

Roller Compacted Concrete

**Norfolk Southern
Intermodal Yard-Columbus, Ohio**

**Presented by:
Robert R. Thompson, P.E.**



Norfolk Southern Intermodal Yard, Columbus, Ohio

- **Fall of 2005** - NS announced intent to build 270 acre Intermodal Facility – Savko Met with NS to introduce RCC
- **Spring 2006** - NS let bid with bituminous pavement as the base bid and RCC pavement as an alternate-all bids were over budget and rejected
- **Fall 2006** – NS let new bid package with RCC as the pavement section with no alternates – Savko was awarded contract



Norfolk Southern

Intermodal Yard, Columbus, Ohio

- Construction began September 18, 2006 and completion is expected in February 2008.
- Required approximately 277,000 CY of off-site soil/borrow to be brought onto the construction site & 300,000 CY of on-site cut and fill in order to raise the site to meet the elevation of the railroad tracks.
- Required approximately 5,000 tons of lime. (Soil Drying Operations)
- Required approximately 400,000 tons of crushed aggregate base. (12" & 13")
- Required approximately 30,000 CY of 16-inch thick roller compacted concrete.
- Required approximately 70,000 CY of 9-inch thick roller compacted concrete.
- Required approximately 1,000 CY of 9-inch thick and 16,000 CY of 16-inch thick conventional concrete.



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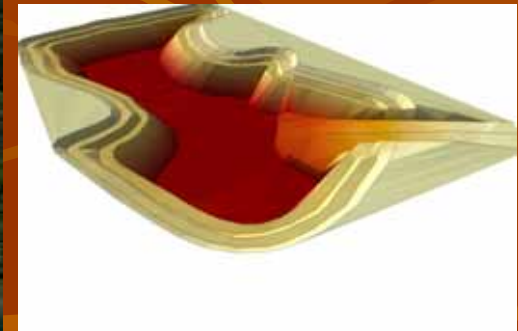
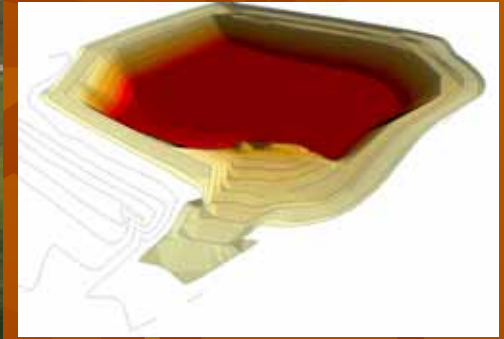
Norfolk Southern Intermodal Yard, Columbus, Ohio Off-Site Borrow



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Norfolk Southern Intermodal Yard, Columbus, Ohio Lime



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Norfolk Southern Intermodal Yard, Columbus, Ohio Stone Placement



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- Required approximately 400,000 tons of crushed aggregate base (12" & 13").
- **Required approximately and 30,000 CY of 16-inch thick roller compacted concrete. (Track Area)**
- **Required approximately 70,000 CY of 9-inch thick roller compacted concrete. (Truck Parking)**
- Required approximately 1,000 CY of 9-inch thick and 16,000 CY of 16-inch thick poured Portland cement.

View of the 9" truck parking area on left and the 16" crane way area on right.

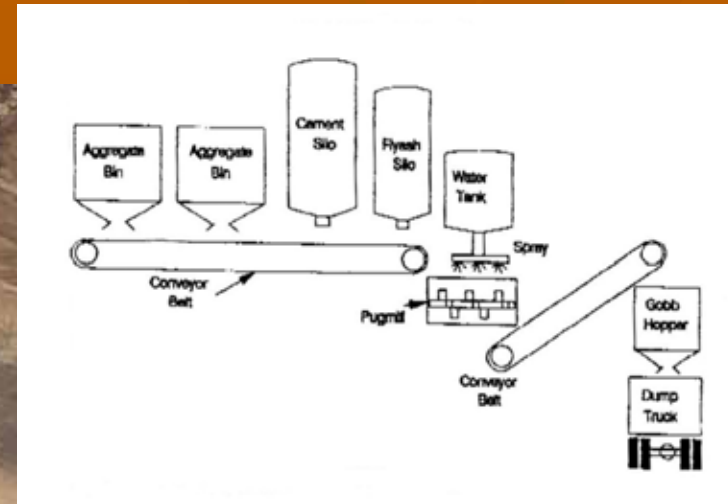
9" Truck Parking



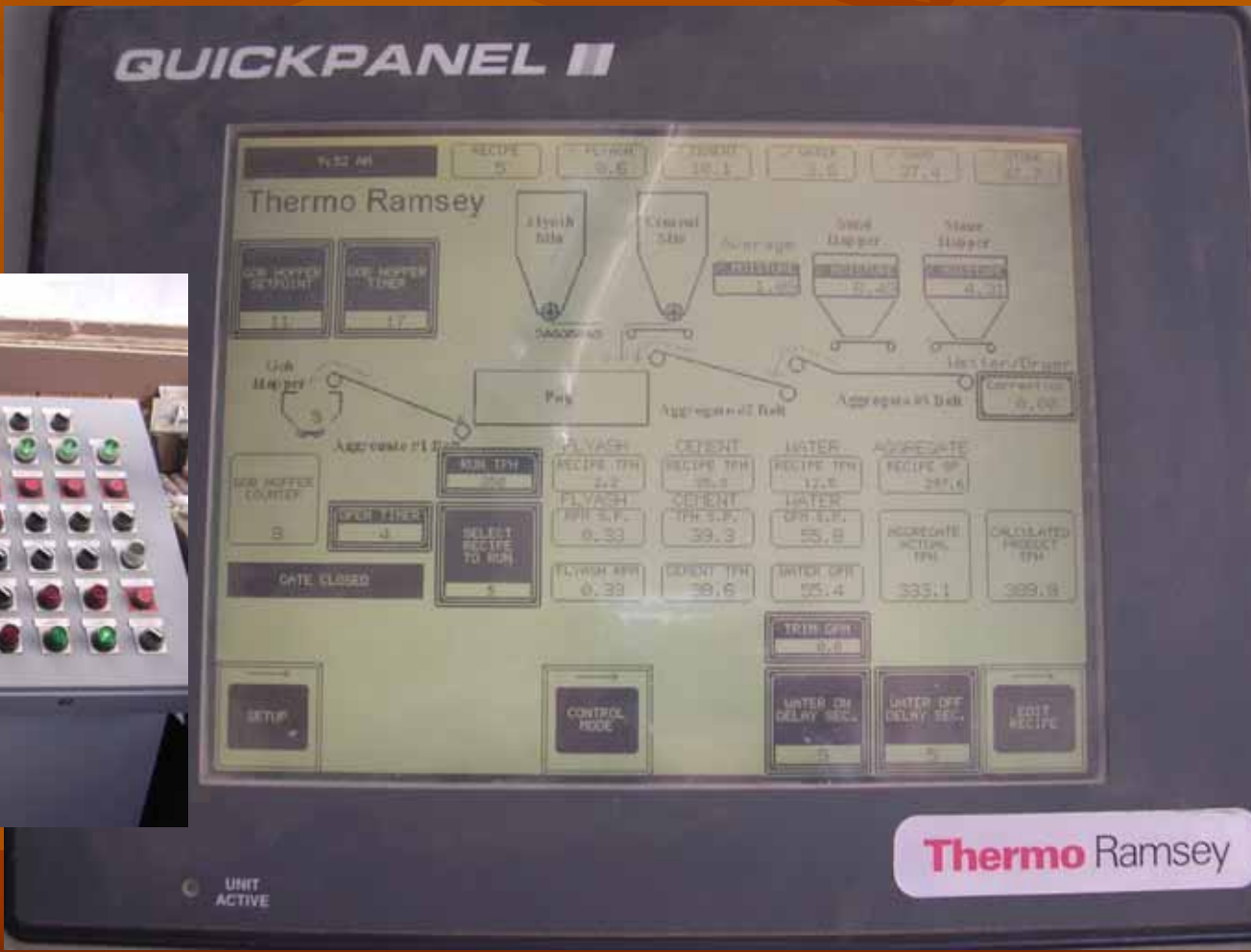
16" Crane Way



Pug-Mill located at north end of site.



A Thermo Ramsey computer panel provides a constant RCC mixture. The cement, fly-ash and water are adjusted off the aggregate weights.



The Pug Mill produced 200 to 250 cubic yards per hour. Daily productions ranged between 1,800 to 2,400 CY per 10 hour day.



Placing Equipment

- High density ABG pavers
 - Vibrating screed
 - Dual tamping bars
 - High initial density, 90-95%
 - Reduces subsequent compaction
 - High-volume placement (1,500 to 2,500 cy per shift)
 - Designed for harsh mixes
 - Provides Smoothest RCC surface
 - Complies with Columbus 1523 Spec.



Compacting

- Proper Compaction Is Critical For Strength And Durability
- 10-Ton Dual-Steel-Drum Vibratory Roller Is Used Within 15 minutes After The RCC Is Placed
- Test Strips Are Performed To Determine The Optimum Number Of Passes Required To Achieve A Minimum Of 98% of The Maximum Wet Density Determined In The Lab For Modified Proctor



First crane way area-16"- depth by 68'
wide by 3,500' long/ over 12" stone



Placement of second 8-inch lift within 60 minutes of first lift



Water was sprayed over first lift to enhance bonding between layers



Two DD-90's where utilized to keep up with the fresh joints



Steel-Drum-Finish-Roller with smooth rubber rear wheels and a vulcanized rubber drum was used to produce final surface texture.



100-gallon tank and 15-foot spray boom provided a quick and effective method of curing



All RCC was cut 1/3 the depth at 30-foot centers. Cold joints were cut full depth.



The truck parking areas where all paved with 9-inches of RCC over 13-inches of stone.



A single width was placed at one end to allow the paver to pull off perpendicular and maintain grade



Fresh joints and finish rolling



Rolling and curing was maintained closely behind the pavers.



RCC Mix Design Criteria Modified City Of Columbus Supplemental Specification 1523

- Compressive Strength: 4,000 psi @ 28 Days
- Flexural Strength, Beams: 570 psi @ 14 Days
- Splitting Tensile Strength, Cores: 400 psi @ 14 Days
- Minimum Cementitious Materials Shall Be 500 Pounds/Cubic Yard

NS RCC Mix Design

- Cement: 375 lbs./cy
- Fly Ash: 125 lbs./cy
- Dense graded aggregate/sand: 4,000 lbs./cy
- Water: 180 lbs./cy
- Water Reducer: 0.12 gal/cy

Preparing Lab Cylinders



9 cores were taken from each week's placement. The cores were split top and bottom and broken in compression and split tensile at 7, 14 and 28 days.



Several tests were taken from the middle to verify the strength across the two layers.



Test Results

Lab Results

Field Results

1-Day Comp.

2,800 PSI

3,200 PSI

7-Day Comp.

5,000 PSI

4,000 PSI

28-Day Comp.

5,100 PSI

5,000+ PSI

14 Day Split

570 PSI

600 PSI

NS Intermodal Yard

6-20-07



NS Intermodal Yard

8-13-07



NS Intermodal Yard

9-13-07



NS Intermodal Yard

9-25-07



Questions?