



# HS2 C1 – M25 Crossing Project Case Study

## Location:

Hertfordshire, UK

## Client:

SOCOTEC UK

## Application Summary:

Monitoring ground deformation above twin bored tunnels

## Tags:

ipx; settlement; deformation; tunnel; top-supported; road;

## Description:

Just a few hundred metres from the launch site of the twin tunnel boring machines starting their 10-mile (16km) journey through the Hertfordshire Chilterns to the North-West of London, the tunnel alignment encounters a range of sensitive infrastructure, including one of the UK's busiest stretches of motorway, a sheet pile retaining wall, a bored pile bridge abutment and bridge, and a series of gantries.

As part of a wider monitoring program including wireless tilt sensors, tilt-beams, robotic total stations monitoring 3D prisms, 3D patch scanning and reflector-less surface monitoring and in-place inclinometers, the In-Place Extensometer was used to monitor vertical, subsurface deformation caused by the tunnelling.

As the source of the movement was coming from below the extensometer installations, control was brought to the instrument through surface patch scans of the road surface which was mechanically coupled to the suspension system supporting the IPX strings.

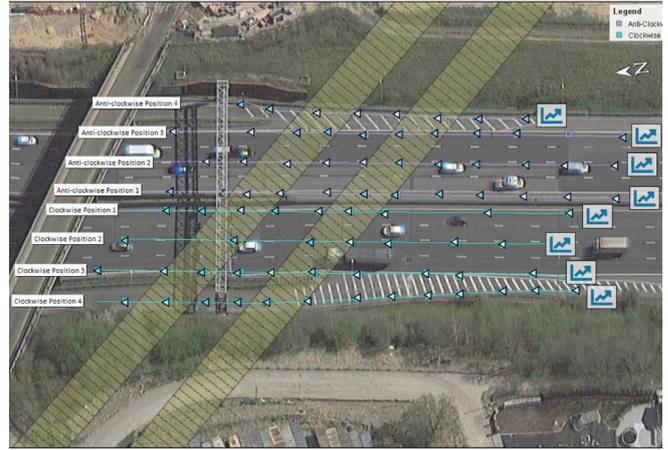
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## Key Benefits:

- High number of sensors within a single borehole
- Low-profile headworks

Up to twelve sensors were installed within a single borehole for the M25 crossing, and further along the alignment up to 44 sensors were installed per borehole. Use of the IPX cut drilling on this section by a half – a significant saving, particularly when drilling on motorway carriageway – and for the installations with more sensors, up to 8 boreholes





would have been required for alternative systems, where the IPX required just one. Thanks to the IPX's single cable digital bus, data logging costs were also significantly lower than alternative systems.

As the IPX sensing is all done in-hole, the headworks comprises only of a small rod suspension cap, meaning the system can be contained within a small well cover rather than requiring a large manhole to accommodate the instrument at the surface.

**Related Articles:**

**Work begins boring first HS2 tunnel under Chiltern Hills**

<https://www.theguardian.com/uk-news/2021/may/13/work-begins-under-chiltern-hills-boring-first-hs2-tunnel>

*“To support the monitoring of ground movement under the motorway, SOCOTEC used monitoring prisms, wireless tilt sensors and boreholes containing automated extensometers (IPX). It also used automated patch scanning to monitor the movement of highways assets before, during and after the TBMs went to work under the M25.*

*With these tools in place, SOCOTEC Monitoring was able to record and specify the exact location of the TBMs.”*

<https://www.newcivilengineer.com/latest/how-hs2-monitored-the-m25-while-tunnelling-beneath-it-05-10-2021/>

*“Thanks to our level of expertise in terms of asset management and our implementation of state-of-the-art technologies, we are proud to have delivered the project to the best of our ability, and look forward to continuing to contribute to the HS2 C1 main works as the project develops”*

<https://www.geplus.co.uk/news/hs2-tunnel-monitoring-completed-on-m25-stretch-05-10-2021/>

