

Southeast Regional ACPA/PA Concrete Pavement Forum

Concrete Overlays
John M. Becker, P.E.
ACPA/PA

October 8, 2020

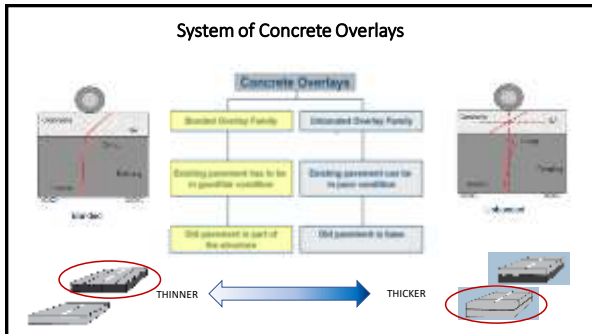
1

Why Concrete Overlays?

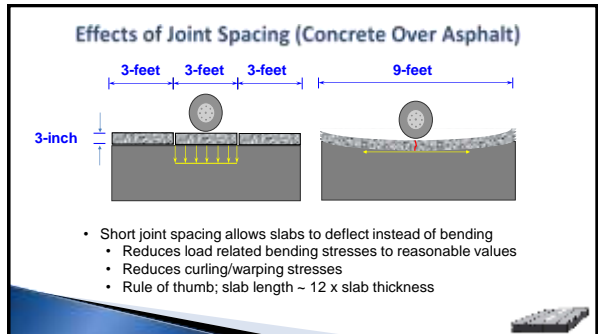
-Our Roads are getting old; we can:

- 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 (\$\$)

2



3



4

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

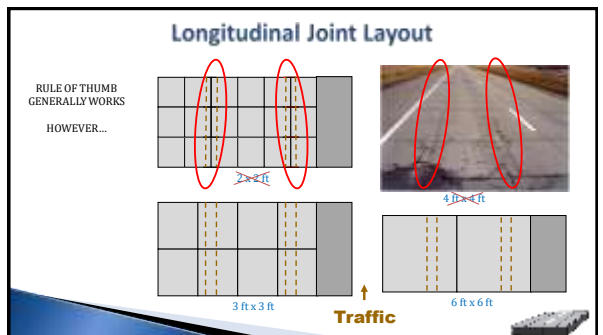
Section 541 (2.5-inches to 4-inches)

- 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-...>


5



6


Examples of Bonded Concrete Overlay

OVER COMPOSITE
US-119 (12-0)
Built in 2010




6 ft x 6 ft

OVER ASPHALT
SR-468 (8-0)
Built in 2011



6 ft x 6 ft

OVER ASPHALT
US-22/I-83 (8-0)
23-years of service



3 ft x 3 ft (3.5 inches thick)

7

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)








8

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








9

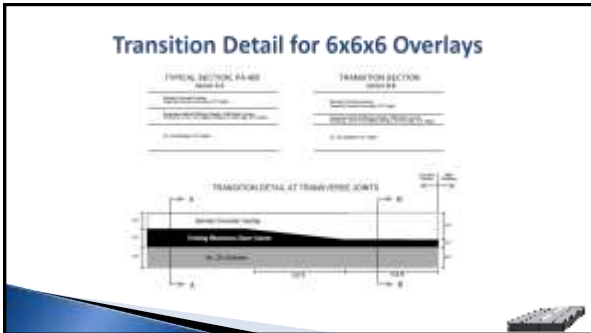
Finishing, Curing, Saw-cutting

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

10




11

Overlay Practices

	Section 540 Bonded Concrete Overlay of Asphalt Surfaced Pavement	Proposed Section 541 Thin Bonded Concrete Overlay of Asphalt Surfaced Pavement <small>Section 523 Ultra-thin PCC Overlay</small>	Section 548 Unbonded Concrete Overlay
Saw Cutting Depth	D/3	D/3	D/3
Dowels	No	No	Yes
Tie-bars	Some Longitudinal Joints	No	Yes
Joint Spacing	Typically 6x6	Typically 3x3	No need to try to mismatch joints
Fibers	Used elsewhere in US	Yes	No

12

Unbonded Concrete Over Concrete




Section 548 in Pub. 408

- Minimal pre-overlay repair of PCC
- Separation layer 1-inch AC or Fabric Interlayer (STIC concept)
- Piloted in Districts 5 & 11


Design

- AASHTO/Darwin
 - Design a new pavement, then adjust overlay thickness based on condition of existing concrete
 - Typically 2 to 4-inches thinner than a new pavement




13

Types of Interlayers



Asphalt




Geotextile


Roles of Interlayer


- Drainage (fabric or open graded HMA)
- Slip plane
- Stress absorption
- Interlayer also allows overlay to bridge any cracks in the old pavement during the period the concrete is gaining strength

Thermal Movements




Differential Deflections





No Reflective Cracking




Reflective Cracking

14

Unbonded Concrete Over Concrete (PA-50, D 11-0)

PA-50, Allegheny County

- Bid as an alternative design alternate bid
 - Crack and seat with a bituminous overlay OR 6-inch unbonded concrete.
 - This \$19 million unbonded concrete overlay prevailed over the two bituminous bids by well over \$2 million.
- Technologies used for the first time in Pennsylvania
 - Variable thickness concrete overlay
 - Mix design optimization for better long-term pavement performance
 - Optimization of the pavement overlay profile
 - String-less paving
 - Real time smoothness



15


I-81 Unbonded Overlay

Up front concerns on this project

- Securing load transfer assemblies into old concrete
- Grade corrections (up to 12-inch) & depth of both dowels and saw-cut depth

Overlooked


- Different base for mainline & shoulder resulted in locked joints
- This addressed with updated Pub 242



16

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



www.CPTechCenter.org

17

Questions & Dialogue

Our Questions for You

What is your experience with concrete overlays performance ?

Any suggestions for improving overlay specifications ?

Constructability Comments/Concerns ?

Your Questions/Comments

18