Sport offers no greater challenge than the Olympic Games. But as **Katherine Royse** explains, developers must rise to some very different challenges before the first starting pistol can be fired in 2012.

Going for gold

At 12.49 on 6 July 2005, the announcement came from Singapore that the London bid to hold the 2012 Olympics had been successful. London had beaten Paris by 54 votes to 50 in a nail-biting finish.

The jewel in the crown of the London 2012 Olympic Games and Paralympic Games will be the Olympic Park. It will be situated in the Lower Lea Valley in the East End of London, within the Thames Gateway redevelopment zone. It will be an opportunity to reform a 500-acre site in one of the city's most under-developed areas into a model for sustainable urban development.

Since the area has already been chosen, one might reasonably ask, 'Why consider the geology now?'

The answer is straightforward. All of the major development projects to be carried out in the run up to the 2012 Games will necessitate construction on ground that is classed as 'difficult' in engineering terms. Compressible soils, high groundwater levels, and contaminated brownfield sites are typical of the problems that will be faced. The Institution of Civil Engineers estimates that about 50 per cent of cost and time over-runs on civil engineering projects are caused by 'unforeseen ground conditions.' This is due, in part, because too little is understood of the three-dimensional (3D) geology, the physical, mechanical, and chemical properties and the processes acting on the ground.

Modelling the shallow subsurface can help predict potentially difficult engineering ground conditions by assessing the thickness, geometry, and distribution of individual geological units. A full assessment of ground conditions using available borehole or trial-pit data can be used to reduce uncertainty in understanding the nature of the ground prior to development. Each unit can be characterised in terms of its lithology and lithostratigraphy and attributed with a variety of property information that may include suitability for foundations, strength, or compressibility.

Construction work under way at the Olympic Park site in east London.

Photograph: London 2012.

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Geological 3D models, especially in urban areas such as the Lower Lea Valley, can include information on the thickness and distribution of artificial ground. This can be linked to land-use history to fully understand changes in the ground surface as a result of anthropogenic activity that may affect the nature of the subsurface. This will ultimately provide an assessment in 3D of the potentially contaminated land within a particular area. The 3D model can then be used to estimate the thickness of these deposits providing the developer with a much clearer indication of the likely cost of remediation measures at the beginning of the planning process.

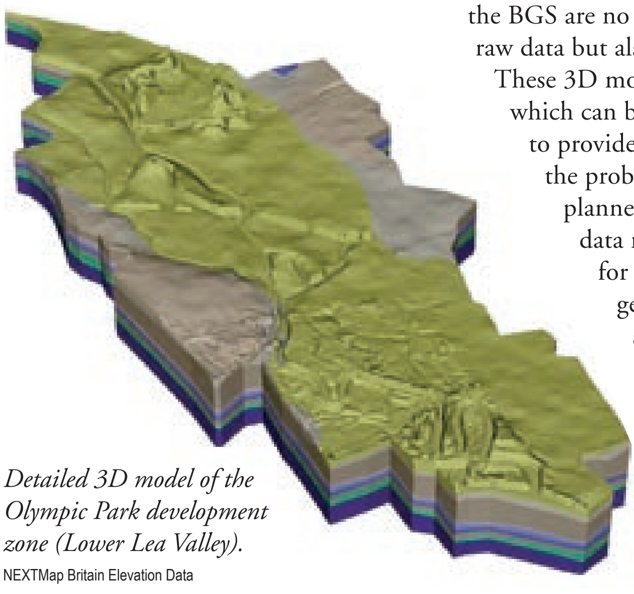
For example, using the 3D model classified in terms of its engineering characteristics, and data from the National Geotechnical Properties Database, a desk study can be carried out to provide information for the construction of a structure with high foundation loads to be built within an area of alluvium. The geotechnical information may indicate that the alluvium is unsuitable for foundations with high loads because it is generally very soft to firm clay with organic peat layers of low bearing capacity and high compressibility. A contour map of the thickness of the alluvium, using data from the 3D model and presented in ArcGIS™, can show that the alluvium is more than 15 metres thick and therefore the structure will have to be founded on piles.

The Olympic development will also necessitate the opening up of watercourses, the extension of wetland areas along the riverbanks, as well as the development of deep foundations, all of which can provide new pathways for contaminants. If unidentified soil and groundwater contamination is present, there is a potential that contaminants will migrate via these newly formed pathways posing a significant risk to groundwater quality. The 3D model will be able to assess more accurately the likelihood of such an event taking place and provide information to help mitigate the situation before it occurs.

Computer-generated image of the London 2012 Olympic Park as it will look when complete.
Image: London 2012.

The 3D Olympic geological model demonstrates that the value in having vast quantities of geoscientific information is not in its possession, but the interpretation and presentation of that information to the people that need it most. Urban geoscientists at the BGS are no longer just providing raw data but also interpreted data. These 3D models illustrate properties which can be used immediately to provide answers to many of the problems encountered by planners and developers. This data revolution will allow for a wider uptake of geoscientific data by non-specialists.

3D geological property modelling is not only a tool to allow geoscientists to present data in a more meaningful way to non-specialists, it is also a valuable scientific tool. In the long term, 3D geological property models will allow for a better understanding of the complex urban earth system. It is clear that the scientific community needs to understand and be able to predict the effect that large-scale developments will have on the environment. It is only with the continued development of 3D models and the integration of currently separate geological disciplines that we will eventually be able to answer these questions.



Detailed 3D model of the Olympic Park development zone (Lower Lea Valley).
NEXTMap Britain Elevation Data

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