



2016 ROAD AND BRIDGE SPECIFICATIONS

DIVISION IV—BRIDGES AND STRUCTURES

SPECIAL PROVISION COPIED NOTES (SPCNs), **SPECIAL PROVISION (SPs)** **and SUPPLEMENTAL SPECIFICATIONS (SSs)**

See “[Web List](#)” for a single list with links to the Specifications. (Future)

Specifications may also be found at the following locations:

- [VDOT Web](#) (Global Web Access)
- [OutsideVDOT](#) (Accessible by permission only)
- <http://www.virginiadot.org/business/resources/const/2016Rev.zip> (“zip” file [compressed WORD[®]])

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| <h2 style="margin: 0;">TABLE OF CONTENTS</h2> <h3 style="margin: 0;">DIVISION IV—BRIDGES AND STRUCTURES</h3> |
|--|

| | | |
|-----------------|---|------|
| 4- | | 4-2 |
| cn404-000100-00 | EXPOSED AGGREGATE FINISH 7-12-16 (SPCN) | 4-3 |
| SP403-000100-00 | DYNAMIC PILE TESTING FOR END BEARING PILES (LRFD) R-10-27-16 | 4-4 |
| SP404-000100-00 | SEALING EXPANSION JOINTS R-7-12-16 | 4-7 |
| SP404-000110-00 | FILL/SEAL PATTERN CRACKS (DECK/OVERLAYS) R-7-12-16 | 4-8 |
| SP404-000120-00 | SEAL CRACKS IN CONC. DECK & OVERLAY W/ ECFM R-7-12-16..... | 4-10 |
| SP405-000100-00 | CFRP CONCRETE PILES 12-8-16..... | 4-12 |
| SP407-000100-00 | METALLIZING FERROUS METAL SURFACES R-7-12-16 | 4-16 |
| SQ404-000100-00 | ELASTIC INCLUSION [Expanded Polystyrene (EPS)] R-7-12-16 | 4-19 |
| SS403-002016-01 | SEC. 403—BEARING PILES I-7-12-16 (2017 Supp) | 4-22 |
| SS404-002016-01 | SEC. 404—HYDRAULIC CEMENT CONC. OPS. 7-12-16 (2017 Supp) | 4-23 |
| SS406-002016-02 | SEC. 406—REINFORCING STEEL I-10-5-16 (2017 Supp) | 4-24 |

GUIDELINES — For projects requiring exposed aggregate finish for soundwalls, curb cut ramps, curbs and/or parapets. {2007-c504c00}

[cn404-000100-00](#)

EXPOSED AGGREGATE FINISH shall be performed by wirebrushing, blasting or surface retarder unless another method is approved by the Engineer.

Concrete for exposed aggregate finish shall conform to Section 217 of the Specifications for the class specified, except gravel shall be tan or light brown in color.

The Contractor shall provide a sample of the exposed aggregate finish for approval by the Engineer prior to beginning work. The sample shall be at least 12 inches by 12 inches and approximately 2 inches in depth. The approved sample shall be kept at the work site for comparison to completed work.

7-12-16 (SPCN)

GUIDELINES — For projects requiring dynamic pile testing for end bearing piles. {2007-S403C01}

[SP403-000100-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
DYNAMIC PILE TESTING FOR END BEARING PILES (LRFD)

February 7, 2014; Reissued October 27, 2016_

I. DESCRIPTION

This work shall consist of dynamic testing of piles by the use of electronic monitoring equipment, reprocessing the data and furnishing a written report of the results.

II. EQUIPMENT

All equipment necessary for the dynamic monitoring such as gages, cables, etc. shall be furnished by the Dynamic Testing Consultant. The equipment shall conform to the requirements of ASTM-4945-08, Standard Test Method for High Strain Dynamic Testing of Piles.

III. PERSONNEL

The Contractor shall employ a Dynamic Testing Consultant to install or supervise the installation of the necessary equipment, to perform the dynamic monitoring and to prepare the Dynamic Testing Report.

The dynamic monitoring operator shall have a minimum of two years experience, at least one of which shall have been in data acquisition from high strain dynamic pile testing and successful performance on at least two projects in similar geotechnical conditions, or who has a Certificate of Testing: Basic Level or better on the Foundation QA Examination for Providers of Pile Dynamic Analyzer (PDA) Testing Services.

The Dynamic Pile Testing Report shall be prepared by a Registered Professional Engineer with a minimum of five years experience, at least two of which shall have been in data interpretation from high strain dynamic pile testing and successful completion of at least five projects in similar geotechnical conditions, or who has a Certificate of Interpretation: Advanced Level or better on the Foundation QA Examination for Providers of PDA Testing Services.

IV. TESTING

Dynamic testing shall be conducted in the presence of the Engineer and during the entire time piles are initially driven or redriven and during pile restrrike testing.

The Contractor shall notify the Engineer of the date and time for dynamic testing at least 48 hours prior to testing. Such notice shall be given during the normal work hours of the Department. If additional dynamic testing is ordered by the Engineer, the Contractor shall schedule the tests in cooperation with the availability of the Engineer.

Where possible, splices to the pile(s) shall be made prior to the start of driving so that dynamic testing can be performed without interruption.

The Contractor shall fasten a pair of transducers and a pair of accelerometers in place prior to testing. Piles shall be driven until the soil resistance measured is equal to or greater than the Nominal Pile Resistance as measured during driving shown on the plans and the required minimum tip elevation and penetration have been obtained or as directed by the plans, approved wave equation analysis or as approved by the Engineer. The Contractor shall remove the transducers and accelerometers after the dynamic testing is completed.

All signals resulting from initial testing and any restrike testing shall be recorded and made available upon the request of the Engineer.

V. REPORTS

If requested by the Engineer, the following information shall be provided within 24 hours after completion of the testing: for each blow from the Dynamic Driving Records provide the Depth, Maximum Transferred Energy, Blows per Minute (include strokes, fuel settings, bounce chamber pressures, etc. as applicable), Maximum Tensile Stress, Maximum Compressive Stress and Pile Capacity.

The Contractor shall furnish the Engineer a Dynamic Pile Testing Report with the production pile order list.

The Dynamic Pile Testing Report shall include the following information for each pile tested:

Project identification and location

Location of test,

Date of test,

Description of the subsurface soil condition including log of nearest boring

Description of the test pile

Description of pile installation equipment, the lead type and any special installation equipment

Description of dynamic testing equipment, including model and software version(s) utilized in obtaining, evaluating and reporting dynamic data.

A copy of the Pile Driving Record

Pile Installation Details and Comments

Discussion of the hammer performance

Discussion of pile integrity

For at least every fifth blow from the Dynamic Driving Records: the Depth, Maximum Transferred Energy, Blows per Minute (including strokes, fuel settings, bounce chamber pressures, etc. as applicable), Maximum Tensile and Compressive Stress and Pile Capacity

A graphical presentation of the following: Pile Penetration versus Maximum Transferred Energy, Maximum Compressive Stress, Maximum Tension Stress and Mobilized Pile Capacity

The results from a signal-matching program that estimates static soil resistance and simulates static load test results including Mobilized Pile Capacity for the shaft and toe with the associated parameters used in the estimation

A summary tabulation of the following information: Pile Location and Designation, Date Driven, Pile Tip Elevation, Visual Blow Count Rate, Transferred Energy, Hammer Efficiency, Maximum Driving Stresses, Dynamic Testing Mobilized Pile Capacity, Signal-Matched Mobilized Pile Capacity for Shaft, Toe and Combined.

Recommendations for production pile driving criteria based on the results of the testing program. Driving criteria shall include: blow count to obtain the required Mobilized Pile Capacity (include: stroke(s), fuel setting(s), bounce chamber pressure(s), etc. as applicable), criteria for controlling driving stresses in the pile including maximum allowable hammer stroke to control driving stresses in the pile and criteria for terminating driving in the event of high blow count before reaching the approved tip elevation. Pile driving criteria shall be approved by the Engineer.

VI. MEASUREMENT AND PAYMENT

Dynamic pile testing (End Bearing) will be measured and paid for at the contract unit price per each, which price shall be full compensation for providing all services of the testing consultant and dynamic monitoring operator as specified herein including providing, installing, monitoring and removing the dynamic testing equipment, for providing the data and preparing the written documentation specified, and for all tools, labor, materials, and incidentals necessary to complete the work.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------------|-----------------|
| Dynamic Pile Test (End Bearing) | Each |

GUIDELINES — For projects requiring expansion joints cleaned and resealed only. {2007-S404D01}

[SP404-000100-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
SEALING EXPANSION JOINTS

June 15, 2015; Reissued July 12, 2016

I. DESCRIPTION

This work shall consist of cleaning and resealing expansion joints according to the Contract and as directed by the Engineer.

II. MATERIALS

Expansion joint filler and sealer materials shall conform to Section 212 of the Specifications.

III. PROCEDURES

Expansion joints shall be cleaned and shall be free of oil, grease, existing joint material or any other foreign material. Loose material shall be removed from the joint with oil-free compressed air delivered with not less than 120 cubic feet of air per minute and a nozzle pressure of not less than 90 pounds per square inch and not more than 200 pounds per square inch.

The Contractor shall protect the edges of pavement adjacent to the joints to be cleaned.

The Contractor shall install joint filler and sealer materials according to the manufacturer's written instructions.

Expansion joints shall be filled and sealed according to Section 404.05 of the Specifications. Joints to be filled shall be completely dry and the ambient air temperature shall be at least 45 degrees F. The applied sealer and finished joint shall be free of entrapped air. Finished sealer shall conform to the lines and grades of existing pavement surfaces.

IV. MEASUREMENT AND PAYMENT

Clean and reseal expansion joints will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall be full compensation for cleaning joints, furnishing and installing joint filler, joint sealer, removal and disposal of debris, and for all material, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

| Pay Item | Pay Unit |
|----------------------------------|-----------------|
| Clean and reseal expansion joint | Linear foot |

GUIDELINES — Use when requested by the Designer. {2007-S404G01}

[SP404-000110-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
FILLING AND SEALING PATTERN CRACKS IN CONCRETE DECKS AND OVERLAYS

May 17, 2010c; Reissued July 12, 2016

I. DESCRIPTION

This Special Provision specifies the requirements for filling and sealing pattern cracks in hydraulic cement concrete bridge decks and overlays with a polymer as directed by the Engineer. Examples of pattern cracking that are defined and pictured in ACI 201.1R-08 *Guide for Conducting a Visual Inspection of Concrete in Service*, include checking, craze cracks, map cracking, pattern cracking, plastic cracking, shrinkage cracking and temperature cracking.

Pattern cracks may originate as plastic shrinkage cracks that are caused by the surface of the concrete drying before the curing material is applied. The cracks typically get wider with age as the concrete under goes drying shrinkage. Pattern cracking that is not identified for filling and sealing prior to the final acceptance of the project or prior to placing traffic on the surface is not covered by this special provision. This special provision does not apply to decks constructed with solid stainless reinforcing steel.

II. MATERIALS

Gravity fill polymer crack sealers shall be a high molecular weight methacrylate, epoxy or urethane conforming to the following:

| PROPERTY @ 75 ± 5° F | TEST METHOD | REQUIREMENT |
|------------------------------|--------------------|--------------------|
| Gel Time, 50 ml sample | ASTM C881 | 6 hrs. max. |
| Tensile Strength | ASTM D638 | 1,500 psi. min. |
| Sand Penetration, MX-45 sand | VTM 101 | 80% min. |

III. CONCRETE AGE AT TIME OF CRACK FILLING AND SEALING

Cracks shall be located, filled and sealed at the oldest age that is practical as determined by the Engineer and prior to the final acceptance of the project and prior to opening the surface to traffic.

IV. LOCATING CRACKS THAT SHALL BE FILLED and SEALED

Crack width shall be measured using a transparent crack comparator placed on the surface of the concrete. The width shall be at the oldest age that is practical as determined by the Engineer and prior to the final acceptance of the project and prior to opening the surface to traffic. The width shall be measured and recorded prior to 3 hours past sun rise. Cracks with a width equal to or greater than 0.2 millimeter shall be marked for filling and sealing.

V. SURFACE PREPARATION AND APPLICATION

Prior to filling and sealing, the cracks shall be protected from materials that can interfere with the filling of the crack and the curing of the polymer crack filling material.

Cracks to be filled shall be dry and free of dust, dirt and other debris prior to filling, and shall be air blasted with oil free compressed air prior to application of the polymer. The concrete surface temperature shall not be less than 55 degrees F when the polymer is applied. The polymer to be applied shall be suitable for use at the concrete temperature at the time of the application. The polymer shall be applied during the lowest temperature period of the day, usually between 1 a.m. and 9 a.m., when the cracks are open to the greatest extent. Cracks wider than 1.5 millimeters shall be filled with dry Grade E sand as prescribed in Table II-22 of the Road and Bridge Specifications prior to placement of the polymer. The mixed polymer shall be applied directly to the areas of the deck that are cracked allowing time for the polymer to seep down into the cracks, making additional applications until cracks are filled. The polymer shall be worked into the cracks with a broom or squeegee. Excess polymer shall be brushed off the surface prior to the polymer hardening. Mixed polymer shall be applied as soon as practical and polymer that exhibits an increase in viscosity and temperature shall not be placed on the concrete surface. Grade D sand as prescribed in Table II-22 of the Road and Bridge Specifications shall be broadcast over the applied polymer at the minimum rate of 0.5 pound per square yard. The sand shall be broadcast as soon as practical and before the viscosity of the polymer begins to increase. Regardless of the application method used, the polymer shall be applied in sufficient quantity and applications to fill cracks level. An application rate of one gallon per 100 square feet of deck is usually adequate. When practical, application of the polymer crack sealer shall be completed prior to grooving of the deck surface and grooving shall not be performed until the polymer has cured a minimum of 48 hours.

The Contractor shall plan and prosecute the work in such a manner to protect persons, vehicles and the bridge structure from injury or damage. Armored joints shall be covered, scuppers plugged and cracks sealed from underneath or other protective measures necessary to protect traffic, waterways and bridge components shall be implemented. In the event polymer materials or solvents harm the appearance of bridge components, removal of such materials will be required as directed by the Engineer. Traffic will not be permitted on the treated surface until tracking will not occur as determined by the Engineer.

VI. MEASUREMENT AND PAYMENT

When a pay item, gravity fill polymer crack sealing will be measured and paid for at the contract unit price per square yard as specified. The price bid for such work shall be full compensation for furnishing and applying the silica sand and polymer crack sealer, for vehicular and pedestrian protection, for crack preparation, for protection of waterways and bridge surfaces and for all labor, tools and incidentals necessary to complete the work.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------------|-----------------|
| Gravity fill polymer crack sealing | Square yard |

GUIDELINES — Use when requested by the Designer. {2007-S404H01}

[SP404-000120-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**SEALING LINEAR CRACKS IN CONCRETE DECKS AND
OVERLAYS USING EPOXY AND CARBON FIBER MESH**

September 16, 2009c; Reissued July 12, 2016

I. DESCRIPTION

This Special Provision specifies the requirements for sealing linear cracks and construction joints in hydraulic cement concrete bridge decks and overlays with epoxy and open grid carbon fiber mesh as directed by the Engineer.

Linear cracks, particularly transverse cracks, can be caused by thermal contraction, drying shrinkage, construction loads, continuous span deck construction sequence and live load induced tensile stress. The width of the cracks may be a function of thermal contraction, drying shrinkage, crack spacing, concrete age, and loads applied to the deck.

The cracks get wider with age as the concrete under goes drying shrinkage. This special provision does not apply to decks constructed with solid stainless reinforcing steel.

II. MATERIALS

Epoxy and aggregate materials shall meet the requirements in Section 431 of the Specifications. Carbon Fiber Mesh Materials shall conform to the following:

4-inch Carbon Fiber Strip Specs:

The carbon fiber mesh is comprised of a high tensile strength carbon fiber. The mesh is not impregnated and is wet out and cured in place in epoxy resin overlay.

| | |
|-----------------------------|-------------------------------------|
| General Information: | |
| Constituent Materials: | 6K Carbon Fiber unidirectional tows |
| Primary Fiber Directions | Closed knit 0° X 90° |
| Color | Black |
| Packaging | 4" X 200 linear ft rolls |

| | | |
|---|---|---------------------|
| Carbon Material Properties | | |
| Nominal Thickness | 0.030 inches | |
| Nominal Tensile Strength per unit width | 400,000 psi | ASTM D3039-08 |
| Nominal Tensile Modulus | 33,000,000 psi | ASTM D3379-75(R-89) |
| Failure Strain | 1.3% | ASTM D3379-75(R-89) |
| Grid Spacing | 1/4" x 1/4" (inch) (longitudinal x transverse) | |

III. CONCRETE AGE AT TIME OF CRACK FILLING AND SEALING

Cracks shall be located and sealed at the oldest age that is practical as determined by the Engineer and prior to the final acceptance of the project and prior to opening the surface to traffic.

IV. LOCATING CRACKS THAT SHALL BE FILLED AND SEALED

Crack width shall be measured using a transparent crack comparator placed on the surface of the concrete. The width shall be at the oldest age that is practical as determined by the Engineer and prior to the final acceptance of the project and prior to opening the surface to traffic. The width shall be measured and recorded prior to 3 hours past sun rise. Cracks with a width equal to or greater than 0.2 millimeter shall be marked for sealing.

V. SURFACE PREPARATION AND APPLICATION

The surface of the concrete on which the carbon fiber mesh will be placed shall be cleaned according to Section 431 of the Specifications. The epoxy and aggregate shall be placed according to the requirements for the first layer in Section 431 of the Specifications. Dump and spread the mixed epoxy resin on the designated area for the placement of the 4-inch Carbon Fiber strip. Apply the epoxy at a minimum rate of 2 ½ gallons per 100 square feet. Immediately place the 4-inch Carbon Fiber strip precut to the required length into the placed epoxy allowing the epoxy to wet into the carbon strip and to penetrate through the openings in the carbon strip to thoroughly encapsulate the strip. A roller or squeegee may be used to assist penetration and to ensure the strip is pressed to the substrate and the epoxy is evenly spread. Use a squeegee to move adjacent epoxy over the strip for complete encapsulation. Broad cast aggregate to excess over all surfaces covered with epoxy.

The Contractor shall plan and prosecute the work in such a manner to protect persons, vehicles and the bridge structure from injury or damage. In the event epoxy materials or solvents harm the appearance of bridge components, removal of such materials will be required as directed by the Engineer. Traffic will not be permitted on the treated surface during the curing period which is specified in Section 431 of the Specifications.

VI. MEASUREMENT AND PAYMENT

Crack sealing will be measured and paid for at the contract unit price per linear foot as specified. The price bid for such work shall be full compensation for surface and crack preparation, for furnishing and applying the epoxy, carbon fiber mesh and aggregate, for vehicular and pedestrian protection, for protection of waterways and bridge surfaces and for all labor, tools and incidentals necessary to complete the work.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Crack sealing using epoxy and carbon fiber mesh | Linear foot |

GUIDELINES - For use on projects where the Plans call for use of Carbon Fiber Reinforcement Strands in Prestressed Concrete Piles.

[SP405-000100-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
CARBON FIBER REINFORCED PRESTRESSED CONCRETE PILES

December 8, 2016

SECTION 105 – CONTROL OF WORK of the Specifications is amended as follows:

Section 105.10(c)3 – Concrete Structures and Prestressed Concrete Members is amended to insert the following:

Working Drawings for concrete structures and prestressed concrete members which are reinforced with Carbon Fiber Reinforced Polymer (CFRP) tendons and other CFRP reinforcement shall provide the following, as required for the successful prosecution of the Work and which are not included in the Plans furnished by the Department: additional details related to tendon coupler locations, stressing sequence accounting for coupler locations and differing moduli of elasticity, and spacing and ties for reinforcing. All additional information shall be included in the sealed package submitted for approval.

SECTION 223 – STEEL REINFORCEMENT of the Specifications is renamed **TENSILE REINFORCEMENT OF CONCRETE** and amended as follows:

Section 223.02(a)8 – Carbon Fiber Reinforced Polymer (CFRP) reinforcement is inserted as follows:

Carbon Fiber Reinforced Polymer (CFRP) reinforcement shall have an ultimate tensile strength of at least 338 ksi based on the nominal area and a minimum ultimate strain of 1.30% when tested in accordance with ASTM D7205.

Section 223.02(b) – Prestressing Tendons is replaced with the following:

Prestressing Tendons, as designated on the Plans, shall be one of the following:

1. **Seven-wire, whether stress-relieved strands, stress-relieved wire, or low-relaxation strands**, shall conform to ASTM A416, Grade 270; ASTM A421; and ASTM A416, Supplement I, respectively, with the following modifications:
 - a. Strands or wires used in units of any one-bed layout shall be manufactured by the same plant.
 - b. A manufacturer's certification and load-elongation curve in accordance with ASTM A416 or ASTM A421 shall be obtained by the prestressed concrete fabricator for each lot of strand planned for use in fabrication. The strand or wire manufacturer shall submit the data in permanent record form to the Engineer for approval prior to fabrication.
2. **CFRP tendons** shall be from the VDOT Materials Division's Special Products Evaluation List (SPEL).

The CFRP tendons shall have a nominal diameter as indicated on the Plans or Standard Drawings. CFRP tendons shall be free of scoring. “Nicks” or “gouges” will not be acceptable. Materials shall be shipped in coil form and shall be stored in such a way that kinks do not develop when the coil is unwound. Any CFRP tendon found to be damaged on the surface, bent, subjected to temperatures above 122°F at any time, or stored out of doors shall be discarded. A special handling guidelines manual shall be provided for CFRP tendons by the manufacturer.

SECTION 403 – BEARING PILES of the Specifications is amended as follows:

Section 403.03(b) – Precast Concrete Piles is amended by replacing the first paragraph with the following:

Precast Concrete Piles: Precast concrete piles with conventional or Carbon Fiber Reinforced Polymer (CFRP) reinforcement or tendons shall be furnished in accordance with these Specifications. Prestressed concrete piles shall be furnished in accordance with the requirements of Section 405. Piles shall be manufactured to conform to Section 404. The Class of Concrete shall be as specified on the Plans or the Specifications. If not specified, then Class A3 concrete shall be used for piles which are not prestressed.

Section 403.03(b)1 – Casting is replaced with the following:

Casting

- a. **All Piles:** Forms shall conform to Section 404 and shall be accessible for vibrating, tamping, and consolidating concrete. Care shall be taken to place concrete to produce a satisfactory bond with the reinforcement and avoid segregation of components, honeycombs, or other defects.

Concrete shall be continuously placed in each pile form and consolidated by vibrating. Forms shall be overfilled, the surplus concrete screeded off, and the top surface finished to a uniform, even texture similar to that produced by forms.

- b. **Piles using CRFP Reinforcement:**

The Contractor shall use self-consolidating concrete (SCC) conforming to Section 217.11 when using CRFP. During concrete placement, internal vibrators shall be encased with a protective polyurethane sheath. External vibrators will be acceptable. Extreme care shall be taken to avoid damage to CFRP tendons and reinforcement from internal vibrators. SCC will not require any vibration; however, limited vibration that will not cause segregation may be applied to ensure flow of material in congested areas, and to provide a smooth surface.

Materials, including anchorages, couplers, and other miscellaneous hardware, shall be carefully handled to prevent any damage or deformation along the reinforcement surface, and will be stored in their original containers until required for use. Materials, including anchorages, couplers, and other miscellaneous hardware, shall not be placed directly on the ground and shall be kept free from grease, dirt, and dust. Any damaged material shall be removed from the final product prior to stressing. Workers shall not walk on or step on CFRP prestressing tendons during the placement of the tendons.

CFRP reinforcement shall be suitably covered to eliminate any environmental factors such as temperatures above 122°F, ultraviolet rays, and chemical substances; and shall be protected from sudden shocks or heavy hard objects and welding sparks. The CFRP reinforcement shall not be mishandled, handled in a rough manner, nor damaged (e.g. shall not be stepped

on, walked on, or dragged over rough or dirty surfaces nor through rough or jagged holes in steel or wood).

CFRP reinforcement shall be properly cut to the lengths as specified on the Plans. Cutting of carbon reinforcement shall be performed by use of a high-speed rotary grinder approved by the Engineer, which will not damage the material. Heat oriented cutting tools, such as gas welding torches, shall not be used. Heating CFRP in any manner is dangerous and shall not be used. CFRP reinforcement shall not be field bent. Draping (harping) of tendons shall only be allowed as provided for in the Plans.

All supports, such as chairs, and tie wires shall be non-metallic material and shall not be in contact with metal reinforcement such as stainless steel. The Contractor shall use an inert, non-metallic, insulating material to prevent direct contact. All CFRP reinforcement shall be sufficiently tied down prior to placing of concrete to eliminate "floating" of reinforcement.

The Contractor shall be responsible for installing the special anchoring system on the CFRP tendons for pretensioning according to the guidelines provided by the CFRP tendon manufacturing company. The jacking operation shall be the same as for conventional steel, except that steel transfer couplers shall be used to transfer prestressing force to the CFRP tendons. The end preparation material and steel transfer coupler shall be provided by, or approved for use with the CFRP tendon by, the CFRP tendon manufacturer.

At least 5 days prior to jacking, the Contractor shall provide the Department with PE approved shop drawings showing the CFRP tendon layout, to include coupler placement locations and offset requirements necessary to prevent collision of couplers during pretensioning due to elongation of the tendon. The Contractor shall perform sequenced tendon jacking operations as noted on the approved Working Drawings. The Engineer shall approve each strand force and strand elongation prior to "lock off" and jack removal. Jacking operations shall proceed to the next strand as sequenced on the approved Working Drawings. Steel transfer coupler shall temporarily be supported for vertical loads and prevented from any rotation movement during prestressing as noted on the approved Working Drawings. Release of the prestressing force for anchoring shall be uniform and gradual and shall not expose any part of the pile cross section to sudden eccentric stresses. A sudden release of pretensioning force shall not be permitted except as part of the approved detensioning process. Release of force shall also be simultaneous at each end of the pile. The jacking force for CFRP tendons shall be 10% greater than desired or effective prestressing force.

Section 403.03(b)2 – Curing is replaced with the following:

Curing: Steam curing will be permitted if the concrete temperature is kept below 165°F. If CFRP is specified, the environment outside the pile where the coupler is located shall be kept below 122°F, as high temperatures will have detrimental effects on carbon reinforcement and slippage in the coupling or the anchoring.

As soon as piles have set sufficiently, side forms shall be removed and the piles moist-cured for at least 7 days. However, if CFRP is used or the concrete piles are to be used in brackish water, tidal water, or alkali soils, the piles shall be moist-cured for at least 30 days before use. Piles shall not be driven until the concrete has reached the minimum 28-day compressive strength specified in Section 217.

SECTION 405 – PRESTRESSED CONCRETE of the Specifications is amended as follows:

Section 405.02(a) – Concrete is amended by inserting the following:

Calcium nitrite will not be required for corrosion protection in piles when Carbon Fiber Reinforced Polymer (CFRP) tendons are specified.

The Contractor shall use self-consolidating concrete (SCC) conforming to Section 217.11 when using CFRP. Vibration of SCC shall conform to Section 403.03(b)1.

Section 405.05(b) – Placing Strands and Wires and Applying and Transferring Pretension is amended to replace the sixth paragraph with the following:

The final stressing of strands shall be performed by applying tension to each strand individually or to all CFRP tendons as a group. The strands shall be tensioned to the total pre-tensioning force as indicated on the plans, with a maximum applied stress indicated below.

| Strand Type | Percent of guaranteed ultimate strength |
|-------------------------|--|
| CFRP Strand | 65% |
| Stress-Relieved Strands | 70% |
| Low-Relaxation Strands | 75% |

The nominal area of the strand and reinforcing shall be confirmed between the precast concrete producer and the strand supplier. Care shall be exercised when cutting the strand to prevent damage to the region adjacent to the cut end.

SECTION 406 – REINFORCING STEEL of the Specifications is amended as follows:

Section 406.02(e) – Carbon Fiber Reinforced Polymer (CFRP) pile confinement reinforcement is inserted as follows:

Carbon Fiber Reinforced Polymer (CFRP) pile confinement reinforcement shall be made from a product listed on VDOT Materials Division's Special Products Evaluation List (SPEL). Ties for pile confinement shall be corrosion free. CFRP confinement reinforcement shall have a reinforcing strength per foot which meets or exceeds the force indicated on the plans.

GUIDELINES — Use when requested by the Designer. {2007-S407D00}

[SP407-000100-00](#)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
METALLIZATION OF FERROUS METAL SURFACES

January 5, 1998c; Reissued July 12, 2016

SECTION 407—STEEL AND OTHER METAL STRUCTURES of the Specifications is amended as follows:

Section 407.01—Description is amended to include the following:

All non-stainless ferrous metal, unless galvanized or protected with other specified coatings, shall be metallized as specified herein.

Section 407.02—Materials is amended to include the following:

Wire material for metallizing shall be zinc, or 85/15 zinc/aluminum alloy as certified by the manufacturer. The materials shall conform to the following quantitative requirements:

Zinc:

| Element | Content (%) |
|--------------|--------------|
| Iron (Fe) | 0.0015% max. |
| Cadmium (Cd) | 0.0015% max. |
| Lead (Pb) | 0.003% max. |
| Copper (Cu) | 0.004% max. |
| Zinc (Zn) | Balance |

85/15 zinc/aluminum:

| Element | Content (%) |
|---------------|-------------|
| Iron (Fe) | 0.020% max. |
| Copper (Cu) | 0.004% max. |
| Cadmium (Cd) | 0.004% max. |
| Lead (Pb) | 0.004% max. |
| Titanium (Ti) | 0.002% max. |
| Aluminum (Al) | 14.0%-16.0% |
| Zinc (Zn) | Remainder |

The manufacturer shall furnish a Certificate of Analysis for each batch of material supplied. Each container or coil wrapping shall be properly labeled to identify component type, supplier, size, batch number and wire lot number.

The size of wire material shall be according to the manufacturer's recommendations for the Flame or Arc Sprayed method. Powder material shall not be used.

All bolts, nuts, and washers shall be hot dipped galvanized, according to ASTM A153.

Sealers and topcoats, if specified on the plans, shall be selected from one of the following systems:

| Manufacturer | DFT, mils |
|-----------------------------|-----------|
| Carboline: | |
| Rustbond Penetrating Sealer | 1.0-2.0 |
| or Rustbond LT | 1.0-2.0 |
| Carboline 133 HB topcoat | 2.0-3.0 |
| ICI Devco Coatings: | |
| Pre-Prime 167 | 0.5-1.5 |
| Devthane 378 topcoat | 2.0-3.0 |
| Xymax: | |
| Monolock PP | 1.5-2.5 |
| Bridge Finish topcoat | 1.0-2.0 |

Material as applied shall not exceed 3.5 pounds per gallon VOC.

Section 407.04—Fabrication Procedures is amended to include the following:

Surface preparation for, and application of, metallizing shall be performed according to ANSI/AWS C2.18-93. Flame cut edges shall be ground to remove the carburized surface prior to blasting. Blasting or metallizing shall not be performed when the surface temperature of or metallizing shall not be performed when the surface temperature of the steel is less than 5 degrees F above the dew point as determined by a surface thermometer. Surfaces to be metallized shall be blast cleaned with a grit abrasive to provide a surface profile of 2.0-4.0 mils with an anchor tooth profile that is sharp, clean and free of embedded friable material with minimal peening effect. Steel shot and silica sand shall not be used. Surfaces shall be metallized within 8 hours after blasting. If flash rusting should occur prior to metallizing, the metal surface shall be reblasted. Surfaces shall be metallized to a thickness of at least 5 mils according to the wire manufacturer's recommendation.

Before starting work, the Applicator shall apply the recommended thickness of the coating to a 2-inch by 4-foot 8-inch by 0.05-inch steel coupon and bend it 180 degrees around a 0.5-inch mandrel to demonstrate the quality and adherence of the coating. Any disbonding or delamination of the coating which exposes the substrate shall require corrective action and additional testing before the metallizing process may continue.

If a sealer is specified, after metallization, bolted surfaces shall be masked off and all other surfaces shall be sealed within 8 hours of metallizing. Sealer and topcoat shall be applied according to the manufacturer's recommendations with regard to application temperature and humidity.

All fully coated and cured assemblies shall be protected from handling and shipping damage with the prudent use of padded slings, dunnage, separators and tie downs. Loading procedures and sequences shall be designed to protect all coated surfaces. Any damaged areas shall be repaired according to the manufacturer's recommendations. Where sealer and/or topcoating is specified, all bolts and areas that were not sealed or topcoated in the shop shall be prepared and sealed or topcoated after erection according to the manufacturer's recommendations.

The Contractor shall provide the Engineer with documentation, which indicates that the applicator has performed successful metallizing work for the last three years.

Section 407.07—Measurement and Payment is amended to include the following:

No separate measurement and payment will be made for metallization of surfaces; therefore, the cost for all labor, materials, transportation, blasting, cleaning, metallizing, sealing and topcoating to the proper completion of the work shall be included in the lump sum price bid for structural steel.

SQ404-000100-00

GUIDELINES — Use when requested by the Designer.{2007-SU421000A}

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
ELASTIC INCLUSION
Expanded Polystyrene (EPS)

June 24, 2003; Reissued July 12, 2016_

I. DESCRIPTION

Elastic Inclusion work shall consist of installation of an elasticized Expanded Polystyrene (EPS) and geotextile separation fabric between the back of concrete surfaces and backfill material, according to these specifications and in conformity with manufacturer's recommendations, the lines shown on the plans or as established by the Engineer.

II. MATERIALS

- (a) **Elasticized Expanded Polystyrene (EPS):** EPS shall have a size tolerance of 1/8 inch for each dimension and conform to the following:

| Physical Property | Test Method | Requirements |
|--------------------------|--------------------|------------------------------------|
| Compressive strength | D-1621 | 720 psf +/-60 psf @10% strain |
| Water absorption | C-272 | Max. 3% by volume |
| Insect Resistance | D-3345-74 | Resistance to ants, termites, etc. |

The EPS shall be elasticized, with a linear-elastic stress-strain behavior up to 10 percent strain and linear proportional stress-strain behavior up to 30 percent strain.

The EPS shall contain no chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) or formaldehyde. It shall be chemically and biologically inert when in contact with acidic and alkaline soils. It shall be treated to prevent insect attack.

Materials shall withstand temperature variations from 0°F to 140°F without deforming and shall maintain their original dimensions and placement without chipping, spalling, or cracking. Material shall not deteriorate because of contact with sodium chloride, calcium chloride, mild alkalis and acids, or other ice control materials.

The EPS shall contain a flame retardant additive.

- (b) **Geotextile Separation Fabric:** A non-woven geotextile separation fabric shall be placed between the EPS and the backfill material. Fabric joints shall have a minimum overlap of twelve inches. Fabric shall extend a minimum of twelve inches beyond the EPS surface and overlap with adjacent concrete surface.

The separation fabric shall have the following properties:

| Physical Property | Test Method | Requirements |
|-----------------------|-------------|----------------------------|
| Grab Strength | D-4632 | Min. 250 lb |
| Puncture Strength | D-4833 | Min. 112 lb |
| Tear Strength | D-4533 | Min. 90 lb |
| Permittivity | D-4491 | Min. 0.5 sec ⁻¹ |
| Apparent Opening Size | D-4751 | Max. No. 50 sieve |

Geotextile separation fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile separation fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours during installation.

Tensile strength requirements are in the machine and cross-machine directions.

- (c) **Adhesive:** Adhesive shall be used to bond the EPS to concrete surfaces and the separation fabric to the EPS. It shall be applied according to the EPS manufacturer's recommendations.
- (d) **Backfill Material:** Backfill material adjacent to the separation fabric shall be as specified in the Contract.

III. PROCEDURES

- (a) **Preparation of Concrete Surface:** Before placement of EPS, concrete surfaces shall be abrasive blast cleaned with a positive contact sandblaster or adhesives manufacturer's recommendation and approved by the Engineer to remove all non-adherent laitance, oil, grease or other foreign or deleterious matter.
- (b) **Installation of Material:**

The EPS shall be attached to the back of the concrete surfaces with an adhesive compatible with the material.

The concrete surface must be thoroughly dry and clean for adhesive for the application of the EPS. Adhesive shall be applied according to the adhesive manufacturer's recommendation or approval.

The separation fabric may be installed after the EPS has been installed or it may be pre-attached to the EPS. The separation fabric shall cover all exposed surfaces of the EPS.

EPS and separation fabric shall be installed according to the manufacturer's recommendations.

IV. TESTING

Elasticized EPS shall be tested by an independent commercial laboratory, to verify the material requirements specified herein. The Contractor shall provide written documentation of all tests specified. Documentation shall include style, lot, roll numbers, and actual results of each test. In addition, the name, address, phone number of the testing laboratory, and date of testing shall be provided.

Geotextile separation fabric shall be tested by an independent commercial laboratory, to verify the material requirements specified herein. The Contractor shall provide written documentation of all tests specified. Documentation shall include style, lot, roll numbers, and actual results of each test. In addition, the name, address, phone number of the testing laboratory, and date of testing shall be provided.

After the EPS has been installed and before the work has been accepted, the Contractor and Inspector shall perform a visual inspection of EPS coverage and adhesion to the concrete surface. Any area deemed unacceptable and questionable as to remaining in position during the placement of the backfill material shall be replaced or repaired, as required.

REPAIR OF FAILED AREA OF EPS: Unacceptable portion of the EPS shall be removed and the concrete surface shall be prepared and the EPS installed according to this special provision. New EPS in the repair areas shall be visually inspected after curing. The cost of all additional work for repairing or replacing of the defective joint material shall be borne by the Contractor.

IV. MEASUREMENT AND PAYMENT

Elastic inclusion, when a pay item, will be measured in square yards along the back of backwall surface area, complete-in-place, and will be paid for at the contract unit price per square yard. Such price shall be full compensation for cleaning surface, for furnishing and installing the EPS material according to these Specifications and the manufacturer's recommendations, separation fabric, testing, and for all material, labor, tools, equipment and incidentals necessary to complete the work. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------------------|-----------------|
| Elastic Inclusion (Thickness) | Square Yard |

Included in the [2017 Supplement to 2016 Specifications page 24](#)

[SS403-002016-01](#)

June 7, 2016; Issued July 12, 2016

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 403—BEARING PILES

SECTION 403—BEARING PILES of the Specifications is amended as follows:

Section 403.07(d) Dynamic Formula is amended by replacing the equation with the following:

$$R_{ndr} = 1.75(E_d)^{0.5} \log_{10}(10N_b) - 100$$

where:

R_{ndr} = nominal pile resistance measured during pile driving (kips)

E_d = developed hammer energy. This is the kinetic energy in the ram at impact for a given blow. If ram velocity is not measured, it may be assumed equal to the potential energy of the ram at the height of the stroke, taken as the ram weight times the actual stroke (ft-lbs)

N_b = number of hammer blows for 1.0 in. of pile permanent set (blows/in.)

Included in the [2017 Supplement to 2016 Specifications page 24](#)

[SS404-002016-01](#)

July 12, 2016

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 404—HYDRAULIC CEMENT CONCRETE OPERATIONS

SECTION 404—HYDRAULIC CEMENT CONCRETE OPERATIONS of the Specifications is replaced with the following:

Section 404.02(a)—Concrete is amended by replacing the first paragraph with the following:

Concrete shall conform to Section 217 of the Specifications. Aggregate used in concrete for bridge decks shall be nonpolishing. All concrete shall be tested for permeability in accordance with Section 217 of the Specifications.

Included in the [2017 Supplement to 2016 Specifications page 25](#)

[SS406-002016-02](#)

July 7, 2016; Issued October 5, 2016

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 406—REINFORCING STEEL

SECTION 406—REINFORCING STEEL of the Specifications is amended as follows:

Section 406.03(c) Fabrication is amended by replacing the first paragraph with the following:

Fabrication: Bent bar reinforcement shall be cold bent to the shape shown on the plans. Fabrication shall be in accordance with the *ACI Detailing Manual – 2004 (SP-66-04)*.

Section 406.03(d) Placing and Fastening is replaced with the following:

Placing and Fastening: Steel reinforcement shall be firmly held during the placing and setting of concrete. Bars, except those to be placed in vertical mats, shall be tied at every intersection where the spacing is more than 12 inches in any direction. Bars in vertical mats and in other mats where the spacing is 12 inches or less in each direction shall be tied at every intersection or at alternate intersections provided such alternate ties will accurately maintain the position of steel reinforcement during the placing and setting of concrete. Placing reinforcing steel in concrete after concrete has been freshly placed is not permitted.

Unless otherwise specified by the Engineer, tie wires used with corrosion resistant reinforcing steel can be: plastic; solid stainless; epoxy-coated carbon (black) steel wire; or plastic-coated carbon (black) steel wire.

The minimum clear distance from the face of the concrete to any reinforcing bar shall be maintained as specified in the table below.

| Location | Minimum Cover (in) | | |
|--|--------------------|------------------------------------|---------------------|
| | Normal Condition | Corrosive Environment ¹ | Marine ² |
| Pier caps, bridge seats and backwalls: | | | |
| Principal reinforcement | 2-3/4 | 3-3/4 | 4 |
| Stirrups and ties | 2-1/4 | 3-1/4 | 3-1/2 |
| Pier caps, bridge seats and backwalls (at open joint locations): | | | |
| Principal reinforcement | 3-3/4 | 3-3/4 | 4 |
| Stirrups and ties | 3-1/4 | 3-1/4 | 3-1/2 |
| Footings and pier columns: | | | |
| Principal reinforcement | 3 | 4 | 4 |
| Stirrups and ties | 2-1/2 | 3-1/2 | 3-1/2 |
| Cast-in-place deck slabs: | | | |
| Top reinforcement ³ | 2-1/2 | 2-1/2 | 2-1/2 |
| Bottom reinforcement | 1-1/4 | 1-1/4 | 2 |
| Precast and cast-in-place slab spans: | | | |
| Top reinforcement ³ | 2-1/2 | 2-1/2 | 2-1/2 |
| Bottom reinforcement | 2 | 2 | 3 |

| Location | Minimum Cover (in) | | |
|--|--------------------|------------------------------------|---------------------|
| | Normal Condition | Corrosive Environment ¹ | Marine ² |
| Prestressed slabs and box beams: | | | |
| Top steel | 1-3/4 | 1-3/4 | 1-3/4 |
| Stirrups and ties | 1-1/8 | 1-1/8 | 1-1/8 |
| Reinforcement concrete box culverts and rigid frames with more than 2 ft. fill over top of slab: | | | |
| Top slab – top reinforcement | 1-1/2 | 2-1/2 | 3 |
| Top slab – bottom reinforcement | 1-1/2 | 2-1/2 | 3 |
| Inside walls and bottom slab top mat | 1-1/2 | 2-1/2 | 3 |
| Outside walls and bottom slab bottom mat | 1-1/2 | 2-1/2 | 3 |
| Reinforcement concrete box culverts and rigid frames with less than 2 ft fill over top of slab: | | | |
| Top slab – top reinforcement | 2-1/2 | 2-1/2 | 3 |
| Top slab – bottom reinforcement | 2 | 2-1/2 | 3 |
| Inside walls and bottom slab top mat | 1-1/2 | 2-1/2 | 3 |
| Outside walls and bottom slab bottom mat | 1-1/2 | 2-1/2 | 3 |
| Rails, rail posts, curbs and parapets: | | | |
| Principal reinforcement | 1-1/2 | 1-1/2 | 1-1/2 |
| Stirrups, ties and spirals | 1 | 1 | 1 |
| Concrete piles cast against or permanently exposed to earth (not applicable for prestressed concrete): | | | |
| | 3 | 3 | 3 |
| Drilled shafts: | | | |
| Principal reinforcement | 4 | 5 | 5 |
| Ties and spirals | 3-1/2 | 4-1/2 | 4-1/2 |
| All other components not indicated above: | | | |
| Principal reinforcement | 2-1/2 | 3-1/2 | 3-1/2 |
| Stirrups and ties | 2 | 3 | 3 |

¹ Corrosive environment affects cover where concrete surface is in permanent contact with corrosive soil.

² Marine includes all locations with direct exposure to brackish and salt water.

³ Includes 1/2 inch monolithic (integral) wearing surface.

Bars that must be positioned by maintaining clearances from more than one face shall be centered so that clearances indicated by the plan dimension of bars are equalized.

Bars shall be placed so that the concrete cover as indicated on the plans will be maintained within a tolerance of 0 to +1/2 inch in the finally cast concrete.

Where anchor bolts interfere with reinforcing steel, the steel position shall be adjusted without cutting to permit placing anchors in their proper locations.

Plastic (composite) chairs may be used to support Corrosion Resistant Reinforcement (CRR) in precast concrete elements; otherwise, CRR in structures shall be supported by steel bar supports as follows, unless otherwise specified by the Engineer:

1. For Class I CRR, steel bar supports shall be: plastic-protected wire bar supports (per CRSI Class 1 – Maximum Protection) when stay-in-place forms are not used and the steel bar support will be exposed; and epoxy-coated bright basic wire bar supports (per CRSI Class 1A – Maximum Protection) when either stay-in-place forms are used or the steel bar support will not be exposed.
2. For Class II and Class III CRR, steel bar supports shall be: either stainless steel wire bar supports or plastic-protected wire bar supports (per CRSI Class 1 – Maximum Protection) when stay-in-place forms are not used and the steel bar support will be exposed; and epoxy-coated

bright basic wire bar supports (per CRSI Class 1A – Maximum Protection) when either stay-in-place forms are used or the steel bar support will not be exposed.

3. Steel bar supports for CRR shall be fabricated from cold-drawn carbon steel wire conforming to the CRSI corrosion protection class listed above for their specific use, except for plastic-protected wire bar supports, which shall be epoxy-coated with plastic protection applied by dipping legs (i.e., capping legs with premolded plastic tips is prohibited).

Carbon (black) steel in structures shall be supported by bright basic wire bar supports (per CRSI Class 3 – No Protection), except when cast-in-place members are cast directly on soil or rock, such as footings and approach slabs. In these cases, precast concrete supports and plastic (composite) chairs may be used. Steel bar supports for carbon (black) steel shall be fabricated from cold-drawn carbon steel wire. Precast concrete bar supports shall have a 28-day design compressive strength of at least 4,500 pounds per square inch and shall be furnished with plastic ties or shaped to prevent slippage from beneath the reinforcing bar.

Side form spacers shall meet the same corrosion protection level as the bar supports.

Bar supports for CRR in bridge decks and slab spans shall be spaced as recommended by CRSI but not more than 4 feet apart transversely or longitudinally. The mat of steel reinforcement closest to the surface shall be supported by bolster supports or individual chair bar supports and intermediate and upper mats can be supported by individual high chair bar supports or continuous bar supports placed between mats. When the upper mat is supported by the bottom mat (e.g., using continuous bar supports placed between mats), all the bar supports shall be spaced as recommended by CRSI but not more than 3 feet apart transversely or longitudinally. Bar supports shall be firmly stabilized so as not to displace under construction activities. Standees (a bar bent to a U-shape with 90 degree bent legs extending in opposite directions at right angles to the U-bend acting as a high chair resting on a lower mat of reinforcing bars to support an upper mat) may be used on simple slab spans provided they hold the reinforcing steel to the requirements specified herein and are firmly tied to the lower mat to prevent slippage. The use of standees will not be permitted for the top mat of steel on any continuous slab spans.

In reinforced concrete sections or elements other than bridge decks and slab spans, the specified clear distance from the face of concrete to any reinforcing bar and the specified spacing between bars shall be maintained by means of approved types of stays, ties, hangers, or other supports adhering to the CRSI corrosion protection classes and specific uses listed above. The use of pieces of gravel, stone, brick, concrete, metal pipe, or wooden blocks will not be permitted as supports or spacers for reinforcing steel. The clear distance between bars shall be at least 1 1/2 times the specified maximum size of coarse aggregate but not less than 1 1/2 inches. Before concrete is placed, the Engineer will inspect reinforcing steel and determine approval for proper position and the adequacy of the method for maintaining position.

Section 406.03(e) Splicing and Lapping is amended by replacing the fourth paragraph with the following:

For corrosion resistant reinforcing bars, mechanical butt splicers shall be of the same material as the bars being spliced.