Florida Department of Transportation

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SECRETARY

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MATERIALS BULLETIN NO. MB-21-09
DCE MEMORANDUM NO. 21-12
(FHWA Approved: 12/08/2021)

TO: **DISTRICT MATERIALS AND RESEARCH ENGINEERS**
DISTRICT CONSTRUCTION ENGINEERS

FROM: Timothy Ruelke P.E., Director, Office of Materials
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Dan L. Hurtado P.E., Director, Office of Construction
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COPIES: Will Watts, Scott Arnold, Ananth Prasad, Mark Clasgens (FHWA), Jose Armenteros

SUBJECT: **USE OF REDUCED SLAG STRUCTURAL CONCRETE MIXES FOR PRESTRESSED PRODUCTS.**

Fly ash is a key component in the durability of FDOT structural concrete, especially the products used in extremely aggressive environments on our projects. The availability of fly ash is currently being impacted by multiple factors that are disrupting the global supply chain. The Department is presently unable to forecast the future direction of these factors or when the situation will return to normal. Based on these impacts, the Department will continue to optimize its specifications to facilitate alternative approaches to the production of durable concrete.

For all contracts, the Prestressed Concrete Producers can develop new concrete mix designs with less than 50% slag cement replacement that comply with the attached Developmental Specification Section 346 (***Dev346RS***).

This memorandum serves as a blanket approval to process a $0.00 contract change to incorporate the above referenced revisions and should be attached to the Work Order or Supplemental Agreement.

Should you have any questions please contact Jose Armenteros, State Materials Office at 352-955-6666, or Patrick Carlton, State Materials Office at 352-955-6676.

TR/ja

STRUCTURAL PORTLAND CEMENT CONCRETE
(REV 12-02-21)

TABLE 346-2, SUB ARTICLE 346-2.3 is expanded by the following:

Table 346-2
Cementitious Materials Concrete Mix Proportions (%)
(Environmental classification is extremely aggressive, unless otherwise noted)

Application	Portland Cement	Fly Ash Type F	Slag	Highly Reactive Pozzolans (4)		
				Silica Fume	Metakaolin	Ultra-Fine Fly Ash
General Use	70-82	18-30				
	66-78	15-25		7-9		
	66-78	15-25			8-12	
	66-78	15-25				8-12
	30-40	10-20	50-60			
	30-50		50-70			
	36-43		50-55	7-9		
	33-42		50-55		8-12	
	33-42		50-55			8-12
Precast / Prestressed	70-85 (1)	15-30 (1)				
	70-82	18-30				
	66-78	15-25		7-9		
	66-78	15-25			8-12	
	66-78	15-25				8-12
	30-40	10-20	50-60			
	30-50		50-70			
	39-70		30-49 (5)	0-9 (6)	0-12 (6)	0-12 (6)
	36-43		50-55	7-9		
	33-42		50-55		8-12	
	33-42		50-55			8-12
Drilled Shaft	63-67	33-37				
	38-42		58-62			
	30-40	10-20	50-60			
Mass Concrete	50-82 (2)	18-50 (2)				
	50-65 (3)	35-50 (3)				
	66-78	15-25		7-9		
	66-78	15-25			8-12	
	66-78	15-25				8-12
	30-40	10-20	50-60			
	30-50		50-70			
	36-43		50-55	7-9		
	33-42		50-55		8-12	
	33-42		50-55			8-12

Notes:
(1) Slightly Aggressive and Moderately Aggressive environments.
(2) For Concrete with Core Temperature T≤165°F.
(3) For Concrete with Core Temperature T≥165°F.
(4) Highly reactive pozzolans may be used below the specified ranges to enhance strength and workability.
(5) Slightly Aggressive and Moderately Aggressive environments only.
(6) Highly reactive pozzolans may be used to enhance early compressive strength and workability.

SUB ARTICLE 346-3.3 is expanded by the following:

346-3.3 Master Proportion Table: Proportion the materials used to produce the various classes of concrete in accordance with Table 346-3.

The calculation of the water to cementitious materials ratio (w/cm) is based on the total cementitious materials including portland cement and any supplementary cementitious materials used in the mix.

Table 346-3
Master Proportion Table

Class of Concrete	28-day Specified Minimum Compressive Strength (f'c) (psi)	Maximum Water to Cementitious Materials Ratio (pounds per pounds)	Target Slump Value (inches)
I (1)	3,000	0.53	3 (2)
I (Pavement)	3,000	0.50	1.5 or 3 (3)
II (1)	3,400	0.53	3 (2)
II (Bridge Deck)	4,500	0.44	3 (2)
III (4)	5,000	0.44	3 (2)
III (Seal)	3,000	0.53	8
IV	5,500	0.41(4)	3 (2)
IV (Drilled Shaft)	4,000	0.41	8.5
V (Special) (5, 6)	6,000	0.37(4)	3 (2)
V (5, 6)	6,500	0.37(4)	3 (2
VI (5, 6)	8,500	0.37(4)	3 (2)
VII (5, 6)	10,000	0.37(4)	3 (2)

Notes:
(1) For precast three-sided culverts, box culverts, endwalls, inlets, manholes and junction boxes, the target slump value and air content will not apply. The maximum allowable slump is 6 inches, except as noted in (2). The Contractor is permitted to use concrete meeting the requirements of ASTM C478 (4,000 psi) in lieu of the specified Class I or Class II concrete for precast endwalls, inlets, manholes and junction boxes.
(2) Increased slump and slip form concrete as defined in 346-3.1.
(3) Meet the requirements of Section 350.
(4) When silica fume or metakaolin is required, the maximum water to cementitious material ratio will be 0.35. When ultrafine fly ash is used, the maximum water to cementitious material ratio will be 0.30.
(5) The prestressed concrete products manufactured with reduced slag cement mixes must be labeled with "RS" next to the Plant QC stamp.
(6) For Mix Design Approval, cast 4 or 5 sets of three 4 x 8-inch concrete test cylinders (depending on criteria below) during the laboratory trial batches or field demonstration batches for surface resistivity (AASHTO T 358) and compressive strength (ASTM C39). Test the sets as follows:

a) One set for compressive strength at 1 day (set 1).
b) One set for compressive strength at 3 days (set 2).
c) One set for compressive strength at 7 days (set 3).
d) One set for surface resistivity at 28 days (set 4). After testing surface resistivity at 28 days, the same set may be used for compressive strength at 28 days.
f) One set for surface resistivity at 28 days when the compressive strength testing lab outsources surface resistivity which must be sent at least 7 days in advance to the selected testing laboratory (set 5).