



A new approach to monitoring subsidence and settlement issues.



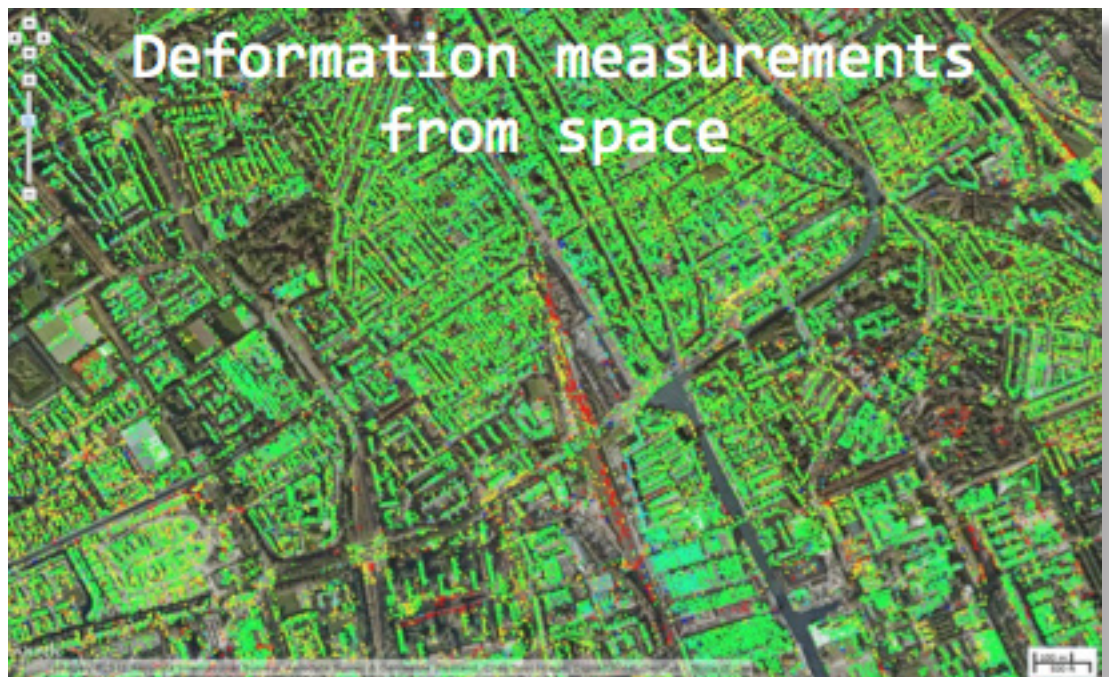
CENTRAL ALLIANCE

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Surface movement monitoring via satellite for the insurance industry

With mounting pressures on the UK's groundwater resources combined with historical mining, natural solution cavities, unpredictable weather conditions and the increase in construction activity including basement construction and tunnelling, subsidence and settlement claims continue to be a major issue for the UK insurance industry. The complex geology of the UK provides a broad range of potential claims over wide geographical areas. With increasing pressure on natural resources and fracking on the horizon the need for a robust monitoring approach has never been greater.

In order to meet these challenges, access to accurate and reliable information is critical to monitor and analyse properties and infrastructure within specific geographical areas so that the industry can take a more holistic approach - only then can claim assessment become truly effective and benefit the whole insurance network.



“The complex geology of the UK, combined with pressures on our groundwater resources, historical mining factors and unpredictable weather conditions present a broad range of potential subsidence and settlement claims over wide geographical areas”.

Richard Pidcock, Technical Director, Central Alliance

Utilising satellite monitoring to further industry understanding of surface movement and settlement

We believe in utilising the best technology available to enable you to assess the risk related to ongoing surface movement. Recent advances in space technology by industry leaders Airbus Defence and Space mean that satellites are now capable of monitoring movement of the ground or structures to a millimetric level. Satellites are positioned to capture images every 11-16 days and sophisticated processing enables us to provide accurate movement monitoring results.

The satellite orbits the earth at around 514km in a polar orbit. As a result we can easily monitor very large areas over a long time span (archive data is often also available, particularly for built up areas) so it is perfect for assessing ongoing surface movement, particularly where infrastructure already exists. Each image can capture a large number of properties, structures, transport networks and construction sites etc. all in one go, so it is very effective for the identification and delineation of areas affected through surface movement caused by man-made activity such as mining and ground-water extraction. This information offers the potential for real discussion and proof pertaining to justified/non-justified requests for damage compensation and other potential insurance liabilities.

Satellite monitoring services use combinations of satellite imagery but also rely on image processing and interpretation skills, delivered by Central Alliance, to deliver specific geo-information (e.g. surface movement analysis). Satellite monitoring can provide:

- A completely tailored service built around area of interest in terms of frequency of data capture, post-processing and reporting.
- Instant access to all relevant information to assess ground movement and make informed decisions
- Remotely accessed information reducing the need for on-site surveillance
- Access to current information and historic data. We may already hold images including site areas that are a priority with regards to asset degradation which will enable a rapid evaluation of surface movements over time.

Satellite monitoring can provide an early warning mechanism and help direct preventative action in the following areas:

- Identify ground and building movements arising from settlement, subsidence, heave, mining, tunnelling, construction, basement construction etc.
- Performance monitoring of maintenance work
- Identification of potential areas of differential settlement causing fracturing of underground infrastructure.
- Monitoring of over ground infrastructure identifying movements on and around critical assets.

It is particularly useful for underground construction monitoring, including:

- Tube/Subway
- Tunnelling
- Underground Parking
- Inner city basement construction
- Adjacent structure/party wall monitoring throughout construction process
- Zone of influence monitoring during de-watering

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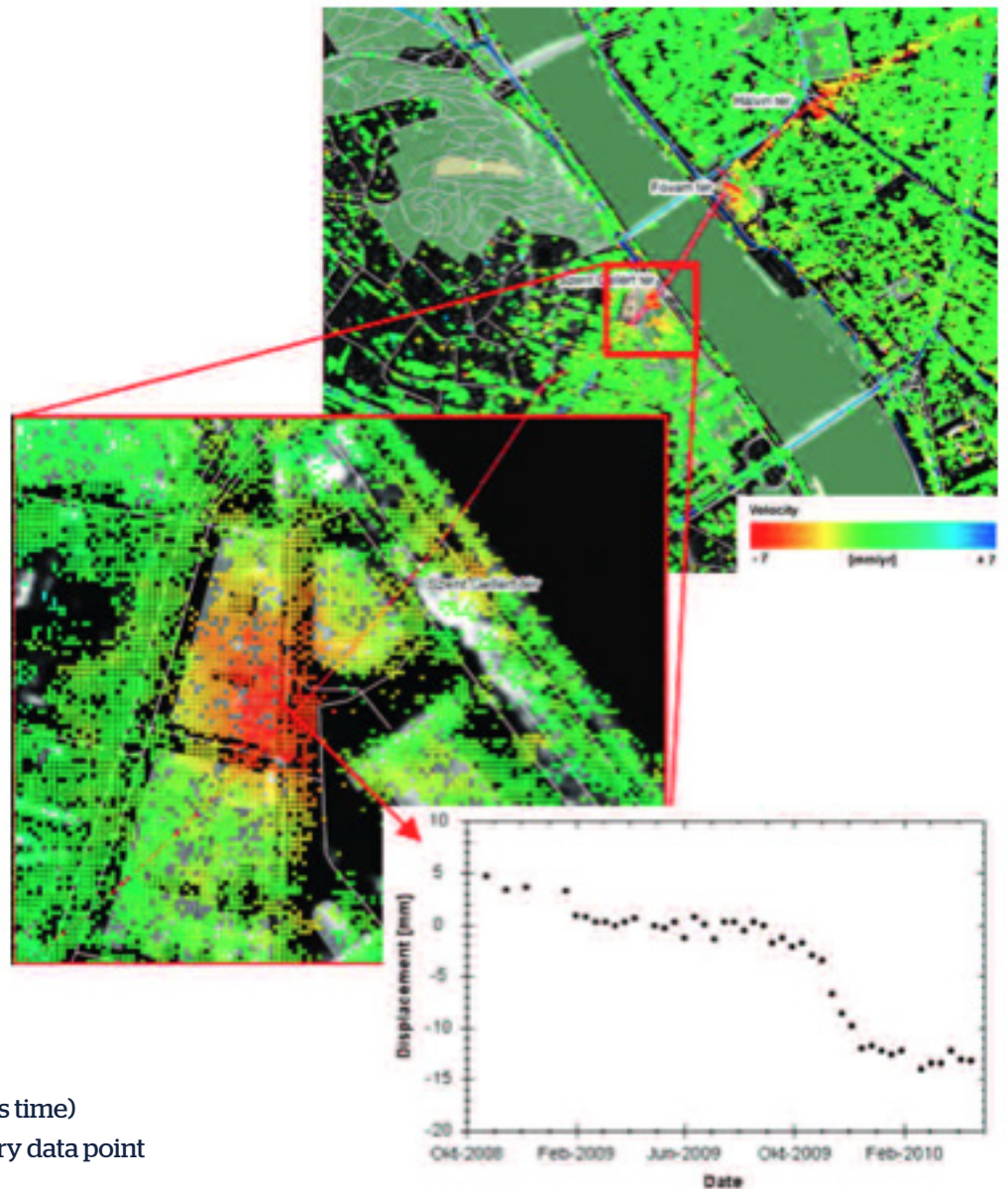


Satellite images and actual examples of how the data highlights settlement issues

Example Case Study
Budapest Metro Line 4 Tunnelling



Interferometric data showing ground movements during tunnel boring



Time series graph (subsidence v's time)
 accessible via web portal for every data point

Satellite data - technical Information (highlight box)

Types of satellite data

- Standard resolution - pixel size <math><75\text{m} \times 25\text{m}</math>
- High resolution - pixel size <math><3\text{m} \times 3\text{m}</math>
- For rail applications high resolution data is most suitable

Measurements from space

- Once every 4-30 days (typically 11, 22 or 30 days)
- Independent of time, clouds, etc
- Each satellite image - 30 km x 50 km

Historical and new data

- Possibility of historical (forensic) analysis from 1992
- New data can be ordered tailor made

Processing algorithms

- Vertical deformations 2-3 mm per measurement point
- <math><1\text{ mm/year}</math> accuracy in trendline estimation
- Horizontal accuracy - 1 metre (sub-pixel)

About Central Alliance

Central Alliance helps organisations to realise the power of integrated pre-construction services.

Through experienced people who understand the importance of precise site information, we ensure you are fully informed and able to move things forward into a successful construction phase. Offering everything from surveying, site investigation and innovative technology solutions to training and health and safety solutions, Central Alliance provides you with the intelligence to transform your projects. A key focus for Central Alliance is to help transform the construction industry through innovation, helping to unlock the business value of available technology and use it to improve outcomes and save money at every stage of the pre-construction process.

Technology can present organisations with new opportunities as a strategic weapon to gain competitive advantage, improve productivity and performance and develop new ways of managing and organising.

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