PROGRAM BOOK

Concrete Conference on Fiber-Reinforced Polymers

Virtual
1-2 June 2021

DAY 1 AGENDA – TUESDAY, 1 JUNE

All times are in U.S. EDT Time Zone

TIME	AGENDA	SPEAKER
8:00 AM	Welcome	ACI Representative
8:05 AM	NEx – Importance of FRP in the Industry	John Glumb, CAE, FACI, IOM
8:10 AM	Implications of the Design of Highway Bridge Beams Prestressed with CFRP Strands	Nabil Grace, PhD, PE, FESD
9:10 AM	FRP-Reinforced Concrete in Coastal Construction	Antonio Nanni, PhD, PE, FACI
9:55 AM	Break	
10:00 AM	Full-Day Q&A Session	—

DAY 2 AGENDA – WEDNESDAY, 2 JUNE

All times are in U.S. EDT Time Zone

TIME	AGENDA	SPEAKER
8:00 AM	Welcome	—
8:10 AM	Seismic Strengthening Using FRP Composites	Tarek Alkhrdaji, PhD, PE
9:10 AM	Use of GFRP Rebar for Concrete in Challenging Environments	Peter Renshaw
9:55 AM	Break	
10:00 AM	GFRP-Reinforced Foundation Slabs for Multi-Story Buildings—Exotics or Reality?	Egor Litvinov
10:50 AM	Full-Day Q&A Session	—
11:20 AM	Closing Remarks	—

PRESENTATION DETAILS

DAY 1

Implications of the Design of Highway Bridge Beams Prestressed with CFRP Strands

Presented by Nabil Grace, PhD, PE, FESD

Several highway bridge projects were recently completed successfully using bridge beams prestressed with carbon fiber-reinforced polymer (CFRP) strands. Nevertheless, the design of CFRP prestressed bridge beams faced several challenges, such as establishing the appropriate level of prestressing force, calibrating strength reduction factors, and ensuring a proper mode of failure. To address these challenges, three half-scale bridge beams prestressed with CFRP strands at different reinforcement ratios were designed, constructed, and tested to failure. A fourth beam prestressed with conventional steel strands served as a control beam and was included in the test matrix. In addition, extensive analytical analysis was conducted to evaluate different design schemes of a recently constructed highway bridge carrying Interstate Highway I-75 over the Sexton and Kilfoil Drain in Allen Park, MI. The analytical study addressed the influence of prestressing force, concrete strength, and mode of failure on the overall design, constructability, and long-term strength of the bridge superstructure. After the I-75 bridge construction was completed, a field load test was conducted using two loaded trucks positioned at key locations within the bridge span. Deformation of bridge beams under truck loads was monitored using internal and external vibrating-wire strain gauges and deflection measuring techniques. Field readings were compared with the results of a finite element model to confirm the performance of the bridge under the traffic load. Results from the experimental and analytical investigations and field tests paved the way for further deployment of CFRP strands and the successful construction of several other CFRP-prestressed highway bridges.

Learning Objectives:

1. Compare possible modes of failure and their impact on the design and construction;
2. Evaluate long-term performance and strength of CFRP prestressed beams;
3. Study the influence of different prestressing levels on the design; and
4. Assess the impact of different strength reduction factors on the design.

FRP-Reinforced Concrete in Coastal Construction

Presented by Antonio Nanni, PhD, PE, FACI

Coastal areas are subject to unprecedented challenges deriving from extreme weather events, sea level rise, depletion of natural resources, and population growth. Reinforced and prestressed concrete remain the materials of choice in coastal construction, even if steel reinforcement corrosion significantly shortens service life and requires maintenance. A possible alternative are structures made of precast and cast-in-place concrete reinforced with fiber-reinforced polymer (FRP) composites, materials immune to chlorides that do not corrode. This presentation will briefly cover recently completed projects using FRP reinforcement for concrete structures, with an emphasis on coastal environments.

Learning Objectives:

1. Know what FRP reinforcement for concrete structures is and where it should be used;
2. Learn some of the fundamental mechanical properties of FRP reinforcement including durability;
3. Become aware of design provisions of concrete members internally reinforced with GFRP bars; and
4. Become aware of relevant FRP-RC projects in coastal regions.

DAY 2

Seismic Strengthening Using FRP Composites

Presented by Tarek Alkhrdaji, PhD, PE

Externally applied FRP composite systems provide attractive and cost-effective solutions for seismic strengthening of concrete structures. These systems can be designed to accommodate various existing structural conditions and geometries are relatively easy to install, and typically produce minimal impact on the aesthetics of structures. FRP systems have been successfully used to increase the shear strength and ductility of columns, improve lap splice performance, increase the shear and bending strengths of walls, and increase the strength of diaphragm members. This presentation aims at providing information on common FRP seismic strengthening applications, experimental testing that demonstrates the effectiveness of these systems, and detailing requirements to ensure their proper performance.

Learning Objectives:

1. Externally-applied FRP composite systems can be used to develop cost-effective solutions for seismic strengthening of concrete structures;
2. FRP systems applications can increase the seismic resistance of concrete columns, walls, and slab diaphragms;
3. Summary of seismic provisions in ACI 440.2R-17; and
4. Typical design and detailing requirements for seismic applications.

Use of GFRP-Rebar for Concrete in Challenging Environments

Presented by Peter Renshaw

For many years, GFRP reinforcing bar has been used internationally in areas where steel is not suitable. Many of the structures relied on the use of ACI Design Guides. This presentation will discuss international infrastructure projects where the risk of corrosion of reinforcing bar was the primary reason to select GFRP reinforcing bar as a suitable reinforcement material. It discusses the important differences in the supply chain between steel and GFRP reinforcing bar that should be considered by the contractor or purchaser. It also covers the cost-effectiveness of the solution and the advantages that were gained.

Learning Objectives:

1. Typical problems that designers addressed by using GFRP reinforcing bar;
2. Additional benefits they found;
3. Simple but important considerations for project timelines; and
4. Applicable Design Guides for GFRP-reinforced structures, and industry standards for GFRP reinforcing bar.

GFRP-Reinforced Foundation Slabs for Multi-Story Buildings—Exotics or Reality?

Presented by Egor Litvinov

Since the early 2000s, FRP reinforcing bar products have been gaining popularity in Russia and the countries of the former Soviet Union. Unlike North America, where FRP reinforcement has been used primarily in infrastructure projects to provide longevity and low-cost maintenance, the Russian construction industry used FRP reinforcing bars in residential construction and nonstructural applications. After 15 years of continuous building code enhancements, the Russian FRP industry is now capable of delivering cost-efficient reliable solutions for the design and construction of FRP-reinforced foundation slabs for multi-story buildings, as well as infrastructural and other commercial projects. The latest advancements in automated structural design software enable a time-saving design process in projects using FRP products to be as simple or simpler than those using conventional carbon steel. Challenges still remain for the full adoption of the FRP products for steel replacement in construction, but the path and direction are clear.

Learning Objectives:

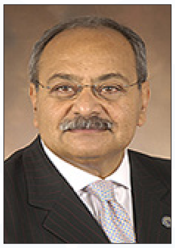
1. Learn about experiences in FRP-reinforced foundation slabs for multi-story building construction outside of the United States;
2. Recognize the design challenges and learn the software support availability in Russia;
3. Understand the construction process with FRP: experiences and challenges; and
4. Demonstrate FRP versus steel cost analysis.

CONFERENCE SPEAKERS

Tarek Alkhrdaji, PhD, PE

Tarek Alkhrdaji is Vice President of Engineering at Structural Technologies. Alkhrdaji has been involved in more than 500 projects involving structural repair and strengthening, many of which have received awards from ACI, the Post-Tensioning Institute (PTI), and the International Concrete Repair Institute, Inc. (ICRI). He is the current Chair of ACI Subcommittee 562-F, Fire, and ICRI Committee 330, Strengthening and Stabilization, and is an active member of several additional professional committees including ACI Committee 562, Evaluation, Repair and Rehabilitation of Concrete Structures; Joint ACI-TMS Committee 216, Fire Resistance and Fire Protection of Structures; and ACI Subcommittee 440-F, FRP-Repair-Strengthening. Alkhrdaji has written more than 40 papers and articles on the repair and strengthening of structures.

Nabil Grace, PhD, PE



Nabil Grace is the Dean of the College of Engineering and the Director of the Center for Innovative Materials Research (CIMR) at Lawrence Technological University, Southfield, MI. Grace's research has been funded by the National Science Foundation (NSF), the Army Research Laboratory (ARL), the U.S. Army's Combat Capabilities Development Command (CCDC) Ground Vehicle Systems Center (formerly TARDEC), the Federal Highway Administration (FHWA), MDOT, ODOT, Maine-DOT, NCDOT, IDOT, ACI, and several private manufacturing organizations. His research activities have attracted some $18 million in private, state, and federal grants, and have been implemented in the design, construction, instrumentation, and field testing for the first CFRP-prestressed concrete highway bridge in U.S. history. Several highway bridges using CFRP have been deployed in many states such as Michigan, Ohio, Virginia, North Carolina, and Maine.

Egor Litvinov

In 2006, Egor Litvinov graduated from Moscow State University of Design and Technology, Moscow, Russia. From 2002 to 2014 he occupied various positions in the leading investment and asset management companies in Russia. In 2014, Litvinov joined the Galen team as a Deputy CEO for Business Development. Since joining Galen, he has been involved in R&D and product development.

Antonio Nanni, PhD, PE, FACI

Antonio Nanni is a Professor of Civil Engineering at the University of Miami, Coral Gables, FL. His research interests include construction materials, their structural performance, and their field application. He is a site-director of the NSF I/UCRC Center for the Integration of Composites into Infrastructure. Nanni's research in materials and structures has impacted the work of technical committees in the U.S. and abroad, including professional and standards-writing agencies such as the American Association of State Highway and Transportation Officials (AASHTO), ACI, the American Society of Civil Engineers (ASCE), ASTM International, and the International Code Council Evaluation Service (ICC-ES). He has published extensively in refereed journals and conference proceedings, and has co-authored two books. He is a licensed professional engineer in Italy, Florida, Pennsylvania, Missouri, and Oklahoma.

Peter Renshaw

Peter Renshaw moved from the United Kingdom to New Zealand in 1991, and began working as a pultrusion R&D scientist at Pultron Composites the following year. Soon after joining Pultron, the company was approached to supply corrosion-resistant reinforcement for concrete within an Australian chemical plant. Renshaw was part of the team that developed the solution in the form of a fiber-reinforced polymer reinforcing bar. Since then, he has been heavily involved with the development of high-performance pultruded composite products, many of which are specifically for the infrastructure sector. Renshaw is now Business Development Director for Pultron Composites, and Chief Technical Officer for Mateenbar. He is a member of ACI Committee 440, Fiber-Reinforced Polymer Reinforcement.