Norfolk International Terminal Selects RCC for Port Facility Expansion

Use of Roller-Compacted Concrete Pavements for Container Terminals

Roller Compacted Concrete (RCC) is a zero-slump concrete consisting of dense-graded aggregate and sand, cementitious materials, and water. The use of RCC as a material to construct pavements began in the 1970s in Canada. In the past 25 years it has gained acceptance as a strong and durable pavement material that can withstand heavy loads and severe climates with little required maintenance.

The use of RCC for pavements at industrial facilities such as port and intermodal container terminals is particularly appropriate because of its ability to construct low-cost concrete pavements over large areas, allowing flexibility in terminal operations over time. Two basic pavement designs are used which incorporate RCC: 1) unsurfaced, where high-strength concrete is used as the surface layer, and 2) asphalt surfaced, where lower-strength concrete is used as a pavement base and an asphalt layer is used for the wearing surface.

Completed RCC slab at the Port of Virginia.

The Port of Virginia Builds RCC Pavement for Tough Duty

The Virginia Port Authority recently completed construction of a roller-compacted concrete pavement for a large container storage and handling area at the Norfolk International Terminals (NIT) in Norfolk, Virginia. This project is part of continuing expansion at the port, currently the second busiest on the east coast in terms of general tonnage. The NIT South Backlands Project – Stage I included 26 acres of RCC pavement 16.5 inches thick (57,300 cubic yards of concrete), topped with 3 inches of asphalt to allow for adjustments for future differential settlement in the underlying soils.

The Norfolk office of Moffatt and Nichol was the engineer for the design and construction of the facility. Pavements for port facilities must be strong and durable because of the heavy loading of the container handling equipment that can have wheel loads of 30-60 kips per tire. In addition, the channelized traffic can cause significant pavement distress.

Rutting in asphalt pavement caused by channelized loading.

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Placing the second lift of the two-lift construction process.

Quality control check using pavement cores after 7 days.

Because of the large pavement area, cost was an important factor. Moffatt and Nichol evaluated several possible pavement strategies, including asphalt, conventional concrete, concrete paver blocks, and RCC. An overall evaluation of strength, cost, time of construction, and expected performance resulted in RCC being selected. The design pavement strength was 450 psi flexural strength in 7 days, which related to a construction specification of 2,500 psi compressive strength in 7 days.

The paving contractor for the project was A.G. Peltz Group, Birmingham, Alabama. The mix consisted of 3,470 lbs of dense-graded aggregate (1/2 inch nominal maximum aggregate size) and 400 lbs portland cement per cubic yard. Water content was 6.2% (by weight) of the dry components. The RCC was mixed on-site with an Aran pug mill operating at 400 tons per hour. Three ABG Titan pavers were used during construction. One model 511 with a hydraulic variable screed was used to pave special widths. Another model 511 and a model 525 were used for large area paving, placing concrete 30 feet wide per pull.

The total 16.5 inch RCC thickness was placed in two lifts. Construction specifications called for bonding between the two layers, so the second lift had to be placed within 1 hour of the bottom lift. The completed surface was water cured until a bituminous seal was applied. Quality control procedures included density measurements during compaction, and taking cores to check for bonding, thickness, and strength.

The overall experience of the project was positive. The final cost ($42 per square yard) and especially the time required for construction (2.2 days per acre) resulted in a lower cost and faster construction than other comparable paving projects at the NIT. This is not surprising since RCC has been successfully used at the Port of Boston, Port of Los Angeles, and for container facilities at rail-truck intermodal yards in Denver, Colorado and Calgary, Alberta. The use of RCC at the NIT is expected to continue, with a project for another 20 acres currently under contract.

More Information

PCA offers a broad range of resources on soil-cement and roller-compacted concrete applications for pavements. Visit our Web site at **www.cement.org/pavements** for design and construction guidelines, technical support, and research on cement-modified soils, cement-treated base, and full-depth reclamation. For local support, tap into the cement industry's network of regional groups covering the United States. Contact information is available at **www.cement.org/local**.

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