



Overview of Roller Compacted Concrete Pavements

SWIFT Conference, September 19-22, 2016

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Definition

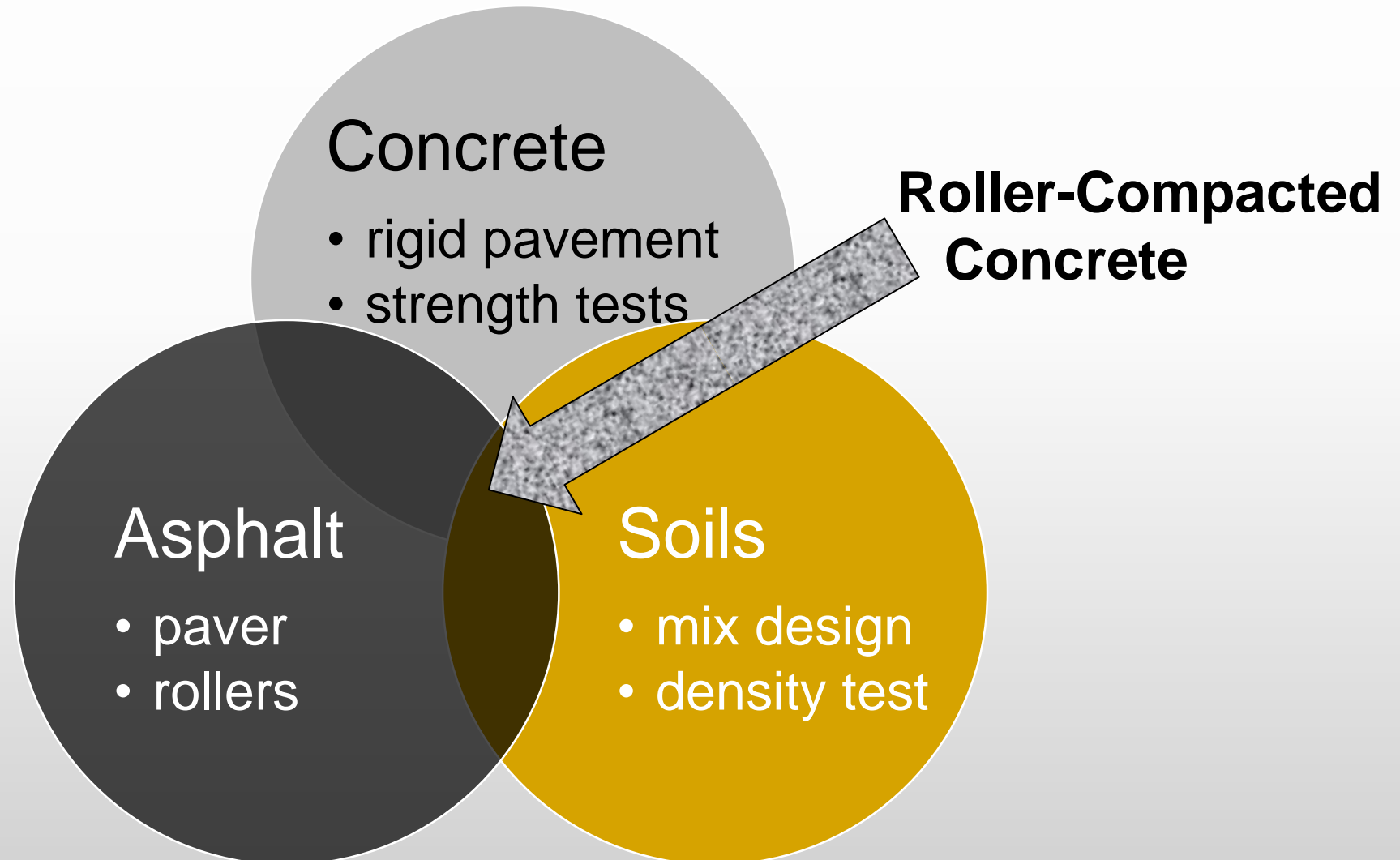
“Roller-Compacted Concrete (RCC) is a no-slump concrete that is placed with asphalt type pavers and compacted by vibratory rollers”

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



Concrete placed in a different way!

Multiple Characteristics



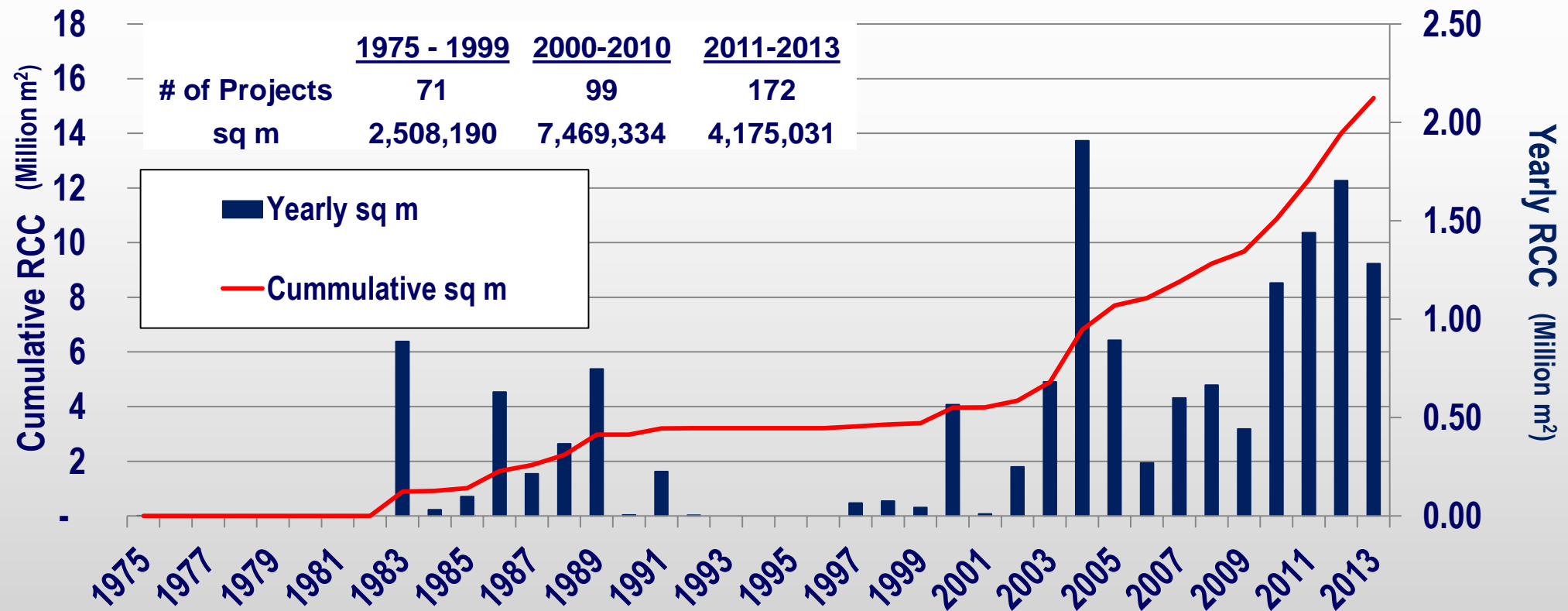
Benefits of Roller Compacted Concrete

- Fast construction
- Economical
- Early load carrying capacity
- Supports heavy loads
- Low maintenance
- Durable
- Light surface reduces lighting requirements and Urban Heat Island effects

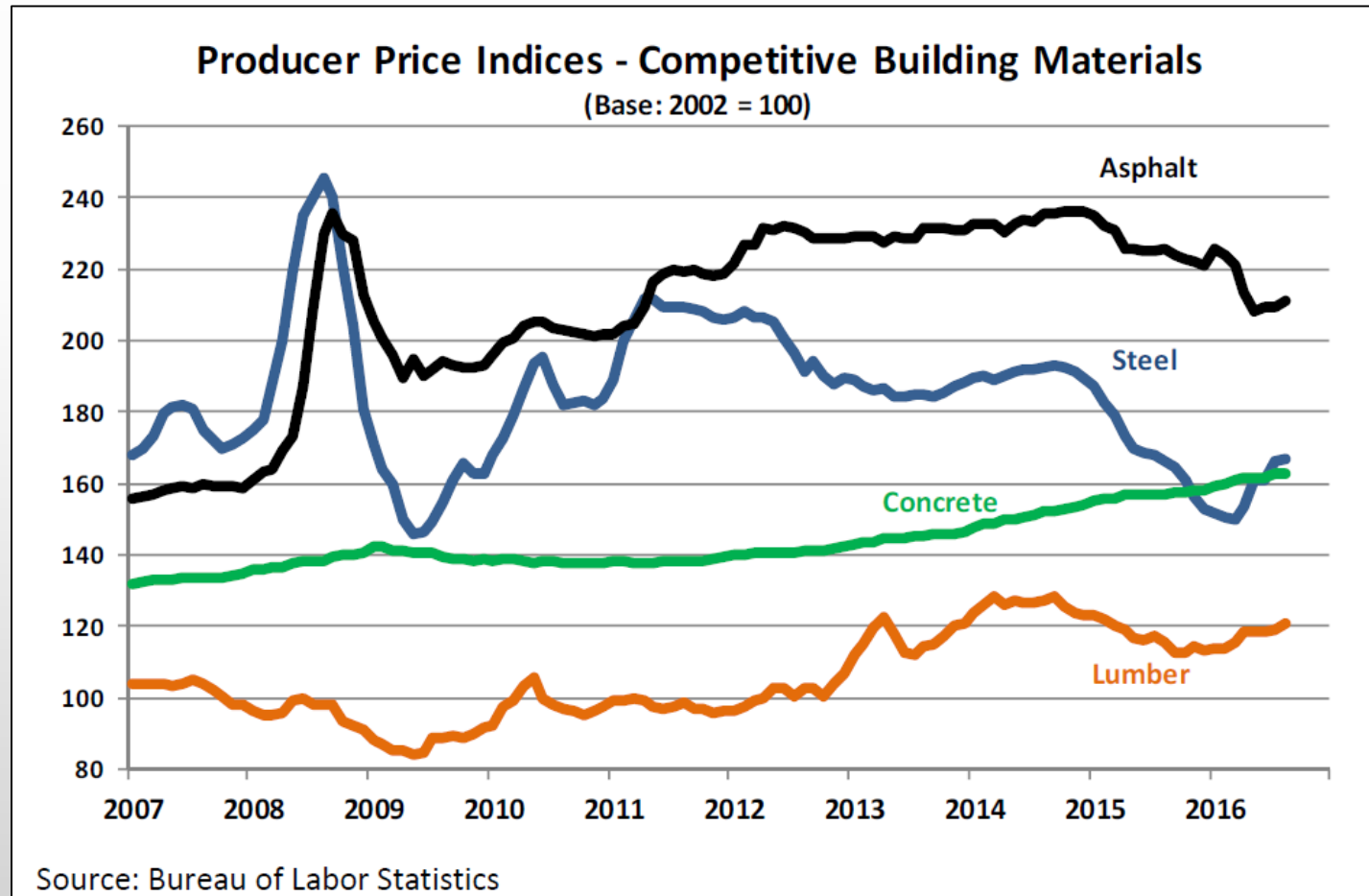


RCC – Experiencing a Renewal

- Originally used for heavy-duty pavements
- Growth has accelerated in last decade
- Increase in private & public road use
- Emergence of asphalt contractors placing RCC



Volatility of Asphalt Prices



RCC Makes Strange Bedfellows

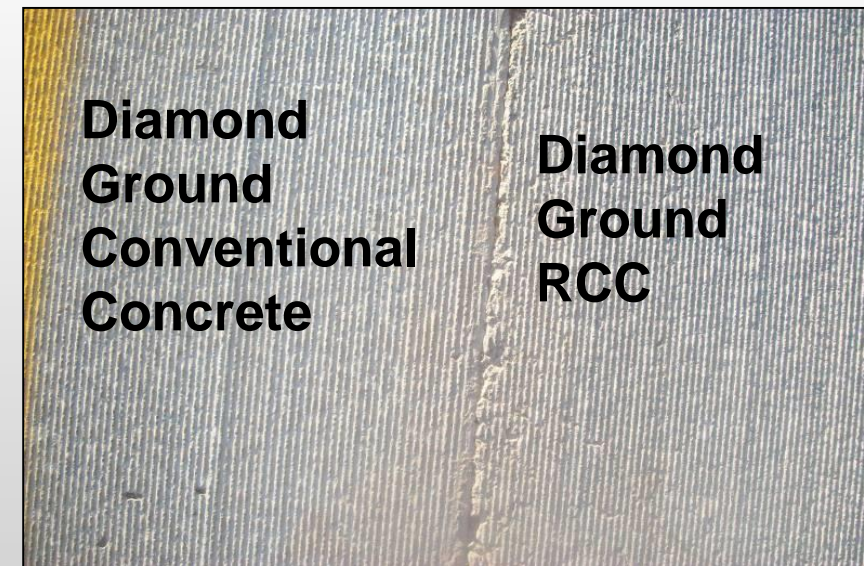
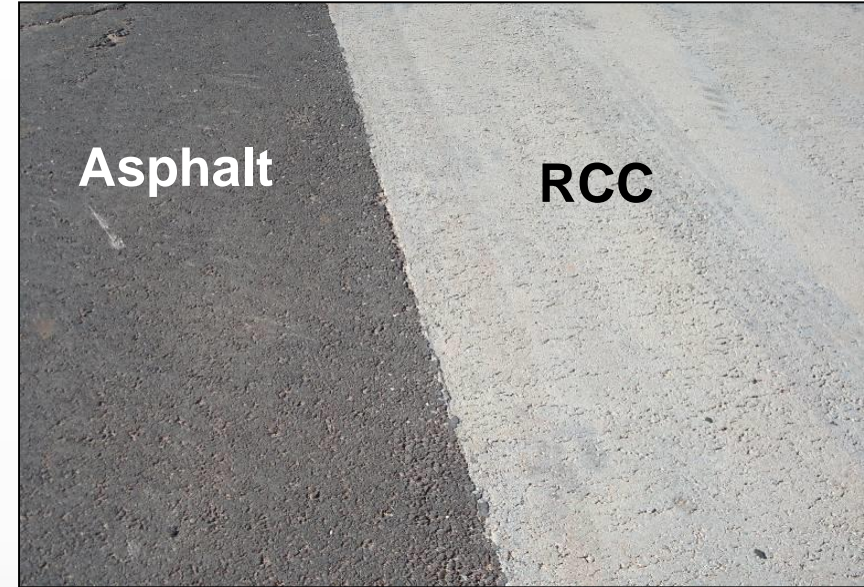


Project Considerations

- Project Size
- Site geometry
- End use
- ***Client expectations***



Surface Appearance



Technologies to Improve Surface Appearance

RCC Surface Pro

- Colloidal Silica
- Reacts with cement to increase paste
- Liquid surface application
- Utilizes power towels
- Improves surface appearance



Aceit

- Andale Ready Mixed, Wichita, KS
- Applied at time of mixing
- Requires aggressive mixer, e.g. pugmill mixer
- Requires high density paver
- Utilizes power towels



Applications

- Ports, intermodal yards and military hard stands
- Warehouse facilities
- Parking areas
- Maintenance & storage yards
- Airport service areas
- Arterial roads
- Highway shoulders
- Local streets & intersections
- Pothole patches



Denver International Airport

Project Information

- Owner: City & County of Denver
- Use type: Snow pad
- Year built: 2008
- Quantity: 17,441 m²
- Thickness: 200 mm RCC over a 150 mm recycled concrete base

Additional Details

- Late fall placement, blankets used
- Joints: 9 X 9 meters
- Compressive strengths:
 - 13.8 Mpa @ 24-hr req / 22.9 MPa achieved
 - 27.6 MPa @ 28-days req / 41.8 Mpa achieved



Construction Requirements

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



Test Section

- Train contractor and testing personnel
- Demonstrate workability and appearance of mix
- Demonstrate equipment capabilities
- Demonstrate construction details
 - Joints, bonding, compaction, etc.
- Develop rolling requirements/pattern
- Test RCC and develop correlation factors for density and f'_c vs. MR
- Test section should not be part of production



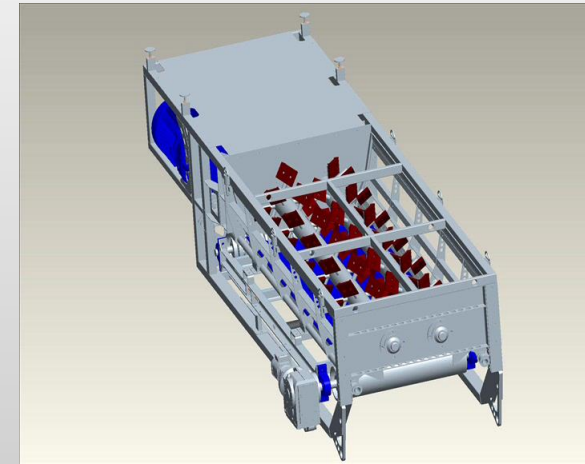
Subgrade Preparation

- Must be firm
- Check with proof roller or compact to 95% min. density
- Replace unsuitable materials
- Shape to proper lines and grades



Continuous Pugmill

- High-volume applications
- 100 to 200 plus m³/hr
- Excellent mixing efficiency
- Mobile, erected on site



Central Concrete Batch Plant

- Highly accurate proportioning
- Local availability
- Smaller output capacity
- Longer mix times than conventional concrete
- More cleaning with drum mixer
- Dedicated production
- Horizontal shaft spiral blade mixer very efficient



Dry Concrete Batch Plant

- Highest local availability
- Very good for small jobs
- 2-step process
 - Feeds transit mixers
 - Discharge into dumps
- Mix 50 -60% capacity
- Low production
- Segregation concern
- Intermittent cleaning required
- Portable pugmill mixers



Aggregates

- ***Aggregate gradation very important***
- 85% of mix by volume
- Responsible for mix workability, segregation & ease of consolidation
- Quality of aggregates should meet ASTM C33



Aggregates

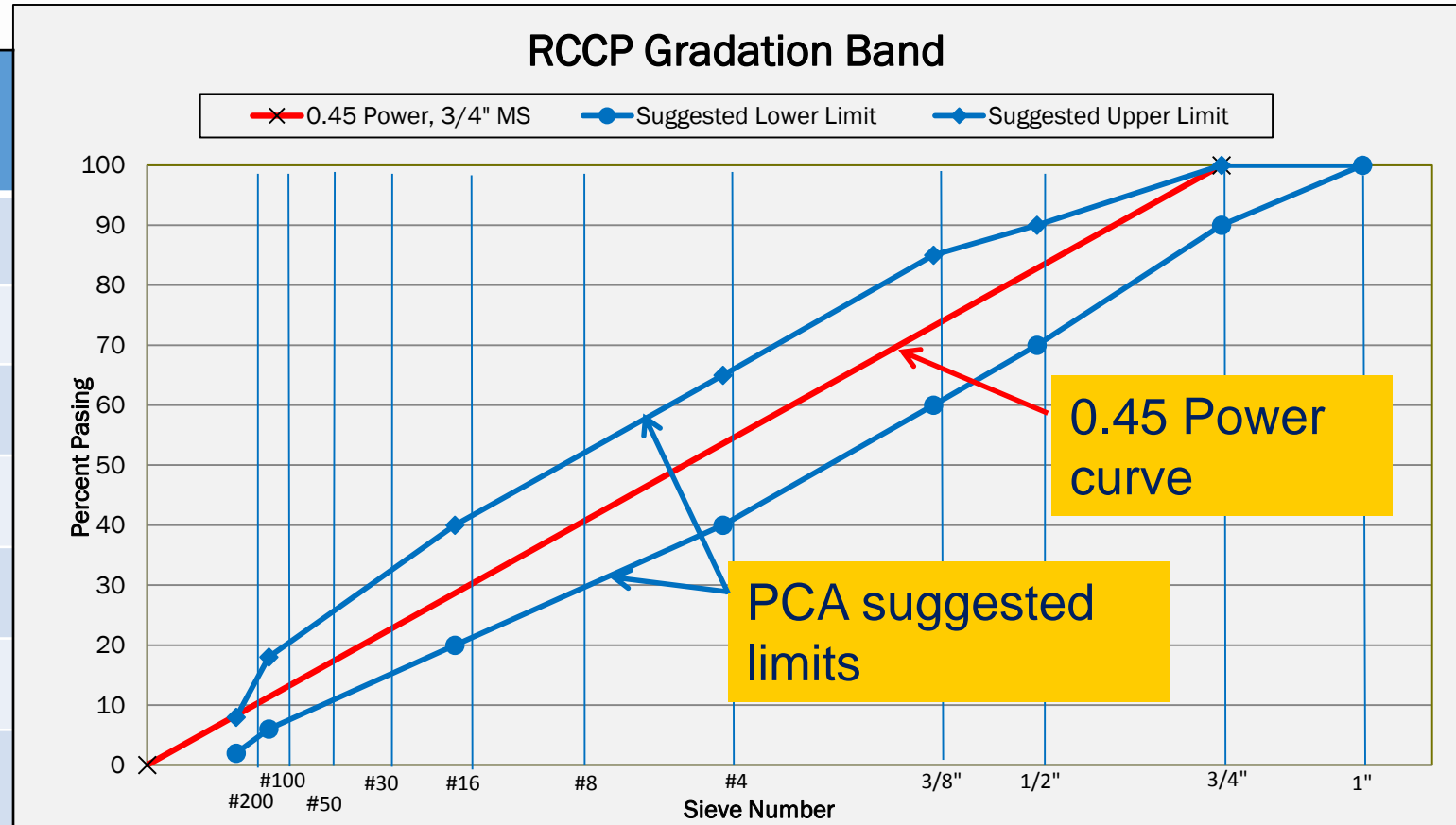
- Nominal Maximum Size Aggregate
 - Most projects: 15-mm to 19-mm
 - As small as 13-mm for tighter surface and reduced segregation
 - 38-mm may be used for non-wearing courses or where surface appearance is not critical
- Manufactured sands provide harsher mix than natural sands
- Multiple aggregate piles
- Consider availability when preparing specs (during design phase)



Aggregate Gradation

Suggested Blend Gradation

Size Number	Percent Passing
1-in (25 mm)	100
3/4-in (19mm)	90-100
1/2-in (13 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



Moisture Content

- ***Moisture content is critical***
- Check at plant
- +/- 0.5% of optimum moisture



Transporting

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



Placing

- Production & transportation should match paver capacity
- Uninterrupted forward
- Layer Thickness
 - 100-mm minimum thickness
 - 225 to 250-mm maximum thickness (single layer)
- Timing Sequence
 - Limited time (generally 60 minutes max.) for placement of adjacent lanes to maintain “fresh joint”
 - Multiple lifts placed within 60 minutes for “fresh joint”

Conventional Asphalt Pavers

- Readily available
- Provide some initial density (80-85%)
- Relatively smooth surface
- Lift thickness: up to 150-mm
- Increased roll down to achieve density



High Density Pavers

- Vibrating tamping bars
- High initial density (> 90%)
- Lift thickness: up to 250-mm
- Less roll-down: 3-mm per 25-mm
- High-volume placement (750 to 1,500 m³ per shift)

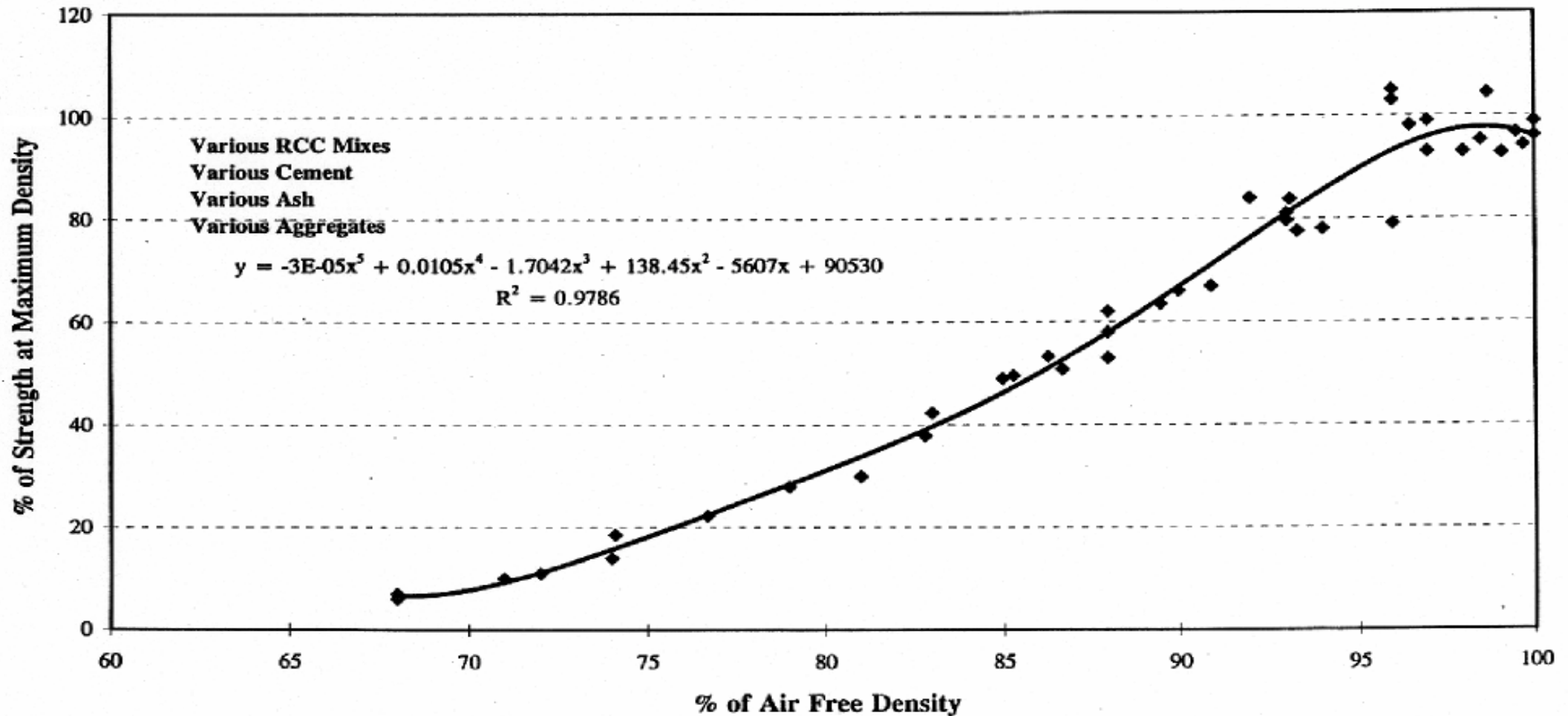


Compaction

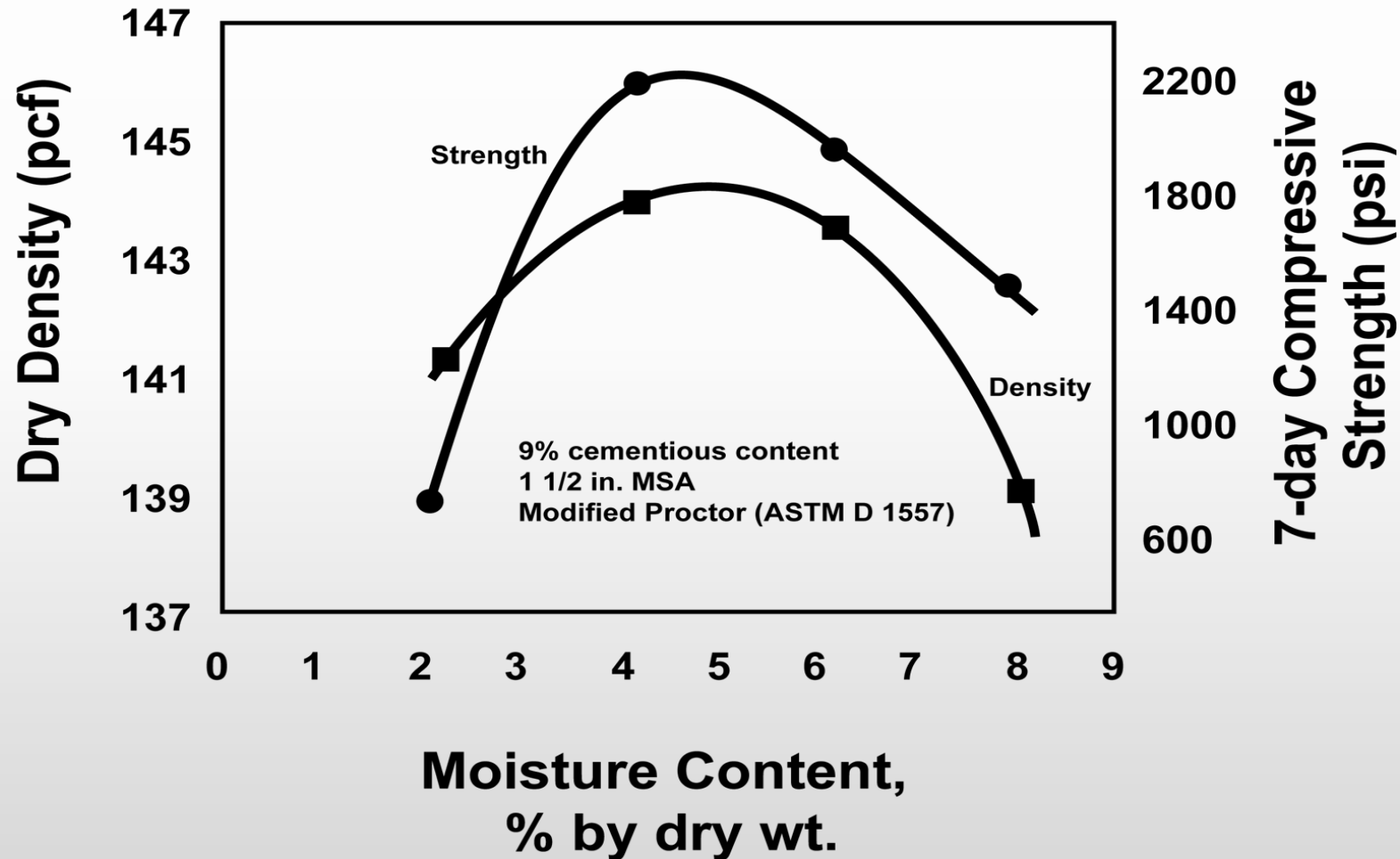
- Proper compaction is critical for strength and durability
- Compact to 98% Modified Proctor (ASTM D1557)
- Vibratory steel dual-drum roller
- Pneumatic tire or rubber coated steel drum to smooth surface
- Finish w/smaller steel roller



Compaction Very Important



Relationship Between Density and Strength



Joints Critical to Performance

- Issue with raveled joints
- Compaction more difficult
- Segregation more likely
- Try to minimize number of cold joints
- Care needed to match grade from cold to fresh joint



Edge Compaction

Compaction shoe



Fresh Longitudinal Joint



- Adjacent lane should be placed within 60-minutes
- Must keep edges moist until adjacent lane placed

Cold Joint Construction

- Cut joints back to fully compacted RCC
- Cut edge should be vertical and clean
- Place fresh RCC slightly higher to allow for reasonable “roll down”



Running Longitudinal Cold Joint



Curing

- Water, sheeting or concrete curing compound
- Application rate depends on surface texture



Quality Control

Moisture & Density

- Tested with nuclear gage in direct mode
- Test density behind paver & after roller to establish rolling patterns to achieve density
- Achieve 98% of modified proctor wet density (ASTM D1557)
- Nuclear gage gives general moisture fluctuation indication - Calibrate with oven dried moisture
- Oven dried is most accurate



ASTM C1040

Compressive Strength

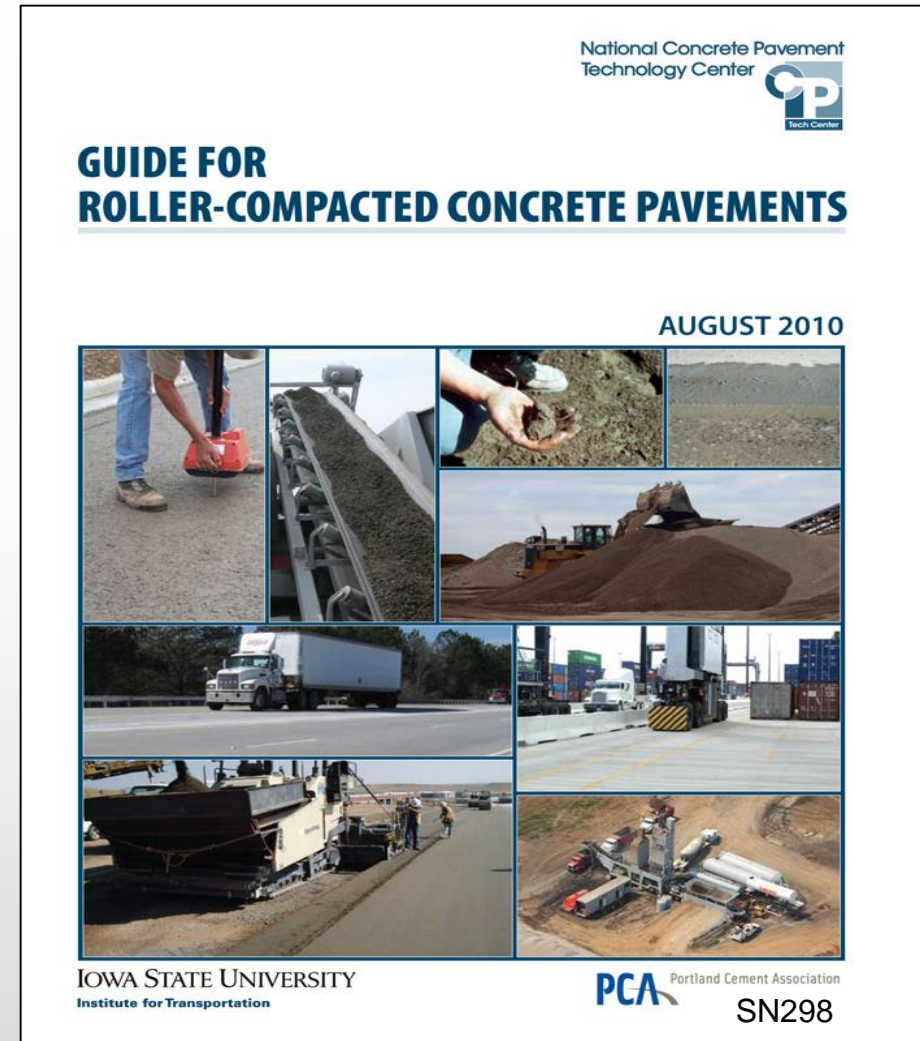
- Cylinders prepared with vibratory hammer
 - Compact in 4 lifts
 - 3 to 4 cylinders per set
 - Strength timing often depends on traffic opening (1, 3, 7, 28 days)
- Cores can be obtained where density is not being achieved



ASTM C1435

Resource Materials

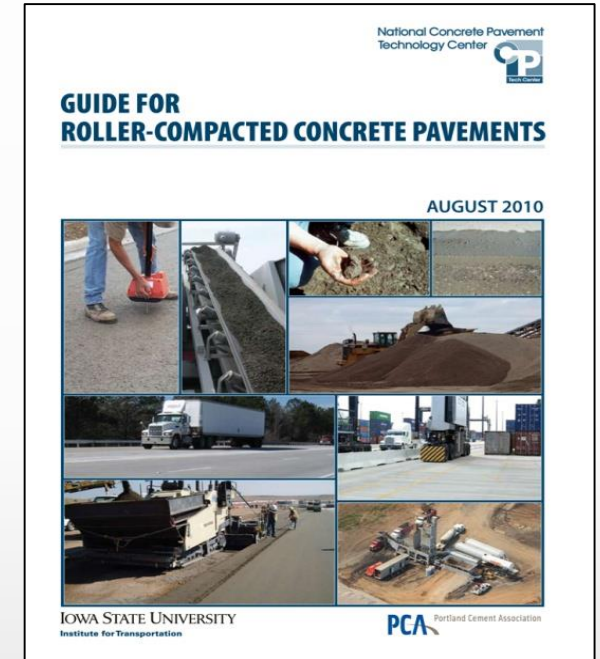
- Introduction
- Applications
- Properties
- Mixture Proportioning
- Structural Design
- Production
- Construction
- Troubleshooting



www.cement.org/bookstore

RCC Training Modules

- Based on RCC Guide
- Six one-hour modules
 - Introduction & uses
 - Properties
 - Mixture proportioning
 - Structural design
 - Production
 - Construction
- Free
- Available at www.nhi.fhwa.dot.gov



ACPA – National RCC Explorer

The National RCC Explorer

[Instructions](#)

259 Items

[MAP VIEW](#) • [TABLE VIEW](#) • [DETAILS VIEW](#)

93 results out of 259 cannot be plotted.

Application

● Airport
 ● Arterial Street
 ● Industrial/Trucking Facility
 ● Local Street
 ● Military
 ● Other (e.g., Logging Facility, Composting Area, Storage Yard)
 ● Port or Intermodal Facility
 ● Widening or Shoulder
 ● mixed

Application

73 Industrial/Trucking Facility

52 Local Street

42 Port or Intermodal Facility

31 Military

State

1 AL

32 AR

1 AZ

RCC Thickness (in.)

5 4 - 5

22 5 - 6

49 6 - 7

47 7 - 8

Contractor

44 A. G. Peltz

1 Abramson L

1 APAC-Georg

1 Archer Wes

Year Constructed

2 1975 - 1980

8 1980 - 1985

36 1985 - 1990

5 1990 - 1995

Project Size (SY)

165 0 - 50000

27 50000 - 100000

8 100000 - 150000

7 150000 - 200000

WEC and PCC Installation

Image 1 of 3

Project Name: Twp

Joint Spacing: 12.5-15 ft

Joint Spacing: 15 ft

CLOSE X

rcc.acpa.org



Supporting research, promotion, and use of Roller-Compacted Concrete Pavement

Founded in 2014, the Council combines leadership from across industries to support research and sustainable market growth.

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Questions ?

Discover how beautiful concrete can be