Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

STEPHANIE C. KOPELOUSOS
SECRETARY

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To: District Directors of Operations, District Directors of Production, District Design Engineers, District Construction Engineers, District Geotechnical Engineers, District Structures Design Engineers

FROM: Robert V. Robertson, P. E., State Structures Design Engineer
David A. Sadler, P.E., Director, Office of Construction

COPIES: Brian Blanchard, Lora Hollingsworth, Larry Jones, Sam Fallaha, Marcus Ansley, Andre Pavlov, Charles Boyd, Tom Andres, Tom Waits, Jonathan Van Hook, Garry Roufa, Peter Lai, Rodrigo Herrera, Chris Richter (FHWA), Jeffrey Ger (FHWA), Bob Burleson (FTBA)

SUBJECT: Temporary Design Bulletin C09-04
DCE Memorandum No: 14-09
Mandatory Utilization of Embedded Data Collectors (EDC) in All Bridge Projects With Square Prestressed Concrete Pile Foundations

DESIGN REQUIREMENTS

1. Utilize the appropriate resistance factor as specified in the following revised **Structures Design Guidelines**, Section 3.5.6, Table 3.1 for determining the nominal pile capacity. Include this information in the Pile Data Table in the plans.

2. Include Pay Item No. 455-146 (Embedded Data Collector – each) in the Summary of Pay Items. The Embedded Data Collector (EDC) quantity will be one per square prestressed concrete pile.

3. For projects with letting dates after January 1, 2010, incorporate the appropriate Special Provision 455 from the January 2010 Workbook for 100% EDC testing into the project Specifications depending on whether test piles are or are not required to determine final pile lengths.

4. Review the plans to assure there are not any conflicts between plan notes and the new specification.

5. Delete **January 2009 Structures Design Guidelines**, Section 3.5.6, Table 3.1 and insert the following:

Table 3.1 Resistance Factors for Piles (all structures)

Pile Type	Loading	Design Method	Construction QC Method	Resistance Factor, φ
Square Prestressed Concrete Piles with Embedded Data Collectors (EDC) in all piles	Compression	Davisson Capacity	EDC based on PDA and CAPWAP	0.75
			EDC based on PDA, CAPWAP and Static Load Testing	0.85
			EDC based on PDA, CAPWAP and Statnamic Load Testing	0.80
	Uplift	Skin Friction	EDC based on PDA and CAPWAP	0.60
			EDC based on PDA, CAPWAP and Static Uplift Testing	0.70
Steel Piles and Concrete Cylinder Piles	Compression	Davisson Capacity	PDA and CAPWAP analysis of Test Piles	0.65
			Static Load Testing	0.75
			Statnamic Load Testing	0.70
	Uplift	Skin Friction	PDA and CAPWAP analysis of Test Piles	0.55
			Static Load Testing	0.65
All piles	Lateral (Extreme Event)	FBPier[1]	Standard Specifications	1.00
			Lateral Load Test[2]	1.00

1. Or comparable lateral analysis program.
2. When uncertain soil conditions are encountered.

COMMENTARY

The increased confidence in achieving the required nominal resistance when dynamic measurements are used to determine pile bearing of all piles is reflected in the use of an increased resistance factor.

EDC systems have not been developed for use with steel pipe piles or steel H-piles. EDC systems are not currently required for concrete cylinder piles because EDC systems have not been tested in cylinder piles. In voided prestressed concrete piles, the length of the solid sections at the tip and toe of the piles shall be at least 4 pile diameters long as shown in Design Standards Index 20630 for 30" Prestressed Concrete Piles. The EDC is cast into these solid sections, along the axis of the pile, ≥two (2) pile diameters from the top, one (1) pile diameter from the tip, and ≥ two (2) pile diameters from any cross-section change such as a pile void.

BACKGROUND

Embedded Data Collector (EDC) technology is the result of a research study by the University of Florida sponsored by FDOT. FDOT made a commitment to advance EDC technology in prestressed piling by establishing a statistically significant database of approximately 200 piles monitored concurrently with both EDC and conventional dynamic monitoring methods and then compiling a statistical comparison of the test results. The statistical comparisons between these two methods (EDC-Fixed Method and conventional dynamic monitoring) compare very well in the 197 pile drives of 143 piles analyzed to date. Comparing the EDC/PDA result ratio, over 97% of the hammer blows are within +/- three standard deviations of the mean ($\mu = 0.98$, $\sigma = 0.17$, COV = 0.17) for the same damping and wave speed values. Therefore, improved confidence in driven pile capacity, and flexibility in pile installation requirements can be realized by using the results of EDC measurements to accept driven piles based on test pile results rather than using hammer stroke vs. blows per foot.

Technical Committee T-15 of the AASHTO Highway Subcommittee On Bridges And Structures recognized the benefit of 100% dynamic testing when it proposed increased resistance factors for the 2004 Bridge Design Specification. FDOT is hereby adopting the resistance factor proposed by Technical Committee T-15 earlier this year for the 2009 ballot for *Driving criteria established by dynamic testing conducted on 100% of production piles* without static load testing. The increases in the resistance factors for Driving criteria established by 100% dynamic testing with static, Statnamic, or uplift load testing reflect the similar differences in magnitude in the 2009 FDOT Structures Manual.

DESIGN IMPLEMENTATION

This policy is effective for all bridge projects including square, solid or voided, prestressed concrete pile foundations with let dates after January 1, 2010. Implementation of this policy is optional for all projects with let dates prior to January 1, 2010.

CONSTRUCTION IMPLEMENTATION

This policy may be incorporated into existing construction contracts at the option of the Contractor or Design Build Team with the approval of the Department. **This document serves as a blanket approval to process this optional specification change and should be attached to the Work Order or Supplemental Agreement.**

CONTACT

Larry Jones
Assistant State Structures Design Engineer
& State Geotechnical Engineer
Florida Department of Transportation
605 Suwannee Street, MS 33
Tallahassee, FL 32399-0450
phone (850)-414-4305, fax (850)-414-4955
e-mail: Larry.Jones@DOT.STATE.FL.US

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