Utilization of Roller Compacted Concrete for Roadways

Chris Carwie, Business Development Manager
A.G. Peltz Group LLC   |   Birmingham, AL
RCC Paving for Roadways

• Todays Agenda
  – What, Where, Why?
  – Why DOT/Agencies are interested
  – Project Types
  – What have we learned?
RCC Paving for Roadways

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**What: Definition**

- “Roller-Compacted Concrete (RCC) is a no-slump concrete that is compacted by high density pavers and vibratory rollers.”
  - Negative Slump
  - No reinforcing steel
  - No finishing
  - Consolidated with vibratory rollers
- Concrete pavement placed in a different way!
Where? Project Feasibility

- Project Size
- Site Geometry
- Loading Characteristics
- Project End User
Why RCC Paving?

- Speed of construction
- Early strength gain
- Durability
- Cost

Source:
RCC Pavement Design and Construction Symposium, Houston, TX
October 5-6 2011
David Pittman & Gary Anderton, US Army Corps of Engineers
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Utilization of RCC for Roadways

Solms Road – New Braunfels, TX
I-85 Interchange – Lagrange, GA
I-285 Shoulder – Atlanta, GA
Woody Hayes Drive – Columbus, OH

Grape Creek Road – San Angelo, TX
SR 6 – Powder Springs, GA
US 78 – Aiken, SC

50th – San Angelo, TX
Wistful Vista Lane – Fairview, OR
RCC Pavement

Why are DOT/Agencies interested?

- Improve Structural Capacity of Existing Roadways
- Urban/fast-track construction
  - Lift thickness limitations
  - Drop-off limitations
  - Maintenance of cross-traffic
  - Construction speed
- Use RCC as base under asphalt
  - Success with Cement Stabilized Aggregate Bases
- Stimulation of competition
  - Lowers cost to the taxpayer
- Expand the portfolio of pavement types available
  - Price run-up of asphalt binder
  - Uncertain petroleum supply in future
- Concrete pavement at a initial price competitive with HMA
RCC Roadways History

- City of Portland
  - Composite Roadways back to 1995
  - 8” RCC with 2” HMA Cap
  - Minimal Maintenance to date

- City of Edmonton, Alberta, Canada
  - Contact: Hugh Donovan, Construction Services Engineer (780-496-6773)
  - Various Industrial and Street Projects, including city streets and arterials in early 90’s
  - Use between 7-11” RCC layer with 2” asphalt surface layer on top
    - No joint sawing – allow material to crack naturally
    - Typically cracks every 40 feet
    - No experience with crack relief layer
RCC Roadways History

• City of Fort St. John British, Columbia, Canada
  – Contact: Victor Shopland, Materials Engineer
  – RCC Placed in 1992 on city streets
  – 9” RCC with 2” HMA wearing surface
  – No sawed joints at all
  – Traverse cracks roughly every 20 feet – crack sealing used as appropriate

• Columbus, Ohio
  – Contact: Vic Cummins – City Engineer (614) 645-0412
  – Largest RCC City Streets program in the country
  – Started in 2001 and have bid over 60 projects since
  – Use 6-8” RCC with varying HMA thickness on top
  – Varying joint treatments including sawcutting through HMA at RCC transverse joints
Early RCC Roadways: Project Pictures

Portland, Oregon
RCC Paving for Roadways

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Roadway applications for RCC-
Project Types Used to Date

- Composite Pavements
- Interstate Shoulders
- Turn Lanes
- Lower Volume Roadways
Composite Pavement System – Volume 1 – HMA/PCC Composite Pavement

- Part of SHRP 2 – Renewal Research, complete in 2013
- Study looked at composite pavement systems using a variety of HMA and concrete pavement types, thicknesses, etc.
  - New and existing composite pavements evaluated
  - Composite systems utilizing JPC, CRC, RCC, and CTB as base layer
  - Several RCC jobs were included in the study – 8”, 15” RCC with 1-3” HMA cap
Summary findings

- Excellent surface characteristics can be obtained from thin (1”-3”) asphalt top layers.
  - Allows rapid renewal of the surface while maintaining high structural carrying capacity in the rigid base.
- There is an avoidance of certain distress types that occur in conventional pavements.
  - Fatigue cracking in HMA was minimal because pavement is almost always in compression
  - Fatigue cracking in PCC was reduced due to the insulating effects of the HMA
  - Rutting is minimized due to high quality materials and thin layer of HMA
  - Transverse cracking controlled through sawing and sealing techniques
SCDOT Projects

- Powell Pond Rd, Aiken County (Demo. Project)
- SC 5, York County
- US 78, Charleston County
- New State Road, Lexington County
- Greystone Boulevard, Richland County
- S. Beltline Boulevard, Richland County
- Richland Street (US78), Aiken County
- SC 9, Horry County
- S-11-171, Cherokee County
US 78 Ladson, SC
Pavement Cross-Section

2” Asphalt

10” RCC Base

Existing Subgrade / Base
- State route with heavy truck traffic
- Poor & wet subgrade/soils resulted in consistent rutting
Must be able to get compaction/density, subgrade improvement may be necessary
Roadway Applications for RCC – Project Types Used to Date

- Composite Pavements
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I-285 Shoulder Replacement
Atlanta, GA

Pavement Design Information
- Owner: Georgia DOT
- Use Type: State Route shoulder
- Year Built: 2006
- Thickness: 6 & 8” RCC
- Quantity: 35 lane miles 38.500 CY

Additional Details
- 2006 SCAN Innovation Award
- Material placed on weekends only
- Removal of shoulders on Friday night starting 9:00 PM
- Had to be off the road by 5:00 AM Monday morning ($5,000 per hour fine)
- Typically 1.5-2 miles per night
I-285 Shoulder Replacement
Atlanta, GA
I-285 Shoulder Replacement: Completed Shoulder
Roadway Applications for RCC – Project Types Used to Date

- Composite Pavements
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Pavement Design Information

- Owner: Georgia DOT
- Use Type: State Route shoulder and Median
- Year Built: 2006
- Thickness: 7” RCC (Shoulder & Median)
- Quantity: 16,500 CY

Additional Details

- First use of RCC in travel way in United States
- Project won 2007 SCAN Quality Award for concrete pavement construction
- ADT - 17,000, 5% trucks – 22 M ESALS
- RCC used for travel lane during construction
State Route 6
Powder Springs, GA
State Route 6
Powder Springs, GA
Roadway Applications for RCC – Project Types Used to Date

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Richland Ave (US 78)
Aiken, SC - 2009

**Pavement Design Information**
- Owner: South Carolina DOT
- Use Type: US Highway
- Year Built: 2009
- Thickness: Milled 10” asphalt
  Placed 10” RCC
- Traffic: 6000 ADT, 4 lanes
- Speed: 45 mph

**Additional Details**
- Replaced 27,500 SY in 15 days
- Placed 10” RCC in 1 lift
- All milled areas were paved within same day
- Maintained 1 lane open in each direction
  - Transverse Joints: 20 ft, early entry saw cut within 3 hours
- Traffic re-opened within 24 hours
- 100% Diamond Ground
RICHLAND AV. (US 78) AIKEN, SC
Completed Surface Texture
High-Volume Asphalt Intersection Milled and Replaced by RCC in 60-hour Weekend Construction
Roadways Utilization of RCC: Residential Streets

Access Provided Directly Behind the ABG Paver (Prior to Roller Compaction)
ACTUAL RCC BIDS ARE VERY COMPETITIVE WHEN THE MARKET IS DEVELOPED
Projects Bid to SC & GA DOT in 2006-2009

<table>
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<tr>
<th>LOCATION</th>
<th>RCC Thickness (in)</th>
<th>BID QUANTITY (CY)</th>
<th>BID PRICE / SY / IN</th>
<th>BID PRICE / SY / CY</th>
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<td>I-385 Lauren Co.</td>
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<tr>
<td>I-285 Atlanta</td>
<td>6” 8”</td>
<td>20,000 18,500</td>
<td>$17.75 $23.67</td>
<td>$2.95 $2.95</td>
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</tbody>
</table>
Today's Agenda

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Roadway Applications for RCC
What have we learned?

- Proper Joint construction is Critical
- RCC can be diamond ground to achieve a smooth ride.
  - Helps improve surface texture.
  - IRI numbers in the 60s are achievable.
- RCC can be milled if it is going to be covered.
  - Milling can cause joint damage.
- 10”+ RCC can cause problems when placed with typical equipment.
- Even with best practices, surface texture is varied and material dependent
- RCC can be placed in an urban environment without excessive traffic disruption.
- You only get one shot at doing it right.
Roadway Applications for RCC

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- RCC can be placed in an urban environment without excessive traffic disruption.
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Questions and Contact Information

Chris Carwie
AG Peltz Group, LLC
ccarwie@agpeltz.com
www.agpeltz.com
2053350579