

**ITEM 584.40 06 – THIN POLYMER OVERLAY WEARING SURFACE FOR STRUCTURAL SLABS**

**DESCRIPTION.**

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

**MATERIALS.**

**1. 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 D 2369, and conforming to the following:

High Molecular Weight Methacrylate (HMWM) Resin		
Property	Requirement	Test Method
Viscosity* (Brookfield RVT with UL adapter, 50 RPM at 25EC)	0.025 Pa.s, maximum	ASTM D 2196
Specific Gravity* (at 25EC)	0.90, minimum	ASTM D 1475
Flash Point* (Degrees C)	82	ASTM D 3278
Vapor Pressure* (mm Hg at 25EC)	1.0	ASTM D 323
Tack Free Time (minutes at 25EC)	400 min. maximum	ASTM C 679
PCC Saturated Surface-Dry Bond Strength (MPa at 24 hrs at 21±1E C)	3.5 MPa minimum	NYS DOT 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 directly with the peroxide will result in a violent exothermic reaction.**

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**2. 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:

COMBINED AGGREGATE		
Sieve Size	9.5 mm Max. Percent Passing	4.75 mm Sieve Max. Percent Passing
12.5 mm	100	100
9.5 mm	83-100	100
4.75 mm	65-82	62-85
2.36 mm	45-64	45-67
1.18 mm	27-48	29-50
600 µm	12-30	16-36
300 µm	6-17	5-20
150 µm	0-7	0-7
75 µm	0-3	0-3

Aggregate retained on the 2.36 mm 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 T 255, shall not exceed one half of the aggregate absorption.

Finish sand shall be a dry No. 8/20 commercial quality blast sand.

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**3. 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:

Polyester Resin Binder		
PROPERTY	REQUIREMENT <sup>a</sup>	TEST METHOD
Viscosity* (RVT No. 1 spindle, 20 RPM at 25EC)	0.075 to 0.20 Pa·s	ASTM D 2196
Specific Gravity*	1.05 to 1.10 at 25EC	ASTM 1475
Elongation	35 percent minimum Type I at 11.5 mm/min. Thickness = 6.5±1 mm	ASTM D 638
	Sample conditioning: 18/25/50 + 5/70	ASTM D 618
Tensile Strength	17.5 MPa minimum Type I at 11.5 mm/min. Thickness = 6.5 ± 1 mm	ASTM 638
	Sample conditioning: 18/25/50 + 5/70	ASTM 618
Styrene Content*	40 percent to 50 percent (by weight)	ASTM D 2369
Silane Coupler	1.0 percent, minimum (by weight of polyester styrene resin)	
PCC Saturated Surface Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1EC	NYSDOT Test Method 701-13F, Bond Test

\*Tested prior to adding initiator

<sup>a</sup> Values are based on specimens or samples cured or aged at 25E C (77 EF) 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 hydroperoxide (CHP) initiators.

**4. Samples.** Samples of materials for all components of the overlay system shall be submitted by the manufacturer to the Materials Bureau a minimum of sixty (60) days prior to the overlay application. Samples shall be representative of the materials to be used in the overlay application and shall consist of one four-liter sample for each liquid component and a 2.3 kg sample for each dry component.

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**5. 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 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 209 liters.

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

1. Delivery of the overlay materials to the project site in acceptable containers bearing all the label information as required in 5. Packaging and Shipment.
2. Receipt of a Manufacturer's certification stating the primer, aggregate and polyester binder meet the material requirements found under MATERIALS, 1-3.
3. Approval by the Materials Bureau based on conformance with the Material requirements above.

**CONSTRUCTION DETAILS.**

A. General. 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.

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.

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.

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.

B. 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.

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C. Equipment

1. Surface Preparation. 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. In those areas not accessible to this machinery, the surface may, with the Engineer's approval, be cleaned with blast cleaning equipment.

Automatic shot blasting units shall be self propelled and include a vacuum to recover spent abrasives. The abrasive shall be steel shot. Magnetic rollers shall be used to remove any spent shot remaining on the deck after vacuuming.

2. Application. Polyester concrete shall be mixed in mechanically operated mixers. Mixer size shall be limited to 0.25 cubic meter capacity. A continuous mixer employing an auger screw/chute device may be approved by the Engineer if a demonstration shows its ability to produce a satisfactory product. The continuous mixer shall 1) be equipped with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes and 2) have a readout gage, visible to the Engineer at all times, that displays the volumes being recorded. The volumes shall be recorded at no greater than five (5) minute intervals along with the time and date of each recording. A printout of the recordings shall be furnished to the Engineer at the end of each work shift.
3. Finishing and Texturing. 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.  
Texturing shall be performed using spring steel tines in accordance with • 502-3.10. Texturing.

D. Surface Preparation. All structural slab surfaces that will be in contact with the overlay shall be prepared as follows:

1. The Contractor shall determine the size of shot, flow of shot, forward speed of shot blast machine and number of passes necessary to provide a surface capable of a tensile bond strength greater than or equal to 1,724 kilopascals or a failure area, at a depth of 3 millimeters 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.  
The Engineer will designate the location of the test patches.

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Before application of the primer, the entire deck surface shall be cleaned by shot blasting and other means using the approved cleaning practice to remove 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. 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. Areas of asphalt larger than 25 mm in diameter, or smaller areas spaced 150 mm apart, shall be removed. Traffic paint lines shall be considered clean when the concrete has exposed aggregate showing through the paint stripe. A vacuum cleaner 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 State 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 shall be dry at the time of application of the overlay.

2. 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.

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.

E. Application.

1. Prime Coat

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Prior to applying the prime coat, the area shall be dry and shall be blown clean with oil-free compressed air. The surface temperature shall be at least 10EC.

The prime coat shall be uniformly applied to completely cover the surface to receive the polyester concrete. The rate of spread shall be approximately 0.78 liters per square meter of deck surface or as recommended by the manufacturer. The prime coat shall be allowed to cure a minimum of 15 minutes before placing polyester concrete.

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.

When modified high alumina based concrete is placed prior to the deck overlay, the prime coat shall not be placed on said concrete until at least 30 minutes after final set.

2. Polyester Concrete

Test Patches

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. Each trial overlay shall be 3.6 m wide, at least 1.8 m long, and the same thickness as the overlay to be constructed. 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 test patches and make the necessary adjustments and test all test areas at no additional cost to the Department until satisfactory test results are obtained.

The test patch shall have a minimum bond strength of 1.7 MPa as determined by ACI 503R-93, Appendix A. to assure that the overlay adheres to the prepared surface.

All material used in the trial overlay, including the concrete test patch shall become the property of the Contractor and shall be removed (if required) and disposed of at the Contractors expense.

The polyester concrete shall be placed within 120 minutes after the prime coat has been applied. The prime coat shall be allowed to cure a minimum of 30 minutes

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before placing polyester concrete.

The polyester concrete shall contain approximately 12 percent polyester resin by weight of dry aggregate; the exact percentage will be determined by the Engineer during placement to enable proper finishing and texturing of the overlay surface.

The polyester overlay shall be placed at a minimum thickness of 19 mm.

Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as a curb. All hand troweling shall be followed by broadcasting aggregate or surface texturing while the resin is still wet to provide acceptable surface friction characteristics.

Expansion joints shall be adequately isolated prior to overlaying or may be sawed within four hours after overlay placement, as approved by the Engineer. The exact time of sawing will be determined by the Engineer.

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. Accelerators or inhibitors may be required to achieve proper set times and shall be used as recommended by the resin supplier.

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.

Polyester concrete shall be placed prior to gelling and within 15 minutes following addition of initiator, whichever occurs first. Polyester concrete that is not placed within this time shall be discarded.

The surface temperature of the area to receive polyester concrete shall be the same as specified above for the prime coat, a minimum of 10EC.

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

The finish sand shall be applied by either mechanical means or hand broadcasting

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immediately after strike-off, before gelling occurs, at a minimum rate of 0.43 kilograms per square meter.

- F. Surface and Thickness Requirements. The overlay surface shall be checked at random by the Engineer immediately after it has hardened to assure that no depressions exist that will pond water. The smoothness of the polyester concrete surface will be tested with a straightedge. The surface shall not vary more than 6.0 mm from the lower edge of a 3.6 m  $\nabla$  0.06 m long straight edge placed in any direction. Any surfaces which fail to conform the above tolerance shall be removed by diamond grinding in accordance with the requirements of • 502 -3.13 Surface Test, until the above tolerance is met.

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.

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 6 mm and shall be applied at no additional cost to the State.

- G. Curing. Traffic and equipment shall not be permitted on the overlay for a minimum of four (4) hours following final finishing. Overlays shall be protected from moisture for not less than four (4) hours after finishing. The polyester overlay shall be allowed to reach final cure before subjecting it to traffic loads. Cure time is dependent upon the ambient and deck temperatures. Actual degree of cure and suitability of the overlay for traffic shall be as determined by the Engineer.

**METHOD OF MEASUREMENT.**

The polyester concrete overlay will be measured by the square meter. The area to be paid for will be based on the dimensions as shown on the plans.

**BASIS OF PAYMENT.**

The contract price paid per square meter for placing the polyester concrete overlay shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the polyester concrete overlay, complete in place, including application of prime coat and furnishing, constructing and disposing of test patch overlays and base.

The unit price bid per square meter shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the work. The unit price bid shall also include the cost of having the polymer manufacturer's representative present as required. Under no circumstances shall the total

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of all progress payments exceed the Estimate of Quantities.

DISAPPROVED