

729 - MULTI-LAYER POLYMER CONCRETE OVERLAY

SECTION 729

MULTI-LAYER POLYMER CONCRETE OVERLAY

729.1 DESCRIPTION

Prepare the surface of the reinforced concrete bridge deck and construct a multi-layer polymer concrete overlay (overlay) as shown on the Contract Documents.

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

BID ITEM

Multi-Layer Polymer Concrete Overlay

UNITS

Square Yard

729.2 MATERIALS

a. General.

- (1) Proportion all polymer materials according to the manufacturer/supplier's recommendations.
- (2) Provide the Engineer with a copy of the polymer materials manufacturer/supplier's mixing and application recommendations.
- (3) If concrete bridge deck patching is specified, polymer concrete materials may be used for patching of the concrete bridge deck. See **SECTION 731**.

b. Epoxy. Provide a Type III epoxy resin as defined in **DIVISION 1700**.

c. Polyester. Provide a polyester resin as defined in **DIVISION 1700**.

d. Aggregate.

- (1) Provide FA-C aggregate meeting **TABLE 1102-5** and **TABLE 1102-6**, or
- (2) As provided by the polymer concrete overlay supplier in a prequalified system, **DIVISION 1700**.

729.3 CONSTRUCTION REQUIREMENTS

a. General. Wet cure concrete on new bridge decks for 14 days and allow the deck to dry for 21 days before applying the overlay.

Portland cement concrete patches require a minimum cure period of 28 days before application of the 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 producing a surface relief equal to the International Concrete Repair Institute (ICRI) Surface Preparation Level 6 to 7 or ASTM E 965 Pavement Macrottexture Depth of 0.04 to 0.08 inch. Final acceptance is based on testing procedures as outlined in KT-70, Part V.
 - (b) Shot/Sand blast equipment capable of producing the required surface relief on the deck 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, scabblers or milling machines.

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- (e) Wet sand blasting is prohibited.
- (2) Mechanical Application Equipment.
 - (a) Polymer mixing and distribution system capable of accurate and complete mixing of the polymer resin and hardening agent, 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 of Surface.

- (1) When specified, perform any required repairs under **SECTION 731** and cure repairs, before preparation of the surface, unless placed with the overlay.
- (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 any remaining contamination of the prepared deck surface or surface of subsequent courses. Sand blast or bush hammer contaminated areas to produce an acceptable surface for placement of the overlay.
- (5) As the final preparation for the placement of the overlay, 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 pavement marking, loose disintegrated concrete, dirt, paint, oil, asphalt, laitance carbonation and curing materials from patches and other foreign material from the surface of the deck.
- (6) 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.
- (7) Place the first coat of the overlay within 24 hours of preparing the deck surface. Prepared surfaces exposed for more than 24 hours must be lightly sand blasted prior to application of the overlay.

d. Placing the Multi-Coat Polymer Concrete Overlay. Place the overlay to the grades, thickness and cross-sections as 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) Visible moisture on the prepared deck at the time of placing the overlay is unacceptable. Identify moisture in the deck by taping a plastic sheet to the deck for a minimum of 2 hours (ASTM D 4263).
- (2) Rain will not necessarily contaminate the surface. However, take care so no contamination has occurred. Traffic adjacent to the prepared surface during a rain will contaminate the surface.
- (3) Follow all manufacturer/supplier suggested safety precautions while mixing and handling polymer components.
- (4) Apply High Molecular Weight Methacrylate Primer, if required, at application rates shown in **TABLE 729-1**, or as directed by the material's manufacturer/supplier.
- (5) Place the overlay in 2 separate courses at application rates shown in **TABLE 729-2** for the system being placed.
- (6) Use notched squeegees or mechanical application equipment to place the prepared polymer on the deck immediately and uniformly at the prescribed rate.

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- (7) If mechanical application equipment is used, take 2 ounce samples for each 100 gallons of resin placed to verify mix ratios and curing times. Place samples on the bridge rail or deck and note time to cure.
- (8) The bridge deck and all polymer and aggregate components must be at least 60°F at the time of application.
- (9) Apply the dry broadcast aggregate to cover the polymer uniformly and completely within 10 minutes of application.
- (10) Remove and replace any first course areas that do not receive enough aggregate before gelling of the polymer.
- (11) Vacuum or broom excess aggregate from the first course after sufficiently cured. If damage or tearing occurs, stop brooming or vacuuming and allow additional curing time. See **TABLE 729-3** for curing guidelines.
- (12) Do not open the first course to traffic.
- (13) Place the polymer and aggregate for the second course at the prescribed rate and in the same manner as the first course. The second course can be placed immediately after brooming of the first course is completed.
- (14) Recoat second course areas that do not receive enough aggregate before gelling of the polymer with additional polymer and aggregate.
- (15) Locate any longitudinal joints along lane lines, or as approved by the Engineer. Keep the joints clear of wheel paths as much as practical.
- (16) Produce and place the overlay within the specified limits in a continuous and uniform operation.
- (17) Correct completed surface variations exceeding 1/8 inch in 10 feet, unless directed otherwise by the Engineer.
- (18) Tape all construction joints to provide a clean straight edge for adjacent polymer concrete placement. This includes joints between previously placed overlay materials and at centerline.
- (19) Finish the exposed edges at the ends of the bridge and at expansion joints to minimize bridge deck roughness.
- (20) Apply a bond breaker to all expansion joints.
- (21) 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.

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

- On bridges with a corral rail, apply the polymer resin to the front face and adjacent sides of all posts.
- On bridges with curbs apply the polymer resin to the top of the curb face.
- On bridges without curbs apply the polymer resin to the edge of the deck.
- On bridges with continuous concrete barrier rails, apply the polymer resin to the first break in the geometry of the barrier or a minimum of 6 inches, uniform. Protect areas above the break line (or minimum of 6 inches) from resin. Apply so the top threshold of the resin follows a uniform line along the rail.

This work is subsidiary to the bid item Multi-Layer Polymer Concrete Overlay. Apply primer (if required) and polymer to the curb or barrier as each of the overlay applications are performed.

f. Application Rates. Place epoxy and polyester materials at the same rate. Place primer (if required) at the application rate shown in **TABLE 729-1**. Place the overlay in 2 separate courses at application rates shown in **TABLE 729-2**.

TABLE 729-1: HIGH MOLECULAR METHACRYLATE PRIMER APPLICATION RATES for MULTI-LAYER POLYMER CONCRETE OVERLAYS	
Primer	Each Coat Not Less Than 0.09 gal./sq yd

TABLE 729-2: APPLICATION RATES for MULTI-LAYER POLYMER CONCRETE OVERLAYS		
Course	Polymer Rate	Aggregate Rate *
1	Not Less Than 0.22 gal./sq yd	10 lbs./sq yd
2	Not Less Than 0.45 gal./sq yd	14.5 lbs./sq yd

*Apply enough aggregate to completely cover the polymer.

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g. Curing.

(1) Epoxy. Minimum curing times are noted in **TABLE 729-3**.

TABLE 729-3: EPOXY CURE TIMES for MULTI-LAYER POLYMER CONCRETE OVERLAYS							
Course	Average Temperature of Overlay Components, °F						
	55-59	60-64	65-69	70-74	75-79	80-85	85+
	Minimum Cure Time (hours)						
1	5	4	3	2.5	2	1.5	1
2	6.5	6.5	5	4	3	3	3

Cure the second course for 8 hours if the air temperature falls below 55°F during the curing period before opening to traffic.

(2) Polyester. Proportion polyester courses so 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 supplier.

(3) Plan and perform the work in such a way as to provide for the minimum curing times specified in this specification or as specified by the material manufacturer/supplier.

h. Testing. Perform Polymer Concrete Overlay Bond Evaluation 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) 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.

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

i. Correction of Unbonded or Damaged Areas. Repair new overlay areas discovered to be unbonded by tapping or chaining and areas where the overlay was damaged by the Contractor's operation. Saw cut the unbonded or damaged areas to the top of the deck surface, remove the overlay with small air tools (15-pound class maximum) or shot blasting. Aggressively sandblast or shot blast the concrete bridge deck surface at the unbonded area to remove contaminants. Replace the overlay according to standard placement procedures at no additional compensation.

j. Weather Limitations.

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

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

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

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

The overlay may 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.

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Submit changes, including a written statement from the polymer manufacturer/supplier recommending the changes, to the Engineer for approval.

729.4 MEASUREMENT AND PAYMENT

The Engineer will measure multi-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 "Multi-Layer Polymer Concrete Overlay" at the contract unit price is full compensation for the specified work.