TABLE OF CONTENTS

A. Construction Requirements
B. Hybrid/Epoxy Polymer Concrete Wearing Surface
C. Diamond Grinding
D. Epoxy Pressure Injecting
E. Rapid Set Concrete Patching Material – Horizontal Repairs
F. Rapid Set Concrete Patching Material – Vertical and Overhead Repairs
G. Barrier Repair (Formed)
H. Deflection and Haunching
I. Shotcrete Concrete Repair
J. Reset Bearings
K. Strengthening Existing Beams
L. Aesthetic Concrete Stain
M. Temporary Shoring

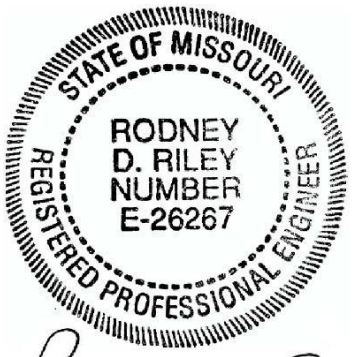
MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 W. CAPITOL AVE.
JEFFERSON CITY, MO 65101
Phone (888) 275-6636

Horner & Shifrin, Inc.
401 S. 18th Street
Suite 400
St. Louis, MO 63103
Certificate of Authority #000159
Consultant Phone #314-531-4321

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

JOB NO. J6S3669
St. Louis County, MO
Date Prepared: 10/18/2024

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



10/18/2024 9:39:44 AM
Rodney D. Riley, PE
MO-026267

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

JACOBS
1001 Highlands Plaza Drive, Suite 400
St. Louis, Missouri 63110

Certificate of Authority # 000704
Consultant Phone #314-335-4482

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

JOB NO. J6S3669
St. Louis County, MO
Date Prepared: 10/18/2024

Only the following items of the Job Special Provisions (Bridge) are authenticated by this seal: A and H thru M

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 structures is 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 The existing slab for the bridges to be redecked was constructed as composite or non-composite as shown in the table below.

Bridge No.	Type of deck
A10722	Composite
A10742	Composite

2.4.1 The girder webs on the existing bridges are 5/16” thick. The contractor shall take extra caution to not damage the existing girders during deck removal or during other construction activities.

2.5 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 Lynn Haven bridge shall be maintained in accordance with the contract documents.

2.6 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.

2.7 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.

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

2.10 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 Straps Removal. Exposed portions of straps for stay-in-place forms shall be removed prior to surface preparation. Straps need not be removed in areas that are not being painted. Flame cutting will not be permitted. The contractor shall exercise care not to damage the existing structure during removal. 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.

3.2 Slab Drains and Stay-In-Place Forms. The stay-in-place forms, 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.

3.3 Existing Bridge Information. The informational plans may be used by bidders in determining the amount of steel to be cleaned and painted/coated with the full understanding that the State accepts no responsibility for accuracy of the estimated tons of existing steel shown in the table below. The bidder's acceptance and use of the estimate shown below shall be no cause for claim for any final adjustment in the contract unit price for the work involved in repainting. 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.

Bridge No.	Estimated Tons		Existing Paint System	Lead Based
	Coating System			
	System G Overcoat	Total		
A10722	13	13	System with Red Lead (1970)	Yes
A10742	12	12	C (1992)	No (potential for high levels of Chromium)

3.4 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

3.5 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

4.0 Method of Measurement. No measurement will be made.

5.0 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. HYBRID/EPOXY POLYMER CONCRETE WEARING SURFACE

1.0 Description. This work shall consist of constructing a wearing surface of hybrid polymer concrete (HPC) or Epoxy Polymer Concrete (EPC) on a prepared surface in accordance with these specifications, as shown on the plans, or as directed by the engineer. Polymer concrete shall be composed of polymer wearing surface components and shall be in accordance with this specification and the manufacturer/supplier's recommendations.

1.1 Acceptable Manufacturer Systems. The chosen HPC system shall meet the performance requirements as stated in this provision and shall be FasTrac CE700 HPC or approved equal. The chosen EPC system shall meet the performance requirements as stated in this provision and shall be E-Chem EPC-OVERLAY or approved equal.

1.2 Required Experience. The contractor shall have experience placing similar thin polymer wearing surface systems on at least three structures prior to performing work on this project. Written proof of this experience along with project contacts shall be provided to the engineer in writing for approval prior to the preconstruction meeting. Prior to installation of the wearing surface, the contractor shall also provide certification by the material supplier that the contractor is a trained and qualified installer of the selected wearing surface system.

2.0 Materials.

2.1.1 HPC Resin Binder. The HPC resin binder shall be a 100% solid two-component, thermosetting hybrid system that is moisture insensitive and shall comply with the following requirements:

HPC Resin Binder		
Property	**Requirement**	**Test Method**
Viscosity*	750 Centipoise, minimum	ASTM C881 / AASHTO M 235
Flash Point	>200° F	ASTM D3278
VOC Content	<10 g/L	EPA 24
Styrene Content	0%, maximum	ASTM D2369
Gel Time	10 minutes, minimum	ASTM C881 / AASHTO M 235
Tensile Strength	2500 psi, maximum at 7 Days	ASTM D638
Tensile Elongation	50% minimum at 7 Days	ASTM D638
Tensile Bond Strength to Concrete	250 psi or 100% Substrate Failure	ASTM C1583 (ACI 503r)
Water Absorption	0.5% @ 24 hours, maximum	ASTM D570
Type D Hardness	60 – 80	ASTM D2240
Thermal Compatibility	Pass	ASTM C884
Chloride Ion Permeability	<10.0 Coulombs	AASHTO T 277

*Spindle and speed selection based upon ASTM D 2556.

2.1.2 EPC Resin Binder. The EPC resin binder shall be a two-part, low modulus epoxy polymer in accordance with the following requirements:

EPC Resin Binder		
Property	**Requirement**	**Test Method**
Viscosity*	<120 Centipoise	ASTM D2196/D2556/D1084
Flash Point- Combined	>180° F	ASTM D3278
VOC Content	<10 g/L	EPA 24
Styrene Content	0%, maximum	ASTM D2369
Gel Time	10 minutes, minimum	ASTM C881 / AASHTO M 235
Tensile Strength	2500-5000 psi	ASTM D638
Tensile Elongation	30%-60%	ASTM D638
Tensile Bond Strength to Concrete	>400 psi	ASTM D4541/C1583/ACI 503R
Water Absorption	1%, maximum	ASTM D570
Type D Hardness	60 – 80	ASTM D2240
Thermal Compatibility	Pass	ASTM C884
Chloride Ion Permeability	>5 Coulombs	AASHTO T 277
Compressive Strength 3 Hours	1000 psi, minimum	ASTM C579
Compressive Strength 24 Hours	4000 psi, minimum	ASTM C579
Modulus of Elasticity 7 Days	1000-2000 psi	ASTM C469

2.2 Mixed Aggregates.

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

2.2.2 Moisture Content. Moisture content shall not be more than one half of the weighted average as determined by AASHTO T 255 at the time of mixing with the resin.

2.2.3 Aggregate Gradation.

Gradation Requirements	
Sieve Size	**Percent Passing by Weight**
1/2”	100
3/8”	98-100
No. 4	77-100
No. 8	60-82
No. 16	34-56
No. 30	5-25
No. 50	0-15
No. 100	0-7
No. 200	0-3

2.3 Surface Aggregates. Only bauxite that meets the requirements of Sec 1039.60.3 shall be used on this job.

2.3.1 All aggregates shall be furnished in appropriate packaging that is clearly labeled and protects the aggregate from any contaminants on the job site and from exposure to rain or other moisture.

2.4 Mixing and Application Requirements. Mixing and application requirements shall be performed in accordance with the manufacturer’s recommendations.

2.5 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 shall be accompanied by a Material Safety Data Sheet (MSDS).

2.6 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 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. The storage space shall keep the materials 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.

2.6.1 Inspection. Stored materials shall be inspected prior to their use and shall meet the requirements of this job special provision at the time of use.

2.6.2 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.

2.6.2.1 Damaged or debonded areas of polymer concrete wearing surface course shall be removed and repaired prior to acceptance. Repair shall consist of saw-cutting in rectangular sections to the top of the concrete deck surface and repairing using the same procedure called for in the specification. All repairs shall be at the contractor’s expense.

2.6.3 Required Amount. Sufficient material to perform the entire HPC or EPC 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.

2.7 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 materials. The installer shall be certified by the HPC or EPC system supplier.

2.8 Technical Support. The materials supplier shall have a representative onsite during the surface preparation and placement of the wearing surface. The material representative shall provide onsite consultation as Quality Control of the installation of the product, but the engineer will have final decision making authority in all matters.

3.0 Mix and Application Procedure. The contractor shall prepare and submit all applicable mixing and application procedures to the engineer for approval prior to the preconstruction meeting. The contractor shall not begin ordering materials for application of the wearing surface until the mixing and application procedures are approved. All equipment and materials used in the mixing and application procedure shall be in accordance with the manufacturer's requirements.

3.1 Trial Area. The contractor shall demonstrate their proficiency by preparing and placing the wearing surface on a 12 x 12-foot area (or approved equivalent area) prior to the placement of the production wearing surface. The trial area shall be constructed with the same material, equipment and construction methods to be used in the work and under conditions similar to those anticipated when the work will be performed. The initial set time of the HPC or EPC shall be determined from the trial. The engineer shall select the location of the trial area. Final wearing surface production shall not proceed without the approval of the engineer and the material representative.

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 polymer concrete.

4.1.1 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 on the plans. The scarification 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. Concrete deck repair shall be in accordance with Sec 704 except as modified by section 4.1.2 of this job special provision.

4.1.2 Any patches encountered shall be completely removed to sound, natural concrete. Polymer Concrete shall be used to repair the deck using the same type of polymer concrete as the wearing surface. Surfaces of concrete patches shall be prepared in the same manner as the rest of the deck. Any new Polymer Concrete patches shall be cured in accordance with section 4.6 of this job special provision.

4.1.3 Removing Contaminants. The textured or scarified deck shall be shot blasted followed by an air blast. The shot 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 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 polymer concrete shall be removed by shot 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. 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.

4.1.4 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.

4.2 Placement of Wearing surface System. The wearing surface system shall not be placed when weather or surface conditions are such that the material cannot be properly handled, placed and cured within the specified requirements of traffic control, or when rain is forecast within 24 hours of application.

4.2.1 Surface Temperature. The concrete bridge deck surface shall be a minimum of 50° F and rising and a maximum of 90° F.

4.2.2 Moisture Content. The wearing surface system shall not be placed if it has been less than 24 hours since the last rainfall.

4.2.3 Relative Humidity. The wearing surface system shall not be placed when the relative humidity is above 90 percent.

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

4.2.4.1 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.

4.2.4.2 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.

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

4.2.6 Contamination. The contractor shall prevent any cleaning chemicals from reaching the wearing surface system components during the mixing operation.

4.2.7 Wearing surface Thickness. The wearing surface shall be placed to the thickness specified on the plans.

4.3 Surface Texture.

4.3.1 Placement of Surface Aggregate.

4.3.1.1 Broadcast Aggregate Application. Dry aggregate shall be applied in such a manner as to cover the wearing surface completely within 5 minutes of application. The dry aggregate shall be placed in a manner such that the level of the wearing surface is not disturbed.

4.3.1.2 Wet spots shall be covered with the aggregate prior to the gelling of the resin binder.

4.3.1.3 After the curing period, all loose aggregate shall be removed by brooming or vacuuming. Any loose aggregate reclaimed for reuse as broadcast aggregate shall be approved by the engineer. At a minimum, the reclaimed aggregate shall be screened and verified to be clean, uncontaminated and dry. All reclaimed aggregate shall be in accordance with the requirements in section 2.0 of this job special provision.

4.3.2 Texturing with Wire Comb. The contractor may texture the surface with a wire comb as an alternate to broadcasting aggregate. The roadway surface, except within 12 inches of the inside face of the curb, shall be textured as soon as the condition of the 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.

4.4 Wearing Surface System. The wearing surface system shall not be permitted to run into drains. Unless otherwise specified, the wearing surface shall not be applied over the expansion joints and joint seals of the bridge deck. Prior to opening a section to public or construction traffic, the wearing surface shall be allowed to cure in accordance with the manufacturer’s recommendations. The contractor shall provide neat clean lines for staging, joints, obstacles or any break in production.

4.5 Testing. Bond testing shall be performed for each bridge placement per stage on each day. Testing will be conducted at three locations 24 hours after placement. Testing will be performed in accordance with ASTM C 1583. A passing test is the failure of the concrete substrate or bond strength above 250 psi. Tests shall not be performed if the deck temperature is above 90°F.

4.5.1 All adhesion strength test areas, thickness test holes or any debonded areas shall be repaired by filling with wearing surface material before final acceptance.

4.6 Curing. Traffic and construction equipment will not be permitted on the polymer concrete wearing surface for at least two hours and until the polymer wearing surface has reached a minimum compressive strength of 3,000 psi as verified by the rebound number determined in accordance with ASTM C 805.

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 area of wearing surface will be measured to the nearest square yard based on measurement longitudinally from end to end of bridge deck and transversely between roadway face of curbs, excluding the area of any expansion devices. The revision or correction will be computed and added to or deducted from the contract quantity.

6.0 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 Hybrid or Epoxy Polymer Concrete Wearing Surface.

C. DIAMOND GRINDING

1.0 Description. This work will only be performed at the discretion of the engineer and will be underrun if not required by the engineer. This work shall consist of grinding the new concrete surface to provide good riding characteristics, a surface texture and proper drainage. If the engineer determines it necessary to provide good riding characteristics, grinding shall be performed on all or part of the bridge approach slabs and sealed in accordance with Sec 703.3.8. The finished surface shall be in accordance with Sec 703.3.7 and as shown on the plans or as directed by the engineer except as modified below.

2.0 Equipment. The equipment shall be of a size that will grind a strip at least 3 feet wide using diamond blades and shall not cause spalls at cracks, joints or other locations.

3.0 Construction Requirements. The construction operation shall be scheduled and proceed in a manner that produces a uniform finished surface. Auxiliary or ramp lane grinding shall transition from the edge of the mainline as required to provide drainage and an acceptable riding surface.

3.1 Deck repair, if required, shall be completed prior to any grinding.

3.2 Grinding shall be accomplished in a manner that eliminates joint or crack faults and provides lateral drainage by maintaining a constant cross slope between grinding extremities in each lane. A maximum tolerance of 1/16 inch will be allowed for adjacent sides of joints and cracks, except that under no circumstances shall the grinding depth exceed 1/4 inch from the top of the original surface. When grinding across faulted joints, a minimum of a 20-foot transition onto the approach side slab shall be used.

3.3 The cross slope of the pavement shall be as shown on the plans and shall have no depressions or misalignment of slope greater than 1/4 inch in 12 feet when measured with a 12-foot straightedge placed perpendicular to the centerline. Areas of deviation shall be reground. Straightedge requirements will not apply across longitudinal joints or outside the ground area.

3.4 As soon as practical after grinding, the surface will be straight edged longitudinally, and all variations exceeding 1/8 inch in 10 feet will be plainly marked. Areas of deviation shall be reground.

3.5 Substantially all of the pavement surface shall be textured. Extra depth grinding to eliminate minor depressions in order to provide texturing on 100 percent of the pavement surface will not be required. No unground surface area between passes will be permitted, except as specified otherwise in the contract documents.

3.6 The grinding process shall produce a final pavement surface that is true to grade and uniform in appearance with a longitudinal line-type texture. The line-type texture shall contain parallel longitudinal corrugations that present a narrow ridge corduroy-type appearance. The peaks of the ridges shall be approximately 1/32 inch higher than the bottoms of the grooves.

The grooves shall be evenly spaced. There shall be approximately 50-55 grooves per foot, measured perpendicular to the centerline.

3.7 The contractor shall remove and dispose of all residue from the grinding in a manner and at a location to satisfy environmental regulations. The contractor shall have the engineer's approval for the method of spreading and disposal of the residue prior to beginning any grinding operations.

3.8 Solid residue shall be removed from the pavement surface before any residue is blown by traffic action or wind.

3.9 Residue shall not be permitted to encroach on open lanes.

3.10 The residue shall not enter into gutters or closed drainage systems.

3.11 The contractor may disperse residue onto unpaved shoulders, adjacent roadside embankments, or median ditch areas of divided highways where the residue runoff can percolate into the soil, unless specified otherwise in the contract. The spread rate shall not generate surface runoff. If surface runoff occurs at a grinding location, the contractor shall haul the residue to an approved location at the contractor's expense.

3.12 Discharge of any residue runoff shall not flow into adjacent rivers, streams, lakes, ponds or other open bodies of water.

3.13 Residue shall not be spread within 100 feet of any streams, lakes or other open bodies of water, or within 15 feet of a water filled ditch.

3.14 The contractor shall use appropriate equipment and methods so the discharging of the residue does not cause erosion of soil or damage to established vegetation along the roadway. The contractor shall repair and reseed any areas where the discharge of grinding residue causes damage to roadway slopes or vegetated areas at the contractor's expense.

3.15 If the solids concentration of discharged residue at any particular area is determined to be excessive by the engineer, the contractor shall provide equipment and material to flush the areas with water as directed by the engineer, at the contractor's expense.

3.16 The pavement shall be cleaned prior to opening to traffic as directed by the engineer.

4.0 Smoothness Requirements.

4.1 No diamond grinding shall be performed until the pavement has attained a strength sufficient to be opened to all types of traffic. All diamond grinding shall be completed on any section prior to opening that section to other than construction traffic, unless approved by the engineer.

4.2 The engineer will be the sole authority for determining if the driving surface is sufficiently smooth.

4.3 The engineer will evaluate the smoothness of the concrete wearing surface after the concrete has cured and direct the contractor to diamond grind where deemed necessary.

4.4 After initial diamond grinding operations, if any, the engineer will again evaluate the smoothness of the concrete wearing surface and approach slab, repeating as many times as necessary to achieve the desired surface smoothness.

4.5 Any deficiencies in the final surface due to improper contractor operations or equipment shall be corrected by the contractor at the contractor's expense.

4.6 All areas shall be tested with a 10-foot straightedge in accordance with section 3.4 of this job special provision.

5.0 Method of Measurement. Measurement for diamond grinding will be made to the nearest square yard. Measurement will be based upon the area of initial diamond grinding completed as directed by the engineer. Subsequent passes of diamond grinding over a previously ground area will not be measured. No deduction will be made for gaps to avoid striping or raised pavement markers. No additional measurement will be made for diamond grinding bridge approach slabs.

6.0 Basis of Payment. Payment for diamond grinding will be paid for at the contract unit price per square yard. Payment for diamond grinding will be considered full compensation for all labor, equipment, material, and incidentals to complete this work, including hauling and disposal of grinding residue and cleaning the pavement prior to opening to traffic.

D. 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. 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.

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.

E. RAPID SET CONCRETE PATCHING MATERIAL – HORIZONTAL REPAIRS

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

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

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

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

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

2.4 Qualification and Project Acceptance.

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

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

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

(a) Brand name of the product.

(b) Certification that the material meets this specification.

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

(d) Specific mixing, handling and curing instructions.

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

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

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

(a) New Products Evaluation Form

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

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

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

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

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

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

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

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

3.1 Commercial Mixtures. Rapid set concrete patching material in its sacked form and mixtures when properly prepared in accordance with the manufacturer's specifications, shall meet the

minimum test requirements given in Table 1. Mixtures may be supplied, as required, as a patching mortar or as a patching mortar with aggregate extension. If the material is to be supplied with extender aggregate, this shall also pass the required tests in Table 1 using the maximum allowed amount of extender aggregate.

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

Table 1
(English Unit)

Physical Test Property	Specification	Requirement for cementitious concrete	Requirement for polymer-modified concrete	Requirement for polymer concrete
Bond Strength by Slant Shear[1]	ASTM C882/C928 [3]	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days	n/a	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days
Linear Coefficient of Thermal Expansion[1, 2] (for bagged mortar only, without extension aggregate)	ASTM C531	n/a	n/a	4 – 8 X 10-6 in/in/deg F
Resistance to Rapid Freezing & Thawing[1]	AASHTO T161 or ASTM C666	80% min. using Procedure B[5] (300 Cycles)	80% min. using Procedure B[5] (300 Cycles)	n/a
Compressive Strength[1]	AASHTO T22 or ASTM C39	3200 psi @ 3 hr & 4000 psi @ 7 days	3200 psi @ 3 hr & 4000 psi @ 7 days	n/a
Rapid Chloride Permeability[1]	AASHTO T277 or ASTM C1202	Bridge Decks 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days	Bridge Deck 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days	Bridge Deck 1000 coulombs @ 28 days Roadway 2000 coulombs @ 28 days
Length Change[1, 4]	AASHTO T 160 or ASTM C157	In water Storage (+0.15) In air storage (-0.15)	In water storage (+0.15) In air storage (-0.15)	n/a
Color		gray	gray	gray

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

[5] Procedure A may be used in lieu of Procedure B

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

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

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

4.0 Construction Requirements.

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

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

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

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

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

F. <u>RAPID SET CONCRETE PATCHING MATERIAL – VERTICAL AND OVERHEAD REPAIRS</u>

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:

(a) 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.

(b) 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.

G. BARRIER REPAIR (FORMED)

1.0 Description. This work shall consist of repairing all areas of damaged or deteriorated barrier curb, particularly where reinforcement is exposed.

2.0 Construction Requirements.

2.1 Repairs shall be made with qualified special mortar.

2.2 Removal, surface preparation, placement, and curing shall be in accordance with Sec 704 for Superstructure Repair (Unformed).

3.0 Method of Measurement. Measurement for barrier curb repair will be made per linear foot along gutter line.

4.0 Basis of Payment. Payment for barrier repair 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 Barrier Repair (Formed).

H. DEFLECTION AND HAUNCHING

1.0 Description. The contractor shall determine haunching based on field measurements, existing bridge plans and/or adjusted dead load deflections based on the difference between the new and existing dead load weights. A spreadsheet showing adjusted girder or beam deflections

due to the weight of the new deck and barriers is included in the contract in the bridge electronic deliverables zip file.

2.0 Construction Requirements. In order to properly form the haunches for the new deck, the contractor shall survey top of deck elevations above each girder or beam including centerline of roadway and along each girder or beam line (top or bottom flange) prior to deck removal followed by surveying elevations of the girders or beams (top or bottom flange) after deck removal.

3.0 Method of Measurement. No measurement will be made.

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

I. SHOTCRETE CONCRETE REPAIR

1.0 Description. This work shall consist of repairing concrete elements or components of the bridge with shotcrete. Repairs 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 repairs, barrier curb repairs, unformed substructure and unformed superstructure repairs. Additionally, shotcrete may be used at the Contractor's option for formed repairs, subject to approval of the Engineer. The work includes deteriorated concrete removal, preparing the repair surface and application of shotcrete to the repair locations.

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), Barrier Curb Repair 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.

J. RESET BEARINGS

1.0 Description. This work shall consist of raising and supporting the existing stringers as required to reset the bearing assembly at Int. Bent No. 3 (bridge A10722) to a vertical alignment at 60 degree F, inspect, clean, lubricate and coat existing bearings prior to being reset, and as directed by the engineer.

2.0 Construction Requirements.

2.1 Raising and Supporting the Superstructure. With the deck removed, the contractor shall exercise caution when supporting the structural steel and shall raise the stringers the minimum extent necessary to perform this work. Raising the stringers at the location of reset bearings shall be done in a manner to prevent any damage to the adjoining steel. The lifting operation shall be done only when authorized, but such authorization shall not relieve the contractor of responsibility for the safety of the operation or for damage to the structure. Any damage caused by the contractor's operations shall be repaired at the contractor's expense as approved by the engineer.

2.2 Bearing Inspection and Repair. After the structural members are supported, each bearing shall be inspected for deterioration. Any or all portions of the deteriorated bearings shall be replaced as determined by the engineer. When required to remove a bearing, removal of the bearing shall cause no damage to the existing anchor bolts in the concrete beam. Prior to removal or disassembly, all bearings shall be match marked for reassembly at ends of each piece by stamping an identification number in the metal with a steel stencil. All existing bearing material determined to be replaced shall be disposed of by the contractor in accordance with Sec 202.

2.3 Cleaning, Lubricating and Coating. Bearings shall be cleaned according to the manufacturer's recommendation and with a minimum of SSPC-SP-3 surface preparation. After cleaning and just prior to resetting the bearings, contact surfaces between the bearing pin and cradle shall be given a heavy coat of graphite and oil. After bearings are reset, the bearings shall receive a final cleaning and a prime coat of Gray Epoxy-Mastic Primer (non-aluminum) in accordance with Sec 1081. The final coat will be applied when the existing structural steel is coated in a future painting contract.

3.0 Method of Measurement. Measurement for the above described work on existing bearings will be made per each.

4.0 Basis of Payment. When required, payment for furnishing any new bearing material will be in accordance with Sec 109. 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 Reset Bearing.

K. STRENGTHENING EXISTING BEAMS

1.0 Description. This work shall consist of strengthening existing beams as shown on the plans after the deck has been removed.

2.0 Materials. No shop drawings will be required.

3.0 Construction Requirements. Structural steel construction shall be in accordance with Sec 712. Prior to installation of the new structural steel, the existing steel shall be carefully inspected for irregularities. Any irregularities shall be brought to the attention of the engineer.

3.1 Traffic. Traffic shall be shifted away from the beam being welded. A reduced speed limit as shown in the traffic control plans shall be applied during the welding process to reduce impact vibrations.

3.2 Contact Surfaces. The surface of the existing flanges that will come in contact with the new steel plates shall be cleaned to a SSPC-SP2 degree of cleanliness. The surfaces of new steel shall be cleaned to SSPC-SP6 degree of cleanliness. The existing and new plates contact surfaces shall be coated with one coat of gray epoxy-mastic primer (non-aluminum) in accordance with Sec 1081.

3.3 Welding Requirements. The areas to be welded shall be cleaned to an SSPC-SP11 degree of cleanliness. All welding shall be performed by a certified welder in accordance with Sec 712. All welding shall be in accordance with Sec 712. E7018 welding electrode or self-shielded welding process from the MoDOT approved electrode list shall be used.

3.4 System G (Gray). The new installed steel, any surrounding touch up areas and any existing paint damaged by the repair work shall be cleaned and coated with one coat of gray epoxy-mastic primer (non-aluminum) in accordance with Sec 1081. The new steel shall be recoated with System G in accordance with Sec 1081 when overcoating the existing structural steel as noted on the plans.

4.0 Method of Measurement. No measurement will be made.

5.0 Basis of Payment. Payment for the above described work, including all material, equipment, labor and any other incidental work needed to complete this item, will be considered completely covered by the contract lump sum price for Strengthening Existing Beams.

L. AESTHETIC CONCRETE STAIN

1.0 Description. This work shall consist applying aesthetic concrete stain to Bridge A10722 in accordance with Sec 703.3.13 and within the limits described in section 2.0 of this special provision.

2.0 Concrete Stain. The concrete stain shall be applied to all exposed vertical faces of all existing bents and to the bottom of the existing intermediate bent cap beams.

2.1 The color of the stain shall be opaque gray, matching Sherwin Williams exterior satin latex paint, color “7066 Gray Matters”. The concrete stain manufacturer shall submit a sample to the engineer for approval and provide documentation stating that the color of the stain will not be altered or deteriorated.

3.0 Method of Measurement. No measurement will be made.

4.0 Basis of Payment. Payment for all work associated with the concrete stain, including all material, material property verifications, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the lump sum price for Aesthetic Concrete Stain.

M. TEMPORARY SHORING

1.0 Description. This work shall consist of installing temporary shoring as required in accordance with Sec 206, the bridge plans and this special provision to retain the approach fill at end bents (existing and new) during stage construction. The limits of the temporary shoring shall extend from the bridge ends a length needed to stabilize the approach fill during stage construction.

2.0 Construction Requirements. The responsibility for the design and construction of the temporary shoring shall rest solely with the contractor. The design and plans for the temporary shoring shall be signed and sealed by a Registered Professional Engineer registered in the State of Missouri. The design shall ensure that the temporary shoring is braced or substantially secured to prevent soil movement during stage construction of the new bridge. When no longer needed, the temporary shoring shall be removed and becomes the property of the contractor.

3.0 Method of Measurement. No measurement will be made.

4.0 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 Temporary Shoring.