



Florida Department of Transportation

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February 3, 2004

MEMORANDUM

TO: District Structures Design Engineers:
(Gerard Moliere, Rod Nelson, Keith Shores, John Danielsen,
Neil Kenis, Kim Saing, Jose Rodriguez, and Agnes Spielmann)

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

COPIES: Assistant Secretary, Ken Morefield,
State Highway Engineer, Freddie Simmons,
Director Office of Design, Bob Greer,
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SUBJECT: **Temporary Design Bulletin C04-01**
FDOT Structures Design Guidelines (LRFD) Topic 625-020-154-b
Section 4.3.1.C Prestressed Beams – Concrete Release Strength
Section 4.3.1.E Prestressed Beams – Maximum Bonded Prestress Force

REQUIREMENTS:

Add the following sentence to Section 4.3.1.C of the Structures Design Guidelines:

“The maximum compressive concrete strength at release must not be greater than 6000 psi for the design of prestressed beams.”

Add the following sub-section “E” to Section 4.3.1 of the Structures Design Guidelines:

The maximum prestressing force from fully bonded strands at the ends of prestressed beams must be limited to the values shown on the Standard Drawings. No losses shall be applied to the calculated prestressing force. The minimum length of debonding from the ends of the beams is half the depth of the beam. The reinforcing in the ends of the beams shown in the Standard Drawings must not be modified without the approval of the State Structures Design Engineer.

For the current Standard Drawings with the following “Issue Dates”, the maximum prestressing force from fully bonded strands at the ends of the beams must be limited to the values in the following table:

<u>Beam Type</u>	<u>Standard Drawing (Issue Date)</u>	<u>Max. Bonded Prestress Force</u>
AASHTO Type II	Index No. 120 (2-14-01)	650 kips
AASHTO Type III	Index No. 130 (2-14-01)	995 kips
AASHTO Type IV	Index No. 140 (2-14-01)	1270 kips
AASHTO Type V	Index No. 150 (7-31-03)	1635 kips
AASHTO Type VI	Index No. 160 (7-31-03)	1800 kips
Florida Bulb-T 72	Index No. 172 (7-31-03)	1300 kips
Florida Bulb-T 78	Index No. 178 (6-30-00)	1430 kips
Florida U 48	Index No. 248 (2-14-01)	2790 kips
Florida U 54	Index No. 254 (2-14-01)	2790 kips
Florida U 63	Index No. 263 (2-14-01)	3070 kips
Florida U 72	Index No. 272 (2-14-01)	3070 kips
Inverted-T	Index No. 320 (10-01-01)	310 kips

COMMENTARY:

Cracking in the ends of AASHTO and Florida Bulb-Tee beams has been observed with vertical bursting reinforcing designed to 20 ksi stress, based on 4% of the bonded prestressing force and distributed over a distance of $h/5$, in accordance with the **LRFD** (2001) Section 5.10.10.1. To minimize these cracks and accommodate the longer distribution length ($h/4$) adopted by **LRFD** in 2002, the maximum prestressing force in the ends of these beams has been limited.

Additionally the maximum design concrete strength at release has been limited to 6000 psi to control the amount of prestress in the ends of these beams. The maximum prestressing force is based on 13 ksi bursting steel stress for AASHTO and Florida Bulb-Tee beams. This is approximately equivalent to a 20% decrease in allowable stress from the **LRFD** (2001) requirements. Florida-U beams and Inverted-T beams have not shown similar problems, so the maximum prestress force is based on 18 ksi and 20 ksi bursting steel stress respectively, which provides equivalent resistance to the previous **LRFD** (2001) requirements.

BACKGROUND:

The use of higher strength concrete, higher release strengths and 0.6" diameter strands in recent years, to accommodate longer spans and wider beam spacings, has resulted in much higher bursting forces in the ends of prestressed beams. This has aggravated the minor cracking traditionally observed in the ends of these beams. Additional reinforcing was added to the ends of the prestressed beams in the June 30, 2000 release of the Standard Drawings to satisfy the Bursting Resistance requirements in **LRFD** and utilize the full strand pattern available in most of these beams. Undesirable cracking in the ends of AASHTO and Florida Bulb-Tee beams has been reported for beam designs near the upper limits of the **LRFD** (2001) Bursting Resistance requirements. Additionally the 2002 Interim Revision to LRFD Section 5.10.10.1, which increased the bursting distribution length from $h/5$ to $h/4$, has effectively increased the allowable bursting forces by approximately 25%, necessitating reduction in the allowable bursting stress or

a limit on the maximum prestressing force in the ends of prestressed beams in Florida to control cracking.

FOLLOW-UP:

The standard reinforcing patterns in the February 2004 Structures Standard Drawings, Index Series 100, 200 & 300 will be modified to accommodate most beam designs when up to a maximum of 25% of the strands are debonded at the ends of the beams.

FDOT recognizes that for some beams the full strand pattern will not be completely utilized with the current limits on the prestressing force from fully bonded strands, however due to constructability considerations and to meet commitments to the Prestressed Concrete Industry in Florida, the reinforcing in the ends of prestressed beams should not be changed.

IMPLEMENTATION:

Effective immediately all projects under design using AASHTO Type II , III, IV, V & VI beams and Florida Bulb-Tees should comply with these new requirements for both LFD and LRFD designs. Florida-U Beams and Inverted-T Beams will not require any design changes if designed in accordance with Section 5.10.10.1 of the AASHTO LRFD Bridge Design Specifications prior to the 2002 Interim Revision.

All projects let after June 2004 shall use the revised February 2004 Standard Drawings. These Standard Drawings will have minor changes to the reinforcing in the ends of the AASHTO & Florida Bulb-Tee beams and list the Maximum Bonded Prestressing Force on the "Typical Beam Details and Notes" Index Nos. 110, 210 & 310. The shear stirrups in AASHTO Type V & VI and Florida Bulb-Tee beams will also be changed from #4 Bars 4K, to #5 Bars 5K.

For projects let in or before April 2004, any changes to the plans to meet these new requirements need only be made at the discretion of the District Structures Design Engineer after notification by the Project Manager, taking into consideration the amount of overstress at the ends of the beams and any adverse impact to the production schedule.

No changes to the Specification Package or Quantities will be required as a result of these changes.

WNN/sjn