Request for Research Funding for FY 2020-2021			
Requesting Office SMO	SMO	**Priority**	# 5 of # 10 (projects may not have the same ranking – no ties)
Proposed Title	Durability of concrete using low slag cement contents.		
Justification	Current FDOT Specifications limit slag cement in concrete mix designs to a minimum of 50% replacement of portland cement concrete. The reasoning for this limitation was based on the concerns about durability of concrete mixes with less than 50% slag cement replacement. Fly ash, is used in 2/3rd of all FDOT concrete mix designs, however, due to the diminishing supply of fly ash, particularly during cooler months in Florida, there is a need to allow for a wider range of replacement of portland cement concrete with other supplementary cementitious materials, particularly slag cement as it is the most abundant and available. Slag use is most limited in the production of Precast and Prestressed Concrete elements, as a 50% replacement of portland cement with slag cement does not provide the needed early age compressive strength. At a lower percentage replacement, the compressive strength can be obtained at an early age, but there is concern about the long-term durability of the concrete mix. Using resistivity testing, rapid migration testing, and other related tests, a qualification method will be developed to estimate long term durability of the concrete mixes and speed up the time to approve these proposed mix designs. In addition, differing chloride levels of slag cement will be investigated to determine what affect, if any, that they have on the corrosion of steel reinforced concrete. Hardened properties such as compressive strength, modulus of elasticity, flexural strength, amongst others will be studied and evaluated. Class V and Class VI concrete mixes used in Precast and Prestressed Concrete elements utilizing #67, or a combination of #67 and #89, coarse aggregate will be used during this study to provide a blanket quality for durability for FDOT concrete mix designs.		
Impact	In recent years, due to the lack of supplementary cementitious materials, the Department has been put in the controversial position to allow for concrete mixes utilizing only portland cement, in the use of Precast and Prestressed Concrete elements. Materials Bulletins have been issued during the winter months when the fly ash supply diminishes to a point where production of FDOT project would be impacted. This project would provide an immediate solution to these issues and relieve the Department of this controversial position.		
Affected Offices	SMO – Tim Ruelke, Pat Upshaw, Thomas Frank, Pat Carlton, Bradley Pearson, Tim Counts. SCO – John Westphal, David Wagner.		
Existing Work	No previous research was found for which this research would be a duplication of effort.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Supplementary cementitious materials, slag, cement, concrete, precast concrete, durability		
Related Contracts (Give contract numbers)	BDV25 977-28, BDV25 977-63		
Funding Request	Estimated cost 180,000	**Anticipated Duration**	Estimated length of time to complete work 18 months
Project Manager	Thomas Frank (PM) Tim Counts (Co - PM)	**Contracting Method**	RFP

Urgency	1	The department needs a definitive solution to avoid the interruption of construction projects due to lack of supplementary cementitious materials.
Implementability	1	There are not significant barriers to implement the project once concluded. A developmental specification can be proposed to expedite the implementation.

Project Benefits (Succinct, complete explanation)

The project will provide an immediate solution to the shortage of fly ash that has been impacting FDOT construction projects in recent years. Slag is a very important supplemental cementitious material (SCM) in the production of high-performance concrete (HPC), and its use has been steadily increasing due to the limited availability of high-quality fly ash. Precast and prestressed concrete manufacturers have resisted using slag cement in their concrete due to the reduction in the rate of strength development from the use of a minimum addition of 50% cement replacement as required by current specifications. This project will establish if there are valid production and durability issues with the use of less than 50% slag cement, particularly for an addition of about 30% replacement, which is expected to be low enough that it will not significantly affect production.

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 to improve concrete durability	Larger reductions in portland cement content when using slag cement can reduce the total heat produced by the mix and can reduce the temperature rise in mass concrete, which will reduce thermal stresses and, subsequently, the probability of cracking.
o Materials Savings		This depends on the relative costs of portland cement, slag cement, and fly ash at the time of production.
o Time Savings	1) Faster turnaround time for precast / prestressed molds when using slag 2) Reduced project delays due to fly ash shortages	This would require tracking by the Construction Office of (1) mold turnaround times as a function of mix design – slag additions versus fly ash additions and (2) production delays due to the unavailability of fly ash. Estimates of production time savings and associated cost savings could be made based on this information.
o Lives Saved/Injuries Prevented	NA	
o Other (Explain)	Environmental benefit from use of lower portland cement contents	Portland cement – slag concrete mixes have lower portland cement contents since slag cement additions are higher than for fly ash additions in portland cement – fly ash mixes. This reduces the carbon footprint since portland cement production releases large quantities of carbon dioxide.

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