

# RCC is Pavement of Choice for Maine Paper Mill

***“We have been thoroughly impressed with the constructability, low cost, and high performance of RCC.”***

**Mike Atherton, Lane Construction Corp.**

Owners of a paper mill in coastal Maine decided in September 2006 that a hard surface was needed in a yard area where new process improvements were being installed. As with many newer industrial processes, it was important to keep the raw material feed areas as clean as possible and free from ground contamination. A hard surface would improve operating efficiency and lower maintenance costs. The resulting design called for construction of 75,000 ft<sup>2</sup> (7,000 m<sup>2</sup>) of pavement for this purpose. With winter fast approaching, construction time was an important factor.

The contractor for the project (Lane Construction Corp.) asked the project engineer (Woodard and Curran, Bangor, Maine) to consider using roller-compacted concrete (RCC) for the pavement area. Lane knew they needed to build the largest pavement area possible for the lowest cost, and it had to be constructed quickly.

RCC has been used in many industrial applications, so the strength and durability of the material were well known, but for this project it offered the additional advantage of rapid construction. In addition, the lower cost of RCC would allow paving of 100,000 ft<sup>2</sup> (9,300 m<sup>2</sup>) instead of the original 75,000 ft<sup>2</sup> (7,000 m<sup>2</sup>).

The pavement was designed for heavy equipment and truck loading, resulting in specifying a 9-in. (225-mm) -thick concrete slab. Site conditions consisted mostly of organic soils with a small percentage of gravel and clay. Unsuitable subgrade material was removed and replaced with approximately 2 ft (0.6 m) of gravel that would provide drainage and serve as an excellent base for the concrete pavement.

The RCC contained a blended cement with 7% silica fume (furnished by Ciment Quebec Inc.), and was mixed using an on-site ARAN



**Vögele high-density paver and density testing with nuclear gauge.**

pugmill. This type of blended cement is popular in eastern Canada and Maine because it greatly improves durability in freeze-thaw environments. The RCC mix consisted of:

- 1771 lbs/yd<sup>3</sup> (1051 kg/m<sup>3</sup>) of 1/2 in. (12.5 mm) NMSA crushed stone
- 1645 lbs/yd<sup>3</sup> (976 kg/m<sup>3</sup>) of sand
- 510 lbs/yd<sup>3</sup> (303 kg/m<sup>3</sup>) of blended cement
- 197 lbs/yd<sup>3</sup> (117 kg/m<sup>3</sup>) of water
- 20.3 oz/yd<sup>3</sup> (785 ml/m<sup>3</sup>) of Grace Daracem 65 water reducer

Paving was completed using a Vögele 2100 high-density paver that contained one tamping bar and two pressure bars in a variable-width screed. Excellent compaction was achieved by the paver, with very little subsequent rolling required with a steel-wheeled compactor. SEM Consultants (Quebec City, Quebec) performed the mix design

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and quality control. Field specimens were tested at 7 days with an average flexural strength of 993 psi (6.8 MPa) and average compressive strength of 6,828 psi (47 MPa). Strengths of field specimens at 28 days were almost 30% higher than results at 7 days.

Pavement placement was in early November, at the end of the construction season. Temperatures were high enough to allow for curing without the use of insulation blankets. Even though this was the first RCC paving project for Lane Construction, the 2,100 yd<sup>3</sup> (1,600 m<sup>3</sup>) project was completed in two days. Mike Atherton, Lane's project engineer says, "We have been thoroughly impressed with the constructability, low cost, and high performance of RCC."

Adjacent to the end of the pavement area, the contractor also placed an 8-ft (2.4-m) -wide strip of pervious concrete, using conventional construction methods. This will capture the surface water draining off the RCC pavement in a trough area where equipment will operate. As an experiment, Lane Construction also placed some pervious concrete in a test area using the Vögele high-density paver, and found that placement went very well. There were concerns that the paver might cause the pervious concrete to be overly dense, but 26% voids were measured in the pervious material after placement.

The engineer, owner, and contractor were all pleased with the results from their first experience with RCC pavement. The high-strength pavement will provide an operating platform with excellent durability under harsh conditions. In addition to the performance and cost benefits, the time savings resulting from the project was impressive. Travis Noyes, of Woodard and Curran, says, "The ability for the entire project team to develop a design, bid the project, and build it within budget using only two days of construction put the project literally months ahead of schedule."



**Rolling and curing operations during construction.**



**RCC pavement after construction.**



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