I-85 RCC Shoulder Construction in NC

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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

Percent Total Weight

<table>
<thead>
<tr>
<th>Material</th>
<th>Conventional Concrete</th>
<th>RCC</th>
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<tbody>
<tr>
<td>Cement + Fly Ash</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>45%</td>
<td>45%</td>
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<tr>
<td>Fine Aggregate</td>
<td>35%</td>
<td>35%</td>
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<tr>
<td>Water</td>
<td>5%</td>
<td>5%</td>
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</table>
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
Admixture technology allows trowel and broom finish
Admixture technology allows trowel and broom finish
Highway Shoulders

I-285 Highway
Atlanta, GA
2005
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
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
# 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/yd³  
50:50 #78M Stone: Natural Sand

**Date Batched:** 05/02/17  
**Time Cast:** 12:30 PM  
**Set No.:** 2 @ 15.0% Cement

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<th>CYL NO.</th>
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<th>AREA (SQ. IN.)</th>
<th>TEST DATE</th>
<th>AGE</th>
<th>MAX LOAD (LBS)</th>
<th>COMP. STR. (PSI)</th>
<th>AVG. COMP. STR. (PSI)</th>
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**Report Date:** 06/06/17  
**JOB NO.:** SL-340-15  
**Specified Strength:** 4500 PSI at 28 days  
**Unit Weight (PCF):** 147.8  
**% Moisture:** 6.4

**Note:**
- **Remarks:**  
  - Cement: 464 lbs  
  - Stone: 331 lbs  
  - Water: 222 lbs

**Tested By:** FG  
**Checked By:** MH
Mill and remove existing shoulder
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<th>Days</th>
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<th>Cylinder No.3</th>
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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.
2nd 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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