

# NEW ENGLAND Construction

## Controlling **Grade** Without **Stakes**

*Sweeney Excavation grades Connecticut subdivision including roadway using GPS grade control system*

■ By Paul Fournier

**A** Connecticut contractor eliminated the setting of hundreds of grade stakes while excavating and grading a large subdivision and its main roadway by using a global positioning (GPS) earthmoving system.

Sweeney Excavation of Hamden employed Trimble SiteVision GPS, an automatic earthmoving grade control system, to speed its site work at Fieldstone Farms, an upscale 95-lot subdivision in Wallingford, Conn. The system eliminated the time-consuming process of setting grade stakes throughout the subdivision, which is being developed by Baker Residential of Pleasantville, N.Y.

Sweeney Excavation's work is divided into two phases: Phase I involves constructing 5,000 feet of a proposed 9,000-foot roadway, plus all storm drains, water mains and sewers, and a 2-acre retention pond. This includes bringing all house lots in Phase I to within 6 inches of finished grade. Phase II will complete the roadway and the remaining house lots.

About 850 feet of the road is designed as a boulevard with a 14-foot-wide island and 20-foot-wide roadways on either side of the island. The remainder of the road is 24 feet wide. There will also be extensive landscaping that will be subcontracted to an as-yet undetermined contractor.

According to Robert Sweeney, president of the Hamden company, the Trimble system worked without a flaw.

"It was absolutely successful, worked even better than I had expected," he said. "We didn't have to use a single grade stake on this job."

Sweeney purchased the system from Whitehall, Pa.-based Keystone Precision Instruments through Tom Hogan, a regional sales manager with a local office in Sherman, Conn. Hogan installed the system on a 2003 Cat D8R dozer that Sweeney had recently bought from Cat dealer H.O. Penn Machinery Co. Hogan installed the system early in May and reinstalled a revised surface model of the job site near the end of June.

Sweeney said he is always looking for ways to improve the speed and efficiency of his earthmoving operations - a search that led him to investigate GPS machine control systems. One of his concerns about employing this new technology was that it might intimidate his team of experienced machine operators. To allay their fears, he took some of his top operators to CONEXPO, the Las Vegas construction show, to introduce them to the machine control technology.

"I researched all of the available GPS systems and decided to buy Trimble," said Sweeney. "One of the things that sold me was the fact it has two antennas on the dozer blade instead of one. This provides better information on the position of the blade and it's invaluable for getting accurate cross slopes."

The system installed on Sweeney's D8R consists of the two GPS antennas - one on each end of the dozer blade - plus a radio, on-board computer, a screen display, and a GPS receiver. In addition, the grade control system utilizes a hand-held Rover radio receiver, and a pole-mounted Base Station and SiteNet radio. The Base Station is calibrated for precise vertical and horizontal location before excavation begins, and serves as a reference, while the SiteNet radio provides communication between the Base Station and the Rover.

Calibration is accomplished by positioning the Rover over known reference points such as manholes or other structures on site that have been established by land surveyors, and taking elevation and location readings. This is part of a correction process that converts latitudinal and longitudinal locations from satellite into more accurate XYZ coordinates for the job site.



Above: Base Station and SiteNet radio are important components of SiteVision system.

Left: A Cat D8R equipped with Trimble SiteVision GPS grade control system is used by Sweeney Excavation to grade Wallingford, Conn. subdivision.

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Corrections are continually fed to the dozer's on-board computer as the machine moves over the job.

Before grading proceeds, information on the site is fed to the on-board computer, usually by means of a flash card similar to that used in digital cameras. This information has been compiled from conventional land surveys and is comprised of two surface models – one of the existing topography of the site, the other of the final design that is superimposed on the existing topography.

During grading operations, the GPS receiver on the dozer computes the exact position of the GPS antennas 20 times per second. This pinpoints the exact location and orientation of the blade in real time. The computer compares the position to the design surface model and continually calculates the required cut or fill at that precise location. This information is displayed on the on-board screen in plan view, cross-section view or text. Three sets of colored light bars guide the operator up or down for grade, and right or left for alignment. With his peripheral vision, the operator uses the lights as he runs the dozer over the terrain.

This system enables the operator to know exactly where his blade is within 1/2-inch horizontally and 1 inch vertically at any time. He can offset the grade at a differential between the bottom of the base and the pavement surface, allowing him to grade the base and, by continuing to change the offset, grade each layer of road base aggregate all the way up to the fine-grade elevation.

Sweeney pointed out that Trimble has another GPS system, BladePro 3D, which carries this stake-less concept further by adding hydraulic machine controls, producing completely auto-

mated earthmoving. He said he is considering having this type of system installed on a smaller dozer that is used for fine-grading. Furthermore, he may install the system on a paving machine.

The Fieldstone Farms project, site of a working dairy farm until last year, is the first job Sweeney undertook with the new GPS system. As part of the contract, the firm is moving about 130,000 cubic yards of cut and fill, and installing approximately 9,000 feet of 15-inch to 36-inch ADS smooth lined, corrugated plastic storm water pipe, 8-inch PVC sewer and 8-inch ductile iron water main.

In addition, the contractor is expanding an existing retention pond to roughly 2 acres. Crews dewatered the pond with pumps and then performed the earthwork using the SiteVision-equipped dozer to grade the entire pond, including side slopes. Later, the pond will be filled with water and stocked with fish.

Sweeney is also responsible for demolishing three old dairy barns and two of three silos – one is being left for aesthetic reasons. Other work involves building a 250-foot by 10-foot-tall retaining wall, possibly of modular block (the final design has not been determined).

As of late August, the Phase I excavation and grading work of the SiteVision-equipped dozer was completed, and Sweeney had moved



**Sweeney graded two-acre retention pond without using a single grade stake.**

it and a second Cat D8 to Milford, Conn., where a 300-unit rental apartment complex called Avalon Bay Community is under construction.

As for the SiteVision system, he had this to say: “This system has turned out to be everything I hoped it would. I thought there would be a much longer learning curve for my operators, but they have adjusted quickly to it. Right now, we have just the one system, so I've been cross-training the operators on the D8 and a number of them are already familiar with it.

“And Tom Hogan at Keystone has worked very closely with us and has been extremely helpful with training. He's always there for us when we call for help.”

Sweeney said he is sold on the use of GPS machine controls:

“This is cutting-edge technology. I believe it's the future for this industry and it certainly is the future for Sweeney Excavating.” □

## A Growing Concern

Owner Robert Sweeney established his business 17 years ago when he was just 22. During high school, he worked for a contractor who installed above-ground swimming pools. He had his own work crew and subbed out excavation to other contractors, but was unhappy with the quality of their work. With his boss's blessing, he bought a used backhoe and set up his own business excavating for pool contractors.

Soon he added asphalt paving to his repertoire with the purchase of a Puckett Bros. self-propelled paving machine. Later, he became licensed as a plumber and also as a sub-surface sewer installer and started working for home builders paving driveways, installing septic systems and doing general excavation for house lots.

After a few years he purchased a larger, Blaw-Knox paving machine, and the company now performs roadway paving.

Another Sweeney venture is Blue Diamond Quarry in East Haven. There, Sweeney sub-contracts blasting to Southern New England Drilling and Blasting of Guilford, Conn., and crushes the material with his own Cedarapids primary jaw and secondary cone crushers. The firm currently produces Connecticut DOT-approved 3/8-inch to 2-inch “clean stone” and 3/4-inch to 2-inch processed stone. He said owning and operating a quarry is a “nice marriage” with his excavation business because he's producing aggregate for Sweeney projects.

Sweeney also moves the crushers around the state working with developers who have tough rocky sites. Sales personnel market this capability to developers, offering to crush and recycle blasted rock on site, and haul surplus aggregate to other sites where it is purchased by contractors. Sweeney shares revenues from these sales with source developers.

With a staff of more than 35 people, Sweeney Excavating has grown to the point where the company now concerns itself primarily with commercial construction. But the firm has not abandoned residential work, where the owner got his start. He recently set up a separate company, Sweeney Residential, geared to serve home owners.

A completely separate operation, Sweeney Residential already has six people on staff with a landscape architect on call, and offers custom landscape design for homeowners. Among company services are landscaping, paving, irrigation installations, patio and paver installations, and retaining wall construction. □



**Sweeney's site superintendent, Pat O'Malley, uses Rover at manhole reference point to calibrate Base Station.**

