2011 ENGINEERING TECHNICIAN ACADEMY

CRITICAL BRIDGE CONSTRUCTION ISSUES

FLORIDA DEPARTMENT OF TRANSPORTATION
OFFICE OF CONSTRUCTION

CONTACT INFORMATION

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17 Street over ICWW, Ft. Lauderdale
First Time use of a Carina Bascule
Pier, Exceptional Aesthetics

PURPOSE OF SESSION

- Heighten awareness of widely misunderstood or overlooked specifications and other issues
- Review specifications that were implemented for the first time in recent years
- Introduce upcoming specification changes that will significantly impact Contractor and CEI efforts

Acosta Bridge over the Saint Johns River, Jacksonville
Main Span 630', Longest Concrete Beam Bridge in Florida
Cast-in-place Concrete Post-tensioned Segmental Box Girder

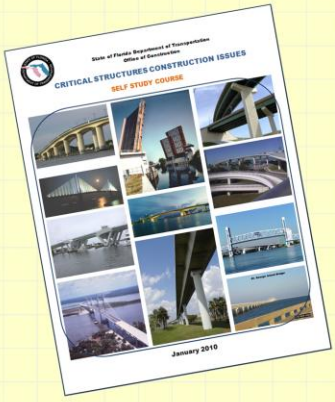
MAIN TOPICS FOR THIS SESSION

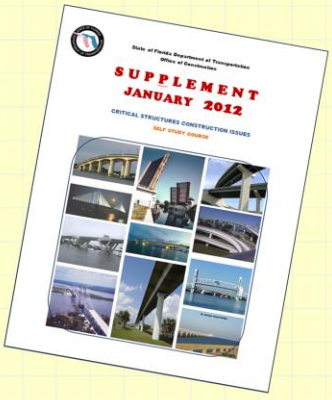
- Universal Concerns
- Footings
- Bearings
- Beams
- Decks
- Concrete Materials
- Miscellaneous Topics
- Qualifications, Experience, Training

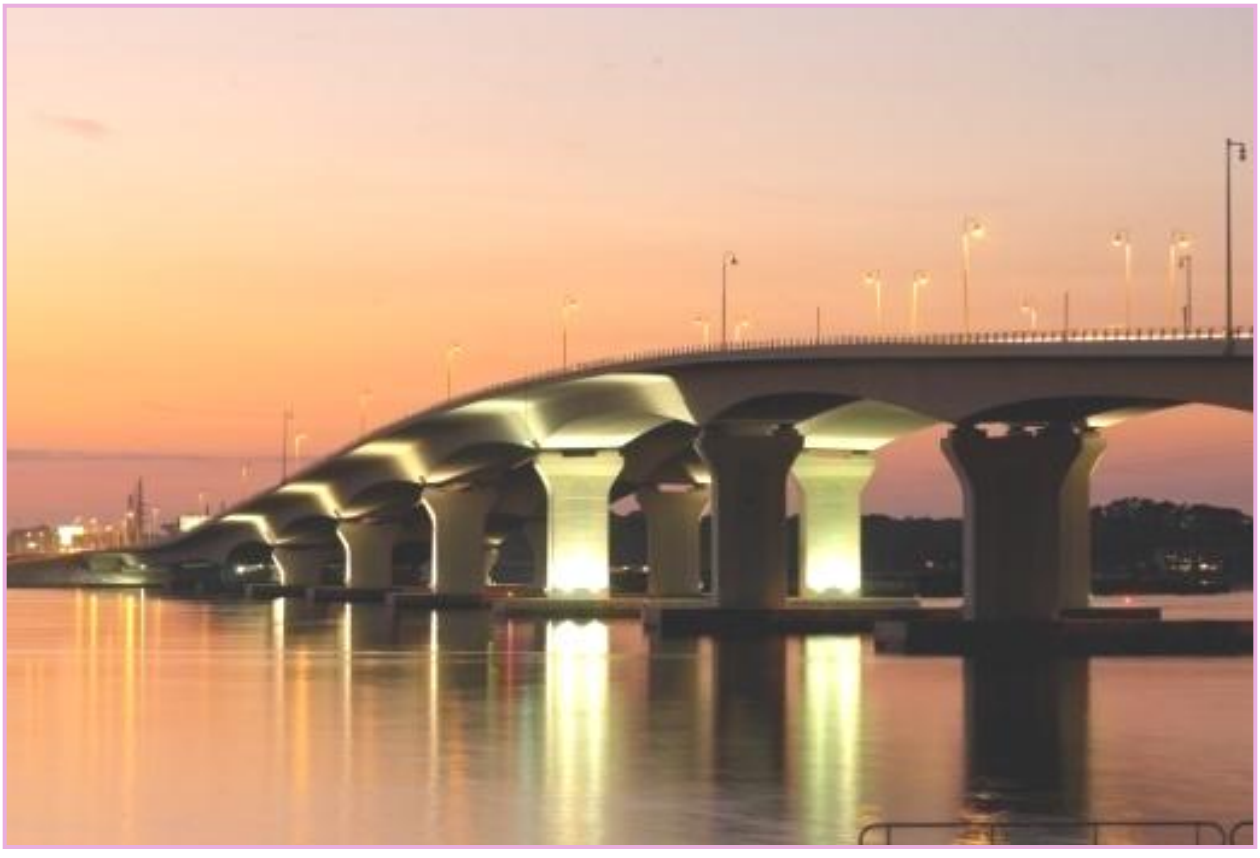
Main Street Bridge over the Saint Johns River, Jacksonville
Vertical Lift Movable, Span 365 ft., Longest in Florida

UNIVERSAL CONCERNS

- Critical Structures Construction Issues - Self Study Course
- **Supplement** - Critical Structures Construction Issues - Self Study Course







Hathaway Bridge , US 98 over St. Andrews Bay, Panama City
Precast Concrete Post-tensioned Segmental Box Girder
Largest Precast Beam Segment Ever Build in Florida
and longest precast span length at 330 feet

UNIVERSAL CONCERNS

- **Administrative Issues**
  - **Bridge Related Guidelists**
    - 8B - Concrete Materials
    - 9 - Structure Foundations
    - 10A - General Concrete
    - 10B - Bearings/Beams/Bolts
    - 10C - Bridge Decks
    - 10D - Post-Tensioning
    - 11 - MSE Walls
  - **Guidelist Website:**
    http://www.dot.state.fl.us/construction/CONSTADM/guidelist/guideindex.htm

Hal Adams – SR 51 over
Suwannee River, Main Span 450'

Hal Adams Bridge, SR 51 over the Suwannee River
Florida's only Suspension Bridge, Main Span 450'

UNIVERSAL CONCERNS

- **Administrative Issues**
  - **Bridge Related CPAM Sections**
    - 8.4 – Shop Drawings
    - 8.11* – Contractor Initiated Submittals
    - 10.1 – Pile Lengths
    - 10.2 – PS Concrete Components
    - 10.3 – Concrete Construction
    - 10.4* – Paint Removal
    - 10.5 – Drilled Shafts
    - 10.6* – Underwater Bridge Construction Inspection
    - 10.7 – Post-tensioned Bridges
    - 10.8 – Auger Cast Piles
    - 10.9 – Structural Steel Components
    - 10.10* – Bridge Construction Issues that Must Involve State Construction Office Staff
    - 10.11* – General Structures Construction Issues

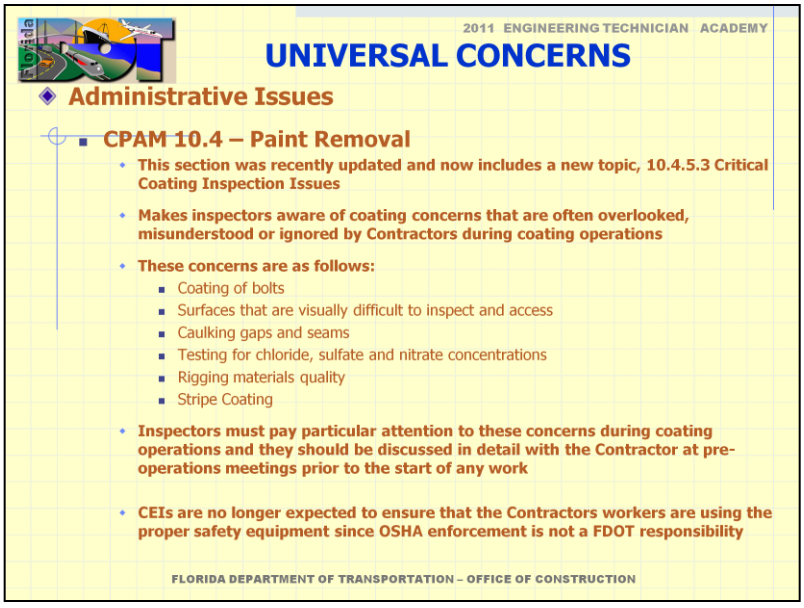
*New or Recently Revised Section

I-295 over the Saint Johns River at Dames Point, Jacksonville
Cable Stayed Bridge Longest Span in Florida at 1,300 ft.

UNIVERSAL CONCERNS

- **Administrative Issues**
  - **CPAM 8.11 – Contractor Initiated Submittals**
    - This section was introduced over two years ago but many CEIs are not implementing the required tracking log
    - The tracking log requires a minimum of 17 items to be tracked for each submittal
    - There are 3 submittal categories: Request for information (RFI), Request for Correction (RFC), and Request for Modification (RFM)
    - Each category must either be tracked with its own log or if there is one log for all 3, there must be an extra "Category Column"
    - Each category has its own processing procedure as covered in CPAM

Hart Bridge over the Saint Johns River, Jacksonville, Through Truss with Suspended Deck, Main Span Length 1,088 ft., 3rd Longest Span in Florida



HENRY H. BUCKMAN BRIDGE

RECORD HELD: Most Dual Bridge Lane Miles (24.8 miles)

LOCATION: I-295 over the Saint Johns River, South Jacksonville

UNIVERSAL CONCERNS

- **Administrative Issues**
  - **CPAM 10.6 – Underwater Bridge Construction Inspection**
    - Needs to be in Scope of Services for the CEI contract
    - Initial inspection is required for concrete voided piles and cylinder piles
    - For all other piles, the PA will make the decision about whether or not initial inspection is needed
    - The PA may call for an underwater inspection (progress inspection) at any time during the construction of the project if there is a question about the condition of an underwater component
    - Inspections must be performed by a qualified commercial diver or an FDOT Certified Bridge Maintenance Inspection Diver
    - Final underwater inspections are required on all projects and must be performed by a FDOT prequalified Engineering Consulting Firm in the Maintenance Inspection category or by FDOT District Structures Maintenance Inspectors

US 17 over the St. Mary's River, Nassau County
FDOT's only remaining Swing Span

CPAM 10.10.4 DEFINITIONS:

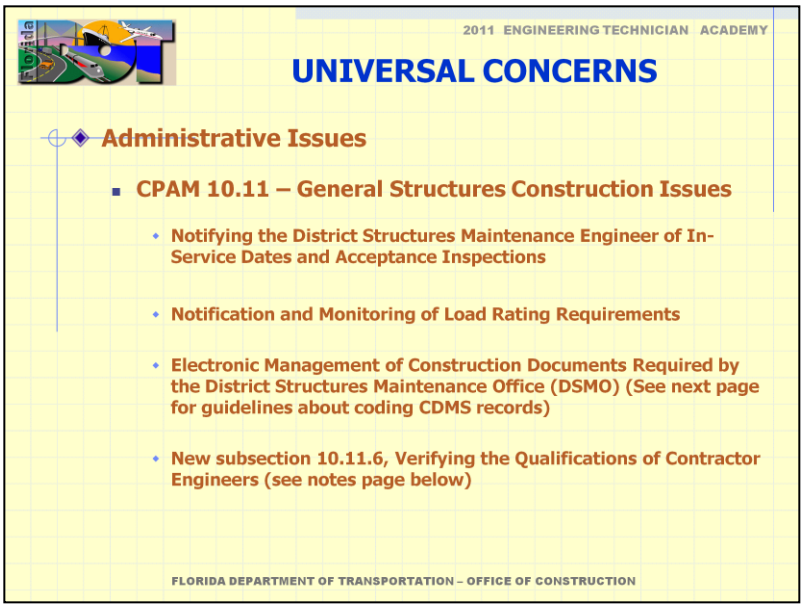
Complex Issues – Those complex bridge issues that fall into the following categories:

- Storage, handling, placement, stressing, grouting, inspection and repair of post-tensioned steel tendons or strands for superstructures and substructures
- Geometry control, casting, storage, handling, erection, joint sealing, inspection and

  repair of segments for concrete segmental bridges
- Storage, handling, installation, inspection, functional checkout and repair of movable bridge machinery components and electrical systems

Complex Superstructure Members – Those bridge superstructure members that fall into the following categories:

- Steel girders of the following type: boxes, curved plates and any span equal to or greater than 170 feet
- Concrete beams of the following type: cast-in-place box, precast or cast-in-place segmental box and continuous post-tensioned beams
- Special superstructures of the following type: trusses, cable stayed and movable (bascule,lift and swing)



10.11.6.1 Specialty Engineer Qualification Verification

The specification requires a specialty engineer to:

(1) Be a Professional Engineer registered in the State of Florida

(2) Have the education and experience necessary to perform the submitted design as required by the Florida Department of Business and Professional Regulation.

CEI staff shall verify for each specialty engineer, that their license is current and active and, if in the judgment of the Resident Engineer, Senior Project Engineer or Project Administrator, there is reason to question compliance with Requirement (2) above then supporting education and experience documents shall be requested of the Specialty Engineer for verification. Also, verify that the specialty engineer is performing only Work Type 3, 4 or 6 of Table 10.11.6.

10.11.6.2 Pre-qualified Specialty Engineer Qualification Verification

In addition to meeting the requirements of Section 10.11.6.1(1), a pre-qualified specialty engineer must be pre-qualified by the Department's State Structures Design Office (SSDO) in the structures design Type of Work (4.1 thru 4.4) for which the engineer is providing services. This process requires the applicant to submit experience and education documents to the SSDO that support their request for pre-qualification. Once an engineer is pre-qualified by the SSDO in the type of work categories for which they are approved, their name and type of work categories are added to a list entitled Pre-qualified Specialty Engineers that is posted on an Office of Construction webpage under the "Contractor Issues" topic. CEI staff shall verify for each pre-qualified specialty engineer that requirement (1) of Section 10.11.6.1 is satisfied and that their name is listed on the Office of Construction webpage. In addition, the CEI staff shall verify that the pre-qualified specialty engineer is only performing work in the type of work category for which that engineer is pre-qualified and performing only Work Type 3, 4, 5 or 6 of Table 10.11.6. For example, a pre-qualified specialty engineer may be qualified for major bridge (Type of Work 4.2) but is still not permitted to perform Work Type 1 or 2 of Table 10.11.6. A pre-qualified specialty engineer that is only qualified to perform Type of Work 4.1.1(Minor Bridge Design), may be approved to perform work on the substructure or foundation components of a bridge that requires qualification for Type of Work 4.2, 4.3 or 4.4 (Major Bridge Design). However, the State Construction Structures Engineer must approve such a request, which may include certain restrictions, prior to commencement of the engineer's work. The CEI staff shall coordinate the processing of all such requests with the State Construction Structures Engineer. If a pre-qualified specialty engineer performs Work Type #5, as shown in Table 10.11.6, that engineer's work must be checked by another pre-qualified specialty engineer. The CEI staff shall verify that the check was performed - written proof shall be retained on file - and that the qualifications of the engineer doing the checking are in compliance.

10.11.6.2 Contractor's Engineer of Record Qualification Verification

A Contractor's Engineer of Record must be employed by an engineering consulting firm that is pre-qualified to perform structures design by the Department in Type of Work categories: 4.1 thru 4.4. Pre-qualified engineering consulting firms are listed on the Department's Procurement Office website along with the Type of Work categories for which they are approved.
CEI staff shall verify that a Contractor's Engineer of Record is employed by an engineering consulting firm that is pre-qualified by the Department's Procurement Office and that they are performing only in the Type of Work categories for which they are approved.

The terms under this column must be used exactly as shown in the column cells and must be the very first characters in the field

CDMS DOCUMENT PROFILE FIELDS FOR CONSTRUCTION DOCUMENTS REQUIRED BY THE DSMO			
DSMO Document Category	**Construction Document Type**	**CDMS Group/ Type No.**	**Mandatory CDMS Document Subject/Description**
As-Built Load Rating Documents	Supporting Calculations, Input Files, Output Files, Load Rating Summary Sheets, EOR Letter stating As-Built Load Rating same as As-Bid Load Rating	15/141*	As-Built Load Rating
Foundation Documents	Pile Driving Records	15/139	Pile Installation
	Drilled Shaft Records		Drilled Shaft Installation
	Geotechnical Reports & Related Docs.		General Geotechnical
Defect/Damage Records and Documents	Crack Maps, Crack Dimension Tables, Crack Growth Monitoring Logs	15/141*	Crack Monitoring
	Request For Correction (RFC) Tracking Logs and Related Correspondence		Defect/Damage Resolution
Shop Drawings	Bridge Bearings	14/134	Bearings
	Electrical Components	14/134	Electrical
	Expansion Joints	14/134	Expansion Joints
	Mechanical Components	14/134	Mechanical
	Substructure Members/Components	14/134	Substructure
	Superstructure Members/Components	14/134	Superstructure
	High Mast Light Components	14/135	High Mast Lighting
	Miscellaneous	14/136	Miscellaneous
	Overhead Sign/Traffic Signal Structure Members/Components	14/138	Overhead Sign/Traffic Signal Structure
Punch List Documents	Final Punch List, Explanation of how Punch List Items were Resolved	15/141*	Punch List
Post-Tensioned (PT) Bridge Records	Stressing Record/Log, Grouting Record/Log, Casting Record/Log	15/141*	PT Bridge Record

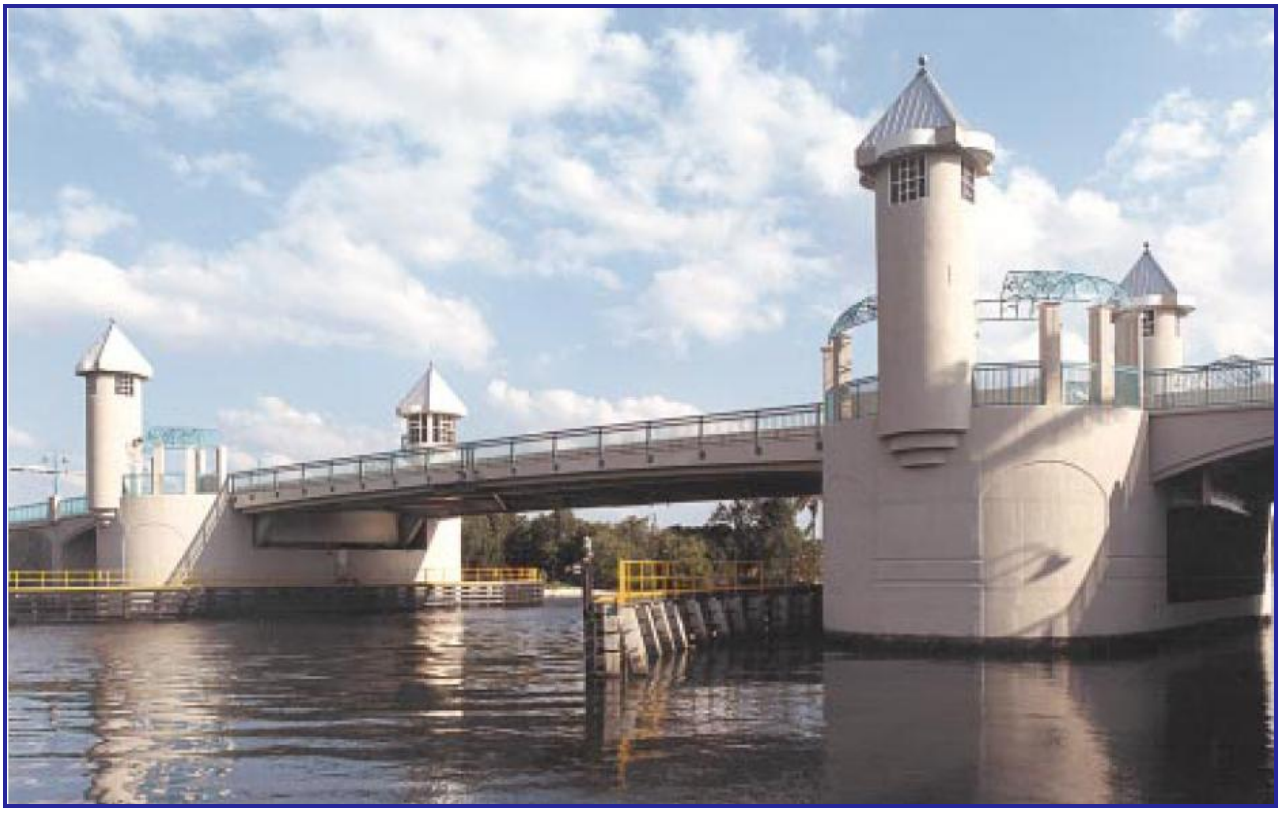
* New CDMS Document Type 141 – Other Structures Documents

UNIVERSAL CONCERNS

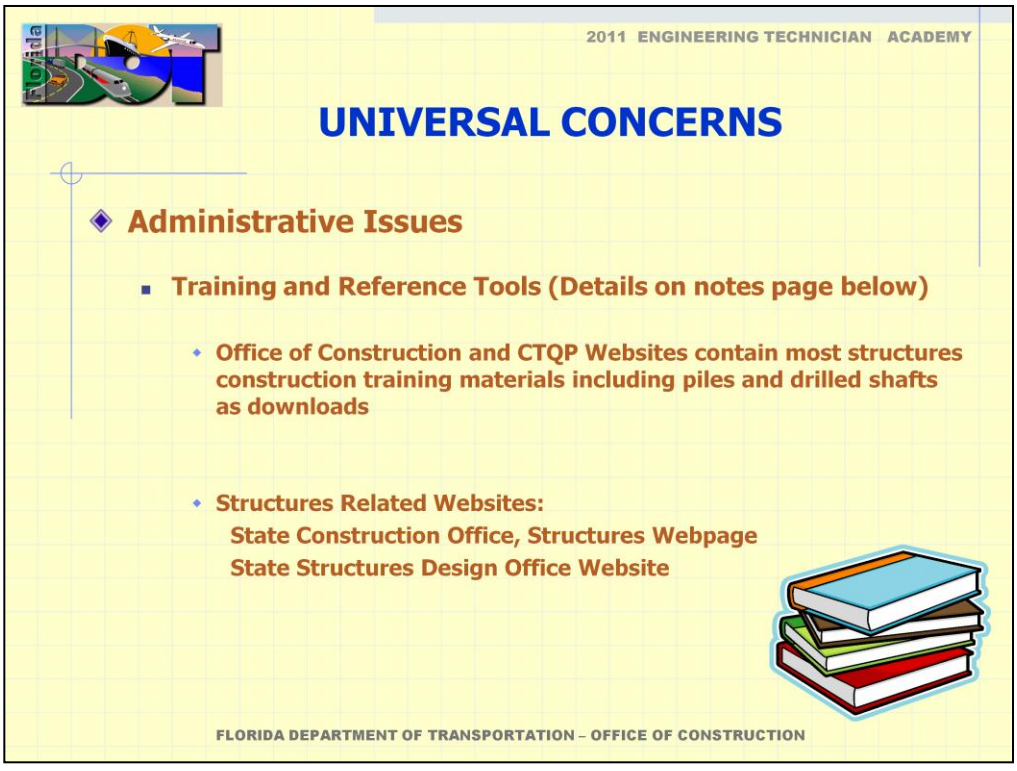
CLASS OF CONTRACTOR'S ENGINEER VERSUS WORK TYPE

Work Type	Contractor's Engineer of Record	Pre-qualified Specialty Engineer	Specialty Engineer
1) Re-design	Yes	No	No
2) Cost Savings Initiative Proposals	Yes	No	No
3) Details of the permanent work not fully detailed in the plans (Example: Pot Bearing Design, non-standard expansion joints, MSE walls, other specialty items)	Yes	Yes	Yes
4) Design and details of the permanent work declared to be minor or non-structural including minor repairs	Yes	Yes	Yes
5) Design and details of the permanent work declared to be major or structural including major repairs * The work must also be checked by another pre-qualified Specialty Engineer	Yes	Yes*	No
6) Design and drawings of temporary works such as falsework, formwork, etc.	Yes	Yes	Yes

FLORIDA DEPARTMENT OF TRANSPORTATION – OFFICE OF CONSTRUCTION



Boynton Beach Bascule Bridge



Office of Construction and CTQP websites have the following online and Downloadable Materials:

- Pile Driving Inspector's Tutorial
- Drilled Shaft Tutorial
- Structures Inspection Part 1 and 2
- Concrete Field Inspector Specification Course Manual
- Critical Structures Construction Issues – Self Study Course
- Website address: http://www.ctqpflorida.com/course_preparation_materials.asp

Grouting Manual and Video

- Hard copy of Manual and Video available at FDOT Maps and Publications Office: http://www.dot.state.fl.us/mapsandpublications/
- Downloadable versions of Manuals at: http://www.dot.state.fl.us/construction/training/training.htm#GroutManual

FDOT Structures Related Websites:

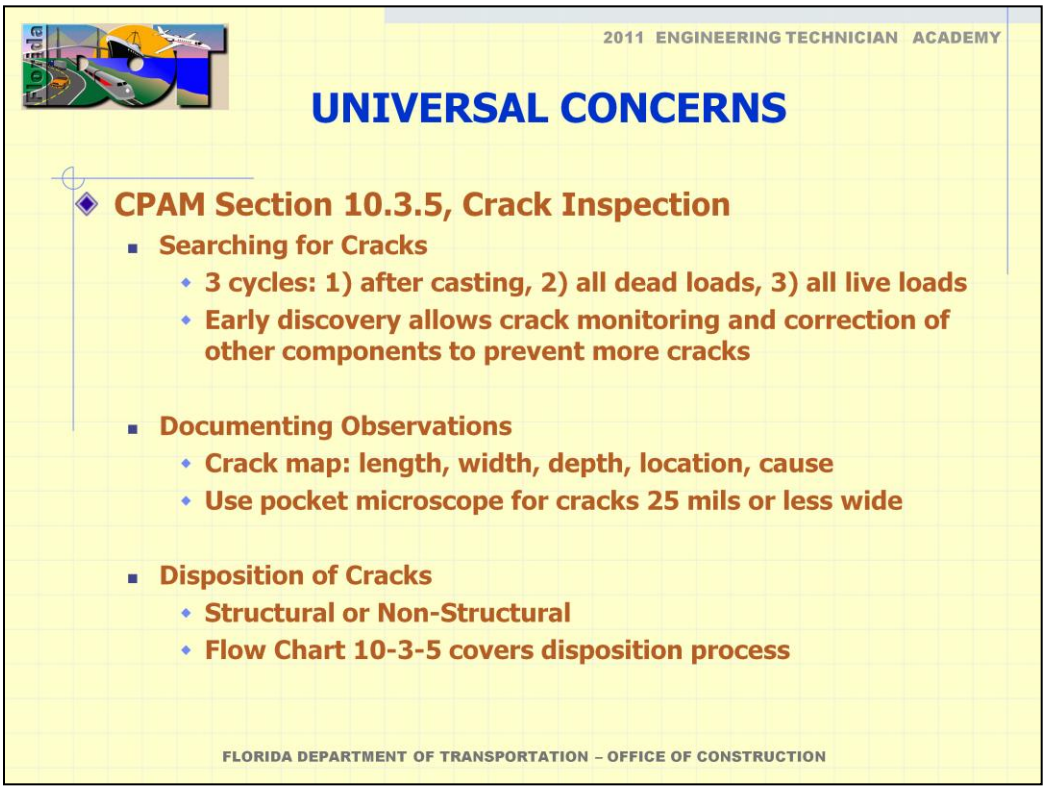
- FDOT State Construction Office, Structures Webpage: http://www.dot.state.fl.us/construction/structures/structures.htm
- FDOT State Structures Design Office Website: http://www.dot.state.fl.us/structures/default.htm

UNIVERSAL CONCERNS

Technical Issues – Concrete Cracks

- Revision of Spec. 400-21, Disposition of Cracked Concrete: the number of cracks is now taken into account
- Revision of CPAM Section 10.3.5, Concrete Crack Inspection: provides instructions for administering Spec. 400-21
- CPAM Section 10.7, Crack and Joint Inspection of Post-Tensioned Bridges
- Guidelist 10A, General Concrete: covers crack inspection (see notes page below)

Clearwater Memorial Bridge, Clearwater
Main Span 360 ft.
Cast-In-Place Concrete Post-tensioned Segmental Box Girder



INSPECTION OF CRACKS IN CONCRETE – The following Guidelist items cover crack inspection concerns:

Guidelist 10A - CRACK INSPECTION

31. Concrete components must have all visible surfaces inspected for cracks on at least the following three occasions: (1) 28 to 31days after a non-precast component has been cast; (2) as soon as possible after the component has been burdened with all dead loads, except for loads from components cast or mounted to the deck, and before Class V finish has been applied; (3) a minimum of 7 complete days after the bridge is fully open to the public for unrestricted use. [Good Practice]

32. The width, length, depth and termination points, and precise location of concrete cracks must be properly documented and crack measuring scopes* should be used to measure cracks 25 mils wide or less. Documented cracks must be monitored to determine if they are continuing to grow. Immediately report all cracks to the Project Administrator so that their status can be addressed appropriately. [Good Practice]

* Possible Pocket Microscope Supplier – Titan Tool Supply, Inc., Phone No.: (716) 873-9907

Web Address -- http://www.titantoolsupply.com/store.asp?pid=11453&catid=19730

UNIVERSAL CONCERNS

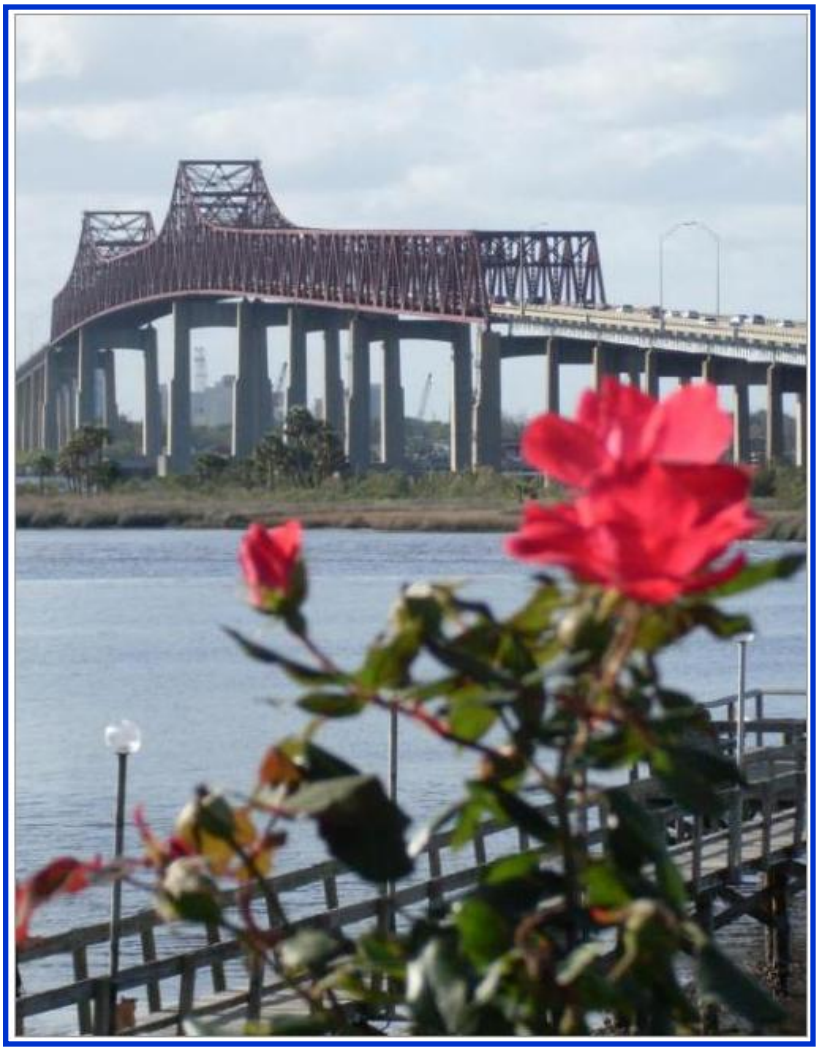
- **Required Contractor Submittals or Actions for Bridge Temporary Works:**
  - In recent years the Department has increased the number and type of temporary works submittals and actions required of Contractors and this has caused some misunderstandings and oversights by both Contractors and CEI personnel related to what is required.
  - The table on the next page is intended to provide a user friendly format for determining the temporary works submittals needed for a given circumstance
  - Each Submittal or Action includes the number of the specification to which it applies.

Matthews Bridge over the Saint Johns River, Jacksonville

Cantilever Truss

Main Span Length 810’,

4th Longest Span in Florida

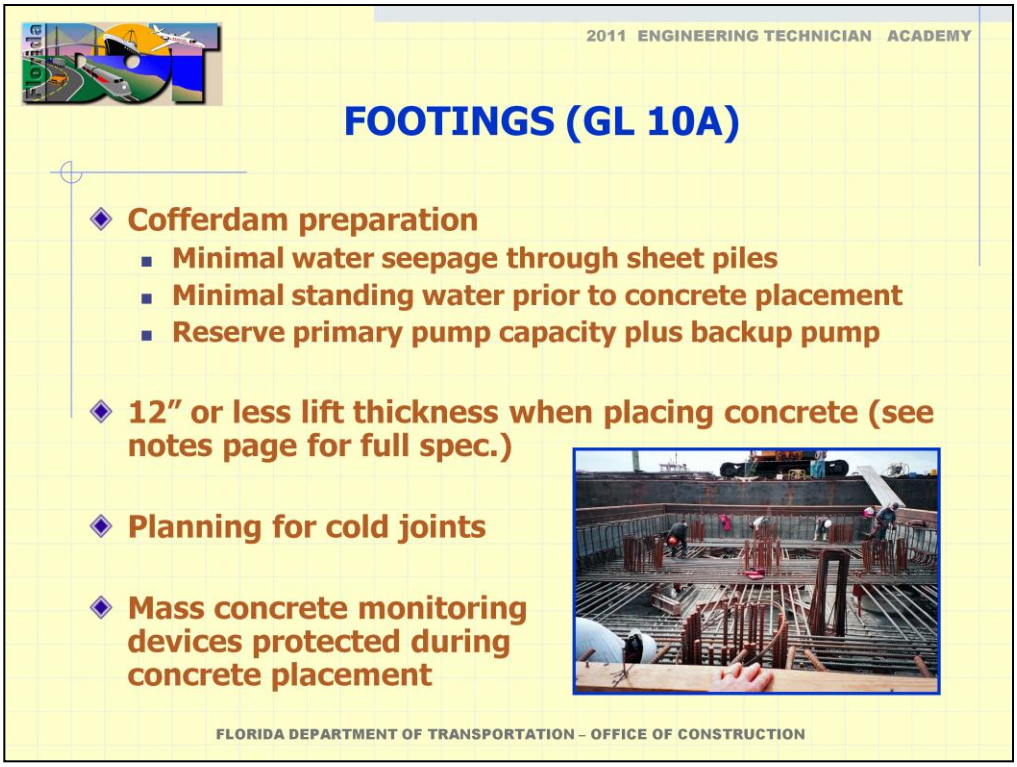


Required Contractor Submittals or Actions Required for Bridge Temporary Works

Contractor Submittal or Action Required for Temporary Works	Temporary Works Category											
	PS Concrete Beam Bracing		Falsework/ Shoring		Beam/Girder Erection Plans		Special Erection Equipment		Scaffolding		Formwork	
	PSN[4]	PS[4]	PSN	PS	PSN	PS	PSN	PS	PSN	PS	PSN	PS
Submittal to the Engineer for review if not steel or post-tensioned beams/girders [5-1.4.5.7 and 5-1.5.4][3]					X	X						
Submittal to the Engineer for review and prepared by the SE[2] for steel and post-tensioned beams/girders [5-1.4.5.7 and 5-1.5.4]					X	X						
At a minimum, girders must be braced at each end of each span [5-1.4.5.6]	X	X										
Submittal to the EOR[1] of design calculations for bracing members and connections prepared by the SE [5-1.4.5.6]		X										
Submittal to the EOR of a certification by the SE that loads do not exceed the assumed loads shown in the plans for prestressed concrete beams that have bracing plan requirements in the plans [5-1.4.5.6]		X										
Submittal to the EOR of beam stability calculations prepared by the SE when temporary bracing requirements are not shown in plans or are revised by the Contractor [5-1.4.5.6]		X										
Submittal to the EOR of shop drawings with applicable design calculations prepared by the SE [5-1.4.5.4]				X			X	X		X		X
Certification to the Engineer by the SE that fabrication and operation are in accordance with approved drawings and calculations [5-1.5.1]							X	X				
Certification to the Engineer by the SE that construction is in accordance with approved drawings and calculations or plans [5-1.5.2, 5-1.5.3 and 5-1.5.4]			X	X		X						X
Inspection by Contractor of erected structural systems each day while they are in a temporary condition and report inspections to the Engineer in writing [5-1.5.4]						X						

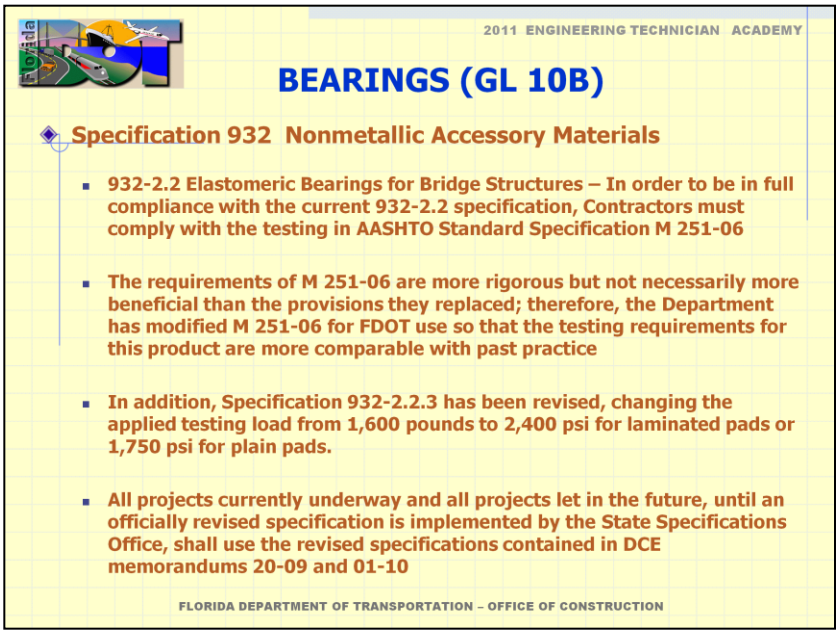
1 – EOR: Engineer of Record, 2 – SE: Specialty Engineer, 3 – Specification references in parenthesis

4 – PSN: Public Safety is Not Affected, PS: Public Safety is Affected



SPECIFICATION FOR LIFT THICKNESS WHEN PLACING CONCRETE

400-7.10 Requirements for Successive Layers: Generally, place concrete in continuous horizontal layers, approximately 12 inches [300 mm] thick. To avoid obtaining a plane of separation between batches, do not allow the time before placing the next successive layer to exceed 20 minutes, unless the Engineer determines that adequate fluidity exists in the underlying layer. Generally, leave each layer of concrete unfinished to secure efficient bonding with the overlying layer. To minimize the visibility of joints on exposed faces, finish the top surface of the concrete immediately adjacent to the forms of the exposed face, smoothing with a plaster mason's trowel. Where required, use inset form work to eliminate featheredges and to obtain concrete layers with a minimum thickness of 6 inches [150 mm]. Conduct the operation of depositing and consolidating the concrete so as to form a dense, impervious mass of uniform texture with smooth faces on exposed surfaces. Remove, dispose of, and replace defective concrete as directed by the Engineer and at no expense to the Department.



DCE MEMO 20-09 : TESTING OF ELASTOMERIC BEARING PADS FOR BRIDGE STRUCTURES

The current 2010 Standard Specification Article 932-2, Structure Bearing, requires elastomeric bearing pads to be furnished in accordance with AASHTO LRFD Bridge Construction Specifications, Section 18.2. LRFD Section 18.2 then refers the reader to AASHTO Standard Specification M 251 for detailed testing requirements. The M 251 source document dated 2004 has been revised in
an interim specification designated M 251-06 which is the document that Contractors must refer to in order to be in full compliance with the current specification. The requirements of M 251-06 are more rigorous then the provisions they replaced. After a review, the Department has modified M 251-06 so that the testing requirements for this product are more comparable with past practice, and the revised version is provided at the end of this memorandum. In addition, there is a revision to Specification 932-2.2.3 that also follows this memorandum, changing the applied testing load from 1,600 pounds to 2,400 psi.

Effective immediately, all projects currently underway and all projects let in the future, until an officially revised specification is implemented by the Specifications Office, shall use the revised AASHTO M 251-06 version provided herein. This memorandum serves as a blanket approval to process a no cost specification revision and shall be attached to the work order or supplemental agreement required for its processing.

Further, there are ongoing projects for which pads have been placed and the Contractor has submitted the required certification stating that the pads are in full compliance with the Contract Documents. This office has been informed that some of these certifications may be invalid because the bearing pad suppliers were not aware of the new provision and did not actually perform all of the required tests. Therefore, on all active projects, District Construction personnel need to review any certifications received to ensure compliance with the detailed provisions of the revised version of AASHTO M 251-06 provided herein. If the pads are not in compliance with all the revised specification testing requirements, then one of the following actions must be taken:

1) The contractor can test a coupon from the same lot of pads that have been previously installed.
2) The Contractor shall provide the Department with a warrantee bond having a five (5) year duration for noncompliant pads.
3) All noncompliant pads must be removed and replaced with compliant pads.

For questions or discussion of this matter, contact Steven Plotkin at (904) 360-5501.

Specification 932-2.2.3 Testing: Comply with the testing requirements established in the "AASHTO LRFD Bridge Construction Specifications" Section 18.2. Unless otherwise shown in the Contract Documents, the rated service load *in pounds* for load testing shall be *2,400 pounds per square inch* 1,600 pounds times the pad area in square inches. When the elastomer material is specified by Shore "A" hardness (durometer), comply with the testing and acceptance criteria in AASHTO M-251, Appendix X1 and X2.

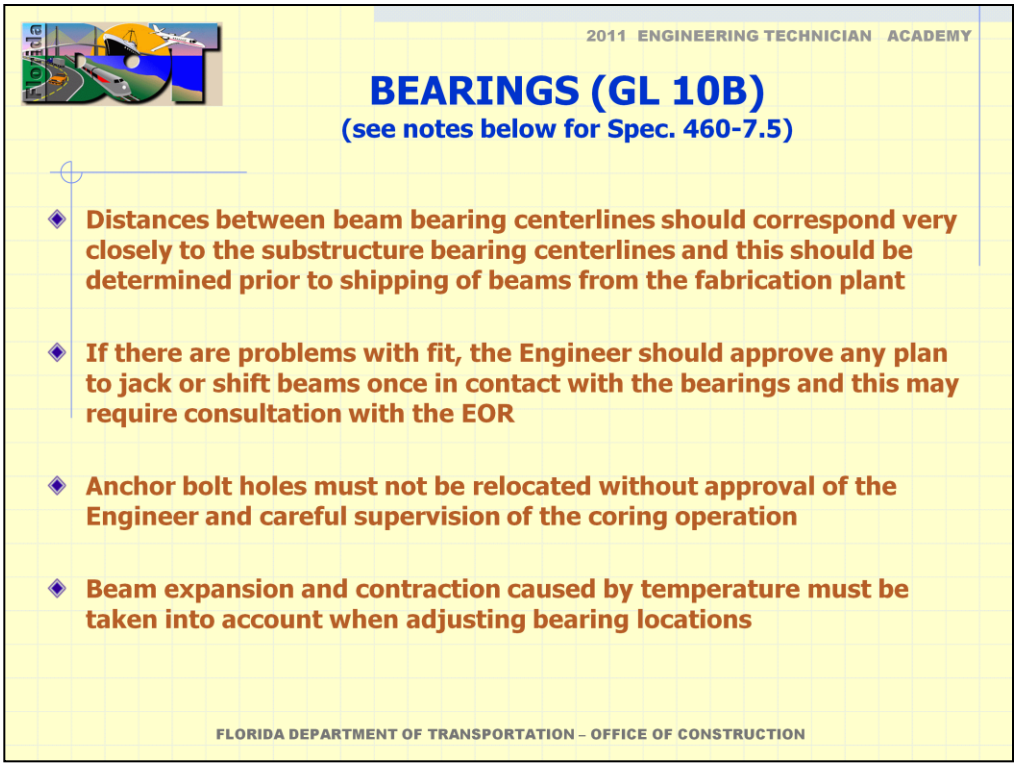
DCE MEMO 01-10: TESTING OF ELASTOMERIC BEARING PADS FOR BRIDGE STRUCTURES

This memorandum is a follow-up to memorandum 20-09 and clarifies the Contractor options offered in 20-09 as well as adding others. All other requirements of 20-09 remain in force. If elastomeric bearing pads have not been shipped or are not in full compliance with the revised specification testing requirements covered in 20-09 then one of the options below must be followed by the Contractor depending on which applies. For pads that have not been shipped from the supplier by February 15, 2010:

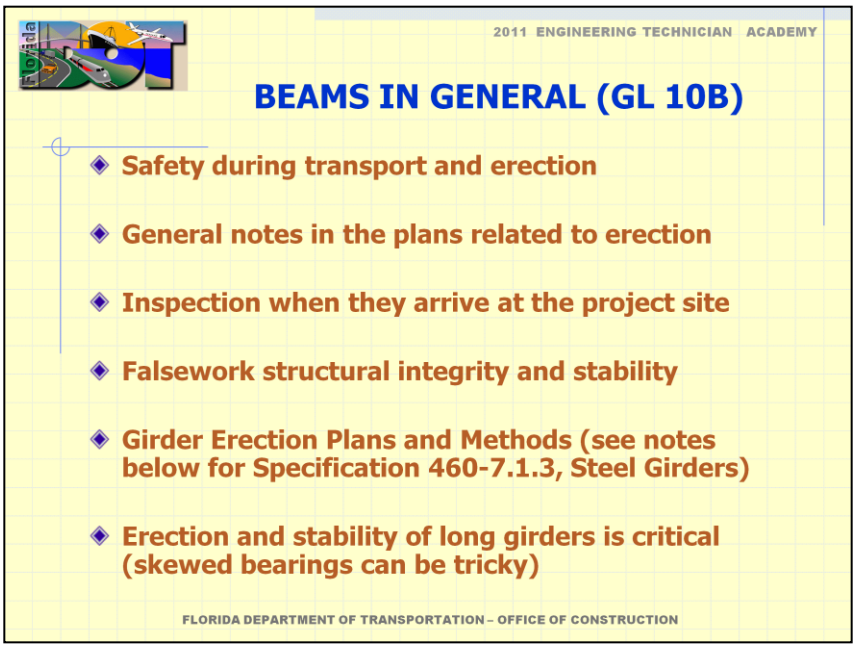
1) The bearing pads shall comply fully with the applicable provisions of Specification 932-2.2 of the project Contract Documents and with AASHTO M 251-06 revised for FDOT and the version of Specification 932-2.2.3 included with DCE Memorandum 20-09.
2) The required Mill Analysis Reports and Certification shall be submitted with the bearings along with proof that an approved independent laboratory has performed the tests or has observed the tests and certifies that they were done properly.

For pads that are in transit from the supplier to the project prior to February 15, 2010, are in storage on the project or that are in their final position on a pile or pier cap, options available to the contractor are:

1) The Contractor can test a coupon from the same LOT of pads that are in storage and/or in their final position.
2) The Contractor shall provide the Department with a warrantee bond having a duration of five (5) years.
3) The Contractor shall remove and replace all noncompliant pads with compliant pads.
4) The bearings shall be in full compliance with the 2007 FDOT Standard Specifications for Road and Bridge Construction, Article 932-2, including Mill Analysis Reports, independent laboratory reports, and Certification. If these conditions are met, the bearing pads will be accepted and will be paid for at 50% of the bid unit price (Pay Item 400-147, Unit: cubic feet).



460-7.5 Preparation of Bearing Areas and Setting of Bearings: Prior to placing superstructure bearing units (including but not limited to neoprene pads and masonry plates), prepare the top of concrete pad (bearing area) in accordance with Section 400. If a discrepancy is identified, report it to the Engineer for resolution. For expansion bearings with slotted holes for anchor rods, which allow movement of the superstructure with respect to the substructure, vary the location of the slotted plate in relation to the anchor rods, in accordance with the prevailing temperature at the time of setting. For fixed bearings at multiple adjacent piers, if necessary, horizontally jack the substructure units to correctly set the centerline of bearing. Adequately account for temperature. Unless specified elsewhere in the contract Documents, locate the theoretical centerline of bearings to within 1/16 inch transverse to longitudinal girder lines; and in the direction parallel to the longitudinal girder line locate the theoretical centerline of bearing within 1/4 inch of the theoretical centerline of bearing. After setting the bearings and installing anchor rod nuts, washers and any other associated hardware specified in the Contract Documents, clean the protruding/exposed surfaces of the assembly of all deleterious material. Finish-coat metal parts in accordance with 460-4.3.4.11.



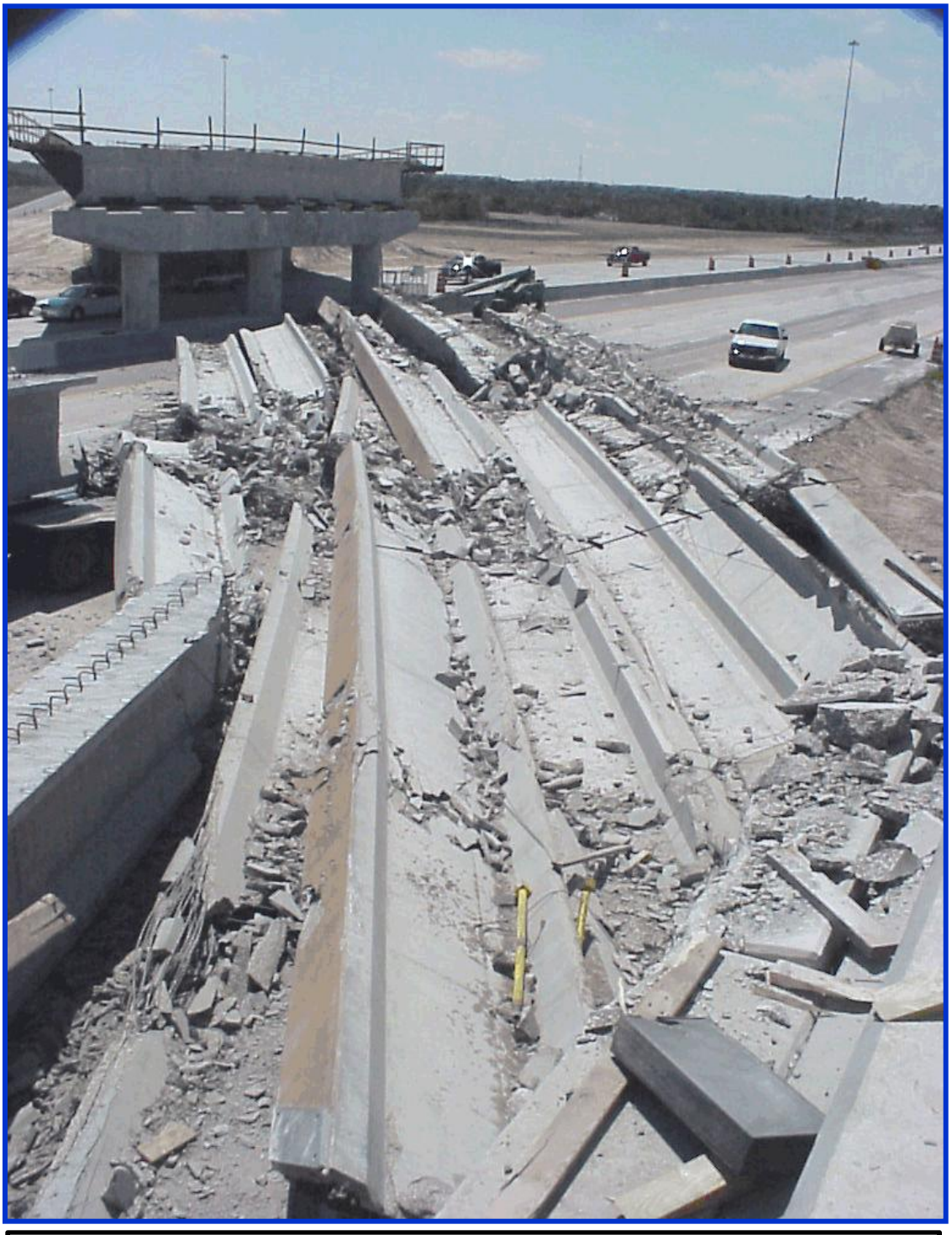
GUIDELIST 10B

4. Concerns for all beams: damage or flaws such as kinks, warps, bends, cracks, plates out of plumbness or squareness; pickup points in proper location; producer acceptance stamp, certification and beam identification; proper storage; correct beam lengths prior to shipment; and erect beams at fixed bearings first. [Spec. 460-4 & Good Practice, CPAM 10.2.4]

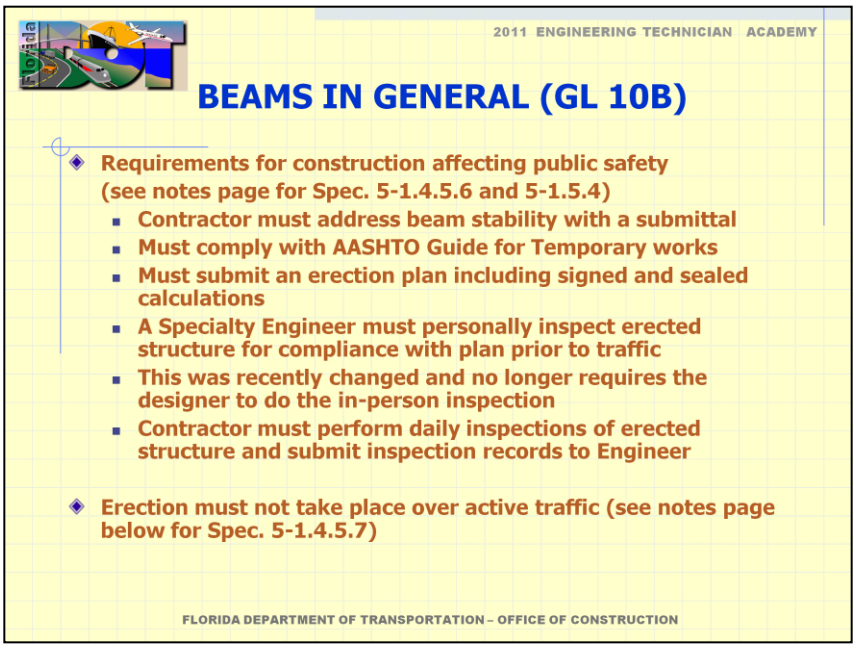
460-7.1.3 Erection Plan:

Submit, for the Engineer's review, an Erection Plan locating all primary members, lifting equipment and temporary supports or braces, and bolting pattern tightening procedures not considered routine. Ensure that the plan includes the Specialty Engineer's signature and stamp. Include supporting calculations indicating that the design unit stresses indicated in the Contract Documents have not been exceeded. Provide this Plan or Plans to the Engineer three weeks before erecting the piece or pieces. Include the following information in the Erection Plan:

1. A plan of the work area showing all substructure units and foundations; surface roads and railroads; all streams, creeks and rivers; and all overhead and underground utilities.
2. The erection sequence for all primary load-carrying members and all primary load-carrying member bracing. Note any and all permanent or temporary support and/or bracing locations, including crane-holding positions.
3. The center of gravity locations, pick weight and delivery orientation for all primary load-carrying members and pick weight.
4. Identify any bolting requirements not considered routine.
5. Locate all pick crane work points.
6. Identify all temporary works and staging areas such as barges, mats and temporary excavation support.
7. Provide capacity charts on the drawings for each crane configuration and boom extension utilized.
8. Details of all temporary bracing, falsework, towers and shoring.
9. Provide any procedures requested by the Engineer and not contained in the Quality Control Plan.



This can happen when bracing methods are inadequate or when handling and lifting are done improperly, particularly for long span skewed bridges



PROPOSED - 5-1.4.5.6 Beam and Girder Temporary Bracing: The Contractor is solely responsible for ensuring stability of beams and girders during all handling, storage, shipping and erection. Adequately brace beams and girders to resist wind, weight of forms and other temporary loads, especially those eccentric to the vertical axis of the products, considering actual beam geometry and support conditions during all stages of erection and deck construction. At a minimum, provide temporary bracing at each end of each beam or girder. Develop the required bracing designs in accordance with the AASHTO Load and Resistance Factor Design Bridge Design Specifications (LRFD) using wind loads specified in the Structures Design Guidelines (SDG). For information not included in the SDG or LRFD, refer to the AASHTO Guide Design Specifications for Bridge Temporary Works and Construction Handbook for Bridge Temporary Works.

For Construction Affecting Public Safety, when temporary bracing requirements are shown in the plans, submit plans and calculations signed and sealed by a Specialty Engineer for the design of temporary bracing members and connections based on the forces shown in the plans. In addition, submit a written certification that construction loads do not exceed the assumed loads shown in the plans.

For Construction Affecting Public Safety, when temporary bracing requirements are not shown in the plans or an alternate temporary bracing system is proposed, submit plans and calculations signed and sealed by a Specialty Engineer including the stability analysis and design of temporary bracing members and connections.

5-1.4.5.7 Erection Plan:

Submit, for the Engineer's review, an Erection Plan that meets the specific requirements of Sections 450, 452 and 460 and this section. The following construction activities are not allowed over the active traffic:

(a) Beam, girder and segment placement.

(b) Deck form placement and removal.

(c) Concrete deck placement.

(d) Railing construction when railing is located at edge of deck.

(e) Structure demolition.

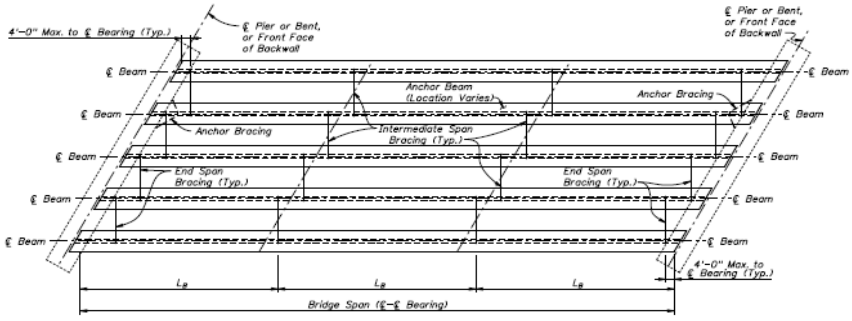
5-1.5.4 Erection:

For Structures affecting public safety, submit an erection plan signed and sealed by the Specialty Engineer to the Engineer at least four (4) weeks prior to erection commencing. Include as part of this submittal signed and sealed calculations and details for any falsework, bracing or other connection(s) supporting the structural elements shown in the erection plan. At least two (2) weeks prior to beginning erection, conduct a Pre-erection meeting with the Specialty Engineer and Engineer to review details of the plan. After erection of the elements but prior to allowing the public below the structure, ensure that the Specialty Engineer has personally inspected the erected member(s) and certified to the Engineer that the structure has been erected and constructed in accordance with its signed and sealed erection plan. Perform daily inspections of the erected structural members until completion of the deck concrete placement. Provide written documentation of the inspections to the Engineer within 24 hours of the inspection.

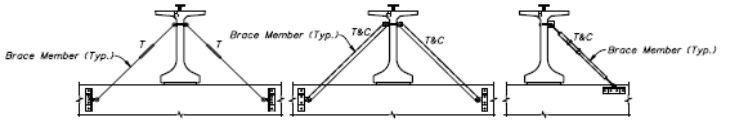
BEAMS IN GENERAL (GL 10B)

- **Revision of Specification 5-1.4.5.6, Beam and Girder Temporary Bracing**
  - Where Public Safety is not a concern, the current spec. requires no formal submittal by the Contractor showing the temporary bracing system for beams
  - Starting in July 2011, temporary bracing details and data will be included in plans as new Standard Index 20005 (see next two pages for an example of Index 20005) and the Contractor will have to comply with the bracing standard
  - Where Public Safety is a concern, the current spec. requires signed and sealed stability calculations to be submitted to the Engineer
  - Starting in July 2011, the Contractor will have to comply with Index 20005 and will have to submit signed and sealed drawings showing the temporary bracing system that complies
  - If the Contractor wishes to use a bracing system not covered by Index 20005 than signed and sealed drawings on the system design must be submitted along with stability calculations

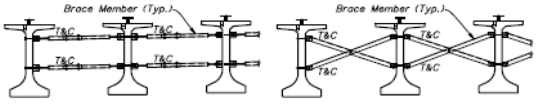
Good Example of PS Beam Erection & Bracing System



PRESTRESSED BEAM TEMPORARY BRACING PLAN VIEW
(Skewed Condition Shown, Non-skewed Condition Similar)



EXAMPLE ANCHOR BRACING TYPICAL SECTIONS
(Beam Ends Only)



EXAMPLE END SPAN/INTERMEDIATE BRACING TYPICAL SECTIONS

LEGEND:

T = Tension Member
T&C = Tension & Compression Member

NOTES:

1. The 'PRESTRESSED BEAM TEMPORARY BRACING PLAN' is to be used in conjunction with the 'TABLE OF TEMPORARY BRACING VARIABLES' in the Structures Plans. The brace locations and quantities shown in the plan view are schematic only, and the actual brace locations and quantities should be determined from the 'TABLE OF TEMPORARY BRACING VARIABLES' in the Structures Plans.

2. The bracing members shown in the sections are schematic only, and are meant to show geometry in which bracing should be placed. The bracing members and connections shall be designed and detailed by the Contractor. Any of the geometric configurations shown in the bracing sections are acceptable. The bracing may be attached through the web or to the flanges of the beam, as necessary. The bracing shall be positively and securely connected to each beam, and shall not be designed to exert any vertical force on the outer edge of the top flange. All bolt holes in beams are to be preformed and filled after use. All bracing is to be placed perpendicular to beams.

3. The anchor beam is a beam which has anchor bracing at its support locations. It is to be set first, and its location may vary. All subsequent beams are to be braced against the Anchor Beam sequentially. The Anchor brace may be located at an exterior girder provided that all required bolt clear distances are met and overhang bracing is not impacted. Anchor bracing may be inclined, as shown in the plan view, or may be installed vertically.

4. Overhang bracing requirements are neither specified here nor in the 'TABLE OF TEMPORARY BRACING VARIABLES.' It is the Contractor's responsibility to design overhang bracing which does not cause excessive deflection or rotation of the exterior girder, or cause the girder stresses to exceed stress limits per the FDOT Structures Manual.

5. The Contractor shall submit documentation required by the Specifications for Road and Bridge Construction, Section 5 for 'Beam and Girder Temporary Bracing.' If the Contractor elects to use the bracing requirements shown in the 'TABLE OF TEMPORARY BRACING VARIABLES,' the documentation shall include signed and sealed certification that the construction loads do not exceed those shown in the 'TABLE OF ASSUMED CONSTRUCTION LOADS' and signed and sealed design of bracing members and connections. If the Contractor elects to use a bracing scheme different from those shown in the 'TABLE OF TEMPORARY BRACING VARIABLES,' the documentation shall include signed and sealed calculation of the bracing requirements and design of bracing members and connections.

REVISIONS						2010 Interim Design Standard	Interim Date	Sheet No.
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION		01/01/10	1 of 1
01/01/10	SJN	New Design Standard				PRESTRESSED BEAM TEMPORARY BRACING	Index No. 20005	

INSTRUCTIONAL NOTES TO DESIGNERS

GENERAL INSTRUCTIONS:

The Standard Drawings for prestressed beam bracing (Index No. 20005) depict notes and details that are schematic for use in the development of beam bracing shop drawings. These drawings and notes are included in the contract documents by reference to the Index No. in the plans. Companion MicroStation CADD cell 20005, which includes the 'TABLE OF TEMPORARY BRACING VARIABLES,' the 'TABLE OF WIND LOAD VARIABLES,' the 'TABLE OF ASSUMED CONSTRUCTION LOADS,' and the 'BEAM TEMPORARY BRACING NOTES'. The tables are to be completed and included in the plans with the note.

The FDOT Beam Stability MathCAD program may be used to determine the variables to be input into the 'TABLE OF TEMPORARY BRACING VARIABLES,' the 'TABLE OF WIND LOAD VARIABLES,' and the 'TABLE OF ASSUMED CONSTRUCTION LOADS.'

The forces that are entered into the columns for beam end and intermediate horizontal bracing forces in the 'TABLE OF TEMPORARY BRACING VARIABLES,' shall be the horizontal reaction forces at each brace point. Forces should not be resolved into a diagonal component, regardless of any inclination of the actual bracing. These forces are to be used by the Contractor to design bracing members and connections.

The assumed weight for the finishing machine is left to the discretion of the EOR, but suggested total weights for the finishing machine are 10 kips for bridge widths less than 45 feet and 20 kips otherwise.

If intermediate span braces are not required, enter "N/A" in the horizontal and overturning force columns for each span for which intermediate span braces are not required.

EXAMPLE PROBLEM

The following example shows the data required for completion of the Data Table for the Prestressed Beam Temporary Bracing Index No. 20005. This case shows a Florida-I 78 Beam (Index No. 20078).

The example assumes a three equal span bridge designed for the following conditions:

Girder Span: 182'-0"
Girder Spacing: 6'-0"
Number of Girder Lines: 7
Deck Thickness: 8½"
Deck Overhang: 3'-0"
Skew Angle: 45°
Bridge Height: 60'-0"
Construction Inactive Wind Load: 44.0 psf (150 mph reduced by 0.6 to 90 mph)
Construction Active Wind Load (20 MPH): 2.2 psf (girder only), 1.1 psf (bridge with forms in place)

Based on beam stability calculations, (1) intermediate brace point would be sufficient, but the bracing force would be very large. Therefore, the bracing requirements will be calculated based on (2) intermediate brace points.

The maximum unbraced length is: 182'-0"/3 = 60'-8"

TABLE OF WIND LOAD VARIABLES	Table Date 1-01-10
WIND SPEED, BASIC (MPH)	150
WIND SPEED, CONSTRUCTION INACTIVE (MPH)	90
WIND SPEED, CONSTRUCTION ACTIVE (MPH)	20
VELOCITY PRESSURE EXPOSURE COEFFICIENT	1.137
GUST EFFECT FACTOR	0.85

TABLE OF ASSUMED CONSTRUCTION LOADS (UNFACTORED)	Table Date 1-01-10
BUILD-UP (PLF)	50
FORM WEIGHT (PSF)	20
FINISHING MACHINE TOTAL WEIGHT (KIP)	20
FINISHING MACHINE WHEEL LOCATION BEYOND EDGE OF DECK OVERHANG (IN.)	2½
DECK WEIGHT (PSF)	113.3
LIVE LOAD (PSF)	20
LIVE LOAD AT EXTREME DECK EDGE (PLF)	75

TABLE OF TEMPORARY BRACING VARIABLES — Table Date 1-01-10

SPAN NO.	L_b, MAXIMUM UNBRACED LENGTH (FT)	HORIZONTAL FORCE AT EACH BEAM END AND ANCHOR BRACE (KIP)	HORIZONTAL FORCE AT EACH INTERMEDIATE SPAN BRACE (KIP)	OVERTURNING FORCE AT EACH BEAM END AND ANCHOR BRACE (KIP×FT)	OVERTURNING FORCE AT EACH INTERMEDIATE SPAN BRACE (KIP×FT)	BRACE ENDS PRIOR TO CRANE RELEASE?	TOTAL NUMBER OF BRACES
1	60.67	8.69	23.90	27.31	63.75	NO	24
2	60.67	8.69	23.90	27.31	63.75	NO	24
3	60.67	8.69	23.90	27.31	63.75	NO	24

BEAM TEMPORARY BRACING NOTES:
Based on investigation of the beam stability, temporary bracing as shown in the 'TABLE OF TEMPORARY BRACING VARIABLES' and Design Standard Index No. 20005 is required. The Table and following information is provided to aid the Contractor in design of beam temporary bracing:

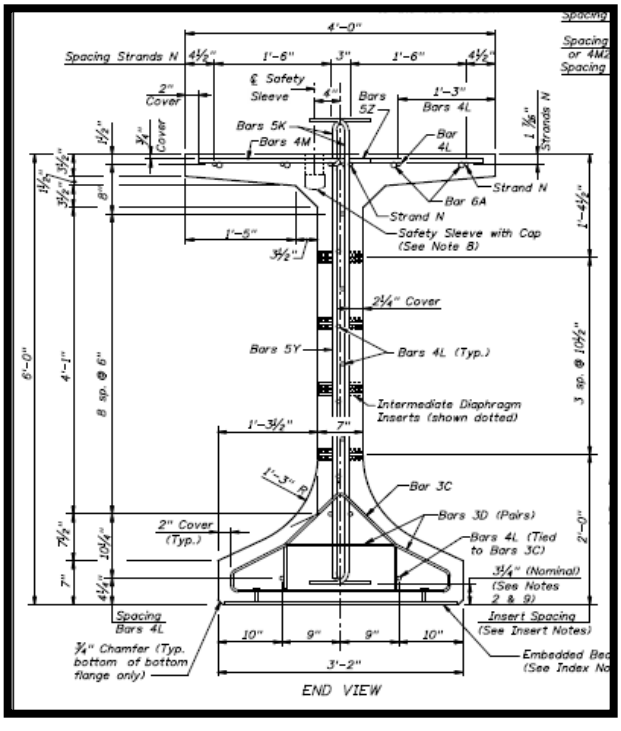
1. Design the bracing members and connections to transfer both compressive and tensile forces equal to the horizontal forces given in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Also design bracing members and connections to be capable of resisting the overturning forces given in the Table, non-simultaneously with horizontal forces. Assume that horizontal bracing forces are applied perpendicular to the beam web at mid-height of the beam, and assume that overturning bracing forces are applied at the centerline of the beam at the top of the top flange.
2. The horizontal brace forces have been determined by application of the Construction Inactive Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES'. The overturning brace forces have been determined by application of the Construction Active Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES' plus the assumed construction loads shown in the 'TABLE OF ASSUMED CONSTRUCTION LOADS'. It is the Contractor's responsibility to re-calculate the bracing requirements if the actual construction loads exceed the assumed loads shown, or if the finishing machine wheel location from the edge of the deck overhang exceeds the value listed.
3. The temporary bracing at the ends of the beams shall be installed prior to crane release if indicated in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Beams shall not be left un-braced during non-work hours. Bracing at the ends of the beams shall remain in place until the diaphragm concrete reaches 2500 psi. The temporary intermediate bracing, if required, shall remain in place until bridge deck concrete reaches 2500 psi.
4. The exposure period (defined as the time period for which temporary load cases of the superstructure exist) is assumed to be less than one year. Horizontal bracing forces, as specified in the 'TABLE OF TEMPORARY BRACING VARIABLES', are not valid if the exposure period is more than one year; for this case the Contractor shall re-calculate bracing requirements.
5. Horizontal and overturning forces are factored per the Strength III limit state for construction.

CONCRETE BEAMS (GL 10B)

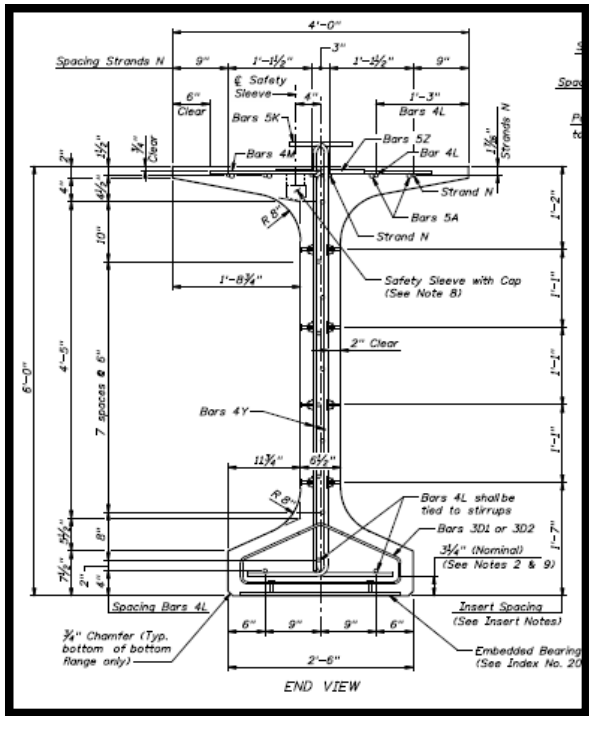
New Index Numbers: 20010 - 20078, Florida I Beam

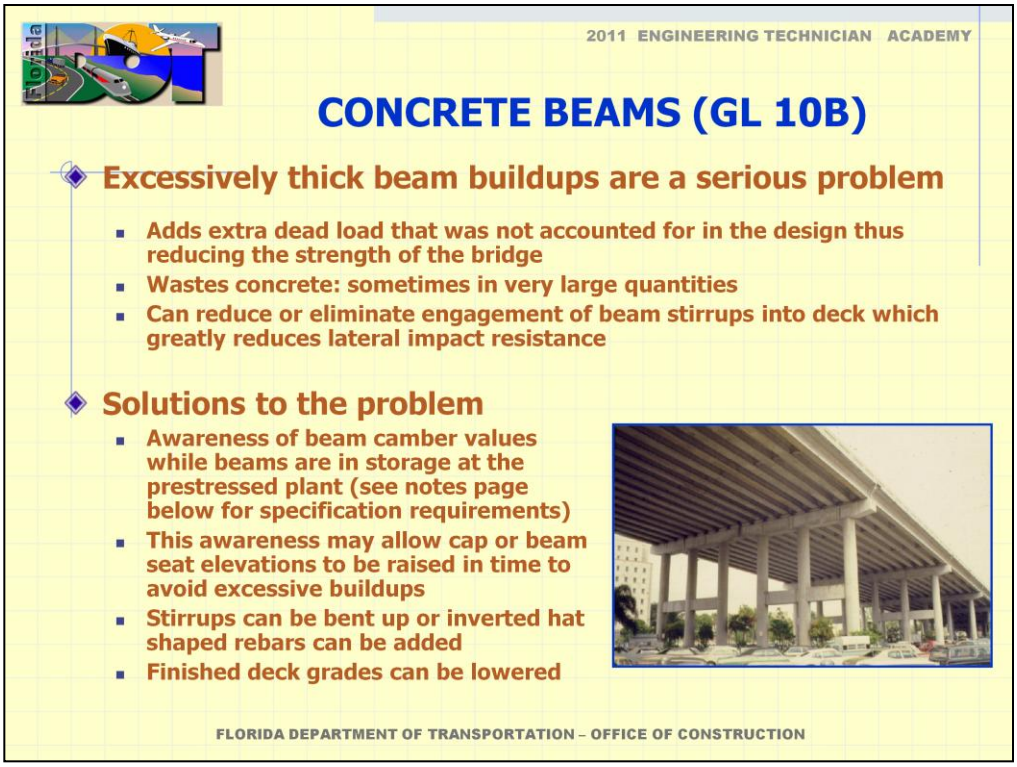
- This new group of standards introduces the Florida I Beam (FIB) which is an improvement over the previously used Bulb-T and AASHTO beam
- The standards include beam depths of 36", 45", 54", 63", 72", 78", 84" and 96"
- Advantages of the FIB versus the Bulb-T or AASHTO are as follows:
  - Higher load carrying capacity than comparable AASHTO or Bulb-T beams of the same span length which can reduce the number of beam lines, resulting in a less expensive superstructure
  - Improved stability during handling, storage and erection due to a significantly wider bottom flange
  - Increased lateral stiffness because of thicker top and bottom flanges

FIB
72" Depth



BULB-T
72" Depth



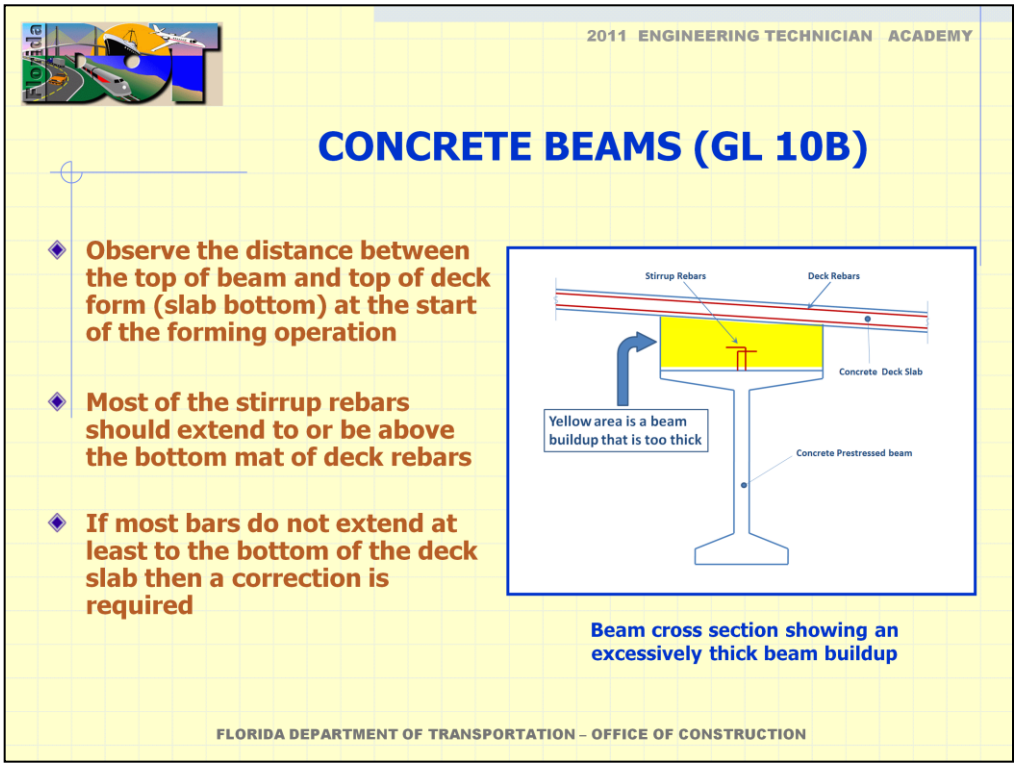


450-16.2

Measure and record the sweep and camber of beams monthly. Keep the measurement records on file for review at any time by the Engineer, and upon request, transmit a copy of these measurements to the Engineer. If the camber exceeds by 1 inch the design camber shown in the plans, , take appropriate actions in accordance with 400-7.13.1 to accommodate the product in the structure.

If the sweep exceeds the tolerance specified, take immediate measures to bring the sweep of the product back to within tolerance.

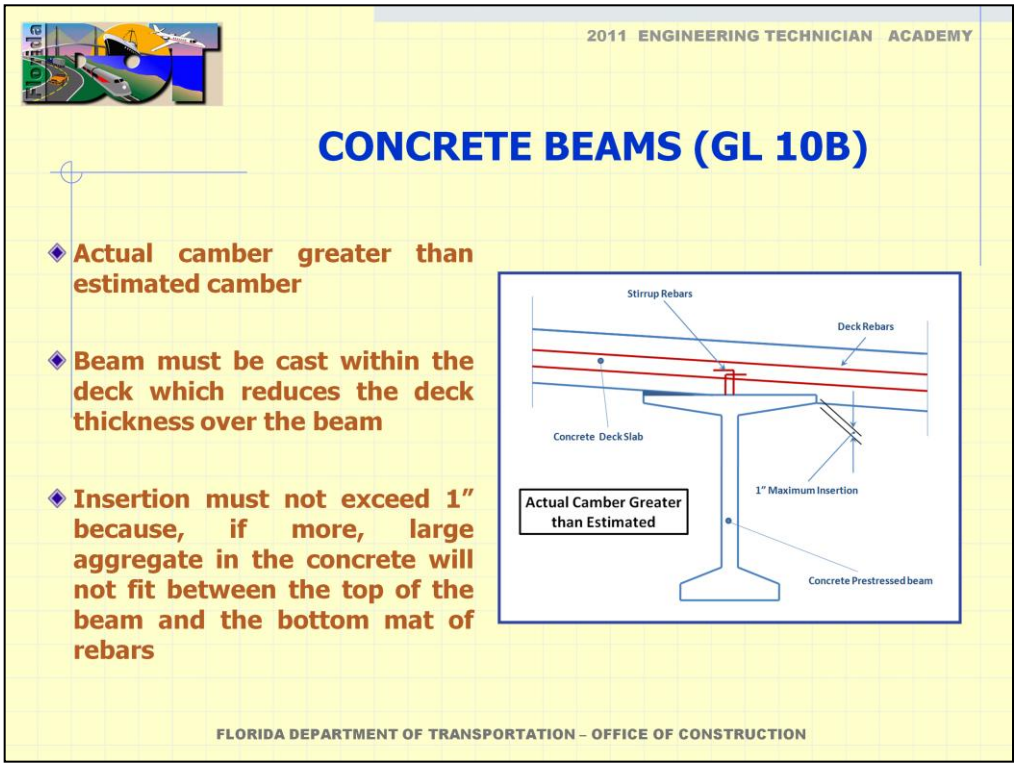
Notify the Engineer immediately when the sweep or camber exceeds the specified tolerances. Special storage conditions for the purpose of removing excessive sweep will not be restricted by requirements of this Sub article nor contained in 450-2.1. If the sweep of the product exceeds the tolerance specified and cannot be removed, the disposition of the product will be in accordance with 450-12.1 and 450-14.



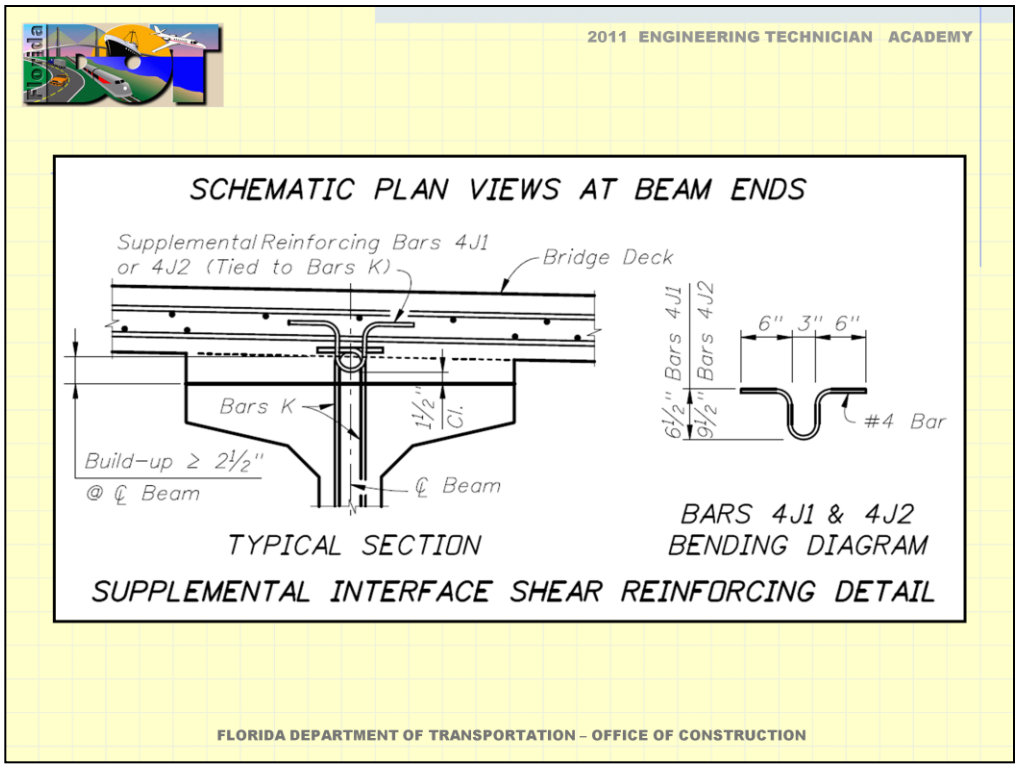
Excessively Thick Beam Buildups: Most of the time the profile grade of the deck is relatively flat compared to the degree of camber; therefore, at the beam mid span, the top of the beam touches or almost touches the bottom of the deck slab but at the beam ends it does not. There are stirrups along the entire length of the beam, and under ideal conditions all stirrups will extend into the slab to at least the bottom mat of deck rebars; however, many times the stirrups at the ends of the beam do not extend to the bottom mat but are still in the slab. Stirrups should always fully engage the deck which is very important structurally because the designer expects the beam and the slab to resist stresses together as a single unit which is referred to as composite action. The stirrups ensure that the composite action takes place and the beam will not be as strong if composite action is not fully developed.

Stirrup engagement is also important because it keeps the beam and deck connected in case of lateral impact. If the stirrups do not extend into the slab but remain in the buildup then the beam can fall away from the deck if a high lateral impact is applied as by the truck in the accompanying photograph.

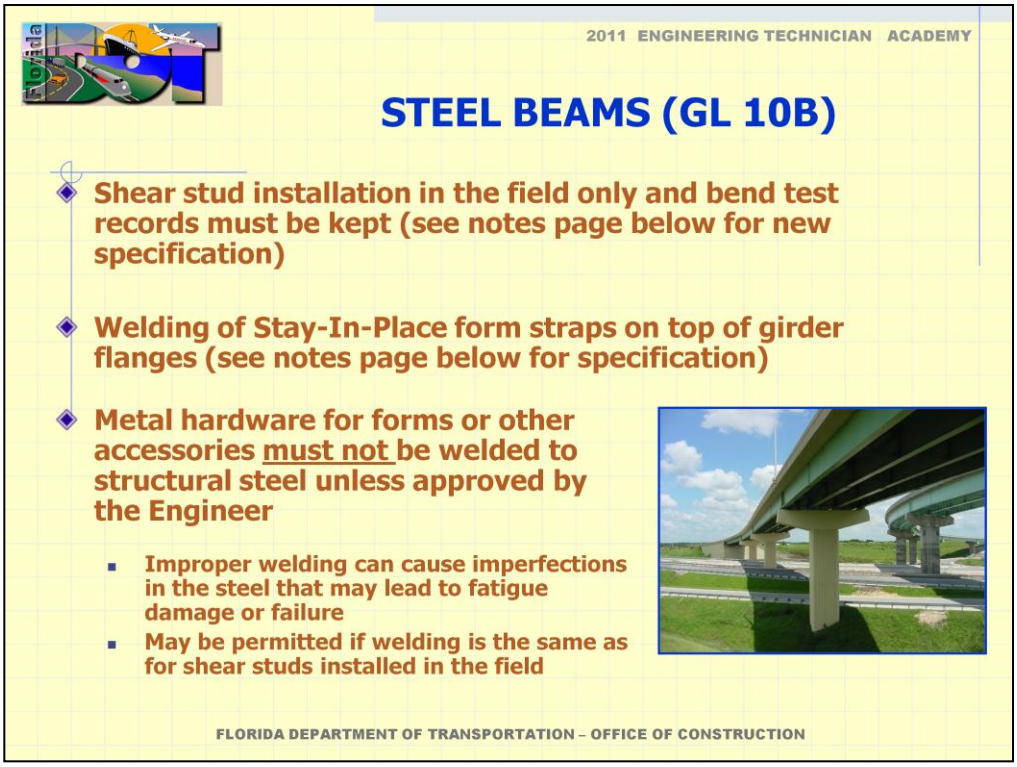

The result of lateral impact to a beam that did not have stirrups extending through the interface between deck slab and beam buildup
Beam 2-6
NB
8 13 2001



Excessive Camber: When the actual camber is much larger than the camber shown in the plans, the beam will have to be inserted into the deck which results in a deck thickness above the beam that is less then shown in the plans as can be seen in the accompanying drawing. This practice is usually acceptable if approved by the EOR but is never permitted if the beam is required to be inserted more than 1". The reason for the 1" limit is because a space between the bottom mat of rebars and the top of the beam that is less than 1" will not allow large aggregates in the concrete to enter the space resulting in deficient concrete. If the 1" limit is exceeded then the deck grade must be raised, as approved by the EOR, in order to provide acceptable clearance.



When Excessively Thick Buildups are Unavoidable: A Contractor worker or a CEI inspector must monitor stirrup extension during deck forming and rebar placement by observing the distance between the top of beam and top of deck form which is the planned slab bottom. If this distance is not at least 1.5 inches less than the vertical length of the stirrup then the buildup is too thick and some corrective action is required prior to concrete placement. If the buildup is too thick by a small amount then with the EOR's approval, the horizontal legs of the stirrups can be bent up at a 45 degree angle if the resulting additional extension into the deck will be adequate as determined by the EOR. When the buildup is too thick to be corrected by bending the stirrup legs then additional reinforcing bars that will extend the stirrups, as shown in the accompanying drawing, will be required and must be approved by the EOR. The stirrup extensions (2 sizes are available) are tied to the existing stirrup tops which results in a correctly positioned stirrup extension in relation to the bottom mat of deck rebars.



Specification 502-1 Description

Furnish and install welded shear connectors on steel beams and girders at locations shown in the Contract Documents. Field weld shear connectors located on the top flange only after the deck forms are in place. Installation of shear connectors in the fabrication plant is not permitted.

Specification 400-5.7.1, Stay-In-Place Metal Forms

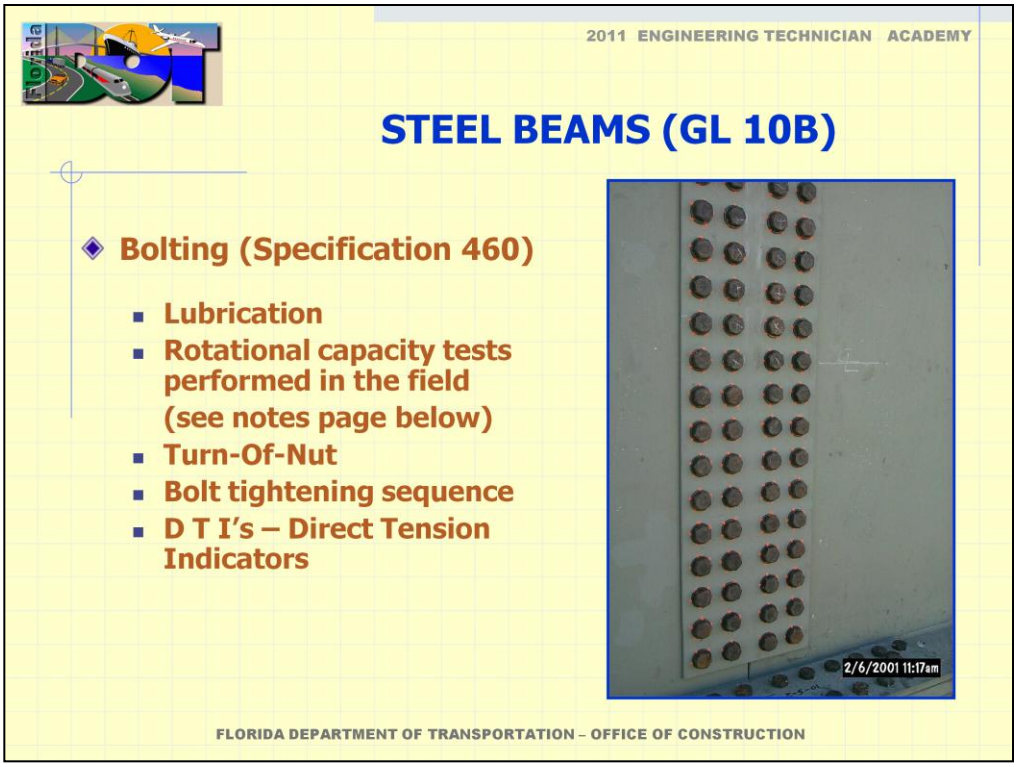
Protect structural steel components from damage by using a shield to guard against weld splatter, weld overrun, arc strikes, or other damaging effects of the welding process. Upon completion of welding, rest the metal form support flush on the supporting steel component. Should any weld spatter, weld overrun, arc strike, or other effects of the welding process be evident or occur to the structural steel component, immediately stop in-place welding of the metal form supports for the remainder of the work. In this event, weld all metal form supports off of the structure and erect the forms after prefabrication, or use an alternate approved method of attaching the form supports. Remove improper weldment, repair the supporting steel component for any improper welding. Perform all required verification and testing at no expense to the Department and to the satisfaction of the Engineer.

STEEL BEAMS (GL 10B)

Specification 6-5.2, "Buy America Policy"

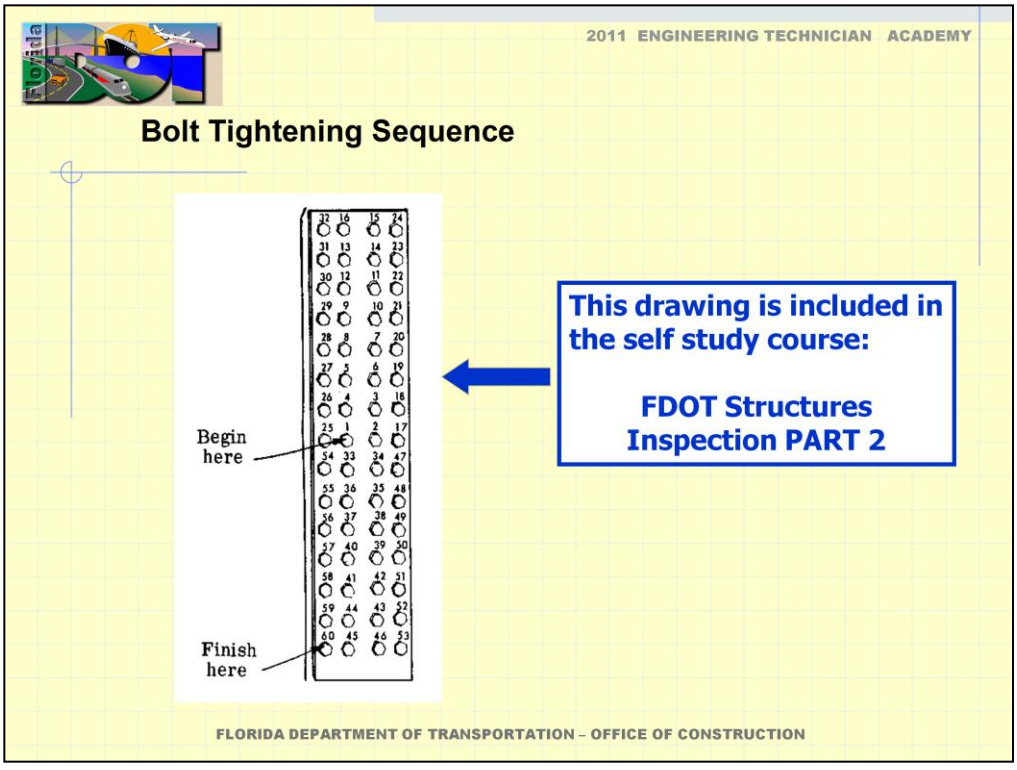
- This article has not been well understood in recent years
- Steel products used on Federal-aid projects must not only be produced in the United States but they must also be fabricated and assembled in the United States
- The only exception is for products that do not exceed 0.1 % of the total contract amount or $2,500.00 whichever is greater
- The following FHWA website provides excellent "Buy America Policy" guidance in a question and answer format: http://www.fhwa.dot.gov/construction/contracts/buyam_qa.cfm

Broadway Bridge, Daytona Beach
Exception Aesthetics

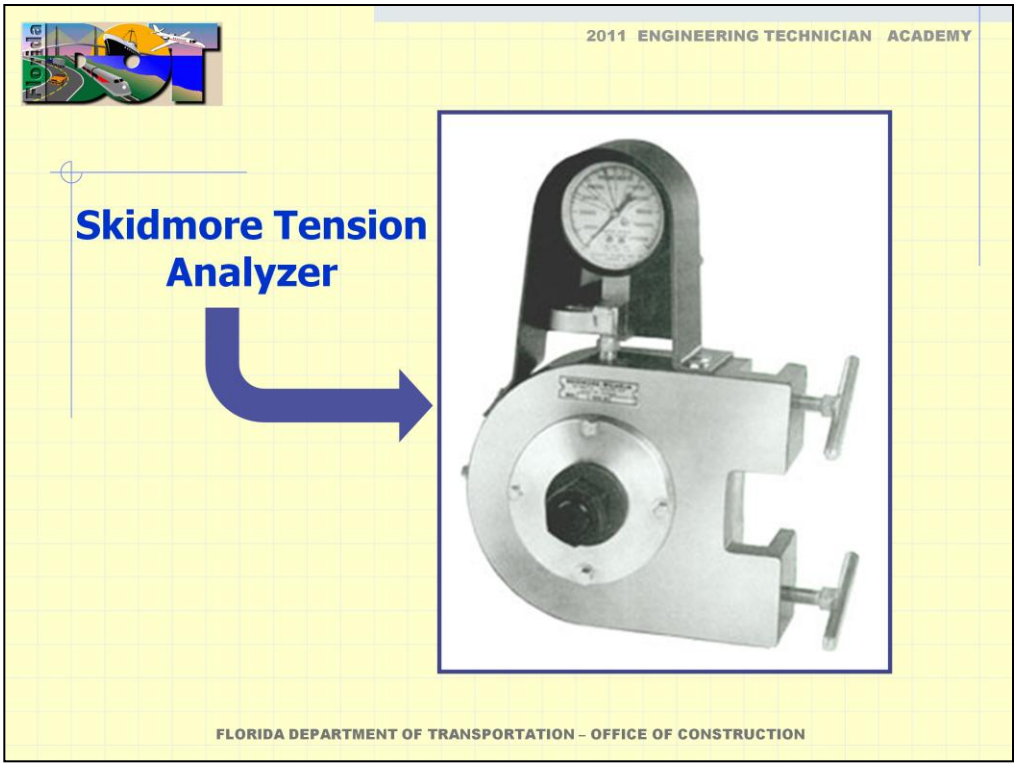


460-5.2.1 Rotational Capacity (RC) Tests

At the location of and prior to installation of permanent high-strength fasteners in main or primary load-carrying member connections, perform RC tests in accordance with Florida Method FM 5-581 (for long bolts) or FM 5-582 (for short bolts) to ensure that the fasteners are capable of developing the specified strength and that the fasteners are properly lubricated. As a minimum, test two assemblies per LOT designation. The bolt, nut and washer shall come from the same LOT and be packed in the same container (or group of containers assigned the same LOT), except in special cases where nuts and washers have only one production LOT number for each size. Short bolts may also be tested using FM 5-583 with DTI's calibrated with long bolts installed in a Tension Measuring Device. Washers are required for RC tests even though they may not be required for jobsite installation. Where washers are not required for jobsite installation, LOT identification is not required. The washer coating shall be the same as that for the bolt and nut. Perform the RC test in a manner that replicates the anticipated fastener installation the technique (e.g. If a spud wrench is to be used as a part of the installation process, use the wrench similarly for the RC test.). If any of the required tests fails, the entire LOT will be rejected.



Turn-of-Nut Tightening – Daily Snug Tight Torque Test for Bolts: Each day that bolts are being installed in a permanent structure, a test must be performed to determine what bolt torque will be needed to snug the connection. The connection is snugged or is "Snug Tight" when the surfaces of the connection plates, referred to as the faying surfaces, are in full contact with each other which requires the bolts to be tightened to a tension of between 10% and 20% of the minimum final tension. If the connection has been snugged properly then when the bolt is turned a further measured amount, that is called out in the specification, the resulting tension in the bolt will be at least the minimum required by the specification for a fully tightened bolt. The procedure used for turning the nut after snugging is referred to as the "Turn-of-Nut" method. A "Daily Snug Tight Torque Test" (Specification 460-5.4.8) is required to be performed on 5 bolt assemblies each day for each LOT and the average of 3 tests – the highest and lowest of the 5 are not used – becomes the "Daily Snug Tight Torque". The test must be performed by the Contractor's technician and must be witnessed by the CEI inspector and requires the use of a Skidmore Tension Analyzer. The correct snug tight torque for that day is determined by tightening the nut using a spud wrench or an impact wrench to a trial tension as measured by the Skidmore after which the nut receives further tightened using the Turn-of-Nut method. If the Skidmore shows a tension after the Turn-of Nut that is at or slightly above 1.05 times the minimum final tension then the trial snug tight tension is acceptable. If the minimum final tension is not produced by the turned nut then a new higher trial snug tight tension must be applied and the procedure repeated until an acceptable minimum final tension is produced by the trial snug tight tension. Once the correct snug tight tension is established then the remaining bolts must be tested using the same snug tight wrench settings or turning force used for the trial bolt. The test data for all 5 bolts must be recorded on the Contractor's form and the average of the middle 3 results will be the snug tight torque that must be used all that day.



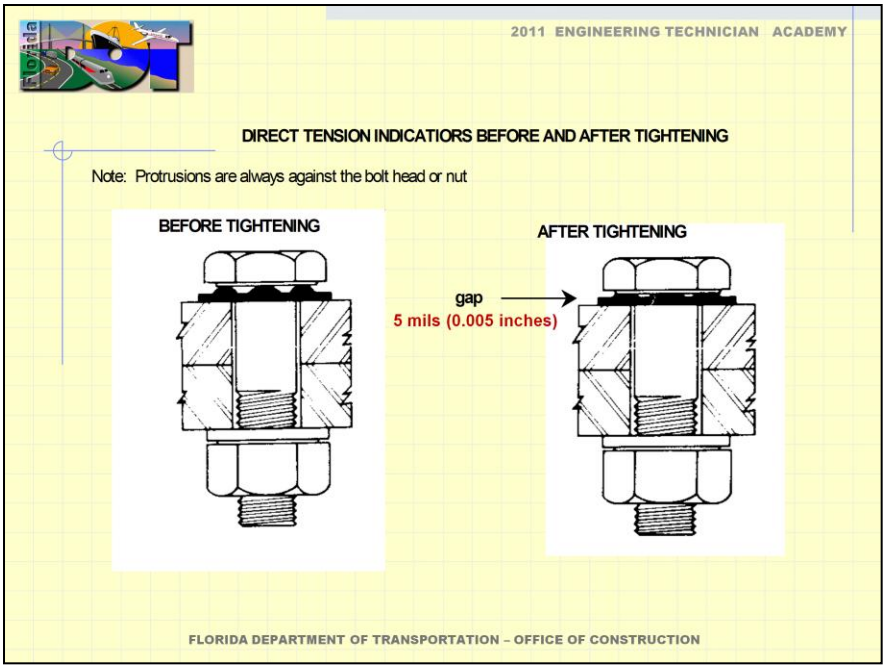
The daily snug tight torque test must be performed each day because the snug tight torque can vary significantly from day to day due to a number of factors that influence the degree of contact friction between the nut and bolt surfaces. These factors are as follows: temperature of the nut and bolt, relative humidity, smoothness and cleanliness of the contact surfaces, and degree of lubrication. A high level of bolt cleanliness and lubrication must be maintained by properly protecting the bolt assembles from the elements at all times while they are in storage.

The Contractor must record the test data (tension values, torque values, required tension, average torque, etc.) and the inspector must verify its accuracy and retain a copy for CEI project records. The SPE/PA must review the daily snug tight test procedure with the Contractor prior to the first test and the Contractor's data collection form must be reviewed for adequacy and completeness prior to use.

Once the daily snug tight torque is determined then installation of bolts in the connection can begin. The inspector must witness this process and the order in which the bolts must be tightened, referred to as the tightening sequence (see accompanying drawing on previous page) must be followed for snugging and for final Turn-of-Nut tightening. As can be seen in the drawing, the bolts at the center of the connection are tightened first followed by the bolts that are farther and farther out. Following this sequence is very important because if the connection plates are warped, this sequence will usually remove the warps as the sequence progresses. If the sequence is not followed then the warps will not be removed which is likely to result in loosening of the initially tightened bolts as the sequence progresses.

Once the Contractor is satisfied that all bolts in the connection are snug tight and that all faying surfaces are in contact then the CEI inspector must personally verify that the bolts have the correct daily snug tight torque by checking the torque of 3 bolts or 10% of the bolts whichever is larger (Specification 460-5.4.11). The photo on the next page shows an inspector performing a torque verification test on a box girder connection with hundreds of bolts. If a sample bolt fails the test then all bolts in the connection must be torque tested and the Turn-of-Nut must not be applied until all bolts are at the snug tight torque required. The CEI inspector must record the results of verification testing and this information must be kept on file in the project records.

Checking Snug Tight Tension with a Calibrated Torque Wrench

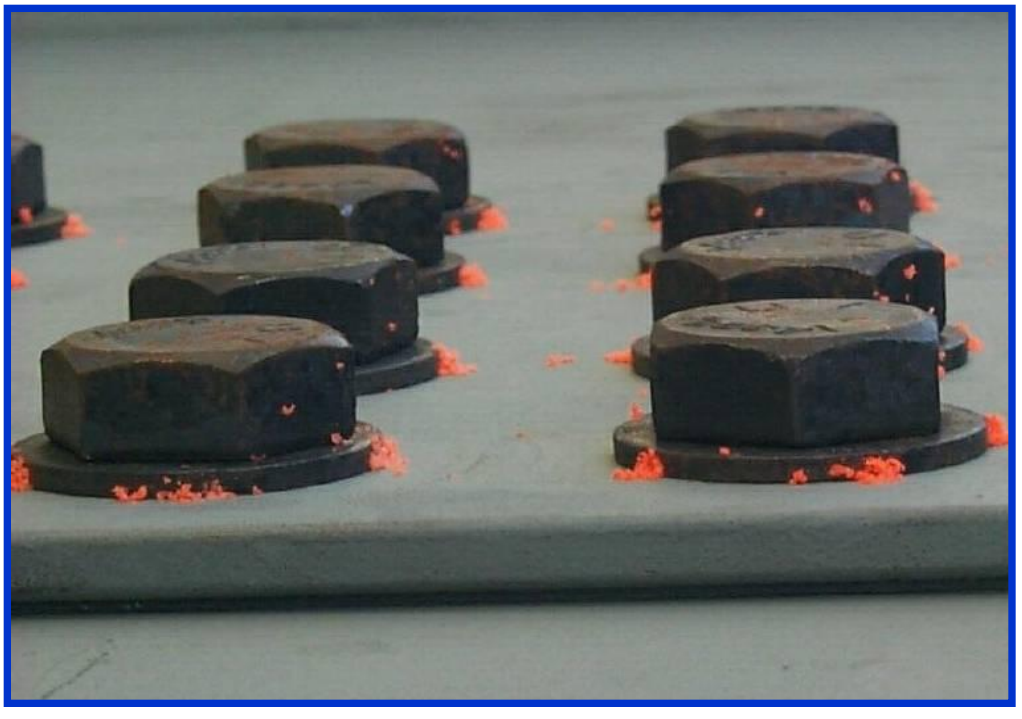


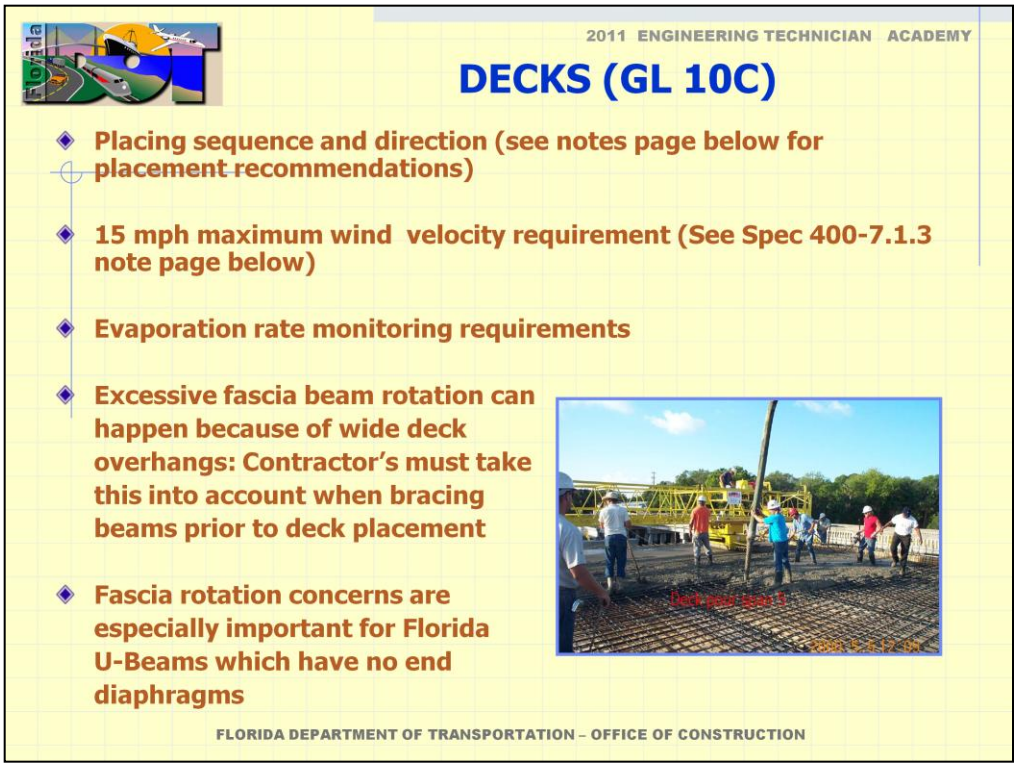
Direct-Tension-Indicator (DTI) Tightening: Another method for ensuring that bolts are tightened to the minimum tension required by the specification, other then Turn-of-Nut, is to use a Direct Tension Indicator (DTI). A DTI looks like an ordinary washer except that its surface has a number of protrusions as seen in the accompanying photo. The DTI is placed between the bolt head and the plate with the protrusions against the bottom of the bolt head as seen in the accompanying photo. Prior to tightening the nut, there is an initial gap between the bottom of the bolt head and the top of the DTI because of the protrusions. As the nut is tightened, the protrusions are crushed which reduces the initial gap and when it is not more than 5 mils, as determined by a feeler gage, then the minimum bolt tension has been achieved. The gap may be less than 5 mils but should never be zero since this may be an indication of over tightening.

DTI's are very accurate and can be more economical for achieving the minimum tension then is the Turn-of-Nut method because they require far less bolt installation labor since match marking and daily snug tight tests are unnecessary. A type of DTI referred to as a "Squirter" DTI has orange gel in the voids behind the protrusions as seen in the accompanying photo. When the 5 mil gap is achieved, the gel squirts out the sides of the DTI which eliminates the need for a feeler gage during the tightening process. If DTI's are used, the CEI inspector must verify each gap with a feeler gage, even when squirter DTIs are used, and the procedure for doing this is covered by Specification 460-5.4.9.2. In addition to the RC test required by Specification 460-5.2.1, an additional test is required for DTIs to verify that DTI LOTs are accurate and this is covered by Specification 460-5.2.2.

The Contractor and CEI inspector must keep appropriate records of DTI tests and of the tightening operation and these records must be kept on file. The SPE/PA must review the test procedures and tightening procedures with the Contractor prior to the first test and tightening operation and the Contractor's data collection form must be reviewed for adequacy and completeness prior to use. Many Contractors are unaware of DTIs since they are relatively new to Florida so the SPE/PA should discuss their use with the Contractor at the preconstruction conference since use of DTIs could save time and effort for the Contractor and CEI.

SQUIRTER DTI'S



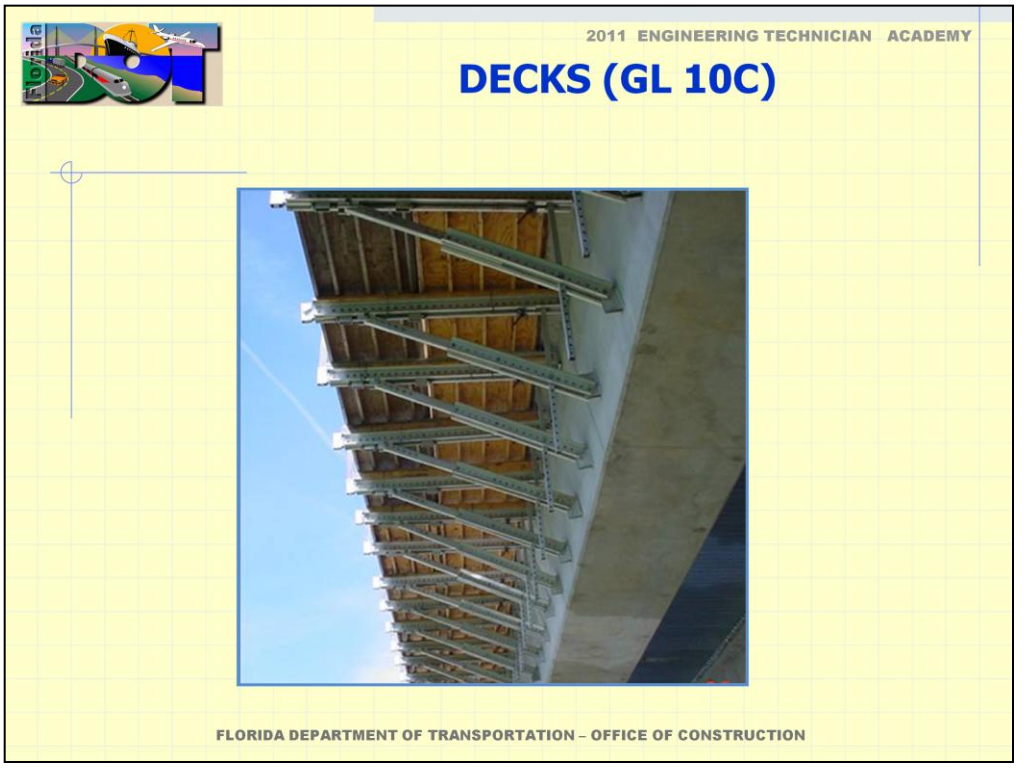


DECK PLACEMENT DIRECTION RECOMMENDATATIONS

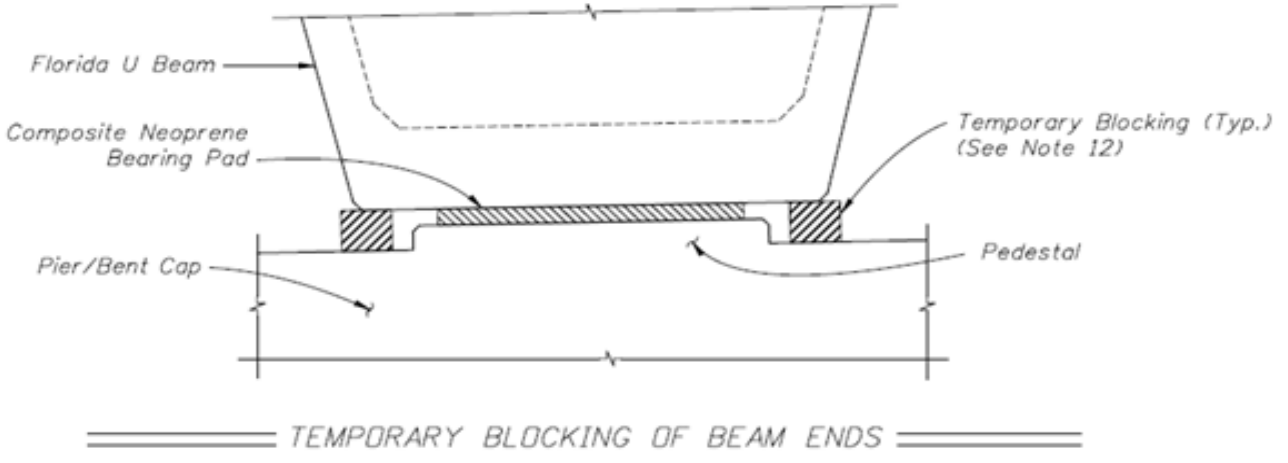
Whenever possible, deck placements that have one end that will be in contact with the face of a previously placed deck section that is cured and hard (cold joint), should begin at the end opposite the cold joint. This procedure should prevent uncontrolled tension cracks from forming in the top of the deck in the vicinity of the cold joint. The reason for this is that the beam ends rotate as the plastic deck concrete load is imposed. By ending the placement at the cold joint instead of beginning at the cold joint, all the beam end rotation generated by the concrete load will have taken place and thus tensio

400-7.1.3 Wind Velocity Restrictions:

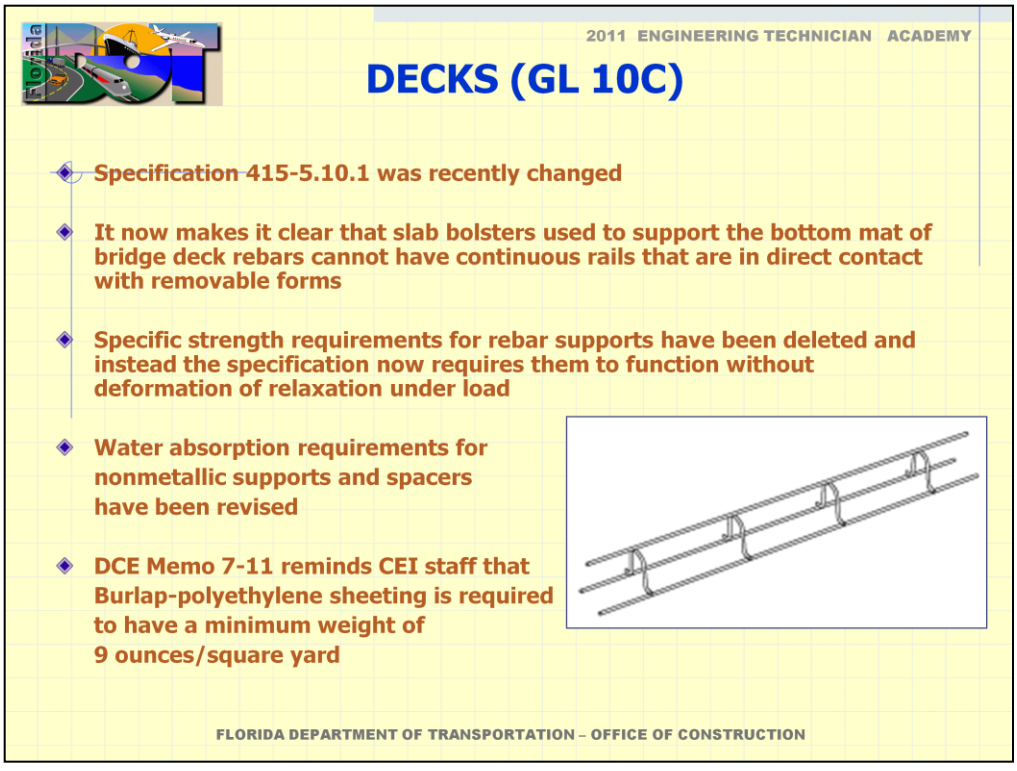
Do not place concrete for bridge decks if the forecast of average wind velocity at any time during the planned hours of concrete placement exceeds 15 mph. Obtain weather forecasts from the National Weather Service "Hourly Weather Graph" for the city closest to the project.



Standard Index 20210, U-Beam Notes (Note 12) and Blocking Detail:



Note 12: Prior to deck placement, based on the deck forming system and deck placement sequence, evaluate and provide, if necessary, temporary bracing between the U Beams. Also, prior to deck placement, provide temporary blocking under each web at both ends of every beam. Ensure the temporary blocking is adequate to resist movements and rotations that occur during placement of the deck. Leave temporary blocking and bracing in place for a minimum of four days after the deck placement.



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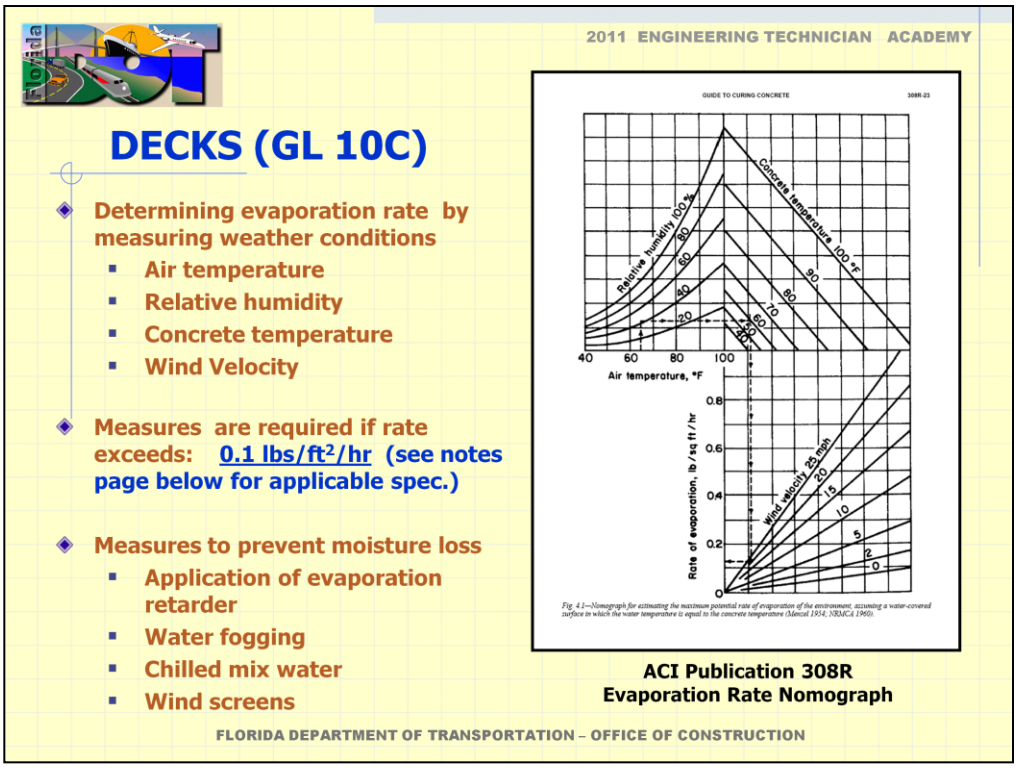


400-16.1 General:

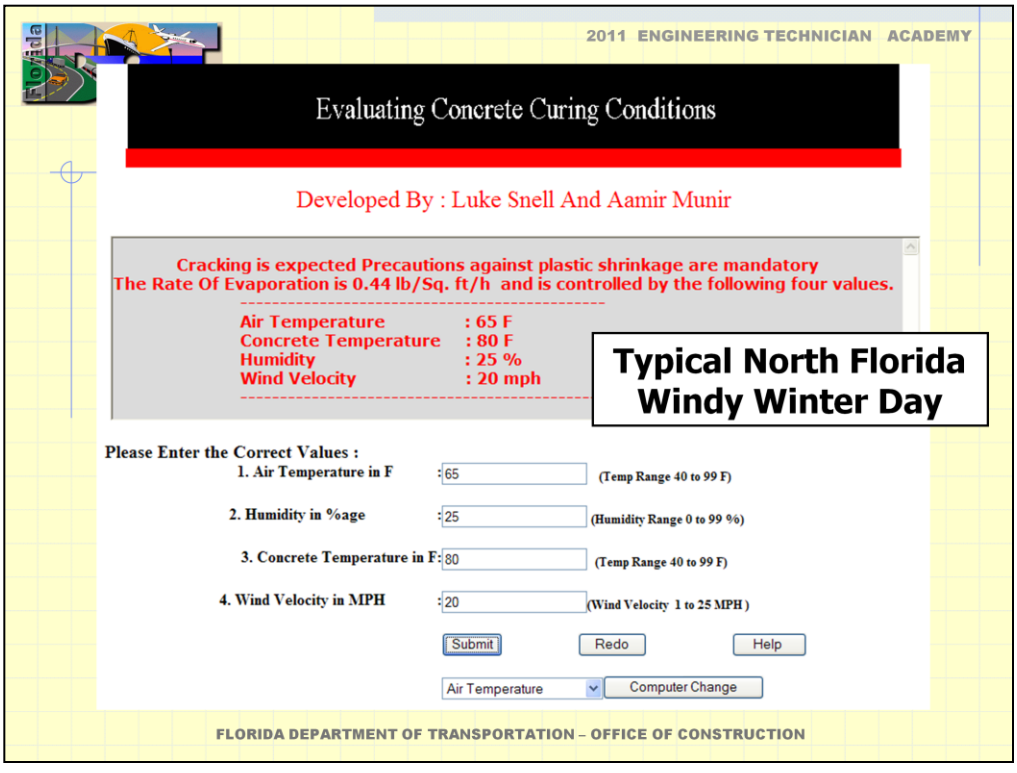
Cure cast-in-place and precast (non-prestressed) concrete as required herein for a minimum duration of 72 hours. If forms are loosened or removed before the 72 hour curing period is complete, expand the curing to cover these surfaces by either coating with curing compound or extending the continuous moist cure area.

Until curing has begun, retain concrete surface moisture at all times by maintaining a surface moisture evaporation rate less than 0.1 lb/ft2/hr. Periodically, at the site of concrete placement prior to and during the operation, measure the ambient air temperature, relative humidity and wind velocity with industrial grade weather monitoring instruments to determine the on-site evaporation rate. If the evaporation is, or is likely to become 0.1 lb/ft2/hr or greater, employ measures to prevent moisture loss such as application of evaporation retarder, application of supplemental moisture by fogging or reduction of the concrete temperature during batching. Compute the evaporation rate by using the nomograph in the ACI manual of Concrete Practice Part 2, Section 308R Guide to Curing Concrete, or by using an evaporation rate calculator approved by the Engineer.

DECKS

- Free evaporation rate calculator available on the web from Arizona State University:
  http://construction.asu.edu/cim/cimasu1/curing/curingfirstpage.htm
- State Construction Office, Structures website also has link to this site under "Technical Notices"

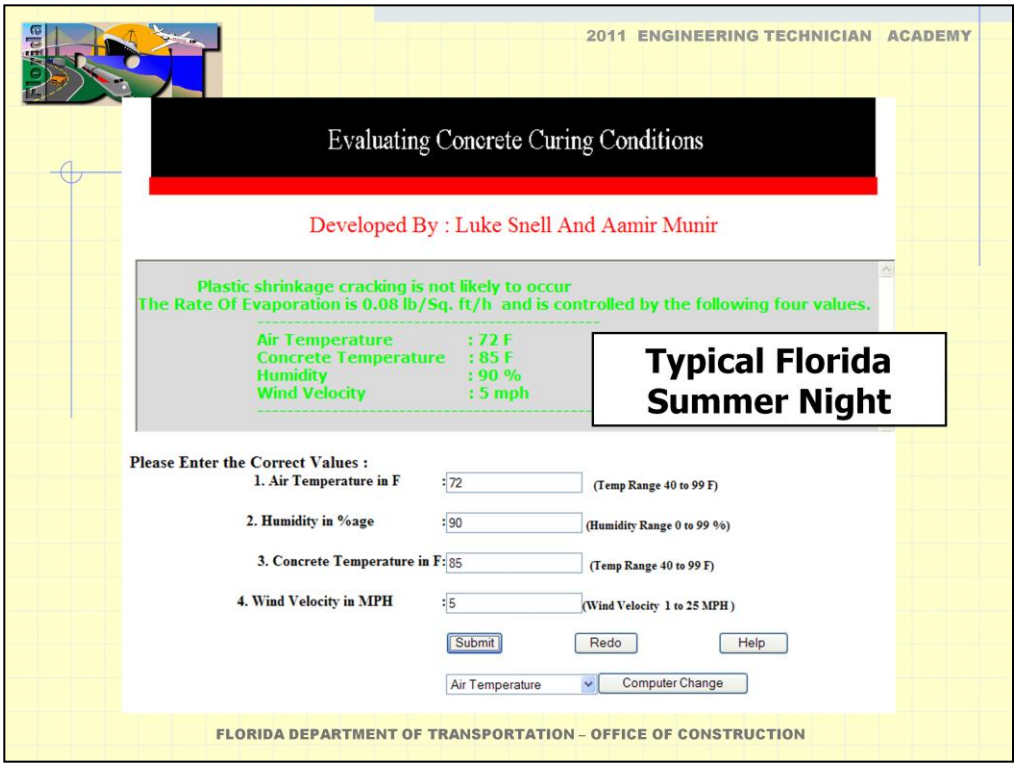
This Device Measures Evaporation Rate and Displays it Directly on the Screen



Second Ave. Bridge over the Miami River, Miami

Span 310’ Trunnion to Trunnion

Royal Park Bridge, Palm Beach, Cast-In-Place Concrete Post-tensioned Segmental Box Girder, with a Bascule Channel Span and Exceptional Aesthetic Treatments



Old (bottom of photo) and New Seven Mile Bridges, Florida Keys
Florida's Longest Total Bridge Length

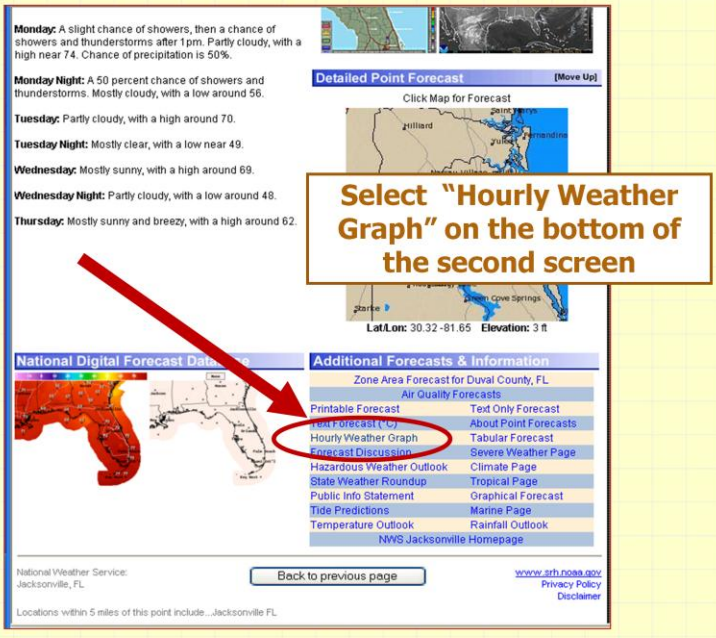
DECKS

- Weather forecasts must be obtained from the National Weather Service website
  http://www.nws.noaa.gov
- Input the name of the city closest to the project site
- Under "Additional Forecasts and Information" select "Hourly Weather Graph" to get the forecast for the next 48 hours

US 27 over the Caloosahatchee River, Moore Haven
Florida's Longest Concrete I Beam Bridge, 320 ft. span

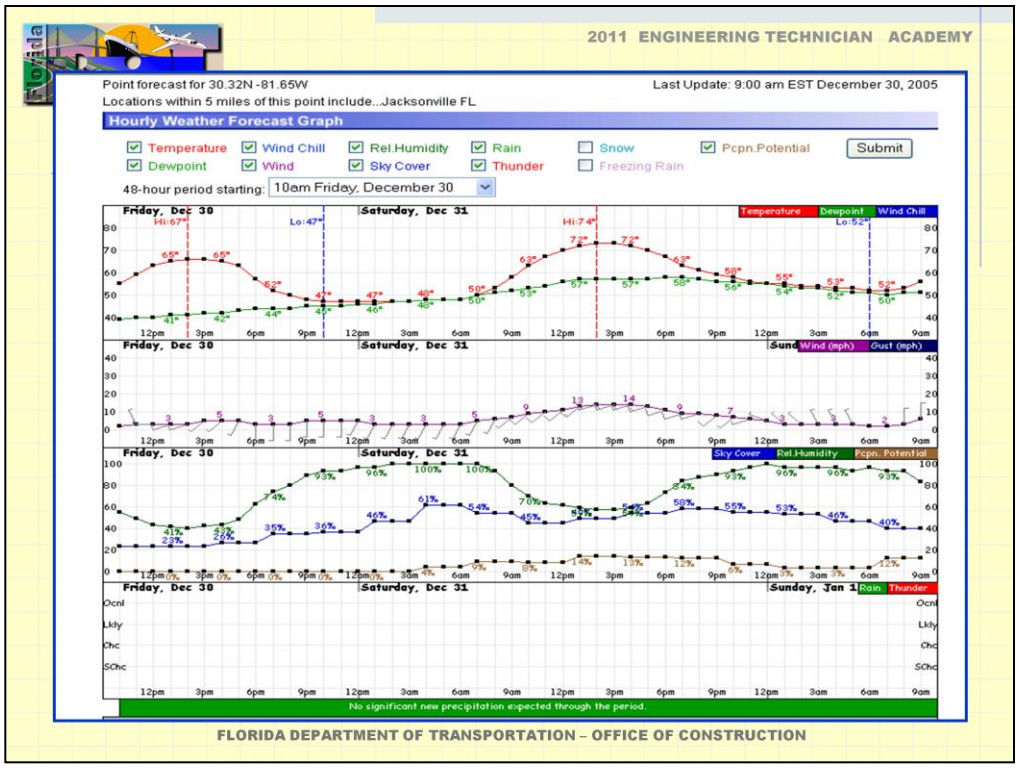
FLORIDA DEPARTMENT OF TRANSPORTATION – OFFICE OF CONSTRUCTION

Regency Bypass Flyover, Jacksonville
Longest Steel Box Girder Span at 372 ft., Box Depth - 10.2 ft.

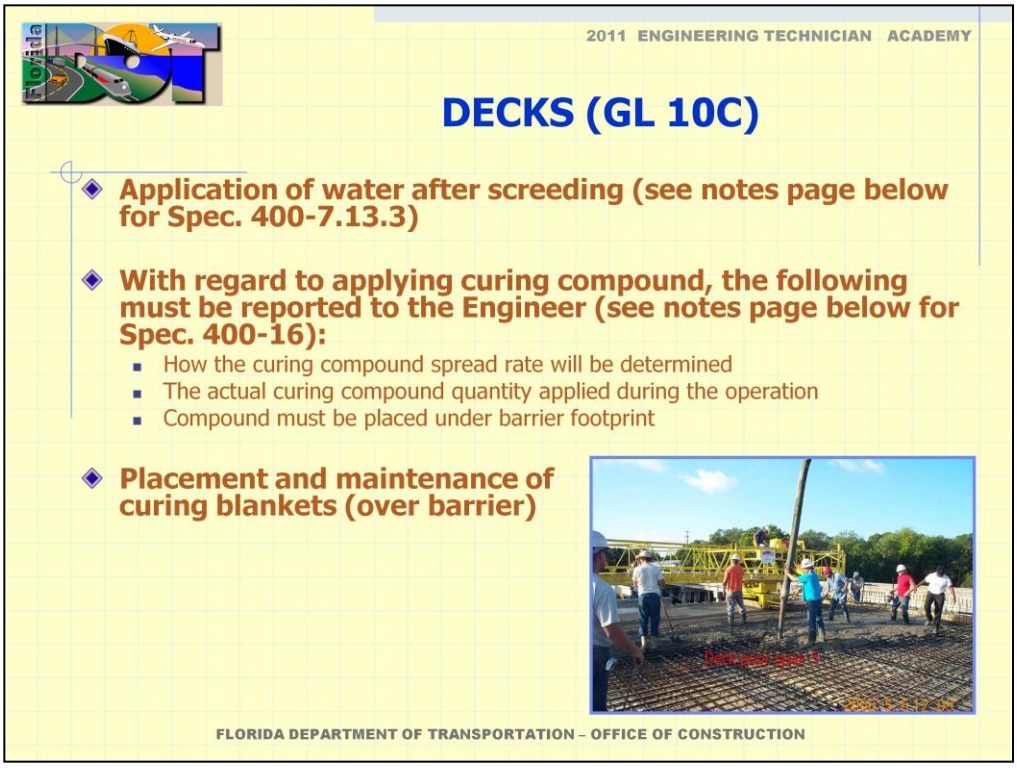


I-95 over New River, Ft. Lauderdale

Longest Steel I Beam or Plate Girder Span at 300 ft.



I-95 over Myrtle Avenue, Jacksonville
Longest Tied Arch Span at 385.5 ft.



400-7.13.3 Screeding Operations: Do not add water to the concrete surface to assist in finishing operations unless specifically authorized by the Engineer. If the Engineer permits the addition of water, apply only a fog mist, above the concrete surface, by means of approved power driven spray equipment approved by the Engineer.

400-15.2.5.3 Plastic Finish and Surface Finish for Long Bridges: Do not moisten, manually float or apply texture to the concrete surface after the screed, with attached smoothing device, has passed unless correction of isolated surface irregularities is warranted and this should be done as soon as possible after screeding while the concrete is plastic. Correct all flaws such as cavities, blemishes, marks, or scratches that will not be removed by planing.

If the Engineer permits the addition of water when correcting flaws, apply moisture to the concrete surface only if required and only in the immediate vicinity of the isolated irregularity. Apply a quantity of moisture not greater than what is needed to facilitate correction of the irregularity and apply only a fog mist, above the concrete surface, by power driven spray equipment approved by the Engineer.

400-16.2 (b) Membrane Curing Compound: Apply a white Type 2 curing compound to all surfaces at a uniform coverage as recommended by the manufacturer but not less than 0.06 gal/yd^2 (1 gal/150 ft^2).

400-16.4 Bridge Decks: Cure bridge decks for a duration of seven days. Immediately after finishing and before the concrete surface moisture evaporates, apply a membrane curing compound to the deck top surface in accordance with 400-16.2 using a compressor driven sprayer. In general, apply curing compound to concrete decks only when the surface is damp and before all surface moisture evaporates and do not apply curing compound to a surface with standing water. For Short bridges, begin applying curing compound immediately after the initially placed concrete has been floated, straightedged, textured and a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. For Long bridges, begin applying curing compound to the initially placed concrete as soon as a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. However, for both Short and Long bridges, the elapsed time between the initial placement of deck concrete and the completed application of curing compound must not exceed 120 minutes. The 120 minute limit may be extended by the Engineer if project specific factors (cool temperatures, high humidity, retarding admixtures, etc.) are prolonging wet surface conditions.

Prior to the first deck placement, submit to the Engineer the method that will be used to periodically measure the gallons of curing compound applied as the deck placement progresses. Prior to the placement of each deck, submit to the Engineer the anticipated quantity of curing compound in gallons along with the corresponding square feet of deck to be covered to meet the coverage rate in 400-16.2. Compute the actual quantity of curing compound applied at the conclusion of each deck placement and submit the quantity to the Engineer. Apply the curing compound from a work platform.

DECKS (GL 10C)

- Revisions to Specification 400-5.7, Stay-In-Place (SIP) Metal Forms, Providing for the use of Polymer Laminated Components
- There are now 4 types of SIP form systems:

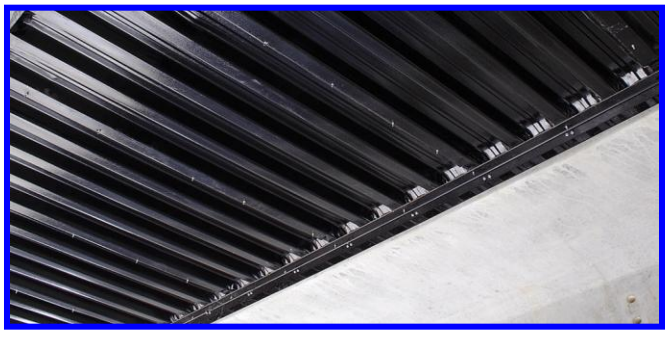
(1) Galvanized with no polymer coating

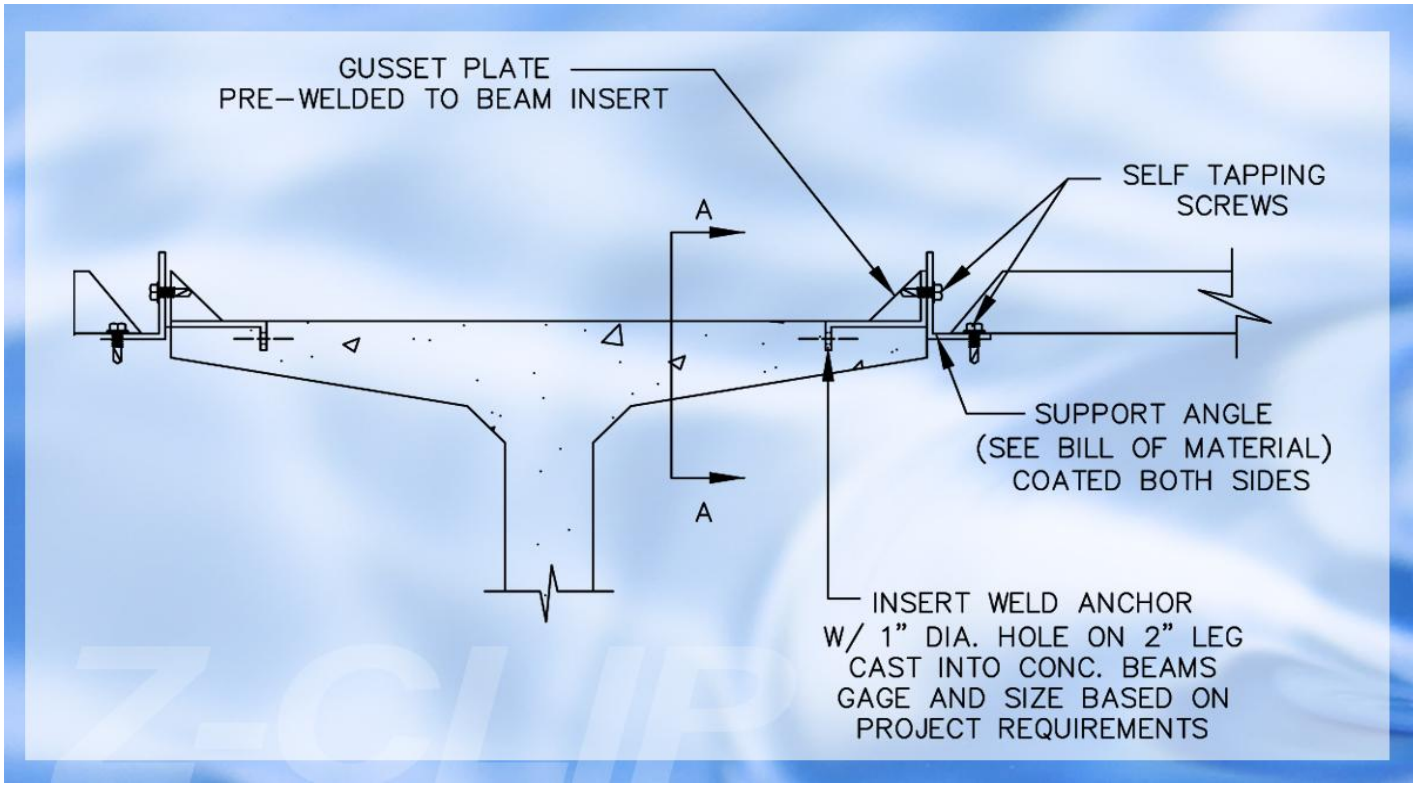
(2) Galvanized with polymer coating on the form top only

(3) Galvanized with polymer coating on the form bottom only

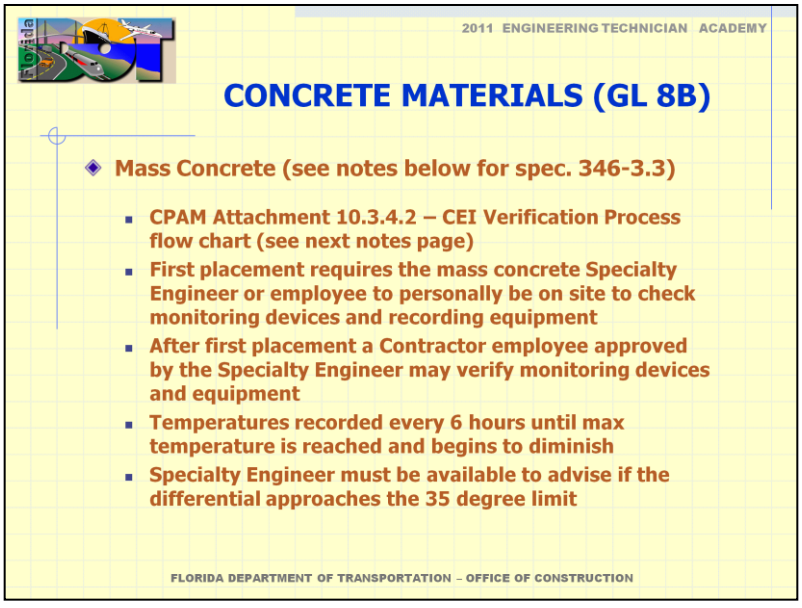
(4) Galvanized with polymer coating on both sides of the form

Note: Sheet metal plates may be used to cover the top or bottom of panels depending of environmental classification





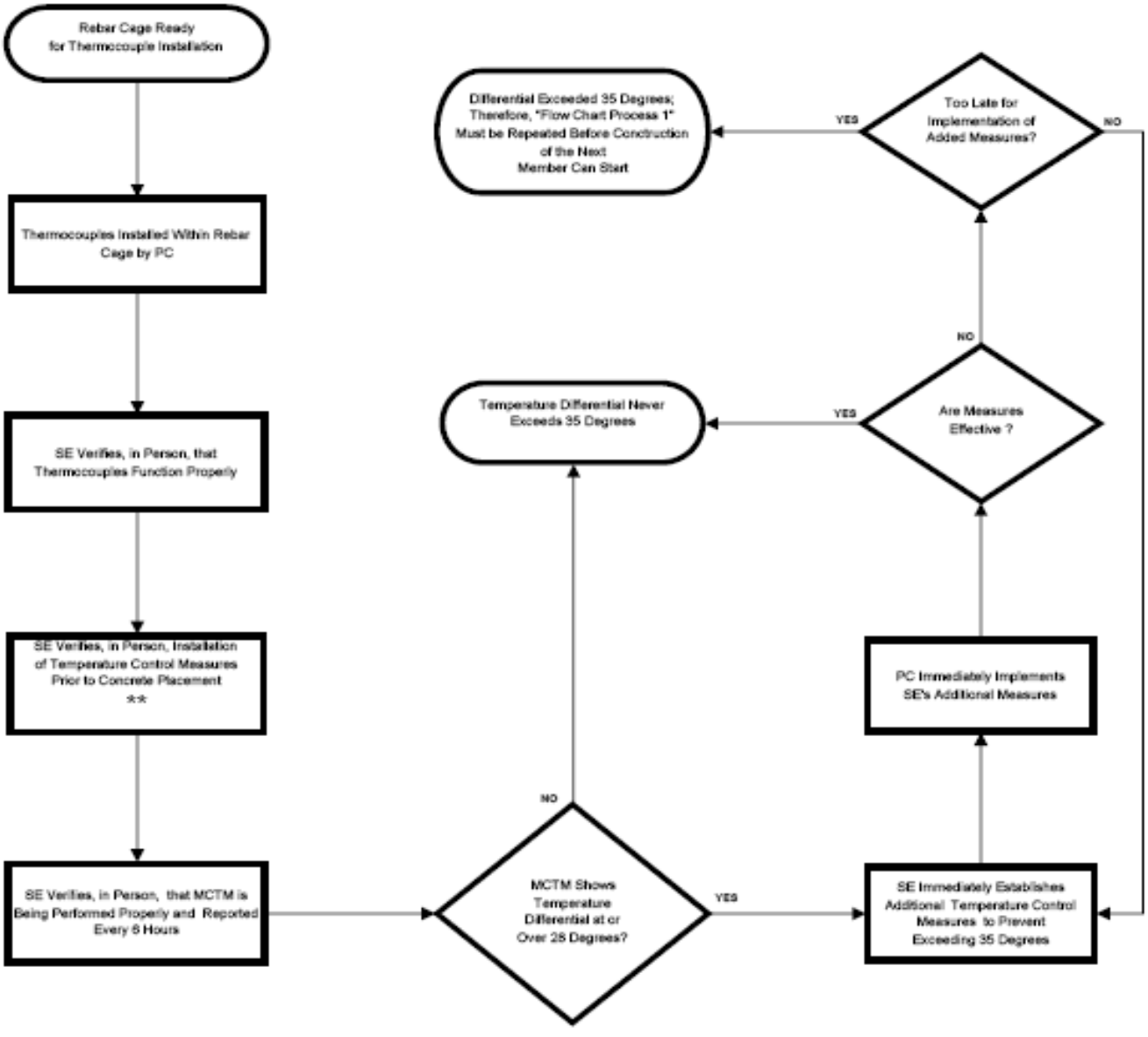
SIP Form Assembly Details



MASS CONCRETE MONITORING SPECIFICATION

346-3.3 Mass Concrete: When mass concrete is designated in the Contract Documents, provide an analysis of the anticipated thermal developments in the mass concrete elements for all expected project temperature ranges using the proposed mix design, casting procedures, and materials. Use a Specialty Engineer following the procedure outlined in Section 207 of the ACI Manual of Concrete Practice to formulate, implement, administer and monitor a temperature control plan, making adjustments as necessary to ensure compliance with the Contract Documents. Describe the measures and procedures intended for use to maintain a temperature differential of 35°F [20°C] or less between the interior core center and exterior surface(s) of the designated mass concrete elements during curing. Submit both the mass concrete mix design and the proposed mass concrete plan to monitor and control the temperature differential to the Engineer for acceptance. The Engineer will review the submittal for acceptance within ten working days of receipt. Provide temperature monitoring devices to record temperature development between the interior core center and exterior surface(s) of the elements in accordance with the accepted mass concrete plan. For the first placement of each size and type mass component, the Specialty Engineer, or a qualified technician employed by the Specialty Engineer, must personally inspect and approve the installation of monitoring devices and verify that the process for recording temperature readings is effective and accurate. For placements other then the first, designate an employee(s) approved by the Specialty Engineer as qualified, to inspect monitoring device installation, to record temperature readings, to be in contact at all times with the Specialty Engineer if adjustments must be made as a result of the temperature differential being exceeded, and to immediately implement adjustments to temperature control measures as directed by the Specialty Engineer. Read the monitoring devices and record the readings at intervals no greater than 6-hours. The readings will begin when the mass concrete placement is complete and continue until the maximum temperature differential (not maximum temperature) is reached and a decreasing temperature differential is confirmed as defined in the temperature control plan. Furnish a copy of all temperature readings to the Engineer and Specialty Engineer as soon as they become available. If the 35°F [20°C] differential has been exceeded, take immediate action, as directed by the Specialty Engineer who must be available for immediate consultation at any time, to retard further growth of the temperature differential. Use a Specialty Engineer to revise the previously accepted plan to ensure compliance on future placements. Do not place any mass concrete until the Engineer has accepted the mass concrete plan(s). When mass concrete temperature differentials are exceeded provide all analyses and test results deemed necessary by the Engineer for determining the structural integrity and durability of the mass concrete element, to the satisfaction of the Engineer. The Department will make no compensation, either monetary or time, for the analyses or tests or any impacts upon the project.

Attachment 10 - 3 - 4 - 2
CPAM SECTION 10.3 -- FLOW CHART PROCESS 2
CEI VERIFICATION * PROCESS FOR CONTRACTOR MASS CONCRETE TEMPERATURE MONITORING

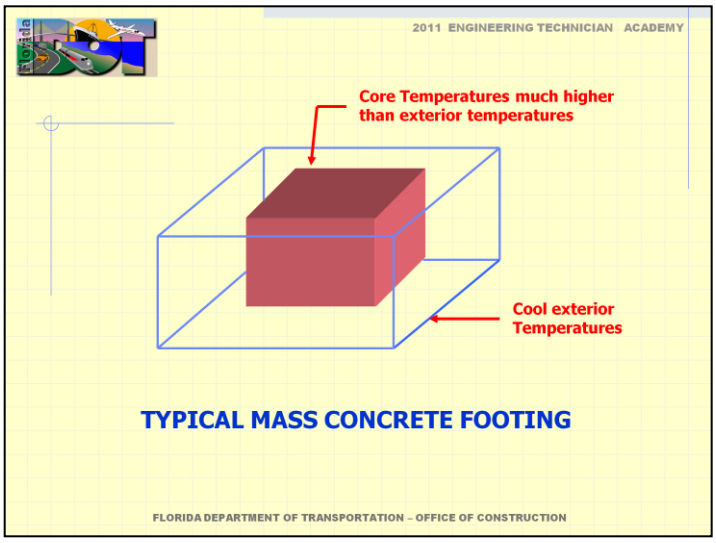


ACRONYM KEY

CEI ——— Construction Engineering and Inspection
MCTM — Mass Concrete Temperature Monitoring
PC ——— Prime Contractor
SE ——— Specialty Engineer

* Each step in this process should be verified by CEI staff

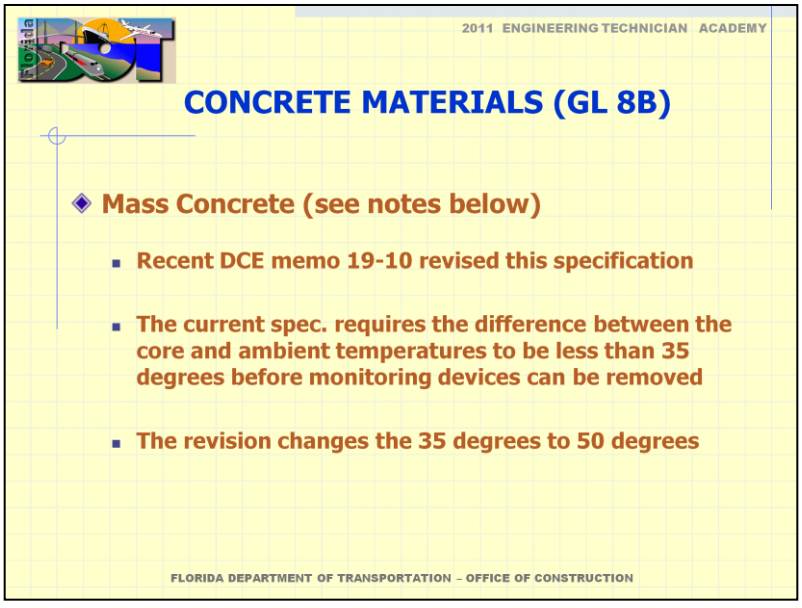
**Examples of Temperature Control Measures include insulating blankets, external heat application and cooled mixing water



Mass Concrete: This specification was revised so that it would be clear about the involvement of the Specialty Engineer in charge of developing and overseeing the implementation of the Mass Concrete Temperature Control Plan. The specification requires the Specialty Engineer to be directly involved at the project site in certain phases of the implementation, and if needed, adjustment or revision of the plan. Therefore, the SPE/PA must confirm that the Specialty Engineer is on site when required by the specification and is consulted appropriately by the Contractor when adjustments or revisions are required. This is important, since on occasion; Contractors have not implemented the plan as intended by the Specialty Engineer because the Specialty Engineer or his employee never visited the project in person for verification. The improper implementation of plans has resulted in the formation of concrete cracks. Guidance about CEI responsibilities related to mass concrete approval and monitoring processes is provided in CPAM Section 10.3.4 and corresponding Flow Charts 10.3.4-1, Mass Concrete Temperature Control Plan Approval Process, and 10.3.4-2, CEI Verification Process for Contractor Mass Concrete Monitoring.

Understanding why mass concrete is likely to crack during curing if temperatures are not controlled and how temperatures can be controlled

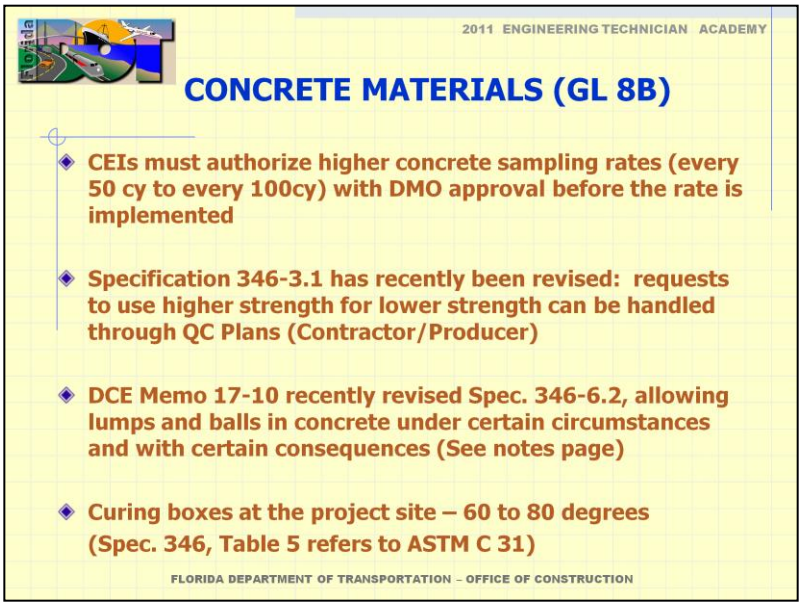
When concrete for a mass (short for massive) concrete component is placed and the curing process begins, the concrete at the core of the component heats up as a result of a chemical reaction of the cement called hydration. In the accompanying figure, the hotter core is shown as the red cube at the center of a typical footing. The blue lines represent the cooler exterior surfaces of the footing. When concrete heats up, it expands and this process of expansion continues until the core begins to cool which usually starts two or three days after concrete placement. If the degree of core expansion is too high then it will push out into the mass of cooler concrete and will cause the exterior surfaces to stretch, or puts them in tension, beyond their strength which will cause cracks. These type cracks are referred to as "Thermal Cracks." In order to prevent thermal cracks, the Contractor must hire a specialty engineer who is an expert in this field of technology and who develops a Mass Concrete Temperature Control Plan which must be approved by the Department. In the Plan, the specialty engineer tells the Contractor how to keep core temperatures from exceeding external surface temperatures by more than 35°F. The temperature difference between the core and the external temperature is referred to as the differential temperature and if it exceeds 35°F, cracking can occur. The Contractor's measures for controlling the core and surface temperatures may include all or some of the following as well as others: use of cold water to mix the concrete which keeps the core cooler; use of insulation on the exterior surfaces to keep them from getting colder; use of external heaters to keep external surfaces from cooling; and use of piping that is installed through the core to allow circulation of cool water that reduces heat buildup. The Contractor monitors the temperature differential by installing electronic temperature sensors called thermal couples in the core and on the surface of the concrete and that are attached to the rebar cage prior to concrete placement. The thermal couples are attached to an electronic reading device that is located outside of the component and which records the differential temperature at least every 6 hours. Recording can be discontinued after the differential peaks and starts to diminish and when the maximum core temperature peaks and starts to diminish. Both conditions must be satisfied before monitoring can be discontinued. The SPE/PA must verify that the monitoring process, with appropriate adjustments as needed, is being done properly and that the required monitoring records are accurate, complete, submitted on time and are kept on file in the CEI office.



DCE MEMO 19-10 MADE THE FOLLOWING CHANGES

The current specification reads as follows: ***Do not remove the temperature control mechanisms until the core temperature is within 35 degrees F of the ambient temperature.***

It has been revised as follows: ***Do not remove the temperature control mechanisms until the core temperature is within 50 degrees F of the ambient temperature.***



346-6.2 Concrete Design Mix: DCE Memo 17-10 revised this specification as follows and this specification will be updated to reflect the DCE memo in the next revision cycle:

In recognition of some challenges facing the concrete industry with regard to the production of high slump concrete (7 inches of slump or above) that is free of lumps and balls, the Department will implement the following on all ongoing and future projects:

1. For all high slump concrete placements the contractor will be required to utilize a grate over the conveyance equipment to capture any lumps or balls that may be present in the mix. The grate shall cover the entire opening of the conveyance equipment and will have square or rectangular openings that are a maximum of 2 ½ inches in either direction.

2. Placement of any concrete mix that has lumps or balls is allowed to continue provided the lumps or balls are removed from the grate and discarded, all at the contractor's risk for strength gain. The Engineer, at his discretion, may make cylinders to verify the strength of the concrete.

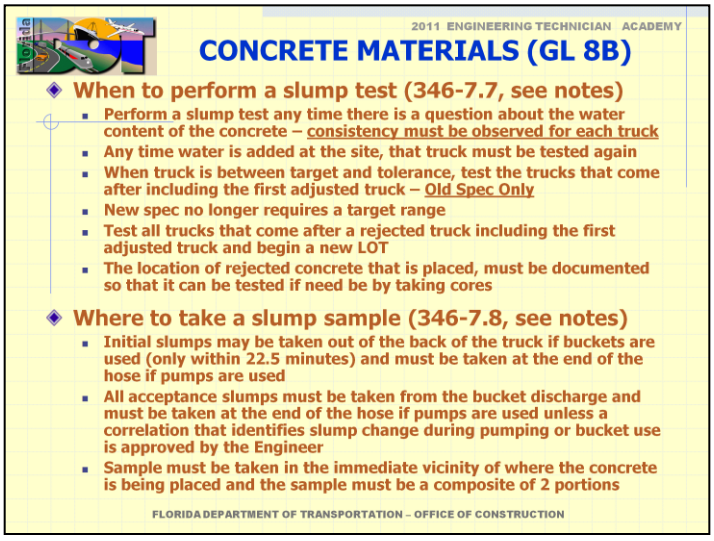
3 The Department project personnel will monitor these placements and note any lumps and balls that are found. This information is to be reported to the District Materials Office so that Department can address the issue with the concrete producer through the Producer's Quality Control (QC) Plan.

The District Materials Office shall use the following process to evaluate and take action on concrete not in compliance with the specifications covering lumps and balls in high slump concrete;

a. If there are lumps and balls present in one truck of high slump concrete the District Materials Office will note this for future plant inspections.

b. If another truck(s) exhibits lumps and balls, the District Materials Research Engineer (DMRE) or their representative will inspect the batch plant to ensure compliance to the concrete producers QC plan, specifically that portion of the plan that addresses the batching of high slump concrete.

If subsequent trucks exhibit lumps and balls, the DMRE or their representative will notify the concrete producer that the Department will not accept high slump concrete from that production facility for any FDOT projects until the concrete producer demonstrates its ability to batch high slump concrete free of lumps and balls. In addition, that production facility will revise that portion of its QC plan that addresses the batching of high slump concrete to reflect QC improvements made. The Department will continue to work with the concrete industry on related issues concerning the allowance of additional mixing revolutions, additional time for placements, and the use of admixtures to help control concrete slump.



346-7.8 Sample Location: Describe concrete placement and sampling methods in the QCP. Obtain samples from the point of final placement.

Where concrete buckets are used to discharge concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge of the bucket. When the concrete is discharged directly from the mixer into the bucket, within 25% of the total allowable transit time before discharge of the bucket, samples may be obtained from the discharge of the mixer.

Where conveyor belts, troughs, pumps, or chutes are used to transport concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge end of the entire conveyor belt, trough, pump, or chute system.

Where concrete is placed in a drilled shaft or other element using a tremie pipe and a concrete pump, samples will be obtained from the discharge of the pump line at the location of the tremie hopper.

Where a concrete pump is used to deposit concrete directly into a drilled shaft which is a wet excavation without the use of a tremie, or other applications as approved by the Engineer, ensure the discharge end of the pump line remains immersed in the concrete at all times after starting concrete placement.

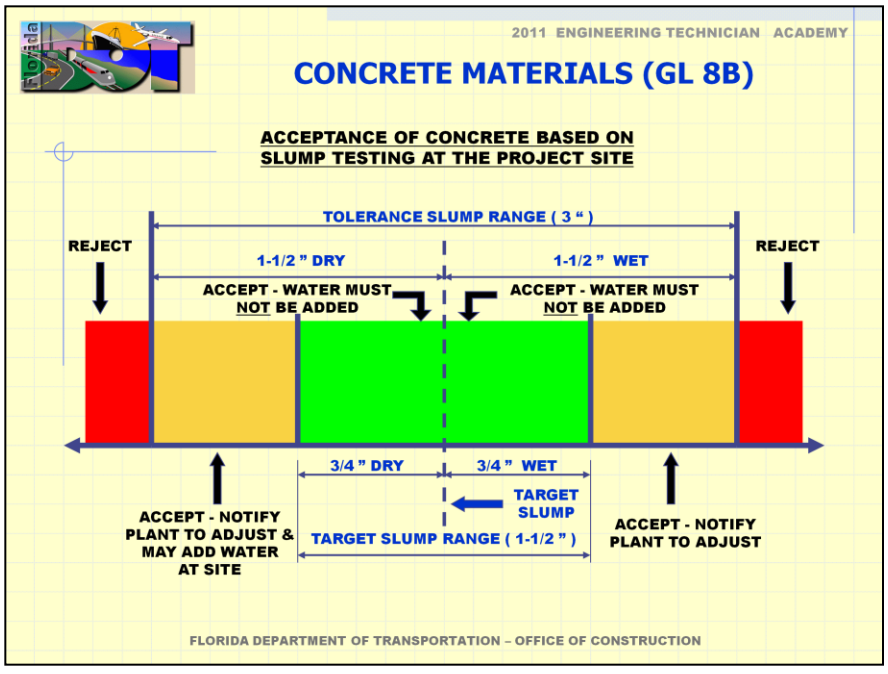
Obtain Department approval for sampling at the discharge of the mixer in lieu of sampling at the point of final placement. Use the following sampling correlation procedure when sampling at the discharge of the mixer:

a. Develop a comparative sampling correlation between the discharge of the mixer and the end of the pump line for slump and air results. Obtain one sample from the discharge of the pump line using the full length of pump line and one sample from the discharge of the mixer for five different loads. Average the five samples from each sample location and compare the two averages to establish the comparative sampling correlation. Ensure the plastic properties of the concrete sampled from the pump line are within the tolerance range.

b. Once the comparative sampling correlation is established, and approved by the Engineer, apply this correlation to the plastic properties tolerances for samples obtained from the discharge of mixer.

c. Obtain all other samples from the discharge of the mixer delivering concrete to the pump. Ensure the plastic properties of the concrete being delivered to the pump compare with the comparative sampling correlation.

d. If the ambient temperature changes by more than 10°F, or the configuration of the pumping system changes, the Engineer may require a new comparative sampling correlation..

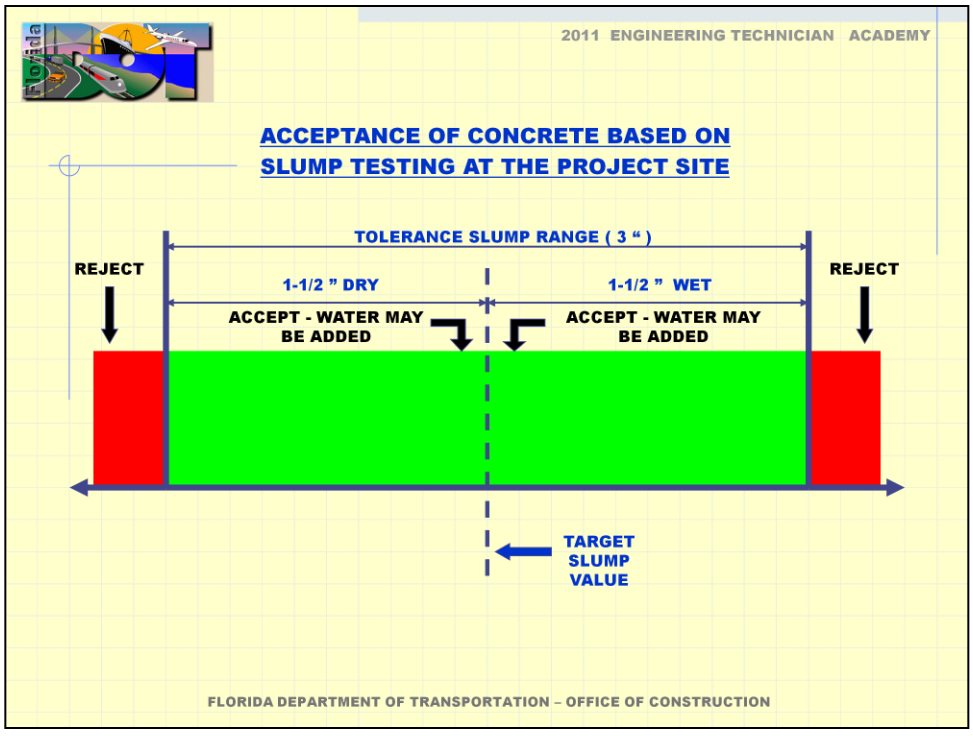


Technicians are often unsure about when to perform a slump test. The slump should be tested on the following occasions.

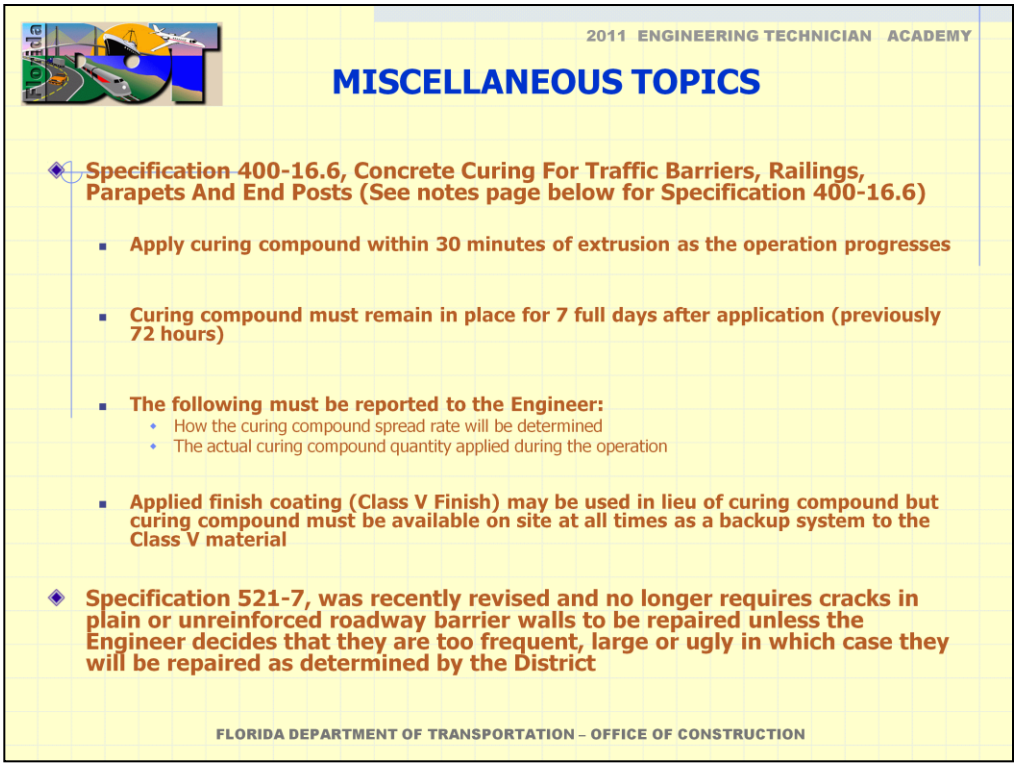
A Concrete Field Technician (CEI or Contractor) must observe the consistency of the concrete for each truck arriving at the project site as discharge begins. The technician should look for signs of excessive dryness or wetness and if in the technician's judgment, one of these conditions exists then discharge should be stopped and a slump test should be performed to verify the water content. The result of the slump test will dictate an action as shown in the accompanying chart: no water added, water added, or rejection of the load. These observations of every truck are very important because as many as 18 loads (180 yd^3 when the QC sampling rate is every 100 yd^3) of concrete could be delivered between acceptance samples that are tested for plastic properties (slump, air, temperature). Therefore, if a responsible technician is not observing each load as it arrives then as many as 18 loads could be placed but be out of target, or worse, be out of tolerance. This would happen without the Department knowing that potentially failing concrete was placed which could have significant consequences if the structure is compromised as a result.

When a concrete truck arrives at the site and if the first slump test is in the too dry amber zone (out of target dry) water may be added to move the slump into the green zone (target range). After the water is added, the truck drum must be rotated at least 30 revolutions at mixing speed and then another slump must be performed to verify that the added water had the desired result of moving it into the green zone. At the same time, the concrete plant must be notified that the mix is out of target and that an adjustment should be made to the mix that will result in concrete within the target. All unadjusted trucks that arrive at the site after the out of target truck must be slump tested since it is likely that they have out of target concrete as well and will require additional water. Finally, when the first adjusted truck arrives at the site, it must be slump tested in order to verify that the adjustment was effective. This procedure is the same for too wet amber zone slump tests except that the addition of water is not permitted.

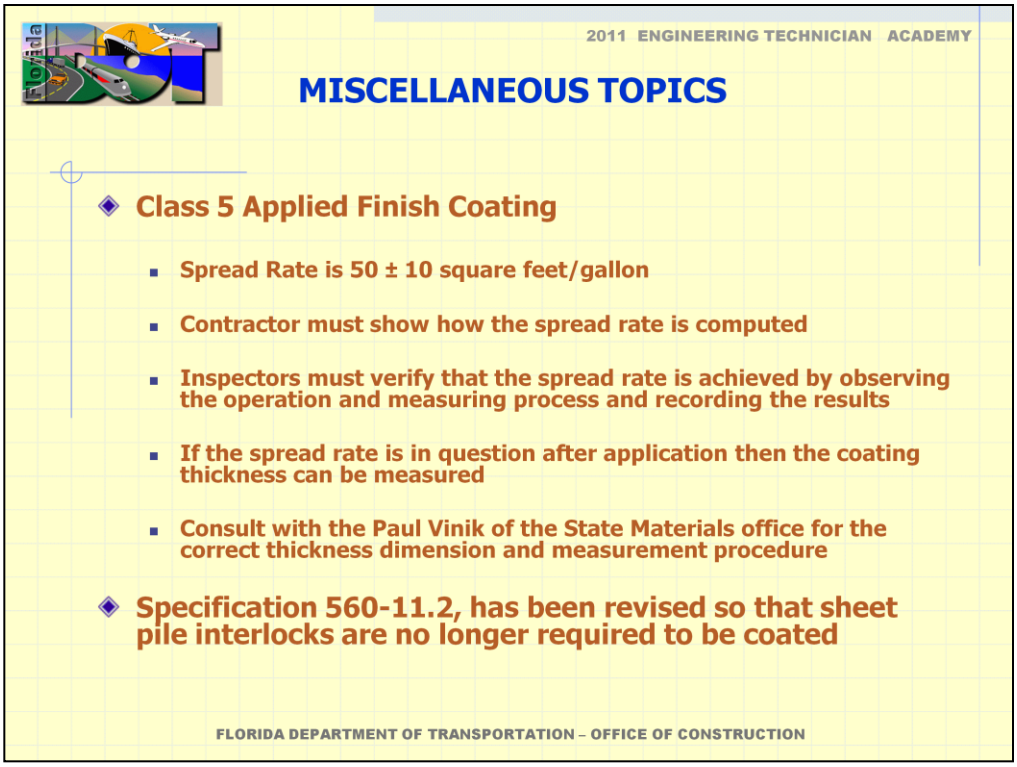
When a concrete truck arrives at the site and if the first slump test is in the too dry or too wet red zone (out of tolerance) the truck must be rejected and the plant must be notified of this and that an adjustment must be made to the mix that will result in concrete within target. All unadjusted trucks that arrive at the site after the rejected truck must be slump tested since it is likely that they have out of tolerance concrete as well. Finally, when the first adjusted truck arrives at the site, it must be slump tested in order to verify that the adjustment was effective.



Seabreeze Bridge, Daytona
Precast Concrete Post-tensioned Segmental Box Girder

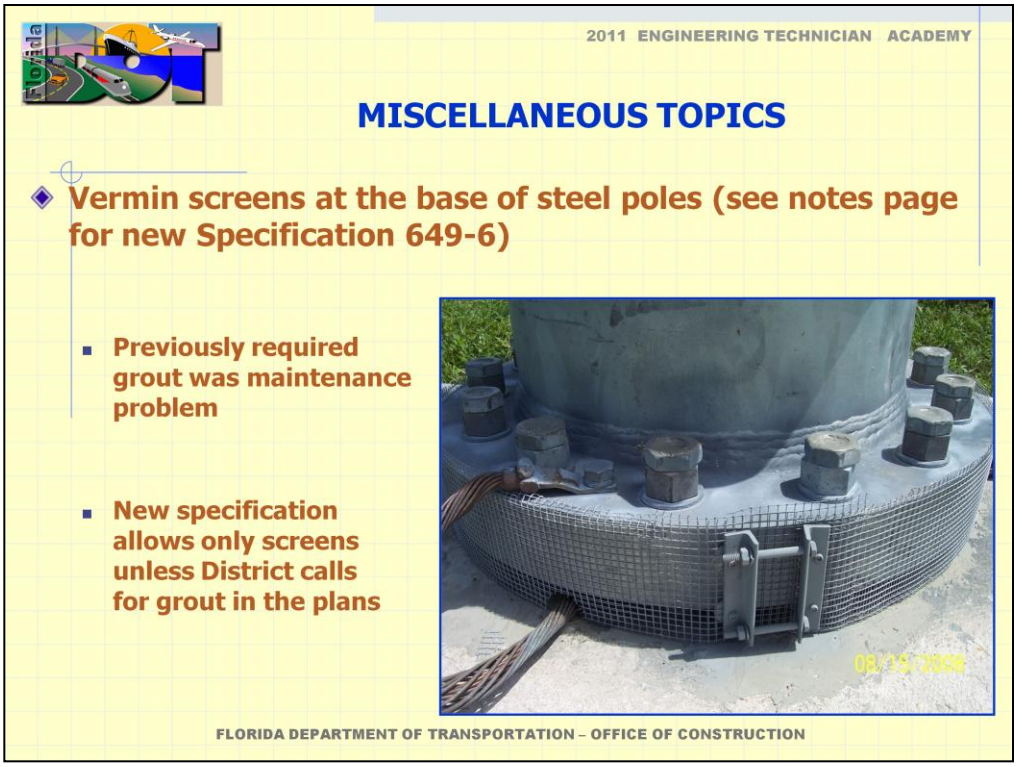


400-16.6 Traffic Barriers, Railings, Parapets and End Post: Ensure concrete is cured in accordance with 400-16.2(b). When construction is by the slip form method, coat all concrete surfaces with a curing compound that meets the requirements of 925-2, either within 30 minutes of extrusion or before the loss of water sheen, whichever occurs first. Ensure a curing compound coating period of not less than seven days after application. Prior to each concrete placement, submit to the Engineer the method that will be used to periodically measure the rate of application in gallons/sq ft. Also, prior to each placement, submit to the Engineer the anticipated quantity of curing compound in gallons that will be used to meet the coverage rate specified in 400-16.2 along with the corresponding square footage of barriers, railings, parapets and end posts to be coated with that quantity. Compute the actual quantity of curing compound that is applied during each concrete placement and submit the quantity to the Engineer. Applied Finish Coatings, that are on the Qualified Products List and that are flagged as permitted for use as a curing compound, may be used in lieu of a curing compound; If an Applied Finish Coating is used in lieu of a curing compound, have a backup system that is in full compliance with 400-16.2(b) available at all times to ensure that an effective alternative system will be immediately available if the Applied Finish Coating cannot be applied within 30 minutes of extrusion or before the loss of water sheen.



400-15.2.6.4 Application: Apply the finish coating utilizing a method recommended by the manufacturer. When applying the finish coating by spraying, supply heavy duty spray equipment capable of maintaining a constant pressure necessary for proper application. Mix and cure all coating materials in accordance with the manufacturer's printed instructions. Apply the finished coating at a rate of 50 ±10 ft2/gal.

The application rate (50 square feet plus or minus 10 square feet per gallon) for Class 5 finish coating has not always been complied with in the last few years. The duration of the service life for Class 5 finish is governed by the quantity of coating that is applied: the less coating applied the shorter is the service life assuming that proper application procedures are followed. CEI staff must verify compliance with the spread rate on all projects with coatings. Written records must be kept showing the number of gallons that were used to coat a given square footage of surface as well as the resultant spread rate in square feet/gallon. The Contractor may produce these records but their accuracy must be verified by the CEI staff. If, for any reason, the CEI staff considers the number of gallons used to be in question or if CEI staff is unable to witness the coating being taken from source containers during application then the coating thickness can be measured to confirm that it is in compliance. If the coating thickness needs to be measured, contact Paul Vinik in the State Materials Office for the determination of the minimum required coating thickness.



649-6 Screen Installation.

Install a screen that will prevent vermin from entering the gap between the bottom of the base plate and the top of the concrete foundation. Cover the entire gap with a wire screen, the bottom horizontal wire of which shall be in full contact with the surface of the concrete foundation and the top horizontal wire of which shall not extend beyond the top surface of the base plate. For the screen, use standard grade plain weave galvanized steel wire cloth with 1/2 inch x 1/2 inch mesh and 0.063 inch diameter wires. Vertical screen wires shall not extend beyond the top and bottom horizontal wires of the screen. Use one continuous section of screen with only one overlapping splice where the ends come together and overlap the layers 3 inches minimum. Attach the screen to the vertical side of the base plate with self-tapping stainless steel screws (#8-1/2 inch long) with stainless steel washers (1/4 inch inside diameter). Drill pilot holes into the base plate to facilitate screw installation. Install screws on 9 inch centers maximum and at least one screw shall be installed through the overlapping splice to clamp the layers together. Also clamp the overlapping splice layers together just above the concrete foundation with an all stainless steel fastener assembly consisting of a machine screw (#8-5/8 inch long), nut and 2 flat washers (1/4 inch inside diameter) and lock washer. Tightly clamp the screen layers between the flat washers.

649-5 Installation.

Install foundations for strain poles, mast arm and monotube assemblies in accordance with Section 455. Do not install the mast arm pole, strain poles or monotube pole until the foundation has cured for a minimum of seven days. Before erecting the pole clean the top of the foundation of any laitance, oils, grease or any other deleterious materials. Erect strain poles in an orientation which considering the rake and the application, cable forces will produce a plumb pole. Erect monotubes plumb at the time of installation. Plumb the pole supporting mast arms after the mast arms, traffic signals or sign panels have been placed.

If the traffic signals and/or sign panels are not in place within two working days after the mast arm is erected, furnish and install a 3 by 2 foot blank sign panel on the bottom of each mast arm within 6 feet of the mast arm tip and plumb the pole. Re-plumb the pole supporting mast arms after installation of traffic signals and sign panels.

Install ASTM A325 bolt, nut and washer assemblies in accordance with the following. Use bolt, nut and washer assemblies that are free of rust and corrosion and that are lubricated properly as demonstrated by being able to easily hand turn the nut on the bolt thread for its entire length. Tighten nuts to the full effort of an ironworker using an ordinary spud wrench to bring the faying surfaces of the assembly into full contact which is referred to as "snug tight." After bringing the faying surfaces to a snug tight condition, tighten nuts in accordance with the turn-of-nut method in Table 460-7 of Specification 460-5. Maintain uniform contact pressure on the faying surfaces during snugging and turn-of-nut process, by using a bolt tightening pattern that balances the clamping force of each bolt, as closely as possible, with the equal clamping force of a companion bolt.

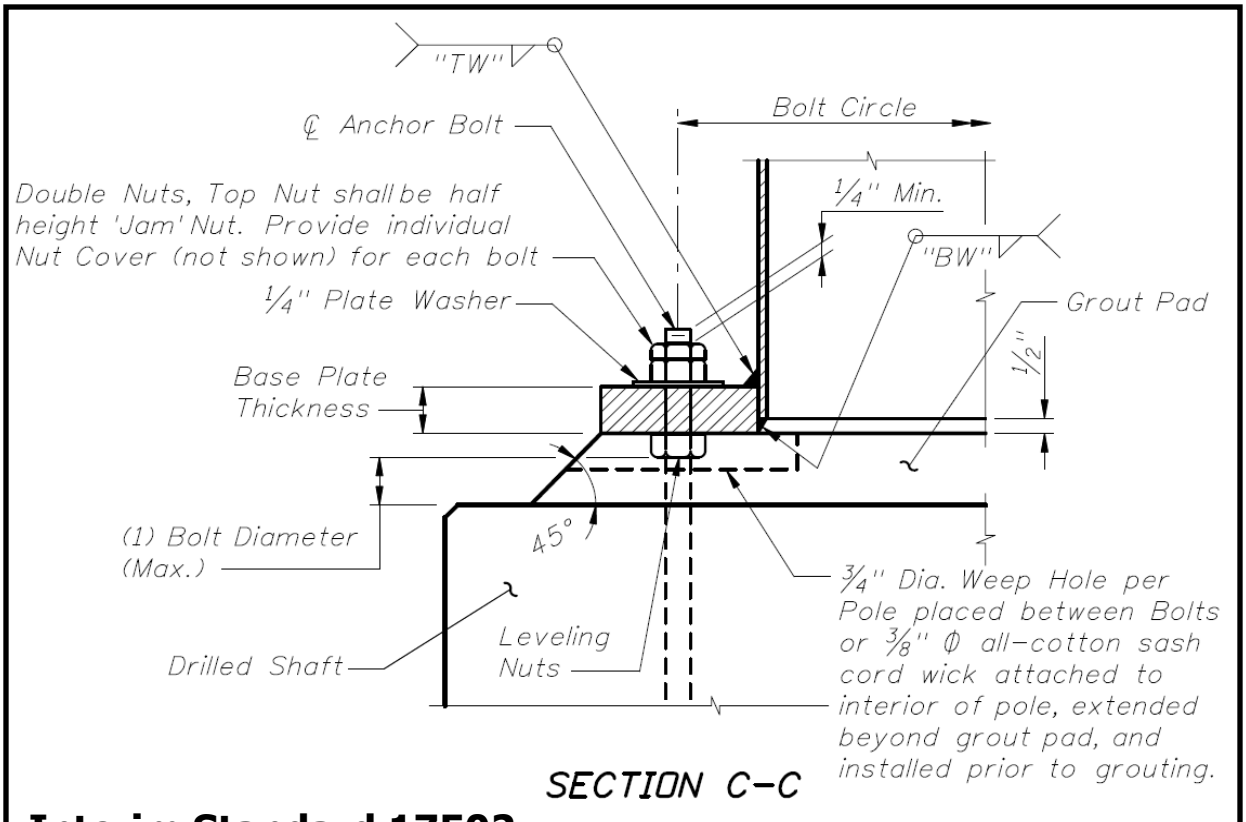
Use ASTM F1554 anchor bolt assemblies that are free of rust and corrosion, and lubricate these assemblies prior to installation so that the nut turns easily by hand the entire length of the bolt thread. Install nuts on anchor bolts in accordance with the sequence that follows.. Ensure that the base plate is level by incrementally adjusting the leveling nuts all of which must be in direct contact with the bottom surface of the base plate at the conclusion of the leveling process and. The distance from the bottom of leveling nuts to the top of the concrete foundation must not exceed one anchor bolt diameter. Tighten all the anchor bolt nuts so they are in direct contact with the top surface of the base plate and are "snug tight." Snug tight is attained by applying the full tightening effort of an ironworker using an ordinary spud wrench. If the top surface of the base plate has a slope that exceeds 1:40, use a beveled washer under the anchor bolt nut. Tighten the leveling nuts until they are snug tight. Match mark the anchor bolt nut relative to the anchor bolt to ensure that the anchor bolt nut is rotated by the fraction of a turn specified in Table A and apply the turn to the nut. Do not exceed the Table A value by more than 20 degrees. Tighten each "retainer" or "jam" nut until it is in firm contact with the top surface of the anchor bolt nut then while preventing the anchor bolt nut from rotating, tighten the jam nut until it is snug tight. During each stage of leveling nut, anchor bolt nut and jam nut tightening, use a pattern of tightening that, as nearly as possible, produces a balanced distribution of clamping forces on the base plate as tightening progresses.

Table A	
Anchor Bolt Diameter (in.)	**Nut Rotation from Snug Tight Condition**
≤ 1 1/2	**1/3 turn**
> 1 1/2	**1/6 turn**

MISCELLANEOUS TOPICS

- **Anchor Bolt Standoff Height for Base Plates**
  - **The standoff height is the distance from the bottom of the leveling nut to the top of the concrete foundation**
  - **Standoff height must not be greater than 1 bolt diameter**

Standoff height greater than 1 bolt diameter is not in compliance



Interim Standard 17502

QUALIFICATIONS

- **Requirements for Technicians Involved with Concrete Materials, grouting and post-tensioning**
  - CTQP Concrete Field Technician - Level I
  - CTQP Concrete Field Inspector - Level II
  - CTQP Grouting Technician - Level I
  - CTQP Grouting Technician - Level II
  - CTQP Post-Tensioning Technician - Level I
  - CTQP Post-Tensioning Technician - Level II
- All these technicians take courses that are offered by agencies that are not connected with CTQP such as ACI, PTI, and ASBI and that issue certifications for successful completion
- Even though technicians are certified by these agencies they are **not** considered qualified for FDOT work until they go through the extra step of getting qualified by CTQP
- If their qualification is not on the CTQP website then they are **not qualified** and this applies to CEIs and Contactors

The Bridge of Lions, Saint Augustine Historical Bridge

The Most Famous Florida Bridge

Sunshine Skyway Bridge, St. Petersburg
Cable Stayed with Precast Concrete Post-tensioned Box Girder Superstructure

Second Longest Main Span in Florida: 1,200 ft.

Second Longest Total Bridge Length: 4.14 miles

Most Lane Miles: 16.6 miles