Matthew Singel. Matt's diverse background in design and construction with concrete, asphalt and soil-cement provides a unique perspective. Matt's experience spans pavement applications from streets and highways to industrial site development, always focused on progressive technologies that reduce construction time and cost while maximizing long-term performance. A University of Pittsburgh graduate, Matt earned his professional engineer's license and has been employed by Benatec Associates (Camp Hill, PA), E.J. Breneman (Reading, PA/Atlanta, GA) and the Southeast Cement Association (Atlanta, GA). Matt was a featured speaker at the 2004 AASHTO Construction Committee Meetings and selected to present at the 2006 and 2011 International Public Works Congress. In addition to articles published and multiple industry technical advisory committees, he was a contributing author for the Guide to Roller-Compacted Concrete Pavements (August, 2010) and is a member of ACI 327 Committee on Roller-Compacted Concrete Pavements. Currently, Cement Council of Texas, soil-cement and RCC pavement program manager, Matt provides educational and technical support and contractor training across Texas.

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Port of Houston Authority Pavement Requirements

- ✓ Heavy Duty Pavements
- ✓ Durability
- ✓ Low Maintenance
- ✓ Level Surface
- ✓ Speed of construction
- ✓ Low Cost

Bayport Container Terminal Complex

- **Location:** South of the Bayport Ship Channel, approximately 20 miles east of Houston, Texas
- **Channel Depth:** Nominal dredged depth of 40 feet mean low tide
- Developed in phases over an estimated 20 year period
- At full development will include seven container berths, intermodal rail-yard, and storage facilities

Bayport Container Terminal to Date

- **2004 Phase 1A** Container yard 60 acres of Conventional Formed Paving (JRCP)
- **2007 Phase 1 Stage 1** was the first of the PHA projects to utilize RCCP
- **2009 Phase 1 Stage 2** is the second of the PHA project to receive RCCP
- **2012 Entry Exit Gate** is the third project that will utilize RCCP

Design Criteria for Pavement

- 30 year pavement design
- Top Pick: 140 kips
- Container Stack: 48 kips
- 16 wheel RTG: 61.5 kips
- 2.3 Million TEU's

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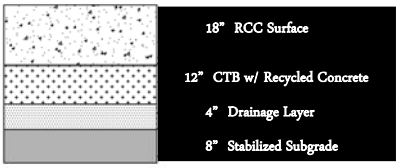
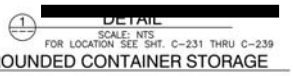
RCC Pavement Section Components





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Subgrade Design

Both Lime (5%) & Cement (5%) Stabilization

Cement-Treated Base

Averages 6 ½ % Cement
500 psi required @ 7 days

RCC Pavement

- **Type I/II cement**
- **Binder content**
  - **12% to 16% of aggregate weight.**
- **For finish**
  - **450 lbs to 550 lbs per cubic yard.**
  - **4,000 psi required at 7 days**

Typical Mixture Design

- **450 – 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 usually dictated by Moisture/ Density Relationship.**

Transporting & Placing

Moisture/Density Testing

- Developed Proctor Density using proposed mixture design.
- Evaluated moisture-density and density-strength relationships in the test section.
- Slabs required 98% compaction throughout the slab to achieve proper flexural strength.

Nuclear Gauge | ASTM C1040

Strength Testing

- Fabricate cylinders with vibrating hammer
- ASTM C1435

Level Surface

Surface After Grinding
(¼ inch Under 10 ft Straight Edge)

2004 Phase 1A

- 60 acres of conventional reinforced concrete pavement (JRCP).
- Average Production of PCCP: 2 acres per month

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2007 Phase 1; Stage 1

- Started construction 12/18/06 and completed 01/29/08.
- 42 acres of Roller Compacted Concrete Pavement (RCCP).
- Average Production: 8 acres per month

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2009 Phase 1; Stage 2

- Started construction 05/26/09 and completed 06/02/10
- 43 acres of RCCP
- Average Production: 8.5 acres per month

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2011 Entry & Exit Gates

- Started construction April 29, 2011
- 23 acres of RCCP
- Estimated Production: 8 acres per month

Benefits of RCCP

- Save Money: 25-40% less costly than convention concrete placement.
- Save Time: Near continuous production possible
  - No forms
  - No joints
  - No dowels
  - No finish work needed

Cement Council of Texas

Thank You!

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