Thin Epoxy Overlay Treatments on Bridge Decks

Michigan DOT Best Practices

2016 Midwest Bridge Preservation Partnership
MDOT Organization
Outline

• History of Thin Overlays in Michigan
• Scoping the Thin Overlay
• Specifications
• Step by Step
• Ensuring Results
• Questions and Answers
Just another Tool in our tool box!
We’ve Come A Long Way
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Since 2006

- MDOT State Forces have placed 1.7 million square feet
- Michigan Bridge Contractors have placed 3.2 million square feet.
- Innovation has led to cost effective materials and application procedures
Scoping the Thin Overlay

• Any deck 1 year or older
• Any deck with a deck bottom rating of fair or better
• Any deck with a surface condition that would warrant deck patching rather than a rigid overlay.
• Any deck you want a higher Skid Number
  – Typical Skid Number on Michigan Bridge Tined Bridge Deck is 40
  – Typical Skid Number on Michigan Bridge Deck with Thin Overlay is 65
Building a Successful Specification

- ACI 503.3-10 Specification for Producing a skid resistant surface on Concrete by the use of Epoxy and Aggregate
  - Aggregate Gradation
  - Aggregate Hardness
  - Surface Preparation
  - Pull Off Test
  - Moisture Test
Building a Successful Specification

- ACI 503.3-10 Michigan Deviation from Specification
  - Aggregate Hardness (Mohs = 6)
    - But Michigan Plow blades have an equivalent Mohs Hardness of 7
Building a Successful Specification

- ACI 503.3-10 Michigan Deviation cont.
  - Surface Preparation (Free of loose and unsound material)
    - ICRI states a CSP of 5 or greater for thin overlays
    - Michigan Experience uses a CSP of 7 or greater
  - Pull Off Test
    - 250 psi test areas usually end up being the cleanest spot on the deck
    - Requiring a CSP 7 everywhere avoids this.
Building a Successful Specification

- **Removal Method**

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(1) Only suitable for freshly placed cementitious materials
Building a Successful Specification

- Removal Method
  - Microcracking

Fig. 4.3: Scarifying, scabbling, rotomilling, needle scaling
Building a Successful Specification

• ACI 503.3-10 Key Note
  – Moisture Test

  • Evaluate moisture content for concrete by determining if moisture will collect at bond lines between concrete and epoxy coating before epoxy has cured.
Building a Successful Specification

• ACI 503.3-10 Key Note
  – Moisture Test
    • Cannot be done with a moisture meter
    • Cannot be done by stating an exact duration in the specification.
    • Must be based on the selected product and the manufacturers expected cure time given atmospheric conditions at the time of installation.
    • Don’t let the contractor run the epoxy into a 5 gallon bucket to check set time. Use manufacturer tables.
Thin Overlay Surface Prep

- Surface preparation is **everything** for the long term performance of the Epoxy Polymer Overlay. All soft, weak surface mortar, laitance or carbonation must be removed to allow the epoxy compound to **bond to the aggregate** within the concrete matrix.
Thin Overlay Surface Prep

- Deck tining must be removed
  - Michigan deck tining is wet installed. Wet installation pushes the aggregate down.
- Aggregate must be exposed
- Paint striping is a bond breaker
- If unsound areas are discovered delay application. Most manufacturers will not recommend their product be placed over concrete less than 28 days old.
- Vehicles are not allowed on the prepared surface
Thin Overlay Surface Prep
Tape Joints & Drains Well

• Epoxy is difficult to remove from strip seal gland
Blow off the Deck

- Dry, Oil Free Air for a final cleaning
- Brooms force dirt into the cracks
Final Cleaning Tip

• Check Underneath Contractor Vehicles
Installation Day

- Minimum recommended air and surface temperatures are 50°F and rising
- If precipitation is expected thin overlay should be delayed
- If shotblast deck gets rained on, the deck will need to be re-blasted and moisture tests redone.
Applying Epoxy

• Squeegee epoxy as soon as it is applied to the deck

• Thin epoxy overlay material estimate
  – First course rate a minimum of 2.5 gal / 100sft
  – Second course a minimum of 5 gal / 100sft
Applying Epoxy
Squeegeeing Epoxy

- Use spike shoes while squeegeeing
- Use notched squeegees that will spread the material at the Manufacturer’s recommended thickness.
- Puddle the epoxy one inch up the barrier
Squeegeeing Epoxy
Squeegeeing Epoxy
Aggregate Placement

• Use of a pressurized pot quickly delivers even aggregate placement
• No visible wet spots
• Aggregate spread at 3.33 lbs/sft. for thin overlay epoxy
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Life Expectancy

• Thin Epoxy Overlays
  – With proper surface preparation thin epoxy overlay treatments will last 15 to 20 years
  – Old flood coats that crack may be crack chased with healer sealer epoxy
  – Delaminated overlays may be repaired
Life Expectancy
Dark aggregate may be beneficial
During the Winter Maintenance Season
Troubleshooting

• If the contractor is applying mechanically
  – Always turn on / off nozzle over bucket
Troubleshooting

• If the contractor is hand mixing
  – Watch for spills. Puddles of A or B on the deck will never set up right and / or form a bond breaker.
Identifying Future Problems

• Inadequate surface profile
Identifying Future Problems

- A&B Puddles
Ensuring a Quality Job

- When in doubt, add a 5 year warranty.
- MDOT 12SP-712C-01 – Performance Warranty, Thin Epoxy Bridge Deck Overlay
Safety

- Consult SDS and follow state safety guidelines
- Respirator recommended
- Avoid skin contact, A and B by themselves are nasty.
- Use common sense
  - Don’t mix the material with other substances
  - Don’t Breathe in vapors from the Bucket while epoxy is Flashing
Thin Epoxy Overlay Summary

• Seals cracks in bridge deck by bridging
• Use on any deck 1 year old or greater with a fair or better top and deck bottom condition
• Increases skid resistance
• Dark Aggregates deter icing of the bridge deck
• Heavily dependent on surface preparation
• Life expectancy 15-20 years
• Deck Preparation Rate – 600 to 850 sft / hr
• Placement rate – 1,000 – 3,500 sft / hr / layer
List of Helpful Documents

- SP for Thin Epoxy Polymer Bridge Deck Overlay
- SP for Performance Warranty, Thin Epoxy Bridge Deck Overlay
- SP for Removal of Thin Epoxy Polymer Bridge Deck Overlay
- Thin Epoxy Overlay Log Sheet
- Healer Sealer Log Sheet
- Results of Aggregate Wear Track Polishing Test
- MDOT Flood Coat Whitepaper
Questions?