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MEMORANDUM

TO: District Structures Design Engineers
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SUBJECT: Temporary Design Bulletin C02-11
Strategy 1 – Enhanced Post-Tensioning Systems
(Reference: New Direction for Florida Post-Tensioned Bridges – Corven Engineering, Inc)
Effective 8/1/02

To emphasize the importance of the Department's new directions for post-tensioned structures which increase the durability and level of performance of these structures, the Department of Transportation is issuing Temporary Design Bulletins C02-11 thru 15 : Enhance PT Systems, Fully Grouted Tendons, Multi-Layered Anchor Protection, Watertight Bridges, and Multiple Tendon Paths. These requirements have been generally incorporated into the August 2002 Structures Design Guidelines (SDG), specifications and new standards. The document containing each these requirements is listed in brackets after each requirement.

The first strategy, Enhanced Post-Tensioning Systems, includes inspectable anchorages, a three level protection system for tendons, minimum thickness of concrete elements, and requirements for longitudinal duct spacing. This policy is being implemented to minimize the possibility of water re-charge in grouted tendons. Currently, post-tensioning systems shall be pre-approved and pressure tested. In the future, post-tensioning systems will be placed on the Department's Qualified Products List. Post-tensioning systems not pre-approved or on the QPL will not be allowed. New policies to enhance post-tensioning systems include the following:

1. Contract Plans and Details shall be consistent with new FDOT Standards and Specifications. [SDG 1.6]
2. Enhanced post-tensioning systems require grout inlets/outlets suitable for inspection from either the top or front of the anchorage. The geometry of the grout outlets must facilitate straight-line drilling for inspection directly behind the anchor plate. [standards and Section B460]

3. Enhanced post-tensioning systems require three levels of protection for tendons and are stated below:

   A. Within the segment or concrete element [SDG 2.9.1]
      1. Internal Tendons
         1) Concrete cover
         2) Plastic duct
         3) Complete filling of annular space between duct and strands with approved grout
      2. External Tendons
         1) The box structure itself
         2) Plastic duct
         3) Complete filling with approved grout

   B. At the Segment or Construction Joint [SDG 2.9.1]
      1. Internal and External Tendons
         1) The epoxy seal for pre-cast construction and wet cast joints for cast-in-place construction
         2) Effective continuity of the plastic duct (couplers)
         3) Complete filling of annular space between duct and strands with an approved grout

   C. Spliced Concrete Girders [To be clarified in SDG]
         1) Concrete cover
         2) metal duct and couplers
         3) Complete filling of annular space between duct and strands with an approved grout

4. Internal post-tensioning ducts are required to be positively sealed with duct couplers at all segment joints to eliminate the possibility of contamination. Therefore, internal tendons shall be designed and detailed to be perpendicular to all segment joints and all closure pours shall be a minimum of 18". [SDG 7.11.1]

5. Post-tensioning systems, embedded items, etc. shall accommodate competitive systems using standard anchorage sizes of 4X0.6"f , 7X0.6"f , 12 X0.6"f , 19 X0.6"f and 27 X0.6"f . [SDG 7.10.10]

6. The design and detailing of post-tensioning tendons shall be based on a 0.6"f strand size. [SDG 7.10.10]

7. Detail tendons, internal and external, to be placed in steel pipes when the radius is less than shown in the table below. Detail all deviation saddles to contain steel pipe regardless of the tendon radius. [SDG 7.11.1, Table 7.3]

Tendon Size	Minimum Radius (ft)
19x0.5"f , 12x0.6" f	8'
27x0.5"f , 19x0.6" f	10'
55x0.5"f , 37x0.6"f	13'

8. All anchorages for post-tensioning systems shall have permanent grout caps made from fiber reinforced plastic and sealed with neoprene "O" Rings. [Section B460]

9. All fully assembled tendons including ducts, grout caps, inlets, and outlets shall be pressure tested in the field. [Section B460]

10. The minimum dimensions for sections containing post-tensioning tendons shall be as follows: [SDG 7.11.2, Table 7.5]

Post Tensioned Bridge Element	**Minimum Thickness**
Webs - I-Girder Bridges	8", or outer duct diameter plus 5" whichever is greater.
Regions of slabs without longitudinal internal tendons	8", or as required to accommodate grinding, concrete covers, transverse and longitudinal P.T. ducts and top and bottom mild reinforcing mats, with allowance for construction tolerances whichever is greater.
Regions of slabs containing longitudinal internal tendons	9", or as required to accommodate grinding, concrete covers, transverse and longitudinal P.T. ducts and top and bottom mild reinforcing mats, with allowance for construction tolerances whichever is greater.
Clear Distance Between Circular Voids – C.I.P. Voided Slab Bridges	Outer duct diameter plus 5", or outer duct diameter plus vertical reinforcing plus concrete cover whichever is greater.

Segment Pier Diaphragms containing external post-tensioning	*6'-0"
Webs of C.I.P. boxes with internal tendons	For single column of ducts -12", or 3 times outer duct diameter whichever is greater. **For two or more ducts set side by side – Web thickness shall be sufficient to accommodate concrete covers, longitudinal P.T. ducts, 3" minimum spacing between ducts, vertical reinforcing, with allowance for construction tolerances.

* - Pier segment halves with C.I.P. closure joint is acceptable.
** - The 3" measurement shall be measured in a horizontal plane.

11. The minimum wall thickness for segmental piers shall be 12". [SDG 5.4]

12. The minimum center to center spacing of ducts shall be as follows: [SDG 7.11.1, Table 7.2]

Post Tensioned Bridge Type	***Minimum Center To Center Longitudinal Duct Spacing**
Precast Segmental Balanced Cantilever Cast-In-Place Balanced Cantilever	8", 2 times outer duct diameter, or outer duct diameter plus 4 ½" whichever is greater.
Spliced I-Girder Bridges	4", outer duct diameter plus 1.5 times maximum aggregate size, or outer duct diameter plus 2" whichever is greater.
C.I.P. Voided Slab Bridges C.I.P. Multi-Cell Bridges	When all ducts are in a vertical plane - 4", outer duct diameter plus 1.5 times maximum aggregate size, or outer duct diameter plus 2" whichever is greater. **For two or more ducts set side by side - outer duct diameter plus 3 ".

* - Bundled tendons shall not be allowed.
** - The 3" measurement shall be measured in a horizontal plane.

13. Because of durability issues (long term performance, duct wear, etc..), Diablos are no longer allowed in post-tensioned structures. [SDG 7.11.1]

WNN/ph