

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



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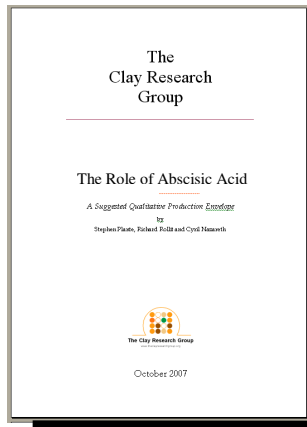
www.theclayresearchgroup.org

October 2007

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CONTENTS

A series of occasional research papers are planned for release over the next twelve months, and the first is available on our web site. It can be accessed using the 'Newsletter' tab > 'ABA - research paper'.



It is entitled "The Role of Abscisic Acid - a suggested qualitative production envelope" and puts forward the view that production is a function of tension in the xylem water column. The objective is to devise an intervention technique based on an understanding of the water uptake mechanism.

"DEAR

A major cause of concern expressed by readers is the suggestion that we claim to model the risk posed by trees - in particular the idea this can be done prior to damage occurring.

To clarify, the risk is probabilistic and might be compared with that presented by smokers to a life insurer. We are told smoking damages your health. Doctors can't always predict which individual will suffer. Some may smoke all of their life and remain in good health. For those that do suffer ill health, it may be regarded as foreseeable.

This is the insurers view of risk. Trees cause damage and it is foreseeable when it happens.

This Edition

We take a brief view of the Disorder Model prior to the release of a detailed paper, preview the new web based applications and look at risk assessment by postcode. Neutron Probe data from Southampton provide an insight into the ground movement profile for the Oak Tree, courtesy of Dr Joel Smethurst.

We plot the postcodes by their geology to sequence the shrink/swell deposits in the UK.

MatLab Limited have supplied the results of the investigations undertaken in the summer of 2007 and we will be publishing a paper shortly, reviewing their findings and comparing them with the 2006 data. This will include comparing disturbed and undisturbed samples for a variety of tests including oedometers, filter paper suction, moisture contents and equivalent moistures.

Opinions and Views

It is worth clarifying the fact that the conclusions and deductions reported in the newsletter are expressly those of the editor unless otherwise stated.

Papers

We now have 18 months worth of data together with results from our field trials assessing the various sensors we have described in earlier editions. We will be producing a series of papers outlining the following topics in detail over the next 6 months ...

Abscisic Acid

A Qualitative Production Envelope.

A Proposed Disorder Model

Numeric Modelling of Random Events.

Site Investigations and Soil Testing

Soil Testing using Disturbed and Undisturbed Sampling Techniques.

Telemetry

Using sensors to monitor building movement and moisture change in soils over time, remotely

Software Applications

Integration with the Claims Process and Benefits

Strategy - Discussion Document

Change. The Business Case.

We would welcome hearing from anyone with an interest in any of the above topics to share their views or contribute. The technical papers outline our findings and have a factual base. As the name suggests, the Strategy Document brings the findings together, outlining a change to our business process for discussion.

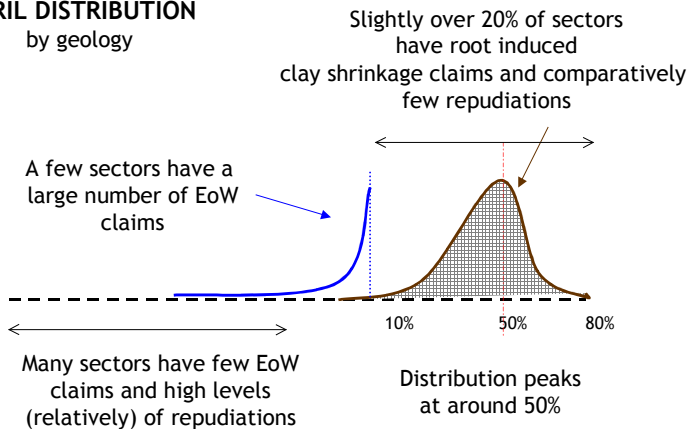
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Peril Distribution by Postcode

In an earlier newsletter we illustrated the peril distribution by postcode in relation to the geology. Below is a simplified and diagrammatic extract.

The 'x' axis plots the postcode sectors, ranked in order of (a) soil Plasticity Index followed by (b) claim count.

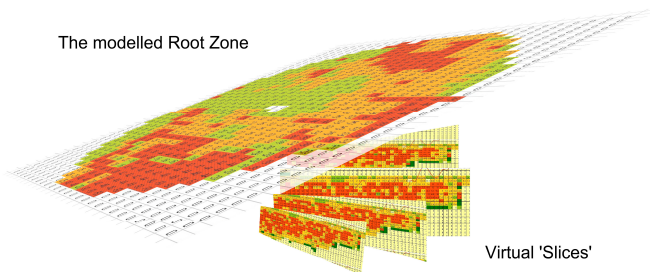
PERIL DISTRIBUTION by geology



We see a high concentration of escape of water claims (EoW) in relatively few sectors (blue line). The clay shrinkage claims (brown, shaded plot) are spread over 20% or so of the sectors, and the distribution curve peaks at an Index property of around 50% which we might expect given the number of houses on London clay.

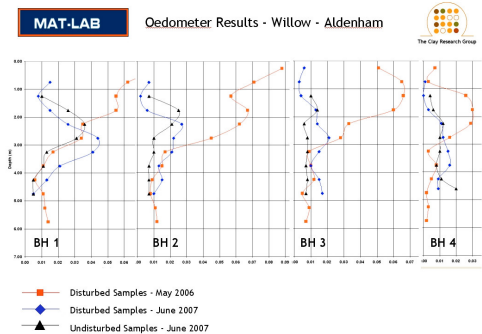
3D Root Zone

We may have exaggerated when we said we have a 3D root zone. We can plot the data on plan, and produce sections, but we don't have an application that can merge them into a visual representation.



Of course, if any one has these skills and feels compelled to work for nothing it would be good to hear from them. It probably doesn't add much to the model - in fact we are sure it doesn't - but just imagine.

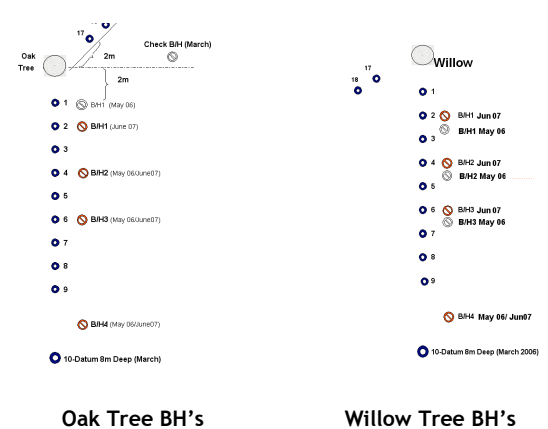
Site Investigations



Site investigations were undertaken in May 2006 and again in July 2007. MatLab Limited have funded the work in its entirety, arranging for both disturbed and undisturbed samples to be extracted and tested using a variety of techniques.

We have four boreholes from each of the two sites (Willow and Oak), and the samples have been tested using the oedometer, filter paper suction technique and gravimetric moisture contents as well as the Plasticity Indices.

The borehole locations are shown below.



The output is substantial, running to nearly 100 pages.

Unfortunately the presence of gravel and silt beds in the vicinity of the Oak where boreholes were sunk have confounded the research on this site. Many of the bores have had to be discarded. Gravels were initially struck in the datum (Station 10) and in the hole sunk for Neutron probe 3.

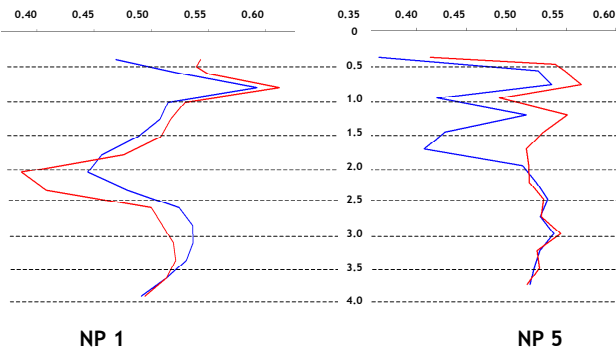
The Willow site has produced some useful data and the results will be published shortly.

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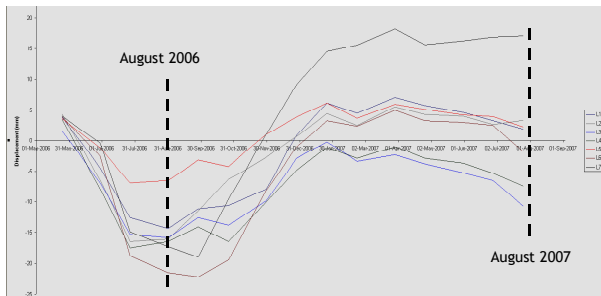
Neutron Probe Data

Below we see comparisons between the data from August 2006 (blue line) and August 2007 (red line).

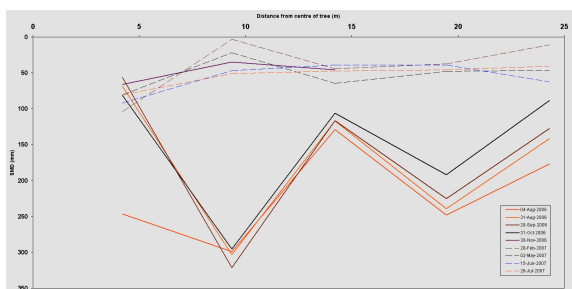
The persistent deficit beneath the tree canopy (NP1) seems to have increased at 2mtrs bGL, whereas the ground has become wetter at the root periphery (NP5).



This wetting-up in NP5 coincides with an increase in the levels when comparing the same period as we see below.



Finally, Joel Smethurst has calculated the SMD values using data from the neutron probe and we see the difference between 2006 (solid lines - bottom) and 2007 (broken lines - top). These tie in with both the modelled values we have seen earlier and the results of the soils analysis.

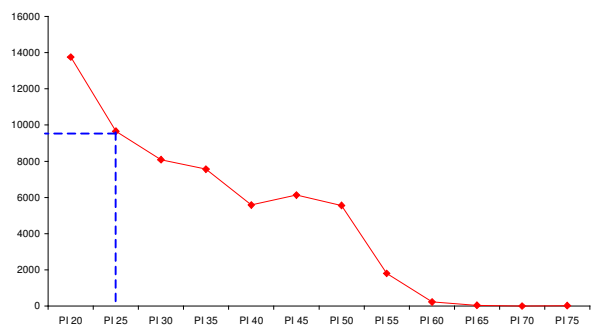


Postcode Geology

An extract of the shrink/swell values for every unit postcode in the UK is plotted below. HA5 5SN has a probable PI of 48%, and the neighbours at HA5 5SA, maybe 50%.

The Plasticity Index is plotted along the 'x' axis and the number of full unit postcodes (that is, "HA5 5SN") - appear along the y axis.

There are 9650 unit postcodes with a PI of 25%, but only 224 with a PI of 60% in this sample.

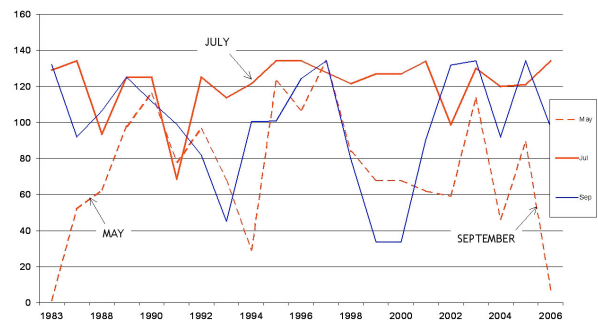


CLIMATE & EVENTS YEARS

Understanding the energy requirement to mobilise trees sufficient to cause ground movement of an order that will cause damage to buildings requires a certain combination of events.

Below we see how different months each play a role. May drives the climate cycle, starting early in the year when the tree comes into leaf. July and not September is the level for high SMD values, and we see them dropping off fairly quickly in late summer.

Climate in Relation to Event Years

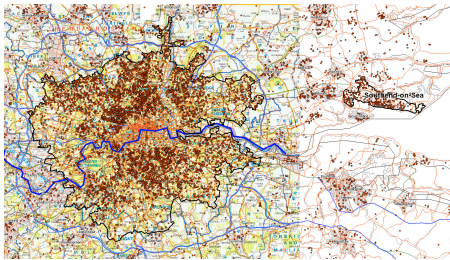


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Frequency

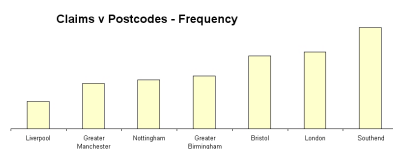
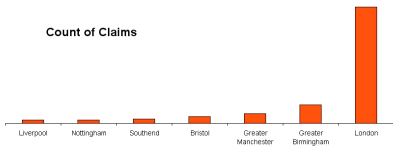
We have touched on risk expressed as frequency of claims against unit postcodes and we can see exactly how difficult it is to get an absolute value for any of the problems we are researching.

Counting claims against population would be nonsensical, and making comparisons with count of buildings isn't as easy as it might first appear when we understand the distortion in the fact we are looking only at domestic subsidence claims.



Not all properties are insured in the domestic market and Local Authorities sometimes have their own self-insuring schemes.

However, taking a broad brush approach we can see how frequency changes our view of the UK in terms of risk. London has far more claims than anywhere else - by a long way - but it isn't necessarily the riskiest of the cities as we see below.

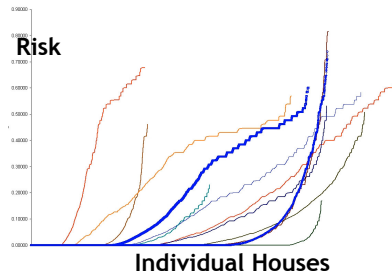


Is Southend-on-Sea a higher risk, or Bristol maybe?

Possibly although we suspect the postcode allocation method may have something to do with it. Flats sharing a postcode etc., in high density urban areas is yet another factor to build in.

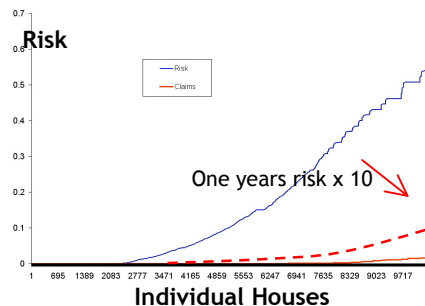
Risk Characterisation

Our work with Addressology involves sequencing risk and although we have published the output before, it is worth re-visiting.



Above we see the sequenced risk for a series of postcodes within the M25 to understand their relative standing. 'Risk free' would be a flat line running along the 'x' axis.

A high-risk postcode would be a vertical line, running along the 'y' axis. As we would expect, each of the sectors lies somewhere between them, but we can see their relative standing, which is useful for underwriters.



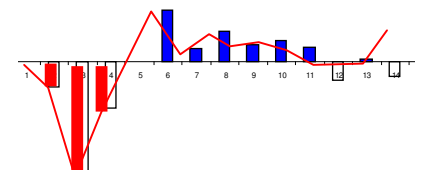
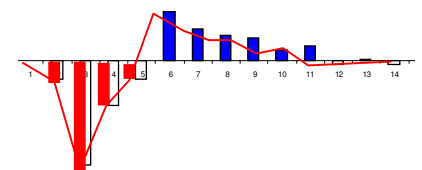
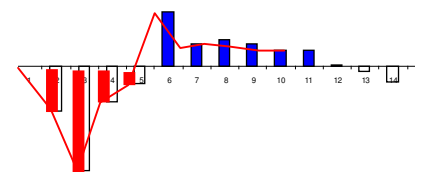
If we take any one of the profiles, we can see the claims (red line) in relation to the risk (blue line) and this is based on claim notifications.

As the risk graphs are modelled based on relationships between soils, climate and trees, the red line (claim notifications) is unlikely to mirror it exactly, and will take an irregular form, but the relationship - the correlation - will be better than 0.7 if the model is robust.

The red broken line - "one years risk x 10" gives the picture over time. The risk remains provided the soil doesn't change, and whilst the tree is in place. Subsidence isn't a 'moment in time' event.

Moisture Uptake ~ Willow ~

Commencing in May 2006 with a reading every month up to and including July 2007 we see the possible moisture uptake at the periphery of the root zone for the Willow tree - Stations 23, 24 and 25.



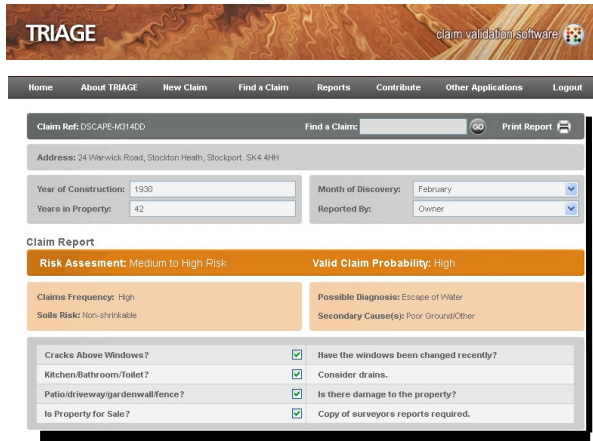
The red bars are indicative of a moisture deficit due to extraction by roots whereas the blue bars suggest a moisture surplus - rainfall exceeding uptake.

Maximum deficits occur in July and turn into a surplus by September.

The limiting value in determining the moisture balance is the soils shrink/swell potential. Clearly the winter months will be wetter but the soil will only swell to field capacity.

For this reason, these graphs are not a measure of rainfall, but illustrate the balance between tree moisture uptake and soil water retention. Once the soil is at field capacity, the 'change by month' values remains as a zero balance.

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The web based applications have had a face-lift. Users can print off reports, store them for retrieval and contribute if they want to.

Triage returns the frequency of claims in the postcode, as well as a probability of whether the claim will be valid or repudiated, the shrink/swell properties of the soil together with the likely peril and a possible secondary operating cause. The assessment takes account of the age of the property, the month of notification as well as prompting certain questions depending on the input data.

Triage is topical and particularly following 2007. Allocation of resource, understanding the technical skill levels required to handle the likely problem, investigations that might be required for a clay shrinkage claim and how the approach might differ for a sulphate claim are all taken into account.

Below we see the new look of the Soils Interpreter and DataREADER.



CRG PRESENTATIONS

John Parvin has kindly invited the CRG to present to CILA at their Special Interest Group Conference at Aston this year.



We will be outlining the various projects and explaining our objectives to the attendees on the 30th October, 2007 at Aston University.

It is a three day conference, commencing on the 29th October and our talk will commence at around 10.00am. Contact CILA for further details.

TECHNICAL REVIEW MEETING

Several members have requested an opportunity to scrutinise the work of the CRG and understand its structure and objectives.

The Subsidence Forum have kindly offered space at the Building Research Establishment following their own meeting on the 4th December 2007.

The agenda covers the individual research topics with technical discussions around each. We should convene just after lunch - following the main event of the day. Download from the CRG website on www.theclayresearchgroup.org > 'Technical Review Agenda'

Valid -v- Repudiated

The red line is the count of valid claims by postcode sector, the grey line is the total number of claims and the blue line represents repudiations. In the sectors below we have mainly valid claims.

