The ACI Foundation promotes progress, innovation, and collaboration in the concrete industry through strategic investments in research, scholarships, and ideas.

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Spring 2018-Spring 2019

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We believe in advancing the world through innovative concrete solutions.
From the Executive Director

Dear Friends,

Thank you for making 2018 a remarkable year for the ACI Foundation. This year marked a new era as our team tripled in size and has worked hard to expand our outreach while strengthening our programs and services.

This year wouldn’t have been a success without our incredible donors. Because of you, the ACI Foundation provided $375,000 in research grants that funded eight essential research projects, distributed over $200,000 in fellowship and scholarship awards to 19 of the best students in the industry to help pay for their schooling, and also gave them access to attend The ACI Concrete Conventions and Expositions. Not only is the ACI Foundation impacting research and education but we also committed over $360,000 toward initiatives that serve new technology and innovation in the concrete industry.

That’s a major testament to the commitment and compassion of our financial supporters, our incredible volunteers, and our staff!

A few program highlights include:
• Record level of funding for research;
• Secured 100% of ACI Board of Directors and ACIF Trustees contributions to the Foundation;
• Mailed our first annual appeal that raised over $13,000;
• Reorganized our council structures/terms and strengthened our policies to make a bigger impact;
• Funded a new Materials Fellowship that emphasizes studies of concrete materials;
• Awarded the Don Marks Fellowship for the first time ever—created for students who lean towards a builder’s “hands-on” career in concrete; and
• Created a development committee that helped bring in over $85,000 in their first year of volunteering.

We are stronger than ever due to our continually expanding community who come together to donate time, resources, and talent in support of our important mission.

Thank you for serving our community.

All my best,

Ann Masek
Executive Director
+1.248.848.3144
ann.masek@acifoundation.org

From the Chair

Dear Fellow Volunteers,

There is no denying the importance of concrete just like there is no denying the importance of being involved in ACI. Thank you to all the selfless ACI members who choose to collaborate, learn, or volunteer within ACI. Every day, you make a difference for the next generation all around the world. Together, we improve concrete to be more efficient, effective, versatile, affordable, sustainable, and so much more.

In addition to your volunteer efforts—your committee work, your research, your presentations, your award submissions—ACI has another important way to help build a better future: the ACI Foundation, which was established by ACI to help promote progress, innovation, and collaboration in the industry.

In its history, the ACI Foundation has funded nearly $5 million of work which funneled new technology, critical research, and people into ACI and the industry, creating enormous benefit and advancing construction and improvement in the quality of modern life.

It has been a privilege to help lead the ACI Foundation. In fact, my career through concrete has been leveraged by supporting the ACI Foundation. You, too, can pay it forward to bring more students into the industry, enhance all citizens’ lives by building better with concrete through research, or stay current on technology that can improve how we build.

The ACI community has long joined together with the common goal of advancing concrete guides, codes, and standards and educating users of concrete. Let’s broaden the ACI Foundation community—get involved today to keep this spirit of kinship through giving back!

Thank you,

Mike Schneider
Baker Concrete Co.
Senior Vice President
+1.513.539.4000
schneider@bakersharedservices.com
Frank-Nelson Muhande Musemate was born and raised in Kenya and moved to the United States about 5 years ago to pursue a university degree in civil engineering. When he was 10 years old, Musemate witnessed a bridge collapse in his hometown, leading to loss of lives and property. Ever since this accident, he has had a passion for engineering and construction, which motivated him enough to educate himself so he can help fix his nation’s infrastructure and buildings.

Musemate comes from humble beginnings and had to finance his studies mainly through scholarship and fellowship grants. He said:

“One of the requirements in the program was to do internships during my summer break, so that pushed me to go out of my way to apply for different kinds of opportunities. The companies ranged from design companies to construction companies. I was able to visit construction sites where reinforced concrete structures were being built and got to see in person ACI specifications being implemented in a real-life setting. On the academic side, I was able to see how the ACI codes could be applied toward ensuring safe and reliable construction.”

Since being awarded the ACI Baker Student Fellowship, Musemate has mentored other students applying for grants and offers this wisdom:

“Be honest and be truthful to yourself…be upfront on why you are pursuing the degree in engineering. If you’re not sure why you are doing something, then you’re not going to be 100% sure on how you will contribute to the future.”

Musemate plans to earn a PhD and is grateful for the ACI Foundation and the opportunities it has given him.

To read the full story, visit acifoundation.org.
The ACI Foundation hosted its first exclusive event, kicking off its new era of fundraising at The ACI Concrete Convention and Exposition in Las Vegas, NV, on October 14, 2018. Attendees learned more about the ACI Foundation and celebrated the achievements its supporters made possible, while having cocktails and hors d’oeuvres. A short program during the event highlighted the importance of research and new technology, engaging students, and giving back to the industry. Thank you to all the ACI members and business affiliates who attended and made the evening such a success!

Above and beyond the ACI spend policy contribution of over half a million dollars, the ACI Foundation, along with its volunteers, worked hard in 2018 gaining thousands of dollars in new funds to supplement and sustain growth.

"ACIF provides an excellent platform for people in the industry to pay back a fraction of their success. Their contribution will ensure the continued success of ACI to lead the concrete industry globally and for the ACI Foundation to prepare the leaders of tomorrow and be the force for technical breakthrough and innovation."

Khaled Awad

"The Foundation...is intended to facilitate idea and innovation that cannot be accomplished elsewhere within the different interests and silos of the concrete industry."

Tracy Marcotte

**Funds Raised for the ACI Foundation in 2018**

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>ACI Board and ACIF Trustee Giving Back campaign:</td>
<td>$58,793</td>
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<tr>
<td>ACIF Program and general donations:</td>
<td>$86,660</td>
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<td>ACI member donations to ACIF after renewing ACI membership:</td>
<td>$2835</td>
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<td>ACIF Fall Appeal:</td>
<td>$13,208</td>
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<td>AOE generous donation given during 2018 Fall Convention:</td>
<td>$100,000</td>
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<tr>
<td>SDC underwritten sponsorships:</td>
<td>$1000</td>
</tr>
<tr>
<td><strong>Total funds raised in 2018:</strong></td>
<td><strong>$262,496</strong></td>
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</tbody>
</table>

$262,496 raised
$195,811 new money
Nearly 75% increase!
ACI Foundation 2018 Donors

**Visionary ($15,000+):**

- Advancing Organizational Excellence (AOE)
- American Concrete Institute
- Khaled Awad
- Baker Concrete Construction, Inc.
- Carolinas Chapter – ACI
- Louisiana Chapter – ACI

**Innovator ($10,000 - $14,999):**

- Ronald Burg and Jill Humphrey
- Jeff and Ayanna Coleman
- CVM
- Kimberly Kayler
- David and Risë Lange
- Randall and Bonnie Poston

**Benefactor ($5000 - $9999):**

- Poppoff, Inc.
- Sharon Wood

**Scholar ($1000 - $4999):**

- Frances Griffith
- Trey Hamilton III
- Brad Inman
- Jim Jirsa
- Jack Moehle
- Debby Orsak
- Mike Schneider

**Advocate ($500 - $999):**

- Ace Avant Concrete Construction
- Joseph Bracci
- Carriérs PCM Inc.
- Holcim
- Michael Kreger
- New Mexico Chapter – ACI
- Pittsburgh Area Chapter – ACI
- Procon, Inc.
- Brian Quinn

**Friend ($25-$499):**

- Paul Albanelli
- Lyad Alsamsam
- American Society of Concrete Contractors
- Hal Amick
- Phillip Antis
- Gergi Ashkar
- Roger Baptiste
- John Baranello
- Barton Malow Company
- BASF Admixtures, Inc.
- Russell Baumgartner
- Robert Behm
- Michael Bley
- Michael Bolatto
- William Boone
- David Bosley
- Francis Brezny
- Heather Brown
- Pete Browne
- John Brun
- Nathan Charlton
- Mark Cheek
- Kun-Young Chiu
- Concrete Contractors Interstate
- Christopher Crouch
- Michael DeBlasio
- Rafael Discipulo
- Anne Ellis
- Euclid Chemical Company
- Jiri Grygar
- Donna Halstead
- John Hayes
- Heidi Helmk
- Roberto Hernandez
- HM Loke Consulting Engineering PC
- Doug Hooton
- Shuyeh Hsu
- Joe Hug
- John Johnston
- Michael Jundt
- Srima Kalaga
- William Klorman
- Cary Kopczynski
- Frank Kozeliski
- Neven Krstulovic-Opara
- Michael Leming
- Giulio Leon Flores
- Lawrence Levy
- Heng Loke
- Lynchburg Ready Mix Concrete Co.
- Tewolde Lyob
- Jeffrey Lyon
- Harendra Mahendra
- Steven Maresca
- Ann Masek
- McC, Inc.
- Donald McMican
- Bernard Meyers
- Kevin Miley
- Antonio Mireles
- Jared Murray
- Tony Nanni
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- William Porter
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- Leonardo Reyes Madera
- Dennis Roby
- Sika Corporation
- Robert Sinn
- Standard Materials, Inc.
- Steven Stelzer
- Ron Stewart
- James Van Wyk
- Don Weempe
- Stephen Wilcox
- William Wilhelm
- Michelle Wilson
- Paul Zia

www.acifoundation.org
Key Volunteers

Nicholas J. Adams, Euclid Chemical Company
Scott M. Anderson, Pankow
Emmanuel K. Attiogbe, Construction Chemicals
Roger J. Becker, PCI
Claude Bedard, Euclid Admixture Canada, Inc.
Tonya Beesley, Baker Concrete Construction, Inc.
Anahid Behrouzi, CA Polytechnic State University
Richard P. Bohan, Portland Cement Association
Joseph M. Bracci, Texas A&M University
Michael C. Brown, WSP USA
Heather J. Brown, Middle Tennessee State University
Kirk Burns, Burns Concrete, Inc.
John P. Busel, ACMA
Rodney J. Chiodo, R-E-D Industrial Products
Matthew D. D’Ambrosia, MJ2 Consulting, PLLC
Om P. Dixit, Dixit Consultants, LLC
Jonathan E. Dongell, Pebble Technologies, Inc.
Anne M. Ellis, Charles Pankow Foundation
Chris A. Forster, Largo Concrete, Inc.
David W. Fowler, University of Texas at Austin
Beverly A. Garnant, American Society of Concrete Contractors
Mario Garza, Barton Malow Company
Benjamin A. Graybeal, Federal Highway Administration
Charles S. Hanskat, American Shotcrete Association
G. Terry Harris, GCP Applied Technologies

Neil M. Hawkins, University of Illinois at Urbana-Champaign
Cecil L. Jones, Diversified Engineering Services, Inc.
Danielle D. Kleinhans, Concrete Reinforcing Steel Institute
Lesley Suz Chung Ko, BASF Corporation
Carl J. Larosche, Wiss, Janney, Elstner Associates, Inc.
H. S. Lew, NIST
Colin L. Lobo, NRMCA
Claudio E. Manissero, ChemCognition, LLC
Paul F. Mlakar, Corps of Engineers
Vilas S. Mujumdar, Consulting Engineer
Gary G. Nichols, ICC Evaluation Service, LLC
Charles K. Nmai, BASF Corporation
Debrethann R. Orsak, Cagley Associates, Inc.
Aleksandra Radlińska, Pennsylvania State University
Joseph C. Sanders, Western Pacific Precast
Glenn E. Schaefer, Structural Technologies
Anton Karel Schindler, Baker Concrete Construction, Inc.
Jackie A. Sempel, Burk-Kleinpeter, Inc.
Michael M. Sprinkel, Virginia Transportation Research Council
Michael S. Stenko, Transpo Industries
Mark E. Williams, Walter P Moore and Associates, Inc.
ACI Foundation Student Fellowships are offered to high-potential students in concrete-related studies who are endorsed by an ACI member. The purpose of the Student Fellowship Program is to identify, attract, and develop outstanding professionals for productive careers in the concrete field. Please visit https://www.acifoundation.org/scholarships.aspx for more details.

2018-2019 ACI Foundation Fellowship Recipients:

**Don Marks Memorial Fellowship**
Matthew David Burton, University of Cincinnati

**Presidents’ Fellowship**
Hope Hall, Oklahoma State University

**Baker Student Fellowship**
Jonathan Lyle, Arizona State University

**Cagley Student Fellowship**
Katelyn O’Quinn, University of Texas at Austin

**Daniel W. Falconer Memorial Fellowship**
Bret Robertson, Oklahoma State University

**Darrell F. Elliott Louisiana Fellowship**
Tyler Young, University of Louisiana at Lafayette

**Tribute to the Founders Fellowship**
Robert Devine, University of Notre Dame

**Barbara S. and W. Calvin McCall Carolinas Fellowship**
Aaron Miller, The University of Alabama

**Baker Student Fellowship**
Hannah Patterson, Arizona State University

**Charles Pankow Foundation Student Fellowship**
Homero Sobrinho, University of New Orleans

**Richard D. Stehly Memorial Fellowship**
Grace Jackson, Valparaiso University
ACI Foundation Graduate and Undergraduate Scholarships
Funded primarily through generous donations, the ACI Foundation administers these scholarships, which are offered to high-potential graduate students in the concrete-related studies. The ACI Richard D. Stehly Memorial Scholarship is awarded to an undergraduate student.

2018-2019 ACI Foundation Scholarship Recipients:

<table>
<thead>
<tr>
<th>Scholarship</th>
<th>Recipient</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI Scholarship</td>
<td>Joseph Arehart</td>
<td>University of Colorado Boulder</td>
</tr>
<tr>
<td>ACI Scholarship</td>
<td>Maranda Leggs</td>
<td>University of Oklahoma</td>
</tr>
<tr>
<td>W. Gene Corley Memorial Fellowship</td>
<td>Jessica Richard</td>
<td>University of California, Berkeley</td>
</tr>
<tr>
<td>Schwing America Scholarship</td>
<td>Jael Wettach-Glosser</td>
<td>Portland State University</td>
</tr>
<tr>
<td>Bertold E. Weinberg Scholarship</td>
<td>Andrew Foerster</td>
<td>Kansas State University</td>
</tr>
<tr>
<td>Richard D. Stehly Memorial Scholarship</td>
<td>Nicholas Rademacher</td>
<td>Rose-Hulman Institute of Technology</td>
</tr>
<tr>
<td>Stewart C. Watson Memorial Scholarship</td>
<td>Bjorn Vors</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Katharine &amp; Bryant Mather Scholarship</td>
<td>David Whitmore</td>
<td>Auburn University</td>
</tr>
</tbody>
</table>

Serving the industry by bringing high-potential students into the realm of concrete through tuition stipends, and professional exposure to the concrete industry and ACI by funding travel to attend The ACI Concrete Convention and Expositions.
The ACI Foundation and ACI joined this industry-wide coalition to encourage performance-based design (PBD) in concrete design for wind. PBD can improve efficiency of design and construction and can potentially improve structural performance. To provide a PBD approach for wind in ASCE/SEI 7, where no guidance currently exists, system reliability targets must be developed. The project will document specific building response parameters and acceptance target limits for the main wind force-resisting system and cladding envelope system subjected to wind effects and environmental demands. The information developed could assist ACI 375 when updating its current documents. The project has broad industry support, including endorsement by FEMA, NIST, and several structural design firms.

A known handicap exists in applying the provisions of the ACI 318 code to the seismic design of reinforced concrete shear walls using the International Building Code and ASCE 7: the types of walls defined in the ACI 318 code are not the same as those defined in IBC/ASCE 7. This inconsistency leads to confusion and, occasionally, misapplication of the ACI 318 code provision. The research, consisting of P695 studies, would begin to remedy this problem by creating a definition and design parameters for the most commonly used shear wall systems for high-rise construction: ED-RCCWs. This would lead to wider adoption of ductile coupled shear walls in general and would greatly clarify the design procedures for structural engineers.

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Reinforced concrete coupled walls are often used in buildings to resist lateral demands from earthquakes and wind. The primary research objective is to fill knowledge gaps on the behavior of diagonally reinforced concrete coupling beams subjected to axial load through large-scale laboratory testing. Based on both new and previously existing work, a database will be created and used to develop new recommendations for nonlinear modeling parameters and acceptance criteria. The research is expected to provide key parameters that influence load-deformation behavior and address gaps in industry documents, including those in ACI 374 and 318.

This research seeks to develop guidelines for the use of recycled concrete aggregates (RCAs) in new concrete and will therefore provide a much-needed link between existing research and practice. Despite extensive existing research and a significant history of use, instructions for use of RCA have not been widely incorporated into North American standards and guidelines. This project will include a holistic review of the existing literature and statistical analyses of existing data. The goals are to develop guidelines for the characterization of RCA and the creation of specifications for mixtures comprising RCA, which could enhance and support standards and specifications in ACI and other industry organizations.

The end-user community (structural engineers, concrete specifiers) have shown significant interest in concrete with enhanced structural properties. This research project addresses creep, shrinkage, and durability of nanomodified concrete. Given proper handling, small dosages of carbon nanofibers and nanotubes exhibit potential as additives for structural concrete. These additives have the capability to improve critical properties such as modulus of elasticity, flexural strength, and cracking resistance. The study will address significant gaps in the state of knowledge of nanomodified concrete—gaps that are preventing its use as a structural material. The results of this work could bring new materials to concrete engineers, specifiers, and producers; and new markets could emerge to provide nanomaterials in additive or admixture forms.
This project will investigate parameters affecting the shear friction capacity of concrete joints with high-strength reinforcement (HSR). The results will be used to improve shear-friction expressions, as well as allow contractors to consider different roughening techniques. If successful, the project results will have a significant impact on design and construction, possibly reducing the requirements for surface roughening and permitting the use of HSR, and influencing codes and standards changes in ACI 318 and ACI 374.

**Project:** Shear Friction of Concrete Joints with High-Strength Reinforcement  
**ACI Committee Support:** ACI 318-H and -R Structural Building Code, Seismic Provisions and High Strength Reinforcement, and ACI 374, Performance-Based Seismic Design of Concrete Buildings  
**Principal Investigator:** Paolo Calvi - University of Washington

The reported critical chloride thresholds in concrete show a wide degree of variability, which makes it challenging to make accurate service/remaining life predictions for structures in service and specify concrete for new construction. A significant source of this variability is the absence of a standard test for measuring chloride thresholds. This proposal will solve a major problem by unifying how chloride thresholds are measured and reported so that uncertainties associated with predicted service lives, specified performance, and scheduled maintenance operations are minimized. The work will impact many ACI committee documents and could lead to an ASTM standard and influence the fib Model Code for Concrete Structures and several NACE documents. The developed test will provide the input data for several service life software packages that are widely used by the industry, helping owners to assess the state of their structures more reliably and consistently so that they can make informed decisions about their future.

**Project:** Collaborative Study for the Development of a Standard Critical Chloride Threshold Test Method  
**ACI Committee Support:** ACI 222, Corrosion of Metals in Concrete  
**Principal Investigator:** Ceki Halmen - University of Missouri - Kansas City  
**Other Funders:** The Curators of the University of Missouri on behalf of the University of Missouri - Kansas City

Life-cycle assessment (LCA) is mainly used to assess the environmental impacts of concrete structures. To better understand the extent to which some of the sources of variability and uncertainty affect the overall results of an LCA, it is important to understand how methods and assumptions, including technical specifications, such as mechanical and durability performance, functional unit, system boundaries, and allocation methods affect a structural LCA. The research will try to understand the effect of these factors on an LCA and harmonize them so that results of an LCA can be used with confidence and provide more certainty to the decision-making on the structure.

**Project:** Guideline Development for Life Cycle Assessment of Structural Concrete through Meta-Analysis and Harmonization  
**ACI Committee Support:** ACI 130, Sustainability of Concrete  
**Principal Investigator:** Hessam Azarijafari - University of Sherbrooke  
**Other Funders:** Cement Association of Canada
Completed Research 2018

Information on all ACI Foundation-sponsored research, including final reports, can be found on the www.acifoundation.org/research/researchprojects.

Project: SEACON: Sustainable Concrete Using Seawater, Salt-Contaminated Aggregates, and Non-corrosive Reinforcement

Principal Investigator: Antonio Nanni, University of Miami

The research addresses the issue of sustainability from the perspective of the construction material most used worldwide: concrete. This 2.5-year project started on October 1, 2015. It was proposed and carried out by a transnational consortium of six partners and four collaborators including two academic institutions, six companies, and a Department of Transportation. The goal of SEACON is to promote the use of best practices in both the production of concrete and reinforced concrete (RC) structures by implementing alternative materials. The aim is to reduce the use of critical resources by replacing them with alternatives that can be chloride-contaminated coupled with non-corrosive reinforcement. This approach would extend the affordability and sustainability of constructed elements under aggressive environmental conditions without affecting their longevity and durability.

Project: Re-examination of Punching Shear Strength and Deformation Capacity of Corner Slab-Column Connection

Principal Investigator: Min-Yuan Cheng, Assistant Professor at National Taiwan University of Science and Technology

This study examined the effects of slab flexural reinforcement on the punching shear strength and deformation capacity of corner slab-column connections without shear reinforcement. “Punching shear strength and deformation capacity of slab-column connections have been extensively studied previously,” stated Cheng. “However, several controversial issues still exist for the applications of the code provisions, particularly on the corner connections. This research dives deeper into this area. The findings from our testing combined with previous research will help to move the concrete industry forward.” Results from the new study and past studies indicate that punching shear strength and deformation capacity per ACI 318-14 are not conservative for corner slab-column connections. The researchers address this by proposing a new shear strength model in the report.

Project: Serviceability Behavior of Reinforced Concrete Discontinuity Regions

Principal Investigator: Robin Tuchscherer, Northern Arizona University (NAU)

The main objective of this study was to create a procedure for predicting the serviceability behavior of discontinuity regions analyzed using the strut-and-tie modeling method. This was accomplished by correlating the cracking behavior of test beams, in terms of crack width and total area of visible cracking, with the internal strain energy estimated from representative strut-and-tie models. A secondary goal of the project was to refine existing photogrammetric methods to collect crack width, crack area, and displacement data from digital images of test beams. The results of this study represent an encouraging step toward better estimation of cracking behavior of deep beams and discontinuity regions. Information from this research project may be used by ACI committees in the creation of new codes and standards.

High-Strength Reinforcement (HSR) Below are two projects, part of an overall plan endorsed and primarily funded by the Charles Pankow Foundation, to allow the general use of reinforcing steels with yield strength greater than 60 ksi (HSR), which may significantly improve the constructability and efficiency of earthquake-resistant structures. Several ACI 318 building code change proposals related to HSR have been introduced and accepted. The ACI 318 code has been improved by allowing HSR.

Project: High-Strength Steel Bars in Earthquake-Resistant T-Shaped Concrete Walls

Co-principal investigators: Andrés Lepage and Rémy Lequesne, University of Kansas

The focus of this study was on the use of high-strength steel in slender walls dominated by flexure and to determine experimentally the influence of selected reinforcing steel mechanical properties on wall deformation capacity. The principal investigator, Andrés Lepage, remarked on the results, “Walls designed for a target flexural strength using Grade 60 or Grade 100 reinforcement, with similar tensile-to-yield strength ratio, had similar strength and deformation capacity.”

Project: Seismic Performance Characterization of Beams with High-Strength Reinforcement

Principal Investigators: Duy V. To and Jack Moehle, University of California, Berkeley

The steel industry is producing higher-grade steels, but with varying mechanical properties. The research program was to characterize the performance of reinforced concrete beams with high-strength reinforcement subjected to reversed cyclic lateral loading simulating earthquake effects.

This research explored critical material and structural behaviors at the boundaries of high-strength steel properties that could currently be achieved, which included stiffness and strength, local bond stress-slip relationship of bars anchored in adjacent concrete sections, spread of plasticity, inelastic rotation capacity, and ultimate failure characteristics.

They conducted both laboratory tests on beams and numerical (analytical) studies of archetype buildings to establish seismic demands for beams and columns. Key findings of the project showed variability of performance characteristics between Grade 60 and Grade 100 and which are detailed in the final report.
Technology and ideas

Striving to be the catalyst to optimize concrete to serve societal needs.

Better concrete for a better world
Intentional and focused investments in research and technology can help the concrete construction industry meet challenges that include a shrinking workforce, flat productivity growth, and environmental impact, among others.

The Strategic Development Council (SDC) helps by boosting the acceptance of new technologies (processes, methods, and materials), helping to fund research that validates using the technology in the field, monetary support to create technical guides in significantly less time than it takes for an SDO, assembling various industry groups for collaboration on common needs, leveraging individuals’ expertise, and nurturing and guiding new technologies.

The SDC recently adopted four new goals to achieve its vision of optimizing the use of concrete for construction. Via innovative technologies and strategic initiatives, SDC strives to improve efficiency, sustainability, and economy of construction, and extend service life of structures.

SDC Technology Forums
We foster innovation by holding twice-yearly 2.5 day Technology Forums where industry leaders and experts connect to discuss industry challenges, and new technologies are given the opportunity to be evaluated and connect to industry, builders, and users of concrete. Industry challenges are explored, and new technologies are nurtured and guided.

4 Challenging Goals

Goal 1: Improve the durability of concrete
Goal 2: Improve the design and rules for design
Goal 3: Improve how innovation gets implemented
Goal 4: Improve productivity and quality performed by the contractor

What happens at our forums?

Steering group meetings
Targeted workshops
Presentations of technological interest
Showcase presentations on new or innovative technologies
Break-out sessions for a deeper dive

Visit https://www.acifoundation.org/technology/forums.aspx to view recent Forum agendas.
In Scottsdale, the focus was on innovation implementation and case studies in 3-D Printing in the concrete industry. The role of technology development served as a springboard to show ways that the concrete industry can morph from a project industry to a product industry. With a technology road map, our concrete product can hold pace with the innovation needed to keep up with the increasingly swift rate of change we experience globally. The workshop illuminated some of the spectrum of issues that the concrete industry faces with advances in technology, including:

- Proprietary versus nonproprietary technologies;
- Near-term versus long-term impact;
- Prescriptive versus performance codes and standards;
- Process-focused versus outcome-focused;
- Design-focused versus constructability-focused;
- Quality versus productivity; and
- Profitability versus sustainability.

Also highlighted were the obstacles experienced by industry members every day that prevent implementing innovation, such as:

- Legal and regulatory restrictions;
- Large investment already in existing approaches;
- Uncertainty of impact of innovation;
- Threats to an established market;
- Fragmentation of industry;
- Lack of communication, rapport, and collaboration; and
- Lack of resources.

**Technology Showcases**

- GCP Applied Technologies, Inc., presented on the benefits of control flow concrete;
- Surface Tech LLC’s digital solutions—built by experienced concrete contractors, commercial and residential builders, and concrete suppliers—that provide best practices when supplying and building with concrete.

In Denver the acceptance and use of technical innovations in concrete projects was discussed by a panel of speakers from the viewpoints of owner, architect, design engineer, and concrete contractor. The value of assessing risk, sharing case studies, and filling a “need” was debated among the panel presenters and attendees. Anol Mukopaydhay presented “Performance Engineered Alkali-Silica Reactivity (ASR) Resistant Concrete,” which included information on improved ASR test methods for aggregates and concrete. It may be of interest to expand this promising research on a broader range of materials.

**Technology Showcases**

- 3-D Printing – For Taller, More Effective Concrete Wind Turbine Towers – Xiaopeng Li, University of California, Irvine;
- Con-Cure NEX – award-winning devices for wireless transmission of concrete temperature and strength information;
- EdenCrete®—a carbon nanotube-enriched admixture that significantly improves the tensile and flexural strength of concrete.
- From Concrete to Glass: Seamless and Impermeable Graded Transition – Shadi Nazarian, The Pennsylvania State University
Improving Productivity with Building Information Modeling (BIM)

Volunteers within the SDC worked to promote the recent publication of “Guide to Use of Industry Foundation Classes (IFC) in Exchange of Reinforcement Models (ACI 131.2R-17),” which was in part funded by the ACI Foundation. This guide and its companion digital IFC will enable automation and reliable efficient exchanges of reinforcing bar information between software products provided by different software vendors. Volunteers and staff worked to collaborate with other industry groups such as BIM Forum and bSI (Building Smart International) to disseminate this important development. Looking to the future, ACI Committee 131, Building Information Modeling of Concrete Structures, is developing additional guides and IFCs for construction scheduling and design.

Improving Durability through a Global Perspective

The SDC committed to a “Literature Review of Concrete Durability and Service-Life Requirements in Global Codes and Standards” with CVM, King of Prussia, PA. The study will also consider the perceived effectiveness of each respective code by local users. Tracy D. Marcotte, CVM, will lead a team with strengths in ACI standards and industry practitioner experience in repairs and structural design that includes durability work in practice. SDC sees a growing need for professionals to be able to design, construct, and manage concrete structures that meet or exceed durability or service-life requirements. It is hoped that the information from the study will contribute to the recent initiative of ACI Committee 201, Durability of Concrete, which is developing mandatory standard practices focused on achieving concrete durability in both design and construction.

Improving Design and Rules for Design with Repair Research

SDC awarded funds to WJE for a research project, “Interface Bond: Development of Appropriate Horizontal Shear Provisions for Concrete Repair.” The need for a rational method to assess interface bond strength in both new construction and repairs is well-recognized. In new construction, interfacial shear strength is a critical factor in design of overlays and in horizontal load transfer at corbels/brackets. In repair, interfacial shear stresses impact the performance of nearly all concrete repairs. Currently, interfacial bond strength in repairs is evaluated via tensile bond testing, which is a highly variable test, and underpredicts the true interfacial shear strength. Accordingly, current repair designs produced using Section 7.4 of ACI 562-16 may be over-conservative and excessively costly. A similar situation exists in new construction. A rational shear test procedure and the associated potential alternate code provisions will create more economical repair designs and potentially allow for repair rather than replacement of existing structures. The research program’s aim via parametric laboratory assessment of interface shear stress using the guillotine shear test, direct tension pulloff tests, and beam/slab tests, using a range of surface preparation and statistical and reliability analyses of the collected data, could do just that.

Improving Design and Rules for Design with High-Strength Steel Reinforcement (HSR)

SDC dedicated funding to three HSR research projects to further understand properties and performance of concrete made with HSR. By co-funding with the Charles Pankow Foundation, SDC committed to facilitating the general use of reinforcing steel with yield strength greater than 60 ksi in the building code, which may significantly improve the constructability and efficiency of earthquake-resistant structures. A main driver for higher grades is the need to reduce bar congestion, material quantities, and construction costs.

Foundation Mats with High-Strength Reinforcement (Jack Moehle, University of California, Berkeley)

Development of Large High-Strength Headed Reinforcing Bars (David Darwin, University of Kansas)

Normal- and High-Strength Continuously Wound Ties (Bahram Shahrooz, University of Cincinnati)
“The U.S. Army Corps of Engineers values its membership in SDC to foster our understanding of and help accelerate the acceptance of current technology in the concrete industry. USACE is responsible for over $250 billion of civil works infrastructure and the SDC provides a forum where, at senior levels, we can discuss strategic issues and tactics to support the sustainment of this infrastructure, which is owned by us all.”

Brian H. Green, RPG, FACI, Research Geologist, U.S. Army Engineer Research Development Center
The Jean-Claude Roumain Innovation in Concrete Award, presented by the SDC for innovation in the field of concrete, as presented to Michael Sprinkel. Sprinkel is acknowledged for his development of epoxy and polymer overlays for bridge deck protection and other construction innovations that have strengthened the concrete restoration and repair industry.

The Robert E. Philleo Award, presented by the CRC for outstanding achievements in the field of concrete materials, was presented to Jason Weiss. Weiss is acknowledged for his outstanding contributions to the advancement of concrete technology through student advising; exemplary service to the profession; and innovative research on shrinkage-reducing admixtures, internal curing, material transport characterization with the formation factor, freezing-and-thawing modeling, and deicing salt damage.

The Arthur J. Boase Award, also presented by the CRC for outstanding achievements in the field of structural concrete, was presented to Conrad Paulson. Paulson is acknowledged for his exceptional work leading to the development and acceptance of high-strength reinforcing steel for concrete construction and its adoption into codes and standards.
Your support of the ACI Foundation programs—such as the Scholarship and Fellowship program or our Research and Technology programs—will enable the ACI Foundation to support our future concrete leaders, and to help advance knowledge of concrete materials, structures, and innovative technology. Thank you for your support!

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