

NEx: 1st Year Impact on the Construction Industry Through Funded Projects in 2022

In 2022, NEx: An ACI Center of Excellence for Nonmetallic Building Materials received sponsorship of more than \$575,000 from Sustaining Member Aramco Americas for project funding. NEx is funding 12 projects under NEx's core functions, namely standards and guidelines, research and development, technical advocacy and awareness, and professional development for nonmetallic building materials. Following is a brief introduction of the awarded projects.



NEx Sustaining Member Aramco Americas sponsored the first round of NEx research projects

Standards and Guidelines

The following projects under standards and guidelines focus on glass fiber-reinforced polymer (GFRP) reinforcing bars, polymer concrete manholes, and nonmetallic pultruded structures.

“Develop Guideline, Recommended Practice Design Manual for FRP Rebar,” executed by ACI (PI: William Gold): The fiber-reinforced polymer (FRP) reinforcing bar design manual will provide guidelines to engineers to design reinforced concrete structures using FRP. This manual will be a

supplementary document to ACI CODE-440.11-22, “Building Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars.” It will include GFRP reinforcing bar design guidelines, step-by-step demonstrations of how and where to use GFRP bars, information on material specifications and vendors, guidelines for product qualification and testing, an outline of common applications and benefits, and design examples to supplement ACI CODE-440.11.

“Develop Guideline, Recommended Practice Design Manual for Pre-Engineered Projects with FRP Rebar,” executed by ACI (PI: William Gold): This manual will include information and guidance on pre-engineered reinforced concrete projects, such as driveways, patios, and nonstructural garden-retaining walls, that can take advantage of the FRP reinforcement benefits. Emphasizing the benefits of the FRP bars, their lightness, noncorrosive nature, and easiness of placement in hot and cold weather will ease the transition from conventional reinforcement to FRP bars. Such guidance is not covered by current ACI publications.

“Develop Standards and Specifications for Polymer Concrete Manholes,” executed by an industry consultant (PI: Nicholas J. Carino): The objective is to develop a specification

on polymer concrete manholes that includes the requirements for the construction of circular precast reinforced polymer concrete manholes for use in sanitary sewers and storm sewers where chemical resistance is required. It also includes the ordering information to be provided by the purchaser to the manufacturer, acceptable materials, design criteria, manufacturing requirements, and documentation for certifying the adequacy of the manhole design.

“Develop Design and Selection Guidelines for Nonmetallic Pultruded Structures,” executed by University of Miami (PI: Francisco Jose De Caso y Basalo): The objective of this project is to develop design and selection guidelines for nonmetallic pultruded structures that will include different pultruded components and applications; a step-by-step demonstration of how and where to use pultruded components; common applications; and benefits, material specifications, guidelines for product qualification and testing, design guideline for the jointing method, and design examples to supplement the upcoming ASCE/SEI-74, “Load and Resistance Factor Design (LRFD) for Pultruded Fiber Reinforced Polymer (FRP) Structures.”

Research and Development

NEx aids and facilitates the research needed for effective and efficient

deployment of advancing technologies in nonmetallics. For the research and development category, NEX is funding the following projects to support the research and development that would result in immediate industry implementation.

“Improvement of Inferior Properties of Aggregates in Construction,” executed by The University of Alabama (PI: Armen Amirkhanian):

The objective of this project is to promote sustainability and lower the carbon footprint by resolving one or more of the off-spec aggregate properties with the use of hydrocarbon derivative chemicals such as, but not limited to, silane or silicone-based penetration sealers.

“Enhance the Use of Carbon Fibers in Civil Infrastructure (Phase 1),”

executed by Arizona State University (PI: Barzin Mobasher): The objective of this project is to conduct an environmental scan and literature review of carbon fibers that will establish the current state of the market, identify emerging materials and applications, and define promising new applications of carbon fibers in the construction sector. The outcome of this market assessment study will outline the NEX Phase 2 project to enhance carbon fiber use in construction.

“Investigate High Dosage of Admixtures on Concrete,” executed by Temple University (PI: Mehdi Khanzadeh Moradillo), and BHEL/Jadavpur University, India (PI: Abdullah Ahmed Laskar):

The objective of these projects is to investigate the increased dosage rate of chemical admixtures to reduce both the cement content and water-cementitious materials ratio (w/cm) of conventional concrete mixture(s), and study its effects on mechanical properties of fresh and hardened concrete. This research is being executed by two different entities based on local standards and construction



Draft cover of the FRP manual

practices. The outcome of these two projects will help to reduce CO₂ emissions and result in lowering water consumption.

Technical Advocacy and Awareness

NEX is engaged in advocating local and international markets on the use of nonmetallics in the building and construction sectors. Technical advocacy of nonmetallic products in construction is one of NEX’s core functions. Consequently, NEX has developed and conducted the first technical advocacy workshop on designing concrete structures reinforced with FRP bars using the new ACI CODE-440.11-22. This workshop was well attended by students, engineers, and professors. This workshop educated attendees on ACI CODE-440.11-22, as well as the application of GFRP-reinforced concrete in the construction industry; see the February 2023 issue of *Concrete International* for more details.

In 2022, NEX participated in various conferences and trade shows, including ACI conventions, CAMX, and Big 5. These advocacy actions promote NEX’s vision and scope, and help to identify potential partners.

Professional Development

NEX aims at technology transfer by developing and delivering programs, including webinars, short courses, and workforce certification to transform the construction industry and ensure safety.



NEX presentation at Big 5, Dubai, UAE, in December 2022 by Aparna S. Deshmukh



NEX representatives at CAMX. From left: Aparna S. Deshmukh; NEX President Waleed Al-Otaibi, Aramco Nonmetallic PMO; Gusai AlAithan; and Jerzy Zemajtis

In 2022, NEX funded one project in this category, **“Develop Certification for FRP Reinforcing Bar Inspector,”** executed by ACI (PI: John Nehasil). NEX is engaged in producing a personal credentialing program that effectively assesses the knowledge of candidates seeking certification as an ACI FRP Reinforcing Bar Inspector.

Future NEX insights will provide detailed updates on the ongoing projects, including projects funded for 2023. As NEX is actively engaged in supporting the construction industry, you are invited to partner with NEX and propose ideas for future projects. For more information on NEX, visit www.nonmetallic.org.