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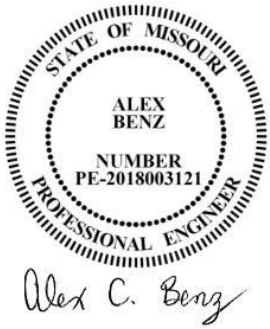

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Alex Benz - Civil
MO PE-2018003121

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 W. CAPITOL AVE.
JEFFERSON CITY, MO 65101
Phone (888) 275-6636

EFK Moen
13523 Barrett Parkway, Suite 250
St. Louis, MO 63021
Certificate of Authority # 001578
Consultant Phone # 314-394-3100

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JOB NO. J9P3308
Cape Girardeau County, MO
Date Prepared: 10/7/2024

Only the following items of the Job Special Provisions (Bridge) are authenticated by this seal: A, C-F, I-L, O-T

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Jonathan C. McGormley - Civil
MO PE-2012016106

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 W. CAPITOL AVE.
JEFFERSON CITY, MO 65101
Phone (888) 275-6636

Wiss, Janney, Elstner Associates, Inc.
3300 Pfingsten Road
Northbrook, Illinois 60062
Certificate of Authority # 001448
Consultant Phone # 847-272-7400

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JOB NO. J9P3308
Cape Girardeau County, MO
Date Prepared: 10/7/2024

Only the following items of the Job Special Provisions (Bridge) are authenticated by this seal: B,G, H, M, N, U

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(s) 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 a lane closure is for the absolute minimum amount of time required to complete the work. A lane shall not be closed until material is available for continuous construction and the contractor is prepared to diligently pursue the work until the closed lane is opened to traffic.

2.2 Bridge work by contractor forces, including erection, rehabilitation or demolition, shall not be allowed over traffic unless a bridge platform protection system is installed below the work area except for work performed above a deck that is intact. The protection system shall be capable of catching all falling objects such as tools, overhang brackets or materials. Lifting of objects that are heavier than the capacity of the bridge protection system shall not be permitted.

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 or onto the roadway. 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. Traffic under the bridge shall be maintained in accordance with the contract documents.

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 A washer shall be required under head and nut when any reaming is performed for bolt installation.

2.8 SSPC-SP2 and SSPC-SP3 surface preparation shall be in accordance with the environmental regulations in Sec 1081 and collection of residue shall be in accordance with Sec 1081 for collection of blast residue. SSPC-SP6, SSPC-SP10 and SSPC-SP11 surface preparation shall be in accordance with the approved blast media and environmental regulations in Sec 1081 and collection of blast residue shall be in accordance with Sec 1081.

3.0 Coating Information.

3.1 Slab Drains. The slab drains and slab drain brackets shall not be recoated, overcoated or damaged during the painting operation. Any portion of the slab drain bracket that is blast cleaned shall be recoated with System G. Any damage sustained 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.

3.2 Existing Bridge Information. The informational plans may be used by bidders in determining the amount of steel to be cleaned and painted/coated. Each bidder is expected to carefully examine the structure(s), investigate the condition of existing paint and prepare their own estimate of quantities involved before submitting a bid. Surface preparation and applying field coatings to the structural steel shall be based on the contract plan quantities. No final measurements will be made. The existing paint system used on the structure(s) was not lead based.

3.3 Environmental Contact. Environmental Section may be contacted at the below address or phone number. The Missouri Department of Health may be contacted at (573) 751-6102.

MoDOT - Design Division - Environmental Section
P.O. Box 270
105 W. Capitol Ave., Jefferson City, MO 65102
Telephone: (573) 526-4778

3.4 Approved Smelter and Hazardous Waste Treatment, Storage and Disposal Facility. The following is the approved smelter and hazardous waste treatment, storage and disposal facility:

Doe Run Company - Resource Recycling Division - Buick Facility
Highway KK
Boss, MO 65440
Telephone: (573) 626-4813

3.5 Impermeable Surface Limits. For the duration of cleaning and recoating or overcoating, the superstructure in any span shall not be draped with an impermeable surface subject to wind loads for a length any longer than 1/4 the span length at any one time regardless of height of coverage. Simultaneous work in adjacent spans is permissible using the specified limits in each span.

4.0 Navigation Requirements.

4.1 All work shall be performed so that the free flow of navigation is not unreasonably interfered with, the navigable depths are not impaired and navigation lighting is visible at all times. Any floating equipment or vessels working in the channel shall display lights and signals as required by the current “Inland Navigation Rules”. If scaffolding or nets are suspended below low steel in the navigation span, the U.S. Coast Guard district office shall be advised so that the temporary reductions in clearance for river traffic can be checked for reasonableness and appropriate notices can be published. Positive precautions shall be taken to prevent the accidental dropping of spark producing, flame producing, lighted or damaging objects onto barges or vessels passing beneath the bridge. All flame cutting, welding or other similar spark producing operations shall be ceased over the channel when vessels are passing beneath the bridge.

4.2 The contractor shall be responsible for submitting a work plan to the engineer for review. When the engineer is in concurrence with the work plan, the contractor will submit the material to the U.S. Coast Guard district office for approval. The U.S. Coast Guard will require at least 30 days to review the work plan prior to any work beginning. The work plan shall be submitted to the District Commander, Western Rivers Operation, Eighth Coast Guard District, Bridge Branch.

5.0 Bridge Inspections.

5.1 The contractor shall allow MoDOT personnel access to perform bridge inspections as required. MoDOT personnel will coordinate scheduling of the inspections with the contractor.

6.0 Method of Measurement. No measurement will be made.

7.0 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 BEARINGS

1.0 Description.

1.1 This work shall consist of but is not limited to raising and supporting existing girders and/or beams at the locations specified on the plans, removing and disposing of the existing bearings and performing all other required preparations prior to installing new bearings as shown on plans.

2.0 Construction Requirements and Materials.

2.1 Raising and Supporting the Superstructure.

2.1.1 Raising and supporting the superstructure shall follow the jacking notes and jacking procedure shown on the plans.

2.2 Bearing Removal.

2.2.1 After the structural members are supported, the contractor shall remove the existing bearings.

2.2.2 The contractor shall reuse the existing anchor bolts, masonry plates and restrainer bolts.

2.3 Cleaning and Painting. The bottom surface of existing flange, which will become faying surfaces of new connections shall be cleaned and painted with one coat of gray epoxy-mastic primer (non-aluminum).

3.0 Method of Measurement. Final measurement for removal of the existing bearings and preparation for the installation of the new bearings will be made per each.

4.0 Basis of Payment. Payment for furnishing and placing all temporary falsework (including stiffeners), materials, removals, disposal of all falsework, labor, tools, equipment and all incidentals necessary to complete this item will be considered completely covered by the contract unit price for Removal of Existing Bearings.

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 (semiannual), 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. EPOXY PRESSURE INJECTING

1.0 Description. Surface cracks in the substructure shall be pressure injected with epoxy. The engineer will designate the cracks to be repaired.

2.0 Material.

2.1 Epoxy. The epoxy material shall consist of a two-component system in accordance with the requirements of ASTM C 881, Type IV, Grade 1, except that the viscosity shall be a maximum of 4.5 poise (0.45 Pa·s). The Class designation of the epoxy shall be determined according to the temperature that exists on the job.

2.2 Certification. The contractor shall furnish manufacturer's certification that the material supplied is in accordance with these specifications. The certification shall include or have attached typical test results for all specified properties required by ASTM C 881 for the injecting resin. The engineer reserves the right to sample and test any or all material supplied.

3.0 Construction Requirements. The surface to receive the epoxy grout shall be cleaned of laitance, grease and foreign matter by sandblasting. The cracks shall be cleaned of debris by using oil-free and water-free compressed air or vacuum. After the cracks are cleaned, the epoxy shall be injected in accordance with manufacturer's recommendations. The temporary surface seal and placement and method of attachment of injection ports shall be in accordance with the epoxy manufacturer’s recommendations.

4.0 Method of Measurement. The extent of epoxy pressure injecting may vary from the estimated quantity but the contract unit price shall prevail regardless of the variation. The epoxy pressure injecting will be measured to the nearest linear foot (0.5 m).

5.0 Basis of Payment. Accepted quantity of epoxy pressure injecting will be paid for at the contract unit price. 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 Epoxy Pressure Injecting.

F. SHOTCRETE CONCRETE REPAIR

1.0 Description. Substructure repair (formed and unformed), superstructure repair (unformed) and slab edge repair shall be in accordance with Sec 704 and as shown on the contract plans. Shotcrete, in accordance with this Special Provision, shall be used for slab edge repair and may be used at the Contractor’s option for formed and unformed substructure and superstructure repairs.

1.1 Shotcrete shall be in accordance with the current requirements of American Concrete Institute (ACI) 506.2-13, "Specification for Shotcrete", except as otherwise specified. Shotcrete shall consist of an application of one or more layers of mortar or concrete conveyed through a hose and pneumatically projected at a high velocity against a prepared surface.

1.2 Shotcrete shall be produced by a dry-mix process. The dry-mix process shall consist of thoroughly mixing all the ingredients except accelerating admixtures and mixing water and conveying the mixture through the hose pneumatically and the mixing water is introduced at the nozzle. For additional descriptive information, the Contractor's attention shall be directed to the ACI 506R-16, "Guide to Shotcrete”.

2.0 Contractor Experience Requirements.

2.1 Workers, including foremen, nozzlemen and delivery equipment operators, shall be fully experienced to perform the work.

2.2 Initial qualification of nozzlemen will be based ACI or EFNARC certification for the application process being used. The nozzlemen shall submit documented proof they have been certified in accordance with the ACI 506.3R-91 “Certification of Shotcrete Nozzlemen” or EFNARC “Nozzleman Certification Scheme”. The certification shall have been done by an ACI or EFNARC recognized shotcrete testing lab and/or recognized shotcreting consultant and have covered the type of shotcrete to be used (plain dry-mix).

2.3 The Contractor may supply 1 reference project for the project nozzleman in lieu of completing test panels in accordance with Section 5.1 of this Job Special Provision to demonstrate the experience of the nozzleman in similar shotcrete application work. Owner contact information for the reference project shall be provided to allow for the Engineer to confirm satisfactory results.

3.0 Shotcrete Materials.

3.1 Shotcrete materials shall consist of one of the following premixed and packaged materials:

a) BASF MasterEmaco S 211SP
b) Euclid Chemical Eucoshot F
c) King Shotcrete MS-D1
d) CTS Cement Low-P

3.2 No material testing is anticipated. Acceptance will be based on the prequalified materials listed in this Special Provision, approval of the nozzleman prior to material placement, and visual inspection. If questions arise based from visual examination, placement methods, curing methods or other potentially undesirable influences the Engineer reserves the right to test any material properties listed on the published product data sheet for the material selected. Testing will be done at the Contractor’s expense.

3.3 Material shall be delivered, stored and handled to prevent contamination, segregation, corrosion or damage.

3.4 Proportioning and Use of Admixtures. Admixtures will not be permitted unless approved by the Engineer.

3.5 Bonding Agents. Bonding agents will not be permitted.

3.6 Air Entrainment. Additional air entrainment admixtures will not be required.

4.0 Construction Submittals.

4.1 At least 15 days before the planned start of formed and unformed substructure repair, a copy of the following information shall be submitted in writing to the Engineer for review:

(a) Written documentation of the nozzlemen's qualifications including proof of ACI or EFNARC certification;

(b) Proposed methods of shotcrete placement and of controlling and maintaining facing alignment including equipment models;

(c) Shotcrete mix; and

(d) One reference project including: Nozzleman's name, material used, process used, and whether a blow pipe was utilized. Owner contact information shall be provided to ensure satisfactory results were accomplished on the reference project; or

(e) A satisfactory test panel shall be provided with the material to be used.

4.2 The Engineer will approve or reject the Contractor's submittals within 10 days after the receipt of a complete submission. The Contractor will not be permitted to begin formed or unformed substructure repair with Shotcrete until the submittal requirements are satisfied and found acceptable to the Engineer. Changes or deviations from the approved submittals shall be re-submitted for approval. No adjustment in contract time will be allowed due to incomplete submittals.

4.3 A pre-construction meeting scheduled by the Engineer will be held prior to the start of work. Attendance shall be mandatory. The shotcrete Contractor shall attend.

5.0 Field Quality Control.

5.1 Production test panels will not initially be required if a reference project for the nozzleman is provided as outlined in Section 2.3 of this Job Special Provision. The Engineer may halt repair work if satisfactory results are not produced by the Contractor and require production test panels.

5.2 If a comparable project demonstrating satisfactory results cannot be provided, the skills of the nozzleman shall be demonstrated and tested with at least one production test panel being furnished prior to performing repairs.

5.3 Production Test Panels (If Required).

5.3.1 Qualified personnel shall perform shotcreting and coring of the test panels with the Engineer present. The Contractor shall provide equipment, materials and personnel as necessary to obtain shotcrete cores for testing including construction of test panel boxes, field curing requirements and coring.

5.3.2 Production test panels shall be made with the minimum full thickness and dimension of 18 x 18 inch and at least 3½ inch thick with 2-#4 bars placed in each direction. The #4 bars shall be centered in the 3½ inch dimension and evenly spaced in each direction with the bars touching at the 4 intersecting locations.

5.4 Test Panel Curing, Test Specimen Extraction and Testing.

5.4.1 Immediately after shooting, the test panels shall be field moist cured by covering and tightly wrapping with a sheet of material meeting the requirements of ASTM C 171 until delivered to the testing lab or test specimens are extracted. The test panels shall not be immersed in water. The test panels for the first 24 hours after shooting shall not be disturbed.

5.4.2 At the direction of the Engineer at least two 3 inch diameter core samples shall be cut at two of the intersections to ensure consolidation around the bars. If voids are present the material and nozzleman are not approved for use. The Contractor may continue with changes to the materials or nozzleman. The same process will be followed until no voids are present.

6.0 Shotcrete Facing Requirements.

6.1 Shotcrete Alignment Control. The final surface of the shotcrete shall maintain the existing concrete plane surface.

6.2 Surface Preparation. In addition to the manufacturer's recommendations, the surfaces to be shotcreted shall be cleaned of loose materials, mud, rebound, overspray or other foreign matter that could prevent or reduce shotcrete bond. Shotcrete shall not be placed on frozen surfaces.

6.3 Delivery and Application. In addition to the manufacturer's recommendations, a clean, dry, oil free supply of compressed air sufficient for maintaining adequate nozzle velocity shall be maintained at all times. The equipment shall be capable of delivering the premixed material accurately, uniformly and continuously through the delivery hose. Shotcrete application thickness, nozzle technique, air pressure and rate of shotcrete placement shall be controlled to prevent sagging or sloughing of freshly applied shotcrete.

6.3.1 The shotcrete shall be applied from the lower part of the area upwards to prevent accumulation of rebound. The nozzle shall be oriented at a distance and approximately perpendicular to the working face so that rebound will be minimal and compaction shall be maximized. Special attention shall be paid to encapsulating reinforcement. Care shall be taken while encasing reinforcing steel and mesh to keep the front face of the reinforcement clean during shooting operations, so that the shotcrete builds up from behind, to encase the reinforcement and prevent voids and sand pockets from forming. If a blow pipe was used to qualify, a blow pipe shall be required. The blow pipe is used to remove rebound and overspray immediately ahead of the nozzle. Rebound shall not be worked back into the construction. Rebound that does not fall clear of the working area shall be removed. Hardened rebound and hardened overspray shall be removed prior to the application of additional shotcrete using abrasive blast cleaning, chipping hammers, high pressure water blasting or other suitable techniques.

6.3.2 When using multiple layer shotcrete construction, the surface of the receiving layer shall be prepared before application of a subsequent layer, by either:

(a) Brooming the stiffened layer with a stiff bristle broom to remove all loose material, rebound, overspray or glaze, prior to the shotcrete attaining initial set.

(b) If the shotcrete has set, surface preparation shall be delayed 24 hours, at which time the surface shall be prepared by sandblasting or high pressure water blasting to remove all loose material, rebound, hardened overspray, glaze or other material that may prevent adequate bond.

6.4 Defective Shotcrete. The Engineer will have authority to accept or reject the shotcrete work. Shotcrete that is not in accordance with the project specifications may be rejected either during the shotcrete application process, or on the basis of tests. Shotcrete surface defects shall be repaired as soon as possible after placement. Shotcrete that exhibits segregation, honeycombing, laminations, voids or sand pockets shall be removed and replaced. In-place

shotcrete determined not meeting the published Technical Information for the product used will be subject to remediation as approved by the Engineer. Possible remediation options range from required latex over coating for excessive cracking up to removal and replacement at the Contractor's expense

6.5 Construction Joints. Construction joints shall be tapered uniformly toward the excavation face over a minimum distance equal to the thickness of the shotcrete layer. Square joints will not be permitted except at the expansion joint. The surface of the joints shall be rough, clean and sound. A minimum reinforcement overlap at reinforcement splice joints shall be provided. The surface of a joint shall be clean and wet before adjacent shotcrete is applied.

6.6 Final Face Finish. Shotcrete finish shall be a wood float, rubber float, steel trowel or smooth screeded finish.

6.7 Additional Construction Requirements.

6.7.1 If the work to be performed is in the vicinity of a jurisdictional water of the US, care shall be taken to avoid any rebound from entering the regulated waterway.

6.7.2 If the work to be performed is in the vicinity of an enclosed drainage system, care shall be taken to avoid any rebound from entering the drainage system.

6.8 Weather Limitations.

6.8.1 The shotcrete shall be protected if placed when the ambient temperature is below 40°F and falling or when likely to be subject to freezing temperatures before gaining sufficient strength. Cold weather protection shall be maintained until the compressive strength of the shotcrete is greater than 725 psi. Cold weather protection includes blankets, heating under tents or other means acceptable to the Engineer. The temperature of the shotcrete mix, when deposited, shall be not less than 50°F or more than 85°F. The air in contact with the shotcrete surfaces shall be maintained at temperatures above 32°F for a minimum of 7 days.

6.8.2 If the prevailing ambient temperature conditions (relative humidity, wind speed, air temperature and direct exposure to sunlight) are such that the shotcrete develops plastic shrinkage and/or early drying shrinkage cracking, shotcrete application shall be suspended. The Contractor shall reschedule the work to a time when more favorite ambient conditions prevail or adopt corrective measures, such as installation of sun screens, wind breaks or fogging devices to protect the work. Newly placed shotcrete exposed to rain that washes out cement or otherwise makes the shotcrete unacceptable shall be removed and replaced at the Contractor’s expense.

6.9 Curing. Permanent shotcrete shall be protected from loss of moisture for at least 1 day after placement. Shotcrete shall be cured by methods that keep the shotcrete surfaces adequately wet and protected during the specified curing period. Curing shall commence within one hour of shotcrete application. When the ambient temperature exceeds 80°F, the work shall be planned such that curing can commence immediately after finishing. Curing shall be in accordance with the following requirements.

> **(a) Membrane Curing.** Membrane curing is required on overhead surfaces that cannot be adequately wet cured. Curing compounds will not be permitted on any surface against which additional shotcrete or other cementitious finishing materials are to be bonded unless the surface is thoroughly sandblasted in a manner acceptable to the

Engineer. Membrane curing compounds shall be spray applied as quickly as practical after the initial shotcrete set at rate of coverage of not less than 7.1 square feet per gallon.

7.0 Safety Requirements. Nozzlemen and helpers shall be equipped with gloves, eye protection and adequate protective clothing during the application of shotcrete. Whip checks are required on air lines. The Contractor shall be responsible for meeting all federal, state and local safety requirements.

8.0 Method of Measurement. Measurement of Substructure Repair (Formed), Substructure Repair (Unformed), Superstructure Repair (Unformed) and Slab Edge Repair shall be in accordance with Sec 704.

9.0 Basis of Payment. Payment for Substructure Repair (Formed), Substructure Repair (Unformed), Superstructure Repair (Unformed) and Slab Edge Repair shall be in accordance with Sec 704.

G. POLYESTER POLYMER CONCRETE WEARING SURFACE

1.0 Description. This work shall consist of constructing a wearing surface of polyester polymer concrete on a prepared surface in accordance with these specifications as shown on the plans or as directed by the engineer. Polyester polymer concrete shall be composed of the following three components – polyester resin binder, high molecular weight methacrylate (HMWM) resin, and aggregate.

Also included are details of coats of primer and polyester resin as shown on the plans and/or as directed by the engineer. Surface sealer after installation of the PPC is covered under the Special Provision Sealer for PPC Wearing Surface.

Hydro-demolition shall not be used with polyester polymer concrete.

2.0 Materials.

2.1 Primer. The prepared surface shall receive a wax-free low odor, high molecular weight methacrylate prime coat. The primer shall comply with the following requirements:

High Molecular Weight Methacrylate (HMWM) Resin		
Property	**Requirement**	**Test Method**
Viscosity *	0.025 Pa-s, maximum (Brookfield RVT with UL adapter, 50 RPM at 77°F)	ASTM D2196
Specific Gravity *	0.90, minimum (at 77°F)	ASTM D1475
Volatile Content *	30%, maximum	ASTM D2369
Flash Point *	180°F, minimum	ASTM D3278
Vapor Pressure *	1.0 mm Hg, maximum (at 77°F)	ASTM D323
Tack Free Time	400 minutes, maximum (at 77°F)	ASTM C679
PCC Saturated Surface-Dry	500 psi, minimum	California Test 551

High Molecular Weight Methacrylate (HMWM) Resin		
Property	**Requirement**	**Test Method**
Bond Strength	(24 hrs at 70 +/- 1°F)	

*Tested prior to adding initiator

2.1.1 Mixing Requirements. The prime coat initiator shall consist of a metal drier and peroxide. If supplied separately from the resin, at no time shall the metal drier be mixed directly with the peroxide.

2.1.2 Storage. The containers shall be stored in a manner that will not allow leakage or spillage from one material to contact the containers or materials of the other.

2.2 Aggregates.

2.2.1 Polyester Concrete. The aggregates shall comply with Sec 1005, except as specified herein.

2.2.1.1 Crushed Particles. Aggregate retained on the No. 8 sieve shall have a maximum of 45 percent crushed particles as determined by AASHTO T 335.

2.2.1.2 Absorption. The aggregate absorption shall not exceed one percent as determined by AASHTO T 85.

2.2.1.3 Moisture Content. At the time of mixing with the resin, the moisture content of the aggregate, as determined by AASHTO T 255, shall not exceed one half of the aggregate absorption.

2.2.1.4 Temperature. The aggregate temperature shall be between 45°F and 100°F at the time of mixing.

2.2.1.5 Combined Gradation. Aggregate for polyester polymer concrete shall comply with the following requirements:

Combined Aggregate		
Sieve Size	**1/2" Max. Percent Passing**	**3/8" Max. Percent Passing**
½"	100	100
3/8"	83 – 100	100
#4	65 – 82	62 – 85
#8	45 – 64	45 – 67
#16	27 – 48	29 – 50
#30	12 – 30	16 – 36
#50	6 – 17	5 – 20
#100	0 – 7	0 – 7
#200	0 - 3	0 – 3

2.2.1.6 Fine Aggregate. The fine aggregate shall consist of natural sand.

2.2.2 Finishing Sand. The sand for abrasive finish shall be commercial quality blast sand having at least 95 percent passing the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested in accordance with AASHTO T 27. The absorption of the sand shall not exceed 1% when tested in accordance with AASHTO T 84.

2.3 Polyester Resin Binder. The resin shall be an unsaturated isophthalic-styrene co-polymer conforming to the following requirements:

Polyester Resin Binder		
Property	**Requirement**	**Test Method**
Viscosity *	0.075 to 0.200 Pa-s (RVT, No. 1 Spindle, 20 RPM at 77°F)	ASTM D 2196
Specific Gravity *	1.05 to 1.10 (at 77°F)	ASTM D 1475
Elongation	35%, minimum (Type I at 0.45"/min. Thickness = 1/4" +/- 0.04")	ASTM D 638
	Sampling Condition: 18 hrs/77°F/50% + 5 hrs/158°F	ASTM D 618
Tensile Strength	2,500 psi, minimum (Type I at 0.45"/min. Thickness = 1/4" +/- 0.04")	ASTM D 638
	Sampling Condition: 18 hrs/77°F/50% + 5 hrs/158°F	ASTM D 618
Styrene Content *	40 to 50% (by weight)	ASTM D 2369
Silane Coupler	1.0%, minimum (by weight of polyester-styrene resin)	
PCC Saturated Surface-Dry Bond Strength	500 psi, minimum (24 hrs at 70 +/- 1°F)	California Test 551

*Tested prior to adding initiator

2.3.1 Silane Coupler. The silane coupler shall be an organsilane ester, gammamethacryloxpropyltrimethoxysilane.

2.3.2 Hardener. The promoter/hardeners shall be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators. MEKP initiators shall be used when the surrounding concrete temperatures are above 60°F. A blend of initiators may be used as approved by the engineer when the surrounding concrete temperature is 50 – 60°F.

2.4 Delivery of Materials. All materials shall be delivered in their original containers bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name, and quantity. Each shipment of polyester resin binder and HMWM resin shall be accompanied by a Material Safety Data Sheet (MSDS).

2.5 Storage of Materials. The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean and dry, and shall contain a high-low thermometer. The temperatures of the storage space shall not fall below nor rise above that recommended by the manufacturer. Every precaution shall be taken to avoid contact with flame.

2.5.1 Inspection. Stored materials shall be inspected prior to their use, and shall meet the requirements of this Specification at the time of use.

2.5.2 Failure. Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejection shall be immediately replaced at no additional expense to the Commission.

2.5.3 Required Amount. Sufficient material to perform the entire polyester concrete application shall be in storage at the site prior to any field application, so that there shall be no delay in procuring the material for each day's application.

2.6 Training. The contractor shall arrange to have the material supplier furnish technical service related to application of material and health and safety training for personnel who are to handle the polyester polymer concrete and the HMWM resin prime coat.

2.7 Technical Support. The materials supplier shall have a representative onsite during placement of the polyester polymer concrete.

3.0 Mix Design. The contractor shall prepare and submit the polyester polymer concrete mix design and mixing procedures to the Construction and Materials Division for approval. The mix design shall include a recommended initiator percentage for the expected application temperature. The contractor shall not begin ordering materials for application of the polyester polymer concrete until the polyester polymer concrete mix design and mixing procedures are approved.

4.0 Construction.

4.1 Surface Preparation. The concrete surface shall be prepared by removing all material which may act as a bond breaker between the surface and the polyester polymer concrete.

4.1.1 New Bridge Decks. On new concrete decks, the surface shall be given a very rough texture while still plastic by use of a wire comb or other approved texturing device, which will produce a bondable surface acceptable to the engineer.

4.1.2 Existing Bridge Decks. On existing concrete decks, the surface shall be uniformly scarified in accordance with Sec 216. If the existing deck is to be removed to a specified depth, then the surface shall be scarified to the removal depth specified in the drawings. The surface receiving the polyester polymer concrete is to be scarified to achieve a texture with an approximate depth of 1/4 inch. The scarifier shall not produce a polished or slick surface. Any epoxy patches or other existing repairs encountered shall be completely removed to sound, natural concrete. Sound concrete repairs may remain.

4.1.3 Existing Bridge Decks Containing Wearing Surface. On existing concrete decks with an existing wearing surface, the wearing surface shall be removed prior to scarifying the substrate and placing the polyester polymer concrete. The exposed concrete surface shall meet the requirements contained in Section 4.1.2 of this specification.

4.1.4 Local Removal. Local removal through hand-tool methods is permitted where conditions prohibit use of scarifying equipment (e.g., at deck overhangs and near existing deck drains).

4.1.5 Concrete Deck Repair. Polyester polymer concrete is permitted to be used for half-sole repairs, but not for full depth repairs or repair of joint headers. Repairs using polyester polymer concrete shall be placed following the procedures recommended by the manufacturer. The maximum lift height recommended by the manufacturer is not to be exceeded. Monolithic

repairs using supplementary wearing surface material are permitted when half the diameter or less of the top bar is exposed.

At the option of the contractor, Class B-2 concrete may be used in place of PPC for half-sole and full depth repairs.

4.1.6 Removing Contaminates. The textured or scarified deck shall be sand blasted followed by an air blast; shot blasting may be used as noted below. The blasting shall remove all dirt, oil and other foreign materials, as well as any unsound concrete or laitance from the surface and edges against which new polyester polymer concrete is to be placed. The compressor shall be equipped to prevent oil in the air supply. Any loose or foreign material detected on the concrete surface prior to placement of the polyester polymer concrete shall be removed by sand or air blasting. The concrete surface may require retexturing where penetration of foreign material is evident. No contamination of the retextured or scarified concrete surface shall be permitted. With approval from the engineer, the contractor may use automatic shot blasting units in lieu of sand blasting. The automatic shot blasting units shall be self propelled and include a vacuum to recover spent abrasive. The abrasive shall be steel shot. Magnetic rollers shall be used to remove any spent shot remaining on the deck after vacuuming. Cleaned surfaces shall not be exposed to vehicular or pedestrian traffic other than that required by the overlay operation.

4.1.7 Steel Surfaces. All steel surfaces that will be in contact with the overlay shall be cleaned in accordance with SSPC-SP10, Near –White Blast Cleaning, except that wet blasting methods shall not be allowed.

5.0 Application of Prime Coat. One coat of HMWM prime coat shall be applied to the prepared concrete and steel surfaces immediately before placing the polyester polymer concrete. The prime coat shall be uniformly applied to completely cover the surface to receive the overlay. The area receiving the prime coat shall be dry and have had no exposure to any moisture within the past 24 hours. Application of the HMWM primer and placement of PPC overlay shall not begin until the substrate is visibly surface dry, and free of water and moisture. ASTM D 4263 modified for 2 hours may be used to verify dryness at the discretion of the Engineer in cases when surface dryness is difficult to determine.

Prior to applying the prime coat, the surface shall be cleaned with compressed air to remove accumulated dust and any other loose material.

Application of HMWM primer and placement of PPC overlay shall not commence if rain is forecast.

As shown on the construction drawings, prime coat shall be applied to face of barriers. Additional resin application over construction joints shall also be performed as shown on the construction drawings.

5.1 Surface Temperature. The concrete bridge deck surface shall be between 50°F and 100°F when applying the prime coat.

5.2 Relative Humidity. Polyester polymer concrete shall not be placed when the relative humidity is above 90 percent.

5.3 Curing. Polyester polymer concrete shall be placed immediately after the prime coat is applied to the bridge deck.

5.4 Prime Coat Contaminated. If the primed surface becomes contaminated, the contaminated area shall be cleaned by abrasive blasting and re-primed at no additional expense to the department.

6.0 Placement of Polyester Polymer Concrete.

6.1 Placement Time. The polyester polymer concrete shall be placed on the prime coat within two hours of placing the prime coat. Where polyester resin is placed over the primer (see 6.6.1) resin shall be placed within two hours of placing the prime coat, and the polyester polymer concrete shall be placed within two hours of placing the resin coat.

6.2 Surface Temperature. The surface temperature of the area to receive polyester polymer concrete shall be the same as specified in Section 5.1 of this special provision.

6.3 Mixing Equipment. The concrete shall be volumetrically mixed at the bridge site by a continuous mixer in accordance with Sec 501.

6.3.1 Batching Information. The continuous mixer shall be equipped with a metering device that automatically measures and records the aggregate volumes and corresponding resin volumes. The volumes shall be recorded at no greater than five-minute intervals along with the time and date of each recording. A printout of the recordings shall be furnished to the engineer at the end of each shift. Readout gages shall be visible to the engineer at all times.

6.3.2 Mixture Consistency. The concrete discharged from the mixer shall be uniform in composition and consistency. Mixing capability shall be such that initial and final finishing operations can proceed at a steady pace.

6.4 Contamination. The contractor shall prevent any cleaning chemicals from reaching the polyester polymer concrete mix during the mixing operation.

6.5 Addition of Initiator. Polyester polymer concrete shall be placed prior to gelling and within 15 minutes following the addition of initiator, whichever occurs first. Polyester polymer concrete that is not placed within this time shall be discarded.

6.6 Amount of Polyester Resin. The polyester resin binder in the polyester polymer concrete shall be 12 percent +/- 1 percent by weight of the dry aggregate. The contractor shall determine the exact percentage as approved by the engineer.

6.6.1 Application of Additional Polyester Resin Coat. As shown on the construction drawings, additional application of the Polyester Resin shall be performed over construction joints including but not limited to: 1) at toe of barrier railing; 2) over existing construction joints in the deck overhang; and 3) over new construction joints at joint headers.

6.7 Amount of Peroxide Initiator. The amount of peroxide initiator used shall result in a polyester polymer concrete set time between 30 and 120 minutes during placement. The initial set time will be determined by using an initial-setting time Gillmore needle in accordance with ASTM C266. Accelerators or inhibitors may be required as recommended by the polyester resin supplier and as approved by the engineer.

6.8 Finishing Equipment. Finishing equipment shall be capable of consolidating the polyester polymer concrete and striking off the polyester polymer concrete to the final grade, thickness and cross-sections as shown in the contract documents.

6.9 Overlay Thickness. The polyester polymer concrete overlay shall be placed at a minimum thickness of 1 inch, and as specified on the construction drawings. Multiple lifts or placements may be required to meet the final plan thickness shown on the construction drawings.

7.0 Surface Texturing. The roadway surface, except within 12 inches of the inside face of the curb, shall be textured as soon as the condition of the polyester polymer concrete will permit. The roadway finishing shall otherwise be in accordance with Sec 502. Hand-operated devices producing a satisfactory texture will be permitted. At the contractor's option, a finned float with a single row of fins may be used. The grooves produced by the finned float shall be approximately 1/8 inch wide at 5/8 to 3/4-inch centers and shall be approximately 1/8 inch deep. This operation shall be performed at such a time and in such a manner that the desired texture will be achieved while minimizing displacement of the layer aggregate particles.

8.0 Curing. Traffic and construction equipment shall not be permitted on the polyester polymer concrete overlay for at least four hours and until the polyester polymer overlay has reached a minimum compressive strength of 3,000 psi as verified by the rebound number determined in accordance with ASTM C805. Rebound number shall be correlated to cylinder compressive strength through development of a calibration curve specific to this project, and as directed by the manufacturer.

9.0 Testing. Bond testing shall be performed for each placement on each day. Testing will be conducted at three locations 48 hours after placement; a test location shall include three individual bond tests. Testing will be performed in accordance with ACI 506R. A passing test is the failure of the concrete substrate or bond strength above 250 psi. Test locations shall be located to avoid intersecting reinforcement.

10.0 Method of Measurement. Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. Furnished PPC overlay material will be measured by the actual volume of polyester concrete material complete-in-place. The volume shall include material used for the overlay and any other deck rehabilitation as directed by the engineer. Tickets provided to the engineer showing quantities of PPC produced shall be sufficient to calculate volume of material placed. Deductions will be made for:

- Material wasted.
- Excess material used when milling depth during scarification exceeds the specified removal depth.

10.1 Place Polyester Polymer Concrete Wearing Surface will be measured and paid for as the quantity of final surface finishing in square yards. Stripe Coat of Resin as shown on the Plans will not be measured separately. Surface preparation and prime coat application to the barriers as shown on the Plans will not be measured separately. Sealer for PPC wearing surface will be measured as outlined in Special Provision Sealer for PPC Wearing Surface.

11.0 Basis of Payment.

11.1 Payment for Furnish Polyester Polymer Concrete Wearing Surface shall include all costs required to furnish the polyester concrete material including HMWM primer, freight to the project site, receiving, storage, and disposal of any unused overlay material. Payment by cubic yard will be based on 135 lbs. per cubic foot and recorded by calibrated mixer unit readouts.

11.2 Payment for Place Polyester Polymer Concrete Wearing Surface will be full compensation for all labor, equipment, and all incidentals necessary to prepare the concrete surface and

complete the overlay placement. No additional payment will be made for surface preparation, prime coat, and stripe coat of resin as shown on the Plans.

H. SEALER FOR PPC WEARING SURFACE

1.0 Description. This work shall consist of preparing and treating the new polyester polymer concrete (PPC) Wearing Surface with a filler material. The filler material shall be either high molecular weight methacrylate (HMWM), methyl methacrylate (MMA), or product proposed by PPC manufacture and approved by engineer for the intended use. This type of surface treatment shall be in accordance with this job special provision, the standard specifications, and the manufacturer's recommendations. The objective of this treatment is to seal PPC overlay termination details at existing barriers and at joints between new PPC overlay and existing concrete in order to preserve and extend the life span of the deck.

2.0 Materials.

2.1 Filler Material. The low viscosity PPC filler material shall be a high molecular weight methacrylate (HMWM) or methyl methacrylate (MMA) system in accordance with Sec 1053 and shall be on MoDOT's qualified product list. Alternative materials proposed by the PPC manufacturer may also be submitted for approval and use for this application.

2.2.2 Finishing Sand. The sand for abrasive finish shall be commercial quality blast sand having at least 95 percent passing the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested in accordance with AASHTO T 27. The absorption of the sand shall not exceed 1% when tested in accordance with AASHTO T 84.

3.0 Construction Requirements.

3.1 Equipment. Application equipment shall be as recommended by the manufacturer. The abrasive blasting equipment, spray equipment, tanks, hoses, brooms, rollers, coaters, squeegees, etc. shall be thoroughly clean, dry, and free of foreign matter, oil residue and water prior to application of the treatment.

3.2 Cleaning, Surface Preparation and Sealing. Surfaces that are to be treated shall meet the approved product's requirements for surface condition. The contractor shall furnish the engineer with written instructions for the surface preparation requirements, and a representative of the manufacturer shall be present to ensure that the surface conditions meet the manufacturer's requirements.

3.2.1 At a minimum, the surface shall be abrasive blasted and thoroughly cleaned to remove dust, dirt, oil, wax, curing compounds, efflorescence, laitance, coatings and other foreign materials. The manufacturer or manufacturer's representative shall approve the use of chemicals and other cleaning compounds to facilitate the removal of these foreign materials before use. The treatment shall be applied within 48 hours following surface preparation.

3.2.2 Blasting and cleaning equipment shall be fitted with suitable traps, filters, drip pans and other devices to prevent oil and other foreign material from being deposited on the surface.

3.2.3 If water cleaning is deemed necessary, the areas to be treated shall be water blasted to clean out joints and allowed to dry prior to sealing.

3.2.4 Before starting sealing operations, all joints shall be blown out with clean, dry, high-pressure air.

3.2.5 The contractor shall prevent sealer material from leaking through the deck at any cracks, construction joints or at precast panel joints on the bottom side of the deck that reflect through the slab. The contractor shall take measures to treat these areas to prevent loss of material intended to seal the deck.

3.2.6 The contractor shall follow the manufacturer's recommendations for a method and material resistant to the effects of the deck sealer to prevent leakage of deck sealer through the bridge deck.

3.3 Test Application. Prior to final application, the contractor shall treat a measured test coverage area on horizontal and vertical surfaces of the different components of the structure to be treated for the purpose of demonstrating the desired physical and visual effect on an application or of obtaining a visual illustration of the absorption necessary to achieve the specified coverage rate. Horizontal test surfaces shall be located on the deck near a construction joint, and vertical test surfaces shall be located on a parapet or safety barrier curb.

3.4 Application. After leakage prevention measures and test applications are completed, a flood application shall be performed on the entire deck surface to be filled. Flood application and broadcast aggregate shall be placed in accordance with the manufacturer's application rates.

3.4.1 The concrete surface temperature shall be above 50°F.

3.4.2 The treatment shall be spread from puddles to dry areas.

3.4.3 If the applicator is unable to complete the entire application continuously, the location where the application was stopped shall be noted and clearly marked.

3.5 Protection of Adjoining Surfaces and the Public.

3.5.1 When applying a treatment, the contractor shall protect adjoining surfaces of the structure that are not to be sealed by masking off or by other means. The contractor shall also make provision to protect the public when treating the fascia of a bridge that spans an area used by the public.

3.5.2 Asphalt and mastic type surfaces shall be protected from spillage and heavy overspray. Joint sealants, traffic paints and asphalt overlays may be applied to the treated surfaces 48 hours after the treatment has been applied. Adjoining and nearby surfaces of aluminum or glass shall be covered where there is possibility of the treatment being deposited on the surfaces. Plants and vegetation shall be protected from overspray by covering with drop cloths. Precautions shall be followed as indicated on the manufacturer's material and safety data sheet.

3.5 Opening to Traffic. Traffic shall be allowed on the deck only after the treated area is visibly dry and cured. Dried coating shall not leave residue on glass, painted metal or automobiles.

4.0 Method of Measurement. Measurement will be made to the nearest linear foot measured longitudinally from end of bridge approach slab to end of bridge approach slab and transversely from roadway face of curb to roadway face of curb. No deduction will be made for gaps to avoid

raised pavement markers, manholes or other obstructions. Final measurement will not be made except for authorized changes during construction or where appreciable 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 Sealer for PPC Wearing Surface.

I. REPLACE CONDUIT AND JUNCTION BOXES

1.0 Description. This work consists of removing and replacing all corroded or damaged conduit and conduit boxes as shown on the plans and as described below.

2.0 Material. Conduit and junction boxes shall meet the requirements of Sections 1060 and 1062, respectively.

3.0 Construction Requirements. The Contractor shall have the option of using single piece conduit or split conduit systems.

4.0 Method of Measurement. No measurement will be made.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Replace Conduit and Junction Boxes.

J. REPAIR RESTRAINER CABLE SHEATH

1.0 Description. This work consists of removing all restraint cover sleeves and epoxy coating the exposed cables as shown on the plans and as described below.

2.0 Material. The epoxy shall be a two-part epoxy according to ASTM D3963 (D 3963M).

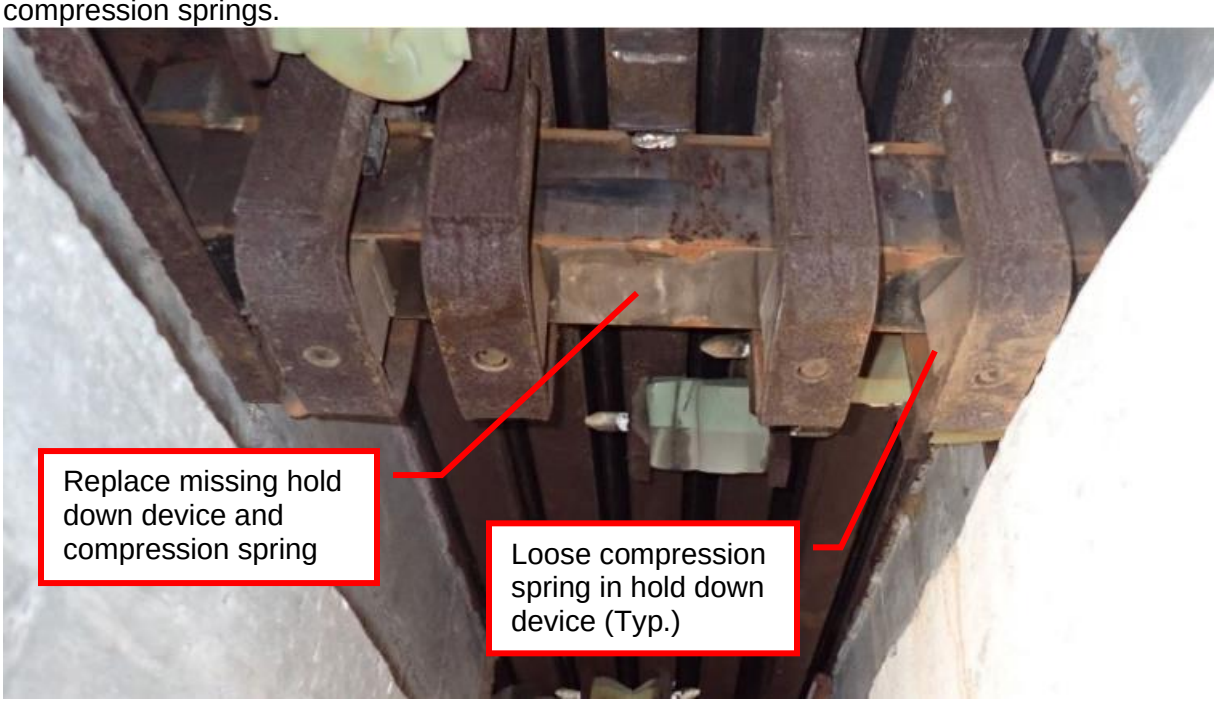
3.0 Construction Requirements. The Contractor shall exercise caution when removing the existing conduit to prevent damage to the existing cables. Any damage caused by the contractor's operations shall be repaired at the contractor's expense as approved by the engineer.

4.0 Method of Measurement. No measurement will be made.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Repair Restrainer Cable Sheath.

K. REMOVE AND REPLACE MODULAR JOINT HOLD DOWN SPRINGS

1.0 Description. This work consists of removing and replacing all loose hold down springs within the modular joint at Bent No. 4 and replacing missing hold down devices and compression springs.



2.0 Material. All materials shall follow the manufacturer's recommendations.

3.0 Construction Requirements.

3.1 The contractor shall follow the manufacturer's recommended replacement procedures, when applicable.

3.2 Before beginning operations, the contractor shall submit to the engineer for review the method and sequence of operations proposed to be used in performing this work. With traffic staged off the joint, the contactor shall exercise caution when performing this work. Removing and replacing the hold down springs shall be performed in a manner to prevent any damage to the existing modular joint system and adjoining steel and concrete.

3.3 The number of hold down springs removed shall be limited to the number that can be fully replaced in the same day.

3.4 Any damage caused by the contractor’s operations shall be repaired at the contractor’s expense as approved by the engineer.

4.0 Method of Measurement. Final measurement for removal and replacement of the modular joint hold down springs will be made per each.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Remove and Replace Modular Joint Hold Down Springs.

L. REMOVE AND REPLACE MODULAR JOINT CONTROL SPRINGS

1.0 Description. This work consists of removing and replacing all control springs within the modular joint at Bent No. 4.

2.0 Material. All materials shall follow the manufacturer's recommendations.

3.0 Construction Requirements.

3.1 The contractor shall follow the manufacturer's recommended replacement procedures, when applicable.

3.2 Before beginning operations, the contractor shall submit to the engineer for review the method and sequence of operations proposed to be used in performing this work. With traffic staged off the joint, the contactor shall exercise caution when performing this work. Removing and replacing the control springs shall be performed in a manner to prevent any damage to the existing modular joint system and adjoining steel and concrete.

3.3 The number of control springs removed shall be limited to the number that can be fully replaced in the same day.

3.4 Any damage caused by the contractor’s operations shall be repaired at the contractor’s expense as approved by the engineer.

4.0 Method of Measurement. Final measurement for removal and replacement of the modular joint control springs will be made per each.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Remove and Replace Modular Joint Controls Springs.

M. REMOVE AND REPLACE SHOCK TRANSMISSION UNIT

1.0 Description. This work involves the replacement of one (1) existing shock transmission unit (STU) with a new matching STU at the plan location in accordance with these Job Special Provisions, plan notes, and the AASHTO *LRFD Bridge Design and Construction Specifications.* The work shall consist of furnishing all labor, materials, equipment, services, and incidentals necessary to execute this work as outlined in the plans and discussed herein.

1.1 Design. The shock transmission device shall function without requirement of any special mechanism or component other than a piston, a cylinder, connecting rods, and pins. It shall contain no valves, springs, balls, ports, compensating devices, bypass channels, pressure limiters, or any other devices that could malfunction. The shock transmission device shall be guaranteed to perform as intended at any time during the bridge service life (75 years).

2.0 Materials and Equipment. The materials and equipment for this work shall be as described below:

2.1 Steel. All parts that slide relative to any seals shall be made from 17-4PH stainless steel. The piston, cylinder, and pin shall be constructed of corrosion resistant steel unless otherwise recommended by the manufacturer.

2.2 Operating Fluid. Inert silicone per U.S. Federal Standard VV-D-1078. The silicone compound shall be formulated such that while exhibiting the characteristics of a rigid body when under the influence of a sudden load, it can react as a semi-solid fluid upon the application of a very gradual load. The properties of the compound shall be such that temperature does not affect the performance over the prescribed operating temperature range. Operating ambient temperature shall be -20 Deg. F to 130 Deg. F.

2.3 Movement. Stroke in either direction shall be +-7 inches.

2.4 Capacity. The nominal force output shall equal 1500 kips.

2.5 Coating. Exposed steel surfaces not of corrosion resistant steel shall be painted with System G in accordance with the painting requirements of this structure.

3.0 Testing. The shock transmission device shall be tested. The transmission device may be used in the structure if the testing results are satisfactory. A complete test report, including all results, shall be submitted to the Engineer within one week of the completion of the testing. The testing shall include the following:

3.1 Translation Test. Low Velocity (V_0 = 0.018 mm/sec)
The testing equipment shall be capable of testing the unit over the entire range of movement of the shock transmission device. The maximum reaction (either in compression or tension) shall not exceed 10 percent of the normal design force.

3.2 Proof Load Test. High Velocity (V_0 = 0.10 mm/sec)

The horizontal load shall be applied at a sufficient rate to simulate a shock load. The shock transmission device shall be tested in both compression and tension. The maximum reaction

shall not be lower than the maximum horizontal design force. There shall be no visible signs of deformation or distress of the unit.

4.0 Construction Requirements

4.1 Removal. Existing STU shall be removed per plan. Existing pins to be cleaned and reused. Contractor to deliver removed STU to MoDOT storage location as directed by the engineer.

4.2 Installation. New STU to be installed in a manner such that it is not damaged or damage the structure. Reuse the existing pins.

5.0 Method of Measurement.

5.1 Measurement for Remove and Replace STU will be per each installation.

6.0 Basis of Payment.

6.1 Payment for Remove and Replace Shock Transmission Unit will be paid at the contract unit price per each installation. Payment for the installation will be considered full compensation for all labor, equipment, material, and incidentals to design, furnish, fabricate, and install the new STU.

N. HLMR BEARINGS

1.0 Description. This work involves the replacement of four (4) existing pot bearings with new High Load Multi-Rotational (HLMR) multi-directional disc bearing assemblies at the plan locations in accordance with these Job Special Provisions, plan notes, and the AASHTO *LRFD Bridge Design and Construction Specifications.* Jacking of the structure to facilitate the bearing replacement is included with this work. The work shall consist of furnishing all labor, materials, equipment, services, and incidentals necessary to execute this work as outlined in the plans and discussed herein.

2.0 Materials and Equipment. The materials and equipment for this work shall be as described below:

2.1 Jacking System. Steel plates and angles, threaded fasteners, hydraulic rams and pumps, instrumentation, dial indicators, and other necessary components to facilitate jacking of the structure to permit the removal of the existing bearings and replacement with new bearings.

2.2 Fabricated Structural Steel. Fabrication of steel components, including but not limited to steel stiffeners that are part of the jacking system, shall conform to Sec 1080. Bearings stiffeners shall be installed as permanent structural components.

2.3 High Strength Bolts. Bolts shall be ASTM F3125, Grade A325 and in accordance with Sec 712.7. Bolts shall be of the size specified on the plans or shall match the size of existing bolts that they are replacing, as applicable. Bolts shall be fully pretensioned in accordance with Sec 712.7.3, unless specified otherwise. Once pretensioned, bolts shall not be reused.

2.4 Disc Bearings. Shall consist of a polyether urethane structural element (disc) confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear resisting mechanism, and/or positive location device to prevent lateral movement of the disc. Bearings shall adequately provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable. New disc bearings are intended to replace the existing pot bearings with respect to vertical load and lateral movement capacities.

2.41 Polyether Urethane. Polyether urethane shall conform to Section 18.3.2.8 and Table 18.3.2.8-1 of the AASHTO LRFD Bridge Construction Specification. The polyether urethane disc shall be designed for a maximum average compressive stress of 5000 psi. If the outer surface of the disc is not vertical, the stress shall be computed using the smallest plan diameter of the disc, excluding the area of any holes.

2.4.2 Steel Plate: ASTM A36, A588 or A572. All steel surfaces in contact with PTFE, or other steel surfaces, shall be finished to a smoothness of 125 micro-inches (rms) or less.

2.4.3 Stainless Steel: ASTM A240, Type 304, with a minimum No. 8 mirror finish. The minimum thickness of stainless-steel sheet shall be 12 gage and shall be attached to their backing plates by continuous fillet welding along their edges. Bonding and/or mechanical fastening of sheets will not be permitted. Welding shall be in accordance with AWS D1.6. The backing plates shall extend beyond the edge of the stainless steel sheets to accommodate the welds and the welds shall not protrude above the stainless steel sheets.

The stainless steel sheets shall face downward and shall completely cover the PTFE sheets in all operating positions, plus two additional inches in the direction(s) of movement.

2.4.4 Polytetrafluoroethylene (PTFE). PTFE sheet shall be manufactured from pure virgin unfilled TFE resin conforming to the material requirements of AASHTO LRFD Bridge Construction Specification, Section 18.8.2. PTFE shall be resistant to acids, alkalis and petroleum products, nonabsorbing of water, stable from -360°F to +500°F and non-flammable.

PTFE sheets shall be a minimum of 0.125 inch thick, epoxy-bonded into a square-edged recess of a depth equal to one-half the PTFE sheet thickness. The shoulders of the recesses shall be sharp and square. After completion of the bonding operation, the PTFE surfaces shall be smooth and free from blisters and bubbles.

2.4.5 Adhesive. Adhesive used for bonding sheet PTFE shall be an epoxy material stable from -100°F to +250°F.

2.4.6 Fabrication. Except as noted, all bearing fabrication tolerances shall be in accordance with AASHTO LRFD Bridge Construction Specifications, Table 18.1.4.2-1. The bearing fabricator shall be certified by the American Institute of Steel Construction (AISC) for Simple Steel Bridges Category and have five years of bearing fabrication experience.

Flatness tolerances are arranged in the following classes:

- Class A: 0.0005” x “Nominal Dimension”
- Class B: 0.001” x “Nominal Dimension”
- Class C: 0.002” x “Nominal Dimension”

1. Upper and lower bearing plate tolerances shall be:
   - Plan dimensions under 30”: -0”, +3/16”

- Plan dimensions over 30”: -0”, +1/4”
- Thickness tolerance shall be: -0”, +1/16”
- Bevel (if required): ±0.002 radians
- Class “B” tolerance for the side in contact with the urethane disc and Class “A” tolerance for the side in contact with other bearing components

2. The tolerance on the diameter of the shear restricting pin shall be –0”, +1/16” and the tolerance on the diameter of the receiving hole shall be –0”, +3/32”.

3. Urethane disc tolerances shall be:
   - Diameters greater than 20”: -3/32”, +3/32”
   - Diameters less than 20”: -1/16”, +1/16”
   - Thickness: -0”, +1/8”

4. Sole plates shall conform to:
   - Plan dimensions under 30”: -0”, +3/16”
   - Plan dimensions over 30”: -0”, +1/4”
   - Centerline thickness: -1/32”, +1/8”
   - Bevel (if required): ±0.002 radians
   - Class “B” tolerance for the upper side and Class “A” tolerance for underside (i.e., side contacting stainless sliding surface) in contact with other bearing components

5. Overall bearing height shall not vary from nominal height dimension by more than +1/4” or less than -1/16”.

2.4.7 Coating. All steel surfaces exposed to the atmosphere, except stainless steel, PTFE, and metal surfaces to be welded, shall be shop coated in accordance with the contract plans. Prior to coating, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating’s manufacturer.

3.0 Construction Requirements

3.1 Field Verification. Complete field survey and measurement of all steelwork and work locations shall be performed as necessary to furnish complete and accurate shop drawings. Adjustment or modification in the field may be necessary to assure a reasonable fit.

3.1.1 Shop drawings of the existing materials are available for the contractor’s use. However, field measurements are recommended to be taken to confirm dimensions where necessary. Fully dimensioned shop drawings of all new materials shall be submitted in accordance with Sec 1080.3.2.

3.2 Temporary Jacking System. The contractor shall be responsible to design, furnish, fabricate, and construct a temporary jacking system for the bearing replacement.

3.2.1 One proposed jacking system is shown in the plans. The contractor may propose an alternate jacking system subject to support the means and methods of bearing replacement.

3.2.2 Calculations and working drawings for the jacking system shall be submitted to the engineer for approval. The system shall be capable of supporting the relevant in-service

loads and construction loads in the bearings. The jacking system design shall be signed and sealed by a licensed professional engineer in the State of Missouri.

3.3 Bearing Sampling and Testing. Production bearing sampling and testing shall be performed in accordance with AASHTO *LRFD Bridge Construction Specifications, Section 18.3.4*

3.3.1 Each bearing shall be visually examined both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as permanently extruded or severely deformed elastomer or cracked steel shall also be cause for rejection.

3.3.2 Bearings shall be tested in a machine with force measuring equipment that is calibrated based on standards that are traceable to NIST. Calibration certificates shall be provided to the engineer.

3.3.3 Identification. Each bearing shall be stamped with the manufacturer's name, bearing type or model number, bearing number and the installed location. The stamp shall be on a surface visible after installation.

3.3.4 Storage. When in storage the bearings will be kept banded, wrapped and secured in a condition suitable for shipment.

4.0 Submittals. Submittals required to perform the outlined work include, but are not limited to the following:

- Design calculations and working drawings for the temporary jacking system for the bearing replacement.
- Qualifications of the bearing fabricator who will supply the replacement bearings.
- Test results for bearings.
- Material certifications for bearing components.
- Working drawings for the bearings.

5.0 Method of Measurement.

5.1 Measurement for HLMR Bearing will be per each install and use of the contractor's designed and furnished temporary jacking system.

6.0 Basis of Payment.

6.1 Payment for HLMR Bearing will be paid at the contract unit price per each installation. Payment for the installation will be considered full compensation for all labor, equipment, material, and incidentals to design, furnish, fabricate, install, and utilize the contractor's jacking system at an installation location.

O. MODULAR EXPANSION JOINT SYSTEM

1.0 Description. This work shall consist of furnishing materials, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test and install the expansion joint system including the concrete and reinforcing steel in the blockouts as specified.

1.1 General. The modular expansion joint system shall consist of multiple strip seal joints that shall allow movements as shown on the plans. The configuration of the expansion joint system shall consist of neoprene strip seals mechanically held in place by steel edge and separation beams. Each separation beam shall be supported by independent multiple support bars welded to the separation beams, or by a single support bar system welded or bolted to the separation beams. The multiple support bars shall be suspended over the joint opening by sliding elastomeric bearings. Scissor type modular expansion joint systems will not be permitted. An equidistant control system shall be incorporated that develops its maximum compressive force when the joint is at its maximum opening. The final completed expansion joint system shall be continuous across the full width of the roadway and continue into the traffic barriers as shown on the plans.

1.2 Qualified Manufacturers. The qualified manufacturer shall have a minimum of 5 years experience in designing and fabricating modular expansion joint systems and be certified under the AISC certification program for either "Simple Bridge" or “Bridge and Highway Metal Component Manufacturers”. The following manufacturers are known suppliers of modular expansion joint systems:

D.S. Brown
300 East Cherry Street
North Baltimore, OH 45872
Telephone (419) 257-3561
www.dsbrown.com

Watson-Bowman & Acme Corp
95 Pineview Drive
Amherst, NY 14120
Phone (716) 691-7566
www.wbacorp.com

D.S. TechStar, Inc.
1219 West Main Cross Street
Findlay, OH 45840
Telephone: (419) 424 0888
www.techstar-inc.com

Mageba USA
575 Lexington Avenue, 4th Floor
New York, NY 10022
Phone (212) 644-3339
www.magebausa.com

2.0 Design Requirements.

2.1 Truck and Impact Loading. The modular expansion joint system shall be designed in accordance with the latest edition of AASHTO LRFD Bridge Design Specifications except that the LRFD truck loading shall be HS-20 Modified (HS-25) and impact being 100 percent. The modular expansion joint system shall be designed for the maximum number of lanes between the barrier curbs, and the lane width shall be considered as 10 feet. The modular expansion joint system shall be designed such that the joint system is designed to support a wheel load being 12 inches from the roadway face of the curb. The modular expansion joint system shall be designed for the staged traffic loading as shown on the plans.

2.2 Field Splices. The design and fabrication of the modular expansion joint system shall be one continuous unit without field splices except as required by stage construction requirements as shown on the plans. If the site and/or stage construction requirements require the need for field splices, the splices shall be located in areas outside the main traffic lanes or as shown on the plans and consist of a welded separation beam splice in which the weld is a full penetration weld, or another connection that is capable of developing the capacity of the spliced members. The contractor shall complete the field splices in accordance with the details and procedures included in the shop drawings.

2.3 Movement. The modular expansion joint system shall be designed to provide the minimum total movement as noted on the plans and to accommodate all expected longitudinal movements (i.e. thermal, creep, shrinkage, elastic shortening, etc.) as well as vertical and

horizontal rotations. This design shall incorporate strip seal glands with a maximum movement range of 3.15 inches per seal.

2.4 Fatigue. The modular expansion joint system shall be tested and designed following the guidelines provided in the National Cooperative Highway Research Program (NCHRP), Report 402 "Fatigue Design of Modular Bridge Expansion Joints" as well as the provisions included in Chapter 14, "Joints and Bearings", of the latest edition of AASHTO LRFD Bridge Design Specifications.

2.5 Water Tightness. After the modular expansion joint system has been completely installed, the joint shall be flooded for a minimum of one hour to a minimum depth of 3 inches. Testing shall be performed in stages with traffic flow maintained in accordance with the traffic control plans. If the engineer observes leakage, the expansion joint system shall be repaired at the contractor's expense. The repair procedure shall be as recommended by the manufacturer and approved by the engineer.

2.6 Corrosion Protection. All steel surfaces, except as noted, shall be hot dip galvanized in accordance with AASHTO M111 (ASTM A123).

2.7 Anchorage of Expansion System. The modular expansion joint system anchorage shall be designed by the manufacturer and included in the design computations and shown in the shop drawings.

3.0 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows.

3.1 Structural Steel. Structural steel shall be in accordance with AASHTO M270, Grade 50 (ASTM A709, Grade 50). All shop-welded connections that splice the horizontal separation beams and edge beams shall be full penetration welds. All separation beams to support bar connections shall be full penetration welds or bolted connections in accordance with NCHRP Report 402 requirements. Aluminum components will not be permitted. All fabrication of structural steel shall be in accordance with Sec 712 and 1080.

3.2 Stainless Steel. The stainless steel shall be in accordance with Sec 1038.4.2.

3.3 Sliding Bearings. The sliding bearings shall be fabricated as steel reinforced elastomeric pads with polytetraflourethylene (PTFE) in accordance with Sec 1038 or other proprietary material (with the engineer's approval) as required by the manufacturer. The bearings shall be designed so that they are removable and replaceable.

3.4 Strip Seals and Lubricant Adhesive. Strip seals and lubricant adhesive shall be in accordance with Sec 717 and 1073. The strip seals shall not protrude above the top of the joint.

3.5 Submittals.

3.5.1 Design Computations and Shop Drawings. The contractor shall submit, for the engineer's review, the design computations and shop drawings. All shall be signed, sealed and stamped by a registered professional engineer in the State of Missouri in accordance with Authentication of Certain Documents in Sec 107. The design computations shall include fatigue design and a strength design for all structural elements and connections. Shop drawings shall be prepared for the modular expansion joint system in accordance with Sec 1080. The shop drawings shall also include the following:

(a) Plans, elevation, and section of the joint system for each movement rating and roadway width showing dimensions and tolerances.
(b) All ASTM, AASHTO or other material designations.

(c) Method of installation, including but not limited to sequence, setting relative to temperature, anchorage during setting and installation at curbs.

(d) Corrosion protection system.

(e) Details of temporary support for shipping and handling.

(f) Details of blockout reinforcement and anchorage.

(g) Fatigue testing report.

(h) Details of adjustments to record drawings based on the selected modular joint system.

3.5.2 Maintenance Manual. The manufacturer shall submit to the engineer a written maintenance manual and part replacement plan at the time of the shop drawing submission. Included in the submission shall be list of parts to be inspected, acceptable wear tolerances and the method of part replacement. The manufacturer shall conduct a pre-installation meeting to train MoDOT's construction inspectors and maintenance personnel on the installation and maintenance of the modular expansion joint system.

3.5.3 Certificates of Compliance. The manufacturer shall provide certification of the manufacturer's experience, including a list of projects, and certificate of compliance with the AISC certification program, in accordance with Section 1.2 of this job special provision, to be submitted to the engineer.

4.0 Construction Requirements. The expansion joint system shall be stored at the job site in accordance with the manufacturer's written recommendations. Damage to the joint system during shipping or handling will be cause for rejection of the joint system. Any damage to the corrosion protection system shall be repaired to the satisfaction of the engineer at the contractor's expense. The support boxes shall rest on cast-in-place concrete or grout pads installed into a preformed blockout. The contractor shall coordinate the size and reinforcing of the blockout with the selected modular joint manufacturer. This includes reinforcement in the blockout, the adjacent and supporting concrete slab and other concrete and structural steel supporting elements. Modifications to the record drawings to accommodate the selected modular system shall be the contractor's responsibility. The contractor shall provide details of any adjustments to the record drawings with the shop drawing submittal. Concrete shall be forced under and around support boxes, anchorage systems and supporting hardware. Proper consolidation shall be achieved by localized internal vibration. Installation of the modular expansion joint system shall be as recommended by the manufacturer. The contractor shall obtain the services of a qualified technical representative, approved by the manufacturer of the expansion joint system and acceptable to the engineer, to assist during the installation. The installation shall not occur without the qualified technical representative being present. The qualified technical representative shall have 3 years of experience working on installation of modular expansion joint systems on bridges. This experience shall also include modular joints that had field splices for staged construction.

5.0 Method of Measurement. Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. Where required, the modular expansion joint system will be measured to the nearest linear foot, based on measurement from the roadway face of curb to roadway face of curb along the centerline of the joint. Portions of the joint that extend past the roadway face of curbs will not be measured for payment. The revision or correction will be computed and added to or deducted from the contract quantity.

6.0 Basis of Payment. Modular expansion joint system, including all material, coating, equipment, labor, fabrication, installation, technical assistance and any other incidental work necessary to complete this work, will be paid for at the contract unit price for Modular Expansion Joint System.

P. REMOVE AND REPLACE MODULAR JOINT SEAL

1.0 Description. This work consists of removing and replacing the modular joint neoprene seals within the modular joint at Bent No. 4 as shown on the plans.

2.0 Material. All materials shall follow the manufacturer's recommendations.

3.0 Construction Requirements.

3.1 The contractor shall follow the manufacturer's recommended replacement procedures, when applicable.

3.2 Before beginning operations, the contractor shall submit to the engineer for review the method and sequence of operations proposed to be used in performing this work. With traffic staged off the joint, the contactor shall exercise caution when performing this work. Removing and replacing the joint seal be performed in a manner to prevent any damage to the existing modular joint system and adjoining steel and concrete.

3.3 Any damage caused by the contractor’s operations shall be repaired at the contractor’s expense as approved by the engineer

3.4 After the seals have been completely installed, the joint shall be flooded for a minimum of one hour to a minimum depth of 3 inches. Testing shall be performed in stages with traffic flow maintained in accordance with the traffic control plans. If the engineer observes leakage due to the new seal, the joint seals shall be repaired at the contractor’s expense. The repair procedure shall be as recommended by the manufacturer and approved by the engineer.

4.0 Method of Measurement. Final measurement for removal and replacement of the modular joint seal will be made per foot.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Remove and Replace Modular Joint Seal.

Q. CLEAN EXPANSION JOINTS

1.0 Description. This work consists of cleaning and disposing of debris from the expansion joint locations at Bents No. 1, 5, 9 & 12.

2.0 Construction Requirements.

2.1 The contractor may use pressure washing to loose debris from joints or hand tools. Care shall be taken to prevent any material from falling into the waterway below. All debris shall be taken from the project site and disposed of in an approved location.

2.2 Before beginning operations, the contractor shall submit to the engineer for review the method and sequence of operations proposed to be used in performing this work. Removing all debris shall be performed in a manner to prevent any damage to the existing modular and finger plate joint systems and adjoining steel and concrete.

2.3 Any damage caused by the contractor's operations shall be repaired at the contractor's expense as approved by the engineer

3.0 Method of Measurement. Final measurement for cleaning expansion joints will be made per foot.

4.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract unit price for Cleaning Expansion Joints.

R. REMOVE AND REPLACE TOWER INSPECTION HATCH DOOR HINGES

1.0 Description. This work consists of removing and replacing the hinges on the tower inspection hatch door with heavy duty hinges with stainless steel pins as shown on the plans.

2.0 Material. All materials shall follow the manufacturer's recommendations.

3.0 Construction Requirements.

3.1 The contractor shall follow the manufacturer's recommended replacement procedures, when applicable.

3.2 Before beginning operations, the contractor shall submit to the engineer for review the method and sequence of operations proposed to be used in performing this work. Removing and replacing the hinges shall be performed in a manner to prevent any damage to the existing door and adjoining steel and concrete.

3.3 Any damage caused by the contractor's operations shall be repaired at the contractor's expense as approved by the engineer

4.0 Method of Measurement. Final measurement for removal and replacement of the hinges will be made per each.

5.0 Basis of Payment. Payment for the above described work including all materials, equipment, labor and any other incidental work necessary to complete this item will be

considered completely covered by the contract unit price for Remove and Replace Tower Inspection Hatch Door Hinges.

S. NAVIGATION LIGHTING SYSTEM

1.0 Description. This work shall consist of the removal of the existing light bulbs and fixtures and controllers, furnishing and installing new navigation lights, including fixtures, and controllers and coordinating service to the bridges with the electric company.

2.0 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Conduit System on Structure	707
Highway Lighting	901

2.1 Navigation Lighting.

2.1.1 All navigation lights shall be of sufficient candlepower as to be visible against the background lighting at a minimum distance of 2000 yards (1.8 km) on 90% of the nights of the year. The lamp and lens shall be of such size and material to provide this visibility.

2.1.2 The navigation lighting shall be in accordance with Sec 901. The navigation light fixtures shall consist of the ML-140 MaxLumina lantern and MLED-RETRO LED Replacement Light Source as made by Tideland Signal Corporation, PO Box 52370, Lafayette, LA 70505, Phone (337) 269-9113 or (800) 824-0575. The fixtures shall be standard product of the supplier and shall be mounted on brackets designed by the manufacturer. Any cast aluminum shall be isolated from steel or concrete with an isolating material as recommended by the manufacturer.

3.0 Construction Requirements.

3.1 New Navigation Lighting. The upstream and downstream sides of the channel piers shall be marked with an 180° pier mounted duplex red channel margin marker lights and securely mounted on the pier to show 90° on either side of a line parallel to the axis of the channel so as to be visible from an approaching vessel. The center of the navigable channel shall be marked with a 360° duplex center channel green lantern on the upstream and downstream side of the bridge span structure in line with the axis of the channel so as to be visible from an approaching vessel. On each bridge, the upstream bridge shall be marked on the upstream side only and the downstream bridge shall be marked on the downstream side only. Navigation light fixtures location shall be as shown on the plans. All wiring and cables for the navigation lighting shall be of the size and type indicated on the plans. All electrical materials, construction and installation shall be in accordance with the current National Electric Code and Sec 901.

3.3 Existing Navigation and Aviation Lighting. Existing navigation lighting and aviation lighting shall remain in use during the construction period as required. Upon notice to proceed the contractor shall become responsible to maintain and operate these existing lights until the permanent lights are in operation. In addition to providing the permanent markers, the contractor shall be responsible for and maintain all circuits, switching, relamping and power service for the existing and permanent navigation lighting until the final and formal acceptance of the complete work. Navigational obstructions fixtures shall be operated automatically from sunset to sunrise and at other times when visibility is less than 2000 yards (1.8 km).

3.4 Navigation Lighting Testing. Testing of the navigation and aviation lighting systems shall be in accordance with Sec 901.

3.5 Maintenance and Operation. The contractor shall supply maintenance and operations manuals, parts lists, and any manufacturer's warranties as necessary to define the conventional and solar navigation lighting systems. The contractor shall also supply one remote control unit for the solar powered lights.

4.0 Method of Measurement. No measurement will be made for the navigation lighting systems.

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 lump sum price for Navigation Lighting System.

T. BRIDGE LIGHTING

1.0 Description. This work shall consist of removing and replacing all existing luminaires and controllers at existing locations including, but not limited to, the fixtures, lights, covers, and any material necessary to attach the new luminaires. Additionally, all bridge lighting controllers and the telephone override system shall be removed and replaced. Installation details shall be in accordance with the plans, the specification below, and the manufacturer's recommendations.

2.0 Materials.

2.1 Lights. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Conduit System on Structure	707
Highway Lighting	901

New luminaires shall have either 200-Watt LED lights with 28,000 total lumens to replace the existing 400-Watt metal halide bulbs or 400-Watt LED lights with 56,000 total lumens to replace the existing 1000-Watt metal halide bulbs. All luminaire covers shall consist of shatter resistant material. The new luminaires shall allow for the same beam angle as the existing luminaires.

Contractor to coordinate light colors with the City of Cape Girardeau.

2.2 Lighting Controllers. All material shall be in accordance with Division 1000, Material Details. A summary of the existing controllers to be replaced is as follows:

2.2.1 The lighting is on a 480 volt system with two main controllers;
- (a) A master located in Pier No. 2 that is fiber interconnected
- (b) A slave controller located in Pier No. 3.

2.2.2 Pier #2 includes
- (a) Panel A contains the master controller controlling the 4 circuits for roadway lighting and controls Panel C
- (b) Panel C contains 16 circuits for aesthetic lights.
- (c) Panel A contains a breaker that is controlled by the controller that supplies power to Panel B which is a stepdown transformer to 240/120 volt for axillary lighting.

(d) Navigation lights and aerial strobes.
(e) The telephone override system

2.2.3 Pier # 3 includes
(a) Panel F with the slave controller for 16 circuits for aesthetic lighting.
(b) Panel D
(c) Interconnect Panel

2.2.4 The telephone override system shall be replaced with a two-way radio link that is turned to the standard Marine Band radio for boat traffic. The contractor shall coordinate with the Coast Guard on the two-way radio override system.

Panel B Panel A Lighting Control Panel A Panel C

Telephone Override

Pier No. 2 Controllers

Panel D

Panel F

Interconnect Panel

Pier No. 3 Controllers

3.0 Construction Requirements

3.1 Aesthetic Lighting Testing. Testing of the aesthetic lighting systems shall be in accordance with Sec 901.

3.2 Maintenance and Operation. The contractor shall supply maintenance and operations manuals, parts lists, and any manufacturer's warranties as necessary to define the conventional lighting systems.

4.0 Method of Measurement. No measurement will be made for the bridge lighting.

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 lump sum price for Bridge Lighting.

U. REPAIR CABLE PROTECTIVE SHEATHING

1.0 Description. This work involves the repair of damaged stay cable protective sheathing at locations designated on the drawings.

2.0 Materials. The materials for this work shall be as described below:

2.1 Polyvinyl Fluride (PVF) Tape. A PVF tape capable of adhering to a properly prepared HDPE or polyester film tape surface when subjected to weather, temperature, and ultraviolet exposure. The following product or an approved equal is acceptable:

3M™Weather Resistant Film Tape 838

2.2 Polyester Film Tape with Fiberglass Reinforcement. At transitions in stay cable diameter, provide polyester film tape with fiberglass reinforcement meeting ASTM D5330, Type II, Class A. Tape shall be a minimum of 8.0 mil thick and provide a tensile breaking strength of 330 pounds.

3.0 Construction Requirements

3.1 Removal. In the area of the protective sheath repair, loosen existing neoprene boots and stainless steel bands and slide out of the way. Unwrap the damaged PVF tape for the full length of the repair area.

3.2 Inspection. Inspect the surface of the HDPE looking for damage or distress. Report damage to the engineer. Complete HDPE repairs as directed by the engineer.

3.3 Installation. After completing the inspection, install the new PVF tape in accordance with the manufacturer's instructions with regard to surface preparation and application. Spiral-wrap tape to match existing overlap.

Where the stay cable transitions in diameter, install the polyester film tape first, wrapping the cable six wraps each end of the transition. Clean and cover polyester tape with PVF tape in a spiral pattern.

Reinstall neoprene boots and stainless steel bands.

3.4 HDPE Repair. At locations where the HDPE has been damaged and determined by the engineer to be repaired, complete the following repair procedure:

1. Squarely cut the HDPE at each end of the damage using a rotary cutter with a minimum distance between cuts of 1 foot. Bevel ends for welding.
2. Remove the damaged portion of HDPE to expose the underlying grouted strands.
3. Install a new two-piece segment of HDPE sized to fit repair opening and with ends and longitudinal seams beveled in preparation for welding.
4. With the repair pieces securely clamped, field weld HDPE with proper material-matched welding rod using appropriate plastic welding iron, heat dispenser or torch with applicable attachments.
5. Allow to cool before removing clamps.

4.0 Method of Measurement.

4.1 Measurement for Repair Cable Protective Sheathing will be per foot along the length of the stay cable. No measurement will be made for any HDPE repairs.

5.0 Basis of Payment.

5.1 Payment for Repair Cable Protective Sheathing will be paid at the contract unit price per foot of installation of the PVF tape. Payment for the installation will be considered full compensation for all labor, equipment, material, and incidentals to perform the repairs to the protective sheathing including repairs to HDPE within the repair area.