Request for Research Funding for FY 2022-2023			
SPR Subpart B Project: OOM-23-02			
Requesting Office	CO Office of Maintenance	**Priority**	2 of 2
Proposed Title	Segmental Bridge History and Inspection Training		
Justification	Florida was an early adopter of the segmental bridge type, a complex design that has challenged and surprised Maintenance, over the years. To instruct current and future personnel on segmental design and care, the Department should (1) synthesize a record of failure and success into a meaningful narrative, (2) record oral histories of segmental construction and maintenance where relevant, and (3) develop an inspection course informed by that history that will help to ensure safe bridge operations. SYNTHESIS. Construction and maintenance records for segmental bridge types are particularly voluminous. However, the collection is too vast for any one student to comprehend without a thoughtful narrative. A synthesis will summarize that history and allow staff to preserve and document specialized knowledge. ORAL HISTORY. Candid interviews with segmental specialists will record history, caution future maintainers, and celebrate some of the successes that the Department has achieved with the segmental bridge type. Gathering ephemeral information from knowledgeable personnel, many of whom have retired from the Department, is urgent. INSPECTION. Develop an inspection module that will use segmental bridge history to clearly state concerns, summarize what to look out for, and explain relevant inspection techniques. Investigate Trejo's manual for Texas and adapt it for Florida, expanding upon that work and putting it into action with in-person training.		
Impact	The results will inform segmental maintenance, construction, and design in Florida. Whereas inspectors now rely upon the National Bridge Inspection program, augmenting their experience as working conditions permit, this segmental course will provide the specialization that is needed for this bridge type. With an overview of construction techniques, what residual stresses persist, how partial failures have presented themselves in the past, personnel will be better prepared for their inspections, more likely to uncover precursors to tendon failures. Construction and Design, also, are likely to benefit by having access to a decades-long history of the segmental experience in Florida – patterns of design, material, and contractor performance. The history can help show where and whether this bridge type is competitive.		
Affected Offices	The affected offices include Structures Maintenance, Structures Design, State Materials, and Construction.		
Existing Work	None is acceptable. Guides exist (A Guide to the Construction of Segmental Bridges, 1989 – FDOT, and TxDOT's Inspection and Repair Manual from 2009). Retrospectives are available (TxDOT's Long History With Segmental Concrete Bridges Continues), and *The Miami Herald* published a series of articles, over the years, about the Keys bridges. But no comprehensive history of Florida segmental bridges exists, nor instructions for their care.		
Keywords Used in Existing Work Search: Segmental, tendon	PRIMARY Trejo (2009) Effect of Voids in Grouted Post-Tensioned Concrete Bridge Construction: Inspection and Repair Manual for External Tendons in Segmental, Post-Tensioned Bridges. *Texas Transportation Institute Project 0-4588.* (https://static.tti.tamu.edu/tti.tamu.edu/documents/0-4588-2.pdf SECONDARY https://trid.trb.org/Results with keywords "segmental AND bridge AND tendon AND corrosion" produces 30 records. Selected works follows, with several from ScienceDirect, too. Abrahms (2007) Inspection and Rehabilitation of Jamestown-Verrazzano Segmental Concrete Bridge. Fourth New York City Bridge Conference (2007). (built 1992, inspected 1999, 7.5% of ducts with voids, some with corrosion) Haber (2010) External Anchorage Failure and Tendon Pull-out Tests on Bridge Piers. *Structures Congress 2010* (paywall, development length required to prevent tendon failures similar to Mid-Bay). Hani (2020) Practical Cross-Section Imaging of External Tendons to Reveal Grout Deficiencies Relative to Strand Pattern. *Journal of Bridge Engineering (Vol. 25, No. 11).*		

	O'Reilly, Matthew (2015). Corrosion Performance of Prestressing Strands in Contact with Dissimilar Grouts. *ACI Materials Journal (Vol. 112, Issue 4)*. https://www.concrete.org/publications/internationalconcreteabstractsportal.aspx?m=details&i=51687751 Pillai (2014) Time-Variant Flexural Reliability of Posttensioned, Segmental Concrete Bridges Exposed to Corrosive Environments. *Journal of Structural Engineering (Vol. 140, No. 8)* (paywall) Rehmat (2017) F Non-Destructive Testing (NDT) of a Segmental Concrete Bridge Scheduled for Demolition, with a Focus on Condition Assessment and Corrosion Detection of Internal Tendons. *DOT-BDV29-977-05* (infrared and inductance at Ft. Lauderdale bridges scheduled for decommissioning) Rehmat (2018) Development of Quality Assurance and Quality Control System for Post Tensioned Segmental Bridges in Florida: Case of Ringling Bridge - Phase II. *FDOT FDOT-BDV29-977-34.* (NDT at Ringling with mixed results) Sagues and Kranc (2000). Initial Development of Methods for Assessing Condition of Post-Tensioned Tendons of Segmental Bridges. *USF Contract #BC374 with FDOT.* https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/structures/structuresresearchcenter/final-reports/bc374.pdf?sfvrsn=32aa4f91_0 Venugopalan (2003) Corrosion Evaluation of Post-Tensioned Tendons on the Mid-Bay Bridge in Destin, Florida. *Recent Developments in Bridge Engineering, Proceedings of the Second New York City Bridge Conference (10-20-2003, New York)* (ebook available in selected paywall/libraries. For a related presentation, see https://www.virginiadot.org/business/resources/bu-mat-Bridge-4-SVenugopalan.pdf) Venugopalan (2008) Corrosion Evaluation of Post-Tensioned Tendons in a Box Girder Bridge . *Transportation Research Circular (Number E-C128) (*field-based account of inspections at a Midwestern segmental bridge) Wang, Lei (2014). Effect of insufficient grouting and strand corrosion on flexural behavior of PC beams. *Construction and Building Materials(Vol. 53)*. http://www.elsevier.com/wps/find/journaldescription.cws_home/30405/description#description		
Related Contracts (Give contract numbers)	(none)		
Funding Request	$250,000	**Anticipated Duration**	24 months
Project Manager	Proposed technical manager to oversee research	**Contracting Method**	RFP
Equipment	NA	N/A	
Urgency	Score 1-5 1= highest , most immediate need	1 – A recent near-failure at the Roosevelt Bridge in District 4 underscores the need for best-available inspection guidance. As one District Structures Maintenance Engineer observed, "these [segmental] bridges continue to surprise us."	
Implementability	Score 1-5 1=greatest likelihood of and proximity to implementing results	1 – this work will be immediately applicable.	

Project Benefits (Succinct, complete explanation)

This project will, for the segmental bridge type, synthesize history, record first-hand observations, and provide a practical inspection course. The activities are essential and interdependent. The course will draw from the past to understand and forecast some of the problems the Department and its personnel should anticipate. While this knowledge will immediately educate bridge inspection personnel, the experience can also improve longer-

term work in the Structures Design division. The direct applicability of this project's outputs for agency training, inspection standards, and broader asset safety/reliability - will provide considerable return on investment for the Department and the project team.