

Manufacturing Industry

0 Comments

Paving with roller compacted concrete: RCC topped with asphalt quickly provides a durable street

Concrete Construction, Feb, 2005 by William D. Palmer, Jr.

"This is the finest product for city streets to come along in years," said Marty Savko of Nickolas Savko & Sons, Columbus, Ohio. "I first read about roller compacted concrete (RCC) pavement in 1995 and it sounded interesting so I did some research then sent our engineers to some jobs to learn more. The more we learned, the better it sounded, so I convinced the city to try it. Since 2001, over 100 street projects have been constructed with RCC pavements in central Ohio. Now we are producing 100,000 cubic yards of RCC a year."

Savko's first RCC street project was in Gahanna, Ohio. "Here in Gahanna, we like RCC for residential street rebuilds," said city engineer Karl Weatherholt. "We're able to get residents back on the street much faster than with an ordinary concrete base."

What is RCC?

RCC was first developed as a paving material in 1976. Some Canadian builders had the idea of doubling the amount of cement in a soil cement mix to stabilize the surface at a log sorting yard. They got much more than they had expected--it was strong and durable, and it went down quickly and easily. A 1998 Portland Cement Association (PCA) study of this log sorting yard in British Columbia found quite a bit of cracking--not surprising since this was very early in the development of the construction method. Nonetheless, the yard continues in full service today and "the operators report that they are very satisfied with the performance of the RCC pavement."

RCC is a very dry (zero-slump) concrete mix with 3/4 inch maximum size aggregate and overall well-graded aggregate so that it remains stable under the action of a vibratory roller. The RCC is placed using dump trucks and a modified asphalt paver, then rolled to get the needed compaction. The resulting surface looks a little rough, but it gains strength rapidly and the very low water-cement ratio soon far surpasses conventional concrete with an equivalent amount of cement. Since it is not as smooth as finished concrete, RCC is typically used as the surface course primarily for industrial areas, parking lots, or low-speed applications (less than 35 mph). For example, the Georgia DOT is currently constructing RCC shoulders on 15 miles of I-285 in Atlanta.

In central Ohio, composite roadways (concrete base with asphalt overlay) have been the standard for city streets for many years. The higher strength concrete base course is more durable and prevents the rutting that might occur with a full-depth asphalt base course. A study of city streets in Columbus by Michael Darter of ERES, a Champaign, Ill.-based engineering firm, concluded that the concrete base provided a load-carrying capacity about four times greater than full-depth asphalt.

Savko's brainstorm was to replace the conventional concrete with RCC. In this application in central Ohio, RCC is normally placed in a single 6-inch-thick layer with a 1 1/2-inch-thick asphalt topping. Occasionally,

designers specify it at up to 9 inches thick, although Savko believes that this is over-designed because the RCC is so much stronger than engineers believe it will be. It can easily achieve 7000-psi compressive strength and 700-psi flexural strength. David Luhr, a PCA engineer and program manager for RCC said, "The higher strength of the RCC allows for the design of a thinner pavement section and will provide longer pavement life."

City streets

Using RCC as the base course for city streets with a thin asphalt overlay is quickly gaining popularity in Ohio and elsewhere. For one thing, since RCC is basically a wet, compacted gravel, light traffic can go onto the new pavement almost immediately--within 10 feet behind the paver in extreme cases. This allows streets to be reopened much more quickly than with conventional concrete--usually about 2 hours after the RCC goes down. Residents can get back home the same evening after paving. Emergency vehicles can get return almost immediately if necessary. Truck traffic, however, should be kept off the pavement for a few days to allow the RCC to gain strength.

As a base course, RCC is much stronger than asphalt, and cheaper and faster going down than conventional concrete. "In one of the Columbus projects," said Luhr, "the city required the contractor to obtain 400psi flexural strength before they could switch traffic back over to the completed RCC. The contractor was able to obtain that in about 24 hours. If the design calls for an asphalt or concrete surface over the RCC, the surfacing operation can begin within a few hours after placing the RCC."

Construction tactics

Because of the very low water content, RCC mixing is not as productive using a central mix plant--so a pug mill is often used, a very high-energy mixing device. Savko bought his own pug mill. Coming out of the mixer, the material looks very much like wet gravel, and it is then transported to the construction site in dump trucks. "The important thing is to control the moisture content," said Savko. "We keep it at 8%. Even 1% over that is too much--the roller starts leaving marks."