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**I**N MAY 2010, Severn Partnership was approached by a major civil engineering contractor to offer a proposal for the monitoring of rails for movement, during the piling works for the new Wichelstowe footbridge adjacent to the railway fenceline. The proposal needed to adhere to Network Rail's standard for monitoring track over or adjacent to civil engineering works (NR/BS/LI/045).

The site is adjacent to the Great Western line just outside Swindon where the line speed is 120mph. Red zone working is prohibited in this area and the opportunity to take T2H possessions on a regular basis is generally considered unacceptable. Given that the monitoring period was expected to last at least two months, an automated monitoring system was proposed. The extent of the monitoring covered 90m of track over four rails, with Leica GMP104 glass prisms located at 3m centres (124 prisms in total). Following acceptance by Network Rail of a number of method statements, prisms were installed, trackside equipment established, and cant and baseline surveys completed.

### Control

Two stable reinforced pillars for prism/target assemblies were constructed clear of the zone of influence within adjacent fields, and two no-dig temporary instrument pillars for prism/target assemblies were installed trackside, also clear of the zone of influence.

A further no-dig pillar for the instrument was constructed trackside, within the zone of influence but such that the lines of sight to all others were maintained throughout the contract period. This facilitated constant free-station observations to correct the instrument position and height from any possible movement resulting from the piling works. The instrument was housed in a purpose built shelter to protect against the elements.

### Instrumentation

A Leica TS30 precision monitoring total station was chosen for the project for its high accuracy, automatic target recognition, fast action and reliability. It has an angular accuracy of 0.5" and a distance accuracy of 0.6mm+1ppm.

A UHF radio link was established between the instrument and a laptop over 500m away in a nearby contractor's cabin using Leica TSPS28 radios. A meteorological sensor was connected to provide readings and corrections for temperature and pressure. A wireless dongle enabled the data to be accessed remotely from a laptop in the office where the data was pushed into a dedicated web interface. With the TS30 operating 24/7, observations were taken of the prisms remotely using GeoMoS software; an automatic deformation monitoring system that is able to collect data from the geodetic sensors for post processing and analysis. All measurements and results were stored in an open SQL database which could be accessed online, locally or remotely, by the surveying team and client.

### Results

The monitoring system was set up to automatically deliver a report of the results of vertical movement, cant and twist by email to the surveying team twice a day. These were analysed and forwarded to Network Rail, with comments, each day. It also offered the facility to assess lateral and longitudinal movements and effectively the gauge. Additional results and trends were obtained and analysed by accessing the site laptop remotely and downloading the results.

Warnings of cant and twist exceeding trigger levels would have been sent by text and email had the situation arisen. The facility to receive this information and view the data on site was available to Network Rail, the contractors and any other interested party.

As was expected, the equipment performed reliably and the results validated the implied accuracy. The system provided not only a cost effective solution, but enabled an accurate monitoring programme to be established within an area that was effectively inaccessible during the monitoring period.

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*Monitoring by day and by night in the purpose built shelter.*