

September 29, 2000

MEMORANDUM:

TO: District Structures Design Engineers
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Area Structures Engineers
(Robert Robertson, Tom Andres, Don Keenan)

FROM: William N. Nickas, P.E., State Structures Design Engineer

COPIES: Secretary Tom Barry; Ass't Secretaries Ken Morefield, David Twiddy, Huey Hawkins,
Edward Prescott, Rick Chesser, Mike Snyder, Jose Abreu, Ken Hartmann, Jim Ely;
Freddie Simmons; William Domico, Bob Nichols, Jack Evans, Charles Boyd, Jeff
Pouliotte, Andre Pavlov, FHWA, Dick Kane

SUBJECT: Temporary Design Bulletin C00-5
Effective October 2000

Due to the failure of some grouted post-tensioning tendons, discovered in recent months, it will be necessary to modify current practices immediately. The corrosion of tendons has been attributed to two factors.

First Factor – Bleed Water

To address this concern all grouts used in tendons shall be a preapproved – bagged – low chloride, low bleed material. As this bleed water phenomenon is directly related to tendon length and tendon geometry, effective immediately; all cable grouts shall conform to the new draft Grout Material Spec. 938.

Grouting plans must be closely reviewed for low point up grouting with adequate access and venting locations provided.

Large pockets of bleed water and/or voids have been found in trumpet areas of tendons. It has been observed that steeper and longer tendons have gathered the most water. Bleed water lenses have been found in Florida bridges along draped tendons in both internal bonded and external tendons. These potential defects have been well documented in Dr. Andrea Schokker's Report from the University of Texas. These bleed water pockets may create two problems, the initiation of corrosion and formation of a void in the duct.

If the void is recharged with water from an outside source then the corrosion will continue.

Second Factor – Chloride Intrusion Through Cracks

In order to achieve 75+ years of service life for bridges, the Florida DOT has enhanced concrete quality

by changing admixtures, clearances and curing practices. Our Agency and many others have a large investment in research and performance enhancement techniques. The corrosion research industry has demonstrated time and time again that chlorides will penetrate cracked concrete twice as fast as uncracked concrete.

It has also been observed that corrosion cell growth in a bundle set of strands is faster than in a single embedded strand (like pretensioned/concrete components) or grade 60 reinforced steel.

Therefore, Florida DOT will require the following for it's substructures:

Structures Over Water – All vertical post-tensioning must be 12' above MHW water elevation.

Structures Over Land – All vertical post-tensioning must be 5' above land. (Fill or Natural Ground).

A further intent of this restriction is to preclude the use of post-tensioning from the submerged substructure (fresh or salt) to an air dry condition within the substructure component. This applies to both CIP and/or precast substructures.

To further clarify this restriction, we offer the following three clarifications:

1. Precast pier segments traditionally have horizontal joints every 7' to 10' feet and at least 4 tendons vertically. Even with the highest attention to field inspection we find that many joints are not water tight. Water and chloride intrusion has been documented in superstructure and substructure post-tensioned tendons in Florida. The interstice area within the 7 wire strand and the space between strands offers too much opportunity for water and oxygen intrusion. Tendon geometry and duct placement (wobble) are factors that contribute to how much grout surround the tendon bundle. During the forensic examinations of the corroded tendons it was observed that duct material must offer the primary protection for the strand material.
2. Precast pier sections with spliced sleeve connections will continue to be allowed. No problems have been reported with this type of rebar connections.
3. The Plant produced post-tensioned or pretensioned cylinder piles, horizontally assembled, stressed and grouted will be allowed due to the small tendon and duct size. The redundancy within the component due to the number of ducts with a maximum of 3 strands per duct has proved effective. This open type pile requires details to include a backup reinforced plug system to be installed inside the pile to develop a redundant load path.

If you are in doubt about a post-tensioning application, please contact the appropriate Area Structures Engineer in our Central Office.

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