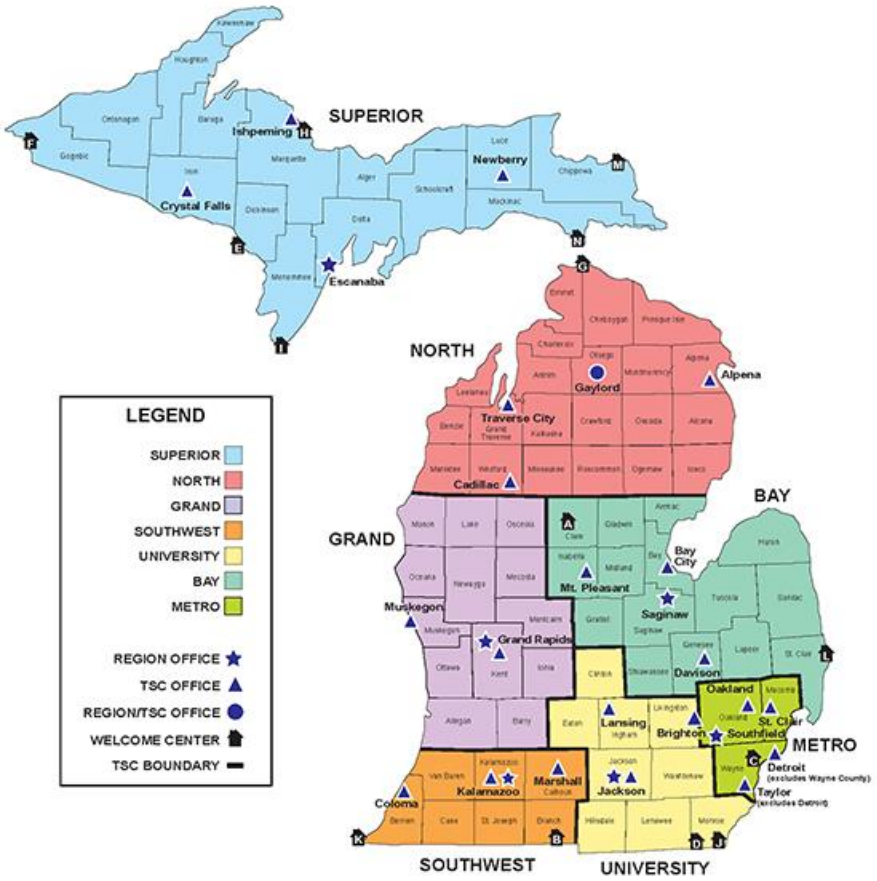
Thin Epoxy Overlay Treatments on Bridge Decks

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

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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 an 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

Surface preparation method	Concrete Surface Profile									
	CSP 1	CSP 2	CSP 3	CSP 4	CSP 5	CSP 6	CSP 7	CSP 8	CSP 9	CSP 10
Detergent scrubbing	■									
Low-pressure water cleaning	■									
Grinding	■	■								
Acid etching	■	■	■							
Needle scaling		■	■	■						
Abrasive blasting		■	■	■	■	■	■			
Shotblasting		■	■	■	■	■	■	■	■	
High- and ultra-high-pressure water jetting			■	■	■	■	■	■	■	■
Scarifying				■	■	■	■			
Surface retarder (1)					■	■	■	■	■	■
Rotomilling						■	■	■	■	
Scabbling							■	■	■	
Handheld concrete breaker							■	■	■	■

(1) Only suitable for freshly placed cementitious materials

Building a Successful Specification

- Removal Method
  - Microcracking

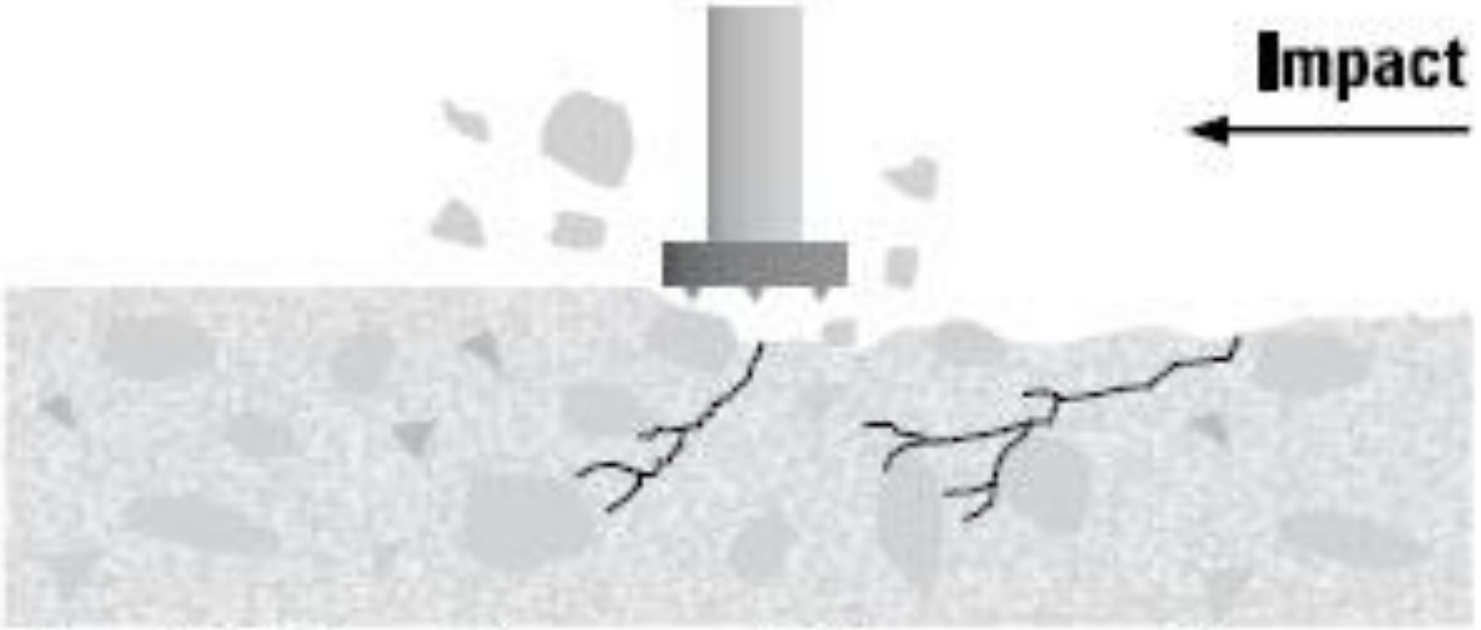

Fig. 4.3: Scarifying, scabbling, rotomilling, needle scaling

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

Aggregate Placement

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?

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