PCCP Overlays
- a Pavement Preservation Option

Purdue Road School
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Pavement Performance

Serviceability

Traffic or Years

Concrete Performance Curve

Asphalt Performance Curve
Rehabilitation Strategies

• Three categories:
  ➢ Restoration
  ➢ Resurfacing
  ➢ Reconstruction

• Which is used depends on existing condition.
Pavement Rehabilitation

• Improves structural and/or functional condition of pavement.
  ➢ Structural condition - the ability to carry traffic.
  ➢ Functional condition - the ability to serve the user comfortably.
Rehabilitation Strategies

Concrete Pavements

- Maintenance/Restoration
  - Full-depth repair
  - Partial-depth repair
  - Diamond grinding
  - Joint & crack resealing
  - Retrofitting dowels
  - Cross-stitching long. cracks/joints

- Resurfacing
  - PCCP Overlays

- Reconstruction
Concrete Overlays

A VERY LONG History of Performance and Cost Effectiveness
Performance Data

Pathways Van Data Collection of existing PCCP overlays
Performance Data

Pathways Van Data Collection of existing PCCP overlays
What are we talking about?

- Concrete overlays over old concrete
- Concrete overlays over old asphalt pavements
- Concrete overlays over old composite pavements
Types of Concrete Overlays

- Bonded Overlay System
  - Bonded Concrete Overlay of Concrete Pavements
  - Bonded Concrete Overlay of Asphalt Pavements
  - Bonded Concrete Overlay of Composite Pavements

- Unbonded Overlay System
  - Unbonded Concrete Overlay of Concrete Pavements
  - Unbonded Concrete Overlay of Asphalt Pavements
  - Unbonded Concrete Overlay of Composite Pavements

Bond is integral to design
Old pavement is subbase
Widely Used Across the Country
Historically – Unbonded Used
... but Bonded is Increasingly Common!
Historically, Mostly on Concrete

- On Concrete: 55%
- On Composite: 5%
- On Asphalt: 40%
... but More and More on Asphalt

Percent that are Bonded or Unbonded

Bonded on Asphalt
Bonded on Composite
Bonded on Concrete
Unbonded on Asphalt
Unbonded on Composite
Unbonded on Concrete
Concrete Overlays

Guidance on Design and Construction
Mechanics of PCCP Overlays

Unbonded

Neutral Axis

Bonded
Short Joints
Reduce Stresses
PCCP Overlay Design Advancements
Design Methods Recommended

AASHTO. Guide for Design of Pavement Structures 1993

Windows Pavement Analysis Software (WinPAS) Guide
Based on the 1993 AASHTO Guide for the Design of Pavement Structures

ACPA

WinPAS

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INDIANA CHAPTER

DARWinME
Mechanistic Empirical Pavement Design

Pv

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Bonded Concrete Overlay on Asphalt (BCOA) Thickness Designer

Background
This bonded concrete overlay on asphalt (BCOA) thickness design web application is based primarily on the results of FHWA-ICT-09-016, “Design and Concrete Material Requirements for Ultra-Thin Whitelining”, a research project conducted in cooperation with the Illinois Center for Transportation at the University of Illinois (ICT), the Illinois Department of Transportation (IDOT), and the

apps.acpa.org

Note: StreetPave12 & BCOA-ME released after guide was published
Welcome to ACPA’s online application library. Here you will find a collection of web- and desktop-based applications created to assist you in the design, construction, and analysis of concrete pavements.

ACPA Members and customers of affiliated ACPA Chapter/State Paving Associations:
Visit ACPA’s Concrete Pavement Resource Center to search and browse a collection of over 1,000 concrete pavement related technical references published by ACPA, FHWA, IPRF, IGGA, CP Tech Center, and other industry groups.

A New Look! Because there are now so many apps that it was becoming difficult to quickly find the one you need, we have redesigned this homepage. You can still sort by category or by using one of the other filters on the left. But, the easiest thing to do is to use the search feature. Start to type “evaporation rate” and see how quickly the relevant apps are found! Looking to convert in./mi to mm/km, search for “converter”.
New CP Tech Guide on Design

• Not a design procedure!
• Background on recommended overlay design techniques
  ➢ 18 pages
• Detailed design examples
  ➢ 35 pages
Single Best Reference

www.cptechcenter.org
INDOT Specification 509 & USP

SECTION 509 - QCQA, PCCP OVERLAY

509.01 Description
This work shall consist of a LINOA, PCCP overlay placed on a prepared existing asphalt pavement in accordance with 303.03. The requirements of 501 shall apply except as modified herein.

509.02 Lotes and Sublots
Lots will be defined as 14,400 yd (13,100 m²) of PCCP. Lots will be further subdivided into sublots of 4,000 yd (3,600 m²) of PCCP within a lot. Partial sublots of 960 yd (880 m²) or less will be added to the previous sublot. Partial sublots greater than 960 yd (880 m²) will constitute a full sublot. Partial lots of one or two sublots will constitute a full lot.

Lots and sublots will be numbered and tested for a given pay item regardless of the number of CM/OF's work and will be closed out at the end of the paving season or construction plan.

509.03 Preparation of Existing Asphalt Pavement
The requirements of 201.10, 201.11, and 301.12 shall not apply.

Preparation of the existing asphalt pavement shall be in accordance with the requirements of 303 except as modified herein.

Asphalt recapturation and profile preparation shall be performed on the existing asphalt pavement in accordance with 203.04 except that the QC/QC for milling shall be in accordance with 223.0.2 section 5.3. The maximum thickness of the milled surface shall be equal to or greater than 1.8 in accordance with ITM 512.

The Contractor may leave milled surfaces open for an indefinite period of time. Liquidated damages will not be assessed in accordance with 309.04 for milled material areas left open to traffic for longer than 5 work days or for non-milled material left open to traffic longer than 10 work days.

Prior to placement of PCCP, the milled asphalt pavement shall be clean and free of loose material. The surface of the milled asphalt pavement shall be uniformly monitored with water jet prior to placement of PCCP. Excess standing water will not be permitted.

Placement of PCCP overlay shall be by the slipformed or formed methods with equipment specified in 308.04.

509.04 Jointing
The requirements of 301.18 shall not apply.

Lateral and transverse construction joints shall not be serrated or sealed. The vertical surface of transverse construction joints shall be formed as shown in the plans.
SR 161 – Dubois County

6.0 “ PCCP Overlay of Existing HMA Pavement
CR 275W – Cass County

6.5” Unbonded PCCP Overlay of 50+ year old PCCP
SR 55 – 4” PCC Overlay w/ Structural Fiber

- 20% Residual Strength
- 2 lanes wide
- 8.7 mi long
INDOT Overlay – Bonded over Asphalt

- SR 161 – SR 64 to Freeman - 6”
- Overlay over milled existing HMA pavement
- Joints sawed at 10’ – 10’x12’ panel
- No Dowels – No tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 77,000 sys – bid at $14.00/sy
- Built 2010
SR 161 Concrete Overlay
INDOT Overlay – Bonded over Asphalt

• SR 55 – SR 2 to US 231 - 4"
• Utilized Structural Macro fibers
• Overlay over milled existing HMA pavement
• Joints sawed at 7’ – 7’x6’ panels
• No Dowels or tie bars
• Road closed to thru traffic
• Local traffic maintained one way
• Access maintained to residents
• 151,000 sys – bid at $21.00/sy
• Built 2015
SR 55 Concrete Overlay
SR 55
Evaluation results can provide information on the stiffness of the asphalt pavement, subgrade support conditions, and variations of these properties over the length of the project, thereby identifying localized areas of weakness requiring strengthening.

Milling can remove a number of asphalt surface distresses.
Bonded Resurfacing of Asphalt or Composite Pavements

- Use when existing pavement is in fair or better structural condition with surface distress.

- Use to eliminate any surface defects; increase structural capacity; and improve surface friction, noise, and rideability.

4”–6” thickness
Evaluations of Existing Pavements for Overlays

• An evaluation of the existing pavement is necessary to ensure it is a good candidate for resurfacing and structurally sound to carry the anticipated traffic loads.

• Information gathered through the evaluation is used to determine required repairs where needed and to establish the concrete overlay design thickness.

• Strongly suggest – take cores of existing pavement

• Concrete material condition can be obtained through analysis of cores taken from the existing pavement.
Also Evaluate/Core Shoulders
Pavement Evaluation:

On high-volume roads, falling weight defectometer (FWD) testing can provide subgrade k-values and variability, concrete modulus, load transfer efficiency, and presence of voids.
Jointing Different for Some Overlays

• Joint spacing depends on bond, stiffness of support, etc.

- Match Existing Joint Spacing/Location
- Joint Spacing based on Thickness; Shorter Panels = Less Curl/Warp
- Joint Spacing is Similar to New Concrete Pavement; Shorter Might be Used, Especially for Unbonded over Concrete
Longitudinal Joint Layout

2 ft x 2 ft

3 ft x 3 ft

4 ft x 4 ft

6 ft x 6 ft

Traffic

Outer Shoulder
Surface Preparation
Cleaning the Surface to Prepare for Bonding

- Sweeping surface followed by compressed air cleaning in front of the paver.
- Air blasting or water blasting is only necessary to remove material that cannot be removed any other way.
- Water or moisture should not be on the surface prior to paving or de-bonding can occur.

Duct Tape Test
Milling: Bonded and Unbonded Resurfacing of Asphalt or Composite Pavements

• The amount of asphalt removal depends on the types and severity of distresses and the thickness of the asphalt pavement.

• The objective of removing material is not to obtain a perfect cross section. It is not necessary to completely remove ruts. Usually 1”–2” of asphalt is removed.

• A minimum of 3”–4” of asphalt should be left after milling because of the reliance on the asphalt pavement to carry a significant portion of the load.

• Profile mill helps achieve desired PCCP thickness
Too Much Preplacement Repairs
HMA Overlay Mindset
Traditional Construction
Traditional Construction
Placement
Placement

SR 55

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Placement

SR 161
Finishing – SR 55
Pay attention to finishing & its impact on smoothness
Finishing

Too small – builds in roughness
Finishing

Use longer float/straightedge
Curing

• Curing is especially critical to concrete resurfacing because their high surface area to volume ratio makes them more susceptible to rapid moisture loss.

• Apply ASAP

• Coat all exposed edges.

• Avoid extreme weather.

• Avoid contact of cure with prepared surfaces because it is a bond breaker
Curing – Be Prepared!!

- Paving operation moves quickly on overlays
- Need curing crew on site ready to apply as paving starts
- Keep curing operation up close behind finishing operation
Curing – desired uniform coverage
Sawing – Be Prepared!!

- Paving operation moves quickly on overlays
- Shorter joint spacing = lot of joint to cut
- Need multiple saws
Sawing
Traffic Control – Lessons learned

• Can manage traffic through the project
• Closed to thru traffic – local access only appears to work best
  ➢ One way thru work zone
  ➢ Contractor needs to aggressively manage
  ➢ Need adequate signage
  ➢ Need cones & warning tape
  ➢ Aggressive flaggers

• Can manage local access to home & businesses
  ➢ Requires regular communication with locals – discuss schedule & options
Local Traffic – one-way thru project
SR 55
Access to local drives – SR 55

Make sure surface is clean & provide compression relief at construction joint
How Handle Overnight Lane Restriction??

• Portable Traffic Signals
• Pilot Vehicles
Need good MOT markings & barriers
Safety Focus – A MUST!!
Tight – restricted workzone
Freshly Cured PCCP – looks a lot like hardened PCCP traffic driving on
CONCRETE OVERLAYS

Payment

Cubic Yard

Square Yard

Divided payment - most equitable and economic
Value Analysis

1 mile of pavement – 24’ wide - = 2 lane miles = 14,080 sys

SR 161 PCCP Overlay – bid at $14.00/sys
Design life: 25 years - Cost/lane mile/year = $3942.40
Design life: 20 years – Cost/lane mile/year = $5280.00

HMA Overlay – expected life 11-13 years
165# HMA Surface = 0.0825T/sys - @$53.25/T = $4.39/sys
275# HMA Intermediate = 0.1375T/sys - @ $53.00/T = 7.29/sys
Cost/lane mile/year (at 11 years) = $7475.20
Cost/lane mil/year (at 13 years) = $6325.17
Value Analysis

1 mile of pavement – 24’ wide - = 2 lane miles = 14,080 sys

SR 55 PCCP Overlay – bid at $21.47/sys
Design life: 25 years - Cost/lane mile/year = $6045.95
Design life: 20 years – Cost/lane mile/year = $7557.44

HMA Overlay – expected life 11-13 years
165# HMA Surface = 0.0825T/sys - @$53.25/T = $4.39/sys
275# HMA Intermediate = 0.1375T/sys - @ $53.00/T = 7.29/sys
Cost/lane mile/year (at 11 years) = $7475.20
Cost/lane mil/year (at 13 years) = $6325.17
Summary - What Have Learned

• Cost competitive
• Good Performance History
• Don’t need dowels on bonded overlays
• Don’t need tie bars
• Keep panels sized properly
• Joints – single cut – unsealed
Summary – Best Practices

• Build with traditional construction practices
• Old surface must be clean – free of debris – duct tape test
• Traffic control is very manageable
• Must be attentive to signage & public communications
• Good finishing practices = smooth pavement for overlays
• Need curing & sawing plan
Questions?

Contacts for further information

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