SP-150716
(New)

SPECIAL PROVISIONS
FOR
METHYL METHACRYLATE POLYMER CONCRETE OVERLAY

Woodbury County
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THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150716.01 DESCRIPTION.

A. These specifications describe requirements for constructing a methyl methacrylate (MMA) based polymer for use as an overlay and riding surface in accordance with the Contract Documents and as directed by the Engineer. The MMA system is a high-performance seamless slurry wearing course with primer, binder, broadcast aggregate and a topcoat sealer.

B. The MMA overlay system will be 3/8 inch total thickness.

C. The Contractor shall have experience placing similar MMA polymer concrete overlay systems on at least three structures prior to doing work on this project. Written proof of this experience along with project contacts shall be provided to the Engineer in writing for approval prior to the preconstruction meeting.

D. The Contractor shall be approved by the manufacturer for installing the MMA overlay system. Written proof of this approval shall be provided to the Engineer in writing prior to the preconstruction meeting.

E. The Contractor shall provide the Engineer with a copy of manufacturer's installation recommendations for all materials listed in Article 150716.02.

150716.02 MATERIALS

A. Methacrylate Primer.

1. The prepared surface shall receive a 100% reactive, methyl methacrylate-based resin capable of full cure in 40 minutes at 68°F.

2. The methacrylate primer shall meet or exceed the requirements of the Table below as related to samples tested at 68° F and 24-hour cure where applicable.

Methacrylate Primer		
Property	**Requirement**	**Test Method**
Viscosity	50-80 cps	ASTM D2393
Density	8-9 lb/gal	ASTM D2849
Pot Life	10-30 minutes	ASTM C881
Flash Point	>43°F	ASTM D1310
Solids Content (with catalyst)	100%	ASTM D1644
Tensile Strength	4000 psi minimum	ASTM D638, Type I
Cure Rate	30-45 minutes	
Elongation at Break	25% minimum	ASTM D638, Type I

B. Polymer Resin Binder.

1. The binder will be comprised of a resin and filler together with a hardener powder that is to be added in accordance with the manufacturer's recommendations.

2. The slurry system polymer resin binder shall meet or exceed the requirements of the Table below as related to samples tested at 68°F and 24 hour cure where applicable.

Polymer Resin Binder		
Property	**Requirement**	**Test Method**
Elongation at Break	50% minimum	ASTM D638, Type I
Density	17-18 lb/gal	ASTM D2849
Flexural Strength	1,500 psi minimum	ASTM D790
Tensile Strength	650 psi, minimum (with filler), 850 psi, minimum (resin only)	ASTM D638, Type I
Tensile Adhesion	290 psi minimum	ASTM C1583
Water Absorption	0.8% at 24 hours maximum	ASTM D570

C. Aggregates.

1. Aggregate shall be clean, dry, angular bauxite or flint. Only light-colored aggregate shall be used on this project.

2. The singly crushed aggregate shall be free of dirt, clay, and foreign or organic material.

3. Aggregate size shall be US No. 6 x 10. Final aggregate selection shall be agreed upon by the manufacturer and the Engineer.

D. Top Coat Sealer.

1. The sealer shall be comprised of a clear methyl methacrylate-based liquid resin component and a hardener powder.

2. The final methyl methacrylate top coat sealer shall meet or exceed the requirements of the Table below as related to samples tested at 68°F and 24 hour cure where applicable.

Top Coat Sealer		
Property	**Requirement**	**Test Method**
Viscosity	200-400 cps	ASTM D2393
Flash Point	>50°F	ASTM D1310
Pot Life	10-15 minutes	ASTM C881
Solids Content (with catalyst)	100%	ASTM D1644
Cure Rate	45-60 minutes	

150716.03 CONSTRUCTION.

A. All materials shall be delivered in the original containers bearing the manufacturer's label, manufacturing date, batch number, trade name and quantity. Provide Safety Data Sheets for each component of the overlay system.

B. The material shall be stored to prevent damage to the products and to ensure the preservation of the quality. The storage area shall keep the materials clean, dry, cool and out of direct sunlight. The temperatures of the storage space shall not fall below nor rise above that recommended by the manufacturer. Precaution shall be taken to avoid contact with flame, sparks or any other sources of ignition. Safety Data Sheets for all components shall be kept on site and be available to the Engineer or other personnel for review. Follow all manufacturer's safety recommendations.

C. Trial Application.

1. Demonstrate proficiency by preparing and placing a trial overlay on a 10 foot by 10 foot area, or approved equivalent, prior to the placement of the production overlay. The Engineer will select the location of the trial area.

2. If the cleaning practices, materials, installation, finishing and/or texturing are not acceptable, remove the failed trial application and reinstall the trial application at no additional cost to the Department until satisfactory results are obtained.

3. The number of trial applications required shall be as many as necessary to demonstrate the ability to construct an acceptable trial overlay section and competency to perform the work. The Contractor, manufacturer and/or proposed equipment/techniques may be rejected by the Engineer if not shown to be acceptable after three failed trial applications.

4. Perform tensile bond strength testing after the placement of the trial application to assure that the overlay adheres to the prepared surface. The test result shall be the average of two successful tests. The minimum direct tension bond strength shall be 290 psi. Testing shall be in accordance with ACI 503R tensile bond method. See Article 150716.03, J for further testing details.

5. Do not proceed with final MMA overlay production without the approval of the Engineer.

D. Preparation.

1. Prepare all surfaces that will be in contact with the overlay by shot-blasting in accordance with ASTM D4259. The surface profile shall not exceed 1/8 inch. Surfaces shall be free of grease, oil, curing compounds, loose material, moss, algae growth, laitance, dirt, bituminous products and previous waterproofing materials. In areas inaccessible to shot-blasting equipment, the surface may, with the Engineer's and manufacturer's approval, be cleaned with sandblasting equipment.

2. Sound the surface of the deck to locate any spalls or delamination prior to installing the primer. Repair all spalled and delaminated areas with a rapid cure concrete repair material that is compatible with the MMA overlay system.

3. A minimum 1/4 inch key cut shall be made at expansion joint edges and drain perimeters to properly seat the MMA overlay system.

4. Close deck drains so the MMA overlay components shall not pass through the drains.

5. Immediately before applying any of the overlay components, clean the surface of the deck to remove all dust and debris with oil-free compressed air. The cleaned surface of the deck shall be dry at the time of application of the primer and overlay.

6. Do not allow construction traffic on any portion of the prepared deck. Prime the deck surface within 4 hours of the surface preparation operation. Re-clean locations showing any evidence of contamination.

7. Application of the overlay system shall occur when air and bridge deck temperatures are between 32°F and 104°F providing that at all times during application the bridge deck is above the dew point.

E. Methacrylate Primer.

1. The primer shall consist of two coats. Apply the primer in a uniform coating at a coverage rate of 100 to 125 square feet per gallon per coat.

2. The primer shall be uniformly applied to the prepared surface. The prepared surface shall be dry and have no exposure to moisture within 24 hours before placing primer.

3. The primer shall be tack-free before application of the seamless overlay.

F. Polymer Resin Binder.

1. Prior to application of the binder, the primer shall be clean and free from loose debris, dust, moisture, or other contaminants.

2. Apply binder in one coat with a nominal thickness of 3/8 inch.

3. The binder shall consist of a resin and filler together with a hardener powder which is to be added in accordance with the manufacturer's recommendations.

4. The hardener powder shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. The filler shall then be added to the catalyzed mixture and dispersed in the same manner to achieve a homogeneous slurry.

5. The slurry shall be applied over horizontal cured primed surfaces using gage rakes, screeds, trowels or other systems approved by the manufacturer.

G. Aggregate.

1. Broadcast the aggregate into the wet, uncured binder in such a way that it falls vertically and covers the binder completely.

2. Coverage rate for the aggregate shall be 1.25 pounds per square foot.

3. Allow the fully broadcast binder to cure for at least 45 minutes.

4. No traffic or equipment will be permitted on the binder during the curing period.

5. After curing period, remove all loose aggregate by sweeping or vacuuming prior to sealer application.

6. No traffic will be permitted on the cured unsealed binder.

H. Top Coat Sealer.

1. The sealer will consist of one coat with an overall coverage rate of 65 to 100 square feet per gallon.

2. The sealer shall consist of a resin and hardener powder which is to be added at a rate in accordance with the manufacturer's recommendations.

3. The hardener powder shall be added to the resin and thoroughly dispersed by suitably approved mechanical means.

4. The sealer shall be roller applied to the cured and swept binder.

5. The sealer shall be fully cured before the completed MMA system may be opened to traffic.

I. Mixing and Placing.

1. Mixing and application requirements shall be done in accordance with the manufacturer's recommendations.

2. All equipment and materials used in the mixing and application production shall be in accordance with the manufacturer's requirements.

3. The Contractor will arrange for an on-site meeting with a manufacturer's representative one day before the start of the MMA overlay placement. The Contractor's staff and representatives from Iowa DOT District Office, Bridges and Structures, and Construction and Materials, will attend the meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, application, finishing, and curing of the MMA overlay system. A manufacturer representative knowledgeable in supplying, mixing, transporting, placing, finishing, and curing of the MMA overlay system must be present during placement. Do not start mixing or placing the primer, binder or sealer until the manufacturer's representative is on site.

4. Use a paintbrush or roller to apply the MMA overlay components on the face of curbs to the top of curb. On bridges with continuous concrete barrier rails apply the components to the first break in the geometry of the barrier to a minimum height of 6 inches above the deck. Apply the components to the curb or barrier rail as each of the overlay applications are performed. Aggregate is not required on vertical surfaces.

5. Locate any longitudinal joints along lane lines, or as approved by the Engineer. Keep the joints clear of wheel paths as much as practical.

6. Produce and place the overlay within the specified limits in a continuous and uniform operation.

7. Longitudinal grooving is not required after placement of the MMA overlay system.

8. Tape all construction joints to provide a clean straight edge for adjacent MMA overlay placement. This includes joints between previously placed MMA overlay materials and at centerline.

9. Finish the exposed edges at the ends of the bridge and at expansion joints to minimize bridge deck roughness.

10. Application of the primer shall not begin until the bridge deck is visibly surface dry, and free of water and moisture. ASTM D 4263 modified for 2 hours may be used to verify dryness at the discretion of the Engineer in cases where surface dryness is difficult to determine. Moisture tests shall be performed by the Contractor and observed by the Engineer.

11. Application of MMA overlay system shall not commence if rain is forecast.

12. Follow all manufacturer's suggested safety precautions while transporting, mixing and handling MMA overlay components.

J. Quality Assurance/ Quality Control.

1. Tensile bond strength testing shall be done for each bridge placement per stage each day. Testing shall be in accordance with ACI 503R tensile bond method. Testing shall be performed by the Contractor and approved by the Engineer. Testing will be conducted at a minimum frequency of three test locations per 5000 square feet. The minimum tensile bond strength of the primer to the substrate shall be equal to or greater than 290 psi or failure shall occur in the substrate at a depth equal to or greater than 1/4 inch. If tensile bond strength is lower than the minimum specified, the Engineer may request additional substrate preparation.

2. Conduct the following tests and submit written results to the Engineer.
- **a.** Air temperature, bridge deck temperature and dew point.
- **b.** Tensile bond strength tests.
- **c.** Quantity of material used for all stages/layers of the MMA overlay system.

3. Repair areas discovered to be unbonded (by tapping or chaining) and areas damaged by the Contractor's operations. Saw cut the unbonded or damaged areas to the top of the deck surface and remove the overlay with small air tools (15 pounds maximum) or shotblasting. Shotblast the concrete bridge deck surface at the unbonded area to remove contaminants and replace the overlay according to these specifications at no additional compensation. Installation of the sealer shall overlap 4 inches onto the existing overlay area located outside of the repair perimeter. Repairs shall be in accordance with any additional manufacturer's requirements.

4. The Engineer and the Contractor will jointly perform a final review of the area in which the completed MMA overlay system has been installed. Any irregularities or other items that do not meet the requirements of the Contract Documents will be addressed at this time at no extra cost to the Department.

150716.04 METHOD OF MEASUREMENT.

The quantity of MMA overlay will be paid at Contract unit price per square yards of MMA overlay placed and accepted. The area will be computed using the dimensions shown on the plans.

150716.05 BASIS OF PAYMENT.

A. The methyl methacrylate polymer concrete overlay will be paid for at the Contract unit price per square yards, which will be full compensation for preparing the surface, testing of the surface preparation, furnishing and applying the overlay in accordance with these specifications, quality control testing as described above, and for furnishing all equipment, tools, labor, and incidentals required to complete the work. The unit price includes all costs for trial overlay as described in Article 150716.03 which will be paid per square yard.

B. No payment will be made for surface preparation that does not meet the requirements of these specifications and therefore needs to be remediated to the satisfaction of the Engineer at the Contractor's expense, or for repairs to the overlay necessitated by damage from Contractor's subsequent operations. No additional payment will be made for remedial solutions to insufficient bonding between the MMA overlay and underlying bridge elements.

C. Additional quantity of material used in the determination of material properties and for acceptance testing as described herein will be furnished at no additional cost to the Department. No additional payment will be made for surface preparation.