Computer modelling

A new dimension to mineral resource planning

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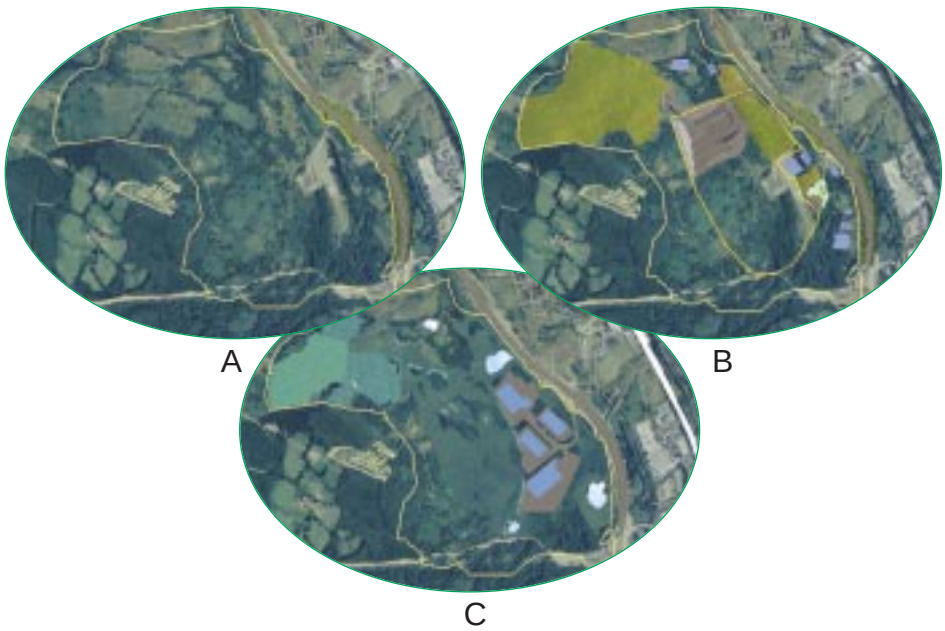
In the last decade, an increasing number of companies engaged in the extraction of minerals throughout the world have embraced the use of modern computer-based methods. These can assist engineers and geologists to plan a mining operation in such a way as to maximise efficiency in the extraction of the commodity whilst minimising any adverse environmental effects. Some of the most powerful tools for this purpose are specialised mine-planning software packages, such as VULCAN, which enable 3D models of a site to be built and calculations to be made of the amount of ore and waste produced. These packages can also handle important variables such as groundwater flow and can drape aerial photography onto the land surface to provide interactive views of the landscape. Many UK mining and quarrying companies are now submitting planning proposals based on such design models.

Some of the latest software also allows the fourth dimension, time, to be included, so that predictive modelling and monitoring data can be incorporated into computer-based planning of the entire life cycle from initial planning, through the extraction phase, to restoration and aftercare. Animated sequences can be built which show predicted changes arising from mineral working and associated activities. These allow full 3D enquiries to be executed on the model, so that the life cycle of a mining operation can be viewed from any perspective at a chosen point in time. In detail, a viewing point can be chosen, on say a hilltop, road or footpath, and the model will allow you to see if, for example, a quarry face or truck haulage route will be visible from that point at any time during the life of the mineral working. It will also show you how the landscape as a whole will look during extraction and following restoration. Another feature of the animator is that it allows for the incorporation of environmental features that are not immediately visible, such as groundwater.

The benefits of these systems are enormous, both for the mineral industry and for the public, as the mine planning is taken from a series of flat 2D drawings or artist's impressions into an exact, animated 3D model of predicted events in the life of a mine.

The model can be changed to take account of different development options (e.g. alternative haulage routes) so that their predicted consequences can be examined. This has already been used to good effect in the real-time slope analysis of open-pit mines, allowing the production of early warning site maps for slope failures. This aspect has many potential applications outside the mining sphere, for example in the assessment of slope stability in areas with known potential for life-threatening natural landslides.

In summary, computer-based modelling and prediction software provides a powerful tool for professionals and others to visualise the likely effects of their actions over a time frame ranging from seconds to years. One of the most obvious applications is in the area of minerals extraction, where it allows planning authorities and the general public to see the likely effects of a proposed mineral development and subsequent restoration from any location over a period of time.



VULCAN 3D image of a mineral working at three points in time: (A) before extraction, showing site boundary (yellow) and old workings; (B) during extraction, showing open-pit working (grey), lagoons (blue), buildings (green) and new landscaping (yellow-green); and (C) after restoration, showing landscaping (blue-green), wetland areas (pale blue), roads and car parks (grey) and the buildings of a small industrial estate (blue). Images reproduced courtesy of Celtic Energy Ltd & Maptec/KRJA.