1. polymer overlay (revised 10-08-20)

Description. This work is preparing concrete bridge deck surfaces and applying primer and a two-layer polymer overlay system. This work also applies to concrete approach slabs if indicated on the plans.

Materials. Furnish materials specifically designed for use on concrete bridge decks.

Polymer Overlay Primer. Furnish a primer compatible with the polymer overlay that is 100% solids, 100% reactive with the following properties:

|  |  |  |
| --- | --- | --- |
| Property | Requirements | Test Method |
| Viscosity A | <225 cps | ASTM D2556, Brookfield RVT, Spindle No. 3, 20 rpm |
| Tensile Elongation B | > 30% | ASTM D638 |
| Tensile Strength B | >2000 psi @ 7 days | ASTM D638 |

A -Uncured, mixed primer

B -Cured, mixed primer

Polymer Resin for Polymer Overlay. Use a polymer resin base and hardener composed of a two-component, 100% solids, 100% reactive, thermosetting compound with the following properties:

|  |  |  |
| --- | --- | --- |
| Property | Requirements | Test Method |
| Gel Time A | 10 - 45 minutes @  73°F to 75°F | ASTM C881 |
| Viscosity A | 7 - 70 poises | ASTM D2556, Brookfield RVT, Spindle No. 3, 20 rpm |
| Absorption B | 1% maximum at 24 hr | ASTM D570 |
| Tensile Elongation B | 30% - 70% @ 7 days | ASTM D638 |
| Tensile Strength B | >2000 psi @ 7 days | ASTM D638 |
| Chloride Permeability B | <100 coulombs @ 28 days | AASHTO T277 |

A -Uncured, mixed polymer binder

B -Cured, mixed polymer binder

Aggregates. Furnish natural or synthetic aggregates which have a proven record of performance in applications of this type. Furnish aggregates that are non-polishing, clean, free of surface moisture, fractured or angular in shape; free from silt, clay, asphalt, or other organic materials; and meet the following properties and gradation requirements:

|  |  |  |
| --- | --- | --- |
| Property | Requirement | Test Method |
| Moisture Content A | ≤ 0.20% | AASHTO T255 |
| Hardness | ≥6.5 | Mohs Scale |
| Fine Aggregate Angularity | 45% Minimum | AASHTO T304 Method A |
| Absorption | ≤ 1% | AASHTO T84 |
| Aggregate Gradation B | 100% passing No. 4  15-25% passing No. 8  0-5% passing No. 16  0-1% passing No. 30 | MT 202 |

A Sampled and tested at the time of placement.

B Or recommended gradation per manufacturer of polymer resin and approved by the Project Manager.

Required Properties of the Overlay System.

|  |  |  |
| --- | --- | --- |
| Property | Requirement A | Test Method |
| Minimum Compressive  Strength (psi) | 1,000 psi @ 8 hrs  5,000 psi @ 24 hrs | ASTM C 579 Method B,  Modified B |
| Thermal Compatibility | No Delaminations | ASTM C 884 |
| Minimum Pull-off Strength | 250 psi @ 24 hrs | ACI 503R, Appendix A |

A Based on samples cured or aged and tested at 75°F

B Plastic inserts that will provide 2-inch by 2-inch cubes shall be placed in the oversized brass molds.

Construction Requirements.

Manufacturer’s Representative. Provide a manufacturer’s representative on site for the duration of the work, to provide expert assistance on compatibility of materials, storage, mixing, surface preparation, application, clean-up, and disposal of materials.

Material Delivery and Storage. Store resin materials in their original containers and in a dry area. Store and handle materials in accordance with the manufacturer’s recommendations. Store all aggregates in a dry environment and protect aggregates from contaminants on the job site.

Submittals. Submit the following to the Project Manager a minimum of 14 calendar days prior to beginning the polymer overlay:

Product data sheets, specifications, and a certified test report from the manufacturer. The Project Manager may request samples of the primer, polymer, and aggregate prior to application, for the purpose of acceptance testing by the Department.

Product data sheets and specifications from the manufacturer consists of literature from the manufacturer showing general instructions, application recommendations/methods, product properties, general instructions, or any other applicable information.

Product history/reference projects and a certified test report from an independent testing laboratory showing compliance with the requirements of the specification. The product history/reference projects consist of a minimum of 5 bridges / locations where the proposed overlay system has been applied in Montana or other locations with a similar climate. Include contact names for the facility owner, current phone number or e-mail address, and a brief description of the project.

Pre-installation Conference. Conduct a pre-installation conference with the manufacturer's representative prior to construction to establish procedures for maintaining optimum working conditions and coordination of work. Provide a copy of the recommended procedures to the Project Manager and apply the overlay system in accordance with the manufacturer’s instructions. Ensure the manufacturer's representative familiar with the overlay system installation procedures is present during surface preparation and overlay placement to provide quality assurance that the work is being performed properly.

Sequence of Operations. The following is the sequence of operations when a Polymer Overlay is required:

Deck Repair.

Surface Preparation

Polymer Overlay Primer

Polymer Overlay

Material Compatibility. Ensure products used for the Deck Repair, Polymer Overlay Primer, and Polymer Overlay are all compatible with each other.

Deck Repair. Perform Class A and B deck repair work as specified elsewhere in the contract. Furnish cementitious-based material for deck repair which is compatible with the polymer overlay primer and polymer overlay system. Follow all manufacturer recommendations, including substrate cure times.

Surface Preparation. Determine an acceptable shotblasting machine operation (size of shot, flow of shot, forward speed, and/or number of passes) that provides a surface profile meeting CSP 5 according to the International Concrete Repair Institute Technical Guideline No. 03732. If the Project Manager requires additional verification of the surface preparation, test the tensile bond strength according to ACI 503R, Appendix A of the ACI Manual of Concrete Practice.

The surface preparation will be considered acceptable if the tensile bond strength is greater than or equal to 250 psi or the failure area at a depth of ¼ inch (6 mm) or more is greater than 50% of the test area. Continue adjustment of the shotblasting machine and necessary testing until the surface is acceptable to the Project Manager or a passing test result is obtained.

Prepare the entire deck using the final accepted adjustments to the shotblasting machine as determined above. Thoroughly blast-clean with hand-held equipment any areas inaccessible by the shotblasting equipment. Do not perform surface preparation more than 24 hours prior to the application of the overlay system.

Prepare the vertical concrete surfaces adjacent to the deck a minimum of 2 inches   
(50 mm) above the overlay according to SSPC-SP 13 by sand blasting, using wire wheels, or other approved method.

Immediately prior to polymer overlay primer placement, clean all dust, debris, and concrete fines from the prepared surfaces including the vertical surfaces with compressed air. When using compressed air, the air stream must be free of oil. Completely remove any grease, oil, or other foreign matter that rests on or has absorbed into the concrete. If any prepared surfaces (including the polymer overlay primer or the first layer of the polymer overlay) are exposed to rain or dew, lightly sandblast (breeze blast) the exposed surfaces.

Protect drains, expansion joints, access hatches, or other appurtenances on the deck from damage by the shot and sand blasting operations and from materials adhering and entering. Tape or form all construction joints to provide a clean straight edge.

The Project Manager may consider alternate surface preparation methods per the overlay system manufacturer’s recommendations. Do not place the polymer overlay primer or polymer overlay prior to Project Manager approval of the final surface profile and deck cleanliness.

Polymer Overlay Primer. Place polymer overlay primer in accordance with Subsection 552.03.19 of the Standard Specifications, except that the sand requirement is rescinded.

Overlay Application. Perform the handling and mixing of the polymer resin and hardening agent in a safe manner to achieve the desired results according to the manufacturer’s instructions. Do not apply the overlay system if any of the following conditions exist:

Ambient air temperature is below 50°F (10°C).

Deck temperature is below 50°F (10°C).

Moisture content in the deck exceeds 4.5% when measured by an electronic moisture meter or shows visible moisture after 2 hours when measured in accordance with ASTM D4263.

Rain is forecast during the minimum curing periods listed under C.5.

Material component temperatures are below 50°F (10°C) or above 99°F (37°C).

Class B repair material concrete age is less than 28 days, unless approved by the Project Manager.

The deck temperature exceeds 100°F (38°C).

The polymer gel time is less than 10 minutes at the predicted high air temperature for the day.

After the deck has been shotblasted and during the polymer overlay primer and overlay curing periods, only necessary surface preparation and overlay application equipment will be allowed on the deck. Begin the polymer overlay primer placement as soon as possible after surface preparation operations, followed by the polymer overlay placement as soon as possible after placement of the polymer overlay primer placement. A wet on wet application of the polymer overlay primer and polymer overlay is allowed.

Use a polymer overlay consisting of a two-course application of polymer and aggregate, consisting of a layer of polymer covered with a layer of aggregate in sufficient quantity to completely cover the polymer. Apply the polymer and aggregate according to the manufacturer’s requirements. Apply the overlay using equipment designed for this purpose. Use an application machine that features positive displacement volumetric metering and can store and mix the polymer resins at the proper mix ratio. Disperse the aggregate using a standard chip spreader or equivalent machine that can provide a uniform, consistent coverage of aggregate.

Apply the polymer overlay in accordance with the manufacturer’s instructions, but not less than the following rate of application:

Application Rates

|  |  |  |
| --- | --- | --- |
| Course | Minimum Polymer Application Rate (GAL/100 SF) | Aggregate A (LBS/SY) |
| 1 | 2.5 | 10+ |
| 2 | 5.0 | 14+ |

A Apply aggregate in sufficient quantity to completely cover the polymer.

If the Project Manager determines that the course application does not receive enough aggregate before the polymer gels, remove and replace the course.

Minimum Curing Period. After completion of the course, cure the overlay in accordance with the manufacturer’s recommendations.

Opening to Traffic. Remove the excess aggregate from the surface treatment by sweeping, blowing, or vacuuming without tearing or damaging the surface; the material may be re-used if approved by the Project Manager and manufacturer.

Clean expansion joints and joint seals of all debris and polymer.

Do not allow traffic on the treated area until directed by the Project Manager.

The Project Manager may require additional sweeping or cleaning to remove loosened aggregates from the deck following opening to traffic.

Repair of Polymer Overlay. Repair all areas of unbonded, uncured, or damaged polymer overlay at no cost to the State. Submit repair procedures from the manufacturer for approval. If no recommendations from the manufacturer, complete repairs in accordance with the following:

Saw cut the limits of the area to the top of the concrete.

Remove the overlay by scarifying, grinding, or other approved methods.

Shot blast or sand blast and air blast the concrete prior to placement of polymer overlay.

Place the polymer overlay in accordance with the application procedures required in this special provision.

Method of Measurement. Deck surface preparation is measured by square yard of deck surface area treated. Bridge Polymer Overlay Primer is measured by the square yard of deck surface area. Polymer Overlay is measured by square yard of deck surface area treated.

Basis of Payment. Payment for the completed and accepted quantities is made under the following:

|  |  |
| --- | --- |
| Pay Item | Pay Unit |
| Prepare Deck | SQYD |
| Polymer Overlay Primer | SQYD |
| Polymer Overlay | SQYD |
|  |  |

Payment at the contract unit price is full compensation for all resources necessary to complete the item of work in accordance with the contract.