



Wayne Adaska is director of pavements for the Portland Cement Association. He has more than 25 years experience in the cement and concrete industries. He is an active member of several ASTM and ACI technical committees including ASTM Committee C09.45 on Roller-Compacted Concrete and ACI Committee 327, Roller-Compacted Concrete Pavements. He has authored several papers and publications on roller-compacted concrete and served as co-author of the Guide to Roller-Compacted Concrete Pavements, a comprehensive manual on the design and construction of RCC pavements. Wayne is a registered professional engineer in the State of Illinois.

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Symposium on Integrated Cement Based Pavement Solutions, Part 2: Roller Compacted Concrete Pavements

March 19, 2012 • 11:00 A.M. - 1:00 P.M.

Learning Objectives:

By attending this session, attendees will be able to:

1. Apply principles learned to use roller-compacted concrete with confidence.
2. Recognize the most important factors to consider when constructing RCC.
3. Avoid the common problems associated with RCC design and construction.
4. Determine whether RCC is appropriate for a particular pavement application.

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Roller-Compacted Concrete Pavements

Wayne Adaska, P.E., Director, Pavements
Portland Cement Association

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Definition

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

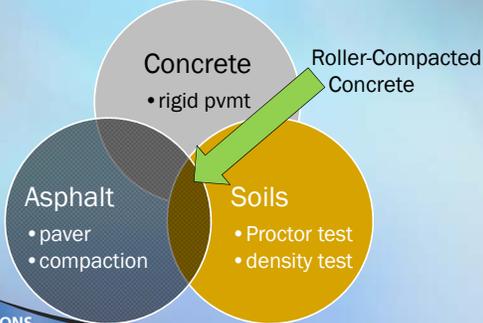
- Zero slump (consistency of dense damp gravel)
- No forms or finishing
- No reinforcing steel
- High production
- Pavers or earth moving equipment
- Consolidated with vibratory rollers



Concrete placed in a different way!

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Multiple Personalities



Concrete
• rigid pvmt

Asphalt
• paver
• compaction

Soils
• Proctor test
• density test

Roller-Compacted Concrete

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Benefits of RCC Pavements

- Fast construction with minimum labor
- Economical
- Early load carrying capacity
- Durable
- Low maintenance
- Light surface reduces lighting requirements and Urban Heat Island effects

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Applications

- Ports, intermodal yards and military hard stands
- Warehouse facilities & auto manufacturing plants
- Maintenance & storage yards
- Airport service areas
- Highway shoulders
- Rural roads
- Local streets & intersections

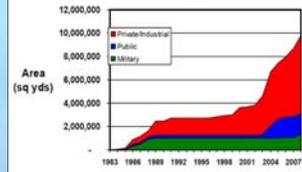


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RCC – Experiencing a Revival

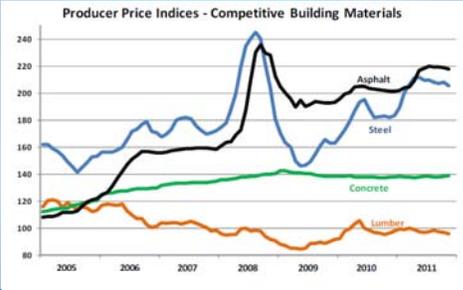
- Growth has accelerated in last seven years
- Used for more than just heavy-duty pavements
- Emergence of asphalt contractors placing RCC



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Asphalt Prices Have Soared



Base Year: 2002 = 100
Source: Bureau of Labor Statistics

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RCC Makes for Strange Bedfellows



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Project Considerations

- Project size
- Site geometry
- Loading characteristics
- End use
- Client expectations



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Surface Appearance

- Not as smooth as conventional concrete
- Important to recognize difference
- Similar appearance to HMA binder layer only light grey instead of black
- Surface can be diamond ground



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Mixture Design

- Dry enough to support vibratory roller
- Wet enough to permit adequate distribution of paste



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Mixture Design

Modifications needed in no-slump conventional concrete mixture procedures (ACI 211.3R) because RCC is:

- Dryer than zero slump
- Not air-entrained
- Lower cement content
- Higher fines content (up to 6% of non plastic fines)
- Nominal max. size aggregate 1/2 to 3/4 in.



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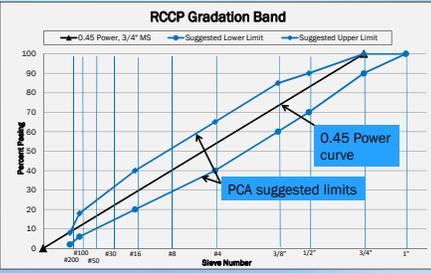
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Aggregate Blend Gradation

Suggested Blend Gradation

Size Number	Percent Passing
1-in (25 mm)	100
3/4-in (19mm)	90-100
1/2-in (12.5 mm)	70-90
3/8-in (9.5 mm)	60-85
No. 4 (4.75 mm)	40-65
No. 16 (1.18 mm)	20-40
No. 100 (150 μm)	6-18
No. 200 (75 μm)	2-8

RCCP Gradation Band



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Soil Compaction Method

- Most common method used in the U.S. for RCC paving mixtures
- Testing equipment readily available at construction materials laboratories
- Three major steps
 - 1) Select aggregate blend with minimal voids
 - 2) Determine opt. m/c and max. density (ASTM D1557 Modified Proctor test)
 - 3) Determine cementitious content

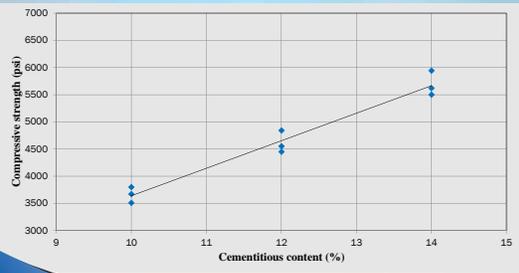


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Determine Cementitious Content



Cementitious content (%)	Compressive strength (psi)
10	3500
12	4500
14	5500

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Concrete Thinking
for a sustainable world

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Construction



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Construction Procedures

- Test section
- Subgrade preparation
- Mixing process
- Transporting
- Placing
- Compacting
- Jointing
- Curing



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Continuous Pugmill

- Excellent mixing efficiency
- High-volume applications
- 125 to 250+ cy/hr
- Mobile, erected on site




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Central Batch Plant

- Highly accurate proportioning
- Local availability
- Smaller output capacity
- Longer mix times than conventional concrete
- Possibly more cleaning
- Dedicated production



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Transporting

- Rear dump trucks normally used
- Minimize transport time
- Covers required for long hauls, or hot/windy conditions



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Transporting




Load in multiple piles or continuous layers to avoid segregation

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Placing Equipment

Conventional asphalt pavers

- Provide some initial density (80-85%)
- Relatively smooth surface
- May require modification
- Increased maintenance




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Placing Equipment

High density pavers

- Vibrating tamping screed
- High initial density, 90-95%
- Less roll-down
- High-volume placement (1,000 to 1,500 cubic yards per day)




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Compaction

- Proper compaction is critical for strength and durability
- Compact to 98% Modified Proctor (ASTM D1557)
- Vibratory steel drum roller
- Rubber coated steel drum, pneumatic tire or lighter steel drum roller to remove ridges and smooth surface



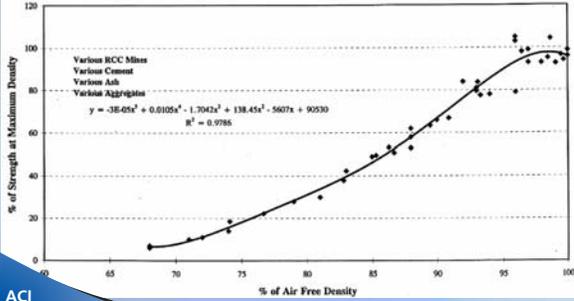


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Compaction Very Important



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Curing

- EXTREMELY IMPORTANT
- Water or concrete curing compound
- Application rate depends on surface texture





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RCC Guide

- Introduction
- Applications
- Properties
- Mixture Proportioning
- Structural Design
- Production
- Construction
- Troubleshooting



www.cement.org/pavements

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RCC Training Modules

- Introduction & Uses
- Properties
- Mixture Proportioning
- Structural Design
- Production
- Construction



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Thank You

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