

## SPECIAL SPECIFICATION

### 4974

### Multiple-Layer Polymer Concrete Overlay

1. **Description.** Prepare deck surfaces, furnishing and applying thin multiple-layer polymer concrete on bridge structures.
2. **Materials.** Furnish a Material Safety Data Sheet (MSDS) for polymer materials used on the project. Maintain the MSDS's for the resin materials with the material at all times. Provide a certificate of compliance to these specifications with each batch of resin.
  - A. **Aggregate.** For aggregate, use an angular-shaped silica with a Mohs scale hardness of 7 or greater or basalt with a hardness of 6 or greater. Use aggregates that are clean, dry (less than 0.2% moisture), and free of dirt, clay, asphalt, and other organic materials. Use aggregate that conforms to the gradation specified in Table 1.

**Table 1**  
**Aggregate Gradation**

	Sieve No. <b>4</b>	Sieve No. <b>8</b>	Sieve No. <b>16</b>	Sieve No. <b>30</b>
% by Weight Passing Sieve	100%	30-75%	0-5%	0-1%

- B. **Epoxy or Epoxy Urethane.** Use an epoxy resin base and hardener composed of a two-component, 100%-solid, thermosetting, moisture-insensitive, flexible, high-elongation compound with the properties specified in Table 2.

**Table 2**  
**Requirements for Epoxy and Epoxy Urethane**

Property	Requirement		Test Method	
	Epoxy	Epoxy Urethane	Epoxy	Epoxy Urethane
Viscosity	7-25 poises	35-70 poises	ASTM D2393	Brookfield RVT, Spindle No. 3, at 20 rpm
Gel Time	15-45 min.	15-45 min.	ASTM C881 Para.	ASTM C881 Para.
Strength w/Aggregate	1,000 psi min. at 3 hr., 5,000 psi min. at 24 hr.	1,000 psi min. at 3 hr., 5,000 psi min. at 24 hr.	ASTM C579 Modified (w/plastic inserts)	ASTM C579 Modified (w/plastic inserts)
Tensile Strength	1,800-5,000 psi at 7 days	1,800-5,000 psi at 7 days	ASTM D638	ASTM D638
Elongation (neat)	35-100% at 7 days	35-100% at 7 days	ASTM D638	ASTM D638

Adhesive Strength (mixed w/aggregate)	250 psi min., 100% failure in concrete	250 psi min., 100% failure in concrete	ACI 503R, App. A or VTM 92	ACI 503R, App. A or VTM 92
Shore D Hardness	60 min.	60 min.	ASTM D2240	ASTM D2240
Absorption*	1% max. at 24 hr.	1% max. at 24 hr.	ASTMD570	ASTMD570
Thermal Compatibility	No delamination of overlay	No delamination of overlay	ASTM C884	ASTM C884
Infrared Spectrum	To be established for each component by each manufacturer	To be established for each component by each manufacturer	AASHTO T237, paragraphs 4 and 5	AASHTO T237, paragraphs 4 and 5
* Values are based on specimens or samples cured or aged and tested at 75°				

- 3. Equipment.** For mechanical applications, use a polymer distribution system, an aggregate spreader, a broom, and a self-propelled sweeper broom or vacuum truck. The distribution system or distributor should accurately blend the polymer components and uniformly and accurately apply the polymer materials at the specified rate to the bridge deck to cover 100% of the work area. Equipment should provide compressed air that is free of oil and water.

For hand applications, restrict the work area to 10 sq. yd. or less. The equipment may consist of calibrated containers, a paddle-type mixer, squeegees, rollers, and a broom suitable for mixing the resin and applying the resin and aggregate.

Do not use magnesium phosphate concrete (for example, SET 45) for patching. Do not use scarifiers, scabblers, or milling machines for surface preparation.

**4. Construction.**

- A. Surface Preparation.** Before placing the polymer concrete overlay, clean the deck surface by steel shot blasting or abrasive blasting. Use a blasting technique that exposes the coarse aggregate and removes asphaltic materials, oils, dirt, rubber, curing compound, paint, carbonation, laitance, weak surface mortar, and potentially detrimental materials including dust and other loose material left from the cleaning operation that may interfere with the bonding or curing of the overlay. Use a vacuum cleaner or oil-free and moisture-free air blast to remove dust and other loose material. Use high pressure (1,500 psi or greater) water cleaning if required.

No visible moisture should be on the concrete surface when the polymer overlay is applied. Identify moisture in the deck using a plastic sheet left taped in place for a minimum of 2 hr. (ASTM D4263) or other approved methods.

Do not place polymer concrete overlay on hydraulic cement concrete that is less than 28 days of age. Follow manufacturer's (approved patching material) recommendations for curing durations to allow placement of polymer concrete over the repaired areas. Curing, patching, and cleaning operations will be inspected and approved before placing each layer of the overlay. Remove any contamination of the deck or

intermediate courses after initial cleaning. Apply all courses following the cleaning before opening the area to traffic. Apply the first course within 24 hr. of cleaning, and place all courses of the overlay within 7 days of cleaning.

- B. Testing of Surface Preparation.** Use the test method prescribed in ACI 503R, Appendix A of the *ACI Manual of Concrete Practice* or VTM 92 to determine the cleaning practice (size of shot, flow of shot, forward speed, and number of passes of shot-blasting machine, and other equipment and procedures) necessary to expose the coarse aggregate and to provide a tensile adhesion strength greater than or equal to 250vpsi or a failure area at a depth of 0.25 in. or more into the base concrete, greater than 50% of the test area. Clean the surface, apply the overlay system to the test areas designated, cure it, and then test it. A test result should be the average of three tests on a test patch of not less than 4.5 sq. ft. Obtain one test result for each 500 sq. yd. or less on the structure. The Engineer will designate the location of the test patches. Ensure that the cleaning procedure, materials, installation procedure, and curing period installed are the same thickness and with the same materials, equipment, personal, timing, sequence of operations, and curing period that will be used for the installation of the overlay.

Do not perform tensile adhesion tests at surface temperatures above 80°F because adhesion failures may occur at values less than 250 psi.

Remove failed test areas and replace them at no additional cost.

- C. Application of Overlay.** An overlay manufacturer's representative should be present at all times during the work through final completion of the work. The manufacturer's representative should make recommendations to the Engineer on the acceptability of every phase of the operation, including but not limited to surface preparation of the concrete-filled grid including type of equipment, mixing of the overlay components, type of application, method of application, and finish.

Handle and mix the polymer materials in a safe manner. Do not place polymer concrete overlay materials when weather or surface conditions do not allow the material to be properly handled, placed, and cured within the specified requirements of traffic control.

Before construction of the polymer overlay, the Contractor must submit to the Engineer for acceptance a work plan for constructing the overlay. The work plan should include but not be limited to the materials, compatibility of patching material and epoxy crack repair material with the polymer overlay material, equipment, procedure, and minimum air and deck surface temperatures (maximum surface temperature 85°F) anticipated schedule for traffic control and project phasing, patching and cure time of crack repair and cure time of epoxy surface preparation, and placement of the overlay, and test reports, documentation, explanation, and justification to support the proposed work plan. The work plan should also meet the approval of the manufacturer of the polymer materials. Any deviations from the application prescribed by this specification must be approved by the manufacturer and explained to the Engineer's satisfaction before acceptance.

The minimum finished overlay thickness should be 0.25 in. Apply the polymer overlay in two separate courses as prescribed by the manufacturer but at a rate no less than

specified in Table 3. The total of the two applications should be as prescribed by the manufacturer but not less than 7.5 gal. per 100 sq. ft. All polymer and aggregate components should be 60°F or above at the time of application. After the polymer mixture has been prepared for the polymer overlay, apply it immediately and uniformly to the surface of the bridge deck surface. Do not apply polymer if the air temperature is expected to drop below 55°F within 8 hr. after application or if the gel time is less than 10 min. Apply the dry aggregate in a manner to cover the polymer mixture completely within 5 min. Remove and replace first-course applications that do not receive enough aggregate prior to gelling. A second course insufficiently covered may be left in place but will require additional applications before opening to traffic. Cure each course of polymer concrete overlay until vacuuming or brooming can be performed without tearing or damaging the surface. Do not permit traffic or equipment on the overlay surface during curing. After the first course is cured, remove all loose aggregate by vacuuming or brooming, and apply the next course to completion. Do not begin brooming the excess aggregate from any course of the overlay until the overlay has cured sufficiently that brooming will not damage the surface. Do not open the first course to traffic without the approval of the Engineer or the manufacturer. Do not allow traffic on the overlay until it has cured sufficiently to prevent damage by wheel loads. Where early opening to traffic is not necessary, the polymer may be placed at a lower temperature with the approval of the manufacturer and the Engineer. Minimum curing periods are specified in Table 4. Measure temperatures as the material is applied.

**Table 3  
Polymer and Aggregate Application Rates**

Course	Polymer (Gal./100 Sq. Ft)	Aggregate (Lb./Sq. Yd.)
1	Not less than 2.5	+ 10
2	Not less than 5.0	+ 14

**Table 4  
Minimum Curing Times for Overlay Courses**

Course	60-64°F	65-69°F	70-74°F	75-79°F	80-84°F	85-89°F
1	4 hr.	3 hr.	2.5 hr.	2 hr.	1.5 hr.	1 hr.
2*	6.5 hr.	5 hr.	4 hr.	3 hr.	3 hr.	3 hr.
* Cure Course 2 for 8 hr. if the air temperature falls below 60°F during curing.						

If work damages or mars the surface of the polymer overlay, remove the damaged areas by saw cutting in rectangular sections to the top of the concrete deck surface and replacing the various courses at no additional cost. For each batch provided, maintain and provide to the Engineer records including but not limited to the following:

- o Batch numbers and sizes,
- o Location of batches as placed on deck, referenced by station,
- o Batch time,
- o Gel time (2-oz sample),
- o Temperature of the air, deck surface, mixed polymer components, and aggregates,
- o Loose aggregate removal time, and
- o Time opened to traffic (if applicable).

5. **Measurement.** Polymer concrete overlay shall be measured in square yards of bridge deck surface, complete and in place.
6. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Multiple-Layer Polymer Concrete Overlay”. This price will be full compensation for surface preparation, presence of manufacturer’s representative at the work site during all planning, phasing and placement activities, testing, furnishing and applying polymer concrete overlay courses, all safety precautions, any necessary repairs, and all materials, labor, tools, equipment, and incidentals necessary to complete the work.