Driving Innovation:
Portland Cement Concrete (PCC) Overlays

US 58 Concrete Overlay Open House
August 23, 2012
Franklin, Virginia

Sam Tyson
Federal Highway Administration

Kurt Smith
Applied Pavement Technology, Inc.
Presentation Overview

- Why Concrete Overlays
- Types of Concrete Overlays
- What’s Being Built On Route 58?
- Concrete Overlay Technology Transfer
- Some Recent Innovations
- Summary
Why Concrete Overlays?

- Long performance lives
- Low maintenance requirements
- Sustains heavy truck loadings
- Low life-cycle costs
- Versatile
- Sustainability considerations
Types of Concrete Overlays

- On Existing Portland Cement Concrete (PCC) Pavements
  - Bonded PCC overlays
  - Unbonded PCC overlays

- On Existing Hot-Mix Asphalt (HMA) Pavements
  - Bonded PCC Overlays (aka, thin and ultra-thin whitetopping)
  - Unbonded PCC overlays (aka, conventional whitetopping)
Concrete Overlay Families

Concrete Overlays

- **Bonded Family**
  - Existing PCC
  - Existing HMA
  - Existing HMA/PCC
  - Bonded to old pavement to help carry load
  - Thinner

- **Unbonded Family**
  - Existing PCC
  - Existing HMA
  - Existing HMA/PCC
  - Separated from old pavement to isolate distress
  - Thicker

- **Existing pavement in good condition**
- **Existing pavement in fair to poor condition**
Overlay Interface Bonding

**Bonded**
- Two layers approach single-slab behavior

**Unbonded**
- Two layers act independently from one another
General Applicability of Concrete Overlays
Nationwide Experience

- Technology dates back nearly 100 years
- Favorable performance under a range of conditions (e.g., CO, IA, IL, KS, MI, MN, MO, OK, PA, UT, WI)
- Significant recent uptick in concrete overlay use (since mid-1990s)
  - Proven performance
  - Versatility
  - Cost effectiveness
  - Improved guidance
Virginia Has Experience!

- 1920s: Virginia’s 1st PCC OL on existing PCC
- 1930s thru 1980s: Some unbonded PCC OLs (primarily airports)
- 1990: Bonded PCC OL (US-13 in Northampton County)
- 1995: Bonded PCC OL (I-295 near Richmond)
- 1995: Bonded PCC OL (I-85 near Petersburg)
- 1999: UTW on Rt. 29N (S. of Charlottesville)
- 2008: Unbonded PCC OL on HMA, Newport News (two projects)
Service Life Expectations

- Concrete overlay thicknesses of 4-6 inches: 15+ years
- Concrete overlay thicknesses > 6 inches: 20 to 40+ years
- But depends on a number of factors:
  - Structural design
  - Existing pavement condition
  - Current and future traffic levels
  - Materials
  - Construction
What’s Being Built on Route 58?

- Two Designs:
  - 4 inch bonded PCC on PCC
  - 7 inch unbonded PCC on PCC
- Existing PCC is a continuously reinforced concrete pavement (CRCP)
Bonded PCC/PCC Overlays

- 3 to 5 in PCC
- Bonded to existing PCC (monolithic behavior)
- Pavements in relatively good condition
- Increases structural capacity and rideability
Bonded PCC/PCC

Existing concrete pavement with surface distresses

Monolithic pavement with new concrete surface

Prepared surface

Cleaning

Sub-drainage

Full-depth patch

Deteriorated partial-depth patch

Random cracking

Spalling

Scaling
Unbonded PCC/PCC Overlays

- 7 to 12 in PCC
- Separated from underlying PCC
- Minimal surface preparation
- Virtually any PCC pavement type and condition
Unbonded PCC/PCC
Concrete Overlay Technology Transfer

- Support the effective use of concrete overlays by highway agencies through:
  - Technical information
  - Guide documents
  - Workshops
  - Field visits
  - Demonstrations
FHWA Concrete Overlays Program

- Joint effort with CPTech Center (Ames, IA)
- Goal: Advance concrete overlay technology
- Available Documentation:
  - Guide to Concrete Overlays
  - Design of Concrete Overlays (Tech Summary)
- Outreach Activities
  - Field applications program
  - Workshops (also through FHWA ACPT)
Guide to Concrete Overlays

- September 2008
- Topics
  - Overlay Types
  - Project Evaluation
  - Overlay Design
  - Materials Selection
  - Work Zones
  - Overlay Construction
  - Specifications
  - Repairs

Design of Concrete Overlays (Technical Summary)

- July 2011
- Topics
  - Overlay Types
  - Background of Design Methods
  - Bonded Design Approaches
  - Unbonded Design Approaches
- Complete report expected late 2012

Field Applications Program

- Assistance to highway agencies in concrete overlay process
  - Initial site review and selection
  - Pavement evaluation
  - Design review
  - Specification review
  - Construction support
- FHWA mobile lab
- Funding for demonstration projects
- Construction assistance to over 8 SHAs, with technical outreach to 10+
American Concrete Pavement Association

- Technical publications on
  - Bonded Concrete Overlays (PCC/PCC)
  - Unbonded Concrete Overlays (PCC/PCC)
  - Whitetopping Overlays (PCC/HMA)
  - Thickness Design for UTW (PCC/HMA)

- National Concrete Pavement Explorer
  - Concrete overlay projects nationwide
  - Overlay type and some construction & performance data

www.acpap.org/webapps/overlayexplorer/index.html
Turn Lane Whitetopping -- J. Clyde Morris Blvd @ Thimble Shoals
Type of Overlay: Unbonded on Asphalt
Application: Street/Road
Constructed in 2008 in Newport News, VA
Contractor: Denton Concrete Services
Engineer: Bob Long
Owner: City of Newport News

New Construction Details
Thickness: 6 in.
Project Size: 560 square yards
Joint Spacing: 6 ft
Doweled Joints: No
Joints Sealed: No
Interlayer Material: None
Integral Widening Constructed with Overlay: NA
Opening Strength: 2000 psi
Opening Time: 24 NA
Reinforcing: NA
Existing Pavement Type: Asphalt

Current Conditions
Still in Service: Yes
Current Condition: Excellent condition -- no repairs.
Last Condition Rating: N/A
Some Recent Innovations

- Mich DOT: Thin, unbonded PCC OL of composite pavements
- IL DOT: Use of structural fibers in thin PCC OL
- Mo DOT (& others): Fabric interlayers
- IA DOT: Stringless PCC OL paving
- Mn/Road: Pervious PCC OL
Summary

- PCC overlays offer a long-lasting, low maintenance sustainable rehabilitation solution
  - Bonded Solutions
  - Unbonded Solutions
- Each a unique structure with specific applications and design/construction considerations
- A number of resources available
- New innovations being evaluated
THANK YOU!

Sam Tyson, FHWA
Sam.Tyson@dot.gov

Kurt Smith, APTech
ksmith@appliedpavement.com