Michigan’s Experience with Floodcoats

Jason DeRuyver, Michigan DOT

Epoxy floodcoats have been used as a preventive maintenance treatment on bridge decks in Michigan since the early 1990’s. The early floodcoats were expensive, time consuming and left many questions regarding effectiveness and longevity. Since then, improvements in material and application made through state employee ingenuity and industry innovation has driven the price of doing a two-coat thin epoxy overlay in Michigan down to $3.80/sq. ft. and a penetrating healer sealer down to $1.80/ sq. ft.

Floodcoat is a term used to describe the flooding of an entire bridge deck with a material to seal or bridge cracks to prevent moisture intrusion. The floodcoat method pours material on the deck and then squeegees or brooms the material over the entire surface, essentially flooding the deck. Epoxy is typically used for floodcoats in Michigan, however, the term may be applied to other materials similar in nature such as polyesters or methacrylates.

Michigan uses two different kinds of epoxy floodcoats. For a penetrating healer sealer floodcoat, the deck is flooded with a one-coat, epoxy that soaks into the deck surface and fills deck cracks. The epoxy is then covered with a fine sand to provide a temporary wearing surface. (See Table 1 for a list of products and application rates used in Michigan) For a thin epoxy overlay, the deck is flooded with a two-coat epoxy that bonds to the bridge deck. After each coat, the epoxy is covered with a course aggregate to provide a permanent wearing surface. The end result is a flexible overlay of the deck that seals the entire surface, (See Table 2 for a list of products and application rates used in Michigan.)
Michigan applies thin epoxy overlays and penetrating healer sealers by both contractor and state forces. Since 2006, Michigan’s state forces have placed 1.7 million square feet of thin epoxy overlay and 2 million square feet of penetrating healer sealer. In the same time, Michigan has contracted out 3.2 million square feet of thin epoxy overlay and 750,000 square feet of penetrating heater sealer.

When scoping a bridge for the appropriateness of a thin epoxy overlay or healer sealer, several factors must be considered. These are preventive maintenance treatments and they will not repair a structurally deficient bridge deck. While most manufacturers recommend a minimum deck rating of 7, as long as the engineer understands the criticality of the surface preparation, Michigan has successfully performed these treatments on bridge decks rated as low as 5.

Penetrating healer sealers are more forgiving and the surface wears off over time. They may be applied to a deck with any condition rating; however, flooding decks with a poor rating will not substantially extend their current condition nor justify the cost of the application. At a minimum, the deck should have a 5 rating, but use of the material on decks rated at 7 or 8 with repeated applications every 5 to 10 years will substantially increase their life expectancy.

### Table 1. Michigan Healer Sealer Estimating and Approved Products

<table>
<thead>
<tr>
<th>Healer Sealer</th>
<th>2014 Cost</th>
<th>Coverage for Estimating</th>
<th>Approved Manufacturer</th>
<th>Approved Aggregate</th>
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</thead>
</table>
| Epoxy coated reinforcement (ECR) continues to be the preferred corrosion protection system of most DOTs. Research conducted by the VDOT indicates that the initial corrosion protection provided by the coating depends on its condition and quality, but over time, the coating can delaminate allowing water and chlorides direct access to the steel surface. The coating can trap moisture, preventing the water from evaporating and increasing the rate of corrosion. Figure 3 shows the corroded ECR in a section of deck that failed in shear in 2009 on I-81 near Marion Virginia after 17 years in service. The green coating has turned brown in the vicinity of the leaking construction joint that was approximately 0.5 mm wide, the typical width of cracks in decks constructed with HPC. For a number of reasons, including geometry, cracks may create a more corrosive environment than joints.

http://concretebridgeviews.com/i75/Article2.php
Surface preparation is the key to success for thin epoxy overlays, and Michigan prepares all bridge decks to receive a thin epoxy overlay to the International Concrete Repair Institute’s (ICRI), Concrete Surface Profile 7 (CSP 7). CSP 7 is a heavy shotblast that removes all of the concrete paste, exposes aggregate and leaves the surface irregular. This heavy shotblast must remove all of the paint lines and surface tining for a successful application. Also, because the epoxy adheres to the exposed aggregate, all of the concrete must be sound and the aggregate well bonded. Unsound areas must be patched and allowed to cure for 28 days prior to overlaying, otherwise the epoxy will crack/debond, reducing effectiveness.

While thin epoxy overlays bridge cracks and provide a high friction wearing surface to the deck, penetrating healer sealers fill the cracks. For this application Michigan prepares the deck surface to a CSP 3, which lightly abrades the surface and rounds the edges of the cracks. Also the deck tining may remain. This allows penetrating healer sealers to be installed much more quickly than thin epoxy overlays. Michigan’s healer sealers are expected to penetrate hairline cracks up to ½ inch. This penetration has been verified by coring cracks and measuring.

When choosing between an epoxy overlay and a penetrating healer sealer, weigh the advantages and disadvantages of each. Is speed of application important? Aesthetics? Budget?

The advantages of thin epoxy overlays are:

- Seals cracks in bridge deck
- Provides aesthetic wearing surface
- Increases skid resistance The darker aggregate retains more heat and reduces icing of the bridge.

The disadvantages of thin epoxy overlays are:

Table 2. Michigan Epoxy Overlay Estimating and Approved Products

<table>
<thead>
<tr>
<th>Epoxy Overlay</th>
<th>2014 Cost</th>
<th>Coverage for Estimating</th>
<th>Approved Manufacturer</th>
<th>Approved Aggregate</th>
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<tr>
<td></td>
<td>$25/Gallon</td>
<td>25 SQF/Gallon</td>
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<td>Best Sand #612 Quartz</td>
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<td></td>
<td>Euclid Flexolith Summ</td>
<td>US Silica EP-5 Modified Quartz</td>
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<td></td>
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<td>Euclid Flexolith HD</td>
<td>Manufacturers Minerals BT-6x10 River Rock</td>
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<tr>
<td></td>
<td></td>
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<td>Unitex Propoxy Type III DOT</td>
<td>Flint Rock Products #7 Chipped Flint</td>
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<td>Poly Carb Flexgrid Mark 163</td>
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<td>E-Bond 526 Le-Mod</td>
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<td></td>
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<td>Axion Akebond 811</td>
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The advantages of thin epoxy overlays are:

- Seals cracks in bridge deck
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The disadvantages of thin epoxy overlays are:
• Time consuming (3 day operation minimum)
• Extremely sensitive to deck preparation
• Susceptible to snow plow damage

The advantages of penetrating healer sealers are:

• Seals cracks in bridge decks
• Quick operation (1 day typical operation)
• Very inexpensive aggregate (mason sand)
• Not reliant on preparation. Same material as used for filling individual cracks by hand, and not through the floodcoat method.

The disadvantages of penetrating healer sealers are:

• Does not provide a wearing surface
• Can be aesthetically displeasing
• Shorter life expectancy

For more information on Michigan’s extensive thin epoxy overlay and penetrating healer sealer program visit: