

Publication: Rail Professional
Date: July 2018
Circulation: 7,894

Improving efficiency in Crossrail construction

The complex £15 billion construction project uses Esri's ArcGIS platform to manage hundreds of simultaneous programmes of work and account for millions of new assets

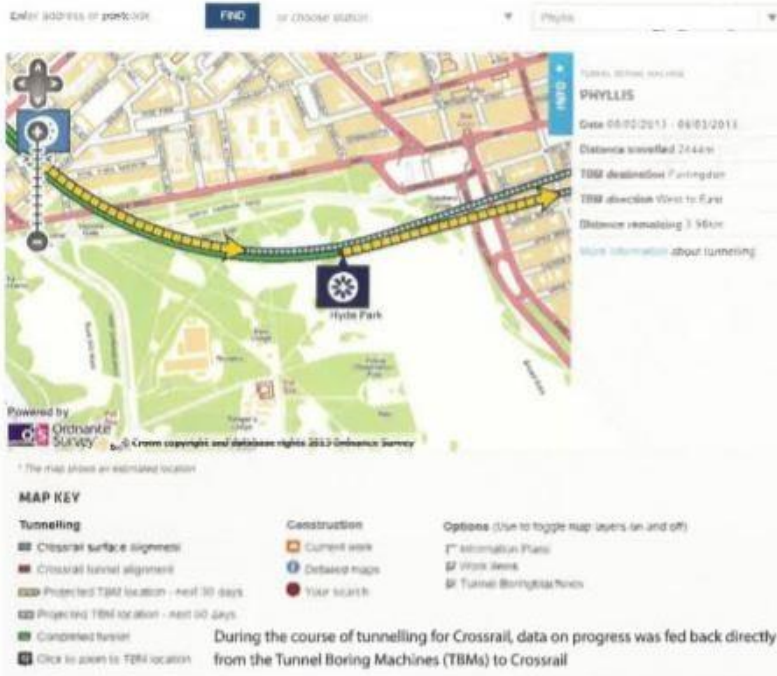
The Crossrail project is delivering a new railway for London and the Southeast of England. As Europe's largest infrastructure project, it encompasses 26 miles of tunnels and ten new stations. The finished railway will be an accessible route of forty stations from Reading and Heathrow in the west, through central London, to Shenfield and Abbey Wood in the east.

A project on this scale requires a geographic information system (GIS) to record and manage the ever-changing inventory of assets and many simultaneous programmes of work. Crossrail's existing GIS needed to be updated to ensure it was fully compatible with modern browsers and operating systems. The proposed new solution also needed to be more

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GIS has been one of the building blocks of Europe's single largest infrastructure project helping the project stay on time and on budget



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time efficient and offer the cutting-edge capabilities needed.

Following a thorough competitive evaluation, Crossrail Ltd entered into an Enterprise Licence Agreement (ELA) with Esri UK. With support from Esri UK's Professional Services team, it then used Esri's ArcGIS platform to develop an integrated suite of server-based, desktop, web, mobile and 3D applications in 14 months.

Value-adding GIS services

The ArcGIS platform has given Crossrail the flexibility to innovate and introduce value-adding GIS services over time. The organisation now uses several tools to prepare data and perform specialist data analysis; make comprehensive, up-to-date information available to employees, designers and contractors via a secure intranet; deliver three dimensional visualisations of facilities and their surroundings; and allow field-based personnel to see and correct the locations of assets, using mobile devices.

Crossrail used GIS extensively during the planning and design stage of the project to assess ground conditions and record information about potential obstructions to the tunnel construction. This included identification and monitoring of all structures that were at risk from settlement resulting from engineering activities, and this information was linked to CAD, Document Control and reporting applications to readily provide outputs to stakeholders on the project.

Openness and transparency

During the course of tunnelling for Crossrail, data on progress was fed back directly from the Tunnel Boring Machines (TBMs) to Crossrail Ltd. This enabled map-based reporting of the progress of the TBMs to be made available to both internal project staff as well as the wider public. This in turn resulted in transparency of the progress of Crossrail works to all parties which led to better decisions being made about associated construction that needed to be carried out within the facilities.

In addition, semi-automated reporting on claims of damage or disruption during bored tunnel construction, based on spatial and temporal extents to establish validity of a claim is estimated to have saved £120,000. Asset Protection Engineers can use the ArcGIS-based app to select, collate and present all of the information required, resulting in up to eighty per cent less time

spent on ground movement reports.

As the responsibility for construction sites passes from one contractor to another in different project phases, the solution was designed to improve understanding of liability and reduce the risk of unauthorised occupation over a multitude of construction sites, avoiding unnecessary delays and cost overruns. By using a temporal slider tool in ArcGIS, employees within the organisation can easily see which contractors are responsible for which parcels of land at any one time.

Introducing 3D

In another initiative, Crossrail is using ArcGIS to model facilities in 3D for the first time and prepare an invaluable 3D asset record for the new station operators. The 3D capabilities of ArcGIS have enhanced the understanding of the relationships between assets and facility spaces, enabling them to be maintained more cost efficiently. Infrastructure Managers can also identify and analyse issues on the ground with greater understanding than before.

When Crossrail's employees survey construction sites, they use the ArcGIS Collector App on mobile tablets to check the exact boundaries against land records and enter any observations or on-site variations. Crossrail can then ensure that hoardings are correctly placed to secure sites and help keep the public separate from the works taking place on site.

The 3D mapping of stations may also prove critical in the future for helping the station operator.

Crossrail also elected to use Esri UK's Data Service, which streams Ordnance Survey background mapping and other contextual data directly into Crossrail's corporate GIS. The use of this service has rapidly improved the quality of background mapping and reduced the need for time-consuming data management, saving several hundred hours of effort per annum.

GIS will continue to expand its role in the rail sector with the increased use of new and improved methods of collecting geospatial data. For a thorough overview of the potential benefits, see Crossrail's paper: *The Geo-centric Railway: Why Location Matters in the Rail Industry*.

