Modelling the quality of sand and gravel resources in 3D

Katy Mee, Katharine A Linley, Joseph M Mankelow and Richard A Shaw

Introduction

The construction industry is a critical sector of the UK economy and natural aggregates, such as crushed rock, sand and gravel, are the most commonly used construction minerals. Demand for aggregates will continue into the future and this demand will primarily be met by indigenous production. However, minerals can only be worked where they occur and with increasing pressure on land use, it is important that mineral resources are identified and appropriately safeguarded. It is imperative that we understand how these deposits are distributed not just on the surface but also underground (Figure 1).

Whilst 2D mineral resource data is proving invaluable in assisting planners, developers and industry in land-use planning and decision-making, it does come with limitations, such as being unable to depict the internal variation in the quality of the deposit with depth or provide an indication of the ratio of mineral to waste. Such information is essential when assessing the economic viability of extraction and, within BGS, 3D modelling techniques are being used to address these issues.

Summary and conclusions

Gocad 3D modelling software and modern geostatistical techniques are being utilised to develop models of the internal variability of sand and gravel resources. The development of such models provides valuable enhancement to existing British Geological Survey (BGS) 2D mineral resource datasets.

Industrial Mineral Assessment Unit (IMAU) borehole data

The BGS Industrial Minerals Assessment Unit (IMAU) undertook a major survey of sand and gravel resources between 1971 and 1998, producing 149 maps and reports and 12 500 detailed borehole interpretations. Particle size (grading) analyses were taken for approximately every 1 m interval down each borehole. By utilising this borehole data in modern 3D modelling packages (Gocad) it is possible to undertake an assessment of the quality (particle size distribution) of particular geological formations identified as aggregate mineral resources. A pilot study is underway in the Reading area of the UK (Figure 2) to determine the feasibility of modelling sand and gravel resources using pre-existing data, through the application of modern geostatistical techniques.

3D modelling

Particle size analyses for each borehole interval in the Reading pilot study area were imported into Gocad as a series of points (Figure 4). This allows the modeller to view the vertical distribution and thickness of waste, overburden and mineral layers within each borehole. Geostatistical methods will be used to interpolate between sampled and unsampled locations to produce a voxet model (Figure 5) showing how the distribution and quality of the resource varies in 3D and will aid planners in making more informed decisions about which areas to safeguard.

Contact information

Katy Mee www.mineralsuk.com email: minerals@bgs.ac.uk