Combining geological modelling and BIM for infrastructure

HoleBASE SI and AutoCAD Civil 3D help Atkins design a new tunnel under London’s River Thames

The use of a fully integrated, multidisciplinary Civil 3D model, including subsurface geology, has been a real eye-opener for the team. By visualizing ground conditions in a design context, we can reduce project risk and project costs during construction.

—Simon Miles
Principal Geotechnical Engineer
Atkins

The project
Transport for London (TfL)—the statutory authority responsible for most aspects of Greater London’s transport system—is planning a new road tunnel under the River Thames in East London. The proposed Silvertown Tunnel between Silvertown and North Greenwich will ease the strain on the nearby Blackwall Tunnel and other existing crossings. Engineering and design consultancy Atkins developed the project’s reference design.

The challenge
The south portal of the tunnel route is the site of a demolished gas works. The soil in that area is contaminated and there are still remnants of the underground foundations of the plant. On the south and north banks, the proposed tunnel location comes close to the pylon foundations of the Emirates Air Line cable car. Additionally, the north bank tunnel portal is in the area of the now-filled western entrance to the Royal Victoria Dock and some demolished warehouses. Like the gas works on the south bank, there are still underground remnants of these features.

“The tunnel on both sides of the river will need to thread through heavily industrialized areas of London, with a myriad of existing soil types, roads, foundations, and other subsurface structures, as well as subsurface remnants of demolished structures,” explains Simon Miles, a principal geotechnical engineer with Atkins. “To reduce the overall project cost and risk, we needed ways to better see and understand subsurface soil conditions in the context of existing built conditions, and calculate earthwork quantities and areas that will be impacted by construction.” The increased costs of treating contaminated materials makes accurate volume calculations vital for assessing cost implications.
Atkins also used Civil 3D to extract volumes for the different materials that will be excavated. “We were able to identify areas that will require specific treatment on-site during excavations, such as the treatment of hazardous material for example,” says Miles. “This gave us a clearer picture as to what material could be reused for construction and helped us refine our cost estimate.”

Production of geological sections and other inter-disciplinary checks were also facilitated by having all the information in a common data environment. “The Civil 3D model helped us maximize efficiency and increase our level of design confidence,” says Miles. “This 3D design environment allowed us to visualize the subsurface conditions in a new way—giving us a better understanding of the site for more informed decision-making.”

For example, the original design for the road as it entered one of the portals placed the road’s ground slab below the local water table level, which would have led to a continuous flow of ground water into the tunnel. “With the ground slab and the geological model in the same 3D environment, we could easily see and quickly make the necessary design changes,” says Miles. Atkins also used the Civil 3D project model in Autodesk® Navisworks for client and partner design reviews and walkthroughs, and in Autodesk® 3ds Max® to create high-end project renderings for TFL’s public outreach efforts.

The result

“The HoleBASE SI Extension for Civil 3D streamlined the flow of information from our site investigation and testing to drawing production and visualization,” says Chamfray. “As a result, we had more time to refine our design and were more responsive to changes from new geotechnical data.”

“The use of a fully integrated, multidisciplinary Civil 3D model, including subsurface geology, has been a real eye-opener for the team,” says Miles. “By visualizing ground conditions in a design context, we can reduce project risk and project costs during construction.”

For more information, visit www.autodesk.com/civil3D and www.keynetix.com/holebase/civil3d