

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PERFORMANCE WARRANTY, THIN EPOXY POLYMER BRIDGE DECK OVERLAY

STM:JD

1 of 11

APPR:MTH:JAB:04-28-21
FHWA:APPR:04-28-21

a. Description. This work consists of cleaning/preparing entire deck surface, applying a minimum two-coat epoxy polymer overlay, and providing a 5 year performance warranty for the thin epoxy polymer bridge deck overlay. Ensure all work is completed in accordance with section 712 of the Standard Specifications for Construction except as modified herein. Bring any discrepancies between the two to the attention of the Engineer.

The epoxy polymer overlay performance warranty consists of satisfying the warranty requirements of the work contained in this special provision. This special provision establishes the common terms and definitions applied to the bridge deck surface requiring warranted work. The epoxy polymer overlay performance warranty assures and protects the Department from specific defects found in the epoxy surface.

The following definitions apply when used herein and on the plans.

Acceptance Date of Warranted Work. The date when the warranted work is complete and confirmed in writing on the initial acceptance document, by the Department, to be in compliance with the contract specifications and is open to traffic. This is the date of initial acceptance and constitutes the start date for the warranty period. There may be more than one acceptance date of construction for a project.

Structure. The entire bridge deck surface of a structure to be overlaid.

Warranty Bond. A surety which guarantees that the warranty requirements will be met.

Warranted Work. Work that is guaranteed not to exceed the specified thresholds of performance during the warranty period.

Warranty Work. Corrective action by the Contractor to bring the warranted work back into compliance. All costs will be borne by the Contractor including traffic control, mobilization, pavement markings, and/or other related work.

b. Materials. Use a solvent-free, moisture insensitive, 100 percent solids, low-modulus, and two-component epoxy polymer system to overlay the structure. Ensure containers are marked clearly "Part A" or "Part B". Select epoxy polymer materials that have the following minimal properties:

Table 1: Properties of Mixed, Uncured Epoxy Binder

Property	Value	Test method
Viscosity	700 to 2000 cP	<i>ASTM C881/C881M</i> (No. 3 at 20 rpm, Brookfield RVT)
Gel time at 73 °F	15 to 45 minutes	<i>ASTM C881/C881M</i> (modified 70 mL)
Flash point	>199 °F	<i>ASTM D1310</i>

Table 2: Physical Properties of Cured Epoxy Binder at 7 Days

Property	Value	Test method
Tensile strength	2 to 5 ksi	<i>ASTM D638 (Type I)</i>
Tensile elongation	30 to 70%	<i>ASTM D638 (Type I)</i>
Modulus of elasticity, maximum	13 ksi	<i>ASTM D638 (Type I)</i>

Table 3: Properties of Thin Epoxy Bridge Deck Overlay

Property	Value	Test method
Compressive strength (a)	>1 ksi (3 hours) >5 ksi (24 hours)	<i>ASTM C579, Method B</i>
Thermal compatibility*	Pass	<i>ASTM C884/C884M, Method B</i>
Bond strength, minimum*	250 psi	<i>ASTM C1583/C1583M</i>
a. Samples must be made using 2.75 volume parts 20-30 sand per <i>ASTM C778</i> , No. 20 to No. 30 sieve to one volume part of mixed epoxy.		

Ensure aggregate meets the gradation requirements in Table 4 and has a hardness of seven or higher on the Mohs hardness scale. Ensure aggregate is angular, consists of natural silica sand, basalt, or other nonfriable aggregate, and contains less than 0.2 percent moisture when tested in accordance with *ASTM C566*.

Table 4: Angular Aggregates Gradation Requirements

Sieve Size	Minimum % Passing	Maximum % Passing
3/8	100	100
4	98	100
8	30	75
16	0	5
30	0	1
Pan	0	0

Provide general certification per the *MQAP Manual* to the Engineer that the materials meet the requirements specified herein.

c. Construction.

1. Equipment. For the epoxy polymer overlay, provide a distribution system or distributor capable of accurately blending the epoxy resin and hardening agent, and uniformly and accurately applying the epoxy materials at the specified rate to the bridge deck in such a manner as to cover 100 percent of the work area including 1 inch of the vertical face of curb/barrier. Provide a fine aggregate spreader capable of uniformly and accurately applying

dry aggregate to cover 100 percent of the epoxy material. Provide a self-propelled vacuum truck.

For hand applications, provide calibrated containers, a Jiffy® type mixer, and notched squeegees which are suitable for mixing and applying the epoxy and aggregate.

For mechanical applications, provide mixing equipment that will automatically and accurately proportion the components in accordance with the manufacturer's recommendations, mix and continuously place the epoxy polymer overlay. Ensure the operation proceeds in such a manner that will not allow the mixed material to segregate, dry, be exposed or otherwise harden in such a way as to impair the retention and bonding of broadcasted aggregate.

2. Surface Preparation. Ensure patching and cleaning operations are inspected and approved prior to epoxy polymer overlay installation. Protect utilities, drainage structures, curbs, bridge joints, and any other structure within or adjacent to the epoxy polymer overlay from surface preparation activities and application of the surface treatment materials. For the purposes of this special provision, the term bridge joints does not include sawed construction joints.

Do not perform surface preparation or installation of epoxy polymer overlay on concrete less than 28 days of age. Ensure that traffic paint lines and surface texturing or grooving are removed. Clean the entire concrete surface by abrasive blasting or shotblasting to remove all materials that may interfere with the bonding or curing of the binder. The cleaned concrete surface must meet the *International Concrete Repair Institute Guideline 310.2R, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair*, concrete surface profile 7 (CSP 7). Ensure mortar is sound and sufficiently bonded to the coarse aggregate, and presents a uniform CSP necessary for adequate bond. Use a vacuum truck or oil-free moisture-free air blast to remove all dust and other loose material. Brooms are prohibited. Remove any oil or other contamination after initial cleaning.

Ensure any contamination of the deck, or to intermediate courses, after initial cleaning, is removed. Ensure both courses of epoxy polymer overlay are applied within 24 hours of the final cleaning and prior to opening the area to traffic.

No visible moisture can be present on the surface of the concrete at the time of epoxy polymer overlay application. Oil-free moisture-free compressed air may be used to dry the deck surface. Use a plastic sheet left taped in place in accordance with the *ASTM D4263* to identify moisture in the epoxy polymer overlay area except as modified herein. Tape an 18 inch by 18 inch transparent polyethylene sheet (4 mil) to the deck every 500 square feet. Ensure all edges are sealed with tape that will stick to the concrete substrate. Leave the plastic sheet in place for a minimum of 3 hours or the manufacturer's recommended cure time for the conditions, whichever is longer. Ensure there is no moisture visible on the polyethylene sheet. Ensure alternate methods to detect moisture are approved by the Engineer.

Remove all debris from bridge joints. Protect the bridge joints, and any other areas not to be overlaid, from damage during preparation of the surface. Ensure the protection is removed once the epoxy and aggregate has been applied and prior to initial set. Ensure removing the protection is done soon enough to in no way harm the adjacent overlay. Ensure protection is applied again prior to the second coat and removed again prior to initial set as to not damage adjacent surfaces. Ensure the protection meets the approval of the Engineer.

3. Application. Ensure handling and mixing of the epoxy resin and hardening agent is performed in a safe manner to achieve the desired results in accordance with the manufacturer's recommendations for a two-coat system or as directed by the Engineer. Do not place epoxy polymer overlay materials if weather or surface conditions are such that the material cannot be handled, placed, and cured within the manufacturer's requirements and the specified requirements of traffic control.

Apply the epoxy polymer overlay in a minimum of two separate courses in accordance with the manufacturer's recommendation for two-coat system with the following rate of application. First course must be no less than 2½ gallons per 100 square feet. Ensure the second subsequent course is no less than 5 gallons per 100 square feet.

Ensure application of aggregate to both the first and second courses is of sufficient quantity so the entire surface is covered in excess. Ensure no bleed through, or wet spots are visible in the overlay. Remove and replace any areas within course applications with wet spots or where epoxy has bled through.

After the epoxy mixture has been prepared for the overlay, immediately and uniformly apply it to the surface of the bridge deck with a notched squeegee. Apply the dry aggregate in such a manner as to cover the epoxy mixture completely within 5 minutes. Minimize all foot traffic on the uncured epoxy and ensure any foot traffic is only done with steel spiked shoes approved by the Engineer. Cure each course of epoxy overlay until vacuuming or brooming can be performed without tearing or damaging the surface. Do not allow traffic or equipment on the overlay surface during the curing period. Remove by vacuuming or brooming all loose aggregate after the first course curing period. Immediately apply the next overlay course to complete the surfacing overlay. Ensure the minimum curing periods are in accordance with the manufacturer's recommendations, as shown in Table 5, or as directed by the Engineer. Remove by vacuuming or brooming all loose aggregate after the second course curing period. Ensure all bridge joints are free of loose aggregate, epoxy and other debris resulting from overlay operations. Excess aggregate may be reused if it is clean, dry, free from foreign matter, and meets gradation requirements. Blend the excess aggregate at a ratio of 3 parts virgin material to 1 part recycled material. Inspect aggregate recovery equipment prior to reclamation operation to prevent the introduction of foreign material. Collect excess aggregate within 24 hours of placement. Do not collect excess aggregate that has been rained on or driven on.

Table 5: Anticipated Cure Time (Hours)

Average Temperature Range. of Deck, Epoxy and Aggregate Components (°F)	1 st Course	2 nd Course
<60		(a)
60-64	2	2
65-69	2	2
70-74	1.75	1.75
75-79	1.75	1.75
80-84	1.5	1.5
>85	1	1
a. Second course must be cured for minimum of 8 hours if the air temperature drops below 60 °F during the curing period, or per the manufacturer's recommendations.		

Plan and execute the work to provide the minimum curing periods as specified in Table 5, or other longer minimum curing periods as recommended by the manufacturer prior to opening

to public or construction traffic, unless otherwise permitted. First course applications must not be opened to traffic. Ensure any contamination, detrimental to adhesion of the second course, is removed from the first course at the Contractor's expense prior to the application of the second course.

Remove and replace any areas damaged or marred by the Contractor's operations in accordance with this special provision. All cost associated with this work will be borne by the Contractor.

Remove and replace areas as directed by the Engineer and in accordance with 20SP-712D – Removal of Thin Epoxy Polymer Bridge Deck Overlay.

Provide the Engineer with all records including, but not limited to, the following for each batch provided:

- batch numbers and sizes (if applicable)
- location of batches as placed on deck, referenced by stations (if applicable)
- epoxy yield, referenced by stations
- batch time (if applicable)
- temperature of air, deck surface, epoxy components, including aggregates
- loose aggregate removal time
- time open to traffic

4. Clean Up. At the end of the project or a minimum 7 days after the epoxy polymer overlay has cured, remove, and dispose all loose aggregate that has shed from the epoxy binder by vacuuming or brooming. Do not re-use this aggregate.

d. Warranty.

1. Limits of Warranted Work. The warranted work includes all epoxy polymer overlays on structures within the project limits unless otherwise indicated in the proposal.

2. Warranty Period. The length of warranty will be 5 years from the Acceptance Date of Warranted Work.

3. Warranty Bond. Furnish a single term warranty bond equal to 100 percent of warranted work for epoxy polymer overlay, prior to contract award. The effective starting date of the warranty bond will be the Acceptance Date of Warranted Work. The warranty bond will be released at the end of the warranty period or after all warranty work has been satisfactorily completed, whichever is later, and a form furnished by the Department is jointly executed by the Department and the Contractor.

4. Initial Acceptance. The Department and the Contractor must jointly review all completed warranted work, or a portion thereof, as determined by the Department. If the work does not meet contract requirements, the Contractor must make all necessary corrections, at their expense, prior to initial acceptance. Initial acceptance will occur as soon as the Department determines that all contract requirements have been met for the warranted work. The date on which initial acceptance occurs is termed the Acceptance Date of Warranted Work.

Initial acceptance will be documented and executed jointly by the Department and the

Contractor on a form furnished by the Department. A copy of the form will be sent to the Contractor's warranty bond surety agent by the Department. Neither the initial acceptance nor any prior inspection, acceptance, or approval by the Department diminishes the Contractor's responsibility under this warranty.

The Department may accept the work and begin the warranty period to accommodate seasonal limitations or staged construction, excluding any area needing corrective work.

5. Rights and Responsibilities of the Department. The Department:

A. Reserves the right to approve the time, traffic control and methods for performing any warranty work by permit through the Region utilities and permit process.

B. Reserves the right to approve or reject the schedule proposed by the Contractor to perform warranty work.

C. Reserves the right to approve all materials and specifications used in warranty work.

D. Reserves the right to determine if warranty work performed by the Contractor meets the contract specifications.

E. Reserves the right to perform, or have performed, routine maintenance during the warranty period. Routine maintenance will not diminish the Contractor's responsibility under the warranty.

F. Reserves the right, if the Contractor is unable, to make immediate emergency repairs to the epoxy polymer overlay to prevent an unsafe road condition caused by defective warranted work as determined by the Department. The Department will attempt to notify the Contractor that action is required to address an unsafe condition. The Department will record the time and date of the attempts for Contractor notification. However, should the Contractor be unable to comply with this requirement, to the Department's satisfaction and within the time frame required by the Department, the Department will perform, or have performed any emergency repairs deemed necessary. Any such emergency repairs undertaken will not relieve the Contractor from meeting the warranty requirements of this special provision. Any costs associated with the emergency repairs will be paid by the Contractor.

G. Reserves the right, if the Contractor is unresponsive, to call the surety to complete the applicable warranty work.

H. Is responsible for monitoring the structure throughout the warranty period by means of the Michigan Bridge Inspection System (MBIS) and in accordance with the National Bridge Inspection Standards (NBIS) and will provide the Contractor all documentation of the epoxy polymer overlay's condition related to the warranty requirements. The Department reserves the right to conduct impromptu inspections to evaluate the performance of the thin epoxy polymer overlay. The Contractor will not be relieved of any responsibility based upon a claim that the Department failed to adequately monitor the structure or to report its findings to the Contractor.

I. Is responsible for notifying the Contractor, in writing, of any corrective action

required to meet the warranty requirements.

6. Rights and Responsibilities of the Contractor. The Contractor:

A. Must warrant to the Department that the warranted work will be free of defects as measured by the performance parameters and specified threshold values for each. Ensure the warranty bond is described on a form furnished by the Department. Ensure the completed form is submitted to the Department prior to award of contract.

B. Is responsible for performing all warranty work including, but not limited to, maintaining traffic and restoring epoxy polymer overlay to the Departments' specifications, at the Contractor's expense.

C. Is responsible for performing all temporary or emergency repairs, resulting from being in non-compliance with the warranty requirements, using Department approved materials and methods.

D. Must notify the Department and submit a written course of action for performing the needed warranty work, 10 calendar days prior to commencement of said warranty work, except in the case of emergency repairs as detailed in this special provision. The submittal must propose a schedule for performing the warranty work and the materials and methods to be used.

E. Must follow a Department approved maintaining traffic plan when performing warranty work. Ensure all warranty work is performed under permit issued by the Transportation Service Center Permits Staff. The permit fee and an individual permit performance bond will not be required. The permit insurance requirements, however, will apply. When applying for this permit, note on the application that warranty work is to be performed.

F. Will be responsible for reimbursing the Department a portion of any incentive payments paid to the Contractor for early completion of the original work. Reimbursements will be required if the proposed maintaining traffic plan for corrective action requires lane closures during peak hour traffic prior to contract completion. Peak hours will be determined by the Region Traffic and Safety Engineer. The daily reimbursement amount will not exceed 25 percent of the original daily earned incentive payment. The Department will determine the actual percentage on a project by project basis.

G. Must furnish to the Department, if warranty work is required, a supplemental lien bond in the amount required by the Department to cover the costs of warranty work using Department approved forms. Ensure the supplemental lien bond is furnished prior to beginning any warranty work.

H. Must complete all warranty work required by this special provision prior to conclusion of the warranty period, or as otherwise agreed to by the Department.

I. Will be liable during the warranty period in the same manner as Contractors currently are liable for their construction related activities with the Department pursuant to the Standard Specifications for Construction, including, but not limited to subsections 104.07.C, 107.10 and 107.11. This liability will arise and continue only during the period

when the Contractor is performing warranty work. This liability is in addition to the Contractor performing and/or paying for any required warranty work and must include liability for injuries and/or damages and any expenses resulting therefrom which are not attributable to normal wear and tear of traffic and weather, but are due to non-compliant materials, faulty workmanship, and to the operations of the Contractor as set forth more fully in subsections 104.07.C, 107.10 and 107.11 of the Standard Specifications for Construction.

7. Evaluation Method. The Department will conduct epoxy polymer overlay evaluations for each structure. Evaluation will consist of field condition reviews. This evaluation may be waived in emergency situations.

The beginning and ending points will be the reference lines of the structures.

8. Warranty Requirements. Warranty work will be required when a threshold limit for a condition parameter is exceeded as a result of defects.

Condition parameters (see Table 6) are used to measure the performance of the epoxy polymer overlay during the warranty period. Each condition parameter has a threshold level applied to each structure and a maximum percentage of defects allowed before corrective action (warranty work) is required.

Definitions:

Spalling. Broken or missing pieces of epoxy polymer overlay.

Scaling. Worn epoxy polymer overlay surface with loss of epoxy and aggregate exceeding 20 percent of overlay thickness.

Delamination. Debonding of the epoxy polymer overlay to the existing bridge surface.

If any of the following minimum performance criteria listed in Table 6 is not met, warranty work is required. Ensure the warranty work is performed prior to conclusion of the warranty period or within such other time frame as agreed to by the Department and the Contractor, unless safety concerns dictate otherwise.

Table 6: Thresholds for Condition Parameters

Condition Parameter	Threshold Limits Per Surface Area for Each Structure
Spalling	1%
Scaling	1%
Delamination	1%

The defective areas of the epoxy polymer overlay may or may not be contiguous to necessitate corrective action. Ensure any corrective action (warranty work) requiring removal or replacement is made at a sufficient depth to restore the integrity of the epoxy polymer overlay surface.

During the warranty period, the Contractor will not be held responsible for epoxy polymer overlay distresses including but not limited to: chemical and fuel spills, vehicle fires, structural

repairs requiring deck patching, removal or replacement, and quality assurance testing such as coring. The Contractor will be responsible for wear or damage by snowplow blades and other winter maintenance operations. Other factors considered to be beyond the control of the Contractor which may contribute to epoxy polymer overlay distress will be considered by the Engineer on a case by case basis upon receipt of a written request from the Contractor.

9. Corrective Actions. Perform the work necessary to repair all deficiencies associated with the warranted condition parameters. The Department will accept the listed corrective action if the action addresses the cause of the condition parameter as listed in Table 6. The Contractor may use an alternative action subject to Department approval.

Table 7: Corrective Actions

Condition Parameter	Recommended Action
Spalling	Repair with epoxy polymer overlay with equal thickness and durability as the original overlay.
Scaling	Repair with epoxy polymer overlay with equal thickness and durability as the original overlay.
Delamination	Sound overlay to determine extent of delamination, remove damaged overlay, and repair with epoxy polymer overlay with equal thickness and durability as the original overlay.

10. Emergency Repairs. If the Department determines that emergency repairs are necessary for public safety, the Department or its agent may take repair action. Emergency repairs must be authorized by the Engineer.

Prior to emergency repairs, the Department will document the basis for the emergency action. In addition, the Department will preserve evidence of the defective condition.

11. Conflict Resolution Team. The sole responsibility of the Conflict Resolution Team (CRT) is to provide a decision on disputes between the Department and the Contractor regarding application or fulfillment of the warranty requirements. The CRT will consist of five members:

- A. Two members selected and compensated by the Department.
- B. Two members selected and compensated by the Contractor.
- C. One member mutually selected by the Department and the Contractor. Compensation for the third-party member will be equally shared by the Department and the Contractor.

If a dispute arises on the application or fulfillment of the terms of this warranty, either party may serve written notice that the appointment of a CRT is required.

At least three members of the CRT must vote in favor of a motion to make a decision. If agreement cannot be reached, the CRT may decide to conduct a forensic investigation. The CRT will determine the scope of work and select the party to conduct the investigation. All costs related to the forensic investigation will be shared proportionally between the Contractor and the Department based on the determined cause of the condition.

12. Non-Extension of Contract. This special provision must not be construed as extending or otherwise affecting the claim process and statute of limitation applicable to this contract.

e. Measurement and Payment. All costs, including engineering and maintaining traffic costs, associated with meeting the requirements of this special provision are considered to be included in the contract unit prices for the warranted work items regardless of when such costs are incurred throughout the warranty period. These costs include but are not limited to, all materials, labor, and equipment necessary to complete required warranty work.

The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item

Pay Unit

Epoxy Ovly, WarrantySquare Yard

Epoxy Ovly, Warranty includes preparing the entire deck surface, preparing and applying a two-coat overlay system, and miscellaneous clean-up. Also includes protecting/cleaning bridge joints.

File 107

cc: Surety Company