

Regent's Crescent - Structural Monitoring

CLIENT: MURPHY GEOSPATIAL

How Murphy Geospatial incorporated wireless monitoring into their structural and environmental monitoring programme during demolition and construction works for a major redevelopment near Regent's Park, London

Challenge

This was a major redevelopment of an iconic crescent near Regent's Park originally built in the 1820s and designed by the renowned architect John Nash. The plan was to demolish the existing structure behind the original façade - which was to be completely refurbished - and for the excavation of new basements. The demolition was carried out by specialists McGee and construction undertaken by Midgard, for the client.

Murphy Geospatial was tasked with crucial structural and environmental monitoring in and around the site including monitoring the London Underground, as the Jubilee line runs beneath the development and the Metropolitan line runs adjacent to the site.

They needed to install, commission and maintain three automated multi stations in a live demolition site in close proximity to operational construction plant and with demolition works underway. They also installed more than 250 Senceive FlatMesh™ wireless tilt sensors in the Jubilee line tunnels, which were maintained throughout the multi-year project.

The monitoring of neighbouring properties, which included medical surgeries and other sensitive facilities, required great thoughtfulness because of the proximity to the demolition and construction works. Real-time data was provided to inform the construction company and all stakeholders to ensure that the agreed parameters were not exceeded and that third parties were protected from any noise and other disturbances to enable the construction works to be carried out on budget and on schedule.



Murphy Geospatial installed the following systems above and below ground:

- Three laser scan station sensors (AMS)
- 300 Senceive tilt sensors - 250 below ground and 50 above ground
- Three optical automatic total stations and manual back-up survey equipment
- Three digital image capturing devices
- 20 seismic vibration sensors
- 10 air pressure and noise sensors
- Four air quality and dust sensors
- A wireless data transfer mesh network
- IoT data communication facilities and alarm systems
- Remote-controlled cameras

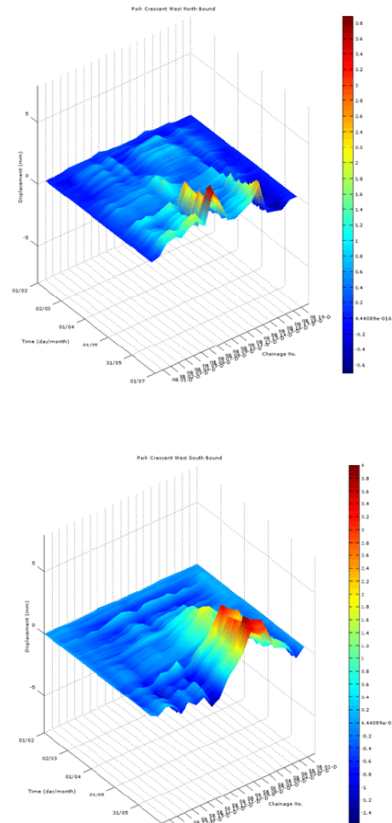


Figure 1 & 2: 3D movement model from Senceive's tilt sensor data before and after demolition, showing heave of tunnel

Solution

In addition to the building and environmental monitoring, Murphy Geospatial was also required to monitor the structural health of 600 m London Underground tunnels. They did this by installing 250 Senceive tilt sensors in sections of five sensors around the circumference of the Jubilee Line tunnels and optical automatic total stations for the larger open tunnel sections of the Hammersmith and City Line. The long distance to the next station required ingenuity for the monitoring data transmission. The limited diameter of the tunnels and the proximity of excavation works needed special, newly developed algorithms to automatically calculate the deformation, heave and settlement of the tunnel structures.

All sensors were managed remotely from Murphy Geospatial's London office and the three integrated cameras enabled visual oversight of the site works.



Source: Bowles & Wyer

Outcome

This was a complex and highly sensitive project, which required the use of remote monitoring solutions to enable measurement without attaching reflectors to the building façade, and other technical innovations to transmit data wirelessly from various sensor types.

In order to reliably relay sensor data to communications gateways located at tube stations many hundreds of metres away, Senceive recommended the use of a fibre optic cable. This enabled the FlatMesh™ tilt sensors to report at high frequency and was found to be “a reliable and elegant solution” by the Murphy Geospatial team.

By combining technology and software from Leica Geosystems and Senceive, Murphy Geospatial was able to develop the so-called ‘patch scan’ solution. This has been adapted by the industry in new specifications for large-scale monitoring projects, avoiding drilling holes into a façade and reducing installation times.

This project was shortlisted for both construction and tunnel awards.

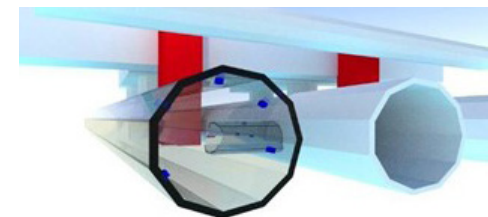


Figure 3: Jubilee Line 3D model with Senceive's tilt sensors