3D modelling of the Subsurface: The Lower Lea Valley including the London 2012 Olympic site

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The Lower Lea Valley, Olympic site will be situated in the East End of London. Most of the major development projects will necessitate construction on ground that would be classed as 'difficult' in engineering terms. The Institution of Civil Engineers estimate that about 50% of cost and time over-runs are caused by 'unforeseen ground conditions.' This is due, in part, because too little is understood of the three-dimensional (3D) geology.

Geological 3D modelling can provide a detailed definition of the subsurface. However the adoption of these techniques has lagged behind technological advances. Recent changes to legislation, in conjunction with modifications to the way that 3D geological information is presented, have unlocked the potential of the 3D geological model to the wider community.

A detailed 3D geological model has been produced for the Lower Lea Valley which can be used to predict potentially difficult engineering ground conditions by assessing the thickness, geometry and properties of individual geological units (Figure 1). Once the 3D geological framework has been constructed, the physical attributes of the modelled units (3D polygons) can be described. Classifications scheme's for each property are based on log descriptions, laboratory test results, plus any other appropriate parameters included in site investigation reports (Figure 1). The attributed geological model is now able to encapsulate, at least in part, some of the natural variability of real geological systems.

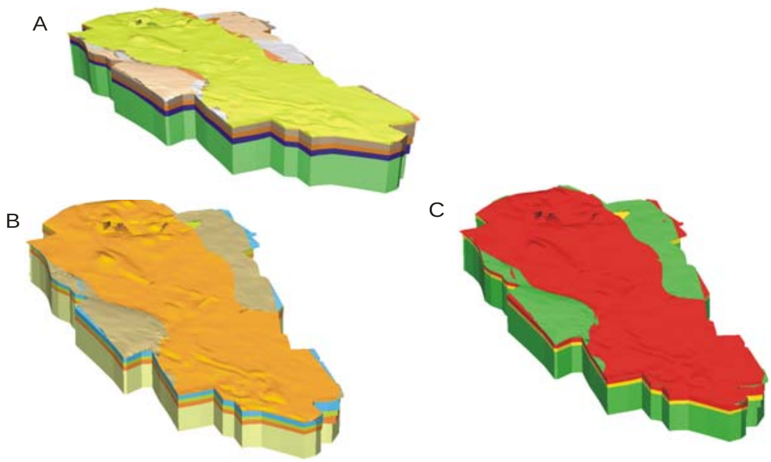

Figure 1: 3D Geological and property models for the Lower Lea Valley
(A) is the geological model, areas of peat (brown) are revealed beneath deposits of alluvium (yellow), River Terrace Deposits (orange) and man-made deposits (grey). Bedrock is composed of Palaeogene deposits (orange, blue and pink) underlain by Chalk (green); (B) displays 3D information on the variation of compressibility, areas of high compressibility are coloured in orange and red, variable compressibility coloured in light brown to green and areas of low compressibility are in blue to brown and finally (C) shows the variation in sulphate potential, high potential in red and low in green.

Engineers and geologists can use the attributed geological model to assist in the recognition and identification of problematic ground conditions and in the design of ground investigation studies. The model can be used to provide information on the depth to founding material, its properties and the variability of these properties. For instance the depth to the top of the gravel formations beneath the alluvium can be exported from the 3D model and displayed as depth or thickness (isopac) contour plots in a GIS. It is then possible to combine the 3D surfaces with other spatially rectified data (be that geotechnical, geochemical, or geographical etc) which, when combined together, provides a way of assessing the suitability of sites for a variety of construction techniques. In summary, 3D geological models will transform the way ground investigations are carried out. As a result, a future where ground investigations will start by testing the validity of a 'real' geological model, is rapidly becoming a reality.