Performance History of Concrete Overlays in the U.S.

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System of Concrete Overlays

Concrete Overlays

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

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

Bond is integral to design
Old pavement is subbase
Concrete Overlays - Introduction

- Vast experience and performance history in the U.S.
- Different overlay types for existing pavement types
- Robust solutions to fit project needs (short-medium-long term)
- Versatile solutions to fit varying facility types
Concrete Overlays - Introduction

- 1,152 concrete overlays in the U.S., dating from to 1901 through 2012
- Concrete overlays have been successfully constructed in 45 different states
Overlays Comprise 14% of Market!

Square Yards in '09 and '10

117,380,000

17,070,000

Full Depth Concrete

[Source: Oman and ACPA]
Relative Proportion of Bonded vs. Unbonded Overlays

Based on over 1,000 concrete overlays from NCHRP Synthesis 99, NCHRP Synthesis 204, and ACPA’s National Overlay Explorer.
... But More and More on Asphalt
Thin (< 6 in.) Concrete Overlays in the U.S.

Square Yards, Thin Overlays

- Total by 1993: 7,000
- Total by 1999: 450,000
- Total by 2004: 1,200,000
- 2009: 5,456,100
- 2010: 3,226,700
Concrete Overlay Case Histories

- Publication from the CP Tech Center

www.cptechcenter.org
Concrete Overlay Case Histories

- Highlights twelve concrete overlay projects across the US
## Concrete Overlay Case Histories

<table>
<thead>
<tr>
<th>Case History #</th>
<th>State</th>
<th>Route</th>
<th>Year Constructed</th>
<th>Existing Pavement Type and Overlay Type</th>
<th>Interstate or Freeway or Expressway</th>
<th>Functional Classification</th>
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</table>
Case History #1
US-69 Oklahoma
Case History #1
US-69 Oklahoma

- Bonded on Asphalt
- 4” and 6” thickness
- 13 years old
- 10,100,000 ESALs
Case History #1
US-69 Oklahoma

• This route serves as a primary freight corridor for trucks serving the Dallas/Ft. Worth metroplex from the north and east.
• The existing asphalt pavement was experiencing stability issues (rutting and shoving). There was no indication of stripped layers. Variable depth pre-overlay milling was performed and profile grade was raised approximately 2".
Case History #1
US-69 Oklahoma

• Typical Section
  - 4” and 6” concrete pavement
    ➢ Slab sizes (w x l): 4’ x 6’, 6’ x 6’ and 7’ x 6’
  - Existing asphalt pavement milled (approx. 11” remaining)
  - Existing granular base
Case History #1
US-69 Oklahoma

- Constructed adjacent to traffic
- Fiber reinforced (3 lb/yd³)
Case History #1
US-69 Oklahoma

- Less than 1% cracked slabs after 9 years
Case History #3
CR-56 LaSalle County Illinois
Case History #3
CR-56 LaSalle County Illinois

- Unbonded on Asphalt

- 5” to 7” thick
- 40 years old
- 8,400,000 ESALs
Case History #3
CR-56 LaSalle County Illinois

• This is a two lane local route providing access from I-80 to Peru, IL with adjacent industrial facilities.
• The existing 18’ wide asphalt pavement was widened to 24’. Contrary to current guidance, no reinforcing or longitudinal joint was placed over the edges of the existing pavement. However, no longitudinal cracking occurred.
Case History #3
CR-56 LaSalle County Illinois

• Typical Section
  – Variable thickness (5” to 7”) concrete pavement
    ➢ Slab sizes (w x l): 12’ x 15’
  – Existing asphalt pavement
  – Existing base/subgrade
Case History #3
CR-56 LaSalle County Illinois

- Local traffic maintained during construction
- Integral widening from 18’ to 24’
Case History #3
CR-56 LaSalle County Illinois

- Diamond ground after 28 years
- Minor patching near a grain elevator
Case History #6
SH-13 Iowa

- Bonded on Composite

- 4” thickness
- 12 years old
- 1,000,000 ESALs
Case History #6
SH-13 Iowa

- This is a rural farm-to-market roadway in Delaware County, IA.
- The original concrete pavement was constructed in 1931. It was overlaid with 2” of asphalt in 1964, and widened from 18’ to 24’ and overlaid again with 3” of asphalt in 1984. Approximately ¼” of asphalt was milled prior to construction of the concrete overlay. Although designed as an unbonded on composite, IA SH-13 is included here as an example of a bonded overlay (Sec 51+00 to Sec 208+00) based on the construction methods and follow-up studies, which showed significant bonding to the existing asphalt overlay.
Case History #6
SH-13 Iowa

• Typical Section
  – 4” concrete pavement
    ➢ Multiple variations of slab size from 3’ to 6’ x 6’
  – Existing composite pavement (1931, 7” to 10”) with asphalt pavement (1964 & 1984, 5”)
  – Milled ¼” nominal
Case History #6
SH-13 Iowa

- Fiber reinforced (3 lb/yd$^3$)
Case History #6
SH-13 Iowa

- Minimal repairs after 12 years
- Some longitudinal cracking attributed to tooled joints
Case History #8
I-35 Oklahoma

- Unbonded on Composite
- 11 ½” thickness
- 12 years old
- 19,100,000 ESALs
Case History #8
I-35 Oklahoma

• I-35 is a major freight corridor connecting Oklahoma City and Dallas.
• The existing concrete pavement had been overlaid with approximately 4” of asphalt. After milling 2” of asphalt, the remainder served as an interlayer between the new concrete overlay and the existing JPCP.
Case History #8
I-35 Oklahoma

• Typical Section
  - 11 ½” concrete pavement
    ➢ Slab sizes (w x l): 12’ x 15’
  - Existing composite pavement (9”) with asphalt pavement overlay (4”)
  - Milled variable depth (cross-slope adjustment) and remaining asphalt served as the interlayer
Case History #8
I-35 Oklahoma

- Existing shoulder reconstructed on the SB lanes for maintenance of traffic
- No observed distresses or repairs after 12 years
Case History #10
I-88 Illinois
Case History #10
I-88 Illinois

- Bonded on Concrete
  - 3” thickness
  - 18 years old
  - 16,800,000 ESALs
Case History #10
I-88 Illinois

- Major east-west route from Chicago, IL to the Quad Cities.
- The existing 8” thick CRCP was milled and shotblasted prior to placement of the 3” thick unreinforced bonded concrete overlay.
Case History #10
I-88 Illinois

• Typical Section
  - 3” concrete pavement
    ➢ Longitudinal joint at centerline
    ➢ No transverse joints (existing CRCP)
  - Existing concrete pavement (8”)
  - 4” stabilized base
Case History #10
I-88 Illinois

- Milling and shotblast surface preparation
- Constructed with traffic diverted to opposite lane
Case History #10
I-88 Illinois

- Debonding and structural failure at a few isolated areas
- 25 full depth patches based on 2012 imagery
Case History #12
I-85 North Carolina
Case History #12
I-85 North Carolina

- Unbonded on Concrete

- 10” thickness
- 13 to 17 years old
- 17,500,000 ESALs
Case History #12  
I-85 North Carolina

- A major freight corridor from Raleigh-Durham, NC north to Richmond, VA.
- The original pavement was 1970s 8” CRCP with punchouts and longitudinal cracking. Two of the 10” unbonded concrete overlay sections were constructed with a 2” thick dense graded asphalt interlayer and the third section utilized a 2” thick permeable asphalt interlayer.
Case History #12
I-85 North Carolina

• Typical Section
  – 10” concrete pavement
    ➢ Slab sizes (w x l): 12’ x 20’ (average)
  – 2” asphalt interlayer
  – Existing concrete pavement (8” CRCP)
Case History #12
I-85 North Carolina

- Two projects constructed adjacent to traffic
- Third project constructed with traffic diverted to opposite lane
Case History #12
I-85 North Carolina

- Mid-panel cracking (1.5%), majority from the first project constructed
- Full depth patching (0.2%)
- Crack sealing

2013
Recent Ohio Overlay Project

- Note that this is not a part of the historical overview we have been looking at.
- HAS-151-12.90, 2 – Lane Concrete Resurfacing
Project Criteria

• Fracking Route
• Flexible Pavement
• Expected Sale no later than FY 16
• Proposed Scope for typical hot mix overlay
• Reasonable Detour
• District Acceptance
• Candidate with limited structural distress
# Pavement History

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### Pavement Condition Rating

![Pavement Condition Rating Graph](image)
Design Concerns

- Jointing/Sealing
- Mill Depth
- Shoulders
Expectations

- Cost – comparison to HMA
- Design life
- Expected maintenance
ODOT Harrison Co. SR151
Thank You!

National Concrete Pavement Technology Center

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