shotcrete MAGAZINE

A quarterly publication of the American Shotcrete Association

VOLUME 24, NUMBER 1 • WINTER 2022

www.shotcrete.org

OUTSTANDING SHOTCRETE Project Awards

american shotcrete association | asa

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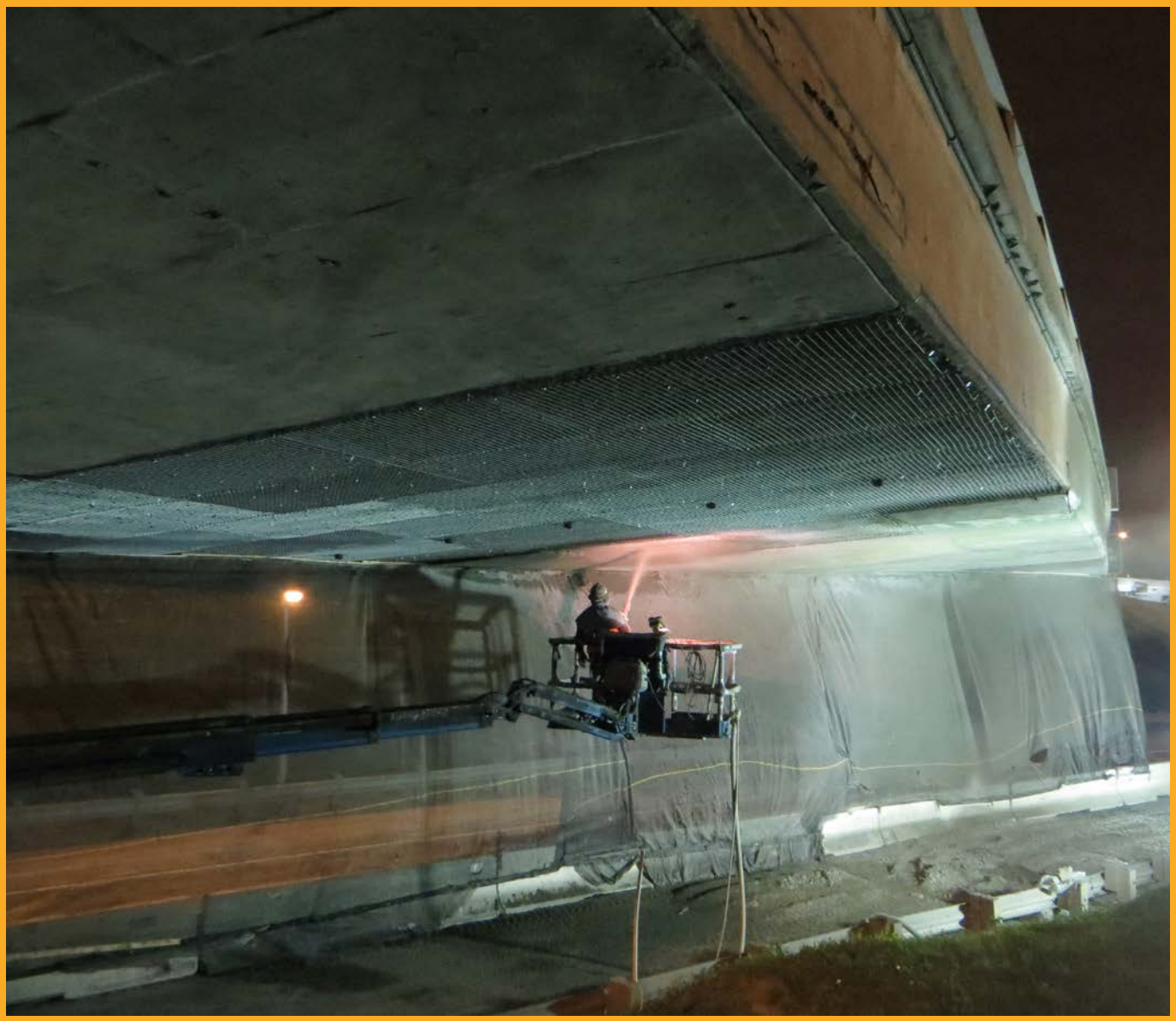

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Volume 24, Number 1 • Winter 2022

FEATURES

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

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Editor's Note: Shotcrete is a placement method for concrete. However, for the sake of readability, the word "shotcrete" is often used either to identify the shotcrete process (method of placement) or the shotcrete mixture (product materials).

ALSO FEATURING

DEPARTMENTS

2021 Outstanding Architecture | New Construction Project - Acoustical Wave Wall, CROM, LLC

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ASA Convention Recap

By Lars Balck

It feels like coming out of a fog, for the first time in 2 years we were finally able to get together in-person, chat and network. How refreshing! Our ASA convention at the Sonesta Resort, on the beach at Hilton Head Island, SC was perfect. The hotel was cozy (a perfect size for our group) and the weather was warm which allowed for reflective walks on the beach. With 125 attendees we were the only group in the hotel. Another plus.

A special thanks to our sponsors who helped make all this possible. See our full ist of sponsors on pages 12 - 14.

Here is a recap of convention activities.

COMMITTEE MEETINGS

ASA's success is due to the work of the committees:

Marketing – Ashley Cruz, Chair
Ashley chaired her first meeting virtually and tasked the committee to focus on updating the Scott card (ASA's Strategic Plan). In addition, she asked the committee to consider the following:

Art of Shotcrete: Working with Tosha, Ashley will explore expanding the outreach of this program to a broader range of users on other social media platforms.

Outreach: Generate a handout offering tips on shooting better images and video footage to update our marketing resources and bring awareness to the shotcrete industry.

Membership – Jason Meyers, Chair
Membership is on track to meet its objectives of retaining 85% of corporate membership and increasing corporate members by 5% and with an increase of 10% of individua. members. The committee also, plans to work in collaboration with the Contractor Qualification committee to encourage more shotcrete contractors to apply for ASA's Contractor Qualification program.

Pool and Rec – Ryan Oakes, Chair
The committee is working on a position paper regarding reinforcement for concrete pools and will do a second paper on rebound and trimmings. It was also reported that Bill Drakeley is chairing ACI committee 506-H Shotcreting - Pools which is balloting a new pool document "Guide to Shotcrete Pool Construction." Charles Hanskat manned the ASA Dallas exhibit and gave several presentations on shotcrete at the International Pool, Spa and Patio show.

Underground – Christoph Goss, Chair
Chistoph conducted his first committee meeting virtually which started off with Christoph acknowledging Axel Nitschke, the previous chairman, who in the last three years revived the underground committee and drove the committee to publish four underground position papers. Committee members and attendees reflected on Axel's contributions and friendship as well.

The Underground committee is working on a new position paper, "Shotcrete Method for Innovative Materials in Underground Application." In addition to working on the position paper, they are collaborating with EFNARC for evaluating how certification for mechanical (robotic) spraying can be implemented in North America.

Contractor Qualification – Marcus Von der Hofen, Chair
Seven companies have been qualified and four companies are currently being reviewed. Recommendations to change the category titles from Basic to Level I and Advanced to Level II were presented and approved by the Board. Some requirements were upgraded for Level II as well as additional requirements for applicants to provide reliable access to references.

Education & Safety – Oscar Duckworth, Chair
A task group was created to work on revising the nozzleman certification education presentation to match the new CCS-4 "Shotcrete for the Craftsman" book. However, it was noted some changes are being held up until ACI updates the ACI CP-60 "Shotcrete Nozzleman Craftsman Workbook" to match CCS-4. Another task group was also created to work on revising the "Safety Guidelines for Shotcrete."

Board of Directors
Charles led a tribute to Axel followed by a minute of reflection.

Committee reports were submitted for Board approval and recommendation and are reflected in the committee updates above.

In an effort to encourage professors to join ASA and increase our outreach to the universities, the Board approved changing the Student membership to Academic membership. This change offers a free membership to professors as well as students.

Awards Dinner and Recognition

Like the Oscars, we had some drama at our awards. In the past, some award winners spent too much time talking about their project. So, to help contain their excitement, we have asked all winners to limit their acceptance speech to 5 minutes. However, when Bruce Russell from CROM started going long, Charles realized he did not get the memo and warned Bruce, only to be rebuffed. Bruce, who is twice Charles's size, was not going to be stopped. We were all well-educated on the splendor of the Wave Wall project and all its glory. The friendly banter between Charles and Bruce added to the evening's amusement and a good time was had by all. You will find the 2021 Outstanding Shotcrete Project Award winners featured in this magazine.

The highlight of the evening however was being able to surprise Alice McComas with the honor of being the recipient of the 2022 President's Award. Although at first, she refused to believe she was getting the award, her 11 years of service to all of us at ASA and administering the admittedly complicated ACI Shotcrete Nozzleman Certification program made her the perfect candidate. Her hard work and dedication are greatly appreciated.

From the feedback the convention was a great success. Everyone enjoyed finally being able to network, chat and just get to know everyone again. Also, one of my goals as President has been to revisit and revise our long-delayed strategic planning meeting. We've finally been able to set a date for this Fall. Many of our Corporate and Sustaining members should receive a survey later this summer to gather feedback to inform our Strategic Plan. Your time in answering and returning that questionnaire would be greatly appreciated!

All the best to everyone and take care. We look forward to celebrating ASA's 25th Anniversary with you at our 2023 Annual Convention in Ojai, CA on February 26-28, 2023.

Marketing Committee

By Ashley Cruz, Chair

Hello! And thank you for reading this column and our quarterly shotcrete publication. Without your support, interest, and dedication to this specialized field of concrete placement, shotcrete, the American Shotcrete Association would not be as strong as it is today.

A large part of the Marketing Committee is based around education and advocacy for shotcrete through presentations to engineers, architects, agencies, educators and students. In 2021, despite COVID-19, we were able to hold 35 presentations and reach over 927 people. Thank you to our presenters and all who were in attendance. Did you know that Sustaining and Corporate members could request to host a complimentary introduction to Shotcrete seminar for your project owners, specifiers, and engineers to better understand and specify shotcrete on your next major project? Do you have contacts at a local college or university whose engineering professors might be interested in a complimentary ntroduction to Shotcrete class for their students. ASA would love to work with you to help reach your community with more information on the quality and benefits of specifying shotcrete on their next project. Contact us at Info@shotcrete.org for more details.

In March 2022, we held our Shotcrete Convention and Technology Conference at the Sonesta Resort at Hilton Head, South Carolina. With the generous support of our sponsors, we were able to host about 115 members, sponsors, educators and students, as well as recognize the winners of the 2021 Outstanding Projects in Shotcrete. In this issue of Shotcrete Magazine, you will be introduced to the winners and read more about their outstanding projects. ASA's awards program is an excellent means of promoting the outstanding role shotcrete could play on projects. It highlights the ingenuity and creativity of shotcrete to create unique shapes, tight tolerances, and difficult to access locations. Featured winners are promoted throughout the year on our website, Shotcrete magazine, press releases and social media. Our speakers will often point to work on a project when answering questions during a presentation. We encourage everyone to take tons of pictures of their projects and submit an entry or two for a chance to win this distinction and be celebrated at the 18th Annual Outstanding Shotcrete Project Awards banquet held at ASA's 2023 Shotcrete Convention and Technology Conference in Ojai, CA (February 26 – 28, 2023)! This will be a milestone event as ASA celebrates our 25th anniversary. The 2022 Outstanding Shotcrete Awards program is now open. Read more about the program and download the application here: www.shotcrete.org/projectawards

The Marketing Committee is calling all social media users. The Art of Shotcrete is a quarterly photo contest to promote imagery of shotcrete through virtual participation, highlighting the creativity of the industry as, "shotcrete in

motion.. Tag @artofshotcrete in any of your social media platforms or submit your photo to info@shotcrete.org, for a chance to be printed in the next issue of Shotcrete Magazine. Take a look at Association News to see the winners of last quarter.

Lastly, I want you to know that our doors are always open and we want you to come in; if you are interested in becoming a part of the Marketing Committee, or any other committee; if you have an idea for a topic or an article for the magazine; if you want to see more content on a specific subject; if you just want to say "hello", shoot us an email or message on any of our social media accounts. Be well, and leave it better than you found it.

Social Media handles:

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email: info@shotcrete.org

Looking to the Future

By Charles S. Hanskat, PE, FACI, FASCE, ASA Executive Director

This issue of *Shotcrete* magazine for another year puts the spotlight on the cool things we do with shotcrete placement in concrete construction. Many times, shotcrete is the only viable way to build a complex concrete section. Other times it is simply the most efficient and sustainable method. The winners of our Outstanding Shotcrete Project awards exemplify the quality, innovation, creativity and commitment our shotcrete contractors bring to the concrete industry.

Yet these award winners are just the tip of the iceberg. Every day our ASA member companies use shotcrete placement to produce high quality, durable concrete. Though we've highlighted a few "winners" here, in truth every shotcrete project using quality materials with proper equipment and placement are the winners because we are building things with concrete that can easily last 50 to 100 years with little maintenance. And we do that with a much more efficient process, with equal or superior in-place properties that often save time and cost on the projects.

In February, we held our third annual convention in Hilton Head, SC. We recognized our award winners, presented technical sessions on the state-of-the-art in shotcrete, and held our ASA committee meetings. Elsewhere in this issue you'll find our president, Lars Balck's column with the actions of our committees. We enjoyed visiting the exhibitors to learn more about their companies and how they help to advance our day-to-day shotcrete work. I certainly want to thank all our generous sponsors who allow us to keep our registration fees lower for attendees and support the mission of ASA.

A highlight from our recent Board decisions includes the revamping of our Student Membership to an Academic Membership. This membership is now extended to not only include students, but also college and university faculty and staff. We have long extended free Agency Membership to government agencies like DOTs in the United States and Canada to bring visibility, resources and information to those specifying shotcrete in the public sector. We feel that participation from faculty and staff will likewise significantly increase the exposure of shotcrete at the college and university level. The earlier students are introduced to knowledge about shotcrete, the more likely they will accept its use on future projects. Membership benefits for this new category include contributing participation on committees, complimentary subscription to Shotcrete magazine, opportunity to publish in Shotcrete magazine, member pricing for ASA conventions, access to educational resources, and student competition opportunities.

Additionally, our incoming ASA Vice President, Frank Townsend, has extended our outreach to students by jump starting a program to provide in-person "shotcrete seminars" to students at their colleges and universities. Frank has personally presented our Introduction to Shotcrete seminar to many student groups at schools across the

Northeastern US. However, with a more aggressive and proactive outreach program, using our ASA members as facilitators, we hope to reach even more students across the US and Canada through these seminars, so that students will graduate knowing that shotcrete is a valuable part of concrete construction options. Keep an eye out for more information in ASA social media platforms and our eNewsletter, "What's in the Mix."

Overall, it was great to be back meeting our members in-person at the convention. There is absolutely no substitute for personal interaction. And this is perhaps the most important aspect of our ASA conventions. The opportunity to bring together the movers and shakers in the shotcrete industry. To network, and confirm, through our involvement in ASA, our vision that quality shotcrete placement produces concrete structures that are equal or superior to form-and-pour. The future is bright for shotcrete, with our ASA member's attention to quality, breadth of applications, and creativity as exemplified by these outstanding project awards. Yet the future also depends on bringing new talent into our industry. Outreach to students to extend their knowledge about shotcrete is essential for our future growth.

2021-2022 Awardee

Sophie-Isabelle Dionne-Jacques is a M.Sc. *Student in the Department of Civil and Water Engineering at Université Laval. The core of her graduate studies is to develop an integrated model of shotcrete rebound. This goal is to be achieved by further explaining the effect of rheology in substrate behavior during impact of aggregate. Her years of experience as a research assistant allowed her to develop concrete skills that she now builds upon to realize her M.Sc. project. She was a winning member of the concrete canoe project and the CAPSTONE design competition. She received her bachelor's degree in civil engineering from Université Laval.*

Nomination for the scholarship for Dionne-Jacques came from Marc Jolin at Université Laval. Jolin's recommendation included the following: "Sophie-Isabelle is a young M.Sc. student who started working in the Shotcrete Laboratory Université Laval, Québec City, Canada over two years ago, initially as a young undergraduate student helping out on shotcrete projects and now (since May 2021) conducting her own M.Sc. project on shotcrete placement optimization. Only a few days into her first shotcrete experiences, she demonstrated an impressive curiosity and a rigorous mind in the way she wanted to understand and improve shotcrete. Her M.Sc. project is the first hybrid project where the precision of automated shotcrete placement is capitalized on to further our understanding and description of rebound and precisely test the effect of combinations of rheology modifiers on rebound. In parallel, she is also preparing a unique paper integrating the most recent observations on rebound and earlier theories for what should be a reference paper for years to come."

DIONNE-JACQUES'S RESEARCH PROJECT

Rebound in Shotcrete: A New Predictive Approach

Rebound has been a major waste-related issue to the spraying process for years. The economic, environmental and efficiency losses related to it have yet to been solved.

The shotcrete research group at Université Laval has, over the years, focused its projects on three main paths to reduce rebound: optimization of the material, the equipment, and the technique. Since the first rebound theory proposed by Armelin in 1996[1], very few improvements have been added. However, the many studies on mixture designs and more recently, on the shotcrete material stream (velocities and special material distribution), have brought to light very interesting and important elements regarding the behavior of the concrete material within the stream and its impact on the substrate[2, 3].

Even with numerous research projects on mixture optimization, there are still no clear boundaries to identify the lowest rebound mixtures possible.

Therefore, it's important to further our understanding of rebound in order to design the most efficient mixture, select the best equipment and use an appropriate placement technique.

OBJECTIVES

To be able to complete Armelin's rebound theory, the project is organized around the following three objectives:

1. **"Zero-rebound" goal**
   This objective is intended to develop an optimized and high environmental added value mixture for the shotcrete industry with zero-rebound.
   Mixtures will be studied for their rebound results but also for their rheological and mechanical properties. A variety of additives and supplementary cementitious materials will be combined to ultimately obtain the perfect mix. The variation of dosages will be studied according to their effect on the rheological properties and consistency[4].

2. **"Small-scale" goal**
   The small-scale goal seeks to establish a relationship between the rebound for a mortar-type mixture and a shotcrete mix, according to the ACI 506R-165 aggregate size distribution #1 and #2 respectively.
   The use of small-scale shotcrete is relevant in experimental testing since it needs less material to characterize a single mixture. The ease of operation of small-scale equipment allows a greater range of mixtures to be tested and analyzed in a short amount of time.

3. **"Rebound rheology" goal**
   The cornerstone and most fundamental aspect of the project, this goal is aimed at truly incorporating the rheological portion of the substrate during spraying, including the effect of the incoming particles. This step will establish the parameters of the fluid zone of the receiving surface (substrate) and the rebound values within its borders.

RESEARCH SIGNIFICANCE

A new rebound model will provide a better understanding of the behavior of shotcrete and therefore offer more parameters to define the rules shotcrete mixture design. This allows the shotcrete mixture design to be optimized, making it possible

to tailor the mixtures to the specific needs of the customer and application.

Ultimately the results of this project will provide general methods to increase the efficiency of mixture composition and elaboration of testing plans.

REFERENCES

[1]H. S. Armelin and N. Banthia, "Development of a general model of aggregate rebound for dry-mix shotcrete- (Part II)," Materials and Structures, vol. 31, pp. 195-202, 1998.

[2]A. Laradh, "Mise en place, énergie et rebond dans le béton projeté," 2020.

[3]N. Ginouse and M. Jolin, "Mechanisms of placement in sprayed concrete," Tunneling and Underground Space Technology, vol. 58, pp. 177-185, 2016.

[4]M. Jolin, D. Beaupré and S. Mindess, "Tests to characterise properties of fresh dry-mix shotcrete," Cement and Concrete Research, vol. 29, no. 5, pp. 753-760, 1999.

[5]ACI Commitee 506, Guide to shotcrete, Farmington Hills, Michigan: American Concrete Institute, 2016.

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2021 Outstanding Rehabilitation & Repair Shotcrete Project

10th Avenue SE Bridge Rehabilitation

By David Graham

BRIDGE HISTORY

Listed on the National Register of Historic Places in 1989, the 10th Avenue Bridge in Minneapolis features seven reinforced concrete arches to span the Mississippi River. The historic 1,141-ft (348 m) open spandrel column arch structure carries over 10,000 vehicles daily, as well as hundreds of pedestrians and cyclists between downtown Minneapolis and an area dominated by the University of Minnesota on the east bank.

Original construction was completed in 1929, and the Minnesota Department of Transportation last restored the bridge in 1976. After 45 years of leaking bridge deck expansion joints and seasonal freeze-thaw damage, the City of Minneapolis initiated an extensive rehabilitation project that would include replacement of the bridge deck and all spandrel column caps, select spandrel columns, and repair of substructure elements including 8 piers, 7 arch rib spans and 146 spandrel columns.

BRIDGE SUBSTRUCTURE REPAIR

After initial sounding and removal of deteriorated concrete, existing reinforcing steel and arch rib Melan truss angle iron was abrasive blasted to near white metal condition and coated with a zinc protective coating.

The next step in the process was to install new #4 and #5 (#13M and #16M) hot-dip galvanized reinforcing bars 12 in. (300 mm) on center both ways. New galvanized reinforcing bars were installed in all concrete surface repair areas. Dry-mix shotcrete was used as the primary method of historic concrete surface repair.

This contract required a preconstruction mockup process where we were required to produce various color samples and submit them to the owner designated historical consultant for approval. As we learned through previous experience from completing historical bridge repair projects, the color selection process can be tedious and lengthy. Fortunately, we were able to provide a satisfactory color sample on the second round of sample submittals. After mockup approval, a specially tinted, prepackaged dry-mix shotcrete material was selected for use on this project. Form-and-pump methods were used to place material for the top of arch rib repairs. A prepackaged, low resistivity material was the required material for the form-and-pump repair areas which were to receive future cathodic protection by thermally applied metal spray.

> THIS PROJECT PROVIDED MULTIPLE PROJECT CHALLENGES.

ACCESS

How does one best access the work areas to maximize concrete repair productivity and coordinate the removal and replacement sequence. Due to complex access requirements, including two 290-ft (88 m) major river spans, both rising 118 ft (36 m) above river elevation and multiple bike paths and roadways that were to remain open to the public,

we decided to use a suspended work platform system for access to the arch ribs and scaffolding for access to the piers and land based arch spans. The Safway QuikDeck® system provided a solid work platform from which we could erect supplemental scaffolding, as required, to access various elevations of curved arch rib elements including bottom, side and top surfaces, as well as various spandrel columns that required repair for the top of arch ribs.

CONSTRUCTION SCHEDULE

As a subcontractor on a project of this size, one of the biggest challenges is to execute your work within the limits of the overall construction schedule. Of primary significance on this project was working around the bridge deck removal and replacement schedule. Original plan quantity for concrete surface repair was 24,200 ft^2 (2250 m^2), however, the actual completed quantity totaled over 39,000 ft^2 (3620 m^2), a 61% increase from original plan quantity. On a project like this, a quantity over run does not provide automatic schedule extension. This proved to be challenging and required various methods to overcome.

We started work in October 2019, at pier 6 on the north side of the river. In an effort to get ahead of schedule we elected to house and heat this area and continue our operations throughout the winter months. Once work began, we realized there could possibly be continuous quantity overruns throughout the project. Over the course of two winter seasons, arch spans 1 and 2 and piers 3, 4, and 6 were enclosed and heated for completion during cold weather months.

Work completed during the winter required containment and heating provisions, supplemental ventilation, dust collection, and temporary lighting. To meet the compressed construction schedule and follow bridge deck replacement sequence, both concrete surface repair and thermally applied metal spray activities were required to proceed continuously for 24 months, 6 days per week, 10-12 hours per day. Arch span and spandrel column repairs were sequenced around deck removal and replacement activities.

Dry-mix shotcrete was placed using Allentown GRH shotcrete machines, and where possible, two shotcrete machines were operated simultaneously to increase production, thus reducing schedule activity duration. We were able to meet all required schedule milestones and were not responsible for causing delay to bridge deck replacement sequence. Depending on the work area available, labor resource requirements varied from 15-35 workers per shift.

HISTORICAL ELEMENT

To duplicate the original 1929-era construction appearance, a board form finish was applied to 29,500 ft^2 (2740 m^2) of the repaired surfaces. This historical finish was accomplished by one of two methods; hand tooling was applied to vertical non-formed surfaces or, where formwork was required, using rough sawn 2 x 10 construction lumber.

CATHODIC PROTECTION

After all concrete surface repair was completed on an arch span, at top surface of arch ribs, CorrSpray® aluminum/zinc/indium thermal metal spray cathodic protection was applied. 25,600 ft² (2380 m²) of thermally-applied metal spray was completed on this project.

MISCELLANEOUS REPAIR

Epoxy injection was used to seal arch rib cracks and the grout-and-seal method was used at construction joints between spandrel columns and top of arch rib.

PROJECT INVOLVEMENT

- Project design was provided by Short Elliot Hendrickson, Mark Maves, project engineer.
- Structural engineer was Steve Olson, Olson, Nesvold Engineers.
- Historical Consultant was Charlene Roise, HessRoise.
- Prime contractor was Lunda Construction Co, Black River Falls, WI. Dan Duffy, Project manager.
- Dry process shotcrete material was provided by TCC Materials.
- Prepackaged low resistivity material was provided by King Packaged Materials/Sika.
- CorrSpray® metal spray wire was provided by Structural Technologies.
- BrandSafway provided and installed QuikDeck® work platform as well as Systems™ scaffolding at arch ribs and spandrel columns.
- Advantage Scaffolding provided and installed sectional scaffold at all piers and at arch rib spans 1 and 2.
- Gary Carlson Equipment provided Putzmeister and Allentown equipment support.
- Gunite Supply and Equipment provided shotcrete hoses and accessories.

***David Graham**, Project Manager for PCiRoads, LLC, since 2007, is an ACI Certified Nozzleman for both dry- and wet-mix shotcrete. With over 30 years of experience in the shotcrete industry, he has managed numerous projects nationwide that include the use of shotcrete on buildings, bridges, tunnels, dams, silos, tanks, and soil stabilization.*

2021 OUTSTANDING REPAIR & REHABILITATION PROJECT

Project Name
10th Ave SE Bridge Rehab

Location
Minneapolis, MN

Shotcrete Contractor
PCiRoads, LLC

Architect/Engineer
Short Elliott Hendrickson

Material Supplier/Manufacturer
TCC Materials & Sika STM

Equipment Manufacturer
Gary Carlson Equipment / Putzmeister

General Contractor
Lunda Construction Co.

Project Owner
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2021 Outstanding Infrastructure Project

Deep Cove Foreshore Development

By Dan Pitts

We got a call from one of the local drilling contractors, Braestone Rockworks to check out a shotcrete shoring project down at Deep Cove in North Vancouver, British Columbia. After further discussion over the phone with Braestone, we were told the client and landscape architect already had tentatively thought of someone to do the rock sculpting portion of the project. This news was a bit of a letdown but we thought maybe we could change their minds. When we initially arrived on site, I could see many logistical challenges, for not only us but for the potential rock sculpting crew the owner had in mind for the project. After waiting a few minutes for the owner to show up, around the corner comes Andre (Andre is a client we recently did a rockwork job for in Whistler, BC). Not sure what to think and why he was here, we started to chat. Only then did we realize he was the owner of the newly purchased property, and we were the rock guys he had in mind to do the project! Now this was cool! But of course now we had to figure out how to get all the rock work done.

SITE ISSUES

Site logistics were tight. The recently built home was full of settlement cracks and a total drop of 1.5 in. (38 mm) in the northwest corner. This prompted the geotechnical engineer to conduct some exploration work. The soil investigation found there were voids in the subgrade due to poorly placed structural fill from the original construction of a marina 30 years ago that had long been removed. The client hired Capilano Builders to be the general contractor for the project which included an almost full gutting of the only 10-year-old home.

This home sits perched up about 60 ft (18 m) from the beautiful Deep Cove. The ocean boasts plenty of sea life and our number one priority was to protect the sea life with an environmental protection plan established by the North Vancouver district and Capilano Builders. To stabilize the house and soils the house was built on required approximately 40 to 50 ft (15 m) anchors installed by Braestone to bear on the bed rock beneath the home. This work required a custom site-specific drill rig. The ocean was protected by close monitoring and a floating tarp system. The tight driveway and private gated road presented further challenges. Keeping access for a fire lane and allowing the flow of cars to access the marina while ready-mix concrete trucks were unloading meant we didn't have any staging

areas for the waiting ready-mix trucks, so timing was everything. Luckily there was an area for the ready-mix to turn around at the marina since it is private, and a gate prevented public entry.

Once we finished the initial shoring application, we were on our way to making the shored property visually appealing and functional with our rockwork to access the water again. Paul Woodbridge, with our ready-mix concrete supplier Rempel Bros. Concrete in North Vancouver, provided much appreciated help in developing corrosion-inhibiting concrete mixture designs to help protect the embedded reinforcing steel from the salt water exposures. One of the main stipulations from the environmental engineer and district staff was we needed a minimum M2 area for planting. This was included in our design, and we ended up not only meeting but exceeding their request. We built planters complete with drainage, irrigation, and lighting with the assistance of Mike at NorVan Lighting and Sprinklers in North Vancouver. The company was very professional and were available whenever we needed them. The property was relatively steep, so we built a custom scaffold system to shoot and sculpt the shotcrete.

EQUIPMENT

We enlisted one of our Putzmeister pumps for this entire project. Our TK20 with hydraulic detachable mixer was the game changer on this project allowing us to mix our own carve coat giving us close control of set time by staging the mix. All our concrete for the structural work core of the rock was supplied by Rempel. By mixing our carve coat concrete onsite, we eliminated any concern about truck delivery time.

As the weather in Deep Cove is similar to that of Hawaii we knew to expect rain so we were setting up tarps for either shade protection or rain protection daily. We tweaked our concrete mixture with retarder and supplemental cementitious materials allowing us even more control of set times to push our production rates while allowing us sufficient time to create all the details we are so well known for. With pumping distance on average of 250 ft (76 m) and a stationary pump location we placed a slick line that stayed in place for a majority of the job. Moving and managing delivery hoses was another tricky aspect of the project. With constant movement and special ability of our talented ACI-certified shotcrete nozzlemen, the shapes and movements were done with precision, requiring constant preplanning. The nozzleman was securely tied off much of the time to avoid falling into the guardrails or into the planters. The backup nozzleman and crew played a huge role in assuring the safety of the nozzleman.

CARVING

Carving a big project like this takes a lot of preplanning with sun, angles, fault lines, colors, viewing points and useability. We were able to incorporate the natural layout of the shoring structure to create multiple pathways, access points and hang-out zones. All these areas needed to be thickened and engineered with armature steel in the early stages of the layout. Making something look natural and having it feel safe to use by the client and guests was another task. All the rock was brought up above the walking path to create a sense of security while walking along the path on the steep hillside. This all needs to designed for the armature steel during the preplanning. We used the fault lines we created in the carved rock to visually line up with the planters and walking path elements. Some of the carving had to be done during a low tide so special timing of carving and concrete mixing was critical.

COLOR

After approximately 16 days of carving and added time for curing we were ready to color. The hot sun worked in our favor drying every layer of our 12-step paint process as fast as possible. Moving around a large project like this with so many nooks and crannies and not missing a single square inch becomes a time consuming race.

COMPLETION

We completed this project that ended up including a new driveway, planters and pathways around the entire house in approximately 8 months. Shotcrete was the essential factor in completion and practically speaking, could not have been done any other way.

Dan Pitt, *Owner/Operator of Ocean Rock Industries, Squamish, British Columbia, Canada. Ocean Rock Art specializes in artisanal concrete rock environments. Everything we do is custom designed and hand-crafted to ensure the perfect fit for your landscaping or construction project. With years of experience and top notch concrete artists, Ocean Rock is ready to build the rock environment of your dreams.*

2021 OUTSTANDING INFRASTRUCTURE PROJECT

Project Name:
Deep Cove Foreshore Development

Location
North Vancouver, BC Canada

Shotcrete Contractor
Ocean Rock Art Ltd.

Architect/Engineer
Kontur Geotechnical

Material Supplier
Remple Bros Ready Mix

Equipment Manufacturer
Putzmeister

General Contractor
Capilano Builders

Project Owner
Andre & Trudel Kroecher

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M4-M5 Link Tunnels

By David Oliveira

Fig. 1 Shallow ramp tunnel before water-proofing treatments

The M4-M5 Link Tunnels in Sydney, Australia, is approximately 7.5 km (4.7 mi) long and accommodates up to four lanes of traffic in each direction. It connects the New M4 Tunnels with the M8 Tunnels to form the 33 km (20 mi) long Westconnex Motorway, mostly underground.

The project decided to use a high-performance shotcrete specification in the structural design of the tunnels' 100-year design life permanent support. This decision targeted reducing shotcrete quantities, thus providing cost savings and achieving better sustainability.

Previous attempts in preceding projects failed to achieve this high specification during production consistently, which resulted in many non-conformance reports and design checks. As a result, at the start of the project, a decision was made to

Fig. 2 Spray of field-scale test panels loaded with hydraulic pressure bags installed behind geotextile fleece that promoted debonding.

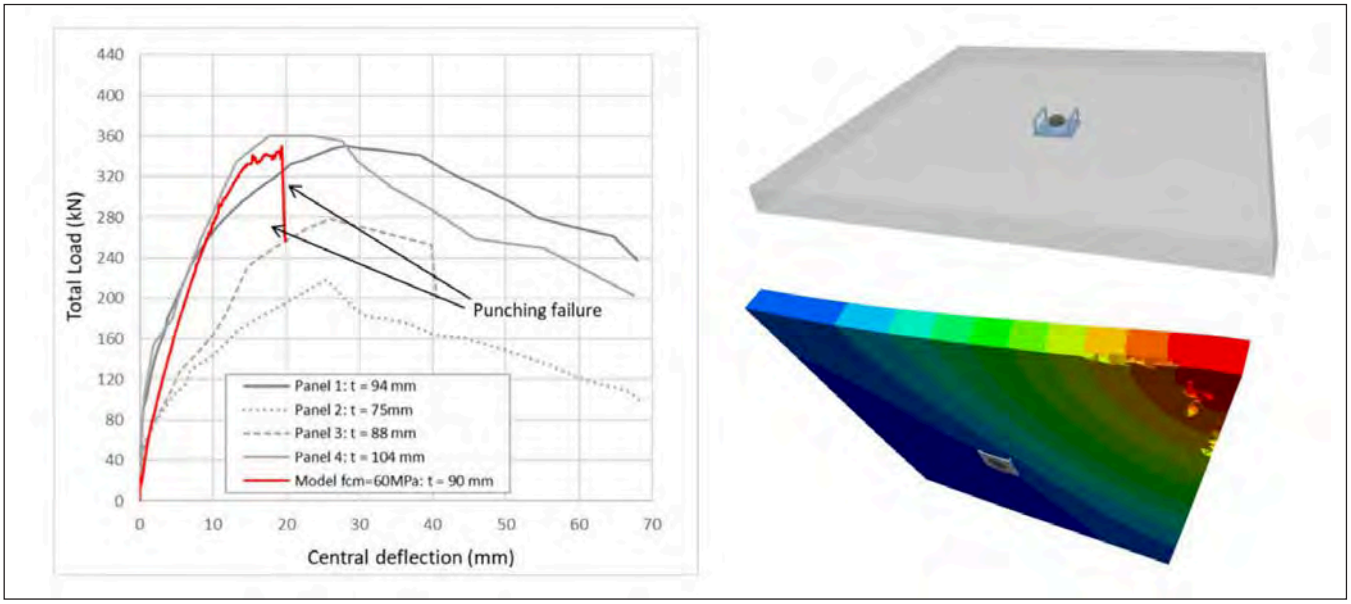

Fig. 3: Results of field-scale tests with examples numerical models used in design predictions.

adopt high-performance end-hooked steel fibres to overcome the challenges previously experienced. Although relatively common in TBM segment design, such high-performance fibres had not been previously used in sprayed concrete in Australia. The M4-M5 Link Tunnels was thus the first project to utilize these fibres in Australia.

The final mix design achieved the targeted structural performance with a strength of 40 MPa (5800 psi) and characteristic values of residual flexural strength of fr1 > 3.5 MPa (510 psi) and fr4 > 3MPa (435 psi). This performance was achieved using only 35 kg/m^3 (59 lb/yd^3)of fibres, which also promoted a saving of 10 kg/m^3 (17 lb/yd^3) from previous experience and compensated for the higher cost of the high-performance fibres.

Besides regular production testing of the shotcrete, including beam testing for residual flexural strength and ASTM C1550 round panel testings for toughness, the project conducted several field-scale tests to confirm the structural performance of its rock bolted-shotcrete lining. These field-scale tests provided greater confidence in the load-bearing capacity of the permanent tunnel linings since up to 6 times greater capacity was estimated compared to previous designs.

After more than 250,000 m^3 (330,000 yd^3) of steel-fibre reinforced shotcrete sprayed in the project, the project confirmed a successful and consistently conforming application of this higher performance shotcrete with an overall quantity reduction in shotcrete of up to 20%.

Dr David Oliveira *is a Technical Director for Jacobs Engineering Group with a focus on Tunnels and Rock Engineering projects. He has 24 years of experience in the design and construction of major infrastructure and mining projects in several different countries. David is a Fellow Member of Engineers Australia, an Adjunct Fellow Researcher with the University of Wollongong and a causal lecturer at a few universities such as the University of Sydney and Monash University.*

2021 OUTSTANDING INTERNATIONAL PROJECT

Project Name
M4-M5 Link Tunnels

Location
Sydney, Australia

Shotcrete Contractor
Acciona Bouygues Samsung Joint Venture

Architect/Engineer
Jacobs Aurecon Joint Venture

Material Supplier
Bekaert

Equipment Manufacturer
Normet Asia Pacific Ltd

General Contractor
Acciona Bouygues Samsung Joint Venture

Project Owner
Jacobs Engineering Group

2021 Outstanding Pool & Recreational Project

Where Form and Pour Stops

By Ryan Oakes

Fig. 1: Where Forms and Pour Stops

DESIGN

Though our primary business, Revolution Gunite, specializes in dry-mix process shotcrete, we also own a design firm called Waterforge, Inc. In this firm, we develop architectural conceptual plans and engineered construction drawings, mostly for swimming pools and other watershapes, including foundations and complicated site conditions.

Often, this side of our business creates unique opportunities for shotcrete…by the ocean, unique homes, perhaps a garden for an eccentric client, or a pool hanging off a cliff.

This project is one of those, right on the side of a beautiful mountain, deep in the Appalachia region, in one of the most coveted and secluded neighborhoods off the Blue Ridge parkway… A neighborhood, for perspective, with 6,000 acres and less than 10 homes.

That's not what make this project so special though. What's really interesting is that the owner has a firm that specializes in form-and-pour concrete. These guys don't just pour concrete, they build big, complicated projects.

Their 20,000 ft^2 (1900 m^2) mountain home has lots of form-and-pour concrete and as you might imagine, they self-performed all that work. In fact, they had considered self-performing the concrete portion of their pool construction.

After one design firm failed to bring something appealing, they began their search, found us, engaged with us and loved the plans we produced. Once we had construction drawings complete, it was time to estimate the cost for the project.

Fig. 2: First the pool floor was shot along with a gutter wall, which allowed the forming of the shelf and additional bar

Fig. 3: Rain protection with a tarp. Nozzleman with an air lance operator at his side, keeping the adjacent material clean. Complex forming

DESIGN DETAILS & CONSTRUCTION METHODOLOGY

At this point, our client was still fairly adamant that they would provide all concrete, until they began to study the plans.

This was not a standard pool in a flat back yard, rather it was to be a second-floor level pool, perched approximately 17 ft (5.2 m) above finished grade on a steeply sloped hill on top of a mountain. There would be a vanishing edge detail on three sides of the pool, a perimeter overflow spa

Fig. 4: Air lance operator keeping the corner free from rebound until the nozzleman places material in the corner. High quality diaphragm water valve ensures a sensitive control of mix water

Fig. 5: Pour in place catch basin and foundation walls with forming above for shotcrete placed walls and catch basin floor

Fig. 6: Finishers working in spa under rain and shade tarp. Upside down boots keep tarp from punching through

Fig. 7: Rebound removal

with contoured benches and numerous therapeutic jets, a shallow water shelf, steps, some unique gutter and vertical trough details along with a catch basin, an equipment room below the pool and most interestingly some vertical panels, intersecting the vanishing edge wall of the pool.

When it comes to swimming pool construction, the standard method in the United States is to place the concrete using the shotcrete process, dry-mix or wet-mix, it doesn't matter. Form-and-pour is not usually used on swimming pools, though it's certainly possible and is often a technique used for commercial fountains. This pool design was very different with some unique challenges, for example, vanishing edge walls are typically topped with an angle and we like to use a 30° slope tipped in toward the waterside.

There were also several questions that we needed to address, such as:

- You can fill linear forms with an 8 in. (200 mm) slump and super plasticizer, but can you then level the fresh concrete off the top of the forms at a 30° angle?
- Can you shape a bench to that of a person's relaxed angle. Perhaps, but in how many pours?
- Can you create vertical walls, freestanding without forms, with small gutters to channel water to a basin 17 ft below the pool?
- Can you do all that and make it watertight?
- And most importantly, can you do it cost effectively?

After taking this project to their engineers, project managers, and construction field superintendents, they realized this project would have to be shotcreted. There really wasn't another practical option.

Fig. 8: Architectural concept

The shotcrete process will always be the best method for placing quality concrete to create durable, watertight swimming pool shells. The high velocity shotcrete placement of the concrete allows for excellent consolidation with full encasement of reinforcing steel, plumbing and electrical conduit and other embedments as well as being able to place a strong, low permeabilty concrete mixture with a low w/cm.

WHO ARE WE?

The client came to us initially to build the project, or the components of the project that they didn't want to build.

We had just decided after 20 years of being a design-build company, to stop building pools. We found our chi. We decidedly are a shotcrete company (Revolution Gunite), a pool pebble plaster company (Revolution Pool Finishes) and a design company (Waterforge, Inc). We are 3 companies, but we focus on niche markets within our industry. We would no longer be a turnkey pool builder.

THE RIGHT PARTNER

Given that we would not be building this project, we were hired to find the right builder or partner, so to speak, for the project. The project drawings were sent to three pool builders to bid on. The owner settled with Artisan Pools from Kitty Hawk, NC due to their flexibility. This suited us really well too, since Artisan also is a quality shotcrete contractor and they really understood how to set up the forms for such a complicated shoot.

Though the project was nearly impossible for a form-and-pour method, but it was still complicated even for the

Fig. 9: Intricate shapes can be placed and finished in one shoot

Fig. 10: Architectural concept

Fig. 11: Intersecting planes shot in place with pool shell

shotcrete process. It involved a great deal of coordination between the owner, Artisan, and us. For starters, the home was remote, on the side of a steep mountain with limited access. Rebound, a natural byproduct of the shotcrete process would need to be removed, not just tossed down the mountain, so a telescopic forklift was employed to hold a rebound collection box. Being in the Appalachian Mountains, an afternoon shower was not only possible but expected. To that end, temporary tarps were always ready to be deployed, and they often were.

THE PROCESS

Even using the shotcrete process, we had to stage the pool shoot over two separate days. The unique benefit of using the shotcrete process is that we can shoot new material over pre-existing concrete, whether next day or 10 years later and still achieve a monolithic and watertight shell. Several steps are needed to achieve full bond between sections, such as having a roughened surface to shoot to upon, having a saturated surface dry (SSD) condition on the bond plane, and keeping the area clean during the placement process with use of an air lance. Once the shell is complete and in a hardened state, it is crucial to water cure the project. This not only helps reduce shrinkage but also helps ensure that free cement is hydrated, improving long term strength and reducing permeability. To accomplish the water curing, Artisan flooded the project, a method we really like better than sprinklers or soaker hoses.

Once the pool shell was in place and cured, the construction would continue for many months to create a very special and unique pool for the client. This project created not only a spectacular view of the mountains beyond, but a new perspective for the client regarding concrete placement methods.

Fig. 12: Water Curing shell by flooding the project

Fig. 13: Intersecting planes mimic perpendicular lines of home architecture

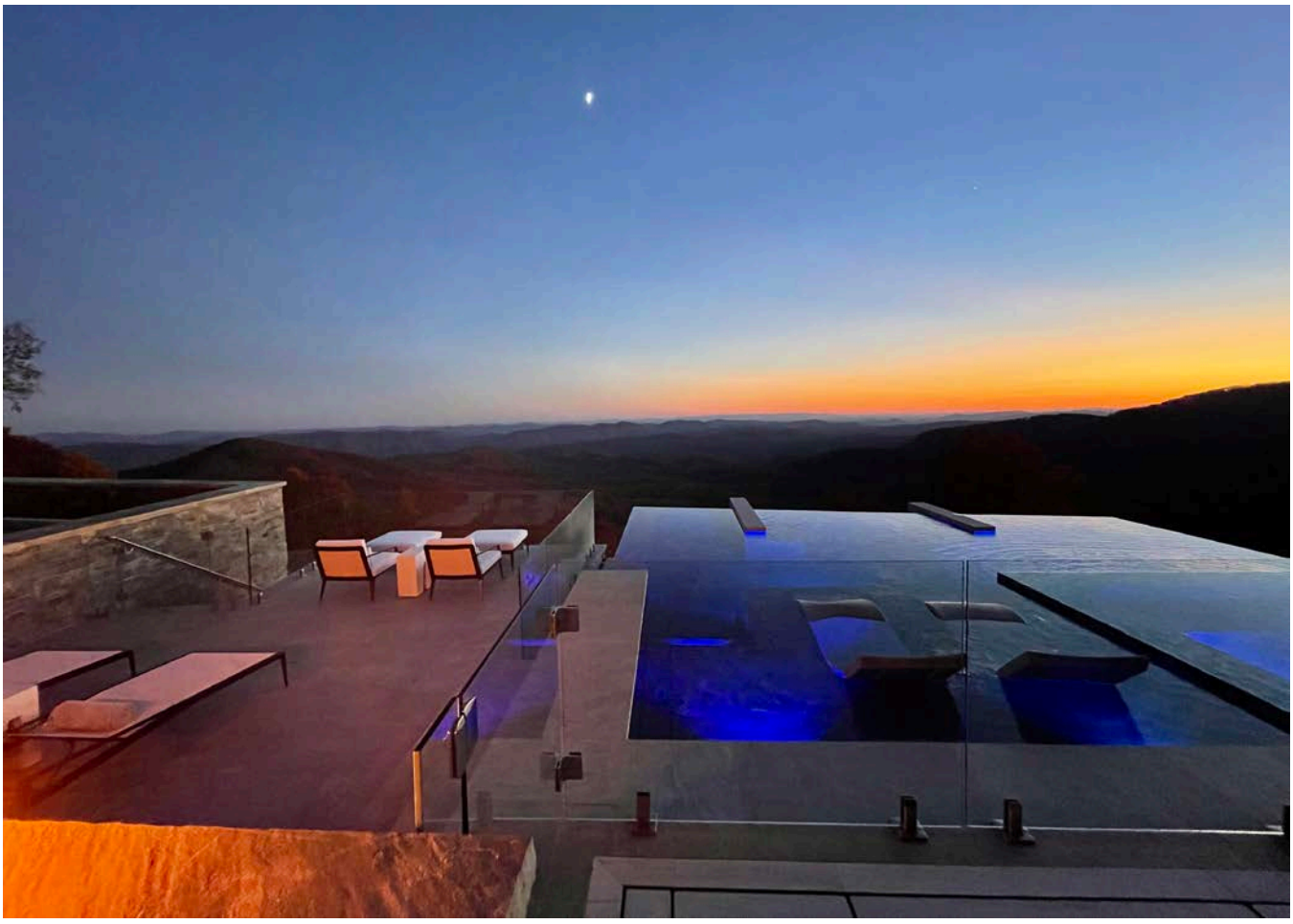

Fig. 14: Dusk in the Blue Ridge Mountains

***Ryan Oakes** is a professional Watershape Designer and President of Clearwater Construction Group, Inc., Revolution Gunite, and Revolution Pool Finishes, all of which are award-winning firms in their respective trade. Oakes is a faculty member at Watershape University, where he continually aims to raise the bar in the swimming pool and the watershape construction industry. As a member of the leadership team for the International Watershape Institute (IWI) and through educational outreach to a vast pool builder network throughout the United States, he aims to improve the building techniques and methods of constructing swimming pools. Oakes is a member of ACI Committee 322 Code Requirements for Concrete Pools and Watershapes, ACI 506, Shotcreting, and ACI Subcommittee 506-H, Shotcreting Pools. He serves on the ASA Board of Directors and also serves as Chair of the ASA Pool & Recreational Shotcrete Committee and the vice-chair of the ASA Contractor Qualification Committee.*

2021 OUTSTANDING POOL & RECREATIONAL PROJECT

Project Name
Where Form & Pour Stops

Location
Blowing Rock, NC

Shotcrete Contractor
Revolution Gunite

Architect/Engineer Company
Waterforge, Inc

Material Supplier Company
Revolution Gunite

Equipment Manufacturer Company
Gunite Supply & Cementech

General Contractor Company
Artisan Pools and MBI Builders

Project Owner
Private

Acoustical Wave Wall

By Bruce Russell

Fig. 1: Dr. Phillips Center for the Performing Arts Orlando, FL

Magnificent. A beautiful sight to see, the project CROM calls "The Wave Wall" stands tall in the new Steinmetz Hall at Dr. Philips Center for the Performing Arts, located in Orlando, Florida. CROM was one of the many contractors working in close proximity, under the direction of HKS Architects Inc. and the general contractor, Whiting Turner. The project included construction on two different structures: the Wave Wall and Egg Wall.

The Wave Wall, second of its kind, was intended to match the first, both on the same site, part of the lobby in the Walt Disney Theater. The purpose of the Wave Wall was to serve as an architectural and acoustical barrier between the lobby and the theater. The mass of shotcreted concrete, curvature of the wall, and the attention to air-tight sealing of joints between the structural elements all served to keep the sound of the lobby from entering the theater. The Egg Wall allows access via walkways from three levels of the lobby into the seating area of the arena while maintaining the acoustical barrier.

Both the Wave Wall and Egg Wall structures were designed to be 6 ½ in. (165 mm). thick, heavily reinforced shotcrete structures, with no construction joints, without cracks, and covered by an architectural plaster polished to a high sheen. The Walt Disney Theater wave wall provided the on-site full-scale specification to meet and to beat in appearance and function (Fig. 2 & Fig. 3).

The Wave Wall is roughly 110-ft (34 m) long horizontally, measured along the curvature, and 70-ft (21 m) tall. Beginning 10 ft (3 m) above the floor of the structure, the Wave Wall is supported by a tubular structural steel framework and reinforced cast-in-place concrete columns and beams (Fig. 4). To eliminate the possibility of cracking in the outermost finished surface, the Wave Wall is reinforced with #4 (#13M) bars at 4 in. (100 mm) on center each way near the outer surface of the wall.

The Egg Wall is roughly 48 ft, 6 in. (15 m) tall, and in plan, the shape of the Egg Wall can best be described as half of an egg; 12 ft (3.6 m) wide across the opening and 11 ft

(3.4 m) deep. Similar to the Wave Wall, the Egg Wall was designed to have a crack-free surface covered with the architectural plaster. Beginning at the ground floor, the Egg Wall extends to the underside of the fourth floor of the lobby.

In the initial inspection of the first phase Wave Wall, it revealed what the design drawings showed, the form for the back of the walls was paper-backed lath. After careful planning and analysis, CROM's extensive shotcrete experience led the way for a proposal to utilize roll-formed galvanized steel shell "diaphragm" and shotcrete instead. To prove that this method was the superior method and that CROM was certified and qualified to perform it, CROM fabricated a tubular steel mock-up at our Project Support Facility in Gainesville, FL, (Fig 5). The method devised, was that of incremental reinforcement installation coupled with PVC form strips to provide a strategic and carefully controlled layered approach to the shotcrete application, rather than the benching that was originally specified.

Fig. 2: Walt Disney Wave Wall completed in 2016 (unknown contractor)

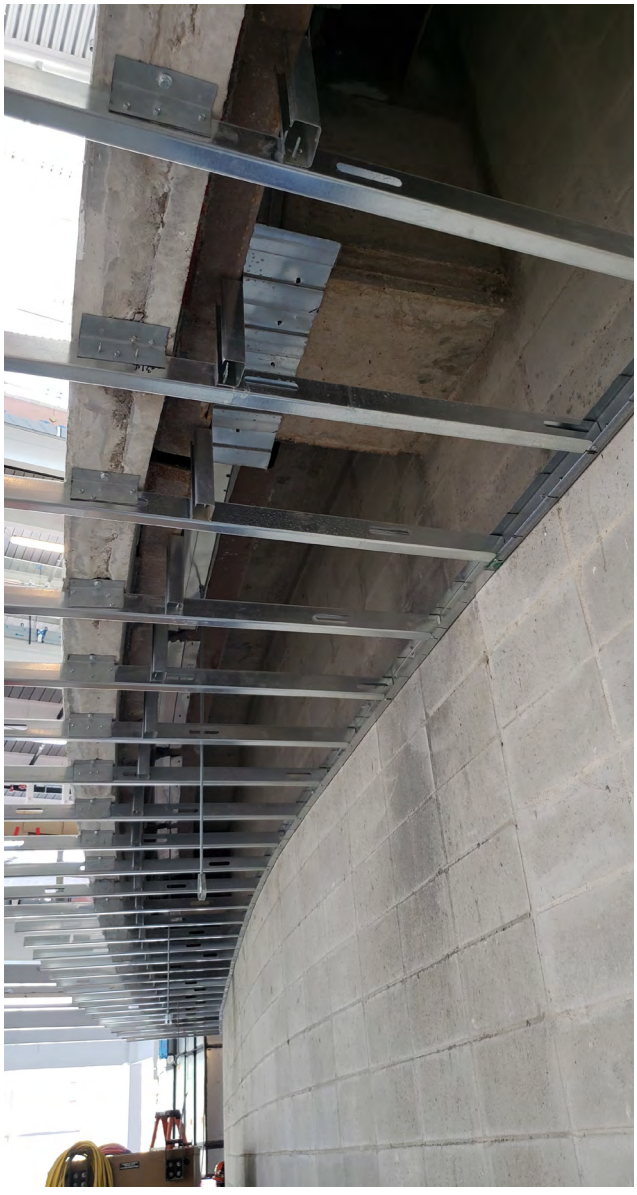

Fig. 4: Tubular structural steel framework and reinforced cast-in-place concrete columns and beams

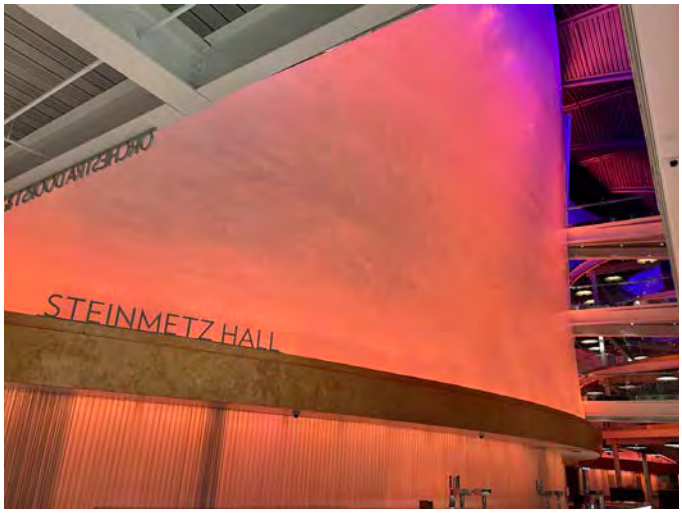

Fig. 3: Steinmetz Hall Wave Wall completed January 2020 (CROM)

Fig. 5: Mock-up for alternative method of formwork (CROM Project Services Facility Gainesville, FL)

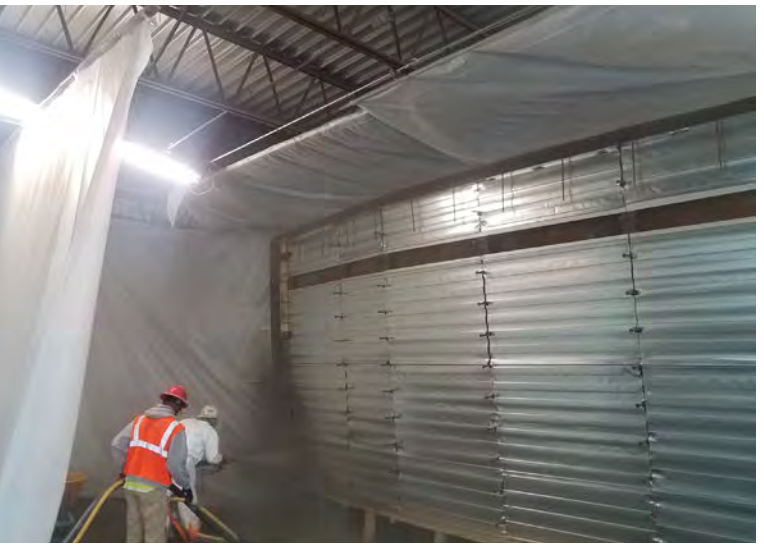

Fig. 6: shotcrete mockup warehouse

Fig. 7: Off-site project mock-up with final eggshell coating system

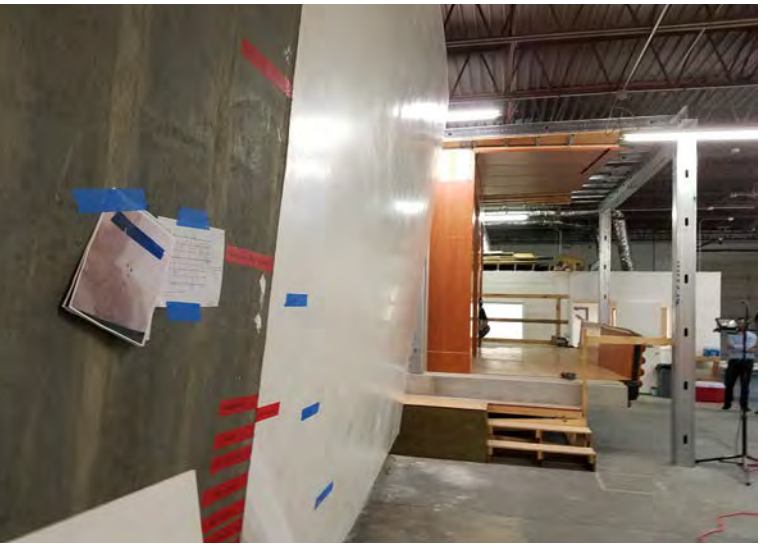

Fig. 8: Clean-up control measures put in place to protect surrounding personnel and existing structures

Fig. 9: Shotcrete application, note extensive containment to control overspray and protect surrounding structures

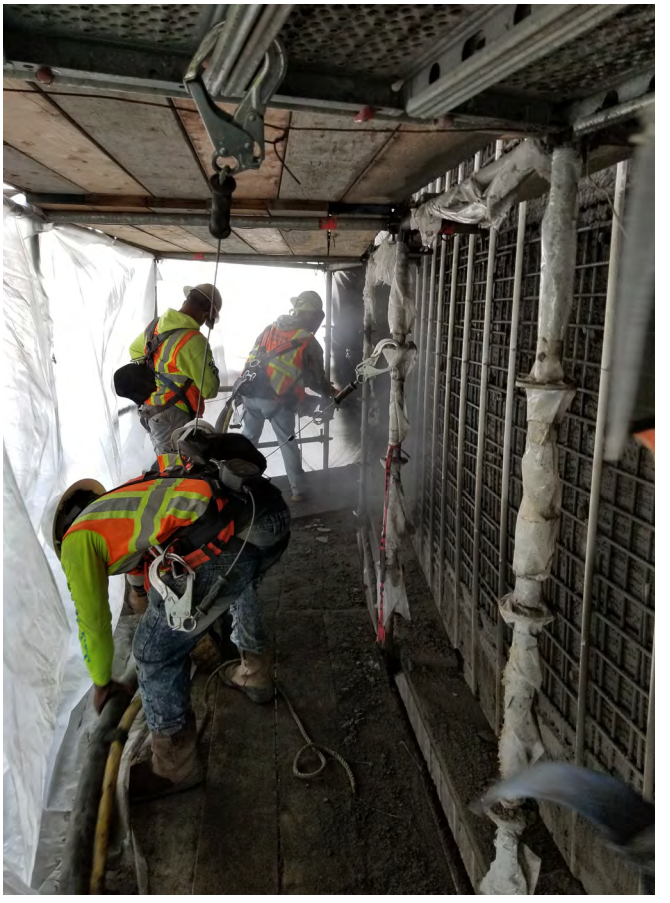

Fig. 10: Extensive containment measures taken to control overspray and protect surrounding structures during shotcrete application

The General Contractor and Owner's representatives joined us to observe this method during the mock-up phase and agreed with the proposed approach (Fig. 6) Subsequently, per the contract documents, CROM also produced a prototype of the curved Wave Wall approach in a warehouse near the jobsite in Orlando, Florida (Fig. 7). The outcome of this demonstration led to acceptance and approval of the materials, and methods of construction.

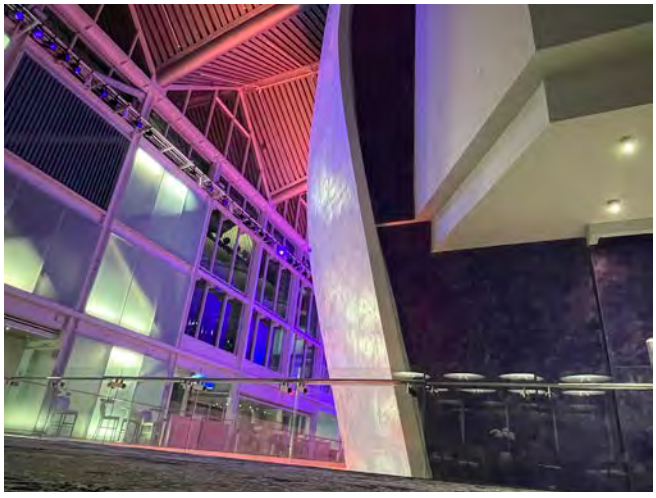

Fig. 11: Completed Wave Wall West end upper level (CROM)

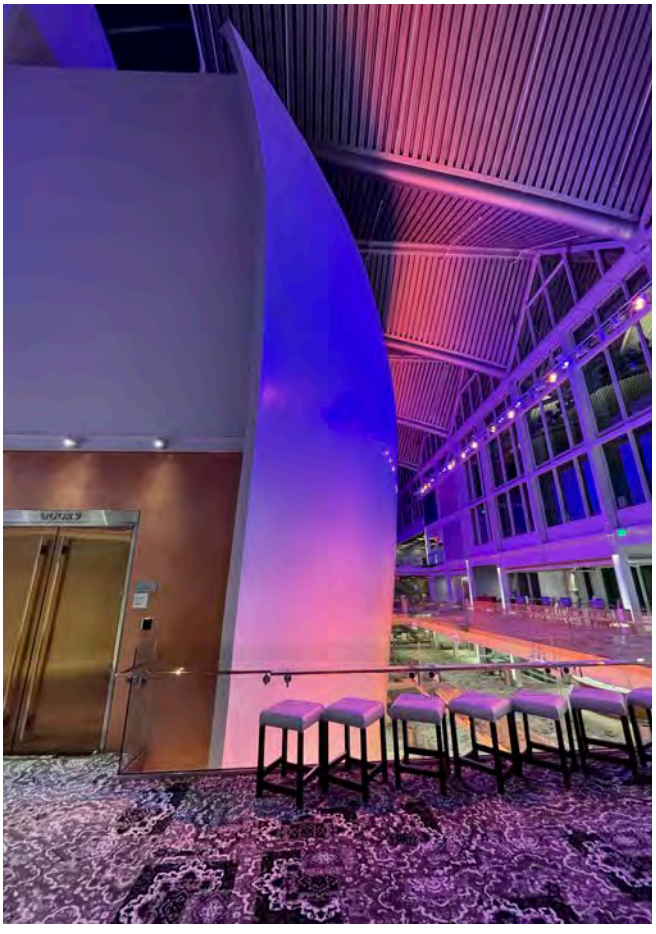

Fig. 12: Completed Wave Wall East end upper level (unknown contractor)

Fig. 13: Wave Wall upper lobby entrance through Egg Wall opening

Fig. 14: Wave Wall upper lobby entrance through Egg Wall opening

As construction was underway, as is often the case, time was of the essence and before the Wave Wall was completed, the project schedule required that the interior portion of the project be air-conditioned, and that glass installation would proceed in certain areas around the site. A new level of care and attention needed to be observed to insure clean, shotcrete placement (Fig. 8). Our skilled and professional crews installed diaphragm, reinforcing steel, and shotcrete in a well-organized and highly productive manner, as usual, even in some unusually tight space conditions (Fig. 9 & Fig. 10). The Wave Wall and Egg Wall were completed as required by the design and on schedule (Fig. 11, 12, 13, 14).

Fig. 15: Steinmetz Hall Wave Wall Dr. Phillips Center for the Performing Arts Orlando, FL

In summary, there were 7500 ft² (700 m²) of diaphragm installed for formwork, 17 tons (15,400 kg) of reinforcing steel bar installed, and 235 yd³ (180 m³) of shotcrete placed. The shotcrete was pumped through over 300 ft (91 m) of 3 in. (75 mm) steel pipe, and 75 ft (23 m) of rubber line. The finish was a steel-trowel finish coated with a Venetian plaster material that created a porcelain eggshell finish.

Due to the complex shape, thickness, and required reinforcing, shotcrete placement was the only practical method of construction. CROM's highly trained and skilled teams executed the Wave Wall and Egg Walls within the project schedule. Successful execution of the shotcrete process was performed while working within close proximity to other trades with no hindrances. CROM's teams maintained high safety standards, quality workmanship, and exceptional aesthetics to these architectural elements. Steinmetz Hall is advertised as one of the world's most acoustically perfect spaces. Truly, this is a magnificent sight to see (Fig. 15).

Bruce Russell *is the Restorations Director and Bid Manager for CROM. He has been involved in the construction of ground water storage tanks ranging from 100,000 gallons to 10,000,000 gallons in the water and wastewater industries since 1984. In 1987 he became, what at the time was considered, a dry-mix "CROM Certified Nozzleman" under standards that Ted Crom created, which he instituted internally to insure quality shotcrete application. In 2004, Bruce became ACI Certified in wet-mix and remains certified today. In 2014, he took over CROM's Nozzleman Certification/Re-certification program. He serves on the ASA Board of Directors, ASA Contractor Qualification Committee and ASA Safety Committee.*

2021 OUTSTANDING ARCHITECTURE | NEW CONSTRUCTION PROJECT

Project Name
Acoustical Wave Wall

Location
Orlando, FL

Shotcrete Contractor
CROM, LLC

Design architect
Barton Myers Associates, Inc.

Executive Architect
HKS Architects, Inc.

Structural/Mechanical/ Electrical Engineer
TLC Engineering Solutions
Arup Los Angeles

Materials Supplier
A1-Block Corporation

General Contractor
The Whiting-Turner Contracting Company

Project Owner
Dr. Phillips Center for the Performing Arts

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Bridle Ridge Subdivision

By James Parent

Fig. 1: Bridle Ridge Subdivision - Mid Wall

In the summer of 2018 Morningstar Homes retained GeoPacific Consultants for the geotechnical design of a proposed development of 109 single family residential lots.

Morningstar Homes has proudly built several thousand quality single family homes in the Lower Mainland of British Columbia over the past 20 years. Morningstar Homes is also an affiliate of Polygon Homes, one of the largest and prominent builders in British Columbia, building over 30,000 homes since 1980.

The development site is located in the Silver Valley area of Maple Ridge, B.C, north of Dewdney Trunk Road and west of Golden Ears Park. The site consists of a single lot, bounded to the north by BC Hydro Right-of-Way and Malcolm Knapp Research Forest, Marc Road to the east, single family residential subdivision lots to the south and Blaney Bog Reserve to the west. The lot encompasses an area of approximately 74 acres (30 hectares), is roughly rectangular in shape and generally slopes east to west with a maximum grade differential of approximately 430 ft (130 m).

GeoPacific specializes in the design of tie-back shoring systems including shotcrete, sheet pile, soldier pile and jet grout shoring. GeoPacific has completed deep excavation shoring designs for excavations up to 95 ft (29 m) below street grade in Vancouver, Burnaby, Surrey, Portland and San Diego. GeoPacific has pioneered the use of jet grout shoring for cut-off walls in Western Canada including projects in: North Vancouver (The Pier), Surrey (Infinity), and Vancouver (Fairmont Pacific Rim and Olympic Village).

Upon review, the geotecnical engineer concluded that tiered retaining walls with a total finished height of 40 ft (12 m) were required at the east and west boundary of the property as well as the interior of the subdivision for lot separation (Fig. 1). It was determined to use permanent shotcrete soil nail retaining walls for the cut portion of the property. A traditional geogrid-reinforced retaining wall system would have required substantially more disturbance to the hillside to allow for conventional bottom-up construction. Therefore, a top-down system was preferred given the retaining wall height.

Fig. 2: Beginning of project

Fig. 4: Pan

Fig. 3: Tier 3

Fig. 5: West end

Fig. 6: Drilling

Vancouver Shotcrete and Shoring Inc. was awarded the opportunity to construct the top down construction of permanent soil anchored shotcrete rockscape retaining walls. After excavation of the slope within the approved shoring sequence, a 4 in. (100 mm) structurally reinforced shotcrete was applied against a sheet membrane drainage system (Delta Drain). This is a time sensitive procedure due to excavated panels required to be shotcreted the same day. After tier one structural shotcrete was complete and all anchors were tested and locked off, excavation of the lower tier was bulked out and drilled, then the shotcrete sequence proceeded again. When an entire lift was completed, scaffold was erected and a second layer of reinforcing steel was added. Thereafter, a 4 to 6 in. (100 to 150 mm) decorative rockscape finish was applied. The second layer was then hand shaped and carved by our in-house finishing crew. After curing, the rockscape finish was acid stained and painted to match the local rock formation coloring.

Morningstar was pleased to be working with Vancouver Shotcrete & Shoring and is proud of the work it has done on the Bridle Ridge project. Morningstar & Polygon are also working with the company on a second project at Nelson Street in the City of Mission.

BY THE NUMBERS:

- 1,500 ft (460 m) long with up to 42 ft (13 m) tall 4 tier permanent shotcrete and soil anchor retaining wall.
- Over 34,000 ft^2 (3160 m^2) of custom hand carved rockscape finish.
- 40,000 ft (12,200 m) of 1 in. (25 mm) high grade anchor bar.
- Over 790 yd^3 (600 m^3) of 5000 psi (35 MPa) shotcreted concrete.
- Follow this link for a video of the project- https://vimeo.com/542930187/32e699bcef

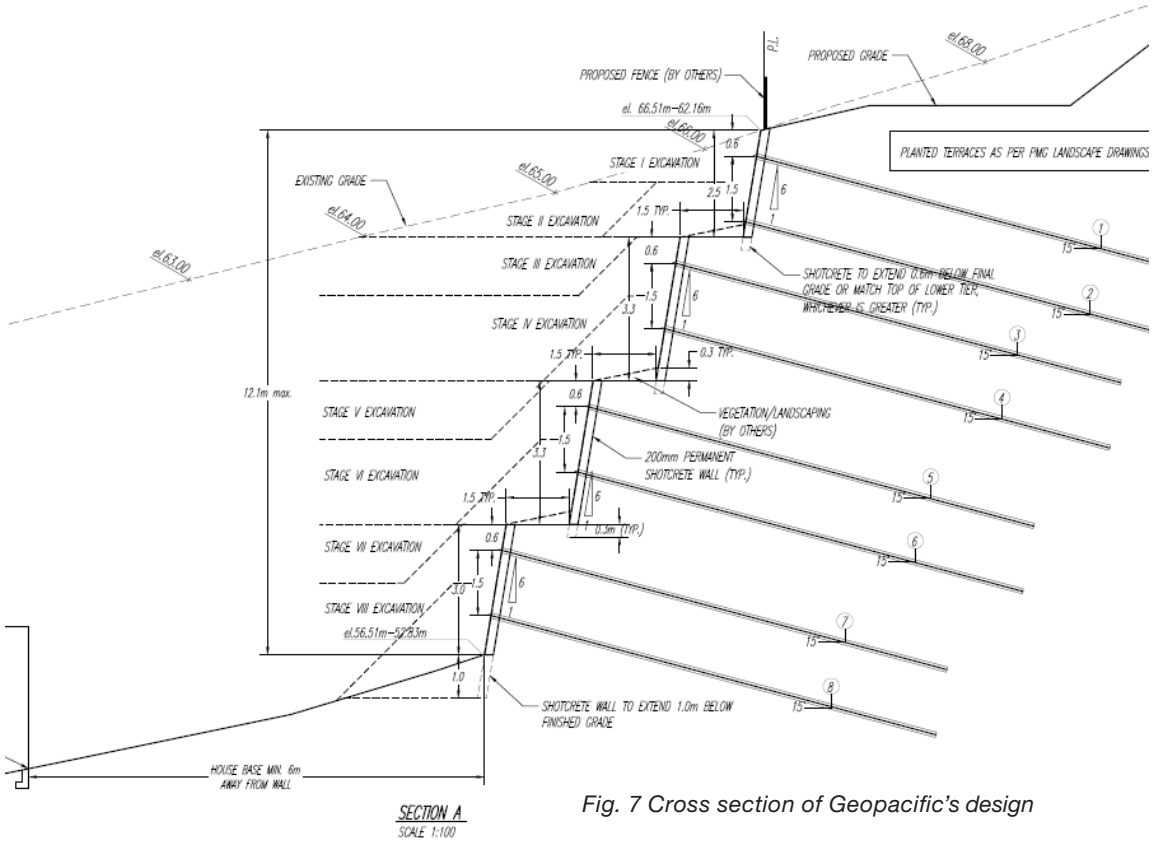

Fig. 7 Cross section of Geopacific's design

VANCOUVER SHOTCRETE & SHORING, INC.

Incorporated in 2005, Vancouver Shotcrete & Shoring Inc. (VSS) was launched to provide customers with viable and sustainable options for their construction needs. VSS has serviced various municipalities and private companies with their top-quality shotcrete projects. As a member of the American Shotcrete Association (ASA), VSS has highly qualified personnel with more than 30 years of experience in shotcrete shoring. All of our key personnel are certified by ACI and follow up-to-date shotcrete standards and specifications. As per the ASA mission, we encourage and promote the safe and beneficial use of the shotcrete process.

James Parent *is a partner at Vancouver Shotcrete and Shoring Inc. (VSS). He is an ACI-Certified Shotcrete Nozzleman who has worked in the Decorative and Structural Shotcrete industry for over 25 years. Currently James is the Division Manager of VSS Pools, VSS Rockscapes, and VSS Special Projects doing Limited Access and High Angle Slope Stabilization and Shotcrete Shoring.*

2021 HONORABLE MENTION

Project Name
Bridle Ridge Subdivision

Location
British Columbia, Canada

Shotcrete Contractor
Vancouver Shotcrete and Shoring Inc.

Architect/Engineer
GeoPacific Consultants

Material Supplier/Manufacturer
Graeystone Ready Mix Inc.

Equipment Manufacturer
REED Concrete Pumps

General Contractor
Morningstar Homes, Ltd.

Project Owner
Morningstar Homes, Ltd.

Want all the benefits of the Shotcrete process?

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1. Start with a project-appropriate specification
2. Use only QUALIFIED CONTRACTORS with relevant project experience
3. Verify Nozzlemen are ACI Certified

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to confirm that the nozzleman on
your job is ACI certified

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2021 Honorable Mention

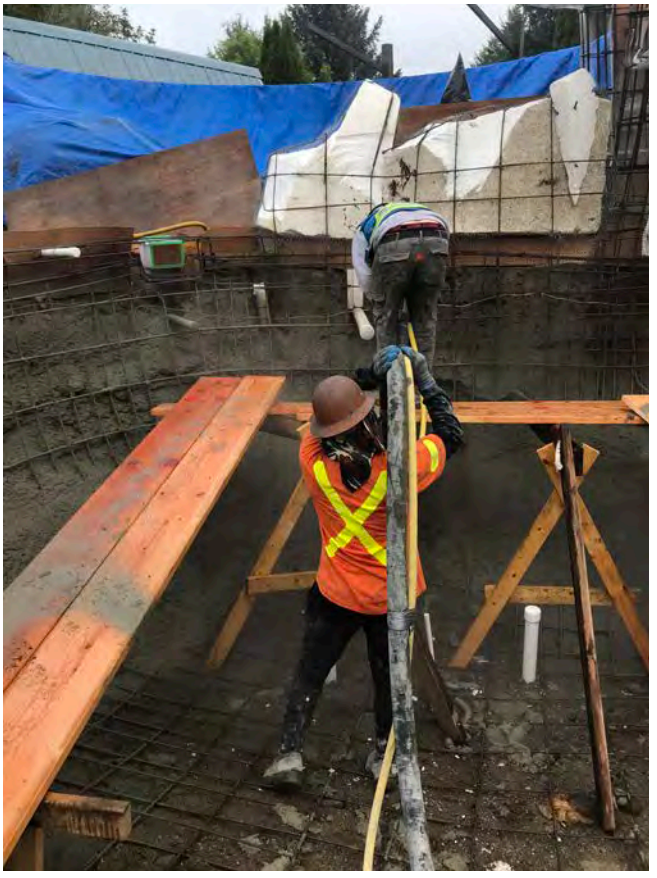
Grotto Falls Lagoon

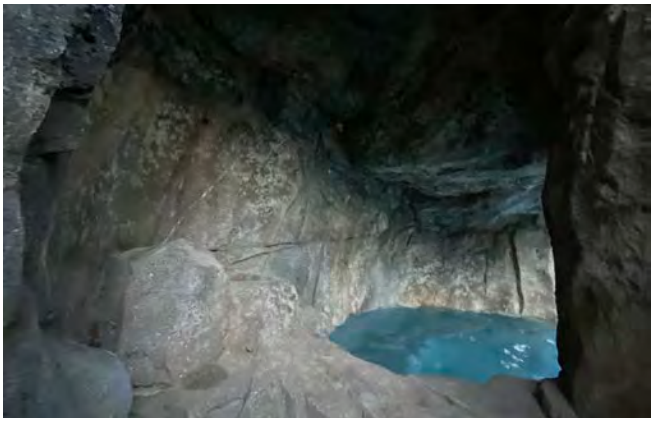
By Dan Pitts

This project came to fruition when the homeowner enlisted us to create a unique pool that was inspired from the natural rock in the Squamish/Whistler area of British Columbia. The client had a vision of a pool that would remind them of when they would hang out in the local river pools of the glacier runoff amongst the waterfalls. However, not freezing their toes off with melted glacier water would be the best perk on their backyard pool.

The grotto aspect of the build was based on the dry and wet entry combination. The suspended slab for the grotto lid was built off the stacked columns of reinforcing bar at three points and the back supporting wall of the grotto. The steel for the rock armature was incorporated into the structure of the pool and angles of the waterfall. The spa sits elevated with a spillover into the pool and has an automated valve that controls the flow of the hot water waterfall return to the spa.

The design included a recently built firepit area as well as a koi pond. This resulted in a space challenge to be sure we would not damage the previous work and the aquatic life. We were able to complete the entire pool and grotto monolithically with the help of LRutt Contracting and a couple of their skilled finishers that came up for the day. After completing the shotcrete pool shell, we water cured it for seven days.





After pumping out the pool we started on our finish carving of the rockwork. The rock carving was completed in four days and then left to cure, while we were getting ready to color. We chose colors to represent the natural rock in the area by doing some reconnaissance missions and gathering physical samples and photos. We used the planters and waterfalls to our advantage when coloring. Streaks of color were added

to model the iron oxide runs found in the natural surrounding rock. We also simulated lichen and mineral stain from plants and runoff. After completing the coloring, it was time for the plaster surface coating. The final stages came together to reveal the client's dream pool. Plants were placed around pockets in the pool deck to help break up the visual impact of the rockwork. Afterwards, trees were dropped into the big planters with heavy machinery before the pool deck flatwork was completed. Everything came together quite seamlessly without encountering any major issues.

Dan Pittls *Owner/Operator of Ocean Rock Industries, Squamish, British Columbia, Canada. Ocean Rock Art specializes in artisanal concrete rock environments. Everything we do is custom designed and hand-crafted to ensure the perfect fit for your landscaping or construction project. With years of experience and top notch concrete artists, Ocean Rock is ready to build the rock environment of your dreams.*

2021 HONORABLE MENTION

Project Name
Grotto Falls Lagoon

Location
British Columbia, Canada

Shotcrete Contractor
Ocean Rock Art Ltd/LRutt Contracting Ltd

Architect/Engineer Company
Kontur Geotechnical

Material Supplier
Cardinal Concrete

Equipment Manufacturer Company
Putzmeister

General Contractor Company
Ocean Rock Art Ltd

Project Owner
Krista Biggard

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Thank you, Sustaining Corporate Members, for your investment in the industry! ASA Sustaining Corporate Members show true dedication to ASA's vision to see "structures built or repaired with the shotcrete process accepted as equal or superior to cast concrete." These industry leaders are recognized for their exemplary level of support for the Association in a variety of ways.

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www.maplesitesolutions.ca/

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2021 Carl E. Akeley Award

Duckworth

The 16th annual Carl E. Akeley Award was presented to Oscar Duckworth from Valley Concrete Services, for his article, " Slump - The Most Misunderstood Characteristic of Wet-Mix Shotcrete," published in Shotcrete magazine, Winter issue of 2021. This perceptive article on the role slump plays in the consolidation efforts of shotcrete placement offers valuable insight and understanding to recognize the visual cues vital for correct placement consistency.

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

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

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

PAST AKELEY AWARD RECIPIENTS

- 2006—Dufour, Reny, and Vézina, “State-of-the-Art Specification for Shotcrete Rehabilitation Projects”
- 2007—K. F. Garshol, “Watertight Permanent Shotcrete Linings in Tunneling and Underground Construction”
- 2008—E. S. Bernard, “Embrittlement of Fiber-Reinforced Shotcrete”
- 2009—Dufour, Lacroix, Morin, and Reny, “The Effects of Liquid Corrosion Inhibitor in Air-Entrained Dry-Mix Shotcrete”
- 2010—L. Zhang, “Is Shotcrete Sustainable?”
- 2011—C. S. Hanskat, “Shotcrete Testing—Who, Why, When, and How”
- 2012—R. C. White Jr., “Pineda Causeway Bridge Rehabilitation”
- 2013—Jolin, Nokken, and Sawoszczuk, “Sustainable Shotcrete Using Blast-Furnace Slag
- 2014—L. Zhang, “Variability of Compressive Strength of Shotcrete in a Tunnel-Lining Project”
- 2015—Yurdakul and Rieder, “Effect of Pozzolanic-Based Rheology Control Agent as a Replacement for Silica Fume on Wet-Mix Shotcrete Performance”
- 2016—M. von der Hofen, “East End Crossing”
- 2017—A. Nitschke, “Modeling of Load-Bearing Behavior of Fiber-Reinforced Concrete Tunnel Linings”
- 2018—K. Yun, “Cellular Sprayed Concrete”
- 2019 — Clements and Robertson, “Compatible Shotcrete Specifications and Repair Materials”
- 2020 — Gagnon, Jolin, and Lemay, “Performance of Synthetic Sheet Waterproofing Membranes Sprayed with Steel Fiber-Reinforced Shotcrete"

References

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

2021 ASA President's Award

Alice McComas joined the American Shotcrete Association (ASA) staff as an executive assistant in 2011. One of her main responsibilities was administration of the ASA/ACI Shotcrete Nozzleman program. Over her 11 years of service, she single-handedly coordinated 732 separate sessions that have included 4410 individual nozzleman certifications. The session load has increased dramatically from 26 in 2011 to 96 in 2021 – almost a 400% increase. These sessions have included new nozzleman and nozzleman-in-training certifications as well as recertifications. She works directly with 19 ASA members who are ACI-approved shotcrete nozzleman examiners to coordinate their conducting of the sessions. Additionally, Alice coordinates our ASA Shotcrete Inspector education sessions which often includes an ACI shotcrete inspector certification exam. In 2021, ASA held eight Shotcrete Inspector Education sessions, many with ACI certification exams, with 56 attendees.

The ACI Nozzleman certification program is one of the most complex programs ACI provides, yet Alice knows and enforces all the policy details for the sessions we conduct. She likely knows the policy better than anyone else in ASA or ACI. Administering the program is extremely time consuming requiring extensive phone and email correspondence to: answer questions from prospective hosts and nozzlemen; provide quotes to the potential hosts; coordinate session dates and details with hosts; collect the required nozzleman work experience forms; compile the candidate list; assign the examiner-of-record and supply them all the required forms and contact information; order the testing materials from ACI and have shipped to the examiner; collect all the session paperwork after the session to verify completeness for submittal in the proper format back to ACI; maintain a database of sessions with host information and costs. As you may imagine, administering the shotcrete nozzleman program with an average of nearly 2 sessions a week throughout the year demands a lot of time and attention to detail.

But that's not all. In her current role as Assistant Director, Alice is involved with all aspects of our Association. This includes interaction with our association management company, Virtual Inc., regarding membership, customer service, inventory, shipping, and financial issues. She reviews and suggests updates for our website and association management system.

Since we started our ASA annual conventions five years ago, Alice has been highly involved with the selection, planning, and execution of our annual convention. Her involvement definitely makes the conventions run smoothly and efficiently.

She attends and takes minutes for our Executive Committee, and Board, as well as attending many of our other ASA committee meetings. Alice developed the Contractor Qualification online application and facilitates updates while constantly reviewing the policy and process for improvements.

Alice McComas is an astounding staff member for ASA. She is always upbeat and willing to help no matter what the issue may be. We at ASA are most fortunate to have Alice working with us. Her dedication, attention to detail, and commitment to process improvement for over a decade has helped us advance the Association is so many ways. A sincere thank you to Alice McComas, my President's Award winner for this year.

Fig.1: Lars Balck, ASA President; Alice McComas, Assistant Director; and Charles Hanskat, Executive Director

UMA Delivers Aesthetic Permanent Sculpted Shotcrete Walls

By Brian DeSpain

UMA Geotechnical Construction Inc. (UMA) typically finishes off the soil nail walls it constructs with a standard shotcrete finish. But sometimes the owner wants a more artistic approach.

That was the case for North Carolina Department of Transportation (NCDOT) on the I-40/I-77 interchange improvements project in Iredell County. UMA was contracted by Lane Construction to install roughly 45,000 ft^2 (4200 m^2) of various sized soil nail walls with aesthetically appealing sculpted shotcrete finishes. UMA's earth retention work was first required to hold up cuts for widened roadway sections and to facilitate new bridge construction.

The NCDOT selected an ashlar stone carved finish, which the department specified to match the previously completed project in 2012, that was constructed by UMA at the same interchange. The ashlar finish consists of a random pattern of multiple sized blocks, like a natural retaining wall, constructed with stacked stones. The department required a pre-production mockup test panel to be completed and approved prior to constructing the sculpted shotcrete walls.

UMA's earth retention and sculpted shotcrete work on NCDOT's I-40/I-77 interchange improvements project held up cuts for widened roadway sections and facilitated new bridge construction.

Unlike some decorative form-and-pour concrete wall finishes, there is no form liner involved with sculpted shotcrete walls; all work is accomplished by craftspeople. Workers working from manlifts did everything by hand, from shotcrete placement to carving the artistic patterns.

"With UMA's normal shotcrete wall, workers use batter boards, grade lines, and levels to make the finished wall flat and smooth," says Project Manager Brendan Falls. "In this case, they're using a hand trowel to carve the wet shotcrete into the predetermined pattern chosen by the state."

Unlike the soil nail wall behind it, which is top-down construction and built up using horizontal layers, the sculpted shotcrete finish is applied across the entire wall with no particular pattern. Shotcrete nozzlemen work primarily from manlifts, shooting up to 70 yd^3 (54 m^3) of material in a single day.

UMA ofrece paredes estéticas de hormigón proyectado esculpido permanente

By Brian DeSpain

UMA Geotechnical Construction Inc. (UMA) generalmente remata las paredes de clavos de tierra que construye con un acabado de hormigón proyectado estándar. Pero a veces el propietario quiere un enfoque más artístico.

Ese fue el caso del Departamento de Transporte de Carolina del Norte (NCDOT) en el proyecto de mejoras de intercambio I-40/I-77 en el Condado de Iredell. UMA fue contratado por Lane Construction para instalar aproximadamente 45.000 ft2 (4200 m2) de paredes de clavos de suelo de varios tamaños con acabados de escopeta esculpidos estéticamente atractivos. LOS trabajos de retención de tierra DE UMA se necesitaron primero para retener los cortes para secciones de carreteras ampliadas y para facilitar la construcción de nuevos puentes.

El NCDOT seleccionó un acabado tallado en piedra de ashlar, que el departamento especificó para coincidir con el proyecto previamente terminado en 2012, que fue construido por UMA en el mismo intercambio. El acabado del ashlar consiste en un patrón aleatorio de bloques de varios tamaños, como una pared de retención natural, construida con piedras apiladas. El departamento requirió que se completara y aprobase un panel de prueba de maqueta de preproducción antes de construir las paredes esculpidas de la escopeta.

La retención de la tierra de UMA y el trabajo esculpido de la escopeta en el proyecto de mejoras de intercambio I-40/I-77 de NCDOT mantuvieron los cortes para tramos de carreteras más ampliados y facilitaron la construcción de nuevos puentes.

A diferencia de algunos acabados decorativos para paredes de hormigón, no hay ningún revestimiento de forma que se implique con paredes esculpidas de hormigón; todo el trabajo es realizado por artesanos. Los trabajadores que trabajaban desde los levantamientos hacían todo a mano, desde la colocación discreta hasta la talla de los patrones artísticos.

"Con la pared de hormigón normal de la UMA, los trabajadores usan tablas de bateador, líneas de grado y niveles para hacer que la pared acabada sea plana y lisa", dice el gerente de proyecto Brendan Falls. "En este caso, están usando una paleta manual para llevar la escopeta húmeda al patrón predeterminado elegido por el estado".

A diferencia de la pared de uñas del suelo detrás de ella, que es de construcción descendente y construido utilizando capas horizontales, el acabado esculpido de escopeta se aplica a través de toda la pared sin ningún patrón particular. Los nozzlemen de escopeta trabajan principalmente desde los levantamientos, disparando hasta 70 yd3 (54 m3) de material en un solo día.

Craftspeople in man baskets performed all sculpted shotcrete work by hand, from spraying material to carving the artistic patterns.

Shotcrete nozzlemen worked primarily from manlifts, shooting up to 70 cubic yards of material in a single day

Once the soil nail wall was constructed, several layers of shotcrete were placed in front of it prior to carving the ashlar finish into the final two-inch layer

"The crew worked in man baskets with grade lines and levels along with trowels to finish out the pattern," explains Falls. "The level ensures straight lines in the pattern and verifies that the surface is flat and smooth."

Once the soil nail wall was constructed, several layers of shotcrete were placed in front of it. UMA started by attaching horizontal and vertical rebar in a grid pattern and applying a 6 in. (150 mm) layer of shotcrete for the temporary facing. Another 6 in. structural layer was sprayed on next to construct the permanent wall facing. The actual carving of the pattern took place after the last 2.in (50 mm) layer was placed.

Despite weather delays, UMA finished the sculpted shotcrete walls on the I-77/I-40 Interchange on schedule in March 2020. Drivers on this heavily traveled new interchange may need some time to learn the new traffic patterns, but at least the view will be good.

Brian DeSpain *is the president of UMA Geotechnical Construction and has been part of the geotechnical construction community since 2003. With a background in construction management, geotechnical engineering management, and strategic planning, he brings wide-ranging experience in the sales, field operations, and management of deep foundation and geotechnical grouting operations. Brian also has extensive experience with grouting equipment, hydraulic equipment, hydraulic equipment design, drilling equipment, polyurethanes, deep soil stabilization and foundation stabilizations of large commercial buildings, tunnels, and highways.*

Artesanos en canastas de hombre realizaron a mano todo el trabajo esculpido de la escopeta, desde el material de pulverización hasta el tallado de los patrones artísticos.

Los nozzlemen de escopeta trabajaban principalmente desde los levantamientos, disparando hasta 70 yardas cúbicas de material en un solo día.

Una vez construida la pared de la uña del suelo, varias capas de excreta fueron colocadas delante de ella antes de tallar el acabado del ashlar en la capa final de dos pulgadas.

"La tripulación trabajó en canastas para hombres con líneas y niveles de calidad junto con las paletas para terminar el patrón", explica Falls. "El nivel garantiza líneas rectas en la matriz y verifica que la superficie es plana y lisa."

Una vez construida la pared de la uña del suelo, se colocaron varias capas de excreta delante de ella. UMA comenzó mediante la fijación de una barra de refuerzo horizontal y vertical en un patrón de cuadrícula y la aplicación de una barra de refuerzo de 6 pulg. (150 mm) de capa de hormigón para el revestimiento temporal. Otra capa estructural de 6 in. Se rocía en el lado para construir el revestimiento permanente de la pared. La talla real del patrón se realiza cuando se coloca la última capa de 2 pulg. (50 mm).

A pesar de los retrasos climáticos, UMA terminó las paredes esculpidas de escopeta en el Intercambio I-77/I-40 en marzo de 2020. Los conductores de este nuevo intercambio muy transitado pueden necesitar algún tiempo para aprender los nuevos patrones de tráfico, pero al menos la vista será buena.

Brian DeSpain *is the president of UMA Geotechnical Construction and has been part of the geotechnical construction community since 2003. With a background in construction management, geotechnical engineering management, and strategic planning, he brings wide-ranging experience in the sales, field operations, and management of deep foundation and geotechnical grouting operations. Brian also has extensive experience with grouting equipment, hydraulic equipment, hydraulic equipment design, drilling equipment, polyurethanes, deep soil stabilization and foundation stabilizations of large commercial buildings, tunnels, and highways.*

2022 ASA OFFICERS AND BOARD OF DIRECTORS APPOINTMENTS

ASA announced its new officers and Board members, elected by the membership, during the ASA Shotcrete Convention and Technology Conference this past March. Lars Balck, Consultant, has graciously returned to serve another 1-year term as ASA President. Ryan Poole, Consultant, will also continue on in his position of Past President. To complete the Executive Committee, elected for the following for 1-year terms include: Frank Townsend, III, Patriot Shotcrete, as Vice President; Bill Geers, Bekaert, as Secretary; and Oscar Duckworth, Valley Concrete Services, as Treasurer.

The following newly elected ASA Directors serving 3-year terms, ending in 2025 include: Dennis Bittner, The Quikrete Company; Jason Myers, Dees Hennessey, Inc.; and Derek Pay, Oceanside Construction. Bruce Russell, CROM LLC, was elected for a 2-year term to fill the position vacated by Bill Geers as he joined the Executive Committee. They will be joining those currently on the Board, completing their final year, ending in 2023: Juanjose Armenta-Aguirre, Gunite Supply & Equipment; Jonathan Dongell, Pebble Technologies; and Marcus von der Hofen, Coastal Gunite Construction Co. Ryan Oakes, Revolution Gunite and Kevin Robertson, Sika STM- Shotcrete, Tunneling, & Mining (USA) will be completing their last two years, ending in 2024.


Balck


Poole


Townsend


Geers


Duckworth


Armenta-Aguirre


Dongell


Oakes


Robertson


Russell


Bittner


von der Hofen


Myers


Pay


Zhang


Cruz


Goss

To support the mission and work of ASA, the following individuals serve as Chairs of ASA Committees: Marcus von der Hofen, Coastal Gunite Construction Company, Contractor Qualification Committee; Oscar Duckworth, Valley Concrete Services, Education & Safety Committee; Ashley Cruz*, Cruz Concrete and Guniting Repair, Marketing Committee; Jason Myers, Dees-Hennessey Inc., Membership Committee; Ryan Oakes*, Revolution Gunite, Pool and Recreational Committee; Lihe "John" Zhang, LZhang Consulting & Testing Ltd., Technical Committee; and Christoph Goss*, Schnabel Engineering, Underground Committee. Special thanks and recognition to Cruz, Oakes and Goss for their newly assigned roles as Committee Chairs. Committee meetings are open to the public and ASA welcomes and encourages the participation of all interested parties in the shotcrete industry. Upcoming committee meetings can be found online under ASA Calendar. For more information, visit www.shotcrete.org. (*First Year)

2021-2022 ASA GRADUATE SCHOLARSHIP AWARDE.

The 2021-2022 ASA Graduate Scholarship was awarded to Sophie-Isabelle Dionne-Jacques. She received a stipend of $3000 (USD) for tuition, residence, books, and materials. Her bio and a summary of her research project can be found in this issue of Shotcrete magazine. Our annual graduate scholarship provides a scholarship to a Laval University graduate student engaged in shotcrete research. Evaluation of the entries includes a review of the relevance of the project's objectives with regards to the needs of the shotcrete industry, quality, originality and scope of the research project, and integration of sustainability elements in the project. Laval University has been a leader in shotcrete research and ASA recognizes and supports their contributions to the industry through this scholarship and funding of other research needs.

CALL FOR ENTRIES FOR 2022 OUTSTANDING SHOTCRETE PROJECT AWARDS PROGRA.

ASA is accepting applications for the 18th Annual Outstanding Shotcrete Project Awards program. These awards confirm and demonstrate the exceptional advantages of shotcrete placement of concrete. Awards are bestowed in the following six categories: architecture/new construction, infrastructure, international projects, pool & recreational, rehabilitation & repair, and underground. The deadline for submissions is October 3, 2022. For more information about the Outstanding Shotcrete Projects Awards and to view past award-winning projects, visit www.shotcrete.org/ASAOutstandingProjects, or contact us at info@ shotcrete.org.

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Looking for a way to grow your business? Investing your marketing dollars through advertising in ASA's *Shotcrete* magazine. *Shotcrete* magazine is the only international magazine focused exclusively on the shotcrete industry. Our magazine covers all aspects of the shotcrete market and highlights our shotcrete advances and achievements—from recognizing outstanding projects, to reports on shotcrete research, to articles exemplifying the state-of-the-art of shotcrete placement. Each issue of *Shotcrete* magazine has a readership of over 17,000 subscribers in over 100 countries.

Themes for 2022 include:

- Spring – Specifications
- Summer – Materials
- Fall – Productivity

Look for the 2022 *Shotcrete* magazine media kit online at www.shotcrete.org/mediakit. For more information, rates, and deadlines, contact Tosha Holden, ASA Editorial and Marketing Manager, at tosha.holden@shotcrete.org or 248.983.1712.

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Project:
Wave Walll
Orlando, FL
Email:
info@cromcorp.com
Phone Number:
(352) 372-3436
IG: @cromllc53

Company: Patriot Shotcrete & Construction
Project: PRime Contracting, UMass McCormick Hall
Phone Number:
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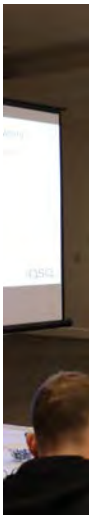


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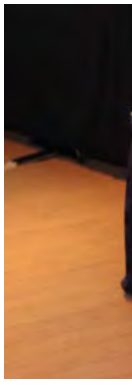


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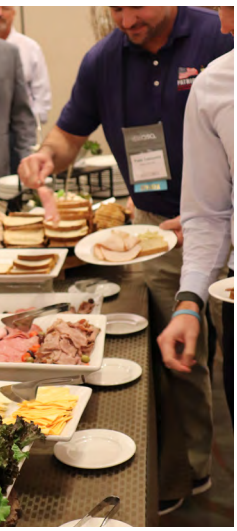
2022 ASA SHOTCRETE CONVENTION




shotcrete
asa
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NEW SAFETY TRAINING ASSESSMENT & RECOGNITION PROGRAM

AMERICAN SOCIETY OF CONCRETE CONTRACTORS
Enhancing the Capabilities of Those Who Build with Concrete

The American Society of Concrete Contractors (ASCC), St. Louis, MO announces a new Safety Training Assessment & Recognition Program (S.T.A.R.). The program is a product of ASCC's Safety & Risk Management Council (SRMC), the mission of which is to make ASCC concrete contractors the safest in the industry.

"S.T.A.R. is a benchmarking and improvement tool that can help contractors dramatically improve safety performance, regardless of company size or scope," says Joe Whiteman, ASCC director of safety services. "It acts as a roadmap for companies' policies, programs, controls and initiatives to refine and grow their company's safety environment."

S.T.A.R. provides 15 Key Performing Indicators (KPIs) that companies can use to assess their present safety programs. Participants score their level of achievement for each component on a weighted point scale and document their safety statistics. They achieve a recognition of level Five, Four, Three, Two or One star based on the data. Owners of companies applying for Four or Five STAR status will be interviewed by a panel of SRMC members.

"The interviews assure that ASCC is properly and diligently approving the highest level recipients, and provides company leadership the opportunity to share their involvement with safety within their companies," says Aron Csont, Barton Malow, council director, SRMC.

QUIKSPRAY INC.

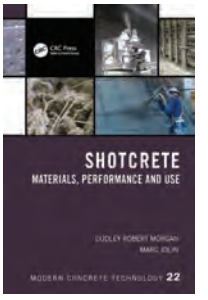
Introducing Quikspray's new 1.5 in. (38 mm) Carrousel® Grout Plant. This compact unit consists of a standard 1.5 in. Carrousel® Pump and 31 in. (790 mm) U-Blend Mixer mounted onto a skid frame—making it one complete unit. The Grout Plant sits on 16 in (400 mm) pneumatic tires which makes it easy to move on the job site. In addition, the skid frame has fork pockets installed to allow contractors to move the unit with a forklift.

The Grout Plant is bolted together and measures approximately 48 x 38 x 56 in. (1200 x 960 x 1400 mm) and 600lbs. The model shown in the photo is driven by two 4 hp air motors and the system requires an air compressor capable of 185 CFM (5.2 m3/min) at 90 psi. (0.6 MPa) to operate. This model is also offered in electric and hydraulic.

Just like the original Carrousel® Pump, the 1.50" Grout Plant is capable of pumping epoxy grouts, heavily bodied materials, re-grouting mortar joints and also spraying fireproofing, waterproofing, EIFS, artificial rock work, stucco, and other commercial coatings.

The pumping system is easy to clean with just running a sponge ball and water through the system. The U-Blend mixer was especially designed with easy clean up in mind. The mixer uses Square-Drive Technology to enable the operator to remove the mixing blades with no tools in order to wash the blades. This speeds up cleanup time and the longevity of the equipment.

NEW TEXTBOOK IN THE MODERN CONCRETE TECHNOLOGY SERIES



Now available for purchase, the Modern Concrete Technology series releases Shotcrete - Materials, Performance and Use, written by Dudley Robert Morgan, Past President of the American Shotcrete Association, Saanichton, British Columbia, Canada; and Marc Jolin, Laval University, Quebec City, Quebec, Canada. Shotcrete is a comprehensive textbook covering current state-of-the-art shotcrete technology and contains chapters on history, shotcrete materials and mixture proportioning, performance, shotcrete research, equipment, and shotcrete application. It also contains shotcrete case history examples including uses of shotcrete in buildings and structures, infrastructure repair and rehabilitation, ground support and shoring, underground support in tunnels and mines, swimming pools and spas, and, finally, architectural shotcrete. To request a copy for review, please contact: https://m.email.taylorandfrancis.com/Review_copy_request. For more information visit: www.routledge.com/978148226410. Use discount code FLA22 at checkout for a 20% discount.

CHARLES K. NMAI ELECTED PRESIDENT OF AMERICAN CONCRETE INSTITUTE

President, Vice President, and Board members elected

The American Concrete Institute (ACI) announces its 2022-2023 president, vice president, and four board members.

Charles K. Nmai has been elected to serve as president of the Institute for 2022-2023, and Michael J. Paul has been elected ACI vice president for a two-year term. Additionally, four members have been elected to serve on the ACI Board of Direction, each for three-year terms: Robert C. Lewis, Anton K. Schindler, Matthew R. Sherman, and Lawrence L. Sutter.

President

ACI President – Charles Nmai

Charles K. Nmai, FACI, is Head of Engineering at Master Builders Solutions Admixtures US LLC in Cleveland, OH, the leading provider of specialty construction chemicals used in the ready mixed, precast, manufactured concrete products, underground construction, and paving markets. He has been with the company since 1987 and is actively involved in technology transfer/standards activities and specification efforts to advance the use of durable and sustainable solutions in the concrete industry worldwide.

He is a member of the ACI Foundation Board of Trustees, the Board of NEU: An ACI Center of Excellence for Carbon Neutral Concrete, and ACI Committees 130, Sustainability of Concrete; 201, Durability of Concrete; 222, Corrosion of Metals in Concrete (Chair, 1999-2005); 363, High-Strength Concrete; and E701, Materials for Concrete Construction (Chair, 1998-2001). Nmai is a member of ACI Subcommittees 130-A, Materials, and130-D, Rating Systems/Sustainability Tools.

Nmai served on the ACI Board of Direction from 2003-2006 and was a Board member of the ACI Foundation Strategic Development Council (SDC). He has also served on several other ACI committees, including the Financial Advisory Committee, Construction Liaison Committee, Educational Activities Committee, and Fellows Nomination Committee.

A corrosion inhibitor patent holder, Nmai was honored in 2009 at the Ninth ACI International Conference on Superplasticizers and Other Chemical Admixtures for outstanding and sustained contributions in this field. He was awarded the 2013 ACI Arthur R. Anderson Medal for outstanding contributions to the advancement of knowledge of concrete as a construction material in the areas of corrosion and chemical admixtures.

In 2012, he was a recipient of the Civil Engineering Alumni Achievement Award presented by the Faculty of the Purdue University School of Civil Engineering. He is an Honorary Member of ASTM International Committee C09, Concrete and Concrete Aggregates, and past Chair of ASTM International Subcommittee C09.23, Chemical Admixtures. A member of the American Society of Civil Engineers (ASCE) since 1984, he was an active member of the Committee for the National Concrete Canoe Competition from 2003 through 2009. He is a member of the Board of Directors for the Fiber Reinforced Concrete Association (FRCA) and a member of the Precast/Prestressed Concrete Institute (PCI).

Nmai received his BSc (first-class honors) in civil engineering from the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, and his MS and PhD in civil engineering from the University of Kansas, Lawrence, KS, USA, and Purdue University, West Lafayette, IN, USA, respectively. He is a licensed professional engineer in the state of Ohio.

Vice President

ACI Vice President – Michael J Paul

Michael J. Paul, FACI, has more than 40 years of construction and engineering experience and is a recognized leader in the concrete industry. He currently serves as Principal Structural Engineer for Larsen & Landis, Inc., based in Philadelphia, PA. In this role, he oversees the engineering, documentation, and management of structural engineering for commercial, institutional, industrial, recreational, and residential projects. Paul's experience includes troubleshooting, repair, restoration, and rehabilitation of existing concrete structures in addition to new structure design.

A Fellow of ACI, Paul's leadership and volunteer efforts with ACI amass a long list. He presently serves as Trustee of the ACI Foundation, Chair of its Development Committee, Chair of the ACI Membership Committee, and on the ACI Financial Advisory Committee. His previous professional service to ACI, which extends nearly 40 years, includes the Board of Direction, Chair of the International Project Awards Committee and ACI Committee 124, Concrete Aesthetics, for which he continues to edit the "Notable Concrete" series produced for ACI conventions and excerpted in Concrete International. In addition, he served on the editorial review panel for both Sustainable Concrete Guides of the U.S. Green Concrete Council. He is a member or past member of several other ACI committees including 120, History of Concrete. A frequent speaker and author on concrete topics, Paul has contributed several articles to Concrete International on projects involving the renovation or restoration of historic concrete structures.

In addition to his ACI activities, Paul is an active member of several ASTM International committees and is a past member of the American Society of Civil Engineers (ASCE), having served on the editorial panel of the Journal of Leadership and Management in Engineering, and ASTM International, serving on Committee E06, Performance of Buildings. His contribution to the industry is also evidenced by his 20 years of undergraduate teaching. Paul was the Coordinator for the Senior Design capstone course in the Department of Civil and Environmental Engineering at the University of Delaware, Newark, DE, USA. The course received the National Council of Examiners for Engineering and Surveying (NCEES) Engineering Award Grand Prize in 2010.

Before joining Larsen & Landis, Inc., Paul held engineering positions for Built Form LLC, Duffield Associates, Thornton Tomasetti, Guardian Companies, Gredell & Paul, among others. He has received numerous honors and awards from professional, technical, and community organizations including the 2018 ACI Strategic Advancement Award and 2008 Engineer of the Year from the ASCE Delaware Section.

Paul received his MSCE and MArch from the Massachusetts Institute of Technology, Cambridge, MA, and his BA from Dartmouth College, Hanover, NH, USA. He is a licensed professional engineer, a licensed architect (American Institute of Architects), and is LEED-AP accredited.

Directors

ACI Director – Robert C. Lewis

Robert C. Lewis, FACI, is the Technical Marketing Manager – Silica Fume, at Ferroglobe, PLC, which is headquartered in Madrid, Spain. He began his career as a field technician in 1978 for Tarmac Topmix in the UK. In his first year, he gained three qualifications with the Institute of Concrete Technology (ICT): Concrete Practice, Concrete Technology, and General Principles. Within 6 years, he progressed to running the regional laboratory and was the assistant to the two area technical managers for the south of England.

Lewis moved to Elkem Materials in 1986 to provide technical support to the international market. During his 32 years at Elkem, he was involved in many varied projects worldwide—ranging from bridges to tunnels, skyscrapers to nuclear power plants, chemical factories to warehouse floors, and underwater placement—where high-performance silica fume concrete was used. He joined Ferroglobe in 2018 as Technical Marketing Manager – Silica Fume, working with the sales teams across the world.

Over the last 40 years, Lewis has written or co-authored numerous papers on silica fume and its use in concrete, most significantly for the ICT Advanced Concrete Technology Diploma course and the fourth and fifth editions of F.M. Lea's The Chemistry of Cement and Concrete. He is a well-known speaker at seminars and conferences, presenting and passing on his knowledge of silica fume concrete technology. He is the UK expert to the CEN (European Standards) committee for silica fume, contributing to the development of the European Standard EN 13263, Silica Fume for Concrete.

Lewis has served on numerous ACI committees and currently is a member of the Committee on Codes and Standards Advocacy and Outreach, International Certification, Educational Activities, Education Award, International Conferences and Conventions, and the Personal Awards Committee; as well as ACI Committees 211, Proportioning Concrete Mixtures; 234, Silica Fume in Concrete (which he chaired for 7 years); and 552, Cementitious Grouting; and Joint ACI-TMS Committee 216, Fire Resistance and Fire Protection of Structures.

He was named a Fellow of ACI in 2013 and a Fellow of the Concrete Society (UK) in 1999. In 2014, he took on the role of Chair of the ICT Technical and Education Committee, at the same time becoming a member of the ICT Council. In 2017, Lewis was elected a Fellow of the ICT, became Chair of the British Standards Committee B/517/04 on Additions for Concrete, and was elected as Vice President of ICT. In 2019, Lewis became the President of ICT for a term of 2 years.

A key achievement of his service with both ACI and ICT has been collaborating on the creation of the ACI-ICT EN Standards Concrete Field Testing Technician certification program, which is running very successfully in the UK, Europe, and areas of the Middle East.

ACI Director – Anton K. Schindler

Anton K. Schindler, FACI, is the Mountain Spirit Professor and Director of the Highway Research Center at Auburn University (AU), Auburn, AL, where he has taught courses in engineering mechanics, structural design, and concrete materials in the Civil and Environmental Engineering Department. He has served on the AU faculty since 2002 and has twice been selected by students as the department's Outstanding Faculty Member.

He was elected a Fellow of ACI and the American Society of Civil Engineers (ASCE) in 2013 and 2019, respectively. He was awarded the 2021 ACI Delmar L. Bloem Distinguished Service Award. He received the 2017 ACI Cedric Willson Lightweight Aggregate Concrete Award and the 2013 Erskine Award from the Expanded Shale, Clay and Slate Institute for his contributions to the use of lightweight aggregate in concrete applications. He was a Fulbright U.S. Scholar from 2015-2016 with the VTT Technical Research Center in Finland to perform research on nuclear concrete structures. Schindler also received the 2006 and 2011 ACI Wason Medal for Materials Research.

Schindler serves as Vice Chair of the ACI Foundation Scholarship Council. He is a member of the ACI Technical Activities Committee (TAC) and ACI Committees 209, Creep and Shrinkage in Concrete, and S803, Faculty Network. Schindler is the past Chair of ACI Committees 237, Self-Consolidating Concrete; and 231, Properties of Concrete at Early Ages. He serves as the Faculty Advisor for the ACI Auburn University Student Chapter that he helped establish in 2014. In addition, he is Chair of the Transportation Research Board (TRB) Standing Committee AKM50, Advanced Concrete Materials and Characterization. He is a member of ASCE and ASTM International. Schindler is also a licensed professional engineer in Alabama.

He received his BSE and Honors Degree (Structural Engineering) from the University of Pretoria, South Africa, in 1993 and 1996, respectively. After working as a structural design consultant for nearly 4 years, he received his MS and PhD from The University of Texas at Austin, Austin, TX, in 1999 and 2002, respectively.

ACI Director – Matthew R. Sherman

Matthew R. Sherman, FACI, is a Senior Principal with Simpson Gumpertz & Heger, in Waltham, MA. He specializes in the intersection of construction operations, structural engineering, and construction materials. As a Senior Principal with Simpson Gumpertz & Heger, Sherman leads

integrated teams of engineers, chemists, petrographers, and other professionals to solve complex interdisciplinary challenges. His work includes evaluating existing structures, assessing materials, conducting nondestructive testing, and supporting construction teams. He has extensive expertise in assessing and evaluating structural- and material-related issues and a passion for working with specialized structures, such as stadia, ice rinks, and swimming pools.

Sherman gives back to the industry in many ways, including writing and lecturing extensively on concrete construction, assessment, and repair; condition assessments and evaluations; and specialty structure repair. He is a Fellow of ACI, Chair of the ACI Financial Advisory Committee, and a member of ACI Committees 201, Durability of Concrete; 221, Aggregates; and 349, Concrete Nuclear Structures. He is a Fellow of the International Concrete Repair Institute (ICRI)—where he serves on the Technical Activities, Corrosion, and Evaluation committees—and is also a member of the Concrete Society and American Welding Society.

Sherman received his BS in civil engineering from Cornell University, Ithaca, NY, USA, in 1991, and his MS in civil engineering (structural) from The University of Texas at Austin, Austin, TX, in 1993. He is a licensed professional engineer in multiple states and Canadian provinces.

Lawrence L. Sutter, FACI, is the Associate Dean of Research and External Engagement for the College of Engineering at Michigan Technological University (Michigan Tech), Houghton, MI. He also serves as a Professor in the Materials Science and Engineering Department at Michigan Tech and as Director of the University's Applied Chemical and Morphological Analysis Laboratory (ACMAL). Sutter is a licensed professional engineer in Michigan.

ACI Director – Lawrence L. Sutter

He has over 40 years of experience in materials characterization and testing and conducting research on concrete-making materials with a focus on durability. He has conducted research on various recycled and secondary materials including fly ash, slag cement, and municipal solid waste incinerator ash, in addition to conventional construction materials such as aggregates, concrete, and asphalt. Significant projects have included extensive studies of the effects of chloride deicers on concrete pavements and the development of tests for application in fly ash specifications.

Sutter is a Fellow of ACI and serves as Chair of ACI Committee 321, Concrete Durability Code; Vice Chair of Committee 232, Fly Ash and Bottom Ash in Concrete; and Secretary of Committee 201, Durability of Concrete. He is a member of ACI Committees 130, Sustainability of Concrete; 221, Aggregates; 225, Hydraulic Cements; 233, Ground Slag in Concrete; 239, Ultra-High-Performance Concrete; 240, Pozzolans; 242, Alternative Cements; 308, Curing Concrete; and E701, Materials for Concrete Construction. He was also a member of the ACI Strategic Development Council (SDC) and past Chair of the SDC Accelerated Technology Implementation Team for Alternative Cementitious Materials. In 2019, he was awarded the ACI-SDC Jean-Claude Roumain Innovation in Concrete Award and the Delmar L. Bloem Distinguished Service Award. He is a past member of the Educational Activities Committee (EAC) and served as Chair for ITG-10, Alternative Cements, which was instrumental in forming Committee 242. He has also served in the past as an Examiner for ACI Field Technician certification.

Sutter is a Fellow of ASTM International and a member of Committees C01, Cement, and C09, Concrete and Concrete Aggregates, serving on the Executive Committee of C01 and as incoming Vice Chair of C09. He serves as Chair of Subcommittees C01.14, Non-hydraulic Cements; C09.24, Supplementary Cementitious Materials; and C09.65, Petrography. He is a member of ASTM Subcommittees C01.10, Hydraulic Cements for General Concrete Construction; C01.13, Special Cements; C09.27, Slag Cement; C01/09.48, Performance of Cementitious Materials and Admixture Combinations; and C09.50, Aggregate Reactions in Concrete. Sutter was presented with the Award of Merit in 2019, the organization's highest recognition.

Sutter is active in numerous other organizations, including the National Concrete Consortium (NCC), Transportation Research Board (TRB), American Association of State Highway and Transportation Officials (AASHTO), and Federal Demonstration Partnership (FDP).

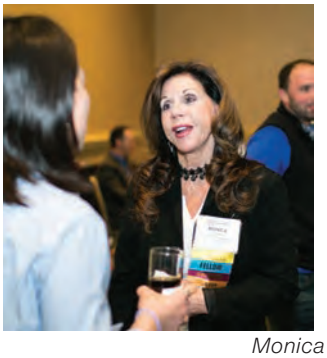
KEN LOZEN RETIRES

ICRI Technical Director Ken Lozen officially retired on January 31, 2022. Ken was here at the beginning—serving as ICRI's first treasurer when the organization was formed (formerly the International Association of Concrete Repair Specialists). After a long career as a consulting engineer, Ken joined the ICRI staff as Technical Director. For the past 9 years has Ken played a crucial role in launching the ICRI Certification programs and has been instrumental in growing the impact of ICRI's technical products and publications. He also paved the way for a seamless transition to his successor, Dave Fuller. At the January ICRI Board Meeting held during World of Concrete, the Executive Committee and staff presented Ken with a cake, a gift card to get him ready for his new boating lifestyle (once the weather in Michigan improves), and a variety of messages sent in from members and colleagues who were unable to attend in person. As you can see, we sent Ken off in style! But he will most certainly be missed.

Is it the delicious-looking cake? OR is it the prospect of his imminent (and well-deserved) retirement? We may never know, but that smile says it all

As the ICRI Executive Committee and staff wished Ken well on his retirement, his replacement, Dave Fuller, pulled Ken aside to answer a few more questions about ICRI's technical activities

ICRI 2022 PRESIDENT'S AWARD



Monica Rourke

The last official act as ICRI President gave Elena Kessi the honor of selecting a recipient for the 2022 President's Award. This award acknowledges the extraordinary dedication, unparalleled achievement, and substantial efforts of an ICRI member who has gone above and beyond with their time and their knowledge in giving back to the repair and restoration industry. Monica Rourke, you are my friend, my mentor and colleague, and you made this decision easy. I am honored to present this award to you. Looking back on the 16 years I have spent in this industry, I have always felt accepted and respected, despite women continuing to be in the minority. Thank you for giving women and men in this industry the confidence to use their voices and find a seat at the table. Monica joined the association in 1991—back when ICRI was called IACRS. In her time as an ICRI member, she has served numerous positions both locally and nationally. Monica was often the only woman in the room, but that didn't stop her from speaking up and getting involved. Over the past three decades, Monica cemented the following firsts:

- FIRST Woman ICRI President
- FIRST Woman ICRI TAC Member
- Founder of WICRI

Committee Eyes were on her to be different. Monica leads with truth, and commands the best from all of us. In addition to her "firsts," Monica's list of ICRI contributions is extensive. She was a founding member of the Connecticut Chapter, where she still serves on the local Board of Directors and served two terms as President. She has attended National Conventions all over the country (and some international) and participates on both administrative and technical committees. Many of you might know her as "the Grout Lady" because she has given countless technical presentations on the many methods of chemical grouting to control water. Some of her favorite ICRI experiences are visiting local chapters as a technical speaker. I asked Monica about her greatest accomplishments in our industry. She humbly stated she's honored to be looked at as a mentor and friend to members of our association. I know I and other members of ICRI have experienced Monica's voice in committee meetings and presentations, and she is the definition of a leader. This leadership earned her the distinguished title of ICRI Fellow—an award given to her by her peers. We also touched on "Why ICRI?" and her response rang clear and true: "Why I joined and why I stayed are two different reasons. I have made personal friends at ICRI, and I don't think that's possible at every organization." Looking forward, Monica is energized to bring new voices to the table within ICRI. She challenges us to keep pushing for diversity and inclusion and to always fight for what makes us stronger as an industry and association. For these and many more reasons, I am so proud to present Monica Rourke with the 2022 ICRI President's Award!

INTRODUCING PUTZMEISTER OCEANIA

We are excited to announce that Putzmeister has acquired CPE Machinery Pty Ltd. In Australia. CPE Machinery will transition to become the Putzmeister Subsidiary Oceania.

CPE Machinery was built with passion and a zest for knowledge of all things about concrete pumping. Its mission has always been to become the best company in this field within Australia and beyond. Managing Director, David Bond believes that this acquisition can take the

company to greater heights; merging the global expertise of the Putzmeister brand and the local know-how of CPE's talents into a stronger company that can serve the market better.

From the perspective of Putzmeister, Head of Asia Pacific, Michael Schmid-Lindenmayer explains "CPE Machinery has for a long time been one of our flagship dealers. For us, seeing the growth of CPE Machinery over the last few years, and the strength of the Australian market, it is a very natural progression to make this acquisition. It presents an opportunity for us to inject further investments into the future of concrete placing in Australia and surrounding countries. We will continue to strengthen the offering, grow the business and ultimately provide the best support possible to the Oceania region."

What does this mean for our customers? You will now be dealing directly with Putzmeister. Putzmeister just got closer to your business. David will continue to be involved in an advisory role for some years. Over the next few months, you'll see some new reinforcements added to the team too. Mostly, it will be the same people, same products and brands[1]. Business as usual!

There will be some changes to the way we look as we transition from CPE Machinery to Putzmeister Oceania, mostly just to reflect the change in the legal entity.

Off the blocks, we are going to offer a new line of concrete pumps! Putzmeister Oceania is now responsible for the distribution and support of SANY Concrete Machinery in Australia. SANY Concrete Machinery complements our existing portfolio by offering a quality alternative at a cost effective price point, supported by the technology and experience of Putzmeister. We also intend to expand our product offering to the mining industry.

We're proud of what we have achieved thus far and thrilled about the opportunities that lies ahead to serve you better as Putzmeister Oceania.

[1] *(including Trelleborg, Esser, ConForms, Boom Makina and Maxon)*

SHOTCRETE FAQs

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

Question: *We have a customer that feels the information regarding cold joints in shotcrete as stated in Position Statement "Monolithic Shotcrete for Swimming Pools (No Cold Joints)" only applies to wet-mix shotcrete and not to the dry-mix process. We sent him the article in the latest Shotcrete Magazine and that did not appease him. He was also given the Position Statement to no avail. We also explained that the term Shotcrete applies to both the wet and dry process. Do you have any additional information?*

Answer: A Portland Cement Association Research and Development Laboratories 1966 report "LABORATORY STUDY OF SHOTCRETE" by Albert Litvin and Joseph J. Shideler on dry-mix and wet-mix shows dry-mix generally had a lower w/cm, was stronger, and had better freeze-thaw durability. Dry-mix uses more air flow (CFM) than wet-mix to achieve the required high velocity.

Also, a Shotcrete magazine article on nozzle velocity "Material Velocity at the Nozzle" by Nicolas Ginouse and Dr. Marc Jolin shows dry-mix has equivalent or higher velocity than wet-mix in the middle of the material stream. The key to bond is high velocity driving cement-rich paste into the bond plane. This article can be found in the Shotcrete magazine article archives at Shotcrete.org/Archive-Search.

Multiple ACI documents including American Concrete Institute Codes 318, 350 and 376, Specifications 301, 506, 563 use dry-mix and wet-mix interchangeably. There is no difference in properties of bond or hardened concrete that differ from each process.

Gunite is the old tradename (expired long ago) for what is now called dry-mix. In fact, "Gunite" is now a registered trademark of a company called "Gunite Corporation" who manufactures brake parts.

Question: *One of our shotcrete suppliers in western North Carolina is running out of a source of fly ash. Are there any substitutes for fly ash or an alternative mix design used in the past under similar situations that you can be used?*

Answer: Fly ash is a supplementary cementitious material (SCM) so acts as a substitute for portland cement. You can always just use cement and with sources of fly ash drying up cement may actually be less expensive. Fly ash does help increase pumpability, slows set and reduces permeability. So, any replacement depends on what properties you are looking for.

- Reducing permeability – either silica fume or slag cement are SCMs that can reduce the concrete's permeability
- Slowing set time – slag cement will help reduce set that is helpful in hotter weather
- Increase pumpability/workability – slag cement should also help while silica fume will not

Typical range of cement replacement for portland cement by slag cement is 25 to 50%. 50% is a common dosage of Grade 120 slag.

Silica fume is used at smaller dosages and be aware it has a high water demand so between 5 and 10% replacement of cement. Common dosage is closer to 5% than 10%.

There are also some natural pozzolans, like metakaolin, but seem to be limited in availability.

If you're mainly looking for a slower set in hot weather, consider using a retarding or hydration control admixture. A retarder may give up to 3 hours of time to place the concrete. A hydration control (sometimes called a hydration stabilizer) can be adjusted to provide most any duration needed up to 3 days.

Question: *I had a question concerning the IBC code. We have a job coming up where we have proposed using structural shotcrete to install some fairly minor underpinning. This is something we do more or less constantly and are very comfortable with it.*

The general contractor (GC) is bound by the contract documents to use the 2015 version of International Building Code (IBC). If I am not mistaken, I have seen a version of the IBC code where it is silent on shotcrete. It just redirects the reader to an ACI document.

Is there a more recent version of the IBC Code that may be applicable?

Answer: The IBC 2021 version has deleted the specific (and outdated) shotcrete provisions and now simply provides this reference to ACI 318:

> **SECTION 1908 – SHOTCRETE**
> **1908.1 General**
> **Shotcrete shall be in accordance with the requirements of ACI 318.**

ACI 318-19 added shotcrete provisions and is more comprehensive and up-to-date than the old IBC provisions. Section R4.2.1.1 in the commentary side of ACI 318-19 lists all the additions that were added to include shotcrete placement in the 318 Code.

Question: *Are deadman switches required when applying shotcrete as a support system for soil walls? Is this technology available?*

Answer: We are not aware of any technology to provide a deadman switch on the shotcrete nozzle. With the high pressures in pushing concrete through the delivery lines having a cutoff at the nozzle could lead to over pressurizing the delivery line and cause explosive failures in the lines. Thus, it would seem a system would need to be implemented to shut down and reverse the concrete pump immediately when a trigger pumping pressure is reached. Since shotcrete placement can require long delivery lines or pushing to elevated areas, setting a practical trigger pressure may be hard to establish.

The shotcrete contractor should always have a line of direct communication between the nozzleman and the pump operator. This may be with a radio, hand signals, intermediate signalers, or the pump operator with a remote near the nozzleman. If at any time the flow of concrete is stopped at the nozzle due to a suspected plug in the line the nozzleman will immediately signal the pump operator to stop and reverse the pump. Experienced pump operators can anticipate this and initiate the stop/reverse process as the pumping pressures increase suddenly and the engine will start to strain.

Perhaps in the future systems using AI to anticipate variable trigger pressures that are appropriate for the placement requirements (concrete mixture properties, length of delivery line, elevation of nozzle) may be developed but such systems are not currently available.

Question: *I am a homeowner that is having a large residential pool constructed in Northeast Florida by a highly regarded local pool contractor. This is an approximate 1000 ft² (93 m²) residential pool that was scheduled for 50 yd³ (38 m³) of shotcrete yesterday to be done in 1 day. Unfortunately, due to some contractor issue only 1 truck arrived and only 10 yd³ (7.6 m³) were installed yesterday. Today only another 10 yd³ was installed because of a faulty spray hose, as well as the contractor rejecting the next two concrete trucks due to poor quality. Due to a local event in our community next week the contractor cannot return until 10 days from today.*

I am very concerned about the contractor spraying new shotcrete over 10-day old, cured shotcrete. My concerns include the potential for improper bonding, cold joints, or other issues which would likely result in a pool structural issues and crack failures that would not normally be experienced if all the shotcrete was installed in 1 day as planned. The contractor has advised that there is no issue with applying new shotcrete over 10 day cured shotcrete, however this is a sizable investment and I want to be absolutely sure about proper next actions.

Answer: When shooting onto existing concrete sections the surface must be properly prepared and then shotcreted with proper shotcrete materials, equipment and placement techniques. This will produce a construction joint that acts monolithically and not be a "cold" joint. Shotcrete placed onto an existing concrete surface will provide an excellent bond IF the following conditions are met:

1. Make sure the surface is roughened and clean.
    a. The amplitude of roughness should be +/- 1/8th in. (3 mm) or more.
    b. If the surface was not roughened when it was left be sure to have the contractor roughen it.
    c. The construction joints should be at a 45° angle to horizontal to promote rebound not collecting in the back corner.
    d. A high-pressure water blaster (5000 psi [34 MPa] or more) or abrasive blasting can help to roughen and clean the surface.
2. Bring the concrete surface to saturated surface dry (SSD) condition. This means the surface feels damp, but water is not picked up on a hand when placed on the surface.
3. Make sure the shotcrete placement is properly executed with high velocity placement and quality materials.
    a. The shotcrete should have a minimum 28-day compressive strength of 4000 psi (28 MPa).
4. Be sure the shotcrete contractor is using an air compressor able to produce at least 185 CFM (5.2m³/min) for wet-mix and 375 CFM (10.6 m³/min) for dry-mix (gunite) of air flow at 100 to 120 psi (0.7 to 0.8 MPa).
5. Use of an ACI-certified shotcrete nozzleman is recommended.
6. No bonding agent should be used. It will interfere with the natural bonding characteristics of shotcrete placement.
7. A minimum thickness of no less than ½ in. is recommended.

For more details, you may find our pool position statement "Monolithic Shotcrete for Swimming Pools (No Cold Joints)" at Shotcrete.org/Resources. The *Shotcrete* magazine article "Shotcrete Placed in Multiple Layers does NOT Create Cold Joints" details the excellent bond between shotcrete layers. You can find this by searching our magazine article archives at Shotcrete.org/ArchiveSearch.

Also, the image you provided shows that the floor was not shot or cast before shooting the walls. All dry loose hardened concrete material in the floor section should be removed to assure the floor is placed at full thickness with quality concrete. Rebound and trimmings from wall do not contain the full concrete mixture and thus should be removed and not incorporated in the final concrete thickness. If the dry concrete material is not removed, be sure the contractor spaces the reinforcing bars up off the base and provides full thickness and cover both below and above the bars in the finished concrete section.

You may find our other pool position statements helpful in learning about the standard of practice in pool construction. Shotcrete.org/resources.

Question: *What is the minimum reinforcement ratio for a swimming pool wall made of shotcrete (not fiber reinforced)? I have been assuming 0.18% based on ACI 318-14, which leads me to provide #3 (#10M) reinforcing bars at 10 in. (250 mm) on center for a 6 in. (150 mm) thick pool wall.*

Calculating with this requirement gives 0.18/100x6 = 0.13 in^2/ft (273 mm^2/m)

Providing #3 bars at 10 in. on center = 0.132 in^2/ft (279 mm^2/m)

However, most contractors in the state provide #3 rebars at 12 in. (300 mm) on center which seems insufficient.

#3 rebars at 12 in. = 0.11 in^2 / ft is 15% less than the 0.13 in^2/ft that would be required by ACI 318-14.

Can you please provide guidance on which one is correct?

Answer: As you properly assumed, shotcrete is simply a placement method for concrete. Thus, the relevant ACI Concrete Codes are applicable. ACI 318-19 *Building Code Requirements for Structural Concrete* would be the current structural concrete design code and includes shotcrete placement. You mentioned 318-14 which may be the code version adopted in your location. Both versions do have 0.18% reinforcement for shrinkage and temperature which are the primary volume change stresses horizontally in most pools. ACI 318 doesn't directly address crack control since most building structures aren't as concerned with through section cracks that would cause leakage. Many pool designers recognize that the ACI 318 0.18% should be the minimum for a structural pool shell. Some designers, especially those designing commercial pools, feel the ACI 350-20 *Code Requirements for Environmental Engineering Concrete Structures*, specifically for design of water-retaining concrete structures, would be the appropriate design code. ACI 350 has higher levels of reinforcement and reduced spacing to promote better crack control and thus watertightness and long-term durability and serviceability. As pools generally don't have movement joints in the walls, depending on the length of the walls there would need to be between 0.3 and 0.5% minimum shrinkage and temperature reinforcement (ACI 350 Table 7.12.2.1).

Thus, as a pool designer recognizing that the pool shell is structural concrete and should meet at least the ACI 318 minimums, your use of #3 at 10 in. is proper. The #3 bars at 12 in. would not meet the ACI 318 requirements. If you do want to provide better crack control for watertightness and longer durability and serviceability you may consider ACI 350 requirements. ASA is working on a Position Statement from our Pool and Recreational Committee on Reinforcement. That should be published later this year. You may find our existing Pool Position Statements on our web site at Shotcrete.org/Resources. These address issues specifically for shotcreted pools including compressive strength of concrete, watertightness, monolithic placements, forming and curing.

Question: *We are going to increase the bending moment strength of an existing basement wall by adding reinforcing to and shooting a 4 in. (100 mm) layer of concrete onto the existing concrete wall surface. What is a reasonable value to use for bond between existing roughened concrete and a new layer of concrete shot onto a wall? I can calculate the shear flow between the existing wall and the new layer of concrete, but once done, I have to have a bonding strength to compare that to.*

Answer: A bond tensile strength of shotcrete using quality materials, proper equipment and application technique on a properly prepared surface should easily achieve 150 psi (1 MPa). Past research has shown bond shear strength can be estimated as 2 to 3 times the bond tensile strength. Shotcrete placed onto an existing concrete surface will provide an excellent bond IF the following conditions are met:

1. Make sure the surface is roughened and clean.
   a. The amplitude the of roughness should be +/- 1/8th in. (3 mm) or more.
   b. If the surface was not roughened be sure to have the contractor roughen it.
   c. A high-pressure water blaster (5000 psi [34 MPa] or more) or abrasive blasting can help to roughen and clean the surface.
2. Bring the concrete surface to saturated surface dry (SSD) condition. This means the surface feels damp, but water is not picked up on a hand.
3. Make sure the shotcrete placement is properly executed with high velocity placement and quality materials.
   a. The minimum 28-day compressive strength of the concrete mixture design should be 4000 psi (28 Mpa).
   b. To get proper velocity be sure the shotcrete contractor is using an air compressor able to produce at least 185 CFM (5.2 m^3/min) of air flow at 100 to120 psi (0.7 to 0.8 Mpa) if using wet-mix, 375 CFM (10.6 m^3/min) or more may be needed for dry-mix application.
   c. Use of an ACI-certified shotcrete nozzleman is recommended.

4. No bonding agent should be used. It will interfere with the natural bonding characteristics of shotcrete placement.

The Shotcrete magazine article "Shotcrete Placed in Multiple Layers does NOT Create Cold Joints" details the excellent bond between shotcrete layers. You can find this by searching our magazine article archives at Shotcrete.org/ArchiveSearch.

Question: *We have a wet-mix steel fiber overhead application progressing in our state.*

The question is about the use of a steel trowel finish. The ASA Shotcrete Inspector education seminar indicated that a steel trowel is less durable, reduces freeze-thaw resistance and can show surface cracking more proximately.

As this particular application is overhead and in a tunnel, there is not as much of a concern with water infiltration and the associated freeze-thaw durability for saturated concrete. We usually don't allow steel trowels for flat work, due to deicing salts, but that concern wouldn't apply here.

Construction is wanting a smooth finish and looks do matter here as it is a high profile project.

If we were to allow the steel trowel finish, what would be the concerns or suggestions to this approach?

Answer: Considering your specific application we'd suggest:

1. Freeze-thaw (F/T) deterioration is dependent on the concrete being saturated in multiple freezing and thawing cycles. In an overhead application where water can't stand on the surface the concrete can't be saturated unless water permeates through from the upper surface. And with good quality concrete in the tunnel, it is expected that water shouldn't permeate through, and thus should be functionally watertight. As a result, F/T likely isn't a critical durability issue.
2. A steel trowel finish does require extra working of the surface and would require the contractor to be very attentive to the proper time to get the finish yet not overly disturb the fresh concrete. Gravity is working against the overhead concrete staying in place.
3. Having a smooth steel trowel finish would make minor shrinkage cracks more noticeable. However, in the tunnel without exposure to sunlight or much wind exposure, and with proper attention to curing surface cracking may be minimal.

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SHOTCRETE CALENDAR

Please check with the meeting provider as some meetings may be postponed or cancelled after publication of this issue of Shotcrete.

SEPTEMBER 12–14, 2022	**Breakthroughs in Tunneling Short Course** University of Denver | Denver, CO
OCTOBER 13, 2022	**Architectural Shotcrete – Creative, Sustainable and Durable Concrete Structures using Shotcrete** McCormick Place | Chicago, IL
OCTOBER 13-14, 2022	**Chicago Build Expo** McCormick Place | Chicago, IL
OCTOBER 22, 2022	**ASA Fall Committee Meetings** TBD | Dallas, TX
OCTOBER 23-27, 2022	**ACI Concrete Convention - Fall** Hyatt Regency Dallas | Dallas, TX
NOVEMBER 7-9, 2022	**ICRI Fall Convention** InterContinental Buckhead Atlanta | 3315 Peachtree Road, NE | Atlanta, GA
NOVEMBER 15-18, 2022	**International Pool Spa Patio Expo 2022** Las Vegas Convention Center | Las Vegas, NV
NOVEMBER 15, 2022	**ASA Shotcrete Nozzleman Education – PSP/Deck Expo 2022** Las Vegas Convention Center | West Hall – W308 | Las Vegas, NV
NOVEMBER 16, 2022	**Quality Shotcrete – Know It When You See It – PSP/Deck Expo 2022** Las Vegas Convention Center | West Hall – W308 | Las Vegas, NV
MORE INFORMATION	To see a full list, current updates, and active links to each event, visit www.shotcrete.org/calendar.

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