Photos by GOMACO

Manatts paved Highway 71 in Iowa using a PaveSmart 3D system (stringless) from Leica Geosystems. Note the prisms extending upward on each side of the paver.

How **3D Technology** Pays Dividends

For a whole host of reasons, Mike Viehdorfer really likes the stringless control system on his new GOMACO GHP-2800 concrete paver. He works for Manatts Inc., a diversified, family-owned construction company based in Brooklyn, Iowa. For this U.S. Highway 71 project in northwest Iowa, Mike is the project manager, and this is his second major stringless paving project.

Typically a concrete paver is controlled by two stringlines set at precise locations on each side of the lane being paved. Three-D machine control, on the other hand, saves contractors considerable time and money because it eliminates all of the detailed survey and manual labor and associated transportation costs normally spent for a highway or runway—staking of hubs, setting blue-tops, and the labor to set up, maintain and tear-down stringlines. Automated 3D control also eliminates the potential for human error with stringline, and its logistical restrictions around the paver.

The $9-million project involves repaving a four-lane divided highway for a 9-mile stretch in Clay and Dickinson Counties. Manatts is placing a 6-inch concrete overlay atop the milled asphalt pavement. In the same single pass, the GOMACO GHP-2800 paver widens the roadway from 24 feet to 34 feet with 8 inches of concrete on each side. On one side the widening unit is 6 feet wide and it is 4 feet wide on the other.

For this project and others to follow, Manatts' new GOMACO GHP-2800

BY DANIEL C. **BROWN**

concrete paver is fitted with a PaveSmart 3D stringless control system from Leica Geosystems. "In the old days, when we were paving on stringline, if you got 50 percent of the available smoothness incentive payments on a project, that was good," says Viehdorfer. "Now with our Leica system, we expect to earn 70 to 80 percent of the smoothness incentives on any given project."

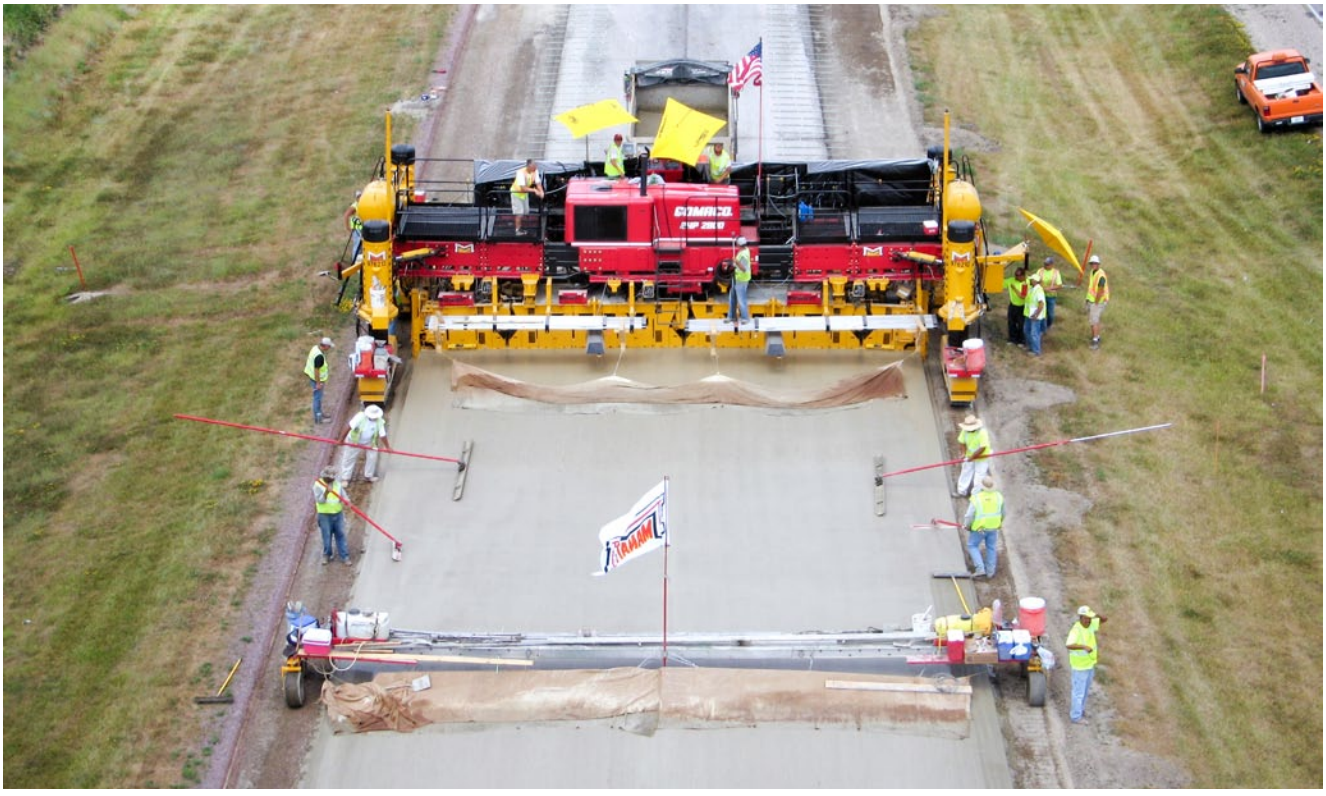
And on Highway 71 in August, the Manatts crew was bettering that—earning maximum incentive on about 95 percent of the pavement placed. Naturally, Viehdorfer gives a great deal of the credit for smoothness to the quality of the GOMACO GHP-2800 paver and the experience of the crew. Manatts is running the Profile Index (PI) system for measuring smoothness, which is comparable to, but different from, the International Roughness Index (IRI).

Check out these numbers. The Iowa Department of Transportation says it takes a PI of less than 22 inches of deviation per mile from a zero blanking band to earn the maximum smoothness incentive. On Highway 71, Manatts has been consistently running between 13 and 19 inches of deviation. "Now that we are running stringless, we expect more and we are getting more," says Viehdorfer.

Production is running well on Highway 71. "Yesterday, we did 4,300 cubic yards of concrete in 12.5 hours," says Viehdorfer. "We can move right along on an overlay. We are averaging a little over 300 yards per hour, or about 330 yards per hour."

As the dump trucks deposit concrete on the milled asphalt, the GOMACO GHP-2800 paver spreads concrete and forms it to the full 34-foot width of the new pavement. With the Leica PaveSmart 3D system, Manatts uses four robotic total stations—with two of them active at any time—to control steering and grade on the paver.

With over 13 years of engineering and commercial collaboration between GOMACO and Leica Geosystems, since the first U.S. street was paved by the two partners using 3D controls back in 1999 , it is perhaps not surprising how well-integrated the Leica controls are on GOMACO equipment.



Photos by GOMACO

Manatts used a GOMACO GHP-2800 to place a 6-inch overlay and widen Highway 71.

Photos by GOMACO

A technician uses a Leica robotic total station to check elevation of the new concrete slab.

Integrating seamlessly with any GOMACO paver or trimmer, Leica PaveSmart 3D regulates the steering, grade, draft and crossfall of the paver with no need to retrofit complex hydraulics. PaveSmart 3D guides the paver in relation to a digitized 3D model of the highway, running on the Leica machine computer onboard the paver.

The paver is equipped with two prisms, mounted above the machine, as tracking targets for the two Leica robotic total stations. When setting up the robotic total stations, a technician back-sights each of them to three known control points. That fixes the location of the total stations relative to the digital model. The two total stations then follow the movement of the two prisms on the paver and communicate to the machine computer the paver's precise location via radio link. The machine computer then computes the differences between the paver's actual location and the digital terrain model. Knowing those differences, the Leica machine computer then instructs the GOMACO GHP-2800 to regulate the mold's steering and grade fully automatically.

Two additional total stations are set up, one ahead, and one behind the GOMACO GHP-2800, to use in checking the new pavement. As the GOMACO GHP-2800 passes the next total station in front of it, the crew moves the rear station around in front. That way the crew "leapfrogs" the total stations down the highway—and the GOMACO GHP-2800 never needs to stop—a capability unique to Leica's technology. Even in traditional stringline paving, stopping the paver is highly undesirable for mainline paving, as it typically introduces a "bump" in the surface which will count against the ride bonus the customer is striving to achieve.

Tim Tometich, machine control manager for Manatts, says his company benefits from the GOMACO-Leica combination. "The value that we have is that GOMACO has built their computer to talk to the Leica PaveSmart 3D computer. The GOMACO computer was built with Leica's stringless technology in mind, and the two computers talk really well to each other." Moreover, says Tometich, Matt Morrison and Kevin Ackley—formerly two key players on Leica's stringless team—now work for GOMACO's new 3D Controls department. "Those two work very tightly with Leica, and they're very good at supporting the Leica system," says Tometich.

We asked Manatts' Viehdorfer why he likes the stringless system. "I love the ease of access to the project," he says. "You don't have strings that people were stepping on and tripping over, or bumping into. I think one of the greatest benefits is that we get smoother pavements. When you can do cross sections every 5 feet on a vertical curve compared to 25 feet with stringline, you just end up with smoother pavement. And you get finer yield control."

Manatts also uses a PaveSmart 3D system to control the milling machine

that re-profiled the asphalt down ahead of the paver. Hence the grade and slope of the milled asphalt is set precisely, meaning that actual concrete quantities paved do not overrun the estimated measured quantities by very much at all. The goal is to get a yield close to 100 percent.

"Before we started this stringless milling, our yields were always 110 percent and greater," says Viehdorfer. "Now that we are using stringless systems for both milling and paving, we are controlling the concrete yields to the 104 to 105 percent range—which is good for the contracting authority. You can base concrete quantities pretty much on a known yield since we started doing things this way." Naturally, this material cost saving drops directly through to Manatts' bottom-line, meaning they can bid confidently, and even more competitively, for paving projects in today's tough economic climate.

Before profile milling with a stringless system, estimating the yield of concrete for an asphalt overlay was "an unknown deal," says Viehdorfer. "There were wheel ruts in it, for example. How do you compensate for that amount? Nobody knows how much that amount is," he says.

What's more, stringless concrete paving frees up the laborers on the stringline crew to work on gravel shoulders behind the paver. "We find that sometimes we can get a little more accomplished with a certain amount of people," says Viehdorfer. "In a way stringless further improves production because the stringline crew can go back and do shouldering. So in the long run it does speed up the job.

Leica PaveSmart 3D is fully "plug and play" with the asphalt milling process. "The Leica system works really well on the milling machine," says Tometich. "We can control line and grade within a couple of hundredths—the same tolerances that we get with the paver. The only thing that you have to be cognizant of is your teeth wear on the mill. The teeth wear changes, so we change teeth more often. And we check grade often with the rover. But the system can control the grade really well."

On Highway 71, Manatts profile milled the nine miles of four-lane asphalt to a depth of 1.5 to 2.5 inches. After the contractor mills the first pass using the PaveSmart 3D system, the crew shuts off the Leica system and uses a ski on one side of the mill to control grade. "We get rid of the frost boils, improve our yield control and correct some of the super-elevations that were not right," says Tometich.

Manatts has two GOMACO GHP-2800 pavers that run stringless with the Leica PaveSmart 3D system. "We also have a couple of GOMACO 9500 trimmers that we can run stringless," says Viehdorfer. "And we have two road mills that also operate with the Leica system for profile milling."

In fact, in 2010 Manatts built an entire project—6 miles of Interstate 35 near Ellsworth, Iowa—with no stakes or stringline whatsoever. The company has Leica GPS systems on two bulldozers and one motorgrader, so that equipment did the earthmoving. "Then we used the same GPS dozers and motorgrader to lay the base rock," says Tometich. "We used a stringless GOMACO 9500 to trim the base rock, and a GOMACO paver running on the Leica machine control system to pave the Interstate." MC

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