Accelerated Deck Overlays

Stephanie Wagner, P.E.

- ❑ **New Overlay Recurring Special Provision**
- ❑ **Latex Modified – Very Early Strength (VE)**
- ❑ **Polymeric Overlay Best Practices**
- ❑ **Questions/Discussion**

Summary of Issues

Designers	• Information in too many places
Office of Materials Management	• Curing requirements inadequate
Construction Inspection	• Confusion in the spec language
Contractors	• Discrepancies in spec enforcement

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3 Specifications for Overlays

- *Standard Specifications* Section 722
- Silica Fume Modified Concrete RSP 736-B-104
- Hydrodemolition Unique Special Provision

09-01-13

736-B-104 SILICA FUME MODIFIED STRUCTURAL CONCRETE BRIDGE DECK OVERLAY

(Revised 05-23-13)

The Standard Specifications are r

SECTION 736, BEGIN LINE 1, INSERT

SECTION 736 - SILICA FUME MOD
DEC

736.01 Description
This work shall consist of plac
structures and incidental construction in

EXISTING OVERLAY REMOVAL, HYDRODEMOLITION
AND LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECK

Description
This work shall consist of the removal of the existing bridge deck overlay followed by preparation of the exposed bridge deck surface in accordance with 722, and shall involve milling and the use of hydrodemolition. Subsequent to the deck preparation, the work shall consist of constructing a latex modified portland cement concrete overlay.

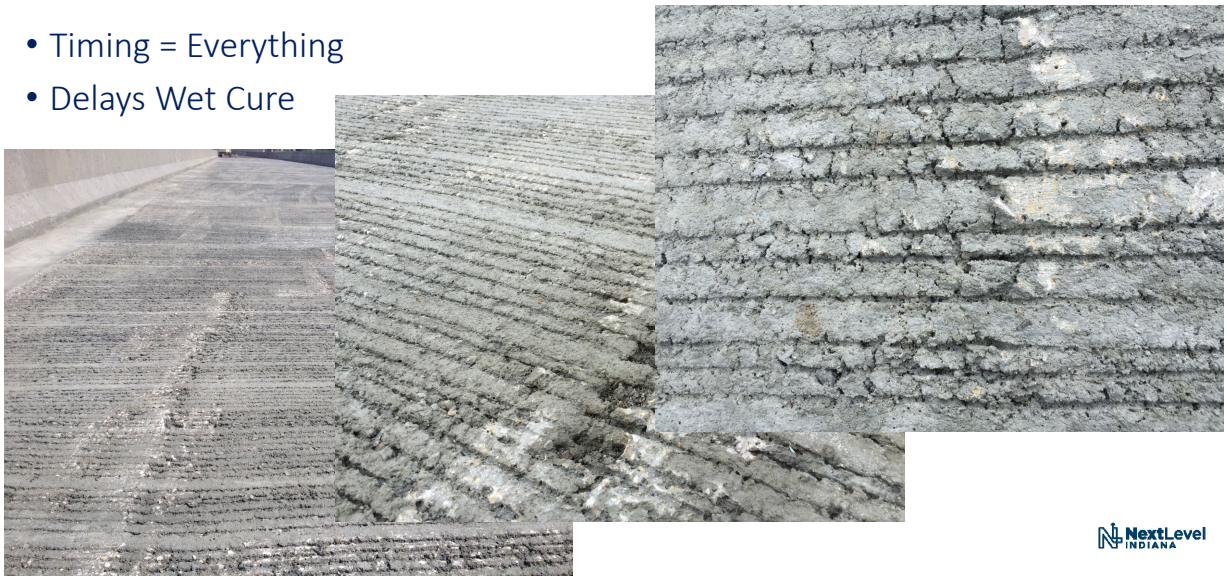
Materials
Materials shall be in accordance with 722.02 and as follows.

Evaporation retardant shall be one of the products listed below. A Type D certification in accordance with 916 shall be furnished to the Engineer prior to use.

Issues in the Field: Curing

Issues in the Field: Texturing by Tining

- Timing = Everything
- Delays Wet Cure



Issues in the Field: Chipping after Hydro

Additional Unsound Concrete Removal After Hydrodemolition

completed, the deck will undergo
unsound concrete. The deck surface

Engineer and shall
handchipping tools
rcement.

original depth, the
reas as determined
uspended from wires
4 sq ft, the forms
perstructure or by

bond between the
oyed, the concrete
mum clearance of 1

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Many months later…

… and with hard work from: Elizabeth Phillips, Mike Nelson and Kurt Pelz

- New RSP 722-B-307 Concrete Bridge Deck Overlays (Effective 12/2018 Lettings)
- Rolls into the 2020 Standard Specifications (Effective 09/2019 Lettings)

INDIANA DEPARTMENT OF TRANSPORTATION
Driving Indiana's Economic Growth

Design Memorandum No. 18-17
Technical Advisory

August 6, 2018
Rev. Aug. 8, 2018

TO: All Design, Operations, and District Personnel, and Consultants

FROM: */s/Elizabeth W. Phillips*
Elizabeth W. Phillips
Manager, Office of Standards and Policy
Bridge Design Division

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SUBJECT: Bridge Deck Overlays

EFFECTIVE: Lettings on or after December 1, 2018

What do designers need to know?

- Continue Optional Bid for LMC and SFMC
  - Unless directed otherwise on a project specific basis
  - See Bridge Design Aid 412-02 for directions
- Show milling depth in plans (updated for 2020 Std. Spec.)
  - ½" is preferred unless project specific reason
  - ¼" is allowed
  - Spec: " ½ in. if not shown in the plans"

What do designers need to know?

- New 722 Pay Items for Silica Fume Modified (formerly in section 736)

  722-01061 Bridge Deck Overlay, Silica Fume Modified (SYS)
  722-96912 Bridge Deck Overlay, Additional Silica Fume Modified (CYS)*
  *Included in Budget Item (Hang in there, we'll get to that)

- New 722 Pay Item for removal items (formerly in section 202)

  722-51822 Bridge Deck Overlay, Remove Existing (SYS)
  722-01066 Hydrodemolition (SYS)

Bid histories still connected to these new pay item numbers

Transverse Grooving

- No more tining! (of overlays)
- Always perpendicular to center line
  - Stepped at exp. joints with steel nosing
  - Otherwise can continue over joint openings
- Pay Item: **722-12382 Transverse Grooving (SYS)**
  - Area same as overlay, don't reduce by 6" offsets
- Updated prices based on December letting
  - $5000 mobilization + $4.00/SYS
- Approx. 1000 SYS can be grooved in a shift
  - Complicated by curves and traffic phasing (resets)

- Per Spec: Surface can be opened to traffic prior to grooving
  - BUT, must have broom finish at placement
  - Must be grooved within 30 days
  - Allows time for phased weekend work and weather unknowns

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New Overlay Budget Pay Item

722-12380 Bridge Deck Overlay, Budget (DOL)

Quantity = Total Estimated Cost

Unit Cost = $1

- Includes fixed price items (similar to erosion control budget)

Pay Item	*Pay Unit Symbol*	*Established Price*
Bridge Deck Overlay, Additional LMC	*CYS*	*$550*
Bridge Deck Overlay, Additional LMC-VE	*CYS*	*$650*
Bridge Deck Overlay, Additional Silica Fume Modified	*CYS*	*$200*
Bridge Deck Overlay, Additional Surface Prep	*LFT*	*$15*

- Only one budget item even for optional bid contracts
- Use higher LMC unit cost for conservative estimating
- No longer including Bridge Deck Overlay Additional as pay item in contracts

Additional Surface Prep?

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Additional Surface Preparation

Remember Hand-Chipping Issues…

4. Additional Surface Preparation around Reinforcing Bars

Where reinforcing bars have been exposed ~~or~~*for a length greater than 2.0 ft and* the bond between the existing concrete and reinforcing bars has been destroyed, the concrete adjacent to the bars shall be removed to a minimum clearance of 1 in. around the entire periphery of the exposed bars. ~~If the concrete is unsound down to the top layer of bottom reinforcing bars, all of the concrete within the marked area shall be removed and the cavity shall require full depth patching in accordance with 722. 06(a).~~

Designers must include quantity for Additional Surface Preparation (LFT) in budget

How does Linear Feet work?

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Additional Surface Prep

From Design Memo 18-17

The following equation may be used to estimate Additional Surface Preparation quantities:

Additional Surface Prep (LFT) = Total Deck Area (SqFt) x 3% x 3 Lft/SqFt

- *3% represents an estimate deck area needing additional removal around the bars for a first overlay. This number may need to be inflated for second overlays.*
- *3 Lft/SqFt of deck represents the length of bars*

Estimating process to be refined as we build a contact history.

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Partial Depth Patching Reminders

- Partial Depth Patching not included when Hydrodemolition utilized
  - Partial depth patching: removal of deteriorated concrete
    - Does NOT include materials for filling the voids
  - Hydrodemolition is a specific type of Partial Depth Patching
    - Handchipping required to remove additional deteriorated concrete included in hydro
    - Handchipping required around debonded bars included in surface preparation (budge item)
- Issues when bundling thin and rigid overlays
  - Need partial depth for polymeric overlays
  - No partial depth for rigid overlays with hydrodemolition
  - Consider clarifying USP or supplemental descriptions with structure numbers

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Unchanged Pay Items

From Design Memo 18-17

Pay Item	Pay Item Description	Unit
722-51401	BRIDGE DECK PATCHING, FULL DEPTH	SFT
722-51852	BRIDGE DECK PATCHING, PARTIAL DEPTH	SFT
722-51874	OVERLAY DAM	SFT
722-60824	SURFACE MILLING	SYS
722-97116	BRIDGE DECK OVERLAY, PATCHING	SFT

Reminder:

All rigid overlay contracts should include a minimal Full Depth Patching quantity.

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Bonus Outcome… Very Early Strength LMC

Latex Modified	Silica Fume Modified	LMC-VE*
• Wet Cure: 48 h (2 day) • Dry Cure: 48 h • Traffic during Dry Cure	• Wet Cure: 120 h (5 day) • Dry Cure: 48 h • Covered during Dry Cure	• Wet Cure: 3 h • Open at 2,500 psi • Weekend Placement • QCP is required!

* To be used where appropriate

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Design Considerations

Bridge Detailing:

- Material Notes – reference LMC-VE
- Select RSP in menu
- Use appropriate pay items

MATERIAL NOTES

BRIDGE DECK OVERLAY:Very Early Strength LMC Bridge Deck Overlay
RCBA: Very Early Strength LMC Overlay

X		722-B-307	**Concrete Bridge Deck Overlays**	A	06-21-18	12-01-18

Pay Item	Pay Item Description	Unit
722-12381	BRIDGE DECK OVERLAY, LMC-VE	SYS
722-12383**	BRIDGE DECK OVERLAY, ADDITIONAL LMC-VE	CYS

** Individual pay item not included in estimate. Established unit price created.

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Other Design Considerations

- Approach Slab
  - Traditional Replacement not possible in Weekend Closure
    - Full depth LMC-VE sets up too quickly RCBA pour
  - What about a Tuesday or Wednesday morning open to traffic?
  - Patch and overlay with LMC-VE
  - Patch and overlay with asphalt
  - Precast Panels? As-Built plans available for pavement ledge?
- Roadway Pavement
  - How to wedge back in?
- Continue Hydrodemolition with LMC-VE*

*Unless there is a project specific reason not to…

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Maintenance of Traffic

- Obtain Shoulder Cores
- Discuss Queue Tolerance
- Max. Placement in a Weekend
  - I-465: 1100 sys
  - I-70: 750 sys

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TTB, Type 2 Considerations

- Type 2 allows for steel barriers
- Large spectrum of deflection widths (65” to 157”)
- Anchorage can reduce width…at a cost
- Leave offset to work zone when possible!
- Storage between phases

Resources:

INDOT Designers webpage/Work Zone Safety/*Guidelines on the Use of Positive Protection in Temporary Traffic Control Zones*

*Includes flow chart for temporary barrier selection

Manufacturer’s websites (Orion, Zone Guard, Vulcan, ect.)

Additional MOT Items

- Truck Mounted Attenuators
  - Additional Protect during Set Up
  - USP on Samples Index
- Automated Work Zone Message System
  - Interstate Highway Congestion Policy exception mitigation
  - Work with Traffic Management Center
  - Utilized on I-70 at US 40 (Richmond)

Virtual Project Tour: I-70 over US 40

SCOPE

- Bridge Deck Overlays
- Median Crossovers
- 4 Phases (Interstate Work)
- 60 Day Ramp Closures

LETTING

March 2018

WINNING BID

Milestone @ $4.9M

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Bridge Work

- Remove Existing Overlays and Hydro Original Deck
- Deck Patching Place and Overlay
- Replace Approach Slabs
- Install Pre-Compressed Foam
- Other Misc. Items
  - Heat Straightening
  - Lighting
  - Paint Superstructure

Cost Reduction Incentive Proposal

Original Contract	CRI Proposal
• Std Spec LMC	• LMC –Very Early
• Crossovers	• Single Lane Closures
• 60 Day Ramp Closures	• 6 Day Ramp Closures
• Cost: $4.9M	• Cost: $3.4M

Savings: $1.5M

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Summary of Savings

Increased Cost *

Overlay : + $263k (80%)	Crossovers: - $90k
Hydro: + $106k (70%)	Temp. Pvmt: - $1.4M
RCBA: + $56k (45%)	TTB reduction: - $261k

Decreased Cost

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*Captures additional costs for time constraints

Maintenance of Traffic

- Automated Work Zone Information System
  - Queue sensors every mile
  - Boards @ 4 & 8 Miles from site
  - Cost $54,000 includes Message Boards
- End of Queue Protection
  - TMA w/ Message Board ½ mi. ahead of queue

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Test Pour at Contractor's Yard

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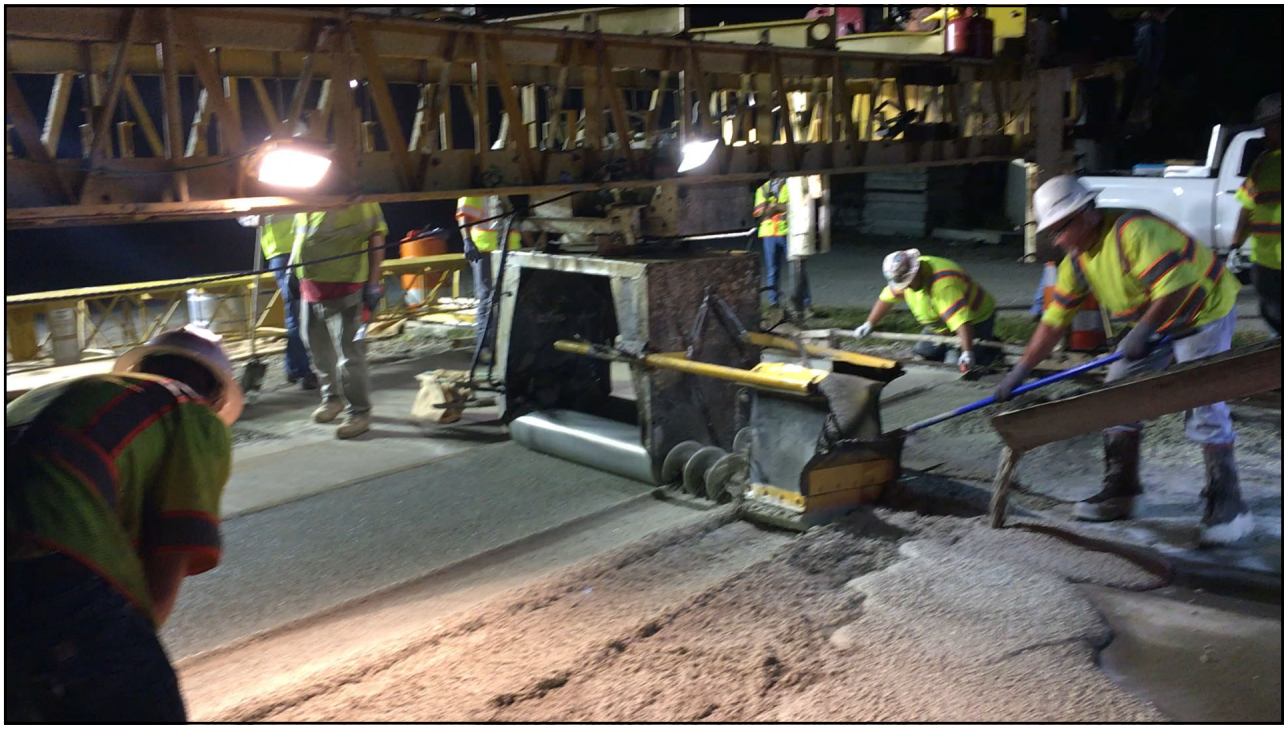
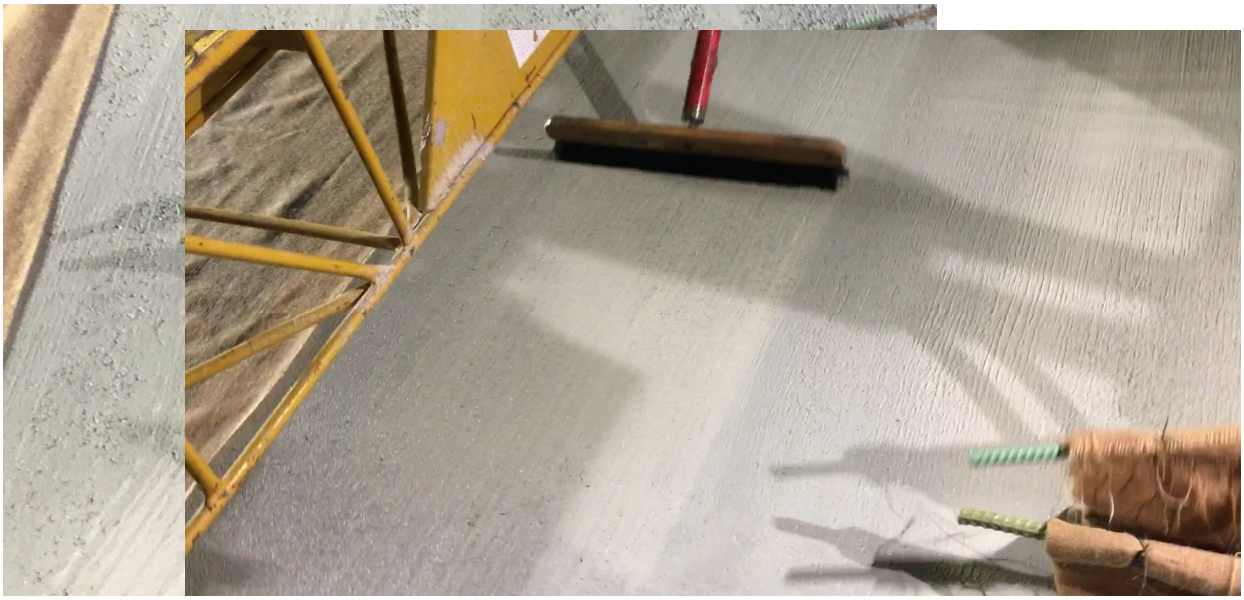


Finishing

- Broom finish required for live traffic prior to grooving



Lessons Learned

- Not your typical overlay!

Go time! Step 1

DAY 1

- Remove Existing Overlay
- Hydro-demolish Deck

Note: Metal Barrier

Desired for installation speed

Step 2

Day 2 & 3

- Remove RCBA's, install formwork and rebar

Day 4

- Construct RCBA's
  - Longer Cure Time
  - 2nd to catch hydro water

Step 3

Day 5

- Clean/Prep Deck
- Cover and Wait

Step 4

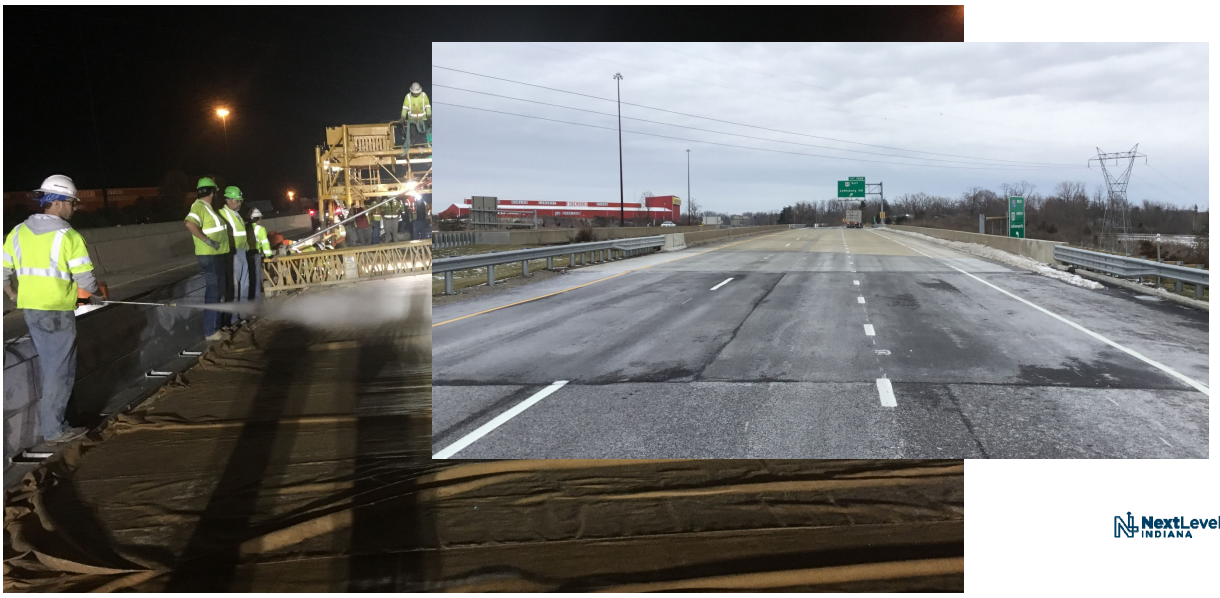
- Pour Overlay (Overnight of Day 5)

Step 4½

- Fog Misting

Step 5

- Curing (Open to Traffic by End of Day 6)



Step 6

- Grooving
  - Overlay & RCBA's
  - Overnight Lane Closure

Overlay Spec and LMC-VE

- Design Memo 18-17
- Still new here in IN
- Communication
- Collaboration

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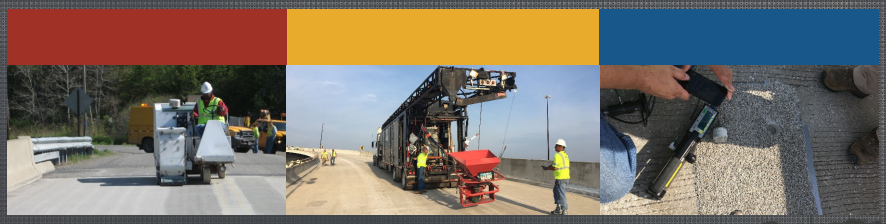

Thin Deck Overlays

Tyler S. Wolf, P.E.
February 14, 2019

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Thin Deck Overlays

History

- Originated in 1950s as Coal Tar Epoxy Broomed on Concrete Deck
- Evolved into Rapid Setting Polymer with Aggregate in1980s

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Thin Deck Overlays

Purpose

- Polymer Overlay:
  - *Acts as a Sacrificial Wearing Surface*
  - *Restores Friction*
  - *Fills Cracks*
  - *Waterproofs Deck*
- Per IDM Fig 412-1A – Can be used when Wearing Surface >4, Superstructure >4 & Max Patching 10%

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Thin Deck Overlays

Procedure/Process

- More and more projects are calling for “Weekend Only” or “Night Only” Construction – Sometimes not possible
- Step 1 – Chain Drag

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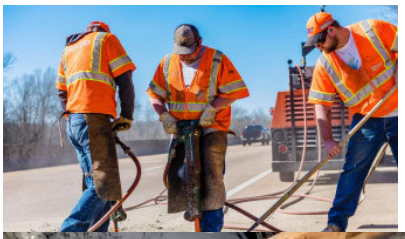
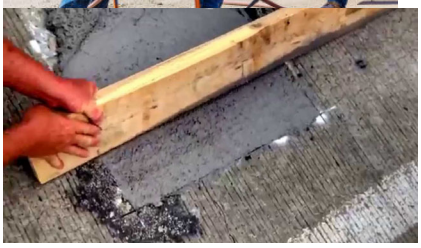
Procedure/Process

- Step 2a – Concrete Removal



- Step 2b – Rapid Set Patch



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Thin Deck Overlays

Procedure/Process

- Step 3 – Shot Blast
- Per Contractor, can shot blast approximately 40,000 sq.ft. per shift

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Thin Deck Overlays

Intermission

- Well – Sort of…

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Thin Deck Overlays

Procedure/Process

- Step 4 – Test Patch
  - *Current INDOT Specification requires Test Patch to be performed*
  - *Place 1st Layer*
  - *Cure – 1 hour to 4 hour Cure Period (Temperature)*
  - *Place 2nd Layer*
  - *Cure – 3 hour to 6.5 hour Cure Period (Temperature)*

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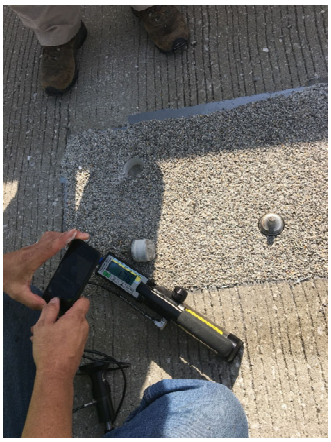
Procedure/Process

- Step 4 – Test Patch
  - *Install Test Puck*
  - *Surface Preparation Test - If this passes, the thin deck overlay can be installed over the entire bridge deck*



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Procedure/Process

- Step 5- Install Thin Deck Overlay
  - *Spray Polymer*
  - *Broadcast Aggregate*

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Thin Deck Overlays

Procedure/Process

- Step 6- Final Coat Testing
  - *Pull-off Test*
  - *250 psi tensile capacity*

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Thin Deck Overlays

Design Considerations

- Roadway
  - *Typically Overlay the Approach slabs, unless approach slab replacement required*
  - *3/8" lip at end of approach slab – Discuss with Area Engineer regarding use of wedge and level*
  - *No "Heated Pavement Markings" placed on the Thin Deck Overlay*
  - *Remove Pavement Markings prior to placing Thin Deck Overlay*

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Thin Deck Overlays

Design Considerations

- Bridge
  - *Joints*
    - SS Gland Removal has become more prevalent. Either replace the gland or avoid the joint.
    - Preferably make existing Shop Drawings available for Contractor
    - Can remove gland and install Precompressed Foam

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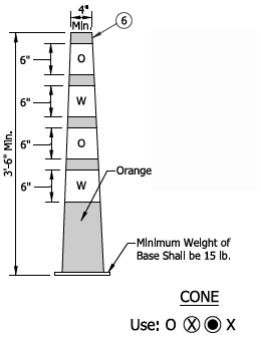
Thin Deck Overlays

Design Considerations

- Maintenance of Traffic
  - *Safety First*
  - *Typically performed with barrels – Cones becoming prevalent*
  - *Prefer temporary signals over flagger operations*



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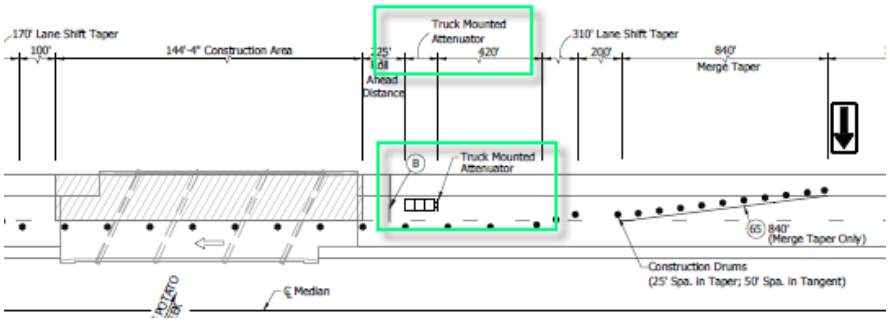
Design Considerations

- Maintenance of Traffic
  - *If not using concrete barrier, consider using attenuator truck*



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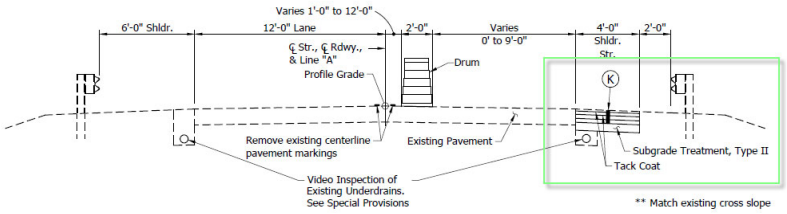
Thin Deck Overlays

Design Considerations

- Maintenance of Traffic
  - *Shoulder Strengthening – Coordinate with INDOT Pavement Design Early*



PHASE I - ROAD SECTION
Scale: 1/4"=1'-0"

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Thin Deck Overlays

Design Considerations

- Provisions
  - *Currently an RSP (738-B-297) since 2016. Could see revision soon.*

(a) Epoxy Polymer

The epoxy polymer used in the overlay shall be a two component system consisting of a resin base and a hardener. The epoxy polymer shall be one of the following products:

1. Pro-Poxy Type III D.O.T., manufactured by Unitex, Dayton Superior
2. E-Bond 526, manufactured by E-Bond Epoxies, Inc. with Indiana marketing rights owned by Transpo Industries, Inc.
3. Mark-163 Flexogrid, manufactured by Olin Epoxy-POLY-CARB.
4. EPX 50-Overlay, manufactured by E-Chem.

Manufacturer Product Name	Approval Number
CORNERSTONE CONSTRUCTION MATERIAL, LLC CE330 EPOXY BINDER	W188010
E-BOND EPOXIES, INC. E-BOND 526	W188011
E-CHEM, LLC. EP50-OVERLAY	W188020
E-CHEM, LLC. EPX50-OVERLAY	W188012
MAPEI CORP. PLANISEAL TRAFFIC COAT	W188013
MAPEI CORP. PLANISEAL TRAFFIC COAT FS	W188019
OLIN-EPOXY-POLY-CARB, INC. MARK-154 SAFE-T-GRID	W188014
OLIN-EPOXY-POLY-CARB, INC. MARK-163 FLEXOGRID	W188015
SIKA CORP SIKADUR 22 LM	W188016
SIKA CORP SIKADUR 22 LM FS	W188017
UNITEX BY DAYTON SUPERIOR PRO-POXY TYPE III D.O.T.	W188018

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Thin Deck Overlays

Design Considerations

- Project Delivery
  - *There are a few Contractors that specialize in Thin Deck Overlays and try to stay to that work:*
    - Thin Deck Overlay
    - Patching (not over large rivers)
    - Maybe Replace Approach Slabs
  - *Won't get into Joint Hardware Replacement, Railing Replacement moderate Approach Work (full depth)*
  - *Keep this in mind when bundling*

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