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Contributions from
Pioneer Live On

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TIGERS & GRADERS

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for the Lazy or Misguided

MACHINE CONTROL

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NO STRINGS



**iPad &
Tablet Ready!**



Flynn used a PaveSmart 3D automated machine control system from Leica Geosystems to guide the paver on U.S. Highway 61 in southeast Iowa.

Why Go Stringless?

They're hard to quantify, but the little benefits add up quickly

“We realize that stringless technology is the future of concrete paving and we want to be part of it,” says Jeff Flynn. That’s not just talk from Flynn, who has invested nearly \$300,000 in automated machine control equipment for a mainline concrete paver, two grade trimmers, a motor grader and a dozer. With his brother Mike, Jeff owns Flynn Co. Inc., a Dubuque, Iowa, concrete paving contractor.

Because of their accuracy, machine controls produce somewhat smoother

pavements than a stringline. And because many states offer contractors incentives for smoother pavements, that accuracy can lead to increased incentive payments based on smoothness measurements.

And it’s difficult to quantify, but Flynn is satisfied that machine control equipment pays for itself by eliminating not only the labor and cost of stringline, but the little variables that are intrinsic to the stringline process. Those little variables add up to a “monster benefit,” he says. For example, if a stringline pin is set near a soft spot in the

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A CMI trimmer—equipped with a PowerGrade 3D controls from Leica Geosystems—trimmed the dirt precisely to grade.

haul road, the concrete trucks can pump the haul road at that location and throw the stringline off grade.

Or if the stringline is set up next to the area where you place base stone material, a worker must hold down the stringline while stone trucks cross over it. Or if you're using a belt placer and the dump man lowers the belt hopper onto a stringline pin, it will tear the belt up and you'll lose a day of paving to replace the belt. Plus, workers can trip on a stringline and injure themselves.

Ten-mile bypass

We visited Flynn's most recent stringless paving project, a 10-mile bypass on U.S. Highway 61 around Fort Madison, Iowa. Working under a \$26 million contract with the Iowa DOT, Flynn was trimming grade, placing and trimming base stone, and paving a 10-inch thick concrete pavement for the four-lane divided highway.

Flynn equipped a Guntert & Zimmerman S850 slipform paver to work 26 feet wide using a PaveSmart 3D automated machine control system from Leica Geosystems. The paver control system bases its guidance on a

digital model of the pavement that is entered into a Leica computer onboard the paver. The paver has two prisms, mounted above the machine, to receive signals from two robotic total stations set up on tripods, one ahead of the paver and one behind it. The prisms on the paver have a relation to four points on the slipform concrete paver's pan, which extrudes concrete for the runway.

When setting up the 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 total stations can then "see" two prisms on the paver and communicate to the paver—by free-wave radio—the paver's precise location. The on-board computer then processes the differences between the actual paver location and the digital model. Knowing those differences, the computer controls the paver pan location automatically.

Flynn actually uses three robotic total stations to control the paver, but only two are active at one time. When the paver moves ahead about 500 feet, out of range of one total station, a technician moves the third total station ahead and

activates it to one of the prisms. That way the paver does not stop while a total station is being relocated. "The robots tell the paver it's at X and Y location, and the digital model tells the paver it needs to be at elevation Z," says Mark Gorton, Flynn's project manager.

When the base has been prepared, the contractor sets out dowel baskets—contraction dowel assemblies with 1-inch diameter bars—in lines spaced across the grade at 20-foot intervals down the roadway. The dowels accomplish load transfer across the 20-foot joints to be sawed in the concrete pavement. A Rex Town and Country belt placer, steered by a stringline, supplies concrete and strikes it off ahead of the paver.

"The G & Z paver gives us a fantastic ride with a stringline, and we have found that it's even smoother with the Leica machine control system," says Gorton. The Iowa DOT's smoothness specification is 26 inches of deviation per mile, from a zero blanking band, to receive full payment. A graduated incentive system results in more money for less deviation. "The stringless system won't take a 20-inch (stringline) ride to



A technician checks the elevation of the fresh concrete slab.

an 8-inch, but it will take a 20-inch to an 16-inch,” says Gorton.

Stringless trimmers

The Highway 61 project is Flynn’s fourth using the stringless paver, but the first to

use stringless trimmers. Working with Vince Moroney, Leica machine control support specialist, Flynn was able to fit up two CMI trimmers—a TR-3503 and a TR 225-BHD—with Power Grade 3D controls suited for robotic total stations.

“I told Leica I wouldn’t pay for those trimmer systems if they didn’t work, and they made them work,” says Jeff Flynn. “Vince is the main reason we have the Leica systems on those trimmers. Prior to this, we used a motor grader and a robotic total station to do the trimming.”

Using one prism and one robotic total station, the CMI TR 3503 trims the dirt subgrade to within 0.02 foot. A smooth drum compactor rolls the subgrade after trimming to seal off the grade.

A fleet of 25 belly-dump trucks place base stone with a top size of 1.5 inches. A Caterpillar D6N equipped with a Leica GPS system spreads the stone, leaving it about one inch high. Compaction follows. “We roll it twice during stone placement operations and once after the final trim,” says Flynn.

The stone base is trimmed with the CMI TR 225 BHD trimmer—again equipped with one prism and guided by one robotic total station. Accuracy is important, because stone is expensive. For the Highway 61 project, Flynn spreads stone to a thickness varying from 6 inches to 10 inches across the grade. And Flynn builds an extra $\frac{1}{4}$ (0.25) inch to $\frac{3}{8}$ inch of concrete thickness into the bid—to prevent short cores. The state would penalize the contractor for cores of concrete pavement that come up less than 10 inches thick.

Flynn says he prefers to use trimmers instead of a motor grader to grade base stone, because the trimmers can lift excess material and load it into trucks. On a highway project in Missouri, Flynn could push excess stone to the outside for



Note the lack of a stringline on the haul road next to the Guntert & Zimmerman paver. Two prisms mounted on masts help position the paver for the robotic total stations.

use on the shoulder. On Highway 61, the CMI trimmer worked 16 feet wide, and it took three passes to cover the two-lane width. With the last pass, the trimmer picked up a windrow of stone and loaded it for use further down the roadway.

When we visited the Highway 61 project, Flynn was running the G&Z paver for the mainline and a Gomaco 2800 paver to pave a Highway 2 tie-in at the south end of the project. A 12-cubic yard batch plant, located 4 miles from the project's south end, supplied both paving operations. The plant produced concrete at a rate of 32 nine-yard batches per hour. A fleet of 14 end-dump trucks, mostly Mack and Peterbilt units, hauled the concrete.

First stringless project

Flynn's first stringless foray was an experimental project by the Iowa DOT on U.S. Highway 65 near Mason City.

For that one, stringless equipment was included as a line item in the bid. It was one of two such projects that Iowa let in 2009. "It was a 14-mile, two-lane project, and we paved it half-width, because the staging worked out better that way," says Flynn. "We bought the Leica system for that project.

"Then last year, we paved a portion of our Highway 67 project near Greenville, Missouri, with the stringless paver," Flynn continues. The next stringless project was a 10-mile job on Interstate 35 in Clarke County, Iowa. Flynn graded both the Highway 67 and I-35 projects with the motor grader and a robotic total station.

For Interstate 35, the state specified that existing concrete pavement be crushed and recycled as base on-site. "We used a motor grader and pushed the crushed material to the outside, then picked up the excess with a trimmer,

loaded it into trucks and moved it forward," says Flynn. "We didn't supply the stone the way we're doing here on 61."

A challenge for the project has been the weather—a wet and colder-than-normal spring. In fact flooding on a Flynn project in Missouri caused the contractor to move the mainline paver north to Iowa sooner than he normally would have. It will return to Missouri for about two weeks when the flood waters recede. Another challenge is the chopped-up nature of the tie-ins between Highway 61 and other roads at both the north and south end of the project. Those just require complicated staging and take time to accomplish, Flynn says. ■

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