ITEM 584.6014--25 - POLYESTER CONCRETE OVERLAY – SURFACE PREPARATION AND PLACEMENT (ROADWAY)
ITEM 584.6015--25 - POLYESTER CONCRETE OVERLAY – SURFACE PREPARATION AND PLACEMENT (CONCRETE FILLED STEEL GRID SIDEWALK)
ITEM 584.6016--25 - POLYESTER CONCRETE OVERLAY – FURNISH MATERIAL

1. DESCRIPTION:

1.01 This work shall consist of furnishing and placing a polyester concrete overlay where indicated in the Contract Documents. The work shall include the preparation of the receiving surfaces.

2. MATERIALS:

2.01 **Primer** – The prepared surface shall receive a wax-free low odor, high molecular weight methacrylate prime coat. The prime coat shall be a resin, and prior to adding initiator the resin shall have a maximum volatile content of 30 percent, when tested in accordance with ASTM designation D2369, and conforming to the following:

High Molecular Weight Methacrylate (HMWM) Resin		
Property	**Requirement**	**Test Method**
Viscosity* (Brookfield RVT with UL adapter, 50 RPM at 77° F)	25 cP, maximum	ASTM D2196
Specific Gravity* (at 77° F)	0.90, minimum	ASTM D1475
Flash Point*	180° F, minimum	ASTM D3278
PCC Saturated Surface-Dry Bond Strength (at 24 hrs. at 70±1.8°F)	0.5 ksi minimum	NYSDOT Test Method 701-13F, Bond Test

* Tested prior to adding initiator.

The prime coat promoter/initiator shall consist of a metal drier and peroxide. If supplied separately from the resin, **at no time shall the metal drier be mixed directly with the peroxide.** The containers shall be stored in a manner that will not allow leakage or spillage from one material to contact the containers or material of the other.

NOTE: Mixing the metal drier with the peroxide will result in a violent exothermic reaction.

2.02 **Aggregate** – Aggregate for polyester concrete *and finishing sand* shall conform to the requirements of §703-07, "Concrete Sand" except the gradation shall meet the following:

2. MATERIALS: (cont'd)

2.02 **Aggregate** (cont'd)

COMBINED AGGREGATE		
Sieve Size	**3/8" Max Percent Passing**	**No. 4 Sieve Max. Percent Passing**
1/2 inch	100	100
3/8 inch	83 – 100	100
No. 4	65 – 82	65-82
No. 8	45 – 64	45 – 67
No. 16	27 – 48	29 – 50
No. 30	12 – 30	16 – 36
No. 50	6 – 17	5 – 20
No. 100	0 – 7	0 – 7
No. 200	0 – 3	0 – 3

The largest aggregate size used shall not exceed one-half the minimum depth of overlay.

Aggregate retained on the No. 8 sieve shall have a maximum of 45 percent crushed particles when tested in accordance with AASHTO Test Method T27. Fine aggregate shall consist of natural sand only.

Aggregate absorption shall not exceed one percent as determined by AASHTO Test Methods T84 and T85.

At the time of mixing with the resin, the moisture content of the aggregate, as determined by AASHTO Test Method T255, shall not exceed one half of the aggregate absorption.

Finish sand shall be a dry commercial quality blast sand conforming to the following:

A. Roadway Surface: No. 8x20
B. Sidewalk Surface: No. 30x50

2.03 **Polyester Binder** – The polyester concrete shall consist of polyester resin binder and dry aggregate. The resin shall be an unsaturated isophthalic polyester-styrene co-polymer conforming to the following:

2. MATERIALS: (cont'd)

2.03 **Polyester Binder** (cont'd)

Polyester Resin Binder		
PROPERTY	**REQUIREMENT[a]**	**TEST METHOD**
Viscosity* (RVT No. 1 spindle, 20 RPM at 77° F)	75 to 200 cP	ASTM D2196
Specific Gravity* (at 77° F)	1.05 to 1.10	ASTM 1475
Elongation	35 percent minimum Type I at 0.45 inch/min. Thickness = 0.25±0.03 inch	ASTM D638
	Sample conditioning: 18/25/50 + 5/70	ASTM D618
Tensile Strength	2500 psi minimum Type I at 0.45 inch/min. Thickness = 0.25± 0.03 inch	ASTM 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM 618
Styrene Content*	40-50 percent, minimum (by weight of polyester styrene resin)	ASTM D2369
Silane Coupler	1.0 percent, minimum (by weight of polyester styrene resin)	
PCC Saturated Surface Dry Bond Strength (at 24 hours and 70±1.8°F))	0.5 ksi, minimum	NYSDOT Test Method 701-13F, Bond Test

* Tested prior to adding initiator
[a] Values are based on specimens or samples cured or aged at 77°F unless otherwise indicated.

The silane coupler shall be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter shall be compatible with methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxice (CHP) initiators.

2.04 **Testing and Sampling:** The Manufacturer shall have the materials for all components of the overlay system tested by an independent testing firm prior to the overlay application. The independent testing firm shall send the material testing results directly to the Engineer.

Samples shall be representative of the materials to be used in the overlay application and shall consist of one one-gallon sample for each liquid component and a 5 pound sample for each dry component.

2.05 **Packaging and Shipment:** A Material Safety Data Sheet shall be furnished prior to use for each shipment of polyester resin binder and high molecular weight methacrylate resin. All components shall be shipped in strong, substantial containers, bearing the manufacturer's label specifying date of manufacture, batch number, brand name, quantity, and date of expiration or shelf life. In addition, the mixing ratio shall be printed on the label of at least one of the system components. If bulk resin is to be used, the Contractor shall notify the Engineer in writing ten (10) days prior to the delivery of the bulk resin to the job site. Bulk resin is any resin that is stored in containers in excess of 55 gallons.

2. MATERIALS: (cont'd)

2.06 **Basis of Acceptance:** Project acceptance of the polyester overlay materials will be based on the following:

A. Delivery of the overlay materials to the project site in acceptable containers bearing all the label information as required in 2.05, **Packaging and Shipment** above.

B. Receipt of an independent testing firm's results that confirm the primer, aggregate and polyester binder are in compliance with the material requirements found under MATERIALS, 2.01, 202, and 2.03 above.

2.07 **Suppliers:** Kwik Bond Polymers, LLC, 231 Market Place, Suite 322, San Ramon, CA 94583 or other approved supplier that can provide materials meeting all requirements of this specification.

3. CONSTRUCTION DETAILS:

3.01 **General:**

A. At least ten (10) days before start of work, the Contractor shall provide the Engineer with two (2) copies of the manufacturer's written instructions for the installation of the overlay system.

B. The manufacturer's technical representative shall be made available for up to three (3) working days to make recommendations to facilitate the overlay installation. This shall include, but not be limited to, surface preparation, overlay application and overlay cure.

C. During surface preparation and overlay application, precaution shall be taken to assure that traffic is protected from rebound, dust, and construction activities. Appropriate shielding shall be provided as required and directed by the Engineer.

D. During overlay application, the Contractor shall provide suitable coverings (e.g., heavy duty drop cloths) to protect all exposed areas not to be overlaid, such as curbs, sidewalks, parapets, etc. All damage or defacement resulting from this application shall be cleaned and/or repaired to the Engineer's satisfaction, at no additional cost.

3.02 **Storage of Materials:** All materials shall be stored in accordance with the manufacturer's recommendation to ensure their preservation until used in the work. Applicable fire codes may require special storage facilities for some components of the overlay system.

3.03 **Equipment:**

A. **Surface Preparation Equipment:**

1. Roadway: All equipment to be used for surface preparation shall be as specified by the overlay manufacturer and approved by the Engineer. Unless otherwise specified, the Contractor shall use automatic shot blasting units to clean pavement surfaces. Shot blasting equipment shall be self propelled and include a vacuum to recover spent abrasives. The abrasive shall be steel shot.

3. CONSTRUCTION DETAILS: (cont'd)

3.03 **Equipment:** (cont'd)

A. **Surface Preparation Equipment:** (cont'd)

1. Roadway: (cont'd)
Magnetic rollers shall be used to remove any spent shot remaining on the deck after vacuuming. In those areas not accessible to this machinery, the surface may, with the Engineer's approval, be cleaned with abrasive blasting equipment.

2. Sidewalk: All equipment to be used for surface preparation shall be as specified by the overlay manufacturer and approved by the Engineer. Unless otherwise specified, the Contractor shall clean the sidewalk surface with abrasive blasting equipment.

B. **Mixing Equipment:**

1. Roadway**:** Furnish mechanically operated continuous mixers specifically built or modified for polyester polymer concrete. Mixers shall:

- Employ an auger screw/chute device,
- Be equipped with a positive displacement resin pump connected to an adjustable catalyst pump,
- Be equipped with a metering device that automatically measures and records the aggregate volumes and corresponding resin volumes. Volumes shall be recorded a no greater than five minute intervals along with the time and date of each recording. A printout of the recordings shall be furnished to the Engineer a the end of each work shift, and
- Have a readout gage, visible to the Engineer at all times, that displays the volumes being recorded.
- Mixing equipment shall be calibrated within 12 months prior to being used on the Contract. A copy of the signed and dated calibration certificate shall be given to the Engineer prior to use. The Authority reserves the right to witness calibration of the unit.

2. Sidewalk: Polyester concrete shall be mixed in mechanically operated mortar-type mixers. Mixer size shall be limited to 0.33 cubic yard capacity.

C. **Finishing Equipment:**

1. Roadway: Use slip-form finishing equipment with an automatic grade control device to strike off the concrete to the established grade and cross section. Finishing equipment shall be fitted with vibrators or other means of consolidating the polyester polymer concrete.

2. Sidewalk: Finishing shall be performed using a vibratory-type mechanical screed riding on preset rails. Screeds shall be approved by the Engineer prior to the application of the overlay.

3. CONSTRUCTION DETAILS: (cont'd)

3.03 **Equipment:** (cont'd)

D. **Texturing:**

1. Roadway: The finished surface shall be textured using spring steel tines in accordance with §502-3.10 A, Longitudinal Tining

2. Sidewalk: The finished surface shall be lightly broomed to a uniform texture in a direction transverse to the sidewalk.

3.04 **Surface Preparation:** All surfaces that will be in contact with the overlay shall be prepared as follows:

A. Before application of the primer, the surface shall be cleaned using the approved cleaning methods to remove all asphaltic material, oils, 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 overlay. The prepared surface shall be capable of providing a tensile bond strength greater than or equal to 250 ksi or a failure area, at a depth of 1/8 inch or more into the base concrete, no greater than 50% of the test area. The testing shall be as per ACI 503R-93, Appendix A. Acceptable cleaning is usually achieved by significantly changing the color of the concrete and mortar and beginning to expose coarse aggregate particles. Mortar which is sound and firmly bonded to the coarse aggregate must have open pores due to cleaning to be considered adequate for bond. A vacuum cleaner or oil-free compressed air shall be used to remove all dust and other loose material.

If the Engineer determines that an approved cleaning practice has changed prior to the completion of the overlay application, the Contractor must return to the approved cleaning methods and re-clean the suspect areas or verify through tests at no additional cost to the Authority that the practice is acceptable.

All patching and cleaning operations shall be inspected and approved prior to placing the overlay. Any contamination of the deck after initial cleaning shall be removed. The entire overlay system shall be applied following the cleaning and prior to opening the area to traffic.

Cleaned pavement surfaces shall not be exposed to vehicular or pedestrian traffic other than that required by the overlay operation. If the pavement is contaminated before being overlaid it shall be re-cleaned by abrasive blasting to the satisfaction of the Engineer. No additional payment will be made for re-cleaning work.

The concrete surface shall be moisture-free at the time of application of the overlay and has been dry for the preceding 24 hours.

B. All steel surfaces that will be in contact with the overlay shall be cleaned in accordance with SSPC-SP No. 10, Near-White Blast Cleaning, except that wet blasting methods shall not be allowed.

3. CONSTRUCTION DETAILS: (cont'd)

3.04 **Surface Preparation:** (cont'd)

B. (cont'd)
After the cleaning operation is completed there shall be no visible evidence of oil, grease, dirt, rust, loose particles, spent abrasives or other foreign material on any of the surfaces to be overlaid.

3.05 **Placement**:

A. General:

1. When magnesium phosphate concrete is placed prior to the deck overlay, the magnesium phosphate concrete shall be placed at least 72 hours prior to placing the prime coat.

2. When modified high alumina based concretes are placed prior to the deck overlay, the prime coat shall not be placed on said concrete until at least 24 hours after final set.

3. The polyester concrete placement operation shall start from the lower elevation and progress towards the higher elevation.

B. **Prime Coat:**

1. Prior to applying the prime coat, the concrete surface shall be moisture-free, dry for the preceding 24 hours, and shall be blown clean with oil-free compressed air. The surface temperature shall be at least 50° F and not more than 100° F, and the relative humidity less than 85 percent when the prime coat is applied.

2. The prime coat shall be uniformly applied to completely cover the surface to receive the polyester concrete. The rate of spread shall be between 70 to 100 square feet of deck surface per gallon or as recommended by the manufacturer. The prime coat shall be in place a minimum of 15 minutes before placing polyester concrete.

C. **Polyester Concrete:**

1. The resin binder shall be initiated and thoroughly blended just prior to mixing with aggregate. The polyester concrete shall be mixed a minimum of 2 minutes prior to placing.

2. The amount of initiator used in polyester concrete shall be sufficient to produce an initial set time between 30 – 120 minutes during placement. The initial set time will be determined by using an initial-setting time Gillmore needle in accordance with the requirements of ASTM Designation: C 266.

3. CONSTRUCTION DETAILS: (cont'd)

3.05 **Placement:** (cont'd)

C. **Polyester Concrete:** (cont'd)

2. (cont'd)
Accelerators or inhibitors may be required to achieve proper set times and shall be used as recommended by the resin supplier.

3. The surface temperature of the area to receive polyester concrete shall be the same as specified above for the prime coat, a minimum of 50° F.

4. **Roadway Overlay**:

a. The polyester overlay shall be placed to the nominal thickness shown on the plans. Placement of the overlay to the profile and cross slope shall be controlled by a taut reference string line. The reference elevation and string line shall be established by the Contractor and subject to the approval of the Engineer.

b. Polyester concrete shall be placed and finished prior to gelling. Polyester concrete that is not placed within this time shall be discarded.

c. The polyester concrete shall consist of a ratio between 11.5: 100 to 15:100 of polyester resin to dry aggregate by weight; the exact proportions will be determined by the Engineer during placement to enable proper finishing and texturing of the overlay surface.

d. The polyester concrete shall be placed after the prime coat has been in place a minimum of 15 minutes and within 120 minutes after the prime coat has been applied.

e. The finishing equipment used shall strike off the polyester concrete to the established grade and cross section. Finishing equipment shall be fitted with vibrators or other means capable of consolidating the polyester concrete to the required compaction.

f. The finish sand shall be applied by mechanical means immediately after strike-off, before gelling occurs, at a minimum rate of 0.8 pounds per square yard.

g. Immediately after the finish sand is applied, the surface shall be textured in accordance with Section 3.03-D Texturing to provide acceptable surface friction characteristics.

3. CONSTRUCTION DETAILS: (cont'd)

3.05 **Placement:** (cont'd)

C. **Polyester Concrete:** (cont'd)

4. **Roadway Overlay**: (cont'd)

h. Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as railing, joints, etc. All hand troweling shall be followed by broadcasting finish sand and surface texturing while the resin is still wet to provide acceptable surface friction characteristics.

5. **Concrete Filled Steel Grid Sidewalk Overlay**:

a. The overlay shall be placed in two separate pours to the thicknesses shown on the plans. The first pour shall be placed after the prime coat has been in place a minimum of 15 minutes and within 120 minutes after the prime coat has been applied. The first pour shall contain 100% resin and initiator (no aggregate added). The first pour shall be placed to the proper thickness using hand methods or other methods acceptable to the Engineer. The first pour shall achieve complete coverage over the entire surface to be overlaid. Finish sand shall be applied at a rate determined with the test patch prior to resin gelation to create a slip-resistant surface and ensure that a good bond can be obtained with the second pour. Prior to placing the second pour, the surface shall be blown off with oil-free, contaminate-free compressed air to remove all loose materials. The surface of the first pour shall be kept clean and dry. The second pour shall be placed a minimum of 4 hours and within 24 hours of the placement of the first pour. The surface of the first pour shall be primed in accordance with section 3.05-B.2 prior to the placement of the second pour. The polyester concrete in the second pour shall consist of a ratio between 11.5: 100 to 15:100 of polyester resin to dry aggregate by weight; the exact proportions will be determined by the Engineer during placement to enable proper finishing and texturing of the overlay surface.

b. Polyester concrete shall be placed and finished prior to gelling. Polyester concrete that is not placed within this time shall be discarded.

c. The finishing equipment used shall strike off the polyester concrete to the established grade and cross section. Finishing equipment shall be fitted with vibrators or other means capable of consolidating the polyester concrete to the required compaction.

d. The finish sand shall be applied by either mechanical means or hand broadcasting immediately after strike-off, before gelling occurs, at a minimum rate of 0.8 pounds per square yard.

3. CONSTRUCTION DETAILS: (cont'd)

3.05 **Placement:** (cont'd)

C. **Polyester Concrete:** (cont'd)

5. **Concrete Filled Steel Grid Sidewalk Overlay**: (cont'd)

e. Immediately after the finish sand is applied, the surface shall be textured in accordance with Section 3.03-D Texturing to provide acceptable surface friction characteristics.

f. Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as railing, joints, etc. All hand troweling shall be followed by broadcasting finish sand and surface texturing while the resin is still wet to provide acceptable surface friction characteristics.

D. **Trial Overlays:**

1. The Engineer will designate the location of the trial overlays.

2. Prior to constructing the overlay, one or more trial overlays shall be placed on a previously constructed concrete base to determine initial set time and to demonstrate the effectiveness of the mixing, placing, and finishing equipment proposed as well as curing period. Conditions during the construction of the overlay and equipment used shall be similar to those expected and to be used for the construction of the polyester concrete overlay. If the cleaning practice, materials, and installation procedure are not acceptable, the Contractor must remove the failed trial overlays and make the necessary adjustments and test all test areas at no additional cost to the Authority until satisfactory test results are obtained.

a. Roadway: Each trial overlay shall be 12 feet wide, at least 20 feet long and the same thickness as the overlay to be constructed.

b. Sidewalk: Each trial overlay shall be 5 feet wide, at least 6 feet long, and the same thickness as the overlay to be constructed.

3. The trial overlay shall have a minimum bond strength of 250 psi as determined by ACI 503R-93, Appendix A, to assure that the overlay adheres to the prepared surface.

4. All material used in the trial overlays shall become the property of the Contractor and shall be removed (if required) and disposed of at the Contractor's expense.

5. The polyester concrete shall be placed as specified in Section 3.05-C for either the roadway or concrete filled steel grid

3. CONSTRUCTION DETAILS: (cont'd)

3.05 **Placement:** (cont'd)

D. **Trial Overlays:** (cont'd)

6. For overlay placed on concrete filled steel grid, the trial overlay shall be completely wetted with water as soon as the overlay has cured and left to air dry.

7. For overlay placed on concrete filled steel grid, the trial overlay shall be inspected after 14 days to determine whether any defects appear. Polyester concrete overlay placement will only be allowed to proceed after approval by the Authority.

3.06 **Surface and Thickness Requirements:**

A. The smoothness of the existing deck that is to be covered with the polyester concrete overlay shall be profilographed in accordance with §502-3.16 of the Standard Specifications. Any surface area not meeting requirements shall be diamond ground until tolerances are met. Diamond Grinding shall be performed in accordance with §502-3.17 of the Standard Specifications.

B. After the polyester concrete overlay is placed and cured, the overlay surface shall be profilographed in accordance with §502-3.16 of the Standard Specifications. Any surface area not meeting requirements shall be diamond ground until tolerances are met. Diamond Grinding shall be performed in accordance with §502-3.17 of the Standard Specifications. In addition, the overlay surface shall be checked at random by the Engineer with a straightedge. The surface shall not vary more than 1/4 inch from the lower edge of a 12 feet ± 0.2 feet long straight edge placed in any direction. Any surfaces which fail to meet to the above tolerance shall be removed by diamond grinding in accordance with the requirements of §502-3.17, until the above tolerance is met.

C. To ensure adequate pavement friction, the completed overlay surface shall be free of any smooth or "glassy" areas such as those resulting from insufficient quantities of surface aggregate. Any such surface defects shall be repaired in the manner recommended by the manufacturer and approved by the Engineer.

D. The thickness of the polyester concrete overlay shown on the plans is the minimum thickness to be placed. Thickness of the overlay shall be checked prior to its initial set using a ruler. If the Engineer determines that the minimum thickness has not been attained, an additional layer shall be applied after the overlay hardens. This layer shall be a minimum of 1/4 inch and shall be applied at no additional cost to the Authority.

3.07 **Curing:** Traffic and equipment shall not be permitted on the overlay until one of two following options is satisfied:

Option 1: A minimum of four (4) hours at 50° F following final finishing has elapsed and the Engineer has determined that the overlay has cured sufficiently to subject it to traffic.

3. CONSTRUCTION DETAILS: (cont'd)

3.07 **Curing:** (cont'd)

Option 2: Three readings of greater than 24 are achieved with a rebound hammer (Schmidt Hammer). The three readings shall be taken at locations where the overlay was placed last and shall be a minimum of one meter apart. All three readings shall be greater than 24 for traffic to be permitted on the overlay. The rebound hammer shall be Manual Model W-M-250 as manufactured by James Instruments Inc, 3727 North Kedzie Ave, Chicago, Illinois 60618 and shall be provided by the Contractor to the Engineer. **No other hammer or model will be accepted.**

Note that cure time is dependent upon the ambient and deck temperatures.

Overlays shall be protected from moisture for a minimum of four (4) hours after finishing under Option 1 or until opened to traffic under Option 2.

For overlay placed on concrete filled steel grid, Option 1 curing requirements apply to both pours of the two pour system.

4. METHOD OF MEASUREMENT:

4.01 **Surface Preparation and Placement:** The work will be measured as the number of square yards of overlay constructed. For the concrete filled steel grid, the work will be measured as the number of square yards of the second pour. No separate payment will be made for the first pour. The area to be paid for will be based on the dimensions as shown on the plans.

4.02 **Furnish Material:** The work will be measured as number of square yards of overlay material placed to produce an overlay to the finished surface shown on the plans.

5. BASIS OF PAYMENT:

5.01 The unit price bid per square yards for the Surface Preparation and Placement shall include the cost of all labor, materials, (except for the polyester concrete), tools, equipment, and incidentals necessary to complete the work, including mixing and placing the polyester concrete, constructing and disposing of trial overlays and base, profilographing, diamond grinding (when required), material sampling and testing, and the cost of having the polymer manufacturer's representative present as required.

5.02 The unit price bid per square yard for Furnish Material shall include the cost of furnishing the polyester concrete material for placement.

5.03 Payment will be made under:

ITEM NUMBER		DESCRIPTION	PAY UNIT
584.6014	25	Polyester Concrete Overlay - Surface Preparation and Placement (Roadway)	Square Yard
584.6015	25	Polyester Concrete Overlay - Surface Preparation and Placement (Concrete Filled Steel Grid Sidewalk)	Square Yard
584.6016	25	Polyester Concrete Overlay - Furnish Material	Square Yard