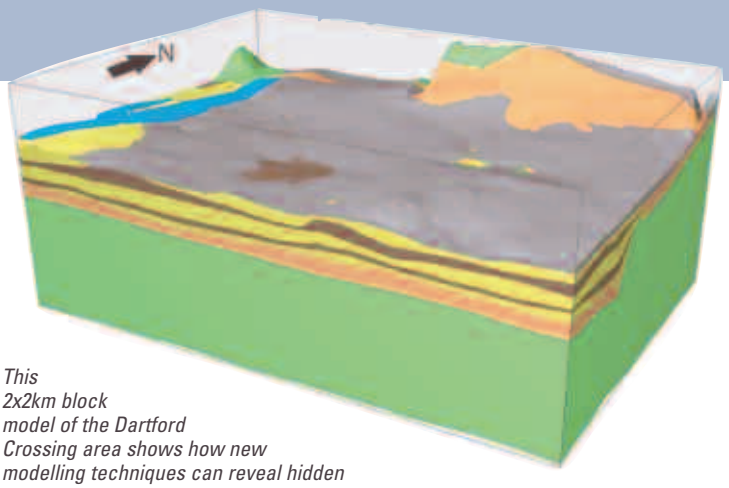
The Thames Gateway

Kate Royse explains why understanding ground conditions can save you time and money.



This 2x2km block model of the Dartford Crossing area shows how new modelling techniques can reveal hidden deposits affecting foundation conditions. In this case, beds of compressible peat (brown) are revealed interbedded with clay (yellow), that in turn overlie gravel (orange). Man-made deposits are in grey; the M25 embankment in blue, and chalk bedrock in green.

The 40-mile stretch of land along the Thames from East London to Essex and Kent, that forms the Thames Gateway, is the focus for the UK's biggest building programme for over 50 years. Planners have already chosen the key areas for redevelopment, so why worry about the geology?

Because, for the most part, they have used picked areas according to socio-economic factors. However, environmental issues – sustainable drainage, biodiversity, flood control and foundation conditions – are important considerations, for which an understanding of the geology can be critical.

Most of the major development projects will be built on 'difficult' ground: compressible soils, high groundwater levels and potentially contaminated brownfield sites. Failure to appreciate this during planning can prove costly and any project may over-run. In 1993, half of 5,000 industrial building projects surveyed by the Institution of Civil Engineers over-ran by over a month; those on redeveloped sites all met unforeseen ground conditions.

The Thames Gateway planning framework document recognises geological issues, including land contamination and flood risk. The Kent County Structure Plan, which applies to much of the Thames Gateway, states that, 'In the Thames Gateway… it is strategic policy to upgrade the quality of the environment, and to enhance the economic base of the area.'

Planners and developers need easy access to information. Whilst some regularly use geological information, a great deal is overlooked. This is partly because often only trained geologists fully understand the implications of the information. This is why BGS has started giving answers rather than just data.

We recently launched a project to make geoscience information for the Thames Gateway more accessible, relevant and understandable. With Geographical Information Systems (GIS), we can now display spatial data as 'layers', which may be queried, and plied with 'what if' scenarios.

Rapid developments in 3D modelling software mean we can now construct high-resolution geological models of the shallow sub-surface. Using this software (and our geological and geotechnical archives), we can start to predict the type of rocks beneath our feet, and their engineering properties (rock strength, shrink-swell characteristics and compressibility) and hydrological properties (permeability, porosity, thickness of the unsaturated zone).

With escalating development and more hard paved surfaces, surface water runoff is a significant issue. Sustainable Urban Drainage Systems (SUDS), including swales, balancing ponds and porous pavements, mimic natural drainage patterns. They can save money, reduce pollution and reduce flood risk. But project designers need to know early on if SUDS techniques will work for them. BGS can quickly and simply assess SUDS, using the 3D model of the rock type, eg sand, clay, peat. Data used in the assessment includes: the slope angle, the permeability of the near-surface deposits and the thickness of the zone above the water table. Further information can be added, such as possible past contamination. This data is easily incorporated into the model for a more sophisticated site-specific interpretation, at a click of a button and viewable in most GIS software packages.

We produce 3D models of foundation conditions by linking the rock type model with physical properties such as soil moisture content. We produced one for West Thurrock, a typical Thames Gateway area. Here the ground conditions were split into six categories, varying from very compressible, corresponding to the presence of peat, to only slightly compressible, including infilled ground. Chalk underlies the whole area. It weathers to a putty where it meets soil, but foundation conditions improve with depth. The 3D foundation model can tell you how deep to go to reach unweathered chalk.

The foundation conditions model enables you to evaluate the ground conditions at the level you plan to build. In West Thurrock, at 2m below the surface, nearly half the area's ground conditions are within the highly to very compressible category. At 5m below surface, only a small proportion is highly compressible. Such data can be used in myriad ways from predicting the project's difficulty and how long it might take, to choosing where to build.

BGS is striving towards producing 3D geological 'property' models, for a wide range of professionals to access, view and query without necessarily involving a geologist.

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