May/June 2023
Vol. 36, No. 3

CRB

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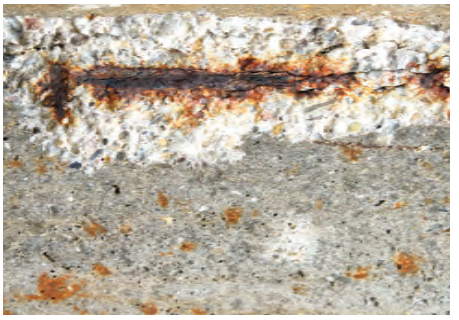

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Concrete Repair Bulletin
is published bimonthly by the:
International Concrete Repair Institute, Inc.
1000 Westgate Drive, Suite 252
St. Paul, MN 55114
www.icri.org

For information about this publication or about membership in ICRI, write to the above address, phone (651) 366-6095, fax (651) 290-2266, or email info@icri.org. The opinions expressed in *Concrete Repair Bulletin* articles are those of the authors and do not necessarily represent the position of the editors or of the International Concrete Repair Institute, Inc.

ISSN: 1055-2936

ON THE COVER: Image from technical article "Mill Creek Division Works Fish Ladder, Corbel Upgrades, and Pier Rehabilitation" on page 24.

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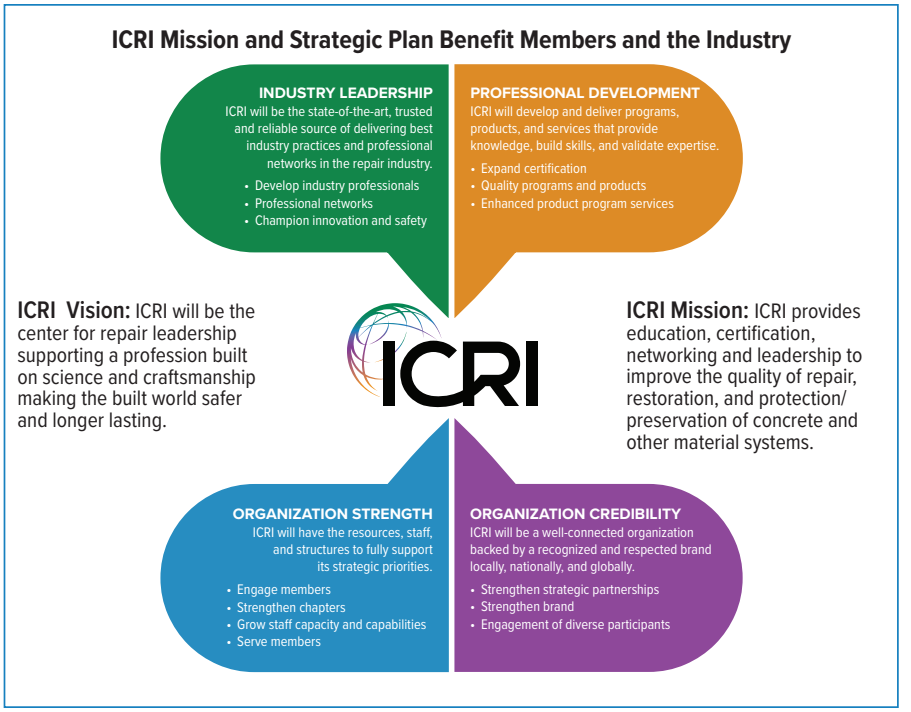
FEATURE ARTICLES

DEPARTMENTS



PRESIDENT'S MESSAGE

Going Big to Better Serve You!

ICRI President & Executive Director Joint Message

PIERRE HÉBERT

ERIC HAUTH

As we write this, we're just about to celebrate the official kick-off of ICRI's 35th anniversary year at the Spring Convention in Vancouver, British Columbia! Reaching this milestone is no small achievement, and we believe ICRI is poised for even greater success in the years to come.

All signs point to another incredible convention in one of the world's most beautiful cities. We are so grateful for our host chapter, ICRI British Columbia, all the ICRI members who registered, our many sponsors, exhibitors, and Supporting Member companies. This great organization could not be what it is today with each of YOU!

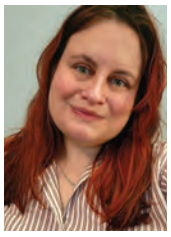
As noted in Pierre's last President's message in this publication, ICRI is embarking on several important new initiatives that build on our 35 years of success and drive our growth and impact in the years to come. These initiatives will provide greater access to important training programs on concrete repair techniques and put new digital tools in the hands of our members on the jobsite.

This past year, we established the following major goals for the organization:

1. Hiring ICRI's first-ever full-time marketing and membership manager; and
2. Replacing ICRI's existing association management system (AMS) platform and website with new, more flexible technology.

The objectives of these goals are to make joining and remaining an ICRI member much easier; improve the user experience of members in accessing professional development opportunities; and support the growth of ICRI chapters.

We have great news to report!



MARISSA ESGUERRA

First, we're excited to welcome aboard Marissa Esguerra, ICRI's new Marketing & Membership Manager. Marissa comes to ICRI with 20 years of association experience, including extensive experience focused on member data and membership technology platforms. Many of you will get a chance to meet Marissa at upcoming ICRI conventions. Even if you can't meet in person, she will be a huge resource and support for all ICRI members!

Second, we're pleased to report that ICRI is very close to signing a deal with a new AMS provider, paving the way for a big upgrade in the technology that powers ICRI national and chapters. This "go big" decision comes after extensive review of ICRI's needs, what's working and what's not, and what solutions provide the strongest value for the organization.

You won't see any immediate changes as this work gets underway. Rest assured, however, that ICRI staff working with our partners at Ewald Consulting will be working behind the scenes to migrate ICRI's data and, with a website developer, build a bolder new website tied to the new AMS. It's our intent to "go live" with the new platform on or before January 1, 2024.

Now, as you may have noticed, ICRI is putting a major focus on professional development offerings to help our members advance the quality of repair and restoration on the jobsite. To better support these programs, ICRI leadership identified the need to ensure that our committee structure reflects this commitment. With the success of our technical webinars, our two education and certification programs—the Concrete Surface Repair Technician (CSRT) program and Concrete Slab Moisture Testing (CSMT) program—plans for a new applicator-focused program, and a planned new training program on fiber reinforced polymer (FRP), the Board of Directors approved consolidating our Education Committee and Certifications Committee into a single Professional Development Committee.

We took this step for the following reasons:

- ICRI has significantly evolved as an organization over the last 10 years;
- The Executive Committee with the support of the Board of Directors recognized that the Professional Development Committee embodies one of the key pillars of ICRI's Strategic Plan;
- We're elevating professional development as a core value of ICRI—multiple committees tend to silo and fragment these efforts; and
- With this new committee, potential new members as well as our current membership will have a better understanding about the opportunities through ICRI to advance their professional skills.

Natalie Faber will chair this new committee with vice-chairs Adam Bakeman and Brad Rogers. ICRI's Technical Director, Dave Fuller, will serve as the primary staff contact working with this new committee.

In addition, we made the decision to sunset the Publications Committee. Through the great work of our volunteers over the years, the committee's objectives to develop ICRI publication policy and standards and establish guiding rules for the CRB have been met and their implementation is now firmly in the hands of ICRI's Technical Director, Dave Fuller. We offer our sincerest thanks to all those who served ICRI on this committee and especially Jerry Phenney, who guided this committee so well over the past number of years and for continuing as editor of the *CRB*!

We have much to be excited about for ICRI in the months and years ahead, and we thank you for your continued commitment and membership in the organization. We hope to see you at upcoming chapter and national events! For now, don't hesitate to reach out to either of us at info@icri.org.

Pierre Hébert
Pierre (Pete) Hébert
2023 ICRI President

Eric Hauth
Eric Hauth
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TACTALK

MATT SHERMAN

Our second TAC objective for this year is to make committee work more rewarding, with better and faster outcomes. Important to this is explaining the balloting process we use for work products, which can sometimes seem arcane, overly-complex, and intimidating.

Balloting is simply a tool to support the consensus-based approach on which our committee work is founded. This consensus process allows us to be viewed as an industry-leading unbiased organization that provides trusted information. Note that consensus does not mean that every person will agree, but instead that common ground is reached.

Fig. 1: Committee Balloting Process

Achieving this consensus takes time, effort, and organization. The time and effort come from our excellent volunteers and staff; the organization comes from our balloting process. While it can sometimes seem intimidating and slow, the process ensures that all voices are heard, all opinions are fairly considered, and all the resolutions are documented. As described in our recent Chair training videos, the process can be condensed to a series of simple steps. (Fig. 1)

The **committee ballot** provides all members of the committee with an opportunity to comment. It isn't just the loudest voice in the room or the person who can attend the meeting, it is everyone.

The committee leadership then **evaluates the results** and determines if the ballot is approved or rejected and plans the next steps.

The committee then **resolves ballot comments**. This is where every voice gets due consideration and discussion. This can be time-consuming, but is key to the process.

Once all comments are resolved, it goes for **TAC review**, where the technical aspects are independently reviewed.

The committee then **resolves the TAC comments**, as they remain the authors of the work product. As before, all voices are heard, and the resolutions documented.

Lastly there is a final **compliance check**, wherein a last check is made that the process was correctly followed.

In sum, our balloting process is simply the tool to support our fundamental consensus process. The process can seem intimidating, but by breaking it down into these simple steps we can see how it ensures that all voices are heard and duly considered, creating the basis for ICRI's reputation and reliability.

***Matt Sherman** is chair of the ICRI Technical Activities Committee (TAC).*

COMMITTEE 110: GUIDE SPECIFICATIONS

MISSION STATEMENT

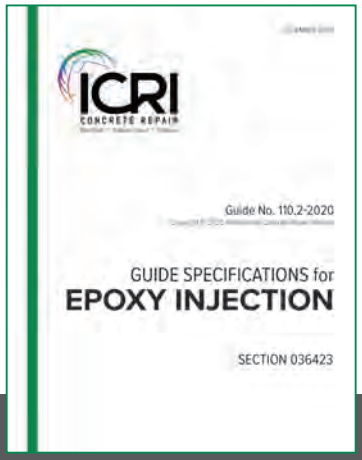
To be a leading resource for education and information to improve the quality of repair, restoration, and protection of concrete and other structures in accordance with consensus criteria.

BENEFITS OF COMMITTEE MEMBERSHIP:

- Network with repair experts within the concrete repair industry, including repair engineers, leading manufacturer representatives, experienced repair contractors, and educators.
- Expand knowledge on best practices used in the concrete repair industry that are essential to an effective and durable repair program.
- Support design professionals to improve their technical specifications for various repair projects.

WHAT WE DO:

- Develop guide specifications for various types of repairs, including concrete, masonry, coating, etc.
- Provide individual guide specifications that can be directly used as a technical specification section in a complete and coordinated project manual.
- Transfer "state-of-the-art practice" to all repair professionals via webinars, technical presentations, and other effective methods.



GOALS/DELIVERABLES

To develop guide specifications to aid the Licensed Design Professional in the preparation of technical specifications, for inclusion directly into a contract for the repair in structural concrete and related items using materials and methods that are in line with the state-of-the-art practices materials and methods used in the concrete repair industry

www.icri.org/page/committees

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Registration Opens Soon

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Introduction to ICRI Technical Guideline No. 710.3-2022: Guide for the Mitigation of Moisture in Concrete Floor Slabs

by Liying Jiang and Eric Muench

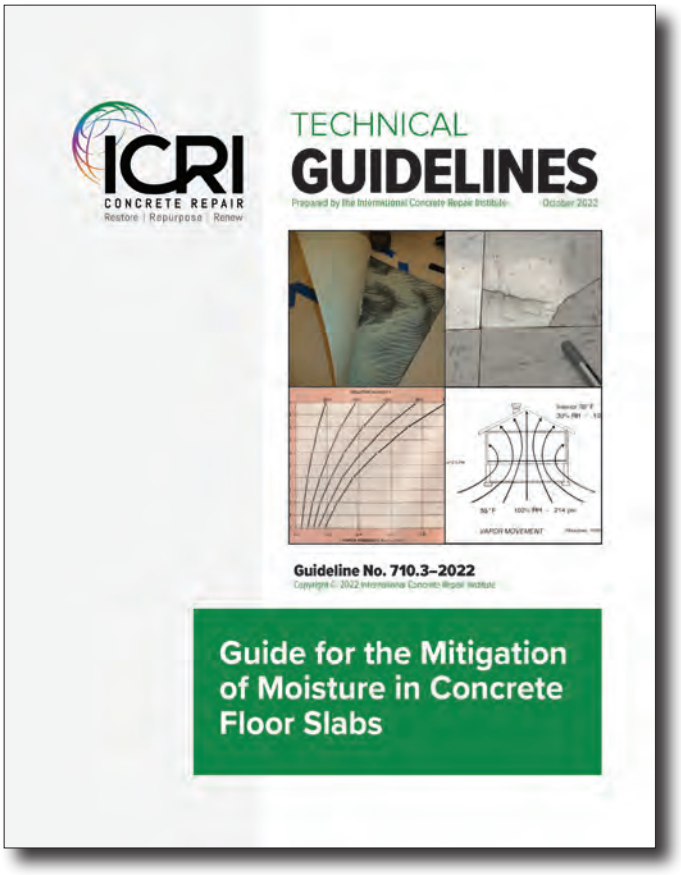
The frequency and magnitude of moisture-related flooring failures have increased noticeably over the past 20 years. The annual cost of addressing such problems is currently estimated to be in the range of hundreds of millions of dollars in the United States alone. As the concrete repair industry leader, ICRI believes that simple changes in the approach to the average floor covering installation project will result in a substantial decrease in unnecessary costs associated with adverse moisture conditions. The ICRI Technical Committee 710—Coatings and Waterproofing has recently published the new ICRI Technical Guideline No. 710.3-2022, *Guide for the Mitigation of Moisture in Concrete Floor Slabs*.

The purpose of this guideline is to provide information and guidance to assist architects, engineers, owners and their agents, developers, general contractors, and flooring contractors who are accountable for the successful installation of a floor covering or coating over an interior concrete sub-floor that is on, below, or above grade. This guideline provides information regarding moisture issues, moisture testing methods, interpretation of test results, and moisture mitigation strategies.

The guideline provides a useful flow chart, "Methodology for the Decision-Making Process for Successful Floor Covering and Coating Installation," that outlines the steps in the decision-making process in determining the proper moisture mitigation strategies for project (Fig. 1). This is fundamental in the evaluation and ultimately leads to the successful installation of floor coverings and coatings.

The guideline is broken down into several key items in the decision process, as illustrated in the flow chart.

1. Moisture Issues
2. Test Methods
3. Interpretation of Results
4. Mitigation Strategies—Alterative Options
5. Mitigation Strategies—Mitigation Systems



MOISTURE ISSUES

It is essential to understand the failure mechanism of installed flooring/coating related to the concrete's moisture, potential moisture sources, and moisture-related distress. Section 3.0 of the guideline provided detailed information on moisture issues, with appendix A describing the moisture sources and failure mechanisms related to moisture.

It should be recognized the most common moisture-related distress visible with flooring installations include adhesive breakdown, buckling and cupping and shrinkage and expansion, peeling and delamination, cracking, blistering, staining, and discoloring, sweating, etc. (Figs. 2 and 3). Examples of different types of flooring failures are provided in the guideline.

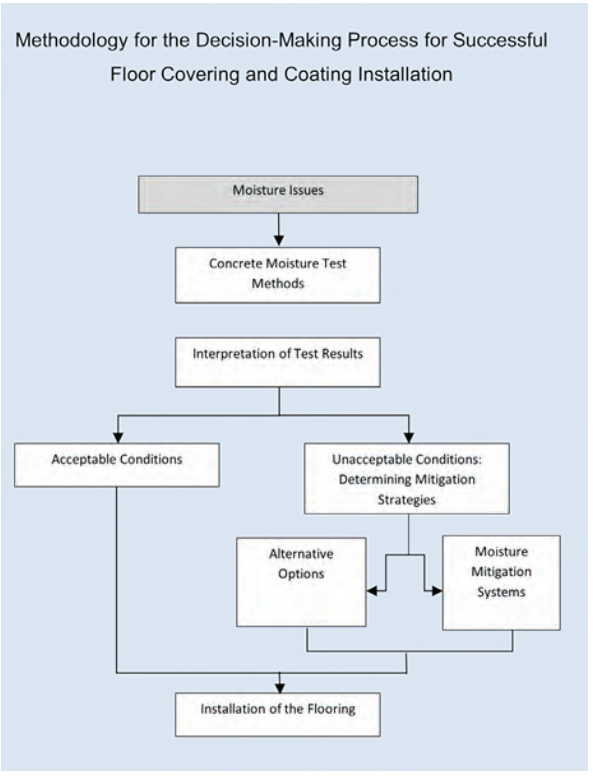


Fig. 1: Figure 1.1 in the guideline, Decision-making process for a successful floor covering and coating installation

The flooring problems listed above can result in poor flooring performance and/or premature flooring deterioration and can occur due to excessive moisture present in a concrete sub-floor, improper conditioning of flooring materials before and during installation, improper sub-floor evaluation, improper surface preparation, improper material selection, improper installation, and/or any combination of the above.

MOISTURE SOURCES

A thorough evaluation of the concrete sub-floor moisture conditions should be performed prior to the installation of a floor covering. The guideline identifies typical sources of moisture within the subfloor, including, free water in the concrete, external water from the topside of the concrete slab, and the upward migration of moisture underneath an unprotected concrete slab-on-ground.

TEST METHODS

Once the moisture issues and related failure mechanisms have been assessed and understood, the next important step is to evaluate and determine the existing and potential moisture levels of a concrete slab. The purposes for performing the appropriate moisture tests are to:

- determine if the moisture condition of the concrete sub-floor meets the flooring manufacturer's requirements for the installation of the flooring materials;
- conform to project specifications and industry standards;
- provide valuable information to guide in the selection of a moisture mitigation product/system, alternative option, or strategy; and
- establish if moisture is the underlying cause of a flooring problem.

Several moisture test methods can be used to establish the moisture condition of a concrete sub-floor. These test methods produce results that are either qualitative or quantitative. The qualitative methods can be used as preliminary evaluations of the comparative moisture condition within the concrete, and the quantitative methods are used to measure the actual moisture conditions of the concrete at the time of the test and to determine whether specific flooring materials can be safely installed over the concrete sub-floor. It is important to select and properly perform the types of tests that will provide sufficient information to those involved in the decision-making process. A brief description of each common moisture test method is provided in Sections 4.1 through 4.3 of the guideline, with additional moisture test methods provided in Appendix B.

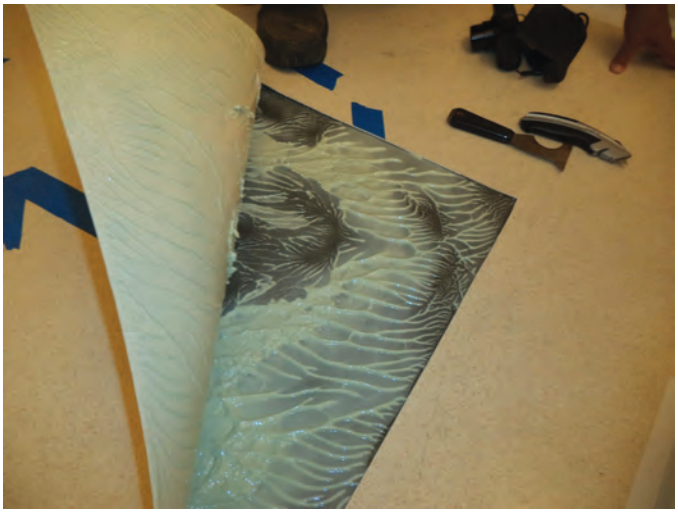


Fig. 2: Investigation identified uncured adhesive under sheet vinyl (photo courtesy of Concrete Science, Inc.)

Fig. 3: Cracked and warped flooring (photo courtesy of Concrete Science, Inc.)

In addition, the collection of project-specific details, such as original concrete construction, composition and quality and condition of existing concrete, history of usage and maintenance, etc., are also critical for the decision-making process. Detailed information is provided in Appendix C of the guideline.

INTERPRETATION OF RESULTS

After all testing and reporting is complete, the next step is interpreting the data. Many testing agencies or ICRI Certified Concrete Slab Moisture Testing Technicians will provide the results of their tests without interpreting those results because of the risk associated with such interpretation. Therefore, this guideline recommends that the role of interpreting data and making recommendations be provided by a qualified individual on the Project Team.

There are two main factors in interpreting the results, risk management consideration and correlation between MVER (Moisture Vapor Emission Rate) and RH (Relative Humidity) test results. As many authorities agree, the limited test results compared with moisture limits for specific projects do not adequately address the risk of a potential moisture-related flooring failure. The issue and conflicts are to be addressed by the qualified individual on the Project Team to cost-effectively reduce the risk of moisture-related flooring problems.

MITIGATION STRATEGIES—ALTERNATIVE OPTIONS

Suppose a qualified individual on the Project Team deems the risk condition associated with concrete slab moisture test results and proposed flooring components unacceptable. In this case, the guideline recommends that a mitigation strategy, including an alternative option or moisture mitigation system, be discussed by the accountable parties, particularly the flooring manufacturer.

MOISTURE MITIGATION STRATEGIES/SYSTEMS

When the concrete slab moisture testing results do not meet the requirements from the flooring system manufacturer, the guideline provides several alternative options, including use of high-performance adhesive, accelerated drying, and alternative flooring materials, etc. Detailed information on these alternative options is provided in Section 8.0 of the guideline.

When other forms of dealing with a high slab moisture condition are deemed unacceptable, insufficient, or impractical, the application of a topical moisture mitigation system can be considered. The guideline discusses commercially available topical mitigation systems, their capabilities, and their limitations. The types of topical moisture mitigation systems include silicate densifiers, liquid isolation membranes, modified cementitious overlays, sheet membranes, and dispersive membranes.

The guideline further recommends that whichever system is ultimately chosen, the amount of moisture emitting from, or transmitting through the concrete slab and the moisture sensitivity of the finished flooring must be thoroughly understood and evaluated by a qualified individual on the Project Team.

Lastly, the guideline states that quality assurance and performance evaluation are essential processes for any project to measure the success of the mitigation system. It is recommended that a qualified individual on the Project Team interpret testing data/results and advise during the design stage and construction process and a qualified inspector be retained to perform the quality assurance and performance evaluation of the moisture mitigation system. Specific responsibilities and duties are listed in Sections 9.3.1 through 9.3.3.

SUMMARY/CONCLUSION

The new ICRI Technical Guideline No. 710.3-2022, *Guide for the Mitigation of Moisture in Concrete Floor Slabs*, is a comprehensive guideline. This article has provided a brief overview of the key areas contained within the guideline. There is significantly more information that will benefit owners, consultants, engineers, and contractors in the process of understanding how to go about evaluating concrete moisture for the purpose of successfully installing floor covering systems.

Liying Jiang is an Engineering Manager with Structural Technologies and is a registered Professional Engineer in Massachusetts. She has 16 years of professional experience in the construction and engineering field, including performing evaluations of existing structures, assessing concrete materials, designing repair and rehabilitation measures, and developing management strategies for structures affected by Alkali-Silica Reaction (ASR), corrosion, and other materials-related distresses, in addition to two years of experience in the precast industry. She is a professional member of the American Concrete Institute (ACI) and International Concrete Repair Institute (ICRI), and currently serving on ACI 228—Nondestructive Testing of Concrete, ACI 364—Rehabilitation, ICRI Technical Activities Committee (TAC), ICRI 710—Coatings and Waterproofing, and ICRI 110—Guide specifications.

Eric Muench has a BS in Mechanical Engineering from the University of Massachusetts – Amherst and an MBA from Drexel University in Philadelphia. He has over 34 years of experience in the construction chemicals field—holding positions in sales, business management, product engineering, marketing, and product management. He has worked the last 23 years with Sika and is currently responsible for Sika's full line of sealants, traffic coatings and liquid applied below grade waterproofing products in the US market. He is currently the Committee chair for ICRI - 710 Coatings and Waterproofing and is part of several committees at the Sealant Waterproofing and Restoration Institute.

Project Profile—Repairs for Cast-in-Place Concrete in the Heights on Austin

by Doug Adam

Fig. 1: Cast-in-place concrete structural walls in need of leak repair

BACKGROUND

Initially known as a Safeway with a parking lot on top of a hill, the site of the Heights on Austin development in Coquitlam, Canada, is in the middle of being transformed into a mixed-use condo tower project by the development company Beedie. The design behind this project is to rebuild the Safeway with its own parkade and bookend it with two 25-story condo towers that will both have six-story parkades of their own, creating a highly convenient living area for residents. With that in mind, the project team had started working on the east tower before moving on to the other one.

Expected to near completion with occupancy in the spring of 2023 for the east tower, the project had its development progress halted temporarily when the project team encountered an ancient and unidentified subterranean river during excavation. This body of water directed a significant amount of water into the worksite, driving a need to repair a number of cast-in-place structural walls that were affected in the parkade area under the east tower (Fig. 1).

EVALUATION

The water ingress from the subterranean river caused significant cracking from the fourth to sixth levels of the east tower's parkade. When evaluated further, the repair team determined that the project team's high-performing crystalline waterproofing admixture had not been used in those areas, so no self-sealing activity in the concrete could take place to mitigate damage.

The team also observed that the steel rails used in conjunction with the rebar had been placed with insufficient cover, further contributing to cracks at regular spacing.

To repair this damage, the team decided to use a full-on concrete leak repair system. This consisted of three products: a rapid-setting hydraulic cement, a crystalline grout with advanced fiber technology and shrinkage-controlling additives, and a surface-applied crystalline slurry treatment. All of these materials were capable of working in synergy with the crystalline waterproofing admixture that had been used in the first three levels of the parkade.

IMPLEMENTATION

To ensure this system was implemented to maximum effect, technical experts visited one of the repair subcontractors at the worksite to provide an on-site demonstration and product training. This complemented the experience that this contractor already had with these products previously when repairing the elevator pit at this same worksite.

Once several repairs of the affected areas were opened and exposed, the repair team decided to use a combination of grout and injection repairs. This was due to a limitation in the concrete leak repair system where the material could reach necessary areas within the concrete chemically, but the crystalline grout could not bond to the steel. As a result, another repair subcontractor was brought in to perform urethane injections in areas where the concrete leak repair system could not be used to stop this leaking.

After the leaks had stopped, the first repair contractor went ahead with applying the concrete leak repair system. This involved installing the rapid-setting hydraulic cement for an extra barrier against flowing water. Next, the crystalline grout was installed in the same area, using its advanced fiber technology and shrinkage-controlling additives to prevent cracking (Fig. 2). It also introduced technology to the concrete that would enable it to react to water and unhydrated cement particles to create crystalline needles. These interlock and fill up capillary pores and micro-cracks to block out water. To add to this protection, the crystalline slurry treatment from the repair system was applied to the same area as well, providing an additional barrier of the same technology.

This repair process went on for over six months. Several factors contributed to this extended time period. These included the need for scheduling coordination between repair subcontractors, delays due to freezing weather, and the tendency for the worksite's water pressure to move around to new locations.

All of these factors impacted the completion of items such as the traffic membrane and line painting. As a result, these items had to be applied on a truncated timeline.

However, this extended timeline and coordination led to a successful repair. The cast-in-place structural walls were left looking pristine and free of any residual water (Fig. 3 and 4). That allowed the Heights on Austin project team to

Fig. 2: Cast-in-place concrete structural walls with a crystalline grout application

Fig. 3: Storage lockers in a leak-free and repaired parkade

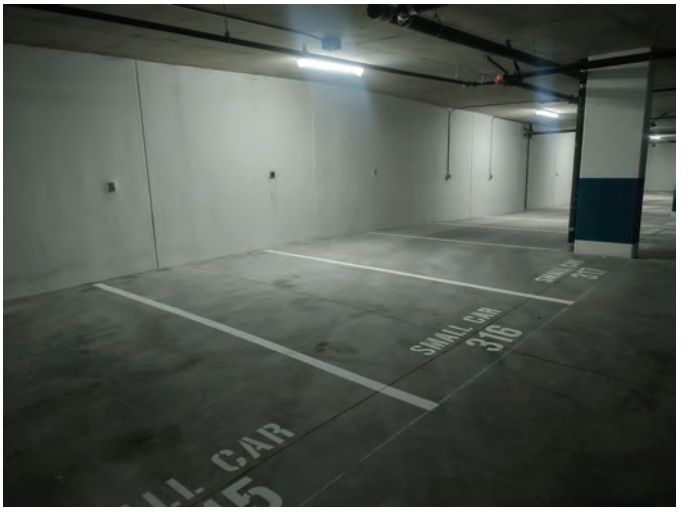


Fig. 4: Parking lots in a leak-free and repaired parkade

move forward in their construction and development of the west tower. Keeping in mind their past observations, the team ensured that the concrete for this tower's parkade would receive the crystalline waterproofing admixture for all levels to prevent further water ingress.

SUMMARY

The success for the Heights on Austin development's east tower repair can be attributed to two key aspects: product choice and expert support. Having a whole concrete leak repair system that can react to water and block out pathways for future water ingress and any contaminants found within provides a permanent repair. For the areas where this method of repair was not able to physically cover the repair area, there was support provided from the urethane injections, both of which would likely not have gone as smoothly without the prior on-site demonstration and product training for the concrete leak repair system.

Doug Adam is a technical services technician at Kryton International, Inc. Over the last six years, within the research and development department at Kryton, Doug has been focusing on waterproofing and direct site support. He has a background in mechanical engineering with 12 years of experience in civil construction, including six years in the infrastructure sector and two years in the oil and gas industry.

Project Profile—Repairs for Cast-in-Place Concrete in the Heights on Austin

Project Profile Team
Coquitlam, British Columbia, Canada

OWNER
Beedie
Burnaby, British Columbia, Canada

BUILDING ENVELOPE CONSULTANT
Morrison Hershfield Ltd.
Vancouver, British Columbia, Canada

REPAIR SUBCONTRACTORS
Syber Concrete Forming Ltd.
Langley, British Columbia, Canada

Fraser Burrard Diving Ltd.
Maple Ridge, British Columbia, Canada

MATERIAL MANUFACTURER
Kryton International, Inc.
(hydraulic cement, crystalline repair grout, crystalline slurry treatment)
Vancouver, British Columbia, Canada

MATERIAL SUPPLIER
Cascade Aqua-Tech Ltd.
Burnaby, British Columbia, Canada

2023 ICRI Project & Safety Awards

Recognizing Outstanding Concrete Repair, Restoration, and Preservation Projects

ICRI conducts an annual awards program to honor and recognize outstanding projects in the concrete repair industry. Entries are received from around the world, and the winning projects are honored each year at the annual ICRI Awards Luncheon at the ICRI Fall Convention.

ICRI CONCRETE REPAIR PROJECT AWARDS 2023

The **ICRI Project Awards** honor and recognize concrete repair projects in the following categories, as well as an overall Project of the Year Award: High-Rise; Historic; Industrial; Longevity; Low-Rise; Masonry; Parking Structures; Special Project; Sustainability; Transportation; and Water Systems.

ICRI CONCRETE REPAIR SAFETY AWARDS 2023

The **ICRI Safety Awards** honor and recognize industry safety best practices, celebrating leaders in the industry. Awards are presented by company size in each of three categories, as well as an overall award for each category: Contractor; Engineer/Architect; Manufacturer/Supplier.

Submit your entry by June 30, 2023!

Entry fee discount if you enter by June 1.

For complete Project and Safety Award details and rules visit:
https://www.icri.org/page/awards-home

Evaluation of Insulating Concrete Form Walls Using Ground Penetrating Radar

by Akshay Beniwal, Byoung-Jun (BJ) Lee, and J. Eric Peterson

Fig. 1: ICF mockup wall prior to concrete pour

Fig. 2: Void and cracking at a typical ICF wall

INTRODUCTION

Insulating Concrete Form (ICF) walls are a commonly used system on residential and commercial construction that combines two layers of insulation connected by internal plastic webs to create insulated walls both above and below grade. Unlike traditional formwork which is stripped after curing of the concrete, ICF remains in place and functions as insulation for the building's thermal barrier. However, since the ICF is never stripped, if there are consolidation issues with the concrete, they can go unseen by the construction team, leading to structural or serviceability problems with the walls.

Historically, voids and consolidation problems in ICF walls would be identified by either sounding or probing the insulation. Such methods were occasionally unreliable if the void was not on the near surface of the wall and large enough to detect. However, most significant problems can be identified using non-destructive methods, such as ground penetrating radar (GPR), for the post placement of the concrete. Using a 2.6 GHz antenna coupled to the surface of the insulation, the authors were successful in identifying the presence of concrete voids in ICF walls through the insulation layer rather than directly coupling with the concrete surface. Once identified, the voids were repaired according to the recommended guidelines from the American Concrete Institute (ACI) to ensure that the ICF walls fulfill their intended purpose effectively. This article discusses the methodology employed, challenges encountered, and the lessons learned during the evaluation of the signals which provide valuable insight into the effectiveness of using GPR as an ICF construction quality control tool.

BACKGROUND

ICF is a building system that is designed to create a highly energy-efficient structure by using insulating foam blocks to construct the walls of a building. The blocks are typically made of expanded polystyrene foam (EPS) and are placed together with reinforcing steel as needed (Fig. 1). Once the ICF blocks are in place, concrete is poured into the cavity between the foam blocks, creating a highly

insulated and durable wall. ICF construction can present several challenges, including difficulties with concrete consolidation and the formation of voids in the concrete that can compromise the strength and durability of the structure (Fig. 2). Identifying these voids in ICF construction can be a challenge, and current methods, such as probing insulation or sounding, are often inaccurate and unreliable. These methods can lead to unnecessary insulation removal at good locations or undetected voids, highlighting the need for more accurate and reliable methods of identifying voids in ICF construction.

GPR is a non-destructive testing method that uses electromagnetic waves to detect changes in the material properties below the antenna. It has a variety of applications, including locating underground utilities, geological mapping, detecting voids, and identifying potential hazards. In the concrete construction industry, GPR is used to identify the thickness of slabs and depth and spacing of reinforcing steel (rebar) in concrete structures. Overall, GPR is a valuable tool that can provide critical information about the structural integrity of concrete structures and can help construction professionals make informed decisions about repairs and maintenance.

The focus of this study is on the utilization of GPR in quality assurance and quality control (QA/QC) during ICF construction. Specifically, the study examines how GPR can be used to detect voids in the concrete, thus enhancing the overall quality of ICF buildings. By utilizing GPR, construction professionals can more accurately identify voids and prevent compromising the structural integrity of ICF structures. As the use of ICF construction continues to grow in popularity, it is essential to utilize advanced technologies such as GPR to ensure the safety, durability, and sustainability of these structures.

METHODOLOGY

GPR works by transmitting electromagnetic pulses into the concrete structure and measuring the reflected signal. The signal reflects off objects within the concrete, such as reinforcing steel, and is then picked up by the GPR antenna. When scanning concrete members, it is important to couple the antenna directly with the surface because the signal strength decreases rapidly with distance. Therefore, to obtain the most accurate and reliable results, the antenna needs to be in close proximity to the surface being scanned. In this study, the presence of a thick insulation layer (approximately 2½ inch) made it challenging to directly couple the antenna with the surface. This is because the insulation layer impedes the transmission and reception of electromagnetic signals. The methodology used for the scans involved performing vertical scans of the ICF walls on both the interior and exterior surfaces using GPR. The scans were conducted at approximately 8 inches on center, adjacent to plastic ICF webs. The data obtained from the vertical scans was recorded and saved for each wall, with files recorded and stored with a traverse scale and manual tick marks at reference points in the ICF where needed for marking conditions.

The velocity of the electromagnetic waves transmitted by GPR in concrete depends on the dielectric constant of the material, which is a measure of how well the material can store electrical energy. When a wave encounters a void, the dielectric constant of the material changes at the boundary, causing some of the wave to reflect back towards the surface. The amount of energy reflected back to the GPR antenna depends on the size and shape of the void, as well as its depth and orientation relative to the scanning direction. The reflected signal is then recorded by the GPR system. Voids in the walls were detected using GPR by identifying a shift in the near-surface waveform corresponding to an increased airspace in front of the concrete wall surface (Figs. 3 and 4). Supplemental scans were performed as necessary to identify the approximate length and interconnectivity of the voids. If surface void conditions were detected, the approximate location and extent of the void were marked on the wall. In cases where GPR indicated the void may

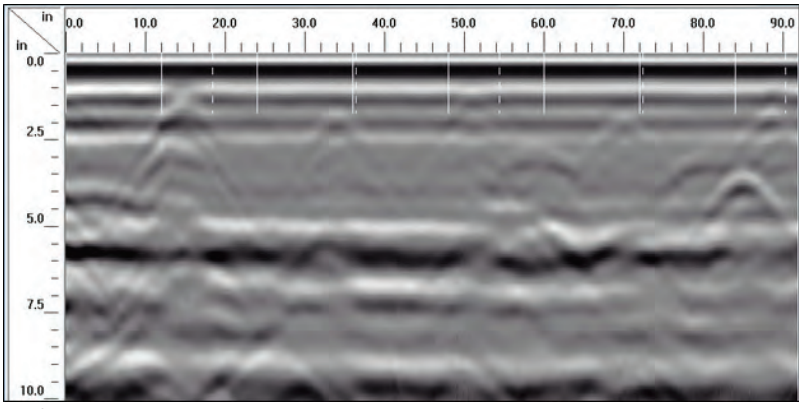


Fig. 3: Void identified by a shift in the near-surface waveform

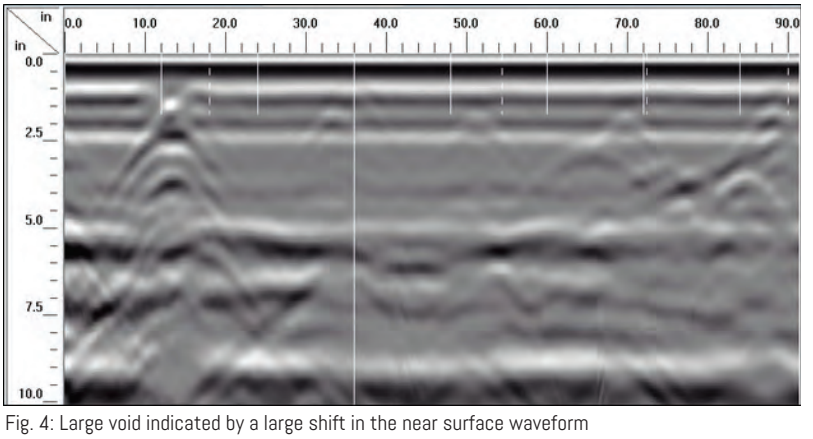


Fig. 4: Large void indicated by a large shift in the near surface waveform

Fig. 5: Void exposed after removing insulation at suspect location identified using GPR scanning

Fig. 6: Void exposed using GPR scanning

Fig. 7: Small void exposed using GPR scanning

be deeper in the wall and a traditional needle probing by hand was ineffective, the wall was drilled with a 3⁄16 inch bit to confirm the presence of the void; and the approximate location and extent were marked on the wall. All marked locations were then subsequently stripped of the insulation 3 inches beyond the edges of each marked void to expose and inspect the surface. During the course of this study, the GPR scanning exercise effectively detected multiple voids of varying sizes (Figs. 5, 6, and 7), which were subsequently categorized into different groups based on their volume.

A corrective action plan was developed, including surface preparation and repair details to address the identified voids and restore the structural stability of the walls. The surface preparation phase involved removing any debris or contaminants present in the void to ensure that the repair material adhered well to the sound concrete. After the surface preparation, the void was filled with an appropriate repair material. The repair materials were selected to ensure that the identified voids were repaired to restore the structural performance, durability, and long-term performance of the ICF wall.

CHALLENGES

One of the major challenges that was encountered during this study was the cure time for the concrete. It was observed that the GPR scanning was not effective in detecting voids in newly constructed concrete; hence, it was crucial to wait approximately four weeks to allow the concrete to cure before GPR could be used to clearly identify voids. The excessive moisture presented in newly placed concrete attenuated the energy of the GPR readings, making it difficult to detect voids in the ICF walls.

Another challenge encountered during the study was horizontal scanning. It was found that scanning horizontally along the length of a wall was less reliable due to several factors. For instance, the vertical bars were spaced much closer than the horizontal bars, interfering with the signals more frequently than during a vertical scan. Additionally, scanning over the closely spaced plastic webs also affected the clarity of the signal.

Most significantly, it proved challenging to identify voids in areas with substantial amounts of reinforcing steel that were located close to the concrete surface. This difficulty arose due to multiple rebars stacked next to each other and periodically spliced together, which made it difficult to detect any void located behind the stacked rebars (Fig. 8). Similarly, it was not possible to detect voids in concrete behind embed plates, steel angles, or other steel elements attached to the wall (Fig. 9).

CONCLUSION

Incorporating GPR scanning as a quality assurance and quality control measure during the construction phase can greatly enhance the success of an ICF project. By

utilizing GPR scanning, contractors can proactively identify concealed voids and areas of poor consolidation at an early stage, allowing them to rectify these issues promptly and deliver a structurally sound building construction. By detecting hidden voids early on, contractors can address these issues before they become more complicated and costly to fix. Moreover, the use of GPR scanning can help contractors avoid potential liability issues associated with the failure of the building's structural integrity. Additionally, consistently delivering buildings that are high-quality and structurally sound can significantly enhance a contractor's reputation, potentially leading to an increased number of clients and business opportunities in the future.

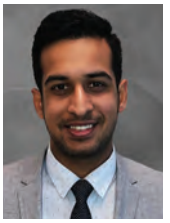
Fig. 8: Multiple rebars closely stacked together

Fig. 9: Concealed concrete behind cast-in-place embed plate

By utilizing GPR scanning during the construction phase to detect and repair voids, owners can avoid the expense and hassle of addressing structural defects after the building is completed. Additionally, early identification of any potential issues through GPR scanning can empower owners to take corrective action swiftly and prevent minor problems from escalating into more significant and costly ones in the future.

Energy-efficient buildings are increasingly becoming a crucial aspect of the sustainable construction and environmental industry, which is why the popularity of ICF walls is expected to grow among building owners in the coming years. As more and more buildings are constructed using ICF walls, it becomes imperative to ensure that the quality of these projects meets the desired standards of both the industry and the building owners.

GPR scanning offers an effective means for contractors to improve their QA/QC procedures, reduce liability issues, and deliver structures that exceed industry standards. By utilizing GPR scanning to detect voids and other defects during the construction phase, contractors can ensure that their ICF buildings are structurally sound, energy-efficient, and meet or exceed the expectations of the building owners.



Akshay Beniwal, PE, is a Project Manager in the Manassas, Virginia, office of WDP & Associates. He is a licensed professional engineer and specializes in structural and forensic engineering and has expertise in the design, evaluation, and repair of building structures and envelopes. Mr. Beniwal is a member of the Structural Engineers Association of Metropolitan Washington (SEA-MW), the American Institute of Steel Construction (AISC), and the American Concrete Institute (ACI). He can be reached at abeniwal@wdpa.com.

Byoung-Jun (BJ) Lee, PhD, PE, SE, is an Associate in the Manassas, Virginia, office of WDP & Associates. He is a licensed professional engineer and specializes in structural and forensic engineering and has expertise in the design, evaluation, and repair of building structures and envelopes. Dr. Lee is a member of the American Concrete Institute (ACI), the American Institute of Steel Construction (AISC), and Post Tensioning Institute (PTI). He can be reached at blee@wdpa.com.

Eric Peterson, PE, is a Principal of WDP & Associates. He is a licensed professional engineer and specializes in structural, material, and architectural engineering related to façades and building envelope failures, nondestructive testing, and design and repair of concrete and masonry structures. Mr. Peterson is a member of the American Society for Testing and Materials (ASTM International), The Masonry Society (TMS), American Concrete Institute (ACI), Fenestration & Glazing Industry Alliance (FGIA— formerly AAMA), and the International Institute of Building Enclosure Consultants (IIBEC – formerly RCI). He can be reached at epeterson@wdpa.com.

Mill Creek Division Works Fish Ladder, Corbel Upgrades, and Pier Rehabilitation

by Alex Daddow

Fig. 1: The Mill Creek Fish Passage along the Kingfisher Trail in Walla Walla, Washington

In 1983, the U.S. Army Corps of Engineers (USACE) constructed the Mill Creek Fish Passage along the Kingfisher Trail in Walla Walla, Washington. The passage was intended to facilitate the migration of steelhead, bull trout, and spring Chinook salmon to and from their spawning grounds upstream (Fig. 1). The channel consists of a hybrid concrete and natural cobble bottom that runs seven miles, including more than two miles through downtown Walla Walla.

BACKGROUND

In 2017, the USACE determined that the passage needed an update. The entire concrete fish ladder passage, including the water diversion system, showed its age and needed extensive repair or even replacement. Corbels supporting the catwalk slab across the passage were spalled and severely deteriorated to the point of exposed steel reinforcement (Fig. 2a and 2b). The concrete piers supporting the corbels also exhibited spalling and exposed reinforcement on downstream ends. Any solution would require some dewatering. If an adequate repair wasn't feasible, the damaged portions might need to be entirely replaced, which would be much more expensive and create a lengthier impact on annual fish migration.

The Walla Walla District Corps of Engineers were vaguely familiar with fiber-reinforced polymer (FRP) and fabric-reinforced cementitious matrix (FRCM) products. The repair solution for the corbels and piers would need to be easy to install due to time constraints from the short in-water work window and provide long-term durability against elements. The product manufacturer recommended an FRP system to provide additional protection to the corbels to increase the longevity of the repairs. The contractor liked the design, and the Army Corps of Engineers approved it. The manufacturer worked extensively with the project team to provide installation training and technical advice as installations were completed. All repairs were specified to follow RAP Bulletin 6 and RAP Bulletin 4, published by The American Concrete Institute (ACI).

PROJECT REPAIR

The repair work began in July 2020.

For the corbel repairs, the contractor needed to clean up the spalled areas and perform surface preparations for the repair solutions. All loose and deteriorated concrete was removed, cracks were identified, and the repair surface

was roughed to an ICRI CSP-6 minimum in accordance with ICRI Guideline 310.2R. Existing reinforcement was exposed and cleaned until existing corrosion was eliminated and bars were exposed for repairs. A single-component zinc-rich primer was applied to the exposed steel reinforcement bars to protect them from further corrosion. The next step was to inject all cracks to shore up the existing concrete. Crack injection was performed with a low-viscosity crack injection epoxy (1500 cP) before any mortar repairs were undertaken. The lower viscosity injection epoxy was required to penetrate cracks with widths between 0.002 and 0.25" thickness. Next, alternating layers of an epoxy bonding agent and rapid-hardening vertical/overhead repair mortar were used to rebuild the deteriorated corbels to their original size. Multiple layers of epoxy bonding agent and mortar were needed to build up the repair mortar adequately within its maximum lift limitations (3" max for the mortar used) and ensure the system bonded to work as a single unit. The corbels were repaired using overhead/vertical mortar to reduce complexity. Finally, the repaired corbels were strengthened with carbon FRP strips providing additional strength and a moisture/vapor barrier over the repair area (Fig. 3a and 3b). A slurry sealer was applied over the FRP to give it a concrete appearance.

The project proceeded smoothly and according to schedule, and the Corps was so pleased with the progress and test values of the repairs that the contract was modified to include rehabilitation of the concrete piers as well. Similar concrete substrate preparations were performed for the pier nosing, including profiling to a CSP-6 following ICRI Guideline 310.2R, including cleaning and removal of all loose concrete. Again, a zinc-rich primer was applied to all exposed bars, and an epoxy bonding agent was applied to the prepared substrate. Instead of electing for a vertical/overhead mortar, a rapid setting form-and-pour mortar was selected to allow the material to be placed in one application. The contractor built a custom curved formwork to perform the application, and the results show for themselves (Fig. 4a and 4b).

On-site FRP samples were created and tested offsite per ASTM D3039. Test values for the layers of mortar in the vertical repairs were very high (>700 psi in some cases), showing excellent adhesion. Adhesion tested through the FRP per ASTM D4541 exceeded the minimum required 200 psi bond.

Figs. 2a and 2b: The corbel was deteriorated beyond what was expected, creating significantly more repair work prior to FRP installation

Figs. 3a and 3b: Carbon FRP was installed over the repaired corbel to extend the life of the structure and assist in preventing future deterioration

Figs. 4a and 4b: The contractor fabricated custom forms to enable access to the repair area for application of the epoxy bonding agent and speedy pour of rapid-hardening form and pour mortar

On October 15, 2020, hardly three months after work started, the repair was complete. The USACE was thrilled to land upon a design solution that saved them the time and expense of replacing the structure entirely. When the work was done, the FRP design restored both the corbels and the piers to their original structural integrity while helping protect them from further deterioration, giving the structure a second lease on life (Fig. 5).

In the words of the Army Corps of Engineers, Walla Walla District, Project Delivery Team, Technical Lead, "This was the first time we have used a Composite Strengthening System (FRP) within the Walla Walla District. Initially, there was hesitation to use this method for rehabilitation; however, the final product exceeded expectations in both strength and appearance. We are looking forward to exploring further applications… of Composite Strengthening Systems in marine environments…"

Fig. 5: Completed Project with damaged sections repaired, strengthened, and protected

REFERENCES

ACI RAP Bulletin 6, "Vertical and Overhead Spall Repair by Hand Application," *Field Guide to Concrete Repair Application Procedures*, ACI Committee E706 American Concrete Institute, Farmington Hills, MI, 2016

ACI RAP Bulletin 4 (Reapproved 2009), "Surface Repair Using Form-and-Pour Techniques," *Field Guide to Concrete Repair Application Procedures*, ACI Committee E706, American Concrete Institute, Farmington Hills, MI, 2016

ICRI 310.2R, *Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair*, International Concrete Repair Institute, St. Paul, MN, 2013.

ASTM D3039, Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials, ASTM International, West Conshohocken, PA, 2020

ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers ASTM International, West Conshohocken, PA, 2022

Mill Creek Division Works Fish Ladder, Corbel Upgrades, and Pier Rehabilitation

PROJECT CATEGORY
RETROFIT

OWNER
U.S. Army Corps of Engineers

APPLICATION
Concrete Repair and Strengthening

MATERIAL MANUFACTURER
Simpson Strong-Tie Products

Alex Daddow is a registered professional engineer in Alaska, California, Colorado, Idaho, Montana, Nevada, Utah, Washington, and Wyoming. He graduated from Cal Poly San Luis Obispo with a degree in Architectural Engineering. Before joining Simpson Strong-Tie in 2019, Alex was a consulting engineer for six years working on podium structures, custom housing, bridges, historic retrofits, schools, and foundation systems.

He is now a Senior Composite Strengthening Systems (CSS) Field Engineer and educates the industry on composite systems throughout the Pacific Northwest region. Alex also works directly with specifiers, installers, and plan reviewers, assisting them with the technical aspects of designing and building with Composite Strengthening Systems.

ICRI**CHAPTER**NEWS

CHAPTER CALENDAR

Be sure to check with individual chapters by visiting their chapter pages to determine if they have made any plans after this publication went to print. You can also contact a chapter leader from any chapter about added events.

BALTIMORE-WASHINGTON
May 10, 2023
SECOND QUARTER DINNER MEETING
Martin's West
Baltimore, MD

CAROLINAS
May 4-5, 2023
SPRING CONFERENCE &
NIGHT AT THE BALLPARK
Hotel Indigo
Mt. Pleasant, SC

June 15, 2023
JOINT ICRI/WCA GOLF TOURNAMENT
Foxfire Resort and Golf Course
Pinehurst, NC

CENTRAL OHIO
June 5, 2023
FIRST ANNUAL GOLF OUTING
Glenross Golf Club
Delaware, OH

CHICAGO
June 8, 2023
CHAPTER GOLF OUTING
White Pines Golf Course
Bensenville, IL

CINCINNATI
May 17, 2023
CHAPTER DEMO DAY
BCR Cincinnati Offices
Cincinnati, OH

July 19, 2023
CHAPTER SUMMER SOCIAL
TopGolf Facility
West Chester, OH

DELAWARE VALLEY
May 17, 2023
TOPGOLF SOCIAL EVENT
TopGolf Facility
Cherry Hill, NJ

FLORIDA FIRST COAST
May 11, 2023
CHAPTER SOCIAL HOUR
Hoptinger Beer Garden and Sausage House
Jacksonville, FL

FLORIDA WEST COAST
June 21, 2023
CHAPTER CIGAR SOCIAL
Grand Cathedral Cigars
Tampa, FL

GEORGIA
May 15, 2023
ANNUAL GOLF TOURNAMENT
Heritage Golf Links
Tucker, GA

MICHIGAN
May 9, 2023
JOINT ACI MEETING
Topic: Surfside Condo Collapse
ACI World Headquarters
Farmington Hills, MI

MINNESOTA
May 1, 2023
SPRING TECHNICAL SESSION
3rd Avenue Bridge Project
Minneapolis, MN

June 22, 2023
ANNUAL BAGS TOURAMENT
Urban Growler
St. Paul, MN

July 18, 2023
ANNUAL GOLF TOURAMENT
Bunker Hills Golf Club
Coon Rapids, MN

NEW ENGLAND
May 9, 2023
DINNER MEETING
Topic: Corrosion Protection with Cathodic Protection
Bellevue Golf Club
Melrose, MA

June 13, 2023
ANNUAL GOLF OUTING
Red Tail Golf Club
Devens, MA

NORTH TEXAS
May 12, 2023
SPORTING CLAY CLASSIC
Elm Fork Shooting Sprots
Dallas, TX

NORTHERN OHIO
May 9, 2023
CHAPTER TECHNICAL PRESENTATION
Topic: VOC Restrictions in Cleaners
Presented by: Prosoco
Holiday Inn Cleveland South
Independence, OH

July 11, 2023
CHAPTER TECHNICAL PRESENTATION
Topic: Impact of Portland Cement Restrictions
Presented by: Euclid Chemcial
Holiday Inn Cleveland South
Independence, OH

OKLAHOMA
May 10, 2023
TECHNICAL PRESENTATION
Topic: Moisture Issues
Speaker: Dave Fuller, ICRI
AGC of Oklahoma
Oklahoma City, OK

PITTSBURGH
May 11, 2023
TECHNICAL LUNCH PRESENTATION
11 Stanwix Street
Pittsburgh, PA

June 2, 2023
ANNUAL GOLF TOURNAMENT
Birdsfoot Golf Course
Freeport, PA

QUEBEC PROVINCE
May 4, 2023
5@8 VIRTUAL GOLF OUTING
Dooly's Henri IV
Quebec, QC

ROCKY MOUNTAIN
May 11, 2023
COCKTAILS AND CONNECTION
Original Brooklyn's Patio
Denver, CO

June 15, 2023
SPORTING CLAY TOURNAMENT
Kiowa Crook Sporting Club
Bennet, CO

July 24, 2023
ANNUAL GOLF TOURNAMENT
Hiwan Golf Club
Evergreen, CO

ICRI CONCRETE REPAIR CHAPTERS

ICRI has 39 chapters, including two student chapters, in metropolitan areas around the world. Chapters hold technical presentations, educational meetings, symposia, and local conventions on repair-related topics.

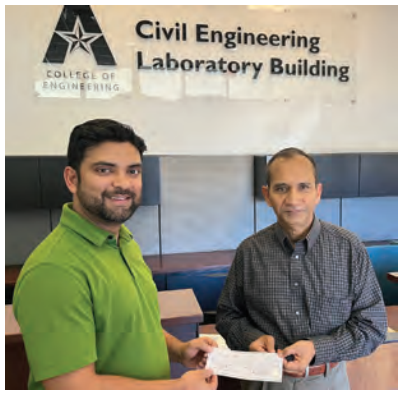
Chapters also provide an outstanding opportunity to meet and build relationships with repair specialists in your area. In addition to the technical meetings, chapters also host golf outings, social evenings, dinner cruises, and other networking events.

CHAPTER ACTIVITIES

NORTH TEXAS SUPPORTS STUDENTS

Thanks to the successful Sporting Clay and Golf Tournament fundraising events held in 2022, the North Texas Chapter was able to provide a total of $8,500 in student scholarships in 2022. Chapter Scholarship Chairperson Julie Bolding, PE, reports that a total of $5,500 was distributed in the Spring to the following six deserving students: John Andruss, Monserrat Chavez, Zayd Hinedi, Travis McIntosh, Larissa Schweigart, and Mohammed Waheb.

More recently, 2022 Chapter President Abhishek Aggarwal, PE, presented a $3,000 scholarship check to Dr. Nur Yazdani, PhD, PE, former Chair of the Civil Engineering Department and current Director of the NDE Laboratory at the University of Texas at Arlington to support students in UTA's Civil Engineering program.



2022 NTX Chapter President, Abhishek Aggarwal, PE (left) presents $3,000 scholarship check to Dr. Nur Yazdani ▶

MICHIGAN DEMO DAY A SUCCESS

The Michigan Chapter hosted its annual Demo Day on March 3, 2023. Despite the day's approaching bad weather, there was a good turnout as the chapter hosted about 50 people to watch live product demonstrations and network with local product vendors. Something everyone can appreciate!

Michigan Mega Demo participants were able to watch several demonstrations

Participants were able to get hands-on with a few of the products

Attendees networked with a number of local vendors and suppliers

NORTH TEXAS RECOGNIZES PAST CHAPTER PRESIDENTS

At the North Texas Chapter's February meeting, Past Chapter Presidents Abhishek Aggarwal, PE (2022), Eddie DeHaro (2021), and Clay Broyles (2020) were recognized for their meritorious service to the chapter. Despite the ongoing threats as the COVID pandemic ebbed and flowed, these presidents worked tirelessly with the Board of Directors to ensure that online educational opportunities were provided, and the traditional Sporting Clay and Golf Tournament fundraising events took place with the necessary safety precautions in place.

2023 Chapter President Casey Jones (right) presents plaque to 2022 Chapter President Abhishek Aggarwal, PE

2023 NTX Chapter President Casey Jones introduced the 2023 NTX Board of Directors, and outlined the calendar of events for the year, including:

- Board Meeting, May 5
- Sporting Clay, May 12, Elm Fork Shooting Range, Dallas, Texas 8 AM – 2 PM
- Membership Meeting, June 15
- Board Meeting, August 11
- Membership Meeting, September 14
- Highways USA Conference and Exhibits, October 4-5, Kay Bailey Hutchinson Convention Center, Dallas, Texas
- Jesse Points Memorial Golf Tournament, October 6, Waterchase Golf Club, Fort Worth, Texas 7:30 AM – 1:30 PM
- Board Meeting, October 13
- Membership Meeting, November 9
- Board Meeting, December 8

2020 ICRI President Mark LeMay provided chapter members with a recap of resources available on the ICRI website, including free PDF copies of ICRI Guidelines for ICRI members, copies of presentations held at ICRI conventions dating back to 2010, and digital copies of ICRI's *Concrete Repair Bulletins* dating back to 2001.

CHAPTER ACTIVITIES

DELAWARE VALLEY GETS THE AXE

On January 26, 2023, the Delaware Valley Chapter hosted its second annual axe throwing social event at Splitting Edge Axe Throwing in Malvern, PA. The event was generously sponsored by ECS Limited. Over 50 ICRI members threw blades and split wood in between refreshments and tacos from BOMBA Tacos + Bar.

The evening started out with team competitions, followed by a single elimination tournament. When all other competitors had been edged out, Vince Budnavage, Aquafin, Inc., and Andrew Thomas, Mara Restoration, Inc., competed for the championship, with Vince's throws ultimately proving to be the sharpest!

Delaware Valley Chapter Members given the axe at January social

And some walked away with swag

Bullseye!

The competition was split on this one

Everyone enjoyed this exciting 2nd annual chapter outing

And everyone enjoyed socializing and refreshments

FLORIDA WEST COAST HITS THE BLADES AS WELL

The Florida West Coast Chapter of ICRI held a social event for members and industry guests at Ferg's Sports Bar in downtown St Petersburg, Florida. Axes and adult beverages brought a record turnout for the event, which also provided an opportunity for the board of directors to have fun and keep members and guests informed about the upcoming 2023 educational opportunities, technical meetings, and social events planned by the Florida West Coast Chapter.

The entire leadership team is looking forward to continued growth for the Florida West Coast Chapter. They are looking forward to the opportunity to showcase the Greater Tampa Bay Area to the Global ICRI membership in Fall 2023.

Florida West Coast Chapter President John Shores shares introductions and updates for 2023 with the crowd

Chapter President John Shores shows solid form as he demonstrates the evening's activity

Join your local chapter! Visit www.icri.org

NEW ENGLAND DIGS PETROGRAPHY

The New England Chapter hosted a sold-out dinner presentation at its headquarters in Waltham, MA, and sponsored by Simpson Gumpertz & Heger, Inc. (SGH). The program focused on the many benefits of utilizing petrography on a variety of concrete repair projects.

Attendees networked over appetizers and drinks and SGH provided tours of its lab spaces before the presentation. Dr. Sidney Carter, PG, and Matthew Sherman, PE, representing SGH, explained how coordination, cooperation, and planning in the investigation phase of a project can lead to better outcomes for all involved. The duo used examples from past projects to explain how designers, analysts, and contractors can work with petrographers and laboratory staff to enhance their projects and outcomes.

The program was extremely well received, and attendees had many questions for the SGH team after their presentation.

Like many chapters, the New England Chapter thanks their sponsors as often as they can


The petrography presentation began with appetizers, drinks, and plenty of samples for the group to view and discuss


The group got to see many "behind-the-scenes" pieces of equipment


They were able to get more in-depth knowledge of the petrography process


And they were able to network and discuss many of the presentations finer points

From Field to Laboratory and Back Again: How the investigation phase and laboratory testing can lead to better project outcomes for all involved


The dinner presentation was sold out and very well-received

ICRI CONCRETE REPAIR CHAPTERS

INTERESTED IN SEEING YOUR CHAPTER NEWS & EVENTS LISTED HERE?

Chapter News & Event Deadlines

JULY/AUGUST 2023 CRB
Deadline: May 1, 2023

SEPTEMBER/OCTOBER 2023 CRB
Deadline: July 1, 2023

NOVEMBER/DECEMBER 2023 CRB
Deadline: September 1, 2023

Send Chapter News and Event by the deadlines above to Program Director Dale Regnier at daler@icri.org.

WOULD YOU BELIEVE AXE THROWING IN PITTSBURGH AS WELL?

The Pittsburgh Chapter kicked off construction season with its first event of 2023—its Annual Freeze Thaw Ball! This year's event was held at Lumberjaxes, Mt. Lebanon, PA. The group had a lot of fun networking, axe-throwing, and meeting new members. Congratulations go out to the axe-throwing winners: Pat Allen, Warren Maxwell, and Dave Marofsky! The chapter would also like to thank all its local sponsors! A great turnout at the Freeze Thaw Ball is a great way to start what everyone hopes will be a busy and energetic year in Pittsburgh!

The whole group of Pittsburgh Chapter axe throwing participants—the axe wielder in the back is contest winner Pat Allen with AES

The chapter was thrilled with a great turnout for their first event of the year

Dave Marofsky, Mapei (left), with Zack Blume, Pullman (center), and Greg Heddaeus, Carl Walker (right) are seen here throwing axes

FLORIDA WEST COAST HAS THEIR OWN DEMO DAY IN MARCH

The Florida West Coast Chapter hosted its Demo Day on March 31, 2023. It hosted the event at a local TWI shop which worked out well for the hosts and attendees. Breakfast was provided with coffee and doughnuts sponsored by Coastal Construction Products. Lunch was provided by Tara's Kitchen food truck, and was sponsored by WillSeal. The chapter welcomed 63 pre-registered guests and ended up handing out a total of 77 meal tickets.

There was such a good combination of specifiers, applicators, and suppliers that the leadership had many opportunities to talk about additional local sponsorships and even a few new ICRI memberships during the day.

The day's demonstrations included: a concrete power tool demonstration focusing on new technologies and dustless options; new balcony traffic coatings including decorative finishes and applications; information on a tile overlay over membrane waterproofing; and concrete repairs around post tensioning. And, finally, chapter leader Tom Buffington was able to assist with a presentation on repair basics and provide commentary based on information taken directly from ICRI Guidelines on rebar prep and anodes.

The Florida West Coast Demo Day featured a fantastic turnout

The food truck was also a popular part of the event

Attendees were treated to several entertaining demonstrations of new technologies, products, and tools

CHAPTERS COMMITTEE CHAIR'S LETTER

JON CONNEALY
Chapters Chair

For those of you who live in the parts of the world that experience winter weather, and the construction slowdown that accompanies it, welcome to full-swing construction season! Workdays start earlier and end later, and ICRI work tends to take a backseat to the work that pays us and family time.

Even the most active members can seem to disappear this time of the year. The best speaker on the best topic can't get these members to take time away from work to sit down for a technical session. Golf carts sit empty at the annual outing because at the last minute something comes up and they can't get away.

For the eager and ambitious chapter leader, the decrease in member engagement can be frustrating. The solution to the problem, in my experience, is to recognize that it ***isn't*** a problem! Take the situation at face value—ICRI activities take a back seat for many of our members this time of year. Rather than planning functions that will be poorly attended, focus your energy on planning the events that occur when you can get the engagement you want. Prioritize ***your*** time as a chapter leader and focus your efforts on wintertime activities.

Or—move to a part of the world where the wintertime air doesn't hurt your face and lungs, where construction continues year-round, and people feel less anxiety about taking time away from their jobs to participate in ICRI functions. The older I get the more tempting this option becomes.

For my chapter mates in the Great Plains—see you when the snow flies! It's time to ***work!***

Jon Connealy, ICRI Chapters Committee Chair
BASF Master Builders Solutions USA

CONCRETEREPAIRCALENDAR

MAY 3, 2023
Concrete Slab Moisture Testing Program (CSMT)
Milwaukee, Wisconsin
Website: www.icri.org

MAY 9, 2023
ICRI Webinar
Understanding Cracks in Concrete and Repairs
Website: www.icri.org

JUNE 20, 2023
Concrete Slab Moisture Testing Program (CSMT)
Stockton, California
Website: www.icri.org

OCTOBER 16 – 18, 2023
2023 ICRI Fall Convention
St. Pete Beach, Florida
Website: www.icri.org

INTERESTED IN SEEING YOUR CONCRETE INDUSTRY EVENT LISTED HERE?

Events can be emailed to editor@icri.org. Content for the July/August 2023 issue is due by June 1, 2023, and content for the September/October 2023 issue is due by August 1, 2023..

ASSOCIATION NEWS

ACPA ANNOUNCES NEW BOARD MEMBERS

The American Concrete Pumping Association (ACPA) recently announced the election of its new executive board at the ACPA Annual Meeting and Awards Presentation on January 18, 2023, in Las Vegas, Nevada, during World of Concrete 2023. Elected to serve a one-year term, the newly elected Executive Board includes:

President: Wayne Bylsma—Cherokee Pumping, Inc., Hampton, Georgia

Vice President: Art Fink—CF & T, Hayward, California

Secretary: Eric Duiker—CanCrete Equipment, Mississauga, Ontario, Canada

Treasurer: Nathan Germany—Tri-Way Concrete Pumping, Inc., Roanoke, Texas

Past President: Gary Brown—R.L. McCoy, Inc., Indianapolis, Indiana

For more information on other board positions recently elected visit https://www.acpa.org/.

ACPA ANNOUNCES AWARD RECIPIENTS

The American Concrete Pumping Association (ACPA) is pleased to announce the recipients of the 2022 ACPA Awards. The awards were presented at the ACPA Annual Meeting and Awards Presentation on Jan. 18, 2023, in Las Vegas, Nevada, during World of Concrete.

Safe Operator of the Year: Dianne McCreary, Blanchet Concrete Pumping.

Pioneer Award: Tony Tye, Texas South Concrete Pumping in San Antonio.

Hall of Fame Award: Tom O'Malley, Brundage Bone Concrete Pumping.

Lifetime Achievement Award: Gary Brown, R.L. McCoy. For more information visit https://www.acpa.org/.

THE INTERNATIONAL GROOVING & GRINDING ASSOCIATION ANNOUNCES NEW TIP SHEET TO IMPROVE BRIDGE DECK CONSTRUCTION

The International Grooving & Grinding Association (IGGA) – a non-profit trade association founded in 1972 that is recognized as the industry's leading technical resource in the development and marketing of optimized pavement surfaces and pavement preservation around the world – has announced the release of a tip sheet, "Tips for Diamond Grinding Bridge Decks: Avoid These Common Mistakes Before Grinding the Bridge Surface." The document is an educational resource for contractors that explains how to avoid damage to bridge joints during construction.

The document comes at a time when road owners are increasingly specifying diamond grinding to improve ride quality, friction and drainage capabilities of new bridge deck surfaces. Because diamond grinding involves removing a thin layer of concrete from the road surface, and because diamond grinding machines have long wheelbases and need to transition slowly into grade changes, the IGGA, in its capacity as a technical resource for the roadbuilding industry, is offering the tip sheet as guidance for accommodating the grinding process.

Read the tip sheet at igga.net.

WISCONSIN READY MIXED CONCRETE ASSOCIATION RECOGNIZES EXCELLENCE IN CONCRETE DESIGN.

The Wisconsin Ready Mixed Concrete Association has recognized the winners for the 41st Annual Concrete Design Awards.

The awards are a part of a prestigious program highlighting best uses of ready-mixed concrete in Wisconsin and Michigan's Upper Peninsula (UP). The Wisconsin Ready Mixed Concrete Association (WRMCA), Acuity Insurance, Carew Concrete & Supply, County Materials, Euclid Chemical, Oshkosh Corporation, Premiere Concrete Admixtures, Schmitz Ready Mix, Sika Corporation & the Wisconsin Chapter of the American Concrete Institute cosponsored the annual award program. Award winners were determined by a distinguished panel of Wisconsin/UP construction professionals.

The Concrete Design Award ceremony took place on Thursday, March 2nd at the Hilton Appleton Paper Valley.

This year's award-winning projects exemplify innovative design in concrete for a diverse range of projects in Wisconsin and Michigan's Upper Peninsula.

For the 41st Annual Concrete Design Awards, projects highlighted represented winners that included owners, architects, engineers, contractors, and ready mixed producers.

To view a summary of each project, go to https://wirmca.com/

AMERICAN CONCRETE INSTITUTE HONORS OUTSTANDING CONTRIBUTIONS TO THE INDUSTRY

The American Concrete Institute (ACI) is pleased to recognize several professionals, groups, and companies for their outstanding contributions and dedication to ACI and the concrete industry. The 2023 honorees include the induction of Honorary Members, ACI's highest honor, which recognizes persons of eminence in the field of the Institute's interest, or one who has performed extraordinary meritorious service to the Institute. The following six individuals are inducted as Honorary Members:

- Claude Bédard
- Ramón L. Carrasquillo
- David W. Johnston
- Zongjin LI
- Jack P. Moehle
- Sharon L. Wood

ACI also recognizes 15 individuals for maintaining their membership and participating in ACI activities for at least five decades. Additionally, ACI honors 20 new Fellows for their outstanding contributions to the production or use of concrete materials, products, and structures in the areas of education, research, development, design, construction, or management. .
To learn more visit concreteproductivity.org.

AMERICAN CONCRETE INSTITUTE INTRODUCES NEW GUIDE FOR SHOTCRETE

The American Concrete Institute, through the work of ACI Committee 506, has released ACI PRC-506-22: *Shotcrete—Guide*. The newly introduced guide provides information on materials and properties of both dry-mix and wet-mix shotcrete and covers most facets of the shotcrete process including application procedures, equipment requirements, and responsibilities of the shotcrete crew.

As a companion document to ACI SPEC-506.2: *Specification for Shotcrete, the Guide* also discusses preconstruction trials, craftsman qualification tests, materials tests, finished shotcrete acceptance tests, and equipment. The document is written such that the numbering of all sections between the Guide and Specification documents are aligned, allowing ACI PRC-506-22 to serve as a non-mandatory commentary on the mandatory specification provisions.

To learn more visit the ACI store.

2022 ASA OUTSTANDING SHOTCRETE PROJECT AWARDS

ASA bestowed six outstanding project awards, as well as recognizing two honorable mention awards.

The American Shotcrete Association (ASA) is proud to announce the recipients of its 2022 Outstanding Shotcrete Project Awards. The recipients were honored at the 18th Annual ASA Awards Banquet held in conjunction with ASA's 2023 ASA Shotcrete Convention and Technology, on February 28, 2023, at the Ojai Valley Inn, Ojai, CA. These awards confirm and demonstrate the exceptional advantages of shotcrete placement of concrete.

The 2022 Outstanding Shotcrete Project recipients include:

- **Outstanding Architecture | New Construction Project**: Highline Garabaldi Springs Rockscape Retaining Wall | British Columbia, Canada
- **Outstanding Infrastructure Project**: Eglinton Crosstown LRT Project at Mt Pleasant Station | Toronto, Canada
- **The Outstanding International Project:** South East Asia Jungle Track |Auckland Zoo, New Zealand

- **Outstanding Pool & Recreational Project:** Thunderbird Falls, Outstanding Shotcrete Project | British Columbia, Canada
- **Outstanding Repair & Rehabilitation Project:** Replacement of Flume 4/5/6 and 30| Pollock Pines, CA
- **Outstanding Underground Project:** Exchange Place Station - 9 Car Program West Corridor | Jersey City, NJ

Honorable Mention:

- Pennsylvania Turnpike Commission - Tuscarora Tunnel Rehabilitation | Burnt Cabins, PA:
- Atlanta Airport Plane Train Tunnel-West Extension | Atlanta, GA

For more information, visit www.shotcrete.org

THE INTERNATIONAL GROOVING & GRINDING ASSOCIATION ANNOUNCES THE WINNER OF ITS FIRST CONCRETE PAVEMENT LONGEVITY AWARD

The International Grooving & Grinding Association (IGGA) – a non-profit trade association founded in 1972 that is recognized as the industry's leading technical resource in the development and marketing of optimized pavement surfaces and pavement preservation around the world – is pleased to announce the Pavement Longevity Award as a new addition to its annual association awards. The IGGA also announces the 2023 award winner: Trunk Highway 210 (TH 210) in Minnesota.

The 2023 award was presented at the Concrete Paving Association of Minnesota (CPAM) Annual Concrete Paving Workshop, held Mar. 9-10 in Waite Park, Minn. Future awards will be presented at the IGGA annual meeting, held each fall.

TH 210 in Minnesota Accomplishes Long Life with Minimal Maintenance

TH 210 was constructed in 1953, and at 69 years of age has an international roughness index (IRI) measurement of 70. IRI is the most commonly accepted standardized roughness measurement, with good or very good ride quality being indicated by values less than 95 inches/mile, according to the Federal Highway Administration (FHWA). TH 210's excellent ride quality was achieved with minimal maintenance throughout the years, making it an economical as well as effective choice in paving material. In 1974, after 21 years of service, joints on the highway were resealed. In 1991, after 38 years of service, full- and partial-depth repairs, along with diamond grinding, were performed as part of an MnDOT project to install turn lanes at major county road intersections. In 2013, after 60 years of service, pavement preservation was performed, including full- and partial-depth repairs, dowel bar retrofit, and diamond grinding.

For more information, visit www.igga.net.

2023 ACI PROFESSORS' WORKSHOP NOW OPEN FOR REGISTRATION

The Professors' Workshop is designed to provide instructors in civil engineering, architecture, architectural engineering, materials science, and construction management programs the latest tools and teaching techniques to effectively engage students in courses that cover structural concrete design, construction, materials, and pavements. Prominent, nationally known faculty and industry representatives will present information and resources to assist professors in preparing or fine-tuning their concrete-related courses.

The workshop will be held in two parts; the first will be an online-only event on July 17 and 18, and the second will be a face-to-face event held at ACI Headquarters on July 25 and 26. Those who purchase tickets will have access to both the online and in-person portions of the event.

The synchronous online portion of the workshop will focus on providing teaching resources that are suited for both online and face-to-face formats.

Face-to-face sessions will be highly interactive. Attendees will participate in numerous breakout sessions to develop course goals, student learning objectives in the context of topical modules, instructional materials, laboratory activities, and assessments.

For more information, visit concrete.org/events/professorsworkshop..

AMERICAN CONCRETE INSTITUTE RELEASES 2023 ACI COLLECTION OF CONCRETE CODES, SPECIFICATIONS, AND PRACTICES

The American Concrete Institute has released the 2023 ACI Collection of Concrete Codes, Specifications, and Practices.

The ACI Collection is the most comprehensive and largest single source of information on concrete design, construction, materials, and repair, with over 50 codes and specifications and more than 200 practices – including all guides, reports, and education publications.

The ACI Collection features ACI 318 "Building Code Requirements for Structural Concrete," ACI 301 "Specifications for Structural Concrete," ACI 562 "Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Struc-

tures," and ACI 440.11 "Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars."

The 2023 version includes dozens of newly published documents ranging from codes on fiber-reinforced polymer to guides for concrete rehabilitation, shotcrete, and much more. Additional categories in the ACI Collection include concrete materials, properties, design, construction, reinforcement, specialized application, repair, structural analysis, and innovation, plus popular topics such as slabs, formwork, and masonry.

For details, visit concrete.org/store.

INTERESTED IN SEEING YOUR NEWS IN THIS COLUMN?

Email your 150-200 word association news to editor@icri.org. Content for the July/August 2023 issue is due by June 1, 2023, and content for the September/October 2023 issue is due by August 1, 2023. ICRI reserves the right to edit all submissions.

PRODUCTINNOVATION

GLOBAL INVENTORY OVER 3D PRINTED BUILDINGS SHOWS COBOD'S LEADING POSITION

- New research shows that by end of 2022, there were 129 3D printed buildings globally found on 105 building sites.
- Geographically, around 30% of 3D printed buildings are located in North America, however all regions are well represented.
- COBOD's 3D construction printers have printed almost 40% of projects globally, equivalent to 51 buildings. These printers have also been present at 40% of the construction sites where 3D printed buildings have been constructed.
- In 2022, 54 new buildings were added to the list, showing the exponential growth of the industry.
- COBOD printers made 30 of these 2022-buildings, almost equivalent to 60% of new buildings made globally.

Of all the applications for 3D printing, 3D construction industry is perhaps the most hyped. For the first time, certain data may now shed light on the activity.

According to a recent study by COBOD International A/S, there are already 129 3D printed buildings spread over 105 distinct construction sites globally. While these numbers might appear surprisingly low given the attention the industry has been getting, it is of little surprise that COBOD's 3D construction printers are behind 40% of all activities.

Focusing on 2022, when 54 new 3D-printed structures were constructed, makes the dominance of COBOD in the sector even more obvious.

For the ful report visit www.cobod.com/global-inventory-3d-printed-buildings/

CAN MCI® FIGHT MICROBIAL INDUCED CORROSION IN CONCRETE?

Three of the main causes of corrosion in reinforced concrete are chlorides, carbonation, and sulfates. While Migrating Corrosion Inhibitors have been known to protect against the first two, more research needs to be done on the power of MCI® against sulfates. However, two recent research projects are already suggesting exciting possibilities for the use of MCI® in sulfate rich environments.

An independent study published in 2018 by several researchers from the King Fahd University of Petroleum & Minerals in Saudi Arabia helps answer the first concern. The study looked at five concrete corrosion inhibitors, including one "based on amine carboxylate" (as are most MCI® admixtures). The inhibitors were tested in a chloride rich environment with sulfate added at 500 and 2000 ppm.

Cortec's MCI® amine carboxylate admixtures typically offer many advantages over CNI, such as biobased content (e.g., MCI®-2005 is a USDA Certified Biobased Product), certification to meet NSF Standard 61 for drinking water system components, protection against carbonation corrosion, and no acceleration of set time.

Although further research must be done, another whitepaper forthcoming in 2023 also suggests exciting possibilities for the use of MCI® in high-sulfate environments like those with MIC problems. In particular, the chemistries used in MCI®-2005 and MCI®-2018 demonstrated a degree of protection against the deterioration of the concrete itself, not simply protection against rebar corrosion in the presence of sulfates.

Contact Cortec® for additional data and consultation: www.cortecmci.com/contact-us/

IS YOUR COATING A GOOD MATCH FOR CORROSIVE CHEMICALS?

The right coating can mean the difference between a concrete floor that lasts for decades and one that starts to disintegrate and corrode shortly after a chemical spill. It is therefore critical to ask if the coating you are considering has what it takes to resist the substances to which it will be exposed. Our "MCI®-2026 Floor Coating Chemical Resistance Guide" makes that easy when looking at the Cortec® option.

MCI®-2026 is a 100% solids, 2-component novolac epoxy coating designed for areas that need high chemical or abrasion resistance. It can be used on concrete floors, on concrete counters, and even on metal tanks (when used with MCI®-2026 Concrete Primer WB). Possible applications include chemical processing plants, manufacturing plants, or just about any industrial facility that gets heavy traffic or is at risk for chemical spills.

Anyone interested in using MCI®-2026 can check the "MCI®-2026 Floor Coating Chemical Resistance Guide" to see if MCI®-2026 is a good match for the substances it is likely to encounter in their facility.

With almost all 100+ chemicals on the list falling in the range of fair to excellent resistance (most in the excellent category), this guide reflects the tough makeup of MCI®-2026 for chemical processors or other manufacturers. For those considering using MCI®-2026 in commercial food processing facilities, the list even includes resistance ratings for several food substances such as mayonnaise, milk, mustard, peanut butter, and vinegar that could easily fall on the floor!

For more information visit https://www.cortecmci.com/product/mci-2026-floor-coating/

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We are focused on the industry's future and **your success.**

ICRI
CONCRETE REPAIR
Restore | Repurpose | Renew

ICRI is the center for concrete repair and restoration leadership, supporting a profession built on science and craftsmanship—making the built world safer and longer lasting.

1. Developing an industry of professionals through networking and best practices
2. Expanding certification programs and services to educate and build skills
3. Building strategic partnerships to strengthen the relevance of ICRI and the concrete restoration industry
4. Serving the needs of members and customers with staff, volunteers, and our chapter network

NETWORKING · EDUCATION · INFORMATION · CERTIFICATION
CONVENTIONS · COMMITTEES · INDUSTRY GUIDELINES

Join Today @ www.icri.org

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RE-CON LINE

SUSTAINABLE CONCRETE SOLUTIONS

Sustainable concrete production means reducing the consumption of natural resources and eliminating waste material streams. MAPEI has developed products and solutions that do just that:
RE-CON ZERO EVO transforms returned concrete into aggregates;
RE-CON DRY WASHING utilizes these aggregates to greatly reduce slurry from washing truck mixers;
RE-CON AGG helps use higher dosages of recycled aggregates or other demanding raw materials.

Transforming concrete production together – from linear to circular towards a sustainable future

MAPEI USA

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