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
- I – 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
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

Final Report

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented. The contents do not necessarily reflect views or policies of the Federal Highway Administration and the Indiana Department of Transportation. This report does not constitute a standard, specification or regulation.

Indiana Department of Transportation
Research Division
June 2004
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

- MP229.1 – 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
I-65 Rehabilitation Options

- 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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<tr>
<th>Option</th>
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<tr>
<td>A. 4” HMA</td>
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<td>$309,822.75</td>
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<tr>
<td>C. 4” PCCP</td>
<td>$244,300.25</td>
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</table>
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, PCP Overlay

509.01 Description
This work shall consist of (a) QCQA, PCP overlay placed on a prepared existing asphalt pavement in accordance with INDOT. The requirements of 509 shall apply except as modified herein.

509.02 Lanes and Sections
Lanes will be defined by 14,000 ft (601 m) of PCP. Lanes will be further subdivided into sections of 2,800 ft (853 m) of PCP within a lane. Lateral sections of 800 ft (244 m) or less will be added to the previous section. Partial widths greater than 600 ft (183 m) will contribute a full lane. Partial lanes or two parallel lanes will contribute a full lane.

Lanes and sections will be numbered and identified for a given map area according to the number of CMU’s used and will be closed out at the end of the paving season or construction phase.

509.03 Preparation of Existing Asphalt Pavement
The requirements of 301.10, 301.11 and 301.12.16 shall not apply.

Preparation of the existing asphalt pavement shall be in accordance with the requirements of 301 except as modified herein.

Asphalt resurfacing and profile preparation shall be performed on the existing asphalt pavement in accordance with 301.5. The QCM for milling shall be in accordance with INDOT Procedure 5.2. The macrotexture of the milled surface shall be equal to or greater than 0.85 in accordance with PTM 012.

The Contractor may leave milled surfaces open for an indefinite period of time. Liquidated damages will not be assessed in accordance with 301.5.4. for milled surfaces left open to traffic for longer than 3 work days or for non-milled areas left open to traffic longer than 7 work days.

Prior to placement of PCP, the milled asphalt pavement shall be clean and free of loose material. The surface of the milled asphalt pavement shall be sufficiently moistened with water just prior to placement of PCP. Excessive standing water will not be permitted.

Placement of PCP concrete shall be by the compression or vibration methods with equipment specified in 509.6.

509.04 Details
The requirements of 501.15 shall not apply.

Longitudinal and transverse contraction joints shall be notched or sealed. The vertical surface of transverse contraction joints shall be flared to ensure the plan.
What Have Learned - Contractor

- Don’t be afraid of different practice
- Don’t make too complicated
- Basic straight forward 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

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

Scale 3/16" = 1'-0"
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”
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<tr>
<th>ITEM</th>
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<th>UNIT</th>
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**Project Bid**

**Tabs - Base:**

FDR w/ HMA Overlay

**Total:**

$912,999.85
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**Base Bid Total:** $815,331.00

**USE:** $660,000.00

**Project Bid Tab:**

**Tabs - Alternate: Concrete Overlay**

**Total:** $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.

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 contents of this spreadsheet are based on the results of ICT R27-3, "Design and Concrete Materials Requirements for Ultra-Thin Whitewashing." 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 contents of this spreadsheet is (are) responsible for the facts and accuracy of the data and calculations presented herein. The contents have 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
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