

Automating Grader Control to Maximize Efficiency

by Daniel Brown

Grading contractor Bernie Schmidlein recently invested in an automated grader control system, and he's glad he did. Last spring Schmidlein used the system – a Leica PowerGrade 3D system – on its first project: a Home Depot warehouse in Topeka, Kansas.

To use a trimmer, stringline and surveying hubs would have taken “three or four times longer,” Schmidlein says, than the scant 45 hours he spent fine-grading the 10.5-acre (4.3 hectares) building pad. In fact, he says the Leica PowerGrade 3D will pay for itself in just two projects the size of the big warehouse job.

In addition to the building pad, the Topeka project entailed grading 20.5 acres (8.3 hectares) of parking. Cuts and fills balanced each other on the site. The total earthmoving quantity was 200,000 cubic yards (153,000 m³), and the maximum cuts and fills were each 12 feet (3.6m). “Our whole grading process is much more efficient with the new system,” says Schmidlein. “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 (15.2cm) of topsoil and stockpile it for future use. For the stripping job Schmidlein 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 sub grade, using a dozer pulling a disk. “Then we started grad-

ing with the scrapers – cutting and moving earth to the fill areas. 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 Geosystems GPS working on Indicate-only,” says Schmidlein. “The dozer had a Leica GradeSmart 3D controller on board 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 Schmidlein’s shop, explains Bob Parker of Laser Specialists, Schmidlein’s Leica Geosystems dealer. “The reference station is connected to the Internet and has a dedicated Internet address,” says Parker. “Users in the field can connect to the reference station using a cellular telephone connection.”

Schmidlein says the scrapers typically made fills of 6 to 7 feet (2m) deep on the building pad. The Leica Geosystems-equipped D6N graded the fills to within plus-or-minus 1/10 foot (3cm). He says the GPS system will permit vertical accuracy of 6/100 foot (1.8cm), but he wanted to leave the grade a tenth high for the finish motor grader. “The Leica GradeSmart 3D 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 PowerGrade 3D system is a relatively simple matter, says Schmidlein. “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. 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 PowerGrade 3D system, which uses a total station for control, the Volvo motor grader can accomplish greater accuracy – 3 to 5 millimeters – than the GPS system can perform. Every morning, Schmidlein sets up the robotic total station and backsights it using two control points. It takes about ten 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. 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 Leica PowerGrade 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 Bernie Schmidlein: “We really like the automated Leica Geosystems 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 2-1/2 miles per hour.”

Next, the contractor rolls the sub grade 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 (23 cm) deep. Compaction follows. After stabilization, the contractor fine grades the fill with the finish motor grader equipped with the Leica PowerGrade 3D system. Actual accuracy is plus-or-minus ¼ inch (6 mm). Then the fill receives 6 inches (15 cm) of crushed stone, spread over both the building pad and the parking lot areas.

The Leica Geosystems system saved untold labor, Schmidlein 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 Geosystems automated system,” says Schmidlein, 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 Geosystems system I checked the grade with a rotating laser to see if it was as close as they said it would be. It was that close, so we don’t even check grades anymore after the blade has done its job!” ■

About the author: Daniel Brown is founder of Techni-Comm, Business Communications Inc.