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

- Zero slump (consistency of damp gravel)
- No forms
- No reinforcing steel
- No finishing
- Consolidated with vibratory rollers

Concrete pavement placed in a different way!
Why Use RCC for Pavements?

- Low cost
- Easy preparation
- High-volume production
- Minimal labor
- High strength and durability
- Proven performance
- Environmental benefits
Engineering Properties

- Compressive strength
  - 4,000 to 10,000 psi

- Flexural strength
  - 500 to 1,000 psi

- Modulus of Elasticity
  - 3,000,000 to 5,500,000 psi
Mixture Design

- Differs from conventional concrete!
  - Not air-entrained
  - Lower water content
  - Lower paste content
  - Larger fine aggregate content
  - Nominal max. size aggregate 5/8 in???
Proportioning Methods

Several methods available:

- Concrete consistency tests
- Soil compaction methods
- Optimal paste volume method
- Solid suspensions model

Always allow time and money for field trial
Aggregate Selection

- Highway base course, asphalt or concrete aggregates can be used
- 5/8 in. NMSA
  - Provides smooth surface, reduces segregation
- Higher fine aggregate content than conventional
  - Economic advantage using non-washed and pit-run aggregates including dense graded aggregate base
  - Provide adequate stability under vibratory roller
- 2%-8% passing #200 sieve
  - Supplements paste to fill voids and maintain tight surface
Proportioning of RCC
Soil Compaction Method

- Select cementitious materials
  - Portland cement: Type I or II (C150 or C1157)
  - Blended cement: (C595 or C1157)
  - Fly Ash (C618), Slag (C989) or silica fume (C1240)
  - Normally 400-600 lb/cy total cementitious (12% to 17% of dry weight)
  - If used, fly ash proportions typically 15% to 25%; silica fume typically 5% to 10%
Soil Compaction Method

- Determine moisture content
  - Construct moisture/density curve
  - ASTM C1435- electric vibrating hammer
  - Assume a median cement content (500 pcy)
Moisture-Density Relationship

The graph illustrates the relationship between moisture content and dry density (lb/ft³). The x-axis represents moisture content ranging from 2% to 8%, while the y-axis shows dry density ranging from 140 to 144 lb/ft³. The data points and the curve suggest an optimum moisture content for maximum dry density, which is approximately 5%.
Soil Compaction Method

- Determine cementitious materials content
  - Use optimum moisture content
  - Run cement series
    - e.g., 11%, 13%, 15%, 17%
  - Select cement content which yields appropriate strength
ASTM C1435
Strength vs. Cement Content

- Chart showing the relationship between 28-Day Compressive Strength (psi) and Cement Content (in percentage).

Axes:
- Y-axis: 28-Day Compressive Strength (psi) ranging from 4,000 to 6,500.
- X-axis: Cement Content ranging from 10% to 18%.

Data points:
- 10% Cement Content: 725 psi
- 12% Cement Content: 697 psi
- 14% Cement Content: 667 psi
- 16% Cement Content: 636 psi
- 18% Cement Content: 603 psi

Trend line indicating an increase in strength with increasing cement content.
Placing Equipment-construction

- Conventional Asphalt Pavers
  - Provides some initial density (80%-85%)
  - Relatively smooth surface
  - May require modification
  - Increased cleaning and maintenance
Placing Equipment

- Spreaders
  - Jersey spreader

- Truck Dumped
  - Motor grader/dozer
  - Low initial compaction
  - Not as smooth as when placed using paving equipment
  - Excellent for low-speed traffic
Paving Train of HD paver

- Paver
- Material Transfer Device
- Truck
Compaction

- Initial compaction provided by paver
- Proper final density is critical for both strength and durability
- Compact to 98% of modified Proctor
- Compaction equipment is at discretion of the contractor
  - Vibratory roller
  - Non-vibratory steel wheel roller
  - Rubber-tire roller
Concrete Curing Compound

- Can apply standard white-pigmented concrete curing compounds
- Apply 1-1/2 to 2 times rate for conventional concrete
- Do not use if asphalt cap to be placed
Natural Cracks

- Most economical
- 30 to 80 ft spacing
- Often first cracks appear within 24 hours
- Narrow crack widths
- Seal if > 1/8-inch
- Best load transfer
- Minimal raveling
Saw-Cut Joints

- More aesthetically pleasing
- Early entry saws very effective, shortly following placement
- Need to saw within 12 hours to avoid uncontrolled cracking
- 1/3 to 1/4 of total layer thickness
Traditional RCC Paving Projects

- Low-speed vehicles
- Industrial sites
- Large and unrestricted paving areas
I-285  Georgia

First Highway Application

Shoulders of 6” and 8” RCC
Access Provided Directly Behind the ABG Paver (Prior to Roller Compaction)

Huge advantage in urban areas!
No Jagged Edges
What's next?
SCDOT- US78 – Ladson, SC

41,700 AADT
10% Trucks
1 mile length

Rutting, shoving, fatigue…!
2” Asphalt Surface
10” Roller Compacted Concrete

RCC- $39.40 yd²
“Integrated Pavement Solution”

Full-depth Reclamation

Roller Compacted Concrete
• FDR with cement performed
• 12 inches deep
• Aggregate and asphalt of varying depths
- 8 inches of RCC paved within 24 hours of FDR
- Entire 500 foot section completed over weekend
- Temperatures around freezing at night
for additional information, please visit our website at
www.cement.org/pavements
Thank You!

Portland Cement Association

wmcconnell@cement.org