

NEx's Third-Year Project Funding and Contributions Support Construction Innovation

Expanding on the achievements of its first 2 years of funding and contributions to the construction industry, NEx: An ACI Center of Excellence for Nonmetallic Building Materials has secured additional funding for its third year of operation. Specifically, NEx received a sponsorship of more than 575,000 USD from its Sustaining Member, Aramco Americas, for project funding in 2022 (detailed in *NEx insights, Concrete International* April 2023). The sponsorship for its 2023 projects exceeded 700,000 USD (highlighted in *NEx insights, Concrete International* August 2023). Moreover, funding for 2024 has reached a significant milestone, surpassing project funding support with a total of 1 million USD. This funding has been approved for 28 projects, set to commence execution in 2024 and span over a 2-year period. This marks a historic advancement in NEx's commitment to revolutionizing the construction industry through the pioneering use of nonmetallic building materials.



Aramco Americas extended its research sponsorship

The sponsorship from Aramco Americas underscores its commitment to NEx's vision. With a strategic focus on maximizing impact, NEx is channeling these funds into a multifaceted array of projects aligned with its core objectives. From establishing industry-leading standards and guidelines

to spearheading cutting-edge research and development initiatives, from fostering technical advocacy and raising awareness to nurturing the professional growth of stakeholders, NEx's endeavors span the breadth of the nonmetallic building materials landscape. This substantial support empowers NEx to expand its reach and deepen its impact, catalyzing innovation and propelling advancements in nonmetallic building materials, thereby driving the construction industry toward a more sustainable and efficient future.

Standards and Guidelines

NEx plays a pivotal role in advocating for the development and acceptance of design and construction codes and specifications tailored for nonmetallic building materials. Its ongoing endeavors related to standards and guidelines encompass diverse areas, including glass fiber-reinforced polymer (GFRP) anchors, nonmetallic piles, polymer concrete, and nonmetallic pultruded structures. The four new projects funded in this category for 2024 are:

- 1) **“Develop Code Language for Adhesive GFRP Anchors for Concrete Structures as a New Chapter for ACI 440.11,”** awarded to **Jeffrey West, Wiss, Janney, Elstner Associates, Inc.:** The project aims to develop a framework of code requirements for post-installed GFRP adhesive anchors for potential adoption into ACI CODE-440.11. The developed chapter will be similar in scope and organization to ACI 318-19 Chapter 17.
- 2) **“Develop Guideline for the use of Non-Metallic Piles in Varying Soil Conditions,”** awarded to **Andrew K. Loff, Axxess LLC:** The primary goal is to create a comprehensive

set of guidelines for the design, installation methods, load testing, and long-term performance assessment of nonmetallic piles in varying soil conditions.

3) “Develop Design Specifications for Polymer Concrete Structures,” awarded to Shreya Vemuganti, The University of Oklahoma: The purpose is to develop design specifications for polymer concrete structures that encompass material properties, structural design considerations, construction methods, and quality control measures.

4) “Develop Design Manual for NM Pultruded Structures,” awarded to Francisco De Caso, University of Miami: The main objective is to develop a companion *FRP Pultruded Design Manual*, based on the recently approved ASCE/SEI 74-23 code, that will provide a detailed description of the design process for a wide range of structural components under typical load conditions. The manual will have an equivalent format and structure as the *Steel Designers’ Manual*, knowing this is a valuable resource for engineers, architects, and other professionals engaged in designing such structures.

Research and Development

NEx’s investment in research and development projects highlights its dedication to fostering collaboration, disseminating knowledge, and making tangible advancements in nonmetallic building materials across diverse research areas. Reflecting NEx’s comprehensive approach to innovation, these funded projects aim to translate research outcomes into practical applications within the construction sector. In pursuit of this objective, NEx is sponsoring 10 projects this year:

1) “Advancing the Seismic Performance and Design of GFRP-Reinforced Concrete Structures: Experimental Testing, Innovative Solutions, Nonlinear Analysis, and Design Procedures,” awarded to Yi Shao, McGill University: The project aims to advance existing knowledge of the seismic performance and design of earthquake-resistant concrete structures reinforced with GFRP reinforcement. The investigated lateral-force-resisting system will include a special moment-resisting frame and/or shear wall system.

2) “Material Specifications to Implement Polyolefin Resins for use in FRP Rebar Applications,” awarded to Brahim Benmokrane, University of Sherbrooke: The objective is to develop a generic specification to include several materials/resins that are not currently covered by ASTM International. This project’s significance is twofold: to examine and conduct physicomaterial durability tests to evaluate the performance of thermosetting polyolefin resins for use in FRP reinforcing bar applications; and to

develop standard specification criteria to be considered for adoption by ASTM Subcommittee D30.10, Composites for Civil Structures; ACI Subcommittee 440-H, FRP-Reinforced Concrete; CSA Group; and ICC Evaluation Service.

3) “Experimental Investigation on GFRP Piles Behavior in Sand Subjected to Various Loads Using Centrifuge Model Tests,” awarded to Kemal Celik, New York University Abu Dhabi: The purpose is to conduct a literature survey on GFRP screw/helical and micropiles in geotechnical applications, perform experimental investigations, collect research and field data, and develop guidelines for applying GFRP piles for different soil conditions subjected to impact loads and incorporate them into existing standards.

4) “Investigate the Use of Reinforced Expanded Polystyrene (EPS) in Foundation Systems,” awarded to Anand J. Puppala, Texas A&M University: The proposed research will undertake a comprehensive literature review for current research and applications of EPS in civil infrastructure, experimental investigation enhancing reinforced EPS use, and development of an industrial guideline on designing reinforced EPS foundation systems.

5) “Structural Response of Artificial Coral Reef FRP-Reinforced Slab with CO₂ Sequestration Potential,” awarded to Konstantin Sobolev, Concretology LLC & Reef Life Foundation: This project aims to investigate the behavior and strength of an Oceanite-based artificial reef (AR) slab reinforced with FRP mesh under various loading conditions, including those induced by currents, waves, and environmental factors. Additionally, it seeks to evaluate the CO₂ sequestration potential of kelp farming on an Oceanite AR by quantifying the carbon uptake and storage capabilities of the farmed kelp, contributing to a better understanding of the environmental impact of this substrate.

6) “Development and Characterization of Ultra-High-Performance Concrete (UHPC) Using Nonmetallic Fibers,” awarded to Srinivas Allena, Cleveland State University: The goal is to develop performance-based UHPC mixtures using optimized nonmetallic fiber dosage that enhance the mechanical and shrinkage performance. Furthermore, comprehensive industrial guidelines will be developed, providing specifications for the effective use of nonmetallic fibers in UHPC.

7) “Development of Design and Utilization Guidelines of Carbon-Textile Reinforced Concrete (C-TRC),” awarded to Akram Jawdhari, South Dakota State University: The main objective is to develop comprehensive design and use guidelines for C-TRC to support the effective application of this material in structural engineering. This guideline aims to provide a framework to enable the use of



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C-TRC in different structural systems and solutions, including lightweight sandwich panels, curved shells, prestressed elements, strengthening and retrofitting techniques, and hybrid structures.

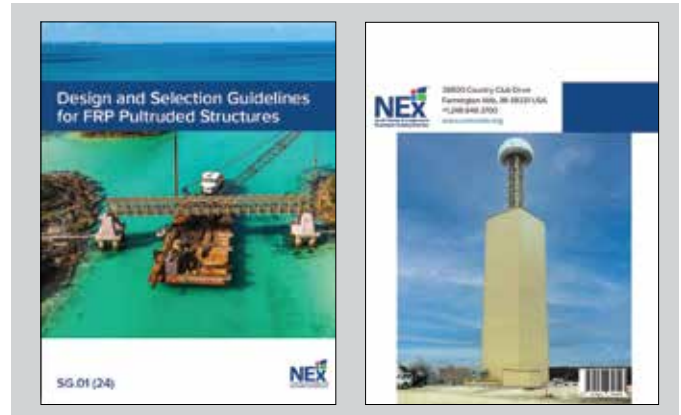
8) “Development of Guidelines for Utilizing Nanotechnology in Building and Construction Industry,” awarded to Weina Meng, Stevens Institute of Technology: The purpose is to create guidelines for supporting the development and applications of nanotechnology in the building and construction industry. This guideline will be developed based on a comprehensive literature review of the existing publications on developments and applications of nanopolymers and nanocomposites.

9) “3D-Printed Polymer Concrete-By-Design,” awarded to Mahmoud Reda Taha, The University of New Mexico: The objective is to establish a comprehensive design framework for the development of three-dimensional (3-D)-printed polymer concrete. Achieving this objective necessitates an integrated approach, including both experimental and computational methods. The project aims to yield efficiently manufactured structural components using 3-D printing that also showcase good mechanical properties and superior durability performance.

10) “Effect of Carbon-Negative Carbon Black on Concrete Properties,” awarded to Sanjeev Kumar, Norfolk State University (NSU): The objective is to drive a transformative shift in the construction industry by harnessing the potential of carbon black for sustainability by investigating the effect of carbon-negative carbon black on concrete properties. Collaborating closely between NSU and the Virginia Transportation Research Council (VTRC), the project encompasses a comprehensive range of strategic initiatives.



MNL-6(23) and MNL-7(23) are the latest publications resulting from NEX projects



“Design and Selection Guidelines for FRP Pultruded Structures,” recently published by NEX

Technical Advocacy and Awareness

NEX is increasing its efforts in technical advocacy with dedication and focus. In addition to using platforms such as trade shows and workshops, NEX is extending full funding support. This includes sponsoring International Road Federation (IRF) student scholarships for three students and sponsoring IRF webinars. Furthermore, NEX is providing funding to Rudolf Seracino of North Carolina State University for the project “Environmental Impact and Life Cycle Assessment of FRP Reinforced Concrete.” Moreover, NEX is promoting awareness regarding the use of nonmetallics in building and construction through sponsorship of events such as the 16th International Symposium on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures (FRPRCS-16), held in conjunction with the ACI Concrete Convention – Spring 2024 in New Orleans, LA, USA. Looking ahead, NEX plans for more proactive involvement in various industry trade shows, including the Concrete Foundations Association Convention, and to organize workshops at the ACI Fall Convention.

Professional Development

In its pursuit of advancing technology dissemination, NEX fosters the development and delivery of educational programs and certification courses tailored to engineers, contractors, and the wider construction workforce. NEX will provide training and awareness sessions on the use of nonmetallic materials in construction for a global audience. NEX will host virtual seminars covering two critical topics: the use of carbon FRP (CFRP) for repair and strengthening, and the education and professional development surrounding concrete 3-D printing.

NEX extends its appreciation to its Board of Directors and

Steering Committee members for their support. As NEX begins to chart its course for 2025, we extend an invitation to all stakeholders to submit project ideas and problem statements for potential funding. Whether the proposal aligns with NEX’s core functions of standards and guidelines, research and development, technical advocacy and awareness, or professional development, NEX welcomes your contributions. If interested, download and complete the project idea form at www.nonmetallic.org/_files/ugd/8d54fa_d42bc6e265c74194b4873da16eec99ff.pdf and send it to info@nonmetallic.org. For more information on submitting a project idea, visit www.nonmetallic.org/nex-projects.

For more information on NEX, visit www.nonmetallic.org.

Additional Online ACI Resources

The following ACI University webinars are free to ACI members:

- On-Demand Course: Practical Utilization of the New ACI CODE-440.11 on GFRP Reinforced Concrete: Manuals for Engineers and Contractors; and
- On-Demand Course: Pultruded Non-Metallics (NM) Solutions for the Built Environment: Why, What, How!?

Visit www.concrete.org/education/aciversity.aspx for more information.