Request for Research Funding for FY 2021-2022			
Requesting Office	Geotechnical	**Priority**	5 of 5
Proposed Title	Using the PENCEL PMT to Reevaluate Foundation Requirements on FDOT Shallow Foundation Sites		
Justification	FHWA-IF-02-054 Geotechnical Engineering Circular No. 6 - Shallow Foundations acknowledges the potential cost savings that can result from the judicious use of shallow foundations and includes a reference indicating that shallow foundations can generally be constructed for 50 to 65 percent of the cost of deep foundations (Briaud & Gibbens, 1995). FHWA-RC/TD-10-001 Selection of Spread Footings on Soils to Support Highway Bridge Structures states that spread footings are underutilized by designers due to various obstacles, including the use of overly conservative settlement prediction methods. Improved settlement prediction methods using the pressuremeter test (PMT) have been developed to obtain more realistic predictions (Briaud, 1992 & 2007). Obtaining settlement parameters from PMT correlations versus SPT correlations for improved settlement estimates was also recommended by BDV24 977-29 completed in 2020. The goal of this work is to: (1) optimize the pressuremter testing by using the direct-push PENCEL pressuremeter versus traditional borehole methods, (2) calibrate the work performed by Briaud to Florida sands which are finer and more poorly graded compared to Briaud's database, and (3) to reevaluate the foundation designs at several Florida sites to determine the cost savings of using spread footings at these sites compared against the traditional deep foundation alternatives (i.e. pile foundations).		
Impact	The use of shallow foundations (spread footings) is generally underutilized, with potential cost savings for using them compared to deep foundations. It is the goal of this project to provide the means and background to justify their use or at least, to require designers to consider their use on projects as an optional foundation. If realized on just a few projects statewide, the potential cost savings would be significant.		
Affected Offices	Geotechnical, Design, Materials. Updates by the researcher will be presented in annual Geotechnical Research in Progress (GRIP) meetings to district geotechnical staff and consultants		
Existing Work	The previous project BD-658 Standardizing the Pressuremeter Test for Determining p-y Curves for Laterally Loaded Piles provided a means to automate the control equipment used for the PENCEL pressuremeter that is still currently in use by the State Materials Office. Another project, BC-354 Evaluation of FEM Engineering Parameters from Insitu Tests, recommended the use of the PENCEL pressuremeter as the insitu test when performing a finite element method (FEM) analysis, including settlement analyses for shallow foundations.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	PENCEL, pressuremeter, PMT		
Related Contracts (Give contract numbers)	The following FDOT research contracts and associated papers: BD-658 Standardizing the Pressuremeter Test for Determining p-y Curves for Laterally Loaded Piles BC-354 Evaluation of FEM Engineering Parameters from Insitu Tests		
Funding Request	$257,063.66	**Anticipated Duration**	24 months
Project Manager	Larry Jones & David Horhota	**Contracting Method**	Direct contract with Florida Institute of Technology (Dr. Paul Cosentino)
Urgency	3	Since shallow foundations are generally underutilized in this state, the intent is to provide guidelines to overcome some of the identified obstacles of obtaining cost effective field data to confidently have them be considered as a bridge foundation alternative. If they are 50 to 65 percent of the cost of deep foundations, then the potential cost savings using them, even on a few projects statewide, could be significant.	
Implementability	3	The previous project BD-658 provided a means to automate the equipment used for the PENCEL pressuremeter that is still currently in use by the State Materials Office, which	

		can be used on pilot projects. The main obstacle will be for bridge designers to consider the use of shallow foundations as an option for bridge foundations.

Project Benefits (Succinct, complete explanation)

The goal of this project is to provide guidelines to help overcome the obstacles in using of shallow foundations (GRS or spread footings) on soils as a foundation for highway bridges by: (1) optimizing the testing program using the PENCEL pressuremeter, (2) developing a Florida-specific, realistic settlement prediction methodology, and (3) showing the potential cost savings of using spread footings at several Florida sites compared against the traditional deep foundation alternative (i.e. piles).

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**
○ Materials Enhancement	Better knowledge of soil parameters	Using the PMT would result in a more accurate assessment of the soil properties (modulus) which would assist in obtaining more accurate settlement predictions, and not have to be overly conservative to account for unknown soil properties.
○ Materials Savings	≈ $250,000 per construction project	Assuming a project with 50 piles, 60 feet long each at $100/foot. While the piles would be eliminated from the project there would likely be some cost associated with a deeper excavation for footing construction, therefore not all the potential savings (50*60*100 = $300,000) would be realized.
○ Time Savings	$10,000 to $200,000 per construction project	Depends on the project size.
○ Lives Saved/Injuries Prevented		
○ Other (Explain)	Reducing bump at the end of the bridge	Bridges founded on shallow foundations settle at the same rate as the approach embankments; therefore, the ride of vehicles traveling on and off the bridge tends to be very smooth compared to bridges founded on deep foundations.

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