Knowledge to Practice:

ACI Foundation

Giving Back to Those Who Have Served

The ACI Foundation announces its participation in a new ACI rebate program for U.S. military veterans who obtain an ACI certification. Thanks to a generous donation of $50,000 to the ACI Foundation from CMEC Holdings, Inc., U.S. military veterans seeking ACI certification may qualify for a rebate. The program provides rebates of $250 to help ease the financial burden of earning an ACI certification in concrete field testing, concrete construction inspection, flatwork finishing, or one of ACI's other 20+ certification programs.

Visit **www.concrete.org/certification/veteranrebate** to see if you qualify.

You Can't Manage What You Can't Measure

The ACI Foundation is participating with more than 30 industry leaders to develop the Embodied Carbon in Construction Calculator ("EC3") tool—an open-access tool to evaluate the embodied carbon impact of building products. The EC3 tool is being developed under the leadership of the Carbon Leadership Forum, in collaboration with Skanska and key development partner C Change Labs.

"The American Concrete Institute, ACI Foundation, and the greater concrete community have been developing industry-leading knowledge on the use of concrete in innovative and sustainable development," stated Ann M. Masek, Executive Director, ACI Foundation. "With the generous support of our members and donors, we are pleased to invest in and join the collective in bringing the EC3 tool into practice."

The EC3 tool is set for formal release November 19, 2019, at Greenbuild, complete with partner demonstrations.

Recap of SDC Technology Forum 46

The Strategic Development Council (SDC) of the ACI Foundation hosted the first Technology Forum under SDC's new strategic goals. The presentations highlighted technologies and innovations such as machine learning, robotics, and code and design influences related to high-strength steel research. The audience learned about the use of nonmetallic reinforcement from the viewpoints of owners, manufacturers, contractors, and researchers in a panel presentation format. Attendees had nothing but positive feedback regarding the new structure of the forum, panels, and presentations. They also enjoyed the welcome reception on the hotel rooftop and a group dinner on the final evening.

For a more detailed recap of all presentations at SDC 46 and to learn more about SDC's new strategic goals, visit **www.acifoundation.org/technology**.

The following are summaries of several presentations:

Research Proposals Are Due December 2

The due date to request the ACI Foundation's Concrete Research Council's annual research funding is December 2, 2019, by 11:59 p.m. Eastern time. Please visit **www.acifoundation.org/research** for more information on requirements, details, and tips to prepare materials for submission.

Strengthening Bridges and Existing Concrete Structures Using Titanium

Presented by Jill Adkins, Perryman Company

Perryman Company has been pioneering the use of titanium in the infrastructure market since 2012. Older concrete bridges in the United States were not designed for the current higher legal truck load demands. When such bridges are rated deficient, transportation departments must select replacement or rehabilitation to ensure safe, ongoing service.

Near-surface mounted (NSM) reinforcement is often considered as a rehabilitation solution. In NSM strengthening, additional reinforcement in the form of bars or strips are used to increase the shear and flexural strength of reinforced concrete bridge girders. The additional reinforcement is installed in grooves that are cut into the concrete at a shallow depth to avoid the internal steel, and epoxy mortar is used to hold the reinforcement within the groove.

Research performed at Oregon State University proved that an innovative rehabilitation system based on the use of titanium bars was a cost-effective alternative. The technique is unique because 90-degree hooks can be fabricated at both ends of a titanium bar, creating a staple (a u-shaped fastener). These hooks securely anchor the titanium bar, providing additional strength without total reliance upon epoxy bond between the bar and the concrete. Titanium has high strength and good ductility along with complete corrosion resistance. It can survive in harsh environments with little or no concrete cover and is often more cost-effective than the competing materials in this application. Titanium NSM strengthening has been used on several bridges, with the state of Oregon leading the way. A design guide and an ASTM specification are available to assist design engineers.

TyBot—An Autonomous Rebar-Tying Robot

Presented by Stephen Muck, Brayman Construction Corporation

The construction industry is facing unprecedented labor shortages. At the same time, the next industrial revolution, centered around robotics and machine learning, is accelerating in other industries. TyBot is leading this technology revolution for the construction industry by proving that robots can reliably, safely, and competently work together with crews on-site using existing construction operations and practices.

Tying reinforcing bar intersections continually, in rain or on the night shift, TyBot represents a reliable and scalable solution to meet labor needs. TyBot provides a return on investment through enhanced productivity, improved safety, increased profits, and reduced schedule risk.

Integrating Traditional Civil Engineering Practices with Artificial Intelligence: A Hybrid Approach to Enhancing Our Understanding of Structural Behavior

Presented by Stephanie Paal, Texas A&M University

A fundamental understanding of the knowledge that can be gained from artificial intelligence (AI) when applied within the realm of civil engineering will have a translational impact on the analysis, design, maintenance, and construction of civil infrastructure. AI models can be firmly grounded in real-world data, allowing structural behavior to be predicted without computationally expensive analytical or empirical evaluations. Moreover, by integrating AI and physics-based models, transformative insights into the behavior of materials and structures and their relation to one another can be discovered, actuating next-generation modeling approaches, experimental methods, empirical relations, designs, and construction methods. A general framework for AI-based understanding of structural performance is being developed, with the goal of using machine vision and other data in conjunction with AI models to evaluate the post-earthquake safety of reinforced concrete structures.

Stephanie Paal demonstrates that artificial intelligence can overcome human error in matters of recognizing patterns

To read summaries for the other key presentations, visit **www.acifoundation.org/technology/forums**.