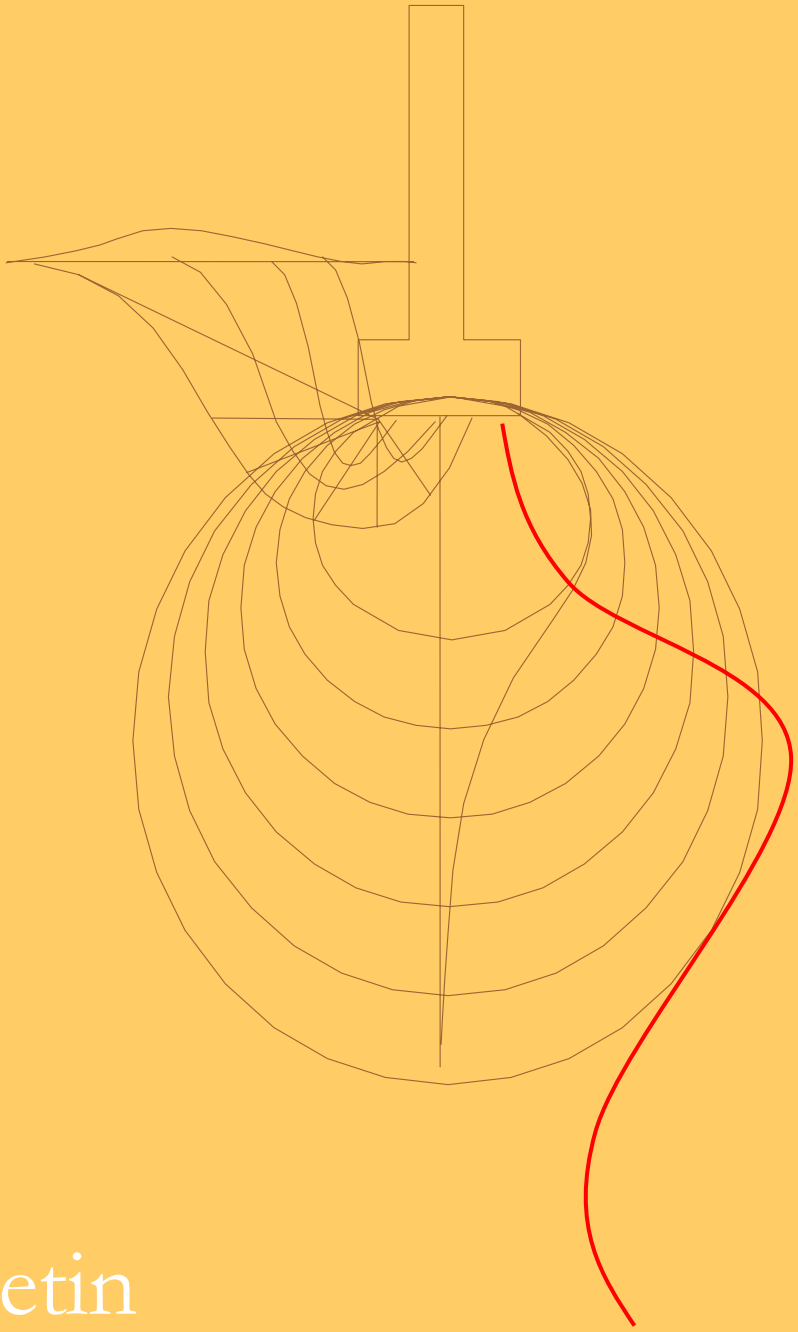
The Clay Research Group



Monthly Bulletin

The Clay Research Group

April 2007

Supporting Research

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Welcome Guests

Tim Freeman, former Head of Foundation Research at the Building Research Establishment and now Managing Director of GeoServ Limited joined us at our last meeting, along with Richard Stow of EnviroScience.

In his time at the BRE Tim set up the levelling stations at Chattenden with rods at varying depths, together with short lengths of strip foundations. His work (together with that of Crilly, Driscoll and Ward) has formed our understanding of root induced clay shrinkage.

Tim is currently engaged as an Expert Witness and has acted on several high profile cases. His business (GeoServ) investigates complex subsidence cases, and offers precise levelling services to the industry.

Tim (left) and Richard at the offices of the CRG, engrossed in discussions about the quality of the ~~beer~~ project.

Richard has a background in the environmental sciences and has mapped ground movement in several locations using radar techniques.

His current work is aimed at trees – helping them to avoid causing damage where possible, and retaining them where sensible. In his own words, Richard is hoping to "encourage rooting away from vulnerable structures".

Richard is looking for a site where he can trial his work, and anyone with suggestions should contact him direct at envisci@onetel.com.

Tim can be contacted at geoservltd@aol.com.

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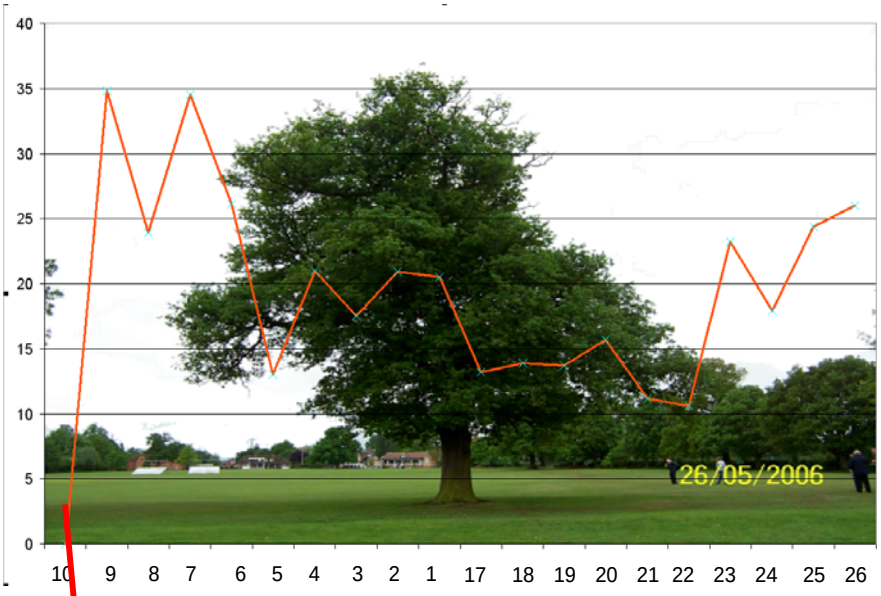
Precise Levels - Oak

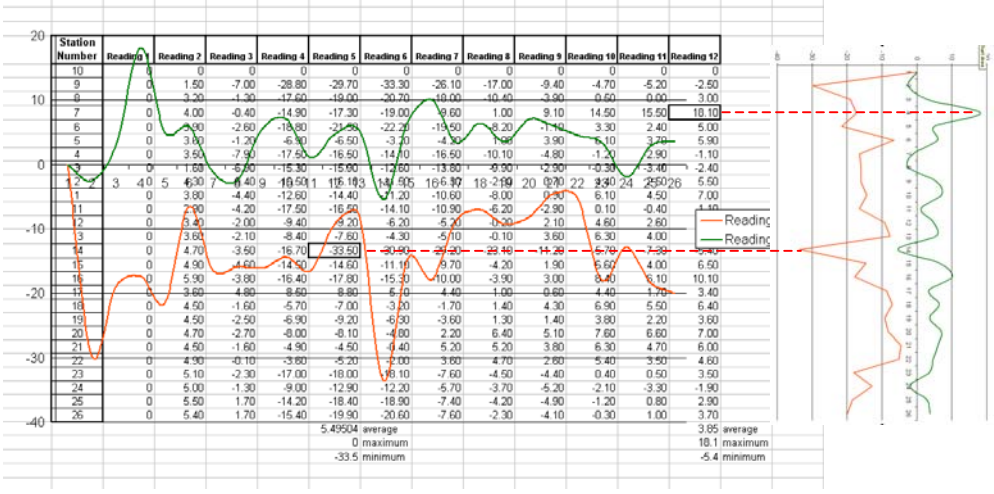
Below we see the Aldenham Oak with the difference between the maximum and minimum ground movement values in the monitoring term. This data covers the period 27.04.06 to 22.02.07. The tree is situated between Stations 1 and 17.



The datum, sunk to a depth of 10mtrs in sandy gravel, is to the extreme left – Station 10. We can see that Stations 7 & 9 have moved 35mm in total. Stations 21 and 22 have moved least – just over 10mm.

Movement appears to be greater beyond the drip line, and less beneath the canopy possibly associated with the protection offered by the canopy against rainfall. No doubt this is the situation beneath many of the impervious driveways that we mentioned in last months edition following the research by Esure and the BGS. The driveway effectively shields the soil in the same way, driving roots further afield for moisture.

Below we see the envelope of movement – the lower graph (red) represents the subsidence values for August 2006 and the upper line (green) plots the recovery values for March 2007. Beneath the graph we have the maximum and minimum values. To the right of the data we have the graph aligned with the Stations. Although we have recorded significant movement over the term, the amount of differential movement has been quite small.



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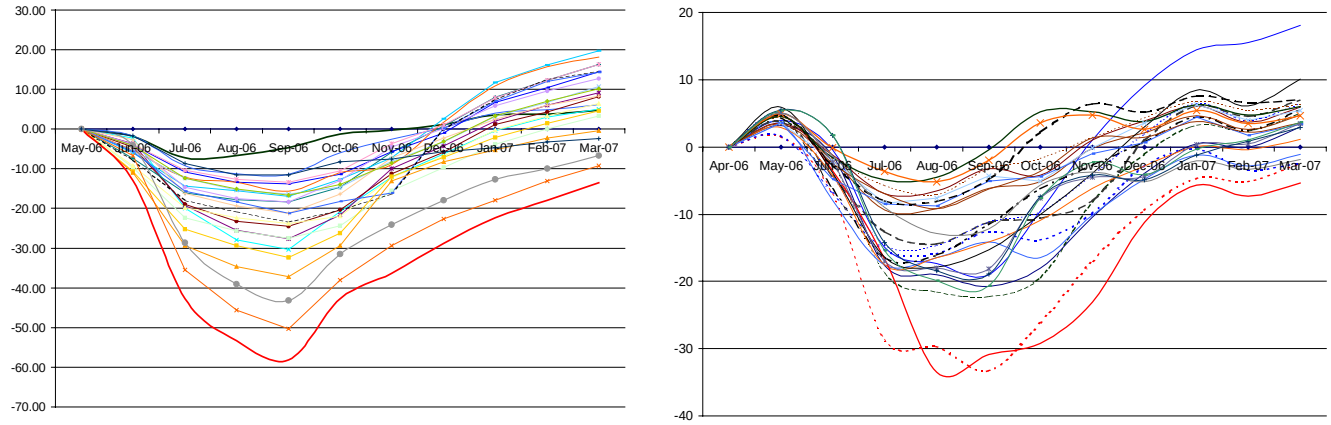
Movement over Time and by Station

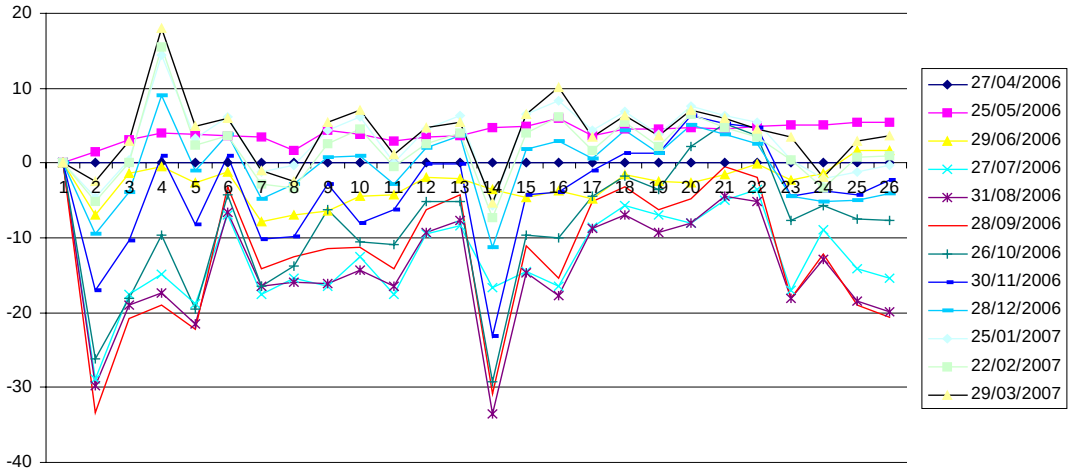
The Aldenham Willow and Oak

Below we plot the movement of individual stations for both trees over time. Note the characteristic signature with maximum subsidence taking place between August and September in 2007 and the point of contraflexure in May for the Oak only - the Willow wasn't instrumented in time.



Nearly all stations are now above their starting point at the beginning of 2006. Some by as much as 20mm.

The pattern is similar for every station, with the amplitude differing. Below we see the data for every station graphed on a particular day. For example, the top, black line of the left-hand graph (willow) shows the movement for all 26 stations on the 29th March 2006.



This provides some idea of the magnitude of movement between dates and differences between the wettest (top line in both cases) and dryest times (lowest line) of the year, showing which stations move most. It's an indicator of clay activity and mineralogy across the site as well as rainwater penetration.

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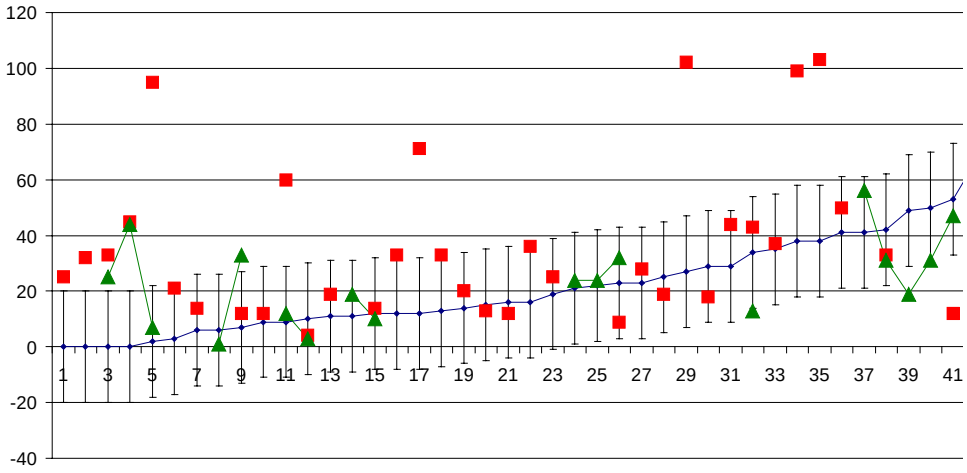
Modelling Ground Movement

The graph below compares the modelled output with soil test results and precise levels from a sample of claims where the data was gathered at or around the same time of year. 'Soil sample' refers to the filter paper test, which has an accuracy of +/- 25%.

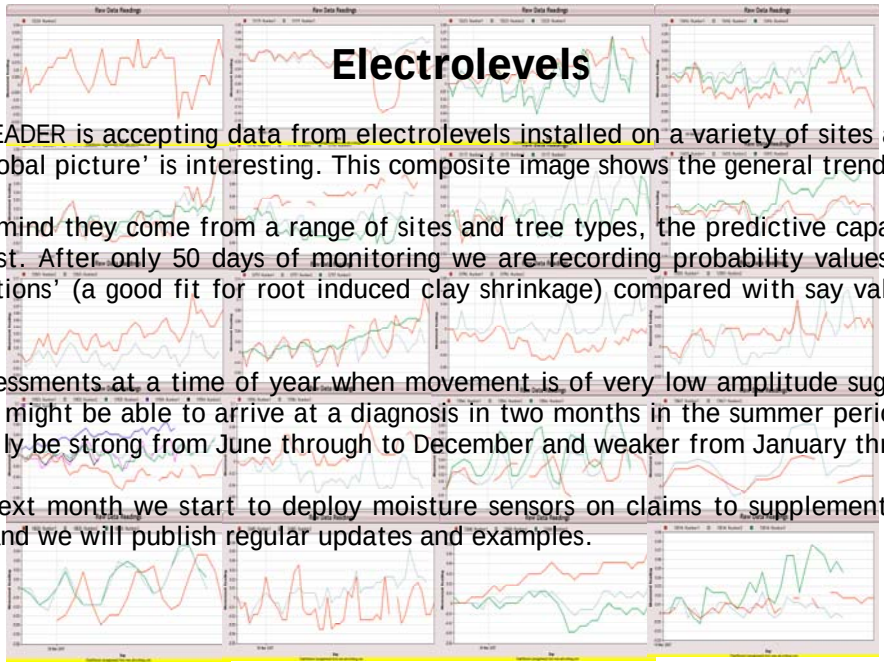


Nearly 80% of the precise levels (▲) fall within +/- 20% of the modelled profile (■). The soils (■) show a wide dispersion, with very little fit. We can see from the data that the model tends to under-predict low order movement (less than 20mm) but is more accurate than the soils test over the remainder of the range, and consistently so.

The cumulative variance in ground movement from the precise level data is twice as much for soils compared with the model. The correlation between Precise Levels and the Soils Model = 0.078 (no correlation at all) compared with 0.44 with the model.

In short, the model performs better than testing the soils on all counts.

Electrolevels



The DataREADER is accepting data from electrolevels installed on a variety of sites across the UK, and the 'global picture' is interesting. This composite image shows the general trendlines.

Bearing in mind they come from a range of sites and tree types, the predictive capability appears to be robust. After only 50 days of monitoring we are recording probability values of 0.91 from 'active stations' (a good fit for root induced clay shrinkage) compared with say values of 0.3 for the datum.

Making assessments at a time of year when movement is of very low amplitude suggests that the technology might be able to arrive at a diagnosis in two months in the summer period. The model will naturally be strong from June through to December and weaker from January through to May.

Over the next month we start to deploy moisture sensors on claims to supplement our evidence gathering and we will publish regular updates and examples.

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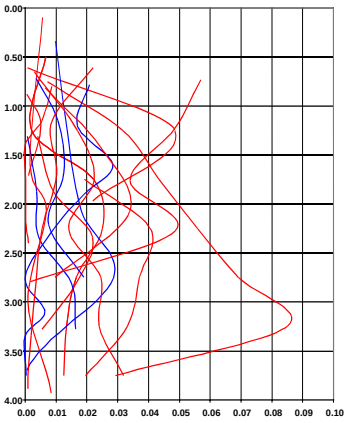
Soil Interpretation Module

Understanding soil reports isn't always easy. "Does the blip at 2.5mtrs mean the soil is desiccated?" And then we have the variety of tests. Filter papers and oedometers produce similar graphs with differing scales. Soil mineralogy can suggest desiccation when in fact it is an anomaly of the filter paper test, not to mention under-draining. Cases where gravity drains the water where we have clay soils overlying chalk, sand or sandstone.



Left we have a montage of results illustrating some of the issues that make interpretation difficult:-

1. Under-draining.
2. Soil Mineralogy and 'odd' Ko lines.
3. Stratification – sand lenses and variable composition.
4. Heave

Our new application - part of the DataREADER suite – will help. It distinguishes between a variety of 'wiggly lines' of the sort we see here.

Simply enter the depth of the sample and the value (strains or suctions) to receive a probability analysis based on pattern matching. The application doesn't need to know about units of measure. It caters for strains of 0.03 equally as well as suctions of 300kPa.

We hope it will be of use to Back-Office claims handlers, insurers who would like to understand the data, Local Authority tree officers when facing apparently complex claims and of course, engineers and surveyors who might not have a geotechnical background.

ASTON UNIVERSITY
BIRMINGHAM

We have had a good response this year and bookings are up by around 15 – 20% for attendance at the annual subsidence conference at Aston University on the 12th June.

In particular we are pleased to welcome a number of arborists to the group along with insurers and adjusters plus private practice engineers.

We will be presenting the results from some of our research at Aldenham, looking at modelling both in the context of claims handling and underwriting as well as discussing how we might apply these techniques to improve the way claims are handled in a practical sense.

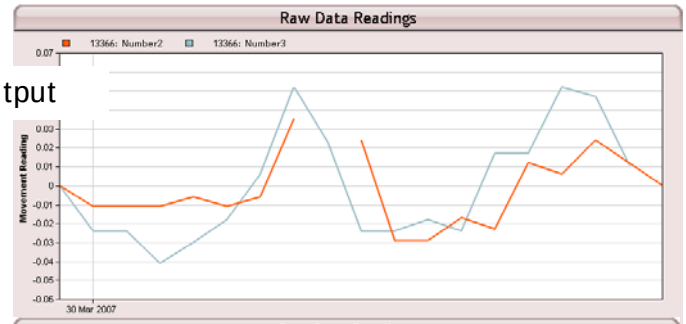
The new 'disorder' tree/climate/soils model will be demonstrated along with the triage application and advances in mapping. Hopefully we will have the telemetry equipment for a live demonstration and in the afternoon we will be advised of recent developments in gathering evidence for Third Party recoveries as well as the current legal position.

Booking details on the last page of this edition.

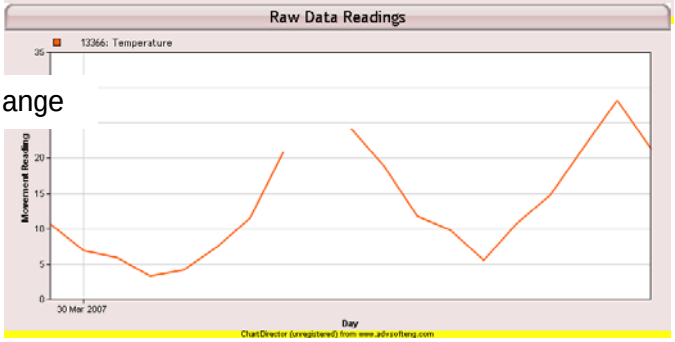
ELECTROLEVELS - Case Study

Electrolevels are being used to monitor movement of a 2.3mtr high retaining wall at a site near Shrewsbury and below we reproduce some early data covering a 54 day period. The top graph is plotting movement (angular rotation in degrees) and the lower graph is plotting temperature.

Electrolevel Output



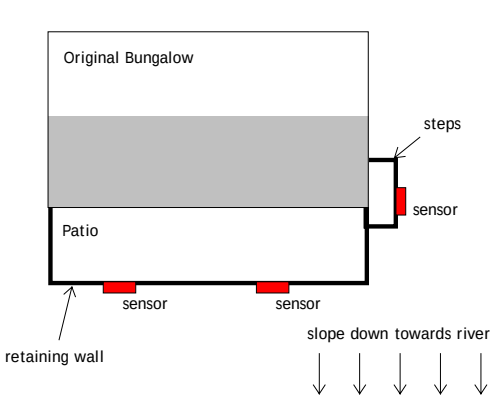
Temperature Change

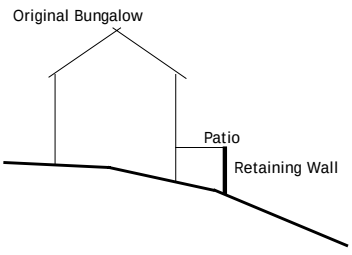


Electrolevels have measured movement in the range of -0.04 to 0.05 = 0.09 degrees. The temperature change in that time has been 22 degrees.

We are measuring approximately 0.004 degrees of rotation for every 1 degree change in temperature. The close correlation between the two sets of data suggest that movement is being driven by temperature change.

The movement is probably of the order of +/- 15mm at Station 3.





General arrangement showing the retaining wall in relation to the bungalow and the sloping site.

Sensor location shown in red.

We will be providing details of actual claims and case studies where electrolevels and moisture sensors have been used ovet the coming months.

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BIRMINGHAM

Aston University presents a One-day Course
in the School of Engineering & Applied Science on Tuesday 12 June 2007

SUBSIDENCE: EMERGING ISSUES 2007

09.15 – 10.00	Registration
10.00 – 10.15	*Opening by Chairman:* **RICHARD ROLLIT**
10.30 – 10.50	*Domestic Subsidence: The Last 30 Years* **STEPHEN PLANTE,** The Clay Research Group
10.50 – 11.25	*Non-invasive Investigation: Modern Techniques* **DR. NIGEL CASSIDY,** Keele University
11.25 – 11.40	----------***COMFORT BREAK***----------
11.40 – 12.15	*Modelling Soils, Climate and Root Activity* **RICHARD ROLLIT**, Crawford & Co.
12.15 – 12.30	Discussion
12.30 – 14.00	----------***LUNCH*** ----------
14.00 – 14.35	*Modelling Subsidence Risk using New Technology* **PAUL STANLEY,** Addressology Limited
14.35 – 15.10	*An Objective Framework for dealing with Third Party Trees* **TIM FREEMAN**, Geo-Serv Limited
15.10 – 15.45	*Tree Root Subsidence – The Developments in Law* **PAUL LEIGHTON & JONATHAN BINGHAM,** Beachcroft LLP
15.45 - 16.15	Discussion
16.15 – 17.00	Tea and Disperse

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