



**SPECIAL PROVISIONS
FOR
BEAM END REPAIR WITH METHYL METHACRYLATE POLYMER CONCRETE**

**Muscatine County
BRF-092-9(165)--38-70**

**Effective Date
October 20, 2026**

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

230437.01 DESCRIPTION.

This work consists of using rapid setting methyl methacrylate (MMA) polymer concrete for the field repair of deteriorated pretensioned prestressed concrete beam (PPCB) ends in accordance with the Contract Documents and as directed by the Engineer.

230437.02 MATERIALS.

Provide a rapid-setting methyl methacrylate (MMA), resin-based, polymer concrete based on the performance requirements of the components in Table 230437.02-1, or as approved by the Engineer. All components shall be supplied collectively through the same supplier, qualified as defined herein, referred to as the System Provider.

Table 230437.02-1: Performance Requirements of Components

Property	Test Method	Minimum Result
Primer/Sealer		
Viscosity	Brookfield	40 - 60 cps
Density	ASTM D2849	8.16 lb/gal
Pot Life @ 70°F	AASHTO T237	8 - 15 minutes
Solids Content	ASTM D1644	100%
Resin		
Viscosity	Brookfield	10 - 12 cps
Density	ASTM D2849	7.63 lb/gal
Pot Life @ 70°F	AASHTO T237	24 minutes
Solids Content (with catalyst)	ASTM D1644	100%

Mortar (Neat)		
Compressive Strength (7 days)	ASTM C579 Method B	8000 - 9000 psi
Flexural Strength (7 days)	ASTM D790	1800 - 2500 psi
Linear Shrinkage	ASTM C531	<0.2%
Tensile Strength (7 days)	ASTM D638 Type I	1000 - 1200 psi
Compressive Modulus	ASTM C469	1.1 - 1.2 x 10 ⁶ psi
Tensile Adhesion (pull-off concrete)	ASTM C1583	>250 psi

A. Aggregate.

Extender aggregate shall not be used with the neat rapid-setting polymer concrete material for beam end repairs unless recommended by the System Provider. If used, ensure extender aggregate is clean and dry. Extender aggregate shall be supplied by the System Provider.

B. Packaging and Shipment.

Provide a Safety Data Sheet for all components prior to use for each shipment. All components shall be shipped in strong, substantial containers. Primer/sealer and resin shall bear the System Provider's label specifying lot/batch number, brand name and quantity.

C. Storage of Materials.

All materials shall be stored in a cool, dry location and in their original containers in accordance with the System Provider's recommendation to ensure their preservation until used in the work. The shelf life for liquid materials stored out of direct sunlight and at temperatures 75°F and below shall be at least 12 months. All aggregates shall be stored in a clean, dry location away from moisture.

230437.03 CONSTRUCTION.**A. Placement Plan.**

Submit a Placement Plan with a detailed construction work schedule to the Engineer for review and approval at least 30 days prior to the scheduled MMA polymer concrete repairs. The following list is intended as a guide and may not address all the means and methods the contractor may elect to use. The Contractor is expected to assemble a comprehensive list of all necessary items for executing the MMA polymer concrete repairs.

1. Schedule of repair work and testing.
2. Responsible personnel and hierarchy.
3. Staging plan describing repair sequence.
4. Description of equipment used for:
 - a. Removals and surface preparation.
 - b. Applying primer.
 - c. Formwork
 - d. Measuring, mixing, placing, and finishing the MMA polymer concrete repairs.
5. Placement procedure - including but not limited to surface preparation of existing concrete surfaces, application of primer, and application of MMA polymer concrete.
6. Quality control of batch proportions, mixing times, and batch placement times.
7. Threshold limits for ambient temperature, ambient relative humidity, batch consistency, batch temperature, batch times, moisture content of existing beams and related corrective actions.

8. Cure time for MMA polymer concrete.
9. Storage and handling of primer and MMA polymer concrete components.
10. Procedure for disposal of excess primer, MMA polymer concrete, and containers.
11. Procedure for cleanup of mixing and placement equipment.
12. Method for cleaning up spills or discharge of primer and MMA polymer concrete, including materials and equipment.
13. A preconstruction meeting will be required to review the Contractor's Placement Plan prior to placement of the MMA polymer concrete repairs. Required attendees include the System Provider's representative, the Contractor's staff, and representatives from the Iowa DOT District Office. Optional attendees include the Bridges and Structures Bureau, and Construction and Materials Bureau. No MMA polymer concrete repair will be permitted until the aforementioned Placement Plan has been submitted by the Contractor and approved by the Engineer.
14. Construction loads applied to the bridge during MMA polymer concrete repair placement and curing are the responsibility of the contractor. Submit the weight and location of concrete placing equipment or other significant construction loads for review as part of the proposed Placement Plan.

B. Equipment.

All equipment for preparing the existing concrete surfaces and mixing and applying the repair system shall be as specified, in accordance with the System Provider's recommendations, and as approved by the Engineer prior to commencement of any work.

1. General.

Provide an overall combination of labor and equipment with the capability of proportioning and mixing the MMA polymer concrete components, and placing the primer and MMA polymer concrete in accordance with this specification and the System Provider's recommendations.

2. Surface Preparation Equipment.

Abrasive sand-blasting equipment capable of removing all loose, disintegrated concrete, dirt, paint, oil, asphalt, laitance carbonation, curing materials, grease, slurry, or rust from the existing concrete surface.

3. Mixing Equipment.

MMA polymer concrete shall be mixed by hand for small quantities or by mechanically operated mixers of appropriate size for proposed batches and as recommended by the System Provider.

4. Formwork.

All interior portions of formwork in contact with MMA polymer concrete shall be lined with 20-mil thick polyethylene sheeting to prevent bonding to forms. Alternately, interior portions of formwork may be sprayed with Plasti Dip Multi-Purpose Rubber Coating or equivalent to prevent bonding to forms.

Forms shall be watertight to prevent leakage of the mix after placement. Seal the perimeter of forms with a non-sag polyurethane sealant sufficiently to prevent loss of MMA polymer concrete.

C. Repair Removal Procedures and Limits.

Remove concrete from each area (either designated in the contract documents or by the Engineer) to a depth and in a manner consistent with the classification for that area. Areas as shown in the contract documents are based on the best information available. The Engineer will determine actual areas.

1. Saw cut the perimeter of the repair area to a depth of 1/2 inch.
2. Removal tools shall be limited to 15 pound chipping hammers and to hand tools without power.
3. Thoroughly clean all reinforcing bars and newly exposed concrete by sandblasting. Where bond between existing concrete and reinforcing steel has been destroyed, remove the concrete adjacent to the bar to a depth that will permit new concrete to bond to the entire periphery of the exposed bar. A minimum of 3/4 inch clearance is required around the bar. Exercise care to prevent cutting, stretching, or damaging any exposed reinforcing steel. The Engineer may require enlarging a designated area should inspection indicate deterioration of concrete or corrosion of reinforcing beyond the limits previously designated.

D. Surface Preparation.

All surfaces that will be in contact with the repair shall be prepared in order to remove all existing loose, disintegrated concrete, dirt, paint, oil, asphalt, laitance carbonation, curing materials, grease, slurry, rust or any other contaminants that could interfere with the proper adhesion of the repair system.

The final prepared surface shall meet the following requirements:

1. Areas to receive the MMA polymer concrete repair shall be cleaned by abrasive sandblasting.
2. The Contractor shall determine the size and flow of abrasive and number of passes necessary to provide a surface free of weak or loose surface mortar, exposing the aggregates within the substrate concrete and visibly changing the color of the substrate concrete. Mortar which is sound and firmly bonded to the coarse aggregate must have open pores due to cleaning to be considered adequate for bond.
3. Cleaned concrete substrates that have been contaminated such that contaminants might interfere with the bonding or curing of the repair must be cleaned to the satisfaction of the Engineer prior to placing the repair material at no additional cost. The cleaned concrete substrate shall be dry at the time of application of the primer and repair.
4. All steel surfaces that will be in contact with the repair shall be cleaned in accordance with SSPC-SP3.

E. Trial Batch and Test Placement.

1. Produce a trial batch and perform a test placement. Provide the Engineer at least 7 calendar days notice prior to this event. The test placement will be witnessed by the Engineer.
2. Mix the trial batch at least 15 calendar days prior to the planned field placement. The trial batch shall be of sufficient quantity to complete the test placement. Produce the trial batch under the same ambient conditions (e.g. time of day, weather, etc.) as anticipated during the field work. Include documentation of ambient conditions at the time of trial batch and anticipated ambient conditions at the time of trial placement in the submittal to the Engineer.

3. For mockup test placement, prepare a full-scale trial batch mix and place in a full-scale mockup as shown in the project plans. Use at least the minimum mix capacity of the mixing equipment for the trial batch, including quantities for sampling and testing. Use the same equipment and the same forming, casting, and curing procedures that will be used during the field work for the trial placement.
4. Perform compressive strength testing on a set of 2-inch cube specimens after 1 day in accordance with ASTM C 579, Method B. Each set shall contain at least six specimens. Testing shall be performed by the Contractor and approved by the Engineer.
5. Submit the results of compressive strength testing to the Engineer for review and approval a minimum of 10 calendar days prior to the use of the MMA polymer concrete in the field. To be considered a successful test placement, there shall be no segregation of the MMA polymer concrete and no visible voids when the forms are removed.
6. A representative of the System Provider knowledgeable in surface preparation, supplying, mixing, transporting, placing, finishing, curing and testing of the MMA polymer concrete, including the primer, must be present during placement. Do not start mixing or placing the primer or MMA polymer concrete until the System Provider's representative is on-site.
7. If the cleaning practice, materials, installation, finishing and/or texturing are not acceptable, the Contractor shall repeat the trial application at no additional cost until satisfactory results are obtained.
8. The number of trial applications required shall be as many as necessary for the Contractor to demonstrate the ability to construct an acceptable trial repair section and competency to perform the work. The installer, System Provider and/or proposed equipment/techniques may be rejected by the Engineer if not shown to be acceptable after three failed trial applications.

F. Placing and Finishing.

1. General.

- a. A representative of the System Provider knowledgeable in supplying, mixing, transporting, placing, finishing and curing of the MMA polymer concrete system, including the primer, must be present during placement. Do not start mixing or placing the primer or MMA polymer concrete until the System Provider's representative is on-site.
- b. Methods indicated in these Special Provisions are typical of general installations. If recommended by the System Provider, modified methods may be submitted for review, subject to approval by the Engineer.
- c. Application of the primer and placement of MMA polymer concrete shall not begin until the substrate is visibly surface dry, and free of water and moisture. A moisture meter may be used to verify dryness at the discretion of the Engineer in cases when surface dryness is difficult to determine. The moisture content shall not exceed 4.5%.
- d. The concrete surface temperature shall be between 20°F to 100°F at the time of primer and MMA polymer concrete placement.
- e. Application of primer and placement of MMA polymer concrete shall not commence if rain is forecast by the National Weather Service within 24 hours of placement.

2. MMA Primer Application.

- a. Primer shall be mixed and applied in accordance with the System Provider's recommendations.
- b. Immediately before placing primer, all exposed surfaces shall be dry in accordance with SP-230437.03, F, 1, c, and blown clean with oil-free compressed air from 185

CFM minimum compressor. Exposed surfaces shall be protected from precipitation and heavy dew during and after the application of the primer.

- c. After the exposed surfaces have been prepared and are dry, primer shall be applied in accordance with the System Provider's recommendations. Primer shall be placed at approximately 100 square feet per gallon. Ensure any cracks present in repair areas are filled with primer.
- d. Primer shall be uniformly spread to completely cover all surfaces to receive repair.
- e. Primer shall be brushed onto all accessible reinforcing steel and prestressing strands.

3. MMA Polymer Concrete.

- a. MMA polymer concrete shall be mixed and applied in accordance with the System Provider's recommendations.
- b. MMA polymer concrete shall be placed within 24 hours of initial primer application.

G. Curing.

Allow material to cure for a minimum period of 1 hour or the minimum curing period in accordance with the System Provider's recommendations, whichever is greater.

H. Acceptance Testing.

- 1. Contractor shall notify the District at least 48 hours prior to anticipated placement to allow them the opportunity to view the operation.
- 2. Testing shall be performed by the Contractor and approved by the Engineer. Testing is summarized in Table 5. Performance frequencies of each test listed are a minimum value and may be performed at a more frequent interval at the discretion of the Engineer.
- 3. At jacked repair locations, a minimum compressive strength of 5000 psi is required before jacks may be removed. The Contractor shall have the option to cast additional test cubes if compressive strength test results are desired before the specified 1-day testing.
- 4. ASTM C 579 – Method B referenced in table 5 shall be modified from a 7-day test to a 1-day test.

Table 230437.03-2: MMA Polymer Concrete Acceptance Testing

Description	Test Method	Acceptance Criteria	Frequency
Compressive Strength	ASTM C 579 – Method B (modified)	≥ 5000 psi (at 1 day)	Shallow/regular repair locations – One test per day
			Jacked repair locations – One test at each location

230437.04 METHOD OF MEASUREMENT.

- A. The quantity of Beam End Repair, Methyl Methacrylate Polymer Concrete will be measured as the number of cubic feet placed and accepted.
- B. The quantity for MMA Polymer Concrete Trial Batch per each includes one trial batch. The Engineer may authorize up to two additional trial batches, to be measured and paid per each.
- C. The quantity for MMA Polymer Concrete Test Placement per each includes one test placement. The Engineer may authorize up to two additional test placements, to be measured and paid per each.

230437.05 BASIS OF PAYMENT.

- A.** The quantity of Beam End Repair, Methyl Methacrylate Polymer Concrete will be paid at the contract unit price per cubic foot. Price and payment is full compensation for surface preparation, supplying, mixing, transporting, forming, placing, finishing, curing, and for furnishing all equipment, tools, labor, and incidental work as indicated in this special provision and the contract documents.
- B.** The quantity for MMA Polymer Concrete Trial Batch will be paid at the contract unit price per each trial batch. Price and payment is full compensation for furnishing all submittals, materials, labor, testing, results, and incidental work for completion of the trial mix as indicated in this special provision and the contract documents.
- C.** The quantity for MMA Polymer Concrete Test Placement will be paid at the contract unit price per each test placement. Price and payment is full compensation for furnishing all submittals, materials, forms, labor, testing, results, and incidental work for completion of the trial placement as indicated in this special provision and the contract documents.
- D.** Additional quantity of MMA Polymer Concrete material used in the determination of material properties as described herein will be furnished at no additional cost to the Contracting Authority.
- E.** If the MMA Polymer Concrete does not meet the minimal material properties as described herein, it will be removed and replaced or remediated to the satisfaction of the Engineer at the Contractor's expense.