



Florida Department of Transportation

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Structures Design Bulletin C10-02,
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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

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SUBJECT: Utilization of Embedded Data Collectors (EDC) in All Bridge Projects With Square Prestressed Concrete Pile Foundations

This bulletin supersedes Temporary Design Bulletin C09-04, DCE Memorandum 14-09 released June 12, 2009.

DESIGN REQUIREMENTS

1. Delete **January 2010 Structures Design Guidelines**, Section 3.5.6, Table 3.5.6-1 and insert the following:

Table 3.5.6-1 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	0.65

Steel Piles and Concrete Cylinder Piles	Compression	Davisson Capacity	PDA and CAPWAP analysis of Test Piles	0.65
			Static Load Testing	0.75
	Uplift	Skin Friction	PDA and CAPWAP analysis of Test Piles	0.70
Static Load Testing			0.55	
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.				

2. Utilize the appropriate resistance factor as specified in the table (**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.

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, \geq two (2) pile diameters from the top, one (1) pile diameter from the tip, and \geq 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 concrete piling by establishing a statistically significant database of approximately 200 piles monitored concurrently with both EDC and conventional dynamic monitoring methods, compiling a statistical comparison of the test results and then evaluating the use of EDC in all applicable piles. The statistical comparisons between these two methods (EDC-Fixed Method and conventional dynamic monitoring) compare very well in the 203 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. For projects with EDC monitored in 100% of the production piles, FDOT is hereby adopting the resistance factor proposed by Technical Committee T-15 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% EDC monitoring with static, Statnamic, or uplift load testing reflect the similar differences in magnitude as in the 2009 FDOT Structures Manual.

DESIGN IMPLEMENTATION

This bulletin is effective for all bridge projects containing square, solid or voided, prestressed concrete pile foundations. The policy contained herein is a revision of existing policy and has no net effect on projects let between the date of this bulletin and September 30, 2010. Revisions of policy as noted in this bulletin are effective on projects with lettings beginning with October 2010. Implementation of this policy is optional for all projects with let dates prior to January 1, 2010.

For projects with letting dates prior to September 30, 2010:

1. 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.
2. Incorporate into the project Specifications the appropriate Special Provision 455 from the January 2010 Workbook for 100% EDC testing depending on whether test piles are or are not required to determine final pile lengths.
3. Review the plans to assure there are not any conflicts between plan notes and the specification.

For projects with letting dates between October 1, 2010 and June 30, 2011:

1. Delete **January 2010 Structures Design Guidelines**, Section 3.5.6, Table 3.5.6-1 and insert the following:

Table 3.5.6-1 Resistance Factors for Piles (all structures)				
Pile Type	Loading	Design Method	Construction QC Method	Resistance Factor, Φ
Driven Piles with 100% Dynamic Testing	Compression	Davisson Capacity	EDC or PDA & CAPWAP	0.75
			EDC or PDA & CAPWAP, and Static Load Testing	0.85
			EDC or PDA & CAPWAP, and Statnamic Load Testing	0.80
	Uplift	Skin Friction	EDC or PDA & CAPWAP	0.60
EDC or PDA & CAPWAP, and Static Uplift Testing			0.65	
Driven Piles with $\geq 10\%$ Dynamic	Compression	Davisson Capacity	PDA & CAPWAP analysis of Test Piles	0.65
			PDA & CAPWAP analysis of Test Piles and Static Load Testing	0.75

Testing			PDA & CAPWAP analysis of Test Piles and Statnamic Load Testing	0.70
	Uplift	Skin Friction	PDA and CAPWAP analysis of Test Piles	0.55
PDA & CAPWAP analysis of Test Piles and Static Load Testing			0.60	
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.				

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 test pile. EDCs will not normally be required in production piles.
3. 100% dynamic testing will only be performed on projects where subsoil conditions meet certain criteria and are approved by the State Geotechnical Engineer. For these special projects where the use of EDC in production piles is justified, the Embedded Data Collector (EDC) quantity will be one per square prestressed concrete pile.
4. Incorporate into the project Specifications the Special Provision 455 from the January 2011 Workbook for EDC in test piles only. For special projects where the use of EDC in production piles is approved, incorporate into the project Specifications the Special Provision 455 from the January 2011 Workbook for EDC in all piles.
5. Review the plans to assure there are not any conflicts between plan notes and the specifications.

For projects with letting dates after July 1, 2011:

New directions will be distributed at a later date (approximately Fall 2010) for projects beginning with July 2011 lettings. It is the intent to bid projects with generic pay items for Dynamic Load Tests without specifying the use of PDA or EDC.

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.**

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