# Building the Future:

## ACI Foundation

### Attend the CIC-hosted Technical Session at the next ACI Concrete Convention

To support ACI's expanding focus on technology and innovation, the Concrete Innovation Council (CIC) of the ACI Foundation collaborates with the concrete community to further innovative solutions for industry-wide challenges by identifying, nurturing, and supporting both new and mature technologies. The CIC also works closely with Rex Donahey, ACI Director of Innovative Concrete Technology, to create a formal connection between council work and ACI. The council comprises a diverse set of industry representatives—from material suppliers, architecture and engineering firms, and contractors to academia, owners, and regulatory agencies.

At the next ACI Concrete Convention in Boston, MA, USA, the technical session "Innovations in Concrete Construction Productivity" will be held on October 29, 2023, from 1 to 3 p.m. in the Westin Boston Seaport District's Marina Ballroom IV. Hosted by CIC and moderated by volunteers G. Terry Harris, FACI, and John J. Myers, FACI, this session will highlight innovations through the three viewpoints key to improving the productivity of concrete construction: the design team, the contractor, and the ready mixed producer. Working together, these three parties can significantly impact concrete construction efficiency and continue the exponential innovation in the design, production, and construction of concrete. A panel of speakers will discuss some of the technologies and then host an open Q&A period.

**Attendees at the CIC-hosted technical session during the ACI Concrete Convention – Spring 2023**

### Appeal Announcement

The ACI Foundation partners with donors to keep the concrete industry at the forefront of technological advances in material composition, design, and construction. Thanks to the generosity of donors, this year, the ACI Foundation funded 13 critical research projects, awarded 19 student fellowships, and granted 14 student scholarships.

Be a part of creating a more sustainable industry and supporting the next generation of concrete professionals by participating in our Annual Fall Appeal! Every dollar donated goes directly to students who excel in an industry-related degree program or research related to new technology, innovation, and implementation. Contributions to the ACI Foundation are an investment in our industry.

To donate, visit **www.acifoundation.org**.

### Impact through Industry Research

The ACI Foundation funds or co-funds projects that inform the work products of ACI technical committees and investigate new technologies, materials, and building methods that will help propel our industry into a more sustainable future.

The Concrete Research Council (CRC) annually issues a request for proposals (RFP) and then reviews, selects, and recommends proposals for funding. One major requirement to apply for the RFP is an endorsement from at least one ACI technical committee.

Assistant Professor Eric Jacques applied for funding for "Development of FRP Retrofit Guidelines for Deficient Reinforced Concrete Horizontal Lateral Force Resisting Systems" with Co-Principal Investigator Matthew Eatherton, both from Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, VA, USA. ACI Committee 440, Fiber-Reinforced Polymer Reinforcement, assessed and endorsed the research concept. The recently completed 2-year project was co-funded by the ACI Foundation; Simpson Strong-Tie Company, Inc.; Structural Technologies; Fyfe-Critica Infrastructure; and Banker Steel (both monetary and in-kind). The completed ACI project, with its practice-oriented focus, complements an ongoing National Science Foundation-funded initiative exploring the use of topology optimization to develop patterns of non-orthogonal fiber-reinforced polymer (FRP) diaphragm strengthening.

The goal of this research project was, in part, to develop design guidelines for strengthening deficient horizontal lateral force-resisting systems (hLFRS) in older reinforced concrete buildings using externally bonded FRP.

"Investigating the behavior of diaphragms, both with and without FRP strengthening, poses significant challenges," said Jacques. "To accurately understand their behavior, they need to be tested at scales approaching their real-world application—a task that is often impractical in the confines of a laboratory."

In the past, due to a lack of data, designers incorrectly relied on experimental tests of FRP-strengthened shear walls to justify hLFRS strengthening applications. The completed research focuses on diaphragm strengthening because of the lack of data. Engineers and manufacturers need proven methods for the use of FRP to address hLFRS deficiencies

From left: Eric Jacques, Matthew Eatherton, Pratiksha Dhakal, and Hunter Hutton

related to inadequate chords, collectors, and in-plane shear capacity.

The research plan consisted of the development of retrofit design approaches, which included both conventional and innovative solutions; a series of large-scale experiments to investigate the behavior, optimal arrangement, and anchorage of FRP to strengthen deficient reinforced concrete diaphragm zones carrying primarily shear; and the development of design recommendations and technical commentary to inform and advise practitioners as part of a future update to ACI 440.2R-17, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures.

The research products developed by Jacques and Eatherton, as well as their Graduate Research Assistants Hunter Hutton and Pratiksha Dhakal, can directly impact ACI Committee 440, which seeks to develop and report on FRP materials, research, products, and industry practice, and develop design guides, specifications, standards, and construction practices for practitioners.

"This research would not have been possible without the support of the ACI Foundation, our dedicated industry partners, and the insights from members of ACI Committee 440. The expert perspectives from our partners enhanced the project outcomes, ensuring we addressed the most pressing needs of practicing engineers and provided experimental validation to previously untested design approaches," Jacques said.

The results of this project provided proposed design recommendations for ACI Committee 440. These recommendations will contribute significantly to increased industry sustainability by helping reuse and reconfigure existing buildings to meet ever-changing usage needs while also alleviating structural deficiencies for resilient performance. Constructing buildings that are capable of long, economically productive service lives reduces the environmental impact of waste generated by demolition and the number of resources consumed by new building construction. While the project solely focused on one aspect of strengthening reinforced concrete diagrams, there are other research needs that relate to ACI Committee 440 goals.

For more details, visit **www.acifoundation.org/research/researchprojects.aspx**.

These types of projects help support early-career professors and their research goals, as well as provide graduate students an opportunity to participate in important concrete research to help develop and apply critical skills in real time. The research opportunity on this project was timely for Hutton, the 2022-2023 ACI Foundation Robert F. Mast Memorial Fellowship awardee.

Hutton is working as a Structural Engineer at McSweeney Engineers, LLC, in South Carolina, USA. He recently graduated from Virginia Tech, where he completed his master's research under the direction of Jacques and assisted in "Development of FRP Retrofit Guidelines for Deficient Reinforced Concrete Horizontal Lateral Force Resisting Systems." Graduate students participating in such roles enhance their experience while pursuing a degree.

"I was very fortunate to have had the opportunity to work as a Graduate Research Assistant at Virginia Tech and to be part of an ACI Foundation and industry co-funded project focused on retrofitting shear-deficient reinforced concrete diaphragms with FRP laminates. I vastly expanded my knowledge of structural engineering," said Hutton.

The ACI Foundation's Fellowship Program offers 10,000 USD annually to support students in their journeys to complete a concrete-related degree. Besides the monetary aid for schooling, the Fellowship recipients are also supported to attend three ACI Concrete Conventions—where they can connect with industry mentors, get to know technical committees and their work products, give presentations, fill leadership roles in ACI Student and Young Professional Activities Committee (SYPAC) subcommittees, and develop their own peer network. To learn more about ACI Foundation fellowships and scholarships, visit **www.acifoundation.org/scholarships.aspx**.

To contribute to the ACI Foundation's mission and for more information, visit **www.acifoundation.org/giving** or contact Kari Martin, ACI Foundation Fundraising Manager, at kari.martin@acifoundation.org or +1.248.848.3757.