

**KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, 2007 EDITION**

Add a new SECTION to DIVISION 700:

REPAIR OF EXISTING POLYMER CONCRETE BRIDGE DECK OVERLAY

1.0 DESCRIPTION

Repair the existing polymer concrete overlay surface.

Provide an overall combination of labor and equipment with the capability of preparing the surface, proportioning and mixing the polymer components, and placing the polymer material and aggregate in accordance with this specification and the manufacturer/supplier's recommendations.

When specified, construct a single coat polymer concrete overlay according to this specification.

BID ITEMS

Polymer Concrete Overlay Repair
Single-Layer Polymer Concrete Overlay

UNITS

Square Yard
Square Yard

2.0 MATERIALS

a. Polymer.

(1) Provide material that is compatible with the existing polymer concrete overlay material and polymer concrete patch material.

(2) Proportion all polymer materials according to the manufacturer/supplier's recommendations.

(3) Provide the Engineer with a copy of the polymer materials manufacturer/supplier's mixing and application recommendations.

b. Epoxy. Provide a Type III epoxy resin as defined in **special provision 07-17010 (latest revision)**.

c. Polyester. Provide a Polyester resin as defined in **special provision 07-17010 (latest revision)**.

d. Methyl Methacrylate. Provide a Methyl Methacrylate resin as defined in **special provision 07-17010 (latest revision)**.

e. Aggregate.

(1) Provide FA-C aggregate meeting requirements of **TABLES 1102-3 and 1102-4, special provision 07-11009 (latest revision)**, or.

(2) As provided by the Polymer Concrete Overlay supplier in a prequalified system, **special provision 07-17010 (latest revision)**.

(3) Provide MA-1 or MA-2 aggregate meeting **TABLE 1102-6, special provision 07-11009 (latest revision)**.

(4) Provide clean dry silica broadcast sand meeting a commercial blast sand 20/40 gradation.

(5) The use of Broadcast Aggregate and/or Broadcast Sand is determined by the type of polymer system used and the overlay manufacturer/supplier.

3.0 CONSTRUCTION REQUIREMENTS

a. General. Portland cement concrete patches require a minimum cure period of 28 days before application of the polymer concrete overlay. At the preconstruction conference, discuss the patching material and the corresponding curing period. Submit changes, including a written statement from the polymer manufacturer/supplier recommending changes, to the Engineer for approval.

b. Equipment. Equipment is subject to approval of the Engineer and must comply with these requirements:

(1) Surface Preparation Equipment.

- (a) Shot-blasting equipment capable of removing all contaminants from the existing polymer overlay without damaging the overlay surface.
- (b) Shot/Sand blast equipment capable of removing all contaminants from the repair patches, existing polymer overlay adjacent to bridge rails and barriers and areas not accessible with shot blast equipment.
- (c) Empty shot blasters and dispose of waste material a minimum of 50 feet from the prepared bridge deck, on long structures empty shot blasters on the unprepared surface a minimum of 50 feet from prepared surface to prevent contamination of the deck by return of dust to the prepared surface.
- (d) The Engineer must approve the use of scarifiers, scrubbers, or milling machines.
- (e) Wet sand blasting is prohibited.
- (f) Do not use hydro-demolition to remove polymer concrete overlay or unsound portland cement concrete.
- (g) Do not use jack hammers or chipping hammers heavier than the nominal 15 pound class for removal of the polymer overlay.

(2) Mechanical Application Equipment.

- (a) Polymer mixing and distribution system capable of accurate and complete mixing of the polymer resin and hardening agent, metered verification of the mix ratio and uniform and accurate distribution of the polymer materials at the specified rate on 100% of the work area.
- (b) A self-propelled aggregate spreader (if required) capable of uniform and accurate application of the dry aggregate over 100 % of the work area.
- (c) An air compressor capable of producing a sufficient amount of oil free and moisture free compressed air to remove all dust and loose material.
- (d) Adequate additional hand tools to facilitate the placement of the polymer concrete overlay in accordance with this specification and the manufacturer/supplier's recommendations.

(3) Hand Application Equipment.

- (a) Calibrated containers for accurate measurement of the polymer components.
- (b) Paddle type mixer or other mixing device capable of accurate and complete mixing of the polymer resin and hardening agent.
- (c) Notched squeegees and brooms capable of spreading the polymer material in accordance with this specification and the manufacturer/supplier's recommendations.
- (d) Aggregate spreader capable of uniform and accurate application of the dry aggregate.
- (e) Adequate additional hand tools to facilitate the placement of the polymer concrete overlay in accordance with this specification and the manufacturer/supplier's recommendations.

c. Preparation For Polymer Concrete Overlay Repair.

(1) When specified, repair unsound bridge deck concrete according to **SECTION 731** and cure repairs prior to performing the polymer concrete overlay repair.

(2) Protect metal deck drains and areas of the curb or railing above the proposed surface from the shot blast.

(3) Close deck drains so the overlay materials will not pass through the drains.

(4) Remove asphalt material and unsound, damaged or delaminated polymer concrete overlay as shown in the Contract Documents and as designated by the Engineer.

(5) Saw cut existing polymer concrete overlay to a depth $\frac{1}{4}$ to $\frac{1}{2}$ inch below the polymer concrete overlay and Portland cement concrete bridge deck interface. Dispose of removed material on sites approved by the Engineer.

(6) Removal area should extend a minimum of 6 inches beyond the edges of the unsound, damaged or delaminated polymer concrete overlay or 6 inches beyond patching of the concrete bridge deck.

(7) Shot blast/sand blast or bush hammer portland cement concrete patch surfaces to produce an acceptable surface for placement of the polymer concrete overlay patch. Produce a surface relief equal to the International Concrete Repair Institute (ICRI) Surface Preparation Level 6 to 7 or ASTM E 965 Pavement Macrotexture Depth of 0.04 to 0.08 inch.

(8) As the final preparation for the placement of the polymer concrete overlay patches, make a complete cleanup by shot blasting and/or other approved means, followed by an air blast with dry, oil free air or vacuum. Brooming is not acceptable. Remove all loose disintegrated concrete, dirt, paint, oil, asphalt, laitance carbonation, curing materials and other foreign material from portland cement concrete patches and the surface of the existing polymer bridge deck overlay.

(9) Place the polymer concrete materials within 24 hours of preparing the surface. Prepared surfaces exposed for more than 24 hours must be lightly sand blasted prior to application of the polymer concrete overlay material.

d. Placing Polymer Concrete Overlay Patches.

(1) Visible moisture on the prepared surface at the time of placing the polymer concrete overlay is unacceptable. Identify moisture in the surface by taping a plastic sheet to the deck for a minimum of 2 hours (ASTM D 4263).

(2) Place the polymer concrete patches in the same manner as the single-layer polymer concrete overlay, according to **subsection 3.0e**.

(3) When an overlay is specified, the polymer concrete overlay patches may be placed when the overlay is placed using polymer overlay material per manufacturer/supplier recommendations.

(4) Rain will not necessarily contaminate the surface. However, take care so no contamination occurs. Traffic adjacent to the prepared surface during a rain will contaminate the surface.

e. Placing the Single-Layer Polymer Concrete Overlay. Place the overlay according to the grades, thickness and cross-sections shown in the Contract Documents. Provide a technical representative of the polymer manufacturer/supplier on the job site during the placement of the overlay at no additional cost. The representative is to provide technical expertise to the Contractor and the Engineer regarding safe handling, placement and curing of the overlay.

(1) Lightly sandblast the existing polymer overlay to remove all contaminants. Do not over blast and damage polymer concrete patches or the existing overlay.

(2) As the final preparation for the placement of the polymer concrete overlay, make a complete cleanup by an air blast with dry, oil free air or vacuum. Brooming is not acceptable. Remove all loose disintegrated concrete, dirt, paint, oil, asphalt, laitance carbonation, curing materials from portland cement concrete patches and other foreign material from the surface of the existing polymer bridge deck overlay.

(3) Follow all manufacturer/supplier suggested safety precautions while mixing and handling polymer components.

(4) Some overlay systems require the placement of a polymer primer coat and/or a polymer seal top coat, with or without broadcast sand or aggregate. In the following requirements, the polymer primer coat and polymer seal top coat will be referenced with the understanding they are system specific. Apply primer, when needed, at the rate prescribed by the manufacturer/supplier. Place the prepared primer uniformly on the existing polymer concrete overlay with roller, brush, airless spray or mechanical application equipment.

(5) Place the polymer concrete overlay at the application rates shown in **TABLE 1**.

TABLE 1: POLYMER CONCRETE OVERLAY APPLICATION RATES	
Polymer Rate	Aggregate Rate *
Not Less Than 0.45 gal./sq yd	14.5 lbs./sq yd

*Apply enough aggregate to completely cover the polymer.

(6) For slurry polymer concrete, place the material with a minimum thickness of 0.25 inches.

(7) Use notched squeegees, gage rakes or mechanical application equipment to place the prepared polymer on the existing polymer overlay immediately and uniformly at the prescribed rate.

(8) If mechanical application equipment is used, take 2 ounce samples for each 100 gallons of resin placed to verify resin and hardener mix ratios and curing times. Place samples on the bridge rail or deck and note time to cure.

(9) The bridge deck and all prepared polymer and aggregate components must be at least 60°F at the time of application.

(10) Apply the dry broadcast aggregate if required to cover the prepared polymer uniformly and completely within 10 minutes of application.

(11) Recoat areas that do not receive enough aggregate before gelling of the polymer with additional polymer and aggregate.

(12) Locate any longitudinal joints along lane lines, or as approved by the Engineer. Keep the joints clear of wheel paths as much as practical.

(13) Produce and place the overlay within the specified limits in a continuous and uniform operation.

(14) Correct completed surface variations exceeding 1/8 inch in 10 feet unless directed otherwise by the Engineer.

(15) Tape all construction joints to provide a clean straight edge for adjacent polymer concrete placement. This includes joints between previously placed polymer concrete overlay materials and at centerline.

(16) Finish the exposed edges at the ends of the bridge and at expansion joints to minimize bridge deck roughness.

(17) Apply a bond breaker to all expansion joints.

(18) Vacuum or broom excess aggregate from the bridge deck after the polymer is sufficiently cured. If damage or tearing occurs, stop brooming or vacuuming and allow additional curing time. See **subsection 3.0g**, for polymer overlay material curing guidelines.

f. Face of Curbs, Barriers, and Corral Rail Posts. Use a paintbrush or roller to apply the epoxy on the face of curbs, barriers, and corral rail posts.

- On bridges with a corral rail, apply the overlay to the front face and adjacent sides of all posts.
- On bridges with curbs apply the overlay to the top of the curb face.
- On bridges without curbs apply the overlay to the edge of the deck.
- On bridges with continuous concrete barrier rails apply the overlay to the first break in the geometry of the barrier or a minimum of 6 inches.

This work is subsidiary to the bid item Single-Layer Polymer Concrete Overlay.

Apply primer (if required) and polymer to the curb or barrier as each of the overlay applications are performed.

g. Curing. Polymer concrete material curing guidelines.

(1) Epoxy. Follow **TABLE 2**.

TABLE 2: EPOXY OVERLAY CURE TIMES						
Average Temperature of Overlay Components, °F						
55-59	60-64	65-69	70-74	75-79	80-85	85+
Minimum Cure Time (hours)						
6.5	6.5	5	4	3	3	3

Cure the epoxy polymer concrete overlay for a minimum of 8 hours if the air temperature falls below 55°F during the curing period.

(2) Methyl Methacrylate.

TABLE 3: METHYL METHACRYLATE CURE TIMES						
Course	Ambient Temperature °F					
	30-40	40-50	50-60	60-70	70-80	80-90
Primer	30	25	22	20	15	10
Polymer Overlay	50	40	35	30	25	20
Sealer	35	30	25	22	20	15

Methyl Methacrylate cure times can be adjusted (longer or shorter) by changing the amount of hardener in the mix.

(3) Polyester. Proportion polyester such that the cure times are between 30 and 120 minutes. Accelerators and inhibitors may be required to achieve proper set times. Proportion all materials as recommended by the material manufacturer/supplier.

(4) Plan and perform the work in such a way as to provide for the minimum curing times specified.

h. Testing. Polymer Concrete Overlay Bond Evaluation for Portland cement concrete patches, polymer concrete patches and existing polymer concrete overlay surfaces as outlined in KT-70 Part V.

(1) Place a polymer concrete test patch of not less than 0.5 square yards per lane or planned completed day's work whichever is smaller. Submit a sequence plan to the Engineer. Test patches shall be full depth, placed by the normal construction sequence. Test patches should be representative of the work being performed.

(2) Perform a minimum of 4 pull-off tests on each patch as outlined in KT-70 Part V.

(3) Final acceptance will be based on the following results of the test outlined in KT-70 Part V:

- Type 1 – Failure in the concrete at a depth greater than or equal to ¼ inch over more than 50% of the test area for 3 out of 4 tests in the test patch.
- Type 2 – Failure in the concrete at a depth less than ¼ inch over more than 50% of the test area for 3 out of 4 tests in the test patch.
- Minimum Tensile Rupture Strength of 250 psi from an average of 3 out of 4 tests on a test patch regardless of depth of failure.

(4) If failure in the concrete is at a depth less than ¼ inch and the Minimum Tensile Rupture Strength is less than 250 psi, or the failure in the concrete is less than 50% of the test area, additional surface preparation is necessary.

(5) If failure is at the polymer to polymer bond and below 250 psi, more surface preparation of the existing polymer overlay or polymer concrete patches is necessary.

(6) If failure is in the new or existing polymer overlay (Type 4), remove the overlay and evaluate the material before proceeding with placement.

(7) A failure in the concrete below 250 psi and greater than ¼ inch deep indicates weak concrete, not poor overlay bond. No additional surface preparation is required.

(8) Do not perform tensile adhesion tests when ambient or deck temperatures are above 85°F.

i. Correction of Unbonded or Damaged Areas On New Work. Repair new overlay areas discovered to be unbonded by tapping or chaining and areas where the overlay was damaged by the Contractor's operation.

(1) Saw cut the unbonded or damaged areas to the top of the concrete bridge deck surface or the existing polymer concrete overlay surface, remove the unbonded or damaged overlay with small air tools (15 pound class maximum) or shotblasting.

(2) Shotblast the existing concrete bridge deck surface or existing polymer concrete overlay surface of the unbonded area to remove contaminants, and replace the overlay according to standard placement procedures at no additional compensation.

j. Weather Limitations.

(1) Epoxy. Do not place the polymer concrete overlay if the air temperature is expected to drop below 55°F within 8 hours of placement.

(2) Methyl Methacrylate. Do not place any component of the polymer concrete overlay if the air or substrate temperature is at or expected to drop below 40°F during installation without inclusion of Cold Temperature Additive at the dosage specified by methacrylate manufacturer/supplier's Mixing Guide.

(3) Polyester. Do not place any component of the polymer concrete overlay if the air or substrate temperature is at or expected to drop below 40°F during installation.

(4) General. Do not place the polymer concrete overlay when the deck temperature will exceed 90°F.

Do not place the polymer concrete overlay if gel time is less than 10 minutes.

Polymer concrete overlay can be placed outside the specified temperature ranges with the approval of the Engineer and the material manufacturer/supplier. Discuss changes to temperature limitations at the preconstruction conference. Submit changes, including a written statement from the material manufacturer/supplier recommending the changes, to the Engineer for approval.

4.0 MEASUREMENT AND PAYMENT

The Engineer will measure Polymer Concrete Overlay Repair areas by the square yard prior to placing the patch material. The measured pay quantity will be those areas sounded by the Engineer and marked as unsound or delaminated polymer concrete overlay.

The Engineer will measure Single-Layer Polymer Concrete Overlay by the square yard. The Engineer will measure the bridge roadway width and the bridge length from end of wearing surface to end of wearing surface.

Payment for "Polymer Concrete Overlay Repair" and "Single-Layer Polymer Concrete Overlay" at the contract unit price is full compensation for the specified work.