



# Technology

by Rippin Blackford

## *Levels the Table*

*GPS: if you're a contractor who's using it, you understand the enormous benefits it offers. You've experienced impressive gains in earthwork productivity, you can start projects when you want without waiting for others, and you have information about grades and quantities right at the jobsite. As GPS becomes widely used for sitework operations, another benefit is emerging: contractors are becoming more informed about the conditions of the jobsite. This is changing the way they do business—in the office, at the conference table and on the jobsite.*

### **The Three-Way Relationship**

To understand the impact of GPS on business, consider the agents and processes involved in a typical construction project. The owner, who is financially responsible for the success of a project, develops a vision of completed work. The architect or engineer (A/E) defines and communicates the owner's vision. The A/E also assists the owner in balancing his expectations and budget. The contractor takes the A/E's communications, including plans and specs, and uses his construction knowledge and resources to make the owner's vision a reality. This three-way relationship has worked well for decades.

Traditionally, the A/E develops and maintains the knowledge base of the project while the contractor is on the receiving end. Over the past two decades, feedback from the contractor has become increasingly important. Technology is giving contractors the ability to contribute even more to a project's knowledge base. GPS systems and software programs enable the contractor to acquire important information

# Contractors using GPS machine control are empowered with information to succeed in business.

about the site, analyze data, and make determinations and revisions quickly and easily. Before GPS, the contractor had to seek and pay for the services of an outside consultant to acquire this information.

Today's pace of development is lightning fast. To be profitable, commercial projects need to move quickly through the design and construction phases. Supplementing design with actual field conditions prior to and during construction expedites the flow of a project, reduces costs and avoids unnecessary delays. The contractor can assist in obtaining this information.

## Value Engineering for Sitework

Value engineering is a process in which the contractor uses his experience and expertise to offer

alternate construction methods or materials that will accomplish the same objectives and offer cost savings. Value engineering usually leads to a better project because the contractor makes a contribution to the knowledge base. This process is exemplified by McGowan-Stauffer Inc. (MSI), a mid-sized earthwork and storm drainage contractor based in Carnegie, Pennsylvania. MSI typically works on two or three projects in the \$500,000-range at any given time. The company has a permanent office staff of eight and employs as many as 20 operators during optimal weather months.

While MSI is like many other site prep contractors, it has a distinct advantage—site engineering savvy. Phil McGowan and George Stauffer, both civil engineers, started their contracting company in 1975. Today Don McGowan, second-generation civil engineer, is strengthening his relationships with owners by offering technically sound advice on how to reduce sitework costs.

MSI contracted to prep a hilltop site for a recent commercial project. Earthwork calculations revealed that 750,000 cubic yards of earth had to be moved to create the desired building and parking areas. The plans included an extensive array of multiple retaining walls around the perimeter of the site. Using Topcon's ([www.topconpositioning.com](http://www.topconpositioning.com)) TopSite software program, McGowan studied alternatives to the retaining walls. He ultimately developed a grading plan that eliminated the need for the walls with minimal impact on the proposed development area. This resulted in a cost savings of \$800,000. To help the owner visualize his proposed changes, McGowan used TopSite to create a 3D model and effectively communicate his proposal.

## Flagging Potential Problems

Owners want to minimize upfront costs and reduce the amount of financial responsibility they will carry until their project is built and the returns begin to come in. A/Es need base information to start their designs at a reasonable cost; they do not want to spend time and money researching and defining existing conditions that will soon be removed or altered.

But saving money by minimizing preliminary investigations, which many A/Es do, can result in several repercussions. For example, inaccurate topographic data from outdated sources or aerial maps not verified on site can lead to busts in earthwork quantities. Incomplete utility investigations can lead to conflicts with storm drainage and other improvements. Spotty soil borings and investigations can lead to unanticipated removal of mass or trench rock.

When these issues are not identified and dealt with during the design development and bidding process, they emerge during construction. And when discovered once sitework is

Topcon's 3D-GPS+ machine control system enables Stanley Construction's Cat D6N operator to carve a lake sideslope with ease.



Jim McGowan of McGowan-Stauffer Inc. checks grades with Topcon's HiPer+ survey system to analyze the site for design adjustments.

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Joel Jenson, field engineer with Kerr Contractors, uses Topcon's HiPer Lite+ rover to check existing grades and avoid unanticipated costs and delays.

underway, they can disrupt the workflow and cause friction between the contractor, owner and A/E. The owner's costs rise and his schedule is delayed, often causing the optimal three-way partnership to break down.

Kerr Contractors Inc., a high-profile, progressive sitework contractor based in Woodburn, Oregon, knows the benefit accurate topographic information can have on the further stages of construction. Founded in 1989, Kerr today employs 120 people and averages \$35 million yearly in total contracts. Specializing in site prep and road projects, its typical scope of work is divided 50/50 between grading and utility construction tasks.

In spring 2005, Kerr's list of upcoming projects gave every indication that it was going to be a banner year. The company was committed to site prep projects for a 100-acre Lowe's and Target site and the construction of two major roadways. To aid its work Kerr decided to invest in Topcon's GPS+ technology in March.

Topcon's HiPer Lite+ GPS+ base/rover system has enabled Kerr's employees to perform their own layout and grade checking. The same GPS+ base station also provides guidance to their machine control systems. Kerr's Caterpillar (www.cat.com) D6R dozer, equipped with Topcon's System Five 3D-GPS+ indicate system, is used to finish general site areas following heavy earthmoving operations. Kerr's Cat 16G motor grader with Topcon's System Five 3D-GPS+ fully automatic controls is used for fine grading/finishing areas requiring higher precision.

These systems enable Kerr to fulfill its business philosophy, which centers on identifying problems and discrepancies at the start of the project to avoid subsequent issues with owners. When they began work at the Lowe's and Target site, Kerr ran a check of existing grades with the HiPer Lite+ system and a John Deere (www.deere.com) Gator four-wheeler.

Brent Kerr, president and owner of Kerr Contractors, explained what they discovered: "We were there the first two days and figured out with our GPS that the site is a half-foot to a foot higher than what the plans show. So it has great impact—the job was originally an import job, now it's an export job. We figured about 110,000 cubic yards [of] difference. It was 40,000 cubic yards of import, now it's 70,000 yards of export."

A major discrepancy like this can have serious consequences to both cost and schedule, especially if discovered several weeks into earthmoving operations. Today most

### GPS Makes Good Operators Great

In addition to the advantages GPS provides to each project, contractors are also discovering that GPS is reducing the strain of having to find skilled operators. Al Stanley, vice president of project management for Stanley Construction in Huntsville, Alabama, noted that finding experienced operators is becoming an increasing problem for his company. The old timers are gone, and the new operators lack the years of experience that can make them productive and efficient.

Stanley uses Topcon's System Five 3D-GPS+ fully automatic machine control on the company's Cat D6N and D6MXL dozers. After working in the field and training new operators, Stanley has come to the conclusion that GPS is making his new operators proficient and his experienced operators more productive.

"GPS makes equipment operators more productive," Stanley explained. "They can actually see what they have to do. They can see the slopes they are working on [and] they can see the cuts and fills."

"Construction is a visual industry," Stanley continued. "What I've found with operators is if you can't picture it in your mind, you really can't fix it. If you can't picture a 3 to 1 slope, there's no way that you can grade one. If you can't picture a ditchline, there's no way that you can grade it."

Stanley described how technology solves this problem: "GPS puts that picture, that visual image right in front of the operator in real-time so that as he moves, he sees that image. He sees the slope and how his blade is oriented in relation to it. He's no longer dependent on his experience to be able to translate what that stake says."



retail and commercial projects are constructed under accelerated time schedules to provide the owner with a quick return on his upfront development costs. The contractor who takes positive steps to discover and resolve these issues right at the start will find favor in the eyes of the owner.

“It helps create another level of trust and dependability where they’re depending on us,” Kerr said. “We can give them a monthly printout of earthwork quantities so they can see our progress. We’re considered an equal player, the mainstay.”

### Changing Roles on the Jobsite

GPS has had another notable impact on construction jobsites: it has changed the traditional roles of personnel. Project superintendents traditionally relied on grade checkers and project surveyors to understand the progress of a project. Many superintendents now carry GPS rovers or mount them in their pickup trucks. They can drive to any part of the site and know exactly where they are located in relation to planned improvements. They can determine whether work areas are high, low or on grade. If a stake for a storm drain inlet gets knocked out, the superintendent can replace it in a matter of minutes.

Dave Kruskamp and Leroy Brechtelsbauer have experienced change in their roles through the advent of GPS on the construction jobsite. Kruskamp and Brechtelsbauer work for Fisher Contracting in Midland, Michigan, Kruskamp as a foreman/surveyor and Brechtelsbauer as an operator of a Cat



Foreman/operator team for Fisher Contracting, Dave Kruskamp (above) and Leroy Brechtelsbauer (left) have experienced changing roles on the jobsite using digital data from today's 3D tools.

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Jim Smith owner of Calco Grading prepares the jobsite for profiling.

Step 1: Sets up Geodimeter



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D6N dozer. The two men work together as a team to manage earthmoving on Fisher's projects. But they accomplish this differently than they used to. Today, they rely on Topcon's complete site management system to perform all required tasks.

Kruskamp today, instead of the old days of measuring tapes, rods and transits, uses Topcon's HiPer+ wireless integrated GPS+ receiver system, FC-100 field controller and Pocket-3D jobsite management software for layout, grade checking and earthwork analysis tasks. Using Topcon's Office-3D, he creates the point files needed for layout and the 3D surface files required for the dozer machine control system. The data files used in these systems are compatible between all components.

The seamless exchange of digital data expedites the coordination and control of field operations: "On big dirt moving jobs, Leroy can topo with the bulldozer and we can figure layers [like] how much he took out that day," Kruskamp explained. "We can use it to track quantities. I might be on a different job. He can E-mail it to me and I can figure the amount that he's removed or how much he has to go [right] on my laptop computer or right on my rover with Topcon's Pocket-3D."

Before starting a job, Kruskamp sends the 3D surface files for the Topcon dozer system to Brechtelsbauer. To study the routing of dirt on the site in advance of the project, Brechtelsbauer uses Topcon's Office-3D on a notebook computer. In the machine simulator mode of Office-3D, he can actually

run a dozer over the site to check the surface and ensure that the 3D surface file will run the machine smoothly.

Working with these types of systems, many dozer operators are now performing the work of grade checkers to direct earthmoving operations. The advanced GPS+ system enables Brechtelsbauer to provide information to scraper and excavator operators working on heavy cut/fill operations by consulting the elevations on his in-cab display. He carries out his own dozer work. When the other machines need guidance, he runs his dozer over their work area. This saves the time and expense of having Kruskamp travel to the site.

Brechtelsbauer explained the advantages: "If we don't have anyone on the job to do layout, I can set stakes off a corner to give the earthmoving crew an idea of where they have to go and what they have to do. It saves a lot of time for everybody and gives us a lot more accuracy."

### A Promising Future for Contractors

Technology is having a huge impact on sitework and changing the way contractors operate their businesses. As more new technologies are put to work, the contractor will become the core information resource during the construction phase of site development. By providing critical information and valuable feedback to owners and A/Es, contractors are raising their level of prominence in the three-way business relationship. **SP**

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