

Indoor Accuracy

Trimble Universal Total Station and GCS900 Grade Control System provide centimetre-level accuracy for indoor excavation project for Europe's largest sub-tropical greenhouse

The arrival of GPS-based machine control systems has greatly boosted the efficiency, accuracy, and ease of use of various kinds of earthmoving equipment. But what if you have to work on a site where you cannot get a satellite signal? That's where Trimble's total station comes in.

The Trimble® Grade Control System lets you load digital designs of complex 3D models into the Trimble Control Box inside the operator's cab. Staking out is no longer necessary, because the machine operator can see the design with the exact position of the cutting edge of the bucket on the control box screen, which makes it easy to dig and level with two centimetre accuracy. This way of working saves time and reduces the chance of errors, both during the preliminary stages and the actual work. Any errors in the 3D design can be identified and fixed quickly and easily at the outset using the office software Trimble Business Center - HCE, which helps both the operator and the machine spend more time on actual work. All of this ultimately results in shorter project times, lower costs, and a better finished product created with greater accuracy.

“ The Grade Control System uses the 3D position information of the prism calculated by the total station to position the excavator's bucket to centimetre-level accuracy ”

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Overview

Customer Profile:

Fuhler is a contracting and rental company based in Emmen, Netherlands.

Business Challenge:

Fuhler was hired for a major earthmoving project as part of the 22-hectare extension to the Wildlands Adventure Zoo in Emmen. Fuhler's eight excavators with 3D GPS-based machine control systems could not be operated under the roof because of the blocked signals. The company turned to SITECH Nederland and Trimble for help maintaining accuracy and efficiency on the portion of excavation work that needed to be done inside an enclosed greenhouse.

Solution:

Trimble GCS900 Grade Control System with Trimble SPS730 Universal Total Station

Benefits:

- Achieved centimetre-level accuracy on indoor excavating project
- Total station system is similar to working with a 3D GPS-based system, making it easy for operators to learn and use
- Eliminated the need for staking

Indoor Accuracy

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However, when working indoors, all this state-of-the-art GPS and GNSS technology becomes pointless, because the satellite signal will bounce off the roof. This is what Fuhler, a contracting and rental firm from Emmen in the Netherlands, found when the company was commissioned by KWS Infra for a major earthmoving job as part of the 22-hectare extension to the Wildlands Adventure Zoo in Emmen.

One part of this extension on the Noordbarger Es site, where the penguins used to be housed, is Europe's largest sub-tropical greenhouse. One of Fuhler's jobs was to excavate the soil inside the greenhouse after completion of the framework, including the roof.

"We wanted to keep using our existing equipment, so we discussed it with our contacts at SITECH Nederland, the supplier of our Trimble 3D GPS systems, at the TKD tradeshow in 2014. They recommended Trimble's total station technology," said Erik Berendsen, site manager for Fuhler. "Starting in July 2014, we worked non-stop with two excavators controlled by Trimble's Universal Total Stations in order to be finished by late 2014."

Total Station system details

Many of the components of the total station-based machine control system are the same as Trimble's 3D GPS machine control systems, such as the digital 3D design drawing, which is generally provided by the client. The Trimble GCS900 Grade Control System is compatible with designs created in most kinds of software. The machine itself is equipped with cables and sensors. If the machine is already 3D GPS-controlled, most of these cables and sensors will already have been fitted. The same goes for the control box and radio receiver for communications. The dual GPS antennas and optional laser receiver are



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not needed when using the total station option and are replaced by a single prism on one of the masts that is used to mount a GPS antenna.

The total station itself is set up over a precisely known 3D position. The GCS900 system uses the 3D position information of the prism calculated by the total station to position the excavator's bucket to centimetre-level accuracy. For this particular job, Fuhler used two Trimble SPS730 Universal Total Stations, which position the machine through the prism using pulsed laser signals. Data communications run through the 2.4 GHz radio link, and the system enables the two-way traffic of signals, as well as highly accurate distance and angle measurements. This is necessary because as the machine moves, the height between the total station, prism, and the bucket changes. Even if an obstacle passes between the instrument and the excavator, the instrument will re-gain its lock to the target quickly and allow work to continue.

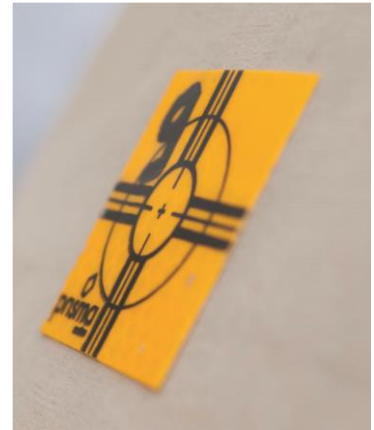
Working with a Total Station

In many ways, working with a total station is similar to working with a 3D GPS-based system. The main similarity is that nothing changes in the cabin and how the machine is operated, which is particularly helpful to the machine operator. The key differences also benefit the operator—greater accuracy of the cutting edge compared to 2 to 3 centimetre accuracy with 3D GPS. The only difference is that the total station must be set up every morning instead of just switching on the GPS Base station.



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The total station and the prism on the back of the excavator work by continuously 'seeing' each other. On site, the surveying team affixed three targets (stickers) of which the exact location (Easting, Northing and Elevation) is known. The total station uses these stickers as reference points to determine its own position on site and in the 3D design drawing. Next, the total station will search for and lock onto the prism on the back of the machine. The total station will also do this search when communication is interrupted due to passing vehicles interrupting the line of sight to the target. As soon as everything is up and running, the 3D design will load automatically if it has



previously been used, or the machine operator can load it from a USB drive or through a wireless connection, and the operator will then be ready to get started.

Multifunctional

The Trimble SPS730 Universal Total Station system and a converted excavator equipped with 3D GPS functionality can provide multifunctional capabilities for contractors. In addition to adding value when performing work indoors with machines, it can also be used as a general measuring system for topographic surveys of existing ground points or to stake out a work area, and for volume calculations in the field. However, this does require surveying experience. Thanks to its great accuracy, this system can also be used for concrete construction and in any application where each millimetre of deviation counts.

