

# Concrete Overlays – What's New and Different

Guide to Concrete Overlays, 4<sup>th</sup> Edition

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National Concrete Pavement  
Technology Center



## Things to Cover

- Chapter 1 Introduction
- Chapter 2 Evaluation of Existing Pavements and Selection of Concrete Overlay Options
- Chapter 3 Overview of Concrete Overlay Design
- Chapter 4 Concrete Overlays on Existing Asphalt-Surfaced Roads
- Chapter 5 Concrete Overlays on Existing Concrete Pavements
- Chapter 6 Materials and Mixtures
- Chapter 7 Plan Development
- Chapter 8 Construction of Concrete Overlays
- Appendices
- *History of Concrete Overlays in the United States*



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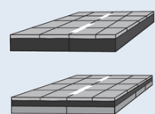
## Chapter 1

### Introduction

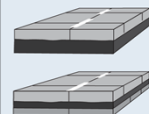
#### Concrete on Asphalt

Concrete on asphalt (COA) overlays can be designed to address a broad range of existing pavement conditions on both composite and full-depth asphalt pavements. Both bonded (COA-B) and unbonded (COA-U) options enable designs to cost-effectively match the condition of the existing asphalt—from deteriorated to good—as well as geometric parameters.

COA-B (Full Depth and Composite)



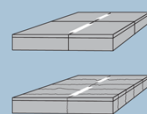
COA-U (Full Depth and Composite)



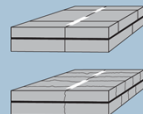
#### Concrete on Concrete

Concrete on concrete (COC) overlays can be designed for applications on both existing jointed plain concrete pavement (JPCP) and continuously reinforced concrete pavement (CRCP). The predominance of COC overlay designs are unbonded (COC-U) systems; however, bonded (COC-B) applications can be successful, provided the existing pavement is in good condition.

COC-B (JPCP and CRCP)



COC-U (JPCP and CRCP)



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## Chapter 2

### Evaluation of Existing Pavements and Selection of Concrete Overlay Options

- Determine the existing pavement type and condition
- Make a preliminary determination of the existing typical section layers and thicknesses
- Conduct an on-site review and evaluation
- Determine the need for milling and accommodating adjustments of the profile grade
- Validate the existing pavement condition – Coring and material testing
- Determine the feasibility of a concrete overlay and the appropriate overlay option



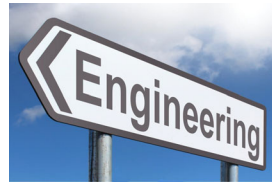
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### Chapter 3

#### Overview of Concrete Overlay Design

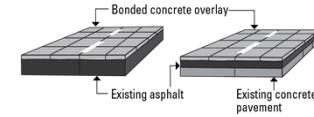
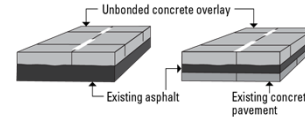
Four common procedures for designing concrete overlays are listed below:

- AASHTOWare Pavement ME Design
- ACPA Pavement Designer
- University of Pittsburgh's BCOA-ME
- University of Pittsburgh's UBOL Design v1.0



### Chapter 4

#### Concrete Overlays on Existing Asphalt-Surfaced Roads



### Chapter 5

#### Concrete Overlays on Existing Concrete Pavements



2007 before overlay in 2008      Route D, MO in 2020



Milling 2" of concrete      3 1/2" on I-70, KS in 2013

### Chapter 6

#### Materials and Mixtures

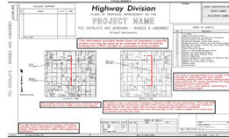
Concrete overlays are constructed with conventional concrete paving materials, which include cement, supplementary cementitious materials (SCMs), aggregate, water, chemical admixtures, dowel bars, tie bars, continuous steel reinforcing (for CRCP overlays), curing compounds, and joint fillers or sealants. They can also include macrofibers as well as separation layers.



## Chapter 7

### Plan Development

- Construction drawings for concrete overlays do not need to be complex. The location, geometric features, and maintenance of traffic requirements of a given overlay project should dictate the level of design detail that is required in the plans.
- For decades, asphalt overlay projects on rural roads have been successfully designed and constructed from a set of drawings consisting of a limited number of sheets. This same approach can be used for concrete overlays.



## Chapter 8

### Construction of Concrete Overlays

The total construction time required for a concrete overlay project is significantly shorter than that required for a roadway reconstruction project because limited quantities of earthwork and base materials are needed (or not needed at all) and concrete placement normally proceeds at a much faster pace.

Additionally, weather has fewer potential impacts on construction schedules. Projects can be opened to traffic within a short period of time with adequate planning, expedited staging, and efficient operations.

I-44  
MO  
2009



Uniontown  
PA  
2010



SH 13  
CO  
2016



## Included

- Appendix A Fundamentals of Concrete Overlay Design
- Appendix B Continuously Reinforced Concrete Pavement Overlays
- Appendix C Concrete on Concrete-Bonded Overlays
- Appendix D Staging Sequence Diagrams for Various Traffic Control Scenarios
- 93 References, 96 Figures, and 14 Tables
- Interactive pdf with links to other parts of the guide as well as pertinent documents.

## History of Concrete Overlays in the United States

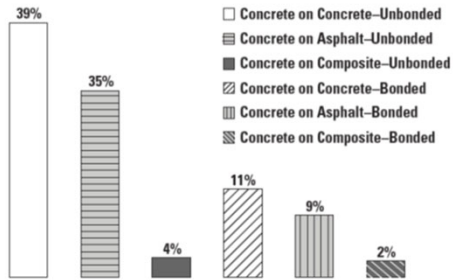


### Case history #3

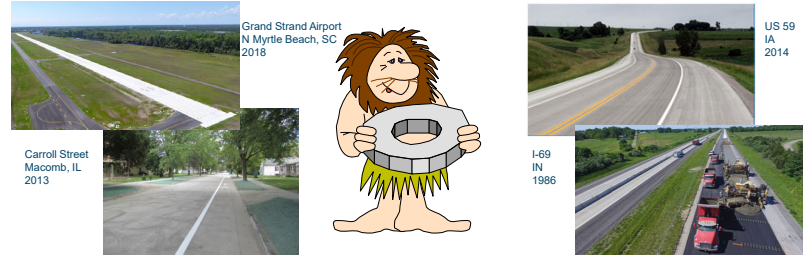
- CR 56 near Peru, Illinois
- 1974 5" w/thickened edge 7"
- Concrete on Asphalt – U
- Estimated ESALs 12.5 million
- 5 projects COA – B
- 2 projects COA – U
- 2 projects COA – B composite
- 2 projects COA – U composite
- 2 projects COC – B
- 2 projects COC – U
- 2 projects COC – U CRCP

### Unbonded – 78% Bonded 22%

National Concrete Overlay Explorer (ACPA 2020)



### Thank you for your time



[www.cptechcenter.org](http://www.cptechcenter.org)



## Concrete Overlays – What's New and Different



Value Proposition/Proven Technology

Tuesday, July 13, 2021

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## Concrete Overlays: Today's Talking Points

- The Challenges
- The Value Proposition
- Addressing Barriers to Implementation
- Getting Started
- Case Histories
- Resources



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## The Challenge to Pavement Owners

- Existing infrastructure is continually deteriorating
  - Weather
  - Traffic
- Demands are increasing
  - Traffic
  - Ride quality
  - Continuous access
- Funding is decreasing
  - Maintenance costs often exceed Agency revenue



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## Maintaining Existing Pavements

- We can toss them out and start again
  - A long term solution
  - Creates a disposal headache
  - 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
  - Effective
  - A shorter term solution



### Maintaining Existing Pavements

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



### Another Tool in the Toolbox

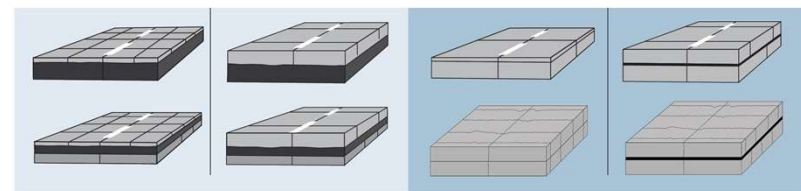
- Concrete Overlays - Concrete placed over an existing paved surface to:
  - Extend life
  - Restore ride
  - Increase capacity



### Concrete Overlays

Concrete on Asphalt

Concrete on Concrete

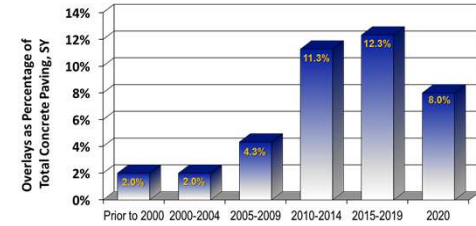


### Proven Applications for Concrete Overlays



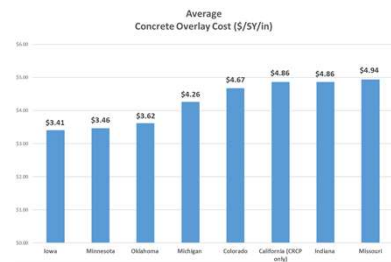
### The Value Proposition

- Costs
- Environmental impacts
- Resiliency
- Effectiveness



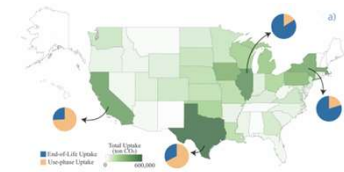
### Costs

- Initial costs depend on
  - Competition
  - Local contractor experience
  - Local materials availability
- Can be competitive with other solutions
- Annual ownership costs are reduced
  - Longer life
  - Less maintenance
- Overall network condition is raised



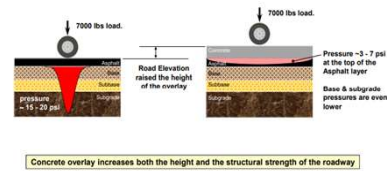
### Environmental Impacts

- 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<sub>2</sub>



## Resiliency

- Flooding saturates and weakens a pavement's underlying foundation
- Concrete overlays reduce the stress at the top of the asphalt layer
- Sensitivity to softening is reduced



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FHWA

## Effectiveness

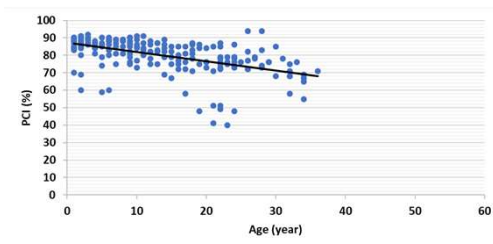
- A long history
  - As early as 1901
  - A number of overlays built in the 1970s remain in service today



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## Effectiveness

- Performance
  - Depends on thickness
  - Condition of existing layer
  - Detailing
  - Life can be up to 35 years



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## Effectiveness

- Versatility
  - Can be applied to all surface types
  - Many degrees of distress can be accommodated
  - Used for a range of applications:
    - Roadways
    - Streets and Intersections
    - Parking lots
    - Airfields



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SGL14

## Effectiveness

- Rapid Construction
  - Depends on preparation effort
  - Placement is fast with thinner sections



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## Effectiveness

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



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## Effectiveness

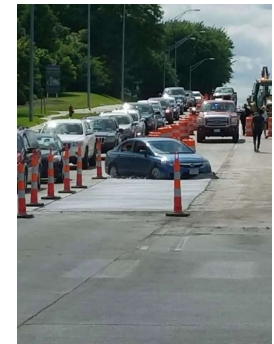
- New technologies improve everything
  - New design methodologies
  - Performance Engineered Mixtures (PEM)
    - Reduced CO<sub>2</sub> footprint
  - Stringless machine control
  - Larger paving machines
  - Vibrator monitoring
  - Real time smoothness
  - Fiber reinforcement



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## Effectiveness

- Safety
  - Reduced frequency of closures



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## Effectiveness

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



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## Challenges

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

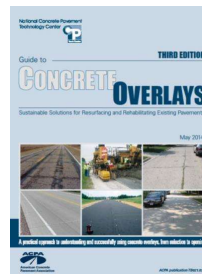
- *Change needs to come from above*



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## Challenges

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



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## 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*



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## Challenges

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



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## Challenges

- Traffic Management/Detour Options
  - *An overlay can be built faster than a reconstruct*
  - *Construction under traffic is possible*
- *Experience has proven that communication and planning are the key...*



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## Challenges

- Perceived Federal Funding Limitations

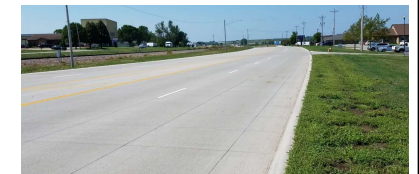
- *Concrete overlays can be considered preventative maintenance, qualifying them for use of federal aid funds.*



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## Getting Started

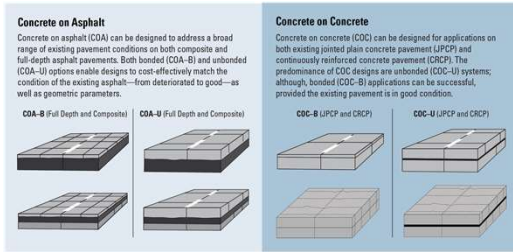
- Start with a simple project
- Get help
- Evaluate performance
- Build competency and confidence
- Integrate the process into a mix of fixes



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## The Process

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



The National Concrete Overlay Explorer [apps.acpa.org](https://apps.acpa.org)

1147 Items

658 results out of 1147 cannot be plotted.

Concrete Overlay Type

- 85 Bonded on Asphalt
- 33 Bonded on Composite
- 147 Bonded on Concrete
- 385 Unbonded on Asphalt

Application

- 700 Highway
- 164 Airport
- 148 Street/Road
- 87 NA

State

- 1 AB
- 3 AL
- 12 AR
- 6 AZ

Overlay Thickness (in.)

- 1 0 - 1
- 3 1 - 2
- 46 2 - 3
- 78 3 - 4

Year Constructed

## CP Tech Technical Guides on Overlays

