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

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CONTENTS

Our thanks to everyone who supplied data for the Sidcup Road study. Details inside. The distribution of claims along this particular road provides a snapshot into both past claims and future risks, as many houses have trees nearby of similar proportions and species.

OCA have supplied an analysis of the risk presented in SE postcodes in terms of the frequency of notifications. Our risk database places SE9 at 16,055 of 1,752,000 records. In the top 10%.

In next months edition Tony Boobier, Insurance Leader EMEA, Business Analytics at IBM provides an overview of where this work sits in the wider context of Business Intelligence.

InterTeQ

The Intervention Technique has now been applied at sites in Worcester Park, Finsbury, Kenilworth (Mercia Mudstone, right), Islington, Golders Green, Essex, Enfield, Dulwich and Northampton. Monitoring is ongoing.

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This Edition

An exceptionally busy month with some projects reaching completion and others commencing. Richard Rollit and Allan Tew met Dr Ian Jefferson of Birmingham University and John Peterson of Foundation Piling to discuss electrokinesis.

Birmingham have a PhD student willing to undertake the required site and laboratory work as part of his original research.

THE UNIVERSITY OF BIRMINGHAM

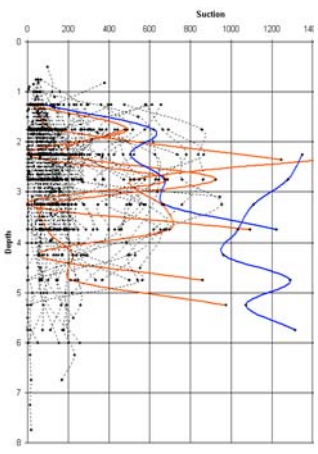
Foundation Piling Ltd

Funding comes from a variety of sources. In addition to the usual grant funding, contributions are being made by John Peterson who is generously topping up any shortfall.

In addition members of the CRG and their clients will be providing a supplement to meet the cost of site trials as required.

The objective is to develop a relatively cheap solution to domestic subsidence that can be installed as a "see and fix" repair, allowing us to retain the tree if possible.

Filter Paper Test Update



MatLab report a significant improvement in the quality of the filter paper soil suction results since calibrating each batch of filter papers, and are now detecting anomalies prior to issue – see left. The sample consisted of just under 200 tests.

The black, dotted lines represent what appear to be 'sensible' results. The odd anomalies are coloured red and blue.

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

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SE – Sidcup Road

~ a joined up project ~

The street scene is characterised by larger style traditional semi-detached houses with Plane trees of similar height, age and distance from the buildings.

At first sight, not a particularly risky area. The trees are around 10mtrs high, and 10mtrs from the houses. They have a fairly open canopy and appear to be relatively young.

And yet, statistically at least, and based on proportions only (not accounting for species), they are probably a higher than average risk. Younger trees, 10 – 12mtrs high, 8mtrs from a building are involved with more cases of subsidence than any other.

Cyril Nazareth of the CRG identified that two neighbouring houses had been damaged, and following investigations (see following page) the cause was proven to be root induced clay shrinkage.

The road offers an interesting opportunity to see why some trees (of similar species, age, height and distance) cause damage, whilst others don't.

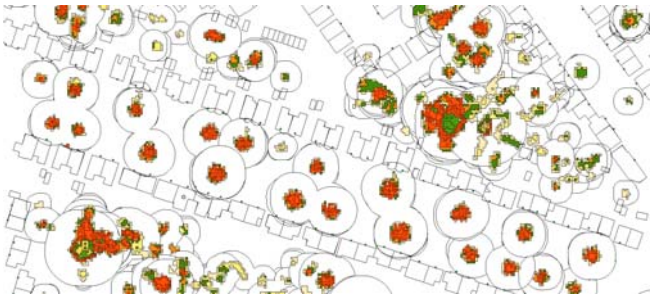
More importantly, they provide an opportunity – over a longer term – to assess which treatments offer most hope.

How can we retain the tree and repair the building, safely and quickly?

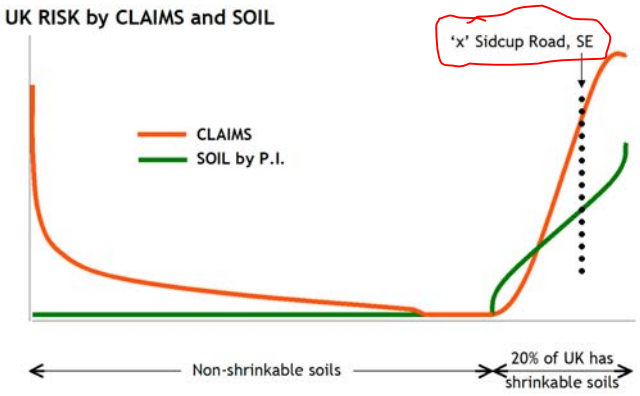
The LiDAR image below reveals the fairly regular physical relationship between the trees and houses along the road.

The periphery of the modelled root zone (the area described by ground movement sufficient to cause movement to a domestic building, rather than any idea this is the extent of the actual root zone) just 'touches' the front house wall.

On the face of it, there appears to be nothing to choose between them. Are they all at risk? Is it just a matter of time?



The relationship reinforces our previous studies describing a danger zone. These trees appear to present a greater risk than others whose roots extend across the entire building footprint.



How does this fit into the UK Risk Model? We have plotted a notional location of a property in Sidcup Road on the national scale, taking account of claims and soil shrink/swell potentials.

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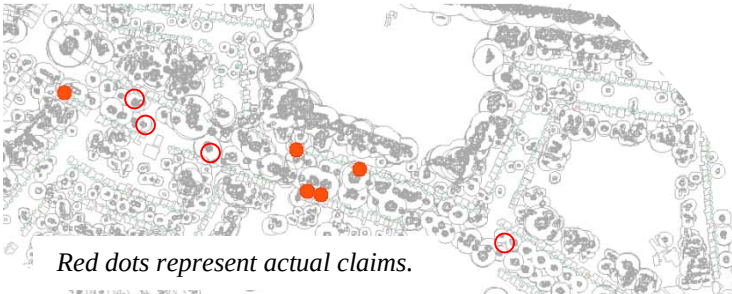
SIDCUP ROAD, SE9

Industry colleagues were approached to see if they would be willing to share their data with us to plot the location of claims.

All but a few replied with actual addresses of claims that had been notified over a five year period. These are plotted below to show the general distribution.

On the basis of the number that replied, and the fact that the one that did not deals with one of the larger insurers, we can probably assume that there are at least another 5 or so claims in this section of road.



Red dots represent actual claims.

11 claims were reported from a sample of around 296 addresses. Of these, some are commercial properties.

The 11 claims represent 3.7% of the whole sample – including domestic and commercial addresses and houses with or without trees in influencing distance.

If we exclude properties with no vegetation nearby (we counted 89 properties in this category) – that is, making the sample representative of the risk - the number of houses damaged rises to 5.3%. Taking account of commercial properties and including unreported claims doubles this figure to around 10%.

The study was also directed towards understanding whether concreting the front garden increases or decreases the risk of subsidence.

Ian Brett-Pitt and James Sloan from Innovation carried out a walk-over survey, classifying gardens as pervious (lawned), semi-pervious (block or crazy paving) or impervious (concrete finish).

Clearly it is not possible to definitively classify water flow and run-off etc., but the evidence appears to suggest that a lawned garden doesn't provide any protection.

In fact, a pervious garden provides an ideal environment for root activity, and the idea that concreting in any way increased the risk was not supported.

The difference appears to reflect the dynamic nature of the problem. Where drives have been concreted over, any remaining water is 'bound', its abstraction causes movement very quickly even though the environment is hostile.

This is in contrast (but with similar effect) to roots attracted to a moist environment (lawned frontages) that can abstract 'free' water rapidly before tackling the bound water. The end result is the same – or so it appears.

Open red circles represent the likely proportion of 'missing' claims and have been placed arbitrarily where there are domestic properties.

Our thanks to all of our colleagues who supplied data.

Two damaged houses, both with lawned front gardens.

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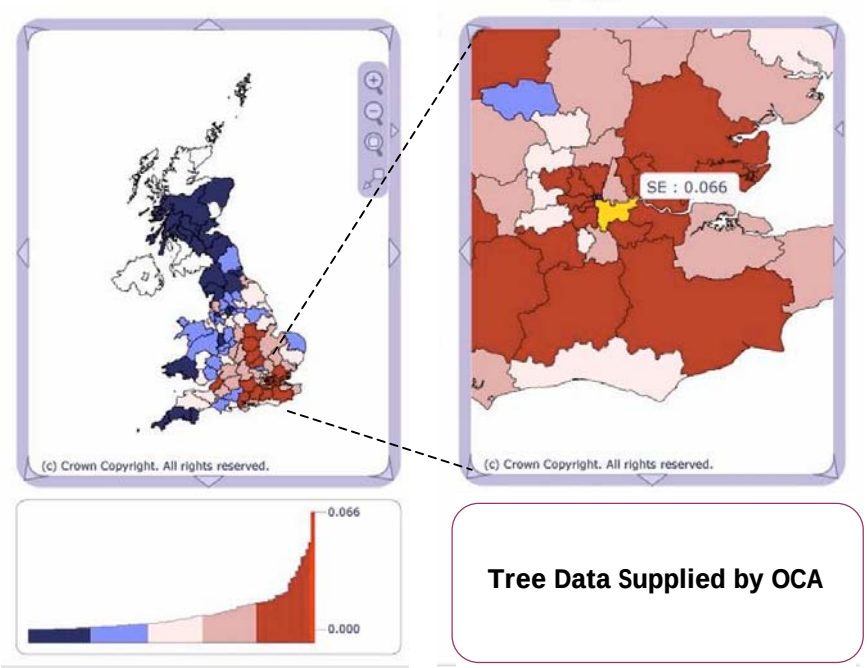
SE Risk by Tree

Michael Lawson from OCA has kindly provided the following maps and graphs plotting a sample of over 28,000 tree related claims and expressed as a % of the annual total, by postcode.

"SE" produces the highest number, as we see below. Coincidentally, this is the location of the Sidcup Road Study.

The distribution describes the clay belt covering the Midlands and the South East.



Tree Data Supplied by OCA

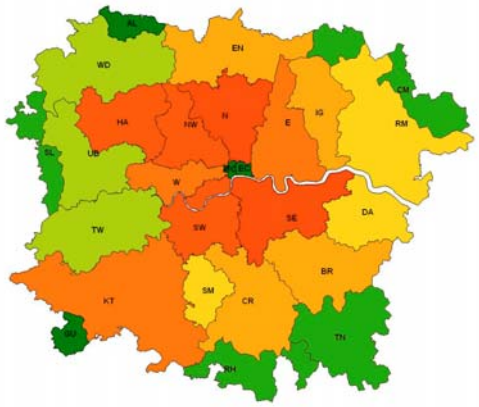
The graphs illustrate the risk clearly (by count – not frequency) with a lot of sectors presenting a fairly moderate risk, and a few accounting for most of our claims experience, even when taking frequency into account.

Michael acknowledges that this won't be a surprise to any professional in our industry, but it does reinforce the message that trees are a problem on clay soils, and the location of that risk. This sort of objective analysis is an essential tool to subsidence practitioners.

Our thanks to OCA for releasing this data and allowing its publication.

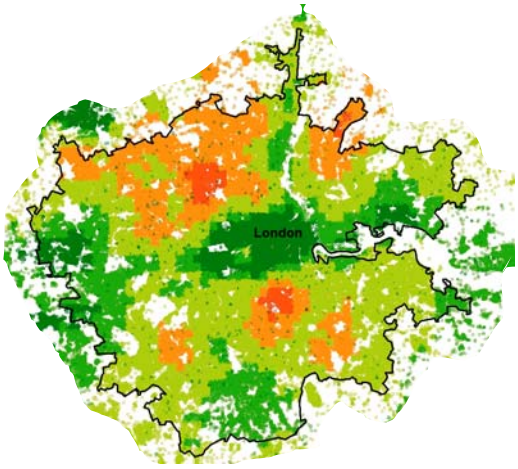
SE Claims

The SE postcode also has a high claims frequency as can be seen from the area plot below.



Is it worth the effort? Yes. There are many houses with identical circumstances and understanding the trigger (assuming there is one), or what to do if there is not, is key to much of our work.

If it is simply 'a matter of time' a quick and economic solution that allows us to retain the tree benefits us all.



The CRG "Claims by Postcode" Map

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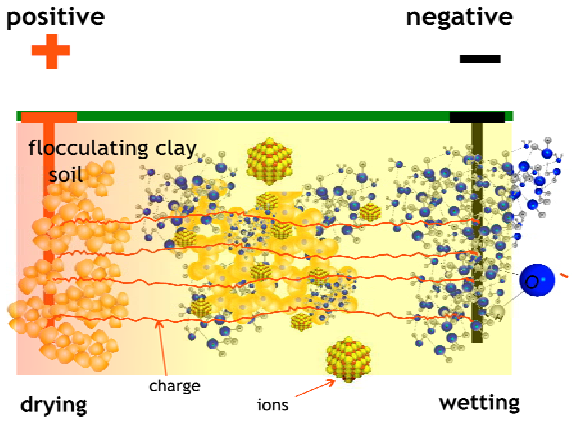
ELECTROKINESIS

Richard Rollit and Allan Tew met Birmingham University academics and John Peterson from Foundation Piling to discuss the electrokinesis project.

The proposal involves cation exchange using a modification of a well-established technique that has been in use for de-watering for probably 60 years or so. The approach involves moving water from one location to another, and flocculating the area from which the water was removed to render it stable – and possibly hostile to root activity.

An electrical charge is passed through the soil between two nodes drawing ions from one pole to the other. The ions effectively 'drag' the negative pole of the water molecule to the new location.



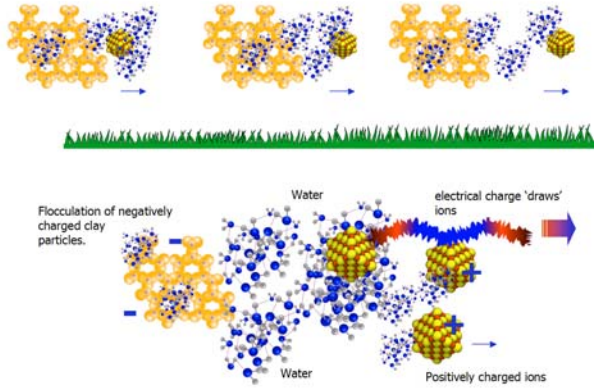
The change is permanent and leads to a reduction in hydraulic conductivity at the positive node. The end-game is to retain the tree, but reduce ground activity beneath the building.

The proposal would stabilise the soil by the building, leaving sufficient moisture on the 'tree side' to satisfy demand.

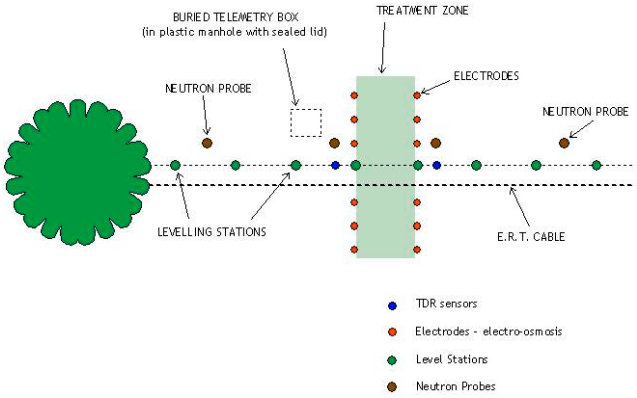
If this process stresses the roots locally, resulting in an increase in ABA production, then so much the better.

Timetable

The current approach will be (a) confirmation of funding for our PhD student, (b) laboratory testing to understand the reaction in a control environment, (c) with the permission of Aldenham School, undertake field trials at the site of the Willow and if successful, (d) identify around 6 actual claims involving root induced clay shrinkage to determine its efficacy.



Assuming the laboratory work is successful (i.e. the treatment doesn't result in greater shrinkage than occurs due to root activity) applying this at the treatment zone of the Willow (see below) and comparing pre- and post-treatment ground movement profiles should yield some useful data.



We will be working with arboricultural colleagues to assess the environmental issues of the treatment. Although NaCl is toxic, the fact the ions are bound to the clay (i.e. not free to be absorbed by roots) may overcome any concerns.

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Triage

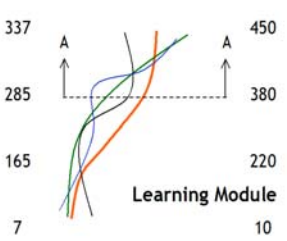
A Beta version of the updated Triage application which takes account of uncertainty using Bayesian and Heuristic analysis has just been handed over to one of our members.

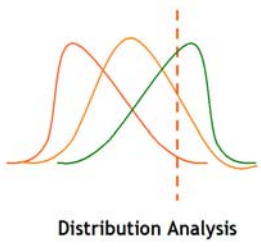
Triage – handling a claim at the point of the initial call and 'putting it on course' for an appropriate process - isn't a precise science, and the application resolves this using statistical techniques.

Conditional probabilities take account of the various permutations of soil, climate and historic experience. For example, whilst around 40% of claims might be valid in the winter months, that might change to say 70% in the summer, but all depending on the soil type, climate and history.

The degree of certainty in correctly assessing the probability increases in a hot, dry year on a clay soil for example and reduces in the winter.

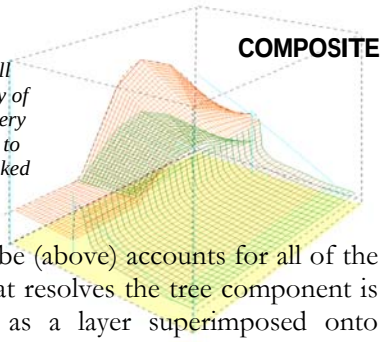
Further layers of uncertainty lie in how the operator handles the call and the description of damage by the homeowner. Small cracks can appear to be evidence of major structural distress to a nervous policyholder.





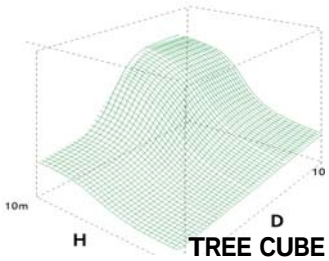
The application also has intelligence. It adjusts to learn from its experience and, as far as we are aware, is an industry first. By constantly reviewing closed claims, the system will modify its decision-making 'on the fly'.

The composite cube accounts for all permutations to deliver a 'probability of valid claim' and 'likely peril' from very limited data. It also drives scripting to ensure only relevant questions are asked at the time of claim notification.



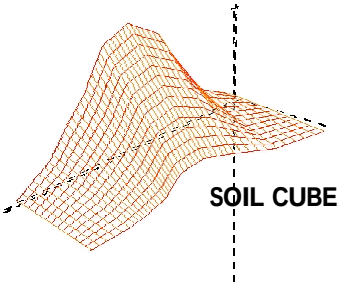
The combined probability cube (above) accounts for all of the elements, and the portion that resolves the tree component is shown below, left. It acts as a layer superimposed onto postcodes with a shrink/swell potential, amplifying the signal, but only at a certain time of year.

The geological element of the probability cube is shown below, right, representing the postcodes on a shrinkable soil that are influenced by seasonal activity.

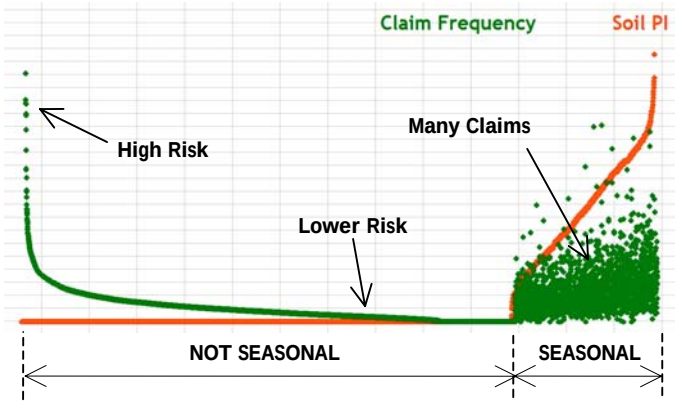


Elements of the cube above, accounting for vegetation and soil. The cubes account for location, risk but more importantly the dynamic nature of the combination seasonally.

Right, clay soils only pose a risk in the summer months, and that risk varies with the soil PI but is amplified by vegetation, which contains a sub-set of risks. "How tall is the tree, how far away, and of what species".



Each layer has a weighting, and some contribute to risk than others. We can see that claims experience amplifies an underlying risk, if one exists, and suppresses it in the alternative.



The cubes illustrates the three-dimensional nature of the problem and above we show our 'risk signature' of the UK with a value attributed to every single postcode.