London Power Tunnels: Checking data integrity in real time

by Konrad Saal

National Grid embarked on a 7-year project, London Power Tunnels, to help ensure future electricity supplies for the UK capital. The transmission infrastructure improvements required a network of tunnels to be built across London, to house what has been described as “a new subterranean electricity superhighway”. Costain Group, one of the UK’s leading engineering solutions providers, was contracted by National Grid to build the tunnels. It used Leica Geosystems’ award-winning Nova MS50 Multi-Station to scan the tunnels and Amberg Technologies’ TMS Tunnelscan software to process the generated information during this project.

In the initial stages of the project, it was clear there would be a number of challenges for the surveying team to overcome. The work involved the construction of 33 kilometres (20.5 miles) of segmentally lined tunnel across central London, including the sinking of 14 shafts and spray concrete lined (SCL) chambers. The excavation of adit chambers around a disused milk depot proved to be one of the most problematic aspects, as the SCL transitioned rapidly from 4 metre (13 foot) diameter circular to 8 metre (26 foot) high elliptical sections.

Nigel Drayton, senior survey manager at London Power Tunnels was part of the team involved in excavating the milk depot adit chambers. “As the adits changed to the elliptical format, it was very difficult for the human eye to ascertain if there were imperfec-
tions in the shape of the tunnel. We needed to make sure we had achieved the required tolerances, with the drives cut to 1 centimetre (0.4 inch) of their final profile.”

As is often the case, the new tunnels had to be completed quickly in order to minimise disruption to third party assets. This meant that conventional scanning was not an option. “It simply would have taken too long for the data to be processed,” explains Drayton. The team needed to find an alternative solution, that could provide high precision scanning data in the timeframe required.

As Costain Group engineers had previously worked with Leica Geosystems and had a positive experience, the decision was made to use the MultiStation, which scanned metre-long advances at 1 centimetre (0.4 inch) grid. The data was then run through Amberg Technologies’ TMS Tunnelscan software, which output excavation profiles at 10 centimetre (4 inch) centres in approximately 10 minutes. “We could then quickly check whether any out of tolerance areas needed to be looked at again, before we carried out further work,” adds Drayton.

Once the correct tunnel profile was achieved, it was given a spray concrete lining. The Leica Nova MS50 MultiStation was then used again, while the spray concrete was still workable, to check the newly lined tunnel’s required thickness. The data captured could also be maintained as part of the build records.

**Accurate tunnel profiles**

By using the MultiStation, accurate tunnel profiles could be produced at a higher speed. Thanks to its seamless workflow and integrated measurement technology, the construction team was able to carry out the necessary scanning and analysis efficiently and accurately. There was a reduction in waste material and the need for reworking, which resulted in time and cost savings for both the Costain Group and National Grid.

Amberg Technologies is a longstanding partner of Leica Geosystems, and the Leica Nova MS50 MultiStation is easily integrated into TMS Tunnelscan. “The crews found the scanner technology easy to use and the technical support on hand was second-to-none,” concludes Drayton. “The structural integrity of the tunnel is absolutely critical and the exceptional lev-
For more than thirty years, Amberg Technologies AG has been developing user-friendly system solutions for geo-referenced data acquisition and processing in the field of infrastructure development. This Swiss company offers standardised products, customer-specific system solutions and project-specific services in the fields of railway surveying, tunnel surveying, tunnel inspections and tunnel seismics.

Three applications collectively known by the name TMS Solution are used for surveying during tunnel engineering and construction. They allow exact surveying of a wide array of critical aspects such as the tunnel profile, including real time deviations of actual surface to design, automatic control of the tunnel heading and precise setout of all tunnel installations. In addition, complete analysis and documentation of the dimensions, deformations and condition of a tunnel structure form part of the scope of TMS Solution.

Costain Group was awarded for the ‘Most Innovative Use of New Survey Technology’ for implementing the MultiStation in the London Power Tunnels project.

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