

Session 17

Jeff Pouliotte

FL. Dept. of Transportation

Beam Stability during Erection, Bolting Criteria for Specs 649 & 700, Concrete Crack Repair & Spec 400

Topic Description

Prestressed Beam Stability during Erection, Bolting Criteria Change for Specifications 649 and 700, and Concrete Crack Repair Change for Specification 400

Speaker Biography

Title: State Construction Structures Engineer

Experience:

29 years, worked for FDOT since December 1994

Professional Engineer since 1982

Education:

BS – Civil Engineering, University of Maine

MS - Civil Engineering, Florida State University

Certified Public Manager, Florida State University

Experience: Construction Troubleshooter, Specifications and Manual Writer, Bridge and Subway Designer, Bridge Field Construction Inspection Experience, Bridge Maintenance Inspection Experience, Bridge Plans Reviewer, Site Designer, Design Project Manager and Project Engineer, Administrator

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PRESTRESSED BEAM STABILITY DURING ERECTION

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Girder Stability during Erection

- ◆ **Lateral Loads on Straight Girders during Erection:**
 - Wind Loads
 - Lateral Torsional Buckling
 - Seismic Loads (N/A in Florida)
- ◆ **Once the Deck Slab is Cast and Cured on a Straight Girder:**
 - Wind Loads (Can be transferred thru Deck to End Diaphragms)
 - Lateral Torsional Buckling (N/A)

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Girder Stability during Erection

◆ **Steel Girders:**

- Permanent Bracing between I-Girders
- Permanent Internal Box Girder Bracing
- Temporary Bracing between Box Girders (Straight Girders)
- Permanent Bracing between Box Girders (Curved Girders)
- End Diaphragms

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Girder Stability during Erection

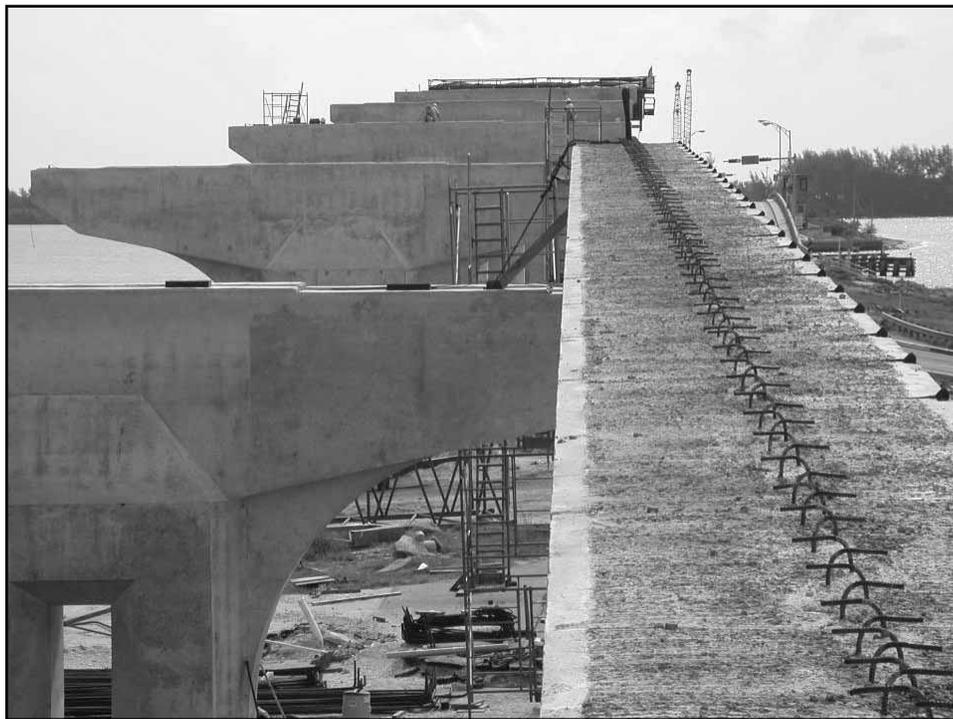
◆ **Prestressed Concrete Girders:**

- End Diaphragms
- Intermediate Diaphragms (occasionally)
- Temporary Bracing between Girders (Sole Responsibility of the Contractor)

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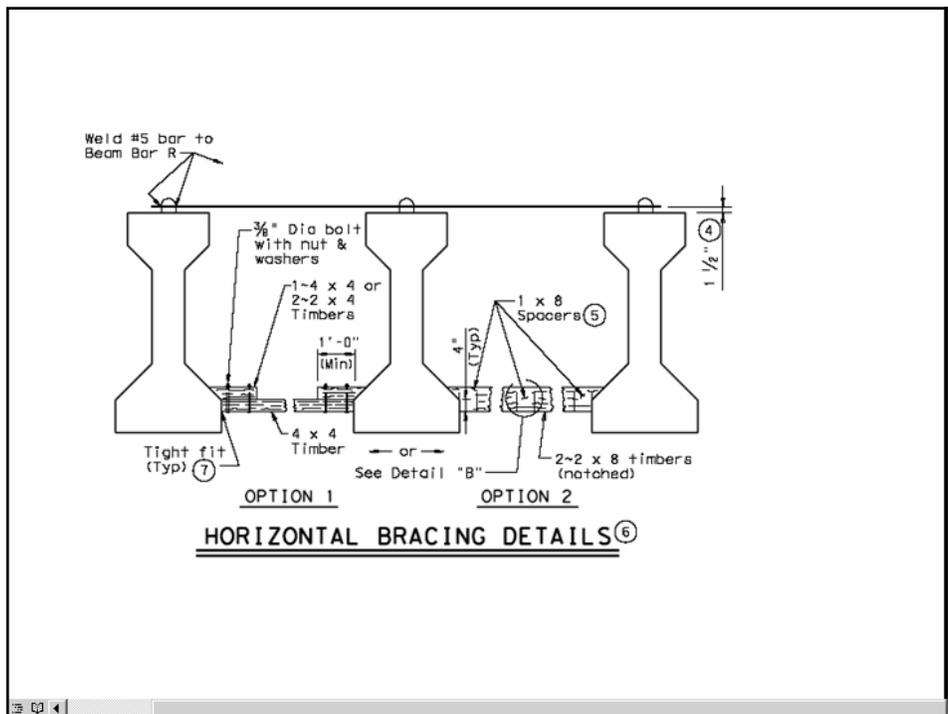
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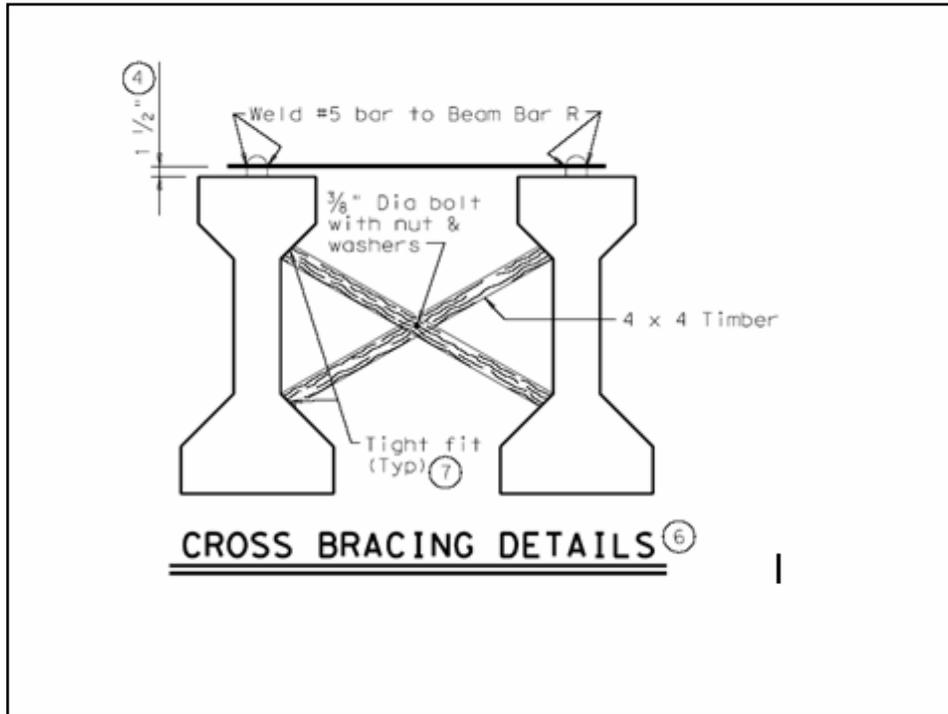
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Girder Stability during Erection

- ◆ **FDOT Primary Concerns:**
 - Public Safety over Travel Lanes
 - Public Safety over Navigational Channels
- ◆ **Contractor Responsibilities/Concerns:**
 - Public Safety
 - Worker Safety

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Girder Stability during Erection

- ◆ **FDOT Recommendations for Prestressed Beam Stability during Erection:**
 - Girder Stability is a Concern, particularly for:
 - ◆ Spans over Traffic Lanes
 - ◆ Spans over Navigational Channels
 - ◆ Long Span Girders
 - ◆ Girders with sharp skews

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Girder Stability during Erection

◆ FDOT Recommendations for Prestressed Beam Stability during Erection, continued...

- Recommended Design References:
 - ◆ AASHTO, Guide Design Specifications for Bridge Temporary Works, 1995
 - ◆ AASHTO, Construction Handbook for Bridge Temporary Works, 1995

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FDOT Construction Specification Change

Change in Bolting Criteria
for
Specification Section 649 for Steel Strain Poles,
Mast Arm and Monotube Assemblies
and
Section 700 for Highway Signing

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Bolting Criteria Change Section 649 & 700

- ◆ Presentation divided into two parts
 - Justification for Specification Change
 - Solution/Specification Changes

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Justification for Specification Change

- ◆ Bolting for Structures governed by Section 649:
 - FDOT Design Standards indicate the use of ASTM A 325 Bolts, for Structures governed by this Section
 - Article 649-5 has an abbreviated turn-of nut bolting tightening procedure for bolts, which is less comprehensive than Section 460
 - Article 649-5 states that bolts can be tightened using galvanized Direct Tension Indicators (DTI), installed according to the Manufacture's recommendations (this is in direct conflict with new Section 460)

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Justification for Specification Change

- ◆ **Bolting for Structures governed by Section 649, continued...**
 - Article 649-5 has no criteria for bolt lubrication
 - Article 649-5 requires anchor bolts to be tightened to a snug tight condition, but has no instructions for how to achieve a snug tight condition

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Justification for Specification Change

- ◆ **Bolting for Structures governed by Section 700:**
 - FDOT Design Standards use of ASTM A 307 Bolts, for Structures governed by this Section
 - Section 700 has no bolt tightening or bolt lubrication criteria for ASTM A 307 Bolts
 - FDOT Design Standards indicate that ASTM A 325 Bolts may be used in lieu of ASTM A 307 Bolts
 - CEI's are insisting that the substitute ASTM A 325 Bolts be tightened to achieve a slip critical connection
 - Section 700 has no anchor bolt tightening criteria

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Solution

◆ **Change Article 649-5, as follows:**

- Delete all bolt tightening specification language and Tables, reference new Section 460 for the turn-of-nut and DTI tightening methods for ASTM A 325 Bolts, and add bolt lubrication criteria
- Develop Bolt Tightening Criteria for Anchor Bolts, which consists of:
 - ◆ Initially Tighten Bolts to achieve Mating
 - ◆ Final Tighten Bolts measuring Rotation in accordance with a Table

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Solution

(Anchor Bolt Tightening Criteria)

Table A	
Anchor Rod Diameter (in.)	Nut Rotation from snug Tight Condition
$\leq 1 \frac{1}{2}$	1/3 turn
$> 1 \frac{1}{2}$	1/6 turn

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Solution

◆ **Section 700: Add Sub-article 700-2.4.3, as follows:**

- For Alternate Splice Connections, reference new Section 460 for the turn-of-nut and DTI tightening methods for ASTM A 325 Bolts
- Add Bolt Tightening Criteria for ASTM A 307 Bolts, which consists of:
 - ◆ Initially Tighten Bolts to achieve Mating
 - ◆ Final Tighten Bolts measuring Torque, in accordance with a Table
- Add bolt lubrication criteria
- Ref. Article 649-5 for Anchor Bolt Tightening Criteria

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Solution

(ASTM A 307 Bolt Tightening Criteria)

Table A

Bolt Diameter (in.)	Minimum Torque (ft.-lbs.)
3/8	15
1/2	37
5/8	74
3/4	120
7/8	190
1	275
1 1/8	375
1 1/4	525

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In Closing

- ◆ DCE Memorandum No. 06-06 was issued on 4/10/06 to implement these proposed changes to Sections 649 and 700 on all Active Projects
 - Zero Cost Specification Change
- ◆ Proposed Specification Changes for Sections 649 & 700 have completed Industry Review, and are currently out for FHWA Review
 - Anticipated Implementation Date: January 2007 Lettings
- ◆ Acknowledgements

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FDOT Construction Specification Change

Proposed Changes
to
Specification Article 400-21
Disposition of Cracks in Cast-in-Place Concrete

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Proposed Changes to Article 400-21

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 - Justification for Specification Change
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Justification for Specification Change

- ◆ **Contractor, CEI and District Personnel confusion on how to Inspect/Identify, Evaluate, Monitor and Determine if Cracks are Structural**
- ◆ **Contractor, CEI and District Personnel confusion on who makes Decisions**
- ◆ **Contractor, CEI and District Personnel confusion on whether to Repair or Replace Concrete**
- ◆ **Contractor, CEI and District Personnel confusion on when to engage a Specialty Engineer**

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Solution

- ◆ **Change Article 400-21 to clarify how to Inspect/Identify, Evaluate, Monitor and Repair or Replace Cracked Concrete**
- ◆ **Change Article 400-21 to clarify the responsibilities of the Contractor and Engineer**
- ◆ **Replace Table 1 in Article 400-21 with two (2) Tables**
 - **Table 1: CIP Substructures & Superstructures other than Decks**
 - **Table 2: CIP Bridge Decks**

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Solution

- ◆ **Tables will Categorize Cracks by Environmental Classification, Crack Width, Height above Mean High Water, and Total Crack Area**
- ◆ **Total Crack Area will be the Percentage of the Total Cracked Concrete Surface Area =
(Avg. Crack Width x Crack Length / Surface Area)**
- ◆ **The Surface Area will be divided up according to Cracking Significance (Deck Spans will be divided up into deck areas with similar size and intensity of cracking)**

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Solution

- ◆ **The Table will have three (3) levels of action:**
 - **Standardized Repairs**
 - **Investigate to Determine Appropriate Repair or Rejection**
 - **Reject or Replace (Engineer will have the discretion to entertain Repair Options)**

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Solution

- ◆ **Types of Repairs permitted by Tables 1 and 2 (Standardized Repairs):**
 - **No Treatment**
 - **Penetrant Sealer**
 - **Methyl Methacrylate**
 - **Epoxy Injection**

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Solution

- ◆ **Proposed Specification Changes for Article 400-21 are currently out for Industry Review**
- ◆ **New CPAM Sub-articles:**
 - **10.3.5 Crack Inspection (under new CPAM Section 10.3 – Concrete Construction)**
 - **10.7.6.9 Crack and Joint Inspection for all PT Bridge Types, particularly Boxes (under CPAM Section 10.7 – Post-Tensioned Bridges)**

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Solution

- ◆ **New CPAM Flowcharts:**
 - **Attachment 10-3-5, CPAM Section 10.3, Crack Inspection and Repair**
 - **Attachment 10-7-12, CPAM Section 10.7, Crack Inspection and Repair**
- ◆ **Acknowledgements**

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**THAT'S
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