

Full Depth Reclamation

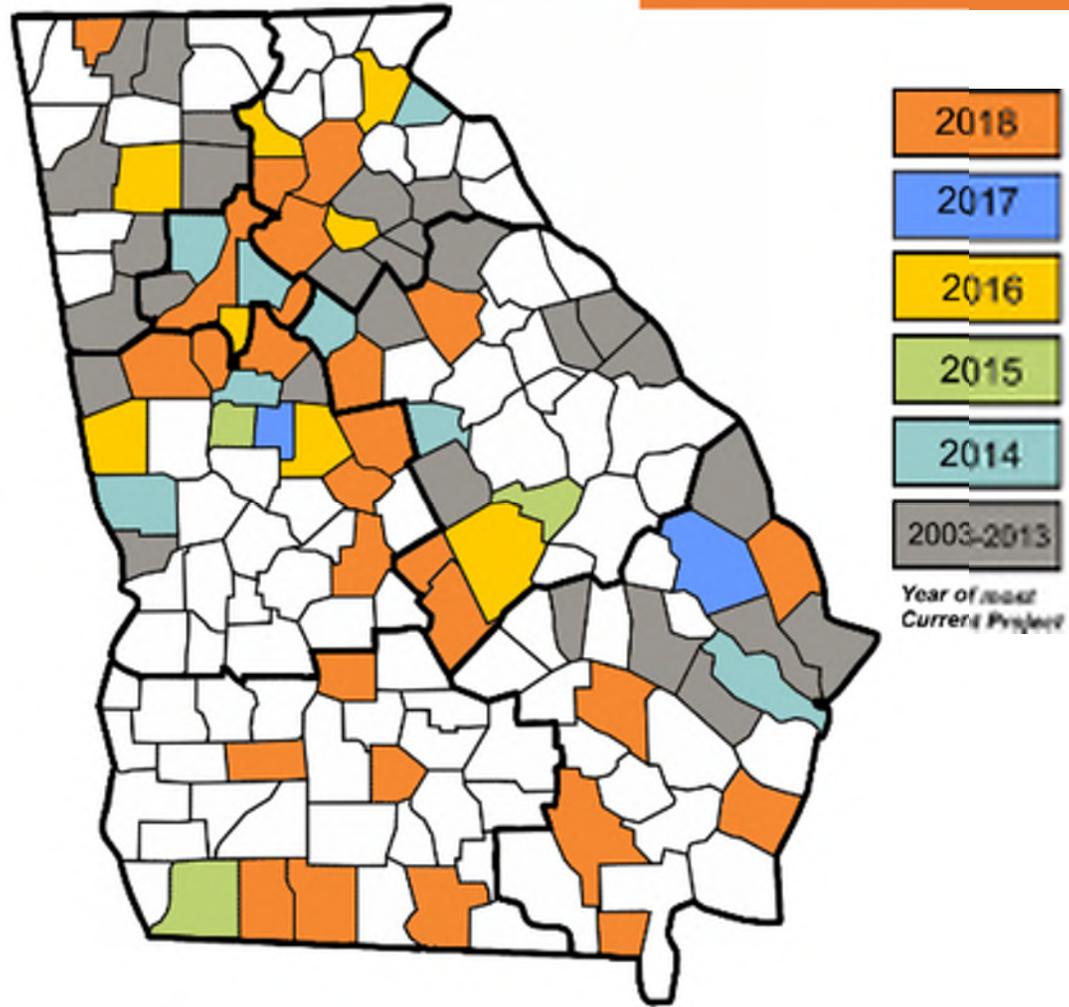
Melissa Campbell, P.E.
Pavement Application Director – Georgia

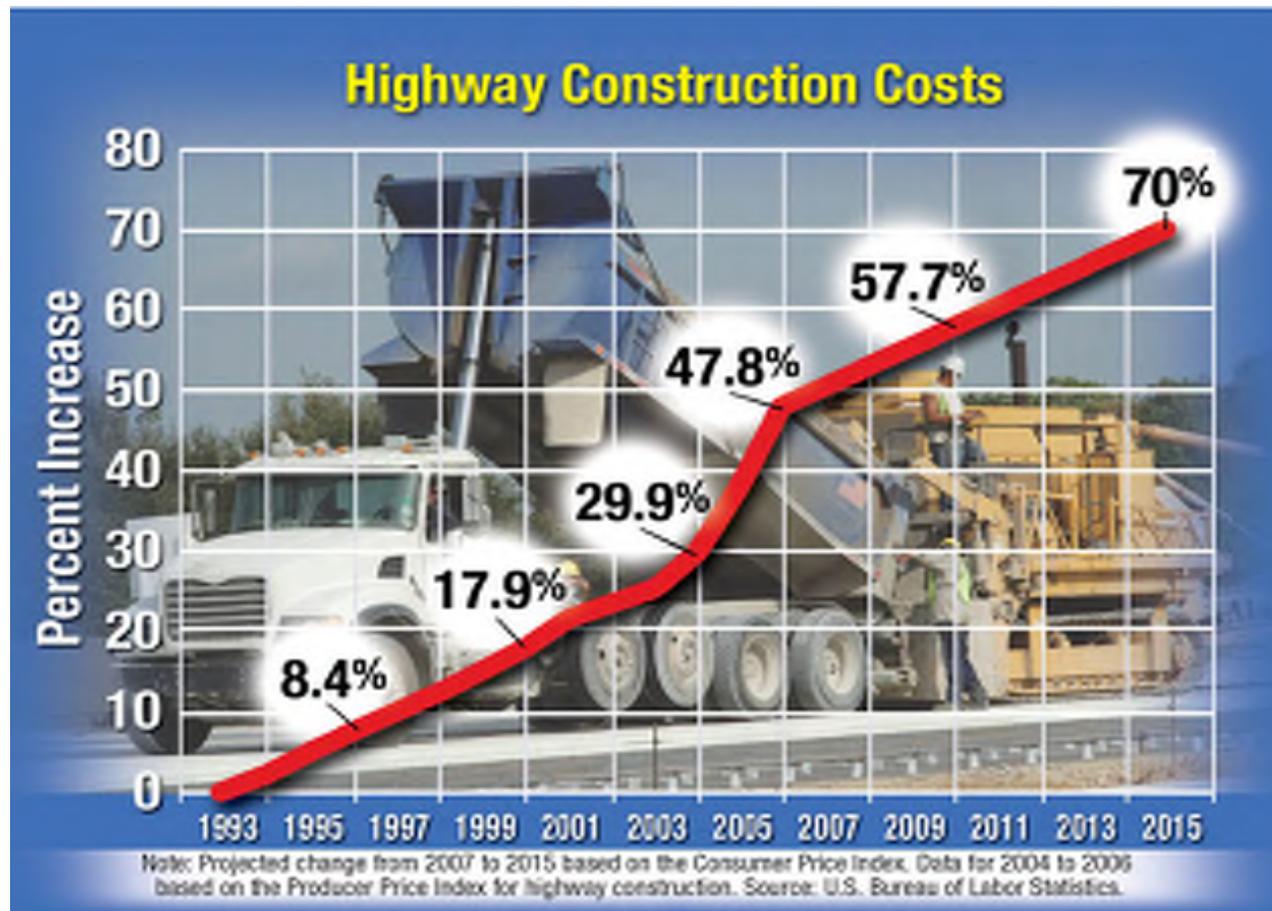
Dwane Lewis
Soil Cement Specialist – Georgia

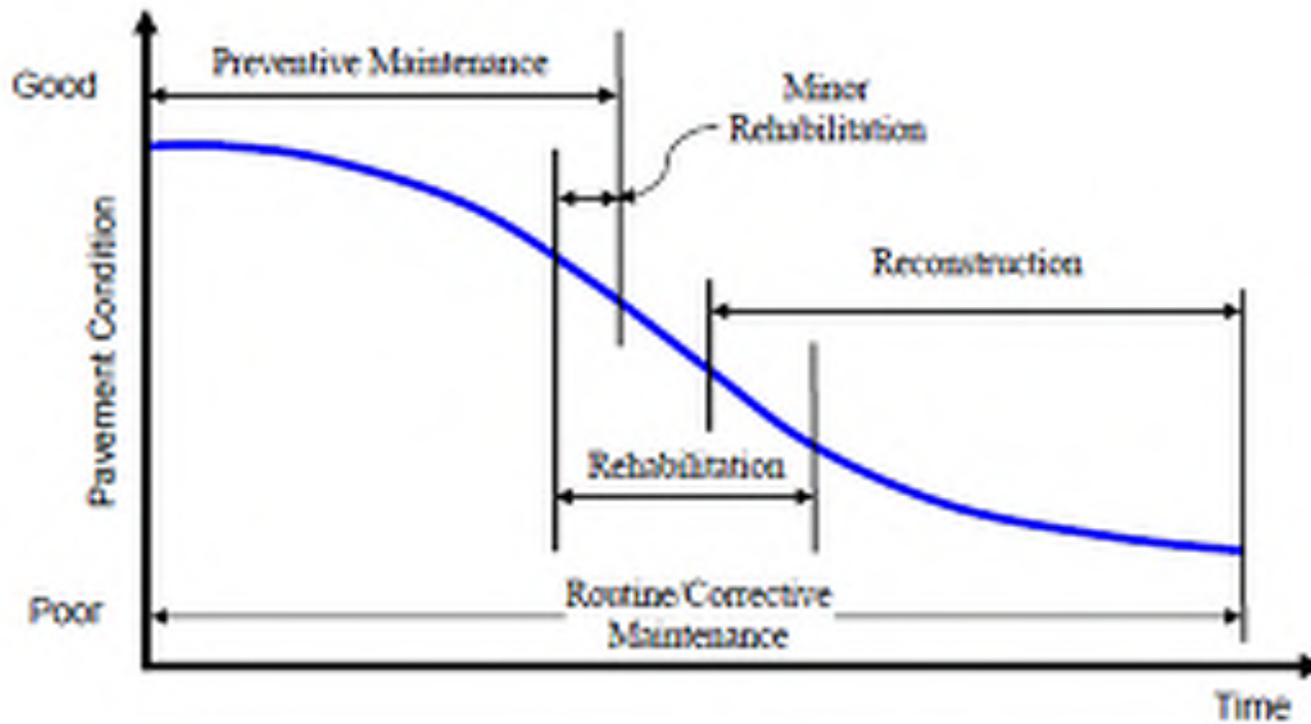
*ITE/ASHE Winter Workshop
March 3-4, 2019*

Cement Reclamation Partners









Why do pavements wear out?

- Load-induced damage
 - ❖ Fatigue of paving materials



Why do pavements wear out?

- Load-induced damage
 - ❖ Permanent deformation of pavement and subgrade



Why do pavements wear out?

- Environmentally induced damage
 - ❖ Water intrusion
 - ❖ Exposure to air and sun
- These factors typically interact to produce failure



Dealing with Pavements that are Sliding Down the Curve

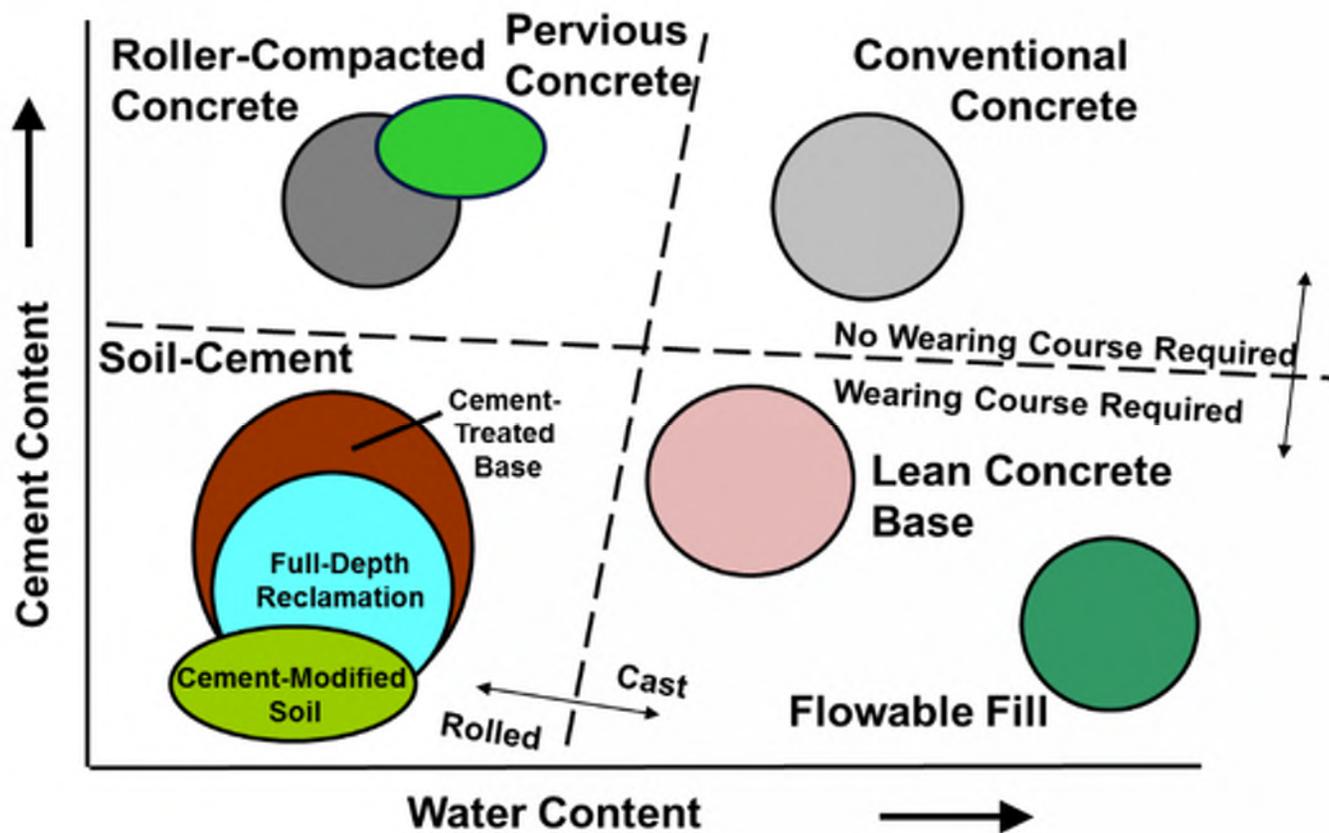
- Mill-and-fill with asphalt is effective if:
 - pavement is structurally adequate for the future traffic but is suffering from “top down” distresses.
- Patching prior to overlay is effective if:
 - patching is primarily to address initial construction variation
 - or to repair isolated weak areas.
- With widespread repair needs, FDR with Portland cement is the most cost-effective rehabilitation method.

Reclamation Methods

- Mechanical Stabilization
 - ❖ No new material is required

- Bituminous Stabilization
 - ❖ Emulsified asphalt
 - ❖ Expanded (foamed) asphalt

- Chemical Stabilization
 - ❖ Portland Cement
 - ❖ Slag
 - ❖ Fly Ash
 - ❖ Kiln Dust
 - ❖ Lime
 - ❖ Other



Full depth patching candidates?



Full depth patching candidates?



Advantages of the FDR process with Portland Cement

- Use in-place materials
 - Saves money
 - Conserve virgin material
 - Saves energy by reducing mining and hauling
- Limits hauling of materials from site
 - Saves fuel and reduced traffic
- Maintains existing grade, restores the cross section, and easily adds additional width
 - Safety

Advantages of FDR with Portland Cement

- Reliably treats all types of pavement distress
 - Versatile and robust
- Reduce construction time
 - Safety
 - User cost
 - Energy wasted due to delay

Advantages of FDR process Portland Cement

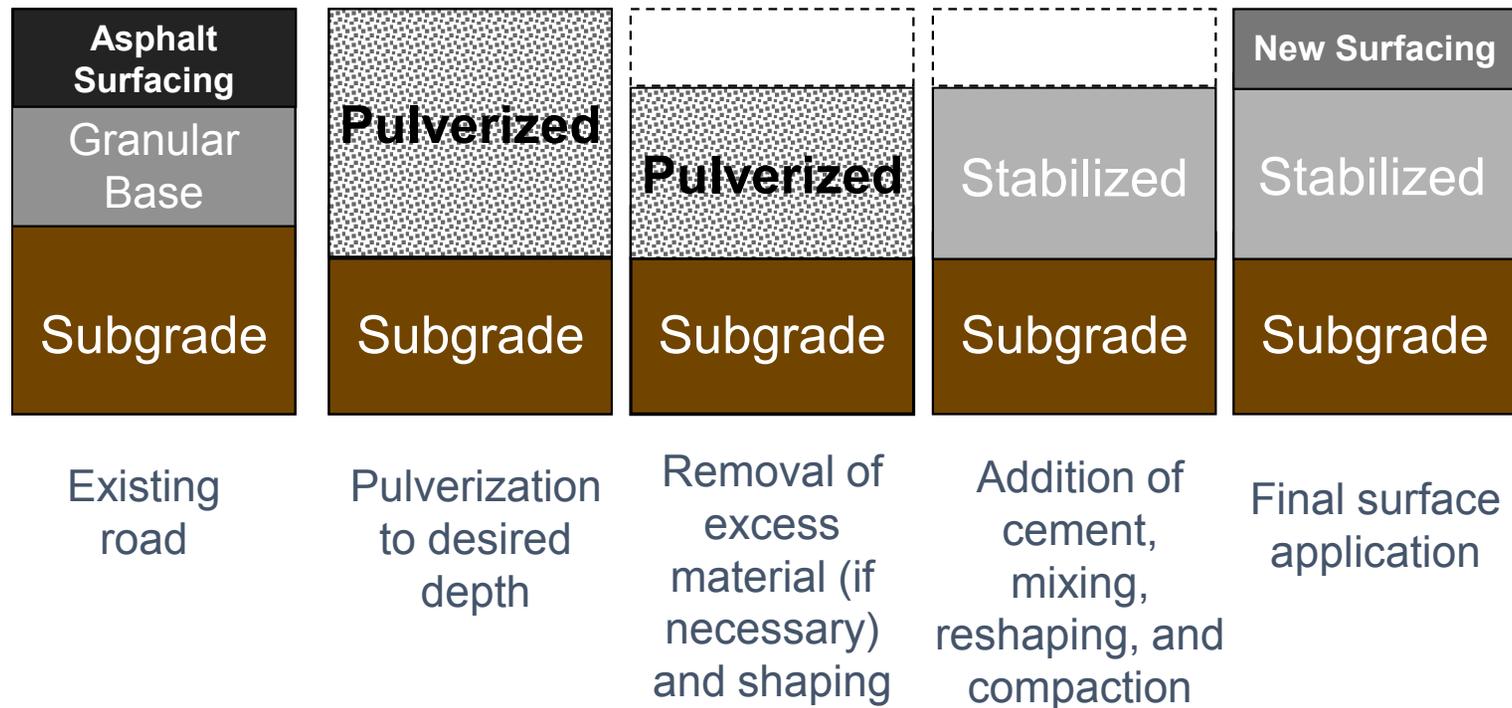
- Engineering benefits
 - Relatively impervious to environmental distress
 - Typically provides the most economical pavement structure when future performance is considered
 - Substantially increases existing pavement strength
 - Provides a uniform cross section when widening

When is FDR most appropriate?

- Distresses in the base or subgrade
- Full-depth patching required on more than 15 to 20 percent of the total surface area
- Existing asphalt thickness 9 inches or less.
- Pavement structure inadequate for current or expected future traffic

FDR Construction Process

Pulverize, Shape, Add Cement, Mix In Place,
Compact, and Surface



- Materials
- QC Plan
- Job Mix Formula (Determined by Engineer)
- Equipment
- Trial Section
- Construction Methods
- Acceptance Testing
- Weather Limitations
- Measurement and Payment

May 3, 2018

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
STANDARD SPECIFICATION**

Section 315 – Cement Stabilized Reclaimed Base Construction (CSR)

315.1 General Description
This work includes constructing a cement stabilized base course by pulverizing the existing flexible pavement, underlying base and subgrade, and mixing with Portland cement. Construct according to these Specifications and to the base, grades, thickness, and typical cross sections shown on the Plans or established by the Engineer.

315.1.01 Related References
General Provisions 101 through 150

A. Standard Specifications

- [Section 109 – Measurement and Payment](#)
- [Section 201 – Soil-Cement Construction](#)
- [Section 412 – Bituminous Prime](#)
- [Section 414 – Soil Base Materials](#)
- [Section 414 – Curbs, Walks](#)
- [Section 422 – Embankment Asphalt](#)
- [Section 424 – Concrete Asphalt Emulsion](#)
- [Section 430 – Portland Cement](#)
- [Section 430 – Water](#)

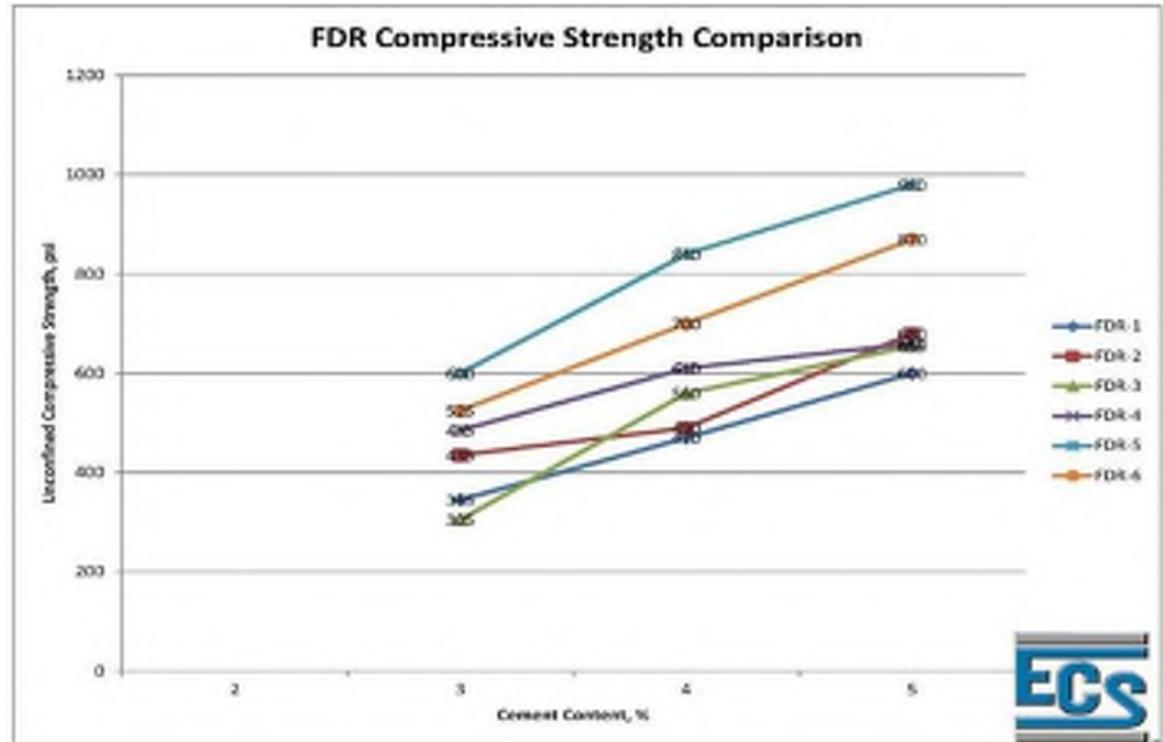
B. Referenced Documents

- GDG 19 – Determining Maximum Density of Soil-Cement Mixtures
- GDG 20 – Determining Field Density of soils with <45% retained on the No. 10 sieve and < 10% retained on the 1 inch sieve
- GDG 21 – Determining Field Density of soils containing >45% retained on the No. 10 sieve or >10% retained on the 1 inch sieve
- GDG 59 – Testing Density of roadway materials with Nuclear Gauge
- GDG 63 – Laboratory Design of Soil-Cement and Cement Stabilized Graded Aggregate
- GDG 67 – Family of Curves Method for Determining Maximum Density of soils
- GDG 86 – Determining the compressive strength of Cement Stabilized Base courses taken from the roadway

315.1.02 Submittals
Prior to construction, submit a Construction Work Plan to the Engineer consisting of the proposed equipment, materials, and operation procedures. If the Engineer determines that the Work Plan is not satisfactory, revise the procedures and equipment or replace equipment, as necessary, to complete the Work.

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- Laboratory testing to determine optimum percentage of stabilizing agent
 - Based on strength
- Materials/Stabilizing Agent(s)
 - Cement
 - FDR
 - Addition of other materials – RAP, rock dust, soil, aggregate,...



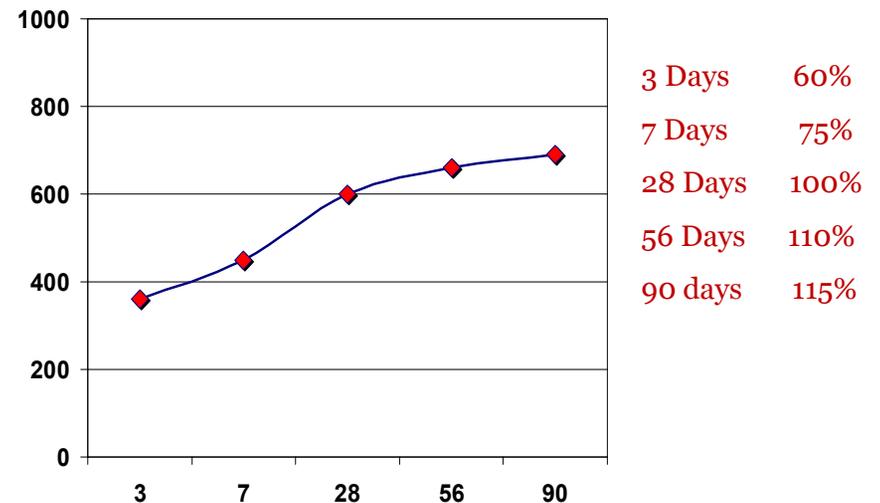
- Pavement evaluation
 - Design depth
- Field Sampling
 - Collect blended samples of pavement structure
- Design Range
 - FDR material – lower range (100% passing 2 inch sieve and 55% of all particles passing 3/8 inch sieve) – Upper range (100% passing 2 inch sieve)



- Specimens are moist/cured for seven days then allowed to air dry to a constant mass.
- Lab target of 450 (PSI) / Quality Acceptance requirement of 300 (PSI).
- Specimens achieving lab target will determine cement percentage, maximum dry density and optimum moisture.



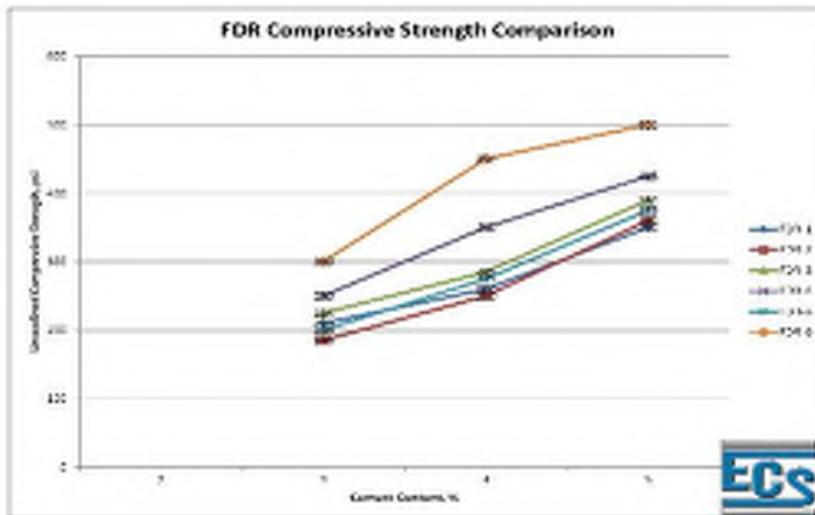
UCS Strength/Time



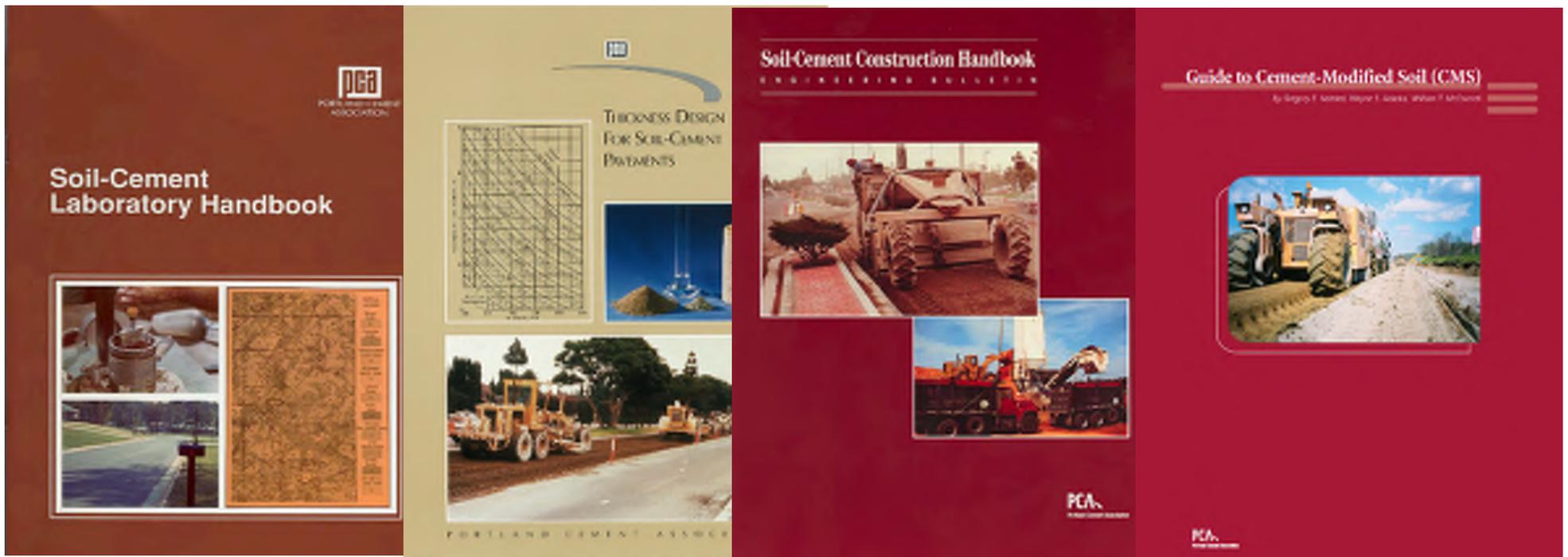
- Uses materials passing the #3/4 sieve.
- Compacted at Optimum Moisture.
- Cured in moist room and protected from free water.
- Samples immersed in water prior to testing.



- Compressive load rate
 - Screw or Hydraulic
- Typical applied load is 3,000 to 4,000 lbs. The 500,000lb load cell of a standard concrete break machine is not calibrated in this range.
- A 10,000lb load cell should be used.



- Go to www.secement.org
- Click on “Resources” menu
- Select “Publications”
- Can sort publications by title and subject

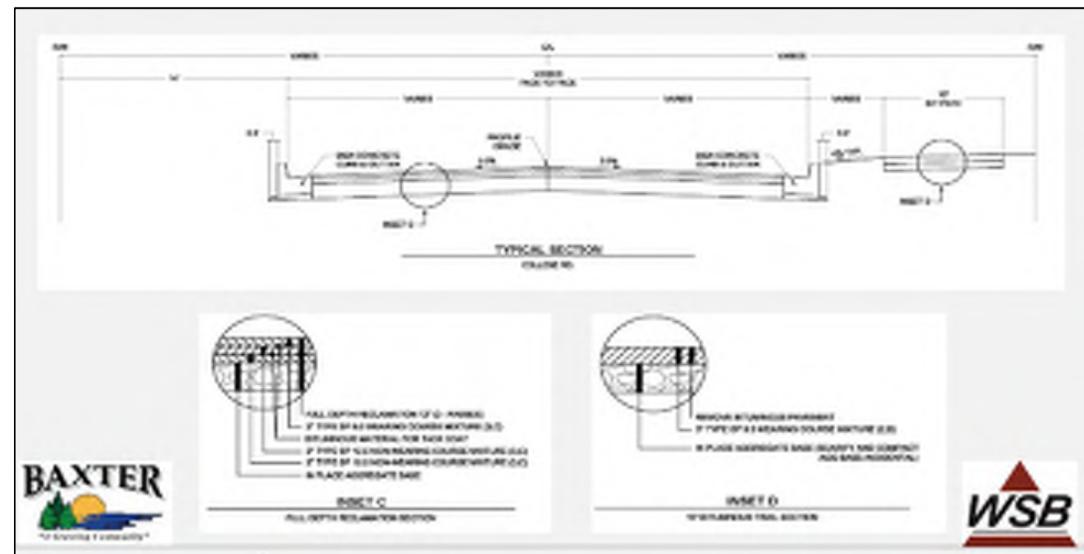


- Preconstruction
- Construction
- Field Testing
- Case Studies



Pre-bid or Preconstruction meeting

- GDOT/Cities & Counties
- Lab/Consultant Firms
- Contractor/Subcontractors
- SCPA is always available upon request
 - Scope of the Work
 - Discuss Design Parameters
 - Hazards/Utilities
 - Quality Control & Acceptance testing





- Cement Spread Rate

- Specified by Engineer
- Use of a calibrated spreader required
- Check using a square yard pan or tarp
- Tolerance is 10% over or under
- Check rate on each tanker of cement or more often as needed

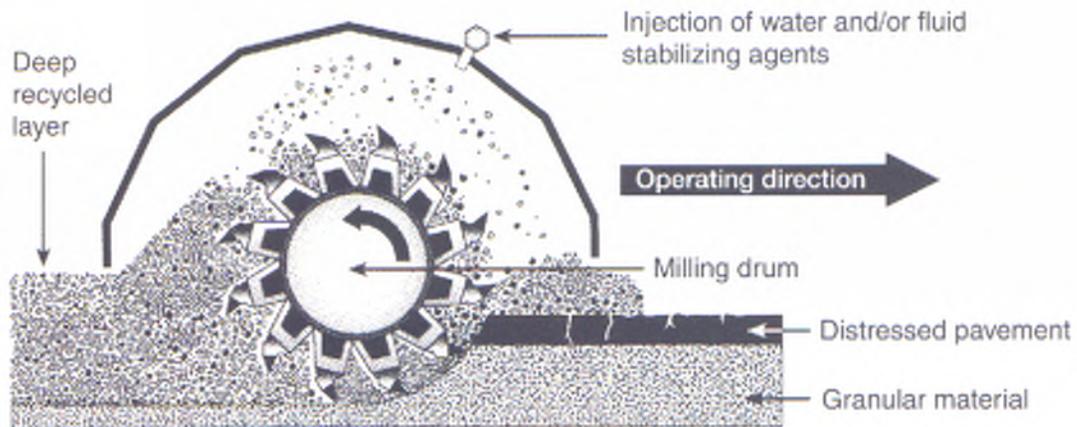


Gradation Tests

- 100 percent passing 3 inch sieve
- 55 percent passing, excluding gravel, passing the No. 4 sieve



Inside a Reclaimer







- In-Situ Moisture
 - Maintained between 100% to 120% of optimum at all times!



Compaction Tests

- According to GDT59 (Nuclear Gauge)
- GDOT requires one test per 1500ft (linear)
- GDOT requires 98% of the dry maximum density as established on the mix design



Finished Surface Tests

- Check transverse profile using:
 - ❖ Template, Stringline, or Level

(Must not be more than ½ inch away from profile)

Thickness Tolerances

- No less than one measurement per 1000 feet per 2 lanes
 - ❖ If thickness is more than ½ inch too thin, correct
 - ❖ If thickness is more than ½ inch too thick, change unit price if paying by cubic yard



Bituminous Prime

- Use RC-30, RC-70, RC-250 or MC-30, MC-70, MC-250 CSS-1h, AE-P, CRS-2 (GDOT Section 316.2)
- Apply prime only to an entirely moist surface
- Requires priming as soon as possible and in no case later than 24 hours after completion of the FDR course.
- Application rate 0.15 to 0.30 gal/y², as determined by the Engineer







FDR with cement has many uses...

- National parks
- Airports
- Elementary schools to colleges
- Parking facilities
- Windmill and solar farms
- Interstate highways to subdivisions to rural secondary routes
- State DOTs to local governments to developers
- Inside buildings(!?)

Moody Bridge Road
Wayne County
(2003)



Athens Street
Gainesville, Ga.
(2005)



Ware County Airport
Waycross, Georgia
(2008)



I-16
Laurens, Twiggs, Treutlen County
(2011)



Peachtree City Resident Streets (2018)



Yes, inside buildings...



SCPA Staff

Home » About SPCA » SCPA Staff



Roger Faulkner, PE
Executive Director
770-497-2844
rfaulkner@seacement.org



Andrew Johnson, PhD, PE
Equipment Applications Director
823-336-2233
ajohnson@seacement.org



Brian Blank, PE
Equipment Applications Director (North Carolina)
704-879-2987
bblank@seacement.org



Dave Arant
Equipment Applications Director (Alabama)
205-322-4242
darant@seacement.org



Melissa Gove Campbell, PE
Equipment Applications Director (Georgia)
678-850-0121
mcampbell@seacement.org



Deane Gove
S&P Cement Specialist (Georgia)
229-987-0027
degove@seacement.org



Julie Anna Boone
Equipment Applications Director (Tennessee)
615-427-0212
jboone@seacement.org

Our Mission Statement

The mission of Southeast Cement Promotion Association is to grow market share and markets for cement-based products through effective promotion and advocacy programs. Our top priorities are:

- Focused promotion and advocacy activity generating measurable results
- Stewardship of our member's funding



Cement Producer Members

The Southeast Cement Promotion Association represents the manufacturers and distributors of Portland cement in the states of Alabama, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia/DC and West Virginia.

