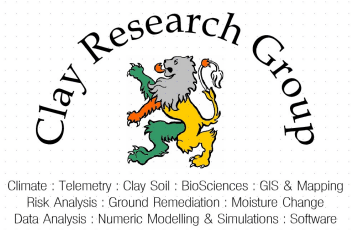
The
Clay Research Group

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



August 2015

Edition 123

The Clay Research Group

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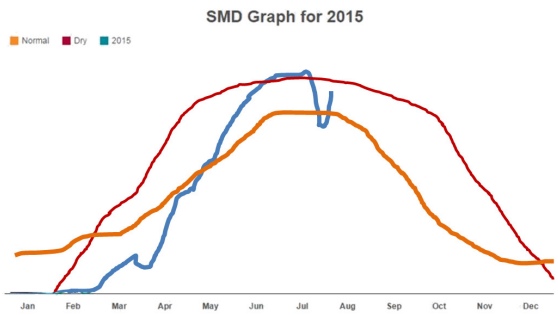


SMD Data supplied by the Met Office. Current position shown by blue line.

Big Data

Subsidence is data rich. We measure soils by their index properties. Trees and shrubs are identified by species, height and distance from damaged buildings. We record the age of the property, time of year the damage was noticed and access to weather data.

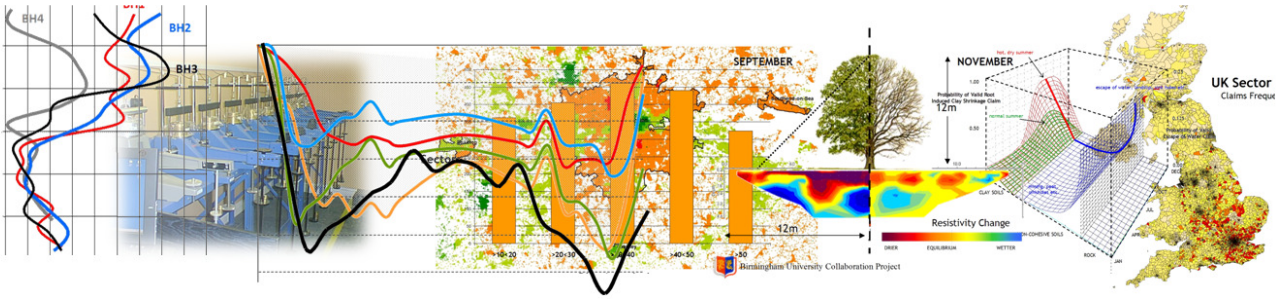
But where is it and how do we use it? Locked away in claims handling systems, usually not available in any useful form. Exchanges by E-mail and pdf files often add to the mystery, rather than resolve it. Dates, soil suction graphs, PI values and so forth have to be searched for, extracted and data re-entered manually. Pdf files, Word documents and Excel spreadsheets contain the answer. If we know where to look.

Over the next few months we take a look at our work in the field of building intelligent systems that learn as they go.

SMD UPDATE

The SMD for grass cover and medium AWAC soil for tile 161 revealed a late but significant deficit with a sharp incline, peaking in July with a maximum value of 134mm before declining (rehydrating) sharply over recent weeks before drying again.

Our prediction is that there is a medium probability of an event year based on the wider climate variations over recent years and the likelihood of intermittent showers.



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Big Data and Systems

Mario Greco, boss of the Italian insurer Generali, put it unequivocally when he forecast that insurers will disappear as a result of not keeping pace with the technical revolution.

He is quoted as saying "this is an industry that has been lagging behind every other industry - it has been paralysed".

As a result, Generali have committed to spend over £1bn to ensure they stay ahead of the technology game.

So, where are we as a small part of that industry? Subsidence is an engineering peril rich in data and numbers. We spend time and money gathering facts and figures. We are dealing with the buildings response to soil hydraulics in the main.

Too much water (leaking drains, landslips and sink holes) or too little (vegetation).

One might imagine that as a result, we would have numerous codified systems handling moderately complex algorithms to deliver solutions.

In fact, we do not. Claim handling systems and pdf files may be digital, but they aren't intelligent. Next month's edition looks at how Big Data and analytics may develop in the sphere of domestic subsidence claims handling.

Knowledge Based and Expert Systems, Artificial Intelligence, Rev. Bayes, Neural Networks etc., all seek to codify our expert knowledge to deliver an improved service quicker and usually at less cost than the alternative and traditional approaches. Most engineers will have encountered them elsewhere prior to dealing with subsidence claims.

Where will the intelligence come from? The system will learn as it goes, but with a head start using industry data as its memory.

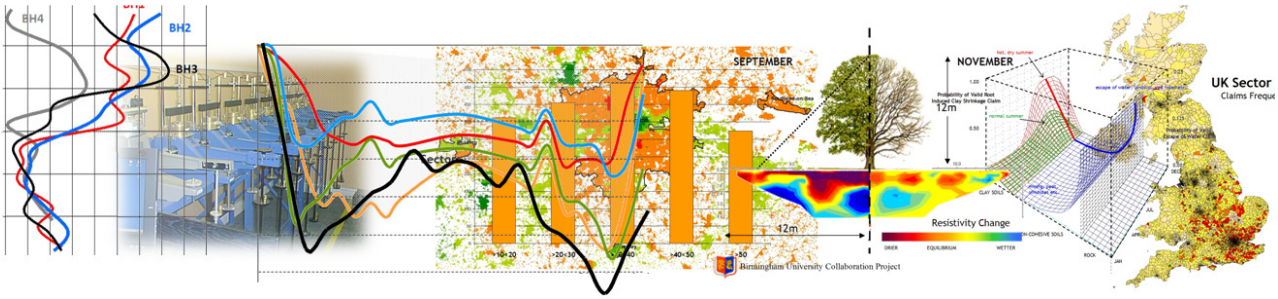
But where are the systems that analyse the data and how do we use the output in relation to subsidence? Where are the models?

What does a valid claim looks like? Once we have a template, new claims can be 'pattern matched' to aid diagnosis. That 'memory' becomes the knowledge that learns as it goes, accounting for changing times.

In short, the system has to be flexible and learn as it develops - in the same way as any professional. The handling of subsidence claims is lagging behind other fields of engineering.

In tandem, the Financial Conduct Authority has an eye on widening the ways in which homeowners and insurers interact, so an upgrade making use of systems and knowledge may be timely.

There is little exciting or novel about 80% of the claims we handle.



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Telematics – Hurdles to Implementation

Telematics has many attractions. It reduces the number of visits for some operations (for example, monitoring) and can deliver data as often as is required from remote locations. Another advantage is the fact the information is digital and can drive some parts of the claim operation by including interpretative modules and alerts. However, there are problems that have to be overcome before it will be adopted for domestic subsidence. This will be a topic in next month's edition, but in the meantime some extracts from the press relating to practical issues faced by current users.

Digital Highways

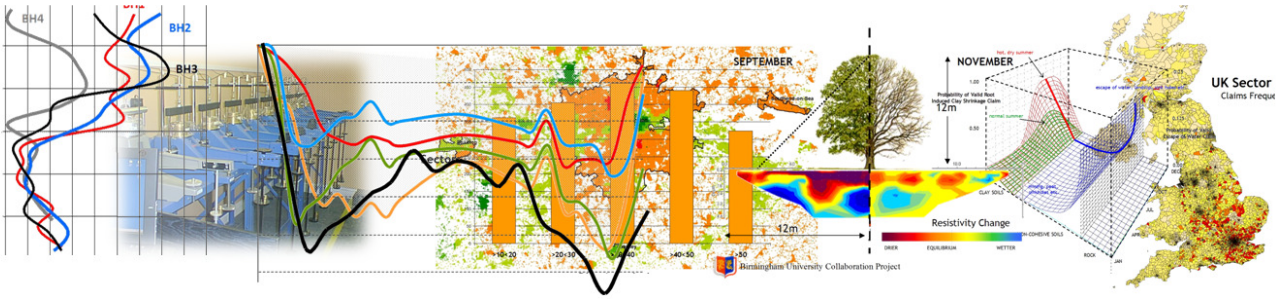
When Typhoon Haiyan hit the Philippines on 8 November 2013, in excess of 1,600 people made 4.5 million entries onto the web site, OpenStreetMap. Although this was really useful in terms of location intelligence, apparently the damage assessments were poor. Not a man to mince his words, Dale Kunce, a geospatial engineer at the American Red Cross said, "The results were terrible".

Crowd-sourced data is a growing tool for mapping and location services, although perhaps further work is needed to refine the interface to regulate data entry for some applications.

Skype your Doctor

We are just learning to maximise the advantages of the digital revolution and there are bound to be some hiccups on the way. Apparently the 'Skype your Doctor' service has been overwhelmed by callers.

The rate of people converting to patients has increased as the barriers to making an appointment, calling to the surgery, waiting for however long it takes and then sitting face-to-face with the doctor have been removed. Feeling just a little out of sorts? The ease of E-mailing the physician and pressing the Skype button is leaving doctors unable to cope with demand. The value of crowd-sourcing for location intelligence is really useful, but interpretation is more difficult. Easing routes to market presents a different challenge.



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Normal years, event years. What's the difference?

If the UK had no outcropping clay soil, insurers would receive around (this section includes many references to 'around', 'possibly', 'on average') 25 - 25,000 claims a year, the majority of which might be repudiated.

This is the day to day business of insurance.

The villain of the piece in terms of geology at least and responsible for the employment of many engineers, adjusters, surveyors, claims handling staff, site investigation crews, laboratory technicians, arboriculturalists, tree surgeons, geotechnicians, building contractors, monitoring technicians, software developers and lawyers is, in the main, clay soil.

Taking an average year (and bearing in mind the problems we have with averages) without clay we might receive around 2,000 claims a month, give or take. That would be 24,000 claims a year. Nothing too exciting.

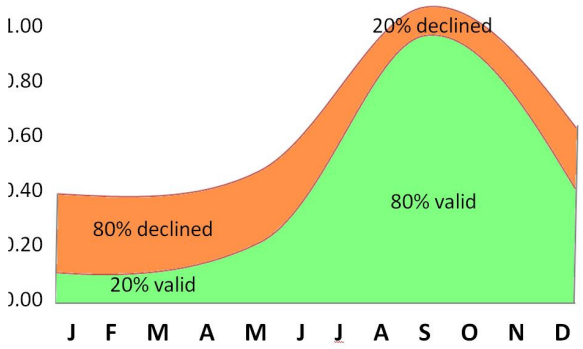
Clay soils deliver a significant and sudden increase over a short period of time. In event years the figure of 2,000 claims a month can leap to around 8 - 10,000 a month in the summer. An increase of x 4 or 5.

2,000 claims for say eight months and 8,000 for four months = 16,000 + 32,000 = 48,000. Still a little short of the 55,000 claims recorded in 2003.

But that's not the only issue. Claims on clay soils are far more likely to be valid. Whereas only 20% or so of claims are valid on 'other' soils in the winter months, that figure increases to 80% on clay, in the summer.

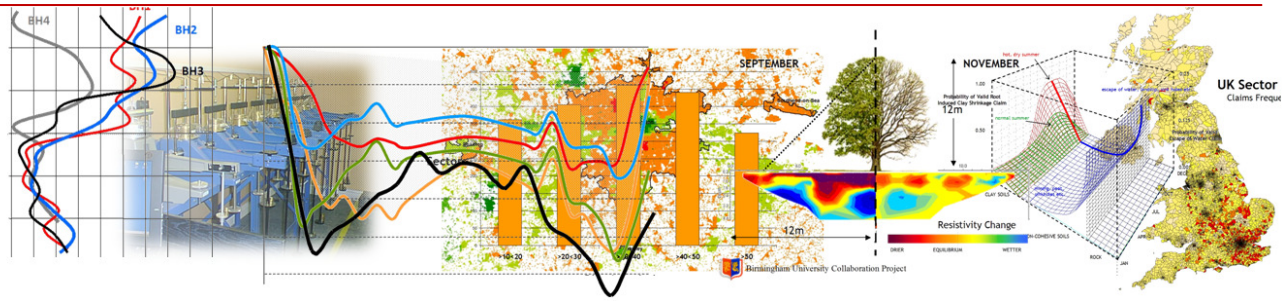
In a wet winter delivering 2,000 claims in a month, only 400 of those might be valid. In an event year, August alone could easily deliver 6 - 7,000 valid claims.

In the absence of vegetation, clay isn't unduly troublesome. It is the localised movement caused by roots from vegetation that can produce differential movement resulting in damage to buildings.



The relative distribution between valid and declined claims in a normal year. In the winter, the great proportion are associated with leaking drains etc., and in the summer, around 70% of valid claims are related to root induced clay shrinkage.

The graph above illustrates the distribution between valid and repudiations over time. The large, green area represents valid claims, the majority of which, in the summer months, will be attributable to clay soil.



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Repudiations throughout the year are interesting in their consistency. The 80% declinatures in the quieter months amount to 1,600 in number. The valid claims in this period (the balance of 20%) are predominantly associated with too much water - leaking drains, landslips and sink holes etc. Escape of water claim numbers remain fairly steady throughout the year.

In the summer and using 8,000 as our total claim numbers for the busy months, repudiations reduce from 80% to 20% but still account for 1,600 claims - the same number as the quieter months, although the starting figures for both periods are of course variable. In short, repudiations remain fairly constant throughout the year - they only vary when expressed as a percentage of a fluctuating total.

In the summer months and assuming 20% of valid claims relate to escape of water and 20% are repudiations, then the balance of valid claims would be 60% of the total, most of which will be related to clay shrinkage. This agrees broadly with the industry quoted figure of 70% - variable by year and climate and increasing at times of surge.

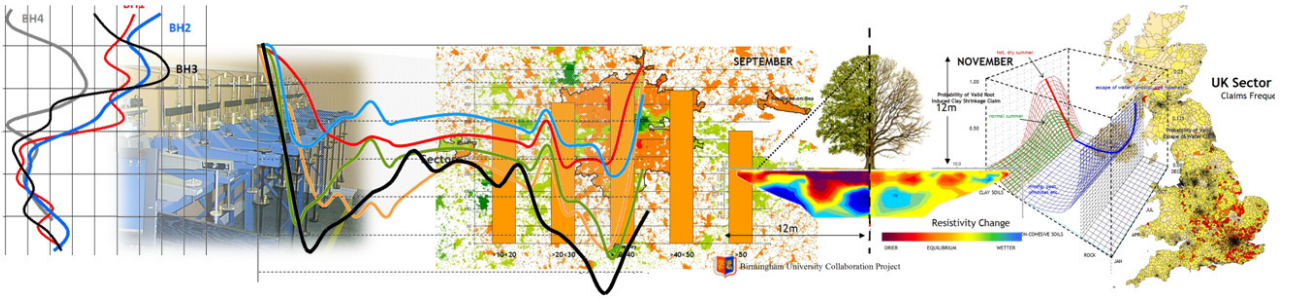
A Vacuum with a Difference

Our thanks for the following report from a colleague who came across a culvert that had been filled with roadstone resulting in a blockage.

What better solution than to hire an industrial vacuum truck (see picture below) to clear the pipe?

Apparently, the vacuum is so powerful the retrieved stones hit the inside wall of the container at speeds of 100mph.

The blockage was cleared fairly quickly leaving only minor repairs being required to the culvert and property.



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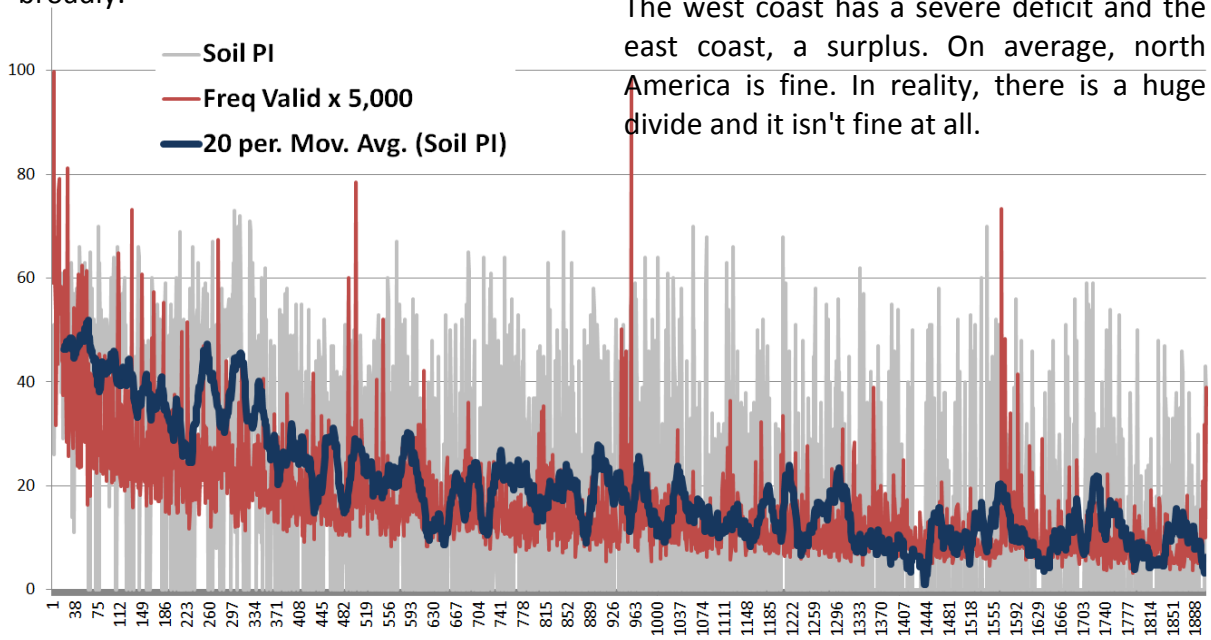
Soils, Claims and Correlations

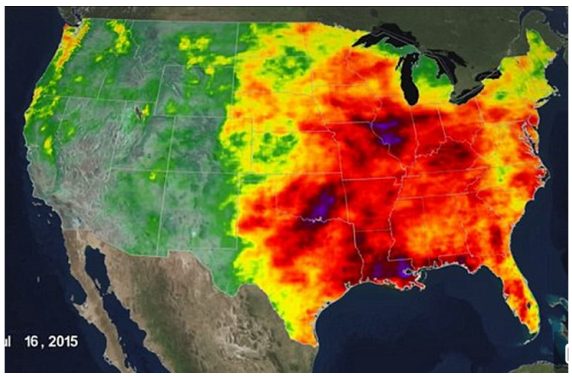
Below, a plot of claims and the PI for the 1,893 postcode sectors for which we have data. The claim frequency values have been multiplied by a factor of 5,000 to align the two plots.

The grey line represents the soil PI, the red line the frequency of valid claims (x 5,000) and the blue line plots the moving average of the soil PI at 20 period intervals.

Although there is a wide spread of index properties, the general trends align and reinforce the findings that soils with a higher plasticity index are riskier - broadly.

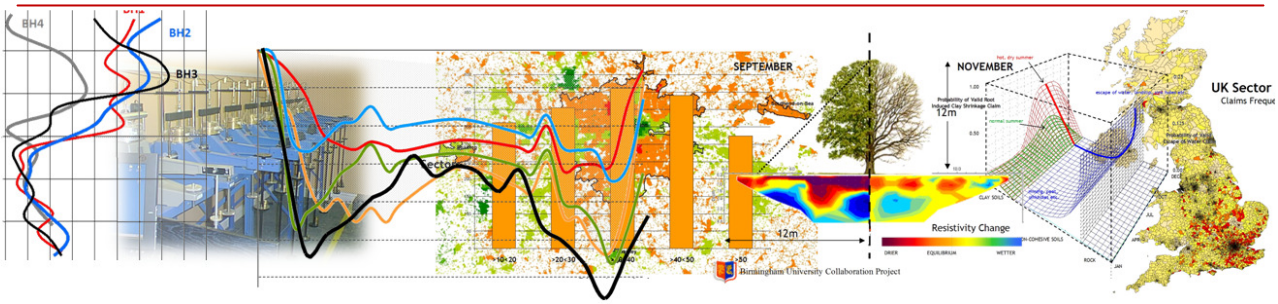


My head is in the oven, my feet are in the fridge ...



This map of rainfall (not temperature) in north America released by NASA illustrates the statisticians reservations about averages and touches on the problem of accounting for global climate change meaningfully.

The west coast has a severe deficit and the east coast, a surplus. On average, north America is fine. In reality, there is a huge divide and it isn't fine at all.



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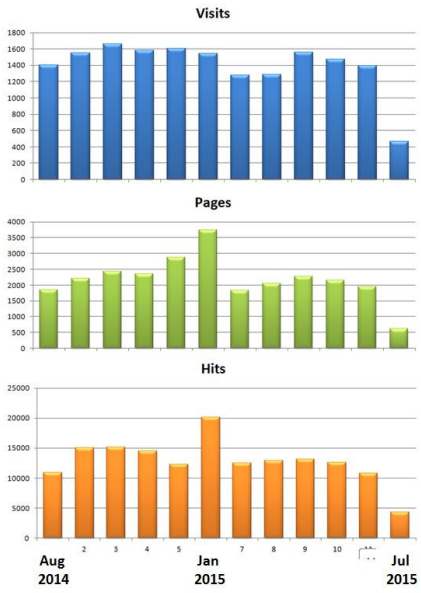
Visits, Hits, Pages

The CRG Web Site



Monthly Data for CRG Web Site

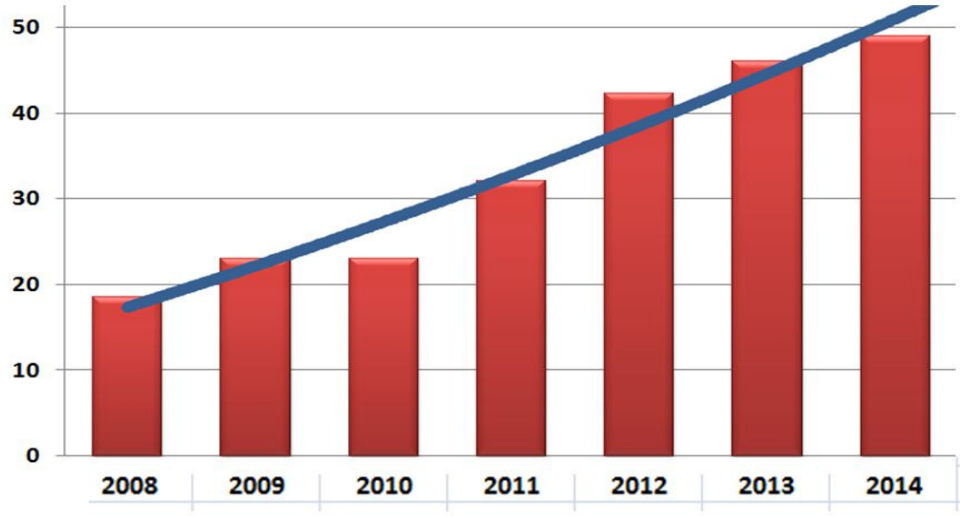
Data from the CRG website reveals a growing readership with 50 visits per day, steadily increasing over recent years - see below.

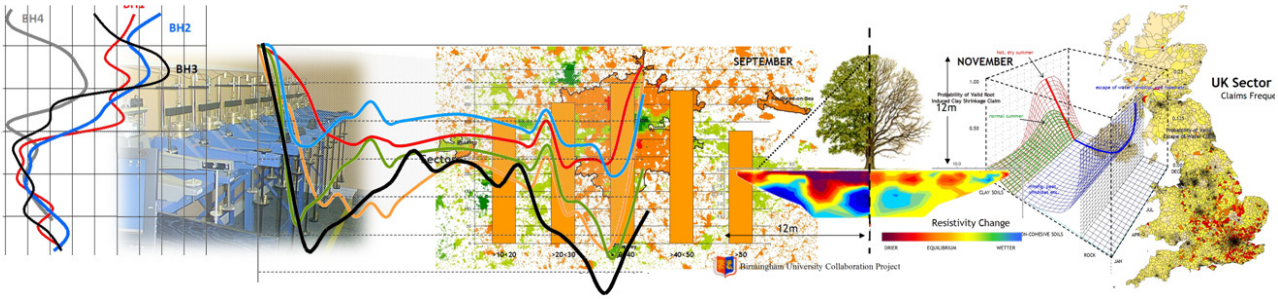
From those visits, 2,000 pages are viewed on average each month, peaking in January 2015.

Not huge figures by the standards of popular journals and periodicals but delivering wide coverage in terms of the subsidence industry - the target audience.

These figures don't include downloads from other sites - the RICS, Subsidence Forum, OCA are all kind enough to either alert members when the newsletter is published and/or list the CRG web address. Some include copies of the newsletters for direct download.

Average 'visits per day' to CRG web site





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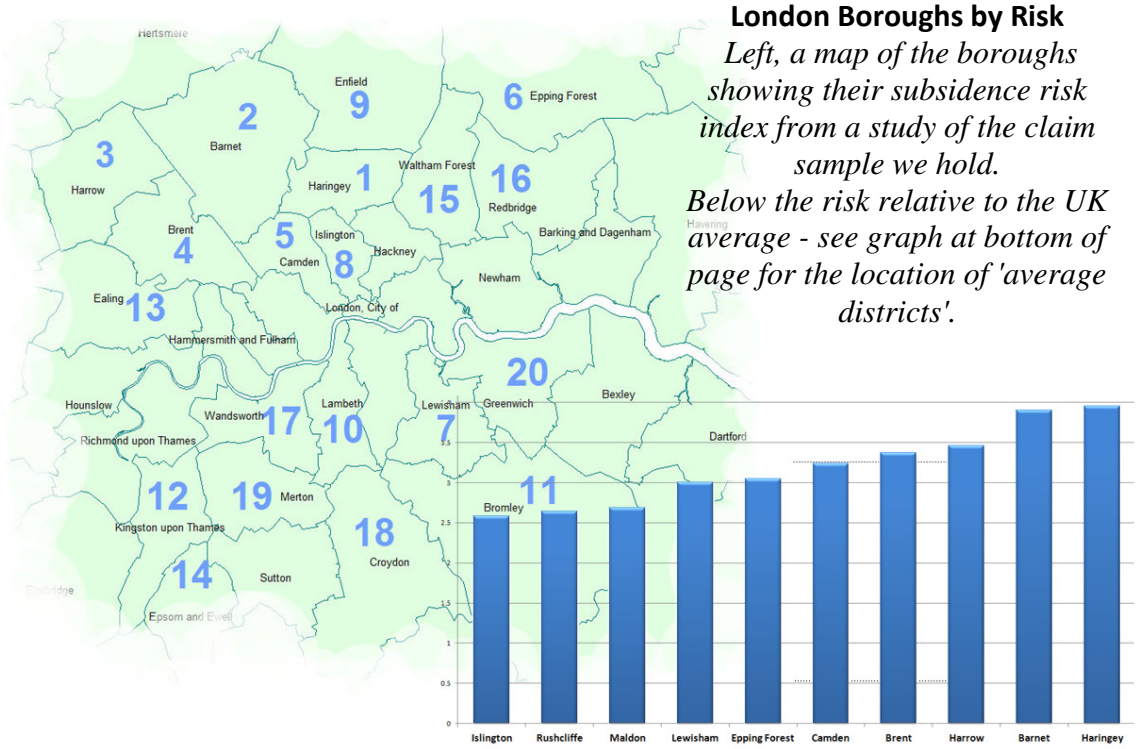
London Borough League Table of Risk

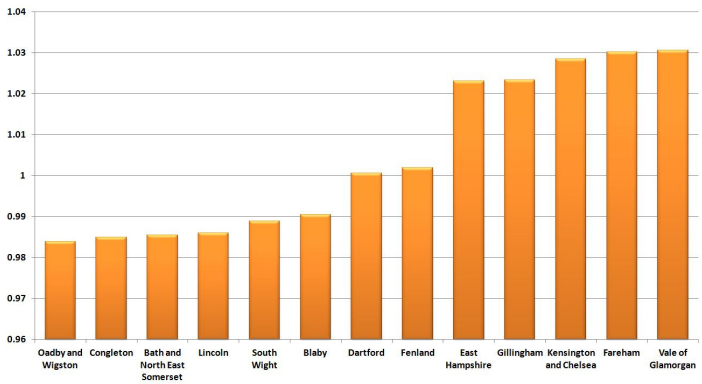
Subsidence Claim Frequency



London Boroughs by Risk

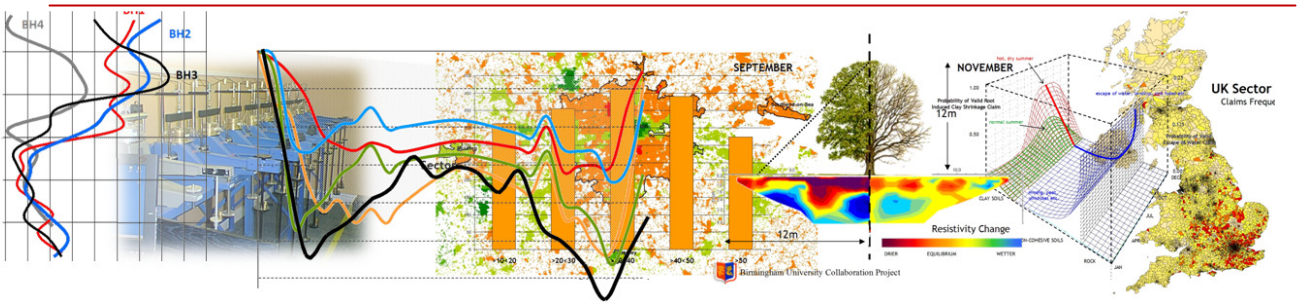
Left, a map of the boroughs showing their subsidence risk index from a study of the claim sample we hold.
Below the risk relative to the UK average - see graph at bottom of page for the location of 'average districts'.

The above map and graph have been produced from a claim sample of 103,000 records plotting claims divided by housing population per borough. The graph plots the output by the 'times riskier than the UK average'. For example Harrow is 3.5 x riskier, and Islington 2.6 x riskier than the UK average. Haringey is top of the table with a value 4 x greater than the UK average.



What is the UK average, and where can it be found?

The graph, left, plots the districts with a score of around 1 - the UK average from our analysis. Closest are Dartford and Fenland.



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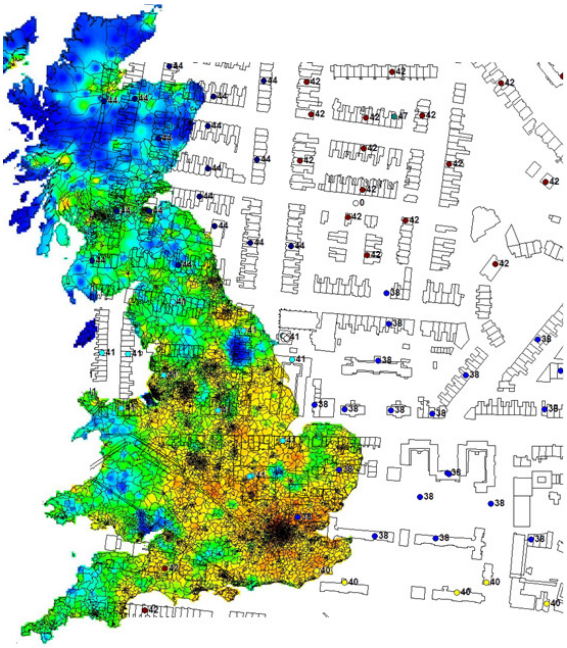
Mapping Soil PI at Unit Level

Below, the CRG map of shrinkable clay soils where they exist in the UK for every unit postcode.

By recording the results of site investigations over the years, we have been able to map the soil PI at 2 metres below ground; the zone of maximum root activity where mature deciduous trees are implicated.

The exercise is useful in triage, assessing risk, modelling root activity and audit.



A unit postcode - "HA5 5SN" for example - usually includes around 15 - 20 houses, variable by housing density.

Misunderstanding Risk

Underwriters take a different view of risk than arborists, which can cause confusion.

The idea that any risk model is flawed because it can't tell which tree will cause what damage, when, is simplistic and has very little to do with insurance underwriting.

It is a bit perhaps like a motor insurer who has a suspicion that red, fast sports cars driven by 12-year-old motorists are high risk.

They arrive at this conclusion because they have lots of data and sometimes, thankfully rarely, one is involved in an accident.

No, they don't know which car will have an accident on what day and where. They just know that certain models with a particular age of person driving are riskier than others and rate the policy accordingly.

Knowing something about the location, height and distance of trees from buildings has value when writing millions of policies where 70% or so of your subsidence claims relate to trees and these claims cost between 20% more than claims on a non-shrinkable geology.

Plotting the location, canopy spread and height of all of the trees in London was an ambitious project and one we see being promoted by our colleagues at TDAG.