Concrete Overlays – A Proven Technology

• The Challenge
• The Value Proposition
• Addressing Barriers to Implementation
• Getting Started
• Project Highlights
• Resources

The Challenge to Pavement Owners

• Existing infrastructure is continually deteriorating
  • Weather
  • Traffic
• Demands are increasing
  • Traffic
  • Ride quality
  • Continuous access
• Funding is not increasing
  • Maintenance costs may exceed Agency revenue

Maintaining Existing Pavements

• We can toss them out and start again
  • A long term solution
  • Creates a disposal headache
  • Loose equity of existing system
  • Takes energy to move them out of the way
  • Takes time = traffic delays
Maintaining Existing Pavements

• We can patch them – buy a few years
  • Limited materials usage, energy and traffic impact
  • Short term solution

Another Tool in the Toolbox

• Concrete Overlays - Concrete placed over an existing surface to:
  • Extend life
  • Restore ride
  • Increase capacity

Maintaining Existing Pavements

• We can overlay them with concrete
  • Use existing equity
  • Minimize sustainability impacts
  • Long term solution
  • Elevations / connections are tricky

The Value Proposition

• Costs
• Performance
• Environmental impacts
• Resiliency
• Effectiveness
Costs

• Initial costs depend on
  • Competition
  • Local contractor experience
  • Local materials availability
  • Can be competitive with other solutions

Environmental Impacts

• Long life and low maintenance reduces environmental impacts
• Improved fuel efficiency
• Low albedo, reducing the heat island effect
• Concrete is 100% recyclable
• May absorb CO₂

Resiliency

• Flooding saturates and weakens a pavement’s foundation
• Concrete overlays reduce the stress in the asphalt layer
• Sensitivity to subgrade softening is reduced
Effectiveness

• History
  • As early as 1901
  • 2000 miles in service in Iowa

Effectiveness

• Performance depends on:
  • Thickness
  • Condition of existing layer
  • Detailing
  • Can be
    • Unbonded from existing layer to prevent reflective damage
    • Bonded to make use of system in place
  • Life can be up to 35 years

Effectiveness

• Versatility
  • Can be applied to all surface types
  • Many degrees of distress can be accommodated
  • Has been used for a range of applications
    • Roadways
    • Intersections
    • Parking lots
    • Airfields

Effectiveness

• Rapid Construction
  • Depends on preparation effort required
  • Placement is fast with thinner sections
  • Productivity is less influenced by weather conditions
  • Traffic can be restored in a weekend
<table>
<thead>
<tr>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traffic Impact</strong></td>
</tr>
<tr>
<td>• Maintenance of traffic is simpler than reconstruction</td>
</tr>
<tr>
<td>• Construction under traffic is possible</td>
</tr>
<tr>
<td>• Early opening is possible</td>
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</table>

<table>
<thead>
<tr>
<th>Effectiveness</th>
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</thead>
<tbody>
<tr>
<td><strong>New technologies improve everything</strong></td>
</tr>
<tr>
<td>• New design methodologies</td>
</tr>
<tr>
<td>• Performance Engineered Mixtures (PEM)</td>
</tr>
<tr>
<td>• Reduced CO$_2$ footprint</td>
</tr>
<tr>
<td>• Stringless control</td>
</tr>
<tr>
<td>• Large, adaptable paving machines</td>
</tr>
<tr>
<td>• Vibrator monitoring</td>
</tr>
<tr>
<td>• Real Time Smoothness</td>
</tr>
<tr>
<td>• Maturity monitoring</td>
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</tbody>
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<table>
<thead>
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<th>Effectiveness</th>
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</thead>
<tbody>
<tr>
<td><strong>Safety</strong></td>
</tr>
<tr>
<td>• Reduced frequency of closures</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Effectiveness</th>
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</thead>
<tbody>
<tr>
<td><strong>Efficiency</strong></td>
</tr>
<tr>
<td>• Similar practices to conventional concrete paving</td>
</tr>
<tr>
<td>• Simple plan sets are possible</td>
</tr>
<tr>
<td>• Guide specifications available</td>
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<tr>
<td>• Guidance documents available</td>
</tr>
<tr>
<td>• Training and troubleshooting available</td>
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</tbody>
</table>
Challenges

- Exclusion from Agency Project Management System
  - Most PMS reflect local institutional experience and practices
  - Innovation is hard
  - Alternative solutions are not considered
- Change needs to come from above

Challenges

- Technical Experience
  - Lack of technical competency of SHA staff can be a concern.
    - Help is available from CP Tech Center and FHWA EDC-6 program
    - Building technical competency is not difficult.
  - Lack of concrete paving contractors with experience may also be a concern.
    - Help is available from ACPA

Challenges

- Agency Focus on Surface Condition Only
  - Pressure to “cover as much as possible”
    - Unsustainable short term fixes
    - Ignores traffic disruptions and safety impacts
    - Diamond grinding can be a cost-effective surface treatment

Challenges

- Difficulty Identifying Candidate Projects
  - Suitable overlay type for the existing system
  - Elevation issues
    - Bridges
    - Connections
    - Services
  - A range of solutions are available
Challenges

- Traffic Management/Detour Options
  - An overlay can be built faster than a reconstruct
  - Construction under traffic is possible

- Communication and planning…

Challenges

- Perceived Federal Funding Limitations
  - Concrete overlays can be considered preventative maintenance, qualifying them for use of federal aid funds.

Getting Started

- Start with a simple project
- Get help
- Evaluate performance
- Build competency
- Integrate the process into the mix of fixes

The Process

- Identify the type of pavement to be overlaid
- Assess the condition of the existing pavement
- Design
- Build
- Repeat
### Project Highlights

<table>
<thead>
<tr>
<th>State/Route</th>
<th>Year Constructed</th>
<th>Existing Pavement &amp; Overlay Type</th>
<th>Functional Classifications</th>
<th>Traffic Volume</th>
<th>Maintenance of Traffic Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Carolina/I-77</td>
<td>2007-2008</td>
<td>CDC-U on CRCP</td>
<td>Interstate</td>
<td>51,500 AADT with 25% trucks</td>
<td>Maintain two-lanes each direction</td>
</tr>
<tr>
<td>Colorado/SH13</td>
<td>2016</td>
<td>COA-B on HMA</td>
<td>Primary Hwy</td>
<td>1,400 AADT with 20% trucks</td>
<td>24-hour pilot car</td>
</tr>
<tr>
<td>Oklahoma/SH51</td>
<td>2016</td>
<td>COA-B on HMA</td>
<td>Primary Hwy</td>
<td></td>
<td>Closed to through traffic</td>
</tr>
<tr>
<td>Iowa/County Route</td>
<td>2009</td>
<td>COA-U on HMA</td>
<td>County road</td>
<td></td>
<td>Closed to through traffic</td>
</tr>
<tr>
<td>Kansas/City of Salina</td>
<td>2012</td>
<td>COA-U on composite pavement</td>
<td>Urban Intersection</td>
<td>52,000</td>
<td>Staged construction maintaining traffic</td>
</tr>
</tbody>
</table>

### Project Highlights

**Yadkin County, NC I-77**

- Existing CRCP circa 1964
- Punchouts
- Ruptured Steel
- Faulting at cracks
- Design-build delivery method

- Median detour with limited duration of one-lane operation
- 11-day closure limit for ramps
- 11 inch JPCP on 1 ½ inch asphalt separation layer
- Bridges were raised to match overlay elevation
- 100% grind

**Moffat County, CO SH-13**

- Existing Asphalt
- Profile milled to optimize volume of concrete and final smoothness
- 6 inch thick JPCP, 6 ft x 6 ft slabs
- Alternate bid
Moffat County, CO SH-13
- Two-way traffic maintained with pilot car
- Project length = 6 miles
- Average IRI < 45 in/mile

Blaine County, OK SH-51
- Asphalt bids rejected twice Overbudget
- 5 inch thick fiber reinforced JPCP, 6 ft x 7 ½ ft slabs
- Profile milled
- Roadway closed to through traffic (5 ½ mile project length)

Blaine County, OK SH-51
- Constructed in sections to allow access for adjacent property owners
- Project completed less than 90 days after bids were opened
- Drainage structures extended to accommodate a widened paved roadway

Worth County, IA S10/S141
- Alternate bid
- 4 inch thick JPCP, 6 ft x 6 ft slabs
- 23 mile long project
- Plan set was 10 pages
Project Highlights
Worth County, IA S10/S141

• No preoverlay repairs
• Roadway closed to through traffic
• Entire project opened to unrestricted traffic in 110 calendar days

Project Highlights
Saline County, KS Crawford and Ohio Streets

• Busiest intersection in Salina, KS > 30,000 ADT
• Partial depth milling
• 8 inch thick JCP, 12 ft x 12 ft slabs

Project Highlights
Saline County, KS Crawford and Ohio Streets

• Staged construction kept the intersection open
• Completed in 45 days

Resources