Request for Research Funding for FY 2025-2026			
Project Number (Research Center Use Only): STR-26-01			
Requesting Office	CO Structures/ District 6 Structures	**Priority**	1 of 5
Proposed Title	Torsion Capacity of Mast Arm Foundations		
Justification	FDOT District 6 Structures Design Office has observed that mast arm foundation designs have required larger and longer drilled shafts in recent years. The cause may be a torsion capacity formula which was revised in 2012, which may not be appropriate in areas with low soil parameters (N < 15). This has raised concerns about overly conservative designs, which may result from oversimplified soil profiles, leading to higher costs and inefficient material use. The research will advance Safety and Resiliency by ensuring balanced, effective designs, Robust Supply Chain by reducing unnecessary material demand, Technology through the use of advanced tools like FB-MultiPier, and Communities by optimizing public spending and supporting sustainable infrastructure development. This research will focus on determining the reason(s) that district 6 has noted larger and longer drilled shafts being required by design. The research would investigate the reason for the more stringent designs, confirm or refute if the cause is the revised torsion capacity equation, determine if the approach is too conservative, and develop a revised method. Design calculations and plans will be reviewed and parametric study or comparative calculations will be completed. In addition, design guidance from other states will be reviewed and compared to FDOT guidance. If the concern is being triggered by "long" drilled shafts that are going through lose sands and into rock (as is possible and even likely in some areas of South Florida), the problem could be oversimplification of the profile into a single soil layer and not apparent over-conservatism of the method. A less conservative design could be achieved by alternate calculations methods, such as hand calculations or FB-MultiPier. The researcher will develop example calculations and design guidelines to ensure appropriate design methods are being used. The consequence of torsional failure of mast arms (that is, rotation during a storm when there is no traffic on the road) can sensibly be considered to be low. Conservative design for torsion may not be necessary. As part of this project, the researcher will investigate the feasibility and associated reliability of reducing the required capacity-to demand ratio for torsion.		
Impact	The results will optimize mast arm foundation designs, reducing unnecessary costs and material use while maintaining safety and improving resiliency. Without this research, overly conservative designs will persist, leading to inefficiencies, misallocated resources, and missed opportunities to adopt more accurate and cost-effective design practices.		
Affected Offices/ Districts	Central Office Roadway Design Office, Central Office Structures Design Office, District Office		
Existing Work	Fu, Chung C (2017). *Fatigue Resistant Design Criteria for MD SHA Cantilevered Mast Arm Signal Structures*, Maryland State Highway Administration Symans, Michael (2015). *Development of Software for Analysis of Traffic Signal Support Structures*, New York State Department of Transportation Rodriguezc, Carlos M, *State of Practice and Literature Review on Foundations for Coastal Traffic Signal Mast Arm Structures*, FHWA Hu, Zhihong (2006). *Influence of Torque on Lateral Capacity of Drilled Shafts in Sands*, American Society of Civil Engineers		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Mast arm foundation, Mast arm, Torsion Capacity, Drilled shafts, Soil Properties		
Related Contracts (Give contract numbers)	BC354		

Funding Request	$250,000	**Anticipated Duration**	2 years
Project Manager	Olga Iatsko	**Contracting Method**	RFP
Equipment	N/A		
Urgency	1	This project scored first in a rating of 13 research ideas by FDOT's Central and District Structures Design Offices.	
Implementability	1	The research findings are highly implementable, as they will directly inform updates to design guidelines and calculation methods used in mast arm foundation projects. By providing example calculations, parametric studies, and comparisons with other states' practices, the results can be seamlessly integrated into FDOT's existing processes. Training and adoption of advanced tools like FB-MultiPier will also enhance the efficiency and accuracy of designs, making the transition practical and impactful for current and future infrastructure projects.	

Project Benefits (Succinct, complete explanation)

The project will optimize mast arm foundation designs, reducing construction costs, material waste, and inefficiencies caused by overly conservative approaches. It will enhance safety and resiliency by addressing site-specific soil conditions, ensuring reliable performance under extreme conditions. Additionally, it promotes the adoption of advanced design tools, supports sustainable resource use, and aligns with FDOT's goals of improving infrastructure efficiency, reducing environmental impact, and maximizing public investment.

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		This research will optimize their usage by refining foundation design requirements, reducing unnecessary material demand.
o Financial Impact		This research will reduce construction costs by optimizing foundation designs, minimizing unnecessary material use, and improving resource allocation, leading to more cost-effective infrastructure projects.
o Time Savings		This research will reduce the construction time by constructing a shorter mast arm foundation
o Lives Saved/Injuries Prevented		This research will maintain safety by ensuring mast arm foundations are designed to withstand site-specific conditions without failure. The impact is moderate, as it prevents over-engineering while maintaining structural reliability during extreme events.
o Other (Explain)		

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