Case Studies - Concrete Overlays

Lessons Learned - Concrete Overlays

Purdue Road School
March 6, 2013
Today’s Topic

1. Overlays
2. New Full-depth
3. Pervious
4. Roller Compacted
5. Full Depth Patching
6. Partial Depth Patching
7. Diamond Grinding
What are we talking about?

- Concrete overlays over old concrete
- Concrete overlays over old asphalt pavements
- Concrete overlays over old composite pavements
What Know or Have Learned

- Cost Competitive
- Long Lasting
- Versatile
- Traditional Construction
- Constructed Rapidly
- Sustainable
- Wide Spread Use Across Country
Competitive

Producer Price Indices - Competitive Building Materials

Source: Bureau of Labor Statistics
Traditional Construction
Traditional Construction
Constructs Rapidly

Single pass – full depth
Constructs Rapidly

Bremen Highway
Joseph Co., IN
Bonded Overlay

4” PCCP Inlay
24’ wide – 0.9 mi.
Paved in 1 day
Sustainable

- Local Materials
- Recycled materials
- One-pass placement
- Longevity, fewer cycles
- Light reflective
- Mitigates “Heat Island” effect
Widely Used Across the Country
How do we know?

Let’s look at a few projects
Indiana’s Concrete Overlays

- Local Streets/Roads
- Airports
- Interstate Highway
- State Highway
Indiana Overlays
Local Roads

- Harding Street – Indianapolis – 6” 1985
- 121st Street – Fishers – 9” 1992
- Indianapolis Bus Lanes – 3.5” 1997
- Allisonville Rd – N. of 96th – 7” 1999
- 56th Street – Brownsburg – 5” 2001
- Market & Columbia – Warsaw – 3.5” 2002
- Rudisill/Broadway Inter. – Fort Wayne – 6” 2006
- Bremen Highway – St. Joseph Co. – 4” 2007
Indiana Overlays
Interstate and State Routes

Interstate and State Routes
- I - 69 North of SR 18 - 11” 1986
- I - 65 North of SR 114 - 10.5” 1994
- 1 - 94 West of SR 39 - 13” 1998
- I - 70 at US 27 - Richmond - 12” 2000
- SR 161 - Dubois Co. - 6” 2010
## Indiana Overlays

**Airports**

- Madison Airport Apron – 3.5” 2000
- Grissom AR Fueling Apron – 6” 2007
- Delphi Runway – 5.75” 2008
- Elkhart Runway – 10” 2009
- Jasper Co. Runway – 6” 2009
- Columbus Runway – 10” 2010
INDOT Research HPR-2064

Life & Cost Analysis of Three Rehabilitation Techniques on I-65 Between SR 2 & SR 114
I-65 Pavement Rehab Comparison

LIFE AND COST COMPARISON OF THREE REHABILITATION TECHNIQUES ON I-65 BETWEEN SR-2 AND SR-114
3 Rehabilitation Techniques

- “Crack and Seated”
  Fiber modified HMA overlay on cracked and seated concrete
  - 8.7 miles

- “Rubblized”
  HMA overlay on the rubblized concrete - 5.7 miles

- “Unbonded Concrete Overlay”
  on 30mm intermediate HMA layer on the existing concrete - 6.2 miles
I-65 Rehab Options

- MP 217.2 – 223.4 – Concrete Overlay
  - Built 1993 - $239,800/center line mile

- MP 223.4 – 229.1 – 13” HMA Overlay over Rubblized old Concrete Pavement
  - Built 1994 - $236,000/center line mile
  - 2000 – route & seal cracks - $17,200/cl mile
  - 2010 – Mill 2” & overlay – $96,800/cl mile

- MP 229.1 – 237.8 – 7.5” HMA Overlay over crack & seated old concrete pavement
  - Built 1993 & 1994 - $180,500/ center line mile
  - 2000 – route & seal cracks - $17,200/cl mile
  - 2008 – mill & overlay all HMA - $355,942/cl mile
I-65 Rehabilitation Options

- 7.5” HMA Overlay over crack & seated PCCP
  - Built 1993 & 1994
  - Route & seal cracks
  - Mill all HMA & overlay 2009
  - 30 years service - $18,455/center line mile/year of service

2009 contract to mill 7.5” & overlay
I-65 Rehabilitation Options

- 13” HMA Overlay over Rubblized old PCCP
  - Built 1994
  - Route & seal cracks 2000
  - Mill 2” & 2” HMA overlay July 2010
  - 30 years service - $11,667/center line mile/year of service

2010 contract to mill 2” & overlay
Concrete Overlay
- Still “Like New” condition
- 30 years service - $7993/center line mile/year of service

No Rehab contracts to date - route & seal 2014??
2004 Findings and Implementation

“Unbonded concrete overlay is a very effective rehabilitation technique for eliminating reflection cracks.”

“Annual visual condition surveys suggest that “concrete” segment has better performance than the “rubblized” and “cracking and seating” segments.”

“Life cycle cost analysis suggests that “concrete” segment is the most cost effective…”

“Unbonded concrete overlays are viable rehabilitation techniques which should be employed on appropriate highway sections.”
Example Projects

Bremen Highway
Joseph Co., IN
Bonded Overlay

4” PCCP Inlay over milled HMA
Built: July 2007
### Alternate Bid Results

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<th>Option</th>
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<td>A. 4” HMA</td>
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Bremen Highway

Mill 4” out & sweep surface

Fill with 4” PCCP
24’ Wide, single pass
0.8 mile long
Bremen Highway

Standard Finishing & Texturing

Saw Cut 4’x4’ Panels
Bremen Highway

Excellent Results
SR 161
(INDOT RS-30682-A)

6” PCCP Overlay
3.77 Miles long
71,000 SY
SECTION 509 QCQA PCW OVERLAY

509.01 Description
This work shall consist of a QCQA PCW overlay placed on a prepared existing asphalt pavement in accordance with 108.9. The requirements of 507 shall apply except as modified herein.

509.02 Limits and Suburbs

Limits will be defined on the basis of 14,400 cu ft (2000 m³) of PCW. Limits will be further subdivided into sections of 2880 cu ft (4000 m³) of PCW within a 2.5 mile (4 km) interval. Limits greater than 2880 cu ft (4000 m³) will be noted as solid limits. Partial limits of up to 1000 cu ft (1300 m³) will be noted as dashed limits.

Limits and widths will be measured and tested for a given paved section utilizing the number of CMP’s used, and will be checked out at the end of the paving season or construction phase.

509.03 Preparation of Existing Asphalt Pavement
The requirements of 501.10, 502.1 and 502.12 shall not apply.

Preparation of the existing asphalt pavement shall be in accordance with the requirements of 208 except as modified herein.

Asphalt millings and profile preparation shall be performed on the existing asphalt pavement in accordance with 501.10. The QCQA PCW overlay shall be in accordance with EM 815 Section 5.1. The macrotexture of the milled surface shall be equal to or greater than 0.9 in accordance with FM 612.

The Contractor may have milled surfaces open for an indefinite period of time. Liquidated damages will not be assessed if opened in accordance with 208.14 for milled materials areas left open to traffic for longer than 3 work days or for non-motorized areas left open to traffic longer than 10 work days.

Prior to placement of PCW, the milled asphalt pavement shall be clean and free of loose material. The surface of the milled asphalt pavement shall be thoroughly wetted with water just prior to placement of PCW. Use of retarder water will not be permitted.

Placement of PCW overlay shall be by the ripper-assisted or forced methods with equipment specified in 501.10.

509.04 Details
The requirements of 501.15 shall not apply.

Longitudinal and transverse contraction joint shall not be sawed or sealed. The vertical surface of transverse contraction joint shall be left to show in the plane.
What Have Learned - Contractor

- Don’t be afraid of different practice
- Don’t make too complicated
- Basic straightforward construction practices
- Traffic control plan on project was very manageable – non-issue
- Profitable – good work
What Have Learned

- Don’t over engineer
- Cost competitive
- Don’t need dowels
- Don’t need tie bars
- Keep panels sized properly
- Joints – single cut - unsealed

Keep it simple
SR 161

Scarify/profile mill

Pave one lane at time
SR 161

Maintain local traffic
one way
SR 161

Bid Tab: $14.00/SY
$2.33/sy/in
($42.36/Ton Equivalent)
Urban Arterial – Allisonville Road - 1999

96th Street to Eller Road
Project Information

- Traffic: 26,360 vpd
- Existing 24’ asphalt pavement
- Scope:
  - widen to outside
  - maintain traffic
  - mill & overlay existing
Pavement Design

- **PCCP**
  - plain, non-doweled with skewed joints
  - overlay: 7 1/2 “ PCC
  - widening: 10 1/2” PCC on 4” #53 aggregate base
  - Lime treated subgrade

- **HMA**
  - overlay: 5” HMA
  - widening: 15” HMA
  - Lime treated subgrade
Allisonville Road Cross Section

TYPICAL CROSS SECTION
Scale $\frac{3}{16}''=1'-0''$

STA. 56+42 "A" to STA. 62+69.47 "A."
STA. 62+69.47 "PR-1" to STA. 75+33 "PR-1"
Allisonville Road

7 ½” PCCP Overlay of old asphalt with 10 ½” PCCP full depth widening Built: 1999
Airports - Delphi Runway 18-36

5” PCC Overlay of old HMA
2600’ – 60’ wide
Delphi Municipal Airport
Design – Concrete Overlay

- 5” Plain Concrete Pavement placed over existing asphalt runway
- Transverse joints spaced @ 12’-0”
- Longitudinal joints spaced @ 10’-0”
- All joints – sawed, beveled and sealed
- Outside longitudinal joint and the 3 transverse joints at north and south ends of runway – tied with ½” deformed bars spaced 3’- 0 c-c

As constructed – concrete overlay averaged 5.75”
## BID TABULATION

**DELPHI MUNICIPAL AIRPORT**

**RUNWAY "18-36" REHABILITATION**

### BASE BID

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### Milestone Contractors, L.P.

3301 South CR 460 East
Lafayette, IN 47905

Jeanne Ramsay
(800) 377-7727

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**Project Bid**

**Tabs - Base: FDR w/ HMA Overaly**

**$912,999.85**
**Project Bid**

**Tabs - Alternate: Concrete Overlay**

$715,935.58
Surface Preparation
Placement
Finishing
Curing
Sawing
Notice crack & broom finish
Concrete Overlays - Resources

The National Concrete Overlay Explorer
http://overlays.acpa.org/

Wonder how far concrete overlay technology has come?
Wonder where concrete overlays are being used and how well they are performing?
Visit the National Concrete Overlay Explorer and investigate construction and performance
details from more than 275 concrete overlay projects across the United States.
Portland Cement Concrete Inlay / Overlay Thickness Design

Version 1.0, August 1, 2008

Use of this treatment shall be according to Bureau of Design and Environment Procedure Memorandum 64-08.

There are two options for designing a PCC inlay/overlay on a pavement with a hot-mix asphalt (HMA) surface.

Option 1 (Left Button):
Specify the underlying HMA thickness and determine the required PCC inlay/overlay thickness.

Option 2 (Right Button):
Specify the PCC inlay/overlay thickness and determine the required thickness of underlying HMA.

Required Thickness of PCC Inlay / Overlay

Required Thickness of Underlying HMA

Acknowledgements
The Illinois Center for Transportation (ICT) is an innovative partnership between the Illinois Department of Transportation (IDOT) and the University of Illinois at Urbana-Champaign (UIUC).

Disclaimer
The content of this spreadsheet is based on the results of ICT R27-3, “Design and Concrete Materials Requirements for Ultra-Thin Whitelining.” ICT R27-3 was conducted in cooperation with the Illinois Center for Transportation, the Illinois Department of Transportation, Division of Highways, and the U.S. Department of Transportation, Federal Highway Administration. The author(s) of the content of this spreadsheet is/are responsible for the facts and accuracy of the data and calculations presented herein. The content has been developed for Illinois use based on Department input regarding Illinois conditions and materials, as well as Department specifications and guidelines, which may not produce valid results for others.
What Have We Learned

- Cost Competitive
- Long Lasting
- Versatile
- Traditional Construction
- Constructed Rapidly
- Design & Tech Guidance Tools Available
- Wide Spread Use Across Country
Questions?

Contacts for further information

www.irmca.com

INDIANA CHAPTER

www.indianaconcretepavement.com