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Automating Grader Control, Maximizing Efficiency

Grading contractor Bernie Schmidtlein recently spent just over $60,000 for an automated grader control system, and he's glad he did. Last spring Schmidtlein used the system on its first project: a 31-acre tract of land that he and the crews of Schmidtlein Excavating graded for a Home Depot warehouse in Topeka, KS.

To use a trimmer, stringline, and surveying hubs would have taken "three or four times longer," Schmidtlein says, than the scant 45 hours he spent fine-grading the 10.5-acre building pad. In fact, he says, the automated control system—a Leica Power Grade 3D system—will pay for itself in just two projects like the big warehouse job. After a short learning curve, it takes the contractor just 10 minutes each morning to set up the Leica robotic total station and get his Volvo motor grader ready for the day.

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Schmidtlein Excavating uses a Leica Power Grade 3D on a Volvo G940 motor grader.

In addition to the building pad, the Topeka project entails grading 20.5 acres of parking. The building pad measures 400 by 1,164 feet and is surrounded on three sides by truck parking. At one end of the building pad lies the employee parking lot. Cuts and fills balance each other on the site. The total earthmoving quantity is 200,000 cubic yards, and the maximum cuts and fills are each 12 feet.

"Our whole grading process is much more efficient with the Leica system," says Schmidtlein. "It's not so much in the volume of earthmoving that you recoup the cost, it's in the total grading area—31 acres."

Grading the site involved several steps; the first was to strip 6 inches of topsoil and stockpile it for future use. For the stripping job Schmidtlein used three large farm tractors plus a Volvo truck-tractor, all pulling tow-behind scrapers.

The next step was to add water as needed and scarify the subgrade, using a dozer pulling a disk. "Then we started grading with the scrapers—cutting and moving earth to the fill areas," says Schmidtlein. "In the fills, typically we used a dozer to knock down the material the scrapers had dumped. We compacted the fills with a sheepsfoot roller.

"And in the cut areas, we used a Caterpillar D6N dozer fitted with a Leica GPS system working on Indicate-only," says Schmidtlein. "The dozer had a Leica Grade Smart 3D controller onboard that we could run with a base station at our shop 13 miles away."

The dozer's Indicate system responded to GPS signals from satellites, but those signals were corrected by a cellular modem signal from the reference station at Schmidtlein's shop, explains Bob Parker of Laser Specialists, Schmidtlein's Leica dealer. "The reference station is connected to the Internet and has a dedicated Internet address," says Parker. "Users in the field, whether they're the dozer or a rover-receiver, can connect to the reference station using a cellular telephone connection."

Schmidtlein says the scrapers typically made fills of 6 to 7 feet deep on the building pad. The Leica-equipped D6N graded the fills to within plus-or-minus one-tenth of a foot. He says the GPS system will permit vertical accuracy of six-hundredths foot, but he wanted to leave the grade a tenth high for the finish motor grader.

"The Leica Grade Smart 3D system shows the dozer operator a detailed plan of the job," says Parker. "It shows him the exact horizontal and vertical location of the blade."

Setting up the GPS system and the new Power Grade 3D system is a relatively simple matter, says Schmidtlein.

"We get a Computer-Aided Design (CAD) file from the engineer, and my son converts that to a usable 3D model—a Digital Terrain Model," says Schmidtlein. "That model is on a flash card, and we install it into our two dozers, the finish motor grader and the rover."

Fitted with the Leica Power Grade 3D system, the Volvo motor grader can accomplish greater accuracy—3 to 5 millimeters—than the GPS system can perform. Every morning, Schmidtlein sets up the robotic total station and backsights it using two control points. It takes about 10 minutes to shoot the two control points with the battery-operated total station. "Position is calculated using a laser signal—an electronic distance measure—and the robotic total station uses a radio system to send location information to a prism on the motor grader," says Parker.

"The robotic total station tracks the motor grader wherever it is on the site," says Parker. "Position information on the total station is being updated at the rate of 12 times a second. That information is continuously being compared to the 3D model on the grader. Cut-and-fill information is generated, and whatever movement is needed is sent by Power Grade to our electronic-hydraulic valve on the grader.

"That valve is tied to the machine's hydraulic cylinders—where elevation, cross-slope and side shift can be controlled," says Parker. "That way the blade's X, Y, and Z coordinates are all controlled by the system."

Says Bernie Schmidtlein: "We really like the automated Leica system. If we didn't have that, we'd need somebody out there checking grade. This saves wasted time checking grade. Plus, I can meet the one-tenth accuracy in third gear on the grader, which is about 2.5 miles per hour."

Next the contractor rolls the subgrade into place. Lime is spread on the building pad area to stabilize the soil; the parking lot areas take less-expensive fly ash as a stabilization agent. Using a stabilizer, which works like a tillage tool, the contractor works the lime or fly ash into the soil 9 inches deep. Compaction follows.

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Bernie Schmidtlein recently lowered the cost of grading by making the move to automated grader control.

After stabilization, the contractor fine-grades the fill with the finish motor grader equipped with the Leica Power Grade 3D system. Actual accuracy is plus-or-minus one-quarter inch. Then the fill receives 6 inches of crushed stone spread over the building pad and the parking lot areas.

The Leica system saved untold labor, Schmidtlein says. If he were to use a trimmer and stringline, grade preparation would take four people: the trimmer operator, a supervisor to set grade, and two laborers to set stringline pins.

"That would take three or four times longer than we need with the Leica automated system," says Schmidtlein, who operates the Volvo fine grader. "A stringline would take 90 to 120 hours of prep time. But when they shoot the two points in the morning, I go over and set the blade on a control point to calibrate the control system. We drove an I-beam into the ground to serve as a bench mark.

"The first time we used the Leica system I checked the grade with a rotating laser to see if it was as close as they said it would be," says Schmidtlein. "It was that close, so we don't even check grades anymore after the blade has done its job."

Schmidtlein is pleased with the service he gets from Leica dealer Laser Specialists in Olathe, KS. "In the field, response time by the dealer is very important," says Schmidtlein. "Bob Parker and the people at Laser give us good service and they explain things to us in language we can understand. That has to play a big part in the system we select."

The Leica system gives the contractor a decided advantage in bidding projects. "I told our estimator to use grading costs from this project for his future bids," says Schmidtlein. "We really like the system. We can run this grader anywhere on the site and it gives us an elevation difference between the design and actual elevations." GX

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