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
Artificial Intelligence

April 2019
Edition 167

The Clay Research Group

CONTENTS

Issue 167, April 2019

SUBSIDENCE FORUM DISSERTATION INITIATIVE 2019

To quote from the web page of The Subsidence Forum, *"Now in its third year, the Subsidence Forum Dissertation Prize scheme offers a cash prize for the best undergraduate, final year dissertation for 2019. The subject matter must be related to subsidence, but it does not necessarily have to be restricted to technical aspects; it may encompass wider issues, such as climate change, social and/or financial impact on communities be they rural or urban and the wider environmental implications."*

http://www.subsidenceforum.org.uk/

Risk by District

Extending beyond the London boroughs, this month we take a look at the housing characteristics (style and ownership), geology and subsidence risk of Leicester, taking into account the likelihood of a claim being valid and the possible cause, all by season.

I Love Claims

The annual 'I Love Claims' conference takes place at the Ricoh Arena, Coventry on the 10th April and speakers include several industry experts covering a wide range of topics.

http://www.iloveclaims.com/events/subsidence/

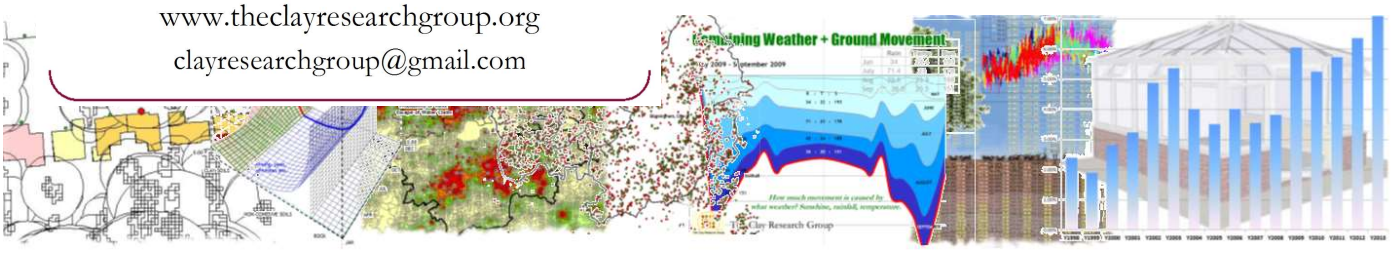
Hot Spots

More on the issue of Hot Spots, reviewing possible benefits, but not ignoring the practical drawbacks. Working together (i.e. insurers and tree owners) sounds attractive but is there any real potential to resolve the problem when council trees cause damage to insured houses?

Ai

Reiterating some of the work from previous articles, we look at the outline of a decision tree relating to Triage, and explore the underlying logic. How do we know the risk varies with the soil properties, and in the case of clay soils, the PI? Does the time of year of claim notification have a bearing, and if so, are the soil properties linked? How do we link them numerically?

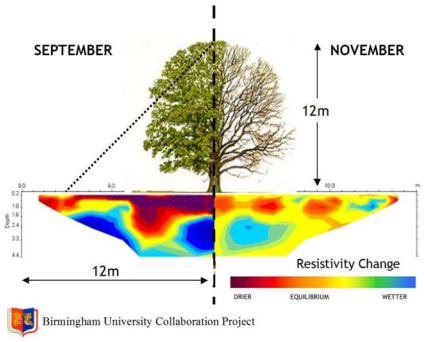
THE CLAY RESEARCH GROUP
www.theclayresearchgroup.org
clayresearchgroup@gmail.com

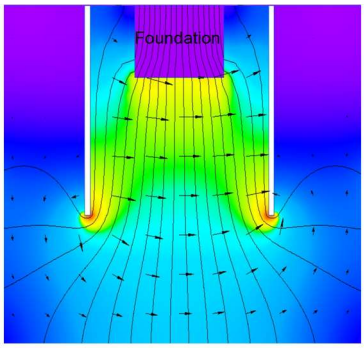


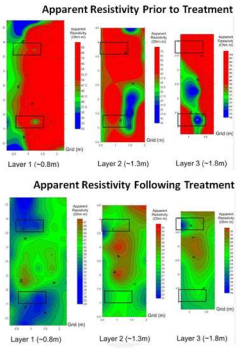
The Clay Research Group

Researching Investigation Techniques

Developing instrumentation to reveal the underground (drains, tree roots, voids etc.) is an important part of several research projects being undertaken by a consortium of universities and the British Geological Survey. The initiatives includes vibro-acoustic, passive electro-magnetic detection, radio frequency, electrical resistivity and focussed ultrasonic techniques. For more details download 'Assessing the Underworld' by selecting the Monthly Newsletter tab.



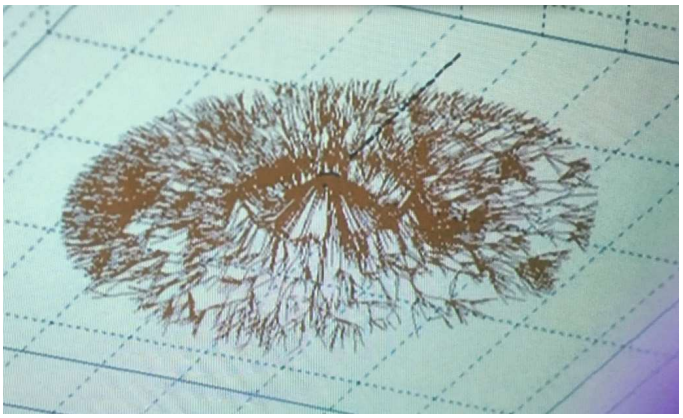




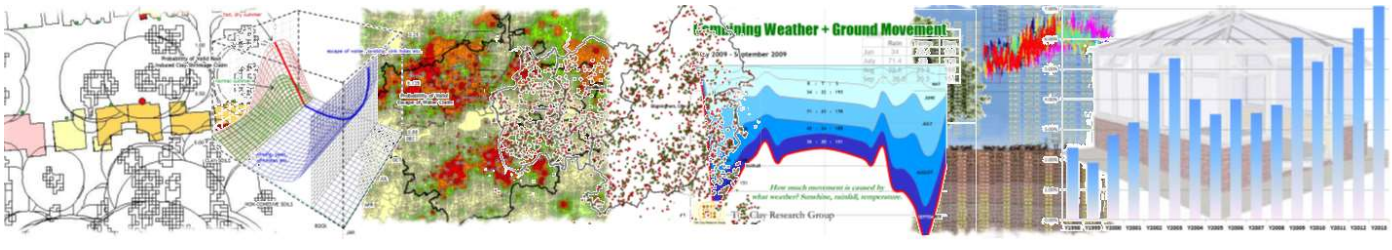
Above, images from similar work undertaken by PhD students at the Aldenham site. Left, electrical resistivity imaging of tree root activity in the vicinity of the oak tree undertaken by Glenda Jones whilst at Keele University. Centre and right, electro-kinetic imaging of moisture change at the site of the Aldenham willow by Tom Clinton, whilst at Birmingham University.

'Britain Beneath Your Feet'

This program on BBC 4 explored a number of topics relating to the geology of the UK, including mining and waterways etc., but of particular interest was the item about tree roots. Sharon Hosegood went to Burley Country Park in Lincolnshire to plot the distribution of roots from a 440yr old oak tree using a ground penetrating radar device.



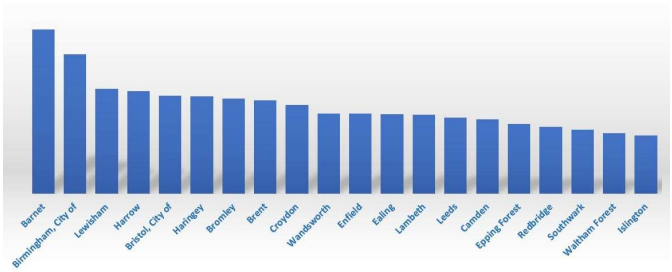
The radar detects roots over a diameter of around 10 – 15mm in diameter, and delivered the image, right.

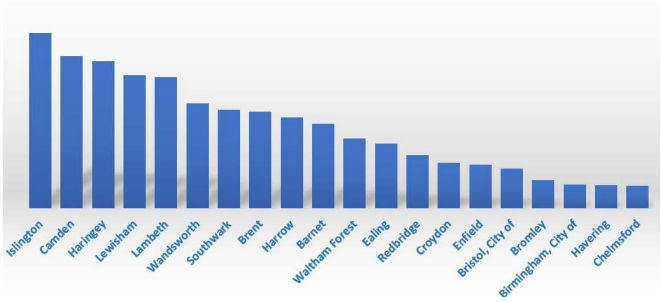


The Clay Research Group

Follow the Data – but understand what it is saying

In an age pre-occupied by data, it's easy to draw the wrong conclusions when we see graphs without understanding the method of derivation. Right, the bar graph shows the count of claims by district, with Barnet at the head of the table, followed by Birmingham and then Lewisham etc.

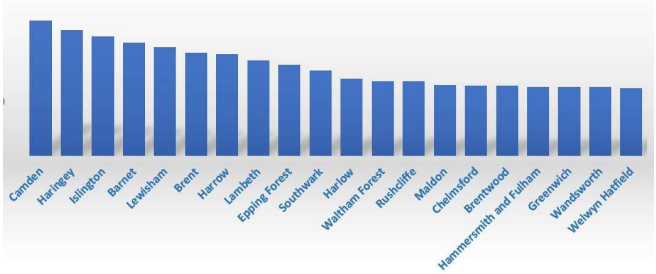




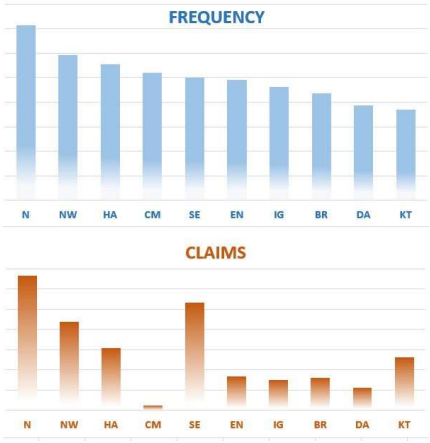
But what does the table look like if we plot the count of claims divided by district area?

Left, and from the sample we hold, Islington takes first position, followed by Camden, Haringey and then Lewisham.

The most meaningful analysis calculates the claim frequency – the number of claims divided by the number of houses - as shown right.



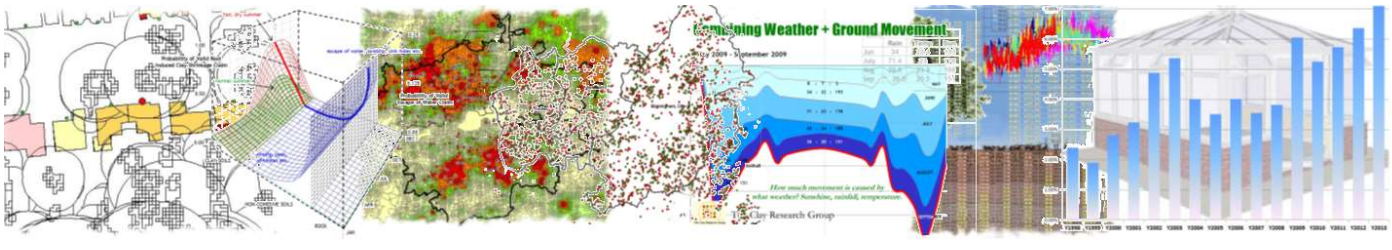
The order of risk changes again, with Camden at the top pf the table, followed by Haringey, Islington and Barnet.



To confuse matters further, risk varies with each refinement and left, the 'risk by postcode area' tells a different story, adding complexions within each district.

In the example left, N is the riskiest postcode area when calculated using both frequency and count, and SE is in second place in terms of count, and 5th place using a frequency estimate.

The risk changes by season and account has to be taken of event years and normal years to understand risk over time. All examples from the sample held.



The Clay Research Group

Hot Spots – working together

The issues around working together (that is to say, council tree officers and insurers) involve funding, negotiation and of course, contract liability. Regarding the latter, joining together effectively removes any prospect of insurers seeking a recovery. Regarding funding, who pays for what? Would insurers agents press for all trees to be felled? Negotiation is more complex. Taking an extreme (and silly) example, the insurer's agent might suggest all trees pose a risk, suggesting they are felled. When they are not, and a claim is notified, would the council be held to be negligent?

Why would insurers bother?

Looking at the 2003 figures, subsidence cost insurers £390m. Assume that 70% of the claims were root induced clay shrinkage. If only 10% of the claims involved trees in council ownership, the cost would have been £390m x 0.7 x .1 = £27m. That's for an event year and and is conservative as it doesn't take into account the fact that LA tree related claims are generally more costly to settle. How does it work in a year where there are fewer claims? In 2017 subsidence cost insurers £74m. Assume only 35% (rather than 70%) of the claims were root Induced clay shrinkage and only 10% of those claims involved council trees, the cost would have been £74m x 0.35 x .1 = £2.59m.

Insurers benefit by …

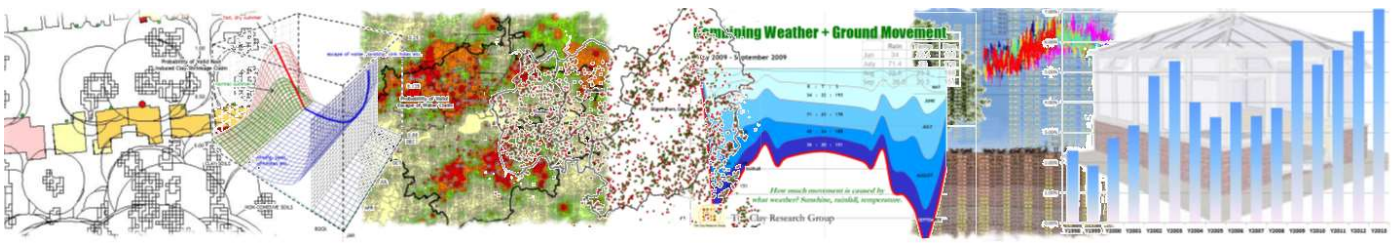
Effectively joining the community and enhancing their environmental credentials whilst anticipating the possible negative influence of Climate Change and improving service delivery to homeowners whilst reducing their exposure.

Councils benefit by …

An increased budget to manage the tree stock where it poses a risk. This might include consultancy, contributing towards the cost of arboricultural work, planting new trees and perhaps removing high risk trees where there is no alternative.

How would it work?

In 'Chainsaw Massacre', May, 2007, published by the London Assembly, it was reported that, on average, London boroughs had an average annual budget of £271k to manage vegetation. Financial assistance to three or four of the highest risk councils could have a significant beneficial effect. Insurers might appoint a specialist team to improve their understanding of the problem, comprising engineers, arboriculturalists etc., who would work with council tree officers to agree what could realistically be achieved. The problems are several. Would insurers agents seek removal of too many trees? It is also important to recognise that houses that have suffered damage will still need repair, so the figures mentioned above will not be realised in full. The objective is to reduce the spend and divert some of the savings to help the local authorities address the problem, rather than litigate. Working together and building relationships is the best way forward – in our view.

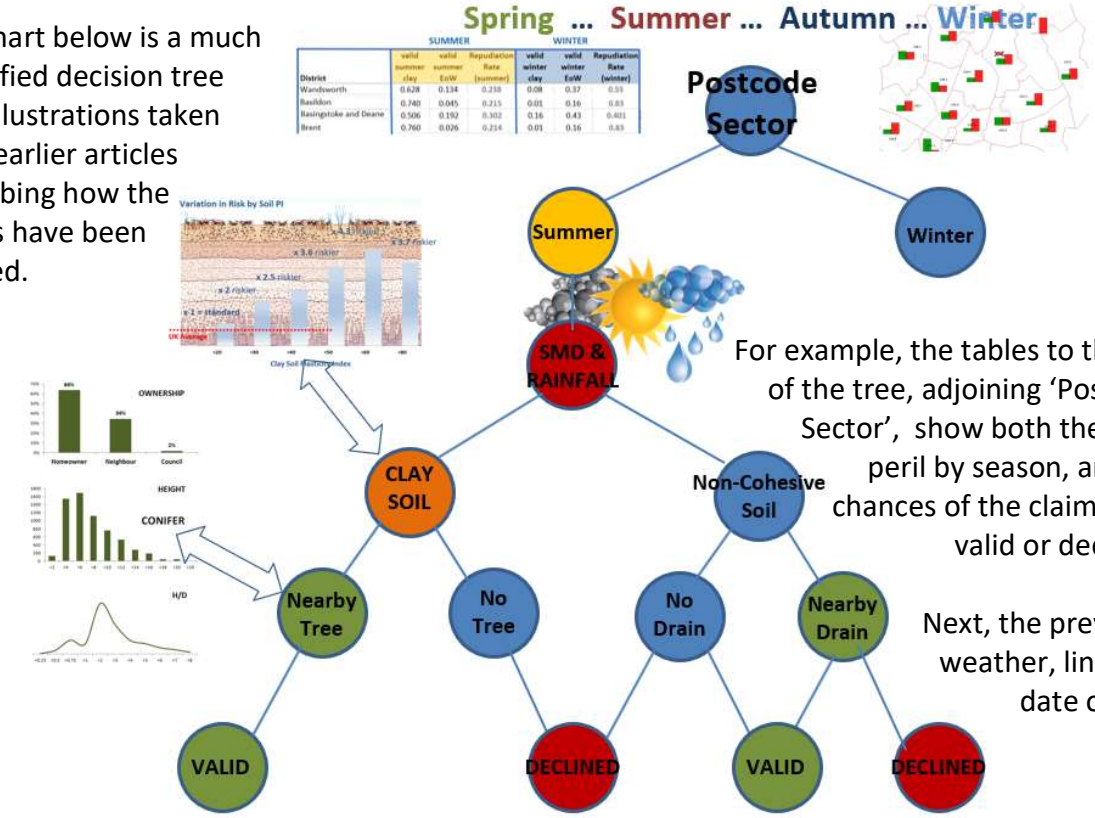


The Clay Research Group

Triage

It's useful to have some idea of what questions to ask homeowners to derive the maximum benefit at the time of first notification of loss (FNoL) and the abbreviated chart below provides an outline of how this might be structured. Entering the postcode triggers a system enquiry to establish the historic performance. How many claims have been valid? What is the dominant peril? Is there a seasonal element? The seasonal element links into the geology – there are a higher percentage of valid claims in the summer months on clay soils and fairly regular number throughout the year if linked to the escape of water peril.

The chart below is a much simplified decision tree with illustrations taken from earlier articles describing how the values have been derived.

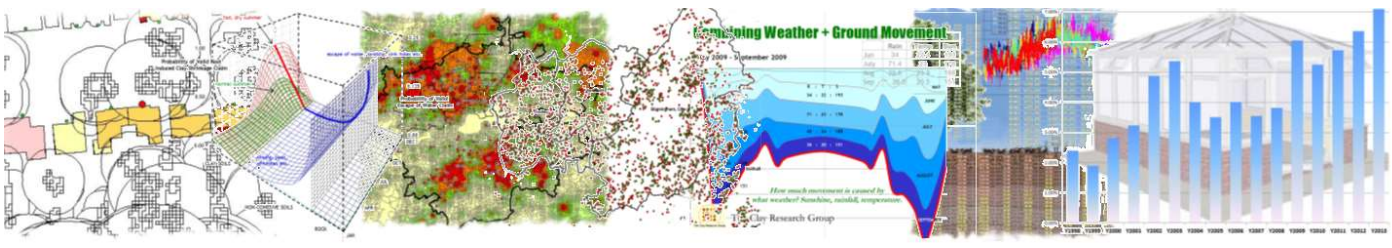


For example, the tables to the top of the tree, adjoining 'Postcode Sector', show both the likely peril by season, and the chances of the claim being valid or declined.

Next, the prevailing weather, linked to date of loss.

To the left, the risks associated with the shrink/swell potential of clay soils, derived from the CRG 250 grid built from site investigations, followed by the risk posed by the tree (if present), both by species, height and H/D.

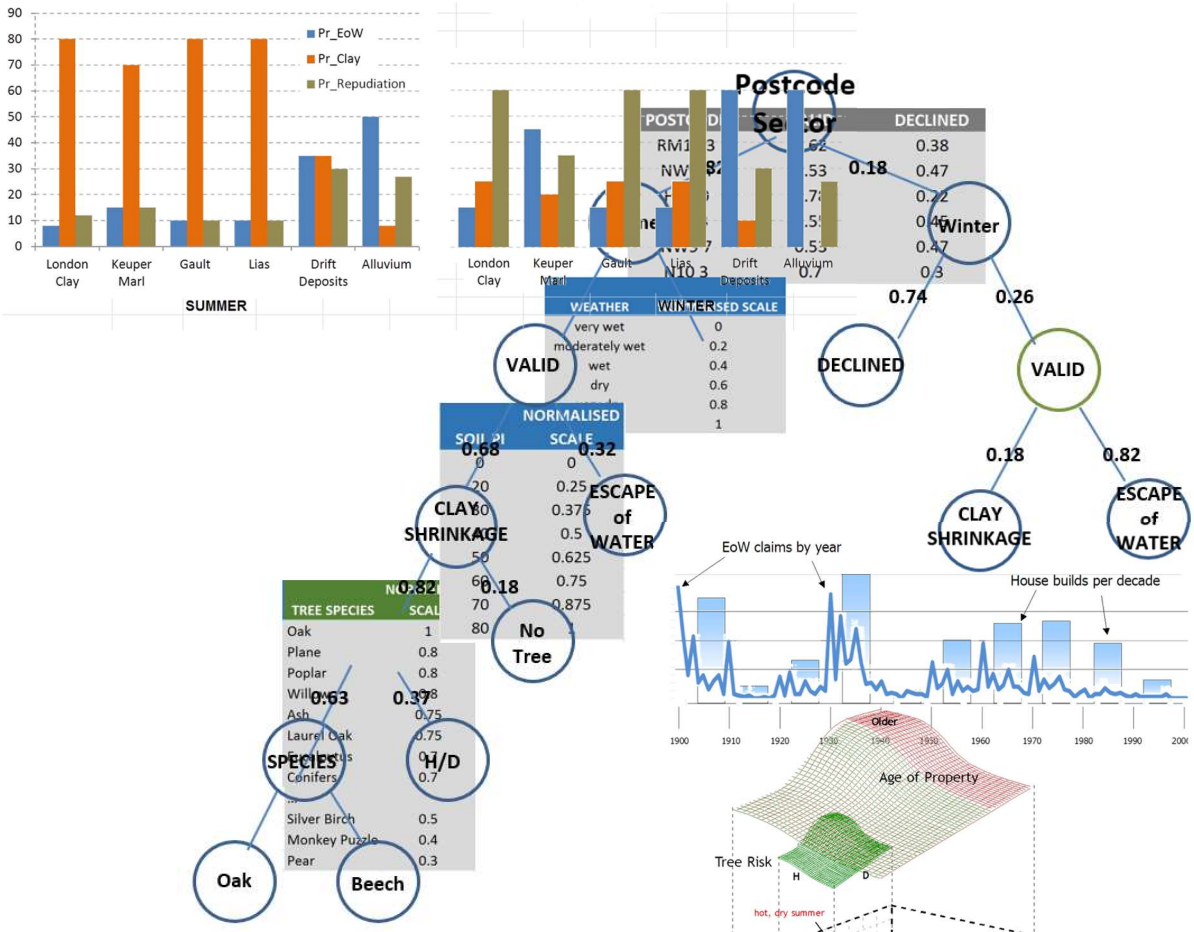
For an 'in the alternative' figure, the chart plots values for non-cohesive soils, linking them to (a) the age of the property, (b) the location of damage, with a positive weighting for 'kitchen', 'bathroom' or 'downpipe/soil stack', and an enhancement for 'rear elevation'.



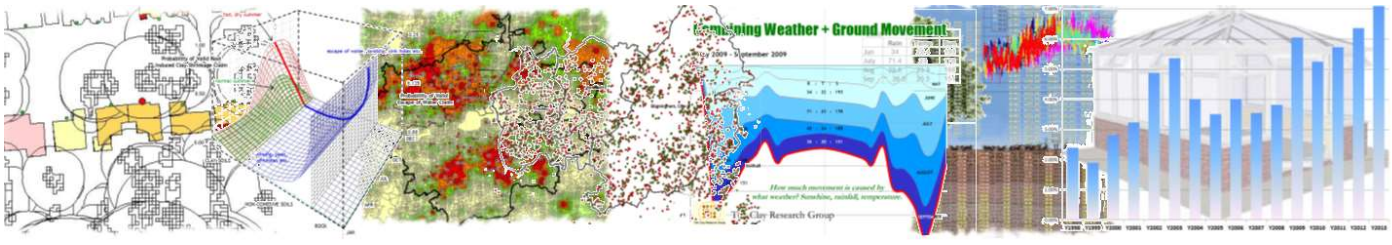
The Clay Research Group

Triage – the underlying tables

Each branch of the probability tree is underlain by a table derived from historic claims data. Our tables have been built using a five-year claims sample, including one event year. A live link to weather data using rainfall and temperature for the sector under consideration will improve the decision-making process. The numbers are for illustration only.



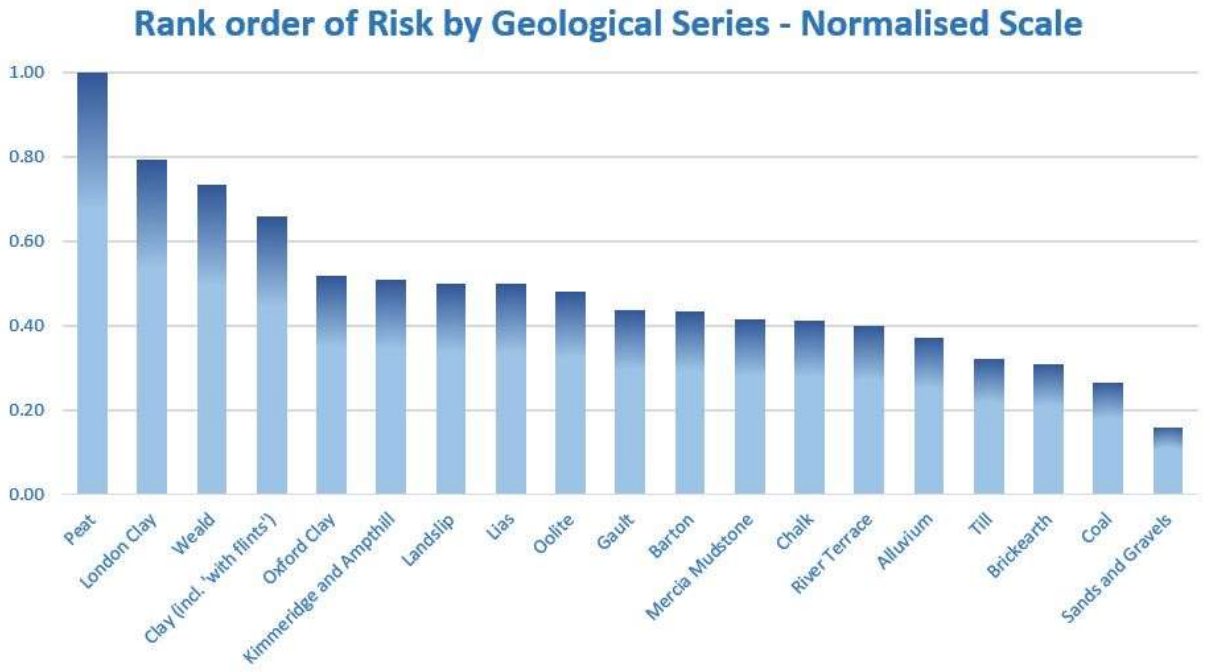
The probability cube, right, sums up all of the individual elements – soil, weather, likely claim cost, peril and the influence of vegetation on clay soils across the UK, taking into account historic performance at postcode sector level and season – all on a 'by month' basis.



The Clay Research Group

Geology - Updated Risk Table

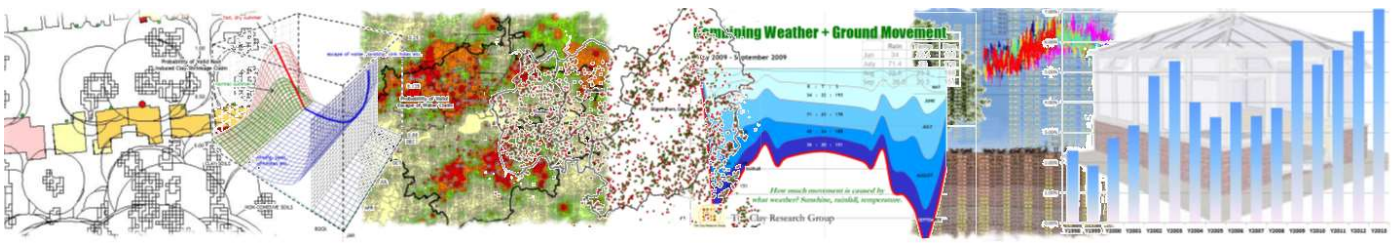
Below, an updated graph showing the rank order of risk relating to the subsidence peril by geological series across the UK, from the sample held. The update is derived by dividing the number of claims in our sample by the number of houses, all by geological series.



The benefit of such an exercise is to link the various elements into a normalised table of risk with numeric values. Most engineers will understand the risk posed by London clay for example, but few will have an idea of just how risky it is numerically compared with other series.

The graph reveals that London clay is twice as risky as the Mercia mudstone, which is over twice as risky as sands and gravels. Peat remains at the top of the league, but with relatively small numbers.

The benefit lies in using the values in the decision-tree type approach, where all contributing elements are on the same scale. A few questions at the time of notification and a visit to the house using Google Earth and Street View will often allow the experienced user to determine the next steps – appoint an arborist perhaps, instruct monitoring and/or arrange site investigations.



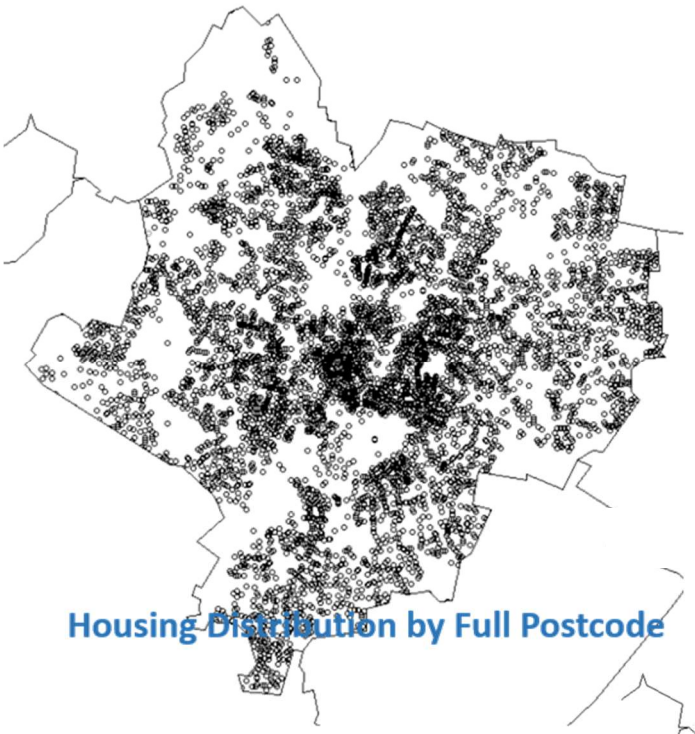
The Clay Research Group

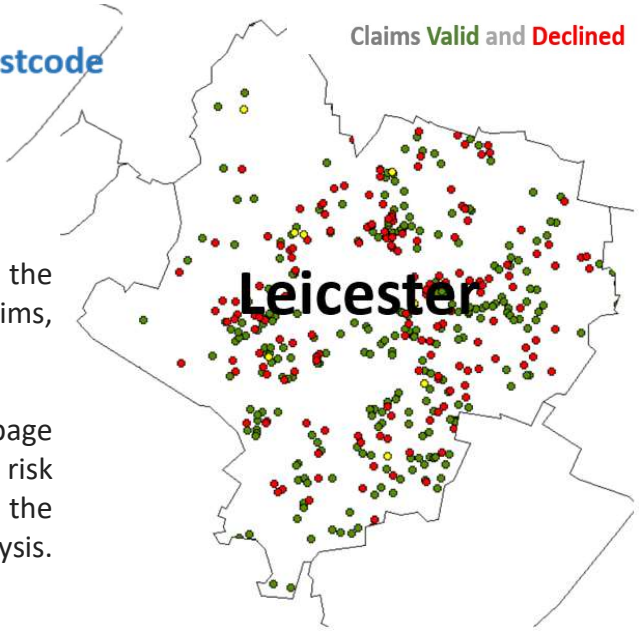
Subsidence Risk Analysis - Leicester

The following pages examine the risk in Leicester, continuing the theme outlined in the table below. Leicester has around 100,000 houses, a population of around 444,000, an area of just over 73km^2 and, according to Wikipedia, is the third most densely populated city in the European Union. All figures rounded.

Borough	Edition	Date
Islington	Issue 47	Apr-09
Camden	Issue 69	Feb-11
Brent	Issue 71	Apr-11
Haringey	Issue 72	May-11
Barnet	Issue 77	Oct-11
Waltham Forest	Issue 79	Dec-11
Welwyn and Hatfield	Issue 80	Jan-12
Ealing	Issue 84	May-12
Sutton	Issue 91	Dec-12
Hillingdon	Issue 106	Mar-14
Havering	Issue 149	Oct-17
Harrow	Issue 150	Nov-17
Enfield	Issue 155	Apr-18
Southwark	Issue 156	May-18
Lewisham	Issue 157	Jun-18
Bromley	Issue 158	Jul-18
Croydon	Issue 159	Aug-18
Basingstoke & Deane	Issue 160	Sep-18
Merton	Issue 161	Oct-18
Wandsworth	Issue 162	Nov-18
Basildon	Issue 163	Dec-18
Redbridge	Issue 166	Mar-19

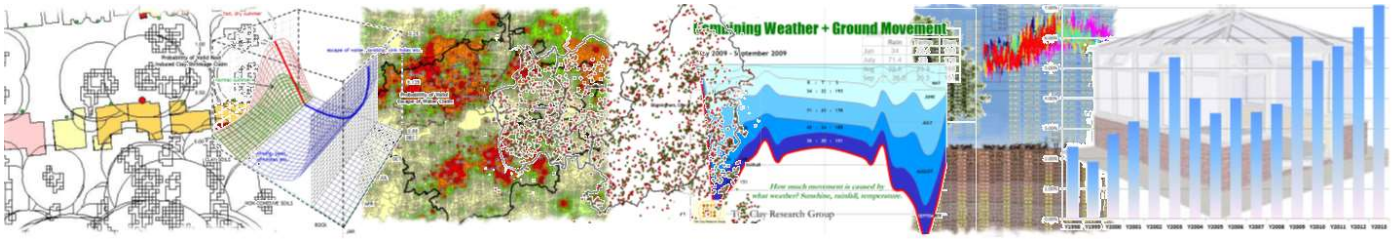
Table of previous studies listing issue and date.





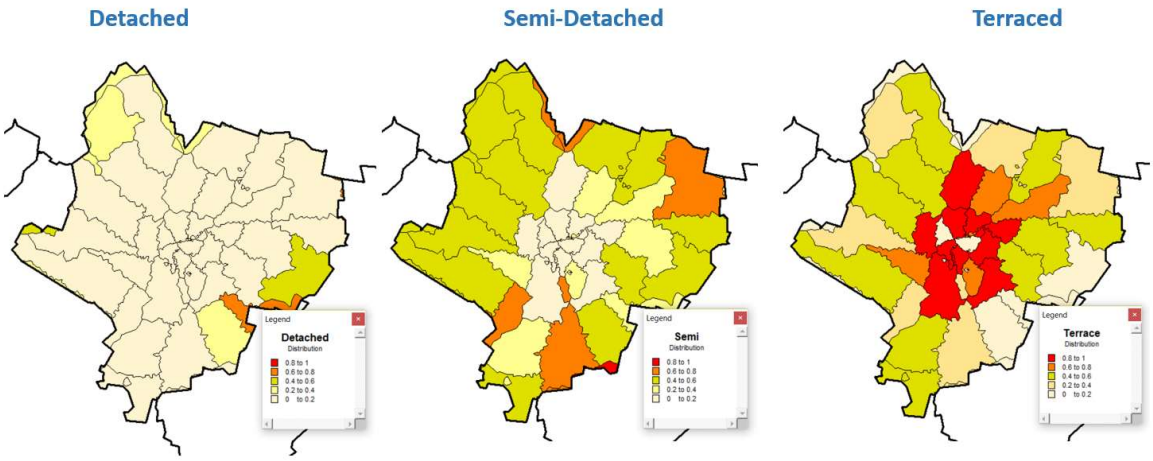
Above, the distribution of housing across the borough and right, the distribution of claims, both valid (green) and declined (red).

Comparison with the geological maps on page 12 appears to reveal a slightly reduced risk related to the alluvial soils, although the commercial centre plays a role in the analysis.



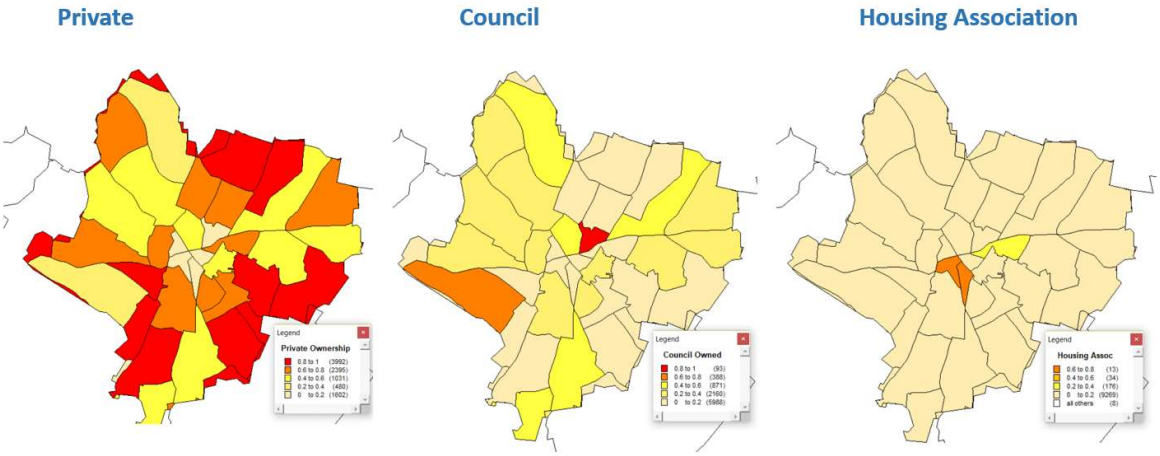
The Clay Research Group

Leicester - Properties by Style and Ownership

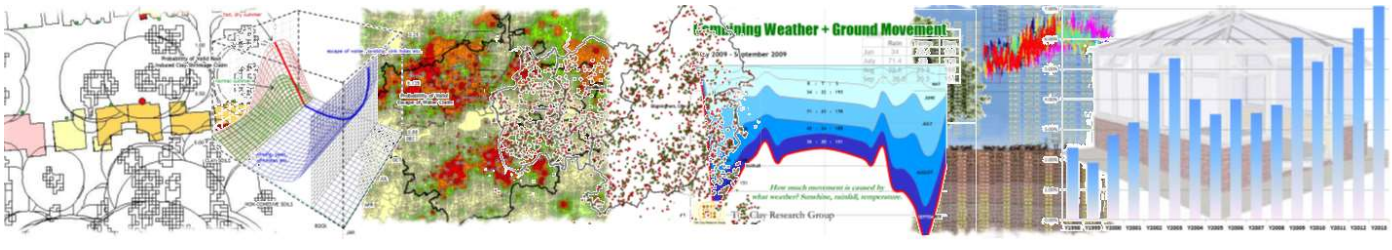


Leicester - House Style

Above, the quintile distribution of differing house styles showing the concentration of terraced houses towards the centre of Leicester. The 2001 census lists 12,000 detached, 43,000 semi-detached and 41,000 terraced (all figures rounded). The area consists of predominantly private housing (below), and the risk map on the following page reflects this.



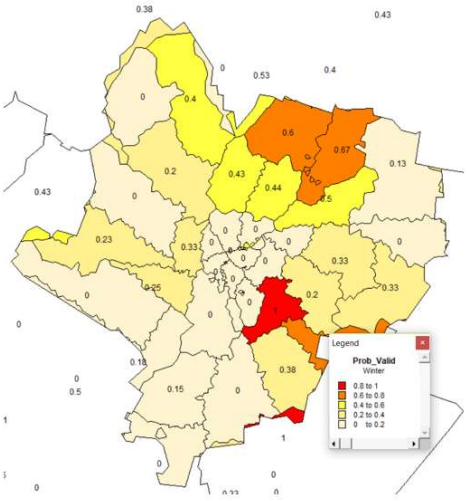
Leicester - House Ownership



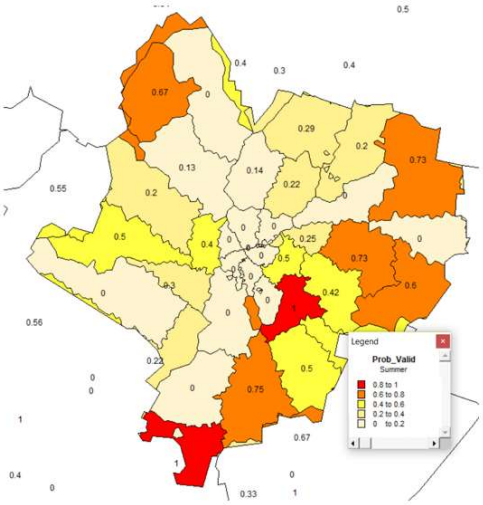
The Clay Research Group

Leicester - Liability – valid by season and ownership.

Probability Winter Valid

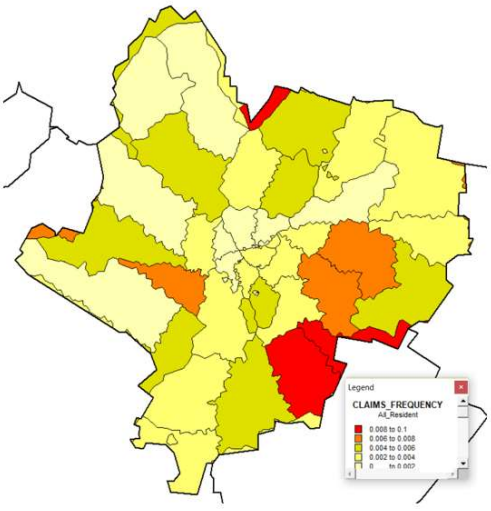


Probability Summer Valid

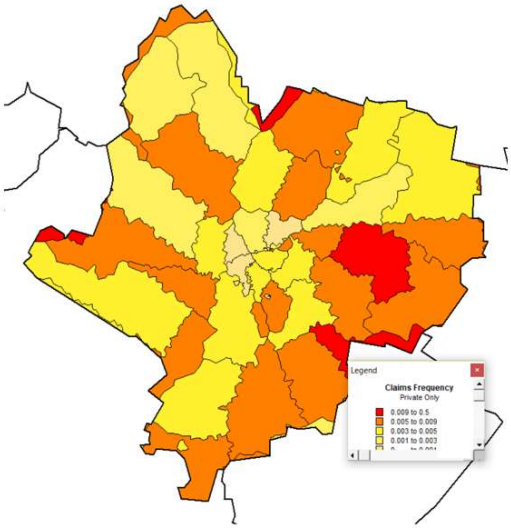


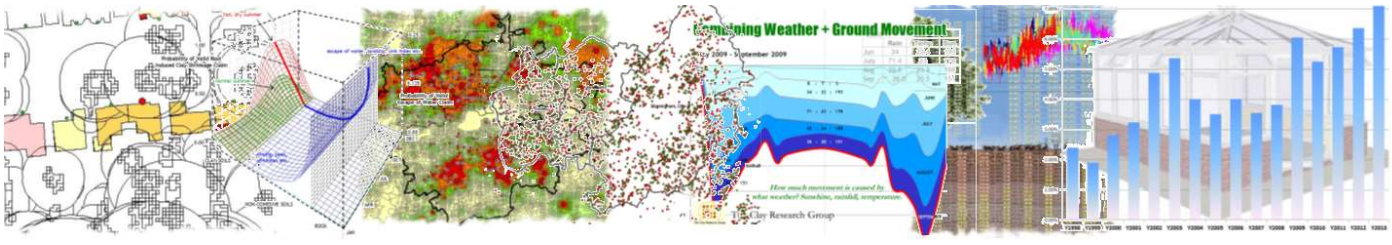
The probability of whether a claim is going to be valid or declined varies by season (above) and and the output can be used to infer the nature of the underlying soil (cohesive or non-cohesive) and its relationship with the weather. Clay soils respond to warm, dry summers, but deliver far fewer claims in the winter months. Houses on non-cohesive soils deliver fewer claims, but with less change by season.

Claims Frequency All Residential



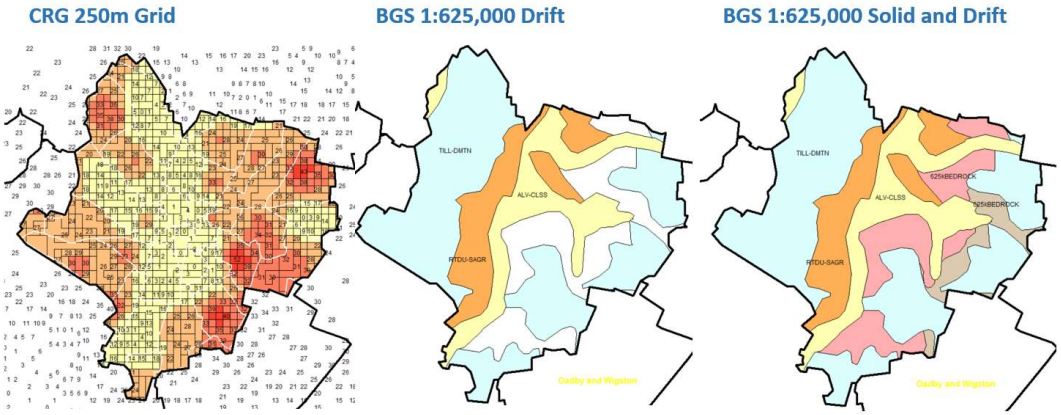
Claims Frequency Private Only



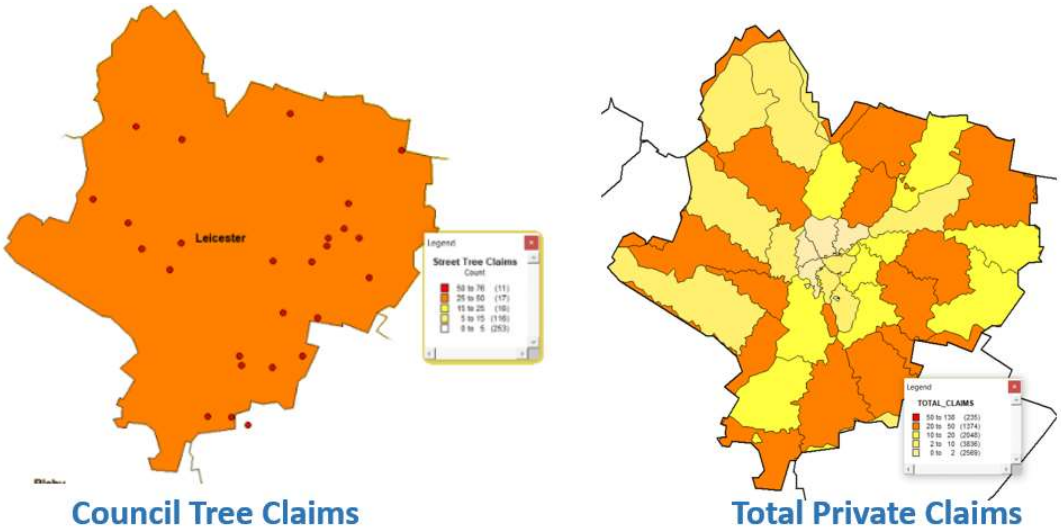


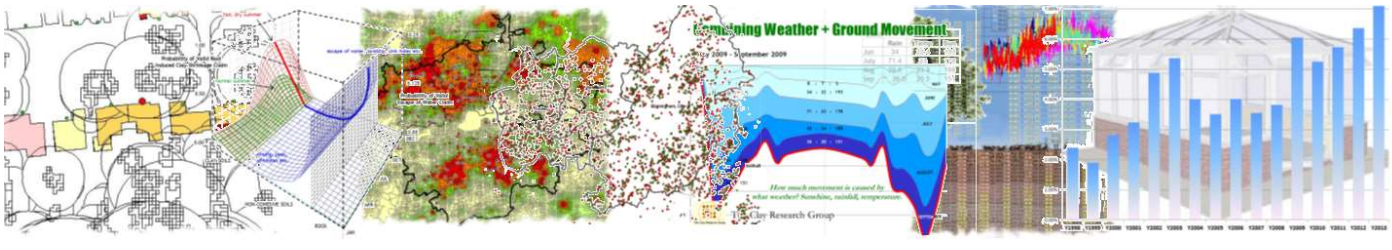
The Clay Research Group

Leicester - Linking into the Geology



The shrinkable clay series, where present, typically has a PI of between 20 – 35% as shown on the CRG map, above left. The divide between soil types roughly corresponds to the British Geological series maps, revealing the variable thickness of the drift as further exposed by the 'Total Private Claims' map below. The dots on the 'Council Tree Claims' map, below, represent properties where damage has been attributable to vegetation in the ownership of the local authority. Is there an identifiable 'Hot Spot'?

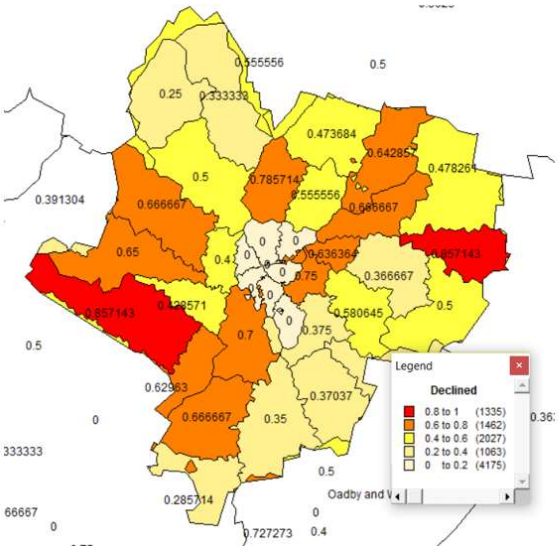




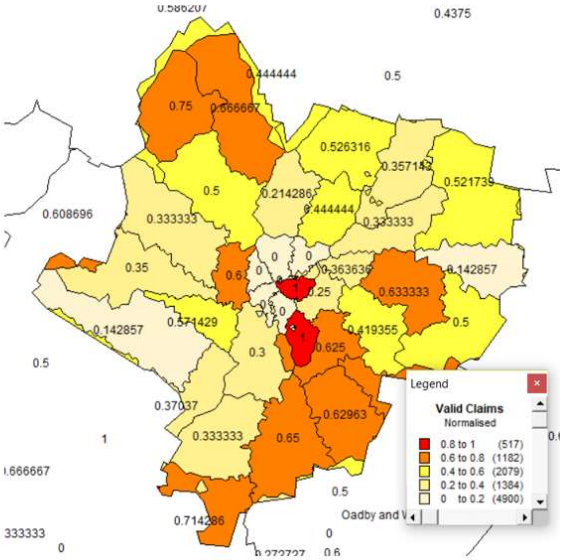
The Clay Research Group

Leicester - Linking to the System - Data Output

Declined



Valid



Above, mapping historic claim liability on a normalised scale revealing postcode sectors where the claim has either high or low probabilities of being accepted as valid or declined throughout the year and not taking into account any seasonal influence.

Below, the table listing the outcome of our analysis at district level, showing that the chances of a claim being declined in the summer are around 30%, and if it is valid, the chances of it being due to clay shrinkage will be around 70%. In the winter, the repudiation rate is higher at 40%, and if it is valid, the chances of it being due to an escape of water is around 70%.

Probabilities - Cause and Liability

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Leicester	0.490	0.208	0.302	0.18	0.42	0.401