North Carolina
DEPARTMENT OF TRANSPORTATION

Concrete Overlay Construction in North Carolina

2015 Virginia Concrete Conference

Nilesh Surti, PE
NCDOT State Pavement Construction Engineer
March 5, 2015

OUTLINE

- NC Highway System Stats
- Concrete Overlays in NC
- Design-Build Project on I-77
  - Construction
  - Traffic Control Phasing
- I-85 Project to VA border
- Drainage Fabric & NCDOT pilot projects
- Concrete Specifications

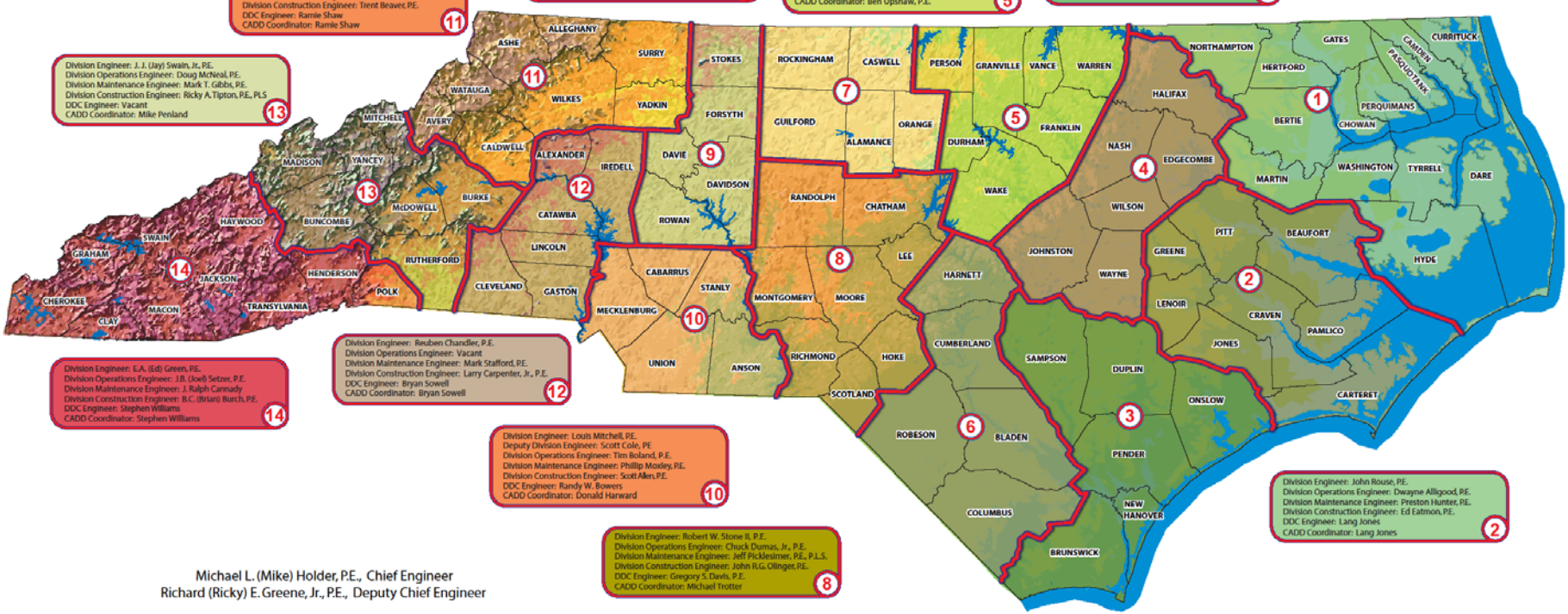
Final Four @ AT&T Stadium

Jerry's SB ring!!!

NC Highway System

NCDOT Highway System

- NC has **79,600** miles of State maintained roadways (second to Texas)
- Interstate (total) = 6400 miles
- **Concrete pavement (total) = 1885 miles**
  - Interstates = 1570 miles
  - US routes = 240 miles
  - NC routes = 75 miles


Division Engineer: Mike Mills, P.E.
Deputy Division Engineer: Vacant
Division Operations Engineer: Pat Wilson, P.E.
Division Maintenance Engineer: Brad Wall, P.E.
Division Construction Engineer: Patty Eason, P.E.
DDC Engineer: Chris Smitherman, P.E.
CADD Coordinator: Jennifer Sour
7
Division Engineer: Tim Little, P.E.
Division Operations Engineer: Vacant
Division Maintenance Engineer: Chris Pendergraph, P.E.
Division Construction Engineer: Wendi O. Johnson, P.E.
DDC Engineer: Dennis Etheridge
CADD Coordinator: Dennis Etheridge
4
Division Engineer: S. Pat Ivey, P.E.
Division Operations Engineer: Mike Shaffner, P.E.
Division Maintenance Engineer: John P. Rhyne, P.E.
Division Construction Engineer: Keith E. Raulston, P.E.
DDC Engineer: William (Al) Blanton, P.E., P.L.S.
CADD Coordinator: Joe Cartwright, P.L.S.
9
Division Engineer: Joey Hopkins, P.E.
Deputy Division Engineer: Brandon Jones, P.E.
Division Operations Engineer: A. Battle Whitley, IV, P.E.
Division Maintenance Engineer: Vacant
Division Construction Engineer: Dennis Jernigan, P.E.
DDC Engineer: Ben Upshaw, P.E.
CADD Coordinator: Ben Upshaw, P.E.
5
Division Engineer: Jerry Jennings, P.E.
Division Operations Engineer: Anthony W. Roper, P.E.
Division Maintenance Engineer: Sterling D. Baker, P.E.
Division Construction Engineer: Shawn Mebane, P.E.
DDC Engineer: Scott Fenwick
CADD Coordinator: Scott Fenwick
1
Division Engineer: Michael A. Pettyjohn, P.E.
Division Operations Engineer: Wayne O. Atkins, P.E.
Division Maintenance Engineer: Charles C. Reinhardt, P.E.
Division Construction Engineer: Trent Beaver, P.E.
DDC Engineer: Ramie Shaw
CADD Coordinator: Ramie Shaw
11
Division Engineer: J. J. (Jay) Swain, Jr., P.E.
Division Operations Engineer: Doug McNeal, P.E.
Division Maintenance Engineer: Mark T. Gibbs, P.E.
Division Construction Engineer: Ricky A. Tipton, P.E., PLS
DDC Engineer: Vacant
CADD Coordinator: Mike Penland
13
ALLEGHANY
ASHE
SURRY
STOKES
ROCKINGHAM
CASWELL
PERSON
GRANVILLE
VANCE
WARREN
NORTHAMPTON
GATES
CURRITUCK
CAMDEN
PASQUOTANK
HERTFORD
WATAUGA
WILKES
YADKIN
FORSYTH
GUILFORD
ALAMANCE
ORANGE
DURHAM
FRANKLIN
HALIFAX
BERTIE
PERQUIMANS
CHOWAN
MITCHELL
AVERY
CALDWELL
ALEXANDER
IREDELL
DAVIE
DAVIDSON
NASH
EDGECOMBE
MARTIN
WASHINGTON
TYRRELL
DARE
MADISON
YANCEY
BURKE
McDOWELL
CATAWBA
ROWAN
RANDOLPH
CHATHAM
WAKE
WILSON
HAYWOOD
BUNCOMBE
SWAIN
GRAHAM
LINCOLN
LEE
JOHNSTON
PITT
BEAUFORT
HYDE
JACKSON
HENDERSON
RUTHERFORD
CABARRUS
STANLY
HARNETT
GREENE
WAYNE
CHEROKEE
MACON
TRANSLYVANIA
POLK
CLEVELAND
GASTON
MECKLENBURG
MONTGOMERY
MOORE
LENOIR
CRAVEN
PAMLICO
CLAY
UNION
ANSON
RICHMOND
HOKE
CUMBERLAND
SAMPSON
JONES
DUPLIN
SCOTLAND
ONSLOW
CARTERET
ROBESON
BLADEN
PENDER
COLUMBUS
NEW HANOVER
BRUNSWICK
Division Engineer: Reuben Chandler, P.E.
Division Operations Engineer: Vacant
Division Maintenance Engineer: Mark Stafford, P.E.
Division Construction Engineer: Larry Carpenter, Jr., P.E.
DDC Engineer: Bryan Sowell
CADD Coordinator: Bryan Sowell
12
Division Engineer: E.A. (Ed) Green, P.E.
Division Operations Engineer: J.B. (Joel) Setzer, P.E.
Division Maintenance Engineer: J. Ralph Cannady
Division Construction Engineer: R.C. (Brian) Burch, P.E.
DDC Engineer: Stephen Williams
CADD Coordinator: Stephen Williams
14
Division Engineer: Louis Mitchell, P.E.
Deputy Division Engineer: Scott Cole, PE
Division Operations Engineer: Tim Boland, P.E.
Division Maintenance Engineer: Phillip Moxley, P.E.
Division Construction Engineer: Scott Allen, P.E.
DDC Engineer: Randy W. Bowers
CADD Coordinator: Donald Harward
10
Division Engineer: Robert W. Stone II, P.E.
Division Operations Engineer: Chuck Dumas, Jr., P.E.
Division Maintenance Engineer: Jeff Picklesimer, P.E., P.L.S.
Division Construction Engineer: John R.G. Olinger, P.E.
DDC Engineer: Gregory S. Davis, P.E.
CADD Coordinator: Michael Trotter
8
Division Engineer: Greg Burns, P.E.
Division Operations Engineer: Jerry Bradley, P.E.
Division Maintenance Engineer: Ken Murphy, Jr., P.E.
Division Construction Engineer: Tracey Conrad Pittman P.E.
DDC Engineer: Sean P. Matuszewski
CADD Coordinator: Neil Butler
6
Division Engineer: Karen E. Fussell, P.E.
Division Operations Engineer: D. Chad Kimes, P.E.
Division Maintenance Engineer: David L. Thomas, P.E.
Division Construction Engineer: Vacant
DDC Engineer: David B. Leonard, P.E.
CADD Coordinator: Douglas N. La Fave
3
Division Engineer: John Rouse, P.E.
Division Operations Engineer: Dwayne Alligood, P.E.
Division Maintenance Engineer: Preston Hunter, P.E.
Division Construction Engineer: Ed Eatmon, P.E.
DDC Engineer: Lang Jones
CADD Coordinator: Lang Jones
2
Michael L. (Mike) Holder, P.E., Chief Engineer
Richard (Ricky) E. Greene, Jr., P.E., Deputy Chief Engineer
NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION MAP AND CONTACTS
Revised: 02-09-2015
NCDOT ENTERPRISE
Visualization

Why would a State Agency use a concrete overlay?

Cost Effective $olution!

Minimal pre-overlay repairs!

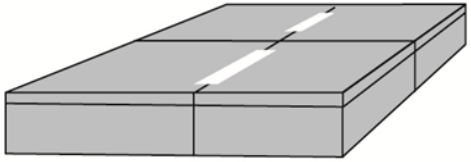
Avoid total reconstruction with rehabilitation!

WHY USE CONCRETE OVERLAYS?

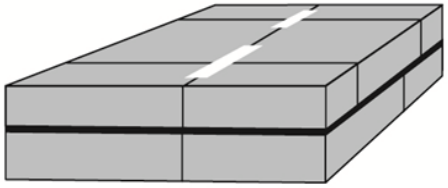
- $$$ = Cost effective solution for pavement rehabilitation
- Time = Existing pavement needs minimal pre-overlay repairs
- Efficient = Quick construction & convenient

Types of CONCRETE OVERLAYS

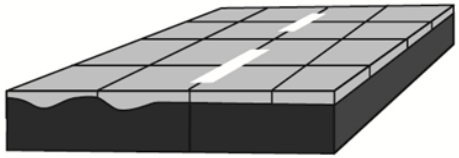
Bonded Concrete Overlays of Concrete Pavements
–previously called bonded overlays–



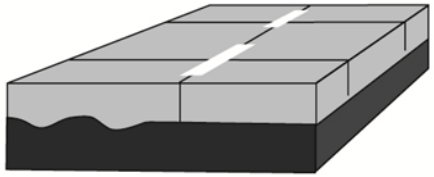
Unbonded Concrete Overlays of Concrete Pavements
–previously called unbonded overlays–



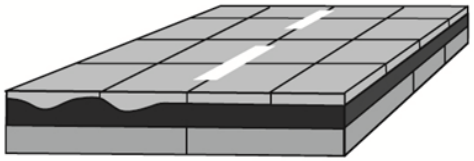
Bonded Concrete Overlays of Asphalt Pavements
–previously called ultra-thin whitetopping–



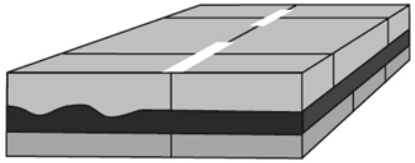
Unbonded Concrete Overlays of Asphalt Pavements
–previously called conventional whitetopping–



Bonded Concrete Overlays of Composite Pavements

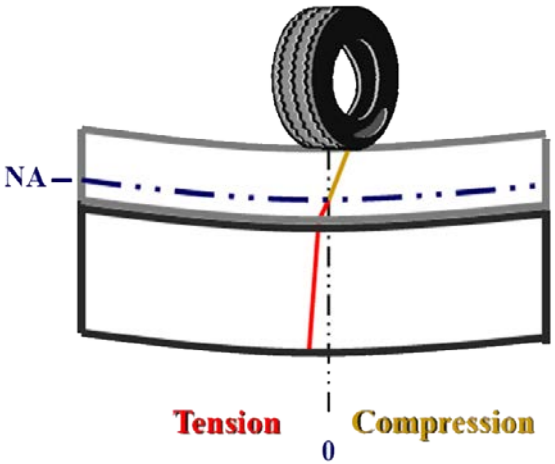


Unbonded Concrete Overlays of Composite Pavements

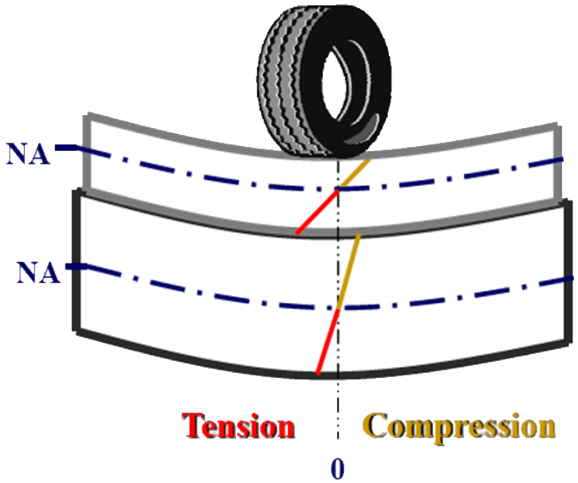


Bonded vs. Unbonded Overlays

- **Bonded:** Use to eliminate surface defects; increase structural capacity; and improve surface friction, noise, and rideability.



- **Unbonded:** Use to restore structural capacity and increase pavement life equivalent to full-depth pavement. Also results in improved surface friction, noise, and rideability.

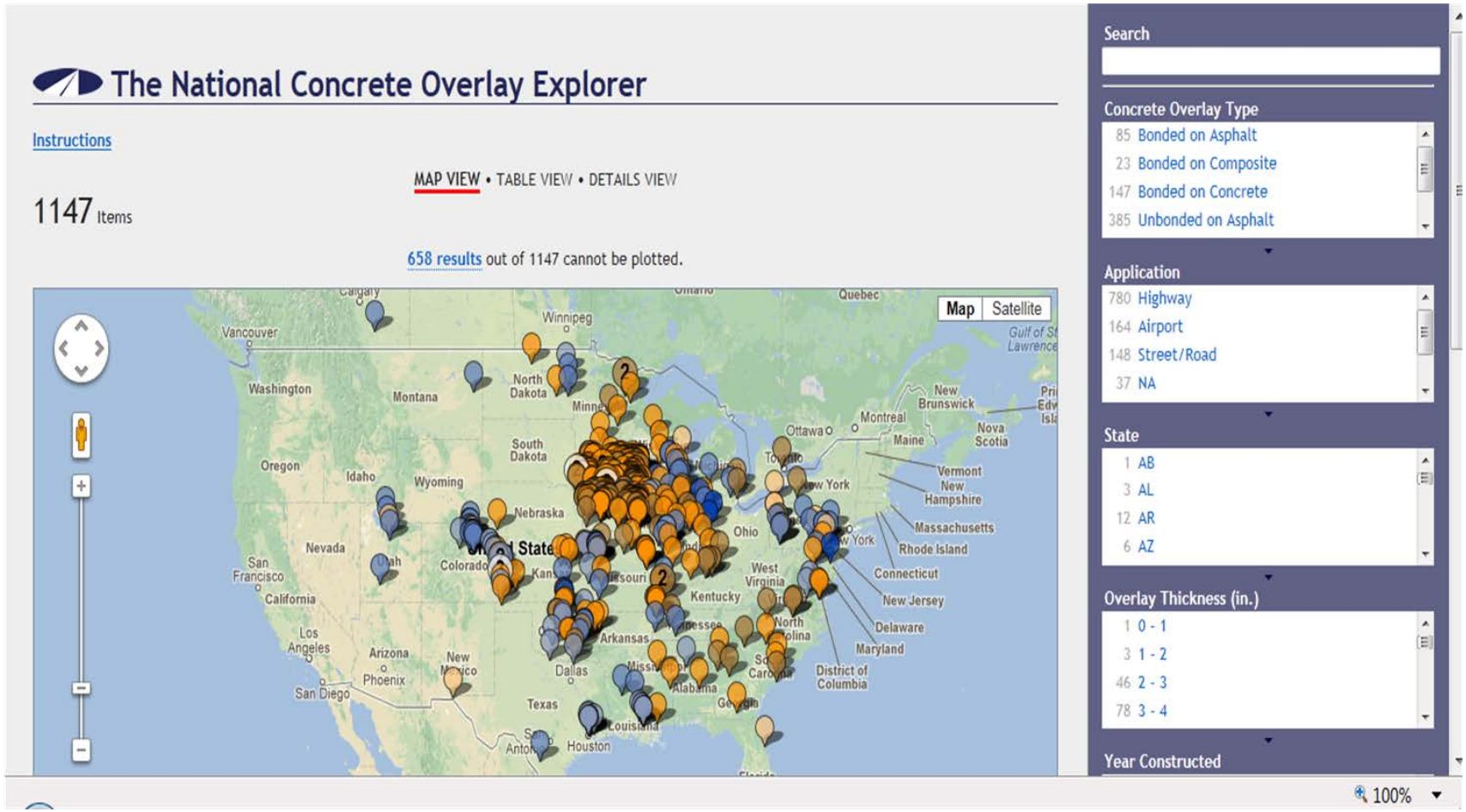


UNBONDED OVERLAYS CAN BE PLACED OVER POOR CONCRETE PAVEMENTS

Need uniform support and good separation layer

Concrete Overlays in NC?

- 10 based on National Concrete Overlay Explorer



Concrete Overlays in NC?

- # based on NCDOT Pavement Management System

Project #	Let Date	County	Type	Thickness	Year Completed
I-2508BB	Jan. 1998	Granville	JCP	10 inches	1999
I-2508BC	Oct. 2000	Granville	JCP	11 inches	2002
I-2807C	April 1999	Surry	JCP	11 inches	2000
I-2807E	Sept. 1998	Surry	JCP	11 inches	2000

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

T.I.P. NO. I-2808A
I-77 FROM SOUTH OF SR 1125 (ASHBURY CHURCH ROAD) TO US 21
YADKIN COUNTY, NC

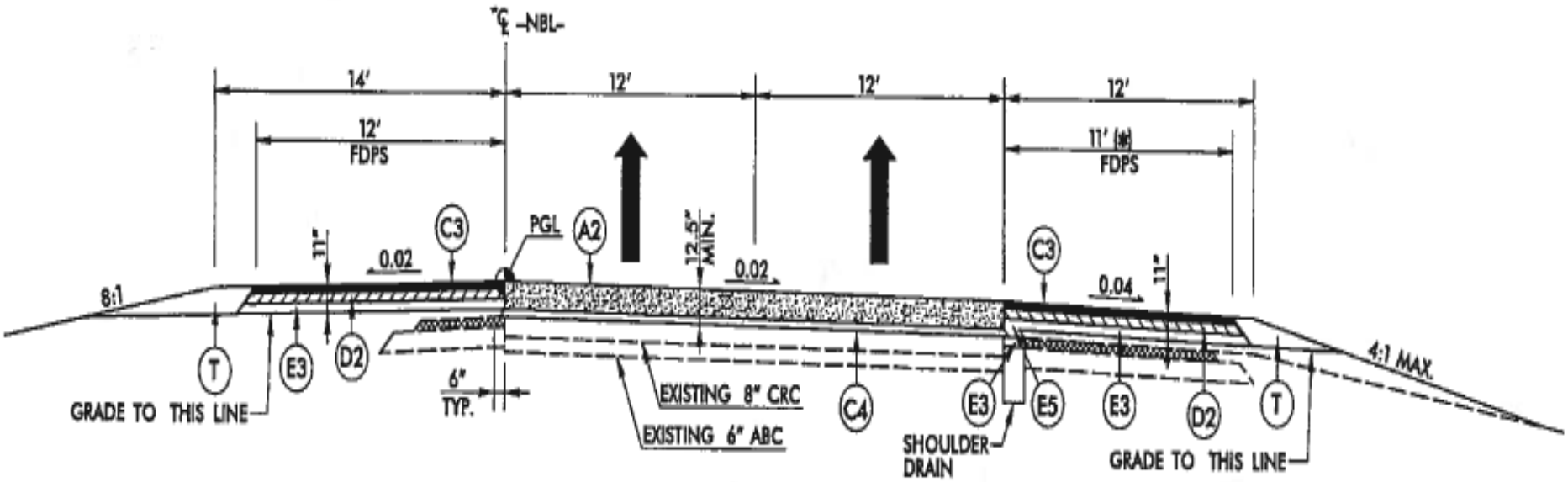
LANE Yadkin County Design Build 7

I-77 Design-Build Project

- Project length = 6.57 miles
- 11” unbonded concrete overlay on existing 8” CRC
- Jointed Plain Concrete Pavement (JPCP)
- 15-ft joint spacing with dowels
- Pavement rehabilitation vs. full reconstruction

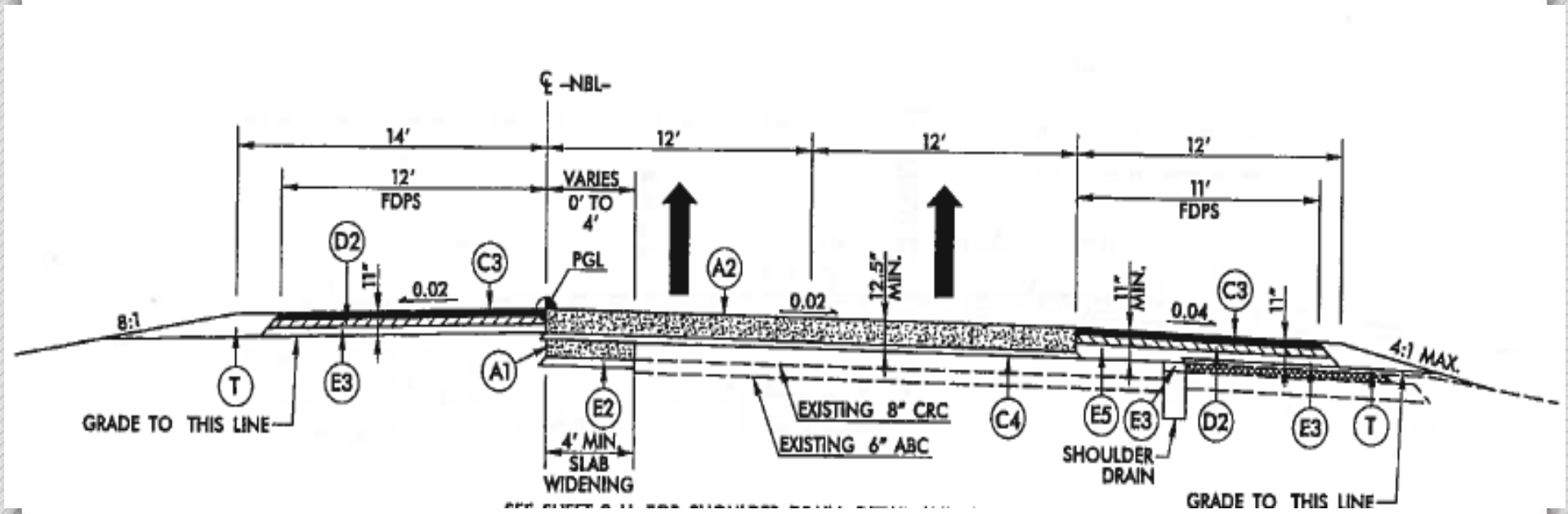
Typical sections

- Mainline typical section



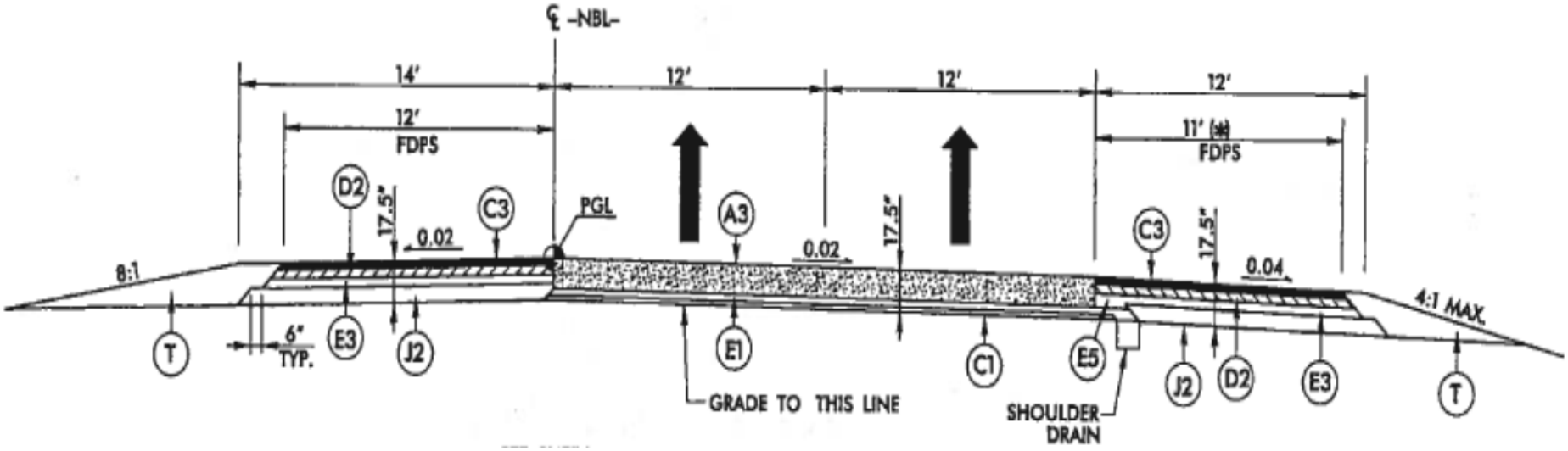
Sections with 4-ft slab widening

- Removal of deteriorated existing asphalt shoulder
- Constructed min. 4-ft concrete slab

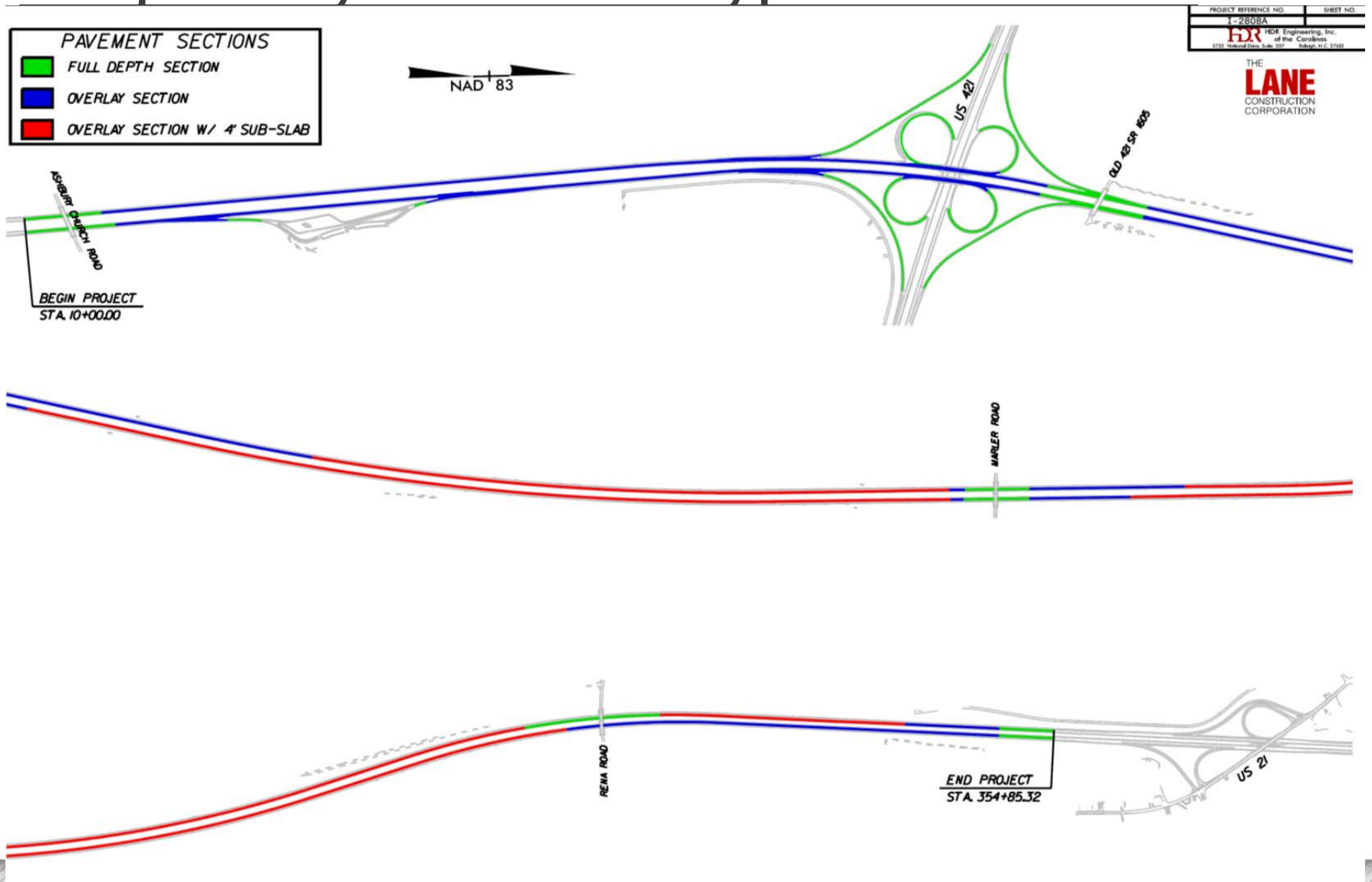


Full depth concrete sections

- PCCP thickness = 13 inches
- At bridge locations
- US 421 Interchange



Project layout with 3 typical sections



Existing pavement condition on I-77

Numerous punchouts and faulting

Ramps had cracking and ASR

Pre-overlay spall repairs – Lesson learned

Construction Strategy

- Minimize right-of-way impacts
- Reduce sliver fills on outside slopes
- Minimize environmental impacts
- Shift traffic with temporary detours to median

Maintenance of Traffic

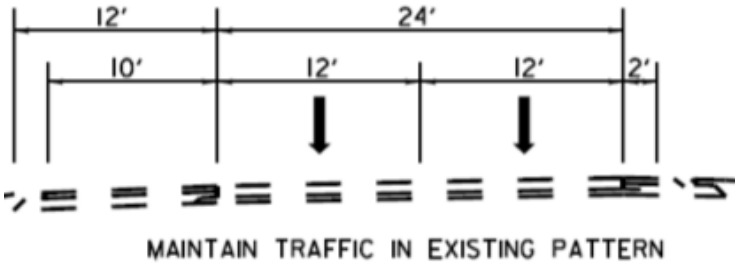
Maintenance of Traffic

- NCDOT had I-77 design plans completed
- Traffic control became a huge barrier

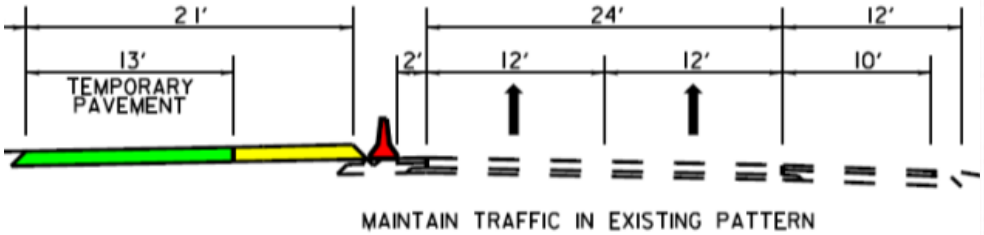
Department switches to Design-Build method for project delivery due to MOT

Maintenance of Traffic

Southbound I-77



Northbound I-77

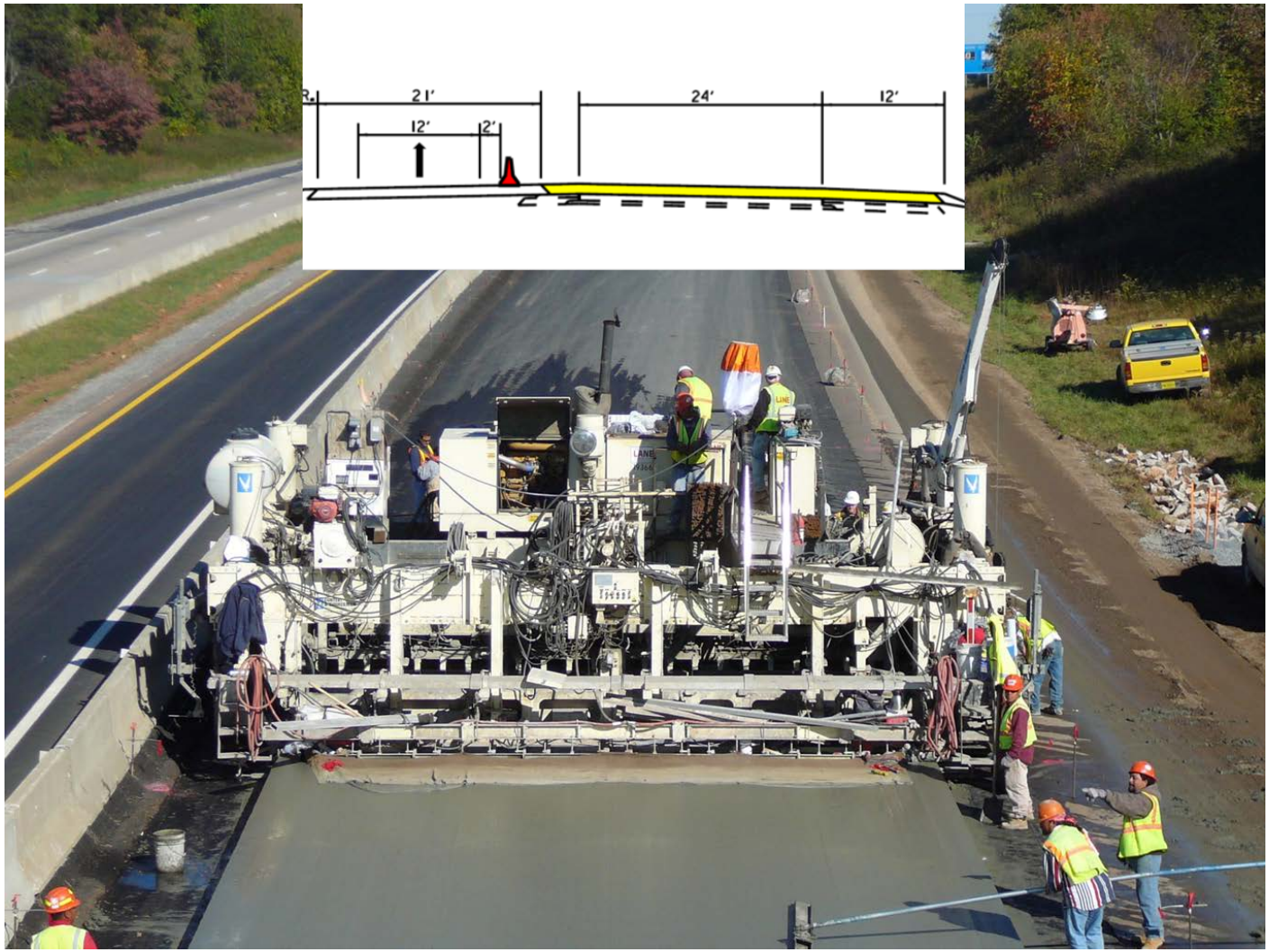


Phase I – Median Detour Construction

Phase I – Median Detour Complete

Phase I – Median Detour in use

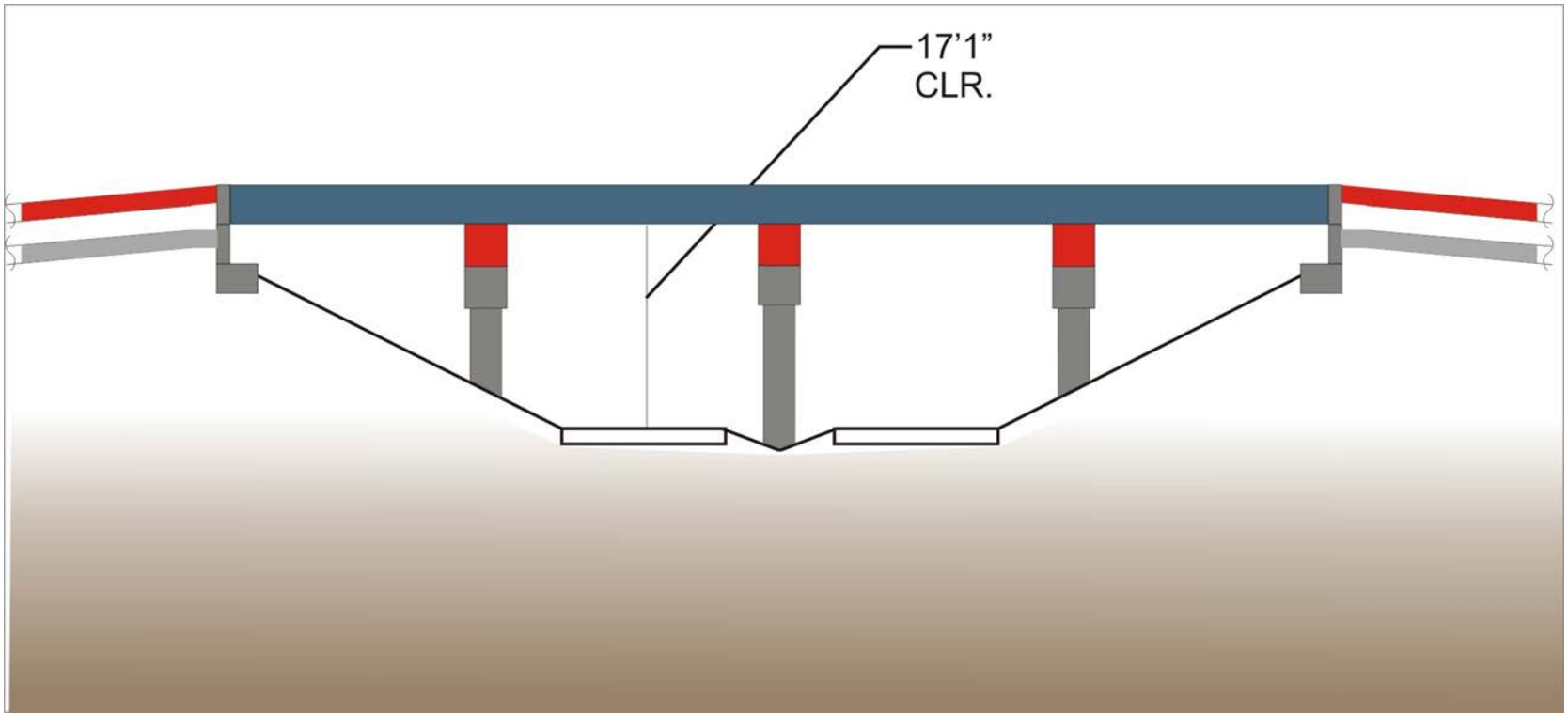
Phase I – PCCP construction



Phase I – Concrete paved

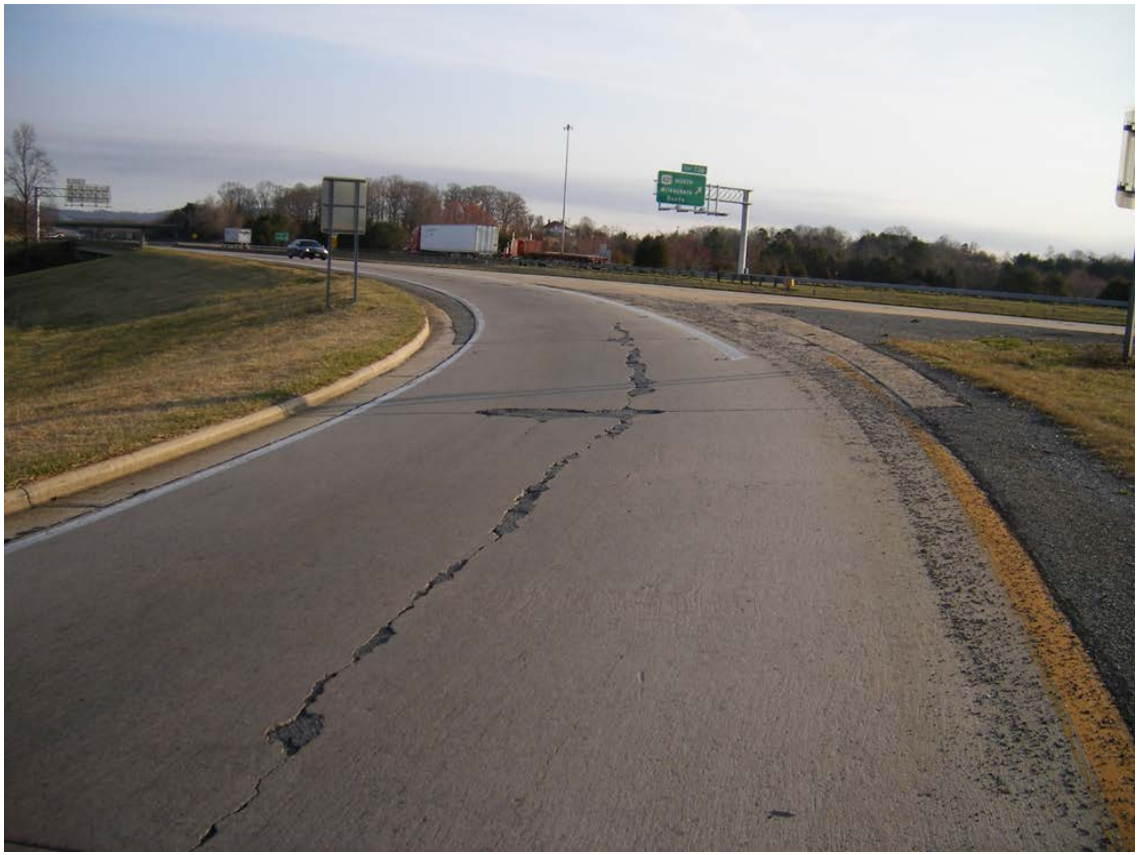
4-ft slab widening section

Bridge Jacking at US 421



Ramp Construction Innovation

Asphalt overlay on ramps changed to concrete overlay



Concrete overlay completed

I-77 received an ACPA Award

I-85 Project in NC
Unbonded Concrete overlay for 20 miles

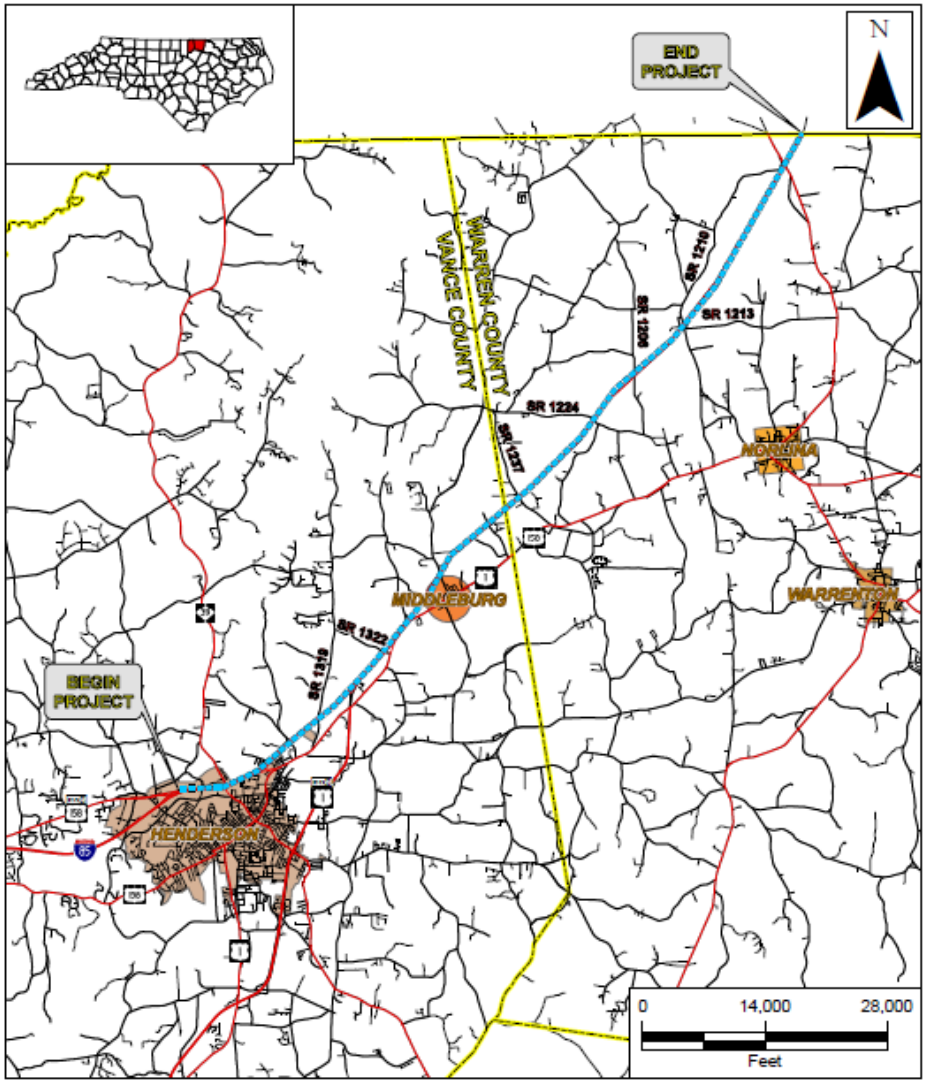
Overlay Thickness = 10 inches

Separator layer = 2 inches PADC

Existing pavement is JPC
30-ft joint spacing
Without dowels?

Patched with asphalt

Novachip on top in 2007



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS BRANCH

I-85 from US 158 in Vance County to Virginia State line
Vance / Warren Counties
TIP PROJECT I-0914B

County: Vance / Warren
Div: 5 TIP#I-0914B
WBS: 38688.1.1
Date: November 2008

Figure 1

I-85 from US 158 to VA state line

Concrete Overlay Workshop for I-85

- FHWA
- CP Tech Center
- Site visit
- Design input
  - Thinner overlay
  - Fabric layer
- Construction input
  - Min. repairs
  - Keep novachip

CONCRETE OVERLAY TECHNICAL ASSISTANCE PROGRAM

Increasing the awareness and knowledge of concrete overlay applications among state DOTs, contractors and engineering consultants.

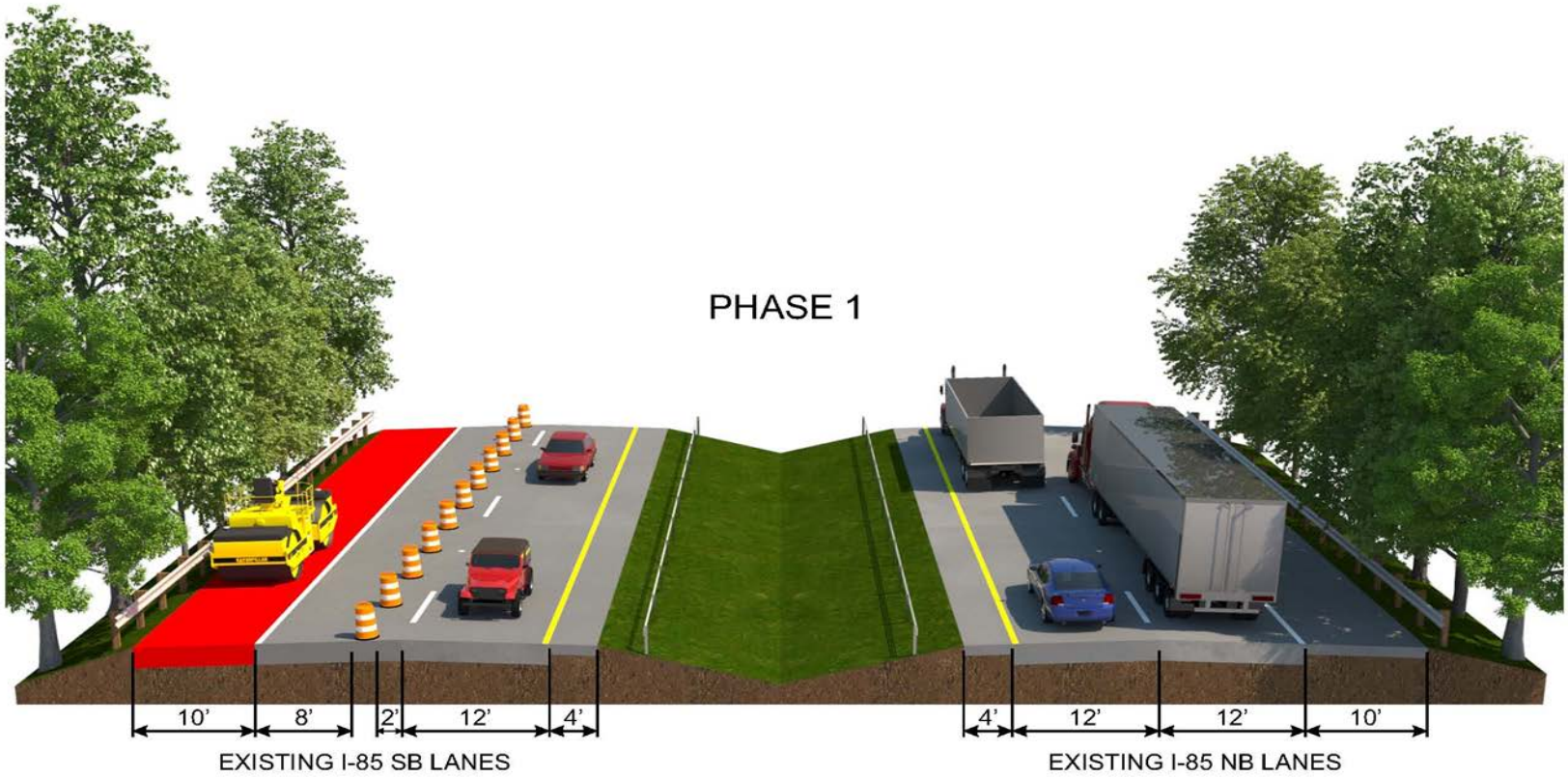
North Carolina DOT Site Visit Implementation Report

NCDOT NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

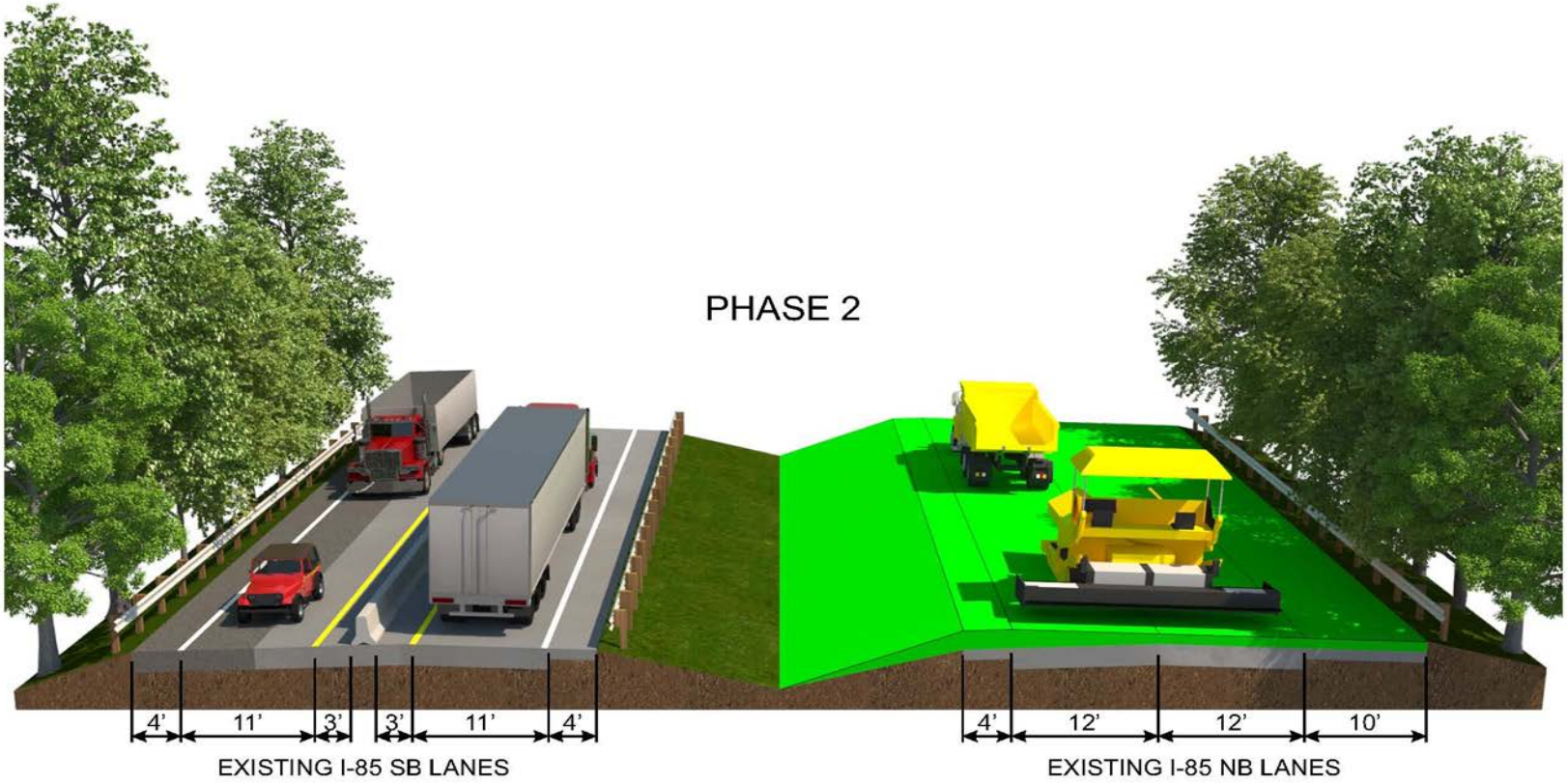
U.S. Department of Transportation Federal Highway Administration

National Concrete Pavement Technology Center CP Tech Center

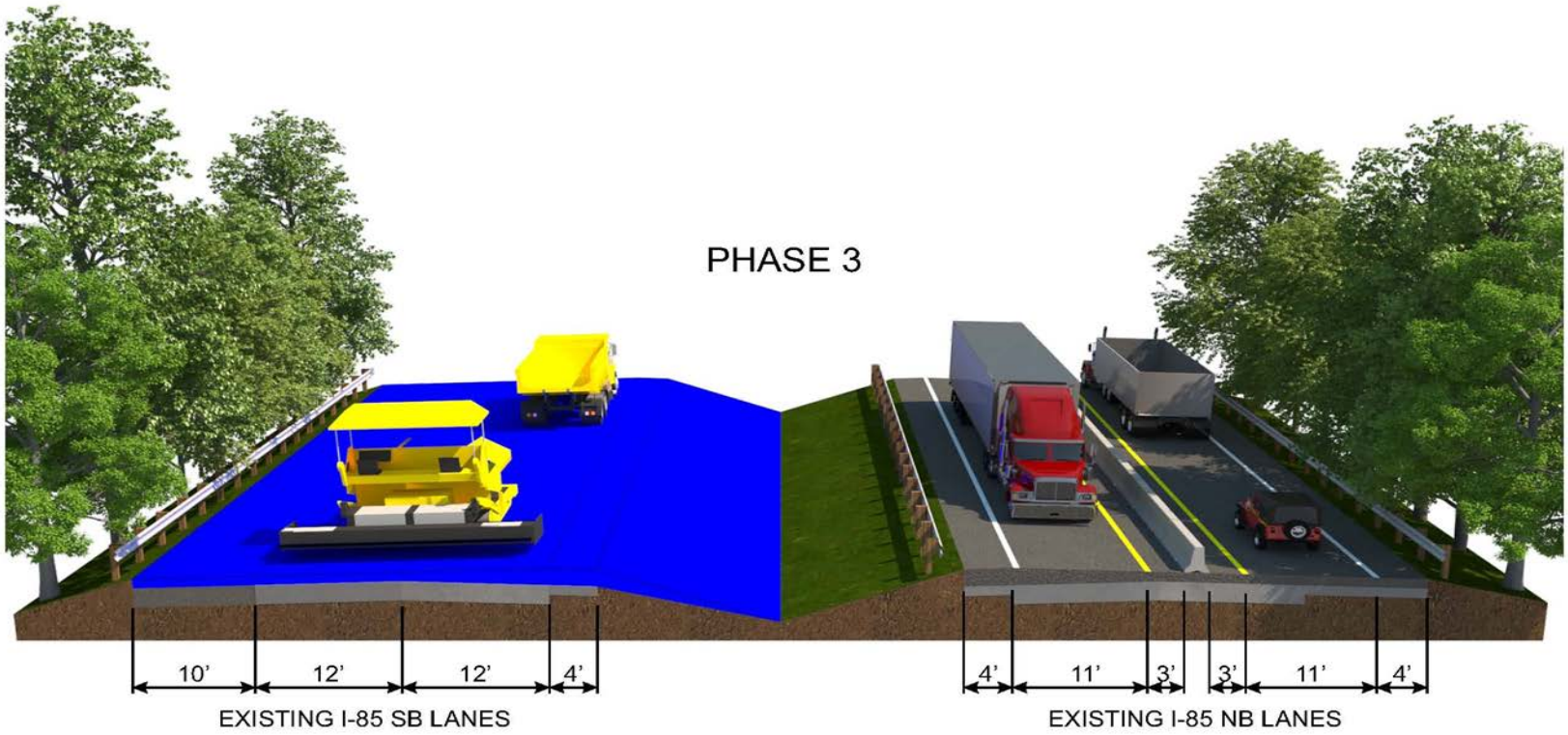
I-85 Proposed Traffic phasing



I-85 Traffic Phase II



I-85 Traffic Phase III



VE Study for I-85

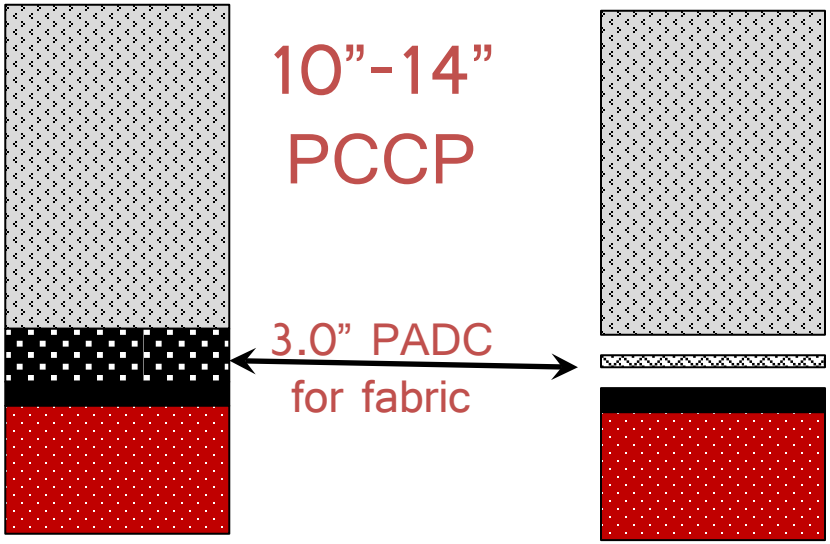
- Eliminate asphalt patch removal with concrete
- Estimated savings = $8,000,000+
- Eliminate milling novachip = $2,000,000+

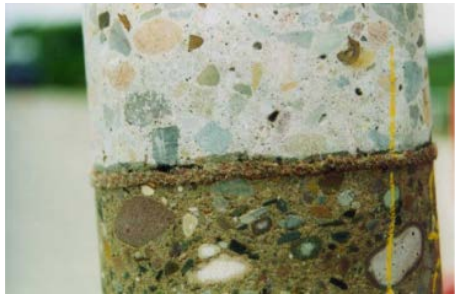
Separation / Drainage Layer

- Required for good performance
  - Isolate overlay from existing distress
    - Prevent reflective cracking
    - Prevent bonding/mechanical interlocking
  - Provides a bedding cushion for the unbonded overlay
  - A system to drain the interlayer
- Recommended separation layer material:
  - 1 in HMA (3 in @ NCDOT)
  - Geotextile fabric

Drainage Fabric under PCCP

- Replace asphalt drainage layer





GEOTEXTILE SEPARATION LAYER (INTERLAYER)

No turn

No wrinkles

Drainage Fabric

- 2 NCDOT pilot projects
  - Weigh Station on ramp
  - Winston-Salem Beltway for 1-mile section
  - Cost savings on 6 lanes = $406,770

Interlayer	Unit Cost	Interlayer Volume	Total Cost
3” Hot Mix Asphalt	$75/ton	1148 tons/mi	$86,100/lane-mi
Geotextile Interlayer	$2.50/yd.^{2}	7,322 yd.^{2}/mi	$18,305/lane-mi
Estimated Project Savings Per Lane Mile			**$67,795**

NCDOT Concrete Specifications

- Formed a Concrete Specs Committee
- DOT and Industry input on current specs
  - Reduced strength (3000 psi) for placing traffic on new PCCP
  - Longitudinal tining as a standard
  - Laser profiler for checking pavement smoothness
  - Temperature changes

Nilesh Surti, PE

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- E-mail: nsurti@ncdot.gov

THANK YOU!!!