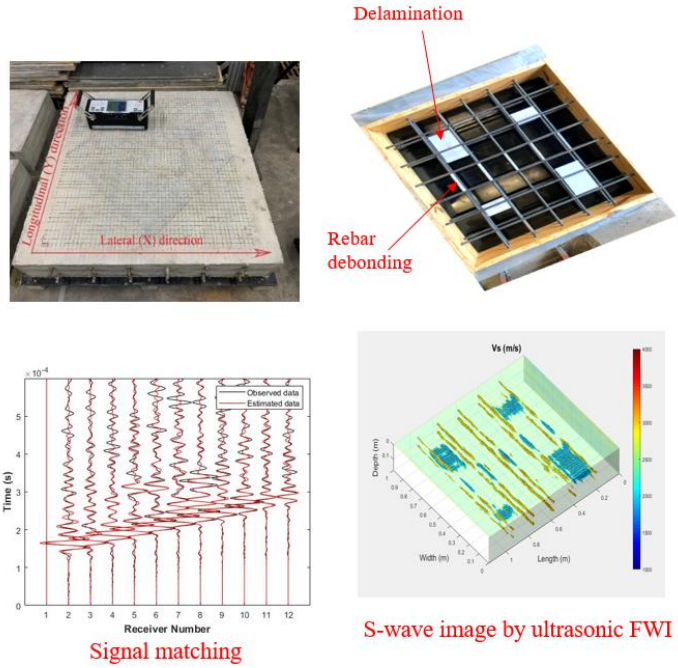
Request for Research Funding for FY 2025-2026			
Project Number (Research Center Use Only): SMO-26-05			
Requesting Office	State Materials Office	**Priority**	5 of 7
Proposed Title	Detection of Corrosion-Induced Damages in Concrete Bridges with Ultrasonic Imaging		
Justification	This research project is to develop an advanced ultrasonic testing system (hardware and algorithm) that can provide 3D images of entire bridge elements at high resolutions (mm-pixel) for detection of corrosion-induced damages. The proposed system will consist of a step-walking shear-wave device for quick data acquisition, and advanced data analyses for both real-time and in-depth inspections of damages. Specifically, the conventional synthetic aperture focusing technique (SAFT) will used for real-time inspection, and the advanced full-waveform inversion (FWI) will be used for in-depth inspection for early detection of damages. The system is expected to provide new capabilities of structural imaging that enables engineers to accurately and efficiently assess the condition of critical bridge elements.  Figure 1 Example of Ultrasonic Inspection		
Impact	The proposed testing system is expected provide currently unachievable imaging and diagnostic capabilities for locating and characterizing corrosion-induced damages of concrete bridge elements. High-resolution images produced by the system would allow for timely (early) assessment of damages and comprehensive evaluation of integrity and long-term durability of the bridge elements. Thus, rehabilitative and mitigation actions can be efficiently performed to maintain the structural health of bridges and ensure safety of traveling public.		
Affected Offices/ Districts	Maintenance, Materials, Construction, Design, Districts		
Existing Work	The existing methods for assessing corrosion-induced damage in concrete bridges, such as visual inspections, GPR, and half-cell potential measurements, often lack precision and are limited in their ability to detect subsurface damage. They provide no information on rebar debonding. As a result, the identification of corrosion-related deterioration may be delayed until the damage has progressed to a more severe stage, leading to costly repairs or even catastrophic failures.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Bridge inspection, Nondestructive testing, Ultrasonic imaging		

Related Contracts (Give contract numbers)	NA		
Funding Request	$200,000	**Anticipated Duration**	18 months
Project Manager	Oliver Chung	**Contracting Method**	Direct contract with UF
Equipment	N/A	N/A	
Urgency	2	Many aging bridges in Florida are deteriorating quickly due to continuously increasing loads on structures from more severe weather events and heavier transportation. As bridge failures will cause severe public safety and economic impacts, there is an urgent need for comprehensive condition assessment of deteriorating bridges for rehabilitative and mitigation actions.	
Implementability	2	The proposed testing system has preliminarily been tested on laboratory concrete slabs at the University of Florida. Excellent results have been obtained as the system was able to image entire slabs in 3D at mm-resolution and detect delamination and rebar debonding. With improvement of data acquisition on large structures, the system will be ready for field implementation on actual bridges.	

Project Benefits (Succinct, complete explanation)

This project will enhance concrete structure imaging, delivering high-resolution, 3D images of bridge elements (deck, girder, pier) at millimeter precision. The testing system developed in this project will enable early detection and detailed characterization of corrosion-related damage (cracks, delamination, rebar issues) and others (honeycombing, deterioration), supporting proactive rehabilitation to prevent accelerated deterioration and potential bridge failure.

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	The proposed system can be used for quality assurance of new concrete structures (e.g., assessment of rebar cover thickness, poor consolidation, honeycomb).
o Financial Impact	N/A	The ability of early detection of damage would reduce the cost of bridge maintenance.
o Time Savings	N/A	The step-walking shear-wave device developed in this project will allow for quick data acquisition, and thus minimize the negative impact caused by closing traffic flow during bridge inspection.
o Lives Saved/Injuries Prevented	N/A	The proposed system can early identify material damage and deterioration in bridge elements for mitigation actions to prevent potential collapses and consequent injuries/fatalities.
o Other (Explain)		

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