

World's First by ABC Lasers in GPS Guidance of Excavators

Grade Indicate, the GPS product from ABC Lasers for dozers and scrapers, has been followed by an ambitious new machine guidance system for hydraulic excavators.

The new system will be sold under the name 'Grade Excavate'. It was recently trialed by Rod Peachey at Ormeau. As we went to press it had just been installed at Pasmenco's Century Mine in north Queensland and was successfully operating on an ore extraction excavator.

The system offers complete guidance of the excavator's bucket in such applications as creating batters, by referring to a 3D design of the job carried in a computer installed on board the excavator.

Sensors on Boom, Stick, Bucket and Cab

To report to the computer, precise sensors are installed on the cab of the excavator to record its rotation (as well as pitch and roll) over the tracks, with others on the boom and stick to feed in details of reach and height.

Another sensor supplies the system with information about the position of the face of the bucket.

These sensors, together with the GPS receiver, are constantly 'talking to' the computer to tell it exactly where the cutting edge of the blade is located, and as part of the process they record a history of where it has recently been.

The operator has a display in the cab that's divided into three sections (see picture).

In the upper part of the display, he can see a cross section view of the machine and the position of the bucket, in relation to the design he is endeavouring to execute.

In the left lower corner, he can see a plan view. This image is interchangeable with a back view of the bucket, as seen from the operator's position.

And in the lower right corner of the screen, figures are displayed that correlate these visual indications to the actual design.

For instance, "Cut 200mm" or Fill 300mm" as the case may be.

A second control box also displays this numerical cut/fill information, together with 'up/down' (in the form of red arrows) or 'on grade' (a green horizontal line).

Further information available to the operator is chainage and offset relative to a selected control line.

In the Peachey trial, the visual indications were very clear indeed. There is no doubt that without pegging, it is quite clear to the operator where the crest of a batter, or the toe, is located - and the slope in between.

By simply resting the tip of the bucket on the ground, he can see exactly where it is situated in relation to the proposed design, and can see the cutting edge moving on the display, in real time.

Dynamic Re-Modelling in Real Time

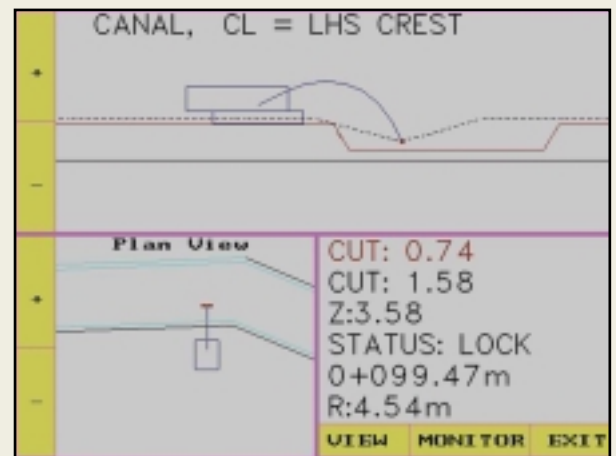
"What on earth is that?" seemed to be an obvious question. Mike Manning of ABC Lasers explains;

"Obviously, the main purpose of the system is to guide the operator without the need for outside indications such as pegging.

"However, since the position of blade is known at all times, and is recorded, a powerful feature of *Grade Excavate* is that it can use this 'history' to update the 'actual surface grid file' in real time.

"This actual surface is continually being re-drawn whenever the bucket makes a cut. The updated surface may then be compared with an earlier model to compute quantities."

In essence the bucket is being used (while it is working) to do an "as built survey", eliminating the need to send a surveyor to re-survey after the event.



An actual printout of the on-board computer screen, as seen by the operator.

The curve in the top display moves continuously, showing the position of the bucket in real time.

In many applications—not only mining—both the volume calculation and the re-modelling performed by *Grade Indicate* will be considered very valuable outputs, in addition to its machine guidance functions

First in the World

The creation of *Grade Excavate* is a very ambitious project that has not been attempted elsewhere in the world. Ambitious in the sense that it is complex, and difficult.

In a previous article we explained that the approach taken by ABC Lasers has been to make use of Aussie know-how, and to source components of their systems from the best and most cost effective supplier.

The on-board computers come from Sweden, where they were developed for Arctic research, and are therefore very robust.

The sensors are made by Mikrofyn of Denmark, long established as world leaders in that technology.

The Ashtech GPS receivers utilised by ABC Lasers feature the latest 'Instant RTK' technology, enabling them to resolve satellite fixes in five to ten seconds under normal conditions.

Antennas are assembled to withstand the rigours of earthmoving and mining operations.

In the case of the software, ABC Lasers commissioned Carlson of the US, who already had a widely recognised background in machine control programming.

Two of Carlson's people came out to talk to potential users including Century Mine, and to sort out with ABC's Mike Forrest and his team exactly how they wanted the system to perform.

Experience in Machine Control.

"We have a decided edge in this area," says Mike Forrest, principal of ABC Lasers, "since we have sixteen years experience in fitting machine guidance equipment to earthmoving machines.

"We know how it works, where to run the cables to avoid damage, and a host of other aspects that you only learn from your own mistakes."

Mike might also add that he has surrounded himself with a very competent team. Michael Manning is a whiz at getting all these bits and pieces to communicate with each other, as is Campbell Hay, who handles installations.

Rod Peachey is impressed. "When the guys get back from the mine I'll be getting a system installed here to do further trials, he says.

"From what we've seen so far, it does work the way ABC Lasers intended it to. It appears to me to be a really practical system with a useful future."

—Peter Kerville



Campbell Hay of ABC Lasers uses a laptop to check outputs of sensors and GPS



Attitude sensors on the boom and stick monitor the position of the bucket at all times

