

# I-85 RCC Shoulder Construction in NC

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March 2, 2018

Richmond, VA

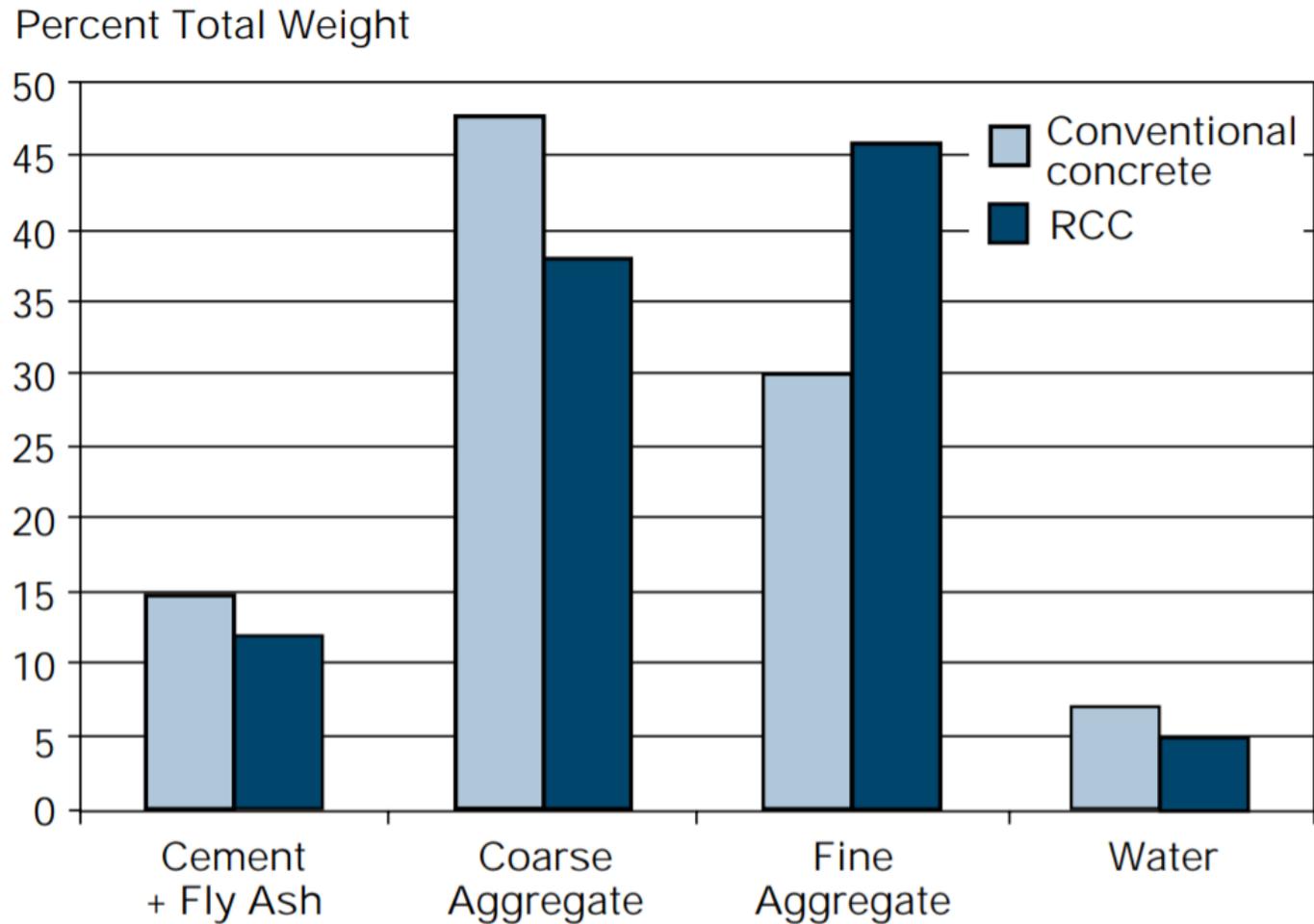
## Definition

“Roller-Compacted Concrete (RCC) is a no-slump concrete that is compacted by vibratory rollers.”

- Zero slump (consistency of dense graded aggr.)
- No forms
- No reinforcing steel
- No finishing
- Consolidated with vibratory rollers

Concrete pavement placed in a different way.

## RCC versus PCC





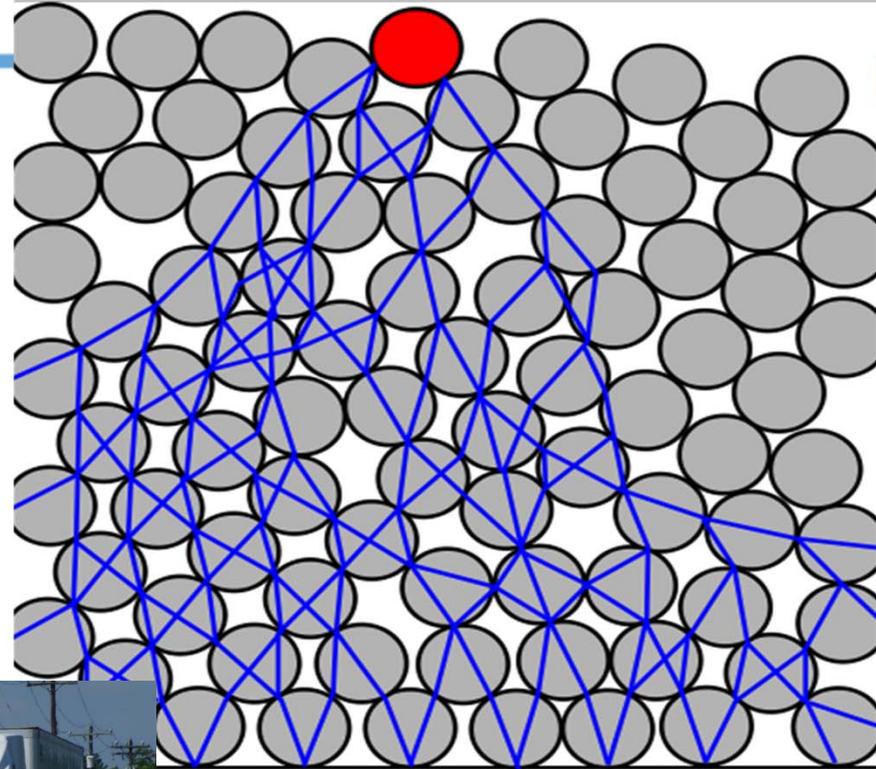


**SOUTHEAST CEMENT  
PROMOTION ASSOCIATION**





## RCC is a Granular Solid Before Curing





## RCC is concrete after curing

- Compressive strength ( $f'_c$ )
  - 4,000 to 10,000 psi
- Flexural strength (MR)
  - 500 to 1,000 psi
  - $MR = C(f'_c)^{1/2}$  where  $C = 9$  (up to 11)
- Modulus of elasticity
  - 3,000,000 to 5,500,000 psi
  - $E = C_E(f'_c)^{1/2}$  where  $C_E = 57,000$  (up to 67,000)



## Surface Appearance

- Not as smooth as conventional concrete
- Important to recognize difference
- Similar appearance to asphalt only light grey instead of black



# Surface Texture





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Admixture technology allows trowel and broom  
finish

## Admixture technology allows trowel and broom finish



## Highway Shoulders



I-285 Highway  
Atlanta, GA  
2005





I-385, Laurens County SC, RCC Shoulder, 2010

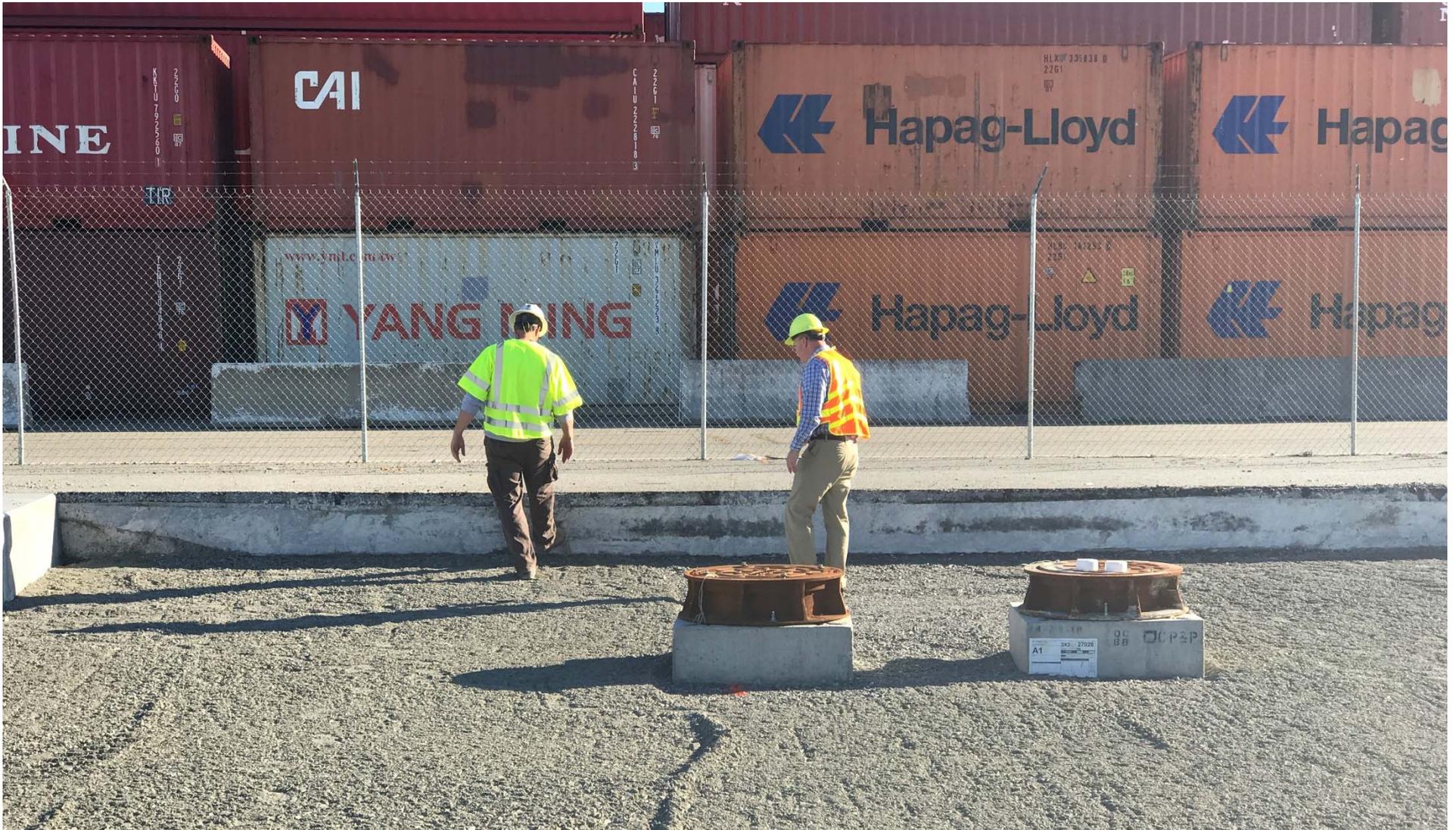
## South Carolina RCC

- SCDOT has let 29 RCC projects totaling about 600,000 sy.
- All mainline projects since 2009 have had asphalt surface.
- Most recent project let in 2015, finished 2017.

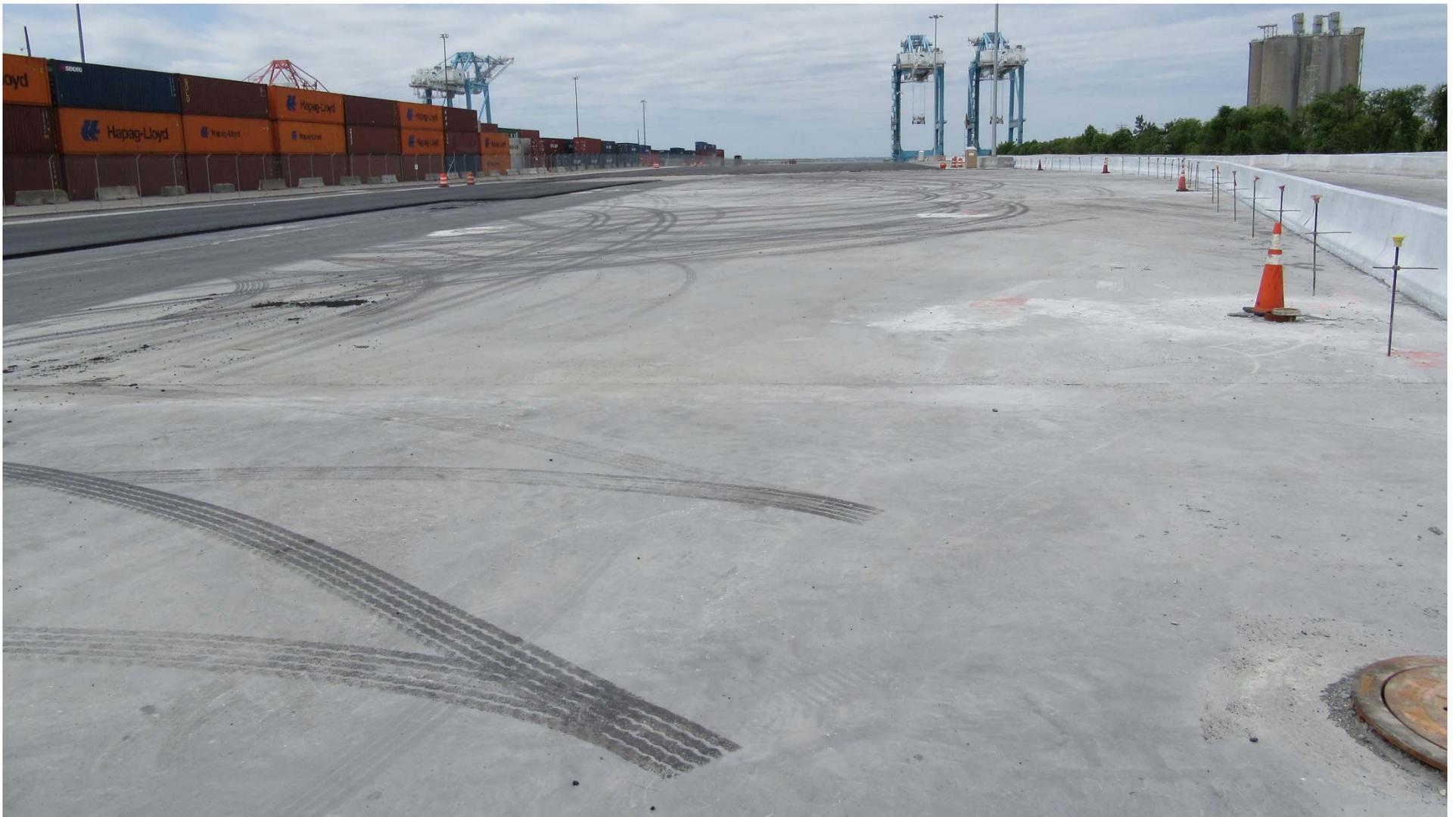
## Virginia RCC

- Norfolk International Terminal
- Park-and-Ride, Stafford
- I-64/295 Ramps, Richmond
- Celadon Trucking, Richmond

# Norfolk International Terminal Expansion



# Norfolk International Terminal Expansion



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## North Carolina RCC

- RCC not new to NC

## Intermodal facility, Charlotte-Douglas Airport



## Intermodal facility, Charlotte-Douglas Airport



## Coal ash landfill, Moncure, NC



## I-85 project near Greensboro, NC

- Replace original asphalt and aggregate base shoulder with RCC.
- Base bid was 63,000 sy of RCC pavement.
- NCDOT RCC specification was conventional.
- Typical order of work:
  - Place traffic control
  - Commence milling existing shoulder
  - Place RCC behind milling operation
  - Perform initial saw cut in RCC
  - Place curing compound
  - Remove traffic control
- NCDOT approved no-cost change order to allow trowel finishing.

## Original shoulders, I-85 near Greensboro, NC





Particle Size Distribution Report

COMPACTION TEST REPORT

COMPRESSIVE STRENGTH REPORT

ROLLER-COMPACTED CONCRETE LABORATORY MIX DESIGN

**CLIENT:** Andale Construction  
**PROJECT:** NCDOT I-85 Randolph/Guilford County  
**MIX DESCRIPTION:** Type I/II Roanoke Cement - 492 lbs/yd<sup>3</sup>  
 50:50 #78M Stone: Natural Sand

**REPORT DATE:** 06/06/17  
**JOB NO:** SL-340-15  
**SPECIFIED STRENGTH:** 4500 PSI at 28 days

**DATE BATCHED:** 05/02/17  
**TIME CAST:** 12:30 PM  
**SET NO.:** 2 @ 15.0% Cement

**UNIT WEIGHT (PCF):** 147.8  
**% MOISTURE:** 6.4

CYL NO.	DIAMETER (IN)	AREA (SQ. IN.)	TEST DATE	AGE	MAX LOAD (LBS)	COMP. STR. (PSI)	AVG. COMP. STR. (PSI)	FRACTURE TYPE
A	6.00	28.27	05/05/17	3	93740	3320	3390	3
B	6.00	28.27	05/05/17	3	97490	3450		3
C	6.00	28.27	05/09/17	7	123310	4360	4370	3
D	6.00	28.27	05/09/17	7	123720	4380		3
E	6.00	28.27	05/30/17	28	146810	5190	5260	3
F	6.00	28.27	05/30/17	28	150800	5330		3

**Ft. Mill, South Carolina** Roller Compacted Concrete  
 Project No: SL-340-15 Figure  
 Tested By: FG Checked By: MH

Project No. SL-340-15 Client: Andale Construction  
 Project: NCDOT I-85 Randolph/Guilford County  
 Roller Compacted Concrete

**Remarks:**  
 Cement: 464 lbs  
 Stone: 3313 lbs  
 Water: 222 lbs

Mill and remove  
existing shoulder





SOUTHEAST CEMENT  
PROMOTION ASSOCIATION









Date Placed	Days	Cylinder No.1	Cylinder No.2	Cylinder No.3	Average	Flex Beam
8/4/2017	3	3420	3360			
	7	4570	4520		4550	830
	28	5390	5300	5300	5330	920, 890

8/2/2017	3	3890	4100		4000
Set 1	7	4730	4710		4720
	28	5520	6040	5990	5850
8/2/2017	3	3720	3670		3700
Set 2	7	4690	4710		4700
	28	5730	5730	5640	5700

## I-85 Project near Greensboro, NC

- Unit price \$32 per square yard.
- RCC paving completed in 16 paving days.  
(5,250 sy/1,312 cy/4,725 lf per day average)
- Change order added to replace inside 4-foot shoulder this year.

## 2<sup>nd</sup> NCDOT RCC project

- Let January 2018
- Replacement of I-85 shoulders near Thomasville
- 74,900 sy
- Unit price \$38/sy

# Thank you!

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