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
### 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

![Unbonded concrete overlay](image1)

Unbonded concrete overlay

Existing asphalt

Existing concrete overlay

1-35 OK 2004

SH 13 IA 2002

---

### Chapter 5

Concrete Overlays on Existing Concrete Pavements

![Unbonded concrete overlay](image2)

Unbonded concrete overlay

Existing concrete pavement

WMA or geotextile separation layer

Bounded concrete overlay

Bounded interface

Original concrete pavement

2007 before overlay in 2008

Route D, MO in 2030

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.

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)

- 39%
- 35%
- 4%
- 11%
- 9%
- 2%

Thank you for your time

www/cptechcenter.org
Concrete Overlays – What’s New and Different

Value Proposition/Proven Technology

Tuesday, July 13, 2021

Gordon L. Smith, P.E.
glsmith@iastate.edu

Concrete Overlays: Today’s Talking Points

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

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

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

- **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

<table>
<thead>
<tr>
<th>Applications</th>
<th>Urban Arterials</th>
<th>Rural Secondary Roads</th>
<th>Urban Freeway/Interstates</th>
<th>Airport Runways</th>
<th>Parking Lots</th>
</tr>
</thead>
</table>

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 CO₂
### 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

![Diagram showing the effect of concrete overlays](image)

### Effectiveness

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

![Image of a construction site](image)

### Effectiveness

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

![Graph showing performance](image)

### 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

![Image of a road project](image)
### Effectiveness

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

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

- **New technologies improve everything**
  - New design methodologies
  - Performance Engineered Mixtures (PEM)
    - Reduced CO₂ footprint
  - Stringless machine control
  - Larger paving machines
  - Vibrator monitoring
  - Real time smoothness
  - Fiber reinforcement

- **Safety**
  - Reduced frequency of closures
## Effectiveness

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

## 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

- Experience has proven that communication and planning are the key…

### 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 and confidence
- Integrate the process into a mix of fixes
The Process

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

CP Tech Technical Guides on Overlays

apps.acpa.org

National Concrete Pavement Technology Center

https://cptrchcenter.org
Advancing the Use of Concrete Overlays in California

July 13, 2021

Charles Stuart, SWCPA, cstuart@swcpa.org

Concrete Overlays: Timeline for implementation

- CP Tech Center offers support to Caltrans
- SWCPA and CNCA begin outreach on overlays
- Caltrans shows first real interest on a project
- Caltrans HQ asks CP Tech Center for support and initiate’s research at UCPRC
- First workshops and site visits, university research begins
- First low-traffic concrete overlays bid for I-10
- First CRCP overlays bid for I-10
- First high-traffic CRCP concrete overlay on asphalt bid for I-10

Concrete Overlays: Timeline for implementation

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- First low-traffic concrete overlays bid for SR 113 and SR 247
- First CRCP overlays bid for I-8
- First high-traffic CRCP concrete overlay on asphalt bid for I-10
Caltrans Concrete Overlay Projects, 1992-2021

<table>
<thead>
<tr>
<th>Dist.</th>
<th>Rt.</th>
<th>Pavement Type</th>
<th>Size (CY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D3</td>
<td>I-80 JPCP-COC</td>
<td>540,000</td>
</tr>
<tr>
<td>2</td>
<td>D3</td>
<td>SR-113 JPCP-CDA, Low traffic</td>
<td>12,700</td>
</tr>
<tr>
<td>3</td>
<td>D8</td>
<td>SR-247 JPCP-CDA, Low traffic</td>
<td>6,400</td>
</tr>
<tr>
<td>4</td>
<td>D11</td>
<td>I-8 CRCP-COC</td>
<td>250,000</td>
</tr>
<tr>
<td>5</td>
<td>D9</td>
<td>SR-14 CRCP-COC</td>
<td>110,000</td>
</tr>
<tr>
<td>6</td>
<td>D8</td>
<td>I-10 JPCP-CDA</td>
<td>500,000</td>
</tr>
</tbody>
</table>

I-80, Sierra Nevada Mountains
- Bid dates: 1992-2010
- Caltrans District 3
- 12 projects
- 540,000 CY of JPCP-COC

1992-2010 Concrete Overlay on Concrete (COC) projects
- Caltrans District 3
- I-80, Sierra Nevada Mountains
- 12 projects
- 540,000 CY of JPCP-COC
SR-113, Woodland, CA
- Bid date: 2018
- Caltrans District 3
- 12,700 CY of JPCP-COA, Low traffic
- Pilot project with research aspect
- 6X6x6 and 6x6x8 design

SR-247, Lucerne Valley
- Bid date: 2018
- Caltrans District 8
- 6,400 CY of JPCP-COA Low traffic
SR-247, Lucerne Valley
- Bid date: 2018
- Caltrans District 8
- 6,400 CY of JPCP-COA Low traffic

I-8, Imperial County to Arizona border
- Bid dates: 2017
- Caltrans District 11
- Two projects with a total of 250,000 CY of CRCP-COC

SR-14, Mojave, CA
- Bid date: 2018
- Caltrans District 9
- 110,000 CY of CRCP-COC
SR-14, Mojave, CA
- Bid date: 2018
- Caltrans District 9
- 110,000 CY of CRCP-COC

I-10, Desert Center to Blythe
- Bid dates: 2021-22
- Caltrans District 8
- Three projects with a total of 500,000 CY of JPCP-COA

Concrete Overlays: Next steps

- Continue supporting Caltrans through training
- Work with our partners through the EDC-6 TOPS initiative
- Develop standard structural sections for low traffic concrete overlays
- Analyze the sustainability benefits of concrete overlays
- Improve initial IRI smoothness and construction quality
- Communicate clearly and frequently about the many benefits
- Be thankful for exceptional collaborative partners!

Thank You!
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