



Florida Department of Transportation

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605 Suwannee Street
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JIM BOXOLD
SECRETARY

July 30, 2015

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section **452**
Proposed Specification: **4520402 Precast Segmental Bridge Construction.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Charles Boyd of the State Structures Design Office to modify the language to allow for use of flexible filler in post-tensioning applications. Revisions to include flexible filler are also proposed for Sections 105, 462, 938, and 960.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to daniel.scheer@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Scheer, P.E.
State Specifications Engineer

DS/dt

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

PRECAST SEGMENTAL BRIDGE CONSTRUCTION.

(REV ~~4-285-18-15~~)

SUBARTICLE 452-4.2 is deleted and the following substituted:

452-4.2 Information Required: Submit detailed shop drawings, calculations, manuals and other information, including, but not limited to, the following:

452-4.2.1 Segment Shop Drawings:

- (1.) A schedule of materials for segment fabrication including concrete, reinforcing steel, prestressing steel, ~~grout~~ **duct filler**, and other similar items.
- (2.) Each segment number and the direction of erection.
- (3.) Segment dimensions including widths, lengths, thicknesses, tapers, fillets, radii, working points, post-tensioning, clearances, rebar dimensions and spacing, embedded items, holes, anchorages positions, and other similar items.
- (4.) Post-tensioning requirements as outlined in Section 462. Check post-tensioning for consistency with pre-approved post-tensioning hardware and provide part numbers for Department pre-approved systems on the shop drawings. Substitution of parts or materials is not allowed.
- (5.) The volume of concrete, weight of reinforcement and weight of post-tensioning in each precast segment and the total weight for reinforcement and post-tensioning for both the superstructure and substructure summarized and tabulated on the shop drawings.
- (6.) Details and calculations for any localized strengthening for concentrated supports and loads or reactions from any special erection equipment placed in locations not already allowed for in the Plans.
- (7.) Details and supporting calculations for any modifications to segment geometry, cross section dimensions, or segment length including any required changes to reinforcing and post-tensioning.
- (8.) Details of permanent and temporary embedded items including inserts, blockouts, temporary openings, holes, and other similar items; and any localized required strengthening and the materials and methods to fill and finish the holes.

452-4.2.2 Casting Yard:

- (1.) Procedures for segment fabrication including layout of the casting yard, set up and operation of the casting cells, movable rain and sun shades, geometry control stations, the storage and handling of rebar cages. the preparation of as built geometry data, placing and finishing concrete, curing of concrete, form stripping, bond breaking, and other similar items.
- (2.) Calculations and details for lifting, storage and stacking of segments. Additional strengthening of the segments to accommodate stacking will be at no expense to the Department.
- (3.) Equipment for segments fabrication, including details of the forms and casting cells for the manufacture of the segments, surveying the segment, lifting and transportation of the segment in the yard, and other similar items.
- (4.) Segment storage including layout of the storage area, method of supporting the segments, single or double stacking, placing erection marks and segment identification, and other similar items.
- (5.) Segment transportation from the casting yard to the site.

452-4.2.3 Erection Manual: Meet the requirements in 452-8.

452-4.2.4 Manual for Geometry Control and Casting Curves: Meet the requirements in 452-6.3.

SUBARTICLE 452-6.3 is deleted and the following substituted:

452-6.3 Casting Control (Geometry): Before commencing the casting operation, submit the proposed method of geometry control for all segment casting operations to the Engineer for approval. This submittal must be in the form of a "Casting Manual" and include but not necessarily be limited to:

(1.) All measuring equipment, procedures and the location of control points to be established on each segment.

(2.) The location and values of all permanent benchmarks and reference points in the precasting yard.

(3.) A geometry control procedure for the vertical and horizontal alignment control for the precasting of segments; including survey controls and procedures, observations, checks, computational and/or graphical methods and correction techniques.

(4.) The casting curves which include the theoretical geometric horizontal alignment, profile grade and superelevation appropriately combined with the camber.

Ensure that the casting manual covers all geometry control operations necessary and is compatible with the chosen methods of casting and erection, including erection survey, elevation and alignment control. Prepare the manual in accordance with submittal requirements of this Section.

Do not begin casting without the Engineer's approval of the geometry control method.

In the precasting yard, use instruments for the geometry control which are mounted on a permanent platform of sufficient height to sight on all control points. In addition, establish and maintain permanent benchmarks and reference points throughout the casting operations.

During casting, make all corrections required in the geometry of the segments from the control points established on each segment.

With a match cast system, after casting and before bond breaking to separate the segments, check the position of the new cast and match cast segments again. If positions are not as desired, make corrections in the next segment. In general, and unless otherwise approved by the Engineer, make observations on the geometry control reference hardware cast into the segments (i.e. elevation bolts, alignment offsets and lengths) to a precision of plus or minus 0.001 foot.

During casting operations, produce and maintain on a daily basis a graphical plot of the vertical and horizontal "as cast" alignments along each vertical and horizontal control line to an exaggerated scale in order to clearly highlight variations. Depict these against both the theoretical geometric vertical and horizontal alignment casting curves on a continuous layout of an entire unit of the bridge between expansion joints. Maintain this plot in good condition so that it may be used and referenced during erection.

Keep all geometry control hardware cast into any segments, such as elevation bolts and alignment hairpins, in place during erection for reference and checking

purposes. Remove the hardware after completion of erection of the unit in the bridge between expansion joints.

Use experienced personnel to operate the instruments and supervise the casting operation. Prior to the commencement of casting, obtain the Engineer's approval of the experience and/or qualifications of the supervisory and instrument operating personnel, particularly with regard to the observational precision required.

SUBARTICLE 452-6.5.3 is deleted and the following substituted:

452-6.5.3 Anchor~~age~~ Plates and Castings: Prior to placing concrete in the forms, fix all tendon anchor~~age~~ plates and anchor~~age~~ castings in their respective position in the forms, connected to their duct and sealed to prevent mortar intrusion. Ensure that anchor~~age~~ plates and castings are rigidly fixed in the forms to maintain their correct alignment and position during concrete placement and consolidation.

SUBARTICLE 452-6.6.3 is deleted and the following substituted:

452-6.6.3 Concrete Placement Sequence:

(1.) Superstructure box segments: First place concrete in the central portion of the bottom slab between the inside edges of the internal web forms, leaving a narrow gap of 6 inches to 12 inches for inspection and consolidation of the bottom corners when the next load is placed in the webs. Then place the concrete in the bottom corners of each web to connect and consolidate with that already placed in the bottom slab. Then place concrete in the remainder of the webs in lifts not exceeding 24 inches at a time up to the top of the webs but not into the slab over the webs. Place concrete in the top slab in the outer wing and mid slab regions between webs before placing, completing and consolidating zones over the top of the webs.

(2.) Substructure and Pier Shaft Segments: Cast precast pier shaft segments vertically. Place the concrete in uniform lifts of approximately 24 inches to 36 inches and consolidate well.

(3.) Obtain the Engineer's approval on any alternative sequences to the above, or for any other precast components.

SUBARTICLE 452-6.7 is deleted and the following substituted:

452-6.7 Curing:

452-6.7.1 General: Where casting cells are intended to operate on a short (daily) cycle and it can be demonstrated to the satisfaction of the Engineer that the required initial concrete strengths for the removal of the forms, application of prestress, moving and handling of the segments and that the final concrete strength can be achieved in a timely and consistent manner, then steam curing will not be required. However, take precautions to promote proper curing by methods approved by the Engineer and in accordance with Section 400. Such precautions must meet or exceed the following:

(a) 1. To prevent moisture loss, cover all exposed surfaces (those not in contact with a form or match cast segment) as soon as possible after casting with a moisture tight

covering (wet curing blankets or other approved equal systems). Avoid spoiling the deck surface finish. Keep the cover on or within 12 inches of the deck surface.

(b)2. Keep the moisture-tight covering substantially in place throughout succeeding operations such as geometry control survey, stripping of internal forms, wing forms and shifting of and working with a segment in a match cast position. Keep the concrete surface wet throughout these operations.

(c)3. After stripping of the side and core forms, continue curing of the precast concrete by the application of a Type 2 (white pigmented) membrane curing compound as specified in 925-2 to all exposed surfaces (including segment exterior once exposed by removal from the form). Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

(d)4. Maintain the moisture tight covering for at least 72 hours.

As an alternative, steam curing may be used.

(e)5. While the new cast segment is in contact with the match cast segment, cover the match cast segment with curing blankets, or other approved equal system, to minimize the effects of differential temperature between the segments.

452-6.7.2 Steam Curing: Meet the requirements of Section 400 modified by the following requirements when steam curing is used.

(1.) Provide a device or devices for simultaneously recording the temperature of three widely separated locations per casting cell. Locate the three temperature sensors near the top, middle and bottom of the enclosure or as otherwise approved by the Engineer. Identify the charts with the hours, dates and segment number and deliver to the Engineer immediately after steam curing is completed unless otherwise approved.

(2.) Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

(3.) Expose match cast segments to the same curing environment (temperature and humidity) as the new cast segment until the new segment reaches the required strength to allow the removal of the forms.

SUBARTICLE 452-6.9 is deleted and the following substituted:

452-6.9 Test Samples: Provide additional test samples and testing for compressive strength on precast segments and field closure joints to control the construction activities and to ensure adequate strength of these components at various stages of their manufacture and assembly.

Make test cylinders, in accordance with Section 346, cured in the same manner as the structural components to ensure adequate compressive strength has been achieved in accordance with the plan requirements for the following conditions:

(a)1. Prior to release of prestressing for components which are to be pretensioned.

(b)2. Prior to form release and/or moving the components to storage.

(c)3. Prior to post-tensioning transverse tendons if the component is less than 28 days old.

(d)4. Prior to placing a component into position in the structure and/or stressing of longitudinal post-tensioning tendons if the component is less than 28 days old.

Determine the number of cylinders in accordance with the proposed method for casting, transporting and erecting the various components.

Provide the results of the compression testing of one or more test cylinders for controlling the time of execution of the various construction operations. Obtain the Engineer's approval for meeting the Specification requirements on casting, curing and testing of concrete test cylinders.

No direct payment will be made for the concrete testing. All costs for such testing will be included in the bid items for the various precast structural components.

SUBARTICLE 452-8.1 is deleted and the following substituted:

452-8.1 Erection Manual: Before commencing erection operations, submit proposals for all segment erection operations to the Engineer for approval. This submittal must be in the form of an "Erection Manual" and include but not necessarily be limited to:

(1.) A detailed step-by-step sequence for the erection of each segment including all intermediate procedures relating to erection equipment, temporary and permanent post-tensioning and making of closures between spans and/or cantilevers and other required sequencing.

(2.) Positioning, use and sequencing of falsework, jacking and/or releasing of falsework, temporary towers, supports, tie-downs, counterweights, closure devices and the like.

(3.) Positioning, use and sequencing of erection equipment such as cranes, beam and winch devices, gantries, trusses and the like, both on and off the structure, including the movement, introduction and/or removal of any supports onto or connections with the structure. Include drawings and calculations for the structural effects of erection equipment on the structure.

(4.) Detailed scheduling of all temporary and permanent post-tensioning operations and sequences in accordance with the segment erection and closure operations and other required scheduling.

(5.) Stressing forces and elongations for post-tensioning.

(6.) Sequencing of ~~grouting~~ **filler injection** operations.

(7.) A method for the field survey control for establishing and checking the erected geometry (elevations and alignments) with particular attention to the setting of critical segments such as, for example, pier segments for balanced cantilever erection. This information may be included in the Erection Manual or may be provided later as a supplementary or separate document.

(8.) Any other relevant operations as required and applicable to the structure type and construction method.

Do not start erection without the Engineer's approval of the erection manual.

SUBARTICLE 452-8.3 is deleted and the following substituted:

452-8.3 Erection Tolerances:

(1.) Ensure that maximum differential between outside faces of adjacent segments in the erected position does not exceed 3/16 inches.

(2.) Ensure that transversely, the angular deviation from the theoretical slope difference between two successive segment joints not exceed 0.001 rad.

(3.) Ensure that longitudinally, the angular deviation from the theoretical slope change between two successive segments does not exceed 0.003 rad.

(4.) Dimensions from segment to segment will compensate for any deviations within a single segment so that the overall dimensions of the completed structure meets the dimensions shown in the Plans such that the accumulated maximum error does not exceed 1/1000 of the span length for either vertical profile and/or horizontal alignment.

Carefully check elevations and alignments at each stage of erection and correct as required to avoid any possible accumulation of errors.

SUBARTICLE 452-8.4.1.1 is deleted and the following substituted:

452-8.4.1.1 Closure Joints: Use concrete meeting the same specifications and criteria as the concrete in the segments. Ensure that concrete reaches the minimum required strength as shown in the Plans or in the Specifications prior to stressing the continuity post-tensioning. Ensure that the closure joint forms provide tolerances as specified under 452-~~56~~.11 Tolerances.

SUBARTICLE 452-8.4.2.1 is deleted and the following substituted:

452-8.4.2.1 Deformations: For computing deformations due to time dependent stress variations, the erection time assumptions are shown in the Plans.

Deformations due to creep and shrinkage and the concrete modulus of elasticity have been computed using the ~~latest edition of the~~ FDOT's [_Segmental Bridge Design Criteria](#) Structures Manual edition noted in the Plans. Obtain the Engineer's approval for method of calculating the above parameters.

SUBARTICLE 452-8.4.3 is deleted and the following substituted:

452-8.4.3 Precast Box Pier Construction - Erection Tolerances:

(1.) Ensure that maximum differential between outside faces of adjacent segments in the erected position does not exceed 3/16 inches.

(2.) Ensure that the rotational angular deviation, measured about a vertical line, between two successive segment joints does not exceed 0.001 rad.

(3.) Ensure that the maximum angular deviation of a segment from a vertical line does not exceed 0.003 rad. and that the maximum overall deviation from the vertical, measured in any direction, does not exceed 0.01 inches per foot of height.

(4.) Ensure the base precast segment is within 1/2 inch of the Plan location.

SUBARTICLE 452-8.6 is deleted and the following substituted:

452-8.6 Packed Mortar Joints for Joints, or Bearings ~~or setting Pier Shaft Segments:~~

Where designated on the Plans, place packed mortar after the ~~precast element~~joint or bearing has been set at the proper final elevation.

Pressure grouting ~~the joint~~ may be allowed with the Engineer's approval of the materials and method to be used. ~~Additionally, where precast piers are shown connected to the footings by packed mortar, temporarily supporting the base segment and casting the footing around the segment will be allowed. Minimum penetration of the base segment into the footing must be 2 inches. No additional payment for this operation or for additional footing concrete will be made.~~

Mortar for packing consists of one part cement and one part fine aggregate, by volume, mixed with a non-shrink admixture as recommended by the manufacturer. Mix the dry elements thoroughly to a uniform mixture. Add water to produce a mealy, slightly adhesive mixture. Pack the mortar until a water sheen is produced on the surface of the mortar.

Build a form around the joint leaving one side open. Secure the form to withstand the required packing forces. Insert a small amount of mortar into the open joint to form a 2 inches thick bead on the opposite side of the form. Pack this bead by striking a special tool made of 1/2 inch by 2 inch steel having a length approximately 10 inches longer than the largest dimension of the joint being packed with a 2 pound hammer. Continue compaction until water begins to bleed out of the mortar. When bleeding has occurred, insert another bead of mortar and pack as described above. Continue this process until the joint is filled to the limits shown in the Plans.

SUBARTICLE 452-13.7 is deleted and the following substituted:

452-13.7 Precast Segment Production: Preparatory operations for superstructure segment casting will be paid for separately at the Contract Lump Sum price for precast segment production. This item consists of the work necessary for establishing and putting into operation segment casting facilities. It includes preparatory work, operations, acquisition or lease of real property, acquisition or lease of segment manufacturing equipment, acquisition or lease of equipment for the handling, transport and storage of the segments, and all other work or operations which must be performed or costs incurred prior to the manufacture of the concrete segments, including engineering services such as shop drawings.

Partial payments will be made as indicated below:

~~a)~~1. Upon production of documentary evidence, such as paid invoices, canceled checks or similar executed financial instruments, the cost for the acquisition of the casting forms for the precast segments by purchase, lease or manufacture will be paid up to a limit of 25% of the Lump Sum Price bid.

~~b)~~2. When the first precast superstructure segment has been cast out of the first operable casting form and the segment is approved and accepted by the Engineer, 25% of the Lump Sum Price bid will be paid.

~~c)~~3. Thereafter, when each succeeding superstructure segment has been cast out of any operable casting form and approved and accepted by the Engineer, 5% of the Lump Sum Price bid will be paid for each segment up to a limit of 50% of the Lump Sum Price bid (i.e., 5% for each of the next ten acceptable segments).

The total Lump Sum Price bid under this item will not exceed the least of:

a) 1. 12% of the sum of the amounts paid for the concrete in the precast segments only (i.e., excluding any cast-in-place concrete in joints, closures or designated cast-in-place segments) or

b) 2. 5% of the Contract amount excluding mobilization and this item.

The balance of the Lump Sum Price not paid after completion of casting the first 11 satisfactory superstructure segments will be paid after completion of the erection of the first span or closure of the first pair of cantilevers, whichever occurs first.

PRECAST SEGMENTAL BRIDGE CONSTRUCTION.
(REV 5-18-15)

SUBARTICLE 452-4.2 is deleted and the following substituted:

452-4.2 Information Required: Submit detailed shop drawings, calculations, manuals and other information, including, but not limited to, the following:

452-4.2.1 Segment Shop Drawings:

1. A schedule of materials for segment fabrication including concrete, reinforcing steel, prestressing steel, duct filler, and other similar items.
2. Each segment number and the direction of erection.
3. Segment dimensions including widths, lengths, thicknesses, tapers, fillets, radii, working points, post-tensioning, clearances, rebar dimensions and spacing, embedded items, holes, anchorage positions, and other similar items.
4. Post-tensioning requirements as outlined in Section 462. Check post-tensioning for consistency with pre-approved post-tensioning hardware and provide part numbers for Department pre-approved systems on the shop drawings. Substitution of parts or materials is not allowed.
5. The volume of concrete, weight of reinforcement and weight of post-tensioning in each precast segment and the total weight for reinforcement and post-tensioning for both the superstructure and substructure summarized and tabulated on the shop drawings.
6. Details and calculations for any localized strengthening for concentrated supports and loads or reactions from any special erection equipment placed in locations not already allowed for in the Plans.
7. Details and supporting calculations for any modifications to segment geometry, cross section dimensions, or segment length including any required changes to reinforcing and post-tensioning.
8. Details of permanent and temporary embedded items including inserts, blockouts, temporary openings, holes, and other similar items; and any localized required strengthening and the materials and methods to fill and finish the holes.

452-4.2.2 Casting Yard:

1. Procedures for segment fabrication including layout of the casting yard, set up and operation of the casting cells, movable rain and sun shades, geometry control stations, the storage and handling of rebar cages, the preparation of as built geometry data, placing and finishing concrete, curing of concrete, form stripping, bond breaking, and other similar items.
2. Calculations and details for lifting, storage and stacking of segments. Additional strengthening of the segments to accommodate stacking will be at no expense to the Department.
3. Equipment for segments fabrication, including details of the forms and casting cells for the manufacture of the segments, surveying the segment, lifting and transportation of the segment in the yard, and other similar items.
4. Segment storage including layout of the storage area, method of supporting the segments, single or double stacking, placing erection marks and segment identification, and other similar items.
5. Segment transportation from the casting yard to the site.

452-4.2.3 Erection Manual: Meet the requirements in 452-8.

452-4.2.4 Manual for Geometry Control and Casting Curves: Meet the requirements in 452-6.3.

SUBARTICLE 452-6.3 is deleted and the following substituted:

452-6.3 Casting Control (Geometry): Before commencing the casting operation, submit the proposed method of geometry control for all segment casting operations to the Engineer for approval. This submittal must be in the form of a "Casting Manual" and include but not necessarily be limited to:

1. All measuring equipment, procedures and the location of control points to be established on each segment.
2. The location and values of all permanent benchmarks and reference points in the precasting yard.
3. A geometry control procedure for the vertical and horizontal alignment control for the precasting of segments; including survey controls and procedures, observations, checks, computational and/or graphical methods and correction techniques.
4. The casting curves which include the theoretical geometric horizontal alignment, profile grade and superelevation appropriately combined with the camber.

Ensure that the casting manual covers all geometry control operations necessary and is compatible with the chosen methods of casting and erection, including erection survey, elevation and alignment control. Prepare the manual in accordance with submittal requirements of this Section.

Do not begin casting without the Engineer's approval of the geometry control method.

In the precasting yard, use instruments for the geometry control which are mounted on a permanent platform of sufficient height to sight on all control points. In addition, establish and maintain permanent benchmarks and reference points throughout the casting operations.

During casting, make all corrections required in the geometry of the segments from the control points established on each segment.

With a match cast system, after casting and before bond breaking to separate the segments, check the position of the new cast and match cast segments again. If positions are not as desired, make corrections in the next segment. In general, and unless otherwise approved by the Engineer, make observations on the geometry control reference hardware cast into the segments (i.e. elevation bolts, alignment offsets and lengths) to a precision of plus or minus 0.001 foot.

During casting operations, produce and maintain on a daily basis a graphical plot of the vertical and horizontal "as cast" alignments along each vertical and horizontal control line to an exaggerated scale in order to clearly highlight variations. Depict these against both the theoretical geometric vertical and horizontal alignment casting curves on a continuous layout of an entire unit of the bridge between expansion joints. Maintain this plot in good condition so that it may be used and referenced during erection.

Keep all geometry control hardware cast into any segments, such as elevation bolts and alignment hairpins, in place during erection for reference and checking purposes. Remove the hardware after completion of erection of the unit in the bridge between expansion joints.

Use experienced personnel to operate the instruments and supervise the casting operation. Prior to the commencement of casting, obtain the Engineer's approval of the experience and/or qualifications of the supervisory and instrument operating personnel, particularly with regard to the observational precision required.

SUBARTICLE 452-6.5.3 is deleted and the following substituted:

452-6.5.3 Anchorage Plates and Castings: Prior to placing concrete in the forms, fix all tendon anchorage plates and anchorage castings in their respective position in the forms, connected to their duct and sealed to prevent mortar intrusion. Ensure that anchorage plates and castings are rigidly fixed in the forms to maintain their correct alignment and position during concrete placement and consolidation.

SUBARTICLE 452-6.6.3 is deleted and the following substituted:

452-6.6.3 Concrete Placement Sequence:

1. Superstructure box segments: First place concrete in the central portion of the bottom slab between the inside edges of the internal web forms, leaving a narrow gap of 6 inches to 12 inches for inspection and consolidation of the bottom corners when the next load is placed in the webs. Then place the concrete in the bottom corners of each web to connect and consolidate with that already placed in the bottom slab. Then place concrete in the remainder of the webs in lifts not exceeding 24 inches at a time up to the top of the webs but not into the slab over the webs. Place concrete in the top slab in the outer wing and mid slab regions between webs before placing, completing and consolidating zones over the top of the webs.

2. Substructure and Pier Shaft Segments: Cast precast pier shaft segments vertically. Place the concrete in uniform lifts of approximately 24 inches to 36 inches and consolidate well.

3. Obtain the Engineer's approval on any alternative sequences to the above, or for any other precast components.

SUBARTICLE 452-6.7 is deleted and the following substituted:

452-6.7 Curing:

452-6.7.1 General: Where casting cells are intended to operate on a short (daily) cycle and it can be demonstrated to the satisfaction of the Engineer that the required initial concrete strengths for the removal of the forms, application of prestress, moving and handling of the segments and that the final concrete strength can be achieved in a timely and consistent manner, then steam curing will not be required. However, take precautions to promote proper curing by methods approved by the Engineer and in accordance with Section 400. Such precautions must meet or exceed the following:

1. To prevent moisture loss, cover all exposed surfaces (those not in contact with a form or match cast segment) as soon as possible after casting with a moisture tight covering (wet curing blankets or other approved equal systems). Avoid spoiling the deck surface finish. Keep the cover on or within 12 inches of the deck surface.

2. Keep the moisture-tight covering substantially in place throughout succeeding operations such as geometry control survey, stripping of internal forms, wing forms and shifting of and working with a segment in a match cast position. Keep the concrete surface wet throughout these operations.

3. After stripping of the side and core forms, continue curing of the precast concrete by the application of a Type 2 (white pigmented) membrane curing compound as specified in 925-2 to all exposed surfaces (including segment exterior once exposed by removal from the form). Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

4. Maintain the moisture tight covering for at least 72 hours.

As an alternative, steam curing may be used.

5. While the new cast segment is in contact with the match cast segment, cover the match cast segment with curing blankets, or other approved equal system, to minimize the effects of differential temperature between the segments.

452-6.7.2 Steam Curing: Meet the requirements of Section 400 modified by the following requirements when steam curing is used.

1. Provide a device or devices for simultaneously recording the temperature of three widely separated locations per casting cell. Locate the three temperature sensors near the top, middle and bottom of the enclosure or as otherwise approved by the Engineer. Identify the charts with the hours, dates and segment number and deliver to the Engineer immediately after steam curing is completed unless otherwise approved.

2. Apply an approved debonding compound to match cast surfaces to serve both as a bond breaker and seal for curing.

3. Expose match cast segments to the same curing environment (temperature and humidity) as the new cast segment until the new segment reaches the required strength to allow the removal of the forms.

SUBARTICLE 452-6.9 is deleted and the following substituted:

452-6.9 Test Samples: Provide additional test samples and testing for compressive strength on precast segments and field closure joints to control the construction activities and to ensure adequate strength of these components at various stages of their manufacture and assembly.

Make test cylinders, in accordance with Section 346, cured in the same manner as the structural components to ensure adequate compressive strength has been achieved in accordance with the plan requirements for the following conditions:

1. Prior to release of prestressing for components which are to be pretensioned.

2. Prior to form release and/or moving the components to storage.

3. Prior to post-tensioning transverse tendons if the component is less than 28 days old.

4. Prior to placing a component into position in the structure and/or stressing of longitudinal post-tensioning tendons if the component is less than 28 days old.

Determine the number of cylinders in accordance with the proposed method for casting, transporting and erecting the various components.

Provide the results of the compression testing of one or more test cylinders for controlling the time of execution of the various construction operations. Obtain the Engineer's approval for meeting the Specification requirements on casting, curing and testing of concrete test cylinders.

No direct payment will be made for the concrete testing. All costs for such testing will be included in the bid items for the various precast structural components.

SUBARTICLE 452-8.1 is deleted and the following substituted:

452-8.1 Erection Manual: Before commencing erection operations, submit proposals for all segment erection operations to the Engineer for approval. This submittal must be in the form of an "Erection Manual" and include but not necessarily be limited to:

1. A detailed step-by-step sequence for the erection of each segment including all intermediate procedures relating to erection equipment, temporary and permanent post-tensioning and making of closures between spans and/or cantilevers and other required sequencing.
2. Positioning, use and sequencing of falsework, jacking and/or releasing of falsework, temporary towers, supports, tie-downs, counterweights, closure devices and the like.
3. Positioning, use and sequencing of erection equipment such as cranes, beam and winch devices, gantries, trusses and the like, both on and off the structure, including the movement, introduction and/or removal of any supports onto or connections with the structure. Include drawings and calculations for the structural effects of erection equipment on the structure.
4. Detailed scheduling of all temporary and permanent post-tensioning operations and sequences in accordance with the segment erection and closure operations and other required scheduling.
5. Stressing forces and elongations for post-tensioning.
6. Sequencing of filler injection operations.
7. A method for the field survey control for establishing and checking the erected geometry (elevations and alignments) with particular attention to the setting of critical segments such as, for example, pier segments for balanced cantilever erection. This information may be included in the Erection Manual or may be provided later as a supplementary or separate document.
8. Any other relevant operations as required and applicable to the structure type and construction method.

Do not start erection without the Engineer's approval of the erection manual.

SUBARTICLE 452-8.3 is deleted and the following substituted:

452-8.3 Erection Tolerances:

1. Ensure that maximum differential between outside faces of adjacent segments in the erected position does not exceed 3/16 inches.
2. Ensure that transversely, the angular deviation from the theoretical slope difference between two successive segment joints not exceed 0.001 rad.

3. Ensure that longitudinally, the angular deviation from the theoretical slope change between two successive segments does not exceed 0.003 rad.

4. Dimensions from segment to segment will compensate for any deviations within a single segment so that the overall dimensions of the completed structure meets the dimensions shown in the Plans such that the accumulated maximum error does not exceed 1/1000 of the span length for either vertical profile and/or horizontal alignment.

Carefully check elevations and alignments at each stage of erection and correct as required to avoid any possible accumulation of errors.

SUBARTICLE 452-8.4.1.1 is deleted and the following substituted:

452-8.4.1.1 Closure Joints: Use concrete meeting the same specifications and criteria as the concrete in the segments. Ensure that concrete reaches the minimum required strength as shown in the Plans or in the Specifications prior to stressing the continuity post-tensioning. Ensure that the closure joint forms provide tolerances as specified under 452-6.11 Tolerances.

SUBARTICLE 452-8.4.2.1 is deleted and the following substituted:

452-8.4.2.1 Deformations: For computing deformations due to time dependent stress variations, the erection time assumptions are shown in the Plans.

Deformations due to creep and shrinkage and the concrete modulus of elasticity have been computed using the FDOT's Structures Manual edition noted in the Plans. Obtain the Engineer's approval for method of calculating the above parameters.

SUBARTICLE 452-8.4.3 is deleted and the following substituted:

452-8.4.3 Precast Box Pier Construction - Erection Tolerances:

1. Ensure that maximum differential between outside faces of adjacent segments in the erected position does not exceed 3/16 inches.

2. Ensure that the rotational angular deviation, measured about a vertical line, between two successive segment joints does not exceed 0.001 rad.

3. Ensure that the maximum angular deviation of a segment from a vertical line does not exceed 0.003 rad. and that the maximum overall deviation from the vertical, measured in any direction, does not exceed 0.01 inches per foot of height.

4. Ensure the base precast segment is within 1/2 inch of the Plan location.

SUBARTICLE 452-8.6 is deleted and the following substituted:

452-8.6 Packed Mortar Joints for Joints or Bearings: Where designated on the Plans, place packed mortar after the joint or bearing has been set at the proper final elevation.

Pressure grouting may be allowed with the Engineer's approval of the materials and method to be used.

Mortar for packing consists of one part cement and one part fine aggregate, by volume, mixed with a non-shrink admixture as recommended by the manufacturer. Mix the dry elements thoroughly to a uniform mixture. Add water to produce a mealy, slightly adhesive mixture. Pack the mortar until a water sheen is produced on the surface of the mortar.

Build a form around the joint leaving one side open. Secure the form to withstand the required packing forces. Insert a small amount of mortar into the open joint to form a 2 inches thick bead on the opposite side of the form. Pack this bead by striking a special tool made of 1/2 inch by 2 inch steel having a length approximately 10 inches longer than the largest dimension of the joint being packed with a 2 pound hammer. Continue compaction until water begins to bleed out of the mortar. When bleeding has occurred, insert another bead of mortar and pack as described above. Continue this process until the joint is filled to the limits shown in the Plans.

SUBARTICLE 452-13.7 is deleted and the following substituted:

452-13.7 Precast Segment Production: Preparatory operations for superstructure segment casting will be paid for separately at the Contract Lump Sum price for precast segment production. This item consists of the work necessary for establishing and putting into operation segment casting facilities. It includes preparatory work, operations, acquisition or lease of real property, acquisition or lease of segment manufacturing equipment, acquisition or lease of equipment for the handling, transport and storage of the segments, and all other work or operations which must be performed or costs incurred prior to the manufacture of the concrete segments, including engineering services such as shop drawings.

Partial payments will be made as indicated below:

1. Upon production of documentary evidence, such as paid invoices, canceled checks or similar executed financial instruments, the cost for the acquisition of the casting forms for the precast segments by purchase, lease or manufacture will be paid up to a limit of 25% of the Lump Sum Price bid.

2. When the first precast superstructure segment has been cast out of the first operable casting form and the segment is approved and accepted by the Engineer, 25% of the Lump Sum Price bid will be paid.

3. Thereafter, when each succeeding superstructure segment has been cast out of any operable casting form and approved and accepted by the Engineer, 5% of the Lump Sum Price bid will be paid for each segment up to a limit of 50% of the Lump Sum Price bid (i.e., 5% for each of the next ten acceptable segments).

The total Lump Sum Price bid under this item will not exceed the least of:

1. 12% of the sum of the amounts paid for the concrete in the precast segments only (i.e., excluding any cast-in-place concrete in joints, closures or designated cast-in-place segments) or

2. 5% of the Contract amount excluding mobilization and this item.

The balance of the Lump Sum Price not paid after completion of casting the first 11 satisfactory superstructure segments will be paid after completion of the erection of the first span or closure of the first pair of cantilevers, whichever occurs first.