

# TECHNICALLY speaking

With cost effectiveness at the forefront and increasing demands coming from government authorities for comprehensive documentation of drilling projects, Measure While Drilling (MWD) is becoming a viable option for contractors.

With the launch of the next generation of Rocket Boomer rigs in 1998, Atlas Copco proved that it is on the cutting edge of creating advanced technology for drilling. The release of the Rocket Boomer L3C series, with ABC Regular and ABC Total, and the recent implementation of the MWD concept further enhances this position.

MWD is the latest supplementary option to the Rig Control System (RCS) that continuously and automatically gathers data along the length of the holes being drilled. MWD data will improve the understanding and prognosis of the geological structures beyond the tunnelface.

It can also be used to visualize the nature and conditions of the rock in front of the rig.

Sensors in the RCS system collect data about the rock conditions at predetermined intervals and store the information on high capacity PC cards (i.e. 10MB computer disks). After finalising the round, the MWD data and the standard round log, are taken back to the site office for analysis, documentation and archiving.

Immediate analyses are done in the support software "Tunnel Manager", where round reports and graphical presentations of MWD data are available.

MWD data can also be sent to a geophysicist for interpretation to help determine excavation methods.

The extent of the information generated depends on the length of the hole, the number of measuring points and the distance between them. For example, a 25 m probe hole will create more than 50 kB data. Nevertheless you can store

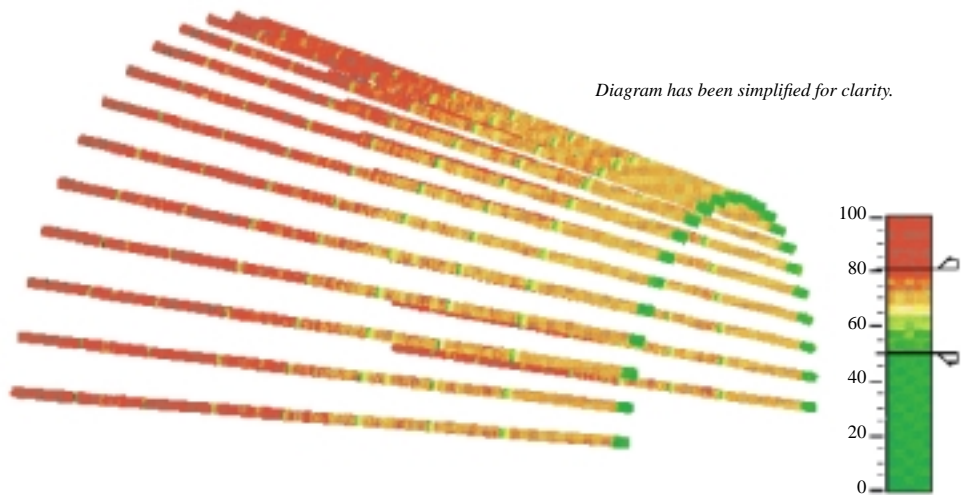


Fig 1. Looking into the rock mass: Using the advanced Tunnel Manager Pro, 3D colour pictures of all the drilled holes can be created. The various colours represent the different characteristics of the rock. By using this method, a 'virtual' picture of the tunnel can be created.

# Measure While Drilling

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more than 100 such probeholes on a single PC-card. And that can give a fantastic amount of detailed information about every hole that is drilled on a particular job. The parameters logged are

penetration rate, hammer pressure, feed pressure, damping pressure, rotation speed, rotation pressure, water flow and water pressure. Logging frequency can be set from every second centimetre upwards.

### ABC + MWD = 3D!

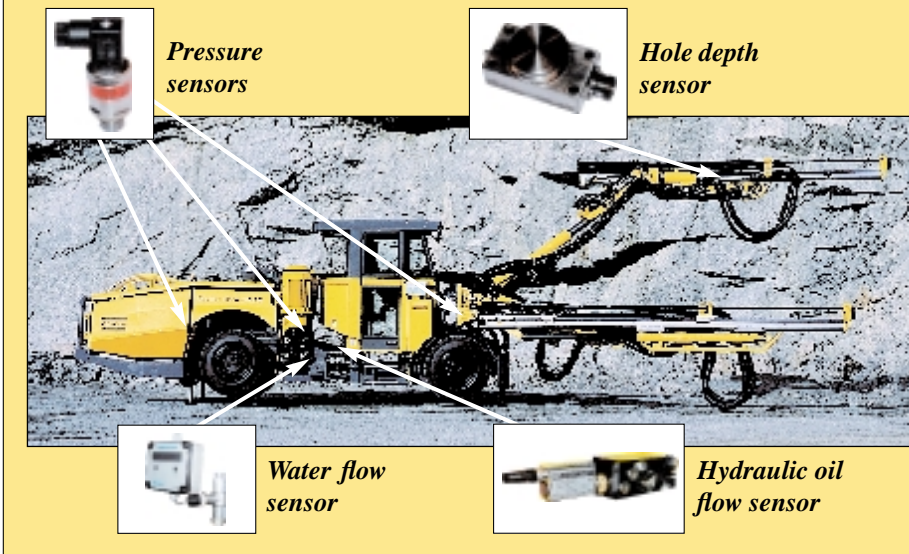
By using the Rocket Boomer ABC rigs with the MWD option and the Tunnel Manager Lite support software, round reports and Excel graphs can be generated.

Using the more advanced Tunnel Manager Pro, 3D colour pictures of the holes can also be created (see Fig 1). The pictures can be viewed from any angle, enlarged or reduced in size. This allows us to see right inside the actual hole!

Different colours are used to represent the parameter values, so that the entire structure of the area being drilled can easily be viewed on screen.

All of our modern drill rigs (i.e. Rocket Boomer ABC rigs with CAN-bus RCS system) can use the MWD technology.

## How the Rocket Boomer collects its data



While drilling, several sensors on the rig are busy gathering data such as penetration rate, hammer pressure, damping pressure, rotation speed and water pressure. Normally, the operator – with help from the on-board computer – uses this information as a guide in determining how to proceed drilling. However, when MWD is being used, information gathered by the sensors is processed by the on-board computer and then stored on a PC card. Accumulated data can then easily be taken to the site office for geological interpretation. This method allows the characteristics and conditions for every single hole drilled on a project to be logged and processed, creating a very effective method for viewing the entire worksite.

Although MWD can gather an amazing amount of information, it does not interpret the data – it's still up to the contractors and their geophysicists to read the data and make their own decisions based on the findings.

MWD is a very helpful tool for gathering information and creating a good picture of the drilling area. It is not, however, to be seen as a replacement for conventional investigation drilling, such as probe drilling or core sampling but as a valuable component in projects where a combination of monitoring techniques are used.

The interpretation still has to be made by experienced professionals. The more information we can provide for our customers, the better the end results will be.

Although this technology has come a long way, the interpretation of data is still at an early stage, but some successful projects are already at hand.

One plan for the future is that the results generated by MWD can be seen directly online, allowing contractors to make on-site decisions and save more time and money.

As every driller knows, making mistakes in this business can be a very costly affair. You do not only want to know that there are challenges, you also want to be able to see them. By using MWD, this will be possible in the future.

### Encouraging results

Only a handful of contractors and mines in the Nordic region are using the MWD system today. We expect that usage will increase quickly as more experience is gained and as clients demand to be in-

formed about drilling conditions while mining and tunnelling projects are in progress.

The Norwegian contractor Selmer is currently using the system at the Södra Länken road tunnel project in the Stockholm area in Sweden, an environmentally sensitive project in a densely populated urban area. At this project the local authorities have asked for comprehensive documentation on all geological findings while drilling is in progress.

When it is difficult to predict the conditions of the rock, MWD can be of great assistance in planning where to place the charges, knowing which areas will need reinforcement and determining suitable drilling equipment.

The Boliden Mining Company is also using MWD in two of its mines in Sweden, collecting data for their central database. The results from all sites using MWD are very encouraging. In a way, the program can be described as the ge-

ologists' "eyes", informing them of the challenges that exist in the whole vicinity of the worksite.

Apart from simply providing information, the system is intended to increase the accuracy of traditional geological surveys.

In tunnelling, for example, MWD measurements can be used for evaluation of the changes in the rock mass and the weathering process. This information helps geologists to determine the position and nature of hard and soft rock formations, in everything from solid, good quality rock to earth, sand and mud. In mining, on the other hand, it helps to determine the extent and nature of the ore body.

A Rocket Boomer equipped with ABC Regular/Total and the MWD option, provides you with the means to fine-tune the drilling process. By actively analysing the MWD data you can optimize the total production and avoid surprises.

M&C 3-00



Data collected by the sensors is stored on a PC card and then transferred to "Tunnel Manager". It can then be taken to a geophysicist for further interpretation.