


Southwest Regional ACPA/PA Concrete Pavement Forum

Bonded Concrete Overlays

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Why Concrete Overlays?

-Our Roads are getting old; we can:

- Toss them out and start again
 - Long-Term Solution (\$\$\$)
 - Creates disposal headache
 - Takes energy to move them out of the way
 - Takes time = Traffic delays
- Patch & Grind them
 - Some material/energy usage
 - Short term Solution (\$)
- Overlay with Concrete
 - Uses existing equity
 - Minimizes sustainability impacts
 - Long-Term Solution (\$\$)



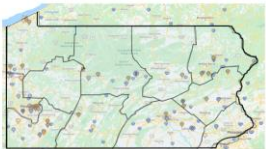
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Concrete Overlays in the ACPA/National Overlay Explorer Database

55 sites between 1938-2016

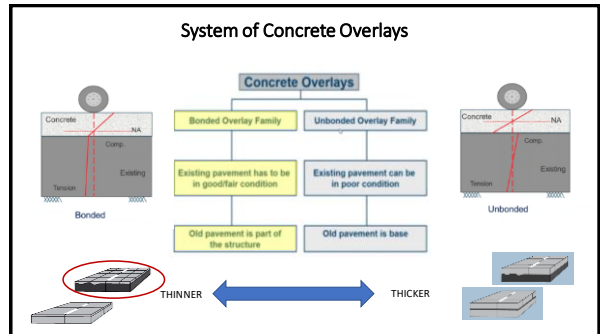
Some in every District

17 sites between 2000-2018

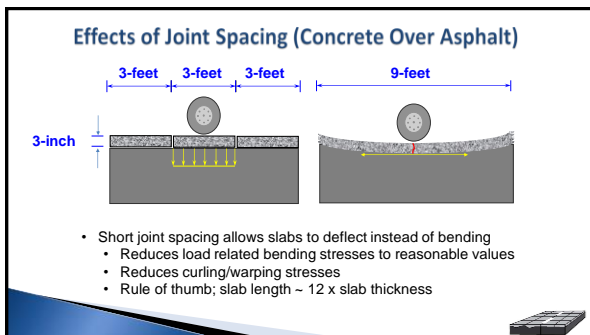


The National Concrete Overlay Explorer

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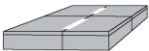


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Bonded Concrete Over Concrete



- **Section 545**
 - Niche tool, used for adding structural capacity to a generally good performing concrete pavement
 - Joints MUST match
 - Usually used with airport pavements
 - Most recently used in Districts 9 & 12
- **Design**
 - AASHTO/Darwin
 - Design a new pavement, then adjust overlay thickness based on condition of existing concrete
 - From 2-inches to 5-inches



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Bonded Concrete Over Asphalt/Composite

Section 540 (4-inches to 6.5 inches)
 • Thickness (inches) ~ Joint spacing (feet)
 • Mill asphalt for bond, minimum 3-inches of asphalt remains
 • 6x6 typical
 • *20 to 25-year alternate to standard overlay*

Section 541 (2.5-inches to 4-inches)
 • *Good application for rutted intersections*
 • Typically 10 to 15-year life

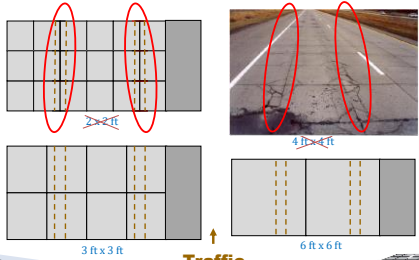
Design
 • PennDOT approved design procedure funded by FHWA
<http://www.engineering.pitt.edu/Vandenbossche/BCOA-...>

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Longitudinal Joint Layout

RULE OF THUMB
 GENERALLY WORKS
 HOWEVER...




3 ft x 3 ft Traffic 6 ft x 6 ft

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Examples of Bonded Concrete Overlay

OVER COMPOSITE
 US-119, District 12
 Built in 2010

OVER ASPHALT
 SR-468, District 8
 Built in 2011



6 ft x 6 ft

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Concrete Overlay Maintenance Cycles

Bonded Concrete Overlay (Pub 242, Chapter 3)	
Year 5	Clean & seal 25% of transverse & longitudinal joints including shoulders If applicable, seal coat or micro-surface asphalt shoulder
Year 10	Patch 5% & diamond grind 50% of pavement area Clean & seal 25% of all transverse joints & longitudinal joints including shoulders If applicable, seal coat or micro-surface asphalt shoulder
Year 15	Clean & seal 25% of all transverse joints & longitudinal joints including shoulders If applicable, seal coat or micro-surface asphalt shoulder
Year 20	Patch 8% of pavement area Clean & seal 100% of transverse joints & longitudinal joints including shoulders Asphalt overlay
Year 25	Asphalt overlay rehabilitation
Year 30	End of analysis period
Thin Bonded Concrete Overlay (Pub 242, Chapter 3)	
Year 5	Clean & seal 25% of transverse & longitudinal joints including shoulders If applicable, seal coat or micro-surface asphalt shoulder
Year 10	End of analysis period



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Another Example of a Bonded Concrete Overlay

22 Thin Bonded Concrete Over Composite
 US 22/I-83 Southbound On-Ramp

PERFORMANCE

- Concrete Overlay placed 1995 (Year 0)
- Repaired <10% cracked slabs in 2013 (Year 18) with minimal repair costs instead of reconstructing or rehabilitation
- 10,000 ADT, 7% Trucks, 765 Daily Rigid ESALs
- Overlay was still performing well, but it was removed in 2018 (Year 23) as part of the interchange reconstruction work for the I-83 Reconstruction project

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Surface Preparation

Bonded Concrete Over Asphalt / Composite

- Sandblast, shot-blast or mill existing surface
- Remaining asphalt after milling must be at least 3-inches thick
- Remove dust and debris
- Wet surface (bonding agent not necessary)




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Pre-overlay Repairs

Bonded Concrete Over Asphalt /Composite

- The purpose of pre-overlay repairs is to restore uniform support
- The preferred method of repair is with concrete rather than asphalt (due to bond)
- Cracks should be filled to prevent reflective cracking Sandblast, shot-blast or mill existing surface

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Finishing, Curing, Saw-cutting

Bonded Concrete Over Asphalt /Composite

- Use of a 12 to 16-foot straightedge immediately behind the paver or screed can improve ride.
- Large surface area to small volume of concrete makes curing even more critical
- Splitting curing compound application; one before sawing, one after may be necessary
- Saw-cutting D/3, conventional or early entry saws

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Bonded Overlay Practices

	Section 540 Bonded Concrete Overlay of Asphalt Surfaced Pavement	Proposed Section 541 Thin Bonded Concrete Overlay of Asphalt Surfaced Pavement	Section 545 Bonded Concrete Overlay of Concrete Surfaced Pavement
	Section 523 Ultra-thin PCC Overlay		
Saw Cutting Depth	D/3	D/3	Depth of overlay plus one-half inch
Dowels	No	No	No
Tie-bars	Some Longitudinal Joints	No	No
Joint Spacing	Typically 6x6	Typically 3x3	Match existing joints
Fibers	Used elsewhere in US	Yes	No

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Joint Layout at Intersections (RC-20M Sheets 5-7)

- Develop joint layout plans before placing concrete
- Avoid long-side to short-side ratios greater than 1.25 to 1.
- Minimize acute angle joints.

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Transition Detail for 6x6x6 Overlays

TYPICAL SECTION, PA 465 Section A-A

TRANSITION SECTION Section B-B

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Lesson Learned - Bonded 6x6x6 Overlay Separation of Untied Longitudinal Joints

- Tie-Bars used only between travel lanes
- Outside longitudinal joint opened; concrete took asphalt base with it

Lesson Learned

- Tie outside one or two longitudinal joints
- Consider use of fibers for bonded concrete over asphalt (Section 540) overlays to keep joint tight
- Note fibers are required for thin bonded concrete overlays (Section 523/541)

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Guide for Concrete Overlays -Resources

- 1st Edition – 2007
- 2nd Edition – 2008
 - Added Managing Concrete Work Zones Under Traffic
- 3rd Edition – May 2014
 - Added Synthetic Fibers
 - Evaluation Flow Chart
 - Geotextile Interlayer
 - 3 D Survey
 - Stringless Paving
 - Plate Dowels
- 4th Edition –2021
 - Being developed in cooperation with FHWA



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Questions & Dialogue

Our Questions for You

How have concrete overlays performed in your District ?

Any suggestions for improving Section 540 or 523/541 ?

Constructability Comments/Concerns ?

Your Questions/Comments

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