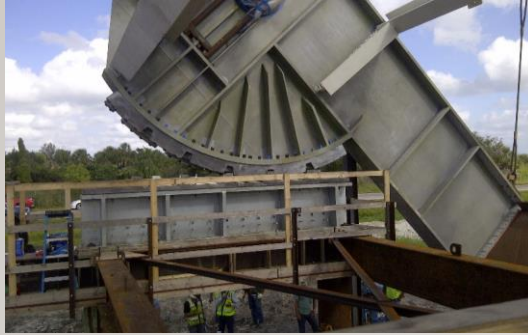




2025 CONSTRUCTION ACADEMY STRUCTURES SESSION





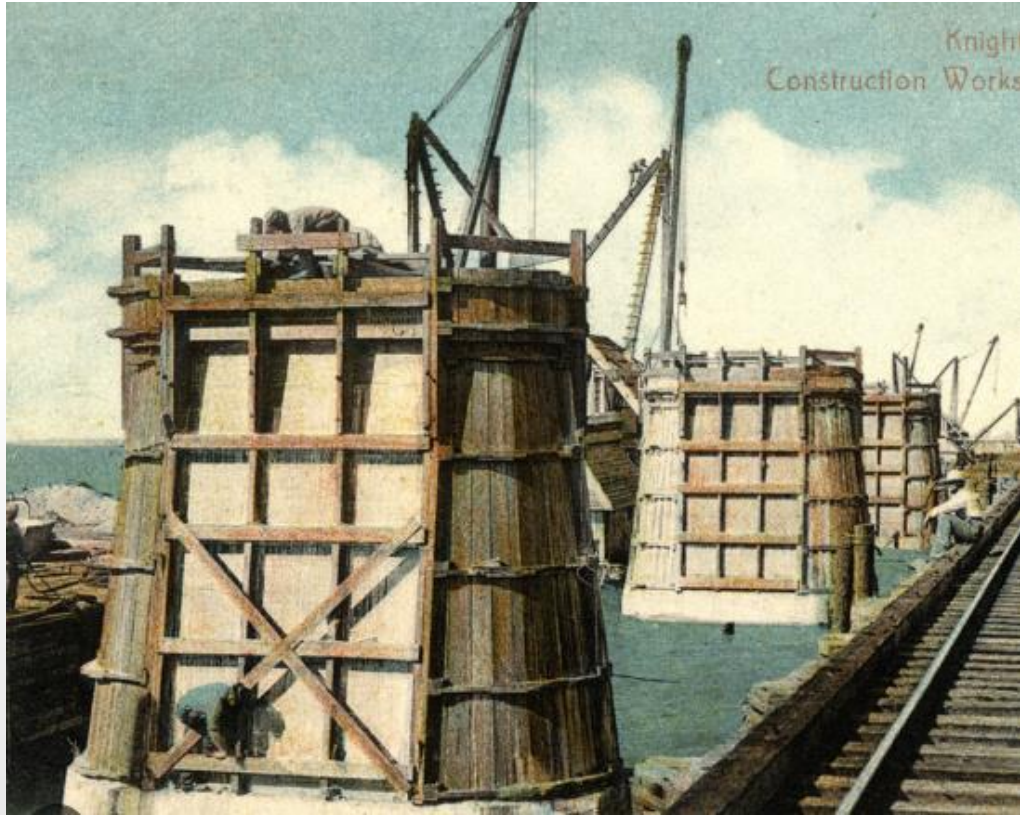
PURPOSE

- Target Audience: FDOT staff & Consultant Project Administrators
- Educate about structures construction
- Review Specifications and CPAM
- Review and Incorporate lessons learned



IMPORTANT TERMS & DOCS

- Construction Project Administration Manual (CPAM)
- Standard Specifications for Road and Bridge Construction (Division I and II)
- FDOT Self Study Courses (Structures Inspection and Critical Construction Issues)
- EOR, CEOR, Department Approved Specialty Engineer, Engineer



CPAM SECTIONS

- 8.4 – Shop and Erection Drawing Process
- 8.11 – Contractor Initiated Submittals
- 10.2 – Prestressed/Precast Concrete Components
- 10.3– Concrete Construction
- 10.4 – Coatings & Asbestos Removal, Handling and Disposal and Structural Steel Coating Issues
- 10.6 – Underwater Bridge Construction Inspection
- 10.7 – Post-tensioned Bridges
- 10.9 – Structural Steel & Miscellaneous Metal Components
- 10.10 – Bridge Construction Issues that Must Involve State Construction Office Staff
- 10.11 – General Structures Construction Issues

CPAM 8.4 SHOP AND ERECTION DRAWINGS PROCESS



- Nine (9) Item Shop Drawing Tracking Log (number, status, status of EOR review, etc.)
- Schedule of submittals required within 60 days of the start of contract
- At weekly progress meetings Contractor reports latest shop drawing priorities, updates
- EOR QC checkpoints required

11. Shop Drawings: A shop drawing is a drawing or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator for prefabricated components. Shop drawings also include all working drawings, erection plans, associated trade literature, material cut-sheets, calculations, schedules, erection manuals, geometry control manuals and other manuals and similar documents submitted by the Contractor to define some portion of the project work. The type of work includes both permanent and temporary works as appropriate to the project.

CPAM 8.4 SHOP AND ERECTION DRAWINGS PROCESS

Table 5-1 Submittal and Review Requirements						
Shop Drawing for:	Originated by Specialty Engineer Not Signed and Sealed	Originated by Detailer Not Signed and Sealed	Originated by Specialty Engineer Signed and Sealed	Originated by Contractor's EOR Signed and Sealed	Requires Review, QA/QC Check prints and disposition stamp by Design EOR	Requires Construction IPR and signed and sealed Certification Letter
Steel Fabrication Drawings		Originator			Reviewer	
Steel Erection Plan			Originator		Reviewer	
Geometry Control Manual				Originator	Reviewer	
Segmental Erection Manual				Originator	Reviewer	Reviewers

SPECS 5-I.4.2 SHOP DRAWINGS SUBMITTAL AND REVIEW REQUIREMENTS

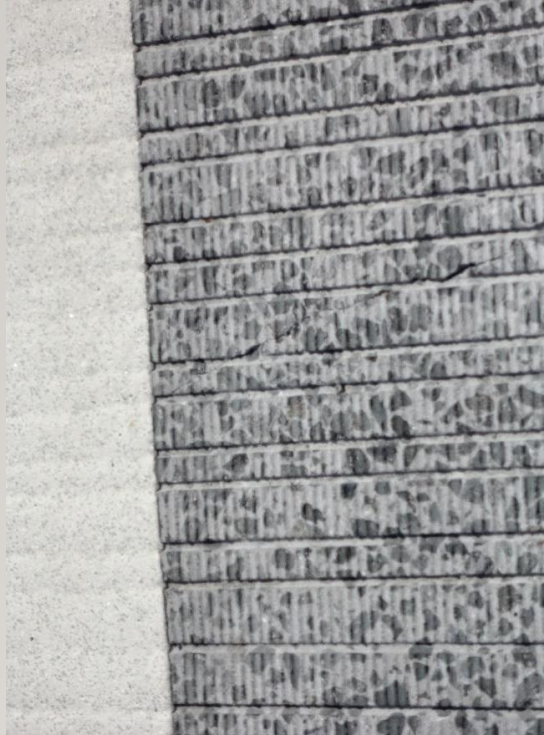
CPAM 8.11 CONTRACTOR INITIATED SUBMITTALS

- Categories of Submittal:
 - Request for information (RFI)
 - Request for Correction (RFC)
 - Request for Modification (RFM)
 - Nonconformance Report (NCR; aka RFC)
 - Engineering Analysis Report (EAR)
- Process/procedure covered in CPAM
- 17-item tracking log for each submittal



CPAM 10.3 CONCRETE CONSTRUCTION

- Spec. 400-21, Disposition of Cracked Concrete: the number of cracks, average crack width, length of cracks taken into account
- CPAM Section 10.3.5, Mass Concrete Control Plan (MCCP)
- CPAM Section 10.7, Crack and Joint Inspection of Post-Tensioned Bridges



CPAM 10.3 CONCRETE CONSTRUCTION

CPAM 10.3 CONCRETE CONSTRUCTION

- 10.3.6: Crack inspection 3X: 1) after casting, 2) all dead loads, 3) all live loads
- Early discovery allows crack monitoring and correction of other components to prevent more cracks
- Crack Maps denoting length, width, depth, location
- Disposition of Cracks:
 - Structural or
 - Non-structural—Engineer makes the determination!

CPAM 10.4 PAINT & ASBESTOS REMOVAL, HANDLING & DISPOSAL AND STRUCTURAL STEEL COATING ISSUES

- Hazardous but also potentially hazardous waste:
 - Asbestos inining Material (ACM)
 - Lead
- Coating Concerns:
 - Surface preparation
 - Bolts, caulking gaps and seams—stripe coating
 - Faying surfaces
 - Testing for chloride, sulfate and nitrate concentrations
 - Containment
- Discuss concerns at pre-operations meetings



CPAM 10.4 PAINT & ASBESTOS REMOVAL, HANDLING & DISPOSAL AND STRUCTURAL STEEL COATING ISSUES

- Blast media for paint removal/surface prep
- Ferrous (top)
- Steel grit (below)





CPAM 10.4 PAINT & ASBESTOS REMOVAL, HANDLING & DISPOSAL AND STRUCTURAL
STEEL COATING ISSUES

CONTAINMENT

CPAM 10.6 Underwater Bridge Construction Inspection

- Initial inspection of voided concrete/cylinder piles
- Other pile types, Engineer makes decision
- Final underwater inspections for all projects by:
 - FDOT prequalified Consulting Firm (Maintenance)
 - FDOT Structures Maintenance

CPAM 10.9 Structural Steel and Miscellaneous Metal Components

- Records must be kept of:
 - Job Inspection Snug Tight Torque Test for Bolts
 - Rotational Capacity Test for Bolts (ROCAP)
 - Steel Girder Shear Connector (shear studs) Bend Test
- Fabrication schedule
- Consultant Inspection of fabrication
- Non-compliances of fabricated components

CPAM 10.9 STRUCTURAL STEEL AND MISCELLANEOUS METAL COMPONENTS



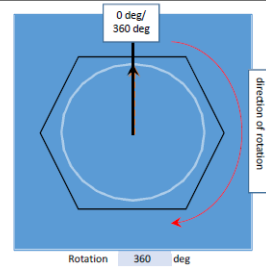
Florida Department of Transportation
ROCAP Testing Tabulation Sheet
 Long Bolts

675-203-154
 CONSTRUCTION
 0817

Bolt Type	A325	bolt grade, choose from drop-down
Bolt dia. (in)	3/4 in	bolt diameter, choose from drop-down
Stick out (in)	0.25 in	measured from nut to the end of the threads (non-bearing side)
Bolt length (in)	4 in	measured from the bottom of the head to the end of the bolts
Initial tension (kips)	3 kips	tension tolerance: -0 kips to +2 kips
Minimum tension (kips)	28 kips	tighten the bolt to this tension value
Required rotation	1	further tighten the bolt to achieve this rotation from the match mark
Minimum final tension (kips)	32 kips	final tension value fastener must achieve with full rotation

BOLT ASSEMBLY #1	
Recorded final tension (kips)	35
Check tension	OK
Recorded torque (lb*ft)	500
Maximum torque (lb*ft)	438
Check torque	No good

BOLT ASSEMBLY #2	
Recorded final tension (kips)	38
Check tension	OK
Recorded torque (lb*ft)	400
Maximum torque (lb*ft)	438
Check torque	OK



CPAM 10.9 STRUCTURAL STEEL AND MISCELLANEOUS METAL COMPONENTS



CPAM 10.9 STRUCTURAL STEEL AND MISCELLANEOUS METAL COMPONENTS

CPAM 10.10 Bridge Construction Issues that Must Involve State Construction Structures Engineer

- Complex or Category II Bridge issues:
 - Steel
 - Segmental
 - Movable
 - Post-tensioned
- Changes to As-Built condition
- Modification of Plans/ Cost Savings Initiatives
- Non-compliances of Steel/Prestressed items

CPAM 10.1 | General Structures Construction Issues

- Notifying District Structures Maintenance Engineer of in-service dates and acceptance inspections
- As-Bid vs. As-Built Load Ratings—changes?
- Department-owned temporary bridging

SPECIFICATION SECTIONS

- 5 – Control of the Work
- 346 – Portland Cement Concrete
- 400 – Concrete Structures
- 450 – Precast Prestressed Concrete Construction
- 460 – Structural Steel and Miscellaneous Metals
- **Not all Structures Specs specifically addressed here**

Spec 5—Construction Affecting Public Safety

- Construction Affecting Public Safety
 - Signed and sealed erection plan prior to erection
 - Daily inspections of structure
 - Specialty Engineer certification prior to opening facility below
- Signed and sealed stability calculations
- Table of Temporary Bracing Details



TD BEAM STABILITY AND TEMPORARY BRACING NOTES:
 1. Verify stability and design temporary beam bracing, including connections, in accordance with the Specifications and the FDOT Structures Manual.
 2. Verify the beam stability and bracing requirements against the design assumptions including:
 a. Loadings given in the plans.
 b. 1/4" Camber (less than 6 inches) and Beam Sweep (in compliance with Specification 450 requirements).
 c. Loadings given in the plans.
 3. Properly connect bracing to each beam. Do not allow the bracing to exert any vertical force on the outer edge of the top flange. Preform all bolt in beams and fill after use in accordance with the Specifications.

OF PRESTRESSED I-BEAM TEMPORARY BRACING MINIMUM REQUIREMENTS AND LOADS

Table Date 8-05-15

[illegible]

acing loads to be determined by the Contractor.

s of Stage 2 bracing, including end bracing, are required to be installed within 24 hours after initial beam placement.

sace bracing along the length of the beams allowing for variations due connection conflicts and skew.

ngth III loads applied to beam at brace point (see SDG 11.6).

s of Stage 3 bracing, including end bracing, are required to be installed prior to deck placement.

ngth I overturning moment applied to beam at brace point (see SDG 11.6).

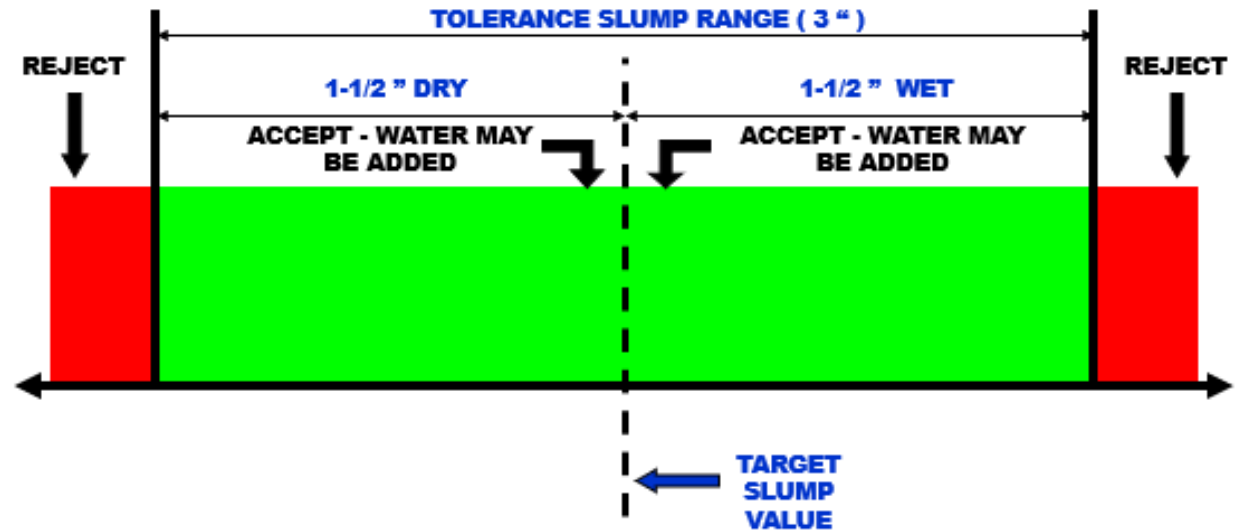
on drawings for temporary bracing plan including locations of preformed beam holes/inserts.

SPEC 5—TEMPORARY BRACING

Spec 346—Plastic Concrete Properties

- Every load requires water cement ratio (w/c) calculation
- Slump test when there is question of water content—consistency must be observed for each truck
- When water is added at the site, truck must be retested
- Test trucks after rejected truck for slump—including the first adjusted truck and begin a new LOT
- Also included are temperature, air entrainment
- VT/CEI/Engineer verifies roughly once per four LOTs

SPEC 346— PLASTIC PROPERTIES

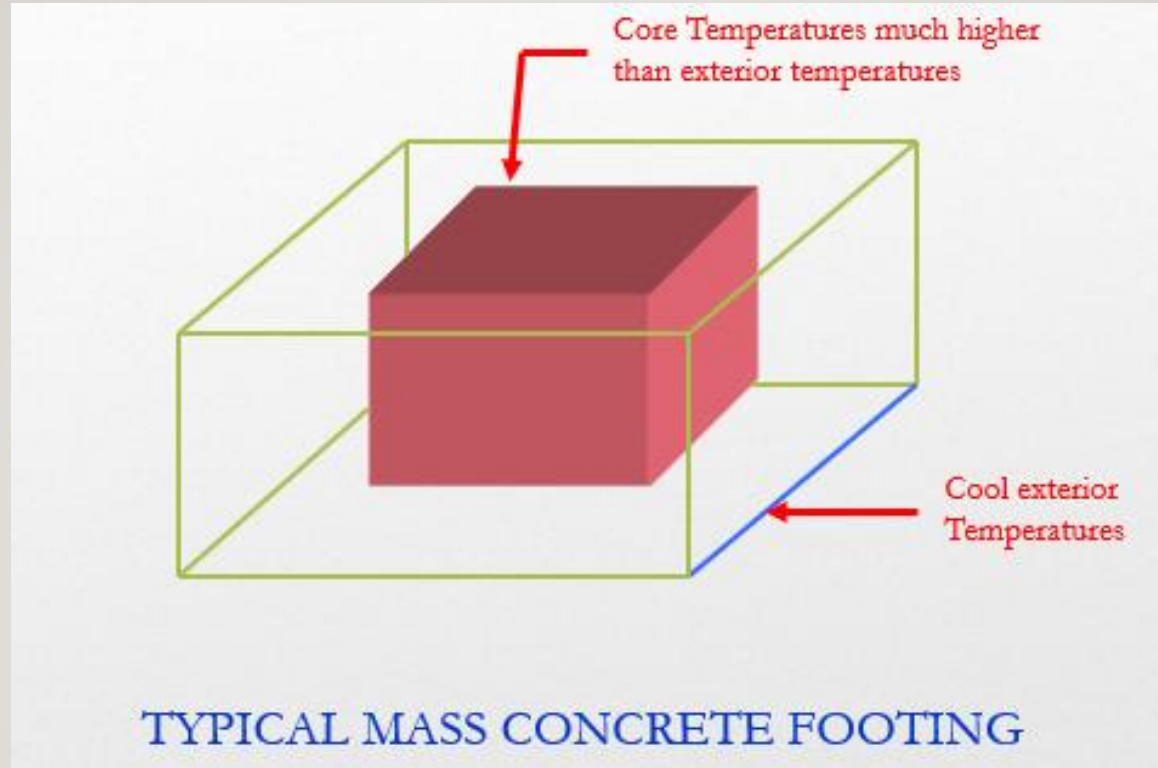


Spec 346—Concrete Class, Sampling, Transit Time

- Department-approval of reduced sampling frequency
- Higher class concrete can be used for lower strength
- Transit Time is the time for all concrete to be discharged from the truck taken from when water is first introduced
- Placement Time of 15 minutes after Transit Time to get concrete to its final position; time extension may be requested

Spec 346—Mass Concrete

- Mass Concrete Control Plan
- Temperature readings every 6 hours until:
 - Max temperature differential (35°F max) and
 - Max temperature (180°F max) and diminishes
- Controls remain until core temperature within 50°F of ambient
- Specialty Engineer must be engaged to advise if issues arise



SPEC 346—MASS CONCRETE



SPEC 346—MASS CONCRETE

SPEC 400—FOOTING PLACEMENT

- Cofferdam preparation—seal concrete or precast “bathtub”
 - Water seepage
 - Standing water prior to concrete placement
 - Primary pump capacity plus backup pump
- 20 inch or less lift thickness when placing concrete
- Mass concrete monitoring devices protected during concrete placement



SPEC 400—DECK PLACEMENT

- Placement sequence/ direction
- Screed demonstration
- Curing compound applied within 120 minutes of initial placement
- Compound spread rate/quantity reported to the Engineer
- Placement and maintenance of curing blankets (over barrier)



SPEC 400— DECK PLACEMENT



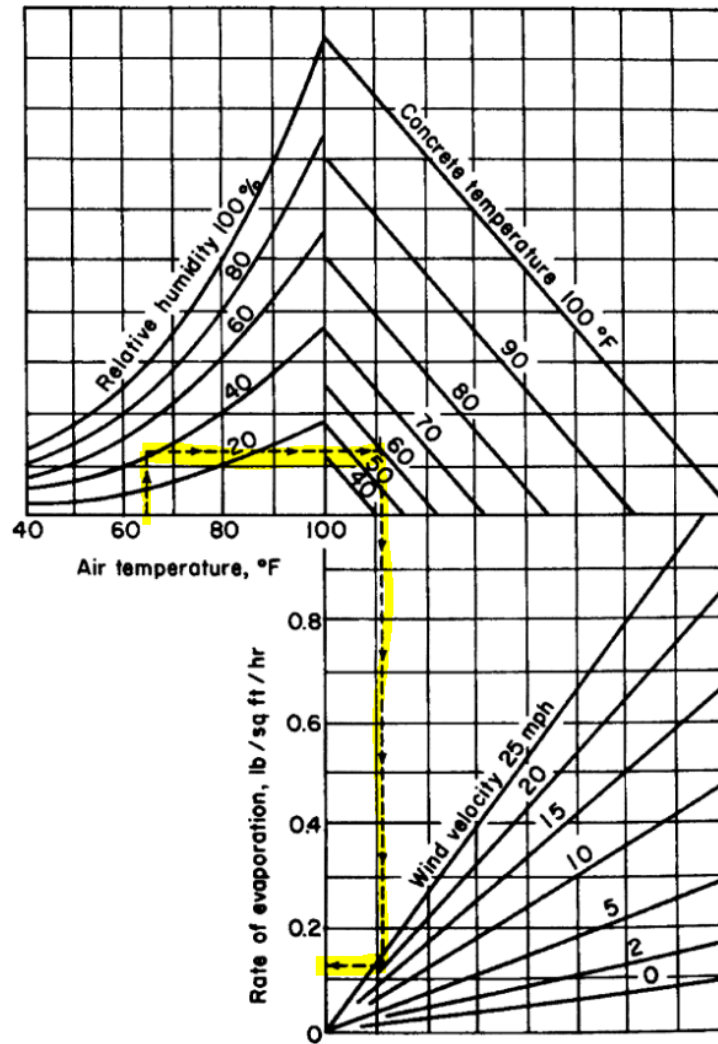


Fig. 4.1—Nomograph for estimating the maximum potential rate of evaporation of the environment, assuming a water-covered surface in which the water temperature is equal to the concrete temperature (Menzel 1954; NRMCA 1960).

SPEC 400—DECK PLACEMENT

- Evaporation rate determined by:
 - Air temperature, relative humidity
 - Concrete temperature
 - Wind Velocity (15 mph max)
- If evaporation rate exceeds 0.1 lbs/ft²/hr including:
 - Evaporation retarder
 - Water fogging
 - Chilled mix water
 - Wind screens



SPECS 400/450— CAMBER

- Monthly camber estimates in the precast yard
- Camber tolerance of 1 inch from design camber in Plans
- Contractor takes appropriate actions (400-7.13.1) to get girder stirrups to “fit” with the deck



SPECS 400/415/460/502— REBAR, SIP FORMS, SHEAR CONNECTORS

- Field welding per Spec 460 only if Engineer approval or if on the Plans
- No welding of SIP forms to flanges
- Bending of reinforcement with Engineer's permission
- Store rebar above ground on dunnage
- Shear stud installation in the field with bend testing



CMC STEEL SOUTH CAROLINA
310 New State Road
Cayce SC 29033-3704

CERTIFIED MILL TEST REPORT
For additional copies call
800-637-3227

We hereby certify that the test results presented
are accurate and conform to the reported grade speci

Richard S. Ray
Richard S. Ray - CMC Steel SC

Quality Assurance Man

HEAT NO.:2071956 SECTION: REBAR 25MM (#8) 60"0" 420/60 GRADE: ASTM A615-18e1 Gr 420/60 ROLL DATE: 11/11/2018 MELT DATE: 11/10/2018 Cert. No.: 11/10/2018 / 071956D036		S O L D T O	S H I P T O	Delivery#: BOL#: CUST PO#: CUST P/N: DLVRY LBS / HEAT: 0.000 LB DLVRY PCS / HEAT:
Characteristic Value		Characteristic Value		Characteristic Value
C	0.41%	Elongation Gage Lgth test 1	8IN	The Following is true of the material represented by this MT *Material is fully killed *100% melted and rolled in the USA *EN10204:2004 3.1 compliant *Contains no weld repair *Contains no Mercury contamination *Manufactured in accordance with the latest version of the plant quality manual *Meets the "Buy America" requirements of 23 CFR635.4 *Warning: This product can expose you to chemicals w known to the State of California to cause cancer, birth d or other reproductive harm. For more information go to www.P65Warnings.ca.gov
Mn	0.85%	Bend Test 1	Passed	
P	0.013%	Rebar Deformation Avg. Spaci	0.675IN	
S	0.034%	Rebar Deformation Avg. Heigh	0.063IN	
Si	0.21%	Rebar Deformation Max. Gap	0.161IN	
Cu	0.27%	Bend Test Diameter	5.000IN	
Cr	0.28%			
Ni	0.12%			
Mo	0.043%			
V	0.000%			
Cb	0.000%			
Sn	0.011%			
Al	0.001%			
Ti	0.001%			
N	0.0115%			
Yield Strength test 1	64.6ksi			
Yield Strength test 1 (metri	446MPa			
Tensile Strength test 1	104.0ksi			
Tensile Strength 1 (metric)	717MPa			
Elongation test 1	13%			

REMARKS :

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Page 1 OF 1

SPEC 6—BUY AMERICA

- Buy America applicable to steel incorporated in the finished work, not the temporary condition
- Not just for Projects with FHWA funding during Construction
- Included if the corridor had FHWA funding through PD&E
- Mill certs need state “Made in USA”



SPECS 400/460/461— BEARINGS, ANCHOR BOLTS

- Inspection of bearings for deformation and general condition
- Anchor bolt hole misalignment
- Expansion and contraction from temperature

Spec 460—Material

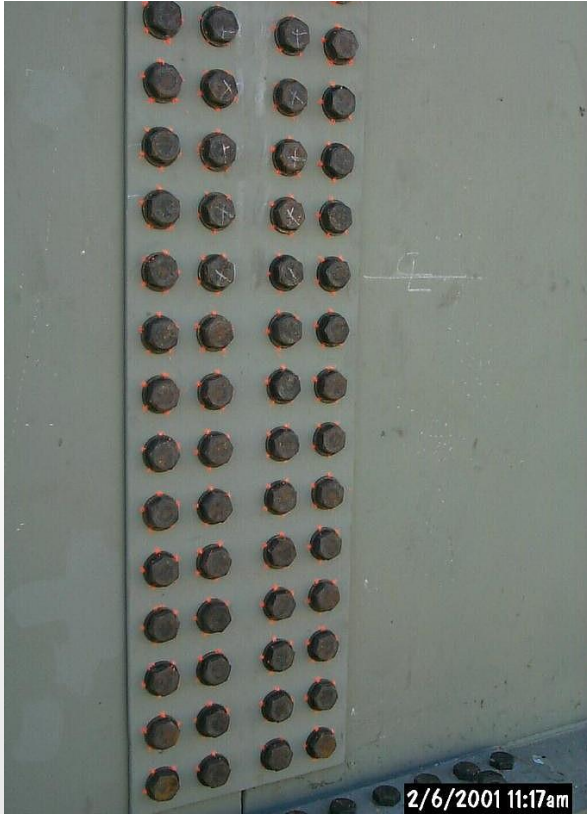
- The Department default material requirement for structural steel superstructures is weathering steel if 4 miles from the coast or greater
- If site conditions are acceptable, painting not required, reduction in maintenance costs over the life of the bridge
- Exceptions permitted but must be approved by the Chief Engineer, requiring justification by the District



SPEC 460—STRUCTURAL STEEL AND MISCELLANEOUS METALS

WEATHERING STEEL GIRDERS

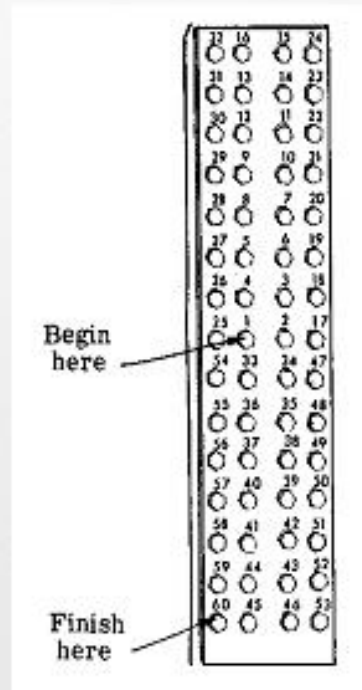
SPEC 460—BOLTING



- Turn-Of-Nut method
- ROCAP/Job-Inspection Snug Tight Torque performed in the field
- Bolt tightening sequence
- Erection Plan
- DTI's – Direct Tension Indicators

SPEC 460— BOLTING

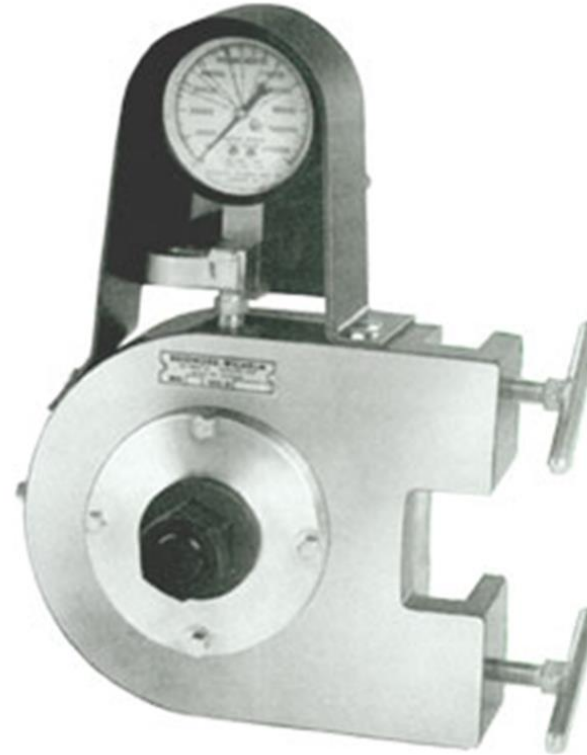
Bolt Tightening Sequence



The Sequence of Tightening is
CRITICAL
→ Most rigid, to least rigid

SPEC 460 SKIDMORE- WILHELM TENSION CALIBRATOR

SPEC 460—TURN OF NUT
BOLTING



SPEC 460— BOLTING

- Checking Snug Tight Tension with a Calibrated Torque Wrench



- **CONTRACTOR'S
ENGINEER OF
RECORD**

Contractor's Engineer

This table provides brief clarifications to the works that are allowed to be performed by Contractor's Engineer of Record, Department Approved Specialty Engineer and Specialty Engineer as defined in Specification Section 1. For definitions, additional information and further clarifications refer to Specification Section 1.

Work Type	Contractor's Engineer of Record	Department Approved Specialty Engineer	Specialty Engineer
Re-design	Yes	No	No
Cost Savings Initiative Proposal	Yes	No	No
Details of the permanent work not fully detailed in the plans	Yes	Yes	Yes
Design and details of the permanent work declared to be minor or non-structural including minor repairs	Yes	Yes	Yes
Design and details of the permanent work declared to be major or structural including major repairs	Yes	Yes*	No
Design and drawings of temporary works, such as falsework, formwork, etc.	Yes	Yes	Yes

*The work must also be checked by another Department Approved Specialty Engineer

Qualifications and Certifications



CTQP Concrete Field
Technician - Level I



CTQP Concrete Field
Inspector - Level II



CTQP Grouting
Technician - Level I & 2



CTQP Post-Tensioning
Technician - Level I & 2



ACI, PTI, and ASBI issue
certifications for
successful completion



ASBI Certification in
Flexible Filler Injection



Technicians certified by
these agencies



Not considered qualified
for FDOT work until
qualification by CTQP

Spec 462 & 960 – Post-Tensioning

- Old Specifications utilized preapproved PT systems which can still be found on FDOT's website: [Structures Design Office Post-Tensioning Jan 2016 Later Specifications](#)
- New approach relies on CEI/EOR to review PT shop drawings and test reports for each project.
- Components and systems detailed in the approved PT drawings MUST be adhered to with no substitutions (excluding local zone reinforcement)
- The sensitivity of PT system performance to the components and workmanship of installation require strict adherence to the approved PT shop drawings that MUST be enforced by the CEI

Spec 462 & 960 – Post-Tensioning

- Current Specifications 462 have adopted a new dehumidification procedure to ensure standing water and moisture is removed from tendons utilizing flexible filler prior to tendon installation and flexible filler injection
- Key points to be aware of:
 - Ensuring the duct stays dry before and after tendon installation
 - Storage requirements for components
 - Ensure proper concrete consolidation around congested anchor regions with local zone reinforcing
 - Accurately install and position/support PT systems prior to concrete placement (duct supports, spiral positioning, etc.)
 - Ensure all Contractor field testing conducted prior to concreting; contractor inspections
 - Adhere to the time limitations outlined in 462 for time between tendon installation and filler injection as well as time between filler injection and pour-back construction
 - Mock-up requirements
 - Grout problems
 - Flexible filler problems

Training and Reference Tools

- Office of Construction and CTQP Websites contain most structures construction training materials including piles and drilled shafts as downloads
 - <https://www.ctqpflorida.com/>
- Structures Related Websites:
- [State Construction Office Training: Self Study](#)
- [State Construction Office, Structures Webpage](#)
 - (<http://www.fdot.gov/construction/>)
- [State Structures Design Office Website](#)
 - (<http://www.fdot.gov/structures/>)



Contact

- State Construction Structures Engineer
 - Alex.randell@dot.state.fl.us
 - (850) 414-4275

Construction Structures Website:

- <https://www.fdot.gov/construction/structures/Structures.shtm>