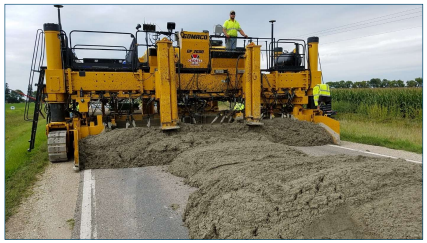
Concrete Overlays
A Proven Technology

IOWA STATE UNIVERSITY
Institute for Transportation

National Concrete Pavement Technology Center

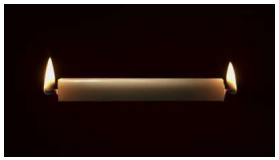
Concrete Overlays – A Proven Technology

- 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

Maintaining Existing Pavements

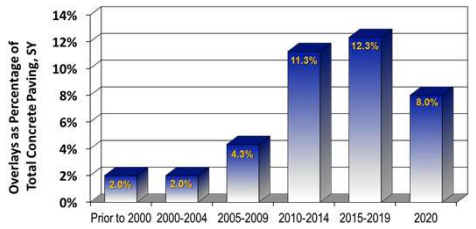
- We can overlay them with concrete
  - Use existing equity
  - Minimize sustainability impacts
  - Long term solution
  - Elevations / connections are tricky

Another Tool in the Toolbox

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

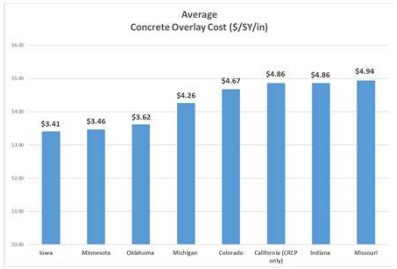
The Value Proposition

- Costs
- Performance
- Environmental impacts
- Resiliency
- Effectiveness



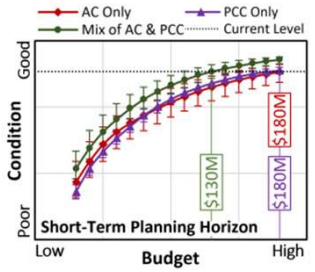
Costs

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



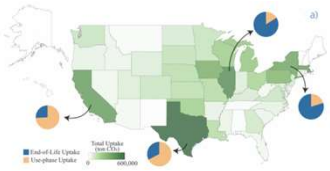
Costs

- Annual ownership costs are reduced
  - Longer life
  - Less maintenance
- Overall network condition is raised



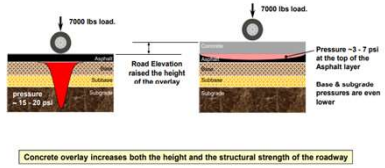
Environmental Impacts

- Long life and low maintenance reduces environmental impacts
- Improved fuel efficiency
- Low albedo, reducing the heat island effect
- Concrete is 100% recyclable
- May absorb CO_2



Resiliency

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

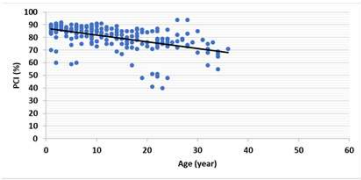


Effectiveness

- 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

Effectiveness

- Traffic Impact
  - Maintenance of traffic is simpler than reconstruction
  - Construction under traffic is possible
  - Early opening is possible

Effectiveness

- New technologies improve everything
  - New design methodologies
  - Performance Engineered Mixtures (PEM)
    - Reduced CO_2 footprint
  - Stringless control
  - Large, adaptable paving machines
  - Vibrator monitoring
  - Real Time Smoothness
  - Maturity monitoring

Effectiveness

- Safety
  - Reduced frequency of closures

Effectiveness

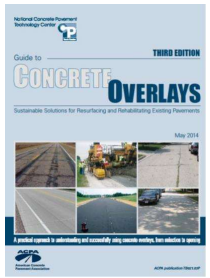
- Efficiency
  - Similar practices to conventional concrete paving
  - Simple plan sets are possible
  - Guide specifications available
  - Guidance documents available
  - Training and troubleshooting available

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

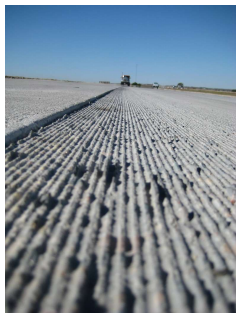
Challenges

- 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



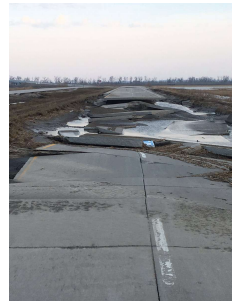
Challenges

- 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

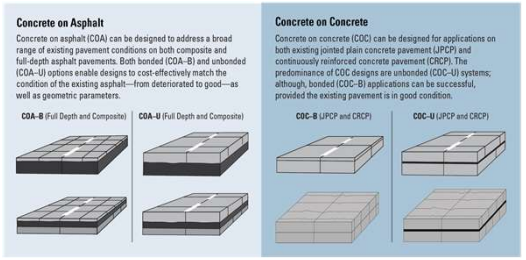
- Perceived Federal Funding Limitations
  - Concrete overlays can be considered preventative maintenance, qualifying them for use of federal aid funds.

Getting Started

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

The Process

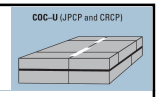
- Identify the type of pavement to be overlaid
- Assess the condition of the existing pavement
- Design
- Build
- Repeat



Project Highlights

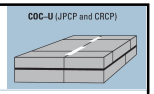
State/Route	Year Constructed	Existing Pavement & Overlay Type	Functional Classifications	Traffic Volume	Maintenance of Traffic Strategy
North Carolina/I-77	2007-2008	COC-U on CRCP	Interstate	31,500 AADT with 25% trucks	Maintain two-lanes each direction
Colorado/SH13	2016	COA-B on HMA	Primary Hwy	1,400 AADT with 20% trucks	24-hour pilot car
Oklahoma/SH51	2016	COA-B on HMA	Primary Hwy	-	Closed to through traffic
Iowa/County Route S10/S14	2009	COA-U on HMA	County road	-	Closed to through traffic
Kansas/City of Salina	2012	COA-U on composite pavement	Urban intersection	32,000	Staged construction maintaining traffic

Project Highights
Yadkin County, NC I-77

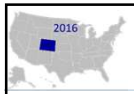


- Existing CRCP circa 1964
  - Punchouts
  - Ruptured Steel
  - Faulting at cracks
- Design-build delivery method

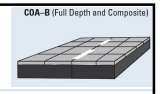
Project Highights
Yadkin County, NC I-77



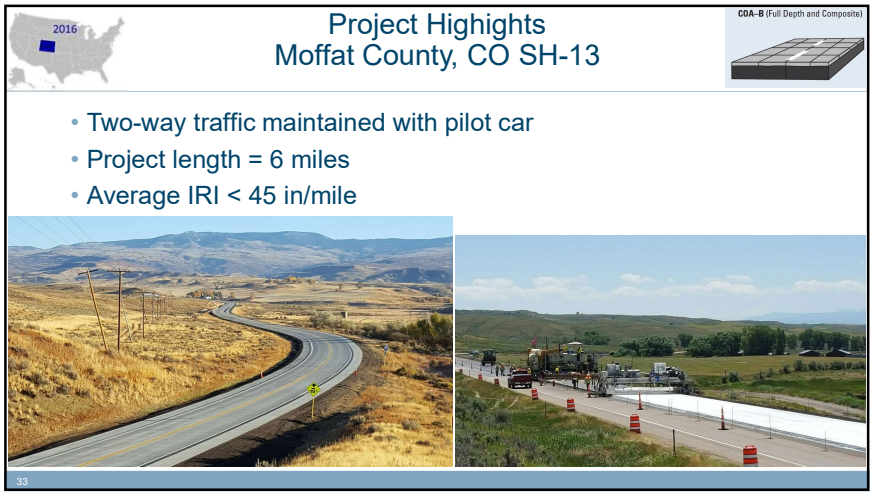
- Median detour with limited duration of one-lane operation
- 11-day closure limit for ramps
- 11 inch JPCP on 1 ½ inch asphalt separation layer
- Bridges were raised to match overlay elevation
- 100% grind

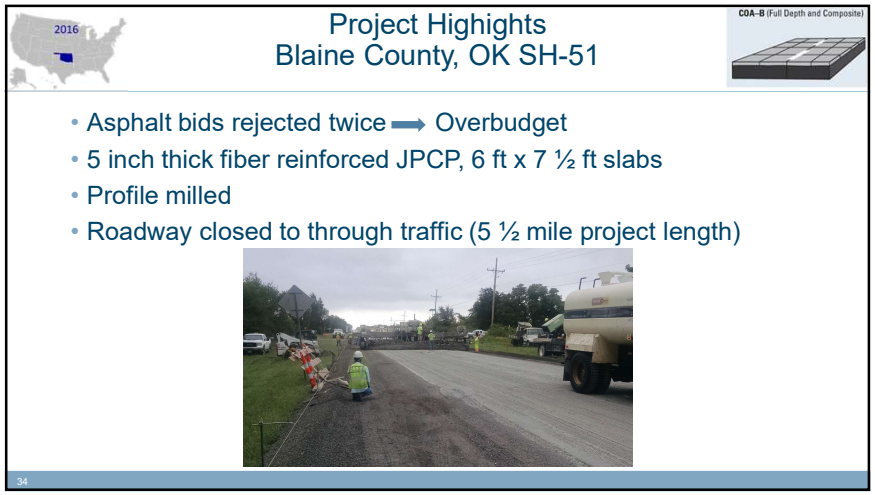


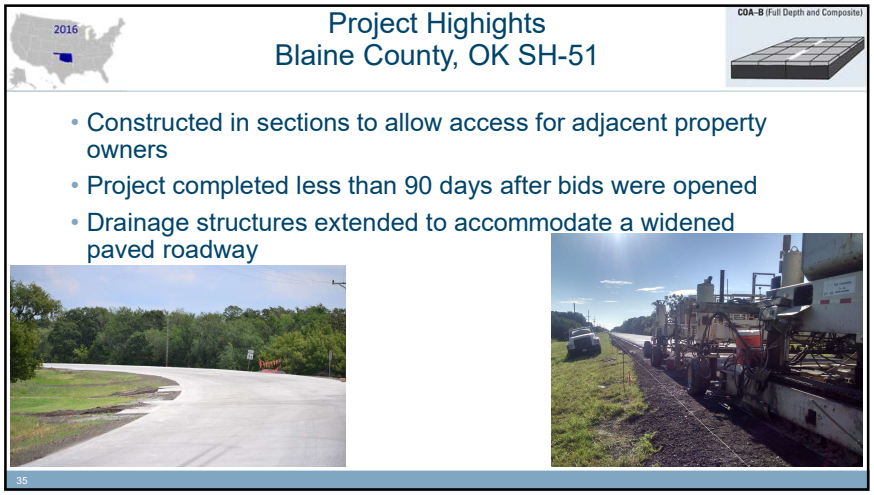
Project Highights
Moffat County, CO SH-13

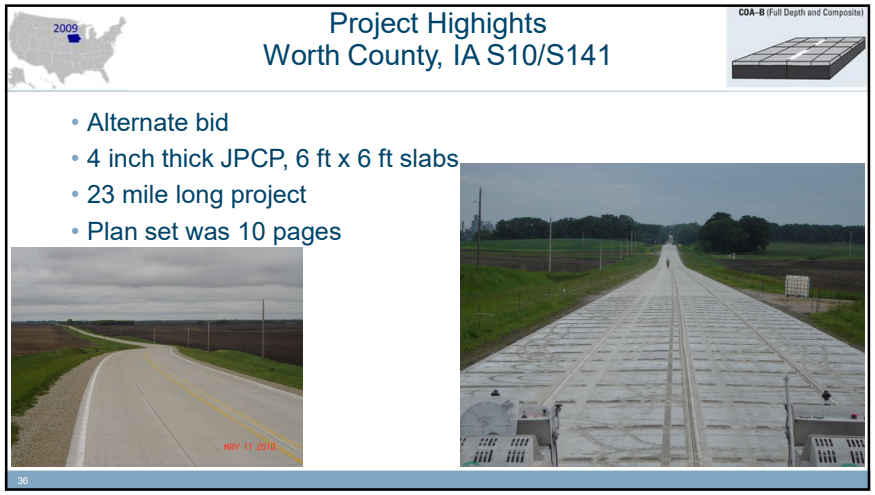


- Existing Asphalt
- Profile milled to optimize volume of concrete and final smoothness
- 6 inch thick JPCP, 6 ft x 6 ft slabs
- Alternate bid

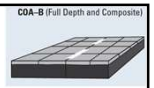

2016
COA–B (Full Depth and Composite)
Project Highights
Moffat County, CO SH-13
• Two-way traffic maintained with pilot car
• Project length = 6 miles
• Average IRI < 45 in/mile
33


2016
COA–B (Full Depth and Composite)
Project Highights
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)
34


2016
COA–B (Full Depth and Composite)
Project Highights
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
35

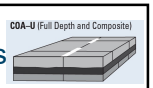

2009
COA–B (Full Depth and Composite)
Project Highights
Worth County, IA S10/S141
• Alternate bid
• 4 inch thick JPCP, 6 ft x 6 ft slabs
• 23 mile long project
• Plan set was 10 pages
36

Project Highights
Worth County, IA S10/S141

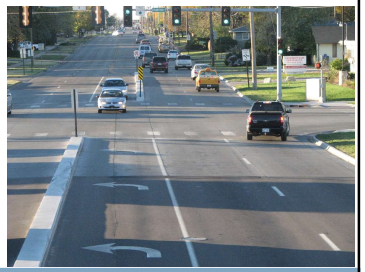


- No preoverlay repairs
- Roadway closed to through traffic
- Entire project opened to unrestricted traffic in 110 calendar days

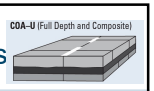
Project Highights
Saline County, KS Crawford and Ohio Streets



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



Project Highights
Saline County, KS Crawford and Ohio Streets

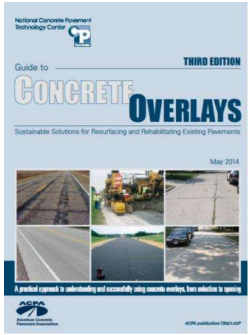


- Staged construction kept the intersection open
- Completed in 45 days


Before


After

Resources

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