

SPECIAL PROVISION

PROJECT #
PIN #

SECTION 03372S

THIN BONDED POLYMER OVERLAY

Delete Section 03372 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Thin bonded polymer overlay system applied to concrete bridge decks and approach slabs for new applications or repairs
- B. Removal of existing polymer overlay from concrete bridge decks and approach slabs for new applications or repairs

1.2 RELATED SECTIONS Not Used

1.3 REFERENCES

- A. ASTM C88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- B. ASTM C131: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C. ASTM C566: Total Evaporable Moisture Content of Aggregate by Drying
- D. ASTM C579: Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- E. ASTM C881: Epoxy-Resin-Base Bonding Systems for Concrete
- F. ASTM C1583: Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
- G. ASTM D570: Water Absorption of Plastics
- H. ASTM D638: Tensile Properties of Plastics

- I. ASTM D790: Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- J. ASTM D2240: Rubber Property – Durometer Hardness
- K. ASTM D4285: Indicating Oil or Water in Compressed Air
- L. ASTM D5821: Determining the Percentage of Fractured Particles in Coarse Aggregate
- M. ASTM D7428: Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- N. ASTM E274: Skid Resistance of Paved Surfaces Using a Full-Scale Tire
- O. ASTM E1621: Elemental Analysis by Wavelength Dispersive X-Ray Fluorescence Spectrometry

1.4 DEFINITIONS

- A. Polymer Overlay System – A thin bonded polymer overlay applied as a wearing surface consisting of a two-part polymer resin broadcasted with aggregate to refusal before it cures and includes a healer/sealer primer where applicable.
- B. Thin Bonded Polymer Overlay, Type I – Consists of a polymer overlay system without healer/sealer primer.
- C. Thin Bonded Polymer Overlay, Type III – Consists of a polymer overlay system with a healer/sealer primer.
- D. Installer – The entity preparing the surface and installing and finishing the polymer overlay system
- E. Provider – The manufacturer furnishing the polymer overlay system

1.5 SUBMITTALS

- A. Provider Qualifications for review
 - 1. Include at least the following:
 - a. Company name
 - b. Name, phone number and experience of the Provider's Technical Support Representative

- c. List of projects using the submitted products with at least four years of satisfactory performance under similar environmental conditions as the project in which it is to be applied. List the following for each project:
 - 1) Project name
 - 2) Bridge locations (state routes, structures numbers and mile posts)
 - 3) Scope of work
 - 4) Products used
 - 5) Approximate date of the system opening to traffic
- B. Materials
 - 1. Manufacturer's Product Data Sheets for review
 - a. Include recommended installation instructions and Material Safety Data Sheets for information
 - 2. Provider's certification for information stating that the provider is the sole provider of the components of the polymer overlay system and that the components:
 - a. Comply with this Section
 - b. Are fully compatible with one another
 - 3. Installer's certification for information including the Provider's written concurrence that the polymer overlay system is fully compatible with all deck repair materials
 - a. Include cure duration recommended for the deck repair material before application of the polymer resin.
 - 4. Certified test report for information from an independent nationally recognized laboratory stating that the polymer resins in the polymer overlay system components meet the requirements in this Section
 - a. Test results must be from within a three-year period of the submittal.
 - 5. Certified Test Report for information from an AASHTO accredited testing laboratory confirming the compliance of the aggregate material with the test requirements of this Section
 - a. Test results must be from within a one-year period of the submittal.
 - 6. Manufacturer's product data sheets for steel shot media, for information
- C. Method for existing polymer overlay removal for information
 - 1. Include equipment information and details
- D. Safety plan for polymer overlay removal and thin bonded polymer overlay installation activities for information

- E. Method for mixing the polymer resins for information
 - 1. The Provider's written concurrence that the selected mixing method is acceptable and compatible with the polymer overlay system.
 - a. Include description of provider proposed equipment.
 - 2. Mixing ratio of the polymer resins.
- F. A warranty letter stating that the Installer guarantees the polymer overlay system against material and installation defects incurred under traffic for a period of 5 years.
 - 1. The guarantee period starts on the date of Physical Completion or written documentation of the partial acceptance of the thin bonded polymer overlay.
 - 2. Include in the letter:
 - a. State Project Pin Number
 - b. State Project Name
 - c. State Structure Numbers
 - d. Contractor, Provider, and Installer Name
 - 3. Defects (performance failures) include:
 - a. Spalling: Broken or missing pieces of polymer overlay system
 - b. Scaling: Visible, exposed, rough surface texture resulting from a loss of aggregate or resin
 - c. Delamination: Visible or audible debonding of the polymer overlay system at the bond line (interface) with the existing bridge receiving surface
 - d. Cracking: Visible cracks not reflected from a crack in the existing deck
 - e. Loss of skid resistance: Skid resistance less than 40 as measured according to ASTM E274
 - 4. The guarantee covers 100 percent of the polymer overlay system materials and installation costs including removal and replacement of the polymer overlay system for failed sections.
 - 5. The Department will notify the Installer of defects to be repaired during the guarantee period.
 - a. Submit detailed plans and procedures of corrective work according to Provider's recommendations and obtain the Department's authorization before commencing work.
 - b. Perform corrective work within 60 days of notification unless stated otherwise.

1.6 TECHNICAL SUPPORT REPRESENTATIVE

- A. Provide a Technical Support Representative from the Provider onsite during surface preparation and application of the polymer overlay system on the first day the polymer overlay system is installed on a structure.
 - 1. The Technical Support Representative must have a minimum of 3 years of experience with the system and with guiding and assisting installers in the polymer overlay system installation.
 - 2. The Technical Support Representative will instruct the workers in proper mixing, application technique, safety precautions, traffic opening time, and environmental requirements.
 - 3. The Technical Support Representative must be available for consultation but not necessarily present at the job site for the remaining work.
 - 4. The Department reserves the right to require the Technical Support Representative to be onsite if at any time the Engineer is concerned with the product installation quality.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Polymer Resin
 - 1. Identify the containers as Part A and Part B and plainly mark with:
 - a. Manufacturer's name
 - b. Manufacturer's address
 - c. Name of the product
 - d. Mixing proportions and instructions
 - e. Lot and batch numbers
 - f. Date of manufacture
 - g. Quantity
 - 2. Transport to and store on the job site in a dry, weather protected environment away from moisture, and within the maintained temperature range of 60 to 100 degrees F and according to Provider's recommended installation instructions.
- B. Broadcast Aggregate
 - 1. Store aggregate in a clean, dry location, protected from rain and other moisture sources.
 - 2. Protect the aggregate from contaminants on the job site.
- C. Handling Liquid Materials
 - 1. Use protective gloves, clothing, boots, and goggles when directly exposed to the material.
 - 2. Provide manufacturer's safety data sheets to workers and inspectors.

PART 2 PRODUCTS

2.1 POLYMER OVERLAY SYSTEM

- A. Use a thin bonded polymer overlay system that chemically cures to provide an impervious wearing surface consisting of the following:
 - 1. Healer/Sealer primer for Thin Bonded Polymer Overlay, Type III
 - 2. Polymer Resin
 - 3. Broadcast Aggregate
- B. Healer/Sealer primer, when applicable
 - 1. Compatible with the repair materials and the polymer resin.
- C. Polymer Resin
 - 1. Two-part Epoxy-Urethane Co-Polymer that meets the requirements of Table 1.
 - 2. Free of fillers, volatile solvents, and external/conventional flexibilizers.

Table 1

PHYSICAL PROPERTIES OF THE CURED POLYMER RESIN		
Property	Value	Method
Compressive Strength, min. psi	5,000	ASTM C579 (Method B)
Tensile Strength, min. psi	2,000	ASTM D638
Tensile Elongation, min. percent	30	ASTM D638
Water Absorption, max. percent by wt.	1.0	ASTM D570
Shore D Hardness, min. 77°F	60-75	ASTM D2240
Gel Time @ 73°F +/- 3°F, minutes	15-45	ASTM C881
Adhesion to Concrete	100% failure in concrete	ASTM C1583
Flexural Yield Strength, min. psi	3,000	ASTM D790
Percent Solids	100	

- D. Broadcast Aggregate
 - 1. Thoroughly washed and kiln dried to maximum moisture content of 0.2 percent by weight according to ASTM C566.
 - a. Do not use recycled or reused aggregate for the first layer of application.
 - 1) Refer to this Section, Paragraph 3.4 E2.
 - 2. Use basalt aggregate meeting the properties in Table 2 and the gradation in Table 3, or use calcined bauxite aggregate meeting the properties in Table 4 and the gradation in Table 5.

Table 2

BASALT AGGREGATE PROPERTIES	
Magnesium Sulfate Soundness, ASTM C88 (5 cycles)	15% max.
LA Abrasion, Grade D, ASTM C131	20.0% max.
Micro Deval Abrasion, ASTM D7428	10.0% max.
Mohs Scale Hardness	7.0 min.

Table 3

BASALT AGGREGATE GRADATION	
Sieve Size	Percent Passing
0.187 inch; No.4	100
0.078 inch; No.10*	10 – 35
0.033 inch; No.20	0 – 10
0.024 inch; No.30	0 – 0.2

* 100 percent of the aggregate retained on the #10 sieve has at least one mechanically fractured face according to ASTM D5821.

Table 4

CALCINED BAUXITE AGGREGATE PROPERTIES	
Magnesium Sulfate Soundness, ASTM C88 (5 cycles)	15% max.
LA Abrasion, Grade D, ASTM C131	20.0% max.
Micro Deval Abrasion, ASTM D7428	3.0% max.
Mohs Scale Hardness	8.0 min.
Aluminum Oxide, ASTM E1621	85.0% min.

Table 5

CALCINED BAUXITE AGGREGATE GRADATION	
Sieve Size	Percent Passing
0.187 inch; No.4	100
0.046 inch; No.16*	0 - 5
0.024 inch; No.30	0 – 0.2

* 100 percent of the aggregate has at least one mechanically fractured face for materials being retained on the #16 sieve according to ASTM D5821.

2.2 EQUIPMENT

- A. Polymer Overlay Removal
 - 1. Diamond grinding
 - a. Provide equipment utilizing diamond blades mounted on a self-propelled machine designed for grinding and texturing pavement.
 - b. Handheld and small walk behind diamond grinders may be used in areas not accessible by larger equipment.
 - 2. Heating and scraping
 - a. Provide equipment capable of heating and scraping off the existing polymer overlay system
- B. Metered Mixing
 - 1. Use equipment capable of metering, mixing, and distributing the polymer resin.
 - a. Use equipment that features positive displacement volumetric metering pumps controlled by a hydraulic power unit.
 - b. Use motionless, in-line mixing.
 - 2. Use equipment that is acceptable to the Provider.
- C. Hand Mixing
 - 1. Use equipment that is acceptable to the Provider.
- D. Polymer Resin Application
 - 1. Use new $\frac{3}{16}$ inch notched squeegee blades for the first layer on each structure.
 - a. Replace notched squeegee if coverage rate does not meet Provider's recommendations.
- E. Broadcasting Aggregate
 - 1. Use mechanical equipment capable of dispensing the aggregate onto the deck in a uniform manner as required by the Provider and as specified.
- F. Sandblaster/Air Compressor
 - 1. Verify air is free of water and oil according to ASTM D4285.

2.3 SHOT BLASTING

- A. Use S-390 or larger steel shot media.

PART 3 EXECUTION

3.1 POLYMER OVERLAY REPAIR AREA PREPARATION

- A. Locate and mark polymer overlay repair areas as shown and in the presence of the Engineer.
 - 1. Delaminated areas
 - a. Sound the polymer overlay around repair area for delamination of the polymer overlay to determine repair limits.
 - 2. Polished areas
 - a. Polished areas are identified as areas where minimal aggregate remains.
 - b. Treat gouges which reduce the overall thickness of the polymer overlay to less than $\frac{1}{8}$ inch as polished areas.
 - 3. Square off and mark the edges of polymer overlay system repair area six inches beyond the determined limits and parallel to the travel lane.

3.2 POLYMER OVERLAY REMOVAL

- A. Saw cut $\frac{1}{2}$ inch deep saw cut along the marked edges of repair areas.
- B. Diamond grinding
 - 1. Create a surface in a parallel, corduroy-type texture consisting of grooves with the following dimensions:
 - a. Width: $\frac{1}{16}$ to $\frac{1}{4}$ inch
 - b. Depth: $\frac{1}{16}$ inch
 - c. Spacing: $\frac{1}{16}$ to $\frac{1}{4}$ inch
 - 2. Limit deviations to an $\frac{1}{8}$ inch from the lower edge of a 10 ft straightedge after grinding.
 - 3. The textured pattern is not required in locations where handheld and walk behind diamond grinders are used.
- C. Heating and scraping
 - 1. Do not damage the concrete substrate.
 - 2. Polymer overlay residue remaining after the heating and scraping operation must be thin enough to be fully removed during surface preparation.
 - 3. Difficult to remove resin within tining may remain.

3.3 SURFACE PREPARATION

- A. Remove paint markings, visible grease, oils, and other surface contaminants prior to shot-blasting.
 - 1. Follow manufacturer recommendations when using solvents to remove contaminants.
 - 2. Complete deck repairs before shot-blasting.
- B. Shot-blast concrete surface to produce a surface relief that meets an International Concrete Repair Institute (ICRI) CSP between 5 and 7.
 - 1. Use abrasive blasting equipment or mechanical grinders only in areas that cannot be reached with steel shot-blasting.
 - 2. Refer to <http://www.udot.utah.gov/go/standardsreferences> for a CSP Examples document.
- C. Remove dust or debris with compressed air just before application of the resin.
- D. Protect expansion joints, cold joints, grates, drains and other elements which may not perform adequately if in contact with hardened resin.
- E. Do not allow traffic on the deck that has been shot-blasted.
 - 1. Only allow the polymer overlay system equipment on cleaned surfaces.

3.4 APPLICATION

- A. Limitations
 - 1. Do not apply the polymer overlay system when it has rained within 24 hours or is expected to rain within 8 hours of application.
 - 2. Verify the concrete substrate is dry before applying the polymer overlay system.
 - a. Measure moisture content with an electronic concrete moisture meter at three locations on the bridge deck to be covered by the polymer overlay system.
 - 1) Take measurements at the beginning, middle, and end of the coverage area.
 - b. Measure moisture content with a concrete moisture meter at each structural pothole patch location to be covered by the polymer overlay system.
 - c. Do not apply the polymer overlay system if one or more measurements exceed 4.0 percent.
 - 3. Apply when the outside air temperature is above 50 degrees F and will remain above 50 degrees F per the manufacturer's recommended cure time.

4. Application over new surfaces
 - a. Allow newly placed concrete to cure for at least 28 calendar days before beginning installation of polymer overlay system.
 - b. Allow newly placed rapid setting mortar materials to cure for at least eight hours, or as recommended by the rapid setting mortar manufacturer, before beginning installation of polymer overlay system.
 5. Application to bridges constructed offline and moved into their final location by self propelled modular transporters (SPMT)
 - a. Apply the polymer overlay system no sooner than 30 calendar days after setting the bridge in its final location.
- B. Mixing Polymer Resin
1. Condition resin material to the proper temperature according to the Provider's recommendations.
 2. Use metered mixing equipment to measure and mix the polymer resin components as recommended by the Provider.
 - a. Maintain mix ratios according to the Provider's recommendations.
 - b. Hand mixing polymer resin may be performed in repair areas and areas with limited access.
 3. Mix polymer resin immediately before dispensing.
 4. Verify the mix ratio by volumetric sampling immediately before beginning the application.
 - a. Use containers with graduated markings with not less than 5 gallon capacity.
 - b. Remove the static mixer and dispense each component into separate containers.
 - 1) Dispense at least five gallons of the primary component for ratio comparison.
 - 2) Uncontaminated samples may be returned to the reservoirs they were originally dispensed from.
 - c. The Engineer or Technical Support Representative may request additional sampling.
- C. Application of Polymer Resin
1. Apply healer/sealer primer according to the Provider's recommended installation instructions when placing a Thin Bonded Polymer Overlay, Type III.
 - a. Apply polymer resin while the healer/sealer primer is still wet.
 2. Evenly distribute the polymer resin at the rate recommended by the Provider.

D. Broadcasting Aggregate

1. Broadcast the aggregate before the polymer begins to gel.
 - a. Do not exceed the maximum time limits in Table 6 between the application of polymer resin and broadcasting the aggregate, unless otherwise directed by the provider's technical representative.

Table 6

Time Limits	
Temperature	Maximum Time
Above 90°F	10 minutes
80°F to 90°F	15 minutes
70°F to 80°F	20 minutes
60°F to 70°F	25 minutes
50°F to 60°F	35 minutes

2. Cover the surface until no wet spots remain.
 - a. Continue to broadcast aggregate over individual wet spots.
 - b. Do not place piles of aggregate.
3. Drop the aggregate vertically.
 - a. Do not project aggregate toward live traffic.

E. Remove Excess Aggregate

1. Completely remove excess and loose aggregate by vacuum or with compressed air after the overlay has hardened and before applying subsequent layers.
 - a. Remove dust and debris with compressed air.
2. Do not reuse removed excess aggregate for subsequent layers unless the following criteria is met:
 - a. Aggregate is removed directly into containers
 - b. Aggregate is screened to required gradation specified in Table 3 and Table 5
 - c. Aggregate is stored free of contaminants

F. Apply Successive Layer of Overlay

1. Provide at least two layers.
2. Longitudinal Joints in the Overlay
 - a. Stagger and overlap joints between successive layers 6 to 12 inches so that no ridges appear between two adjacent lanes.
 - b. Maintain straight construction joints between adjacent placements and layers.
3. Provide a total overlay thickness of at least $\frac{3}{8}$ inch when using Basalt aggregate.

- G. Traffic
 - 1. Do not allow vehicles on the polymer overlay while it is curing.
 - 2. Traffic may be allowed on the final layer or on non-final layers after the resin has cured, as determined by the Provider
 - a. Remove excess and loose aggregate before allowing traffic on the thin bonded polymer overlay system.
 - b. Brush blast the surface with shot blast according to the Provider's recommendations before applying additional layers when traffic has been allowed on the cured surface between layers.
- H. Final Cleanup
 - 1. Remove excess and loose aggregate by vacuum or sweeper truck two weeks after traffic has been on the polymer overlay.
 - 2. Completely remove aggregate from joints.

3.5 PROTECTION

- A. Prevent sandblasting material, shotblasting media and debris from falling into waterways, pedestrian areas, traffic areas, or onto railroad tracks.

END OF SECTION