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	<p><b>MISSOURI HIGHWAYS AND                  TRANSPORTATION COMMISSION</b>                  105 W. CAPITOL AVE.                  JEFFERSON CITY, MO 65101                  Phone (888) 275-6636</p>
	<p>JOB NO. J4i3012                  Jackson County, MO                  Date Prepared: 12/24/2012</p>
Date:	

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A. CONSTRUCTION REQUIREMENTS

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

**2.0 Construction Requirements.** Plans 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** 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 repairing concrete deck (half-soling), 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.

**2.3** Provisions shall be made to prevent any debris and materials from falling onto the roadway. Any debris and materials that falls below the bridge outside the limits mentioned previously and if determined necessary by the engineer, the debris 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.

**2.4** 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.

**2.5** 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.

**2.6** SSPC-SP2 and SSPC-SP-3 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-SP-11 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 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.

- (a) MoDOT - Design Division - Environmental Section  
PO Box 270  
105 W Capitol Ave, Jefferson City, MO 65102  
Telephone (573) 526-4778

**3.2 Approved Smelters and Hazardous Waste Treatment, Storage and Disposal Facilities.** The following are the approved smelters and hazardous waste treatment, storage and disposal facilities:

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- (a) Doe Run Company-Resource Recycling Division-Buick Facility  
 Highway KK  
 Boss, MO 65440  
 Telephone 573-626-4813
  
- (b) Doe Run Company-Herculaneum Smelter  
 881 Main Street  
 Herculaneum, MO 63048  
 Telephone 314-993-3164

**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. POLYESTER POLYMER CONCRETE OVERLAY**

**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.

**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:

<b>High Molecular Weight Methacrylate (HMWM) Resin</b>		
<b>Property</b>	<b>Requirement</b>	<b>Test Method</b>
Viscosity *	0.025 Pa-s, maximum (Brookfield RVT with UL adapter, 50 RPM at 77deg. F)	ASTM D 2196
Specific Gravity *	0.90, minimum (at 77 deg. F)	ASTM D 1475
Volatile Content *	30 percent, maximum	ASTM D 2369
Flash Point *	180 deg. F, minimum	ASTM D 3278
Vapor Pressure *	1.0 mm Hg, maximum (at 77 deg. F)	ASTM D 323
Tack Free Time	400 minutes, maximum (at 77 deg. F)	ASTMC 679
PCC Saturated Surface-Dry Bond Strength	500 psi, minimum (24 hrs at 70 +/- 1 deg. F)	California Test 551

\*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.

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**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 deg. F and 100 deg. F at the time of mixing.

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

<b>Combined Aggregate</b>		
<b>Sieve Size</b>	<b>1/2" Max. Percent Passing</b>	<b>3/8" Max. Percent Passing</b>
1/2"	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:

<b>Polyester Resin Binder</b>		
<b>Property</b>	<b>Requirement</b>	<b>Test Method</b>
Viscosity *	0.075 to 0.200 Pa-s	ASTM D 2196

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	(RVT, No. 1 Spindle, 20 RPM at 77 deg. F)	
Specific Gravity *	1.05 to 1.10 (at 77 deg. F)	ASTM D 1475
Elongation	35 percent, minimum (Type I at 0.45"/min. Thickness = ¼ " +/- 0.04")	ASTM D 638
	Sampling Condition: 18 hrs/77 deg. F/50% + 5 hrs/158 deg. F	ASTM D 618
Tensile Strength	2,500 psi, minimum (Type I at 0.45"/min. Thickness = ¼ " +/- 0.04")	ASTM D 638
	Sampling Condition: 18 hrs/77 deg. F/50% + 5 hrs/158 deg. F	ASTM D 618
Styrene Content *	40 to 50 percent (by weight)	ASTM D 2369
Silane Coupler	1.0 percent, minimum (by weight of polyester-styrene resin)	
PCC Saturated Surface-Dry Bond Strength	500 psi, minimum (24 hrs at 70 +/- 1 deg. F)	California Test 551

\*Tested prior to adding initiator

**2.3.1 Silane Coupler.** The silane coupler shall be an organosilane 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 deg. F. A blend of initiators may be used as approved by the engineer when the surrounding concrete temperature is 50 – 60 deg. 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.

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**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 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. The surface shall be scarified to an approximate depth of ¼ inch. The scarifier shall not produce a polish or slick surface. Any epoxy patches encountered shall be completely removed to sound, natural concrete. Polyester polymer concrete or other patching material, approved by the engineer, may be used to repair the deck. Surfaces of concrete patches placed in the deck after scarifying shall be textured to an approximate depth of ¼ inch before placing the overlay.

**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 placing the polyester polymer concrete. The exposed concrete surface shall meet the requirements contained in Sec 4.1.2 of this specification.

**4.1.4 Removing Contaminates.** The textured or scarified deck shall be sand blasted followed by an air blast. The sand 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.

**4.1.5 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 had no exposure to any moisture within the past 24 hours. Prior to applying the prime coat, the surface shall be cleaned with compressed air to remove accumulated dust and any other loose material.

**5.1 Surface Temperature.** The concrete bridge deck surface shall be between 50 deg. F and 100 deg. 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.

**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.

**6.7 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  $\frac{3}{4}$  inch.

**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 two 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.

**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. Testing will be performed in accordance to ACI 506R. A passing test is the failure of the concrete substrate or bond strength above 250 psi.

**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. Where required, the area of polyester polymer concrete will be measured to the nearest 1.0 square yards of accepted, in-place polyester polymer concrete. The revision or correction will be computed and added to or deducted from the contract quantity.

**11.0 Basis of Payment.** The contract unit price for polyester polymer concrete will be full compensation for all materials and other items entering into the construction of the polyester polymer concrete. The accepted quantity of polyester polymer concrete will be paid for at the contract unit price.



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C. CLASS 2 PENETRATING CONCRETE SEALER

**1.0 Description.** This work shall consist of preparing and treating the concrete bridge deck, approach slabs, roadway face and top of barrier curb surfaces with a class 2 penetrating concrete sealer meeting this specification. This type of sealer shall be used in lieu of the normal surface sealing for concrete in accordance with Sec 703.

**2.0 Materials.** The sealer shall meet the requirements of this job special provision. The sealer selected by the contractor shall be submitted to the engineer for approval two weeks before application and shall be listed on MoDOT's Pre-Qualified Product List. If the contractor chooses to submit a new product for MoDOT's Pre-Qualified Product List, the product shall be submitted to the engineer 30 days prior to application. Either submittal shall include certified test data from an independent test laboratory and the concrete mix design and curing procedure on the test specimens in which sealer was tested.

**2.1** The sealer shall be a solvent-free 100% solids isobutyltrialkoxysilane, with low oligomer and polymer compound content. The chemical composition shall meet the following requirements:

Property	Specification
Purity	98% minimum monomer by weight
Solvent	Less than 0.1% by weight
Siloxan or polymer Residue	Less than 0.1% by weight
Chloride Ion Content	Less than 40 PPM
Density	ASTM D2111: 7.2 to 7.4 pounds per gallon
Flash Point	ASTM D93: greater than 145 degrees F
Dry Time	ASTM D7539: less than one hour

**2.2** The sealer shall meet the following performance criteria based on a single application at the manufacturer's recommended application rate. All test specimens shall be produced using MoDOT Class B-2 concrete in accordance with Section 501.

Test	Test Method	Duration	Max Absorption / Cl <sup>-</sup>
Water Immersion	ASTM C 642	48 hours	0.5 percent by weight (mass)
Water Immersion	ASTM C 642	50 days	1.5 percent by weight (mass)
Salt Water Ponding (based on non-abraded specimen)	AASHTO T 259	90 days	0.50 lbs/cu yd (0.30 kg/m <sup>3</sup> ) Cl <sup>-</sup> Depth: (1/2 to 1") (13 to 25 mm)

**2.2.1 Absorption.** The absorption of the treated concrete under total immersion shall not exceed 0.5 percent after 48 hours or 1.5 percent after 50 days per ASTM C 642 as modified below for non-air entrained concrete.

**2.2.1.1** In addition to ASTM C 642 section 4.1, one 4-inch (10 cm) diameter by 4 inch (10 cm) long core shall be retrieved from the surface of a concrete test specimen to which sealer has been applied. No coring are to be taken from the bridge deck. The core shall be oven dried as designated by ASTM C 642 section 5.1. The core shall be sealed with a rapid setting two part epoxy on the sides and bottom. The epoxy shall overlap the top edge of the core 1/8" (3mm). The core shall be weighed to determine the oven dry weight (mass) of the core and coating. The weight (mass) shall be designated as "A".

**2.2.1.2** The core, processed in accordance with section 2.2.1.1 of this job special provision, shall be immersed in a suitable receptacle and covered with tap water. The procedure as

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designated by ASTM C 642 section 5.2 shall be followed to determine the soaked surface dry weight (mass) of the core and coating. This weight (mass) shall be designated as "B".

**2.2.1.3** The percent moisture absorption of the core shall be determined by ASTM C 642 section 6.1, equation (1). ASTM C 642 sections 5.3, 5.4, 6.1 and equations (2) through (7) shall not apply.

**2.2.2 Salt water ponding.** After 90 days ponding of 3 percent NaCl solution per ASSHTO T 259, the chloride ion content of the concrete shall not exceed 0.5 pounds per cubic yard (0.30 kg/m<sup>3</sup>) at ½ to 1 inch (13 to 25 mm) depth.

**2.3** The sealer shall not permanently stain, discolor or darken the concrete. Application of the sealer shall not alter the surface texture or form a coating on the concrete surfaces. Treated concrete shall be surface dry within 60 minutes after application.

**2.4** The sealer shall be tinted with a fugitive dye to enable the coating to be visible on the treated concrete surface for at least 4 hours after application. The fugitive dye shall not be conspicuous more than 7 days after application when exposed to direct sunlight.

**2.5** The sealer shall be delivered to the project in unopened containers with the manufacturer's label identifying the product and with the seal(s) intact. Each container shall be clearly marked by the manufacturer with the following information:

- Manufacturer's name and address.
- Product name.
- Date of manufacture and expiration date.
- Lot identification.
- Storage requirements.

**3.0 Construction Requirements.**

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

**3.2 Cleaning and Surface Preparation.** Surfaces which are to be treated shall meet the approved product's requirements for surface condition. Sealing shall not be done until all concrete construction or repair has been completed and cured to the requirements of the manufacturer. A minimum of a 7 day wet cure and 5 day drying period are required. The contractor shall furnish the engineer with written instructions for the surface preparation requirements and a representative of the manufacturer shall be present to assure that the surface conditions meet the manufacturer's requirements.

**3.2.1** Sealing shall be done after the bridge deck has been textured.

**3.2.2** At a minimum, the surface shall be thoroughly cleaned to remove dust, dirt, oil, wax, curing components, 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.

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**3.2.3** 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.

**3.3 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. In the latter case, the applicator shall use at least ½ gallon (1.9 liter) of treatment following the manufacturer's recommended method of application for the total of the test surfaces. Horizontal test surfaces shall be located on the deck and on the curb or sidewalk, and vertical test surfaces shall be located on a parapet or safety barrier curb so that the different textures are displayed.

**3.4 Application.** The sealer shall be applied by thoroughly saturating the concrete surfaces at an application rate of 175 square feet per gallon or the rate designated on the plans.

**3.4.1** The concrete surface temperature shall be above 35°F (2°C).

**3.4.2** Allow concrete to dry a minimum of 48 hours after any measurable precipitation.

**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 the sealer, the contractor shall protect adjoining surfaces of the structure that are not to be sealed by masking off or by other means. Sealer shall not leave residue on glass, painted metal or automobiles. The contractor shall also make provision to protect the public when sealing 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 product and material safety data sheet.

**3.6 Opening to Traffic.** Traffic shall be allowed on a deck only after a treated area is visibly dry. Dried coating shall not leave residue on glass, painted metal or automobiles.

**4.0 Method of Measurement.** No direct measurement will be made.

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

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D. CLEANING AND COATING EXISTING BEARINGS

**1.0 Description.** This work shall consist of clean and coat existing bearings as specified on the plans and as directed by the engineer.

**2.0 Construction Requirements.**

**2.1 Cleaning and Coating.** Bearings shall be cleaned and coated in accordance [Sec 1081](#). Coating of bearings shall be as indicated for coating existing steel as specified in the contract documents.

**3.0 Method of Measurement.** Measurement for cleaning and coating existing bearings will be made per each.

**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 unit price for "Cleaning and Coating Existing Bearings".

E. 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:

- (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.

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

<b>Table 1 (English Unit)</b>				
<b>Physical Test Property</b>	<b>Specification</b>	<b>Requirement for cementitious concrete</b>	<b>Requirement for polymer-modified concrete</b>	<b>Requirement for polymer concrete</b>
Bond Strength by Slant Shear	ASTM C882/C928 <sup>2</sup>	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 <sup>1</sup> (for bagged mortar only, without extension aggregate)	ASTM C531	n/a	n/a	4 – 8 X 10 <sup>-6</sup> in/in/deg F
Resistance to Rapid Freezing & Thawing	AASHTO T161 or ASTM C666	80% min. using Procedure B <sup>3</sup> (300 Cycles)	80% min. using Procedure B <sup>3</sup> (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

<sup>1</sup> Not required for extended mixtures if the mortar passes this requirement.

<sup>2</sup> ASTM C882 shall be performed on non-water based materials. ASTM C928 shall be performed on water-based materials.

<sup>3</sup> 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.

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**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.

**F. 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

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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:

- (c) New Products Evaluation Form
- (d) Certified test results from an independent laboratory showing compliance with this special provision.



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- (e) 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.
- (f) 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.

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<b>Table 1 (English Unit)</b>				
<b>Physical Test Property</b>	<b>Specification</b>	<b>Requirement for cementitious concrete</b>	<b>Requirement for polymer-modified concrete</b>	<b>Requirement for polymer concrete</b>
Bond Strength by Slant Shear <sup>1</sup>	ASTM C882/C928 <sup>3</sup>	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 <sup>1,2</sup> (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 <sup>1</sup>	AASHTO T161 or ASTM C666	80% min. using Procedure B <sup>5</sup> (300 Cycles)	80% min. using Procedure B <sup>5</sup> (300 Cycles)	n/a
Compressive Strength <sup>1</sup>	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 <sup>1</sup>	AASHTO T277 or ASTM C1202	<u>Bridge Decks</u> 1000 coulombs @ 28 days <u>Roadway</u> 2000 coulombs @ 28 days	<u>Bridge Deck</u> 1000 coulombs @ 28 days <u>Roadway</u> 2000 coulombs @ 28 days	<u>Bridge Deck</u> 1000 coulombs @ 28 days <u>Roadway</u> 2000 coulombs @ 28 days
Length Change <sup>1,4</sup>	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

<sup>1</sup>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.

<sup>2</sup>Not required for extended mixtures if the mortar passes this requirement.

<sup>3</sup> ASTM C882 shall be performed on non-water based materials. ASTM C928 shall be performed on water-based materials.

<sup>4</sup> As modified by ASTM C928.

<sup>5</sup> 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

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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.

G. CLEAN AND EPOXY SEAL – BR. NO. A14962

**1.0 Description.** In order to protect the bridge superstructure concrete from deicing chemicals and other contaminants, loose and delaminated concrete shall be removed and an epoxy seal shall be applied to the concrete at the bottom of slab below the longitudinal construction joints in accordance with the bridge plans and this job special provision.

**2.0 Construction Requirements.** All loose and delaminated concrete in the areas as required by this job special provision shall be removed in the cleaning process with hand tools. Hand tools may include chipping chisels, wire brushes, dust brushes, etc. After the loose and delaminated concrete has been removed to the satisfaction of the engineer, the epoxy sealing preparation and applying the epoxy to these areas shall be in accordance with [Sec 704](#). The areas to be cleaned and epoxy sealed shall be as shown on the bridge plans.

**3.0 Method of Measurement.** The area to be cleaned and epoxy sealed will be computed to the nearest square foot (0.1 m<sup>2</sup>). Final measurement will not be made except for authorized changes during construction or if appreciable errors are found in the contract quantity.

**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 based

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on the contract plan quantities and will be considered completely covered by the contract unit price for "Clean and Epoxy Seal". Any change in the contract plan quantities, based on approved change orders, will be paid for at the contract unit price.

H. REMOVAL OF EXISTING CATHODIC PROTECTION SYSTEM

**1.0 Description.** This work shall consist of disengaging the power to the cathodic protection system during rehabilitation. The removal of the cathodic protection system shall include all of the cathodic protection system except as shown on the plans and noted herein.

**2.0 Removal Requirements.**

**2.1** The existing cathodic protection system shall be turned off as directed by the engineer prior to beginning work. The existing cathodic protection system shall not be reused. All insulated wiring associated with the removal of the cathodic protection system shall be disposed by the contractor and as approved by the engineer.

**2.2** With the cathodic protection system wiring through the slab removed, the existing access holes in the slab shall be plugged with grout or special mortar.

**2.3** After removal of existing concrete wearing surface plus 1/2 in. of the existing deck, any remaining existing cathodic protection system in the longitudinal slots in the top of the deck shall be removed. Component parts of the cathodic protection system (Reference Cells, Rebar Probes, etc.) that are embedded in B-1 concrete and are in the same horizontal plane as the top mat of slab reinforcing steel shall be left-in-place.

**2.4** The cathodic protection system in the top of the sidewalks shall be left-in-place except in areas of sidewalk concrete repairs.

**2.5** If during removal of the cathodic protection system, the existing concrete deck is damaged and not covered by new concrete, the areas on the deck shall be repaired with Class B-1 concrete in accordance with [Sec 704](#). If the concrete is damaged at other locations, the repair areas shall be made with a qualified special mortar. The qualified special mortar shall be in accordance with [Sec 704](#).

**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 "Removal of Existing Cathodic Protection System".

I. SURFACE SEALING LOW SLUMP CONCRETE

**1.0 Description.** This provision allows surface sealing low slump concrete to be applied as last order of work.

**2.0 Construction Requirements.** The surface of the low slump concrete shall be surface sealed in accordance with [Sec 703.3.8](#) except that lanes may be opened to traffic after the low slump concrete has properly cured in accordance with [Sec 505](#) and the sealant applied as a last

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order of work. Any lanes open to traffic prior to surface sealing shall have foreign materials removed. Surfaces that are sealed after each stage of construction shall have all vertical construction joints between stages protected from the surface sealant. If asphalt roadway surface is adjacent to the new low slump concrete, the asphalt surface shall be protected from spillage of the sealant.

**3.0 Method of Measurement.** No measurement will be made.

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