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If a seal is present on this sheet, JSP's has been electronically sealed and dated.

JOB NO. J5P3542
Gasconade County, MO
Date Prepared: 8/15/2023

Only the following items of the Job Special Provisions (Bridge) are authenticated by this seal: A - I

A. CONSTRUCTION REQUIREMENTS

1.0 Description. This provision contains general construction requirements for this project.

2.0 Construction Requirements. The plans and the asbestos and lead inspection report for the existing structure are included in the contract in the bridge electronic deliverables zip file for informational purposes only.

2.1 In order to assure the least traffic interference, the work shall be scheduled so that the bridge closure is for the absolute minimum amount of time required to complete the work. The bridge shall not be closed until material is available for continuous construction and the contractor is prepared to diligently pursue the work until the closed bridge is opened to traffic.

2.3 Qualified special mortar shall be a qualified rapid set concrete patching material in accordance with Sec 704. A qualified rapid set concrete patching material will not be permitted for half-sole repair, deck repair with void tube replacement, full depth repair, modified deck repair and substructure repair (formed) unless a note on the bridge plans specifies that a qualified special mortar may be used.

2.4 Provisions shall be made to prevent any debris and material from falling into the waterway. If determined necessary by the engineer, any debris and material that falls below the bridge outside the previously specified limits shall be removed as approved by the engineer at the contractor's expense.

2.5 Any damage sustained to the remaining structure as a result of the contractor's operations shall be repaired or the material replaced as approved by the engineer at the contractor's expense.

2.6 Provisions shall be made to prevent damage to any existing utilities. Any damage sustained to the utilities as a result of the contractor's operations shall be the responsibility of the contractor. All costs of repair and disruption of service shall be as determined by the utility owners and as approved by the engineer.

2.7 The contractor shall schedule the substructure repairs as one of the first orders of work so that the fiber reinforced polymer wrap for shear strengthening can be installed as required by job special provision Fiber Reinforced Polymer (FRP) Wrap for Concrete Beams.

3.0 Method of Measurement. No measurement will be made.

4.0 Basis of Payment. Payment for the above described work will be considered completely covered by the contract unit price for other items included in the contract.

B. REMOVAL OF EXISTING SUPERSTRUCTURE

1.0 Description. This work shall consist of removing and disposing of existing bridge superstructure and any other items necessary to construct Bridge No. J00092 as shown on the plans or as directed by the engineer.

2.0 Removal Requirements. The existing bridge superstructure shall be removed by methods such that the substructure that is to remain in place is not damaged. The methods used to remove the superstructure shall prevent any debris being dropped into the stream. Disposal

of materials shall be in accordance with Sec 202. Any damage sustained to the structure that is to remain in place as a result of the contractor's operations shall be repaired or the material replaced as approved by the engineer at the contractor's expense.

2.1 Salvage Requirements. The two bronze plaques on either end of the Corral Rail shall be removed by methods such that they are not damaged. The plaques are to be incorporated into the new Corral Curbs. See Corral Curb sheets.

3.0 Method of Measurement. No measurement will be made.

4.0 Basis of Payment. Payment for the above described work will be considered completely covered by the contract lump sum price for Removal of Existing Superstructure.

C. RAPID SET CONCRETE PATCHING MATERIAL – HORIZONTAL REPAIRS

1.0 Description. This specification covers cementitious concrete, polymer-modified concrete and polymer concrete that are suitable for repairing concrete surfaces on bridges or roadways, particularly under fast setting or special conditions. The repairs would involve horizontal applications. The work shall consist of removing, furnishing, preparing, and placing materials at locations as shown on the plans or as directed by the engineer.

2.0 Material. All materials shall be in accordance with MoDOT specifications and as noted herein.

2.1 Aggregate For Extending Commercial Mixture. Coarse and fine aggregates shall be in accordance with Sec 1005, except the requirements for gradation and percent passing the No. 200 sieve shall not apply. Coarse aggregate meeting Gradation E requirements shall be used for repairs greater than one inch (25 mm) in depth. Fine aggregate will be allowed for repairs less than one inch (25 mm). Aggregate specified, bagged, labeled and furnished by the rapid set concrete patching material manufacturer may also be used for mortar extension.

2.2 Material Applications. The contractor shall select and use the product most suitable for the work and field conditions in accordance with these specifications.

2.3 Curing. Rapid set concrete patching material shall be cured until the minimum compressive strength 3200 psi is attained using standard curing specifications, unless otherwise specified by the manufacturer.

2.4 Qualification and Project Acceptance.

2.4.1 Inspection. All materials shall be subject to inspection and sampling by MoDOT at the source of manufacture, intermediate shipping terminal or destination. MoDOT will be allowed free access to all facilities and records as required to conduct inspection and sampling.

2.4.2 Qualification. Prior to use, rapid set concrete patching material shall be qualified. In order to become qualified, a material shall have completed testing through AASHTO's National Transportation Product Evaluation Program (NTPEP). The manufacturer shall contact the AASHTO/NTPEP coordinator to obtain the testing location for the rapid setting concrete patching material.

2.4.2.1 Requested Information. The manufacturer shall submit with samples of the materials, a written request to Construction and Materials with the following information:

(a) Brand name of the product.

(b) Certification that the material meets this specification.

(c) NTPEP test results showing compliance with this special provision.

(d) Specific mixing, handling and curing instructions.

(e) Application type (i.e., bridge or roadway).

2.4.2.2 Qualified List. Upon approval by the engineer, the brand name and manufacturer will be placed on a qualified list of rapid set concrete patching materials. The listing of qualified materials is available from Construction and Materials or on MoDOT's web site. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed. The material will be subject to removal from the qualified list if there is evidence of unsatisfactory performance or a change in manufacturing process or formulation, or when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

2.4.3 Provisional Approval. Provisional approval may be granted provided the following requirements have been met:

(a) New Products Evaluation Form

(b) Certified test results from an independent laboratory showing compliance with this special provision.

(c) Documentation prepared by MoDOT covering two years of field performance on MoDOT's system. MoDOT will need to approve the location of the test site. Documentation will contain the placement date, field observations (semi annual), description of field performance and photographs of in-place material.

(d) During placement the manufacturer's representative shall be present on the project to provide technical expertise.

2.4.3.1 Disqualification. If during the two year observation period the repair area(s) fails provisional approval will not be granted. Repair area(s) experiencing any cracking, debonding or spalling will be considered a failure.

2.4.3.2 Length of Provisional Approval. Provisional approval will be granted for three years or until NTPEP testing is completed.

2.5 Certification. The contractor shall supply a manufacturer's certification to the engineer for each lot of material furnished. The certification shall include the name of the manufacturer, a manufacturer certification statement that the material supplied is the same as that qualified and listing the date of qualification.

2.6 Acceptance. Acceptance of the material will be based on the use of a qualified or provisionally approved material, the manufacturer's certification that the material supplied is the same as that approved and upon the results of such tests as may be performed by the engineer.

3.0 Mixture. Unless otherwise specified, rapid set concrete patching material shall be approved commercial mixtures meeting Sections 3.1 – 3.1.3 or deck repair cementitious mortar meeting Section 3.2. Rapid set concrete patching materials shall be specifically designed for the application needed.

3.1 Commercial Mixtures. Rapid set concrete patching material in its sacked form and mixtures when properly prepared in accordance with the manufacturer's specifications, shall meet the minimum test requirements given in Table 1. Mixtures may be supplied, as required, as a patching mortar or as a patching mortar with aggregate extension. If the material is to be supplied with extender aggregate, this shall also pass the required tests in Table 1 using the maximum allowed amount of extender aggregate.

3.1.1 Mixture Requirements. Rapid set concrete patching material shall be single packaged dry mix requiring the addition of water or other liquid component just prior to mixing. The material shall be capable of ½ inch (13 mm) to full depth repair and require no bonding agent. The material shall not contain soluble chlorides as an ingredient of manufacture. The material shall be placed in accordance to the manufacturer's recommendations.

Table 1
(English Unit)

Physical Test Property	Specification	Requirement for cementitious concrete	Requirement for polymer-modified concrete	Requirement for polymer concrete
Bond Strength by Slant Shear[1]	ASTM C882/C928 [3]	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days	n/a	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days
Linear Coefficient of Thermal Expansion[1, 2] (for bagged mortar only, without extension aggregate)	ASTM C531	n/a	n/a	4 – 8 X 10-6 in/in/deg F
Resistance to Rapid Freezing & Thawing[1]	AASHTO T161 or ASTM C666	80% min. using Procedure B[5] (300 Cycles)	80% min. using Procedure B[5] (300 Cycles)	n/a
Compressive Strength[1]	AASHTO T22 or ASTM C39	3200 psi @ 3 hr & 4000 psi @ 7 days	3200 psi @ 3 hr & 4000 psi @ 7 days	n/a
Rapid Chloride Permeability[1]	AASHTO T277 or ASTM C1202	Bridge Decks 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days	Bridge Deck 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days	Bridge Deck 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days

Length Change[1, 4]	AASHTO T 160 or ASTM C157	In water Storage (+0.15) In air storage (-0.15)	In water storage (+0.15) In air storage (-0.15)	n/a
Color		gray	gray	gray

[1]The commercial mix test values can be located in the AASHTO's National Transportation Product Evaluation Program (NTPEP) reports for Laboratory Evaluations of Rapid Set Concrete Patching Materials. Data for provisionally approved materials is located at the Construction and Materials Division.
[2]Not required for extended mixtures if the mortar passes this requirement.
[3] ASTM C882 shall be performed on non-water based materials. ASTM C928 shall be performed on water-based materials.
[4] As modified by ASTM C928.
[5] Procedure A may be used in lieu of Procedure B

3.1.2 Construction Requirements. The manufacturer shall provide with the bagged mixture, specifications for the mixing procedure, amount and kind of liquid to be added, and the amount of aggregate extension allowed, if any. All mixing, handling and curing practices recommended by the manufacturer shall be followed and will be considered a part of these specifications.

3.1.3 Removal from Qualified List. All mixtures shall be approved before use. Reoccurring failures of any mixture for any reason will be cause for removal from the qualified list.

3.2 Deck Repair Concrete. A qualified rapid set concrete patching material indicated for horizontal use and intended for patching concrete bridge decks may be used when specified on the plans and as approved by the engineer. If this option is selected, the contractor shall provide a trial mix to determine the total cure time needed to achieve a compressive strength of 3200 psi (22 MPa). Compressive specimens shall be prepared in accordance with current MoDOT test methods and cured to simulate actual field conditions. Testing of compressive specimens shall be performed by methods and at facilities acceptable to the engineer. The repaired deck shall not be opened to traffic until at least 4 hours after the last placement of deck repair concrete, the established cure time has elapsed and until such concrete has achieved a compressive strength of 3200 psi (22 MPa). A new trial mix may be required if the engineer determines the field conditions vary substantially from trial mix conditions. The engineer will make field cylinders to verify the 3200 psi (22 MPa) minimum strength.

4.0 Construction Requirements.

4.1 Mixing. Rapid set concrete patching material shall be mixed and finished according to the manufacturer's recommendation.

4.2 Preparation of Repair Area. Deteriorated, damaged or defective concrete as shown on the plans, required by the specifications or as directed by the engineer, shall be removed. All exposed reinforcement shall be thoroughly cleaned as shown on the plans, required by the specifications or as directed by the engineer. Unless otherwise specified by the commercial mixture manufacturer, the existing surface shall be damp and all free water shall be removed prior to placement of the required material.

4.3 Bonding Agent. A bonding agent may be used if recommended by the rapid set concrete patching material manufacturer.

5.0 Method of Measurement. No measurement will be made for rapid set concrete patching material.

6.0 Basis of Payment. Rapid set concrete patching material will be paid for at the contract unit price for other items and will be considered full compensation for all labor, equipment and material to complete the described work.

D. RAPID SET CONCRETE PATCHING MATERIAL – VERTICAL AND OVERHEAD REPAIRS

1.0 Description. This specification covers cementitious concrete, polymer-modified concrete and polymer concrete that are suitable for repairing concrete surfaces on bridges or concrete structures, particularly under fast setting or special conditions. The repairs would involve vertical or overhead applications. The work shall consist of removing, furnishing, preparing, and placing materials at locations as shown on the plans or as directed by the engineer.

2.0 Material. All materials shall be in accordance with MoDOT specifications and as noted herein.

2.1 Aggregate For Extending Commercial Mixture. Coarse and fine aggregates shall be in accordance with Sec 1005, except the requirements for gradation and percent passing the No. 200 sieve shall not apply. Coarse aggregate meeting Gradation E requirements shall be used for repairs greater than one inch (25 mm) in depth. Fine aggregate will be allowed for repairs less than one inch (25 mm). Aggregate specified, bagged, labeled and furnished by the rapid set concrete patching material manufacturer may also be used for mortar extension.

2.2 Material Applications. The contractor shall select and use the product most suitable for the work and field conditions in accordance with these specifications.

2.3 Curing. Rapid set concrete patching material shall be cured until the minimum compressive strength 1500 psi is attained using standard curing specifications, unless otherwise specified by the manufacturer.

2.4 Qualification and Project Acceptance.

2.4.1 Inspection. All materials shall be subject to inspection and sampling by MoDOT at the source of manufacture, intermediate shipping terminal or destination. MoDOT will be allowed free access to all facilities and records as required to conduct inspection and sampling.

2.4.2 Qualification. Prior to use, rapid set concrete patching materials need to be qualified.

2.4.2.1 Requested Information. The manufacturer shall submit with samples of the materials, a written request to Construction and Materials with the following information:

(a) New Products Evaluation Form

(b) Brand name of the product.

(c) Certification that the material meets this specification.

(d) Certified test results from an independent laboratory showing compliance with this specification.

(e) Specific preparation instructions of repair area.

(f) Specific mixing, handling and curing instructions.

(g) Application type (i.e., vertical or overhead).

2.4.2.2 Field Evaluation. Final approval will be granted when the following requirements are met:

(e) MoDOT report documenting two years of field performance on MoDOT system. The report will contain the placement date, field observations (semi annual), description of field performance and photographs of in-place material.

(f) A manufacturer's representative shall be present during placement of the material to provide technical expertise.

2.4.2.2.3 Disqualification. If during the two year observation period the repair area(s) fails the product will not be added to the qualified list.

2.5 Qualified List. The listing of qualified products are available from Construction and Materials or on MoDOT's web site. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed. The material will be subject to removal from the qualified list if there is evidence of unsatisfactory performance or a change in manufacturing process or formulation, or when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

2.6 Certification. The contractor shall supply a manufacturer's certification to the engineer for each lot of material furnished. The certification shall include the name of the manufacturer, a manufacturer certification statement that the material supplied is the same as that qualified and listing the date of qualification.

2.7 Acceptance. Acceptance of the material will be based on the use of a qualified product, the manufacturer's certification that the material supplied is the same as that approved and upon the results of such tests as may be performed by the engineer.

3.0 Mixture. Unless otherwise specified, rapid set concrete patching material shall be approved commercial mixtures meeting Sections 3.1 – 3.1.3.. Rapid set concrete patching materials shall be specifically designed for the application needed.

3.1 Commercial Mixtures. Rapid set concrete patching material in its sacked form and mixtures when properly prepared in accordance with the manufacturer's specifications, shall meet the minimum test requirements given in Table 1. Mixtures may be supplied, as required, as a patching mortar or as a patching mortar with aggregate extension. If the material is to be supplied with extender aggregate, this shall also pass the required tests in Table 1 using the maximum allowed amount of extender aggregate.

3.1.2 Mixture Requirements. Rapid set concrete patching material shall be single packaged dry mix requiring the addition of water or other liquid component just prior to mixing. The material

shall not contain soluble chlorides as an ingredient of manufacture. The material shall be placed in accordance to the manufacturer's recommendations.

Table 1
(English Unit)

Physical Test Property	Specification	Requirement for cementitious concrete	Requirement for polymer-modified concrete	Requirement for polymer concrete
Bond Strength by Slant Shear	ASTM C882/C928 [2]	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days	n/a	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days
Linear Coefficient of Thermal Expansion [1] (for bagged mortar only, without extension aggregate)	ASTM C531	n/a	n/a	4 – 8 X 10-6 in/in/deg F
Resistance to Rapid Freezing & Thawing	AASHTO T161 or ASTM C666	80% min. using Procedure B[3] (300 Cycles)	80% min. using Procedure B[3] (300 Cycles)	n/a
Compressive Strength	AASHTO T22 or ASTM C39	1500 psi @ 3 hr & 3000 psi @ 24 hr	1500 psi @ 3 hr & 3000 psi @ 24 hr	n/a
Rapid Chloride Permeability	AASHTO T277 or ASTM C1202	1000 coulombs @ 28 days	1000 coulombs @ 28 days	1000 coulombs @ 28 days
Length Change	AASHTO T 160 or ASTM C157	In water Storage (+0.15) In air storage (-0.15)	In water storage (+0.15) In air storage (-0.15)	n/a
Color		gray	gray	gray

[1] Not required for extended mixtures if the mortar passes this requirement.
[2] ASTM C882 shall be performed on non-water based materials. ASTM C928 shall be performed on water-based materials.
[3] Procedure A may be used in lieu of Procedure B

3.1.2 Construction Requirements. The manufacturer shall provide with the bagged mixture, specifications for the mixing procedure, amount and kind of liquid to be added, and the amount of aggregate extension allowed, if any. All mixing, handling and curing practices recommended by the manufacturer shall be followed and will be considered a part of these specifications.

3.1.3 Removal from Qualified List. All mixtures shall be approved before use. Reoccurring failures of any mixture for any reason will be cause for removal from the qualified list.

3.2 Vertical Repair.. A qualified rapid set concrete patching material approved for vertical use may be used when specified on the plans and as approved by the engineer. The engineer will make field cylinders to verify the 1500 psi (10 MPa) minimum strength. The material shall adhere to the concrete surface without sagging.

3.3 Overhead Repair. A qualified rapid set concrete patching material approved for overhead use may be used when specified on the plans and as approved by the engineer. The material shall be placeable in layers of at least 1 inch on overhead applications without the use of formwork or anchoring devices. The material shall adhere to the concrete surface without sagging. The engineer will make field cylinders to verify the 1500 psi (10 MPa) minimum strength.

4.0 Construction Requirements.

4.1 Mixing. Rapid set concrete patching material shall be mixed and finished according to the manufacturer's recommendation.

4.2 Preparation of Repair Area. Deteriorated, damaged or defective concrete as shown on the plans, required by the specifications or as directed by the engineer, shall be removed. All exposed reinforcement shall be thoroughly cleaned as shown on the plans, required by the specifications or as directed by the engineer. Unless otherwise specified by the commercial mixture manufacturer, the existing surface shall be damp and all free water shall be removed prior to placement of the required material.

4.3 Bonding Agent. A bonding agent may be used if recommended by the rapid set concrete patching material manufacturer.

5.0 Method of Measurement. No measurement will be made for rapid set concrete patching material.

6.0 Basis of Payment. Rapid set concrete patching material will be paid for at the contract unit price for other items and will be considered full compensation for all labor, equipment and material to complete the described work.

E. DECORATIVE PEDESTRIAN FENCE

1.0 Decorative Fence.

1.1 The work under this item shall consist of fabricating and installing steel decorative fence to provide a complete and properly functioning fence system as indicated in the plans and this specification.

1.2 Detailed shop drawings of the system shall be submitted to the engineer for review and approval prior to beginning fabrication.

1.3 Structural calculations shall be provided on the fence components and details for attachment to the concrete sidewalk for the design loads and thermal movements, indicating compliance with the requirements specified herein. Calculations shall be stamped by a professional engineer, licensed in the state of Missouri.

1.4 Shop drawings shall indicate component dimensions, sizes, details, materials, finishes, connection and joining methods, expansion joints, embedment installation details and the relationship to adjoining work. All materials shall meet the requirements of Sec 106.9.

1.5 Manufacturer's installation instructions shall be submitted for the fence mounting method shown.

2.0 Performance Requirements.

2.1 Fence systems shall be designed to meet the requirements of Section 13.8 of the *2020 AASHTO LRFD Bridge Design Specifications*. 50 lb/ft and 200 lb loading shall not be applied simultaneously.

2.2 Apply each load to produce the maximum stress in each of the respective components comprising the fence system.

2.3 Allow for thermal movement of the system with consideration of differential thermal expansion characteristics of the fence and concrete sidewalk to which it is mounted.

2.4 Design and furnish flanged base plate and anchor system for mounting. Anchors shall be galvanized and shall be cast into concrete.

3.0 Materials. Decorative pedestrian fence system products shall meet or exceed the following requirements.

3.1 Acceptable Manufacturer Systems. Fence system shall meet the performance requirements as stated in this provision and shall consist of one of the following fence styles or an approved equal. Selection of one of these systems does not waive the performance requirements as stated in this specification.

Ameristar Fence Products, Inc.
1555 N. Mingo
Tulsa, OK 74116
Phone: (800) 321-8724
www.ameristarfence.com

Iron Eagle Industries, Inc.
1256 Cardiff Blvd.
Mississauga, Ontario Canada L5S1R1
(905) 670-2558
www.ironeagleind.com

Betafence USA
3309 S.W. Interstate 45
Ennis, TX 75119
Phone: (888) 650-4766
www.betafenceusa.com

Merchants Metals
6575 Romiss Court
St. Louis, MO 63134
(800) 293-3363
www.merchantsmetals.com

3.2 Visual Condition. Provide metal, free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

3.3 Surface Coatings. Finish coating and base coatings shall be per the manufacturer's recommendations. Finish coat shall be colored Federal Standard # 17038 (black).

4.0 Construction Requirements.

4.1 Delivery, storage, handling, and installation methods shall be per fence manufacturer's recommendations.

4.2 Fence posts shall be spaced per the approved shop drawings, plus or minus ½". For installations along sloping grades, the post spacing will be measured along the grade. Separation gaps shall be provided at a minimum of every 6 panels.

4.3 Fence posts shall have one draft hole near base of pole. Hole shall be drilled into the post during the fabrication process and prior to application of any coatings. Draft hole will be 3/8" diameter, approximately 3" above the mounting plate or the finished concrete.

4.4 For field assembly, apply zinc-rich primer to thoroughly cover field-cut or field-drilled edges. Apply two coats of manufacturer supplied finish paint to match fence color.

5.0 Warranty. All structural fence components shall be warranted by the manufacturer for a period of 10 years from the date of final acceptance by the engineer. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering, or corrosion and necessary labor required to replace or restore such parts.

6.0 Method of Measurement. Measurement shall be to nearest linear foot of fence installed.

7.0 Basis of Payment. Payment for the work described above and in the contract plans, including all material, equipment, labor, and any other incidental work necessary, will be considered completely covered by the contract unit price for "(60 in.) Decorative Pedestrian Fence".

F. FORM LINERS

1.0 Description. This work item shall consist of constructing the form liner aesthetic treatment on cast-in-place concrete as shown on the plans and described in this special provision.

2.0 Materials.

2.1 Shop Drawings. Contractor shall provide complete shop drawings of all aesthetic treatments.

2.2 Formwork. Formwork for aesthetic treatment of the cast-in-place concrete shall be a type that produces uniform results consistent in both, pattern and depth of relief with the project design aesthetics. The contractor shall be responsible to coordinate the aesthetic treatments of all components to meet the design aesthetic criteria described herein and as shown on plans. No mixing of pattern numbers or manufacturers will be permitted. The form liner pattern shall be one of the patterns listed on the plans or approved equal.

2.3 Form Ties. Wall form ties shall be placed in a uniform pattern. In surface areas receiving the aesthetic treatment form liner, all form ties shall be placed in the simulated stone surface. Form ties shall be fiberglass ties that shall hold the forms in the correct alignment. The color of the ties shall closely match the concrete wall color. Ties shall be ground flush with the surface of concrete prior to pressure washing.

2.4 Form Release Agent. Form release agents shall be the manufacturer's standard non-staining, non-petroleum based and compatible with surface sealer finish coating. Form release agents shall be applied to all surfaces of the form liner at the manufacturer's recommended rate.

2.5 Gaskets. Closed cell compressible neoprene of such thickness as is appropriate to assure leakage prevention shall be used to prevent joint leakage. One face shall be coated with an adhesive tape to assure proper positioning at the time of form closure. The neoprene shall be sufficiently compressible as to assure virtual "zero" separation of the forms as a result of the use of this product.

2.6 Aggregates.

2.6.1 Aggregate Source. The aggregate incorporated into the concrete mix of all aesthetic concrete bridge components shall be from the same source as the balance of the bridge concrete work. The purpose for this provision is to ensure uniformity of materials and color once areas are pressure washed and aggregates become exposed. Single-source shall be interpreted as one contiguous rock quarry, gravel pit or dredging location. This provision in no way alters the specification requirements for aggregate quality specified in other sections of the project specifications.

2.6.2 Aggregate Gradation. Concrete mixes supplied for the construction of the aesthetic treatments shall be in accordance with the following requirements. The concrete aggregate for the aesthetic treatment mix shall be Gradation E in accordance with Sec 1005 for any areas where aesthetic treatment is formed monolithically with the structure. This requirement for aggregate size is necessary to permit concrete mixture to flow freely and fill completely into reveals and form liner proposed in the aesthetic treatment. Gradation E aggregate shall meet the aggregate source requirements.

2.7 Joint Materials. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The backup material shall be compressible, non-shrink, non-reactive with the sealant and non-absorptive material type such as extruded butyl or polychloroprene foam rubber. The joint sealant shall be an elastomeric, multi-component sealant, in accordance with Federal Specification TT-S-227, Type II. The sealant color shall match the pressure washed concrete surface color.

3.0 Construction Requirements.

3.1 Reveals and Texture. All reveals and texture shall be continuous from element to element through construction joints and around corners. Techniques shall be utilized to ensure true continuous texture between separate elements. Sand blasting will not be permitted for cleaning concrete surface, as sand blasting will reduce the special surface texture specified. Pressure washing with water is the preferred method of removing laitance. Pressure washing cleaning shall provide a minimum pressure of 3000 psi at a rate of 3 to 4 gallons per minute (11.4 to 15.1 L/min) using a fan nozzle held perpendicular to the surface at a distance of 2 to 3 feet. The completed surface shall be free of blemishes, discolorations, surface voids and conspicuous form marks to the satisfaction of the engineer.

3.2 Sample Test Panels. Sample test panels shall be constructed to demonstrate the contractor's workmanship for all form liner textures and patterns as shown on the plans. The sample test panels may also be used for demonstration special surface finish if approved by the engineer. The architectural surface treatment of the finished work shall achieve the same final effect as demonstrated on the approved sample test panels. The materials used in construction of the sample test panels shall be in accordance with all standards as listed in this specification and the plans. The concrete mix shall be consistent with the project specifications and criteria. The minimum size of the sample test panels shall be 6 x 6 feet x 8 inches. The form liner finish shall be demonstrated in a vertical strip covering one-half to three-quarters of the sample test panel(s).

3.3 Patches. Holes and defects in concrete surface shall be filled within 48 hours of when the forms are removed. The same patching materials and techniques shall be used that were approved on sample test panels. The patches shall be made with a stiff mortar made with the same material sources as the concrete. The mortar mix proportions shall be adjusted so the dry

patch matches the dry adjacent concrete. White cement shall be added to the mortar mix if necessary to lighten the mortar mix.

3.4 Joints. Joints shall be sealed when the sealant, air and concrete temperatures are above 40°F. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendation. All construction control and expansion joints shall occur within the vertical joints as shown in the elevation views on the plans. All vertical expansion joints shall be filled with preformed fiber expansion joint filler covered with bond break tape and sealed with elastomeric, multi-component sealant.

4.0 Method of Measurement. Final measurement will not be made except for authorized changes during construction or where significant errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

4.1 Form Liners for Cast-In-Place Concrete. Measurement of form liners will be made to the nearest square yard.

5.0 Basis of Payment.

5.1 Form Liners for Cast-In-Place Concrete. Payment for form liners will be based on the contract plan quantities. Payment for the above described work, including all material, additional concrete, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for "Form Liners". Any change in the contract plan quantities, based on approved change orders, will be paid for at the contract unit price.

G. FIBER REINFORCED POLYMER (FRP) WRAP FOR CONCRETE BEAMS

1.0 Description. This work shall consist of designing, furnishing, and placing carbon or glass fiber reinforced polymer (FRP) composite wrap to shear strengthen the concrete beams at the locations as shown on bridge plans and as directed by the engineer.

2.0 Materials. The storage and handling of materials for the FRP composite work shall be in accordance with the manufacturer's written recommendations in factory sealed containers with the FRP manufacturer's labels. Labels shall be intact and legible with date of manufacture and shelf life.

2.1 Material Properties.

2.1.1 The contractor shall provide a unidirectional, high-strength fiber fabric fully saturated with compatible epoxy resin per manufacturer's recommendations. FRP provided shall meet or exceed ASTM D3039 test procedure requirements (tensile modulus, stress and strain) as determined from independent laboratory testing.

2.1.2 The contractor shall provide a flexible, waterproofing, non-vapor barrier protective top coating compatible with the FRP manufacturer's recommendations to protect the FRP from ultraviolet radiation and heavy abrasion with a design life of 50 years. This protective top coating shall closely match the gray color appearance of the existing concrete color.

2.2 Product Data. Manufacturer's product data including physical and chemical characteristics, material specifications for each component, limitations on use of the system, construction or

application specifications, maintenance instructions and general manufacturer's recommendations regarding each system shall be provided. Product data on the proposed primer, putty, resin, saturant, and carbon or glass fiber shall be included. Testing information on the combination of the proposed carbon or glass fiber reinforcement and epoxy when used together as a system shall be provided. The contractor shall provide certifications by the producers of the materials that all materials supplied are in accordance with all the requirements and standards of the appropriate ASTM and other agencies. Manufacturer's Material Safety Data Sheets (MSDS) for all materials to be used shall be provided.

2.3 Contractor Submittals. The contractor shall submit the following documentations and obtain approval 30 days before work commences.

2.3.1 Contractor Qualifications. The contractor shall provide a manufacturer's certification of technical training, FRP system selected, project supervisor, and documentation showing the contractor has been certified or approved by the manufacturer of the FRP system. A contractor specializing in the supply and installation of FRP repair systems with minimum of 5 years of documented experience or 25 documented similar field applications with acceptable reference letters from respective owners in performing FRP composite retrofits shall perform the work. A trained project supervisor shall remain at the work site at all times to instruct the work crew in the FRP application procedures.

2.3.2 Shop Drawings. Shop drawings shall be submitted signed and sealed by a Missouri Professional Engineer in accordance with Sec 107 for Authentication of Certain Documents. Shop drawings shall include the detail of types, locations, dimensions, number of layers and splice details and orientation of all FRP materials and coatings to be installed.

2.3.3 Calculations.

2.3.3.1 Concrete Beam Shear Strengthen. Signed and sealed calculations with the shop drawings shall be submitted indicating that the proposed system provides the additional design forces required at the locations indicated on the plans. The fiber reinforced polymer wrapping shall be designed in accordance with NCHRP Report 678, Design of FRP System for Strengthening Concrete Girders in Shear.

3.0 Construction Requirements.

3.1 FRP Wrapping. FRP shear reinforcement shall be by complete wrapping except where objects interfere, in those places U-wrap shall be used. FRP wrapping along the portion of the member length to be strengthened may be applied continuously or as discrete strips with a maximum of 12" spacing centerline to centerline. Fibers in the FRP in its final position on the concrete component shall be oriented in the direction that maximizes the effectiveness of the FRP reinforcement. Anchorage shall be required for U-wrap and overlap shall be required for complete wrap as per the manufacturer's recommendation. Additional horizontal strips of FRP shall not be used as anchorage for FRP shear reinforcement**.**

3.2 Concrete Moisture Requirement. The surfaces of the concrete to receive the FRP composite shall be reasonably dry based on the following test. A 3 x 3 foot polyethylene sheet shall be taped to the existing concrete surface and at any substructure repair area. If moisture collects on the underside of the polyethylene sheet before the epoxy would cure, the concrete shall be allowed to dry longer. The concrete surface shall pass this test before the FRP can be applied.

3.3 Surface Preparation. Spalled and loose concrete shall be removed and concrete surfaces restored to their original dimensions using substructure repair in accordance with Sec 704. The new concrete in the substructure repair areas shall cure for a minimum of 28 days before the FRP is applied. Concrete surfaces of existing or patched concrete to receive an application of FRP material shall be prepared by abrasive blasting or grinding to remove existing laitance and expose aggregate to a minimum ICRI-CSP3 concrete surface profile. All FRP contact surfaces shall have all laitance, dust, dirt, oil, curing compound, existing coatings and any other foreign matter removed that could interfere with the bond between the FRP system and the concrete. Localized out-of-plane variations, including form lines, shall not exceed the smaller of 1/32 inch or the tolerances recommended by the FRP manufacturer's recommendation. Sharp and chamfered corners shall be rounded off to a minimum radius of 1/2 inch by grinding or forming with the system's thickened epoxy. Variations in the radius along the vertical edge shall not exceed 1/2 inch for each foot of length.

3.4 Installation of FRP. The concrete and atmospheric temperatures shall be between 40°F and rising and 90°F and falling during installation of the FRP. Tension adhesion testing shall be conducted using ASTM D7234 with the strengths reaching 200 psi. Any failure shall exhibit failure of the concrete substrate before failure of the adhesive. Tension adhesion testing shall cease when strengths reach 200 psi. Any failure of the concrete substrate and/or FRP adhesion shall be repaired at the contractor's expense and as directed by the engineer. Two adhesion tests shall be performed for each bent having FRP being applied. The FRP shall be installed in accordance with the manufacturer's written recommendations and as required by the job special provisions.

4.0 Method of Measurement. Fiber reinforced polymer wrap will be measured to the nearest square foot based on the member surface area as detailed on the contract plans. No additional compensation will be given for the use of multiple layers of material to achieve design strength. Final measurements will not be made except for authorized changes during construction or where significant errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

5.0 Basis of Payment. Payment for the above described work, including all material, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for Fiber Reinforced Polymer Wrap.

H. GALVANIZED STEEL PRESS-BRAKE-FORMED TUB GIRDER (PBFTG)

1.0 Description. Steel press-brake-formed tub girder (PBFTG) elements shall be designed and manufactured according to the plans, the standard specifications and as contained herein. The Steel Press-Brake-Formed Tub Girder (PBFTG) shall be produced by an approved manufacturer by Bridge Division. The PBFTG shall be produced by the following manufacturer or approved equal:

Valmont Industries, Inc. - North American Structures
Guy C. Nelson, P.E., S.E.
Product Development Director
616-813-8514
guy.nelson@valmont.com

2.0 Design. The PBFTG shall be certified that the design is in accordance with current AASHTO LRFD Bridge Design Specifications and as supplemented by the Standard

Specifications for Bridge Construction, and any applicable structural specifications. Design live loading shall be AASHTO LRFD HL-93 or as indicated on the plans. The design live loading shall be indicated on the shop drawings submitted to the owner. The design shall be signed, sealed and stamped by a Professional Engineer in the State of Missouri.

3.0 Shop Drawings. Shop drawings of the PBFTG shall be submitted to Fabrication@modot.mo.gov for approval. Shop drawings shall be in accordance Sec 1080.3.2 and shall include the physical dimensions, methods of manufacture, structural steel dimensions, structural steel material properties, recommended installation procedure, design assumptions, design loads, and design calculations. Shop drawings shall be submitted for review at least 30 calendar days prior to fabrication. The shop drawings shall be signed, sealed and stamped by a Professional Engineer in the State of Missouri. Fabrication shall not begin until the approved shop drawings has been received from the engineer stamped For Files and Distributions, weld procedures has been approved and notification of inspection has occurred in accordance with Sec 1080.3.1.2.

4.0 Materials. Materials used shall meet the requirements of the current version of AASHTO LRFD Bridge Construction Specifications:

4.1 Structural Steel. Steel used shall meet AASHTO M270. All primary steel material used in the main girders, including all splice plates, shall be AASHTO M270, ASTM A709 Grade 50 T2 steel and charpy v-notch tested for non-fracture critical components, Zone 2. Other requirements:

4.1.1 Charpy Impact Requirements (Zone 2): ASTM A673 and A370
4.1.1.1 less than or equal 2” thick: 15 ft-lbf @ 40° F
4.1.1.2 over 2 to 4” thick: 20 ft-lbf @ 40° F
4.1.2 Silicon content:
4.1.2.1 To 1-1/4” thick: 0.06% maximum
4.1.2.2 Over 1-1/4” to 6”: 0.15% to 0.40% (Aim for 0.15% to 0.25%)
4.1.3 Mill analysis and test report required
4.1.4 Plate tolerances shall be in accordance with Sec 1080.3.3.5.5
4.1.5 Carbon Equivalent:
4.1.5.1 0.45% max. per the following formula:
CE= C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15
Comments:
- ASTM A572 Gr. 50/55 may be substituted via Engineering and Customer Approval.

4.2 Shear Connectors. Shear connectors shall be in accordance with Sec 1037 and shall be installed prior to galvanization.

4.3 Galvanization. Galvanizing shall be in accordance with Sec 1081.20.

4.4 High Strength Fastener Assemblies. High strength fastener assemblies shall be in accordance with Sec 1080.2.5.

5.0 Steel Fabrication. Fabrication and inspection shall be in accordance with Sec 1080.3 and as specified herein. PBFTG shall be manufactured by an AISC Certified Bridge Fabricator - Intermediate (IBR). Shipping of fabricated material shall be in accordance with Sec 1080.3.5.

5.1 Welding. Any welding performed shall be in accordance with Sec 1080.3.3.5. No welding will be allowed except where specifically shown on approved shop drawings.

5.2 Bolt Holes. All bolt holes required shall be drilled 1/8" larger than the fastener size.

5.3 Cold-Bending. Structural steel shall be cold bent per the current AASHTO LRFD Bridge Construction Specifications, except as noted below:
5.3.1 The minimum bend radii for cold-bending (at room temperature), measured concave to the face of the plate, shall be taken as 5.0 times the thickness of the base plate material.

5.4 Inspection Hatch Opening. Provisions shall be made to ensure interior visual inspection and drainage of girders.
5.4.1 Inspection hatch cover shall rotate to allow entry.

5.5 Handling. The PBFTG handling shall be by a method approved by the manufacturer and engineer.
5.5.1 Holes shall not be drilled in the PBFTG for lifting or handling.

5.6 Product Marking. The interior of each PBFTG shall be clearly marked with the following information with a steel ID tag seal welded to the member, or other means approved by the engineer, at a location easily visible through the inspection hatch.
5.6.1 Assembly part number.
5.6.2 Customer order number.
5.6.3 Shop order number.

6.0 Tolerances. All PBFTG shall meet the tolerances specified below.

TYPE OF PART	DIMENSION	ALLOWABLE DEVIATION FROM NOMINAL
PLASMA CUT PBFTG PLATE (PRIOR TO BENDING)	1. WIDTH	+/- 0.13”
	2. LENGTH (0’ – 144”)	+/- 0.06”
	3. LENGTH (Greater than 144”)	+/- 0.13”
	4. SQUARENESS (0’ – 144”)	+/- 0.13”
	5. SQUARENESS (Greater than 144”)	+/- 0.25”
	6. LAYOUT LINES FOR BENDING	+/- 0.13” in the flat
PRESS BRAKE BENDING	7. FLAT PATTERN	
	8. LAYOUT LINE VERIFICATION	+/- 0.13” in the flat
	9. BEND LOCATION	+/- 0.13” after forming
	10. FORMED ANGLES	+/- 1.00°
COMPONENT PARTS	11. WIDTH or LENGTH	+/- 0.13” in the flat
	12. LENGTH	+/- 0.13” in the flat
	13. HOLE LOCATION	+/- 0.03”

TYPE OF PART	DIMENSION	ALLOWABLE DEVIATION FROM NOMINAL
	14. BOLT HOLE SPACING	+/- 0.03”
	15. DRILL HOLE SIZE	+0.03”, -0”
	16. THERMAL CUT HOLE SIZE	+0.03” long, +0.06” wide
	17. INSPECTION ACCESS PORTAL	+/- 0.25”
	18. SOLE PLATE FLATNESS AFTER WELDING	+/- 0.06”
PBFTG ASSEMBLY	19. LINEAR DIMENSIONS AND ASSEMBLY COMPONENTS (unless noted otherwise on the drawing)	+/- 0.06”
	20. HOLE LOCATION	+/- 0.03”
	21. BOLT HOLE SPACING	+/- 0.03”
	22. DRILL HOLE SIZE	+0.03”, -0”
	23. THERMAL CUT HOLE SIZE	+0.03” long, +0.06” wide
	24. SLOTTED HOLE SIZE	+ 0.13”
	25. BOLTED SPICE GAP AT ENDS	+ 0.13”, - 0.19”
	26. STUD START LOCATION	+/- 0.06”
	27. CAMBER (LENGTH 0” TO 600”)	+ 0.25”
	28. CAMBER (FOR EVERY 120” IN EXCESS OF 600”)	Additional + 0.13”
	29. ANGLE FROM SQUARE	+/- 1 degree
	30. STUD TO STUD SPACING	
	Longitudinal	+/- 0.13”
	Across	+/- 0.25”
	31. STUD ANGULARITY	+/- 2 degrees

7.0 Weld Testing and Inspection. Testing and inspection of welds shall be in accordance with below. Ultrasonic testing acceptance or rejection criteria shall be based on Tension Stress Table.

7.1 Primary Members
7.1.1 100% penetration groove welds loaded in shear with FCAW: 100% Visual, 100% Ultrasonic Test
7.1.2 Fillet & PJP Groove welds welded with FCAW: 100% Visual, 100% Magnetic Partial Test
7.2 Secondary Members
7.2.1 Fillet & PJP Groove welds welded with FCAW: 100% Visual
7.3 Other
7.3.1 Stud welds
7.3.1.1 Shift Start Bend Test
7.3.1.2 100% Visual Inspection (in accordance with AWS D1.5 Clause 9.8)
7.3.2 Weld repairs
7.3.2.1 Primary or secondary member weld repair shall use FCAW
7.3.2.2 Stud weld repair shall use SMAW
7.3.2.3 Additional NDT shall be performed on repaired welds
7.3.2.4 Additional NDT shall be provided 2” beyond the defect in all direction

8.0 Installation.

8.1 Handling and Storing Materials. Structural steel material shall be stored on platforms, skids, or other supports above high-water elevations. Materials shall be maintained free of dirt, oil, or other contaminants and protected from corrosion. Structural steel members shall be padded in storage at points of contact. Trough sections shall be pitched to provide drainage. Long members shall be supported at frequent intervals to prevent deflection. Members shall be handled, stored, and braced in the erected position to avoid distortion, unless otherwise authorized by the engineer.

8.1.1 Fabricated structural steel members and primary components of main members shall be handled with clamps or plate hooks that do not leave nicks, gouges, or depressions. Damage to main members shall be repaired using methods approved by the Fabrication Operations Engineer. Damage consistent with the delivery of structural steel shall be repaired in accordance with Sec 1080.3.3.5.5. Chains or chokers shall not be used for handling structural steel, unless placing a protective shield (softener) between the chain or choker and the structural steel.

8.1.2 Handling stresses shall be minimized on beams during transportation, storage, and erection. One-point pickup shall be used so overhang does not exceed the values specified below. The distances specified below between hooks for a two-point pickup shall not be exceeded.

Rigging Requirements					
Beam Size	**U12**	**U18**	**U24**	**U30**	**U33**
Overhang for one point or two-point pickup, maximum	20’	25’	30’	35’	45’
Distance between hooks for two-point pickup, maximum	40’	50’	60’	70’	90’

8.2 Shipping. The owner shall be provided with copies of the bill of lading as directed by the engineer.

8.2.1 The weights shall be shown of individual members on the statements. Structural members shall be loaded, transported and unloaded using trucks or railcars, without stressing, deforming, or otherwise damaging members. A protective shield shall be placed between the chain or chain binder and main members during shipping, to prevent gouging the flange edges or damaging the coating.

8.3 Erection. Proposed equipment and erection methods shall be reviewed by the engineer before beginning work. Material intended for the finished structure shall not be used for erection or temporary purposes, unless otherwise shown on the plans or approved by the engineer.

8.3.1 The engineer’s review/approval does not relieve the contractor of the responsibility for the safety of the method or equipment.

8.3.2 Bearing pads shall be positioned with a full, uniform bearing on the substructure concrete. Bearing pad positions shall be adjusted to compensate for temperature at the time of erection.

8.3.3 Beams shall be positioned on the substructure. Bearing pads shall be shimmed to provide full bearing contact with the bottom of the beam. Beams shall be rigidly blocked in place before beginning deck and diaphragm forming.

8.4 Assembly. Parts shall be assembled according to the plans and approved shop drawings. Structural steel shall not be damaged during erection. Rust, loose mill scale, dirt, oil or grease, and other deleterious material shall be cleaned from bearing surfaces and surfaces in permanent contact before assembly. High-Strength bolt installation shall be in accordance with Sec 712.7.

8.5 Repair of Field Damaged Galvanized Surfaces. Exposed underlying steel or coating thickness less than 50% of the specified thickness of 3.9 mils is considered damage. Repair of galvanizing shall be in accordance with Sec 1081.20.

9.0 Measurement and Payment. The completed work will be measured and paid for at the contract unit price using the following contract item (pay item):

Contract Item (Pay Item)	Pay Unit
PBFTG Structural Steel, Furnished and Fabricated.....	Lbs.
PBFTG Structural Steel, Erection……..	Lump sum

PBFTG Structural Steel, Furnished and Fabricated includes all labor, equipment, and material necessary to design, manufacture and deliver the Galvanized Steel Press-Brake-Formed Tub Girder (PBFTG) and shall include bearing pads, sole plates, shear developers, bolts, washers, welding, welding materials, and hardware as required.

PBFTG Structural Steel, Erection includes all labor, equipment, and material necessary to erect, connect and install all items included in the pay item for PBFTG Structural Steel, Furnished and Fabricated.

The contractor is responsible for ordering and obtaining position dowels or anchor bolts in accordance with the details in the plans.

I. SPECIAL CHANGE ORDER AND VALUE ENGINEERING CONSIDERATION

1.0 Description. Increased Federal Share has been approved by FHWA for an innovative technology or practice. The Commission will receive an additional five percent (5%) Federal Share of the overall contract value due to innovations within the following pay item(s):

Pay Item Number	Pay Item Description	Innovation
7129901	PBFTG Structural Steel, Erect	New type of bridge girder
7129911	PBFTG Structural Steel, Furn and Fab	New type of bridge girder

Due to the increased federal share, the project components related to the innovation(s) described above must be constructed with the materials, quantities, methods and innovations as shown on the project plans and specifications. If the contractor requests materials, quantities, methods or innovations other than those included in the plans and specifications, the request must be reviewed and approved by the Commission and FHWA. Approved changes to the innovation items above shall be at no additional cost to the Commission and shall not increase the contract time.

2.0 Consideration of Change Orders and Value Engineering Change Proposals (VECP). Change ordering and/or value engineering the pay item(s) listed in section 1.0 of this job special provision jeopardize ability for the Commission to receive an additional Federal Share for the overall contract value. Special consideration should be given to the change order value for removing such item(s) from the contract ensuring that the benefit outweighs the cost.

3.0 Contacting Financial Services. If it is determined that the proposed change order and/or VECP outweighs the additional overall five percent (5%) Federal Share value, the engineer shall notify the MoDOT project manager.