

A Lot's At Stake; Keep Control Of Your Project

Decentralization and electronic technology have added speed and efficiency to construction-site staking. But they also raise the risk of costly errors. To build yourself a safety net, set up firm procedures and have an expert keep an eye on the big picture.

By Mike Larson, editor

Advances in electronic technology have simplified project designing and construction immensely over the past couple of decades, but they have also spawned new chances for costly mistakes that companies in the construction industry need to be aware of.

Electronics Can Simplify And Speed Up Work

CAD programs have simplified the designing and revising of project plans. Being able to easily transfer the design files electronically from the architect to the engineer, then to the general contractor and subcontractors, has increased efficiency exponentially.

That efficiency has bred advances in electronic staking, as GPS and total-station electronic measurement systems have cut the time needed to stake and re-stake a job by 20 percent, or more.

Said one contractor recently, "With electronic staking, you get 10 hours of production in a 10-hour day. With manual staking, it's more like eight hours of production and two hours of staking."

The site marking that once took a surveying crew several hours to measure and mark using multiple fixed points, a transit, a tape measure, and wooden stakes can now be done much more quickly – and often more accurately – by just one person using an electronic GPS or total-station system.

Electronic site measurement can also boost productivity by actually guiding equipment operators as they cut, fill and grade. In some cases, a GPS system can even take over control of a bulldozer or motor grader to automatically put the fine-grading touches on a project with fraction-of-an-inch accuracy.

New Project-Control Trend Opens Door For Error

Thanks in part to the speed and efficiency provided by modern electronic file transfer and electronic staking, the various contractors on a construction project now work more independently, each responsible for laying out its own segment of the work.

In fact, general contractors are more and more often requiring specialty contractors to do their own staking.

The earthmover does its own staking, as do the utility contractor, the concrete contractor, the electrician, the plumber, and others.

Although parceling out the staking work simplifies things for the general contractor and lets the subcontractors work without waiting for outside checking, it also opens the door for huge and costly errors.

Lost in this decentralization are:

- Having surveying done by someone trained in that specialized skill.
- Making sure that CAD files from multiple design firms are reviewed together to identify conflicts just before construction starts. This vital cross-check, now often skipped, previously caught errors before they morphed into concrete, steel, copper – and cost.

Not so long ago, construction projects were controlled by a small, close-knit team that included the designing engineer and a professional surveyor.

All of the project's contractors and subcontractors worked from control points and measurements set up by the surveyor, who also checked the



To provide an extra measure of security for clients, Paul Sims of R.A. Smith National carefully scrutinizes the details of building plans to be sure the project will go smoothly. Photo courtesy of R. A. Smith National.



Modern electronic technology such as total stations and GPS can add both productivity and accuracy to construction projects. For extra assurance, it's a good idea to have a trained surveyor check the work of multiple contractors staking on a site. Photo courtesy of R. A. Smith National.



Rover units, like the one used here by R.A. Smith National's Mike Bartelson and Chad Kurtz, can be used to stake electronically, to guide manual stick-in-ground staking, and to check the accuracy of completed construction. Photo courtesy of R. A. Smith National.

accuracy of each contractor's layout to catch errors before work began.

What's more, someone on the control team continually checked how all the project's pieces fit together, in order to identify and correct conflicts before they caused delays and extra cost.

For example, a person assigned to keep an eye on the big picture would have caught these costly mistakes before construction had started:

- Although a building's first floor was within the property line, the third-floor balcony reached into the neighboring lot.
- A bridge pier was built on the wrong spot and cost \$250,000 to remove and replace.
- 20 building pads sat a foot too high and cost \$750,000 to tear out and replace.

Skilled Surveyor, Clear Procedures, And Big-Picture Check Are Key

So how do you take advantage of speed offered by shared staking responsibility and electronic technology, yet minimize the risk of major mistakes?

Don Chaput, Registered Land Surveyor (RLS) and director of surveying for R.A. Smith National, Brookfield, says the keys to having the best of both worlds are being sure to involve a professional surveyor in the project, establishing clear procedures for the survey work, and assigning someone to double-check for big-picture errors.

Skilled Surveyor

"Typically, a surveyor's services costs less than 1 percent of a project's

total. That's a small investment for being sure you won't face hugely expensive tearing out and rebuilding later in the project," he says.

"One reason contractors risk not having their staking checked is that they need the review done right away so work can continue. Surveyors need to respond more promptly in order to meet that need. R.A. Smith tries to provide same-day service," says Chaput.

A trained surveyor, says Chaput, not only understands how to properly check locations and elevations, he or she also understands where and how errors are most likely to happen, how to spot them, and how to fix them.

For example, he says, errors in the original project drawing can carry through to the job site because the electronic drawing is passed to contractors who automatically accept it as correct.

Other common causes of errors, he says, include improper establishment or use of site survey control points, improper use of measuring equipment, and having many surveyors working totally independently of each other.

Consistent Procedures

Chaput recommends using a consistent procedure for your projects to cut down chances for error. His recommended steps include:

1. Completing an ALTA/ACSM land title survey before construction begins.
2. Preparing a plat showing the proposed improvements as part of the permitting process.
3. Having a professional surveyor make a detailed plan takeoff at the

start of construction – and then share the data with all other surveyors who will work on site.

4. Establishing at least three horizontal and three vertical control points through professional surveying procedures – and, again, sharing the information with all surveyors who will work on site.

5. Independently verifying key layout points – physically, on site – before construction starts. Chaput says this is essential when several surveyors are working the site for different contractors.

Big-Picture Checks

The final key to minimizing the risk of big errors is being sure that someone is frequently checking to see that all the planned pieces of the project fit together without getting in each other's way or causing costly rework.

For example, finding out that a storm-sewer pipe will run through a stairway foundation is easier and cheaper to correct before the pipe or steps are put in place.

Modern CAD programs that combine all the layouts and show a composite view in three dimensions can actually help with this.

By combining the services of a skilled surveyor, consistent procedures and big-picture checks, contractors can reap the efficiency and speed of independent construction staking while minimizing the risk of costly mistakes. ■

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