The Clay Research Group

RESEARCH AREAS

Climate Change ◆ Data Analysis ◆ Electrical Resistivity Tomography
Time Domain Reflectometry ◆ BioSciences ◆ Ground Movement
Soil Testing Techniques ◆ Telemetry ◆ Numerical Modelling
Ground Remediation Techniques ◆ Risk Analysis
Mapping ◆ Software Analysis Tools

The Clay Research Group
www.theclayresearchgroup.org

November 2010

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ALDENHAM SCHOOL RESEARCH SITE

Our research has relied heavily on the generosity of Aldenham School. The site – 100 acres in North London – has allowed academics to gather and share the data they have collected using a wide range of techniques.

The value has been correlating one method with another. Understanding which soil testing technique is reliable by comparing the results with precise levels for example. Determining actual soil moisture deficiency using the neutron probe. Reviewing emerging methods like electrical resistivity to measure moisture change over time. Sending data from site using telemetry.

Aldenham has been a generous host since work commenced in 2006.

THE CLAY RESEARCH GROUP
www.theclayresearchgroup.org
splante@hotmail.co.uk

5 Year Review

What has the last five years delivered? Too few answers unfortunately, but it has clarified some of the questions that we might want to ask. Next months newsletter reviews the work of the CRG over this period.

The CRG borrows heavily from the work of others. For example, the BRE were monitoring the Chattenden site years before the CRG was formed and have produced extensive guidance on a range of topics under the direction of Richard Driscoll, Tim Freeman and Mike Crilly. Ward defined the problem and came up with many of the answers half a century ago. Giles Biddle measured moisture change beneath several species of tree on a variety of soils. Both have produced tables putting trees in rank order of risk, as have Cutler & Richardson.

Electrolevels were in use by the BRE for monitoring the leaning Tower of Pisa. TDR sensors are in common use in agriculture around the world. Very little of our work is new or novel. The CRG offers a platform for new methods to be tested and reviewed by colleagues. In next months edition we review progress.

Congratulations to **Richard Rollit** on gaining his MBA. Several years of hard work at the same time as holding down a demanding position at Crawford & Co., can't have been easy.

We are holding our Christmas bash at Aldenham this year, and **Giles** is busy looking at his diary to see if it clashes with his demanding schedule acting as an Expert Witness, dealing with TPO appeal decisions for Planning Inspectorate, desk-topping some claims … and sailing his yacht to Florida to avoid the winter snow.

Margaret McQueen from OCA continues to drive us all forward and is heavily involved with several complex Court cases as well as keeping abreast of developments relating to planning and changes in the TPO legislation.

Tim Freeman has allowed us to publish his suggestions on the use of precise levels to establish causation and resolve disputes on tree related claims.

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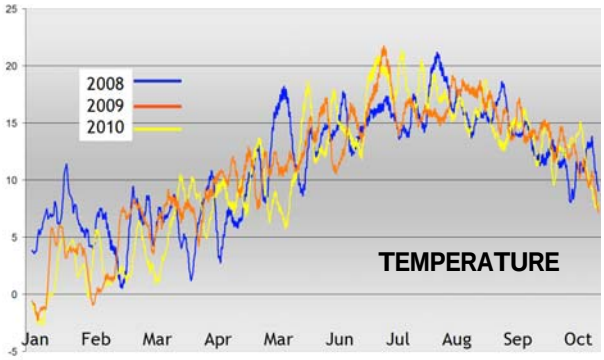
WEATHER DATA

On the face of it there seems to be little difference between temperature plots for 2008, 2009 and 2010.



In contrast, the Relative Humidity plots for the same years reveal that the readings for 2010 were much lower than preceding years.

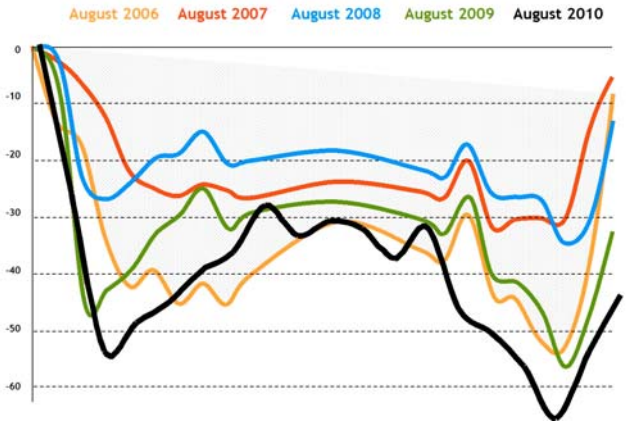
There is little doubt that RH is one of the most important factors driving transpiration and may explain the difference in claim numbers between busy and normal years when other measures appear similar.

GROUND MOVEMENT
~ August Profiles ~

Comparison plots of the ground movement profiles beneath the Aldenham Willow for the month of August over several years are shown top, right.

2006, 2009 and 2010 were relatively dry years. In contrast, 2007 and 2008 were much wetter. The plot reveals the influence of the weather on root moisture uptake.

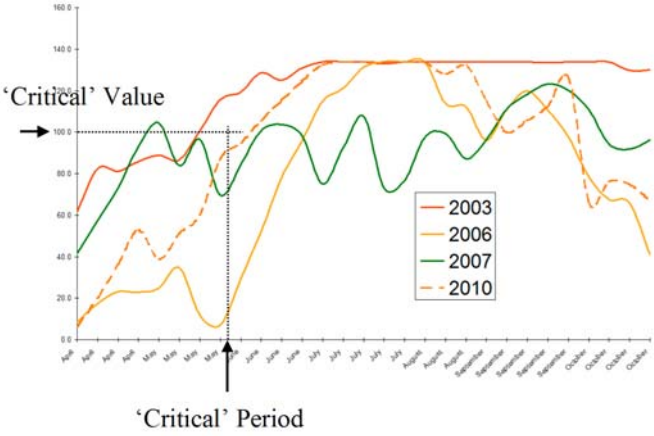
The difference occurs mainly at the root periphery in the case of the Aldenham Willow. Peak ground movement in dry years is around twice that recorded in wet years.



SMD VALUES
~ Supplied by the Meteorological Office ~

The 2003 profile started early and was maintained throughout the summer, revealing the characteristic signature of an event year. In contrast, 2007 was a quiet year in terms of claim numbers.

2006 was busy throughout the summer, and 2010 threatened, but didn't deliver, even though the SMD values were high for a few months, matching the 2003 values.



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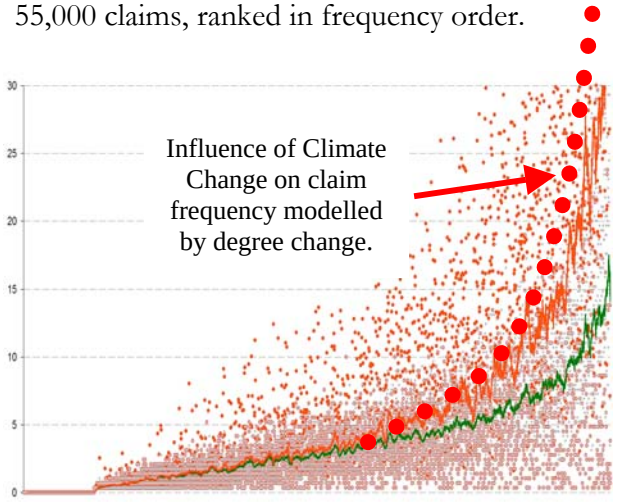
CLAIM FREQUENCY AND COUNT

We have touched on this before. How risky sectors tend to get riskier at times of surge. The graph below models two years, one with 38,000 claims (grey dots and green moving average), and another (red dots and moving average) for 55,000 claims, ranked in frequency order.



The count of claims per sector for the above years suggests busy sectors double their count whilst others will only see a small increase.

Just over 12% of the sectors have no claims notified at all.

Sectors with say 4 claims in normal years, on a low shrink/swell soil may receive around 5 maybe. Sectors on highly shrinkable soils with say 9 claims could see that figure reach 15 or more.

The greatest change – the sectors at highest risk from Climate Change – are those on clay soils. The base figures can be flexed to match the developing year, using 'by-month' weather and SMD data.

This model will provide insurers with some idea of what Climate Change will deliver in terms of what claims will occur and where.

'MEMORY' OF DESICCATION

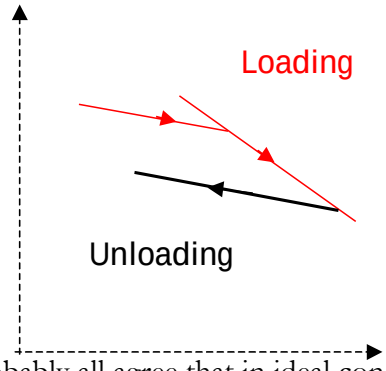
It is very frustrating to receive claims late in the year, possibly associated with root induced desiccation, only to find the tree is out of leaf and knowing from experience that we may have arrived too late to record desiccation using traditional techniques.

The penetrometer may deliver added value in this situation due to the recent stress history.

As we know, soils consolidate when desiccated, and don't fully recover as we see from the graph below.

Clive Bennett from MatLab describes it as follows. *"Root can desiccate soils and when the tree dies or is removed* (or in the winter months) *the soil recovers along the unloading line (a lot flatter than the virgin compression line (approx 1/5)). The soil will then display a bulge in its shear/unconfined compressive strength profile due to the previous existence of the tree but there is no suction present at the time of the test".*

We have growing confidence in the penetrometer test, but it has to be used sensibly – in homogenous London clays with samples free from bands of sand, gravel and so forth. Sands and gravels will produce high readings not associated with desiccation.



We probably all agree that in ideal conditions, the suction test is preferable as a measure of root activity, but it has problems as we have seen in recent studies.

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GEO-SERV
020 82084476

LEVELS –v- INVESTIGATIONS

GeoServ have provided some useful examples of how powerful precise levels can be when diagnosing subsidence.

Tim Freeman, the Managing Director of GeoServ and former head of Foundation Research at the BRE takes the view that sometimes investigations and soil testing can be a waste of effort. He explains *"it is no surprise when looking at a claim in North London to find a property with foundations say 600mm deep or so, bearing onto clay, and finding desiccation in a dry year".*

He regards it as little more than a *'glimpse of the obvious'.*

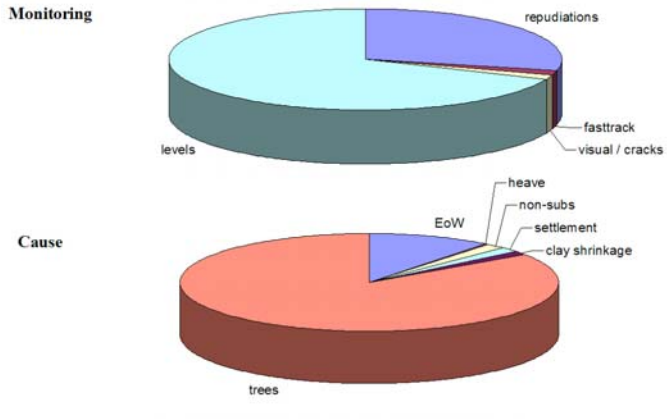
Precise levels tell us if the building is actually moving, and if so, by how much, and where.

It delivers the most compelling evidence and the results are easy for the arborist and homeowner to understand.

Tim delivered a presentation at Aston in 2007 entitled *"An objective framework for dealing with third party trees"*, in which he said…

As can be seen from the pie chart, in about 85% of valid claims the cause was suspected to be tree-related shrinkage in the soil, reflecting the hot summer in 2003 and the prevalence of clay soils in our catchment area. 103 of these claims (49%) involved trees belonging to Local Authorities.

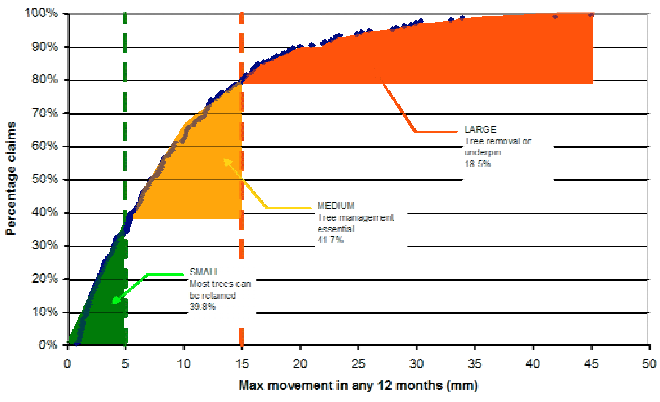
By way of clarification, Tim provides expert witness services and his use of precise levels (top pie chart) reflects the complex nature of his portfolio which has a bias towards North London, although his company, GeoServ, provide a nationwide service.



In an attempt to resolve the sometimes endless exchanges between parties when dealing with Recovery claims Tim has compiled the following graph, outlining his recommendations for handling root induced clay shrinkage claims.

In summary, 40% of claims from his sample record movement less than 5mm over 12 months, suggesting that the tree could be retained. For the next 40% of claims with movement between 5 – 15mm, Tim suggests tree management is essential.

The balance of 20% - those with movement in excess of 15mm - requires either tree removal or underpinning.



This appears to be a good a starting point for discussion as any. If anyone would like further information, please visit the GeoServ web site.

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Next Generation …

We have been working on a proof-of-concept system since the middle of 2009, using the Apple Iphone. It's a 'gather data from site' application with simple selections from a few screenshots and easy data transmission.

The Iphone already has links to the BGS maps allowing users to determine the geology from their location, a location and mapping tool, measuring device plus the ability to view surrounding claims via Google. A very basic spirit level application measures angular distortion and users are able to dictate notes.

In the News …

Fresh concerns have been raised about available water by a large team of researchers led by Martin Jung from the Max Planck Institute in Germany (Nature, 21st October, 2010). The letter suggests that available water from evapotranspiration peaked around 12 years ago, and has been in decline since.

The model suggests that in Australia and Africa increases in temperature have literally drained the land. Trees are sucking moisture from the soil, but rain falls elsewhere. Not the place from which it was taken.

The team have used weather data from around the world, and microwave satellite observations. They conclude that this could be due to either Climate Change or simply natural weather cycles.

Useful links …

Displaying your data on Google Earth has just been made a lot easier thanks to a new web site.

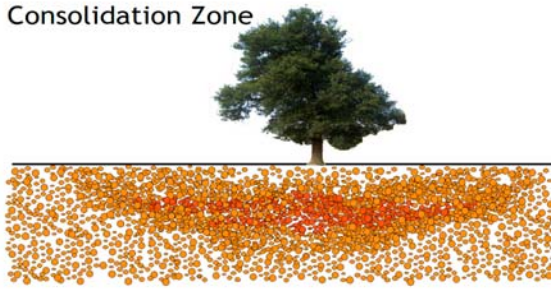
http://www.batchgeo.com/

Enter the postcodes you want to plot in an Excel spreadsheet, and the application delivers a file in KML - Google format for sharing and display. A free, easy to use mini-GIS system that doesn't require specialist knowledge for limited 'where is 'x'" data display.

FILTER PAPER TESTING

It is worth checking that the laboratory is using polythene bags when carrying out the filter paper test. It is easier and faster to avoid this step but there are important considerations that could influence the accuracy of the results.

The relative humidity of the laboratory can easily distort the readings if the filter papers are weighed without the polythene bags.



Although the soils are saturated due to winter recovery, the clay particles will have consolidated and the 'memory of desiccation' could be revealed by the penetrometer, but missed by the suction test.

InFront innovation
ADDRESSOLOGY
Crawford
Aldenham SCHOOL
MAT·LAB
KEELE UNIVERSITY
University of Southampton

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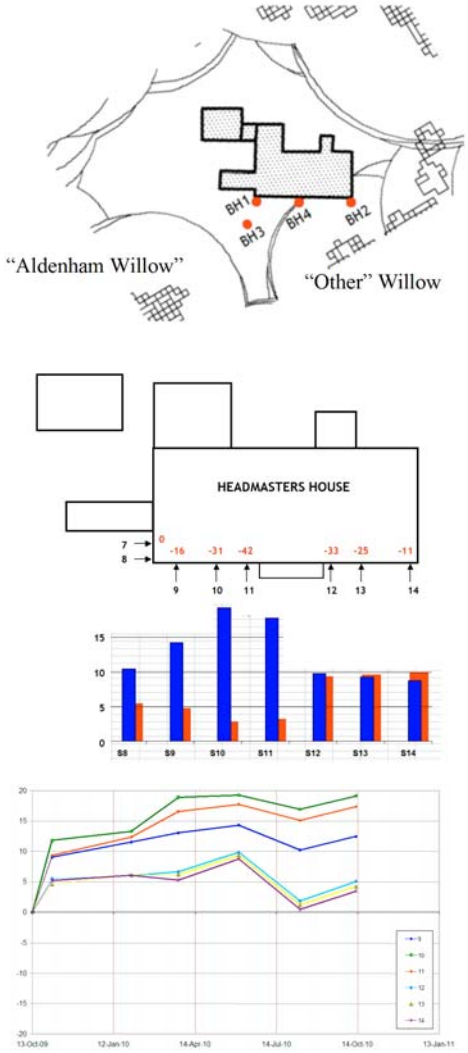
HEADMASTERS HOUSE UPDATE

The latest precise level readings (bottom image) confirm that removal of the shrubs has stabilised the most significant movement along the rear wall of the Headmasters House at Aldenham.

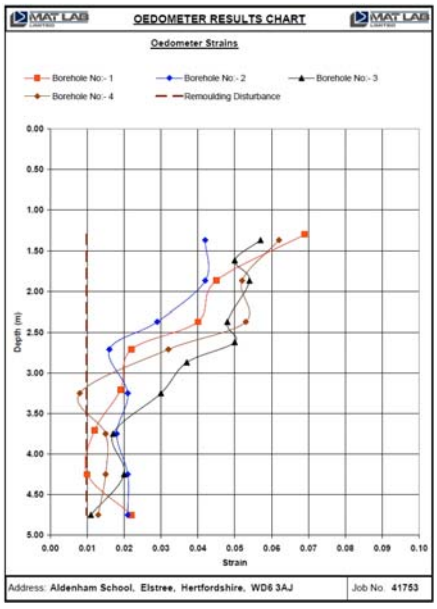


Minor ongoing movement (8mm or so) has been recorded to the rear right hand corner when viewed from the rear garden, which implicates another Willow tree growing nearby.

The interesting points are (a) precise levels have been successful in indicating which items of vegetation were contributing most when there were several trees and shrubs nearby and (b) the amount of movement (42mm) that the Wisteria had caused and (c) the seasonal influence of the Willow which may not, at this stage, have caused any damage.

It appears that the Aldenham Willow has been entirely innocent of any involvement.

In contrast, the boreholes and various soil tests (oedometers shown below) simply indicated the soil was dry in every location. It was impossible to distinguish which of the shrubs and trees were causing most of the damage, or exactly how much movement had already taken place, and what was happening seasonally.



Soil testing confirmed desiccation in all 4 bores, but gave little information about which shrub or tree was implicated. Precise levels were far more useful.