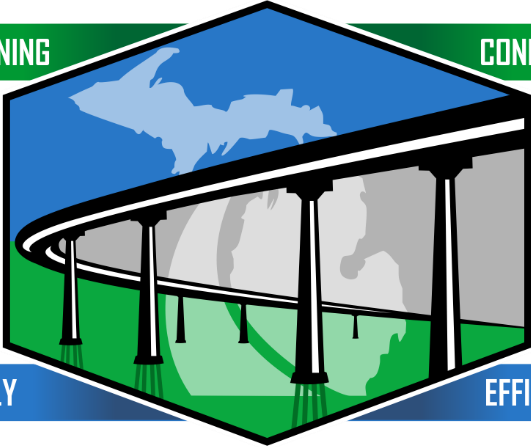


BUREAU of BRIDGES

SPANNING

CONNECTING



SAFELY

EFFICIENTLY

and STRUCTURES

Michigan DOT Best Practices

Bridge Maintenance – You Can Do It Too.



2023 CTT Michigan Bridge Maintenance Workshop

Structure Maintenance

News and Information

Projects and Programs

Maps

Reports, Publications and Specs

About MDOT

Doing Business

Aeronautics

Title VI
Nondiscrimination

Sign up for email
from MDOT! 

Preservation, RFA, Structural Design/Maintenance, Technology, and Materials & Equipment Support

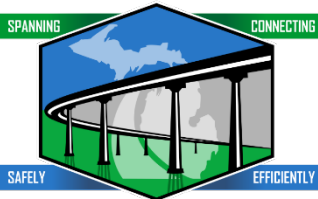
Provides technical expertise to the Regions, local agencies, and consultants for structural maintenance. Provides structure design for Request for Action. Trial new technologies in equipment and materials for structure maintenance. Provides training.

Jason DeRuyver, Priority Preservation and Maintenance Support Unit Engineer
517-242-2988
DeRuyverJ@michigan.gov

Andrew Zevchak, Priority Preservation Engineer
517-256-8439
ZevchakA@michigan.gov

Jacob Creisher, Structure Maintenance Engineer
517-243-7821
CreisherJ@michigan.gov

Aaron Porter, Structure Maintenance Support Coordinator
517-242-5788
PorterA@michigan.gov



Structure Maintenance

- Maintenance Resource
- Develop Standards and Specifications
- Provide Technical Support
- Develop Contracts
- Investigate New Materials and Methods
- Design and Detail Complex Repairs
- Liaisons with Industry Partners



Structure Maintenance Special Provisions

- 20SP-602C – Pressure Relief Joint
- 20SP-602D – Expansion Joint, Type E3
- 20Sp-706A – Sealing Localized Cracks
- 20SP-706C – Polyurethane Joint Sealant
- 20SP-707C – Metal Mesh Panels
- 20SP-710B – Penetrating Healer Sealer
- 20SP-710C – Substructure Horizontal Surface Sealer
- 20SP-712B – Thin Epoxy Overlay
- 20SP-712C – Performance Warranty, Thin Epoxy Overlay
- 20SP-712D – Removal of Thin Epoxy Overlay



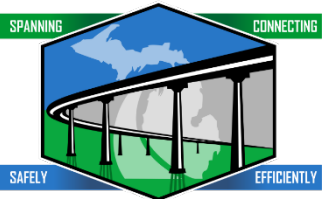
Structure Maintenance Special Provisions

- 20SP-800A – HFST
- 20SP-811A – Protective Overlay for Pavement at Snowmobile Crossings
- 20RC712(A290) – Bridge Cleaning
- 20RC712(A550) – Deck Scaling
- 20RC712(A615) – Performance Warranty HFST
- 20RC712(A295) – Resealing Construction Joints on Structures
- 20RC713(A490) – Temporary Column Support Left In Place



Structure Maintenance Special Provisions

- 20RC706(A645) – Wood False Decking, Left in place
- 20TM717(A260) – Maintainable Drain, Steel
- 20TM710(A290) – Silane Treatment for Bridge Concrete
- 12BR712(A855) – Rapid Setting Polymer Concrete Patching Material – Needs Update
- 12SM701(A305) – Self Expanding Joint
- 12ST710(A020) – Spray Applied Waterproofing Membrane
- Salvaging Temporary Barrier



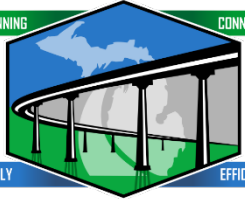
Bridge Cleaning

- Recommended Special Provision
- Potable Water
- Remove & collect materials such as dirt, nests, bird excreta
- Use sufficient water pressure
- Flush Drains
- Clean to extent shown on plans



Bridge Cleaning - Tips

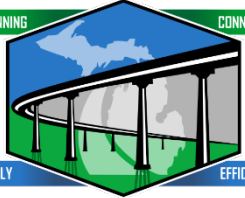
- Engage your local Fire Department
- What about Birds?
- Migratory Bird Protection in the SP –
Cleaning Prohibited April 15th –
September 1st when Present.



Bridge Cleaning

- Clean Joints





Bridge Cleaning

- Clean Joints





Bridge Cleaning

- Clean Toe of Barrier Wall





Bridge Cleaning

- Clean Toe of Barrier Wall



Bridge Cleaning

- Vacuum Excreta





Bridge Cleaning

- Vacuum Excreta

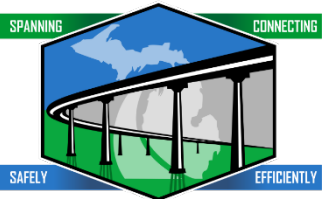




Bridge Cleaning

- Vacuum Excreta





Bridge Cleaning

- Benefits
- Reduced Deterioration and Corrosion Rates
- Difficult to determine cost benefit
- Washington DOT Research Reports
 - WA-RD 811.1
 - WA-RD 811.2



Benefits to Properly Maintained Vegetation

- Safety
- Cost
- Environmental
- Aesthetics

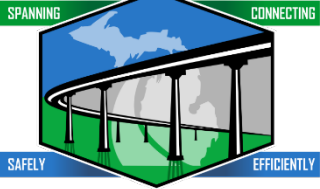




Safety

Improve Line of Sight to Obstacles Rigid and Mobile

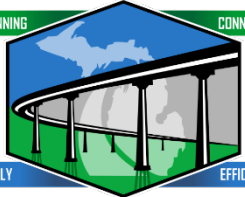




Safety

- Inspector access
- Visibility
- Trapping of moisture on structural elements
 - Beams
 - Deck Fascias
 - Paint Systems





Safety

Remove Hazardous Trees, Tree Limbs,
Brush and Poison Ivy

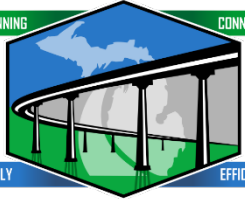




Safety

Reduce Standing Water on Roadways
Full Sun Exposure Speeds De-Icing Efforts





Safety

Reduces Fire Potential

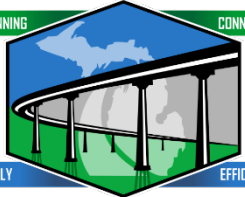




Cost

Vegetation Management Reduces
Maintenance Costs and Protects
Highway Assets

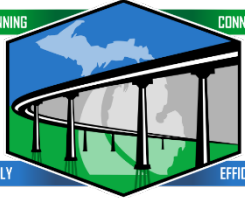




Strip Seal Gland Replacement

- A joint may not require replacement if adjacent concrete is sound, rail is intact, and deck grades remain unchanged

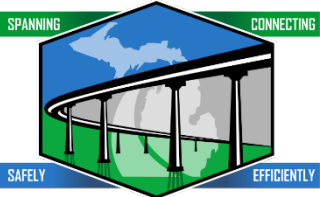




Strip Seal Gland Replacement



- A torn or broken gland may be the cause of leakage





Strip Seal Gland Replacement

- Clean gland and rail cavity with toluene to remove oils
- Apply an approved lubricant-adhesive liberally to the gland before inserting into rail

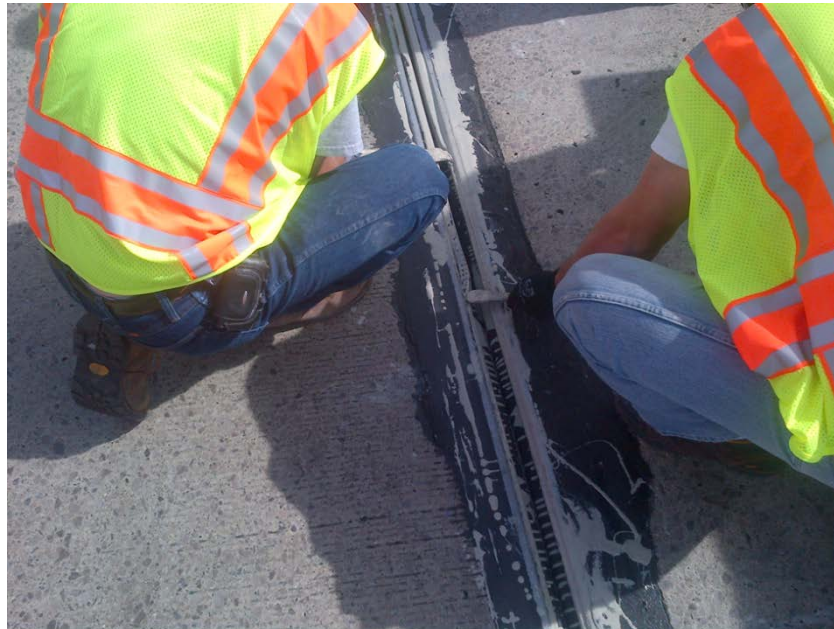
Sealing Element Cross-Section	Sealing Element	Movement Range		Joint Opening	Corresponding Steelflex® Rail
		MR _L	MR _T		
 A2R	A2R – 400	4.0 (102)	±2.0 (51)	0.5 – 4.5 (13) (114)	SSCM2 SSA2 SSE2M
	A2R – XTRA	7.0 (178)	±2.0 (51)	0.5 – 7.5 (13) (191)	
	A2R – O	4.0 (102)	±0.5 (13)	1.0 – 5.0 (25) (127)	
 L2	L2 – 400	4.0 (102)	±2.0 (51)	0 – 4.0 (0) (102)	SSPA SSCM
	L2-500	5.0 (127)	±2.0 (51)	0 – 5.0 (0) (127)	
	L2-O	4.0 (102)	±0.5 (13)	1.0 – 5.0 (25) (127)	

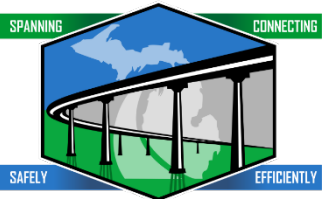
Bold numbers represent inches; metric (mm) in parentheses



Gland Installation

- Install the gland in one continuous piece
- If the gland is not continuous and requires splicing use cold vulcanization or other approved means





2020 Spec Book - Gland Replacement

- Standard Pay Item (712.04) –
–*Bridge Joint, Strip Seal Gland Replacement*



Crack Sealing

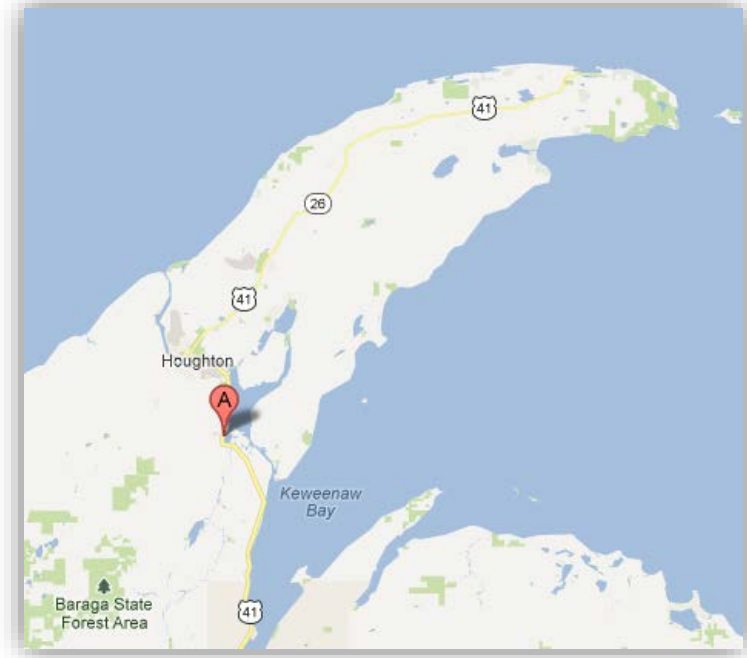
- Whenever you go out to a bridge, plan on crack sealing.

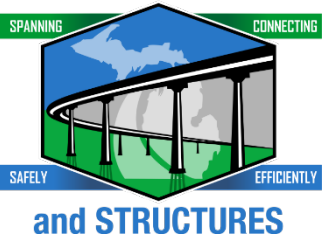




Substructure Repair

- BO4-31051: US-41 over Sturgeon River
- 1.8 Miles SE of Chassel





Substructure Repair

- North Abutment
- Spalls to Steel
 - Beams 7W and 8W



Substructure Repair

- Temporary Supports





Substructure Repair

- Saw cut perimeter approx. 1½” deep
- Removed all delam. concrete and chip at least ¾” behind reinforcement

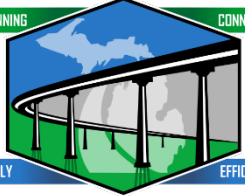




Substructure Repair

- Blast clean concrete, bottom of masonry plate, and existing reinforcement





Substructure Repair

- Drilling holes for adhesive anchored reinforcement

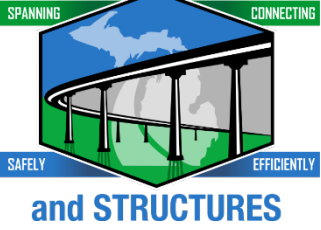




Substructure Repair

- Apply cold galvanizing to masonry plate
- Install anodes





Substructure Repair

- Form





Substructure Repair

- Mix Concrete Grade C-L On Site





Substructure Repair

- Pour and Consolidate

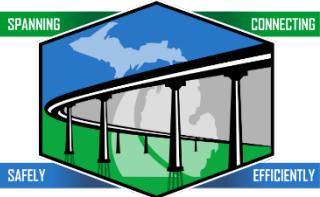




Substructure Repair

- Cure and Remove Forms





Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by pavement growth.





Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by pavement growth.





Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by frozen or improperly designed bearings.

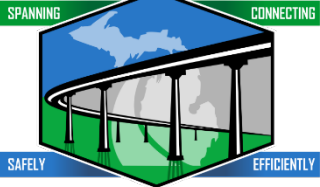




Substructure Repair

- PRJ Products
 - EMSEAL – BEJS (Pre Compressed)
 - Watson Bowman – Wabo H-Seal (Pre Compressed)
 - Lymtal – Iso-Flex – Silfast XL





Culverts - Scour





Culverts - Scour





Thin Epoxy Overlays Just another Tool in our tool box!

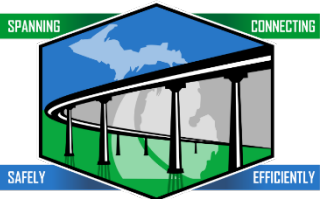




Since 2006

- 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





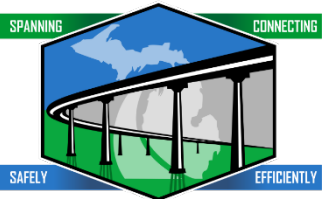
Scoping the Thin Overlay

- 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



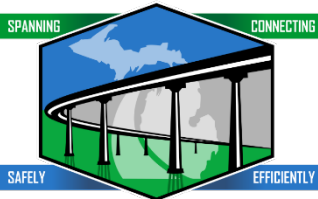
Building a Successful Specification

- 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 adhesion between concrete and epoxy is a passing test. This test is waived for our warranty specification.



Building a Successful Specification

- Removal Method
 - Microcracking

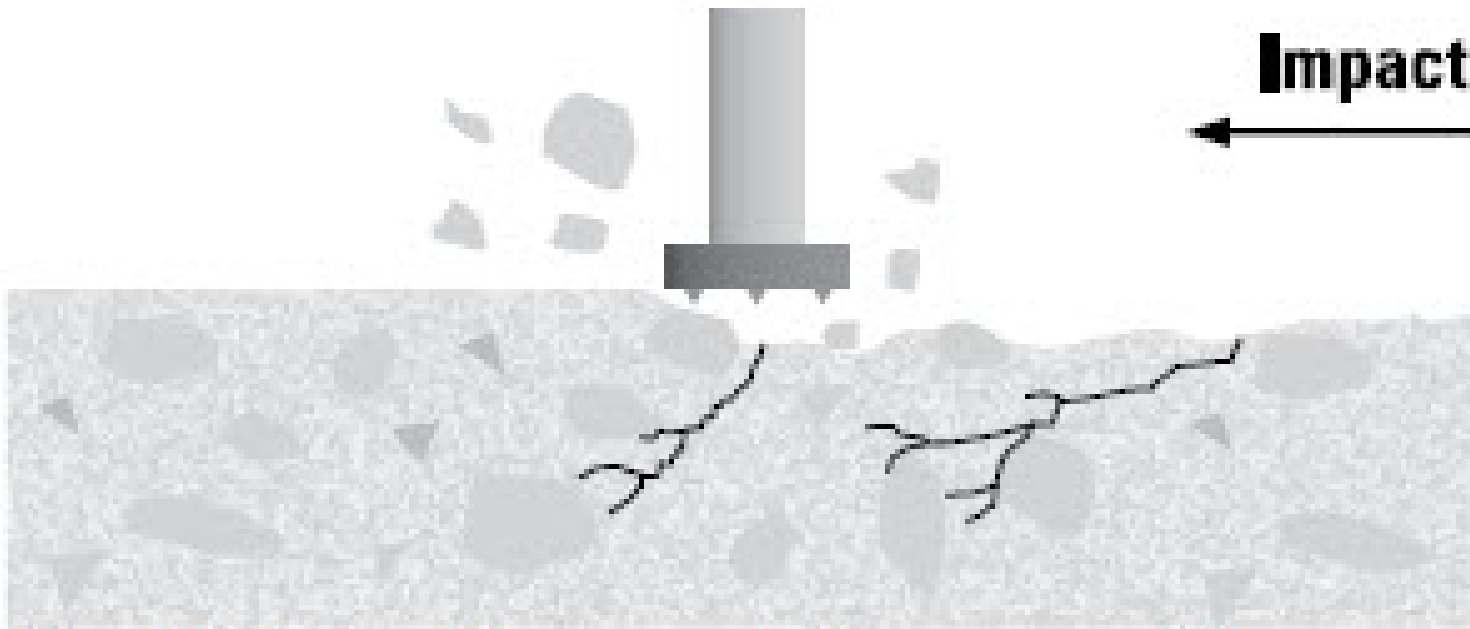
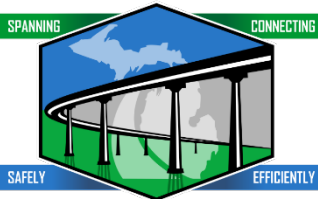
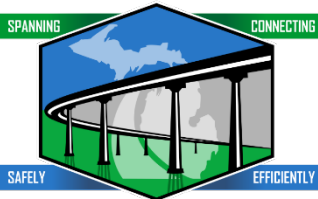


Fig. 4.3: Scarifying, scabbling, rotomilling, needle scaling



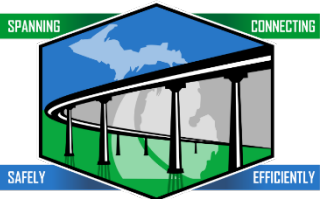
Building a Successful Specification

- 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.*



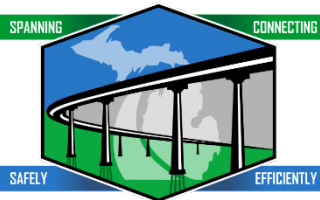
Building a Successful Specification

- 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.



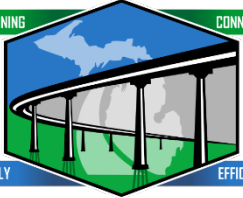
Thin Overlay Surface Prep

- 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.



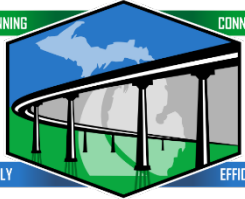
Thin Overlay Surface Prep

- 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

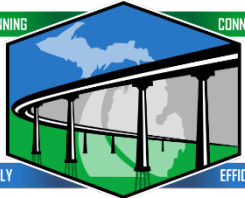




Tape Joints & Drains Well

- 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

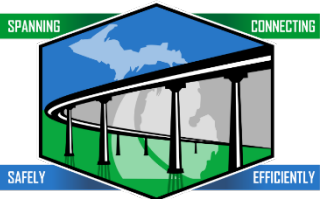




Final Cleaning Tip

- Check Underneath Contractor Vehicles

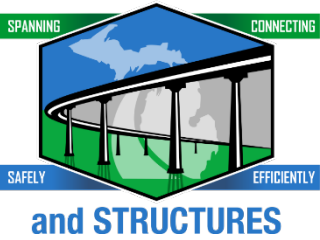




Installation Day

- 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





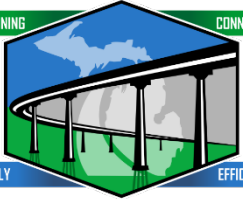
Squeegeeing Epoxy

- 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





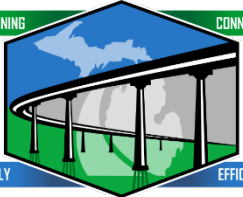
Aggregate Placement





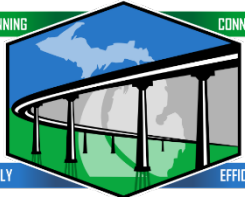
Life Expectancy

- Thin Epoxy Overlays
 - With proper surface preparation thin epoxy overlay treatments will last 15 to 20 years
 - Old thin epoxy overlays that crack may be crack chased with healer sealer epoxy
 - Delaminated overlays may be repaired



Life Expectancy

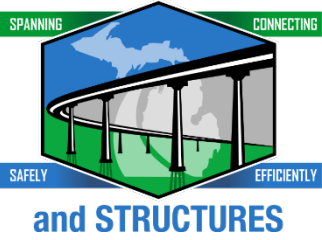




Troubleshooting

- 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

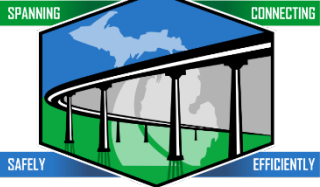
- Inadequate surface profile





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
- 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
- \$34.86/SYD Contracted Thin Overlay
- \$36.15/SYD Contracted and Warrantied for 5 years



Questions?

