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Concrete Repair Bulletin

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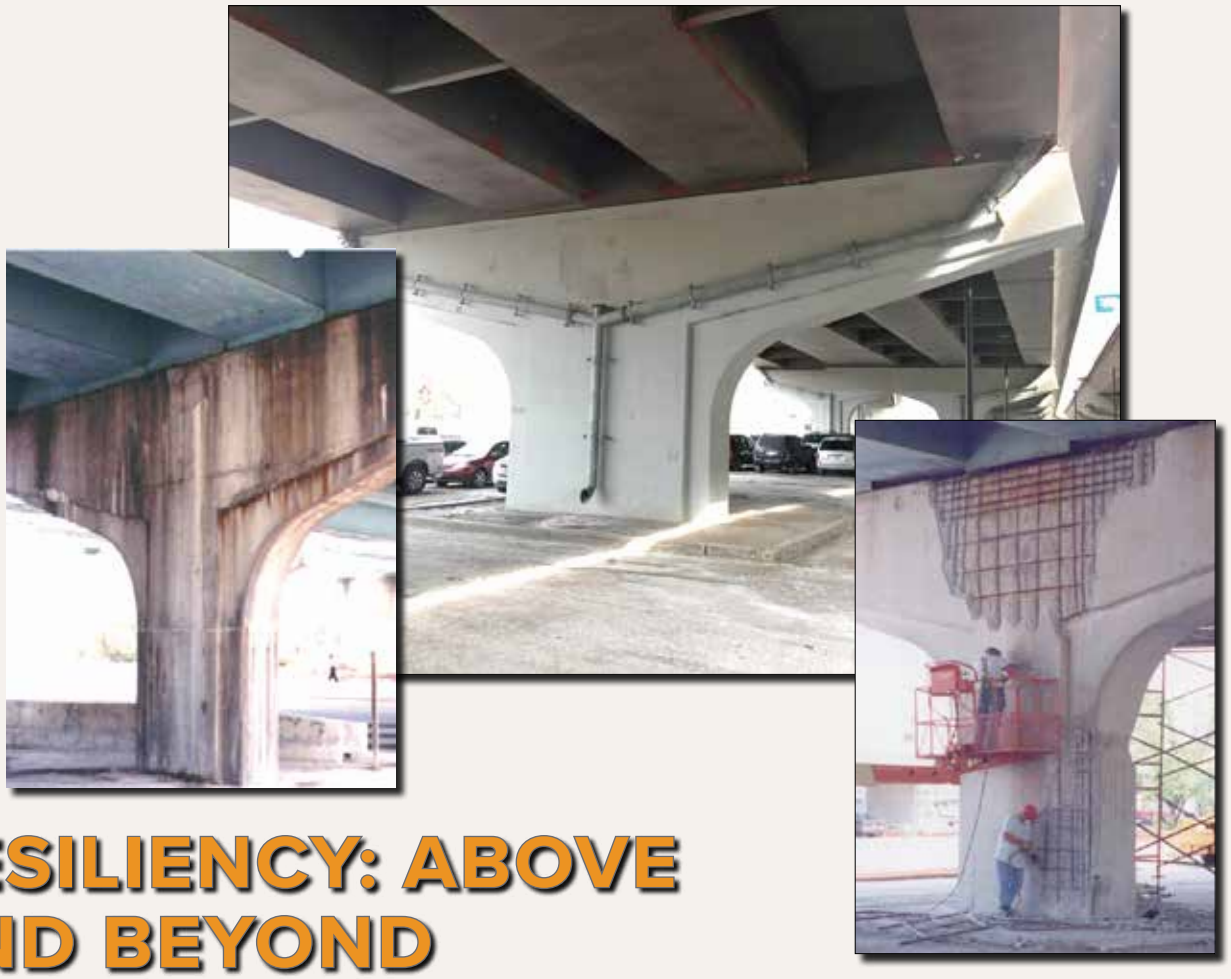

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ON THE COVER: Repair of pier for longevity highlighted in a Brian Pailes article, page 14.

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CONCRETE REPAIR Bulletin

FEATURE ARTICLES

DEPARTMENTS

NOTE FROM THE EDITOR

The construction year is well on its way and around the country ICRI members are gearing up for Spring and the busy summer construction season. This will continue to be a year of change for ICRI. We will be rolling out the Institute's rebranding over the next few months. Chapters will be receiving new logos and the *Concrete Repair Bulletin* will be undergoing an update over the next few issues.

The Spring Convention in April is themed *Waterproofing with Aesthetics—Making It Dry and Appealing to the Eye*. The convention will be held in Jacksonville, Florida and will feature numerous presentations, technical meetings and numerous networking opportunities.

The theme of this issue of the *Concrete Repair Bulletin* is "Resiliency: Above and Beyond Concrete Restoration." The issue will recap the 2018 Fall Convention from Omaha, Nebraska.

I hope you have all have a successful and safe 2019 and look forward to seeing you at this year's events!

Jerry Phenney, Editor, CRB
MAPEI Corporation

PRESIDENT'S MESSAGE


CHRIS LIPPMANN

The institute is off to a great year, and the World of Concrete was a fantastic start. Our newly branded logo and tag line were in place and seen throughout the entire event.

We had a record-breaking turnout at the annual ICRI Kick-Off Party that took place at Paris Hotel's Chateau Nightclub. This event has become the industry-leading function prior to the start of World of Concrete. Amongst the views of the Las Vegas strip, it was a great night of networking and celebration for both members and guests. I want to give a special thank you to our event sponsors who helped make the night such a success.

Earlier that same day, we conducted our annual meeting with the board of directors and guests. It was an honor to introduce our new and returning board of directors Pat Gallagher, Dan Wald, Jim Spiegel, Rick Edelson, and David Marofsky. During the meeting, each director made a personal commitment to champion specific strategic tasks during their term served. The entire leadership team agreed to be innovated leaders and motivators to help drive our objectives of professional development, organizational credibility, organizational strength, and Industry leadership. I could not be more proud to lead this incredible team.

More recently I came back from another outstanding chapter roundtable event. ICRI has been utilizing this forum for eight years, and it is an absolute continued success. It was great to meet and discuss different issues and themes with chapter leaders from the West Coast, British Columbia, Mountain States, and Texas. We all have similar challenges and this is a great forum to interact and learn from one another. I want to thank all the chapter leaders who participated with a special shout out to the Rocky Mountain chapter who sent four participants and were great contributors to the event. We may have a new future "chapter of the year" in the making.

The Spring convention is upon us and we are expecting our biggest turn out, ever. If you want to stand out in the repair market as an industry leader, this is the venue for you. Come and enjoy incredible industry presentations to continue your professional development. Come interact and get involved with different technical and administrative committees that are open to all attendees. Come learn about new technologies and meet the premier suppliers or our industry. Come network with leading professionals of our market. It worked for me, I know it will work for you. I hope to see you there.

Christopher R. Lippmann

Chris Lippmann
2019 ICRI President

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TACTALK

FRED GOODWIN

Most of us in ICRI would agree that concrete is a pretty amazing material. Concrete is economical with a long life and low maintenance; does not usually rot, corrode, or decay; can be molded or cast into almost any desired shape; is fire-safe and able to withstand relatively high temperatures; and is resistant to wind, water, rodents, and insects. It is resilient meaning that in event of disasters concrete structures are some of the most likely to survive. Concrete also has a long history with structures existing at several thousand years age.

However, compared to other building materials, concrete has a relatively low tensile strength (approx.10% of compressive strength), low ductility (i.e., it's brittle), a low strength-to-weight ratio (it's heavy), responds to the environment (it changes with time), has permeability (allowing the ingress of liquids and gases), and is susceptible to chemical attack (acids, AAR, etc.).

Factors contributing to premature failure of concrete structures include poor quality concrete (i.e., low strength and high permeability due to a high water to cementitious material ratio), improper consolidation that fails to create a homogeneous material encapsulating reinforcement and free from honeycombing, damage from freezing due to failure to protect the concrete in cold weather or provide for adequate air entrainment, alkali aggregate reaction from improper materials selection, poor structural design such as lack of reinforcement cover, cracking from thermal stress, cyclical loading, mechanical overloading, impact, seismic damage, poor workmanship factors such as inadequate curing, failure to account for drying shrinkage, insufficient cover over reinforcement and environmental factors such as chlorides and carbonation causing reinforcement corrosion, deicing scaling, fire damage, and exposure to aggressive chemicals such as acids.

According to the Portland Cement Association (PCA), corrosion of reinforcing steel and other embedded metals is the leading cause of deterioration in concrete.[1] Metals are usually present in their lowest energy state in nature as ores. Refining and smelting use energy to reduce the metallic compounds to a purer form such as from iron ore to steel. The metal wants to return to its original lower energy state by corroding. The corrosion cycle must be interrupted to keep this from happening. Prevention keeps corrosion from starting either through the selection of more noble metals, reversal of the flow of electrons from an external source, or otherwise creating conditions where corrosion does not occur. Protection isolates the metal from its environment such as through a barrier coating. Mitigation addresses corrosion that has begun by controlling the rate of corrosion to an acceptable level.

It is possible to estimate the service life of concrete structures. Service life according to ACI 365.1R is "an estimate of the remaining useful life of a structure based on the current rate of deterioration or distress, assuming continued exposure to given service conditions without repairs"[2], or in other words, time. Another useful term is life-cycle cost analysis (LCCA), which can be described as "a method for assessing the total cost of facility ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system".[3] LCCA usually includes initial costs (capital investment costs for land acquisition, construction, or renovation and for the equipment needed to operate a facility), operational expenses for energy, water, and other utilities based on consumption, current rates, price projections, operating costs, maintenance and repair (OM&R) costs, replacement costs, and residual value (salvage). A discount rate is applied to equalize costs over the service life, to reflect an investor's opportunity cost of money over time to achieve a return at least as high as that of the next best investment. Usually a factor to account for inflation is also applied to equalize costs over time. LCCA is in terms of money. The saying "time is money"[4] can be revised when discussing service life and LCCA so that "money is also time" as an investment in higher quality construction, maintenance, or repair can extend the service life of a structure.

One can consider dividing the service life into a deterioration time scale. The design phase includes selection of materials, installation of embedded monitoring, construction detailing, temperature control, adequate compaction, protection of fresh concrete, and curing to be detailed in the specifications, and that inspection and testing be carried out to ensure that the specifications are being followed. The performance requirements need to be stated explicitly, and the objectives made clear. Monitoring and maintenance can be planned.

During the predictive maintenance phase, the owner may spend a fixed annual maintenance cost to assess conditions and install and renew systems such as protective coatings or quickly repair any cracks that appear to slow down the deterioration process. Investment in the predictive maintenance phase will extend the duration of the phase over time by slowing or mitigating the root cause of deterioration if identified early.

In the reactive maintenance phase, the deterioration mechanisms are in place, but will not be visible in the early stages. Some references further divide this into the initiation (the early stages) and propagation phases (once deterioration becomes visible). With many types of structural and civil infrastructure, deterioration rates are rapid and irreversible.

Finally, there is the replacement phase where "wholesale" deterioration occurs throughout the structure at such a rapid

rate that repair costs may exceed the costs of replacing the entire structure. However, total replacement of the structure may not be an option because of interruption to the function of the structure.

With each succeeding phase, the cost of extension of service life increases. Changes made to improve durability during construction planning may increase the initial cost (such as installation of a cathodic prevention system) but result in very effective long-term savings. Design for durability concepts is becoming more common with techniques for achieving an anticipated service life implemented in the initial design (such as the fib Model Code for Concrete Structures 2010).[5] ACI 562-16 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures and Commentary* states that "recommendations should be provided to the owner on inspection and maintenance to be undertaken during the remaining design service life of the repair material or the repaired part of the structure" but maintenance requirements for new structures appear to be somewhat lacking in the concrete related documents.[6] Both ICRI and other organizations have extensive documentation regarding concrete repairs that are reactive.[7, 8]

ACI 365.1R describes three criteria for determination of the end of service life: Technical service life is the time from now until unacceptable safety, spalling, or failure; Functional service life is when the structure is obsolete or not functional; and Economic service life is where the maintenance cost is greater than the resources available or where replacement of the structure improves revenue. When any of these criteria is met, the service life should no longer be extended through repair or maintenance.

ICRI Committee 160 - Life Cycle and Sustainability[9] is working to improve our tools and understanding of service life, life-cycle, and how concrete repair is one of the greatest sustainability aspects of our industry. You are invited to join the committee and help with this exciting task, just join ICRI and complete the form at https://www.icri.org/page/Join_Committee . All technical committee meetings are open to anyone attending the convention and we welcome your input.

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Fred Goodwin *is chair of the ICRI Technical Acivities Committee (TAC).*

SECRETARIATUPDATE

PIERRE HÉBERT

Golly! Another year that flew by too quickly. Oh well, c'est la vie!

Here is some news from your Secretariat.

As a kind reminder, our mission is to assure that ideas and issues are heard, disseminated, and managed by the appropriate ICRI committees and task groups. We received and processed 17 new ideas in 2018. That is basically one every 3 weeks and we love using the IDEA Form available on ICRI's web site:

For example, after the Fall convention in Omaha, Fred Goodwin thought that it would be a good idea that safety be considered for every convention, since each site is unique and safety needs are best identified by the said site. He suggested that during the convention site selection, the site facility be asked for completion of a safety checklist such as how to call 911, location of fire escape, severe weather protocol, location of exits, defibrillators and first aid kit availability, etc. Such information could be made available to ICRI committees prior to the convention.

Here's another IDEA that we received. In December, Rick Edelson felt that it became apparent that there is a rather large gap between the process of creating ICRI work

product and the process of marketing and distributing such products to the industry. His IDEA is that a task group be initiated to improve the flow of information documented in the Go To Market Form and to determine a way of how to assist our Committee Chairs in getting the Go To Market Form submitted. Furthermore, the task group should address how we can have our management company at least see the work product well before the product is actually completed.

This will be my last article as a secretariat as I'll be devoting my time as a member of the ICRI Executive Committee.

With this, I'm pleased to share the new secretariats Andrew Fulkerson (MAPEI) and Timothy Gillespie (SIKA). Welcome aboard!

Finally, I would like to wish you and your loved ones peace, love and laughter for 2019!

Pierre Hebert *is Secretary on the Executive Committee and past member of the ICRI Secretariat. Pierre has also served on the Technical Activities Committee (TAC).*

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Electrochemical Treatments Significantly Extend the Service Life of Reinforced Concrete Structures

by Brian Pailes

INTRODUCTION

Corrosion of steel reinforcement is one of the most significant resiliency challenges that concrete structures face throughout the world. Corrosion typically results from the ingress of chlorides or carbonation which breaks down the naturally passive state of steel in concrete. There are a multitude of preservation options for reinforced concrete including galvanic anodes and impressed current cathodic protection. However, electrochemical treatments can also provide significant service life extensions with minimal maintenance and upkeep, making them very attractive options for infrastructure preservation. In the preservation of reinforced concrete structures, there are two primary electrochemical treatments that are implemented, electrochemical chloride extraction and re-alkalization.

Electrochemical chloride extraction (ECE) draws chlorides away from the embedded steel reinforcement and out of the concrete thereby restoring the steel's passivity. Re-alkalization increases the alkalinity of carbonated concrete and restores the passivity of the steel reinforcement. Both these processes are achieved by temporarily installing an externally mounted anode and applying an electric field between the temporary anode and the steel reinforcement. In ECE, this electric field transports chloride ions away from the steel, and in re-alkalization, it transports an alkaline solution into the concrete. These methods are also covered in ICRI 510.1, *Guide for Electrochemical Techniques to Mitigate the Corrosion of Steel for Reinforced Concrete Structures*[1], that provides a great resource regarding electrochemical preservation techniques.

This article will focus on two electrochemical treatment case histories; Interstate 480 (I-480) through downtown Omaha, Nebraska in which ECE was conducted on the substructure and University Hall at the University of Chicago in which re-alkalization was implemented on the façade.

CHLORIDE INDUCED CORROSION

Reinforcing steel in concrete is protected from corrosion by the high alkalinity of the concrete pore solution, typically greater than a pH of 12. The high pH of the pore solution causes the formation of a passivating film on the surface of rebar, thereby preventing corrosion. Reinforced concrete structures exposed to chloride ions from seawater, de-icing salt application or chloride-containing soil can have the passivating film destroyed. Chloride ions diffuse from the concrete surface, and once their concentration at reinforcement depth reaches a threshold value, corrosion is initiated. The generally accepted chloride threshold for the initiation of corrosion at the depth of steel in reinforced concrete is between 1 to 2 lbs (0.45 to 0.9 kg) of chloride per cubic yard (0.76 cubic meter) of concrete. Concrete can also contain background chlorides, which are either admixed into fresh concrete or are naturally present in cement products or aggregates. Admixed chlorides could be added to the concrete mix through the use of chloride-containing chemical admixtures or the use of seawater instead of potable water. Admixed chlorides and chloride ions that diffuse into the concrete from the environment are referred to as "free" chlorides and are responsible for chloride-induced corrosion in reinforced concrete. Chemically bound chlorides present in aggregate are not able to initiate corrosion.

CARBONATION INDUCED CORROSION

Carbonation lowers concrete's pH as carbon dioxide diffuses into moist concrete. The carbon dioxide reacts with the free lime present in the concrete pore structure, thereby reducing the OH- concentration within the concrete. If the pH of the concrete surrounding the reinforcing steel is lowered below pH 11, depassivation of the reinforcing begins and general corrosion initiates. Carbonation can cause corrosion in concrete that has not been contaminated with chlorides and can also propagate through cracks. In

chloride-contaminated concrete, carbonation can work in tandem with chlorides to initiate corrosion much more quickly and at lower concentrations.

ELECTROCHEMICAL CHLORIDE EXTRACTION (ECE) AND RE-ALKALIZATION PROCESS

The primary objective of the ECE and re-alkalization process is to reestablish the passivity of the reinforcement steel. In the ECE process, this is conducted by a combination of moving chloride ions away from the reinforcement and generation of additional hydroxyl ions at the steel surface (Fig. 1). With re-alkalization (Fig. 2), this is implemented by increasing the concrete pH around the steel by transporting a basic solution into the concrete.

With both systems, a temporary external anode is installed along the surface of the element to be treated. Typically, the temporary anode is comprised of carbon steel like a welded wire fabric; however, in some applications, stainless steel or titanium mesh is used. Spacers are used to offset the anode from the surface of the element, enough so that a conductive media can completely encapsulate the anode. Once the anode is in place, the conductive media (electrolyte) is placed over and around the anode to create an ionic couple between the anode and concrete surface. The conductive media allows for charge transfer to occur between the external anode and the steel reinforcement within the concrete. The media is kept wet using soaker hoses and by wrapping the treatment in plastic.

The temporary anode is wired to the positive terminal of a DC power source while the reinforcement in the element being treated is connected to the negative terminal of the power source. The power source provides approximately 100 mA to 200 mA of current per square foot (0.1 square meter) of steel surface area during the treatment process. In the ECE process, the positively charged anode will draw chlorides towards it while the negatively charged steel reinforcement will push the chlorides away. In the re-alkalization process, potassium carbonate solution is included in the conductive media. The potassium carbonate is drawn to the embedded reinforcing steel by the charge transfer between the temporary external anode and the embedded steel reinforcement.

A benefit of the ECE and re-alkalization processes is that when the steel is negatively charged during the treatment, an electrochemical reaction occurs at the steel in which hydroxide ions are formed. This increases the pH locally around the steel reinforcement resulting in the formation of a passive layer, similar to when the steel is first cast into fresh concrete. The process of removing chlorides and increasing the concrete pH will passivate active corrosion of steel reinforcement and buffer against further corrosion activity.

CASE STUDIES

I-480 Omaha – Substructure Rehabilitation

I-480 is an elevated highway structure that carries traffic through downtown Omaha. The Nebraska Department of Transportation (NDOT) in the summer of 1998 undertook a major rehabilitation of the approximately 0.6 mile (1 km) long structure. The rehabilitation included replacement of the deck in both the eastbound and westbound directions, along with major repairs to the substructure. The substructure is comprised of approximately 50 hammerhead piers. The bridge was suffering from chloride-induced corrosion resulting from the application of de-icing chemicals.

The substructure was being exposed to chlorides contained in contaminated runoff from the deck through leaking deck joints. In addition, the drainage piping that collects runoff from the deck was built inside the piers. Unfortunately, the piping was backing up and leaking inside the piers, providing the piers with another chloride contamination source. The rehabilitation of the substructure included typical concrete repairs, moving the drainage piping to the exterior of the piers and then performing ECE on 23 of the hammerhead piers. Figure 3 is an example of the piers prior to the rehabilitation. It can be clearly seen that there is water and corrosion staining along the pier face.

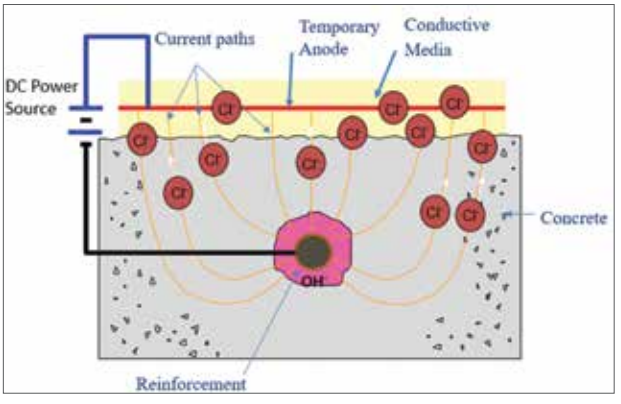

Fig. 1: Electrochemical chloride extraction (ECE) process

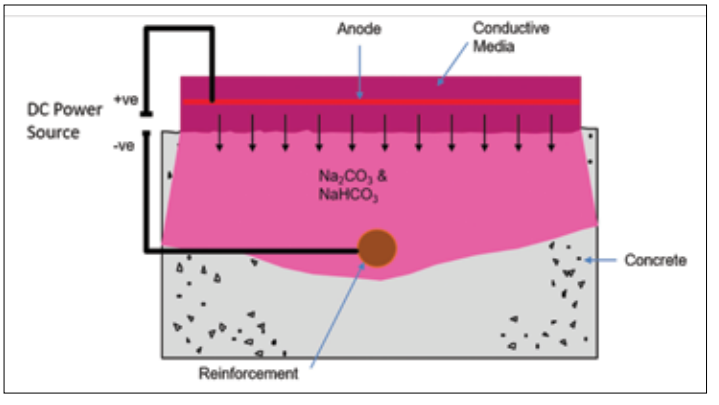

Fig. 2: Re-alkalization process

The first step in the rehabilitation of the I-480 piers was to remove and replace the delaminated and spalled concrete that had resulted from years of corrosion activity (Fig. 4) as ECE cannot restore physical deterioration that has occurred to the concrete. ECE can only mitigate corrosion; therefore, physically deteriorated concrete must be removed and repaired prior to the ECE treatment.

Once the concrete had been repaired, the temporary external anode was installed on the complete surface of the pier (Fig. 5). Wood battens were used to space the steel welded wire fabric anode away from the surface of the pier so that the conductive media could fully encapsulate the anode. Once the anode was in place, and wire connections were made to both the anode and the steel reinforcement, the conductive media was sprayed completely over the pier to fully encapsulate the anode (Fig. 6). Once the conductive media was applied, the piers were wrapped

Fig. 3: Pre-treatment pier condition

Fig. 4: Removal of delaminated and spalled concrete

Fig. 5: Application of temporary external anode

Fig. 6: Application of cellulose electrolyte

in plastic to prevent the media from drying out. Soaker hoses were also used to keep the media wet throughout the treatment process. The conductive media provides a low resistance path to pass current between the anode and steel reinforcement. The DC power source was then connected and the treatment proceeded on each of the 23 piers for approximately 6 weeks (Fig. 7). When the treatment was complete, the temporary anode and conductive media were removed and the pier was abrasive blasted and coated to help prevent future exposure to chlorides. Figure 8 shows the completed piers after treatment and coating.

To verify the reduction in chloride, concrete samples were collected from the piers before and after the ECE treatment. Figure 9 provides the average results of the chloride concentration before and after the ECE treatment process. It can be seen that there is a very significant decrease in chloride concentration throughout the sampled depths. There was an average 74% reduction in chloride concentration in the concrete after the ECE process (66% reduction at a sample depth of 0-1 in [0-25 mm], 76% at 1-2 in [25-50 mm], and 80% at 2-3 in [50-75 mm]). At the steel depth, ranging from 2 to 2.5 in (50-65 mm), the chloride concentration is well below the threshold for chloride initiation after the ECE process.

In 2018, the author revisited the I-480 bridge and performed a site inspection to review the condition of the piers at 20 years after the treatment process. From purely a visual assessment, the piers looked to be in great condition (Fig. 10). For most piers, signs of corrosion deterioration were not observed. In a few instances, some signs of corrosion distress were observed at the ends of the piers (Fig. 11). This issue appears to be due to joints above those piers that are leaking chloride contaminated water onto the piers again. This re-exposure had allowed new chlorides to migrate into the concrete matrix. However, on the rest of the pier surface area where the chloride exposure was mitigated, the ECE process has effectively prevented further deterioration of the piers. The service life of the I-480 piers has been substantially extended due to the ECE process.

University of Chicago – University Hall Façade Repair

The re-alkalization process was recently conducted on the University of Chicago's main administrative building, University Hall, designed by legendary architect Walter Netsch in the Brutalist style (Fig. 12). University Hall is a 28-story tower built in 1963 and has a cast-in-place reinforced concrete frame façade with precast concrete window panel infill. Due to age and environmental exposure, carbonation-induced corrosion of the reinforcing steel has been occurring resulting in concrete damage, such as cracking and spalling. As a result, the façade needed extensive repairs and restoration. To mitigate future deterioration and restore the exterior appearance of the building, façade concrete repairs and re-alkalization treatment of the surface concrete was conducted. In total, 72,300 sf (6,715 m^2) of concrete surface was treated with re-alkalization at the University Hall façade.

Fig. 7: ECE treatment in progress

Fig. 8: Completed ECE process and coated piers

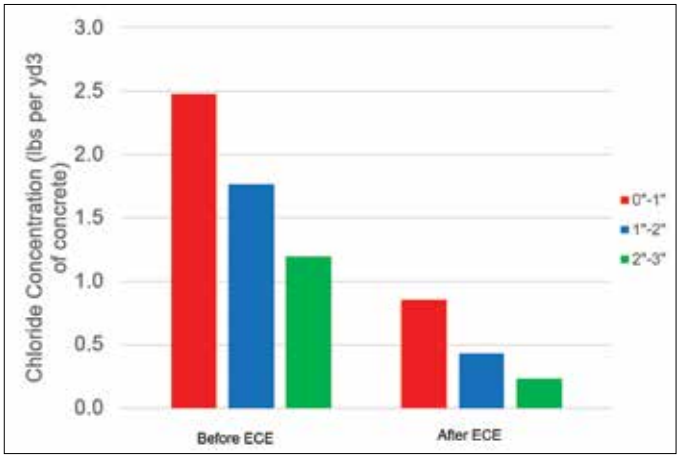

Fig. 9: Results of chloride sampling before and after ECE treatment

In this case, the temporary anode utilized was a mixed metal oxide coated titanium mesh. The building was separated into treatment zones and the re-alkalization process was conducted throughout the entire façade. Once each section of the façade was prepared, the treatment was typically run for 7 days with the anode and conductive media being kept wet with a potassium carbonate solution. Once the treatment was complete in a section, the system was removed and the next treatment zone was prepared. This process was repeated throughout the whole building façade.

To ensure that the re-alkalization process was effective, cores where removed after treatment and tested with phenolphthalein, a pH indicator. Phenolphthalein reacts to an alkaline environment of pH 9.5 or greater by changing color from clear to a deep purple/pink. Figure 13 depicts a core collected prior to the re-alkalization treatment and a core collected after re-alkalization. Both cores had been sprayed with phenolphthalein. The core prior to re-

Fig. 10: Typical pier at 20 years after ECE treatment

Fig. 11: Potential deterioration at leaking joint

Fig. 12: University of Chicago – University Hall

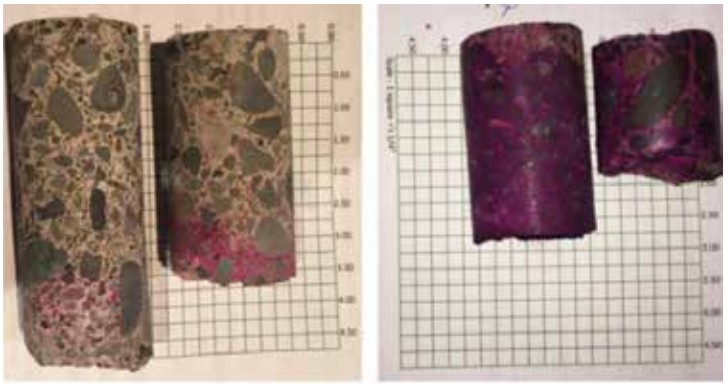

Fig. 13: Pre and post-treatment core testing

Table 1: Environmental Impacts Deferred by I-480 and University of Chicago Projects

Description	I-480	University of Chicago
Concrete Maintained In-place: cy (m^3)	6,700 (5,125)	1,300 (995)
Release of Nitrous Oxide: lbs (kg)[5]	6,530 (2,962)	1,267 (575)
Release of Carbon Dioxide: tons (kg)[1]	3,663 (3,323,018) (equivalent to annual emissions of 833 people)[2]	711 (645,008) (equivalent to annual emissions of 162 people)[2]
Use of Natural Resources: tons (kg)[3]	13,191 (11,966,674)	2559 (2,321,486)
Use of Potable Water (Personal Daily Use): days/person[4]	1,695	329
Solid Waste in Landfill: tons (kg)[6]	15,975 (14,492,276)	2633 (2,388,617)
Waste Heat Generation: MMBTU (GJ)[7]	15,141 (15,975)	2,938 (3,100)

[1] Based on CO2 emissions of 0.13 kg CO2/kg concrete + 2.8 kg CO2/kg of steel, Scrivener (2014) *Options for the Future of Cement*, *The Indian Concrete Journal*, Vol.88, Issue 7, pp 11-21.

[2] Based on 20 metric tons per person per year; https://www.sciencedaily.com/releases/2008/04/080428120658.htm

[3] 1.6 tons of ore to make 1 ton of pig iron, https://www.worldsteel.org/steel-by-topic/raw-materials.html; 1.5 tons of raw materials to make 1 ton of cement, http://ietd.iipnetwork.org/content/raw-material-preparation; and raw material calculations for coarse and fine aggregates are based on typical mix proportions.

[4] Only mixing water was considered at 100 gal of water/day per person, https://www.phila.gov/water/educationoutreach/Documents/Homewateruse_IG5.pdf

[5] 1.8 kg Nox /tonne clinker, https://www.ademe.fr/sites/default/files/assets/documents/33324_guide_nox_anglais.pdf

[6] Mass of retained concerete is volume of retained concrete x concrete density

[7] A.K. Schindler, K.J. Folliard, *Heat of Hydration Models for Cementitious Materials*, ACI Mater. J. 102 (2005) pp 24–33; Summerbell, D. L., Barlow, C. Y., and Cullen, J. M. (2016), *Potential Reduction of Carbon Emissions by Performance Improvement: A Cement Industry Case Study*, *Journal of Cleaner Production*, 135, pp 1327-1339; and Kuroki, T., Kabeya, K., Makino, K., Kajihara, T., Kaibe, H., Hachiuma, H., and Fujibayashi, A. (2014), *Thermoelectric Generation Using Waste Heat in Steel Works*, *Journal of Electronic Materials*, 43(6), pp 2405-2410.

alkalization has a pH below 9.5 as the phenolphthalein remained clear. The core collected after the treatment process turned purple/pink due to the phenolphthalein reacting with the high pH concrete indicating that the concrete pH has been increased. All treatment zones had cores removed after the treatment process to verify pH with phenolphthalein testing.

Sustainability

In both of the presented projects, steel reinforced concrete was exposed to contamination that led to serious corrosion and subsequent physical deterioration. The electrochemical treatments improved the environment around the reinforcement and returned the steel to a passive state.

Maintaining existing concrete in place is not only an economical benefit, but also provides a substantial environmental benefit over replacement. Concrete production and transportation generates emissions, wasted heat generation, and consumption of natural resources. In the I-480 project, the useful service life of 6,700 cy (5,125 m^3) of concrete was extended and maintained, while in the University of Chicago project, 1,300 cy (995 m^3) of concrete was protected.

Rebuilding these concrete elements would have created a significant negative impact on the environment. Table 1 estimates the environmental impact of replacing these structures that have been prevented by the use of the electrochemical treatments.

CONCLUSION

Electrochemical chloride extraction and re-alkalization are effective and economically beneficial methods of addressing active corrosion and extending the effective service life of reinforced concrete structures. The use of these electrochemical treatments positively contributes to the structure's sustainability and improved environmental impact.

REFERENCES

1. ICRI 510.1, *Guide for Electrochemical Techniques to Mitigate the Corrosion of Steel for Reinforced Concrete Structures*, International Concrete Repair Institute, St. Paul, MN 55114, 2013, 24 pp.

ACKNOWLEDGEMENT

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Moisture Effects on Resilient Floor Covering and Coatings

by Pierre Hebert

For many years, the moisture-related failure of resilient floor coverings and coatings installed over concrete were unfairly blamed on the flooring products themselves, or that the flooring contractor did not properly install the floor. Today, both the flooring and concrete industries recognize, and better understand, the challenges involved with installing any type of moisture-sensitive material over a concrete sub-floor.

When a concrete slab rests directly on the ground, installation failures can occur due to the effects of excess moisture in the slab, or from the transmission of moisture from the ground when an effective vapor retarder is not present directly below the slab. A slab may seem dry, but without an effective vapor retarder directly below the concrete, once the surface of the slab is covered by a low-permeance floor covering or coating, the slab will reach equilibrium with the relative humidity in the ground that can reach up to 100%, regardless of the depth of the water table.

The passage of moisture from the ground, into, and through an unprotected concrete slab-on-ground is referred to as the Water Vapor Transmission Rate (WVTR). The rate that moisture emits from the surface of a slab is referred to as the Water Vapor Emission Rate (MVER).

Concrete itself is an very alkaline material with a higher concentration of soluble alkali salts typically found in the very surface region of a slab than deeper in the body. If the level of moisture in a slab is high enough to place these surface-region alkali salts into solution, it can have an adverse affect on flooring and coating materials. Elevated concrete slabs are also subject to similar concerns if the moisture level in the concrete is high.

Elevated levels of moisture and/or moisture-induced alkali solutions that are present below a floor covering or coating installation can cause the following problems:

1. Adhesive deterioration
2. Bumps, ridges or bubbles
3. Color change
4. Mold, mildew, or bacteria growth
5. Efflorescence (alkali build-up at the tile joints)
6. Peaking or curling of vinyl tiles
7. Osmotic blistering

Any of these conditions can occur at any time after installation if a high enough level of moisture is present or develops below the floor covering or coating.

Proper sitework, slab construction, subfloor preparation, and environmental controls can help make a successful installation more likely. However, since installers and resilient floor manufacturers have little control over these factors, installation failures due to the presence of excess moisture and alkali are generally not warranted by the manufacturer. A review of the manufacturer's warranty is recommended.

The following guidelines are offered as suggestions only for the use of the facility owner and design team in preparing specifications for facilities where resilient floor coverings are to be installed. The issuance or use of these guidelines shall not be construed to mean that the Resilient Floor Covering Institute (RFCI), the flooring contractor, or the floor covering manufacturer accepts any responsibility for the construction or performance of the concrete slab.

ASTM F710[1], *Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring,* offers important information about preparation of the substrate before any installation work begins. The reader is encouraged to consult this standard.

SITE PREPARATION

The single most important consideration affecting resilient floor covering installations on concrete in contact with the ground is to ensure that the ground has been taken completely out-of-play by specifying and installing an extremely low-permeance vapor retarder that complies with the requirements of ASTM E1745[2], *Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs*, Class A. Preventing an alkali solution from developing directly beneath a resilient flooring installation eliminates a multitude of potential problems.

Assuming there is no control over the site selection, there are many preparatory procedures that can be employed before slab placement begins.

Following is a list of considerations:

1. Obtain a geotechnical survey to determine geological strata and water table levels
2. Survey records for historical data on ground water and flooding situations for the area
3. Determine water drainage characteristics for the area
4. Provide detailed instructions for any excavation required
5. Properly prepare the subgrade where required with appropriate fill
6. Where possible, utilize 4 in (100 mm) to 8 in (200 mm) of washed and graded gravel over acceptable subgrade to create a capillary break. Place a thin layer of sand or crusher fines over the surface of coarse gravel to choke off the surface and create a smooth surface plane
7. Insure positive gravity outflow to resist buildup of hydrostatic pressure
8. Implement mechanical means of achieving outflow if gravity outflow is not possible, as with many below-grade slabs

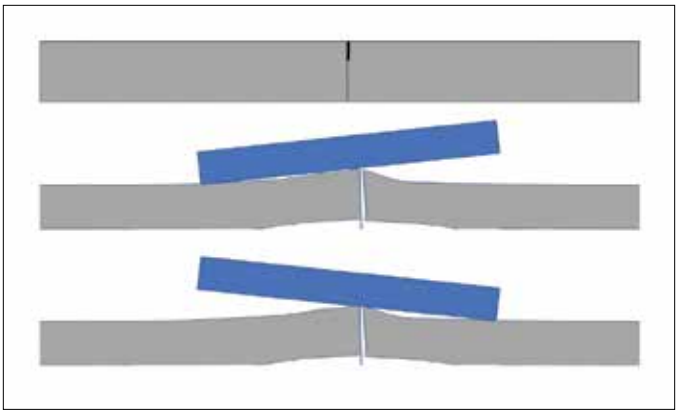

Fig. 1: Slab curling

9. Install a low-permeance vapor retarder conforming to the requirements of ASTM E1745, Class A, directly below the slab. Make sure that the seams are overlapped and taped and the membrane is not punctured during the concrete placement.

CONCRETE FLOOR AND SLAB CONSTRUCTION

Resilient flooring manufacturers require that new and existing concrete subfloors meet the requirements of the latest edition of ASTM F710.

After the site has been properly prepared, a vapor retarder with a permeance of less than 0.1 perms (0.2 metric perms), as measured in accordance with ASTM E96/E96M[3], *Standard Test Methods for Water Vapor Transmission of Materials*, must be installed directly under the concrete slab for on and below grade installations. The permeance requirements can be found in ASTM E1745. The retarder must be resistant to deterioration as well as to puncture during construction and must remain intact and continuous.

The specific composition of the concrete floor should be in accordance with the guides and practices of the American Concrete Institute (ACI) but should have a minimum density of 100 lbs per cubic foot (1600 kg/m^3). Information for construction of many concrete floors is contained in the guides and standard listed below:

1. ACI 302.1R[4], *Guide to Concrete Floor and Slab Construction*
2. ACI 360R[5], *Guide to Design of Slabs-on-Ground*
3. ACI 223R[6], *Guide for the Use of Shrinkage-Compensating Concrete*
4. ACI 302.2R[7], *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials*
5. ASTM F710, *Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring*

If joints are present in the slab, they should be checked for curl. If curl is not present and the joint is considered to be non-moving, the joint should be cleaned and filled with

Fig. 2: MVER test in progress (photo courtesy of ICRI)


Fig. 3: Relative humidity (RH) testing being performed on test slab (photo courtesy of ICRI)


Fig. 4: pH testing using indicator paper (photo courtesy of ICRI)

a moisture-insensitive Portland cement-based patching compound. If the joints are curled (Fig. 1), the joints must first be stabilized and rendered static before filling the joints.

Experience has shown that properly formulated concrete, specifically with respect to water/cementitious ratios, will produce benefits of lower porosity concrete.

Some additives promoting shortened cure time, or easier/longer concrete workability, may increase concrete's natural alkalinity leading to increased risks of resilient flooring failure if sufficient moisture is present within the slab to place the soluble alkalis into solution below the floor/adhesive system.

TESTING FOR MOISTURE IN CONCRETE SLABS (New or Existing Slabs)

Resilient flooring manufacturers require that all concrete substrates, both new and old, be tested for moisture content to determine if the concrete is acceptable under the manufacturer's installation requirements. There are several tests available for moisture testing including those listed below. The specific moisture test method required will be included in the flooring manufacturer's installation specifications.

Calcium Chloride Moisture Vapor Emissions Rate (MVER)

MVER tests have been used to measure the moisture emission rate of a concrete slab since the 1960's (Fig. 2). The test method is designated as ASTM F1869[8], *Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride*. Each flooring manufacturer recommends the maximum pounds/1000 sq. ft. / 24 hours for a flooring product before it is installed.

Internal Relative Humidity (In-Situ)

RH tests have become more widely used today because MVER testing only provides information for moisture present in the top ½ to ¾ in (13 to 19 mm) of the concrete (Fig. 3). RH testing provides a more meaningful determination of the moisture in a concrete slab by using probes to measure the concrete's internal relative humidity. The probes are placed in holes that are drilled to a depth of 40% of the thickness of the concrete slab. The RH measurement at 40% of the slab thickness is a predictor of what the RH level will be in the slab, top-to-bottom, once it is covered. The test is designated as: ASTM F2170[9], *Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes*. Each flooring manufacturer recommends a maximum relative humidity (RH) % for the concrete slab before a floor can be installed. Internal or "in-situ" relative humidity provides an indication of the potential moisture that may come out of the slab.

Resilient flooring products can have different moisture limit requirements depending on the construction of

the product, the specific adhesive utilized, or based on the type of installation (full glue down, floating, etc). The resilient flooring manufacturer should be contacted for this information as well as information concerning concrete surface preparation, adhesives or installation. Most of this information can be found on the flooring manufacturer's website or technical data sheets.

Consider also using moisture meters which can help locate "hot spots" (which can indicate locations where high moisture conditions are likely present). Refer to ASTM F2659[10] for more information about electronic meter testing.

Test Results Assessment

All moisture test results indicate the condition of a concrete slab for the actual area tested at the time the test was performed. The most accurate test results will only be achieved when taken in a room acclimated to its expected normal environmental condition (temperature and humidity). Moisture vapor emission rates will vary from one area to another, and over time for numerous reasons beyond the control of the flooring contractor or installer.

Surface Alkalinity on Concrete Substrate

A high pH alkali solution that develops below a floor covering has been known to degrade adhesives and resilient floor coverings which can lead to poor appearance, maintenance difficulties, and in extreme cases, total floor failure. The measure of alkalinity is typically expressed in terms of a pH number. The pH scale ranges from 1 to 14 with 7 being neutral. Numbers moving upward from 7 indicate increasing alkalinity. A pH range between 7 and 9 is generally considered as acceptable. A pH reading above 9 generally requires corrective measures and indicates the presence of a high concentration of soluble alkali salts. Testing is typically performed using pH indicator paper (Fig. 4), an electronic pH meter, or in some cases, a phenolphthalein solution. Check with the manufacturer regarding their specific recommendations.

Who Should Conduct These Tests?

General contractors, concrete finishers and floor covering installers, in general, do not have all the expertise necessary to determine if the slab is ready to receive the floor covering or the floor finish. Independent professionals and testing laboratories have or should have the necessary equipment to measure the level of humidity and pH as well as have the proper training to obtain specific and quantifiable results. To that end, contacting an ICRI Certified Concrete Slab Moisture Testing Technician (CCSMTT) should be on your to do list! CCSMTT's undertake a rigorous training program in which the individual must demonstrate comprehensive knowledge of the following ASTM standards:

- F710, *Preparing Concrete Floors to Receive Resilient Flooring; Section 5.2 pH Testing*
- F1869, *Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride*
- F2170, *Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*
- F2659, *Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter*
- F3191[11], *Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring*

More information can be found on ICRI's web site (icri.org/page/ccsmtt_list) where certified individuals are listed by state/province.

CONCLUSION

Where a concrete slab-on-ground is not properly protected from moisture below, or where there is not sufficient time in the project schedule for a protected slab to dry naturally to an acceptable level, it will be necessary to install a topical moisture mitigation system. Refer to manufacturer's recommendations as well as ASTM F3010[12].

Note that ICRI Committee 710's subcommittee 710-B is developing a guideline on "Moisture-Related Issues with Concrete Floor Finishes" anticipated to be available this year.

REFERENCES

1. ASTM F710-17, *Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 8 pp.

2. ASTM E1745-17, *Standard Specification for Water Vapor Retarder Used in Contact with Soil or Granular Fill Under Concrete Slabs*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 3 pp.

3. ASTM E96/E96M-16, *Test Methods for Water Vapor Transmission of Materials*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 14 pp.

4. ACI Committee 302, *Guide to Concrete Floor and Slab Construction* (ACI 302.1R-18), American Concrete Institute, Farmington Hills, MI.

5. ACI Committee 360, *Guide to Design of Slabs-On-Ground* (ACI 360R-10), American Concrete Institute, Farmington Hills, MI.

6. ACI Committee 223, *Guide For the Use of Shrinkage-Compensating Concrete* (ACI 223R-10), American Concrete Institute, Farmington Hills, MI.

7. ACI Committee 302, *Guide for Concrete Slabs That Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06), American Concrete Institute, Farmington Hills, MI.

8. ASTM F1869-16a, *Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 4 pp.

9. ASTM F2170-18, *Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 7 pp.

10. ASTM F2569(10)-15, *Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 6 pp.

11. ASTM F3191-16, *Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 4 pp.

12. ASTM F3010-18, *Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings*, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, 4 pp.

Pierre Hebert is the Manager of Technical Services at MAPEI Inc (Canada) and has provided product support to customers and the professional community for 30 years. He is a member of CSC (Construction Specification Canada, the equivalent to AIA in the USA) and he chairs one of the committees at the Montreal Chapter. He's a member of ICRI's Executive Committee, a member of ICRI Committee 320 Materials and Methods, and a member of the Moisture Related Issues with Concrete Floor Finishes sub-committee. He's a member of the ACI (American Concrete Institute). Pierre supported the SSPC (The Society for Protective Coatings) on reviewing a number of documents. He's a member of the TTMAC (Terrazzo, Tile, Marble Association of Canada) on which he participates on the Technical Research and specification committee, and the Inspection Committee Report, and he's the Director for the supplier division Eastern region. He is one of the co-authors of a Position Document about moisture and floor coverings by the FQRS (Fédération Québécoise des Revêtements de Sol) and the president of the association. Pierre has also authored numerous articles and conferences.

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I Wanna Rock! The Significant Role of Aggregates in Creating Great Concrete Repair Materials

By Joe Rizzo

This article discusses how the proper selection and gradation of coarse and fine aggregates significantly affect the performance of concrete and mortar including their strength, durability and flow.

Aggregates, by far, make up the majority of the weight of concrete, comprising more than 70% of the total weight. Yet when judging the factors affecting performance, more attention seems to be given to the other components in the mix, rather than the sand and stone which make up so much of it. Though aggregate is often viewed as little more than a low-cost inert filler, its function is integral to the performance of the concrete.

In concrete repair applications, the significance of aggregate is magnified since the concrete or mortar is expected to perform under more challenging conditions than the original. Aggregates affect every significant property of concrete repair materials including flow, strength and shrinkage. When improperly selected, proportioned, graded or cleaned, aggregates can lead to concrete cracking, delamination and loss of durability even at a low water/cementitious (w/c) ratio with performance enhancing admixtures.

SIZING AND GRADATION

One way to design a concrete mix is to determine the amount of strength that is required for its intended use and to specify an amount of cement historically known to provide that level of performance. For example, a high strength concrete may require 658 lbs (298.5 kg) of portland cement, mixed with no more than 276 lbs (125.2 kg) of water (0.42 w/c), to dependably reach the minimum strength. Admixtures may be specified to achieve a particular flow, or other beneficial properties.

In order to calculate the quantities of the sand and stone and get a complete mix design, the following steps could be taken using the volumetric method of proportioning concrete:

1. Calculate the volume of the known quantity components using their specific gravity. For cement at 3.15 specific gravity (s.g.), which is typical for portland cement, and water at the above quantities, the volume of the mix is 7.8 cubic feet (0.22 cubic meters).

2. Subtract the volume of the cement and water from 27 cubic feet (1 cubic yard) [0.76 cubic meters]. The required volume of aggregate in this mix is approximately 19.2 cubic feet (0.54 cubic meters).

3. Calculate the required weight of the aggregate, knowing its weight and specific gravity. 19.2 cubic feet (0.54 cubic meters) of aggregate at 2.6 s.g. is 3,095 lbs (1404 kg). Note that this assumes that the coarse and fine aggregates have the same specific gravity. Though not rare, that is not always the case and is being done here to simplify calculations.

The very simplified theoretical mix design, not accounting for moisture and admixtures, is therefore:

- 658 lbs (298.5 kg) portland cement
- 3,095 lbs (1404 kg) of coarse and fine aggregate combined
- 276 lbs (125.2 kg) water

It can immediately be seen that the weight of aggregate dwarfs the other components. Further, it has been demonstrated by experiments that the concrete will gain the desired strength by using the amount of cement and water determined by the historical data, almost independently of the aggregate. Well, that's the theory anyway. The reality is that the quality of the concrete, other than its compressive strength, may render it unusable if great care is not taken in selecting the proper aggregate and aggregate distribution. Though admixtures can significantly alter the properties of concrete, a more prudent next step would be to evaluate the nature and properties of this most prevalent portion of the concrete.

If the unrealistic premise that sand and stone are simply inert fillers is temporarily assumed to be true, some extreme assumptions can be made to illustrate a point. A mix of the specified design can be made using nothing but 2 in (50.8 mm) stone and another with only fine particle sand. The expectation of achieving the desired strength at 28 days is still realistic if the amount of cement and water are not varied. However, it is easy to predict the results. The 2 in (50.8 mm) stone mix appears to have very little cement in it and the stones protrude from the surface of the concrete, since most of the cement is in the voids between the aggregate. Even though the concrete is somewhat flowable, the cement flows away from the stones. Finishing is next to impossible, with the trowel scraping over the top of bare rocks. If the 2 in (50.8 mm) stone is uniform and cubically shaped, heavy vibration / compaction might fortuitously cause the stones to settle and stack neatly (aggregate is rarely so square that it resembles dice and stacks in that manner). If possible, this would minimize the voids between each stone and a good amount of cement will be seen on top of the mix as the stones settle. Of course upon hydrating, with no aggregate on the surface, there is nothing to prevent extreme shrinkage and cracking even at the relatively low w/c. This is not a usable, or effective mix.

Moving on to the highly sanded mortar (mortar being a mix of sand and cement, with no stone) a very different product is observed. The mortar is not bony at all – bony being an adjective used to describe concrete with too much coarse aggregate in it. On the contrary it can be shaped, quite well since the mix will not flow at all. A finish is achievable even though the surface may tear, since again much of the cement is in the voids between the single size small particles. Essentially what has been created is a version of masonry mortar with the consistency of a loose sculpting clay. This is possibly an effective mix in certain applications where no flow is required, but it is not concrete that can be flowed as a slab, or poured into forms. Further problems which would occur are long term as the small sand particles can easily be abraded from the hardened mortar without any large aggregate to stabilize them in the matrix.

Figure 1 shows how adding different sizes of particles in a container decreases the overall volume of voids between the particles. This is intuitively easy to understand; the progressively smaller particle sizes nest in the voids between the successively larger particles. The void volume between single size particles is the same regardless whether the particles are large or small. This is because although the voids between smaller particles are also smaller, the number of particles and individual voids are proportionately larger. In the two extreme example mixes, this made itself evident in different ways; the large stones produced a mix where the cement moved through the large voids in a non-cohesive manner, whereas the fine sand, also lacking in cement, showed a complete absence of flow.

Concretes using multiple sizes of well graded aggregates have less potential shrinkage since there are fewer voids, i.e. pockets of unaggregated cement in the mix. Studies and experiments have found that these mixes handle and place better than poorly graded concretes. The Portland Cement Association (PCA)[1] states, “In general, aggregates that do not have a large deficiency or excess of any one size and give a smooth grading curve will give the most satisfactory results.”

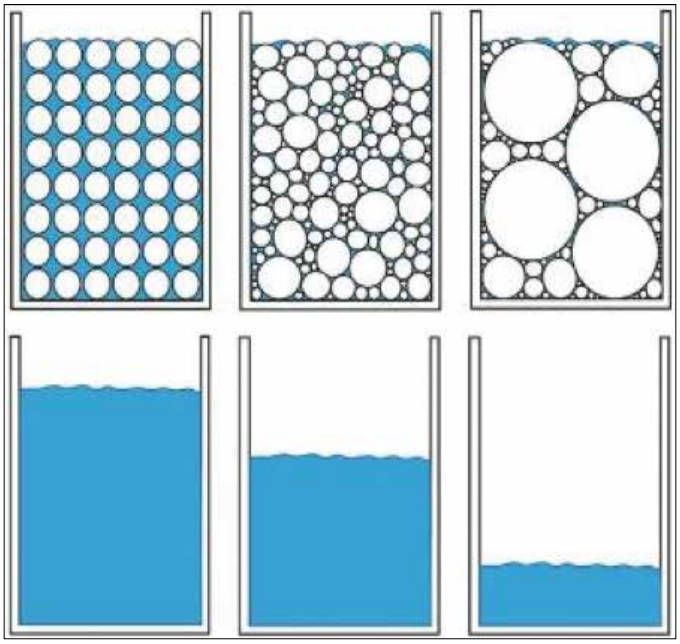

Fig. 1: The effect of varying aggregate size on void filling

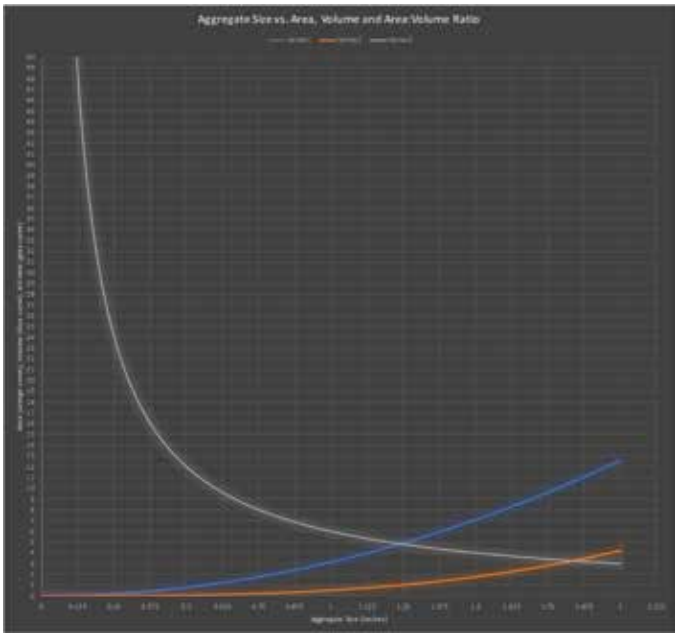

Fig. 2: The effect of increasing aggregate diameter on area, volume and area to volume ratio (PCA)

Figure 2 further elucidates the characteristics of the example extreme single size aggregate mixes. The blue and orange curves represent how the aggregate area and volume respectively increase with particle size. As particles get larger, their volume increases faster than their surface area – this can be seen by the way the blue curve pulls away from the orange curve. The gray curve quantifies this by showing how the ratio of area to volume decreases asymptotically toward 0 as aggregate size increases. The larger the surface area of a particle relative to its volume, the more friction it has and the more it resists flowing. A concrete with very small particles or fines has considerably greater resistance to flow vs. one with larger particles. It is for this reason that (in general) concrete flows better than mortar given similar cement content and w/c ratio. It is also the reason that all manufacturers of concrete repair materials mandate that when extending their materials with coarse aggregate it must be clean and washed to remove the flow robbing characteristics of low volume, large surface fines.

The gray curve turns the corner toward the more horizontal portion of the asymptote at around 3/8 in (9.5 mm), which is recognized by the PCA to be the first aggregate size to be considered coarse. A concrete with a minimum 3/8 in (9.5 mm) aggregate is approaching optimal flow for a given w/c ratio. At that size, the aggregate is large enough to have negligible resistance to flow compared to fines, but can still be used in areas as thin as 1-1/8 in (28.6 mm) given ACI's[2] parameters that the largest aggregate size can be no larger than 1/3 the pour thickness. This makes a 3/8 in (9.5 mm) aggregate size ideal for the majority of repair applications from just over 1 in (25.4 mm) thick to full depth.

A SURE WAY TO ENSURE PROPER GRADATION

A balance must be found between the use of graded aggregates which include small sand sizes to minimize voids and the flow advantage and economy of large size aggregates. Luckily, ASTM C33[3] strikes that balance by defining an empirically determined gradation of seven (7) fine aggregate particle sizes and additional gradations for coarse aggregate that have been shown to optimize placement and in-place properties. Figure 3 shows an ASTM C33 gradation including the 7 fine sizes and an additional 3/8 in (9.5 mm) coarse size. All the material passes the 1/2 in (12.7 mm) sieve, meaning there are no 1/2 in (12.7 mm) particles.

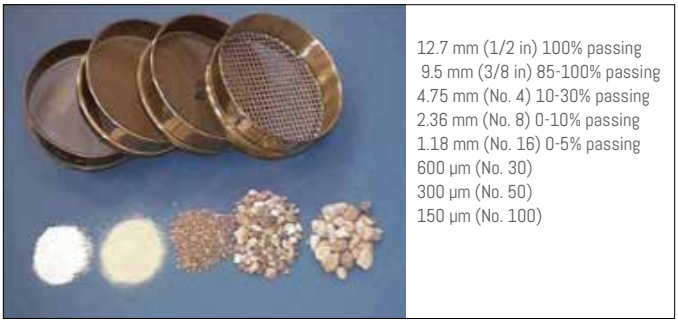

Fig. 3: ASTM C33 gradation for 3/8 in (9.5 mm) nominal maximum aggregate size

AGGREGATE SILICA REACTION (ASR) AND AGGREGATE SHAPE

Another fact that is intuitively obvious: rounder aggregate flows better than crushed stone because, wait for it, it's round and it rolls. Most manufacturers of repair materials, in addition to specifying clean, washed and 3/8 in (9.5 mm) size coarse aggregate when extending their products, also almost universally specify pea gravel, not crushed stone, to take advantage of the better flow characteristics.

ASR is a reaction in concrete that can happen between the silica in the aggregate and the alkali hydroxides in cement (Fig. 4). The reaction causes expansion which leads to concrete cracking. Typically, this is not a concern when purchasing commercially available concrete repair materials, because the manufacturer will have accounted for this potential and will be using aggregates and cement that are compatible, and will not undergo the ASR reaction in normal circumstances. Ready-mix concrete suppliers also take ASR into consideration in their selection of raw materials.

Caution needs to be exercised when extending with coarse aggregate in the field for thicker applications. In this situation, two unknown materials are being brought together creating a condition under which ASR may occur. This is another reason that a bagged engineered concrete with properly sized and selected coarse aggregate pre-added by the manufacturer is worth considering. This type of product will ensure that the aggregate meets the requirements discussed in previous sections, but also minimizing or eliminating ASR potential.

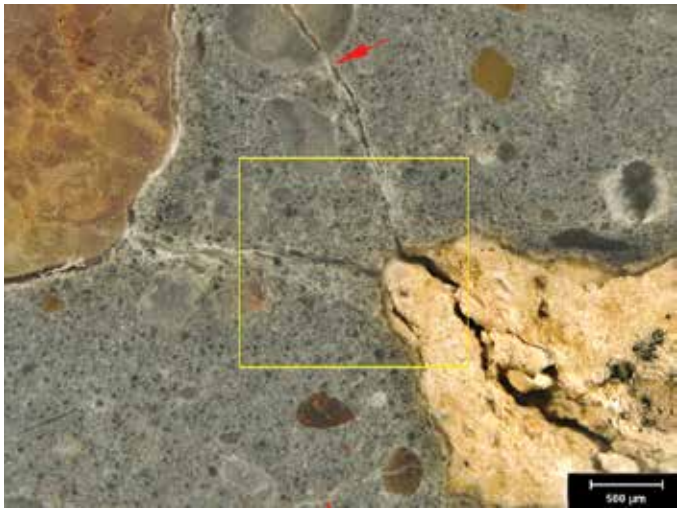

Fig. 4: ASR identified in petrographic analysis

TAKING ADVANTAGE OF KNOWLEDGE

Designers, material specifiers and users should take particular note to call for cement-based materials that contain properly graded aggregates per ASTM C33. This data is not always shown on data sheets of repair products, which tend to show more information on in-place performance than material make-up and usability. Additionally, if the repair area has appropriate clearances, consider a pre-packaged concrete repair material that is formulated with 3/8 in (9.5 mm) compatible coarse pea gravel included in the mix. In addition to all the performance advantages and avoidance of alkali aggregate reactions, you might be surprised how much easier it is to mix and place a properly engineered concrete.

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ACKNOWLEDGEMENT

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Introduction to the ACI 562 Code Article Series

by Keith Kesner

The development of the ACI 562-16 Standard (*Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures and Commentary*) represents a milestone event in the concrete repair industry. ACI 562 is the first material specific building code for repair of existing structures and the first code that was specifically developed to work with the International Existing Building Code (IEBC). ACI 562 was developed to improve the performance of concrete repairs, and ensure that repaired concrete structures have adequate levels of structural reliability and durability.

More significant than the development of ACI 562, is the growing trend of adoption by reference of ACI 562 into state-wide building codes and building code official approved use of ACI 562 as a standard for repair of existing concrete structures. The growing use of ACI 562 necessitates development of documents that provide context and background on the code provisions to help ensure successful use of the standard.

ACI and ICRI members recognize and embrace the need to provide design professionals a fully-developed set of documents that support use of the ACI 562 repair code. The developed supporting documents include the jointly published ACI / ICRI Guide to the Code for Assessment, Repair and Rehabilitation of Concrete Buildings, and an article series that was published in ACI's Concrete International (CI). The ACI / ICRI Guide was initially published in 2013, and was updated with the publication of ACI 562-16. The guide provides both an explanation of the code provisions and worked examples that describe use of the code on typical concrete repair projects.

The CI article series was developed to provide detailed explanations and the rationale behind specific items in the ACI 562 code. These articles have included explanations of terminology, the reliability basis for the unsafe conditions provisions, load testing requirements and other topics. These articles were developed with a goal of raising awareness for specific topics covered in ACI 562. The ACI / ICRI Guide focused on "how" the ACI 562 provisions worked. The CI article series attempted to explain more of the "why" some of the code provisions exist. The CI article series was also written to inspire discussion and use the resulting dialogue to identify potential code needs and research areas.

In the hopes of educating and eliciting discussion from ICRI members, the CI article series will be reprinted in the Concrete Repair Bulletin. For this issue, ICRI will start with Part 1, "Standardization of Terminology" from the 11-article series "Evolution of the ACI 562 Code," authored by Gene Stevens, ACI 562 committee member, and Keith Kesner, ACI 562 Committee Chair. ICRI will follow up with further articles from the series in upcoming issues of the CRB.

ICRI and members of ACI 562 are looking forward to receiving comments and other feedback on the articles.

Keith Kesner is a Senior Project Manager with CVM Professional in King of Prussia, PA. He is a structural engineer with over 25 years of professional experience in the evaluation of existing structures. He is the current chair of ACI Committee 562, and is a Fellow of the American Concrete Institute (ACI) and a member of ICRI. He has engineering degrees from the University of Connecticut and Cornell University, and is a licensed professional engineer in several states.

Evolution of the ACI 562 Code—Part 1

by Gene R. Stevens and Keith Kesner

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EXISTING CONCRETE STRUCTURES—LEARNING LESSONS AND ADVANCING SOLUTIONS

ACI Committee 562, Evaluation, Repair, and Rehabilitation of Concrete Buildings, strives to advance the practice of engineering and improve the repair and rehabilitation of existing concrete structures. The Education subcommittee of Committee 562 (ACI 562-E) is dedicated to helping engineers, building officials, contractors, owners, inspectors, and others by conveying information in more detail than is possible solely through the ACI 562 Code and Commentary. To this end, and in the hope of improving these documents, members of ACI 562 are providing a series of articles under the main theme, "Existing Concrete Structures—Learning Lessons and Advancing Solutions."

Through this series, the committee members explain the rationale behind some of the upcoming changes in the ACI 562 Code as well as share example problems, ideas, concepts, and the thoughts discussed in ACI 562 Committee meetings. It's also anticipated the series will help the committee address questions from the engineering and construction sectors, solicit answers to problems, and review areas of needed research.

In each article, a topic related to the evaluation, repair, or rehabilitation of existing concrete structures is addressed. Topics will be selected with the intentions of increasing awareness, improving understanding, and expanding perspectives related to this important theme.

The first set of articles will discuss key features in the updated version of the ACI 562 Code. The updated Code has been reviewed by the ACI Technical Activities Committee (TAC) and is in the public review phase until February 18. The committee members are looking forward to receiving comments on the revised document and the eventual publication of the Code.

Clarity and precision are required in any code or standard. In particular, terminology, definitions, and explanations must be specific. During the drafting of the next edition of *Code Requirements for Evaluation, Repair, and Rehabilitation of Concrete Buildings (ACI 562-13) and Commentary*, ACI Committee 562 extensively debated the terminology used in both the existing and new documents. In particular, the terms **evaluation** and **assessment** garnered close attention.

EVALUATION OR ASSESSMENT?

While these terms have been used in a number of existing standards, they have not been consistently defined. For example, the International Code Council's *International Existing Building Code* (IEBC) has no definitions for these two terms but uses the term "evaluation" extensively.

Documents produced by the Federal Emergency Management Agency (FEMA) and the Applied Technology Council (ATC)—such as FEMA-178[1] and ATC-14,[2] respectively—have used "evaluation" when referring to the process of determining the current seismic resistance of existing buildings.

Standards and guidelines produced by the American Society of Engineers (ASCE) include both terms. ASCE/SEI 41-13[3] uses a circular definition of evaluation: "An approved process or methodology of evaluating a building for a selected Performance Objective." However, ASCE/SEI 30-00[4] defines assessment as: "Systematic collection and analysis of data, documentation, evaluation, and recommendations regarding the various portions of an existing building envelope that are the subject of the investigation." ASCE/SEI 11-99[5] also defines the assessment procedure and places structural evaluation under the umbrella of the assessment process. Per this document, **structural evaluation** is: "The process of determining the structural adequacy of the building or component for its intended use and/or performance. Evaluation by its nature implies the use of personal and subjective judgment by those functioning in the capacity of experts." Also per this document, **structural assessment** is:

"Systematic collection and analysis of data, evaluation, and recommendations regarding the portions of an existing building which would be affected by its proposed use."

For the updated ACI 562 Code, ACI Committee 562 adapted these definitions for concrete structures:

- **structural evaluation (evaluation)**—the process of determining, and judging the structural adequacy of a structure, member, or system for its current intended use or performance objective.

- **structural assessment (assessment)**—the process of investigating by systematically collecting information that affects the performance of an existing structure; evaluating the collected information to make informed decisions regarding the need for repair or rehabilitation; detailing of findings as conclusions; and reporting recommendations for the examined structural concrete work area (member, system, or structure).

Based on these definitions, the committee has revised the title of the updated version of the Code—replacing the term "evaluation" with "assessment" and "concrete buildings" with "existing concrete structures" in ACI 562-13.[6] The committee also provided extensive commentary on the two terms.

EVALUATING TERMS

Further reflecting the importance of the terms, ACI Committee 562 provided in-depth discussions of the rationale behind each.

> *Commentary:* **structural evaluation**—this definition is adapted from ASCE/SEI 11—"The process of determining the structural adequacy of the structure or component for its intended use and/or performance.
>
> Evaluation by its nature implies the use of personal and subjective judgment by those functioning in the capacity of experts." An evaluation should determine, to the best of the licensed design professional's knowledge, the level of quality (structural adequacy, serviceability, or durability) of an existing structure based upon a measured criteria and the judgment of the licensed design professional. An evaluation may require professional judgment to gage structural adequacy. Structural analyses may be required to determine possible ranges of existing structure capacities and variations in demands. The goal of the evaluation process is to appraise the in-place condition to determine adequacy for current or proposed future use. Structural appraisal requires determining capacity and demand, which may vary widely depending on the acquired information, tests, models, and analyses; determining the demand-capacity ratios; and judging structural reliability limits, which may be open to interpretation based on project requirements, structural experience, knowledge, and past performance.
>
> Evaluation activities may include:
> a) Tests to confirm reinforcement location, strength of material properties or structural capacity of existing members or systems or for presence of contaminants
> b) Analysis of test results to establish reinforcement, statistical equivalent material properties, limits of faulty construction, and structural capacity
> c) Screening of observations and tests for mechanisms and causes of damage, distress, and deterioration
> d) Establishing the assessment criteria
> e) Calculating demand loadings, serviceability limits, lateral displacements, and durability requirements
> f) Analysis of the structure to determine the capacity of the structure to withstand current or future load demands and comply with serviceability limits:
> (i) Determination of demand-capacity ratios to appraise structural adequacy, ascertain classifications, and judge the need for repair and rehabilitation
> (ii) Determination of maintenance requirements necessary for the service life of the structure
>
> *Commentary:* **structural assessment**—this definition with specific details for existing concrete is adapted from ASCE/SEI 11—"Systematic collection and analysis of data, evaluation, and recommendations regarding the portions of an existing structure which would be affected by its proposed use." Herein, assessments should be limited to the work area and may include:
> a) Investigation of the in-place condition of the existing structure by:
> (i) Collection and review of field data for the structure, such as geometry, material strengths, conditions, symptoms of distress, extent of damage, measurement of displacements, environment factors, and reinforcement sizes and placement
> (ii) Collection of background data, such as plans, construction records, original, current, and Code governing existing buildings, and historical events
> b) Evaluation of an existing structure, member, or system of the work area (see commentary for structural evaluation)
> c) Detail findings and conclusions of the investigation and evaluation include:
> (i) Define the existing structure, member, or system rehabilitation category using the assessment criteria of this Code
> (ii) Identify the work area, scope of work, and likely cause or mechanism of damage, distress, and

deterioration
(iii) Identify faulty construction limitations
(iv) Appraise test results to determine cause of failure and predict future performance

d) Determine repair and rehabilitation concepts, strategies, alternates, and recommendations:
(i) Develop cost-impact or economic study as necessary to appraise remedial work and maintenance
(ii) Describe repair and rehabilitation work recommendations

e) Report conclusions and recommendations include:
(i) Work area limits and limitations of information collected and evaluated
(ii) Assessment criteria and work of the evaluation such as calculations, tests, and analyses
(iii) Details of findings (conclusions) and recommendations
(iv) Safety issue requirements (recommendation for any temporary shoring etc.)

A structural assessment is the process of acquiring knowledge of the existing structure used for the purpose of judging the future performance. The results of the investigation and evaluation are used to make decisions on the appropriate course of action regarding the future use of the structure and the suitability of the structure to continue in service.

ADDITIONAL TERMS

To add clarity, several terms used within the commentary for the terms **assessment** and **evaluation** are also defined in the updated ACI 562 Code. Commentary is also added where the committee determined additional explanation was warranted.

- **assessment criteria**—codes, standards, loads, demands, capacities, strength reduction factors, material properties, materials, connections, details, and protections used in the evaluation.

- **capacity**––the strength, stiffness, ductility, energy dissipation and durability of a material, member or system as determined by analysis or testing.

  Commentary: **capacity**—this definition has been expanded from ACI Concrete Terminology (ACI CT-13) for this Code.

- **design-basis criteria**—codes, standards, loads, displacement limits, material properties, connections, details, and protections used in the design of mandated and voluntary work.

- **rehabilitation**—repairing or modifying an existing structure to a desired useful condition.

  Commentary: **rehabilitation**—this definition is adapted from ACI Concrete Terminology (ACI CT-13)—"the process of repairing or modifying a structure to a desired useful condition." The definition is specific for concrete rehabilitation and is inclusive of the IEBC definition— "Any work, as described by the categories of work defined herein, undertaken in an existing building." Herein, concrete rehabilitations include: repair to restore original capacity; strengthening to increase the capacity to the current building Code requirements; seismic retrofits per ASCE/SEI 41; and modifications addressing additions, alterations, and change of occupancy.

- **repair**—the reconstruction or renewal of concrete parts of an existing structure for the purpose of its maintenance or to correct deterioration, damage, or faulty construction of members or systems of a structure.

  Commentary: **repair**—the definition of repair from ACI Concrete Terminology (ACI CT-13) is "to replace or correct deteriorated, damaged, or faulty materials, components, or elements of a structure." The definition of repair from IEBC is "The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage." The definition herein is adapted from the IEBC and is specific for repair of materials, components, or elements of existing concrete structures where structural repair or durability is addressed. Faulty materials, components, or elements of a structure are interpreted to be faulty construction resulting from errors or omissions in design or construction.

- **repair, structural**—restoring a damaged or deteriorated structure or increasing the capacity of a structure.

  Commentary: **repair, structural**—this definition is adapted from ACI Concrete Terminology (ACI CT-13)—"increasing the load-carrying capacity of a structural component beyond its current capacity or restoring a damaged structural component to its original design capacity." Herein, the definition addresses increasing the capacity to include enhancements such as ductility of existing concrete members. Repairs to nonstructural members, whose failure would cause or result in unsafe conditions, are considered structural repairs.

- **structural analysis (analysis)**––process of using engineering mechanics to determine internal demands on, and capacities of a structure, member, or system.

UPCOMING ARTICLE—UNSAFE CONDITIONS

This first article has provided an explanation of key terminology used in the updated version of the ACI 562 Code. In the next article, the framework used by ACI

Committee 562 to define unsafe conditions within existing structures will be discussed.

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The success of the International Concrete Repair Institute and its work in the industry depends on a strong, active volunteer force. As a member of ICRI, you are invited to participate in the meetings and projects of any ICRI administrative or technical committee. All are volunteer-led and depend on your expert contributions.

ICRI's volunteer program strives to create an environment that is friendly and welcoming. As an ICRI volunteer, you work closely with volunteer leaders and ICRI staff—active parts of each committee—and available to assist you to answer questions about how ICRI operates, and to help you be the most effective volunteer possible.

Length of Commitment

Most volunteer commitments are ongoing and leadership positions are a 3-year commitment. Committees usually meet monthly for 1-1.5 hours. In addition, committees often require tasks to be completed outside of the meetings on the volunteer's own time.

For more information on ICRI committees visit the committee page at **www.icri.org**.

ICRI Committees

Follow Your Interests

View the list of administrative and technical committees, attend their meetings and learn what each is working on. Then decide where your area(s) of interest fit best. The ICRI staff is here to answer your questions and help align you with your interests. You are welcome to attend any meeting of any committee on the administrative or technical committee list. You attend—you can decide if you want to join.

To join a technical committee, just complete a technical committee application and the committee chair will place you as a voting or consulting member.

To join an administrative committee, just talk to the committee chair about potential openings. Administrative committees seat new volunteers at the beginning of each year.

ICRI
CONCRETE REPAIR
Restore | Repurpose | Renew

INTERNATIONAL CONCRETE REPAIR INSTITUTE
1000 Westgate Drive, Suite 252
St. Paul, MN 55114

Phone: 651-366-6095
www.icri.org
info@icri.org

Administrative Committees

ICRI Board of Direction
Chair: Chris Lippmann, HDSupply

Awards Committee
Chair: Brian MacNeil, Kryton International Inc.

Certification Committee
Chair: Thomas Donnelly, Sika Corporation

Chapters Committee
Chair: Michelle Nobel, Sika Corporation

Conventions Committee
Chair: Ingrid Rodriguez, Ingrid Shawn Corp.

Education Committee
Chair: Bryan Heery, Everclear Enterprises, Inc.

Executive Committee
Chair: Chris Lippmann, HDSupply

Fellows Committee
Open to attend, must be a fellow to join.
Chair: Peter Golter, 3M

Finance Committee
Chair: John McDougall, Baker Restoration

Marketing Committee
Chair: Jessi Meyer, Cortec Corporation

Membership Committee
Chair: Jeff Barnes, Barnes Consulting

Nominating Committee
Contact chair with questions, open only to those elected.
Chair: Brian Daley, C.A. Lindman of South Florida LLC

Publications Committee
Chair: Jerry Phenney, MAPEI

Advisory Committees

Coordination Committee
Chair: Jeffrey S. Barnes, Barnes Consulting Group, LLC

Secretariat
Chair: Jeffrey S. Barnes, Barnes Consulting Group, LLC

Special Interests

Women in ICRI
Organizers: Katherine Blatz, BASF South East Asia Pte Ltd, and Monica Rourke, MAPEI

Young Professionals Mentorship Program
Organizer: Elena Kessi, Aquafin Building Product Systems

Technical Committees

Participation on ICRI technical committees and subcommittees increases your knowledge in almost every area of repair and enables you to stay on the leading edge of best industry practices.

Technical Activities Committee (TAC)
Chair: Fred Goodwin, BASF Construction Chemicals

TAC-A Technical Programs
Chair: Peter Golter, 3M

Committee 110—Guide Specifications
Chair: Liying Jiang, Simpson, Gumpertz & Heger

Committee 120—Environmental Health and Safety
Chair: Paul Farrell, Carolina Restoration and Waterproofing

Committee 130—Procurement Methods and Relationship Arrangements
Chairs: Jeffrey R. Carlson, Consulting Engineers Group, Inc., and Michael Saulnier, ABC Supply

Committee 160—Life Cycle and Sustainability
Chair: I-Wen Huang, BASF

Committee 210—Evaluation
Chairs: Charles Mitchell, Smislova, Kehnemui & Associates, P.A. and David Rodler,Smislova, Kehnemui & Associates, P.A.

Committee—310 Surface Preparation
Chair: Pete Haveron, Texas Concrete Restoration, Inc.

Committee 320—Concrete Repair Materials and Methods
Chair: Mark Kennedy, Simpson Strong-Tie Company, Inc.

Committee 330—Strengthening and Stabilization
Chair: Tarek Alkhrdaji, Structural Technologies

Committee 410—Masonry
Chairs: Jason Coleman, O'Donnell & Nacarrato, Inc.

Committee 510—Corrosion
Chair: Jorge Costa, Durability, Inc.

Committee 710—Coatings and Waterproofing
Chair: Mark Nelson, Nelson Testing Laboratories

ICRI committees are open to **all** and they are looking for **your** involvement.
Lend your expertise and help improve the industry!

Scences From Omaha

by Gigi Sutton, MBA
ICRI Associate Executive Director

Each year, the ICRI Fall Convention gives our members the opportunity to contribute to important and ongoing committee work, learn something new from our technical presentations, and celebrate the winners of our coveted annual project awards. The 2018 ICRI Fall Convention held November 7-9, 2018, at the Omaha Marriott Downtown at the Capitol District, proved that membership in ICRI is more important than ever.

RESILIENCY
Above and Beyond Concrete Restoration

The convention kicked off with five technical sessions on Wednesday morning followed by an afternoon chapter event hosted by the ICRI Great Plaines Chapter. Attendees then gathered on Wednesday evening to mix and mingle with a full complement of 45 exhibitors and industry professionals from around the globe. The conventions theme, *Resiliency, Above and Beyond Concrete Restoration* helped the Technical Activities Committee recruit a wide variety of the finest concrete repair professionals the industry has to offer. It gave attendees a unique glimpse into what is going on in our industry, from repair of concrete utility poles with use of migrating corrosion inhibitors, restorative waterproofing for below grade parking structures, strengthening of concrete were just a few of the 15 presentations that provided insight and provoked discussion.

Much of what ICRI does as an industry association comes from the work of the technical and administrative committees. ICRI broadens its reach and expands the industry by working together in these committees in which drawing in more members to share their expertise. Committee meeting attendance was exceptional at the convention, with many first-time attendees getting involved.

The highlight of Thursdays networking lunch was the launch of ICRI's rebranded logo. This is an exciting time for ICRI as we leap into the future. A special thanks to ICRI Marketing Committee for working to hard and passionately on the rebrand of ICRI. Their vision for our association has moved us into the future.

With the Annual Awards Banquet being the highlight of any Fall Convention and this one did not disappoint. Our emcees for the evening, Awards Committee Chair, Elena Kessi and Awards Vice-Chair Brian MacNeil, provided the opportunity for everyone to hear about the challenging work and exceptional achievements necessary to be an award winner. Not only did we honor the 2018 Project of the Year, but we presented the 2018 Awards of Excellence and Awards of Merit. A very special thank you to this year's judging panel and congratulations to those ICRI award winners for their hard work, not only on the projects themselves, but on the high quality of all entries we received.

The convention wrapped up Friday evening with the 30th Anniversary Celebration hosted by the ICRI Great Plaines Chapter—a one of a kind experience.

ICRI wishes to thank all the attendees, exhibitors, sponsors, presenters, and award winners for joining us. A very special thank you to the ICRI Great Plaines Chapter for putting together such a fun filled event.

To see more photos of the Fall Convention, please visit www.icri.org

We hope to see everyone at the ICRI 2019 Spring Convention in Jacksonville, FL, April 8-10, 2019. We extend an invitation for you to get involved. Make the most of your membership and come to a convention.

Ed Kluckowski presenting the rebrand of ICRI

Technical Sessions

(left to right) Jeff Barnes, Shannon Counsil, Brian MacNeil, & Kevin Robertson at the First Timer's Reception

Left to Right: Pat Gallagher, Ed Kluckowski, Adam Hibshman, and Tom Donnelly at the Friday night event at the Slowdown hosted by the Great Plaines Chapter

ICRI Awards Chair, Elena Kessi and Vice-Chair, Brian MacNeil presenting at the Project Awards Ceremony

Past President Ralph Jones and his lovely bride Brenda gracing us at the Awards Ceremony

ICRI Kicks Off 2019 In Style

by Gigi Sutton, MBA
ICRI Associate Executive Director

For the institute's 11th Annual Kick-Off Party, guests gathered at one of the hottest spots in Las Vegas, NV: the elegant Chateau Nightclub Rooftop at the Paris Vegas Hotel. Chateau's Rooftop provided an unparalleled outdoor experience, with panoramic views of the Las Vegas skyline. ICRI had the pleasure of welcoming more than 275 members and guests to this year's event. The evening included a variety of food items for guests to nibble on, an open bar, and the occasion to mix and mingle with other members, association leadership, and staff.

Each year, ICRI strives to find a location that is comfortable and fits the size of our ever-growing list of attendees. This one hit the mark for many of the guests. ICRI would like to extend a very special thanks to all of our generous event sponsors. No event is possible without their support and dedication. Thank you!

Thank you to our 2019 ICRI Kickoff Party Sponsors

WWW.ICRI.ORG

Waterproofing with Aesthetics

making it dry and appealing to the eye

2019 ICRI SPRING CONVENTION

April 8-10 ◆ Omni Jacksonville Hotel ◆ Jacksonville, Florida

Enhance Your Knowledge. Build Your Career. Grow Your Network.

EXHIBIT / SPONSOR
OPPORTUNITIES AVAILABLE

COMMITTEE MEETINGS
WHERE ICRI WORK GETS DONE—ALL ARE WELCOME TO ATTEND

CHAPTER SPONSORED SOCIAL EVENTS
THE LOCAL ICRI CHAPTER HAS PLANNED SOCIAL EVENTS FOR ALL TO ENJOY

EARLY REGISTRATION DISCOUNTS!
REGISTER EARLY FOR THE BEST DISCOUNTS!

SPECIAL HOTEL RATE!
STAY AT THE OMNI JACKSONVILLE HOTEL AND SUPPORT ICRI—BOOK EARLY FOR ICRI DISCOUNTED RATES

ICRI
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Plan to join the International Concrete Repair Institute (ICRI) in Jacksonville, Florida for its 2019 Spring Convention. You can expect another dynamic convention featuring concrete repair industry experts sharing their expertise with you. As novice and seasoned professionals, this is your best opportunity to expand your understanding of concrete repair, protection and restoration through networking, technical sessions with PDH credits, and participating in ICRI committee meetings.

"Contacts, education, knowledge and experience all found in one place."

INDUSTRYNEWS

ICRI BOARD MEMBER BRIAN MACNEIL,

Kryton International, Inc., presented an ICRI overview to the members of Concrete SASK that consists primarily of ready-mix concrete companies in Saskatchewan and Manitoba in Canada.

MCCANN INDUSTRIES BUILDS NEW FACILITY IN MARNE, MICHIGAN

New CASE Dealer Location Expands Service Bays and Parts Inventory

McCann Industries has begun construction of their new location in Marne, Michigan. The new, state-of-the-art facility will include seven service bays to assure a quick turnaround for maintenance and repair of any make or model of equipment. The complete CASE construction equipment line will be available, and a wide selection of rental machines will be available for short or long term needs. The current location at 3260 142nd Ave. in Dorr will continue to operate until the new facility is complete in mid 2019.

"McCann Industries is investing in Western Michigan, because we plan to be here for the long haul," said Jim McCann, president and CEO at McCann Industries. "We're putting down strong roots to build a better, stronger future for the region. Our fifty plus years of experience in the industry is a critical part in assuring our success in Michigan."

State-of-the-art diagnostic equipment is a critical addition with the expansion. McCann's certified technicians are experienced and adept at completing both preventive maintenance and repairs. McCann's ability to provide parts within 24 hours also helps minimize downtime.

Visit www.McCannOnline.com for more information.

SIMPSON STRONG-TIE EXPANDS STUDENT SCHOLARSHIP PROGRAM, ADDS 32 ADDITIONAL SCHOLARSHIPS FOR 2019-2020 ACADEMIC YEAR

Pleasanton, Calif. — Simpson Strong-Tie, the leader in engineered structural connectors and building solutions, announced it has increased the number of scholarships in its Student Scholarship Program for the 2019–2020 academic year. The company added 32 more scholarships to the program, bringing the total number of available scholarships to 100.

The Simpson Strong-Tie Student Scholarship Program supports education and encourages the design and building of safer structures in our communities by assisting architecture, structural engineering, and construction management majors in meeting their education costs. Up to 100 scholarships of $2,000 per recipient are awarded every academic year to university students at 93 participating schools.

The online application for the 2019–2020 academic year is now available for interested students at strongtie.com/scholarships. The deadline to apply is March 25, 2019. Awards are for undergraduate study only (juniors and seniors) and are not renewable, but students may reapply to the program each year they meet eligibility requirements.

The Simpson Strong-Tie Student Scholarship Program is administered by Scholarship America, the nation's largest designer and manager of scholarship and tuition reimbursement programs for corporations, foundations, associations and individuals. Awards are granted without regard to race, color, creed, religion, sexual orientation, age, gender, disability or national origin.

WAGNER METERS NAMES FISHMAN FLOORING SOLUTIONS 2018 DISTRIBUTOR OF THE YEAR

Wagner Meters, a leading manufacturer of moisture management technology for the flooring industry, has named Fishman Flooring Solutions its 2018 Distributor of the Year. This is the first time Wagner Meters has presented the award. "Fishman has been a top-performing distributor since our partnership with them began in 2010," said Jason Spangler, flooring division sales manager for Wagner Meters.

Fishman Flooring Solutions, based in Baltimore, Maryland, distributes flooring and flooring installation products to contractors and others in 13 states, primarily along the Eastern seaboard and in the Midwest. The company was specifically recognized by Wagner Meters, which is headquartered in Rogue River, Oregon, for its superior sales growth and its unmatched representation of Wagner's line of moisture measurement products to its customers, according to Spangler.

INTERESTED IN SEEING YOUR NEWS IN THIS COLUMN?

Email your 150-200 word industry news to editor@icri.org. Content for the May/June 2019 issue is due by April 1, 2019 and content for the July/August 2019 issue is due by June 1, 2019. ICRI reserves the right to edit all submissions.

WOMEN in ICRI

"We empower one another by supporting and helping one another."

ADVANCE KNOWLEDGE

address barriers that may be controversial regarding growth and participation in policy making and industrial leadership

network

Recognize the challenges and successes of women who share a place in the concrete repair industry.

ICRI CONCRETE REPAIR
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ICRI is pleased to offer this dynamic forum for its female constituents and members. If you are interested in participating in this forum, contact: Gigi Sutton, gigij@icri.org

ASSOCIATIONNEWS

2019 ASA OFFICER AND BOARD OF DIRECTORS APPOINTMENTS

Cathy Burkert to serve as 2019 President

The American Shotcrete Association (ASA) is proud to announce its new officers and board members that were elected by membership. **Cathy Burkert**, American Concrete Restorations Inc., will serve a one-year term as President. Burkert succeeds **Lihe "John" Zhang**, LZhang Consulting & Testing Ltd. As stipulated by the ASA bylaws Zhang will assume the position of Past President of the Board of Directors.

To support Burkert, the ASA membership also elected the following for one-year terms: **Ryan Poole**, Consultant, as Vice-President; **Lars Balck**, Consultant, as Secretary and **Axel Nitschke**, WSP USA, as Treasurer.

Newly elected ASA Directors to serve three-year terms include: **Frank Townsend**, Superior Gunite; **Mike Reeves**, Gunite Specialists, Inc. and **Jason Myers**, Dees-Hennessey Inc.

Returning ASA Directors include: **Jonathan Dongell**, Pebble Technologies; **Oscar Duckworth**, Valley Concrete Services; **William Geers**, Bekaert-Maccaferri Underground Solutions; **Mason Guarino**, South Shore Gunite Pools & Spas, Inc.; **Marcus von der Hofen**, Coastal Gunite Construction Company and **Ryan Oakes**, Revolution Gunite.

For more information, visit www.shotcrete.org.

THE BEST IN CONCRETE RENOVATION HONORED AT WOC CEREMONY

The most innovative and challenging projects completed by CSDA contractors in 2018 were recognized during a prestigious World of Concrete ceremony in Las Vegas.

On Wednesday, January 23, 2019, the association hosted the sixth annual Concrete Openings Awards at its booth in the Central Hall of the Las Vegas Convention Center. CSDA Executive Director Patrick O'Brien acted as Master of Ceremonies while the association's vice-president, Matthew Finnigan, presented the awards to the winners. World of Concrete attendees and members of the industry media joined CSDA to celebrate with the winning contractors. The winners are:

Road, Bridges & Airports
Atlantic Concrete Cutting (Mount Holly, NJ)
Four-Billion Dollar Tappan Zee Bridge Demolition Project

Building Construction
Donley Concrete Cutting Company (Pickerington, OH)
Historic Church Renovation and Reinforcement Project

Industrial Renovation
Cuts, Inc. (Knoxville, TN)
Custom Fabricated Table Created to Assist with University Research Project

Infrastructure Renovation
Cutting Edge Services (Batavia, OH)
Advanced Concrete Sawing (St. Paul, MN)
Red Rock Hydroelectric Dam Project

FOURTH EDITION OF THE CONTRACTOR'S GUIDE TO QUALITY CONCRETE CONSTRUCTION IS NOW AVAILABLE

The American Concrete Institute (ACI), Farmington Hills, MI, and American Society of Concrete Contractors (ASCC), St. Louis, MO, announce the fourth edition of the best-selling Contractor's Guide to Quality Concrete Construction is now available in printed and digital formats.

The new guide provides up-to-date knowledge of quality concrete construction practices and was unveiled at World of Concrete in Las Vegas, NV. Written by and for contractors, and referenced by many licensing authorities, this guide details proven practices to produce quality concrete construction. Contents include planning for quality, concrete mixtures, specifications, foundations, formwork, reinforcement and embedments in structures, joints and reinforcement for slabs-on-ground, preparing for concreting, concrete placing and finishing, common field problems, safety, and legal issues.

Now 262 pages—over 100 pages longer than the previous edition—the guide includes full-color photos and illustrations, a new, easier-to-read layout, and substantial content updates. Also included in the fourth edition are 43 Position Statements from ASCC, details on ACI Certification programs, and an appendix introducing several legal issues of interest to concrete contractors. A summary, review questions, and additional recommended reading list accompany each of the 12 chapters.

Published jointly by ACI and ASCC, the guide is intended for all levels of experience. The guide is available in both printed and digital format) for $89.00; ACI and ASCC members will receive a member discount. A Spanish version is expected to follow. To learn more about the new Contractor's Guide to Quality Concrete Construction, contact ACI at concrete.org or ASCC at ascconline.org.

AMERICAN CONCRETE INSTITUTE LAUNCHES NEW CONCRETE REPAIR SUBSCRIPTION

The American Concrete Institute – the global authority for information on concrete design, construction, repair, and materials – announces the launch of its new Concrete Repair Subscription. The online subscription includes digital access to the American Concrete Institute's technical and education content on concrete assessment, repair, rehabilitation, and more.

Subscribers will receive twelve months of access to ACI's existing concrete repair-specific code requirements/commentary, specifications, guides, reports, symposium volumes, and ACI University on-demand courses, plus new materials as they are published/developed. Contents include:

65+ codes, specifications, guides, and reports.

16+ educational publications and documents.

33+ on-demand courses through ACI University.

25+ symposium volumes containing 500 total papers on a diverse range of concrete repair topics.

Additionally, new concrete repair content developed by the Institute will be made available to subscribers through the life of the subscription. An annual subscription costs $249 and is a substantial savings over the cost of purchasing the resources individually; the annual subscription cost is reduced to $99 for ACI members.

Learn more at concrete.org/repairportal, subscribe through the ACI store at concrete.org.

AMERICAN CONCRETE INSTITUTE ANNOUNCES RECIPIENTS OF THE ACI CERTIFICATION AWARD AND ACI CONSTRUCTION AWARD AT WORLD OF CONCRETE 2019

The American Concrete Institute (ACI) announced the recipients of the ACI Certification Award and the ACI Construction Award at a press conference during World of Concrete, Las Vegas, NV, USA, January 22, 2019.

Christopher J. Robinson receives the ACI Certification Award. Robinson was recognized for outstanding leadership and service on ACI Certification Committees, and tireless service in developing, promoting, supporting, and delivering ACI Certification programs.

Claude E. Jaycox receives the ACI Certification Award for outstanding service on ACI Certification Committees, and tireless service in maintaining, promoting, supporting, and delivering ACI Certification programs.

Werner K. Hellmer receives the ACI Certification Award for outstanding leadership and service on ACI Certification Committees, and tireless service in improving, promoting, supporting, and delivering ACI Certification programs.

The ACI Construction Award is awarded to **Pedro Serna Ros, Juan Ángel López, Esteban Camacho Torregrosa, Juan Navarro-Gregori,** and **Hugo Coll Carrillo**, for their paper on the construction of an Ultra-High Performance Fibre-Reinforced Concrete footbridge over the Ovejas ravine in Alicante, Spain. (*Footbridge over the Ovejas Ravine in Alicante: An Economical Alternative Made Only of Ultra-High Performance Fibre-Reinforced Concrete*, SP-310-41, March 2017, pp. 435-450).

For more information on the ACI Honors and Awards, please visit www.concrete.org.

POST-TENSIONING INSTITUTE ANNOUNCES EFFORTS TO AUGMENT DURABILITY OF POST-TENSIONED BRIDGES & OTHER STRUCTURES

New & updated Specifications, Certification programs announced in response to feedback from the bridge industry

The Post-Tensioning Institute (PTI) announced during a press conference at the World of Concrete current and future initiatives to help augment durability of post-tensioned concrete bridges and other structures.

In response to feedback from the industry, PTI is currently working on several products and services to meet the growing demands of owners, con-

tractors, DOT entities, and others who wish to design and build post-tensioned concrete structures.

First, PTI is currently working alongside the American Segmental Bridge Institute (ASBI) to publish the second edition of "Specification for Multistrand and Grouted Post-Tensioning," expected to be released in March. This state-of-the-art multistrand and grouted PT specification provides technical information for industry stakeholders as well as rules for the contractor regarding materials, installation, stressing, and grouting. The updated publication will include added commentary and new information on PT anchorage testing, duct specifications, and other updates.

Second, PTI will be publishing the fourth edition in March of *Specification for Grouting of Post-Tensioned Structures*. This comprehensive grouting specification provides information on grout materials, engineered grout, testing, and grouting procedures. The updated edition will include new requirements on material certification, robustness testing, and wet density testing for each tendon.

The seventh edition of the third relevant publication, *Recommendations for Stay Cable Design, Testing, and Installation* was published in Oct. 2018 and provides updated information on saddle testing provisions, fire resistance qualification testing, and vibration control system requirements.

The Institute also announced updates to its certification program offerings.

Thousands of field personnel have been certified through the 'Level 1 & 2 Multistrand and Grouted PT Specialist' PTI certification program. This comprehensive three-day class includes a field demo portion and instructs attendees on various topics such as PT basics, tendon protection levels, PT systems and components, materials and testing, installation, stressing and safety, grout testing and grouting procedures, contract documents, and troubleshooting. This certification has been found beneficial for major bridge projects, giving all involved the opportunity to review all aspects of the post-tensioning on their project.

New in 2019 is PTI's 'Multistrand and Grouted PT Inspector' field personnel certification program.

Also launching in 2019 will be the PTI 'Level 3 Unbonded PT Repair, Rehabilitation, and Strengthening' certification program.

Later in 2019, PTI will be launching its 'PT System Qualification Testing and Certification' program.

More information about PTI products and services can be found at www.Post-Tensioning.org.

ACI FOUNDATION'S STRATEGIC DEVELOPMENT COUNCIL ANNOUNCES NEW LEADERSHIP

The ACI Foundation's Strategic Development Council (SDC) is pleased to announce that **Charles H. Hanskat** is the organization's new Chair, effective Jan 1, 2019.

Hanskat is the Executive Director of the American Shotcrete Association, (ASA), and is a former Vice Chair of SDC. He received his BS and MS in civil engineering from the University of Florida in Gainesville and is a licensed professional engineer in many states. Hanskat has been involved in the design, construction, and evaluation of environmental concrete and shotcrete structures for over 40 years.

Hanskat's service to the engineering profession is exemplified through his involvement with the American Society of Civil Engineers (ASCE), the National Society of Professional Engineers (NSPE), and the Florida Engineering Society (FES), and in more than 50 committee and officer positions at the national, state, and local levels. In 2011, he received the Outstanding Reviewer Award for the Journal of Performance of Constructed Facilities.

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 2019 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: Gregory P. Chacos, Uğur Ersoy, Michael C. Forde, Catherine E. French, Robert Douglas Hooton, and Kenneth C. Hover.

ACI is also pleased to recognize 15 individuals for maintaining their membership and participating in ACI activities for at least five decades. Additionally, ACI honors 13 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.

Learn more about each of the awardees at concrete.org.

WRMCA ELECTS 2019 BOARD OF DIRECTORS

The Wisconsin Ready Mixed Concrete Association selected the 2019 Board of Directors at the annual meeting on January 31, 2019 in Madison. The 2019 WRMCA Board of Directors and officers include:

President: Wally Jankowski, Advanced Concrete

Vice President: Mike Tews, Carew Concrete & Supply

Secretary/Treasurer: Scott Zignego, Zignego Ready Mix

Producer Directors:
Todd Brockman, MCC, Inc.
Ron Carlson, Wingra Redi-Mix
Matt Flynn, American Materials
Jason Johnson, Ozinga Ready Mix
Luke Knadle, River City Ready Mix
Mike Rivecca, Riv/Crete Ready Mix
Dan Trierweiler, Trierweiler Construction & Supply
Joel Werner, Verrette Materials

Associate Directors:
Dave Kepler, Buzzi Unicem USA
Dan Large, Fiber Reinforcing & Consulting
Paul Piekarski, Sika Corporation
Rick Ross, Oshkosh Corporation
Keith Nault, Solomon Colors
Gary Wallis, St. Marys Cement

TACA MEMBERS VISIT TEXAS LEGISLATORS TO BUILD AWARENESS OF KEY ROLE PLAYED BY AGGREGATES, CONCRETE, CEMENT INDUSTRIES

\More than 75 members of the Texas Aggregates & Concrete Association (TACA) met with Texas legislators about issues important to the aggregate, concrete, cement and other associated industries as part of the association's Capitol Day, which took place Feb. 5.

The event included a Legislative Breakfast, which featured remarks from Sen. Brian Birdwell (Granbury), Chairman of the Senate Natural Resources and Economic Development Committee.

In the afternoon, TACA members met individually with more than 85 legislators and legislative staff members to discuss these vital industries.

TACA member companies and employees are committed to and an essential part of the communities in which they operate. The state of Texas and nearly all its commercial base relies on aggregates, concrete, cement and other related materials to support growth and to build new structures and repair and modify existing infrastructure, such as schools, roads, hospitals and homes.

TACA members also contribute to state and local economies by creating blue collar and skilled jobs – more than 100,000 statewide, expanding communities' tax bases and purchasing goods and services in the communities in which they operate. This spending supports thousands of families across the state.

CONCRETE PUMPING ASSOCIATION OF CANADA MERGES WITH AMERICAN CONCRETE PUMPING ASSOCIATION

The American Concrete Pumping Association (ACPA) announces the Concrete Pumping Association of Canada (CPAC) will now operate as an ACPA chapter, continuing under the CPAC name. The merger will give ACPA members from Canada a dedicated forum for addressing issues affecting Canadian pumpers. Current CPAC members will benefit from ACPA's strong safety, training and concrete pump operator certification program.

Concrete pumpers in the United States and Canada share many issues including safety, workforce development and promotion of the industry. The merger solidifies the concrete pumping industry's presence in the North American marketplace and brings increased visibility to concrete pumping across the borders.

For more information visit www.concretepumpers.com.

WISCONSIN READY MIXED CONCRETE ASSOCIATION RECOGNIZES EXCELLENCE IN CONCRETE DESIGN

The Wisconsin Ready Mixed Concrete Association has recognized the winners for the 37th Annual Concrete Design Awards.

The awards are a part of a prestigious program showcasing best uses of ready-mixed concrete in Wisconsin and Michigan's Upper Peninsula (UP). The Wisconsin Ready Mixed Concrete Association (WRMCA), Carew Concrete & Supply, Euclid Chemical, GRT-Mapei, Riv/Crete Ready Mix, Sika Corporation, and ACI Wisconsin cosponsored the annual award program, now in its 37th year. Award winners were determined by a distinguished panel of Wisconsin/UP educators and construction professionals.

The award program recognizes excellence in the ready-mixed concrete industry in the following categories: Agricultural, Commercial, Concrete Overlay, Decorative, Education, Healthcare, and Public, ICF, Industrial, Facility, Municipal Infrastructure, Parking Lot, Tilt-Up and regional projects.

The Concrete Design Award Ceremony took place on Thursday, February 7th at the Kalahari Resort in Wisconsin Dells.

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 37th Annual Concrete Design Awards, projects showcased represented winners that included owners, architects, engineers, contractors and ready mixed producers.

Visit www.wrmca.com for more information.

ACI FOUNDATION ANNOUNCES 2019 AWARD RECIPIENTS

\The ACI Foundation is pleased to announce its 2019 awardees.

David Darwin receives the Robert E. Philleo Award in recognition of his lifelong and continuing efforts in the field of concrete material research and bridge construction practices and its implementation in practice in the United States and around the world.

Long T. Phan receives the Arthur J. Boase Award in recognition of his research on the response of high-strength/high-performance concrete structures to extreme loads, the effect of ASR on reinforced concrete material properties and structural capacities, and committee work to transfer the research results into design practice.

Lawrence L. Sutter receives the Jean-Claude Roumain Innovation in Concrete Award in recognition of his leadership in concrete materials education and research which has advanced the knowledge of deicer interaction, utilization of fly ash and alternate cements, and the nature of the air-void system to overall improve the sustainability and durability of concrete.

More information about the awards, including nomination information, is available at acifoundation.org.

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ICRI
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ICRI Young Professionals Mentorship Program

Are you a potential mentor?

Share your ideas on how your experience can benefit young professionals

Are you a potential mentee?

Share what you would like to learn from a mentor and where you feel you could benefit ICRI is developing a Mentorship Program geared toward young professionals within ICRI to help build leadership skills and guide career growth. The program will involve activities and interactions at the National and Local Chapter level.

Get involved and help drive it forward.

Contact Elena Kessi, elena@aquafin.net, to get involved.

PEOPLEONTHEMOVE

JQ INFRASTRUCTURE ANNOUNCES PROMOTION OF JERRY W. SNEAD, II, PE TO PRINCIPAL

Jerry W. Snead, II, PE has been promoted to principal, according to JQ Infrastructure president Murali K. Kariyarveedu, PE.

Snead has designed more than 300,000 linear feet (LF) of pipeline incorporating both open-cut and trenchless construction. Snead's expertise includes the design of water and wastewater pipelines, water supply and drainage projects in Texas, Alabama and Louisiana, as well as construction observation experience for large diameter pipelines, tunnels and municipal wells. Among Snead's current projects are:

- IPL to Bachman Water Treatment Plant Alignment Study, Dallas Water Utilities, Dallas, Texas
- Influent Piping and Equipment Rehabilitation, Central Wastewater Treatment Plant, Dallas Water Utilities, Dallas, Texas
- EF-R3 Sewer Rehabilitation and Replacement, Trinity River Authority, Dallas, Texas

In addition to these projects, Snead has been involved in the American Water Works Association (AWWA) as a member of the Air Release Valve Standards Review Committee, with the Texas AWWA as Chair of the Texas Section Water Distribution Division, and in the American Society of Civil Engineers as a member of the Pressure Pipeline Design Committee.

INTERESTED IN SEEING YOUR NEWS IN THIS COLUMN?

Email your 150-200 word industry news to editor@icri.org. Content for the May/June 2019 issue is due by April 1, 2019 and content for the July/August 2019 issue is due by June 1, 2019. ICRI reserves the right to edit all submissions.

CHAPTERCALENDAR

ARIZONA
March 29, 2019
ANNUAL SPORTING CLAY TOURNAMENT
Rio Salado Sportsman's Club
Mesa, AZ

BALTIMORE-WASHINGTON
March 21, 2019
CHAPTER BREWERY TOUR AND HAPPY HOUR
Guinness Open Gate Brewery and
Barrel House
Halethorpe, MD

BRITISH COLUMBIA
March 14, 2019
DINNER MEETING
Topic: Urethane Grout Injection
Speaker: Monica Rourke
1285 W Broadway, Lower Boardroom
Vancouver, BC

CAROLINAS
April 25-26, 2019
SPRING CONFERENCE
Featuring a Night at the Ball Park
Holiday Inn–Charlotte Center City
Charlotte, NC

CENTRAL OHIO
April 25, 2019
CHAPTER DINNER MEETING
Location: TBD
Columbus, OH

CHICAGO
April 16, 2019
CHAPTER DINNER MEETING
Westwood Tavern
Schaumburg, IL

GEORGIA
April 25, 2019
LUNCH'N'LEARN
Maggiano's Perimeter
Atlanta, GA

HOUSTON
March 15, 2019
SPROTING CLAY SHOOT
Joint Outing with ICRI and ACI
Greater Houston Gun Club
Houston, TX

INDIANA
April 18, 2019
JOINT MEETING WITH CSI
Topic: Concrete Forensics
Speaker: Steve Bruns, ICRI
Location: TBD
Indianapolis, IN

METRO NEW YORK
March 21, 2019
CHAPTER TECHNICAL MEETING
Club 101, Park Avenue
Manhattan, NY

April 25, 2019
ALL DAY SEMINAR
Club 101, Park Avenue
Manhattan, NY

MICHIGAN
March 1, 2019
DEMO DAY
J. Dedoes
Wixom, MI

MID-SOUTH
March 20, 2019
SPRING MEETING
Topic: Field Observations and Case Studies
Speaker: Chad Eades, Simpson Strong-Tie
Whole Hog Café
Little Rock, AR

NEW ENGLAND
March 11, 2019
CHAPTER TECHNICAL SEMINAR
Topic: Strengthening with FRP
Speakers: Gustavo Tumialan of SGH and
Brian Stratman of MAPEI
Stockyard
Brighton, MA

QUEBEC
March 7, 2019
BREAKFAST SEMINAR
Topic: Champlain Bridge reinforcement
Quebec City, QC

March 13, 2019
ANNUAL GENERAL ASSEMBLY
Sheraton Hotel
Laval, QC

ROCKY MOUNTAIN
March 1, 2019
ANNUAL SKI TRIP
Loveland Ski Area
Clear Creek County, CO

VIRGINIA
May 2, 2019
CHAPTER SPRING SYMPOSIUM
AND GOLF TOURNAMENT
Topic: Façade Restoration and
Above Grade Waterproofing
Colonial Heritage
Williamsburg, VA

"As someone relatively new to the concrete restoration industry, one of the very first things I did after starting my new job was join my local ICRI chapter. It immediately gave me access to best-in-class training documents (especially the ICRI Guidelines). ICRI also offered informational videos and a peer network that accelerated my knowledge and confidence out of the gate. I highly recommend membership to anyone new thinking about entering the field."

Jeff Konkle, MAK Construction Products Group

CHAPTERNEWS

BALTIMORE WASHINGTON 4th QUARTER DINNER MEETING

Members of the ICRI Baltimore Washington Chapter attended the 2018 fourth quarter dinner meeting and awards banquet at The Hotel at the University of Maryland located within the University of Maryland Campus at University Park. Many thanks go out to Rich Barrett from Lymtal and the Facilities Committee for setting up the event at the new location. Members enjoyed a cordial social hour as final ballot submissions were collected by Shannon Bentz, with Desman, and the Nominating Committee for 2019 positions to the Board of Directors. Conversation between old friends and new continued into the main dining hall where a delightful spread was provided buffet style for dinner prior to the start of the night's events.

Final ballots were counted and the following individuals have been elected to serve on the Baltimore Washington ICRI Board of Directors:

The 2019 Chapter Officers are:

- President— Kevin Kline (CP&R)
- Vice President— Rich Barrett (LymTal)
- Secretary—Brian Radigan (Tremco)
- Treasurer—Nick Henn, P.E. (ETC)
- Past President—Robert Radcliff, P.E. (ETC)

The 2019 Chapter Directors are:

- Paul Askham (1 year term)- Gale Associates
- David Bickel, Sr. (1 year term) - Concrete Protection & Restoration, Inc.
- Michael Payne, PE, PMP (1 year term) - Facility Engineering Associates, P.C.
- Brian Baker (2 year term) - PPSI
- Adam Hibshman (2 year term) - Valcourt Exterior Building Services
- Justin Long, P.E. (2 year term) - Smislova, Kehnemui & Associates, P.A.
- Kevin Goudarzi, P.E. (3 year term) -KGS Construction Services, Inc.
- Tommy Dacanay (3 year term) -Building Envelope Consultants & Scientist, LLC
- Matthew S. Smith, E.I.T. (3 year term) - Charles J. Merlo Inc.

The awards banquet opened with the out-going President, Bobby Radcliff from ETC, providing a summary of the year's events and providing some updates to several events still scheduled prior to the end of 2018. Nick Henn, also with ETC, and a part of the Education and Scholarship Committee presented the award of six $1,000 scholarships to go towards tuition of several college students from the University of Maryland and Catholic University, or as a continued education award for several ICRI members looking to obtain professional certifications. Congratulations to all scholarship winners and good luck with your studies.

Following, Bobby began to introduce the night's presenters, which consisted of the three winning project teams for the 2018 Baltimore Washington Outstanding Project of the Year Awards. Brian Radigan from Tremco and the Awards Committee Chair and the other sub-committee members received a total of four submissions for consideration for the award. A group of nationally active ICRI members across the country judged the submissions on the basis of the established scoring criteria which included: Planning/Phasing, Design Issues & Project Administration, Structural and Architectural and/or Operational Improvements, Technical Innovation, and Costs.

3rd Place: Liberty Towers—submitted by SRG with CRS

Kaveh Afshinnia with SRG presented this project, which involved structural parking garage restoration work at the Liberty Towers apartment complex in Arlington, VA. SRG utilized in-situ testing such as rebound hammer testing and half-cell potential testing to identify concrete strength deficiencies and possible corrosion of embedded steel reinforcing. SRG also utilized finite element analysis to assist in phasing of extensive concrete repairs performed at the concrete slabs.

Bobby Radcliff presents 3rd place project award to Kaveh Afshinnia of SRG

2nd Place: Beau Court—submitted by ETC with Avon and Culbertson

Bobby Radcliff of ETC presented the 2nd place project award. The project scope addressed structural deficiencies and settlement concerns with 4 garden style condominium buildings located at Beau Court Condominiums. 1930's era buildings with wood framing and brick and terra cotta bearing walls were identified with significant settlement and building overturn (up to 7 inches). Numerous

Brian Radigan presents 2nd place project award to Bobby Radcliff of ETC

surveys, design, and testing was performed before work was underway to install supplemental foundation support, repair and strengthen load bearing walls, and correct plumbness of the structure. The project team had to hurdle many issues including completing repairs in phasing without disrupting occupancy of the residents!

1st Place: Waterside Towers— submitted by CPR

Patrick O'Malley presented the 1st place project award on behalf of CPR. The project involved a multimillion-dollar structural rehabilitation and waterproofing project at the plaza and below-grade parking garage at the Waterside Towers property in southwest Washington, D.C. The property was found to have significant concrete deterioration from leaks in the plaza level which created the need

Brian Radigan presents 1st place award to Patrick O'Malley of CPR

to remove plaza finishes to complete more than 30,000 square feet of concrete repairs (over 28,000 square feet of full-depth concrete repairs) and replace the existing waterproofing membrane. In some instances, overhead repairs in the below-grade garage occurred below occupied space and CPR utilized robot demolition machines to safely complete the work. Some project issues that had to be overcome included difficulties with plaza overburden removal and replacement to fit landscape architect requirements, as well as visual considerations to comply with the local fine arts commission.

All three project awards proved resilience in completing challenges identified during a unique and successful restoration project. Each recipient received a plaque celebrating the project award and thanking them for their entry. Although only three winners could be chosen from the submission, the Baltimore Washington Chapter of ICRI commemorates all project teams that chose to submit a project for consideration.

GERARD MOULZOLF TALKS PETROGRAPHY AT NORTH TEXAS

In the final 2018 NTX Chapter Meeting for 2018, Gerard Moulzolf, Chief Petrographer at American Engineering Testing and ICRI Board Member, presented an enthusiastic and immensely informative program on petrography, on how it is performed, and the myriad of things that it can tell you about in-place concrete. A good-sized crowd gathered at Pappasito's Mexican Cantina to network and feast on chicken and beef fajitas prior to the meeting.

Beginning with concrete cores, the concrete is cut and polished and examined under microscopes. Examples were shown of improperly vibrated concrete, overworked concrete, and overwatered concrete. Did you know that air bubbles can be counted in air-entrained concrete?! Thin slices are cut and polished from the concrete cores, backlit and examined under high-powered microscopes to check for the formation of gels indicative of alkali silicate reaction (ASR).

Gerard Moulzolf presents to a large crowd at the November NTX Chapter meeting

NTX Chapter President, RW Smith, presents Gerard with a commemorative Chapter pen

2019 CHAPTER NEWS DEADLINES

MAY/JUNE 2019
March 10, 2019

JULY/AUGUST 2019
May 10, 2019

SEPTEMBER/OCTOBER 2019
July 10, 2019

NOVEMBER/DECEMBER 2019
September 10, 2019

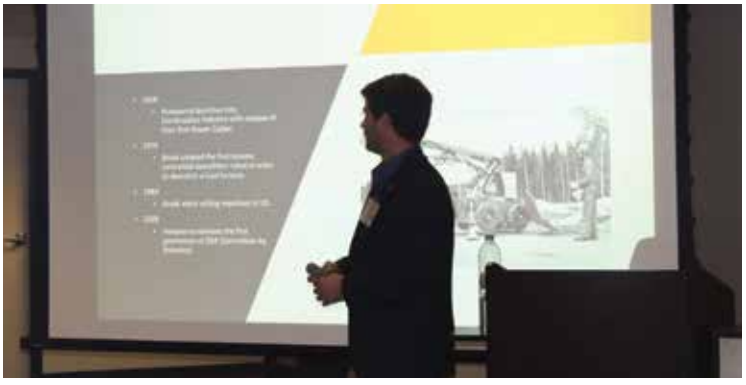
Send your Chapter News by the deadlines to Dale Regnier, Director of Chapter Relations, daler@icri.org

For the latest ICRI Chapter information visit www.icri.org

BALTIMORE-WASHINGTON HOSTS FALL TECHNICAL SYMPOSIUM

The Baltimore-Washington Chapter's annual technical seminar for 2018 was held on Thursday December 6, 2018 at CP&Rs headquarter office in Windsor Mill, MD. The topic for this year was Alternative Concrete Demolition. As always, this event was very well attended and everyone enjoyed some interesting presentations about robotic demolition, hydro demolition and dust control methods for pneumatic tools to meet the new OSHA standards. A highlight for this year were the live demonstrations. Ryan Dunigan with Husqvarna showed us how their new robot could be used to demo concrete not only more efficiently, but more safely as well. Then, Carroll Bassett gave a short presentation on his micro-blasting technology along with a case study video, then showed the attendees how it can be used to blow up concrete blocks and slabs. Needless to say, the day ended with a bang! Thank you to all of our presenters.

Below is a collection of photos from the Baltimore-Washington Fall Technical Seminar



NORTH TEXAS HOSTS FIRST-EVER CHAPTER-SPONSORED CSRT EVENT

The North Texas Chapter hosted a first-ever, Chapter-sponsored live CSRT Tier 2 Performance Exam on February 14, 2018 at the Simpson Strong-Tie facility in McKinney, Texas. Six participants properly demonstrated their abilities to make concrete cylinders, perform concrete slump and slump flow tests, core drill through a concrete overlay applied to a concrete slab, properly adhere steel disks to cored concrete, and perform an in-situ tensile pull-off test. ICRI Technical Director, Ken Lozen, provided oversight for the judging, assisted by Jacob Borgerson, PE from WJE's Houston Office, and Jonathan O'Conner from Terracon's Dallas office.

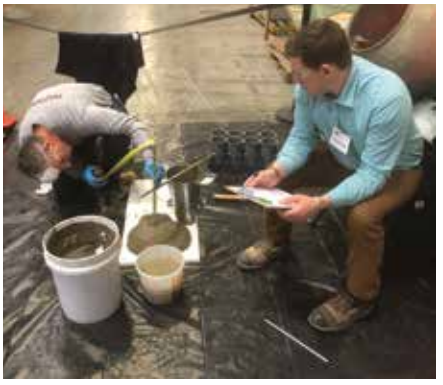
North Texas chapter volunteers (L-R) Juancarlos Escalante, Chad Eades, Julie Bolding, Pete Haveron, Patrick Jorski, Stephen Grelle, Mark LeMay, (not pictured) Clay Broyles, Jon Carrier, Robert Milton

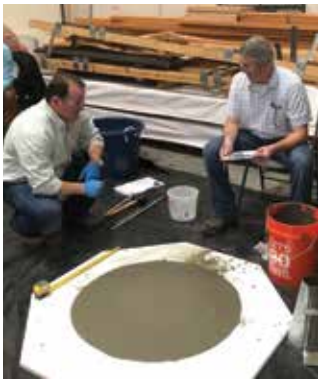
The following six participants successfully completed the CSRT Tier 2 Performance Exam and are now Certified Concrete Surface Repair Technicians:

- RW Smith, Master Construction & Engineering, Dallas, TX
- Greg Musgrove, G & B Tile & Plaster, Lewisville, TX
- Pete Haveron, Texas Concrete Restoration, Midlothian, TX
- Michael Whyman, Terracon, Dallas, TX
- Jason Christensen, Jason Holdings, LLC, New Braunfels, TX
- Mark LeMay, JQ Engineering, LLP, Fort Worth, TX

Special thanks go to the following volunteers who assisted before and during the event: Patrick Jorski, BASF, Clay Broyles, Euclid Chemical, Jon Carrier, Mid-Continental Restoration, Julie Bolding, Armstrong-Douglass Partners, Juancarlos Escalante and Mark LeMay, JQ Engineering, LLP, Stephen Grelle, WJE, and Adam Turner, Billy Viars, Robert Milton and Chad Eades, Simpson Strong-Tie.

In addition, the Chapter thanks the following companies that donated materials, equipment, supplies and pre-event set-up: Mid-Continental Restoration, Euclid Chemical, Texas Concrete Restoration, BASF, JQ Engineering, LLP and Simpson Strong-Tie.


G&B Tile & Plaster President, Greg Musgrove, performing a concrete slump test


North Texas Chapter President, RW Smith, performing a concrete slump flow test


North Texas Treasurer, Pete Haveron, core-drilling an overlaid concrete slab under the watchful eye of CSRT judge, Jacob Borgerson


Terracon's Michael Whyman performing a concrete slump test for judge Jonathan O'Connor


ICRI Technical Director, Ken Lozen, quizzes Jason Holdings' Jason Christensen at the tensile pull-off test station


ICRI Vice President, Mark LeMay, performing a concrete slump flow test

NORTHERN OHIO ICRI CHAPTER FEBRUARY MEETING

The Northern Ohio Chapter held a chapter meeting on February 12, 2019. The meeting topic was "Job-site Climate Control: The Key to Project Schedules, Safety, Savings, and Success." It was presented by Heath Warner of the Chas. E. Phipps Company. The presentation reviewed the changes in equipment used to control climates on construction sites over recent years and the changes in OSHA regulations regarding that equipment. Heath discussed the types of equipment that can be used to control the temperature and humidity on a jobsite during different times of the year and how that can affect the project schedules and costs.

The 2019 Chapter Board was introduced to the chapter and Tom Lavelle was recognized by the chapter for his work as Chapter President. This year's board is: Matt Krauss – President (Chas. E. Phipps); Jerry Phenney – Vice President (Mapei); Sara Peters – Secretary (THP Limited); Corey Shontz – Treasurer (R.L. Wurz); Kevin Kasner – Director (Chas. E. Phipps); Aimee Pergalsky – Euclid Chemical (Director); William Vermes – Director (Jones-Stuckey); Scott Luthman – Director (M-A Building and Maintenance); Mark Churpek – WJE (Director); Jim Wamelink – Director (WR Restoration).

ROCKY MOUNTAIN HOSTS WINTER LUNCH SEMINAR

The Rocky Mountain Chapter held its Winter Lunch Seminar at the View-House in Centennial, Colorado on Wednesday, February 20, 2019, with 38 members and guests in attendance. The topic of the Technical Seminar was "ACI 562 Evaluation, Repair, and Rehabilitation of Concrete Buildings." Mr. Carl "Chuck" Larosche with WJE presented case studies based on Chapter 8 – Durability in ACI 562-16. This luncheon was originally scheduled to coincide with the Rocky Mountain Chapter's hosting of the Concrete Surface Repair Technician (CSRT) live performance testing to be held on April 25, 2019 in Denver, CO.

Guest speaker Chuck Larosche from WJE is seen here presenting on durability and ACI 562-16 to the Rocky Mountain chapter

Terry McGovern (left) from WJE is the past Treasurer of the Rocky Mountain Chapter and Chuck Larosche (right) also from WJE pose together prior to the presentation

CHAPTERNEWS

CHAPTERS COMMITTEE CHAIR'S LETTER

MICHELLE NOBEL
Chapters Chair

Now that the new year has started, all the holiday decorations have been put away, the World of Concrete ICRI Kickoff Party is over, which set a new record for attendees and proved to be one of the highlights at the WOC, and the first ICRI Chapter Round Table has occurred, it's time to start thinking about the ICRI Spring Convention!

Before I go into that, I want to discuss the ICRI Chapter Round Table that we had in Phoenix February 11-12. In attendance were representatives from each of the following chapters: Arizona, British Columbia, Northern California, North Texas, Pacific Northwest, Rocky Mountain, and Southern California. Unfortunately, Houston and South Central Texas were unable to attend, but once they hear what they missed, I'm certain they will be at the next one! Also, in attendance were the current ICRI President Chris Lippmann, current ICRI President-Elect Mark LeMay, me as Chapters Committee Chair, as well as the Regional Representatives from Region 5 Jon Connealy, and Region 9 Brian MacNeil. Staff members in attendance were; Executive Director Mike Levin, Technical Director Ken Lozen, and Chapters Director Dale Regnier. All in all, with 20 people in attendance, it was a another successful and productive ICRI Chapter Round Table, with a lot of notes of new ideas being taken down, to help strengthen all the Chapters in the West! I'm looking forward to the next ICRI Chapter Round Table in Chicago in October, details will be coming out shortly.

By now, the chapter awards paperwork should have been filled out by all the past presidents for 2018. This is a great way to gauge how well your chapter is performing. After filling out the paperwork, you can see the areas that may need improvement. I can't wait to see who brings home the illustrious "Chapter of the Year" Award and the new ICRI Fellows!

CHAPTERS COMMITTEE CHAIR'S LETTER (continued)

Next on the agenda is the ICRI Spring Convention in Jacksonville, Florida, April 8-10, 2019, *Waterproofing with Aesthetics - Making It Dry and Appealing to the Eye* at the Omni Jacksonville Hotel. I'm looking forward to seeing Florida's ICRI Chapters coming out in full force to represent for ICRI, as well as all the ICRI Chapters across North American and beyond! There's a lot of fantastic things planned for this convention and you don't want to miss out!! Remember to sign up your delegates for this event. It's one of the benefits of being an ICRI member and you really don't want to miss it! To find out the top reasons to attend, as well as the registration, sponsors & exhibitors, convention schedule-at-a-glance, technical & committee schedules, chapter hosted social events, Women in ICRI Social, travel and hotel information, visit: https://www.icri.org/mpage/spr19-convention-home.

Other dates to mark on your calendar are:

Concrete Slab Moisture Testing March 13-14, 2019 in Detroit, Michigan

ACI Spring 2019 Concrete Convention and Expo March 24-28, 2019 in Quebec City, Quebec

Concrete Slab Moisture Testing April 3-4, 2019 in Northbrook, Illinois

ICRI Spring Convention April 8-10, 2019 in Jacksonville, Florida

CSRT (Concrete Surface Repair Technician) – Tier 2 Live Performance Exam April 25, 2019 in Denver, Colorado

Concrete Slab Moisture Testing May 5-6, 2019 in Fort Worth, Texas

Concrete Slab Moisture Testing June 27-28, 2019 in Pompano Beach, Florida

Concrete Slab Moisture Testing September 25-26, 2019 in Baltimore, Maryland

ACI Fall Convention and Expo October 20-24, 2019 in Cincinnati, Ohio

Concrete Slab Moisture Testing October 14-15, 2019 in Atlanta, Georgia

The ICRI Chapter Round Table October 2019 in Chicago, Illinois (Date TBD)

The ICRI Fall Convention November 11-13, 2019 in Philadelphia, Pennsylvania.

For other chapter events like other ICRI Chapters, visit: https://www.icri.org/events/event_list.asp?DGPCrSrt=&DGPCrPg=1

Remember to turn in your chapter events so they can be listed on the ICRI website, and don't forget to check the ICRI website to see if there's an event while you're traveling. Reach out to the local chapter president to see if they're having an event while you're in town. At ICRI we're always trying to support all our ICRI Chapter Members!

The technical guidelines and the concrete surface profile chips are a great item to sell at your dinner meetings, demo days or any other event your chapter may be hosting. As members of ICRI, you get a discounted price if you want to sell them at your chapter meetings and events. You can use them as a fundraiser or pass the savings along to members. It's another ICRI benefit that can be utilized to increase revenue for your chapter and help your members. Reach out to Dale Regnier and arrange to get these items for your members!

If you're looking to become a qualified concrete surface repair inspector. The Concrete Surface Repair Technician (CSRT) Certification Program, the Certified Concrete Slab Moisture Testing Technician (CCSMTT) Certification Program and ACI 562-16 Repair Code and Guide Training are training programs offered by ICRI. To find out more information on these programs please visit icri.org and go to the Education tab at the top of the page or contact the ICRI Office at (651)-366-6095.

In the inspirational words of Henry David Thoreau, "Success usually comes to those who are too busy to be looking for it." So, make it a goal to have a successful ICRI Chapter!

As always, be careful, travel safe, and I'll see everyone in Chicago for the next ICRI Chapter Roundtable!

Sincerely,

Michelle Nobel
2018 Chapters Committee Chair

ICRI CONCRETE REPAIR
Restore | Repurpose | Renew

ICRI has 38 chapters, including 2 student chapters, in metropolitan areas around the world. Chapters hold technical presentations, educational meetings, symposiums, 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.

PRODUCTINNOVATION

BOSCH X-LOCK INTERFACE MAKES FAST, SIMPLE GRINDER WHEEL EXCHANGE A SNAP

Advanced interface makes accessory change up to 3x faster than conventional interface

Bosch is the acknowledged leader in development of professional interface systems for power tools – interfaces so technically advanced that they've become industry standards. Today, the company has added another breakthrough to that impressive history with the introduction of the X-Lock interface for grinders.

Bosch metal-cutting and grinding abrasive wheels with the X-Lock mount offers a wheel change that's three times faster than conventional interfaces. X-Lock wheels are ejected with a lever pull and firmly connected without the need for a spanner wrench or flange nuts. An audible snap tells the user that the wheel is installed securely on the tool.

The X-Lock accessories not only provide faster change-out for grinders with X-Lock mounts, but most are backward compatible with standard 7/8 In. mounts. High-quality wheels will cover core grinding applications including but not limited to bonded discs, flap discs, wire wheels, and diamond blades.

To learn more about the Bosch X-Lock interface or to find a local Bosch dealer, visit www.boschtools.com.

NEW ULTRABOND ECO® 811 ADHESIVE CAN HANDLE ANY CARPET TILE

MAPEI recently launched Ultrabond ECO 811, a mint-colored adhesive that provides an enhanced, aggressive tack for installing all types of carpet tile and has releasable properties for easy removal of flooring. *Ultrabond ECO 811* provides a secure adhesive base for standard PVC-backed carpet tile as well as non-PVC-, polyolefin-, felt- and bituminous-backed carpet tile. This universal carpet tile adhesive can also be used to bond fiberglass-reinforced vinyl sheet flooring.

As a leading manufacturer for a wide variety of floors, MAPEI has introduced *Ultrabond ECO 811* to meet the needs of the increasing demand for carpet tile installation. Carpet tiles add depth and texture to a room, while also being easily replaceable versus replacing an entire floor. To meet this versatility, *Ultrabond ECO 811* is specially designed to provide the option of a permanent or releasable base, accommodating the remodeling cycles typical in residential homes, office buildings, hospitality settings and institutional locations.

For a releasable application, Ultrabond ECO 811 should be allowed to dry to its tacky phase before the floor installation. For permanent installations, flooring should be installed into *Ultrabond ECO 811* while it is wet. This adhesive is also Green Label Plus certified, contributing to LEED v4 points and verified as "Red List Free" according to the most current Red List on the Living Building Challenge website.

Ultrabond ECO 811 is suitable for various substrates including wood underlayments, exterior-grade plywood, cement terrazzo and fully bonded vinyl composition tile.

GEOPHYSICAL SURVEY GROUND PENETRATING RADAR SYSTEMS

Geophysical Survey Systems, Inc., the world leader in the development, manufacture, and sale of ground penetrating radar (GPR) equipment, primarily for the concrete inspection, utility mapping and locating, road and bridge deck evaluation, geophysics, and archaeology markets.

GSSI knows its customers operate in environments that can be as tough as it gets. To bring their latest industry-leading Ground Penetrating Radar (GPR) systems to market, GSSI needed a capable, flexible controller platform for use with their highly specialized devices. After considering other players in the rugged computing market, GSSI decided to pair their GPR device with the Panasonic Toughpad FZ-G1 and Toughpad FZ-M1 tablets. By deploying the Toughpad tablet, GSSI was able to create a partnership with a brand that has a similar reputation for being rugged enough for the toughest field environments. GSSI now offers customers a highly capable solution in a device that will last, eliminating fears of damage or replacement.

For more information visit https://www.geophysical.com/

SIMPSON STRONG-TIE LAUNCHES NEW FIELD-ADJUSTABLE RAFTER HANGER DESIGNED FOR EASY RETROFIT INSTALLATIONS

Simpson Strong-Tie, the leader in engineered structural connectors and building solutions, today announced the launch of the patent-pending LSSR slopeable and skewable rafter hanger. It's the first product of its kind designed to allow retrofit installation after rafter systems have been assembled in place, helping contractors accelerate job sequencing for improved productivity.

The field-adjustable LSSR features an enhanced flange design allowing for skew adjustments from 0° to 45°, is easier to install than predecessor rafter hangers, and features an easily adjusted swivel stirrup that attaches to both sides of an I-joist for a stronger connection.

Prior to the launch of the LSSR, hanger systems had been installed on the rafter and then attached to the ridge beam, with an installer nailing the hanger into place. With the LSSR, installers can cut all the rafters and tack them into place, then use a retrofit approach to nail hangers onto the roof assembly. Providing an innovative, retrofit-application solution is expected to particularly benefit builders in regions where stick-built framing dominates the new homebuilding market.

The new LSSR rafter hanger features a ZMAX® finish for extra corrosion protection and is available off the shelf, making it easily accessible for contractors on the go. It's an enhanced and improved design of the LSSU, which it will replace in the market. For more information about the LSSR rafter hanger, visit strongtie.com/LSSR.

QUIKRETE® RE-CAP INTRODUCED AT WORLD OF CONCRETE NEW RESURFACER ARMS CONTRACTORS WITH UNMATCHED CONCRETE RESTORATION CAPABILITIES

QUIKRETE®, the leading manufacturer of pre-blended commercial-grade cement and concrete products, has redefined concrete restoration with its new QUIKRETE® Re-Cap Concrete Resurfacer. An affordable and effective alternative to replacing worn concrete, QUIKRETE® Re-Cap Concrete Resurfacer introduced at the World of Concrete in Las Vegas Convention Center last week.

Designed to repair and renew old, spalled concrete with a permanent wear resistant surface that can withstand foot, vehicle and other heavy traffic, the new QUIKRETE® Re-Cap Concrete Resurfacer has a bond to concrete that is four times stronger than the concrete itself. That means, a concrete substrate will fracture or crack before its bond with QUIKRETE® Re-Cap Concrete Resurfacer. In addition, QUIKRETE® Re-Cap Concrete Resurfacer has superior working time and flow characteristics than other resurfacers on the market. As a result, it's easier and faster to transform a deteriorated concrete surface into a durable, long-lasting sidewalk, driveway or patio.

A proprietary blend of Portland cement, graded sand, polymer resins and other additives, QUIKRETE® Re-Cap Concrete Resurfacer is a proven shrinkage compensated repair material for making thin structural repairs to sound concrete in need of surface renewal. Applied with a squeegee, trowel or brush, one 40-pound bag will cover approximately 40 square-feet at 1/8 inch thick and up to 80 square feet as skim coat. With a walk-on time of eight hours and drive-on time of 24 hours, it can renew a surface for about 25 cents per square foot versus more between $3.50 and $5.50 per square foot to remove and pour a new slab.

For more information visit https://www.quikrete.com/

AVANTI INTERNATIONAL ANNOUNCES 50-YEAR PRODUCT WARRANTY ON AV-100 CHEMICAL GROUT FOR MUNICIPAL APPLICATIONS

Avanti International announces a 50-year product warranty on its AV-100 Chemical Grout for municipal applications of sealing mainline pipes, service laterals and lateral connections.

According to the United States Environmental Protection Agency (EPA), almost half the flow to wastewater treatment facilities comes from infiltration and inflow (I&I), which is clean groundwater entering the collection system. This extraneous flow overloads treatment plants and costs taxpayers.

Public works authorities in small towns, mid-sized communities and large sewer districts may now choose to be proactive with a 50-year product warranty supporting the proper application of AV-100 Chemical Grout. Using low-pressure, AV-100 is injected through faulty joints and defects, creating a bond with the soil for a positive seal and impermeable barrier to infiltration.

Avanti has now chosen to offer the 50-year product warranty on AV-100 due to the company's confidence in scientific evidence, empirical data and experience.

New Scientific Evidence—In September 2018, Avanti released a white paper with supporting data from an independent third-party laboratory. The study measured the relative humidity (RH) in soil depths consistent with the collection system. Field results showed that even in arid climates, the RH level at these various depths remained near 100 percent. Additional laboratory analysis observed the effects of AV-100 in the presence of high RH over time, and showed no desiccation or loss of moisture. This means that AV-100 grout shows no signs of shrinkage with climatic wet/dry cycles.

Empirical Data—One of the most exhaustive studies on AV-100 Chemical Grout was performed in 1988 by the United States Department of Energy. At 20 percent gel strength, the data from this study supports a 362 year half-life of AV-100 in the soil. At the new 12 percent gel strength standard for municipal grouting, the expected service life of grout can be calculated to be minimum 50 years.

Experience—Avanti has always operated on the premise that if there is a problem with the product, we will replace it. According to Britt N. Babcock, PE, president of Avanti, "Over the last 40 years that our company has been in business, AV-100 has never been replaced due to an issue with the product."

Warranty Specification
Building on the current National Association of Sewer Service Companies / Infiltration Control Grouting Association (NASSCO/ICGA) standard, Avanti has produced the AV-100 Warranty Specification with the following requirements:

- Standard grout mix at 12 percent gel strength.
- A certified technician on every grout truck.
- Onsite Inspection
- 50-year product warranty.
- Service warranty to be defined by engineer and municipal owner.

Many municipalities can no longer choose to postpone necessary maintenance for their aging collection systems. Grouting is a logical choice as a standalone solution or in conjunction with cured-in-place pipe (CIPP) methods. Performed properly, injection grouting is a low-cost, high-value method for increasing the longevity of existing assets.

With Avanti's AV-100 50-year warranty, municipalities can rest assured that repairs to the infrastructure will be done correctly by a certified technician, and that the product will greatly extend the life of the collection system.

More information can be found at http://www.avantigrout.com/.

CINTEC™ FIRE RESISTANT ANCHORS

As a leader in structural preservation, Cintec™ has always been an advocate for the restoration of safe buildings through fire-resistant anchors, as long ago as 1993 fire tests were carried out by the internationally recognized Building Research Establishment. The fire rig was designed for use in the measurement of the performance of Cintec's™ anchors in a fire situation while subjected to a mechanical load which might be a result of wind suction of fire-induced thermal movement.

Cintec's™ remedial anchors survived a two-hour test without failure of any of the samples. Every sample reached several hundred degrees in the part of the anchor nearest to the fire face. This indicates the anchor system can be recommended for repair work to buildings requiring a fire rating of up to two hours.

Cintec™ anchors are the cementitious fire-resistant alternative to resin anchors. Since Cintec's™ anchors are based on reliable restoration materials, cementitious grout and stainless steel, they easily provided the elusive fire rating typically absent in other systems.

For more information visit www. cintec.com.

AQUANIL™ PLUS PENETRATING SILANE SEALERS NOW AVAILABLE WITH MIGRATING CORROSION INHIBITOR PROTECTION

ChemMasters, Inc. has announced the addition of three new versions to its popular Aquanil Plus line of deep penetrating, chemically reactive silane sealers. The new Aquanil Plus MCI series silane sealers feature the addition of a migrating corrosion inhibitor (MCI) for superior corrosion protection of structural steel and rebar in concrete in a single application.

Aquanil Plus 40 MCI (40% solids silane, <600 g/L VOC), Aquanil Plus 40-A MCI (40% solids silane, <250 g/L VOC) and Aquanil Plus 100 MCI (100% solids silane, <250 g/L VOC) are formulated to offer a V.O.C. compliant option for all regions within the US and Canada. They are non-etching, will not harm most uncoated glass or metal frames and leave no residue to clean, making application quick and easy.

Silanes provide superior protection to concrete from damage caused by exposure to freeze/thaw cycles and deicing chemicals at the substrate surface. Adding migrating corrosion inhibitor delivers fortified protection from tensile stresses on concrete because underlying structural steel and rebar corrode from water exposure and chloride intrusion from above, as well as from water vapor originating beneath the slab.

The enhanced protection of Aquanil Plus 40 MCI, Aquanil Plus 40-A MCI and Aquanil Plus 100 MCI delivers "MAX Protection" for exterior cast in place concrete, bridge and parking decks, columns, beams, and roadways. Wherever long term protection of concrete surfaces and structural steel or rebar is critical to long-term performance, these products are an outstanding choice.

ChemMasters, Inc. is a 60 year-old manufacturer of specialty concrete chemicals used to improve, repair and protect concrete and masonry. The company is the acknowledged leader in the formulation and manufacturing of low-VOC solvent-based products for use in the states that require them. A state-of-the-art research and development facility is operated by ChemMasters to advance the science of concrete improvement.

For more information visit www.chemmasters.net.

SIMPSON STRONG-TIE® 2019 WOOD CONNECTORS CATALOG ALIGNS WITH 2015 AND 2018 I-CODE CHANGES, SHOWCASES ROBUST PRODUCT LINES AND EXPERT INNOVATIONS

The Simpson Strong-Tie 2019–2020 Wood Construction Connectors catalog, a comprehensive guide to the company's most recent innovations and product line expansions for wood construction applications, is now available in print and online.

The new catalog is the first in the industry with updated connector allowable load tables to meet the new ASTM test standards required by the 2015 and 2018 International Building Code® (IBC®). It is designed to assist engineers, architects, designers and contractors in selecting the right products for improved performance, efficiency and productivity. And in an ongoing effort to make it easier for pro suppliers to manage inventories, we've streamlined and simplified our product line offerings.

The new catalog features more than 14 new products and product line extensions, including new additions to the Outdoor Accents® collection of decorative hardware, and the MPBZ moment post base and BT brick tie product lines. To simplify product specification, Simpson Strong-Tie has eliminated redundancies to make it easier for customers to choose the right product, and has moved a portion of specialty items to the website in order to further streamline the catalog and provide for an enhanced user experience both in print and online.

Important Load Table Changes

Both the 2015 and 2018 IBC and the International Residential Code® (IRC®) require manufacturers to test joist hangers and similar products to a new standard, ASTM D7147. Simpson Strong-Tie has worked diligently to re-evaluate all of its related wood connectors to meet the new test standard. The new 2019 Connectors catalog reflects this exhaustive work in the updated tables for allowable loads of connectors used for wood-to-wood, wood-to-concrete, wood-to-masonry and wood-to-steel connections. Allowable loads that changed more than 5% — up or down — are indicated in red in the product load tables. All Simpson Strong-Tie connector IBC code reports have now been updated to the 2015 IBC, and 85% of those connector reports have been updated to the 2018 IBC.

Construction professionals engaged in designing current and future projects in states adhering to the 2015 or 2018 I-Codes® should check existing product load tables against our updated load values. While these load changes do not affect completed and permitted projects, Simpson Strong-Tie recommends using these new values going forward. To view the ICC code adoption map, click here. (Note: You'll need to click on each state to view the code adoption details.) Check with your local building officials to ensure acceptance.

Current projects in jurisdictions using 2012 or older building codes can reference the load values in our 2017–18 Wood Construction Connectors catalog and use the current versions of our Connector Selector® software and Joist Hanger Selector web app. (Note: This software will be updated with the new allowable loads by the end of March 2019.)

For more background about how we re-evaluated our connectors to meet the new standards, see our recent Structural Engineering Blog post.

For more information or to order your copy of the Simpson Strong-Tie Wood Construction Connectors catalog, visit strongtie.com/connectorscatalog.

INTERESTED IN SEEING YOUR NEW PRODUCT IN THIS COLUMN?

Email your 150-200 word product information to editor@icri.org. Content for the May/June 2019 issue is due by April 1, 2019 and content for the July/August 2019 issue is due by June 1, 2019. One (1) high resolution product photo may be included. ICRI reserves the right to edit all submissions.

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MAPEI provides a **world** of Concrete Restoration Systems

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MAPEI offers a full spectrum of products for concrete restoration, waterproofing and structural strengthening. Globally, MAPEI's system solutions have been utilized for bridges, highways, parking garages, stadiums, buildings and other structures.

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