DOT Utilization of Roller Compacted Concrete

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DOT Utilization of RCC

- What ?
- Where ?
- Why?

What is RCC? 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?

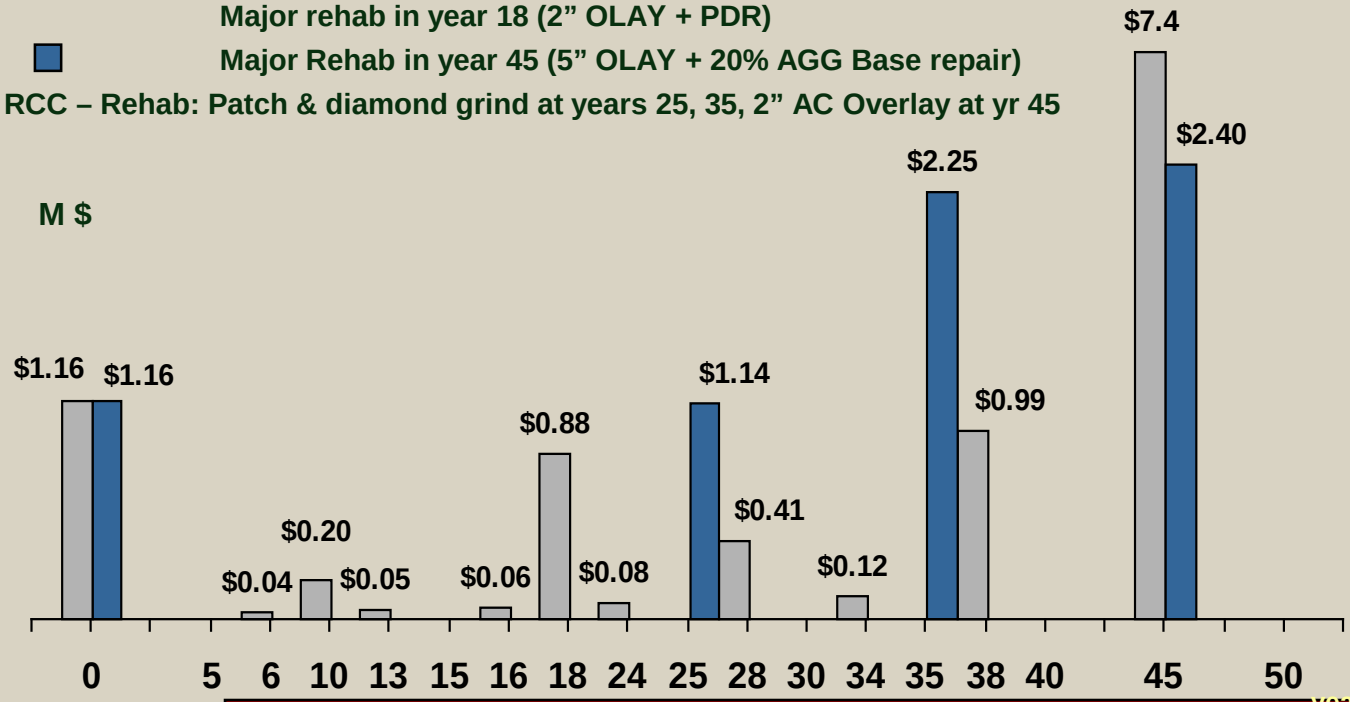
- Speed of construction
- Early strength gain
- Durability
- Cost

Why RCC? Offers Lower Life Cycle Cost

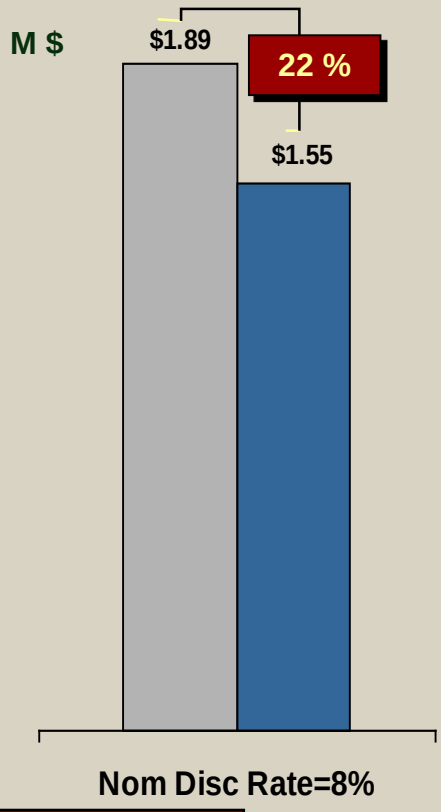
Nominal Expenditures by Pavement Type

Asphalt – Rehab: Crack / cape sealing in years 6, 13, 16, 24, 34, 38
Microsurfacing in years 10, 28
Major rehab in year 18 (2" OLAY + PDR)
Major Rehab in year 45 (5" OLAY + 20% AGG Base repair)

RCC – Rehab: Patch & diamond grind at years 25, 35, 2" AC Overlay at yr 45



Total Cost Net Present Value



Asphalt is 22% more expensive than RCC throughout the life cycle of the road

Rehabilitation – Activities based on Proper Maintenance Cycles for asphalt pavements. Current year costs are inflated at 4%. Rehab costs also include other Incidental Costs (striping, mob, etc) - 40% of material costs, Traffic Control - 5% of material cost, and Engineering & Inspection - 5% of material cost

DOT Utilization of RCC

Materials & Mix Design

Typical Mixture Design

- 400 – 550 lbs/CY Cementitious Material.
- 3400 –3700 lbs/CY Well Graded Aggregate.
- 20 – 30 gallons/CY Water.
- W/C Ratio usually between 0.3 – 0.45.
- Water amount dictated by Moisture/ Density Relationship.

Surface Texture

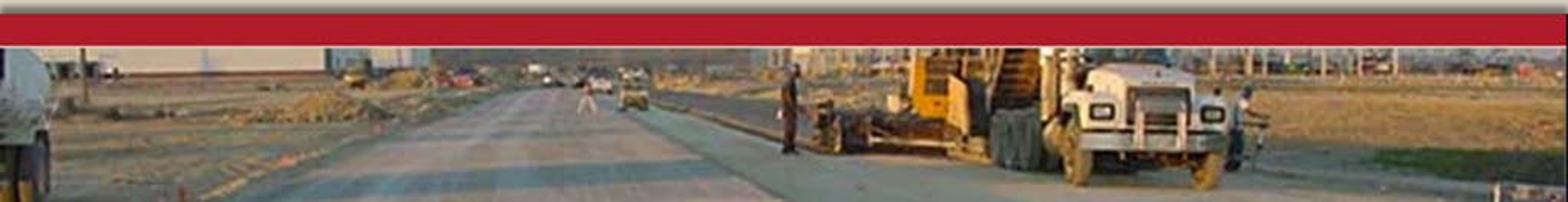
Highly dependent on aggregate gradation and binder content.

DOT Utilization of RCC

Construction

Continuous Mix Pug Mill

- High-volume applications
- Excellent mixing efficiency for dry materials
- 250 to 900+ tons/hr
- Mobile, erected on site
- Mobilization costs

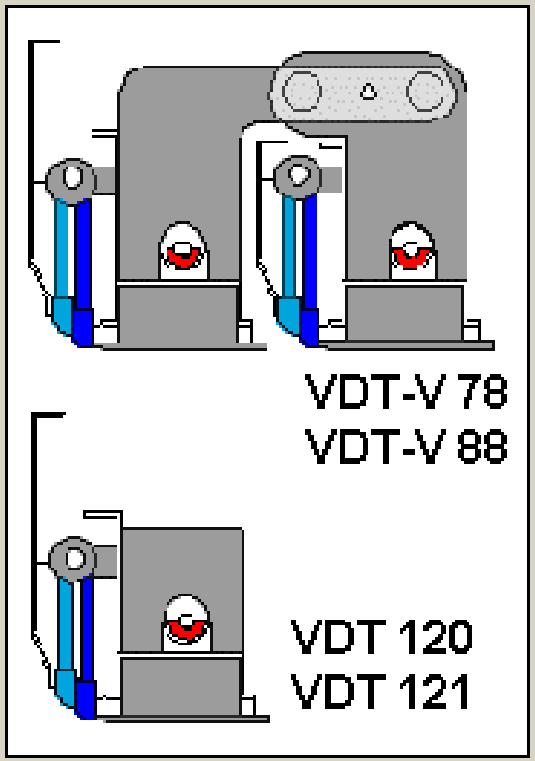


Transporting & Placement

Placing Equipment

- High density pavers
  - Vibrating screed
  - Dual tamping bars and or pressure bars
  - High initial density, 90-95%
  - Reduces subsequent compaction
  - High-volume placement (1,000 to 2,000 cubic yards per shift)
  - Designed for harsh mixes
  - Smoothest RCC surface

High Density Screed



Compacted Edges through the use of Edging Shoes

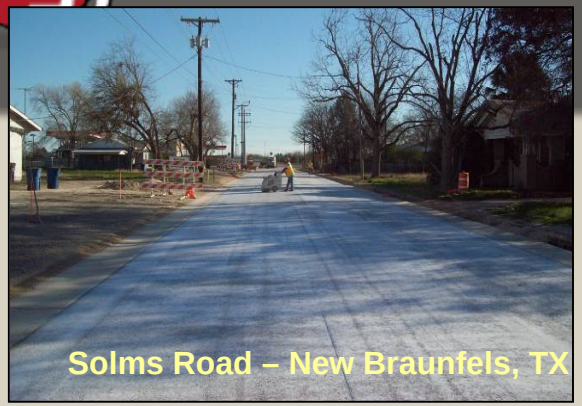
Compaction-Final Density

- Final density is critical for strength and durability
- Compacted to 98% Modified Proctor
- Dual Steel Drum Roller
- Combination Roller
- Rubber coated steel drum roller

Concrete Curing Compound

- White-pigmented concrete curing compounds
- Apply 1 to 1.5 times the normal application rate

DOT Utilization of RCC


Solms Road – New Braunfels, TX

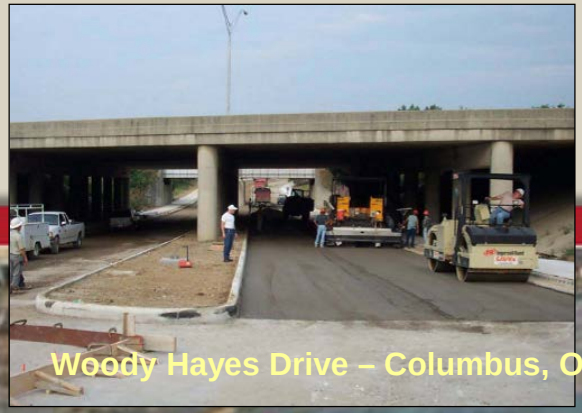

50th
–
San Angelo, TX


Grape Creek Road – San Angelo, TX


I-85 Interchange – Lagrange, GA


SR 6 – Powder Springs, GA


Wistful Vista Lane – Fairview, OR


Woody Hayes Drive – Columbus, OH


US 78 – Aiken, SC

RCC Pavement
Why are DOT's 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

DOT Utilization of RCC

- Composite Pavements
- Interstate Shoulders
- Turn Lanes
- Lower Volume Roadways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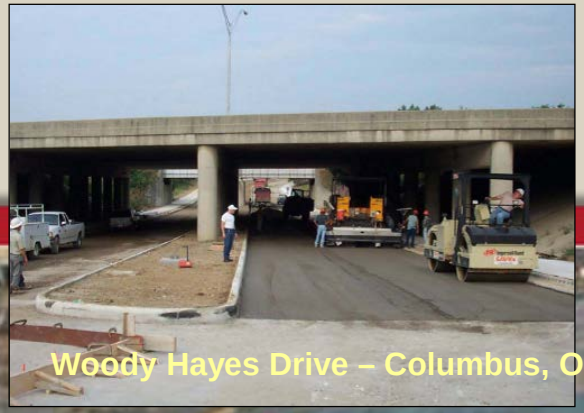
Woody Hayes Drive – Columbus, OH

I-285 Shoulder – Atlanta, GA


US 78 – Aiken, SC

DOT utilization of RCC – Project Types Used to Date

- Composite Pavements
- Interstate Shoulders
- Turn Lanes
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Typical RCC Composite Pavement Cross-Section

1” – 3” Asphalt
6” – 10” RCC Base
Existing Subgrade / Base

Composite Pavement History

- Select cities started using RCC as a base layer over 25 years ago
  - Portland (1985)
  - Fort St. John (British Columbia)
  - City of Edmonton (92-93)
- Columbus, Ohio adopted an aggressive city streets program in 2001
  - Over 50 projects to date
- Various methods of treating cracks from saw and sealing to allowing to crack naturally

RCC - City Streets Examples

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

US 78 Ladson, SC 2009

- State route with heavy truck traffic
- Poor & wet subgrade/soils resulted in consistent rutting

US 78 Ladson, SC 2009


US 78 Ladson Co.
Completed Project

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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

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I-285 Shoulder Replacement
Atlanta, GA

I-285 Shoulder Replacement: Completed Shoulder

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STATE ROUTE 6

Powder Springs, GA

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

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State Route 6
Powder Springs, GA

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State Route 6

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Richland Ave (US 78)

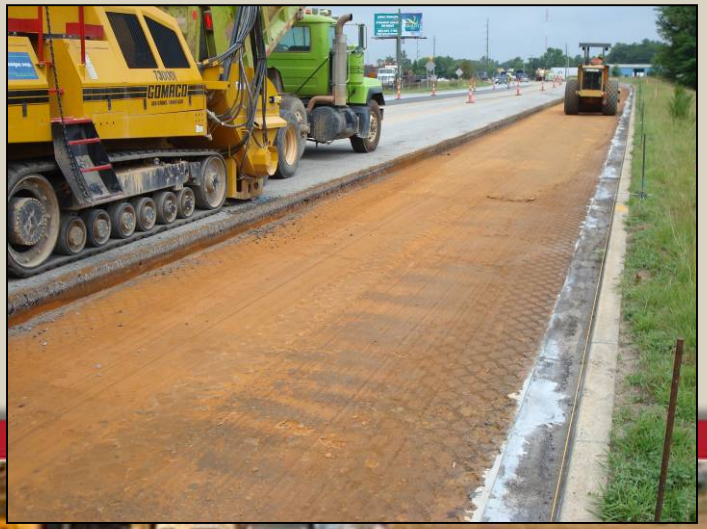
Aiken, SC - 2009

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

RICHLAND AV. (US 78) AIKEN, SC


RICHLAND AV. (US 78) AIKEN, SC
Completed Surface Texture

ACTUAL RCC BIDS ARE VERY COMPETITIVE WHEN THE MARKET IS DEVELOPED

Projects Bid to SC & GA DOT in 2006-2009

LOCATION	RCC Thickness (in)	BID QUANTITY (CY)	BID PRICE / SY	BID PRICE / SY / IN
US 78 Aiken Co.	10	27,050	$ 29.93	**$ 2.99**
Lexington/ Richland Co.	10	51,500	$ 33.60	**$ 3.36**
Rock Hill	10	25,650	$ 33.00	**$ 3.30**
I-385 Lauren Co.	10	135,387	$ 22.00	**$ 2.20**
I-385 Greenville County	8	54,957	$ 21.85	**$ 2.73**
SR 6 – Powder Springs	7”	16,500	$28.78	
I-285 Atlanta	6” 8”	20,000 18,500	$17.75 $23.67	

DOT Utilization of 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.**

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Questions and Contact Information

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