Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.
SECRETARY

July 17, 2012

Monica Gourdine
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section **450**
Proposed Specification: **4500500 Precast Prestressed Concrete Construction.**

Dear Ms. Gourdine:

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

These changes were proposed by Gevin McDaniel of the State Structures Design Office to address minor changes in the fabrication of and the correction of deficiencies in prestressed concrete products.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965TT or trey.tillander@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4140.

Sincerely,

Signature on file

V. Y. “Trey” Tillander, III, P.E.
State Specifications Engineer

TT/dt
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

PRECAST PRESTRESSED CONCRETE CONSTRUCTION.
(REV ~~1-18-12~~5-~~8~~14~~21~~-12)

SUBARTICLE 450-5 (of the Supplemental Specifications) is deleted and the following substituted:

450-5 Shop Drawings.

Submit shop drawings when the Contract Documents do not contain all the detailed information necessary to fabricate and erect the pretensioned prestressed concrete product. Ensure the submitted shop drawings meet the requirements of 5-1 and any additional Contract Document requirements.

Shop drawings are not required to depict supplemental reinforcing steel used to facilitate fabrication of products.

In lieu of shop drawings, furnish one copy of the following to the Engineer:

1. A copy of the Framing Plan with product designations for all superstructure components.
2. Strand detensioning schedule.
3. Tensioning and elongation calculations.
4. Details of supplemental steel that remains as part of the finished product.
5. Drawings, details and spacing for embedded items associated with fall protection systems used on beams.
~~5~~*6*. When proposing to use materials and/or methods that differ from the requirements of the Contract Documents, submit full plan details and Specifications for the alternate materials and methods. Ensure the alternate materials and methods meet the following requirements:
   a. The provisions of the Contract Documents.
   b. The AASHTO LRFD Bridge Design Specifications, edition with interims as referenced in plans.
   c. The recommendations of the material manufacturer.
   d. Any materials change proposed by the Contractor and approved by the Engineer.
   e. Net compressive stress in the concrete due to prestressing acting alone, after all losses, is not less than that provided by the stranding shown in the plans.
   f. Ultimate strength of the structure with the proposed changes is not less than the ultimate strength of the original design.
   g. The provisions of the Departments Structures Design Guidelines.

SUBARTICLE 450-6.4.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-6.4.2 Cold Weather: Provide a distance of at least 5 feet from the end header to the stressing anchorage, when the ambient temperature is expected to be below 55ºF between the time of tensioning and detensioning. When the ambient

temperature is expected to be below 55ºF between the time of tensioning and detensioning and the product~~'s'~~ exposed strands between the stressing anchorages are not protected, maintain a 25 foot minimum free length of stressed strands, between the end header and the stressing anchorage at each end of a bed line. When cold weather concrete conditions as specified in 450-10.1 are in effect, protect all exposed strands between stressing anchorages regardless of length. When the products and strands between stressing anchorages are protected, provide protection adequate to maintain the ambient temperature of the air around the strands at or greater than 55ºF until the products are detensioned *or 24 hours after placing concrete, whichever is less*.

SUBARTICLE 450-10.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

450-10.1.1 Cold Weather Concreting: When the temperature of the surrounding air is expected to be below 40ºF within 24 hours after placing concrete, the temperature of the plastic concrete as placed must be 55ºF or greater. Maintain the temperature of the concrete after placement at or above 55ºF for the first 24 hours or until detensioning, whichever occurs first~~, then maintain the temperature at or above 50°F until the prestressing steel is detensioned~~. For piles and other members with a minimum section dimension of 12 inches or more, maintain the ~~concrete~~ temperature *of the concrete after placement* at or above 50°F for the first 24 hours or until detensioning, *whichever occurs first*~~. then maintain the temperature at or above 40°F until the prestressing steel is detensioned~~. Make arrangements for heating, covering, insulating or housing the concrete work in advance of placement and maintain the required temperature without injury due to concentration of heat. Do not use direct fired heaters during the first 24 hours after concrete placement, unless actions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide. Continuously monitor the temperature of the concrete or the ambient air around the product until the product is detensioned. Monitor by the use of thermocouples located in the product cross-section or temperature recording devices located under the enclosure. Provide one thermocouple or temperature recording device for each 200 feet of bed length or part thereof. Locate the thermocouples within the products cross-section as shown in the QC Plan or as approved by the Engineer. Record the monitored temperatures determined by each thermocouple. Review the recorded temperatures to ensure that they are within the specified limits. Initially calibrate recording devices or thermocouples and recalibrate them at least annually in accordance with the manufacturer’s recommendations.

SUBARTICLE 450-10.6 (of the Supplemental Specifications) is deleted and the following substituted:

450-10.6 Curing: Cure prestressed concrete as required for a minimum duration of 72 hours. If forms are loosened *upon setting of concrete and/*or removed before the 72 hour curing period is complete, expand the curing to cover the newly exposed surfaces by either coating with curing compound or extending the continuous moist cure area. Maintain concrete surface moisture at all times until curing is begun. If a water sheen is

not present, apply supplemental moisture by fog misting or prevent water sheen loss on flat work by use of an evaporation retarder.

After the finishing operations have been completed and as soon as the concrete has hardened sufficiently to permit the application of curing material without marring the exposed surface, cover the exposed surfaces of all prestressed concrete products by one of the following procedures or other alternate curing methods. Alternate curing methods and details proposed by the Contractor must be included in the QC Plan or otherwise approved by the Engineer. Base alternate curing methods upon a demonstrated ability to retain surface moisture of the concrete and to control curing temperatures within acceptable limits. Discontinue use of any alternate curing method other than those included herein upon any indication of noncompliance with this Specification.

450-10.6.1 Continuous Moisture: Place burlap on the surface and keep it continuously saturated for the curing period by means of soil soakers, leaking pipes, or automatic sprinklers. Do not apply moisture manually. If side forms are removed during the curing period, extend the burlap to completely shield the sides of the product. Water flow may be metered to cycle repetitively for five minutes on and five minutes off during the 72 hour curing period. When it is not practical to apply moisture or curing compound inside the voided piles, cover their ends with wet burlap to prevent moisture loss.

450-10.6.2 Membrane Curing Compound: Apply a white Type 2 curing compound to all surfaces in a single-coat, continuous operation, at a uniform coverage as recommended by the manufacturer but not less than 1 gal~~.~~*lon* per 150 square feet. Apply the curing compound on the concrete surfaces that are still damp but no free standing water. Allow surfaces covered by the membrane curing compound to remain undisturbed for the curing period. Recoat any cracks, checks or other defects in the membrane seal which are detected during the curing period within one hour. If side forms are loosened during the curing period, remove them at that time and immediately coat the formed surfaces with a clear membrane curing compound and maintain the surface seal for the remainder of the curing period. Bottom surfaces must be similarly coated after removal of the forms. Remove membrane curing compound to applied surfaces of concrete products to which other concrete is to be bonded by sandblasting or water-blasting until all traces of membrane curing compound are removed.

When the curing compound is applied by spraying, use a compressor driven sprayer of sufficient size to provide uniform spray at the nozzle. Keep all nozzles clean to ensure a uniform application of compound. For compressor driven sprayers, provide a calibrated reservoir which will allow the quantity of applied materials to be accurately determined. Maintain standby equipment in case of mechanical failure. If a mechanical failure occurs, a hand held pump-up sprayer may be used to apply curing compound to the remainder of the products cast in the day's production. Suspend additional concrete placements until the mechanical sprayer is functioning properly.

450-10.6.3 Curing Blankets: Curing blankets may be used for curing the top surfaces of products. Do not use curing blankets which have been torn or punctured. Securely fasten edges to provide as tight a seal as practical. Allow curing blankets to remain in place for the curing period. Should the system fail to maintain a moist condition on the concrete surface, discontinue the use of curing blankets and take immediate corrective action to prevent further loss of concrete moisture.

SUBARTICLE 450-11.1 (of the Supplemental Specifications) is deleted and the following substituted:

450-11.1 General: The required concrete strength at which the prestressing force may be transferred to the concrete in a product will be a minimum of 4,000 psi, unless specified otherwise in the plans. Verify the release strength by compressive strength cylinder tests or other approved means, no later than 24 hours after casting and every 24 hours thereafter until release strength is developed. In lieu of every 24 hour testing, the contractor is permitted to estimate the strength development of concrete by the maturity method in accordance with ASTM C 1074, the pulse velocity method in accordance with ASTM C 597, or any other nondestructive test method acceptable to the Engineer, until the time of the detensioning. Before detensioning, verify the concrete release strength by testing the compressive strength test cylinders. Make a minimum of two compressive strength release test cylinders daily for each individual mix or for each LOT, or fraction thereof, of given concrete mix design where the daily consumption exceeds this volume or when non-continuous batching or dissimilar curing is used. The release strength test, representing the LOT, is the average compressive strength of two test cylinders, which are cured under conditions similar to the product or match-cured test specimens, which are match cured until the time of release. For products cured using accelerated curing, release the prestressing force immediately after terminating the accelerated curing process. After the detensioning operation is completed, continue to 72 hour curing period using one of the methods listed in 450-10.6. For products cured using methods other than accelerated curing, release the prestressing force within a detensioning time limit, not to exceed five calendar days after the verification of release strength by compressive strength cylinder test or other approved strength gain monitoring system. For all products in a casting line, use the same test method for determining their release strengths. Ensure the detensioning time limit is included in the Plant's QC Plan. Cure concrete cylinders used for detensioning strength tests in the same manner and location as the prestressed concrete products.

For I-girders, where side forms are loosened upon setting of concrete or removed before the 72 hour curing period is complete, the top flange dormant strands may be released after the concrete reaches a compressive strength of 2,000 psi.

SUBARTICLE 450-12.2.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-12.2.2 Spall: A spall is a depression resulting when a fragment is detached from a larger mass by impact, action of weather, by pressure or by expansion within the larger mass.

A cosmetic spall is a circular or oval depression not greater than 1.0 inch in depth nor greater than 3.0 square inches in area, and must be repaired in accordance with 450-13.2.

With the exception of spalls in the bearing areas and edge of the top flange, a minor spall is defined as a spall not larger than 2.0 square feet and no

deeper than ~~the back of the first layer of rebar plus~~ one inch plus the sum of the concrete cover and the diameter of the bar in the first layer of reinforcing. Repair minor spalls in accordance with 450-13.4.

Spalls located at the edges of the top flange are considered minor spalls as follows:

1. A spall on one edge of the top flange, without a coincident spall on the other edge of the top flange, is considered a minor spall if the total longitudinal length of the defect does not exceed 10 feet and any lateral dimensions of the spall measured perpendicular to the longitudinal axis of the beam are not greater than 25% of the width of the top flange.

2. Coincident spalls on opposite edges of the top flange are considered minor spalls if the total length of the defects within both spalls does not exceed 10 feet and any lateral dimensions of the spalls at a given location measured perpendicular to the longitudinal axis of the beam are not greater than 25% of the width of the top flange.

Spalls located in the bearing area that extend back into the concrete within the limits above the bearing plate are considered major spalls.

~~With the exception of the spalls at the top flange of the beam ends, a minor spall is defined as a spall not larger than 2.0 square feet and no deeper than concrete cover. A spall located at the edge of the top flange, within 1/4 length from the beam end, is considered *a* minor spall if the total longitudinal length of the defect does not exceed 10 feet and any of the lateral dimensions of the spall perpendicular to the longitudinal axis of the beam is not greater than 15% of the width of the top flange. Repair minor spalls in accordance with 450-13.4.~~

A major spall is a spall that any of its dimensions exceeds the dimensions that are described for minor spalls. A major spall requires engineering evaluation and disposition in accordance with 450-14.

SUBARTICLE 450-12.5 (of the Supplemental Specifications) is deleted and the following substituted:

450-12.5 Cracks: A crack is the separation of a product or portion thereof which may appear before or after detensioning and may or may not cause separation throughout the product thickness or depth. Identify cracks by the classifications and locations described below and subject them to the disposition required by the identified crack. ~~Regardless of the classifications and locations of cracks within any single product, i~~*I*f the total surface length of all cracks *within a single product, regardless of width, located between the end zones*~~on any and all surfaces~~ exceeds one-~~third~~ *quarter* of the product's length, ~~the product requires~~*an* engineering evaluation and disposition in accordance with 450-14 *is required*. Establish crack sizes subsequent to release of all pretensioning forces.

The Engineer will reject any pile that is cracked to the point that a transverse or longitudinal crack extends through the pile, shows failure of the concrete as indicated by spalling of concrete on the main body of the pile adjacent to the crack, or which in the opinion of the Engineer will not withstand driving stresses. Occasional hairline surface cracking caused by shrinkage or tensile stress in the concrete from handling will not be cause for rejection.

450-12.5.1 Classification and Treatment of Cracks: Regardless of cause and for the purposes of Section 450, cracks in precast prestressed components, excluding piling, will be identified according to their surface appearance in accordance with the following classifications:

Cosmetic cracks are any cracks which are less than 0.006 inch wide and are located in non-critical locations on the product. Based on the environmental classification of the site where the product will be located, treat cosmetic cracks as follows:

(1) Slightly or moderately aggressive environment: Do not treat cracks.

(2) Extremely aggressive environment: After detensioning, apply penetrant sealer in accordance with Section 413.

Minor cracks are any cracks which are between 0.006 and 0.012 inch wide, inclusive, and are located in non-critical locations on products. Based on the environmental classification of the site where the product will be located and the final elevation of the product on the site, treat minor cracks as follows:

(1) Slightly aggressive environment: Do not treat the cracks.

(2) Moderately aggressive environment:

(a) For products that will be located at an elevation of more than 12 feet above the existing ground level or above mean high water elevation: Do not treat cracks.

(b) For products that will be located at an elevation within 12 feet above the existing ground level or above mean high water elevation: Apply a penetrant sealer on the cracks after detensioning in accordance with Section 413.

(3) Extremely aggressive environment:

a. For products that will be located at an elevation of more than 12 feet above the existing ground level or above mean high water elevation: Apply a penetrant sealer on the cracks after detensioning in accordance with Section 413.

b. For products that will be located at an elevation within 12 feet above the existing ground level or above mean high water elevation: Inject epoxy into the cracks after detensioning in accordance with Section 411.

Major cracks are any cracks of any width which are located in critical locations on products or cracks in non-critical locations of the product that are greater than 0.012 inch wide. Major cracks require an engineering evaluation, including crack depth measurement and disposition, in accordance with 450-14.

Cracks in the Riding Surface: Repair cracks in the top surface of components which will become the riding surface (with no overlays), once in service, regardless of the environmental classification as follows:

(1) Epoxy inject cracks wider than 0.006 inch in accordance with Section 411, unless the Engineer approves the sealing of cracks with high molecular weight methacrylate in accordance with Section 413.

(2) Seal cracks that are 0.006 inch wide or less by applying a penetrant sealer in accordance with Section 413.

450-12.5.2 Locations of Cracks: Regardless of cause and for the purposes of this Specification, cracks will be identified as occurring in either critical or

non-critical locations of the product in accordance with the following criteria and conditions:

Critical locations of cracks are any locations in which a crack would tend to open under stresses occurring at any time during the service life of the structure, or which may reduce the ultimate capacity or fatigue life of the product. Specifically, critical locations of cracks are any locations in a product not defined and not included in 450-12.5.3 as non-critical. Cracks in critical locations require engineering evaluation and disposition in accordance with 450-14.

Non-critical locations of cracks are defined by the position within a product's length, the position within a product's depth, and the orientation of the crack.

450-12.5.3 Non-critical Locations of Cracks by Product Type:

450-12.5.3.1 Piles: Surface cracks in any direction and of a length not exceeding twice the width of the pile.

450-12.5.3.2 *All Types of* Simple Span ~~Prestressed~~ *Pretensioned* Concrete Beams:

End zones (within a distance of three times the depth of the product from the end):

(a) ~~One h~~*H*orizontal *or diagonal* crack*s* at either or both ends in the top flange and web of the product, not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed ~~half~~ the product's depth.

(b) Vertical cracks extending through the top flange not to exceed one-*half* ~~quarter~~ of the product's depth after detensioning.

Mid-span region (between end zones): Vertical cracks extending through the top flange and web of the product.

Any Location: Horizontal crack at the interface of the web and top flange which is not longer than the product's depth.

Intermediate diaphragms of Florida U-Beams: cracks at any location.

450-12.5.3.3 Simple Span Double-T Beams:

End zones (within a distance of twice the depth of the product from the end): One horizontal crack at either or both ends and in the top flange of the product, not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed half the product's depth.

Mid-span Region (between end zones): Vertical cracks extending through the top flange and not exceeding half the web depth of the product.

Any Location: Horizontal crack at the interface of the web and top flange which is not longer than the product's depth.

450-12.5.3.4 Pretensioned I-~~-~~Beams Containing Longitudinal Post-tensioning Ducts:

End zones (within a distance of twice the depth of the beam from the end): Vertical cracks in the bottom half of the beam within an end zone with no post-tensioning anchorages and where the post-tensioning ducts are located in the top of the beam at the location of a permanent substructure support. *Horizontal or diagonal cracks at either or both ends in the top flange and web of the product where no post-tensioning anchorage zone is present.*

Mid-span Region (between quarter points): Vertical cracks in the web and top flange of the beam provided the beam is to be supported at each end in its final position in the structure.

Any Location: Horizontal cracks not longer than the beam's depth and only at the interface of the web and top flange provided the beam is to be supported at each end in its final position in the structure.

450-12.5.3.5 Post-Tensioned Beams for Drop-In Spans:

Pier Sections: Horizontal or diagonal cracks at either or both ends in the top flange and web of the product.

Drop-In Sections: Same as simple span pretensioned concrete beams.

End Sections: At end of beam with post-tensioning anchorages: same as Pretensioned I-Beams Containing Longitudinal Post-tensioning Ducts. At end of beam adjacent to pier sections: same as for simple span pretensioned concrete beams.

450-12.5.3.~~5~~*6* Simple Span Prestressed Slab Units:

End Zones (within a distance of twice the depth of the product from the end): One horizontal crack at either or both ends in the top half of the product, which is not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed half the product's depth.

Any Location (after detensioning)~~:~~~~,~~ Vertical cracks in the top half of the product's depth.

SUBARTICLE 450-14.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-14.2 Submittal of *Repair* Proposal ~~for Engineering Evaluation~~:

~~Proposals must include an evaluation of the product's relative ability to perform its intended function in the structure and its durability relative to other acceptable, similar products. Submit the proposal in writing to the Engineer as outlined below.~~

~~If the proposal is accepted by the Engineer, all Department costs associated with review of the proposal, including the cost of any and all engineering evaluation and testing services required, will be deducted from payment to the Contractor, but not to exceed 15% of the product value based on unit bid prices.~~

~~Prepare the proposal to~~ *The repair proposal must be completed by the Contractor's Engineer of Record and shall* consist of the following:

1. A cover letter prepared on the Contractor's letterhead *addressed to the Engineer* describing the product ~~and addressed to the Engineer.~~~~,~~

2. Information *in a format acceptable to the Engineer* describing the details of the non-compliance and the proposed repairs ~~in a format acceptable to the Engineer.~~~~,~~

3. *An engineering evaluation: A structural performance and durability evaluation which ~~of the product which must~~ explains why the performance and durability of the repaired deficient~~cy~~ product is acceptable as compared to that of an*

undamaged comparable product. ~~*as*~~ *The evaluation must be supported by* ~~*any*~~*one or* ~~*all*~~*more of the following types of information:*~~.~~

a. Written evidence of a previously approved comparable deficiency and its repair.

b. Documented research that demonstrates the proposed repair to be effective.

c. If applicable, engineering calculations providing support for recommendations.~~A structural and durability evaluation of the product,~~

4. A proposed credit to the Contract proportionate to the product's deficiency. The credit is in addition to the cost for review and evaluation of the proposal.~~,~~

5. Any other supportive information, pictures and drawings. For cracked elements, show on a drawing the location, average width, depth, length, and termination points of each crack along the surfaces. Provide the distance from each termination point to a fixed reference point on the component, such as beam end or edge of flange. The description of the proposed repair and the structural and durability evaluation of the product must be prepared by or under the direct supervision of the Contractor's Engineer of Record and must bear his/her signature and seal.

If the proposal is accepted by the Engineer, all Department costs associated with review of the proposal, including the cost of any and all engineering evaluation and testing services required, will be deducted from payment to the Contractor, but not to exceed 15% of the product value based on unit bid prices.

Include in the proposed credit consideration of the Department's added costs which may include but are not necessarily limited to re-inspection, testing, reduced durability, or increased maintenance cost. The Engineer will review and evaluate the Contractor's proposal and will notify the Contractor of its disposition. The Engineer's review of the Contractor's proposal does not amend or delete code requirements, unless such changes are specifically brought to the Engineer's attention and accepted by the Engineer. The Engineer's acceptance of a proposal does not relieve the Contractor of his responsibility to provide products that are structurally adequate to resist the loads specified in the Contract drawings and that maintain the intended aesthetic, durability and maintenance aspects of the product. The Engineer will not accept repaired products unless repairs are made as proposed or described, the resulting repairs are sound in all aspects, and the repairs are aesthetically acceptable. Replace a rejected product with a product meeting the requirements of the Contract Documents at no additional expense to the Department.

PRECAST PRESTRESSED CONCRETE CONSTRUCTION.
(REV 5-21-12)

SUBARTICLE 450-5 (of the Supplemental Specifications) is deleted and the following substituted:

450-5 Shop Drawings.

Submit shop drawings when the Contract Documents do not contain all the detailed information necessary to fabricate and erect the pretensioned prestressed concrete product. Ensure the submitted shop drawings meet the requirements of 5-1 and any additional Contract Document requirements.

Shop drawings are not required to depict supplemental reinforcing steel used to facilitate fabrication of products.

In lieu of shop drawings, furnish one copy of the following to the Engineer:

1. A copy of the Framing Plan with product designations for all superstructure components.
2. Strand detensioning schedule.
3. Tensioning and elongation calculations.
4. Details of supplemental steel that remains as part of the finished product.
5. Drawings, details and spacing for embedded items associated with fall protection systems used on beams.
6. When proposing to use materials and/or methods that differ from the requirements of the Contract Documents, submit full plan details and Specifications for the alternate materials and methods. Ensure the alternate materials and methods meet the following requirements:
   a. The provisions of the Contract Documents.
   b. The AASHTO LRFD Bridge Design Specifications, edition with interims as referenced in plans.
   c. The recommendations of the material manufacturer.
   d. Any materials change proposed by the Contractor and approved by the Engineer.
   e. Net compressive stress in the concrete due to prestressing acting alone, after all losses, is not less than that provided by the stranding shown in the plans.
   f. Ultimate strength of the structure with the proposed changes is not less than the ultimate strength of the original design.
   g. The provisions of the Departments Structures Design Guidelines.

SUBARTICLE 450-6.4.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-6.4.2 Cold Weather: Provide a distance of at least 5 feet from the end header to the stressing anchorage, when the ambient temperature is expected to be below 55ºF between the time of tensioning and detensioning. When the ambient

temperature is expected to be below 55ºF between the time of tensioning and detensioning and the product's exposed strands between the stressing anchorages are not protected, maintain a 25 foot minimum free length of stressed strands, between the end header and the stressing anchorage at each end of a bed line. When cold weather concrete conditions as specified in 450-10.1 are in effect, protect all exposed strands between stressing anchorages regardless of length. When the products and strands between stressing anchorages are protected, provide protection adequate to maintain the ambient temperature of the air around the strands at or greater than 55ºF until the products are detensioned or 24 hours after placing concrete, whichever is less.

SUBARTICLE 450-10.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

450-10.1.1 Cold Weather Concreting: When the temperature of the surrounding air is expected to be below 40ºF within 24 hours after placing concrete, the temperature of the plastic concrete as placed must be 55ºF or greater. Maintain the temperature of the concrete after placement at or above 55ºF for the first 24 hours or until detensioning, whichever occurs first. For piles and other members with a minimum section dimension of 12 inches or more, maintain the temperature of the concrete after placement at or above 50°F for the first 24 hours or until detensioning, whichever occurs first. Make arrangements for heating, covering, insulating or housing the concrete work in advance of placement and maintain the required temperature without injury due to concentration of heat. Do not use direct fired heaters during the first 24 hours after concrete placement, unless actions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide. Continuously monitor the temperature of the concrete or the ambient air around the product until the product is detensioned. Monitor by the use of thermocouples located in the product cross-section or temperature recording devices located under the enclosure. Provide one thermocouple or temperature recording device for each 200 feet of bed length or part thereof. Locate the thermocouples within the products cross-section as shown in the QC Plan or as approved by the Engineer. Record the monitored temperatures determined by each thermocouple. Review the recorded temperatures to ensure that they are within the specified limits. Initially calibrate recording devices or thermocouples and recalibrate them at least annually in accordance with the manufacturer’s recommendations.

SUBARTICLE 450-10.6 (of the Supplemental Specifications) is deleted and the following substituted:

450-10.6 Curing: Cure prestressed concrete as required for a minimum duration of 72 hours. If forms are loosened upon setting of concrete and/or removed before the 72 hour curing period is complete, expand the curing to cover the newly exposed surfaces by either coating with curing compound or extending the continuous moist cure area. Maintain concrete surface moisture at all times until curing is begun. If a water sheen is not present, apply supplemental moisture by fog misting or prevent water sheen loss on flat work by use of an evaporation retarder.

After the finishing operations have been completed and as soon as the concrete has hardened sufficiently to permit the application of curing material without marring the exposed surface, cover the exposed surfaces of all prestressed concrete products by one of the following procedures or other alternate curing methods. Alternate curing methods and details proposed by the Contractor must be included in the QC Plan or otherwise approved by the Engineer. Base alternate curing methods upon a demonstrated ability to retain surface moisture of the concrete and to control curing temperatures within acceptable limits. Discontinue use of any alternate curing method other than those included herein upon any indication of noncompliance with this Specification.

450-10.6.1 Continuous Moisture: Place burlap on the surface and keep it continuously saturated for the curing period by means of soil soakers, leaking pipes, or automatic sprinklers. Do not apply moisture manually. If side forms are removed during the curing period, extend the burlap to completely shield the sides of the product. Water flow may be metered to cycle repetitively for five minutes on and five minutes off during the 72 hour curing period. When it is not practical to apply moisture or curing compound inside the voided piles, cover their ends with wet burlap to prevent moisture loss.

450-10.6.2 Membrane Curing Compound: Apply a white Type 2 curing compound to all surfaces in a single-coat, continuous operation, at a uniform coverage as recommended by the manufacturer but not less than 1 gallon per 150 square feet. Apply the curing compound on the concrete surfaces that are still damp but no free standing water. Allow surfaces covered by the membrane curing compound to remain undisturbed for the curing period. Recoat any cracks, checks or other defects in the membrane seal which are detected during the curing period within one hour. If side forms are loosened during the curing period, remove them at that time and immediately coat the formed surfaces with a clear membrane curing compound and maintain the surface seal for the remainder of the curing period. Bottom surfaces must be similarly coated after removal of the forms. Remove membrane curing compound to applied surfaces of concrete products to which other concrete is to be bonded by sandblasting or water-blasting until all traces of membrane curing compound are removed.

When the curing compound is applied by spraying, use a compressor driven sprayer of sufficient size to provide uniform spray at the nozzle. Keep all nozzles clean to ensure a uniform application of compound. For compressor driven sprayers, provide a calibrated reservoir which will allow the quantity of applied materials to be accurately determined. Maintain standby equipment in case of mechanical failure. If a mechanical failure occurs, a hand held pump-up sprayer may be used to apply curing compound to the remainder of the products cast in the day’s production. Suspend additional concrete placements until the mechanical sprayer is functioning properly.

450-10.6.3 Curing Blankets: Curing blankets may be used for curing the top surfaces of products. Do not use curing blankets which have been torn or punctured. Securely fasten edges to provide as tight a seal as practical. Allow curing blankets to remain in place for the curing period. Should the system fail to maintain a moist condition on the concrete surface, discontinue the use of curing blankets and take immediate corrective action to prevent further loss of concrete moisture.

SUBARTICLE 450-11.1 (of the Supplemental Specifications) is deleted and the following substituted:

450-11.1 General: The required concrete strength at which the prestressing force may be transferred to the concrete in a product will be a minimum of 4,000 psi, unless specified otherwise in the plans. Verify the release strength by compressive strength cylinder tests or other approved means, no later than 24 hours after casting and every 24 hours thereafter until release strength is developed. In lieu of every 24 hour testing, the contractor is permitted to estimate the strength development of concrete by the maturity method in accordance with ASTM C 1074, the pulse velocity method in accordance with ASTM C 597, or any other nondestructive test method acceptable to the Engineer, until the time of the detensioning. Before detensioning, verify the concrete release strength by testing the compressive strength test cylinders. Make a minimum of two compressive strength release test cylinders daily for each individual mix or for each LOT, or fraction thereof, of given concrete mix design where the daily consumption exceeds this volume or when non-continuous batching or dissimilar curing is used. The release strength test, representing the LOT, is the average compressive strength of two test cylinders, which are cured under conditions similar to the product or match-cured test specimens, which are match cured until the time of release. For products cured using accelerated curing, release the prestressing force immediately after terminating the accelerated curing process. After the detensioning operation is completed, continue to 72 hour curing period using one of the methods listed in 450-10.6. For products cured using methods other than accelerated curing, release the prestressing force within a detensioning time limit, not to exceed five calendar days after the verification of release strength by compressive strength cylinder test or other approved strength gain monitoring system. For all products in a casting line, use the same test method for determining their release strengths. Ensure the detensioning time limit is included in the Plant's QC Plan. Cure concrete cylinders used for detensioning strength tests in the same manner and location as the prestressed concrete products.

For I-girders, where side forms are loosened upon setting of concrete or removed before the 72 hour curing period is complete, the top flange dormant strands may be released after the concrete reaches a compressive strength of 2,000 psi.

SUBARTICLE 450-12.2.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-12.2.2 Spall: A spall is a depression resulting when a fragment is detached from a larger mass by impact, action of weather, by pressure or by expansion within the larger mass.

A cosmetic spall is a circular or oval depression not greater than 1.0 inch in depth nor greater than 3.0 square inches in area, and must be repaired in accordance with 450-13.2.

With the exception of spalls in the bearing areas and edge of the top flange, a minor spall is defined as a spall not larger than 2.0 square feet and no deeper than one inch plus the sum of the concrete cover and the diameter of the bar in the first layer of reinforcing. Repair minor spalls in accordance with 450-13.4.

Spalls located at the edges of the top flange are considered minor spalls as follows:

1. A spall on one edge of the top flange, without a coincident spall on the other edge of the top flange, is considered a minor spall if the total longitudinal length of the defect does not exceed 10 feet and any lateral dimensions of the spall measured perpendicular to the longitudinal axis of the beam are not greater than 25% of the width of the top flange.

2. Coincident spalls on opposite edges of the top flange are considered minor spalls if the total length of the defects within both spalls does not exceed 10 feet and any lateral dimensions of the spalls at a given location measured perpendicular to the longitudinal axis of the beam are not greater than 25% of the width of the top flange.

Spalls located in the bearing area that extend back into the concrete within the limits above the bearing plate are considered major spalls.

A major spall is a spall that any of its dimensions exceeds the dimensions that are described for minor spalls. A major spall requires engineering evaluation and disposition in accordance with 450-14.

SUBARTICLE 450-12.5 (of the Supplemental Specifications) is deleted and the following substituted:

450-12.5 Cracks: A crack is the separation of a product or portion thereof which may appear before or after detensioning and may or may not cause separation throughout the product thickness or depth. Identify cracks by the classifications and locations described below and subject them to the disposition required by the identified crack. If the total surface length of all cracks within a single product, regardless of width, located between the end zones exceeds one-quarter of the product's length, an engineering evaluation and disposition in accordance with 450-14 is required. Establish crack sizes subsequent to release of all pretensioning forces.

The Engineer will reject any pile that is cracked to the point that a transverse or longitudinal crack extends through the pile, shows failure of the concrete as indicated by spalling of concrete on the main body of the pile adjacent to the crack, or which in the opinion of the Engineer will not withstand driving stresses. Occasional hairline surface cracking caused by shrinkage or tensile stress in the concrete from handling will not be cause for rejection.

450-12.5.1 Classification and Treatment of Cracks: Regardless of cause and for the purposes of Section 450, cracks in precast prestressed components, excluding piling, will be identified according to their surface appearance in accordance with the following classifications:

Cosmetic cracks are any cracks which are less than 0.006 inch wide and are located in non-critical locations on the product. Based on the environmental classification of the site where the product will be located, treat cosmetic cracks as follows:

(1) Slightly or moderately aggressive environment: Do not treat cracks.

(2) Extremely aggressive environment: After detensioning, apply penetrant sealer in accordance with Section 413.

Minor cracks are any cracks which are between 0.006 and 0.012 inch wide, inclusive, and are located in non-critical locations on products. Based on the environmental classification of the site where the product will be located and the final elevation of the product on the site, treat minor cracks as follows:

(1) Slightly aggressive environment: Do not treat the cracks.

(2) Moderately aggressive environment:

(a) For products that will be located at an elevation of more than 12 feet above the existing ground level or above mean high water elevation: Do not treat cracks.

(b) For products that will be located at an elevation within 12 feet above the existing ground level or above mean high water elevation: Apply a penetrant sealer on the cracks after detensioning in accordance with Section 413.

(3) Extremely aggressive environment:

a. For products that will be located at an elevation of more than 12 feet above the existing ground level or above mean high water elevation: Apply a penetrant sealer on the cracks after detensioning in accordance with Section 413.

b. For products that will be located at an elevation within 12 feet above the existing ground level or above mean high water elevation: Inject epoxy into the cracks after detensioning in accordance with Section 411.

Major cracks are any cracks of any width which are located in critical locations on products or cracks in non-critical locations of the product that are greater than 0.012 inch wide. Major cracks require an engineering evaluation, including crack depth measurement and disposition, in accordance with 450-14.

Cracks in the Riding Surface: Repair cracks in the top surface of components which will become the riding surface (with no overlays), once in service, regardless of the environmental classification as follows:

(1) Epoxy inject cracks wider than 0.006 inch in accordance with Section 411, unless the Engineer approves the sealing of cracks with high molecular weight methacrylate in accordance with Section 413.

(2) Seal cracks that are 0.006 inch wide or less by applying a penetrant sealer in accordance with Section 413.

450-12.5.2 Locations of Cracks: Regardless of cause and for the purposes of this Specification, cracks will be identified as occurring in either critical or non-critical locations of the product in accordance with the following criteria and conditions:

Critical locations of cracks are any locations in which a crack would tend to open under stresses occurring at any time during the service life of the structure, or which may reduce the ultimate capacity or fatigue life of the product. Specifically, critical locations of cracks are any locations in a product not defined and not included in 450-12.5.3 as non-critical. Cracks in critical locations require engineering evaluation and disposition in accordance with 450-14.

Non-critical locations of cracks are defined by the position within a product’s length, the position within a product’s depth, and the orientation of the crack.

450-12.5.3 Non-critical Locations of Cracks by Product Type:

450-12.5.3.1 Piles: Surface cracks in any direction and of a length not exceeding twice the width of the pile.

450-12.5.3.2 All Types of Simple Span Pretensioned Concrete Beams:

End zones (within a distance of three times the depth of the product from the end):

(a) Horizontal or diagonal cracks at either or both ends in the top flange and web of the product, not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed the product's depth.

(b) Vertical cracks extending through the top flange not to exceed one-half of the product's depth after detensioning.

Mid-span region (between end zones): Vertical cracks extending through the top flange and web of the product.

Any Location: Horizontal crack at the interface of the web and top flange which is not longer than the product's depth.

Intermediate diaphragms of Florida U-Beams: cracks at any location.

450-12.5.3.3 Simple Span Double-T Beams:

End zones (within a distance of twice the depth of the product from the end): One horizontal crack at either or both ends and in the top flange of the product, not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed half the product's depth.

Mid-span Region (between end zones): Vertical cracks extending through the top flange and not exceeding half the web depth of the product.

Any Location: Horizontal crack at the interface of the web and top flange which is not longer than the product's depth.

450-12.5.3.4 Pretensioned I-Beams Containing Longitudinal Post-tensioning Ducts:

End zones (within a distance of twice the depth of the beam from the end): Vertical cracks in the bottom half of the beam within an end zone with no post-tensioning anchorages and where the post-tensioning ducts are located in the top of the beam at the location of a permanent substructure support. Horizontal or diagonal cracks at either or both ends in the top flange and web of the product where no post-tensioning anchorage zone is present.

Mid-span Region (between quarter points): Vertical cracks in the web and top flange of the beam provided the beam is to be supported at each end in its final position in the structure.

Any Location: Horizontal cracks not longer than the beam's depth and only at the interface of the web and top flange provided the beam is to be supported at each end in its final position in the structure.

450-12.5.3.5 Post-Tensioned Beams for Drop-In Spans:

Pier Sections: Horizontal or diagonal cracks at either or both ends in the top flange and web of the product.

Drop-In Sections: Same as simple span pretensioned concrete beams.

End Sections: At end of beam with post-tensioning anchorages: same as Pretensioned I-Beams Containing Longitudinal Post-tensioning Ducts. At end of beam adjacent to pier sections: same as for simple span pretensioned concrete beams.

450-12.5.3.6 Simple Span Prestressed Slab Units:

End Zones (within a distance of twice the depth of the product from the end): One horizontal crack at either or both ends in the top half of the product, which is not in the plane of nor intersecting any row of prestressing strands, and extending from the end of the product for a length not to exceed half the product's depth.

Any Location (after detensioning): Vertical cracks in the top half of the product's depth.

SUBARTICLE 450-14.2 (of the Supplemental Specifications) is deleted and the following substituted:

450-14.2 Submittal of Repair Proposal:

The repair proposal must be completed by the Contractor's Engineer of Record and shall consist of the following:

1. A cover letter prepared on the Contractor's letterhead addressed to the Engineer describing the product.
2. Information in a format acceptable to the Engineer describing the details of the non-compliance and the proposed repairs.
3. An engineering evaluation: A structural performance and durability evaluation which explains why the performance and durability of the repaired deficient product is acceptable as compared to that of an undamaged comparable product. The evaluation must be supported by one or more of the following types of information:
   a. Written evidence of a previously approved comparable deficiency and its repair.
   b. Documented research that demonstrates the proposed repair to be effective.
   c. If applicable, engineering calculations providing support for recommendations.
4. A proposed credit to the Contract proportionate to the product's deficiency. The credit is in addition to the cost for review and evaluation of the proposal.
5. Any other supportive information, pictures and drawings. For cracked elements, show on a drawing the location, average width, depth, length, and termination points of each crack along the surfaces. Provide the distance from each termination point to a fixed reference point on the component, such as beam end or edge of flange. The description of the proposed repair and the structural and durability evaluation of the product must be prepared by or under the direct supervision of the Contractor's Engineer of Record and must bear his/her signature and seal.

If the proposal is accepted by the Engineer, all Department costs associated with review of the proposal, including the cost of any and all engineering

evaluation and testing services required, will be deducted from payment to the Contractor, but not to exceed 15% of the product value based on unit bid prices.

Include in the proposed credit consideration of the Department's added costs which may include but are not necessarily limited to re-inspection, testing, reduced durability, or increased maintenance cost. The Engineer will review and evaluate the Contractor's proposal and will notify the Contractor of its disposition. The Engineer's review of the Contractor's proposal does not amend or delete code requirements, unless such changes are specifically brought to the Engineer's attention and accepted by the Engineer. The Engineer's acceptance of a proposal does not relieve the Contractor of his responsibility to provide products that are structurally adequate to resist the loads specified in the Contract drawings and that maintain the intended aesthetic, durability and maintenance aspects of the product. The Engineer will not accept repaired products unless repairs are made as proposed or described, the resulting repairs are sound in all aspects, and the repairs are aesthetically acceptable. Replace a rejected product with a product meeting the requirements of the Contract Documents at no additional expense to the Department.