

Fibre optic instrumented geogrid for early detection of sub-surface ground movement

Introduction

Failures in earthworks are unpredictable due to the variable nature of the ground, as well as the presence of unknown elements, such as sinkholes, dissolution features and mining legacy voids. The incorporation of fibre optic (FO) sensors into earthworks has the potential to provide significantly improved information on the *location* and *magnitude* of post-construction ground movements, thus benefiting the management and resolution of these issues before they can disrupt transportation networks or compromise user safety.

Development of FO geogrid

CSIC, Huesker and Epsimon have developed *Sensorgrid*, a geogrid instrumented with distributed FO strain and temperature sensor cables, which can be embedded in earthworks to provide an early detection system of vertical or horizontal sub-surface movement at depth. The performance of Sensorgrid has been evaluated through extensive testing at CSIC, prior to being deployed on site.



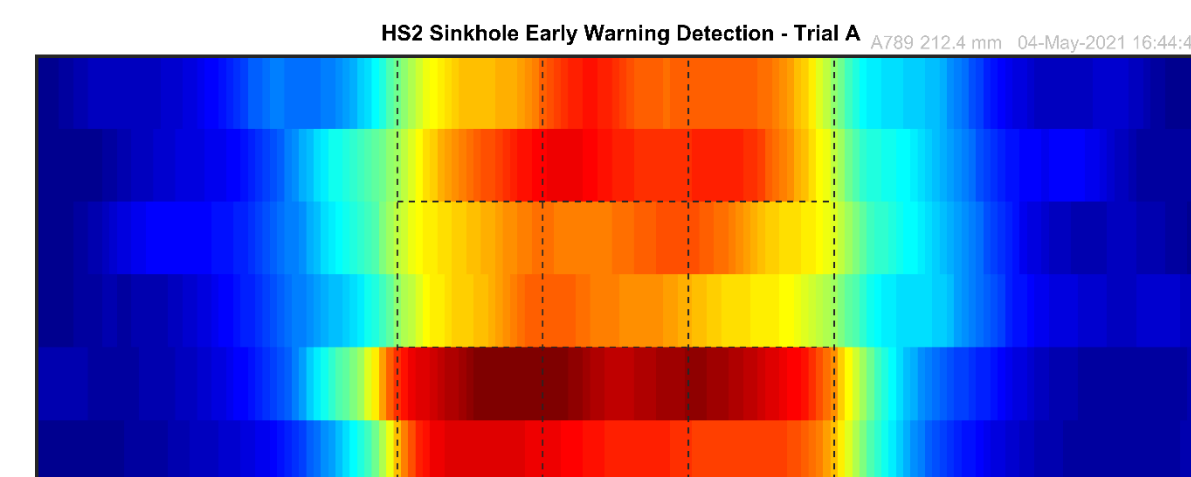
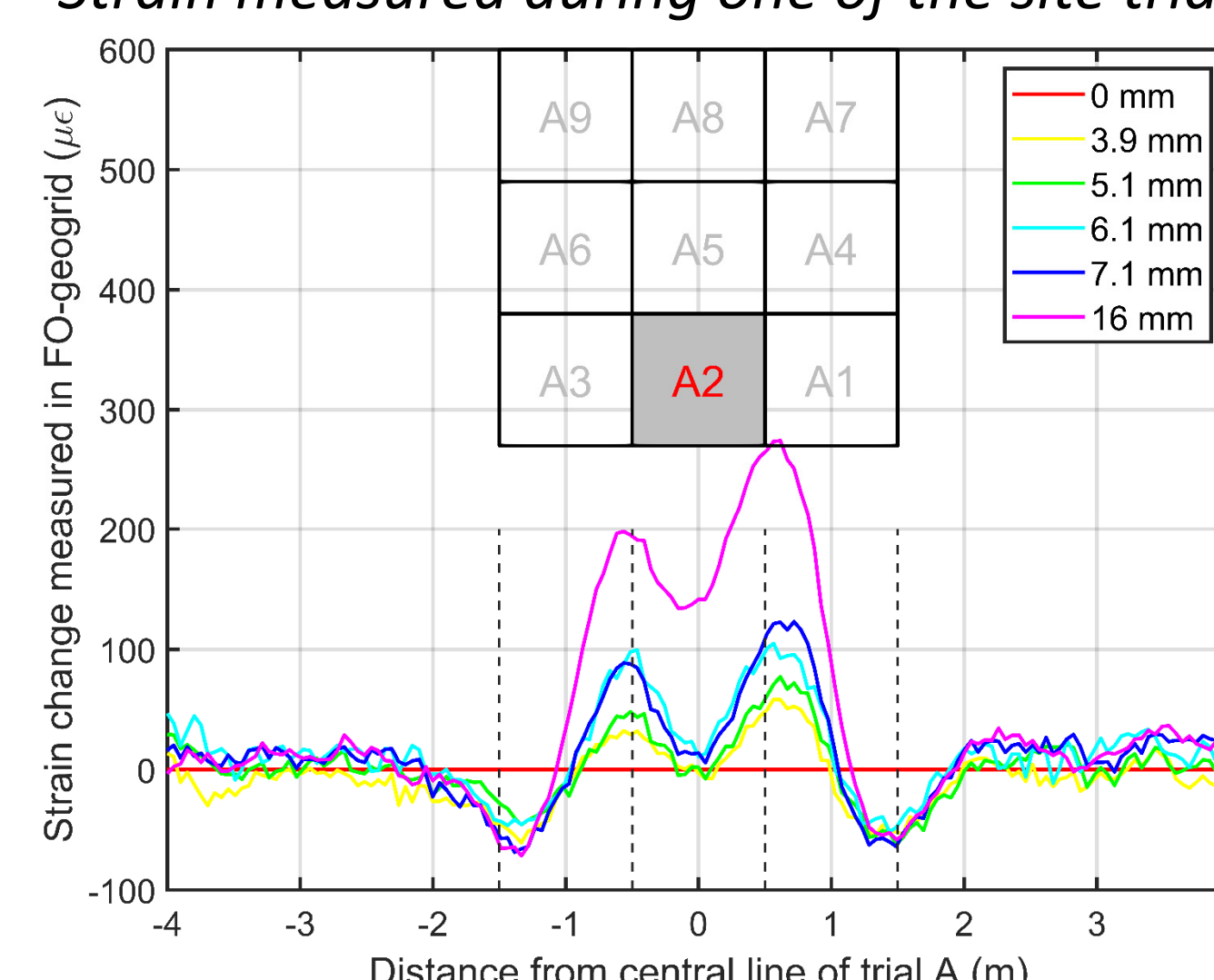
CSIC tensile testing rig

Field trials

The capability of Sensorgrid to monitor ground movement was verified during a series of field trials at HS2's Chilterns Tunnel south portal site. The results showed that Sensorgrid can detect ground movement from an early stage as it is sensitive to small settlement at the millimeter scale.



Strain measured during one of the site trials

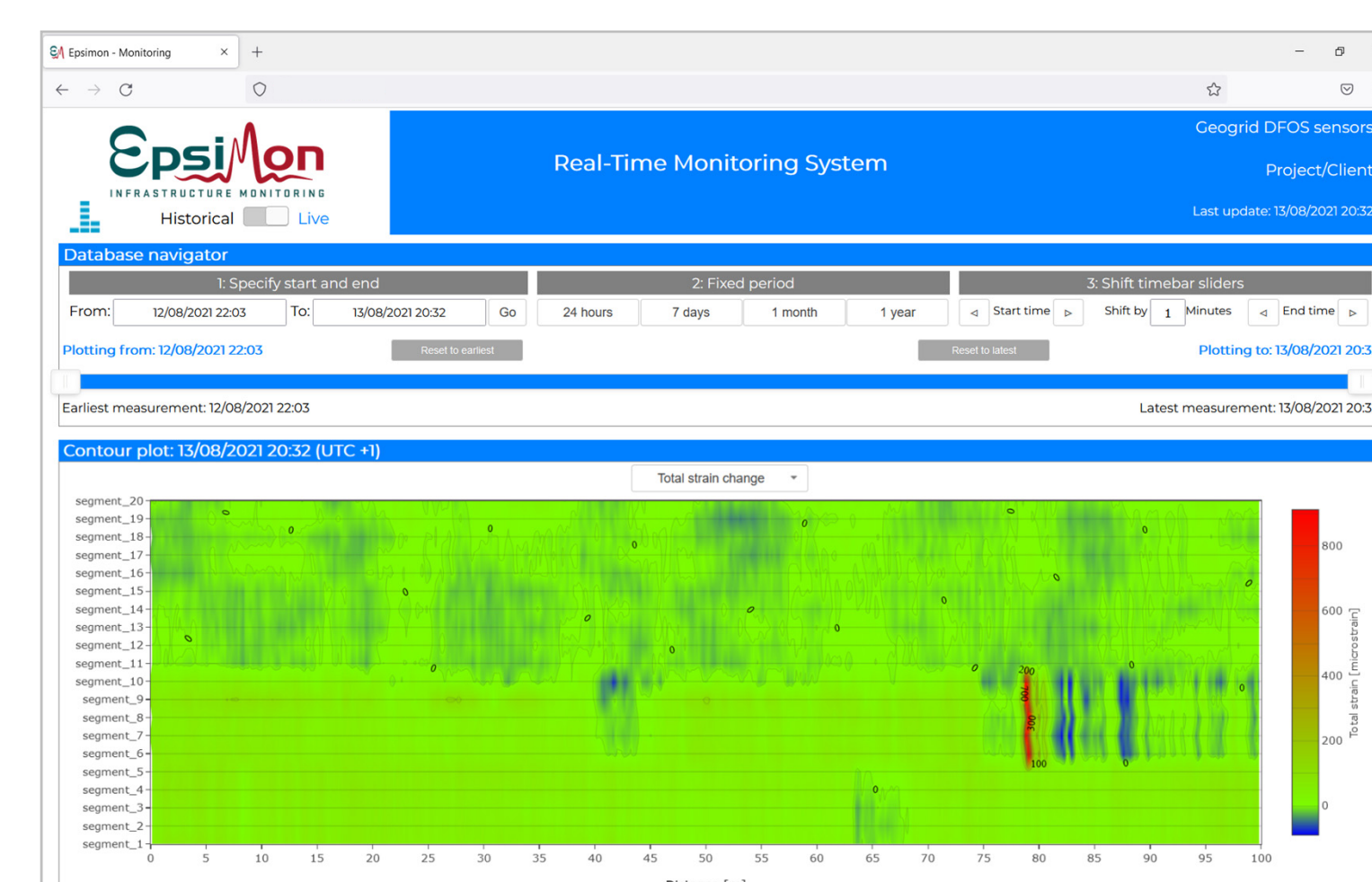


2D strain map of the test site

Monitoring ground movement on HS2

Sensorgrid is now being deployed to monitor the ground movement beneath a 100 m-long, 10 m-wide stretch of the mainline alignment on the HS2 site at Tilehouse Lane Cutting (TLC), with a view to using the technology more widely along the HS2 route. This project is a collaborative effort between CSIC and its industry partners Huesker, Epsimon, Jacobs, ALIGN JV and HS2.

The Sensorgrid at TLC will be monitored continuously for 2 years during the construction of HS2. The data acquired from the FO cables will be automatically processed and displayed on a real-time online visualisation dashboard developed by Epsimon. This will enable the project engineers to detect any incipient ground movement below the road surface, long before it becomes problematic, thus enabling them to take timely preventative action when necessary.



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