Best Practices for Concrete Overlays

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Concrete Overlay Families

Concrete Overlays

- Bonded Family
- Unbonded Family

Existing PCC
Existing HMA
Existing HMA/PCC

Bonded to old pavement to help carry load
Separated from old pavement to isolate distress
Existing pavement in good condition
Existing pavement in fair to poor condition

Concrete Overlays in VA (courtesy David Kaulfers)
- 1920s: Virginia's first PCC overlay on existing PCC
- 1930s thru 1980s: Some unbonded PCC overlays (primarily airports)
- 1990: Bonded PCC overlay on US-13 in Northampton County
- 1995: Bonded PCC overlay on I-295 near Richmond
- 1995: Bonded PCC overlay on I-85 near Petersburg
- 1999: UTW on Rt. 29N south of Charlottesville

BONDED OVERLAY FAMILY
- PCC/ PCC
- Thin and Ultra-Thin Whitetopping

Bonded PCC/PCC
- 3 to 4 in PCC
- Bonded to existing PCC (monolithic behavior)
- Aggressive surface preparation
- Increases structural capacity and rideability

Feasibility
- Pavements in good condition with need for:
  - Increased structural capacity
  - Improved surface characteristics
- Unsuitable candidates:
  - Pavements with structural deterioration
  - Pavements with moderate/severe MRD
Key Considerations

- Pre-overlay repair (as needed)
- Effective surface preparation
- Overlay joints match those in underlying pavement
- Effective timing and sawing of transverse & longitudinal joints
  - Through entire overlay thickness + ½ inch
- Effective curing

Surface Preparation

- Needed to ensure monolithic behavior
- Process:
  - Mechanical preparation (generally shotblasting or sandblasting)
  - Surface cleaning (e.g., airblasting)

Bonded PCC/PCC

Matching of Joints

Within 1 inch

New Joints

Cut through entire depth of overlay

Existing PCC Paving

Existing Joints

Performance

- Mixed performance
- Extensive use in TX and IA
- Performance issues:
  - Inappropriate use (too far deteriorated)
  - Effective bond
  - Joint details
- Virginia projects:
  - US 13: 3.5 in PCC / 8 in JPCP (1990)

Thin and Ultra-Thin Whitetopping (TWT/UTW)

- UTW
  - 3 to 4 in
  - 3 to 6 ft slabs
  - Possible fibers
- TWT
  - 4 to 7 in
  - 6 x 6 panels

Feasibility

- TWT (moderately loaded routes)
  - State/county hwys
  - Secondary routes
  - Collectors
- UTW (lightly loaded routes)
  - City streets
  - Urban intersections
  - Parking lots

Pavements in relatively good condition and with structural integrity
### Key Considerations
- Pre-overlay repair (as needed)
- Effective surface preparation
- Joint design
  - Maximum panel spacing: 12 to 15 * D
  - Avoid placement in wheel paths
- Effective timing and sawing of joints
- Effective curing

### Surface Preparation
- Milling HMA surface
  - Remove rutting
  - Restore profile
  - Enhance bond
- Minimum HMA thickness remaining after milling: 3 to 5 in
- Surface cleaning (e.g., airblasting)

### Milled Surface
- Removal of HMA surface
  - Remove rutting
  - Restore profile
  - Enhance bond
- Minimum HMA thickness remaining after milling: 3 to 5 in
- Surface cleaning (e.g., airblasting)

### Longitudinal Joint Layout
- 2 ft x 2 ft
- 3 ft x 3 ft
- 4 ft x 4 ft
- 6 ft x 6 ft

### Performance
- **TWT:** Good performance
  - CO and IL
- **UTW:** Fair-to-good performance
  - TN, KS, KY
- Performance issues:
  - Proper application
  - Effective bond
  - Effective joint design (layout)
- Virginia Project (1995)
  - Experimental UTW on Rt. 29N
  - Various thicknesses and fiber usage

### Colorado TWT Experience
- Early 1990s
- 6 x 6 x 6 design
- Conventional concrete mixture
- Milled and cleaned HMA surface
- No dowels
- Deformed tie bars across longitudinal joints
- Single cut, sealed joints (silicone)
UNBONDED OVERLAY FAMILY

- PCC/ PCC
- Conventional Whitetopping

Unbonded PCC Overlays

- 8 to 12 in PCC
- Separated from underlying PCC
- Minimal surface preparation
- Virtually any PCC pavement type and condition

Feasibility

- PCC pavements in poor to fair condition
- Any traffic level
- Any existing PCC pavement type
- Site factor considerations
  - Lane-closure time
  - Overhead clearances
  - Shoulders

Key Considerations

- Limited pre-overlay repair required
- Placement of separator layer
- Joint design
  - Spacing < 21 * D (max 15 ft)
  - No need to match joints (offset if practical)
  - Dowel as for conventional pavements

Separator Layer

- Isolates overlay from existing pavement
  - Prevents reflection cracking
  - Prevents mechanical interlocking
- Provides level surface for overlay construction
- Recommended interlayer material:
  - 1-2 inch dense-graded HMA

Performance

- Generally good performance
- Extensive use by many highway agencies (e.g., IA, MI, MN, CO)
- Performance issues:
  - Adequate separator layer
  - Adequate structural design
  - Effective joint design
- Virginia: No recent experience
Conventional Whitetopping

- Slabs > 6 in thick
- Placed directly on HMA pavement (little preoverlay repair)
- Designed as a new PCC pavement (assuming no bonding)

Feasibility

- Badly deteriorated HMA pavements
- Any traffic level
- Site factor considerations
  - Lane-closure time
  - Overhead clearances
  - Shoulders

Key Considerations

- Localized pre-overlay repair
- Limited surface preparation
  - Milling if significant distortions
- Joint design
  - Spacing < 21 * D (max 15 ft)
  - Dowel as for conventional pavements

Performance

- Good to excellent performance
- Extensive use in Iowa, Nevada, California, Texas
- Performance issues
  - Uniform support
  - Effective joint design
- Virginia: no recent experience

Summary

- PCC overlays offer a long-lasting, low maintenance rehabilitation solution
  - Bonded Solutions:
    - On existing PCC
    - On existing HMA (TWT/UTW)
  - Unbonded Solutions
    - On existing PCC
    - On existing HMA (whitetopping)
- Each a unique structure with specific applications and design/construction considerations