Unexpected ground conditions continue to be a major cause of project delays and inaccurate cost estimates in construction. Building information modelling (BIM) for the subsurface may greatly improve that, but the necessary export and sharing of geotechnical data is still far from common practice.

Long-term cost savings are the most recognised and documented benefits of BIM. The UK government, for instance, says that using Level 2 maturity BIM (defined as file-based collaboration and library management) has helped secure 20% cost savings on the capex of construction projects.

Still, BIM often seems to start from the surface up, ignoring the risks hidden subsurface. But there are various benefits to applying BIM principles to geotechnical data management and including geotechnical data in BIM, says Gary Morin, technical director at Keynetix.

“It allows considered design optioneering and refinement at the outset of a project; it helps to minimise geotechnical risk in construction and enables cost-effective repairs and maintenance of assets throughout the project’s lifetime,” he lists.

“More significantly, if there is a recognition by other project team members of the critical importance of high-quality geotechnical information in creating an accurate BIM model, the messages that early and thorough site investigation can reduce project risk and that geotechnical engineering is an integral part of the entire project will be reinforced.”

**DIGITALISING DATA**

However, while sharing geotechnical data digitally has been possible for decades, common data-sharing formats such as AGS only allow for the transfer of factual data. Interpreted data, such as geological surface, is thus still rarely included in BIM.

Among Keynetix’s data-management systems are systems that can export both factual and interpretive geotechnical data. HoleBASE SI, for example, can manage all of a project’s geotechnical data (including historical information) and its extension for AutoCAD Civil 3D allows visualisation of information such as geological surfaces for use in both BIM models and the AutoCAD environment.

Among the companies taking full advantage of the optimised systems is engineering, environmental and mining consultancy Wardell Armstrong.

The company’s recent project, which devised landform options that supported the development of a residential scheme on a...
former quarry site, won Keynetix’s BIM Geotechnical Data Management Award.

During the project Keynetix’s systems enabled Wardell Armstrong to export both factual and interpreted data, create data-rich ground models and quickly visualise complex datasets, says technical director Chris Smith.

“As a result of the improving consistency in AGS data transfer from drilling contractors and testing laboratories, we have been able to incorporate an increasing amount of third-party and site-investigation data into our own systems, with the result that our engineers and geologists are now able to create data-rich ground models and quickly visualise complex datasets,” says Smith.

“Keynetix’s HoleBASE SI allows us to collate and handle large datasets reliably and efficiently. As our business operates over a number of sites, we are also able to have project teams made up of people from different offices, working remotely and still able to input and access the entire project dataset.”

The workflows used on the project allowed Wardell Armstrong to produce a ‘BIM-compliant’ output with all of the project’s geological data stored within HoleBASE SI and combined with models of other designers within one AutoCAD Civil 3D model.

“By being able to combine design models, we were able to produce a more resilient final landform that we, the client and wider design team could have confidence in being deliverable,” stresses Smith.

THE NEXT STEP

Software like HoleBASE SI and the extension for AutoCAD Civil 3D allow users to work at, or near, Level 2 BIM, providing one location to store geotechnical data that can be integrated with other data within AutoCAD Civil 3D and Microsoft Excel. The tools will therefore be of even greater benefit.

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Incorporating geotechnical data in BIM allows considered design optioneering and refinement at the outset of a project.
advantage in the future, believes Smith: “The ability to export and manipulate ground investigation and laboratory datasets in Excel, for statistical analysis, and also directly in the design environment using AutoCAD Civil 3D, has been a great improvement to our workflows.

“This innovation has great potential to improve our design processes further as the move to Level 2 BIM becomes more commonplace among our clients.”

When it comes to higher-level BIM (including Level 3), the cloud-based database of UK geological and geotechnical data and 3-D models is hoped to be a major step on the way.

The BIM for the Subsurface research project, which is funded by Innovate UK, is led by Keynetix in partnership with the British Geological Survey (BGS) and also includes consultant Atkins and BIM pioneer Autodesk.

It is hoped that the project will also decrease the widespread reluctance among geotechnical teams to share interpreted data with the wider project team because they fear that the data might be misused.

“A big problem is the limited availability of high-quality geotechnical data, which is stored mainly in project archives. If this was easily available, construction teams could access better data, site investigations would be more focused and ground risk reduced, saving time and money,” says Keynetix’s Gary Morin. “Including 3-D interpretative models in the cloud will also make it possible to plan investigations in 3-D. An added benefit is that the use of geotechnical data in building information modelling should also grow.”

In the anticipated outcome, geotechnical professionals are responsible for all the geotechnical data stored in a central project database and allow other project partners access through web services. The important point is that the data is maintained and managed by the geotechnical team.

The BIM for the Subsurface project finishes in March 2017. The results of the project will be coming on stream from April onwards.

Collecting digital data on site makes sharing simpler and faster