I/UCRC Executive Summary - Project Synopsis		**Date**: May 10, 2021
Project: Physio-mechanical characterization of composites for infrastructure applications		
Center/Site: Center for the Integration of Composites into Infrastructure (CICI) / University of Miami		
Tracking No.: UM-01	**Phone :** (305) 284-6150	**E-mail:** fdecaso@miami.edu
Center/Site Director: UM/Antonio Nanni (PI), and Francisco De Caso (Co-PI)		**Type:** Continuous
Project Leader: Dr. Francisco De Caso		**Proposed Budget**: $100,000

Project Description: This project evaluates and validates the physio-mechanical properties and performance of FRP composite materials for internal (reinforcement) and external (strengthening) applications for concrete and masonry structures. It investigates various types of FRP composites (glass, carbon and basalt) as well as physio-mechanical properties with the aim to: on the one hand provide a robust database of material characterization values with the overarching objective to review and update specifications (i.e. ASTM and acceptance criteria development); while on the other identify how mechanical properties vary based on QC/QC and manufacturing changes.

Experimental plan: Types of FRP composite systems made of glass, basalt and carbon fibers with different manufacturing processes are tested and compared to benchmark results to determine retention properties. Physio-mechanical properties include: tensile strength, interlaminar shear, transverse shear, bond to substrate, moisture absorption, density, geometry, glass transition temperature, creep rupture and degree of cure.

Related work elsewhere: The results can enrich available data in literature, and from a database to validate the physio-mechanical properties based on characterization tests. These values are being used to provide updated recommendations for specifications such as ASTM, FDOT and ICC-ES.

How this project is different: It includes FRP systems from different manufactures with different fiber and resin formulations for both internal and external applications: rebar, laminates, fabrics, sheet architecture, while provides updated properties reflecting today's material performance. Moreover, testing includes 'non-conforming' materials which helps to identify how different FRP manufacturing aspects affect the overall manufacturer FRP system and can help improve the specification of QC/QA. The aim is to improve the implementation of FRP composites in infrastructure projects by evaluating critical design properties and the effect of manufacturing deviations.

Milestones for the current proposed year: Evaluating non-conforming materials, re-testing and potentially inter-laboratory testing to provide statistical data for specifications.

Deliverables for the current proposed year: Anchor testing methodology and evaluation for externally bonded FRP systems, as well as determining what experimental values/parameters can be used towards design validation.

How the project may be transformative and/or benefit society: This project will generate and contribute to enhance the necessary technical information to develop robust specifications.

Research areas of expertise needed for project success: Design of experiments, Civil engineering, material science, structural engineering. Propel integration of composite rebar into infrastructure application by validating the long-term performance.

Sponsor Member Company: Arkema, Creative Pultrusions, ACMA, Galen, Structural Technologies, Structural RS, Owens Corning Infrastructure, QuakeWrap, Simpson Strong-Tie, LiteForm Technologies, TUF-N-LITE, Miller & Long Company

Progress to Date: 50% completion

Estimated Start Date: 11/2019	**Estimated Knowledge Transfer Date**: 11/2022

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I/UCRC Executive Summary - Project Synopsis		**Date**: May 10, 2021
Project: Determining the Durability of Composites for Infrastructure Applications		
Center/Site: Center for the Integration of Composites into Infrastructure (CICI) / University of Miami		
Tracking No.: UM-02	**Phone :** (305) 284-6150	**E-mail:** fdecaso@miami.edu
Center/Site Director: UM/Antonio Nanni (PI), and Francisco De Caso (Co-PI)		**Type:** Continuous
Project Leader: Francisco De Caso		**Proposed Budget**: $200,000
Project Description: This study evaluates FRP rebar composites in two aspects: 1) Alkaline resistance (with and without load) accelerated conditioning, and 2) creep rupture limit. While it evaluates FRP repair systems to accelerated conditioning that includes: 1) saltwater resistance, 2) humidity resistance, 3) heat resistance, 4) alkaline resistance, 5) fuel resistance, and 6) freeze-thaw cycles. The work applied to selected FRP bars and FRP externally bonded systems and seeks to evaluate the retention properties and corresponding design coefficient factors.		
Experimental plan: The experimental plan includes test durations of up to 90 days for accelerated conditioning of FRP bars and up to 20,000 hrs. for externally bonded FRP systems.		
Related work elsewhere: Benchmark results and specifications are available, and this work will enhance and add to validate current available results towards design coefficient factors.		
How this project is different: It includes extended time of exposure is applied to current fiber materials that differ from what was previously tested.		
Milestones for the current proposed year: Completion of 10,000 hrs. exposure		
Deliverables for the current proposed year: Continue to include additional FRP bars form different manufactures and determine the alkaline resistance properties, add new Carbon FRP composites systems		
How the project may be transformative and/or benefit society: This research project will help to validate durability related design coefficient factors which is critical for the development of a code dependence document for FRP bars; and support the integration of FRP strengthening systems in department of transportation related work, where extended durability evaluation is necessary.		
Research areas of expertise needed for project success: Civil engineering, Design of experiments, material science, structural engineering, Modelling science. Proper integration of composite rebar into infrastructure application by validating the long-term performance.		
Sponsor Member Company: Arkema, Miller & Long Company, Structural Technologies, Simpson Strong-Tie, ACMA, Galan, QuakeWrap, Tokyo Rope, Structural RS, TUF-N-LITE LLC, Owens Corning Infrastructure, Basalt Engineering LLC, Bluegrass Composites, Inc		
Progress to Date: 30% completion		
Estimated Start Date: 11/2020	**Estimated Knowledge Transfer Date**: 11/2024	

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I/UCRC Executive Summary - Project Synopsis		**Date**: May 10, 2021
Project: Implementation of Composites Solutions Through Experimental Testing and Design		
Center/Site: Center for the Integration of Composites into Infrastructure (CICI) / UM		
Tracking No.: UM-03	**Phone :** (305) 284-6150	**E-mail:** fdecaso@miami.edu
Center/Site Director: UM/Antonio Nanni (PI), and Francisco De Caso (Co-PI)		**Type:** Continuous
Project Leader: Francisco De Caso		**Proposed Budget**: $100,000

Project Description: The aim of this project is to address practical barriers that limit the implementation of FRP composites, build on existing work to understand the process of integrating design and construction aspects. This project is now focusing on addressing the issue related to the longer development lengths needed in FRP bar, pre-streesing implementation, and the need for cost-effective and feasible splicing solutions by evaluating the implementation swaged couplers on GFRP bars.

Experimental plan: The first step is to investigate the feasibility of evaluating nominal no. 4 GFRP bars with swaged couplers by applying currently available methods and determining the potential load transfer capacity.

Related work elsewhere: No splicing solutions are currently available for GFRP bars.

How this project is different: It addresses the identification of barriers to implement of FRP bars from a construction and practical application point of view.

Milestones for the current proposed year: Identification of available and feasible coupler solutions that can be applied to FRP bars.

Deliverables for the current proposed year: Determine the load transfer capacity and validate the feasibility of the swaged couplers by understanding the impact and mechanics on FRP bars.

How the project may be transformative and/or benefit society: Swaged couplers can be used at precast plants to meet the length of conventional prestressing beds by splicing GFRP bars to traditional steel prestressing strands.

Research areas of expertise needed for project success: Design of experiments, Civil engineering, material science, structural engineering.

Potential Member Company Benefits: Provide practical solutions to expand the application of FRP bars in the pre-cast market forming a significant market segment of the construction where the advantages of FRP bars can be leveraged.

Sponsor Member Company: ACMA, Galan, TUF-N-LITE LLC, Owens Corning Infrastructure, Basalt Engineering LLC, Bluegrass Composites, Inc. LiteForm Technologies, Miller & Long Company.

Progress to Date: 20% completion

Estimated Start Date: 11/2020	**Estimated Knowledge Transfer Date**: 12/2022

I/UCRC Executive Summary - Project Synopsis	**Date**: May 10, 2021

Project: Propelling the use of FRP Composites with Meaningful Codes and Guidelines

Center/Site: Center for the Integration of Composites into Infrastructure (CICI) / University of Miami

Tracking No.: UM-04	**Phone:** (305) 284-6150	**E-mail:** nanni@miami.edu
Center/Site Director: UM/Antonio Nanni (PI), and Francisco De Caso (Co-PI)		**Type:** Continuous
Project Leader: Antonio Nanni		**Proposed Budget**: $250,000

Project Description: This project aims to identify knowledge gaps and critical design applications related to areas of the application of FRP composite systems and develop/review supporting documents, design methodologies, specifications and guidelines as needed for the practical implementation. The work leverages the synergistic approach between the testing results and applying the outcomes and knowhow towards the development/review of documents.

Experimental plan: This work is no focused on the design of GFRP-PC piles for bulkheads reviewing the current state of the art/practice, updating provisions accordingly and leveraging the advantages of FRP composites towards this application. Provisions and updated design algorithms are then tested in a number of scenarios, and validated.

Related work elsewhere: The project formalizes inputs from other trust areas in regulatory language, and highlights research areas to be prioritized to define a more rational design approach, and ease technology deployment.

How this project is different: It includes new structural element applications and revision of existing structural element design applications. Thi work now focuses on implementing GFRP as a prestressed element in concrete piles for bulkheads

Milestones for the current proposed year: Axial-flexural interaction diagrams for different configurations including: (a) Existing FDOT Prestressing Shapes; (b) Partially Prestressed GFRP Shapes; (c) Hybrid Prestressed GFRP/Carbon-Steel Shapes; (c) Prestressed GFRP Shapes.

Deliverables for the current proposed year: Determine tension and compression stresses as a function of relative ram weight in the piles. Funding is leveraged via the NCHRP IDEA Project 207.

How the project may be transformative and/or benefit society: This project sensibly enlarges the field of applications of GFRP in infrastructures. This project answers the demand for corrosion-resistant reinforcement from state DOTs, framing technology deployment in a regulatory language.

Research areas of expertise needed for project success: Structural engineering, civil engineering, material science, codes and standards, structural design.

Sponsor Member Company: Arkema, ACMA, Galan, TUF-N-LITE LLC, Owens Corning Infrastructure, Basalt Engineering LLC, Bluegrass Composites, Inc, Miller & Long Company

Progress to Date: 30% completion

Estimated Start Date: 12/2019	**Estimated Knowledge Transfer Date**: 11/2024

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