Request for Research Funding for FY 2020-2021			
Requesting Office	CO Structures Office	**Priority**	4 of 6
Proposed Title	Anchorage Zone of PT Pier Caps Integral with Steel Girders		
Justification	Post-tensioned integral pier caps in which the tendons penetrate the girder webs are frequently used on FDOT projects, yet there is little if any design criteria and guidance that addresses the anchorage zone with the presence of the steel girder. This research will investigate the anchorage zone and develop appropriate design guidance to ensure consistently safe designs are being used.		
Impact	Design-build projects continue to push the capabilities of post-tensioned integral pier caps. If design of complex structures is not sufficiently understood, there could be problems during construction or while the bridge is in service.		
Affected Offices	State Structures Design Office		
Existing Work	To our knowledge, no work has been completed or is in progress related to this specific topic.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Pier cap anchorage zone, post-tensioning anchorage zone		
Related Contracts (Give contract numbers)			
Funding Request	$325,000	**Anticipated Duration**	3 years
Project Manager	Will Potter	**Contracting Method**	RFP
Urgency	4	This project scored fourth in a rating of research ideas by FDOT's Central and District Structures Design Offices.	
Implementability	1	Results of this research would be implemented as design guidance in the FDOT Structures Design Guidelines.	

Project Benefits (Succinct, complete explanation)

Due to the rapid growth in Florida, designers are using post-tensioned integral bent caps more than ever before and the limitations of that type of structure are being tested. More knowledge is required to properly design the disturbed region of post-tensioning anchorage zones when an integral steel girder is present. Current guidance does not consider the presence of a steel girder and designers may place reinforcement beyond the steel fascia girder, ignoring the effect of the bursting force location in the modified disturbed zone. The presence of the transverse girder results in discontinuity of the disturbed zone where bursting steel reinforcement is typically located. Research is needed to better understand the forces in the anchorage zone of post-tensioned pier caps integral with steel girders and to ensure safe, durable and consistent bridge designs.

The objective of the research would be to address the following concerns:

1. The distance from the end of the PT pier cap to the exterior girder is often too short for the large PT forces being used, leading to the potential for significant cracking. Designers often limit this distance by the dimension of the deck overhang. The steel girders are considered a discontinuity which is likely modifying the disturbed zone. Designers are likely not accounting for this in the design of the anchorage zone. Research should determine the minimum length of the disturbed zone and recommend details to accommodate the bursting forces.
2. Shear connectors are typically attached to the girder webs in the anchorage zone. The confinement required to resist the large PT bursting forces can be significant. The PT forces cause a transverse Poisson tensile stress which is not accounted for in the design of the steel. Vertical welded transverse stiffeners at the edges of the PT pier cap in addition to closed stirrups could be considered as a means of confinement.

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		Potential use of UHPC or other materials in the anchorage zone to enhance this region and simplify the bursting reinforcement.
o Materials Savings		
o Time Savings		This research could prevent construction problems, such as severe concrete cracking and stress exceedance in steel girders. Avoidance of construction problems equates to time savings.
o Lives Saved/Injuries Prevented		Ensuring designs are appropriate enhances safety.
o Other (Explain)		

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