Request for Research Funding for FY 2023-2024			
Project Number (Research Center Use Only): SMO-24-07			
Requesting Office	State Materials	**Priority**	7 of 12
Proposed Title	Extraction and Physio-Mechanical Testing of FRP reinforcing from 5-year-old Seawater Concrete Test Blocks on Halls River Bridge Bulkhead		
Justification	Basalt Fiber Reinforced Polymer (BFRP) reinforcement has potential to be a strong competitor in concrete reinforcement. Its corrosion resistant nature and high relative strength makes it a cost effective and promising alternative to steel reinforcement. It also has similar properties and cost to Glass Fiber Reinforced Polymer (GFRP) reinforcement while also having improved sustained load performance and is reportedly more environmentally friendly. Previous research sponsored by the Department and performed by independent laboratories found that BFRP reinforcement significantly deteriorates (25% strength retention) when conditioned for 180 days in simulated concrete pore solutions with elevated temperature (55ºC), high chloride content, and a pH 13. Under these conditions many BFRP reinforcement specimens completely deteriorated within 300 days, while better performing products completely deteriorated within 600 days. BFRP reinforcement was found to fare significantly better in other research using a more realistic simulated concrete environment of being embedded in seawater sea-sand mortar and submerged in seawater solution. In the highest expected pH conditions (12 and at 55ºC BFRP reinforcement retained 45% of its tensile strength after 270 days. When specimens were embedded in the mortar that was mixed with 35% silica fume to reduce alkalinity (~pH 10), BFRP consistently retained over 85% of its tensile strength and showed minimal deterioration. The FRP Guidelines section of the Structures Manual Volume 4 currently restricts BFRP reinforcement from being used in concrete that is permanently submerged. Obtaining characterization test data on bars removed from bulkhead cap test beams that have been in place at Halls River Bridge since December 21, 2017 will help the Department fill some knowledge gaps regarding the long-term performance of this material in realistic conditions and its suitability for use in aggressive marine environments. Additionally, CFRP strands and GFRP bars in the same test beams can be tested to provide relative comparisons of strength degradation with other FRP materials currently in use in submerged and tidal conditions.		
Impact	The results of this research would provide justification to the Department to either maintain or alter the existing restrictions on the use of BFRP reinforcement in submerged marine environments. Currently, 3 BFRP reinforcement manufacturers are seeking Department approval to produce for the State of Florida. This research will directly impact their scope of approval.		
Affected Offices	State Materials – Rodrigo Antunes, Ph.D., P.E.; Alexander Lewis Structures Design – Steven Nolan, P.E. State Construction Office – David Wagner, P.E. State Structures & Facilities Maintenance Office – Bruno Vasconcelos, P.E.		
Existing Work	• FDOT Research Project – BE694 • FDOT Research Project – BDV30 706-01 • *Yong Yi, Deju Zhu, Md Zillur Rahman, Guo Shuaicheng, Sheng Li, Zhijian Liu, Caijun Shi, Tensile properties deterioration of BFRP bars in simulated pore solution and real seawater sea sand concrete environment with varying alkalinities, Composites Part B: Engineering, Volume 243, 2022, 110115,ISSN 1359-8368, https://www.sciencedirect.com/science/article/abs/pii/S1359836822004917*		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Basalt Fiber, Composite, BFRP, FRP, bars, rebar, durability,		
Related Contracts (Give contract numbers)	N/A		
Funding Request	$100,000	**Anticipated**	12 months

		Duration	
Project Manager	Alexander Lewis	**Contracting Method**	RFP
Equipment	N/A	N/A	
Urgency	2	This project may provide FDOT with an immediate need to update Structures Manual Volume 4, FRP Guidelines.	
Implementability	2	Since this project mostly involves characterization testing of real-world samples and builds on previous research the only possible barrier to implementation would be inconclusive data. The results of the testing will otherwise justify either relaxing the FRPG restriction on BFRP reinforcement or leaving it as-is.	

Project Benefits (Succinct, complete explanation)

This project will validate or refute the existing usage restrictions on BFRP reinforcement imposed by the Structures Manual - Volume 4, Fiber Reinforced Polymer Guidelines.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
o Materials Enhancement	N/A	
o Materials Savings	N/A	Evaluating existing samples allows implementable results to be obtained without the need for new research with new materials.
o Time Savings	N/A	Evaluating existing samples allows implementable results to be obtained faster than if new research had to be proposed.
o Lives Saved/Injuries Prevented	N/A	Ensuring long term durability of concrete reinforcement should be a safety consideration for its residents, visitors, and businesses. The goal is to provide a fatality free transportation system.
o Other (Explain)	N/A	Will provide additional market competition to GFRP reinforcing manufacturers for competitive bid pricing by Contractors on construction future projects.

*Comments should explain and support urgency, financial benefit, and implementability scores