Section 10.7

POST-TENSIONED BRIDGES

10.7.1 Purpose

The purpose of this procedure is to direct Construction Engineering and Inspection (CEI) personnel in the inspection, monitoring and engineering duties required to assure quality post-tensioned (PT) bridge construction in compliance with the Contract Documents. This procedure is ~~primarily~~ intended to be used by CEI staff ~~familiar~~ experienced with PT bridge construction. This procedure includes PT system installation, post-tensioning operations, segment casting and duct filler injection operations. Duct filler material can be one of two types: flexible filler (wax) or grout filler.

10.7.2 Authority

Section 334.048, Florida Statutes

Rule Chapter 5J-17, Florida Administrative Code

10.7.3 CEI Responsibility Categories

In Person Observations: The responsibilities of this category require CEI staff to be physically present when a construction activity is being performed by the Contractor or shortly before an ~~critical~~ operation is to be performed and to visually verify that the activity is being performed in accordance with the Contract Documents. Responsibilities of this category also include personally performing, while in the field, surveying, documenting, testing and measuring. At a minimum, conduct a pre-operation meeting with the Contractor prior to the first time a construction activity of a given type (control survey, casting, erection, stressing, filler injection) is to be performed.

Verification of Contractor's Procedures and Records: The responsibilities of this category require CEI staff to review Contractor procedures and records to verify their accuracy and compliance with the Contract Documents. These reviews may not require CEI staff to directly observe the specific construction operation performed by the Contractor. Responsibilities involve review of Contractor calculations including the Geometry Control Manual, Casting Manual and Erection Manual~~,~~; observation of Contractor Quality Control (QC) test procedures and other QC procedures, review of contractor survey data, verification of data collection form accuracy and completeness as well as other required Contractor records.

Record Keeping: The responsibilities of this category require CEI staff to ~~personally~~ gather and record data for entry into various forms and ~~other~~ records. These forms and records shall be ~~on file at the~~ kept electronically by the CEI ~~field office~~. Other forms may be developed by the CEI as necessary. ~~Upon approval of the State Construction Structures Engineer (SCSE),~~ CEI staff may use ~~copies~~ versions of Contractor forms or records that have been~~are~~ verified ~~by the CEI staff~~ to be accurate and complete but ~~the~~ any copies~~y~~ ~~shall bear~~ must have a statement of verification~~that it was verified by the CEI~~ and ~~shall~~ include the ~~signature~~ initials of the CEI ~~employee~~ staff that performed the verification. The CEI ~~shall~~ must ~~retain~~ maintain~~an~~ independent copy of all such verified records.

10.7.4 Additional Requirements

Verify that all Contractor operations are conducted in accordance with the following QC Guidelists:

8B Concrete Materials

10A Bridge Structures – General Concrete

10C Bridge Structures – Concrete Decks

10D Bridge Structures – Post-tensioning (PT)

10.7.5 Segmental Casting Yard Operations

A. Activities Required Prior to Casting a Segment

1. In Person Observations

   a. Survey tower and casting beds are rigidly constructed and will not deflect. Perform periodic independent surveys to verify tower position throughout the course of the project. Perform independent surveys to develop and maintain survey control data throughout the course of the project.

   b. Record independent horizontal and vertical measurements at formwork control points for each segment. Verification measurements may be taken at the same time that Contractor QC measurements are taken. If permitted by the Contractor, Contractor survey equipment may be used by the CEI for performing formwork surveys prior to casting a segment.

   c. FORMS – Observe and verify the following:

      - Forms are rigidly constructed and have sufficient strength to prevent deformation while supporting plastic concrete.

      - Form surfaces are in good condition.

      - Form and match-cast surfaces are coated with form release compound.

      - Mandrels or other devices used to secure duct openings and alignment at the bulkhead are rigid and properly positioned.

      - Form joints are sufficiently tight to prevent leakage of concrete ~~slurry~~paste.

   d. REINFORCEMENT – Observe and verify the following:

      - Size, spacing, position, grade and cover are correct. ~~(~~For segmental construction, extra attention should be paid to reinforcing in pier segments and deviator segments.~~)~~

      - Spacers, chairs and bolsters have sufficient strength to prevent deformation during concrete placement and are listed on the Department's ***Approved Products List***.

      - Tie wires do not protrude into the concrete cover.

- Reinforcing and prestressing steel are free from loose rust, dirt, paint, etc.

- Reinforcing is securely tied.

e. DUCTS – Observe and verify the following:

- All PT system components must meet the requirements of Section 960 and be selected from the Structures Design Office (SDO) Approved PT Systems website. No substitutions, modifications, or deletions of any PT components are allowed without consent from the SDO and the SCSE, with the exception of mild reinforcing and prestressing steel.

- Post-tensioning ducts are free from debris and are securely capped.

- Pipe deviator position and rotation are correct.

- Duct size, position, alignment and cover are correct. (For segmental construction, extra attention should be paid to ducts in pier segments and deviator segments.)

- Ducts are properly sealed with no cuts, breaks, lips, kinks, dents, or unacceptable deviations.

- Duct couplers are properly installed within the match-cast segment.

- Diabolos are installed correctly per Plans and the approved Shop Drawings. Verify excess diabolo material is trimmed flush with concrete surface.

2. Verification of Contractor's Procedures and Records

a. Prior to commencement of field survey operations, verify that the segment geometry control/adjustment methodology ~~proposed~~ in the approved ~~***Contractor's***~~ ***Casting Manual*** and ***Geometry Control Manual***~~and~~ ~~proposed method for geometry adjustments~~ provide the accuracy and precision required in the Contract Documents.

b. Segment geometry measurements are accurate and have been correctly recorded.

c. Check Contractor's calculations for revised segment geometry to correct segment alignment per the ~~theoretical~~ casting curve.

3. Record Keeping

    a. Generate and maintain independent records and geometry adjustment calculations for elevations and horizontal measurements at survey control points for comparison with the Contractor’s records.

    b. Generate checklists to track the Observations and Verifications listed above. See ***Attachments 10-7-1(a) and 10-7-1(b) “Sample Segment Casting Record”***.

B. Casting Activities

1. In Person Observations

    a. Concrete is placed according to the Contract Documents. Vibrators are only used in accordance with the ***Specifications***. Areas prone to lack of concrete consolidation are adequately and thoroughly vibrated.

    b. Verify the ~~“~~Mass Concrete Control Plan~~”~~ (MCCP) has been approved by the Department (if applicable) and that monitoring of temperatures is being done per the ***MCCP*** and the ***Specifications***. Consult ***CPAM 10.3*** for additional guidance for CEI requirements regarding mass concrete.

2. Verification of Contractor’s Procedures and Records

    a. Contractor concrete QC test specimens are taken from the point of placement.

    b. Curing compound application rate is calculated by contractor, that there are records documenting this and that it meets the requirements of the Contract Documents.

3. Record Keeping

    a. Generate checklists to track the Observations and Verifications listed above.

C. Post-Casting Activities

1. In Person Observations

    a. Record independent horizontal and vertical measurements at segment control points for each segment. Verification measurements may be taken at the same time that QC measurements are taken. If permitted by the Contractor, Contractor survey equipment may be used by the CEI for performing segment surveys.

b. Visually inspect segment surface per ***CPAM 10.3***. Use a pocket microscope to accurately measure crack widths smaller than 25 mils.

c. Follow ***CPAM 10.2*** for the disposition of defects.

d. All duct end openings are capped such that water or other foreign material cannot enter duct.

e. Verify mass concrete temperature readings are within allowable Specification limits (if applicable).

f. Lifting, transportation, and storage of segments are per ***Specification 452-7***.

g. If segment post-tensioning is required prior to removing the segment from the form, complete the procedures in ***Section 10.7.~~6~~5 (B)*** of this chapter.

h. Mark segments which have passed all inspections and which are ready for delivery to erection site by means of a stamp applied with indelible ink. Record date that each segment is stamped.

2. Verification of Contractor's Procedures and Records

a. Elevations and horizontal measurements of as-cast segment are accurate and have been correctly recorded.

b. Concrete has reached strength required in the Contract Documents prior to tendon stressing, removal from formwork and lifting as applicable.

c. Segment dimensions agree with those required by ***Contractor Casting Manual*** and ~~theoretical~~ casting curve to within the tolerances specified in the Contract Documents.

3. Record Keeping

a. Develop and maintain forms to track the Observations and Verifications listed above.

b. Graphically depict crack maps, spalls, honeycombs, or other concrete surface flaws or repairs on an accurately scaled drawing of each segment (refer to ***CPAM 10.3*** for detailed requirements).

10.7.6 Field Construction Operations

A. Segmental Erection Activities

1. In Person Observations

   a. All erection operations are in accordance with the Contract Documents and approved ***Erection Manual***. Verify forces in temporary erection PT components.

   b. Elevations and horizontal measurements at survey control points, and bearing seats are recorded before and after segment erection. Review QC survey information for compliance with theoretical alignment.

   c. Only approved shimming procedures and materials or other methods are used to correct vertical and/or horizontal misalignments. Notify the SCSE if shimming frequency exceeds every other segment for one full span or full cantilever.

   d. Duct couplers are correctly installed in all continuous ducts.

   e. Allowable mixing/application time of epoxy jointing material is not exceeded. Verify epoxy temperature limits are not exceeded.

   f. Epoxy jointing material between segments is uniformly applied immediately before segment erection. At closure pours, epoxy bonding compound, if used, has been uniformly applied on adjacent segments immediately before placing concrete.

   g. Contractor's method for preventing epoxy from falling beneath the bridge is effective.

   h. Verify PT ducts permit passage of a torpedo through duct immediately after initial stressing of bars or tendons.

   i. Epoxy "squeeze out" is visible along entire length of joint.

2. Verification of Contractor's Procedures and Records

   a. Check the Contractor's proposed Erection and/or Geometry Control Manual and method for calculating adjustments to elevations and horizontal measurements at survey control points.

   b. Contractor's Erection Manual and temporary loads are in accordance with the Contract Documents.

   c. Elevations and horizontal measurements at survey control points are accurate and have been correctly recorded.

d. Check calculations to adjust elevations and horizontal measurements at survey control points.

e. Verify the Contractor's proposed methods to correct vertical and/or horizontal misalignment.

f. Proposed epoxy jointing material properties comply with the Contract Documents.

3. Record Keeping

a. Generate independent records and geometry adjustment calculations for elevations and horizontal measurements at survey control points, for comparison with the Contractor's records.

b. If cracks or spalls occur during erection or stressing, graphically depict crack maps or spalls on an accurately scaled drawing of each segment (refer to ***CPAM 10.3.5*** for detailed requirements).

c. Develop and maintain epoxy jointing records of all epoxy jointing operations. ***See Attachment 10-7-2 "Sample Epoxy Joint Record"***.

B. Stressing Operations for all PT Bridge Types

1. In Person Observations

a. PT steel is properly stored and protected.

b. PT steel is placed into the ducts properly without damage to prestressing steel or ducts with a clean strand surface.

c. Concrete has reached strength required in the Contract Documents prior to erection and tendon stressing.

d. Witness and record all PT stressing operations, including~~:~~ hydraulic jack gauge pressure readings and tendon or PT bar elongation measurements.

e. Stressing equipment is furnished by the supplier of PT system.

2. Verification of Contractor's Procedures and Records

a. Hydraulic jacks have been properly calibrated and certified calibration curves have been provided for each hydraulic jack, in compliance with the Specifications.

b. In-Place Wobble and Friction Tests and/or Tendon Modulus of Elasticity Tests have been performed and obtain test reports.

c. Verify the Contractor’s procedures, measurement, calculation and documentation of tendon elongations, and documentation of hydraulic jack gauge pressure readings and jacking forces.

d. The Project Administrator shall coordinate a resolution to all differences between the CEI and the Contractor in the measurement and/or documentation of tendon elongations. In the event that measured elongations do not match those predicted by the Specialty Engineer and/or differences exist between the CEI and the Contractor in the way hydraulic jack readings and/or elongations are measured and recorded, the Project Administrator shall contact the SCSE and notify the Contractor that his Specialty Engineer needs to be involved in resolving these differences. If approved by the SCSE, the stress in a tendon can be verified using lift-off tests at either the live or dead end of a tendon, if deemed appropriate, on a case-by-case basis.

3. Record Keeping

Develop and maintain independent stressing records of all PT stressing operations. See ***Attachment 10-7-3 “Sample Stressing Record”***.

C. Filler Injection Operations: Grout

1. In Person Observations

a. Air pressure tests are performed successfully.

b. Grouting equipment is tested for accuracy on each day of use before performing grouting operations.

c. Confirm location of all leaks and/or crossovers during the Duct Field Pressure Test for each tendon.

d. Field grout operations are performed as specified, within specified time, and in conjunction with specified tests. A minimum of two CEI Inspectors shall be present during field grouting operations, one to observe grout mixing and pumping operations, and one to observe grout discharge at outlet locations.

e. Confirm duct grout ports at high points and inlets and outlets located at anchorages have been drilled out, inspected for voids using a borescope, and vacuum grouted to fill voids where needed.

f. Confirm anchorages are as shown on the Design Standards and that all levels of protection at anchorages are in compliance with Specification 462-7.3.3.

2. Verification of Contractor’s Procedures and Records

a. Verify acceptance of the Contractor’s Grouting Operations Plan.

b. Verify full-scale mockup was performed successfully.

c. Prepackaged grout is on the ***Approved Products List***, and proposed equipment is in compliance with the Specifications.

d. Obtain grout manufacturer’s Quality Control Data Sheets to obtain specific density and mixing parameters for each shipment of grout on the project. Verify time that grout has been stored on the project site does not exceed six months.

e. Verify submittal of the Contractor’s Grouting Report after each grouting operation.

f. Verify the accuracy and completeness of the Contractor’s Grouting Records after each grouting operation.

g. Confirm all required grout testing have been performed and documented on the grouting record sheet. See ***Attachment 10-7-4(a)*** for required testing information.

3. Record Keeping

a. Develop and maintain Grouting Records, separate from the Contractor’s records. See ***Attachment 10-7-4(a) “Sample Grouting Record”***.

b. Document the results of the post grouting inspection. See ***Attachment 10-7-5(a) “Sample Post-Grouting Inspection Record”***.

D. Filler Injection Operations: Wax

1. In Person Observations

a. Air pressure and vacuum tests (when using vacuum assistance) are performed successfully.

b. Confirm location of all leaks and/or crossovers during the Duct Field Pressure and Vacuum Tests (when using vacuum assistance) for each tendon.

c. Confirm wax temperature is within 212°F and 240°F per the Specifications and that the entire mass of wax is liquefied prior to commencement of injection.

d. Wax injection operations are performed as specified. A minimum of two CEI Inspectors shall be present during wax injection operations, one to observe wax pumping operations, and one to observe wax vacuum (when using vacuum assistance) and /or discharge operations at outlet locations.

e. Confirm duct high points and anchorages have been visually inspected for voids, and address any voids using the methods described in the approved Wax Injection Operations Plan and Specification 462-~~8.3.2~~7.4.2.1.

f. Confirm anchorages are as shown on the Design Standards and that all levels of protection at anchorages are in compliance with Specification 462-7.3.3.

2. Verification of Contractor's Procedures and Records

a. Verify acceptance of the Contractor's Wax Injection Operations Plan.

b. Verify full-scale mockup test was performed successfully.

c. Microcrystalline wax is on ***Approved Products List***, and proposed equipment is in compliance with the Specifications.

d. Obtain wax manufacturer's certification that the product meets the requirements of the Specifications. Obtain the manufacturer's Quality Control Data Sheets for each shipment of wax on the project.

e. Verify submittal of the Contractor's Wax Injection Operations Report after each wax injection operation.

f. Verify the accuracy and completeness of the Contractor's Wax Injection Records after each wax injection operation.

3. Record Keeping

a. Obtain written certification from the PT system manufacturer installation technician that the installation process is in conformance with the approved Wax Injection Operations Plan for the first two days of wax injection.

b. Develop and maintain Wax Injection Records, separate from the Contractor's records. See ***Attachment 10-7-4(b) "Sample Wax Injection Record"***.

c. Document the results of the post wax injection inspection. See ***Attachment 10-7-5(b) "Sample Post Wax Injection Inspection Record"***.

E. Post Grouting Inspection of External Tendon Ducts and Couplers

1. In Person Observations

   a. Inspect external tendon ducts and couplers for grout voids, fractured grout, delamination, as well as duct and coupler material punctures, splits or other damage by sounding them and by visual inspection of all visible duct and coupler surfaces. Sound each duct and coupler a minimum of seven days after grouting is complete by tapping the surface using a 16 ounce steel hammer~~ with a steel head~~. Use a tapping force that will not cause the duct or coupler material to split, dent, crush or incur any other damage and that will not cause fracturing, chipping or damage to the grout within the duct or coupler. Sound each duct and coupler at ~~12 inch~~ one foot intervals along their length and at each interval, as a minimum, tap them on the top sides and bottom.

   b. Mark the limits of any defect on the surface of the duct or coupler with a high visibility permanent marker and when it can be determined for sounding or observation alone, label the defect type as one or more of the following: void, fracture, delamination, split, other.

2. Verification of Contractor's Procedures and Records

   Verify that the Contractor repairs all defects. Before corrective action is taken, verify Contractor's proposed course of action in accordance with ***CPAM 10.10.6.3***. Prior to the any void investigation, the Project Administrator shall contact the State Materials Office Corrosion and Durability Lab for guidance regarding how fluid contained in a void is to be captured as well as to establish what the State Material Office role will be in the investigation of the fluid.

3. Record Keeping

   a. Document the location and type of all defects found.

   b. Document all corrective actions.

F. Post Wax Injection Inspection of External Tendon Ducts and Couplers

1. In Person Observations

   a. Inspect external tendon ducts and couplers for wax voids as well as duct and coupler material punctures, splits or other damage by sounding them and by visual inspection of all visible duct and coupler surfaces. For external tendons, note any spots along the length of accessible areas that are cool to the touch. Cool spots along ducts immediately after wax injection are indicative of voids present in the duct. Sound each duct and coupler between 24 and 48 hours after wax injection is complete by tapping the surface using a rubber mallet. Use a tapping force that will not cause the duct or coupler material to split, dent, crush or incur any other damage. Sound each duct and coupler at ~~12 inch~~one foot intervals along their length and at each interval, as a minimum, tap them on the top sides and bottom.

   b. Mark the limits of any defect on the surface of the duct or coupler with a high visibility permanent marker and when it can be determined for sounding or observation alone, label the defect type as one or more of the following: void, split, other.

2. Verification of Contractor's Procedures and Records

   Verify that the Contractor repairs all defects. Before corrective action is taken, verify Contractor's proposed course of action in accordance with ***CPAM 10.10.6.3***.

3. Record Keeping

   a. Document the location and type of all defects found.

   b. Document all corrective actions.

ATTACHMENT 10-7-1(a)
SAMPLE SEGMENT CASTING RECORD

FDOT Project No:__________________ **Bridge No:**________________ **CEI Inspectors:**____

Casting Date:______________________ **Segment Type:** **Pier / Typical / Deviator / Expansion Joint** **Drawings Used:**____________________________

Form Removal Date:_________________________ **Curing Method:**_______________________________________

Formwork			
Item	**Inspected & Date**		**Remarks**
Form Dimensions			
Match Segment Aligned			
Form Clean / Oiled			
Joints Tight / Sealed			
Form Ties / Supports			
Match Cast Debonding Agent			
Core Form Setup			
Form Venting			
Blockouts Installed			
Drip Edge Installed			
Blister Dimensions			
Deviator Dimensions			
Shear Keys (at Bulkhead)			
Alignment Keys (at bulkhead)			
Chamfer Form			
Duct/Anchorage Position			

Embedded Items			
Item	**Inspected & Date**		**Remarks**
Access Openings			
Lifting holes / lugs			
All Debris Cleaned			
Embedded Bearing Plates			
Blockouts			
Geometry Control Insert			
PT Bar Sleeves			
Filler Vents			
Steel Pipe (at Deviator or Diaphragm)			
Drainage Opening			
Special Inserts for Erection Equipment			
Plumbing / Elec. Conduits			

Note: This standard data collection forms is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-1(b)
SAMPLE SEGMENT CASTING RECORD

Reinforcing			
Item	**Inspected & Date**		**Remarks**
Bottom Slab, Web, Top Slab Rebar			
Blister Rebar			
Deviator Rebar			
Diaphragm Rebar – Position / Congestion			
Cathodic Protection (if applicable)			
Bar Spacing			
Clear Cover (including tie wire)			
Bar stability - % tied - Walls			
Bar stability - % tied – Slabs			
Bar stability - % tied – Diaphragm/ Deviator			
Embedded PT anchorages			
Splice Lengths			
Local Zone Anchorage Reinforcement			
PT Duct alignment			
Duct couplers			
Ducts secure?			
Transverse Tendons Inserted			

Post Tensioning			
Item	**Inspected & Date**		**Remarks**
Cantilever PT Ducts			
Cantilever PT Anchorages			
Transverse PT Ducts			
Transverse PT Anchorages			
Ducts Securely Tied			
Filler Outlets Plugged			
Ducts Capped			
Continuity PT Ducts			
Continuity PT Anchorages			
Filler Tubes			
Bulkhead Mandrels in Place			
Match Cast Duct Coupler			
Contingency Ducts			
Vertical PT in Diaphragm			
Horizontal PT in Diaphragm			
Vertical Web PT			
Deviator Pipe Orientation/ Rotation			
Temporary PT Ducts			

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ATTACHMENT 10-7-2
SAMPLE EPOXY JOINT RECORD

FDOT Project No:________________ **CEI Inspectors:**________________ **Contractor Personnel**________________

Bridge No:________________ **Contractor:**________________ ________________

Manufacturer & Epoxy Bonding Agent Components:________________

Joint Location	Date	Ambient Temp.	Concrete Temp.	Lot Nos. (for all Epoxy Bonding Agent Compounds)	Time Mixing Started	Time Applied	Time Stressed	Epoxy Volume	Weather Conditions	Shims – TBR (Top, Bottom, Right, etc)

Remarks:

Method of Application; Repairs (include locations and reason for repairs) ________________

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-3
SAMPLE STRESSING RECORD

FDOT Project No:______________________
Bridge No:______________________
Location:______________________
Jack No. End 1:______________________
Jack No. End 2:______________________
Gauge No. End 1:______________________
Gauge No. End 2:______________________

Tendon Position:______________________
# of Strands/Diam:______________________
Strand Area:______________________
Elongation in Jack:______________________**(d)**
Jacking Force:______________________
Reel/Heat #:______________________
Pack #:______________________

CEI Inspector(s):______________________
Contractor:______________________
Contractor Personnel:______________________
____
Date Installed:______________________
Date Stressed:______________________

Theoretical Dead End Anchor Set:______________________
Actual Dead End Anchor Set:______________________
Theoretical Dead End Anchor Set (100%-20%):______________________**(c)**
Actual Modulus of Elasticity:______________________**(g)**

Theoretical Live End Anchor Set:______________________
Actual Live End Anchor Set:______________________
Theoretical Modulus of Elasticity:______________________**(f)**
Ratio (R=f/g):______________________**(R)**

Sequence	Tendon Number	Stressing Mode: Single End or Double End	20% Stressing Force Gauge Pressure	100% Stressing Force Gauge Pressure	Elongation at 20% Stressing Force (b)	Elongation at 100% Stressing Force (a)	Theoretical Elongation Between Wedges (e)	Expected Elongation 100%-20% (0.8x(e+d)+c)xR	Actual Elongation (a-b)	Percent Elongation Actual vs. Expected	Elongation Pass (P) of Fail (F)

Notes:

1. 100% Elongation measurement is before lock-off.
2. The Contractor's Engineer of Record will determine whether Live End Anchor Set is to be measured separately and added to the Expected Elongations.

Remarks:____
____

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-4(a)
SAMPLE GROUTING RECORD

FDOT Project No:____________________

Bridge No:____________________

Location:____________________

Bag Weight:____________________

Bags (Grout Batching):____________________

Water/Cement Ratio:____________________

Grout Type:____________________

Grout Manufacturer:____________________

Lot Number:____________________

Bag Date:____________________

Water (Grout Batching):____________________

Grout Temperature:____________________

Inspectors:____________________

Contractor:____________________

Contractor Personnel:____________________

Bags (Grout Batching):____________________

Date:____________________

Ambient Temperature:____________________

Tendon No.	Tendon Length	Bleed Test	Efflux Time (Fluidity Test)			Maximum Pressure (psi)	Estimated Time (sec)	Actual Time (sec)	Theoretical Grout Volume	Measured Grout Volume	Discharged Grout Volume	Post Grout Inspection	Date Tendon Installed	Date Tendon Stressed
			Batch	High Point	Discharge									

Tendon #:_______ **Wick Bleed Test Results:** 15min:_____ 30min:_____ 45min:_____ 60min:_____ 120min:_____ 180min:_____ **Air Test Pressure Loss**:__________

Tendon #:_______ **Wick Bleed Test Results:** 15min:_____ 30min:_____ 45min:_____ 60min:_____ 120min:_____ 180min:_____ **Air Test Pressure Loss**:__________

Tendon #:_______ **Wick Bleed Test Results:** 15min:_____ 30min:_____ 45min:_____ 60min:_____ 120min:_____ 180min:_____ **Air Test Pressure Loss**:__________

Tendon #:_______ **Wick Bleed Test Results:** 15min:_____ 30min:_____ 45min:_____ 60min:_____ 120min:_____ 180min:_____ **Air Test Pressure Loss**:__________

Tendon #:_______ **Wick Bleed Test Results:** 15min:_____ 30min:_____ 45min:_____ 60min:_____ 120min:_____ 180min:_____ **Air Test Pressure Loss**:__________

Remarks:

(Note whether Standard or Modified Fluidity test was used, problems encountered, variations to approved grouting plan, etc.)______________________________

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-4(b)
SAMPLE WAX INJECTION RECORD

FDOT Project No:_________________________
Bridge No:_________________________
Location:_________________________
Ambient Temperature:_________________________

Wax Type:_________________________
Wax Manufacturer:_________________________
Lot Number:_________________________
Date of Injection:_________________________

Inspectors:_________________________
Contractor:_________________________
Contractor Personnel:_________________________

Tendon No.	Tendon Length	Wax Locking Pressure (psi)	Vacuum Gauge Pressure (psi) / % Vacuum	Wax Temperature (°F)	Theoretical Wax Volume	Actual Wax Volume in Duct	Volume of Wax Discharged	Post Wax Injection Inspection	Date Tendon Installed	Date Tendon Stressed

Tendon #:________ **Air Test Pressure Loss**:___________ **Vacuum Loss (%) = (P1-P2)/P1*100%:**_______________
Tendon #:________ **Air Test Pressure Loss**:___________ **Vacuum Loss (%) = (P1-P2)/P1*100%:**_______________
Tendon #:________ **Air Test Pressure Loss**:___________ **Vacuum Loss (%) = (P1-P2)/P1*100%:**_______________
Tendon #:________ **Air Test Pressure Loss**:___________ **Vacuum Loss (%) = (P1-P2)/P1*100%:**_______________
Tendon #:________ **Air Test Pressure Loss**:___________ **Vacuum Loss (%) = (P1-P2)/P1*100%**:_______________

Remarks:

(Note problems encountered, variations to approved wax injection plan, etc.)____

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-5(a)
SAMPLE POST GROUTING INSPECTION RECORD

FDOT Project No:______________________ **Inspectors:__________________________________** **Bridge No:___________________________**

			Anchor Cap					Grout Tube				
Anchor Location	Span	Tendon Designation	Location of Inspection	Void Found?	Estimate % of Void	Grout Condition (Solid/Wet/Soft)	Depth Probed with Wire	Void Found?	Depth of Borescope Inspection	Grout Condition (Solid/Wet/Soft	Exposed Strands?	Free Water?

			Anchor Cap					Grout Tube				
Anchor Location	Span	Tendon Designation	Location of Inspection	Void Found?	Estimate % of Void	Grout Condition (Solid/Wet/Soft)	Depth Probed with Wire	Void Found?	Depth of Borescope Inspection	Grout Condition (Solid/Wet/Soft	Exposed Strands?	Free Water?

Void in External Tendon Duct? ____________
If yes, indicate size and location below.

(Shade in voided area)

Notes:____

____

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-5(b)
SAMPLE POST WAX INJECTION INSPECTION RECORD

FDOT Project No:_________________________ **Inspectors:**____ **Bridge No:**________________________________

			Anchor Cap				Wax Tube		
Anchor Location	Span	Tendon Designation	Location of Inspection	Void Found?	Estimate % of Void	Depth Probed with Wire	Void Found?	Depth of Borescope Inspection	Exposed Strands?

			Anchor Cap				Wax Tube		
Anchor Location	Span	Tendon Designation	Location of Inspection	Void Found?	Estimate % of Void	Depth Probed with Wire	Void Found?	Depth of Borescope Inspection	Exposed Strands?

Void in External Tendon Duct? ______________
If yes, indicate size and location below.

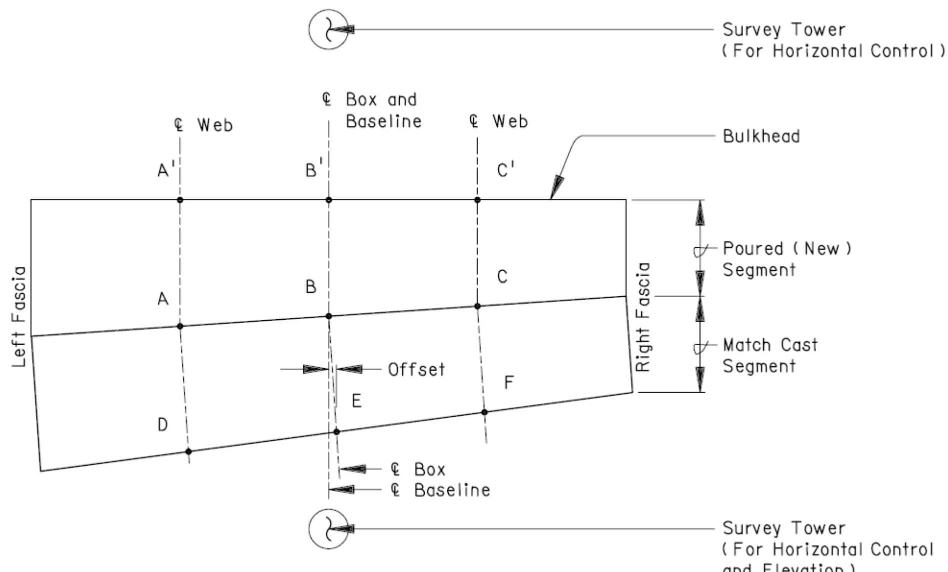
(Shade in voided area)

Notes:____

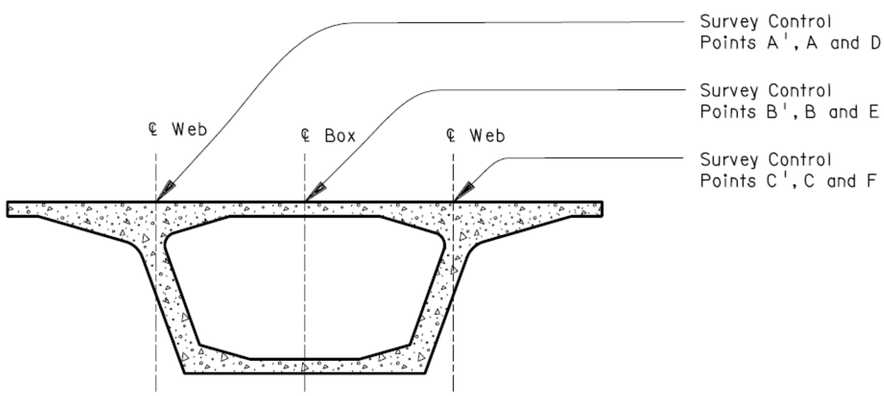
____

Note: This standard data collection form is provided as an example of minimum data collection requirements. Additional fields may be added by the Senior Project Engineer. All data fields on the attached forms shall be incorporated into the forms used for the project. If certain data fields are not applicable for a project, these fields may be omitted from project forms with written approval of the SCSE.

ATTACHMENT 10-7-6
SAMPLE CASTING YARD SURVEY CONTROL POINTS FOR SEGMENTAL SUPERSTRUCTURES



SEGMENT PLAN VIEWS IN THE CASTING YARD

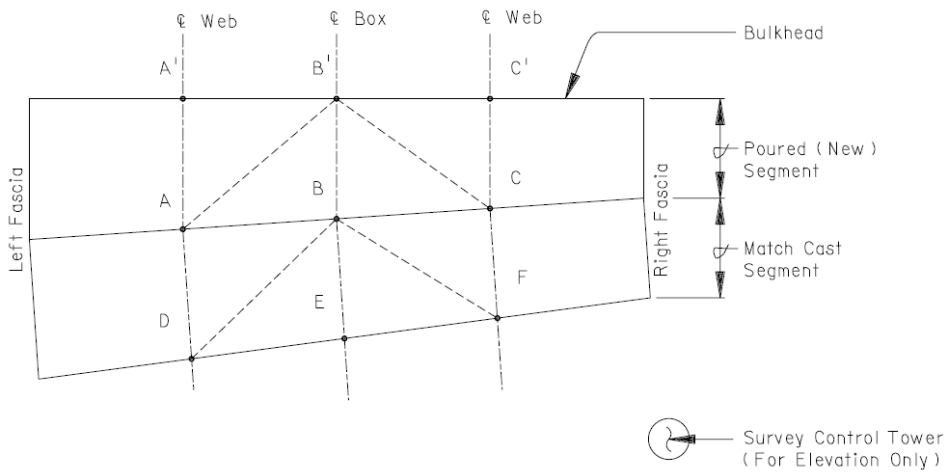


SEGMENT CROSS SECTION

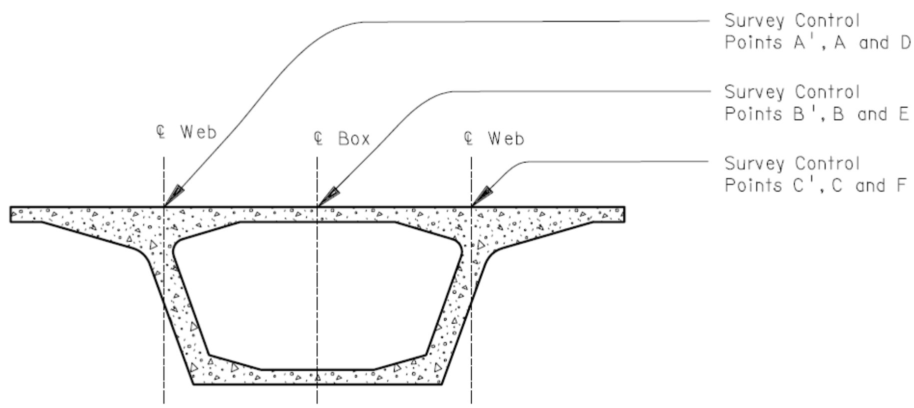
NOTES:

1. The horizontal Baseline is established between Survey Towers, and the bulkhead is set perpendicular to this Baseline.
2. Points B' and B are on the Baseline, and Point E is offset from the Baseline as shown.
3. Horizontal Measurements are taken between Control Points A-A', B-B' and C-C'.
4. Elevations are taken at Points A', C', A, C, D and F.
5. All elevations and measurements are taken before and after casting the Poured (New) Segment.

ATTACHMENT 10-7-7
ALTERNATE SAMPLE CASTING YARD SURVEY CONTROL POINTS FOR SEGMENTAL SUPERSTRUCTURES



SEGMENT PLAN VIEWS IN THE CASTING YARD

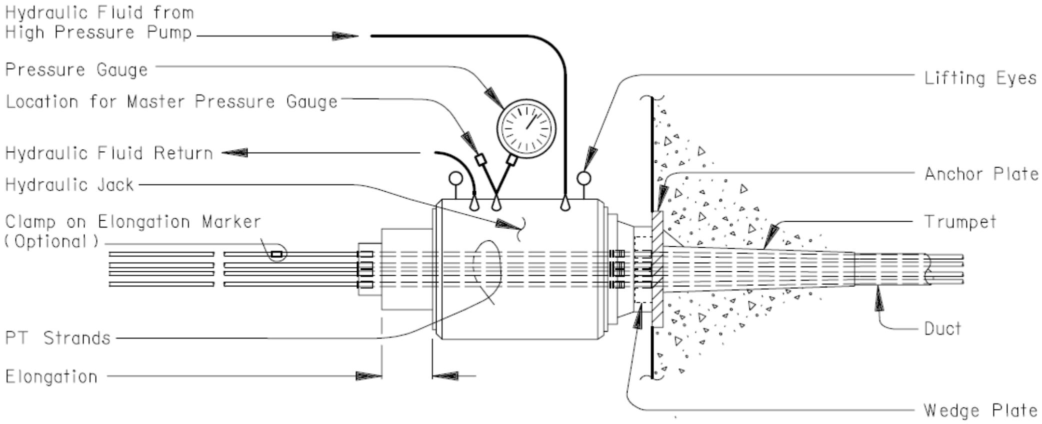


SEGMENT CROSS SECTION

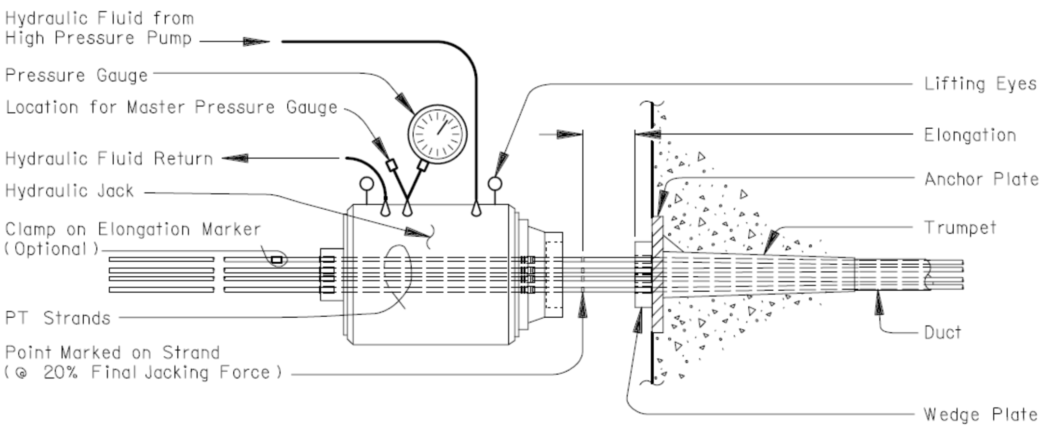
NOTES:

1. Horizontal measurements are taken between Control Points A-A', C-C', A-B', C-B', A-D, C-F, B-D and B-F before casting the Poured (New) Segment.
2. Elevations are taken at Points A', C', A, C, D and F before and after casting the Poured (New) Segment.
3. Horizontal measurments are taken between Control Points A-A , C-C , A-B and C-B after casting the Poured (New) Segment.

ATTACHMENT 10-7-8
TENDON ELONGATION MEASUREMENT FOR A TYPICAL HYDRAULIC JACK

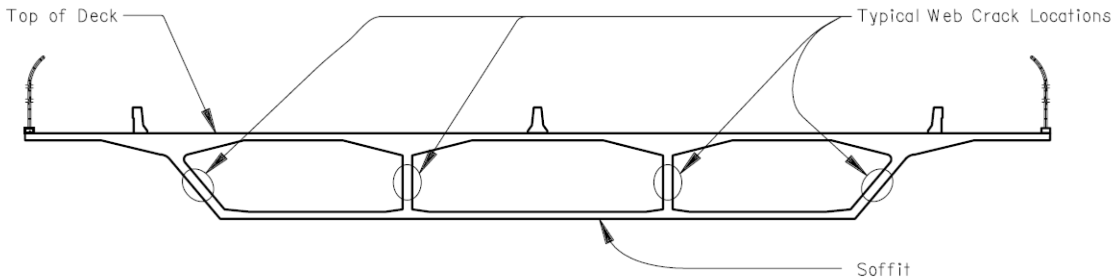


HYDRAULIC JACK DURING STRESSING

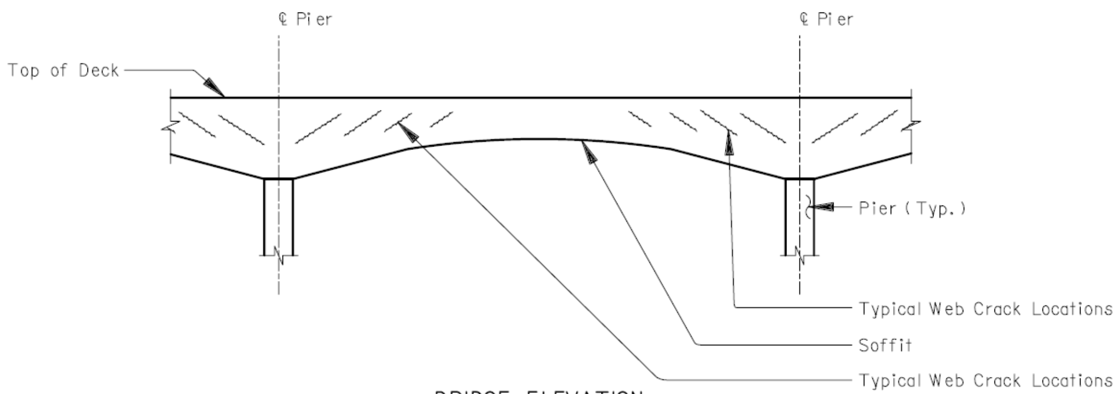


HYDRAULIC JACK AFTER STRESSING
(WHEN JACK IS PULLED BACK)

~~ATTACHMENT 10-7-9~~
~~TYPICAL WEB CRACKS ON SEGMENTAL SUPERSTRUCTURE~~

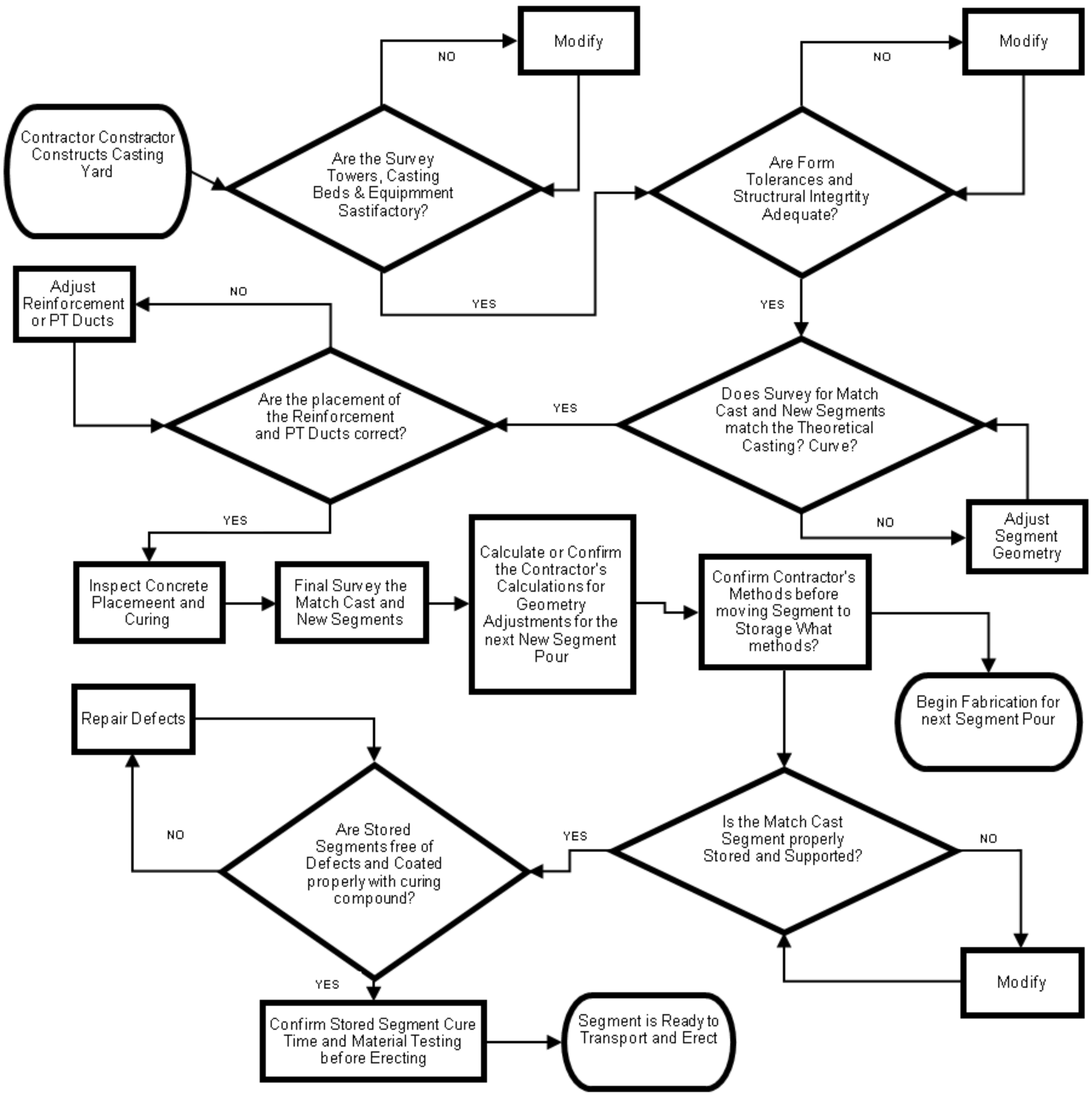


SEGMENT CROSS SECTION

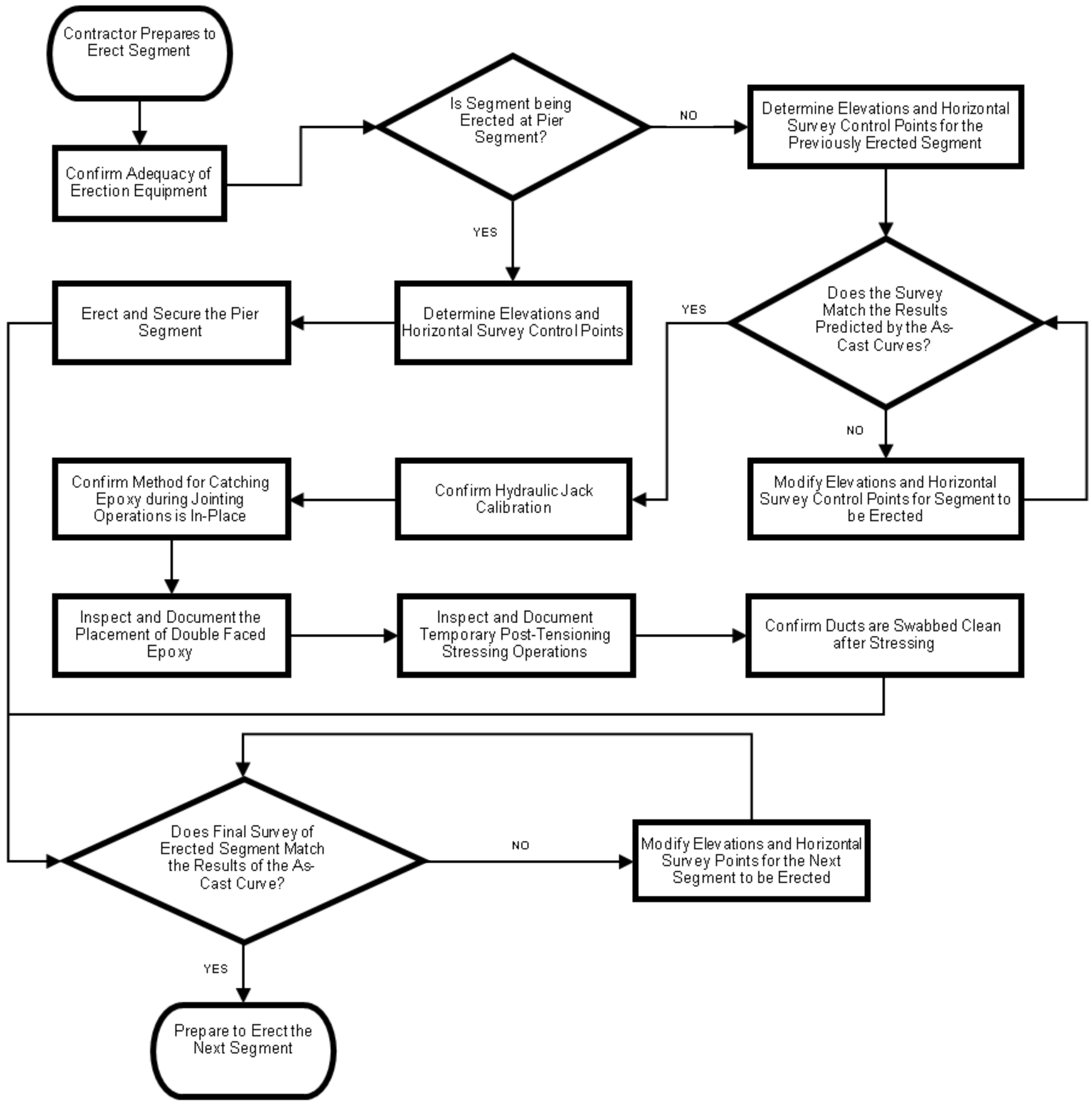


BRIDGE ELEVATION

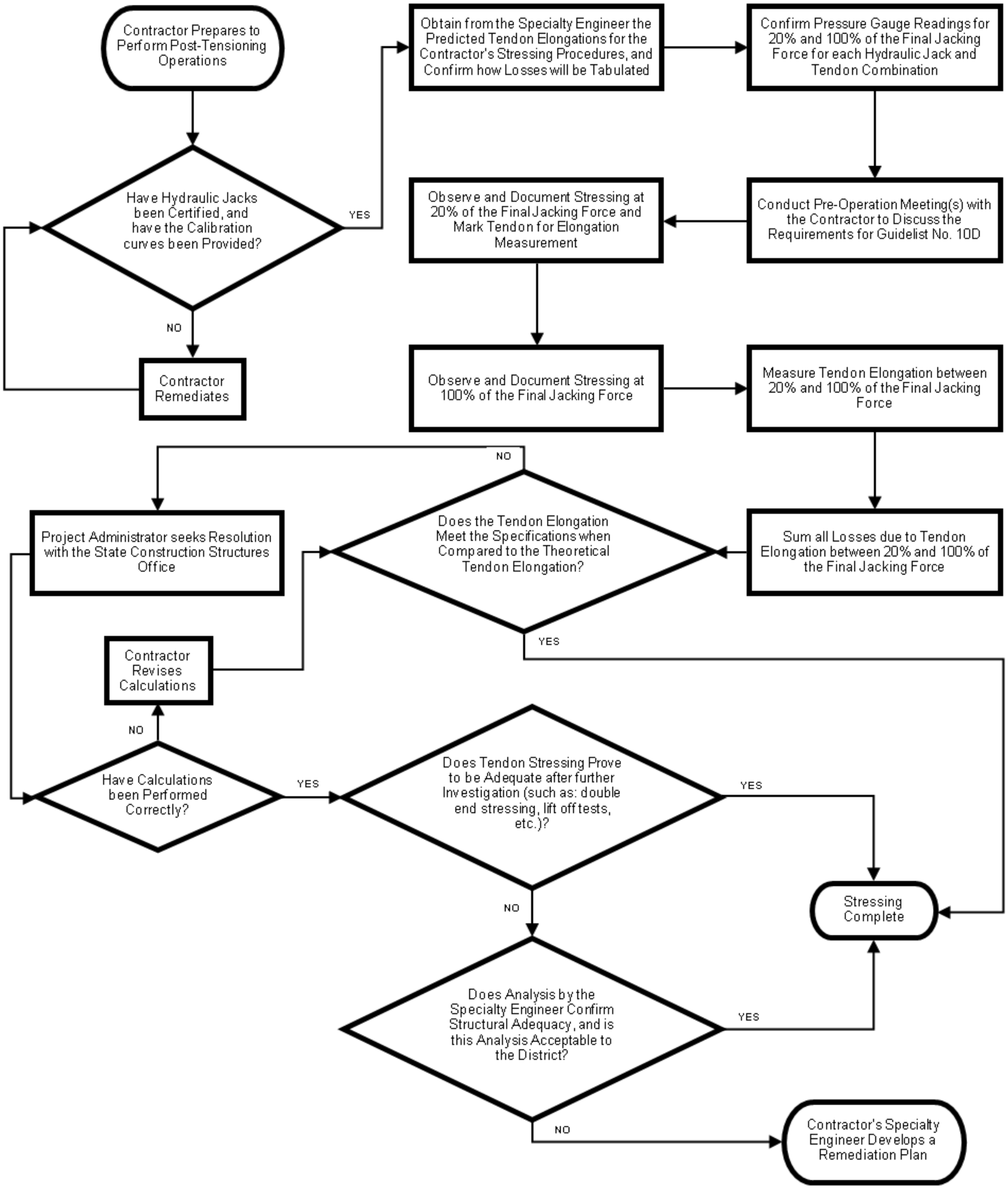
ATTACHMENT 10-7-~~10~~9
CASTING YARD AND SEGMENT FABRICATION



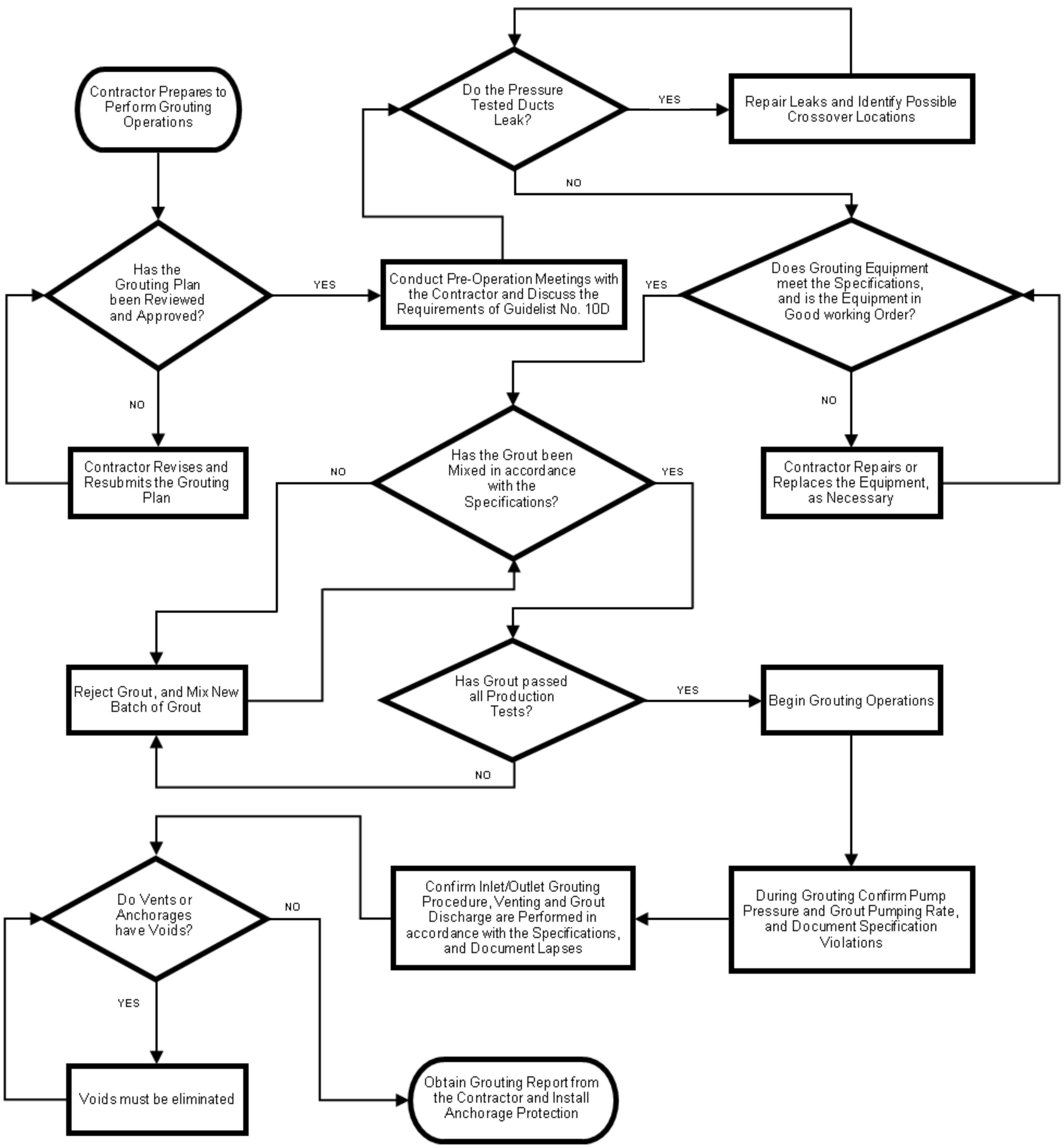
ATTACHMENT 10-7-1~~1~~0
SEGEMENT ERECTION AND JOINTING



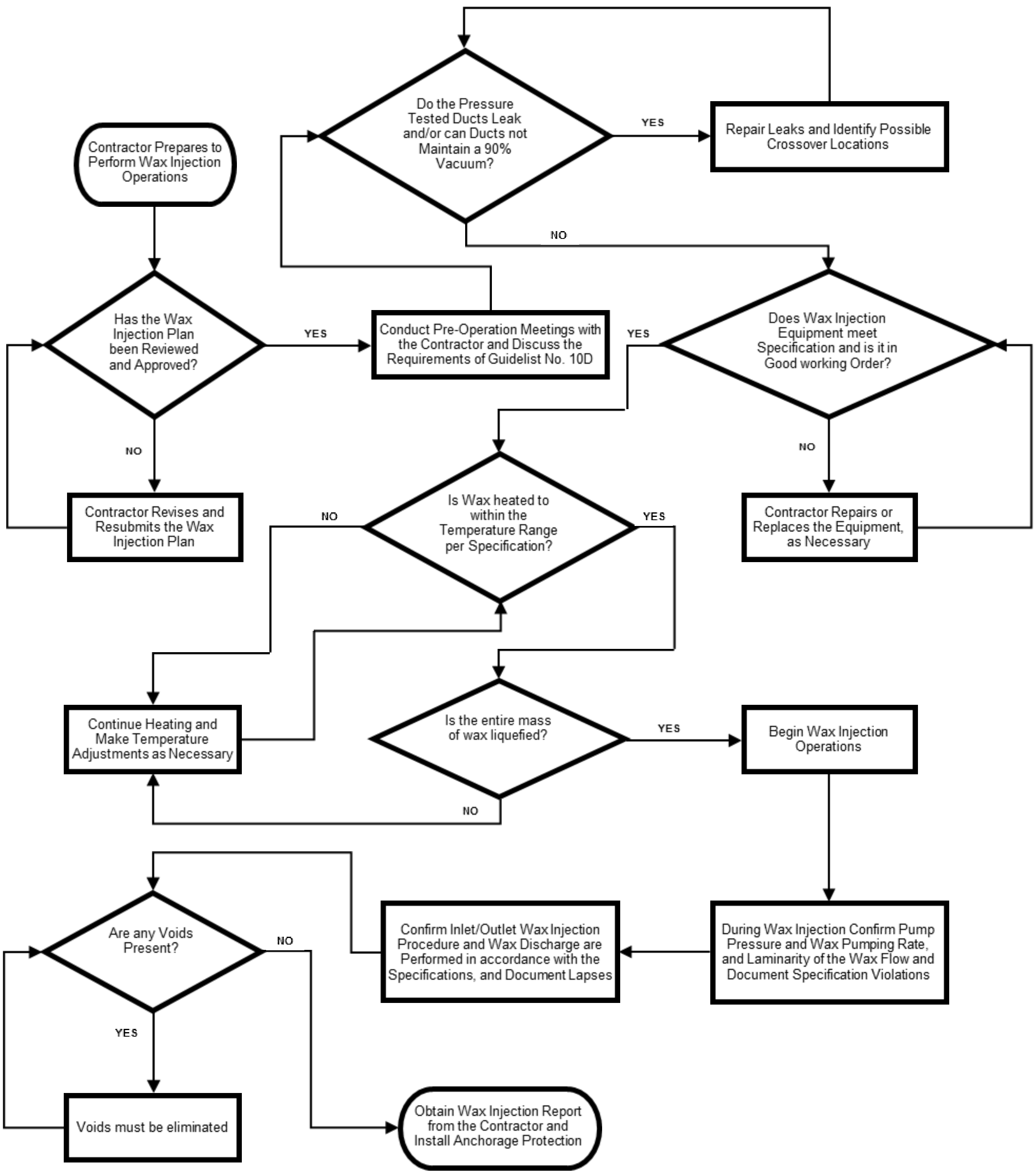
ATTACHMENT 10-7-1~~2~~1
POST TENSIONING



ATTACHMENT 10-7-1~~3~~2(a)
GROUTING



ATTACHMENT 10-7-1~~3~~2(b)
WAX INJECTION



ATTACHMENT 10-7-1~~4~~3
CRACK INSPECTION AND REPAIR