

2023 Construction Academy Structures Session





**READ THE
SPECS
AND
CPAM!**

Purpose

- Educate about structures construction
- Review Specifications and CPAM
- Much to know, remember, and keep track of so:

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

CPAM 8.4 Shop and Erection Drawings Process

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 8.11 Contractor Initiated Submittals

- 3 Categories of Submittal:
 - Request for information (RFI)
 - Request for Correction (RFC)
 - Request for Modification (RFM)
- 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

- 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 Containing 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

Stripe coating of irregular surfaces



CPAM 10.4 Paint & Asbestos Removal, Handling & Disposal and Structural Steel Coating Issues

Containment and Coating/Metallizing

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 Bend Test
- Fabrication schedule
- Consultant Inspection of fabrication
- Non-compliances of fabricated components



CPAM 10.9 Structural Steel and Miscellaneous Metal Components

CPAM 10.9 Structural Steel and Miscellaneous Metal Components

Florida Department of Transportation
ROCAP Testing Tabulation Sheet
Long Bolts

975-210-154
CONSTRUCTION
06/17

| | | |
|------------------------------|---------|---|
| 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 |

0 deg/
360 deg

direction of rotation

Rotation 360 deg



CPAM 10.9

Structural Steel and Miscellaneous Metal Components

CPAM 10.10 Bridge Construction Issues that Must Involve State Construction Office Staff

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

CPAM 10.11 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

- b. Securely 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 holes in beams and fill after use in accordance with the Specifications.

| TABLE OF PRESTRESSED I-BEAM TEMPORARY BRACING MINIMUM REQUIREMENTS AND LOADS | | | | | | Table Date 8-09-15 | |
|--|----------|---|---|--|---|---|---|
| SPAN NO. | BEAM NO. | STAGE 1 | | STAGE 2 | | STAGE 3 | |
| | | BRACE ENDS PRIOR TO CRANE RELEASE? ¹ (YES/NO) | TOTAL LINES OF BRACING ^{2,3,7} | MINIMUM NUMBER OF ADJACENT BEAMS ERECTED | HORIZONTAL LOAD AT EACH BRACE ⁴ (KIP) | TOTAL LINES OF BRACING ^{3,5,7} | OVERTURNING MOMENT AT EACH BRACE ⁶ (KIP-FT) |
| | | | | | | | |
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¹ Anchor Bracing loads to be determined by the Contractor.

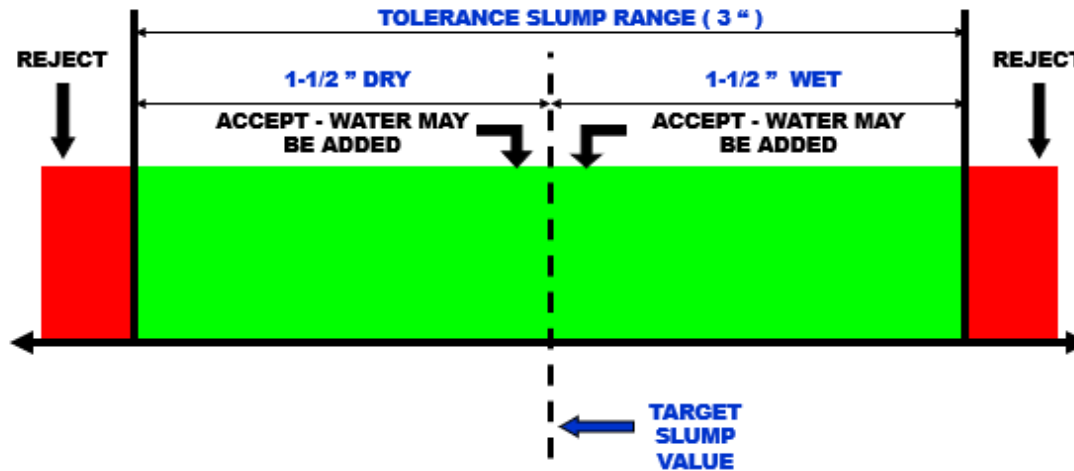
Spec 5—Construction Affecting Public Safety



Spec 5— Construction Affecting Public Safety

Spec 346—Plastic 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 Delivery Ticket

TITAN AMERICA, INC
APPENDIX "A"

F.D.O.T. Concrete Delivery Ticket Structural Concrete

*215 1 Mapped
Inside Red
Palmetto*

Financial Project No. 433108-6-52-01 ✓ Ticket # 79311
 Plant No. 93-363 Date 03/05/19
 Concrete Supplier DELRAY RM Delivered to: PRINCE
 Phone Number 561-278-3984 Phone #: 0
 Address 1300 S. SWINTON AVE., DELRAY BCH, FL 33444 Address: L95 NB ON PALMETTO PARK RIGHT ST
 Tarmac Mix No: D4054400

| | | | |
|--|--|---|--------------------------------------|
| Truck No. 15060 | DOT Class CL IV | DOT Mix No. 06-0544 | Cubic yards This Load 3.00 |
| Allowable Jobsite Water Addition: 21.80 gal. | Time Loaded <i>3:55 → 4:55</i> 3:29 PM | Mixing Revolutions 70 | Cubic yards Today 3.00 |
| Chloride Test Results 0 | | Chloride Test Date 10/1900 | |
| Cement Type TYPE III Amount 1,760 LBS MEDLEY - PENNSUCO | SPOLLO BEACH - BIG BEND FLYASH Type Amount LBS Air Entrainment Admix AE 90 27 | BASF / Air Entrainment Source Type Amount OZS Admixure BASF / Type A, B, D 961R 132 | |
| Coarse Agg. Pit # 87-339 %Moisture 1.4% Amount 5,060 LBS Ortona | BASF / Type A, B, D 961R Source Type Amount OZS | | |
| Fine Agg. Pit # 05-045 %Moisture 5.6% Amount 3,480 LBS Ortona | BASF / Type A, B, D 961R Source Type Amount OZS | | |
| Batch Water GAL Metered Water 3 Total water 53 GAL | BASF Type Amount OZS 0 0 | | |
| ICE 0 GAL | Truck Water 0 GAL | GALS Source Type Amount OZS Admixure BASF Source Type Amount OZS 0 | |

Insurance of this ticket constitutes certification that the concrete batched was produced and information recorded in compliance with the Department Specification requirements for Structural Concrete.

B65072155

CTOP Technician identification Number B65072155 Signature of Plant Operator *R. Brown*

| | | | |
|---|---|--|---------------------------------|
| Arrival Time at job 4:30 | Number of revolutions upon arrival at job site 125 | | |
| Total Water added at job site (gallons) | Admixtures added at the job site (ounces) | Additional mixing revolutions with water added | |
| Time concrete completely discharged 4:47 | Time admixture added | Total number of revolutions 165 | |
| Initial Slump 4" | Initial Air 1.75 | Initial concrete temp 83° | Initial w/c Ratio .32 |
| Acceptance Slump 4" | Acceptance Air 2.0 | Acceptance concrete temp 83° | Acceptance w/c Ratio .32 |

Insurance of this ticket constitutes certification that the maximum specified water cementitious ratio as not exceeded and the batch was delivered and placed in compliance with Department specification requirements.

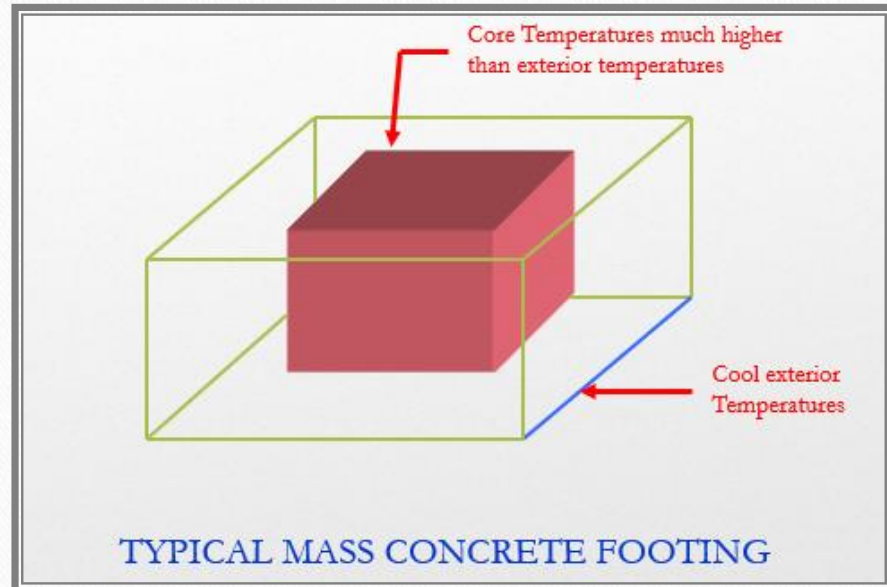
236232068 CTOP Technician identification Number Signature of Contractors Representative *Handwritten*

CC4A 016Q

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

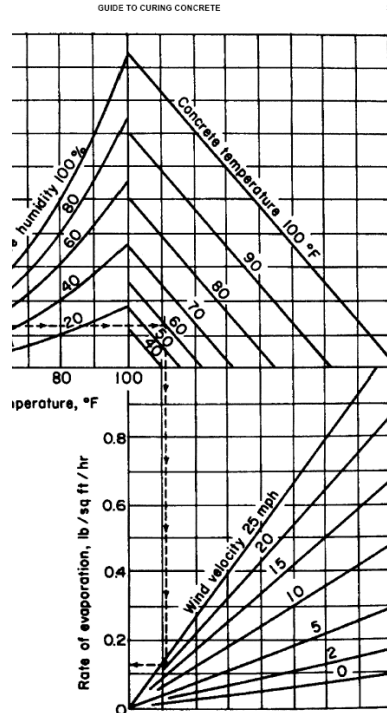


- Placement sequence/ direction
- Screed demonstration
- Curing compound applied within 120 minutes of initial placement
- Compound spread rate/quantity reported to the Engineer
- Placement and maintenance of curing blankets (over barrier)



Spec 400—Deck Placement

Spec 400—Deck Placement



Estimating the maximum potential rate of evaporation of the environment, assuming a water-co temperature is equal to the concrete temperature (Menzel 1934; NRMCA 1960).

- 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 permitted per Spec 460 if on the Plans
- No welding of SIP forms to flanges
- Bending of reinforcement with Engineer's permission
- Store rebar above ground
- 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
are accurate and conform to the rep

Richard S.
Richard S. Ray - CMC



| | | | |
|--|----------------------------|----------------------------|---|
| I.:2071956 I: REBAR 25MM (#8) 60"0" 420/60 ASTM A615-18e1 Gr 420/60 JTE: 11/11/2018 JTE: 11/10/2018 : 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 / DLVRY PCS / |
|--|----------------------------|----------------------------|---|

| Characteristic | Value | Characteristic | Value | Characteristic |
|---------------------------|----------|------------------------------|---------|----------------|
| C | 0.41% | Elongation Gage Lgth test 1 | 8IN | |
| 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 | | | |
| ld Strength test 1 (metri | 446MPa | | | |
| Tensile Strength test 1 | 104.0ksi | | | |
| tsile Strength 1 (metric) | 717MPa | | | |
| Elongation test 1 | 13% | | | |

The Following is true of the material
 *Material is fully killed
 *100% melted and rolled in the
 *EN10204:2004 3,1 compliant
 *Contains no weld repair
 *Contains no Mercury containin
 *Manufactured in accordance w
 of the plant quality manual
 *Meets the "Buy America" requi
 *Warning: This product can exj
 known to the State of California
 or other reproductive harm. Fo
 to www.P65Warnings.ca.gov

S :

03/28/2019 21:39:23
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

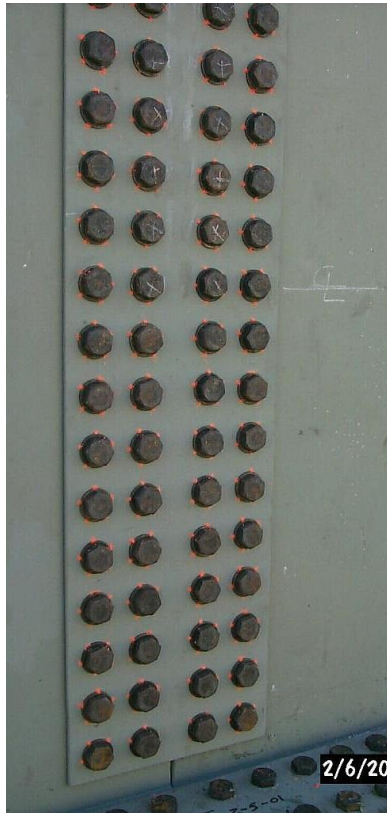
- The Department requires structural steel superstructures to be fabricated with weathering steel if 4 miles from the coast or greater
- Painting not required, reduction in maintenance costs over the life of the bridge
- Exceptions permitted but must be approved by the Chief Engineer, requiring justification by the District



Spec 460—Structural Steel and Miscellaneous Metals

Weathering steel girders

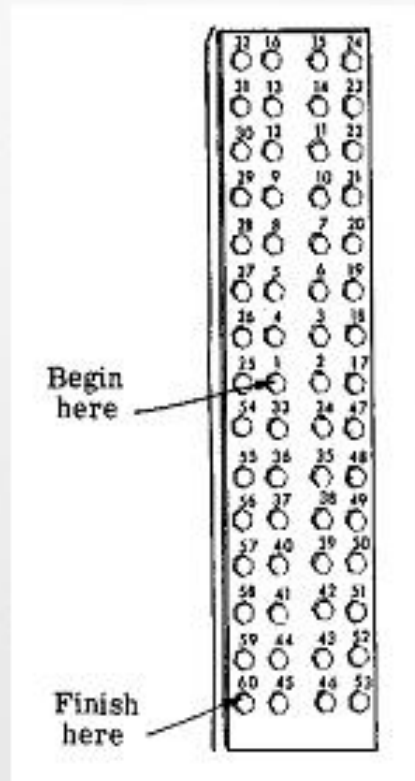
Spec 460—Bolting



- 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



Construction

Office of Construction / Engineering Area / Specialty Engineer

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

Contractor's Engineer of Record

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

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, Structures Webpage](#)
 - (<http://www.fdot.gov/construction/>)
 - [State Structures Design Office Website](#)
 - (<http://www.fdot.gov/structures/>)



Contact

- State Construction Structures Engineer
 - david.wagner@dot.state.fl.us
 - (850) 414-4141

Construction Structures Website:

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