Ms. Phillips
Date: 12/19/13

SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO SPECIAL PROVISIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The current "thin polymeric deck overlay" spec consists of various unique special provisions. As we move forward with the Bridge and Culvert Preservation Initiative, more and more of this treatment will be done. INDOT needs a standard specification for this treatment.

PROPOSED SOLUTION: Make the unique a recurring special provision.

APPLICABLE STANDARD SPECIFICATIONS: N/A

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: 72.3 - Bridge Deck Overlays

APPLICABLE SECTION OF GIFE: N/A

APPLICABLE RECURRING SPECIAL PROVISIONS: N/A

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Organization: INDOT

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Date: May 22, 2013

APPLICABLE SUB-COMMITTEE ENDORSEMENT?
Ad hoc - Tommy Nantung, Todd Shields, Scott Trammell, Jim Reilman, Drew Storey, Elizabeth Phillips, George Snyder, Tony Zander

REVISION TO SPECIAL PROVISIONS

PROPOSED NEW 738-B-XXX POLYMERIC CONCRETE BRIDGE DECK OVERLAY

738-B-XXX POLYMERIC CONCRETE BRIDGE DECK OVERLAY

(Adopted XX-XX-XX)

Description

The polymeric concrete bridge deck overlays shall consist of an epoxy polymer that acts together with special aggregate to form an overlay system that adheres to the substrate deck concrete to prevent water and chloride intrusion. This work shall consist of preparing the surface to be treated and furnishing and placing the polymeric concrete bridge deck overlay in accordance with 105.03.

Materials

All material certifications shall be in accordance with 916 for the type specified and shall be submitted to the Engineer at least 14 calendar days prior to applying the materials. A Type C certification shall be submitted for the epoxy polymer and shall include the product trade name and manufacture. A Type A certification shall be submitted for the aggregate. The material requirements are as follows:

(a) Epoxy Polymer

The epoxy polymer used in the overlay shall be a two component system consisting of a resin base and a hardener. The epoxy polymer shall be one of the following products:

1. Pro-Poxy Type III D.O.T., manufactured by Unitex, Dayton Superior

2. E-Bond 526, manufactured by E-Bond Epoxies, Inc. with Indiana marketing rights owned by Transpo Industries, Inc.

3. Mark-163 Flexogrid, manufactured by Poly-Carb, Inc.

The Contractor shall provide technical literature with instructions on storing, mixing, applying the epoxy polymer, clean up, and disposing of excess materials. The epoxy polymer shall be stored according to the manufacturer’s recommendations.

(b) Aggregate

The aggregates for all layers shall be non-friable, and non-polishing. The aggregate shall be in accordance with 917.01, 904.02 SMA and 904.02 (c), with the exception that limestone or crushed gravel be from an approved PRA source. Alternate aggregate recommended by the manufacturer of the polymeric concrete bridge deck overlays may be permitted provided these requirements are met and approved by the Engineer, with the exception that it may come from a non-CAP source. The aggregate shall be clean and dry to a maximum moisture content of 0.2% by weight in accordance with AASHTO T 255 and free of dirt, clay, asphalt and other foreign or organic materials.

Aggregate gradation shall be:

Sieve Size	Passing by Weight

#4 (4.75 mm)	100%
#8 (2.36 mm)	30 to 75%
#16 (1.18 mm)	5% max.
#30 (0.6 mm)	1% max.

(c) Patching Materials

Patching material used for partial or full depth bridge deck patching shall be bridge deck patching concrete in accordance with 722.

Construction Requirements

(a) Weather Limitations

Polymeric concrete overlays will not be permitted to be applied between October 15 and April 1. Materials shall not be placed when ambient air temperatures are below 55°F or above 90°F or when deck temperature is below 60°F or above 100°F. All components shall have a temperature no less than 70°F at the time of mixing and placement. Materials shall not be placed when rain is forecast within 24 hours of application of the overlay.

(b) Equipment

Equipment, at a minimum, shall consist of a polymer distribution system, aggregate spreader, application squeegee and oil-free compressed air, and a source of lighting if work will be performed at night. The distribution system, or distributor, shall blend the polymer materials at the manufacturer’s required proportioning and apply the materials to the work area at the proper rate to cover the entire bridge deck. The aggregate shall be applied in a uniform manner.

The equipment used to perform the Surface Preparation Test and Final Coat Test shall be in accordance with ITM 407. The test equipment will be approved by the Engineer prior to use. Test equipment shall include all miscellaneous equipment and materials to perform the tests and clean the equipment.

(c) Inspection and Repair of Existing Deck

Prior to the installation of the polymeric concrete bridge deck overlays on any deck section, the Engineer will sound the entire surface. The sounding is to identify any areas of deck that are in need of repair before applying the system. These areas include any delamination in the concrete deck, spalling, and breakouts. These areas shall be properly marked and repaired a minimum of 28 days before the polymeric treatment installation can begin. The repair shall be in accordance with 722.06.

(d) Preparation of Concrete Surfaces

Full depth patching and partial depth patching of the bridge floor shall be in accordance with 722.06 except that only bridge deck patching concrete shall be used to fill the patches. Latex Modified concrete shall not be used. Before placement of the polymeric concrete surface treatment, the entire concrete bridge deck shall be thoroughly cleaned by steel shot blasting to ensure proper bonding between the treatment system and concrete substrate. A final shot blast texture

meeting the International Concrete Repair Institute Levels 5 through 7 shall be achieved.

The surface shall be free of asphalt material, oil, dirt, rubber, curing compounds, paint carbonation, laitance, weak surface mortar and other potentially detrimental materials, which may interfere with the bonding or curing of the treatment system. Loosely bonded patches shall be removed and repaired. Traffic marking materials within the application area shall be removed. Compressed air shall be used to remove all dust and other loose material. Mechanical brooms, without water or vacuuming, may be used in certain applications to remove any residual dust that adheres to the prepared surface after it has been blown off with compressed air. The surface must then be blown again with compressed air after brooming to remove all loose residual dust. Compressed air used for shot blasting and other surface preparation shall be moisture and oil free in accordance with ASTM D 4285.

Pretreatment for cracks per the manufacturer's recommendation shall be incorporated in the polymeric concrete bridge deck overlays installation. The pretreatment polymer material shall be in accordance with the manufacturer's specifications.

To provide assurance that the cleaning procedure, materials, installation procedure, and curing period provide the desired treatment system, test patches shall be installed with the same materials, equipment, personnel, timing, sequence of operations, and curing period to be used for the installation of the overlay as required by section (e), entitled application.

The concrete or any deck repairs shall not be less than 28 days old at the time of surface preparation and installation of the test patches. After completion of the test patches, the Contractor shall perform the Surface Preparation Test. Each test patch shall 1.5 ft. by 3 ft. in area, and shall be installed to represent each bridge span or 300 square yards, whichever is smaller. Test patches shall be placed in wheel paths, between wheel paths or in other areas that represent the worst surface conditions as determined by the Engineer. Three pull off tests shall be performed in each test patch. The center to center distance of adjacent pull-off tests within a patch shall be at least 6 inches. The distance from the center of a pull-off test and the edge of the patch shall be at least four inches. If the concrete cover is less than 3/4 inch, pull-off testing is not to be done directly over the uppermost bar of the mat of steel reinforcement.

Tensile pull-off testing shall not be performed when the surface temperature is at or above 90°F. The pull off test shall be performed in accordance with ITM 407. Each single pull off test shall have tensile bond strength greater than or equal to 250 psi in order for the results to be considered passing. In the case of a lower tensile bond strength, the mode of failure shall be visually examined.

If it is determined that the mode of failure involves a fracture depth at least 1/4 inch into the base concrete and the fractured concrete covers at least 50% of the pull-off test area, the test will

be given a pass designation. All three tensile pull off tests must pass in order for the test area to be considered passing.

The cleaning method, materials, and installation procedure will be approved if all test patches pass the surface preparation tests.

If a test patch fails, the shot blasting method shall be adjusted for the area represented by the failing test patch. Surface preparation testing shall be repeated until satisfactory results are attained. Once an acceptable shot blasting procedure is established, it shall be continued for the balance of the work. The Contractor may, with written permission of the Engineer, change the shot blasting procedure or equipment, in which case additional surface preparation testing shall be required.

If the Engineer determines that an approved cleaning method has changed prior to the completion of the job, the Contractor shall return to the approved cleaning methods and re-clean the suspect areas or verify through tests that the altered method is acceptable.

All test patches for tensile pull off must be removed by a method approved by the Engineer. All damage to the deck surface caused by removal shall be repaired by an approved method with no additional payment.

(e) Application

Patching and cleaning operations shall be inspected and approved prior to placing each layer of the treatment system. Any contamination of the deck or intermediate courses, after initial cleaning, shall be removed. Both courses shall be applied within 24 hours following the final cleaning and prior to opening the area to traffic.

There shall be no visible moisture present on the surface of the concrete at the time of application of the polymeric concrete bridge deck overlays. A plastic sheet left taped in place for a minimum of 2 hours, according to ASTM D 4263, shall be used to identify moisture in the deck. Compressed air in accordance with ASTM D 4285 may be used to dry the deck surface.

Handling and mixing of the epoxy polymer resin and hardening agent shall be performed in a manner to achieve the desired results in accordance with these specifications, and the manufacturer's recommendations as approved or directed by the Engineer. Polymeric concrete bridge deck overlay materials shall not be placed when weather or surface conditions are such that the material cannot be properly handled, placed, spread and cured within the specified requirements of traffic control.

The polymeric overlay system shall be applied in two separate courses in accordance with the following rate of application, and the total of the two applications shall not be less than 7.5 gal./100 sq ft.

Course	**Rate, Gal./100 sq ft**	**Aggregate, lbs/sq yd***
1	No less than 2.5	No less than 10

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2	No less than 5.0	No less than 14

* Application of aggregate shall be of sufficient quantity to completely cover the epoxy.

After the epoxy polymer mixture has been prepared for the polymeric concrete bridge deck overlays, it shall be immediately and uniformly applied to the surface of the bridge deck with a squeegee. The temperature of the bridge deck surface and all polymer adhesive and aggregate components shall be 60°F or above at the time of application. The treatment system materials shall not be applied if the air temperature is expected to drop below 55°F within 8 hours after application, or the gel time is less than 10 minutes.

The dry aggregate shall be applied in such a manner as to cover the polymer mixture completely within 5 minutes. Each course of polymeric concrete treatment system shall be cured until vacuuming or brooming can be performed without tearing or damaging the surface.

Traffic or equipment shall not be permitted on the treatment system surface during the curing period. After the first course curing period, all loose aggregate shall be removed by vacuuming or brooming and the next treatment system course applied to completion.

The minimum curing periods shall be as follows:

Course	**Average temperature of deck, polymer and aggregate components, °F**					
	60-64	65-69	70-74	75-79	80-84	>85
1	4 hours	3 hours	2.5 hours	2 hours	1.5 hours	1 hour
2	6.5 hours*	5 hours	4 hours	3 hours	3 hours	3 hours

* Course 2 shall be cured for 8 hours if the air temperature drops below 60°F during the curing period.

The Contractor shall plan and prosecute the work to provide the minimum curing periods as specified herein, or other longer minimum curing periods as prescribed by the manufacturer prior to opening to public or construction traffic, unless otherwise permitted. The first course applications shall not be opened to traffic.

Unless otherwise specified by the Engineer, the polymeric concrete bridge deck overlays shall not be applied over the expansion joints of a bridge deck. The expansion joints shall be coated with a bond breaker or covered using an approved tape that can adequately seal the joints from the polymer. Duct tape may also be used to delineate application areas. All taped areas or bond breakers shall be removed before the polymer fully cures.

In the event the operation damages or mars the epoxy treatment system, damaged areas shall be removed by saw cutting in rectangular sections to the top of the deck surface and replacing the course in accordance with this specification.

For all materials provided, the Contractor shall maintain and provide records including but not limited to, the following:

1. Batch numbers and sizes;
2. Location of batches as placed on deck, referenced by stations;
3. Batch time, gel time; temperature of the air, deck surface, polymer adhesive components, including aggregates;
4. Loose aggregate removal time; and time open to traffic.

Prior to construction of the polymeric concrete bridge deck overlays, the Contractor shall submit to the Engineer for approval a QCP for constructing the treatment system. The QCP shall include, but not be limited to, the materials, equipment, procedures and minimum and maximum air and deck surface temperatures; anticipated schedule for traffic control, patching, crack repair, surface preparation, and placement of the treatment system; and test reports, documentation, explanation, and justification to support the proposed QCP. The QCP shall also meet the approval of the manufacturer of the polymer materials. Any deviations from the application prescribed by this specification shall be explained to, and approved by, the Engineer before such deviation.

The Contractor shall plan and prosecute the work to provide the minimum curing periods as specified herein, or other longer minimum curing periods as prescribed by the manufacturer prior to opening to public or construction traffic.

(f) Final Coat Testing

Tensile Bond Pull-Off Tests in accordance with ITM 407 shall be performed after the final coat of the polymeric concrete surface treatment is cured and excess aggregate is removed to verify adequate bond strength of the epoxy to the cover aggregate and concrete substrate. Locations of the tensile pull-off test will be determined by the Engineer and shall be spaced at intervals of 75 linear feet for polymeric treatment widths of 24 ft. Final coat testing shall be performed prior to opening to traffic. Tensile pull-off testing shall not be performed when the surface temperature is at or above 90°F.

Damage resulting from the tensile bond pull-off testing shall be repaired using a small amount of the epoxy and aggregate used in the polymeric concrete bridge deck overlays.

All individual tensile bond pull-off tests which do not achieve a passing designation as previous defined for surface preparation shall have further testing performed according to the type of failure. Additional testing will determine the limits of further remedial action. If the pull off assembly does not achieve a load of 250 psi and detaches from the treated surface at the adhesive-aggregate interface, the test will not be valid. In such a case, the Contractor shall perform additional tests at 1 ft intervals until a valid test result, either pass or fail, is determined. In the case of a failing tensile pull off test, additional testing shall be performed to determine the limits of further remedial action under the following conditions.

1. Concrete failure. If the mode of failure for the tensile pull-off test involves a fracture depth at less than 1/4

inch into the base concrete or the fractured concrete covers less than 50% of the test area, the tensile pull off test will be given a failing designation. Additional tensile pull-off tests shall be conducted at one foot intervals in each direction from the failing result to determine the length and width of remedial action. The deficient area shall be repaired in accordance with the Construction Requirements (d) with the exception that a test patch is not required. Once the area is repaired and the polymeric concrete bridge deck overlays is applied, final coat testing will be performed on the repaired area.

2. Epoxy or Aggregate failure. Separation of the polymeric concrete surface treatment from the concrete surface or pull-off of the aggregate from the epoxy will be considered a failure. The Contractor shall perform at least two additional pull-off tests. One test shall be performed between 10 ft and 15 ft back from the failing test and one test shall be performed between 10 ft and 15 ft ahead of the failing test. The polymeric concrete surface treatment shall be removed and replaced at the Contractor's expense. The limits of polymeric surface treatment removal shall be defined 1/2 the distance back and 1/2 the distance ahead of the adjacent passing tests for the entire width of original placement.

(g) Pavement Markings

Heat bonded pavement markings shall not be permitted on the polymeric concrete bridge deck overlays.

Method of Measurement

The accepted quantities of the polymeric concrete bridge deck overlays will be measured by the square yard. Full depth patching and partial depth patching will be measured in accordance with 722.14. The bridge deck patching concrete used in full depth or partial depth patching will not be measured.

Basis of Payment

Full depth patching and partial depth patching will be paid for in accordance with 722.15. Polymeric concrete bridge deck overlays will be paid for at the contract unit price per square yard.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Polymeric Concrete Bridge Deck Overlay	SYS

The cost of hand-chipping, removal of unsound concrete, preparation of cavity surfaces, furnishing and applying bond coat or epoxy resin adhesive as required, furnishing and placing patching material, and necessary incidentals shall be included in the cost of bridge deck patching, full depth, or bridge deck patching, partial depth.

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The cost of all re-cleaning suspect areas or verification through tests that the altered cleaning method is acceptable shall be included in the cost of the polymeric concrete surface treatment pay item.

All costs of cleaning the bridge deck by shot blasting or other approved methods, the tensile bond pull-off tests, removal of any crack sealants, removal of excess aggregate, any profile grinding, removal and disposal of all waste materials, and furnishing all equipment, labor, materials, and incidentals to perform the work described herein shall be included in the cost of the polymeric concrete surface treatment pay item.

COMMENTS AND ACTION

PROPOSED NEW 738-B-XXX POLYMERIC CONCRETE BRIDGE DECK OVERLAY

Motion: Second: Ayes: Nays:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections affected: NONE Recurring Special Provision affected: NONE Standard Sheets affected: NONE Design Manual Sections affected: SECTION 72.3 GIFE Sections cross-references: NONE	_____ 2016 Standard Specifications Book ____ Revise Pay Items List _____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ ____ Revise RSP (No.____) Effective ____ Letting RSP Sunset Date: ____ Standard Drawing Effective ____ ____ Create RPD (No. ____) Effective ____ Letting ____ Technical Advisory GIFE Update Req'd.? Y __ N __ By ____ Addition or ____ Revision Frequency Manual Update Req'd? Y__N__ By ____ Addition or ____ Revision Received FHWA Approval? _____