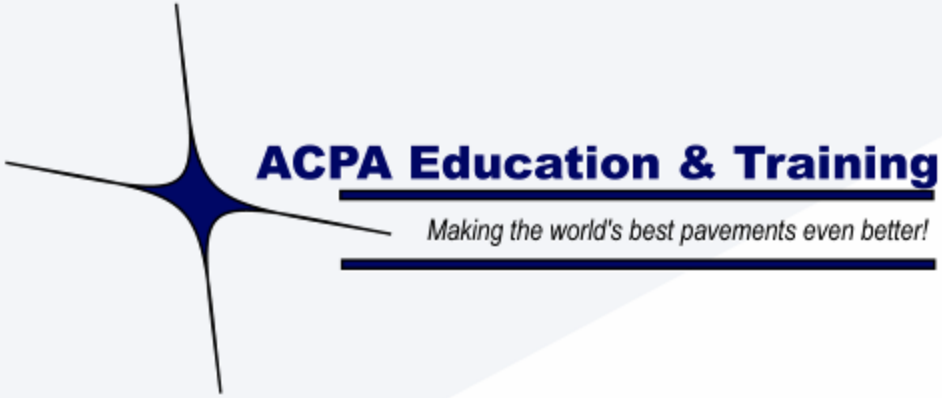
# Concrete Overlays and Inlays




**Southeastern States Pavement Management and Design Conference**
**New Orleans, LA May 11-13, 2009**

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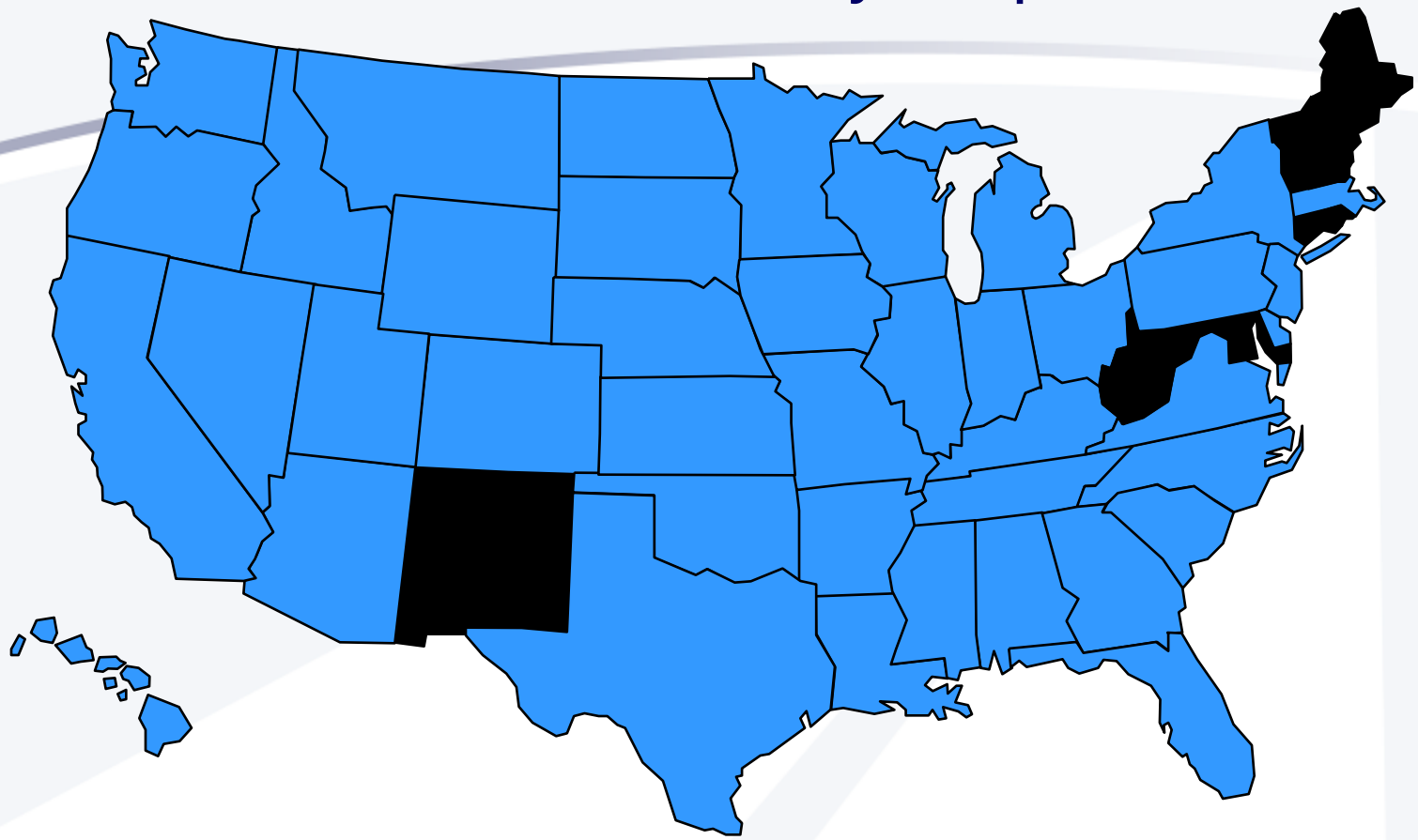
# States with Concrete Overlay Experience



With concrete overlay experience (mainly overlays on asphalt)

With little known concrete overlay experience

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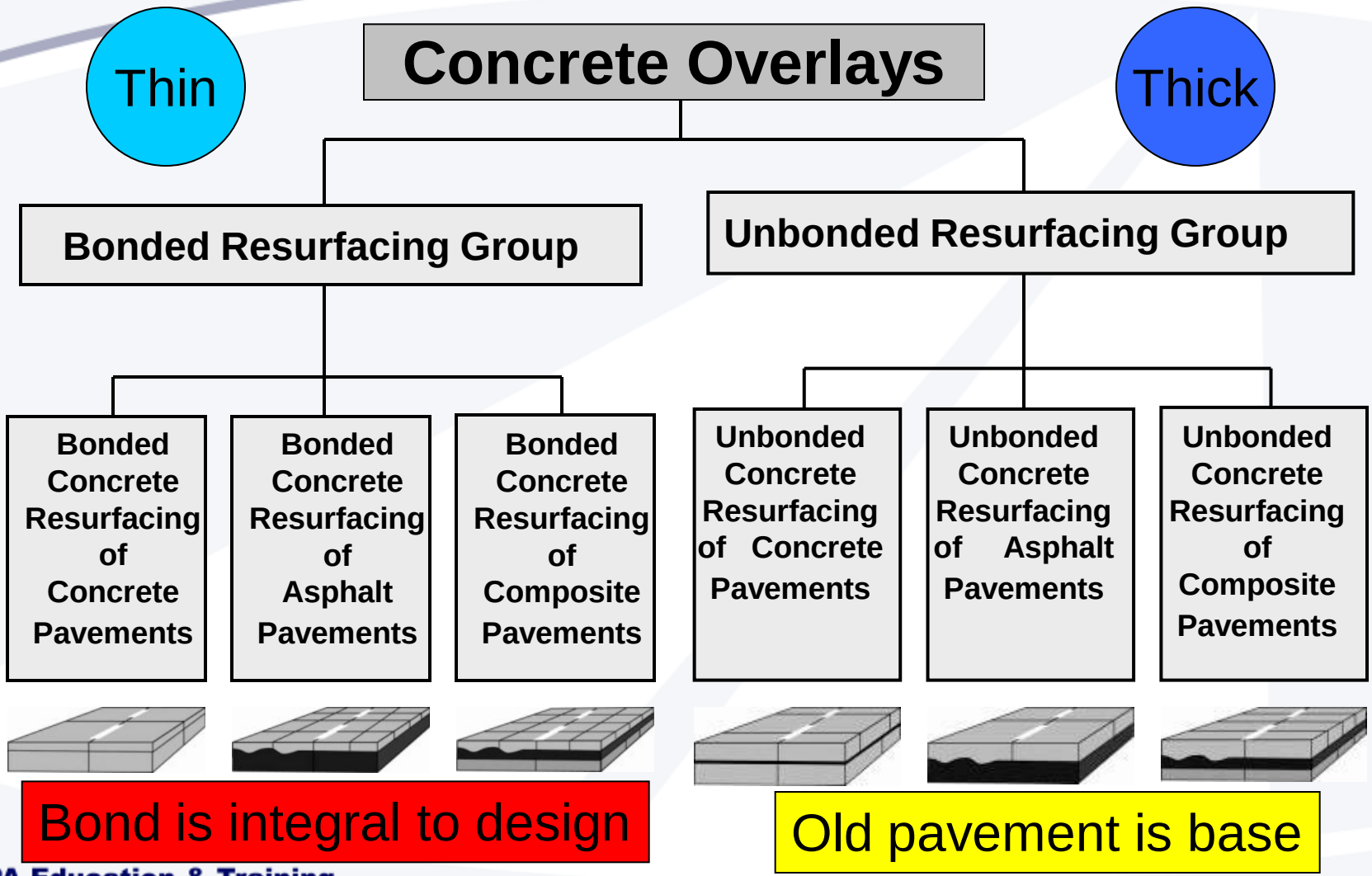
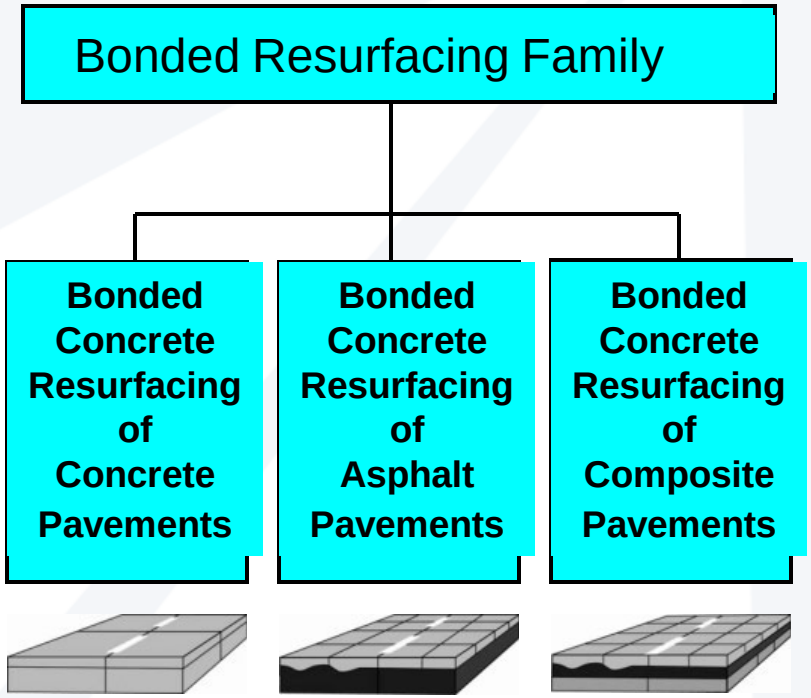
# Classes of Concrete Overlays



# Bonded Resurfacing Family

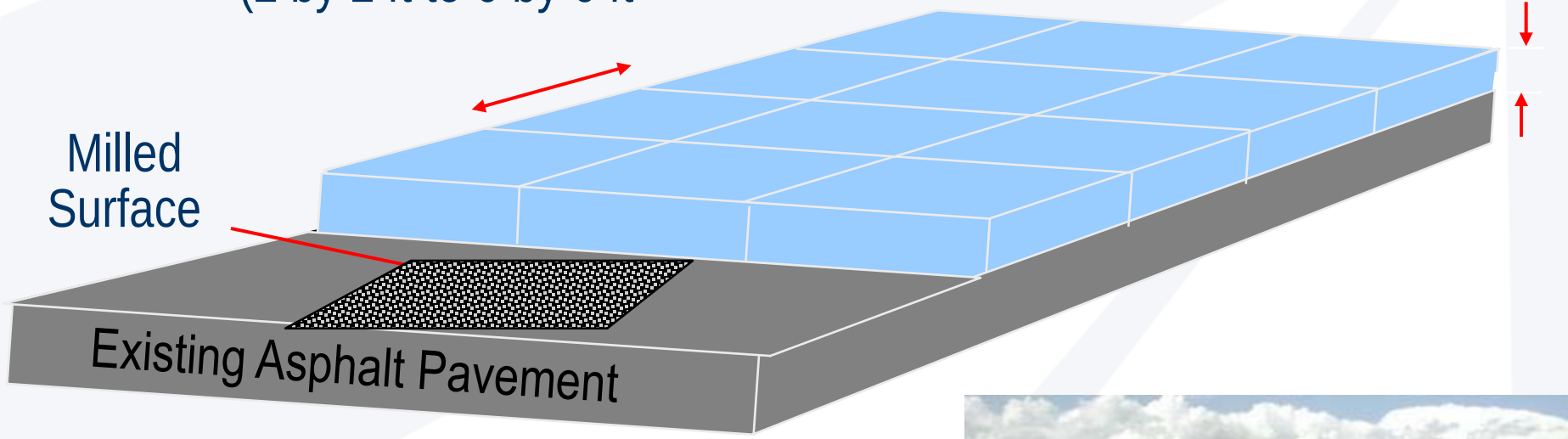
- Thin overlays (2” – 5”).
- Constructed over concrete, asphalt, and composites.
- Bond is critical!



# Feasibility

- HMA pavements with reasonable structural integrity.
  - Limited structural (fatigue) cracking.
  - No stripping or raveling in HMA layers.
  - HMA thickness after milling > 3 in to 4 in.
- Rutting in HMA layers is ok.
- Non-load associated cracking is ok.

# Thin Bonded Concrete Overlays of Asphalt Pavements



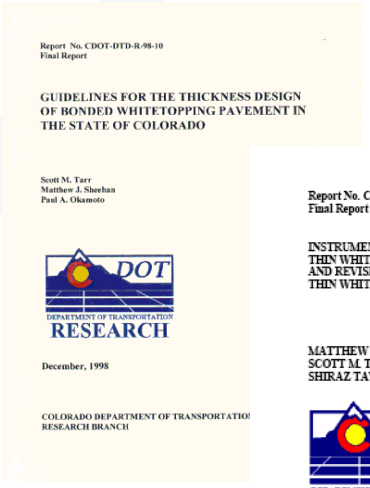

# Ultra-Thin Whitetopping
# Savannah (2001 ±)

# US 80/SR25 Chatham Co – June 2004


COLUMBIA, SC  Blossom & Assembly

# Research – mid 1990's to 2004

- Instrumented test sections
- Developed practical Guidelines for Design & Construction of UTW and TWT
  - Design rationale: ADT, MR, E, k-value, etc.
  - Optimum thickness
  - Joint spacing
  - Treatment of the existing surface
  - Use of dowel and tie bars


Report No. CDOT-DTD-R-98-10
Final Report

GUIDELINES FOR THE THICKNESS DESIGN OF BONDED WHITETOPPING PAVEMENT IN THE STATE OF COLORADO

Scott M. Tarr
Matthew J. Sheehan
Paul A. Okamoto

DOT
DEPARTMENT OF TRANSPORTATION
RESEARCH

December, 1998

COLORADO DEPARTMENT OF TRANSPORTATIO
RESEARCH BRANCH


Report No. CDOT-DTD-R-2004-12
Final Report

INSTRUMENTATION AND FIELD TESTING OF THIN WHITETOPPING PAVEMENT IN COLORADO AND REVISION OF THE EXISTING COLORADO THIN WHITETOPPING PROCEDURE

MATTHEW J. SHEEHAN
SCOTT M. TARR
SHIRAZ TAYABJI

DOT
DEPARTMENT OF TRANSPORTATION
RESEARCH

AUGUST 2004

COLORADO DEPARTMENT OF TRANSPORTATION
RESEARCH BRANCH

# CDOT Recommendations

- Min. AC thickness after milling = 5 in.
- Need good bond between AC and PCC
- Preferred Design (Colorado after 2000)
  - TWT – 5 or 6 in. thick & 6 x 6 ft joint spacing
  - Deformed tie bars at longitudinal joints
  - Dowels not necessary
  - Fibers not necessary
- TWT viable rehab for ACP using LCCA

# Parker Road TWT Project
## May-November, 2004

- 6 lanes, ~ 2 miles (6x6x6)
- ADT – 52,000 vpd
- LCCA performed
- Total cost: ~$5,000,000
- Concrete cost: ~$2.1 million

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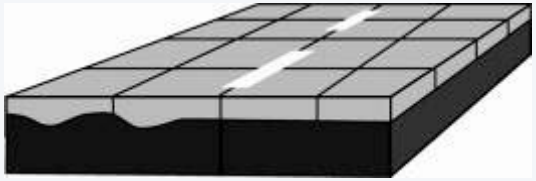
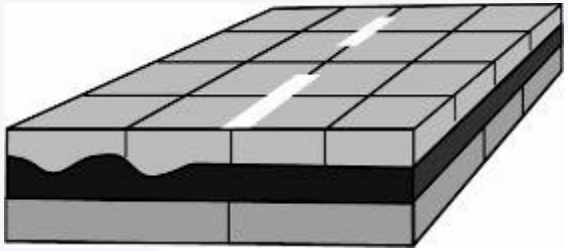
# Project Specification

- Design
  - TWT thickness: 6 inches
  - Cross slope correction to 2%
- Concrete:
  - 1.5 inch Aggregate
  - 28 Day Compressive Strength = 4,200 psi
  - 4 to 8% Air Content
- 6 x 6 ft Joint Spacing
  - #4 epoxy coated tie bars at the longitudinal joints @ 30 in.
  - Single cut and silicone sealed

Paving width – 36 ft

# Bonded Concrete Overlays of Asphalt/Composite Pavements - Keys to Success

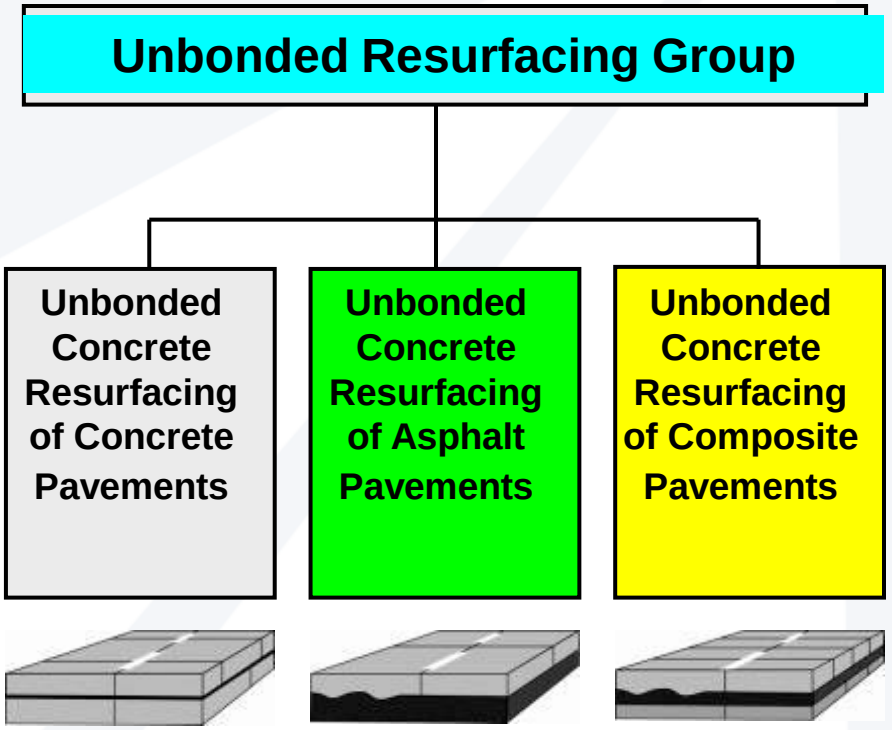




- Bonding is critical.
- Small square panels reduce curling, warping, & shear stresses at bond (1 to 1.5 times thickness).
- Mill if necessary to correct crown, remove surface distresses, improve bonding. Be sure to leave 3" of HMA after milling.
- HMA surface temperature below 120 F before paving.
- Transverse joints must be sawed T/3.
- Joints in the overlay should not be placed in wheel paths, if possible.
- Application of curing compound or curing methods must be timely and thorough.

# Unbonded Resurfacing Family

- Thicker overlays than bonded.
- Constructed on existing concrete, asphalt, or composite pavements.
- Bond is not considered in the design. However, some bonding still exists.

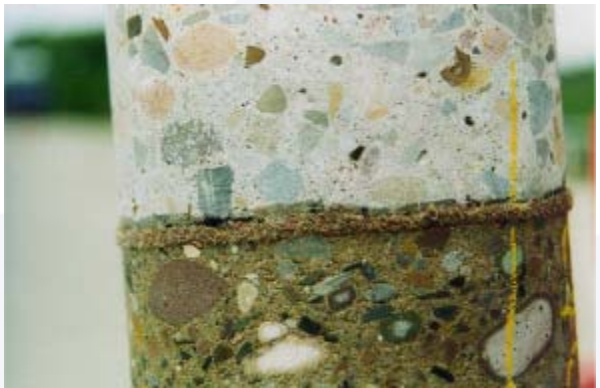


# Uses and Advantages - Unbonded Concrete Overlays

- Typically used when existing pavement is significantly deteriorated:
  - Severe rutting.
  - Potholes.
  - Alligator cracking.
  - Shoving and pumping.
  - Exhibits past D-cracking and ASR.
- Used when underlying pavements and subbase are stable and uniform except for isolated areas (minimal pre-overlay repairs).

# Separator Layer

- Required for good performance.
  - Isolate overlay from existing pavement:
    - Prevent reflection cracking.
    - Prevent bonding/mechanical interlocking.
  - Provide level surface for overlay construction.
- Recommended interlayer material:
  - 1-2 inch dense-graded HMA.
  - GEOTEXTILE ?? (Missouri Demo – Sept 2008).



# I-85 Anderson County, SC

- Constructed 1963
  - 9 inches Jointed Plain Concrete
  - 25 foot joint spacing w/o load transfer
  - Asphalt shoulders
- First rehabilitation 1978
- Second rehabilitation 1991
- By 1996, distress was at very high levels

# I-85 Anderson County, SC

- 1998 - Funding shortage, decided to rubblize northbound lane only
  - ADT = 38,000, 35% trucks
  - Assumed rubblized structural coefficient = 0.30
  - Overlay thickness = 8 inches

# I-85 Anderson County

- Massive problems:
  - No traffic without two lifts on rubblized PCC
  - Extended lane closures
  - Post-rubblized deflections in excess of 100 mils
  - Overlay increased from 8 to 12 inches
  - Reconstruction between bridges
  - 6 mile traffic jams, numerous complaints
  - Chain collision accident with multiple fatalities


I-85 SC 9-26 N from 81

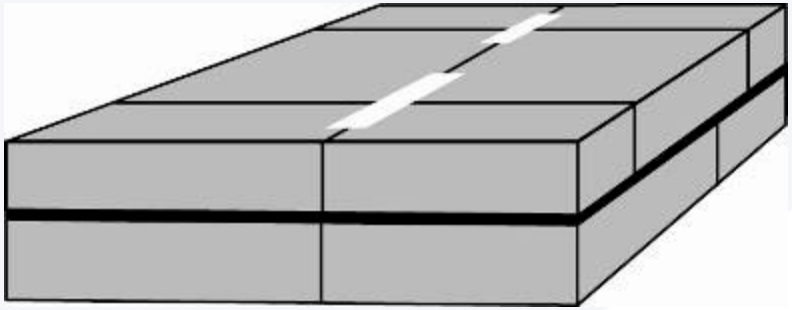
# I-85 Anderson County

- What to do for the southbound lane?
  - Condition was very poor
  - No suitable detour available
  - Traffic volumes justified widening from four to six lanes
  - Decided to do unbonded concrete overlay

# I-85 Anderson County

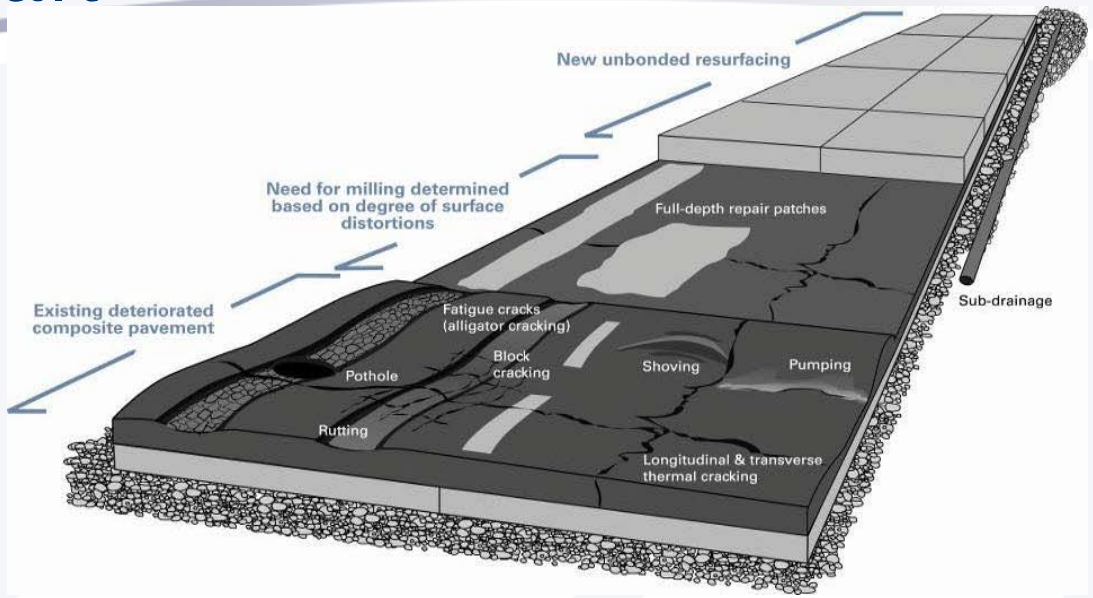
- Project let February 13, 2001
- A+B bid prices
- Low bidder – Lane Construction
  - A = $60,945,869.20
  - B = $4,117,500.00
  - Total = $65,063,369.20

# Unbonded Concrete Overlays of Concrete Pavements - Keys to Success



- Full-depth repairs are required only where structural integrity is lost at isolated spots.
- Separator layer (normally 1” asphalt) is important to isolate unbonded overlay from underlying pavement and minimize reflective cracking.
- With heavy truck traffic, adequate drainage design may be important to reduce pore pressure in asphalt separation layer.
- Faulting of 3/8 in. or less in the existing concrete pavement is not a concern when asphalt separation layer is 1 in. or more.
- Shorter joint spacing helps minimize curling and warping stresses. Transverse joints at 1.5 times thickness for <6” and 2 times thickness 6” or greater up to 15’.
- No need to match joints with those of the underlying concrete pavement.

# Unbonded Concrete Overlays of Asphalt and Composite Pavements

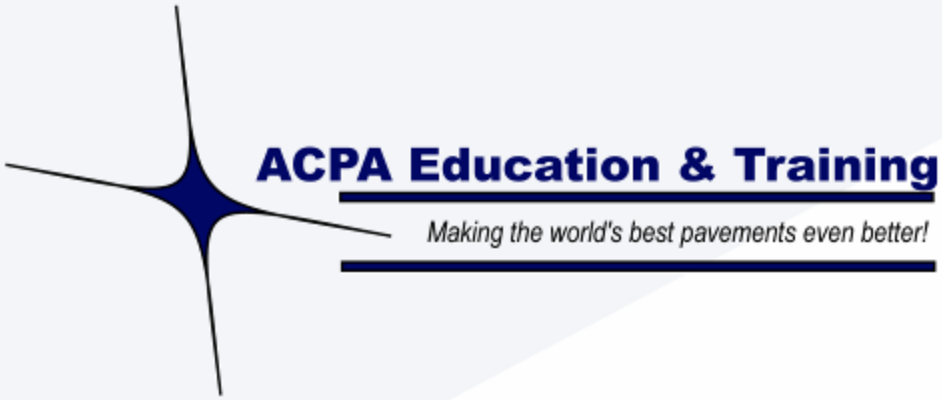



- Asphalt condition can be a good indicator of the underlining concrete pavement condition.
- Review the profile grade line for significant deviation.
- Localized areas of weakness can be strengthened through patching. Milling can remove a number of asphalt surface distresses.

# Design Basics: Conventional Unbonded Overlay Over Asphalt

- Thickness:
  - Designed as new pavement on asphalt base.
  - Assumes no bonding to the existing asphalt.
- Jointing:
  - Spacing - same as new concrete pavement.
  - Depth - adjust for AC distortion.
  - Reinforcing & dowels - same as new pavement.

# Concrete Inlays

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# US 501 & US 378 Intersection
# Conway, SC


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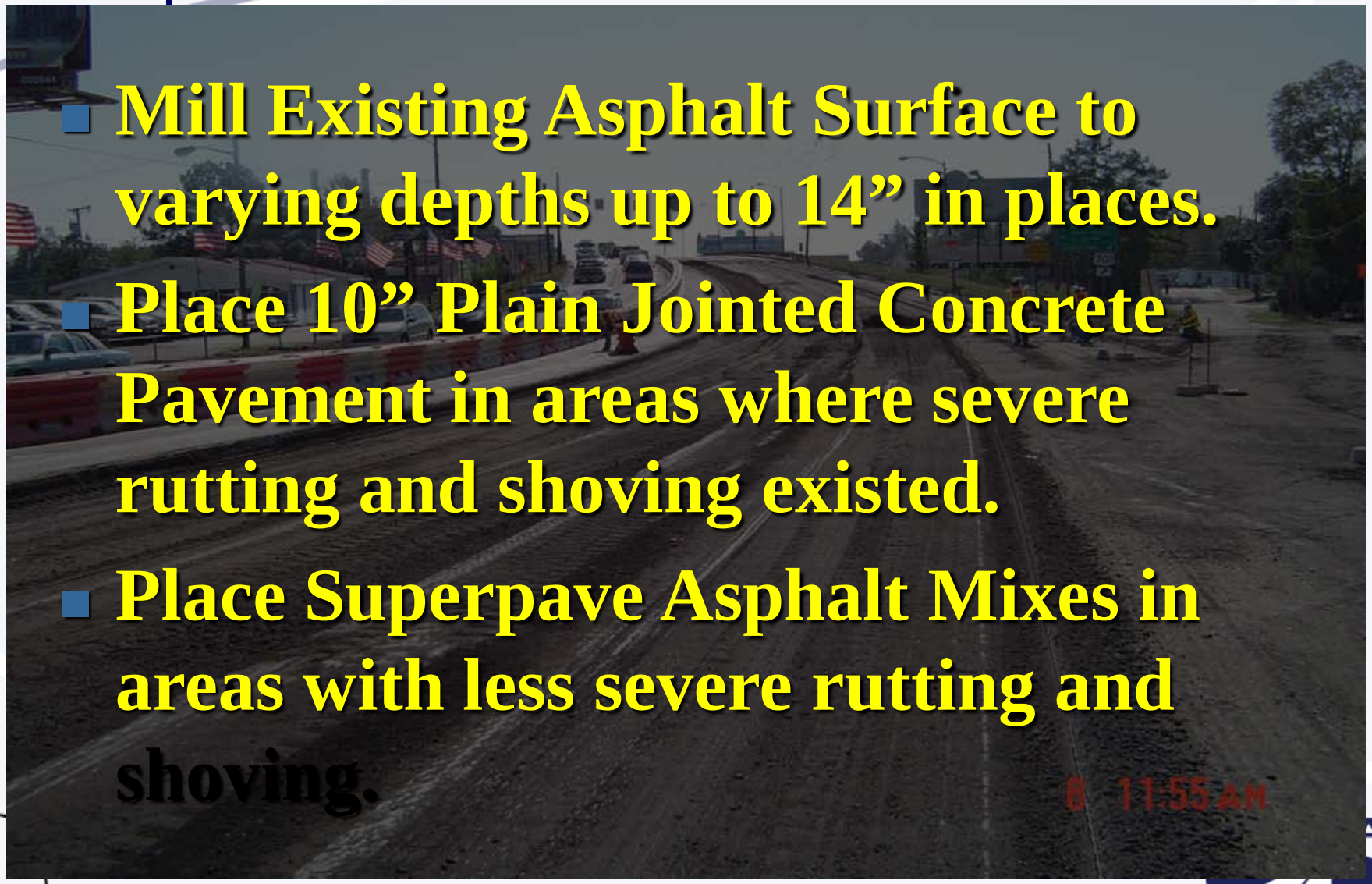
# Existing Pavement

# Scope of Work



- **Mill Existing Asphalt Surface to varying depths up to 14” in places.**
- **Place 10” Plain Jointed Concrete Pavement in areas where severe rutting and shoving existed.**
- **Place Superpave Asphalt Mixes in areas with less severe rutting and shoving.**

# Lane Closure Details

- Lane Closures allowed around the clock from Sunday 8:00pm until Friday 6:00am

- Any other lane closures would be limited to 8:00 pm until 6:00am each night.

# Time Constraints

**Removal of Existing Pavement and Placement of Concrete Pavement Limited to**

**TWO WEEKS**


Self
Cash
1.79
1.95
1.98
PAWN SOUTH
DO NOT BLOCK
8 12:00 PM


002645
ONLY
ONLY
SUBWAY
SUBWAY
CHEVROLET

# I-55, Carroll Co., MS Warranty Project

- Completed Spring 2002 w/ 10-year warranty
- 7.1 miles of 4-lane interstate
- 10” thick
- 196,969 sq. yds. @ $20.40/sy
- 78 days SB, 32 days NB
- PI= 1.9 SB, 3.1 NB

  Grinding:  22 SB, 20 NB


COMACO

# CONCRETE INLAY
# I-75 Cobb/Cherokee Co., GA

May 2007

October 2008

# Project Overview

- 170,000 ADT Section of I-75
- Trucks: 11% MU; 3% SU
- 650,000 SY PCC = 217,000 CY
- 91 Lane Miles Reconstruction
- 3 Construction Stages
- Lane Closure Restrictions
- Holiday Shut Downs
- Full Grind on ALL Completed PCC Pavement
- Paving start March 2007
- Project Completion April 2009


ROAD
WORK
1 MILE

# Asphalt Mill & PCC Inlay

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# October 16, 2008

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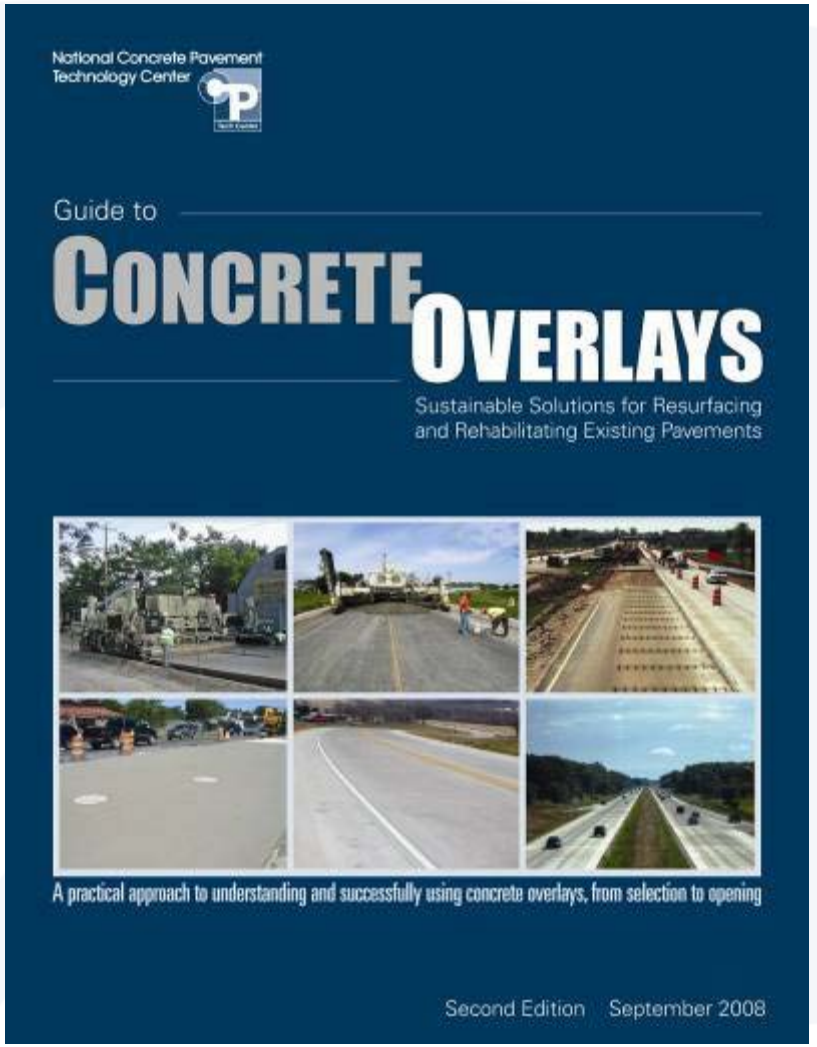
# Concrete Overlay Guide, Second Edition

Contents:

- Overview of Overlay Families
- Overlay types and uses
- Evaluations & Selections
- Six Overlay Summaries
- Design Section
- Miscellaneous Design Details
- Overlay Materials Section
- Work Zones under Traffic
- Key Points for Overlay Construction
- Accelerated Construction
- Specification Considerations
- Repairs of Overlays

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Second Edition September 2008

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# Concrete Overlays – Expected Service Life

- Thickness of 2 to 6 in. – 15 to 25 years
- Thickness > 6 in. – 20 to 30+ years

Overlay service life is dependent upon :

•Sound overlay structural design - compatible with expected traffic and site conditions, and

•Good construction practices

# Summary

- Both bonded and unbonded concrete overlays have shown excellent performance if designed and constructed correctly.
- The choice of overlay type is based on the condition of the existing roadway and the desired objectives.
- Pre-overlay repairs are generally not required for most projects.
- Fast-track techniques are frequently employed to promote early opening to traffic.

# Questions?