

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
SPECIAL PROVISION**

Section 519 – Concrete Bridge Deck Overlay

Add the following:

Section 519—TWO-PART POLYMER BRIDGE DECK OVERLAY

519.1 General Description

This work includes preparation of the bridge deck and furnishing and placing of a two-part polymer bridge deck overlay at the location and thickness as indicated on the plans. This bridge deck overlay system consists of a minimum 3/8 inch (9.5mm) thick application to provide complete waterproofing as well as providing a non-skid surface that withstands continuous heavy traffic and extreme changes in weather conditions.

519.1.01 Definitions

A. Standard Specifications

General Provision 101 through 150.

[Section 107 – Legal Regulations and Responsibility to the Public](#)

[Section 504—Twenty-Four Hour Accelerated Strength Concrete](#)

[Section 886—Epoxy Resin Adhesives](#)

[Section 934—Rapid Setting Patching Materials for Portland Cement Concrete](#)

519.2 Materials

- A. Submittals:** Submit the bridge deck overlay materials to the Office of Materials and Research for approval. The Office of Materials and Research will grant approval based on laboratory test results and on the system’s performance during a 2 year field evaluation.
- B. Pre-treatment:** Use pre-treatment only when recommended by the overlay manufacturer. Use pre-treatment consisting of a two-part hybrid polymer that is free of any fillers or volatile solvents and formulated to provide simple volumetric ratio of two components such as one to one or two to one by volume. Formulate the two-part hybrid polymer to provide a unique combination of extremely low viscosity and low surface tension coupled with an affinity for concrete and steel. Use two-part hybrid polymer pre-treatment having the following physical requirements when cured:

PHYSICAL PROPERTIES FOR CURED PRE-TREATMENT SYSTEM		
TEST	REQUIREMENTS	TEST METHOD
Compressive Strength	5,500 PSI (38MPa) min.	ASTM C 109
Tensile Strength	3,100 PSI (21MPa) min.	ASTM D 638
Tensile Elongation	30% min.	ASTM D 638

Water Adsorption	0.10% max.	ASTM D 570
Shore "D" Hardness	65 min.	ASTM D 2240
Pot Life	40-70 minutes	GDT-58
Adhesion to Concrete	100% failure in concrete	ACI-503-R (Pull Out Test)

C. Bridge Deck Overlay: Use a bridge deck overlay consisting of a two-part polymer that is free of any fillers or volatile solvents and formulated to provide simple volumetric mixing ratio of two components such as one to one or two to one by volume. Use a two-part polymer system formulated to provide flexibility in the system without any sacrifice of the hardness, chemical resistance or strength of the system. Do not use external or conventional plasticizers. Introduce flexibility by interaction of elastomers to chemically link in the process of curing so that the flexibility of the molecule is minimally affected during the low temperature conditions that are confronted in actual use. Use a two-part polymer overlay system having the following physical properties when cured:

PHYSICAL PROPERTIES FOR CURED TWO PART POLYMER OVERLAY SYSTEM		
TEST	REQUIREMENTS	TEST METHOD
Compressive Strength	7,000 PSI (48MPa) min.	ASTM C 109
Tensile Strength	2,500 PSI (17MPa) min.	ASTM D 638
Tensile Elongation	30% min.	ASTM D 638
Water Adsorption	0.20% max.	ASTM D 570
Shore "D" Hardness	60 min.	ASTM D 2240
Pot Life	15-40 minutes	GDT-58
Flexural Creep	0.0065" (0.17mm) in 7 days	California Method 419
Adhesion to Concrete	100% failure in concrete	ACI-503-R (Pull Out Test)

D. Aggregate: Use bauxite, crushed porphyry, aluminum oxide or other similarly hard durable aggregates as recommended by the manufacturer and approved by the Engineer. Use embedded exposed aggregate conforming to the following gradation.

FINE AGGREGATE GRADATION	
SIEVE SIZE	% PASSING BY WEIGHT
No. 4	100
No. 20	0 – 5
No. 200	0 – 1.0

Broadcast coarse aggregate conforming to the following gradation over the first layer of polymer, immediately prior to broadcasting fine aggregate.

COARSE AGGREGATE GRADATION	
SIZE	% PASSING BY WEIGHT
5/8"	98 - 100
1/2"	55 – 60
3/8"	12 – 14
1/4"	0 - 1

519.2.01 Delivery, Storage and Handling

Deliver all materials in their original containers, bearing the manufacturer's label, specifying date of manufacture, batch number, trade name brand, quantity and mixing ratio.

Store all materials to prevent damage from the elements and to insure the preservation of its quality and fitness for the work. Avoid contact with flame.

Inspect all stored materials, although accepted before storage, prior to their use in the work. Ensure that all stored materials meet the requirements of the Contract at the time of use.

Remove from the site of the work immediately, any material rejected because of failure to meet the required tests or rejected because of damage. Replace all removed material at no additional cost to the Department.

519.3 Construction Requirements

519.3.01 Preparation

A. Removal and Preparation of Repair Area

Sound all visual bridge deck defects of greater than 1" X 6" (25mm X 150mm) to determine the limits of the damaged areas. Strike the deck surface around the defect with a hammer, chain drag, or other similar tool to detect unsound concrete having a "flat" or "hollow" sound. Mark the limits of the defective areas on the deck by making a rectangular area 2 inches (50mm) beyond the outer limits of the unsound concrete area to serve as a guide for sawing. Mark spalled areas within less than 6 inches (150mm) of each other as one spall area.

Saw the rectangular marked areas with near vertical faces not less than one inch (25mm) in depth. Exercise extreme care not to saw or damage the reinforcing steel. Remove all unsound material within the sawed areas. Remove concrete to a minimum depth of $\frac{1}{2}$ inch (13mm) below the top mat of reinforcing steel by power chipping or hand tools. Do not use pneumatic hammers heavier than a 15 lb. class (nominal). Do not operate pneumatic hammers and chipping tools at an angle exceeding 60 degrees relative to the surface of the deck slab. Such tools may be started in the vertical position but must be immediately tilted to a 60 degree operation angle. Clean all exposed reinforcing steel of all rust, corrosion products, oil, dirt, concrete fragments, loose scale and any other coating of any character that would destroy or inhibit the bond with the patching material. Exercise utmost care not to damage or fracture the sound concrete substrate left on the bottom of the spall repair area. Do not use sharp pointed bits.

Hold "over-cutting" of the bridge deck beyond marked areas to the minimum amount possible. Thoroughly clean all "over-cutting" of "saw slurry" and other contaminants. Then repair by filling full-depth with an approved Type II epoxy adhesive as specified in Section 886. Make such repairs as soon as possible.

Just prior to placing the patching material, thoroughly clean the surfaces within the repair areas by abrasive blasting and air blasting to remove any oil, dust, dirt, slurry from saw operation, and other contaminants. Remove abrasives from the blasting operation from the bridge deck. During blasting, protect traffic in adjacent lanes.

B. Placement of Patching Material

The Contractor shall use Repair Method No. 1 or Method No. 2 as described below. For both repair methods, ensure the surface within the repair areas is dry and thoroughly cleaned of all contaminants immediately before placement. Use air compressors equipped with suitable traps capable of removing all surplus water and oil in the compressed air for cleaning repair areas. Do not use contaminated air. Use air compressors capable of delivering compressed air at a continuous pressure of 90 psi (620kPa).

Ensure the finished surface meets a surface tolerance of $\frac{1}{16}$ inch (1.6mm). Utilize such approved measures as necessary to keep the deck surface adjacent to the patching operation reasonably clean of excess grout and other materials at all times. Unless otherwise specified, complete all patching operations and open all lanes to traffic before sunset each day.

1. Repair Method No. 1 (24 Hour Accelerated Strength Concrete)

After the repair area preparation is complete, completely coat all concrete surfaces within the repair area with a film of Type II epoxy at a thickness of 10 to 20 mils (0.25 to 0.50mm).

Use concrete meeting the requirements of Section 504. Mix the concrete on site. Use a mix design and mixing method approved by the Laboratory. Deposit concrete in the repair area while the epoxy is still tacky and vibrate sufficiently to form a dense, homogeneous mass of concrete, completely filling the area of the patch. Screed the concrete to the proper grade and allow to remain undisturbed until the water sheen disappears from the surface. Then cover the concrete with wet burlap or membrane curing compound. Continue curing for a minimum of 3 hours. The Engineer may require a longer curing time to ensure sufficient strength development of the concrete prior to opening to traffic.

2. Repair Method No. 2 (Rapid Setting Patching Material)

Follow the above requirements for Repair Method No. 1. Additionally, prepare the surfaces in the repair areas in accordance with the manufacturer's written recommendations. Handle, mix, place, consolidate, screed, and cure the patching material in accordance with the manufacturer's written instructions as approved by the Laboratory. Continue curing for at least one hour and until the section is opened to traffic.

519.3.02 Construction

- A. Surface Preparation:** Clean the bridge deck by shotblasting to remove any oil, dirt, rubber or any other potentially detrimental material such as curing compound and laitance which may prevent proper bonding and curing of the material.

The Contractor is directed to Section 107 of the Standard Specifications giving the Contractor responsibility for the work site, and requiring conformance to all federal, state, and local laws relating to pollution control and worker protection. In particular, ensure that the Contractor is familiar with and in full compliance with the provisions of the laws concerning the management of waste and worker protection.

Do not allow construction traffic on any portion of the deck that has been shotblasted or on the overlay without specific approval of the Engineer. Overlay the deck surface within 24 hours of the surface preparation operation.

Ensure all surfaces to be overlaid are dry at the time of application. Immediately before applying the overlay system, clean all prepared surfaces with compressed air (or vacuum) to remove dust and debris. Use air compressors equipped with a filter to prevent oil in the air supply. Do not apply the overlay system when rain is forecast to occur within 24 hours of application. Do not apply the overlay system unless the minimum ambient temperature is 50° and rising.

If, in the opinion of the Engineer, the surface has become soiled or contaminated prior to the application of the overlay, re-clean the surface to the satisfaction of the Engineer at no additional cost to the Department.

- B. Field Test:** Prior to commencing the overlay operation, place a test area of overlay on the bridge deck. Prepare the area for the test overlay as described above. Ensure the test is large enough so the cleaning equipment and methods to be employed in the full-scale operation can be used for the field test. Ensure the degree of cleaning used on the test area is the minimum used on the remainder of the structure. Use the application of the overlay system to the test area to establish proper procedures and techniques for applying the overlay to the full structure.

After the test area has cured for 72 hours, check adhesion in accordance with ACI 503R-1980. Test a minimum of three sample areas. Ensure no adhesion test has an adhesive strength less than 250 psi (1725kPa) and the minimum average value for the 3 tests is greater than 300 psi (2070kPa).

If the test of a sample area fails to meet the above requirements due to a cohesive failure of the concrete substrate, the adhesive strength of the sample area will be considered acceptable. Successful completion of the adhesive strength tests will be required before the full-scale overlay operation is to begin.

- C. Application:** Provide suitable coverings, such as heavy duty drop cloths, to protect all exposed areas not to be overlaid, such as curbs, railings, parapets, deck drains, locations of expansion joints that are to receive expansion joint membranes, etc. Clean or repair any damage or defacement resulting from the application, at the Contractor's expense, to the satisfaction of the Engineer.

Ensure the application of the overlay system is done by the supplier, or by a factory trained or licensed applicator, with written approval from the manufacturer of the overlay system.

Ensure each component of the two-part polymer is metered, mixed together, and distributed onto the deck by machine. Use a dispensing machine capable of ratio check verification at the pump outlets as well as cycle counting to monitor output. Ensure the in line mixing is motionless so as not to overly shear the material. Ensure the machine makes maximum use of the working time of the polymer by mixing it immediately prior to dispensing onto the deck.

Provide the number of layers and the application rates of the materials in the various layers as recommended by the manufacturer in order to achieve a minimum $\frac{3}{8}$ inch (9.5mm) and maximum $\frac{1}{2}$ inch (13mm) overlay thickness when measured from the top of the concrete substrate to the top of the polymer (not the peaks of the aggregate). Ensure the application of the overlay system is as follows:

1. **APPLICATION OF POLYMER:** After mixing of the components, evenly distribute the polymer on the clean, dry deck surface at the rate recommended by the manufacturer.
2. **APPLICATION OF AGGREGATE:** After application of each layer of polymer, allow a minimum lapse period as required by the manufacturer's instructions before broadcasting the aggregate. Ensure the method and rate of aggregate application is in accordance with the manufacturer's recommendations.

3. **CONSOLIDATION:** If required by the manufacturer, use a hand operated roller as approved by the Engineer and the manufacturer within 10 minutes of the aggregate application to evenly consolidate the aggregate into the polymer.
4. **REMOVAL OF EXCESS AGGREGATE:** After initial cure, remove excess aggregate by a power vacuum or other Engineer approved method prior to the application of subsequent layers of polymer.
5. **APPLICATION OF ADDITIONAL LAYERS:** Additional layers may be applied immediately after the initial set of the preceding layer (as determined by the Manufacturer and Engineer) and removal of all excess aggregate. The maximum time allowed between each layer shall be at the discretion of the Engineer and the Manufacturer and may vary depending on the temperature and circumstances of the project. Ensure joints are staggered and overlapped between successive layers so that no ridges will appear.
6. **TRAFFIC CONSIDERATIONS:** Traffic may be allowed on the final layer after the polymer has reached its final cure (as determined by the Manufacturer) and after removal of all excess, loose aggregate.
7. **OVERLAY SURFACE:** Ensure the finished surface consists of a uniform coat of imbedded exposed aggregate.

519.3.03 Quality Acceptance

A. Thickness Verification

Ensure the overlay is at least $\frac{3}{8}$ " (9.5mm) thick as measured from the concrete substrate to the top of the polymer at three random locations for every 1000 yd² (830 m²) of surface area. Recoat thin areas as described above and re-verify thickness at no additional cost to the Department. This verification may consist of cores, holes, etc., but in all cases repair any areas tested to destruction before final acceptance.

In thin areas that have been recoated to obtain the required minimum thickness, the Engineer may require additional adhesion strength tests in accordance with ACI 503R-29 to verify the Contractor's procedure for recoating existing overlay.

519.3.04 Contractor Warranty and Maintenance

The polymer manufacturer and the Contractor, by acceptance of the work described in this Specification, shall jointly agree to guarantee the wearing surface against all defects incurred during normal traffic use for a period of ten years. Submit this agreement in writing to the Engineer signed by both the polymer manufacturer and the Contractor. Commence the ten year period on the date of acceptance of the work. The guarantee shall cover all labor and materials required by the Department to satisfactorily repair and replace the wearing surface.

519.4 Measurement

519.4.01 Surface Preparation:

Measure the area of the deck acceptably repaired and blast cleaned prior to installation of the overlay in square yards (meters) computed from surface measurements taken to the nearest 0.1 foot (30mm). Do not measure the blast cleaning of any longitudinal or transverse construction joints or vertical surfaces for payment.

519.4.02 Polymer Overlay:

Measure the area of the deck acceptably overlaid with polymer and broadcast spread crushed aggregate in square yards (meters) computed from surface measurements taken to the nearest 0.1 foot (30mm).

519.5 Payment

519.5.01 Surface Preparation:

Surface preparation is paid for by the square yard (meter) of the deck acceptably repaired and blast cleaned prior to installation of the overlay. Payment includes all expenses associated with removal of existing concrete, repair and blast cleaning operations.

519.5.02 Polymer Overlay:

Polymer overlay is paid for by the square yard (meter) of the deck overlaid, complete in place and accepted, provided, however, that the specified minimum overlay thickness requirement is met. The individual layers necessary to attain the specified thickness will not be paid for individually. Payment includes all labor and material cost, procurement, handling, hauling and processing, coring for thickness verification, guarantee, and includes all equipment, tools, labor, and incidentals necessary to complete the work.

Payment will be made under:

Item No. 519	Surface Preparation	Per square yard (meter)
Item No. 519	Polymer Overlay	Per square yard (meter)

Item No. 519-0515 Surface Preparation per Square Yard (Meter)

Item No. 519-0530 Polymer Overlay per Square Yard (Meter)