

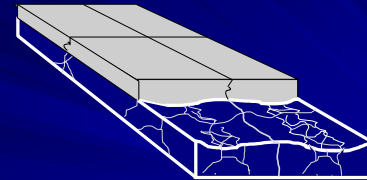
## Why Concrete Overlays?

- Long performance lives (20 to 40+ years)
- Low maintenance requirements
- High load-carrying capacity
- Withstands heavy truck traffic
- Low life-cycle costs
- Can be used over deteriorated asphalt and concrete pavements

## Types of PCC Overlays

- On Existing PCC Pavements
  - Bonded PCC overlays
  - Unbonded PCC overlays
- On Existing HMA Pavements
  - Conventional whitetopping (CWT)
  - Thin whitetopping (TWT)
  - Ultra-thin whitetopping (UTW)

## Whitetopping...what is it???

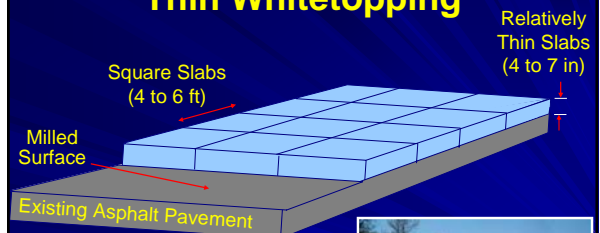


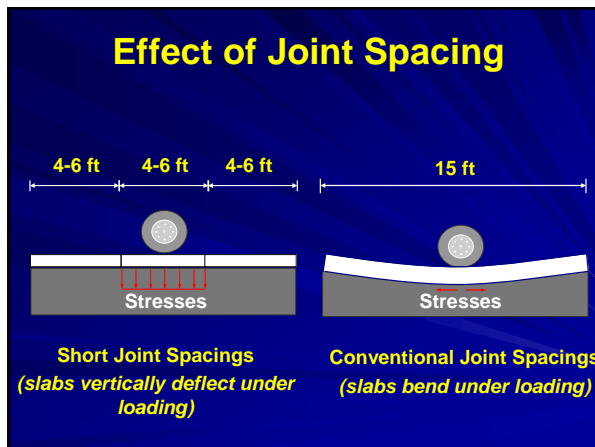
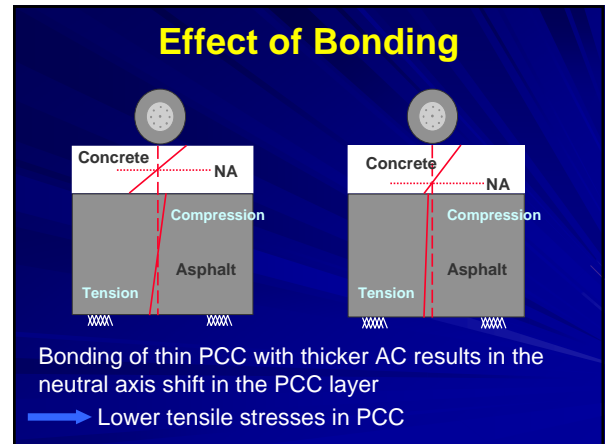
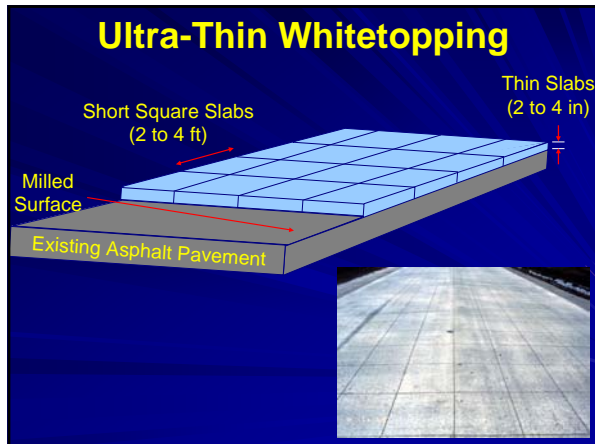
Bonded Concrete Resurfacing of Asphalt Pavements

## Definitions

- Thin Whitetopping
  - 4 to 7 inch slab thickness
  - 4 to 6 ft panel size (typ. 6 x 6)
  - Bonded to milled asphalt pavement
- Ultra-Thin Whitetopping
  - 3 to 4 inch slab thickness
  - 2 to 6 ft panel size
  - Bonded to milled asphalt pavement

## Thin Whitetopping



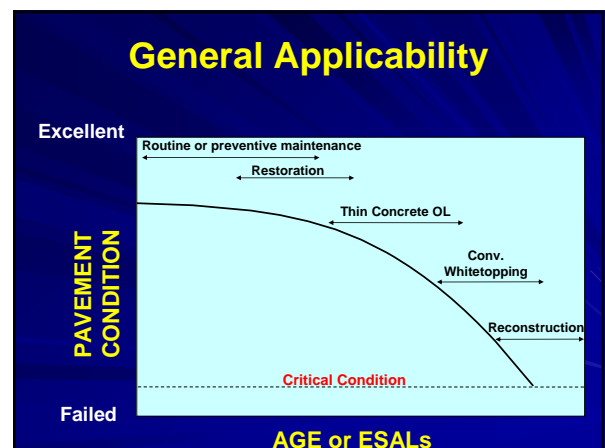


### Applications

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

### Feasibility

- HMA pavements with structural integrity
  - Limited structural (fatigue) cracking
  - No stripping/raveling in HMA layers
  - HMA thick > 3 to 5 inches (after milling)



### Thickness Design

- Current AASHTO design procedures do not apply
- Interim procedures available that account for traffic, HMA thickness, slab size, PCC strength
  - TWT: Colorado DOT
  - UTW: ACPA Interim Procedure



### TWT Thickness Design (Colorado Procedure)

- Mechanistic-based fatigue analysis of both PCC and HMA layers
- Based on instrumented test sections
- Inputs:
  - PCC thickness
  - PCC strength
  - Joint spacing
  - k-value
  - HMA thickness
  - HMA stiffness
  - ESAL or Axle Loading



### UTW Thickness Design (ACPA Example Chart)

(Medium Traffic,  $k=100$ )

Allowable Number of Trucks (in thousands)

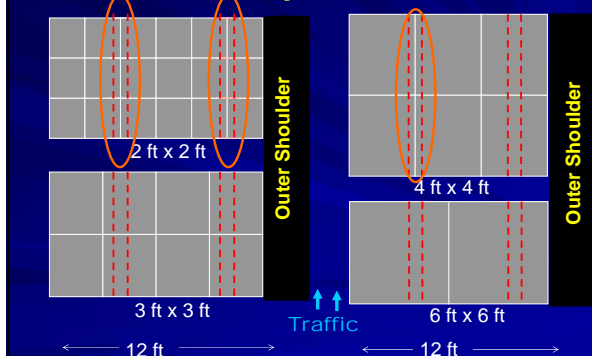
PCC MR, psi	HMA Thick, in	UTW Thickness, in					
		2		3		4	
		Joint Spacing, ft					
700	3	NR	29	1	38	8	136
	4	15	90	43	122	98	299
	5	90	228	168	301	273	593
	>6	259	529	428	672	639	1181

### Joint Design

- TWT
  - Maximum spacing of 12 to 15 \* D (6 x 6 ft common)
  - Dowels for pavements with heavier truck traffic (> 6 in)
  - Some agencies include tie bars at longitudinal joints
- UTW
  - Maximum spacing of 12 to 15 \* D
  - No dowels (aggregate interlock)



### Longitudinal Joint Layout



### PCC Mix Design


- TWT
  - Conventional PCC mixes (or fast-track as required)
- UTW
  - Often high strength mixes (low w/c + high cement contents)
  - Smaller top size aggregate ( $\leq 0.75$  inch)
  - Synthetic fibers (polypropylene, polyethylene) sometimes used

### Surface Preparation

- Localized repairs
- Milling HMA surface
  - Remove rutting
  - Restore profile
  - Enhance bond
- Minimum HMA thickness remaining after milling: 3 to 5 in
- Surface cleaning



### Milled Surface



### Surface Cleaning



Air Blasting

Power Sweeping

Water Blasting


### PCC Placement and Finishing

- Same as conventional PCC paving
  - Slipform
  - Fixed form
- Avoid surface contamination
- Minimal hand work




### Texturing

- Important for surface friction and noise
- Performed immediately after bleedwater sheen disappears
- Methods
  - Low speed facilities
    - Burlap/turf drag or brooming
  - High speed facilities
    - Tining (transverse or longitudinal)



### Curing

- Very important due to high surface-area-to-volume ratio
- Liquid curing compounds commonly used
  - Application rate of 100 ft<sup>2</sup>/gal
  - Apply to surface and all exposed edges
- Additional measures may be warranted for special conditions



## Joint Sawing

- Timing critical
- Sufficient sawing crews required
- Depths: 1 inch to D/3
- Narrow joint widths (1/8 in)
- Joint sealing in accordance with local practices



## Completed Projects



UTW  
Iowa

TWT  
Illinois



## Colorado TWT Experience

- Early 1990s
- 6 x 6 x 6 design
  - (6 inch slabs with 6 ft by 6 ft panels)
- Conventional concrete mixture
  - 4200 psi at 28 days
  - 0.44 w/cm
  - 4 to 8% air
- Milled and cleaned HMA surface
- No dowels
- Deformed tie bars across longitudinal joints
- Single cut, sealed joints (silicone)

## Completed TWT Projects (CO)



S.H. 119 – Longmont, CO

Parker Av. A, Denver, CO - 1997

## Performance

- TWT
  - Good performance (CO projects)
- UTW
  - Fair-to-good performance
  - UTW with thicker slabs perform better
- Key factors affecting performance:
  - Proper application (traffic, pavement condition)
  - Effective bond
  - Effective joint design (layout)

## Summary

- Thin concrete overlays of existing HMA
  - Relatively new technology
  - Significant recent usage
  - Short-term performance promising
- Key items contributing to performance:
  - Bond
  - Short and properly spaced joints
  - Adequate HMA thickness and condition

**For More Information...**

The collage features several technical documents and brochures:

- NCI SYNTHESIS**: A document with a red and white cover, featuring a landscape image and the text "A Synthesis of".
- CPTP ULTRATHIN and**: A document with a blue and white cover, featuring a landscape image and the text "CPTP ULTRATHIN and".
- guide to CONCRETE**: A document with a blue and white cover, featuring a landscape image and the text "guide to CONCRETE".
- Thin Whitening - the Colorado Experience**: A document with a blue and white cover, featuring a landscape image and the text "Thin Whitening - the Colorado Experience".