrete is applied the module has all of these features built-in—all with a minimum of labor.

The roof modules are also made using shotcrete. Like the standard housing modules, reinforcing bar, welded wire mesh, window openings, electrical conduit, and electrical junction boxes are all placed onto the mold prior to application of shotcrete so that all of these features are built directly into the structure. Because the roof does not require supporting rafters or trusses, the resulting attic space is very useful to the homeowner, including having light fixtures and electrical outlets. In Chile, where homes do not have basements, this extra space has proven to be a tremendous selling feature. The homeowner can use it for an office, an extra bedroom, a play area, or simply for storage.

A steam-curing process is used to accelerate the curing of the concrete modules. The day after the shotcrete is applied, the modules are launched onto the production assembly line where they pass



*A Uni-Crete-Cell™ module ready for the assembly line*



*In-factory window installation on a Uni-Crete Cell housing module*



# Outstanding Shotcrete Project Award Winner

through seven stages until they are completely finished, including the installation of:

- Plumbing lines and fixtures, including sinks and bathtubs
- Electrical wiring and fixtures
- Kitchen cabinets and closet organizers
- Flooring (ceramic, carpet)
- Interior demising walls
- Interior wall finishes (wallpaper or paint, with ceramic in the kitchen and bathrooms)
- Stippling of the ceilings
- Windows
- Doors
- Insulation
- Exterior stucco and paint
- Roofing shingles



*A Tekcrete™ roof module—a monolithic structure*



*Shingled and insulated Tekcrete roof module ready for painting and window installation*



*A fully finished Tekcrete roof module leaving the factory by flatbed truck*



*In-factory shingling of a Tekcrete roof module*



*A fully finished Uni-Crete Cell housing module ready to ship to site*

# Outstanding Shotcrete Project Award Winner

Once all of the finishing processes have been completed and the modules arrive at the end of the assembly line, they are transported to the housing project site by means of a flatbed truck. There, they are assembled, or stacked, on site by means of a mobile crane.

Shotcrete is the very essence of the project. The entire structures of the houses were created in our factory using shotcrete. The walls, floors, ceilings, and roof are all composed of shotcrete.



*A line-up of Tekcrete homes in the Garden Valley (Jardines del Valle) Housing project*

## Outstanding International Project

### *Project Name*

Garden Valley (Jardines del Valle) Housing

### *Project Location*

Santiago, Chile

### *Shotcrete Contractor*

Canadian Rockport Homes Int'l, Inc.\*

### *General Contractor*

Canadian Rockport Homes Int'l, Inc.\*

### *Architect/Engineer*

Canadian Rockport Homes Int'l, Inc.\*

### *Material Supplier*

Canadian Rockport Homes Int'l, Inc.\*

### *Project Owner*

Canadian Rockport Homes Int'l, Inc.\*

\*Member of the American Shotcrete Association



*A fully finished Tekcrete home: seven modules, approximately 1125 ft<sup>2</sup> (105 m<sup>2</sup>)*



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## 2008 Outstanding Repair & Rehabilitation Project

# Manchester Terminals, LLC, Dock Rehabilitation



*Finished product*

In the summer of 2006, our company was presented the challenge of restoring the largest independently-owned shipping terminal in Houston, TX, to its original state. Built in 1926, Manchester Terminals had seen its share of spot repairs. This hurricane-rated concrete facility, however, never had full-scale rehabilitation. At first sight, this project seemed to be an impossible task. The 1500 ft (457 m) international shipping facility showed significant damage and deterioration to over 90% of its existing concrete supports. Entire columns were missing in some areas, and

the entire concrete dock system was in danger of crumbling. During the site inspection of this project, company officials noted that it was the most extensive and challenging rehabilitation project our experts had ever seen.

Early discussions of the project with engineering staff included plans for accomplishing the repairs while keeping the facility in full service. Initially, it was believed that this project could only be accomplished by hand-patching and form-and-pour operations. The engineers, however, were willing to explore the idea of shotcrete as an alternative method if cost savings could be realized and accepted by the owner. Discussions then began focusing on the ability of shotcrete to be placed on nearly any surface and at any angle with little to no formwork needed. The engineers were also sold on the compressive strengths and past performance of shotcrete. Test reports from previous projects allowed our company to show data-backed examples of shotcrete testing at much higher strengths than required. Of additional importance was the ability of our company to maintain such a small work area to accommodate ongoing shipping operations at the facility. After discussions with both the owner and engineer, shotcrete was the overwhelming choice. Contracts were then issued and the project was underway.

Dry-process shotcrete was used for the project. Our staff set lofty goals beginning at Station 0000 with plans to work continuously to Station 1500 and complete the over 20,000 ft<sup>2</sup> (1858 m<sup>2</sup>) project



*Typical damage due to environmental effects on concrete*



# Outstanding Shotcrete Project Award Winner

in less than 180 days. Work began on the meticulous removal of deteriorated concrete to sound concrete with special care given, ensuring that the demolished waste was not introduced back into the Houston Ship Channel. The owner quickly came to appreciate the small footprint that our operations consumed and pointed out that, contrary to initial concerns, no disruptions in service were seen as a result of our project.

Our company was faced with an additional challenge shortly after beginning the shotcrete operations. A loaded ship struck the dock, causing significant damage. The damage could have shut down that portion of the dock, significantly limiting the owner's ability to meet the demands of signed contracts for ships en route to the facility.

The flexibility of shotcrete allowed us to immediately mobilize our operations to the newly-damaged site. Within a matter of weeks, we were able to repair and reopen the damaged area. In contrast, it was estimated that form-and-pour repairs would have taken significantly longer and forced both the previous work area and the emergency repair area to stay closed to ship traffic throughout the process. It was at this point that the owner truly came to appreciate the value of shotcrete. The owners embarked on a full-scale rehabilitation of the entire dock system, adding an estimated 21,000 ft<sup>2</sup> (1951 m<sup>2</sup>). The total dock rehabilitation included the repair of all support columns and beams, as well as a large number of spall repairs to the underside of the deck floor. Additionally, the owner opted to install a state-of-the-art fender system to help prevent future damage.

All loose and unsound concrete was removed by pneumatic chipping and steel reinforcement. Surface preparation was accomplished by concrete. A corrosion inhibitor was applied to the reinforcing steel prior to the application of shotcrete. A minimum 2 in. (50 mm) clearance was used throughout the process to ensure proper encasement of the steel.

As one can imagine, with the booming chemical, gas, and oil refining operations in the Houston area, care needed to be given to provide a consistently solid material that could resist the natural effects of salt water and chemical attack common in this region. In response to this challenge, our company chose to use a prepackaged fiber-reinforced, silica-fume enhanced, structural dry-process shotcrete mixture. In doing so, we were able to ensure that no contaminants were introduced during the batching process as a result



*B & A Contractors, Inc., uses a bolted rubber bumper system to protect Manchester Terminals dock system from future damage resulting from ship strikes*



*Typical state of the dock system prior to repairs*



*Typical damage to Manchester Terminals prior to shotcrete application*



*Damage as seen in over 90% of support columns prior to repair*



*Using pneumatic tools, deteriorated concrete was removed, allowing for shotcrete repairs*



*Using one-sided form technology, damaged support members were rehabilitated to their original state after being struck by ships*

of other environmental unknowns. This material was of great interest to this project due to our past experience with the product and its high bond strength, low permeability, and excellent resistance to freeze-and-thawing cycling and salt scaling. This project also called for a high compressive strength due to the large ships, which have a tendency to “bump” the docks. In response, our material choice proved to have an average 28-day compressive strength of over 7000 psi (48 MPa), which far surpassed other application methods and materials explored. Once application was completed, the area was trimmed to true lines, relieved of any excess material, and given a natural gun finish to beams and deck underside and a steel trowel finish to the columns and dock facing.

Shortly after the completion of the dock face repairs and installation of the new fender system, another large fully-loaded ship “bumped” the dock. To the owner’s amazement, the only visible damage was to the bolts anchoring the fenders. In fact, the steel bolts bent to the point that the ends were touching the shotcrete surface of the dock. No damage was present on or around the shotcrete repair. This incident proved the importance of shotcrete to this project and caused the owner to have a newfound trust in this method of repair.

This project was initially slated for only one phase, which included the dock face along with associated columns and beams. By completion, the project had seen the addition of three phases. This is a testament to what we in the industry already know—that shotcrete, when installed properly, is a far superior product to other types of similar materials.

In summary, our company took on a project that many in the industry deemed the “impossible, company-breaking” project. Yet, through the innovations seen in recent years within the industry, we were able to take a project never designed for shotcrete and not only make the repairs cost-effective but also underbid all other methods explored. It should also be noted that we did not “break” the company and in fact were able to complete the project on time and within budget. Since the completion of this project, we have been fortunate to have the opportunity to make other engineers and construction managers aware of the shotcrete method, its ease of installation as compared to other forms or repair, its cost effectiveness, and its varied type of application.

The importance of shotcrete to the Manchester Terminals project cannot be overstated. This project was initially engineered to be a hand-



# Outstanding Shotcrete Project Award Winner

patch, form-and-pour project. Not only would this have proven to be an unwise choice, but it would likely have caused the owner to endure countless additional repairs, a substantially larger amount of money over the course of several years, and several lengthy repair cycles. The notion that shotcrete could be a viable repair option for such an extensive project was initially hard to swallow. In reality, the project was an easy sell. Shotcrete's past performance record truly worked to our advantage. Shotcrete's versatility and history of success was without a doubt the single most important selling point for this project.

As the project progressed, our method showed shotcrete's durability as evidenced by a ship striking the dock and causing no structural damage. This reaffirms that the proper application of shotcrete produces a substantially stronger product than like material installed using other methods. The project owner's appreciation for the shotcrete method was shown by the full rehabilitation of the dock system, which more than doubled the initial contract and amount of shotcrete applied at this facility.

Our company also saw first-hand the importance of the shotcrete method with the addition of several other projects that were initiated by other engineers and contractors viewing and witnessing the advantages of the shotcrete method at the Manchester Terminals project. As the saying goes, "we in the shotcrete business have a single disadvantage over other types of repair in that we tend to work ourselves out of business." In other words, our process is so reliable that one repair is all it takes to outlast our lifetime!

## Outstanding Repair & Rehabilitation Project

### *Project Name*

Manchester Terminals, LLC, Dock Rehabilitation

### *Project Location*

Houston, TX

### *Shotcrete Contractor*

B & A Contractors, Inc.\*

### *General Contractor*

B & A Contractors, Inc.\*

### *Architect/Engineer*

Hollie Stanley at Stanley Engineering Company, Inc.

### *Material Suppliers*

Builders Products, Inc., and BASF Admixtures, Inc.\*

### *Project Owner*

Manchester Terminals, LLC

\*Member of the American Shotcrete Association



*Manchester Terminals dock begins to find new life as shotcrete application progresses*



*Finished product from a distance*

A Shotcrete feature:

# SAFETY SHOOTER

## Don't Get Buried

By Chris Zynda, Director of Shotcrete Operations, Joseph J. Albanese, Inc.,  
ASA President and Safety Subcommittee Chair



My company recently started work on a 164 ft (50 m) long-course competition swimming pool with an attached diving well at Stanford University, Palo Alto, CA. The pool is 82 yd (75 m) long by 90 yd (82 m) wide by 3.6 ft (1.1 m) deep and transitions into a 13 ft (4 m) deep diving well.



The vertical excavation was limited to 5 ft (1.5 m) with a sloped top. Pool excavation started in the deep end and proceeded to the shallow end. The excavation surface included both bench and sloped banks



The pool's gutter is a trough that is incorporated into the bond beam at the top of the pool shell. Since the entire deep end was built with this design, there was a need for a sturdy and elaborate forming system. A sturdy form is needed to hold the mass of the concrete, as well as a reinforcing bar to keep the filled formed system from falling forward. The forming system consisted of a 3/4 in. (19 mm) plywood shin with 2 x 4 studs at 2 ft (0.6 m) on center



A double waler system was used to increase the sturdiness of the form works



An improperly secured form and/or reinforcing bar can result in movement of the formwork system and reinforcing bar toward the nozzleman with a pressure in excess of 0.12 psi (0.02 MPa). The mass of the reinforcing bar, plumbing, and shotcrete are included in the pressure calculation



This is what will happen if the form is not sturdy

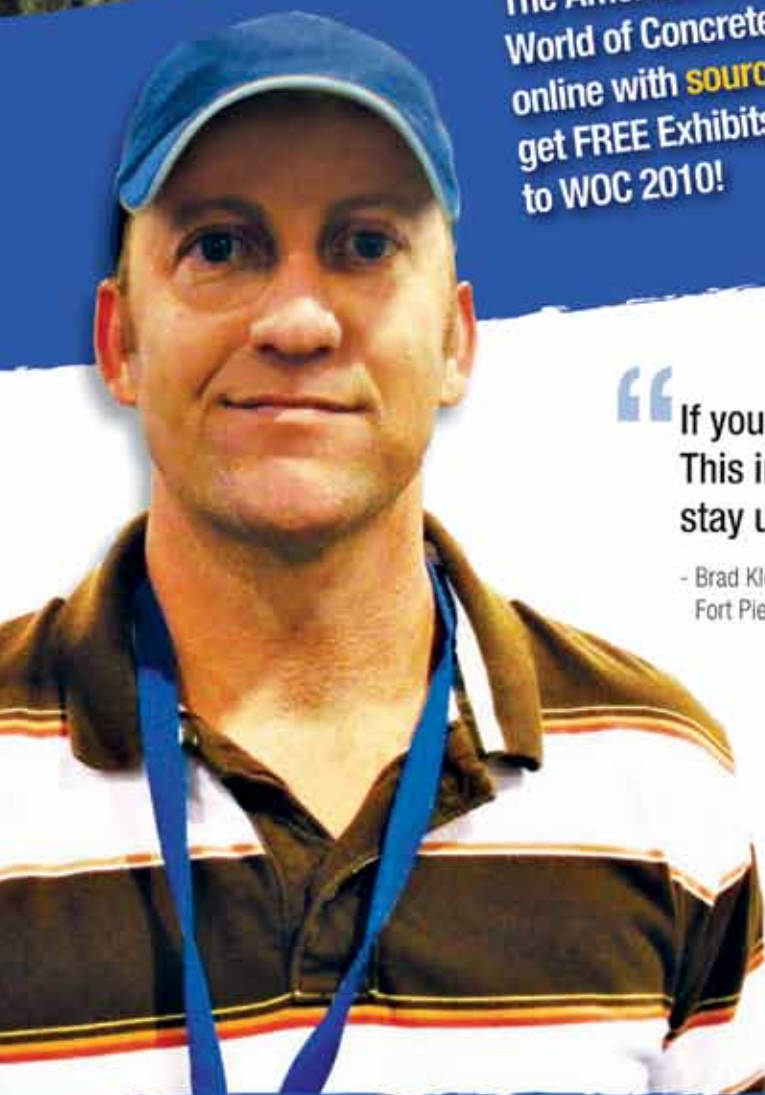


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## Fibercon International, Inc.

It began in the late 1950s as a research project funded by U.S. Steel at Carnegie Mellon University to develop a new method to control cracking in concrete, which was the beginning of steel fiber-reinforced concrete. Soon afterwards, Fibercon International was started, a leading manufacturer of steel fibers for reinforcement in the shotcrete industry. Fibercon started in western Pennsylvania and continues to produce steel fibers in the U.S.

Unlike wire mesh and reinforcing bar, which are placed in a single plain, Fibercon steel fiber reinforcement is "isotropic," meaning it provides reinforcement throughout the entire matrix of the shotcrete, providing a crack-preventing interceptor at each randomly placed fiber. Fibercon manufactures a variety of shotcrete fibers, including low carbon and stainless steel. Low carbon steel fibers are used for civil applications and stainless steel fibers are for use in refractory shotcrete, as it is oxidation resistant and melts at a very high temperature.

### Applications

Fibercon steel fibers have been used in shotcrete for years and are still the choice of countless shotcrete contractors worldwide for both wet- and dry-mix shotcrete in the following applications:

**Tunneling and Mining**—Fibercon steel fibers can be mixed directly into wet-mix shotcrete either at the concrete batching plant or on site in an on-site batching system, or directly in the back of a ready-mix truck. Fibercon steel fibers help increase the flexural strength and toughness of the concrete and eliminate the need to install labor intensive welded

wire mesh or reinforcing bar. Fibercon fibers are being used in wet-mix shotcrete on the New York City subway tunneling projects, and in tunnels in California, West Virginia, Virginia, and Ohio.

Fibercon steel fibers are being used for dry-mix shotcrete in mines and tunnels in Nevada, Montana, and Utah, and soon in eastern Canada. The simple shape of the Fibercon steel fiber makes it a favorite choice for shotcrete contractors because of the ease of placement and the lack of fiber balling.

**Slope Stabilization**—Steel fiber-reinforced shotcrete is an excellent choice for slope stabilization because the shotcrete follows the contour of the slope, which helps eliminate voids behind reinforcing bar and mesh.

**Refractory Shotcrete**—Fibercon International also manufactures stainless-steel fibers which are a good choice for refractory applications as the stainless steel resists corrosion and can withstand high temperatures. Fibercon is the leader in supplying stainless steel fibers for the refractory shotcrete industry.

Since Fibercon shotcrete fibers are manufactured in the U.S. in Evans City, PA, just north of Pittsburgh, the fibers can be shipped either by truck or placed in shipping containers and sent by train or barge throughout North America and abroad.

Testing programs using the ASTM C 1018-97 specifications have confirmed that the Fibercon steel fibers are equal or superior to any low-carbon steel fiber in the world.

For information regarding Fibercon International, visit the Fibercon Web site at: [www.fiberconfiber.com](http://www.fiberconfiber.com), or call (724) 538-5006 or (800) 521-9908 and ask for Mike McPhee.



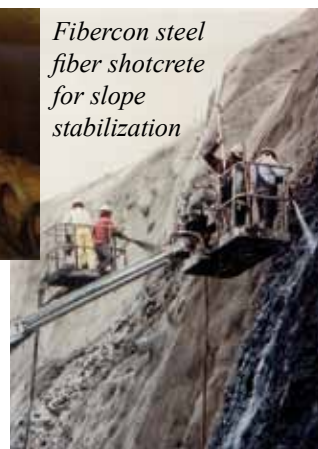
*Stainless steel fibers are added to the dry-mix bulk materials to be used for refractory shotcrete*

*Fibercon stainless steel fiber shotcrete for refractory use*



*Fibercon steel fiber shotcrete for wine caves*

*Fibercon steel fiber shotcrete for slope stabilization*





# ASA ANNOUNCES AVAILABILITY 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](http://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/Pozzolan Materials
- Consulting
- Contractors
- Equipment
- Fibers
- Shotcrete Materials/Mixtures

Searches can be further refined using over 100 subcategories and geographic criteria.



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# 3<sup>RD</sup>

## INTERNATIONAL CONFERENCE ON ENGINEERING DEVELOPMENTS IN SHOTCRETE

An international conference on engineering developments in shotcrete will be held in Queenstown, New Zealand, March 15-17, 2010.

This conference will focus on technical subjects related to the use of shotcrete, ranging from material properties, spraying technique, and structural design, to analysis of shotcrete interaction with supported ground. The scope of the conference will appeal to geotechnical engineers, research specialists, consultants, and mining and tunnelling contractors wishing to learn about the latest advances in shotcrete technology. A trade exhibition of shotcrete-related products will operate in parallel with the presentations. Delegates and potential presenters are welcome to visit the conference web site at [www.eds2010.com](http://www.eds2010.com) to find out more. If you are interested in shotcrete and travelling to New Zealand, now is the time to act!

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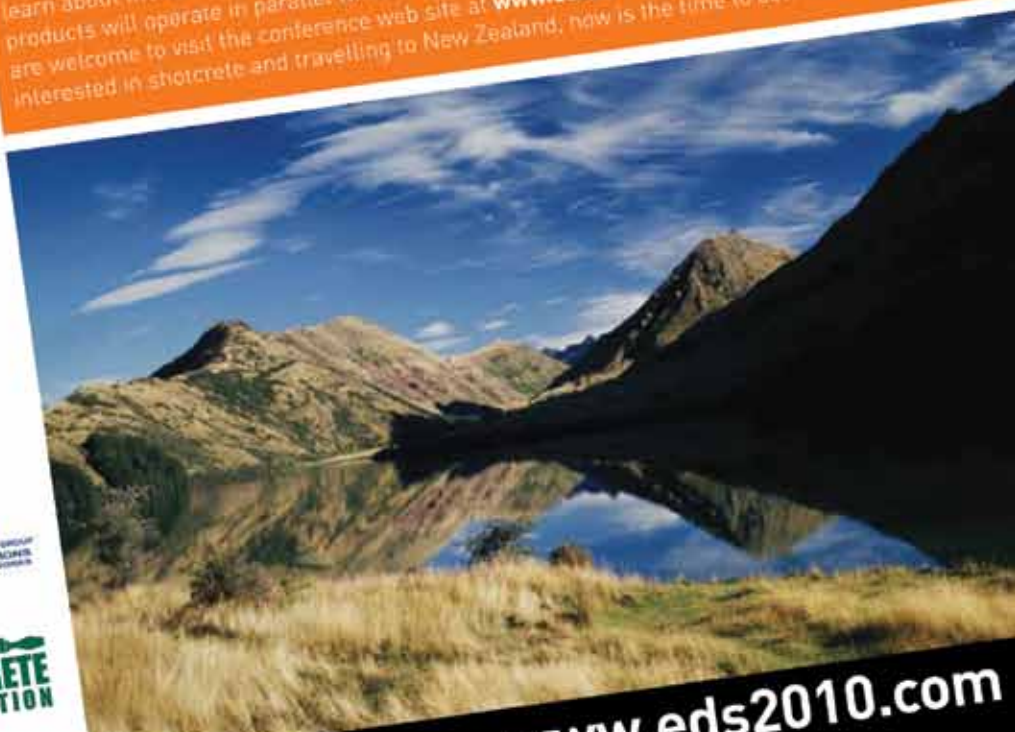


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## Competition for Stimulus Projects Driving Down Bids—More Projects and Jobs Possible

A survey by the American Association of State Highway and Transportation Officials (AASHTO) found that some states are reporting project bids coming in from 5 to 27% below estimates.

At the first oversight hearing on the American Recovery and Reinvestment Act effort, conducted by the House Transportation and Infrastructure Committee, Pennsylvania Secretary of Transportation **Allen D. Biehler** testified that the lower bids will help states whittle away at the backlog of projects, which “far exceeds the available recovery dollars.”

Biehler, who also serves as AASHTO’s President, described examples of the wide range of recovery projects being approved, from Interstate reconstruction in Oklahoma to critical bridge repairs and replacements in his home state of Pennsylvania.

Biehler’s testimony, a summary report *Delivering on the Promise*, the AASHTO state bid survey, and a comprehensive AASHTO video presentation about the American Recovery and Reinvestment Act effort are available at [www.transportation.org](http://www.transportation.org).

## U.S. Construction Spending Rises Unexpectedly in March

U.S. construction spending posted a surprising 0.3% March rebound after five straight declines, as strength in nonresidential projects and government building offset a further slide in housing. The Commerce Department indicated that the increase is the best showing since a similar rise last September. Economists surveyed by Thomson Reuters had expected spending to drop 1.5%.

Nonresidential construction rose 2.7% in March, the biggest advance in 9 months. It marked the second straight increase and was led by gains in office construction, hotels, and power plants. Government building activity also showed strength in March, rising 1.1%. A 1.3% gain in state and local activity offset a 1.7% drop in spending on federal projects.

## St. Lawrence Cement Announces Name Change to Holcim (Canada) Inc.

St. Lawrence Cement formally announced a change of company name to Holcim (Canada) Inc. and the launch of the Holcim brand in Canada. This is a significant milestone in the company’s history, providing an opportunity to further build a strong, national presence and capitalize on the benefits of being part of the Holcim Group.

**Abraham Lincoln Memorial Bridge is the longest bridge in Illinois supported by 86 piers and elevated approximately 70 feet above the Illinois River, numerous local roads, lakes, wetlands, and railroads.**

**The bridge was named the 2008 ASA Outstanding Infrastructure Project and voted #7 on the 2008 Top 10 Bridges in *Roads & Bridges* magazine. Thank you to all those who participated in completing this job safely and successfully!**



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Circle #45 on reader response form—page 56

To reflect greater alignment with the corporate brand, the visual identities of Holcim Canada's aggregates, ready mixed concrete, and construction divisions, which operate under Dufferin brand names in Ontario and Demix brand names in Quebec, have also been refreshed.

Employing approximately 3500 Canadians and generating annual revenues over \$1.3 billion, Holcim (Canada) Inc. is a leading producer and supplier of products and services for the construction industry, serving customers across Canada.

## ACI Foundation Pledges \$50,000 to Concrete Industry Management Program

The ACI Foundation, a wholly-owned subsidiary of the American Concrete Institute (ACI), announced a donation of \$50,000 to the Concrete Industry Management (CIM) program.

The donation, which will be paid in the amount of \$5000 for the next 10 years, will come from the ACI Foundation's Innovative Concrete Education (ICE) program, which was created under the Foundation for the purpose of collecting and distributing funds for new or ongoing innovative concrete-related educational programs.

The CIM program is qualified to receive funds through the ACI Foundation's ICE program because of its goal to produce broadly educated, articulate graduates grounded in basic construction management, who are knowledgeable of concrete technology and techniques and are able to manage people and systems and promote products or services related to the concrete industry.

## Isaak Presented with ACI Certification Award



*Merlyn Isaak*

Honorary American Shotcrete Association (ASA) Lifetime Member **Merlyn Isaak** was presented with the American Concrete Institute's (ACI) Certification Award for his "outstanding service as Member and Chair on ACI Certification committees, and in promoting and administering ACI Certification programs."

Isaak lives in Oregon after a career in materials engineering, failure analysis, and construction quality control. He was a licensed civil engineer in three states, but practiced primarily in the San Francisco Bay Area of California. He spent 25 years with Testing Engineers, Inc., including 10 years as President and Chairman. He finished his career as a Senior Vice President at Signet Testing Labs and later in a consulting capacity to the industry. He retired in 2006.

Isaak served on the ACI Board of Direction from 1995 to 1997, as President of the ACI Northern California and Western Nevada Chapter from 1975 to 1976, and as Finance Committee Chair for the chapter's support of the 1986 ACI Convention in

San Francisco, CA. He has also served as Chair of ACI Committee C660, Shotcrete Nozzleman Certification, and the Certification Programs Committee. He is a member of ACI Committees 506, Shotcreting, and C630, Construction Inspector Certification. Isaak is a past member of ACI Committees 311, Inspection of Concrete; C610, Field Technician Certification; and the ACI Marketing Committee. He received the ACI Henry L. Kennedy Award in 1997.

Isaak is a Life Member of the American Society of Civil Engineers (ASCE).

He received his BS in civil engineering from South Dakota State University, Brookings, SD, in 1957, and was awarded their Engineering Department's "Distinguished Engineer" citation in 2000.

## Dufour Appointed to Replace Morgan as Canadian Representative on ITA's WG12



*Jean-François Dufour*

The International Tunneling and Underground Space Association (ITA) supports 20 different Working Groups (WG) driving various topics related to tunneling and mining. One of the Working Groups, WG12, is related to shotcrete use, and is currently working on guidelines for nozzleman certification, sprayable mortars for fire protection, as well as a test program on evaluation of fiber-reinforced shotcrete. The WG12 is represented by 15 different countries and chaired by **Tarcisio B. Celestino** from Brazil.



*Rusty Morgan*

ASA Board Member **Jean-François Dufour** from King Packaged Materials Company has been appointed as the new Canadian representative of the group, replacing past ASA President **Dudley R. "Rusty" Morgan** from AMEC after his retirement in March 2009. Morgan has been a member of this group for the past two decades.

## Jolin Awarded ACI Young Member Award for Professional Achievement



*Marc Jolin*

**Marc Jolin**, former ASA Board Member, was awarded ACI's Young Member Award for Professional Achievement. The award cited his "contributions in advancing the state-of-the-art of shotcrete technology, technology transfer through supervising and mentoring undergraduate and graduate students, and active involvement in ACI Certification programs."

Jolin is an Associate Professor in the Department of Civil Engineering at Laval University, Quebec City, QC, Canada.



He is Chair of ACI Committee C660, Shotcrete Nozzleman Certification, and Secretary of ACI Committee 506, Shotcreting. He is a member of the ACI Chapter Activities Committee, and a former member of the ACI Certification Programs Committee. He is also a member of the Research Center on Concrete Infrastructures (CRIB).

Jolin received his bachelor's degree in civil engineering and his MSc from Laval University, Quebec City, QC, Canada, in 1994 and 1996, respectively. He received his PhD from the University of British Columbia, Vancouver, BC, Canada, in 1999. In 1994, he was awarded the W.R. Grace Fellowship Award in support of his graduate studies. His research interests include shotcrete and the service life of concrete structures.

## Putzmeister Concrete Pumps GmbH Appoints von Baer New CEO



*Ralf von Baer*

Putzmeister Concrete Pumps GmbH (PCP) announced its new CEO, **Ralf von Baer**, who will oversee sales and marketing at PCP while simultaneously upholding his CEO responsibilities for Putzmeister Holding GmbH (PMH).

"With his five years' experience at PMH, Ralf will focus on the PM Group and their organizational methods while integrating effective management teams at different levels," says **Karl Schlecht**, Chair of the Putzmeister Supervisory Board and KS Foundation. "As Putzmeister's past has confirmed, our success is largely based on the innovative technology and the high quality of products we deliver. The drive and commitment behind our innovative technology must start from the top and I know Ralf will continue to help drive that."

PCP is a global organization that comprises 16 manufacturing and sales operations worldwide. Putzmeister America is the North American division of PCP.

## Henry Batten Elected New NRMCA Board Chairman



*Henry Batten*

The National Ready Mixed Concrete Association (NRMCA) has elected a new slate of officers at its annual convention held last month in Orlando, FL. Association membership chose **Henry Batten**, Concrete Supply Company, Charlotte, NC, as Chairman of the Board of Directors, succeeding **Frank Craddock** of Cemex in Houston. **Tim Becken** of Cemstone Concrete Products, Mendota Heights, MN, was elected Vice Chairman and **Karl Watson, Jr.** of Cemex, West Palm Beach, FL, is now NRMCA Secretary/Treasurer.

Batten has been with Concrete Supply Co. since 1998 in various capacities, including Chief Financial Officer, Vice

President of Finance, and Executive Vice President. He participates in the Carolinas Ready Mixed Concrete Association through committee work and is a member of the Construction Financial Managers Association. He has also served on NRMCA's Operations Environment and Safety, Business Administration and Legal Activities committees. Batten earned his BS in accountancy from Arizona State University, Tempe, AZ, and his MBA in business administration from the University of Alabama, Montgomery, AL.

## Martin named Allentown Shotcrete Technology, Inc., Western Regional Sales Manager



*Dan Martin*

Allentown Shotcrete Technology, Inc., announced the addition of **Dan Martin** as Western Regional Sales Manager. Martin's primary responsibility will be introducing core products and mortar equipment throughout the western U.S. Martin will report directly to Allentown's President, **Patrick Bridger**.

"Allentown has been busy evaluating processes over the past few months with a goal of becoming even more efficient and to provide even better service to both Putzmeister and Allentown customers," says Bridger. "Dan has vast knowledge of Putzmeister's small line equipment and we have no doubt he will easily transfer that knowledge to the Allentown product line. We're thrilled to have him on our team," says Bridger.

## Harmon Named Refractory Product Manager



*Bob Harmon*

Allentown Shotcrete Technology, Inc., announced the addition of **Bob Harmon** as Refractory Product Manager. Harmon's primary responsibilities include globally managing and overseeing the sales of the refractory equipment product line as well as training and safety. Harmon reports directly to Allentown's President, Patrick Bridger.

"Bob's vast expertise of the refractory industry will be an enormous asset to Allentown and will help propel our equipment into the global marketplace even more," says Bridger.

"I'm looking forward to the opportunity of advancing Allentown's strategy in the world refractory equipment market," comments Harmon.

*Do you have a news item about your organization? Send us the information at [info@shotcrete.org](mailto:info@shotcrete.org).*

## New E-Magazine Version of ASA's Shotcrete Magazine Now Available

Beginning with this Summer 2009 issue of *Shotcrete* magazine, all American Shotcrete Association (ASA) members and subscribers (who have supplied ASA with their e-mail address) will begin receiving an electronic version of the magazine *in addition* to a printed copy.

This new electronic version of the magazine offers our members and subscribers a number of new benefits including:

- The ability to search the entire magazine by keyword(s);
- The ability to open and save the magazine as a PDF;
- Hot links from magazine advertisements, articles, and features to corresponding Web sites; and
- Reader-friendly functionality that more closely resembles a printed magazine, as opposed to other electronic formats such as a PDF.

In addition, our approximately 1500 subscribers outside North America across 95 countries will no longer experience delivery delays of the latest issue of the printed magazine.

You can view the electronic version of the Summer 2009 issue of *Shotcrete* at [www.Shotcrete.org/FirstEMag](http://www.Shotcrete.org/FirstEMag).

Beginning with the Fall 2009 issue, you will need the link sent in your e-subscription (sent via e-mail) to access future issues. *If you did not receive an e-mail link for the Summer 2009 issue, it is because we do not have your e-mail address. Please forward your name and e-mail address to [info@shotcrete.org](mailto:info@shotcrete.org) to ensure that you receive all future issues of Shotcrete.*

Beginning with the Fall 2009 issue, nonmembers outside the U.S. and Canada will receive the e-subscription only. Nonmembers outside North America will need to become an ASA member to receive a printed copy subscription.

## "What's in the Mix" Bimonthly E-Newsletter

ASA has replaced its mass e-mails with a bimonthly e-newsletter. We are doing this to reduce the number of e-mails our members and subscribers receive while still keeping them informed of the association's new products, services, events, and other initiatives. In exchange, ASA asks that you add [info@shotcrete.org](mailto:info@shotcrete.org) to your "allowed e-mail addresses."

## ASA's New Online Buyers Guide Offers Concrete World Free Access to Products and Services of the Leading Companies in the Shotcrete Industry

"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," said Joe Hutter, ASA Board Member and Co-Chair of the ASA Marketing/Membership Committee.

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; Consulting; Contractors; Equipment; Fibers; and Shotcrete Materials/Mixtures. Searches can be further refined using over 100 subcategories and geographic criteria. Visit the ASA Online Buyers Guide at [www.shotcrete.org/BuyersGuide](http://www.shotcrete.org/BuyersGuide).

## ASA 2009 Outstanding Shotcrete Project Awards Program Now Open

The American Shotcrete Association (ASA) is pleased to announce the opening of the fifth annual ASA Outstanding Shotcrete Project Awards Program to recognize excellence and innovation in projects in which the application of shotcrete has played a significant role.

Six award categories have been designed to ensure that all areas of the shotcrete industry have the opportunity to be nominated for an award. These categories are: Architecture; Infrastructure; International Projects, Pool & Recreational; Rehabilitation & Repair; and Underground. Award recipients from 2008 can be viewed at [www.Shotcrete.org/2008Projects](http://www.Shotcrete.org/2008Projects).

We encourage all ASA Corporate Members to go to [www.shotcrete.org/ASAOutstandingProjects.htm](http://www.shotcrete.org/ASAOutstandingProjects.htm) and review the guidelines and submittal process. All submissions must be received by ASA by September 1, 2009.

If you are not an ASA Corporate Member but have a project you think should be considered, it may be time to seriously consider becoming a member and adding the ability to submit your entry to the numerous other ASA membership benefits.

## 2009-2010 ASA Graduate Scholarship Program Open

The American Shotcrete Association (ASA) is now accepting applications for graduate scholarships for the 2009-2010 academic year. The purpose of the ASA Graduate Scholarship Program is to attract, identify, and assist outstanding graduate students pursuing careers in the field of concrete with a significant interest in the shotcrete process.

One \$3000 (USD) scholarship will be awarded to a graduate student attending an accredited college or university within the U.S., and a second \$3000 (USD) scholarship will be awarded to a graduate student attending Laval University in Canada.

Based on essays, submitted data, and references, the ASA Scholarship Committee will select scholarship recipients who appear to have the strongest combination of interest and potential for professional success in the shotcrete industry.

Applications and all required documents must be received by 5 p.m. EST on September 1, 2009. All application information and requirements can be found at [www.shotcrete.org/ASAScholarships.htm](http://www.shotcrete.org/ASAScholarships.htm).

**Editor's Note:** The Association News section of the Spring 2009 issue mistakenly stated "...Treasurer Michael Cotter, American Concrete Restorations." The text should have read "...Treasurer Michael Cotter, formerly of American Underground Engineering and currently a shotcrete hydro demolition consultant." We apologize for any confusion this may have caused.



# So what are you still waiting for?



## It's time to get your nozzlemen trained and certified!

The American Shotcrete Association, in partnership with the American Concrete Institute, has developed a comprehensive program to upgrade the knowledge and skills of shotcrete nozzlemen and to facilitate ACI examination and certification. Provide your clients with the assurance that your nozzlemen have demonstrated that they have the capabilities to perform the job right—the first time!



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To learn more or to schedule an ASA training session and an ACI Shotcrete Nozzleman Certification examination, visit [www.shotcrete.org](http://www.shotcrete.org) or call (248) 848-3780.

## Gas from Landfill Will Power Lafarge Cement Plant

The largest supplier of cement products in the U.S. and Canada, the Lafarge-Sugar Creek Cement Plant in Missouri, will use landfill gas to replace almost 20% of its traditionally coal-derived energy. According to Republic Services, the company managing the landfill, "The project will use 2400 ft<sup>3</sup> (68 m<sup>3</sup>) per minute of landfill gas as a direct fuel to assist in firing the kiln during portland cement production."

Landfill gas consists of almost 50% methane, a greenhouse gas that is 23 times more potent than CO<sub>2</sub>; it is created when organic material in a municipal solid waste (MSW) landfill decomposes.

The methane capture project will reduce CO<sub>2</sub> emissions by an estimated 33,000 tons (30,000 metric tons) annually, which is the equivalent of planting more than 8000 acres of forest or removing emissions from more than 5500 motor vehicles.

## Concrete for a Sustainable World Short Film

The Cement & Concrete Association of New Zealand (CCANZ) and Concrete3 have produced a short film that demonstrates

how concrete meets the current global imperative of operating in a sustainable manner.

By using the medium of film to highlight innovations and efficiencies in concrete's manufacture, along with its attributes in a range of applications, "Concrete for a Sustainable World" presents an informed understanding of concrete's contribution to sustainable building solutions.

The 10-minute film offers an insight into the benefits afforded by building with concrete; it is of interest to architects, engineers, contractors and their clients, and anyone involved in the design, construction, or operation of buildings and infrastructure.

The film can be viewed at [www.YouTube.com](http://www.YouTube.com) by searching on "Concrete for a Sustainable World."

## Easier ENERGY STAR® Compliance with Concrete Homes

The latest *Technology Brief* from the Portland Cement Association (PCA) explains how concrete home building technologies can more easily meet the exterior envelope requirements of the U.S. EPA ENERGY STAR® Program. Concrete wall systems offer homebuilders a fast, simple approach to building high-performance exterior wall construction that meets ENERGY

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STAR insulation and air barrier installation requirements. A PDF of the document can be downloaded from the PCA Web site at [www.cement.org](http://www.cement.org).

## Concrete Associations Unite in Joint Sustainability Initiative

The National Ready Mixed Concrete Association (NRMCA), Portland Cement Association (PCA), American Concrete Institute (ACI), Concrete Reinforcing Steel Institute (CRSI), National Concrete Masonry Association (NCMA), and Precast/Prestressed Concrete Institute (PCI) have signed a Memorandum of Understanding to align sustainable development activities.

As a group, the organizations will concentrate on the sustainable development applications of all concrete structures, which it defines as all vertical and horizontal applications of concrete products. The memorandum outlines eight specific social values that these structures provide: resource efficiency, safety/protection, financial responsibility, operational continuity, longevity/durability, by-products reduction, aesthetics, and societal connectivity.

The agreement aligns all the groups with the goal of providing advocacy, technology, and educational resources to convey the social value of concrete structures.

## PCA's "Concrete Stimulus" Ads Work to Improve and Educate Washington, DC

The Portland Cement Association (PCA) has implemented an ad campaign, running targeted "Concrete Stimulus"-themed advertising in Washington, DC-based publications and Web sites. The campaign seeks to inform key Washington decision makers of concrete's cost effectiveness, energy efficiency, and sustainability, along with the creation of jobs that will come with its use in construction projects funded by the economic stimulus package.

Ads are scheduled to run in print editions of *CQ Today*, *Roll Call*, and the Washington edition of *The Weekly Standard*. In addition, PCA will run Web site and banner ads on *CQ.com*, *NationalJournal.com*, *Politico.com*, and *WeeklyStandard.com*. Banner ads will take users to the PCA Web site ([www.cement.org](http://www.cement.org)), which will feature "Concrete Stimulus" resources on the home page throughout the campaign, which began February 2, 2009.

**The Elkin Hi-Tech Stimulus Plan**

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Circle #8 on reader response form—page 56

# 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](mailto:info@shotcrete.org). Selected FAQs can also be found on the ASA Web site: [www.shotcrete.org/ASAfaqs.htm](http://www.shotcrete.org/ASAfaqs.htm).

**Question:** *I am repairing a concrete masonry unit (CMU) block wall that was partially damaged when a portion of the roof collapsed. The engineer on the project is proposing to apply shotcrete to one side of the wall to help structurally reinforce the wall. I would like to know if there is a way to finish the wall so it is cosmetically pleasing, especially since this is on the inside of an existing building with the other walls being a painted CMU. Also, were can I get some conceptual pricing for applying the shotcrete?*

**Answer:** Shotcrete can, and often is, finished to provide nice printable wall surfaces. To be the same general texture of the concrete block wall, you should specify a wood or rubber float finish. You can access the ASA Buyers Guide at [www.Shotcrete.org/BuyersGuide](http://www.Shotcrete.org/BuyersGuide) to locate organizations regarding budget or conceptual pricing.

**Question:** *I have an unfinished (dirt) basement with a stacked stone and mortar foundation. Can I shotcrete the existing dirt walls and floor with shotcrete MS (micro silica enhanced) and have it adhere to the dirt portion of the basement? If so, what method would be best?*

**Answer:** Shotcrete would work well for the overlay of the walls. In most cases, floors are placed by a conventional cast-in-place method. Either the wet- or dry-mix procedure would work well

for the walls. To ensure good bond of the shotcrete to the walls, the walls should be cleaned and prepared to assure that the shotcrete is bonding to sound material rather than contaminates such as dirt or weathered material. You might also want to consider reinforcing the walls, but you should consult with an engineer on how to do this and with what material. If you were to use the wet-mix process, you could use the same equipment to place the floor as you are using for the walls.

**Question:** *I am lining a below-ground conical shaped excavation with shotcrete. Dimensions are approximately 90 ft (27.4 m) diameter by 45 ft (13.7 m) depth. Sand will be moved in and out of the container daily. Temperature range is 590 to 740 °F (310 to 393 °C). Can you tell me if a mixture is available that can meet the following specific conditions:*

- Withstand the temperature ranges noted above without spalling, cracking, etc.; and
- Resist abrasion assuming hot sand is flowing over the surface area daily?

**Answer:** You certainly have adverse conditions to work with! There are products on the market based on calcium aluminate cements that will tolerate the temperatures you mention and are durable. These products can be placed using the shotcrete process. A list of companies who supply this product can be found at [www.Shotcrete.org/BuyersGuide](http://www.Shotcrete.org/BuyersGuide).

## Looking for Shotcrete Equipment?



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# Shotcrete for Repair and Rehabilitation of Concrete Structures

The American Shotcrete Association (ASA) is proud to offer *Shotcrete for Repair and Rehabilitation of Concrete Structures*, the first in a series of digital PowerPoint presentations designed to provide specifiers with a better understanding of the shotcrete process. This presentation specifically focuses on the use of shotcrete for concrete repair and rehabilitation applications. Topics include shotcrete references, definitions, processes, uses, the history of shotcrete, and important components of a shotcrete specification.

The presentation is provided on a 2 gigabyte USB flash drive that also includes the following ASA publications: *The History of Shotcrete* by George Yoggy, *Shotcrete Versatility Plus*, the video of the World of Concrete Mega Demo, and the ASA brochure, *Shotcrete, A proven process for the new millennium*.



Future editions of the presentation will include information on mining and tunneling, pools and recreational shotcrete, and other sectors of the concrete construction industry.

ASA Members: \$25.00 each

Nonmembers: \$45.00 each

To order call ASA at (248) 848-3780  
or visit [www.shotcrete.org](http://www.shotcrete.org)

## Have YOU Visited the ASA Web site Lately?

There have been significant changes and new services added!



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# New Products & Practice

## New “Shotlining” Rehabilitation/ Relining of Culverts, Storm Sewers, and Other Infrastructure by Shotcrete Technologies, Inc.

Deterioration and complete failure of storm drains, culverts, water, and sewer lines are a looming problem for federal, local, and state governments; departments of transportation (DOTs); and private owners. Shotcrete Technologies, Inc., has developed a method and proprietary materials to facilitate repairing or relining culverts (CMPs), storm sewers, and water lines that are efficient, nondisruptive (that is, require no excavation), and more cost-effective than conventional techniques.

The shotline process normally relines a circular or oval pipe with 1 in. (25 mm) of material to extend its life (50+ years) and provide structural support with 6000+ psi (41.4+ MPa) shotcrete. Pipes varying in size from 18 to 96 in. (457 to 2438 mm) may be relined using the 5000 rpm spinning head. The shotline system travels through the pipe filling eroded and damaged sections of the invert while providing the 1 in. (25 mm) structural lining. An average of 400 to 500 linear ft/day (121.9 to 152.4 m) of a 60 in. (1524 mm) ID pipe may be completed using this cost-effective, nondestructive technique. The pipe may be placed back in service 4 hours after application.

For more information on the shotline technique, visit [www.ShotcreteTechnologies.com](http://www.ShotcreteTechnologies.com).



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## Western Shotcrete Equipment, Inc., Introduces Model 3050HP Warrior Shotcrete Pump

Warrior Model 3050HP comes equipped with a Cummins QSB6.7 Engine, 220 HP, with a Tier III EPA standard. This new design incorporates a large radiator, charge oil cooler, and oil cooler package that enables this machine to run cooler and more efficient. The Warrior 3050 HP comes standard with 4 in. (101 mm) hydraulic cylinders and 6 in. (152 mm) material cylinders.

For more information on the Warrior 3050 HP, visit [www.wseshotcrete.com](http://www.wseshotcrete.com) or e-mail [sales@wseshotcrete.com](mailto:sales@wseshotcrete.com).



## Putzmeister America, Inc., Expands BSA High-Pressure Trailer Pump Line

Putzmeister America, Inc., announces the expansion of its well-recognized and respected BSA High-Pressure Trailer Pump Line with four new models.

Two of the four new models being added to the product line include the heavy-duty, high-pressure BSA 100-D and BSA 120-D, and are designed for superb performance over a long lifespan.

“These two new models add depth to our BSA offering,” says Bill Carbeau, Putzmeister’s Director—Special Applications Business. “They combine Putzmeister’s robust S-valve and high-volume capabilities for efficiency and versatility across a range of applications. In addition, the BSA 120-D features our signature free-flow hydraulics.”

With a maximum volume output of 104 yd<sup>3</sup>/hour (80 m<sup>3</sup>/hour) for the BSA 100-D and 114 yd<sup>3</sup>/hour (87 m<sup>3</sup>/hour) for the BSA





# New Products & Practice

120-D, both machines are ideal for use in high-rise jobs, civil construction, tunnels, and mines. The BSA 100-D provides pressure up to 910 psi (6.3 MPa) and the BSA 120-D provides pressure up to 1030 psi (7.1 MPa).

In addition, Putzmeister has enhanced its line of large trailer-mounted concrete pumps with a new version of its BSA 14000 HP-D and the BSA 14000 SHP-D.

The new version of the BSA 14000 HP-D boasts the same high-performance capabilities as the original BSA 14000 HP-D, but it features 7 x 83 in. (180 x 2100 mm) material cylinders. This version of the BSA 14000 HP-D features high pressures up to 2683 psi (18.5 MPa) and an output of 107 yd<sup>3</sup>/hour (82 m<sup>3</sup>/hour).

The BSA 14000 SHP-D also features 7 x 83 in. (180 x 2100 mm) material cylinders, also making it ideal for extreme concrete pumping with its impressive piston side, super high pressures up to 3636 psi (25 MPa), and low output of 47 yd<sup>3</sup>/hour (36 m<sup>3</sup>/hour).



Other models in the BSA product line include the BSA 2109 H-D, the BSA 2110 HP-D, and the original two BSA 14000 HP-D models.

For more information and specifications on the BSA product line, visit [www.putzmeister.com](http://www.putzmeister.com).

## NRMCA Updates Cement Burn Prevention Program

The National Ready Mixed Concrete Association (NRMCA) has updated its popular Cement Burn Prevention Program. This training program and kit provides tools that can be used to communicate the cement burn hazard to employees and customers.

For more information, visit [www.nrmca.org](http://www.nrmca.org).

## ARTBA Unveils New Personal Protective Equipment Safety Video

A new training video from the American Road & Transportation Builders Association (ARTBA) on the proper use of personal protective equipment (PPE) for roadway and heavy construction sites is now available.

The video was developed by ARTBA's expert safety team and reviewed by leading road construction industry and PPE executives.

The DVD contains two segments, available in English and Spanish on the same disc. The first segment helps company managers understand what to look for when purchasing PPE and provides tips on motivating workers to wear it.

The second—and most valuable—segment is a must-see for company employees. It compares scenes from sporting events to roadway construction work, educating workers about the importance of properly wearing their PPE even if they don't see the hazards around them.

Details can be found at [www.artbastore.org](http://www.artbastore.org).

## ACI eLearning Now Available

The American Concrete Institute (ACI), in partnership with Elsevier, Inc., announced the launch of its new online training program: ACI eLearning. Through ACI eLearning, concrete industry professionals have the opportunity to participate in ACI training programs on a variety of industry-critical topics and earn CEUs online.



To familiarize participants with how the courses work, ACI and Elsevier are hosting a short, free training module, "Concrete Basics," available at [www.acielearning.org](http://www.acielearning.org).

## FHWA Launches Online ASR Reference Center

The Federal Highway Administration (FHWA) has gone live with an online Alkali-Silica Reactivity (ASR) Reference Center. It was developed to provide users with access to pertinent information related to ASR. It was organized for quick, easy access and will be updated regularly. The Reference Center includes research reports, guidance documents, specifications related to ASR, field trials reports, and helpful links.


The ASR Reference Center can be found at [www.fhwa.dot.gov/pavement/concrete/asr/reference.cfm](http://www.fhwa.dot.gov/pavement/concrete/asr/reference.cfm).

*Do you have a new product or practice that the shotcrete world should know about? Send us information at [info@shotcrete.org](mailto:info@shotcrete.org).*

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<small>Tel: (604) 294-3811 Fax: (604) 294-4664 E-mail: <a href="mailto:john.laxdal@amec.com">john.laxdal@amec.com</a></small>	

Circle #6 on reader response form—page 56

# Does the **SHOTCRETE WORLD** need to know about **YOUR COMPANY** and its **PRODUCTS or SERVICES?**

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Advertising in *Shotcrete* magazine is the most cost-effective way to reach the shotcrete industry.

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The many benefits of advertising in *Shotcrete* have significantly increased with the addition of the electronic version of the magazine.

All advertisers in *Shotcrete* will now have their advertisement appear in **BOTH** the printed copy and the new electronic copy of the magazine at no additional charge.

The electronic copy of *Shotcrete* is sent to all subscribers, and advertisements include a hot link to the advertiser's Web site.

You can also hire our design department to create professional advertising design for your company. From concept to production and printing, we can produce the promotional materials for your ad campaign.

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# Shotcrete

A quarterly publication of the  
American Shotcrete Association  
**MAGAZINE**



# ASA New Members

## CORPORATE MEMBERS

**Allied North America Insurance**  
Brokerage of California, LLC  
Fremont, CA  
Primary Contact: Marcus A. Norton  
mnorton@alliedna.com  
www.alliedna.com

**Alltech Solutions, Inc.**  
Moncton, NB, Canada  
Primary Contact: Trevor Tomilson  
tomilson@alltechsolutions.ca  
www.alltechsolutions.ca

**Azteca Gunitite**  
Houston, TX  
Primary Contact: Ozzie Martinez  
info@aztecagunitite.com  
www.aztecagunitite.com

**Grindline Skateparks, Inc.**  
Seattle, WA  
Primary Contact: Roger Hubbard  
monk@grindline.com  
www.grindline.com

**Gunitite Specialists, Inc.**  
Norristown, PA  
Primary Contact: Scott Zimmerman  
gsipoolfinishes@live.com

**Testing, Engineering & Consulting Services**  
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Primary Contact:  
James Glenn McCants III  
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## CORPORATE ADDITIONAL MEMBERS

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York, NE

## INDIVIDUAL MEMBERS

**Tony Cook**  
Cascade Pools, Inc.  
Vancouver, BC, Canada

**Jesse Humphreys**  
Humphreys & Humphreys, Inc. dba  
Deluxe Shotcrete & Concrete  
Construction  
Santa Rosa, CA

## INTERESTED IN BECOMING A MEMBER OF ASA?

Find a Membership Application on page 54, and read about the benefits of being a member of ASA on page 55.

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Circle #19 on reader response form—page 56

# The Fifth Annual ASA Outstanding Shotcrete Project Awards Program is Now Open!



The American Shotcrete Association (ASA) is pleased to announce the fifth annual **ASA Outstanding Shotcrete Project Awards Program** to recognize excellence and innovation in projects in which the application of shotcrete has played a significant role.

Six categories were chosen to ensure that all areas of the shotcrete industry have the opportunity to be nominated for an award. These categories are:

- Architecture
- Infrastructure
- International Projects
- Pool & Recreational
- Rehabilitation & Repair
- Underground

Each entry must be submitted by an ASA Corporate Member and include one official entry form, Part I and Part II; up to 12 photographs (8 1/2 x 11 in. maximum size); written permission from project owner (when applicable); and the entry fee of \$50.00 USD. Put everything together in one three-ring binder and mail your entry to ASA, 38800 Country Club Drive, Farmington Hills, MI 48331. ASA will accept submittals until **5:00 PM EST on September 1, 2009**.

The success of the **ASA Outstanding Shotcrete Project Awards Program** will depend on the enthusiastic participation of all of our members. So don't delay and submit your entry today!

The winners will be given the opportunity to present their projects at the ASA Annual Meeting & Awards Banquet in Las Vegas, NV, on February 2, 2010. In addition, the winning projects will be featured on ASA's Web site and featured in the Spring 2010 issue of *Shotcrete* magazine.

Guidelines and entry forms can be found on the ASA Web site at <http://www.shotcrete.org/ASAOutstandingProjects.htm> or by contacting ASA by phone at (248) 848-3780.



# Shotcrete Calendar

*July 29-30, 2009*

**Splash! New Zealand Pool & Spa Trade Show**

Hilton Auckland, New Zealand

Glebe, NSW, Australia

Web site: [www.splashnzexpo.co.nz](http://www.splashnzexpo.co.nz)

*October 21-23, 2009*

**ICRI 2009 Fall Convention**

Theme: "Flooring Issues"

The Buttes, A Marriott Resort

Tempe, AZ

Web site: [www.icri.org](http://www.icri.org)

*October 22-27, 2009*

**2009 AASHTO Annual Meeting**

Desert Spring, A JW Marriott Resort & Spa

Web site: [www.transportation.org](http://www.transportation.org)

*November 7, 2009*

**ASA Fall Committee Meetings**

Marriott New Orleans

New Orleans, LA

ASA Executive Committee Meeting—CLOSED

7:00 am-9:00 am

Publications Committee Meeting

9:00 am-10:00 am

Pool & Recreational Committee Meeting

10:00 am-11:00 am

Education Committee Meeting

11:00 am-12:00 pm

Safety Committee Meeting

12:00 pm-1:00 pm

Marketing & Membership Committee Meeting

1:00 pm-3:00 pm

ASA Board of Direction

3:00 pm-5:00 pm

*November 8-12, 2009*

**ACI Fall 2009 Convention**

Theme: "Spice Up Your Concrete"

Marriott New Orleans

New Orleans, LA

Web site: [www.concrete.org](http://www.concrete.org)

*November 9, 2009*

**ASA Underground Committee Meeting**

5:00 pm-7:00 pm

Marriott New Orleans

New Orleans, LA

*November 13-18, 2009*

**International Pool/Spa/Patio Show**

Conference: November 13-18

Exhibits: November 16-18

Mandalay Bay Convention Center

Las Vegas, NV

Web site: [www.poolspapatio.com](http://www.poolspapatio.com)

*December 7-9, 2009*

**ASTM International Committee C09,  
Concrete and Concrete Aggregates**

Hyatt Regency Atlanta

Atlanta, GA

Web site: [www.astm.org](http://www.astm.org)

*February 1, 2010*

**ASA WOC Annual Meetings**

Las Vegas Convention Center

Las Vegas, NV

Publications Committee Meeting

8:00 am-9:00 am

Pool & Recreational Committee Meeting

9:00 am-10:00 am

Education Committee Meeting

10:00 am-11:00 am

Safety Committee Meeting

11:00 am-12:00 pm

Marketing & Membership Committee Meeting

12:00 pm-2:00 pm

ASA Underground Committee Meeting

2:00 pm-3:00 pm

*February 1-5, 2010*

**World of Concrete 2010**

Seminars: February 1-5

Exhibits: February 2-5

Las Vegas Convention Center

**Visit ASA at booth S10749**

Las Vegas, NV

Web site: [www.worldofconcrete.com](http://www.worldofconcrete.com)

*February 2, 2010*

**ASA Annual Membership Meeting &  
Fifth Outstanding Project Awards Banquet**

Reception: 6:00 pm-7:00 pm

Dinner: 7:00 pm-10:00 pm

Monte Carlo Resort & Casino

Las Vegas, NV

*March 15-17, 2010*

**Australian Shotcrete Society's International  
Conference/Engineering Developments  
in Shotcrete**

Millennium Hotel

Queenstown, New Zealand

## MEMBERSHIP APPLICATION

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_ Sponsor (if applicable) \_\_\_\_\_

Address \_\_\_\_\_

City / State or Province / Zip or Postal Code \_\_\_\_\_

Country \_\_\_\_\_ Phone \_\_\_\_\_ Fax \_\_\_\_\_

E-mail \_\_\_\_\_ Web site \_\_\_\_\_

### Please indicate your category of membership:

- |   |  |
|---|--|
| <input type="checkbox"/> Corporate                                    | \$750  |
| <input type="checkbox"/> Individual                                   | \$250  |
| <input type="checkbox"/> Additional Individual from Member Company    | \$100  |
| <input type="checkbox"/> Employees of Public Authorities and Agencies | \$50   |
| <input type="checkbox"/> Nozzleman                                    | \$50   |
| <input type="checkbox"/> Student                                      | Free (Requires copy of Student ID card or other proof of student status) |

*NOTE: Dues are not deductible as charitable contributions for tax purposes, but may be deductible as a business expense.*

### Payment Method:

- ☐ MC ☐ Visa ☐ Check enclosed (U.S. \$)

Card# \_\_\_\_\_ Expiration date \_\_\_\_\_

Name on card \_\_\_\_\_ Signature \_\_\_\_\_

### Company Specialties—Corporate Members Only

Company Specialties are searchable in the printed and online Buyers Guide.

#### Admixtures

- ☐ Accelerating
- ☐ Air Entraining
- ☐ Foaming
- ☐ Retarding
- ☐ Shrinkage Compensating
- ☐ Special Application
- ☐ Stabilizing
- ☐ Water Proofing
- ☐ Water Reducing-Accelerate
- ☐ Water Reducing-High Range
- ☐ Water Reducing-Mid Range
- ☐ Water Reducing-Normal
- ☐ Water Reducing-Retarding
- ☐ Water Repellent

#### Cement/Pozzolan Materials

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

#### Consulting

- ☐ Design
- ☐ Engineering
- ☐ Forensic/Troubleshooting
- ☐ Project Management
- ☐ Quality Control Inspection/Testing
- ☐ Research/Development
- ☐ Shotcrete/Gunite
- ☐ Skateparks

#### Contractors

- ☐ Architectural
- ☐ Canal Lining
- ☐ Culvert/Pipe Lining
- ☐ Dams/Bridges
- ☐ Domes
- ☐ Flood Control/Drainage
- ☐ Foundations
- ☐ Grouting
- ☐ Lagoons
- ☐ Mining/Underground
- ☐ Parking Structures
- ☐ Pumping Services
- ☐ Refractory
- ☐ Repair/Rehabilitation
- ☐ Residential
- ☐ Rock Bolts

#### Contractors, contd.

- ☐ 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
- ☐ Guide Wires
- ☐ Gunning Machines

#### Equipment, contd.

- ☐ 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



## 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 <i>Shotcrete</i> magazine (Hard Copy)	X	X	X	X	X	
Electronic Subscription to quarterly <i>Shotcrete</i> magazine	X	X	X	X	X	X
Free advance general admittance registration to World of Concrete	X	X	X	X	X	X
Reduced advance registration fees to ASA annual meetings	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	
Discounted ASA Member prices on all ASA products	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 <i>Shotcrete</i> magazine	X	X	X	X		
Free logo and link advertising on ASA website homepage for duration of each issue you advertise in <i>Shotcrete</i>	X					
Opportunity to submit items for Industry News and New Products & Practice sections of <i>Shotcrete</i> magazine at no charge	X	X	X	X		
Voting privileges at meetings and director/officer elections	X		X			
All company employees have opportunity to receive discounted Corporate Additional ASA Memberships (\$150 off regular membership price for each employee)	X					
Company & specialty information listed in <i>Shotcrete</i> magazine's annual Buyers Guide	X					
Company & specialty information listed in ASA online Buyers Guide	X					
Opportunity to submit entries into the annual Outstanding Shotcrete Project Awards Program	X					
Discount on ACI Nozzleman Certification program and ACI Recertification program	X					
Discount on ASA Underground Shotcrete Education Program	X					
ASA Promotion of nozzleman certification on a national basis in conjunction with ACI						X
<b>Education &amp; promotion of your shotcrete industry to the overall concrete industry</b>	X	X	X	X	X	X

# ANNOUNCING THE

# 2009-2010 American Shotcrete Association Graduate Scholarship PROGRAM

The American Shotcrete Association (ASA) is now accepting applications for Graduate Scholarships for the 2009-2010 academic year! The purpose of the ASA Graduate Scholarship Program is to attract, identify, and assist outstanding graduate students pursuing careers in the field of concrete with a significant interest in the shotcrete process.

Two \$3000 (USD) awards are available through ASA to eligible applicants for the 2009-2010 academic year. Applications and all required documents must be received by 5:00 pm EST on **September 1, 2009**.

Obtain all application information and requirements at:  
**[www.shotcrete.org/ASAScholarships.htm](http://www.shotcrete.org/ASAScholarships.htm)**



## American Shotcrete Association

### Reader Response Service

Please send information on the products or services circled below:

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*Please Print Clearly*

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Fax or mail to: American Shotcrete Association  
 38800 Country Club Dr. • Farmington Hills, MI 48331  
 Phone: (248) 848-3780 • Fax: (248) 848-3740

Summer 2009

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