

Deck Seals, Thin Overlays, And Waterproofing Membranes

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Overview

- Preservation vs Rehabilitation
- When to take action
- Deck seals vs Thin Overlays
- Preparing the deck
- Applying thin overlays
- Applying deck seals
- Waterproofing membrane for Asphalt
- Crack Injection

Rehabilitation

- Deck Replacement or Structural Overlay.
 - Requires long term traffic disruption.
(Staging = 50-60% of project costs)
 - High cost can lead to complete bridge replacement.
 - Drain on maintenance until project can be planned.



Preservation

- Deck seals and thin overlays
 - Only requires short term traffic control.
 - Inexpensive and very cost effective.
 - Deck doesn't currently require maintenance resources as the deck condition is still relatively good.

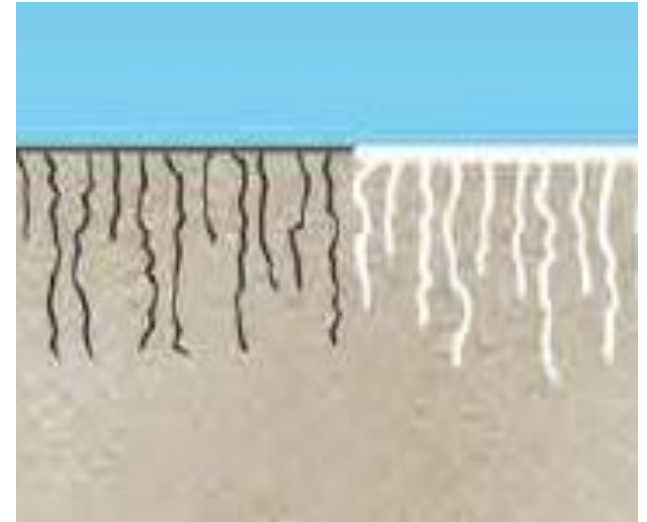


Deck Seal: Lots of Products

Attribute	Silane/Siloxane	Heavy Weight Methyl Methacrylate, Polyurethanes	Epoxy Healer Sealer	Injection Epoxy
Typical Applications*	Waterproofing good condition concrete	Crack sealers for widespread fine cracking	Crack sealers for widespread fine cracking	Crack sealer for widespread discrete larger crack widths
Viscosity (Centipoise)	<1	20 - 200	50 - 150	500 - 2000
Pot Life (Minutes)	NA	5 - 45	20 - 60	15 - 30
Minimum Cure Time (Hours)	1 - 4	2 - 12	3	2
Expected Useful Life (Years)	3 - 5	5 - 10	5 - 10	5 - 10

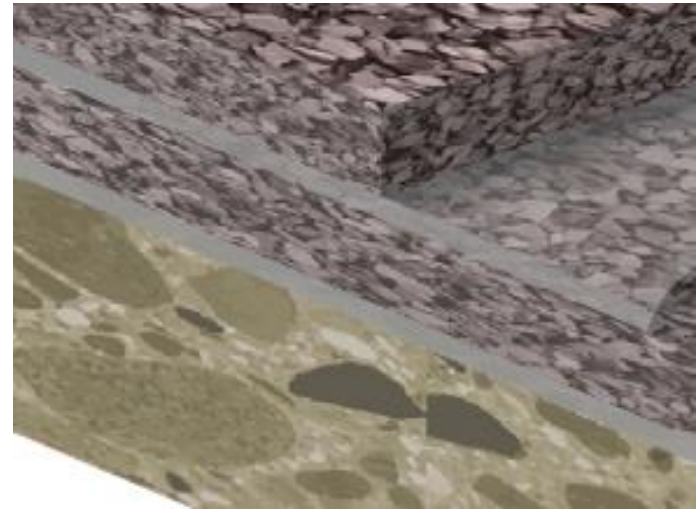
Deck Seals:

- Epoxy Healer Sealers are most common
- Very low viscosity (like water)
- Penetrates deep into the deck to fill cracks
- Does not create a barrier to water and salts, but slows them down.
- Isn't intended to provide a new wearing surface



Thin Polymer Overlay (MPCO)

- Is a new wearing surface
~3/8" thick
- A barrier that water and salt
can't penetrate.
- Significantly increases skid
resistance (In short term)
- Doesn't really penetrate into
deck cracks.



Candidates for Preservation

- Deck Sealing:
 - New decks and structural overlays that exhibit shrinkage cracking.
 - Deck with cracking and/or efflorescence in soffit. (Low Mod sealer could help map cracking, but is an indication it could need rehabilitation)
- Thin Polymer Overlays:
 - Sound decks with only minor spalling.
 - Areas with heavy studded tire use.
 - Areas with heavy deicer applications.
 - Use caution if bridge is on curve

Selecting a Product: ODOT QPL

<https://www.oregon.gov/ODOT/Construction/Documents/qpl.pdf>

- Sealers Section 2060
- Thin Overlays Section 556

02060.10	CONCRETE AND CRACK SEALER LOW MOD EPOXY	EP-100	E-CHEM LLC. 720/201-8810
02060.10	CONCRETE AND CRACK SEALER LOW MOD HMWM	KBP FLEX	KWIK BOND POLYMERS,LLC DAN ULDALL 360/600-7762
02060.10	CONCRETE AND CRACK SEALER LOW MOD HMWM	TRANSPO SEALATE T70MX-30	TRANSPO INDUSTRIES 914/636-1000
02060.10	CONCRETE AND CRACK SEALER LOW-MOD EPOXY	PRO-POXY 40 FS	DAYTON SUPERIOR/UNITEX STEVE HACKWORTH 253/2450263 WILLIAMS FORM ENG 800/255-0560 KNIFE RIVER 503/648-3100

Selecting a Product: TSP2 Deck Overlay Matrix

- <https://tsp2bridge.pavementpreservation.org/files/2013/05/WBPP-Deck-Overlay-Product-Matrix-Final-2.docx>

Field Conditions	Typical Thickness Range Min - Max (in)	Min Ambient Temp at Application (F)	Max Ambient Temp at Application (F)	Moisture Insensitive at Application	Total Cure Time for 1st layer (hrs) (See Note 1)		Total Cure Time for 2nd layer (hrs) (See Note 2)	
					At minimum reported temp	At +/- 70°F	At minimum reported temp	At +/- 70°F
Deck Overlays								
T-48 Slurry	0.25 - 0.375	50	90	dry surface	8-12 hrs	2-4 hrs	na	na
T-48 Chipseal	0.25 - 0.375	50	90	dry surface	5 hrs	2-3 hrs	5 hrs	2-3 hrs
T-18	0.25 - 0.375	32	90	dry surface	1-2 hrs	1 hr	na	na

Deck Preparation

- Essential to avoid early failure of overlay system.
- Will improve how well sealers penetrate into the cracks.
- Easy and inexpensive to do right!



Weather:

- Deck must be dry for successful application
- Temperature will impact how quickly the products setup
 - Check Manufacturer Recommendations for min temp (>50 degs)
 - May want to test new products if traffic control must be removed at certain time.
 - Cold weather products are available.

Deck Prep: Spalls and Delams



Deck Prep: Shot Blast



Deck Prep: Pick up Extra Shot



Excess shot is cleaned up

Thin Overlay: Deck Prep



Thin Overlay: Deck Prep



Curb is sandblasted

Deck Prep: Blow off deck



Surface is cleaned with high pressure air

Deck Prep: Tape Joints



Deck joints are taped

Thin Overlay: Installation

- Timing and coordination is critical. Have preplacement meeting to ensure everyone knows their role.
- Place tarps under mixing areas.
- Clearly mark measuring containers.
- Have supply of rags and solvents for cleanup.
- Have enough material on hand to complete the job (See manufacturers installation guidelines)
- Immediately before installation blow off deck with compressed air and perform final inspection.

Mixing the epoxies:



Jiffy Mixer



Thin Overlay: Placing resin

- Place a bead the full lane width.
- Use notched squeegee to spread the material. (Avoid over working).
- Avoid walking in resin once it is spread.



Thin Overlay: Broadcast aggregate

- ODOT recommends 2lbs of aggregate per square foot of deck.
- Begin application as soon as possible and before the resin gels.
- Continue application until no wet spots are visible.



Thin Overlay: 1st Lift Cleanup

- Once the resin is fully cured, remove all of the excess and loose aggregate.
- Powered brooms or pickup sweeping trucks are OK. But should avoid steel bristle brooms that could dislodge aggregate.
- Blow deck with compressed air before applying second lift.



Thin Overlay: 2nd Lift

- Install the second lift just as done on the 1st lift.
- 2nd lift will require more resin and aggregate.
- Final overlay thickness is approximately 3/8”.



Thin Overlay: Opening to Traffic

- Do not return to traffic until resin is fully cured and all excess aggregate has been removed.
- Rule of thumb is 2 hrs after resin appears to be hardened.
- Do a pull off test with a bond failure of 250 psi or greater.



Thin Overlay Installation Video



Thin Overlay: When it goes wrong

- Improper Mix Ratio and/or not thoroughly mixed.



Thin Overlay: When it goes wrong

- Poor Deck Prep: Shot blasting didn't remove cure compounds and/or contaminants on deck prevented good adhesion.



Thin Overlay: When it goes wrong

- Weak concrete layer.
Should have avoided thin overlay installation.



Thin Overlay

- Creates a barrier that will nearly stop salt and water intrusion.
- Provides a new wearing surface that is intended to last.
- Cost is approximately \$6 per square foot. (About \$20,000 for a 100 foot structure)
- Not recommended if deck has significant spalling or delamination's.
- High stud use can significantly reduce the life of overlay.
- Can polish over time reducing the decks skid numbers.
- 10 to 15 year lifespan (Depending on traffic volume)

Deck Seal: Installation

- Epoxy sealers are mixed and placed in a manner similar to thin epoxy overlays.
- Rollers, squeegees or brooms are used to evenly distribute the product over the deck.



Deck Seal: Installation

- Before product begins to gel, use a roller or broom to remove excess product.
- Broadcast topping sand before product gels



Deck Seal: Application Video



Deck Seal: When it goes wrong



Deck Seal: When it goes wrong

- Topping sand applied too late or not enough



Deck Seal: When it goes wrong

- Excess resin not removed before applying topping sand.



Deck Seal: When it goes wrong

- Poor Cleanup:



Deck Seal:

- Doesn't create a barrier to salt intrusion, but does slow it down.
- Topping sand layer will wear off quickly. But really it's just the cracks that are being targeted.
- Cost for low modulus epoxy overlay = \$2/SQFT (2018 data).
- Suitable for decks of all condition.
- Reapply every 3 to 5 years.

Sealing Asphalt:

- Spray Applied Membranes (Polyurea)
- Polymer Membrane (Epoxy)
- Rolled Membrane (Fabric)



Spray on Membrane: Construction

- Mill off existing ACWS
- Perform Deck Repairs
- Shot Blast Deck
- Apply Primer
- Apply Top Coat with Aggregate
- Hot Tack Deck
- Pave ACWS

Spray on Membrane: Deck Prep

- ODOT has special requirements for milling equipment on bridge decks.
- The deck preparation is fairly extensive to ensure the membrane bonds well. All AC is removed. Hand tools are utilized as required.
- Any delamination's or spalls are patched.



Spray on Membrane: Primer



Spray on Membrane: Base Coat



Spray on Membrane: Top Coat



Spray on Membrane: Complete



Spray on Membrane: Hot Tack



Spray on Membrane: Pave



Spray on Membrane: Summary

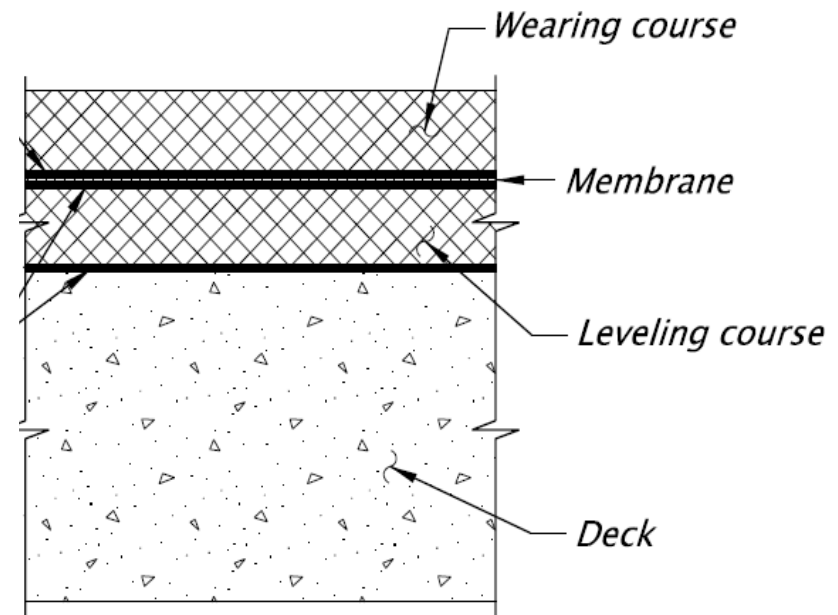
- Requires Specialty Installation Equipment.
- Bond of the AC to the membrane is the weak link.
- Aggregate should be included in the top layer.
- Can be open to traffic for short durations.
- Requires staging (days) between milling and paving for deck preparation and membrane placement.
- Cost = \$12-\$17 per Square Foot (Most expensive of membrane alternatives)

Polymer Membrane: Summary

- ODOT Developed Membrane System
- Consists of an epoxy deck seal with a single lift thin overlay
- Only Recommended for cast-in-place concrete decks
- Cost = \$5 per Square Foot

Rolled on Membrane: Construction

- Mill off existing ACWS
- Perform Deck Repairs
- Hot Tack Deck
- Pave 2" leveling course
- Place rolled membrane
- Pave 2" wearing course



Rolled on Membrane: Leveling Course



Rolled on Membrane: Installation



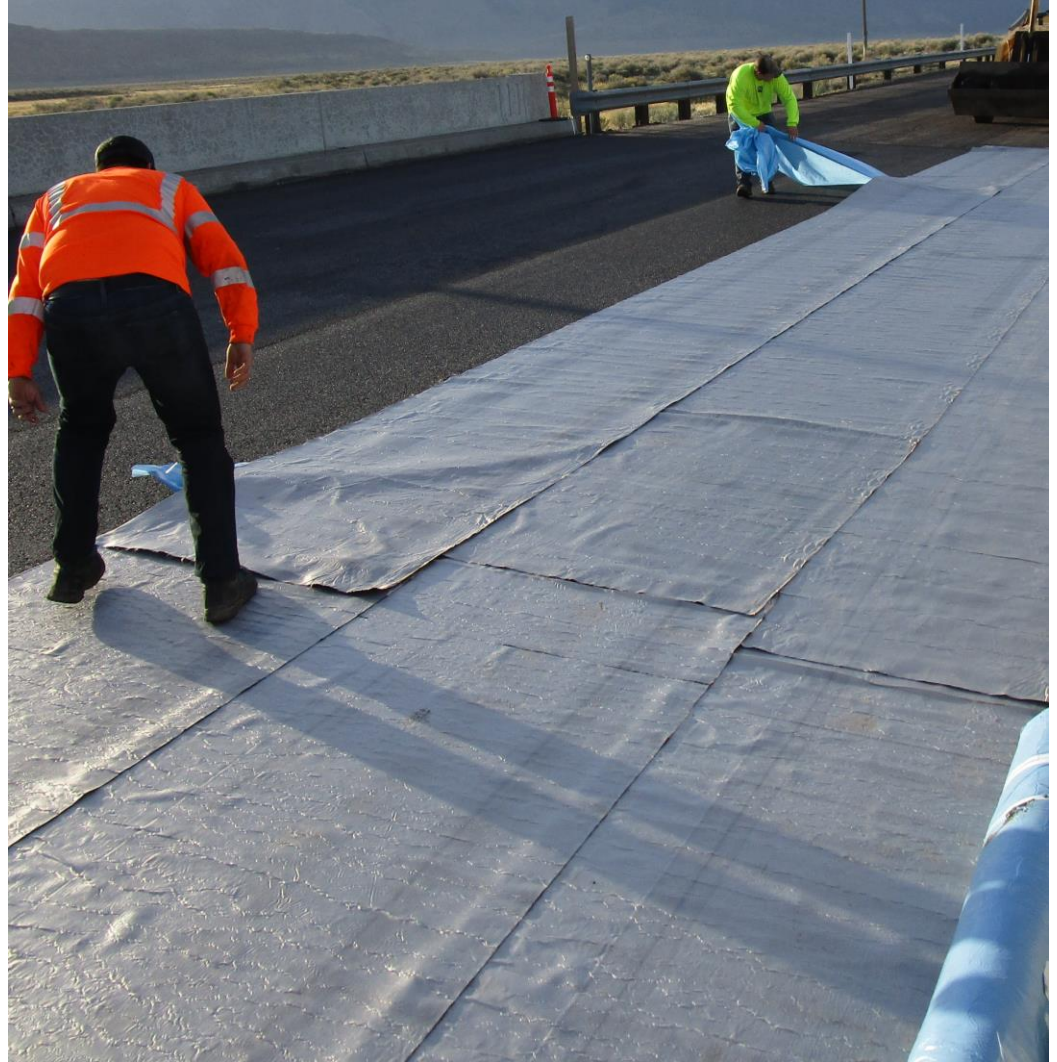
Rolled on Membrane: Installation



Extend Membrane up Curb

Rolled on Membrane: Installation

- Overlap and offset seams per manufacturer recommendations.
- Have laps splices going downhill.



Rolled on Membrane: Pave Top Course

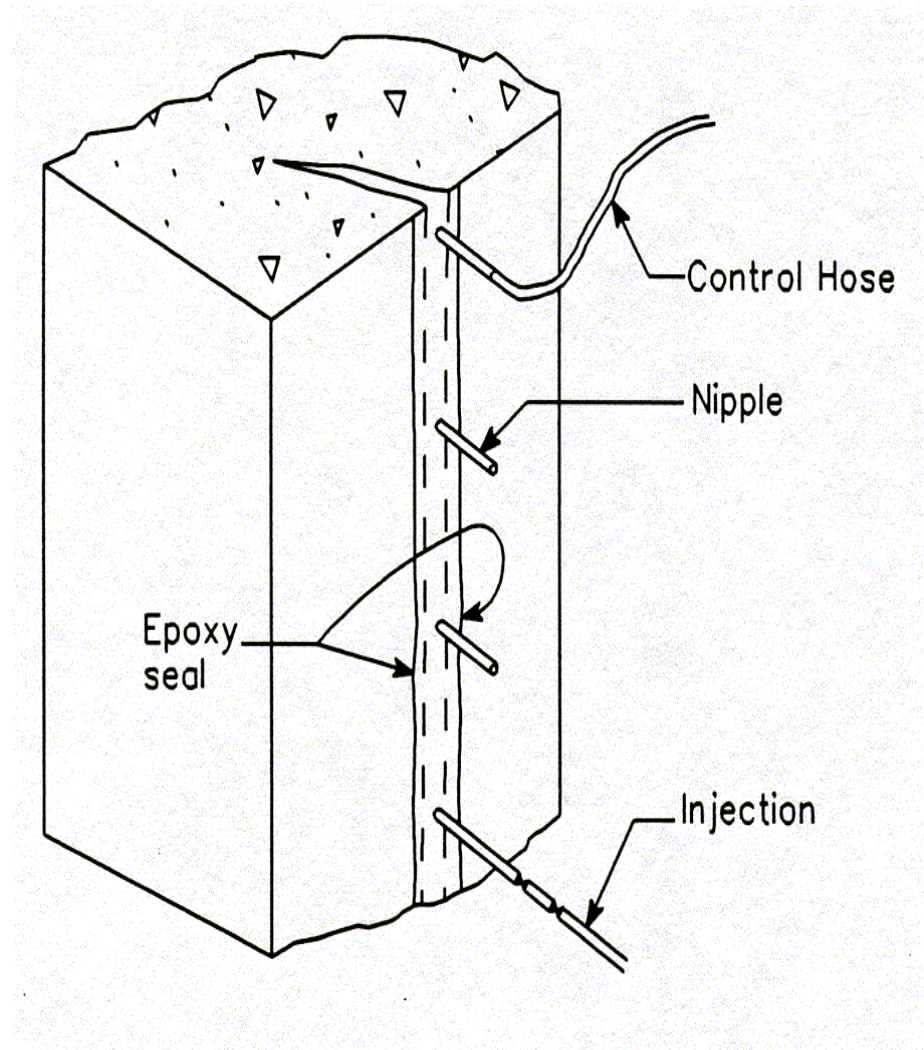


Rolled on Membrane: Summary

- No specialty tools required for installation.
- Leakage is weak link of system.
- Overall construction timeline is significantly reduced due to less deck preparation for paving leveling course.
- ODOT specifications and details are in draft stages.
- Cost = \$3 per square foot (Cheapest Membrane)

Crack Injection

1. Clean the cracks
2. Seal the crack surface
3. Install entry and venting ports
4. Prepare epoxy
5. Inject the epoxy
6. Remove surface seal





Questions