Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

STEPHANIE KOPELOUSOS
SECRETARY

June 4, 2007

Dr. Leslie McCarthy, PhD, P.E.
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 452
Proposed Specification: 4520800 Precast Segmental Bridge Construction - Erection

Dear Dr. McCarthy:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Precast Segmental Bridge Construction.

This change was proposed by Larry Sessions of the State Structures Design Office to clarify segment shimming as a repair method and to provide guidance for obtaining the substrate temperature for the selection of the appropriate type of epoxy for joining box girder segments.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Signature on File

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/ft
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

PRECAST SEGMENTAL BRIDGE CONSTRUCTION – ERECTION.
(REV ~~9-21-05~~*6-4-07*) ~~(FA 12-6-05) (7-06)~~

ARTICLE 452-8 (of the Supplemental Specifications) is deleted and the following substituted:

452-8 Erection.

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 etc.

(2) Positioning, use and sequencing of falsework, jacking and/or releasing of falsework, temporary towers, 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, including the movement, introduction and/or removal of any supports onto or connections with the structure.

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

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

(6) Sequencing of grouting 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.

(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.

452-8.2 Erection Geometry Control:

452-8.2.1 General: Numerical or graphical methods may be used for alignment control and checking during erection. Establish the key stages for checking of the erection in the erection manual and obtain the Engineer's review and approval. Key stages would include, for example, setting a pier segment during cantilever erection and various intermediate points during subsequent segment erection, at span closure and upon completion.

Prepare a table of elevations and alignments required at each key stage of erection in accordance with the plans, as cast geometry, camber and erection elevations for establishing erection controls and submit to the Engineer for approval.

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

If geometric corrective measures are necessary, the Engineer will require the Specialty Engineer to develop the means and methods to ensure the epoxy

joint remains watertight and free from localized stress concentrations. The Specialty Engineer will be required to submit the corrective measures to the Engineer for approval.~~Propose to shim joints only after all other corrective measures have been eliminated. Submit methods and procedures that have been developed by the Specialty Engineer for approval by the Engineer. Include the anticipated bridge geometry both with and without shims being placed.~~ Use shims made of ASTM A 240 Type 304 wire cloth (roving) with a maximum of 1/8 inch thickness.~~ Use small patch wire cloth shims having a maximum thickness of 1/8 inch and minimum area of 1 ft^2 at the intersection points of webs and slabs to attain the required geometric change. Fully impregnate shims with epoxy prior to placement. Place shims at any single joint to modify the geometry in a single direction, either vertical or horizontal. Ensure that all shimmed joints are fully epoxied and water tight. Do not place any shims until the methods and procedures are approved by the Engineer.~~

452-8.2.2 Span-by-Span and Wet Joint Erection: Position each span segment according to the final longitudinal alignment, grade, camber and cross-slope. Keep the horizontal and vertical alignment of the pier segment within 1/16 inch of that required by the approved erection plans.

Correct any deviation more than the tolerance allowed above using a method approved by the Engineer.

452-8.2.3 Balanced Cantilever and Progressive Cantilever Erection: Check the alignment and elevations of the cantilever(s), using two independent surveys, within one hour of sunrise on each day that segments are to be erected. Check the measurements made by each survey and ensure they agree to within 1/4 inch. When measurements do not agree, discontinue erection of segments until discrepancies in measurements are resolved to the satisfaction of the Engineer.

Accurate positioning of the pier segments is very important as it will establish the line and grade for cantilevers in each direction. Position each pier segment according to the final longitudinal alignment, grade and cross-slope and ensure no further erection continues until and unless these segments are properly located on the piers by the means provided. Keep the horizontal and vertical alignments of the pier segment within 1/16 inch of the alignment values required to control points as established by the approved erection plans.

Check at each key stage of erection, in accordance with approved erection procedures, the ends of cantilevers for required elevations and alignment. Correct any deviation from the required alignment by a method approved by the Engineer.

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 inch.

(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 on 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.

452-8.4 Other Miscellaneous Erection Requirements:

452-8.4.1 Span-by-Span and Wet Joint Erection:

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 on the plans or in the Specifications prior to stressing the continuity post-tensioning. Ensure that the closure joint forms provide tolerances as specified under 452-5.11 Tolerances.

452-8.4.1.2 Wet Joints: Where forming joints between segments using cast-in-place concrete, the above conditions for closure joints also apply to wet joints. In addition, the cast-in-place "Wet Joints" cannot be less than 3 inches wide, nor greater than 9 inches wide unless otherwise approved by the Engineer.

452-8.4.1.3 Formwork: Adequately support formwork at all wet joints and closure joints to take all loads applied and do not remove them until the concrete in the joints has reached its required strength and the longitudinal tendons have been tensioned.

452-8.4.2 Balanced Cantilever and Progressive Cantilever Erection:

452-8.4.2.1 Deformations: For computing deformations due to time dependent stress variations, the erection time assumptions are shown on 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. Obtain the Engineer's approval for method of calculating the above parameters.

452-8.4.2.2 Temperature Restrictions: Meet the requirements of 453-~~3~~ *4* for substrate temperatures, epoxy formulation and thermal controls where precast segments are jointed with epoxy. *Measure the substrate temperature at the mid-depth of the top slab for box girder sections or 4 inches from the top surface for slabs and other sections.*

452-8.4.2.3 Permissible Loads on Cantilever: During balanced cantilever erection, unbalance the cantilever by only one segment at any time. In addition to the unbalanced load due to one segment, the cantilevers are designed for loads applied by the erection equipment as listed on the plans. Use alternate erection methods which comply with the assumptions on the plans or otherwise approved by the Engineer.

452-8.4.2.4 Span Closure Joints: Use concrete for closure joints which comply with the same specifications and criteria as the concrete in the segments. Ensure that concrete reaches the minimum required strength as shown on the plans or in the Specifications prior to stressing the transverse or continuity post-tensioning. Ensure that the closure joint forms provide tolerances as specified for precast segments.

452-8.4.2.5 Falsework and Formwork: Support falsework and formwork at closure pours by the cantilever ends or terminating segments of each series of segments to be joined. Secure cantilever together vertically, longitudinally, and transversely so that the applied loads will yield equal deflections to both cantilevers. Do not remove securing devices until the closure pour concrete has reached its required

strength and longitudinal continuity tendons are tensioned. Submit calculations and details to verify that the devices and methods have adequate rigidity and do not impose excessive loads and stresses on the structure.

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 do not exceed 3/16 inch.

(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 in/ft of height.

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

452-8.5 Epoxy Jointing of Precast Segments: Meet the requirements of Section 453 for epoxy jointing precast segments. *Select the appropriate epoxy material based on the job requirements as either normal or slow set epoxy within the formulation temperature range based on the substrate temperature.*

452-8.6 Packed Mortar Joints for Joints, Bearings or setting Pier Shaft Segments: Where designated on the Plans, place packed mortar after the precast element 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 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.

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