

SESSION #1: Deck Preservation Discussion Topics

1. Is it better to protect the deck initially or allow some deterioration then provide protection?
2. At what stage in the life of a bridge deck is it necessary to apply a waterproofing membrane?
3. Are penetrating concrete sealers effective for vertical and overhead applications?
4. Is it worthwhile to apply a concrete sealer to all concrete parapets?
5. Why do some states overlay new bridge decks and others leave them bare?
6. Is it worthwhile to take the additional steps to waterproof the bond between old concrete and the patch material?
7. Can GPR be useful in detecting potential punch-through locations?
8. What materials and methods can repair crews use to minimize the downtime for deck repairs?
9. Do hot applied sheet membranes outperform cold applied sheet membranes?
10. Do epoxy coated rebars help extend the service life of a bridge deck?

Table 1 SESSION #1: DECK PRESERVATION DISCUSSION TOPICS

1. Latex Modified Concrete in Maryland. Philosophy 20 years life. . Tried polymer type. Quick bond. (5 on NBI is the target.) Noticed cracking – microcracking. Installed while traffic on deck. Use GPR to narrow search & then core (figuring out rebar condition.) Usually exposes the top mat. Most of the time poor cover.

DC. Not as much emergency business. Removing existing overlay and placing new Latex Modified Concrete. Like what they are doing. Use RJ Watson on joint headers. Works well with traffic. 50% are scanned with GPR. Review it and traditional deck analysis. Compare. Chain drag, etc. & then overlay. Does not show the conditions of rebar. Noticed - outside lanes are the most trouble.

Some discussion epoxy rebar. Rely on fixing flakes.

Providing protection is the key. Hard to pinpoint why we get cracks in some places other than others.

*Do some things initial in design. Initial treatment is the key. Case is still out. Some disagreement.

2. Membrane.

Maryland – don't use membrane. Voided slabs looking to use. Bare deck or Concrete WS.

If you are going to use HMA you would use a membrane.

3. Sealers.

Suretreat. Bridge piers. RR use a lot. Used 20 years. Effective.

DC Use sealers for tunnels. Method of vacuuming out (with plastic) and then apply sealer. 3 years. In the process of monitoring.

4. DC Not for their inventory. Specific locations. Pier caps, scuppers. Maryland when they are doing an overlay, they would include.

5. Maryland. Issues with HMA. Trapping may cause adverse effects. Philosophy of fixing what's wrong, not covering it up.

DC New design is an overlay. Overlay is ok. Research facility would be nice to keep track of this issue. FHWA may have one.

6. Our particular group did not think so. We prefer the bonding of concrete to concrete.

7. GPR

DC – we believe and hope so. Let us know next year.

Maryland – same. Doing a few right now.

8. Materials/Methods.

Rapid set early high strength materials.

Phoscrete – header.

Polycrete.

SpeedCrete – Maryland.

What compressive stress is needed. All over the map. Standard??

It would open up a lot more materials if that could be lowered to 1800 psi.

9. Can't really answer because no many use the membrane enough.

Maine – probably say hot.

10. Epoxy coated.

Yes – now we'll find out. 30-40 years in Maryland.

Difficult to answer that one.

Kauffman

ACTION ITEMS

Noted: A lot of folks around the country is using the Latex Modified Concrete.

Study of overlays. Western States did some. Good Effort. Best practices for putting material down. What about freeze-thaw? Maybe mirror this for NE weather.

Question Number 5 could be a research subject.

Group number: 2

Discussion topic: Deck Preservation

Discussion Highlights *membrane install or not, conc. or asphalt*

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Moisture problems before membrane placements an issue

Conc. overlay life? Mass. , Low ADDT – 25 yrs Hi ADDT – no history yet
Del = average life is 25 years

Use BidWell machine to put down conc. overlay

Contract out preservation work vs. in-house forces, lose preservation skills in –house

Mass. contracts out 60% preserv. and rest in-house
Del. has preserv. contract for what they don't do in-house (70% contract / 30% in-house)

Epoxy coated rebar – some states backing off... Fla.

Starting use stainless steel... marine stainless

Del. – been using epoxy coated rebar since 80's

Hot or cold membranes?

Mass. needs fast setting materials due to hi ADDT and cut extended lane closures..

Notable Practices (*Note practices, strategies, policies, products, etc that are working well*)

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Mass. – always used asphalt , easier to do repairs with road repairs. I-495 project went from 8” to 11” deck with low permeable conc. All decks should be conc. instead of asphalt.

“used Sterling Lloyd membrane system?”

Del.-uses predominantly Latex modified conc. decks. Starting to use asphalt for accerlerated bridge projects.

More flexibility with membrane waterproofing

Action Items (*Note recommendations for research, leadership, communication, facilitation, technical assistance, etc*)

- **Determine if epoxy coated rebar extends life of conc. decks**
- **Is there any inspection technology to better determine deterioration of bottom of decks**
- **Any information as to which membranes othe bridge owners have had good success using.**

Group number: 4

Discussion topic: Deck Preservation

Discussion Highlights *(note main discussion items)*

- It's better to protect initially
- Problems with overlays 20-25 years after construction because of trapped moisture but good if done initially
- How much deterioration can you afford and still be functional? Cost vs performance (dependent on what the base deck is made of and what conditions the deck experiences)
- Understand each structure on a case by case basis and pick the best tool for that condition
- New Jersey has a very poor success rate with asphaltic overlays when done later on
- Connecticut uses woven glass and cold spray applied on new construction
- Penetrating concrete sealers has problem with vertical and overhead applications because of gravity
- Overlays are sometimes used to compensate for uneven new construction
- If construction is done well an overlay may be unnecessary although if done initially you are already beginning your preservation practices
- Bonding between old and new concrete is always a problem
- Opinion: GPR won't be able to identify punch through
- Calibration on GPR is crucial, if done wrong repair costs can be 2-3 times more than what expected. The bigger the bridge, the more critical
- Minimizing downtime usually results in lower quality of work
- Hot vs Cold applied membranes: comes down to application and prep work
- Cold applied works well with new deck, needs a clean sound surface
- Torch applied is possibly repaired if damaged during milling
- States differ in whether they allow epoxy coated rebar or not
- Epoxy coated galvanized bar

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- For deck protection, determine service life based on current condition and pick solution based on these observations. One solution isn't best for every problem
- Coating or vacuum pressure injection work best for vertical and overhead applications
- In critical locations with high traffic that are hard to close its valuable to overlay new decks because of traffic closure difficulties and costs
- If using GPR calibration is critical, but may have trouble detecting punch through. Infrared can also be a useful tool when lined up above and below correctly.
- Look at minimizing downtime over years not on a day to day basis. If the

work is done correctly the first time the bridge will have less maintenance in the long term. Don't rush, DO IT RIGHT THE FIRST TIME with the correct prep and tools.

Action Items (*Note recommendations for research, leadership, communication, facilitation, technical assistance, etc*)

- **Research: Looking at service life to determine the correct time to perform preservation work or rehab and the cost benefit of these actions**
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GROUP 5 Deck Preservation

Q: Which is better, bituminous overlay or bare deck?

Q: Who takes the initiative to try new products?

Q: Specs do not take into account the value of products that last longer vs. short term.

#3 At what stage do you apply the sealer....

Maine uses a linseed oil for first three years to preserve the new concrete.

Manufacture: After the cracks have occurred.

#4 Is it worthwhile to apply a concrete sealer.....

NJ seals the parapets when sealing the deck, NY finds that sealing them works better than not.

NY generally applies every five years.

Other states have found that the coatings only work on the surface, but not penetrating into and sealing the cracks.

NY uses a thin Rossfaut material for a deck membrane.

#5

#6

#7 Locating areas of deterioration

1. Chain drag
2. Ground Penetrating Radar.
3. Inferred Thermography for membrane quality check and wearing surface delamination.

#8 Quick set concrete for patches...

Maine uses several types of materials like Saratech.

NY uses low viscosity polymer (120) works well on headers and 20 minute set-up

#9

#10 Epoxy coated rebars help extend life?

There are several choices now such as fiberglass and stainless with benefits to each.

Group number: 6

Discussion topic: Deck Preservation

Discussion Highlights *(note main discussion items)*

Question #1

New Hampshire, Maine & Connecticut protects initially with asphalt

Maine: Bridge Maintenance use concrete WS only.

WS type depends on factors such as condition, traffic or regional preference

Questioning the use of deck weeper drains.

Question #2

15 -25 years or when top later starts to deteriorate.

Depends on deck design.

Try to align with current paving projects.

Question #3

No more linseed oil for NH. Used in Maine and considered effective

Protective coatings can retard ASR concrete cracking.

Question #4

Yes, seal parapets. NH is using silane and others.

Question #5

Matter of preference.

Question #6

N/A

Question #7

Not much support for this practice based on experience.

Question #8

Perma patch is popular, rapid set

Question #9

Yes

Question #10

Yes, Maine used in harsh environmental

NH uses mmfx re-steel. Corrosion resistance steel.

Stainless to expensive.

Notable Practices (*Note practices, strategies, policies, products, etc that are working well*)

- **Practices vary between states.**

Representatives from Maine, New Hampshire, Consultants & FHWA

Action Items (*Note recommendations for research, leadership, communication, facilitation, technical assistance, etc*)

- **Continue research and development. Try new products for protection**

Group number: 7

Discussion topic:

Discussion Highlights (*note main discussion items*)

- **ME - Membrane Essential**
- **ME - No stay in place forms**
- **Raise concrete cover requirements**
- **Bare decks NY, Polymer Overlay's over older decks (8-10 years)**
- **Additional admixtures, traffic sensitive construction = cracking/less quality/leaking**
- **DC – No bituminous overlays**
- **Spray on membranes – over filled arches/etc., railroads**
- **Process for rehab – chlorides, infared, half-cell**
- **High volume – rehabs – GPR**
- **NY - Quick replacements (10 Day) – High volume – precast**
- **Cathodic Protection**
- **Penetrating Deck Protection**
- **Crack sealant –hot rubber (cheap, fast)**
- **ME - Deck Cores prior to wearing surface replacement (chlorides, compression)**
- **Coated Bars – Epoxy (Good), Stainless (Cost Prohibitive)**
- **Concrete ws – Much more labor intensive for contractors**
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Table 8 Session 1 Deck Preservation

Turnpike: uses high performance membrane, compaction issues, looking into concrete. Generally happy with results with high performance membrane. MTA does some bridge cleaning, especially joints.

MaineDOT: High performance membrane gives another option to choose from. Does use bare deck with an extra 1in, used on low volume roads.

How to find effectiveness of membrane? Coring is best but damages membrane. Chain dragging and visual inspection more reliable than GPR.

Best methods to inspect membranes.

1. Coring
2. Chain drag (concrete wearing surface only)
3. Visual for leakage.
4. Pavement deterioration
5. GPR

Maine attempts to keep joints sealed to prevent substructure deterioration. Uses mostly linseed oil to seal concrete and starting to use silane on new construction. Concerns about silane penetration over previously sealed concrete

MDOT has a bridge washing program. Uses plain water, no chemicals added. Rain does not flush or keep bridges and drains clear. Clean high traffic bridges in spring and fall.

Industry: Vermont used to use latex modified deck.

PENDOT: Uses primarily sheet membrane. Epoxy overlay 10-20 years. Latex modified used in a few spots. PENDOT does more bridge cleaning than washing. Does clean bearings and bearing seats.

Rubberized pellet added to pavement very expensive for bridge application.

Question 1/2: PENDOT and MAINEDOT better to protect the deck as soon as possible. NYDOT uses silane on concrete wearing surfaces. Silane has better penetration with dry concrete over wet concrete. MAINEDOT uses a linseed oil blend. Linseed oil costs about \$18/gallon. Generally apply linseed oil about 3-5 year intervals. Look for when linseed oil stops penetrating. Hard to coordinate using the same products within regions. Need to look into coverage rates. Silane coverage rates are rising per gallon. Silane averages about \$18/gallon for 40%. MTA is using Silane.

Question 3/4: PENDOT, MTA, and MDOT apply concrete sealer to all vertical and overhead applications and it is worthwhile to apply to all concrete parapets.

Questions 5: Southern states still use bare concrete decks.

Question 6; Industry says It is worthwhile. MaineDOT does not use bonding agent between new and old concrete. Bonding agents not applied correctly in many instances.

Question 7;

Question 8;

Question 9

Question 10; MDOT does not routinely use epoxy coated bar. Good product in theory, issues with damaging coating in construction process. PENNDOT and MTA does use epoxy coated rebar. Galv. rebar does not respond well to high salt environments.

ACTION ITEMS;

MaineDOT would like a way to test for silane penetration. When can Silane be applied over linseed oil?

September 23, 2013 Table #10

- Maine membranes both new construction and rehabs.
- Vermont uses membrane for both bituminous and concrete wearing surfaces.
- New Jersey only uses bituminous overlays if they had them already. Only used cold applied membranes. Had a few issues with failures – like those in presentation. Latex modified concrete overlay, 20 yrs old, replaced with Rosphalt (impervious, do not need membrane). NJDOT has bridge deck waterproofing surface course spec. Legacy was NJ was bare deck state in late 80s. Rosphalt issues – no wheel ruts issue, NJ uses a lot of salt, so no ice issues, hot mix applied in 1.5-2.5 inch single lift.
- Maine Turnpike Authority uses high performance membrane on all bridges – new and rehab.
- NY does extensive silane treatment – water sealant. Performance test for states to use for silane treatments? States take cores and do moisture absorption test. Want ¼ inch of silane absorption into the concrete. Illinois, OK & Wisconsin uses this too. Drying time is 1hr to 4 hr depending on product. Moisture content should be checked to get absorption. Can also be used with wearing surfaces.
- Polymer concrete overlays? NJ Turnpike has used as a pilot project and will be investigated in the future. Prep included milling existing deck, blasted then product applied. Product chosen for healing cracks and improving the ride.
- Deck cracking – preferences for deck cracking material? No states had any preferences.
- Bridge joints create issues for paving operations and choice of materials.
- MaineDOT – heavy salt and sanding getting to bearings thru failed seals. Crews do yearly cleanings. Beam ends painted. Pour in place, glad & compression seals.
- Vermont applies marine oil to bridge girders in lieu of repainting. Use on paint rated less than a 6 and decks rated higher than 5 - discuss more in steel preservation.
- Joint materials – Emseal – any experience in longevity.
- HPC and cracking issues. Some Midwest states use epoxy sealers.
- NJ Turnpike uses rapid set for deck repairs under membrane and overlay for quick construction.
- NJDOT uses rapid set polymer concrete for deck repairs.
- Concrete header repairs with Silspec 900 – MaineDOT and NJDOT has started using it and is happy with the ease of installation and performance so far.

Best practices:

Membranes and overlays work as long as you install properly. Rosphalt 50, membrane-less product has been successful in NJ. Silane and sealers for bare decks is looking promising in NY and Midwest.

<p>Group number: 12</p>	<p>Discussion topic: Type of Rebar</p>
<p>Discussion Highlights <i>(note main discussion items)</i></p> <p><i>Types used</i> <i>How they are used</i> <i>How well they work</i> <i>Some Costs</i></p>	
<p>Notable Practices <i>(Note practices, strategies, policies, products, etc that are working well)</i></p> <ul style="list-style-type: none"> • <u>Types of Rebar:</u> • <u>MaineDOT - MMXR</u> • <u>Epoxy</u> • <u>Galvanized Reinforced Bar – 10 cents</u> • <u>Pre cast panel - Cracking through entire deck (No longitudinal post tensioning)</u> 	
<p>Action Items <i>(Note recommendations for research, leadership, communication, facilitation, technical assistance, etc)</i></p> <ul style="list-style-type: none"> • <u>Table comprised of:</u> • <u>Maine - DOT</u> • <u>Penn – Contractor/DOT</u> • <u>Delaware -</u> • <u>Connecticut – Federal highway</u> • <u>Mass -</u> • <u>Rhode Island – Consultant</u> • • <u>Data exchange between states on new innovations.</u> 	

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<p>Notable Practices (<i>Note practices, strategies, policies, products, etc that are working well</i>)</p> <ul style="list-style-type: none"> • <u>Penn – Overlay – Sealing after cracks</u> • <u>MaineDOT - Linseed oil (cheap, easy to get) – Maintenance reapplies Linseed oil every 5 years – 2 coats, 2 separate days.</u> • <u>Corrosion Inhibitors - Penn – doing research on spray on chemical that absorbs into concrete. (costly). Ability to pour down a crack.</u> • <u>MaineDOT – Sileen (used when no membrane with mill out inch of concrete)</u> • <u>PennDOT- Overlay, epoxy, latex modified concrete</u> • <u>MaineDOT – Rubberized asphalt</u> • <u>Univeristy of Wisconsin did study on 20 different deck sealers – permeability testing - came down to 5 products that WiscDOT could use.</u> • <u>MaineDOT – Contractors do everything with DOT supervision.</u> • <u>PennDOT – do own rural – contractors do urban</u> • 	

Action Items (*Note recommendations for research, leadership, communication, facilitation, technical assistance, etc*)

- **Table comprised of:**
- **Maine - DOT**
- **Penn – Contractor/DOT**
- **Delaware -**
- **Connecticut – Federal highway**
- **Mass -**
- **Rhode Island – Consultant**
-
- **Data exchange between states on new innovations.**

Group number: 13

Discussion topic: DECK
PRESERVATION

Discussion Highlights (*note main discussion items*)

- **Waterproofing Membrane should be placed on the concrete deck when the bridge is first built**
- **Sealers used are typically linseed oil & silane, also fluid sealer on barrier rail**
- **Mixed results with Ground Penetrating Radar (GPR)**
- **Rapid setting concrete has been used to minimize the downtime for deck repairs**
- **Hot applied sheet membranes appear to be outperforming the cold applied, but still use the cold applied sheet membranes with good results in certain situations (but is more expensive)**
- **Rhode Island uses galvanized reinforcing steel and has used a stainless clad to see how it performs, Maine has used stainless reinforcing steel in a few situation and some epoxy coated, but for the most part still use black reinforcing steel, Pennsylvania & New Jersey use Epoxy Coated**
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Notable Practices (*Note practices, strategies, policies, products, etc that are working well*)

- **Rhode Island is eliminating joints where possible on their structures when they design them**
-