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

March 2023
Issue 214

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Issue 214, March 2023

Declining Claim Numbers

Although 2018 and 2022 have been busy years, the classification of surge years is based on the increase from the previous year, not total claim count. ABI figures show a noticeable decline in numbers since peaks in 2003 and 2006. This seems perverse given the warming data provided by the Met Office. The primary subsidence peril is root induced clay shrinkage driven by warming and absence of available water. Is this the result of pro-active action being taken with vegetation perhaps? Or an increase in rainfall? See following page.

Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at: *clayresearchgroup@gmail.com*

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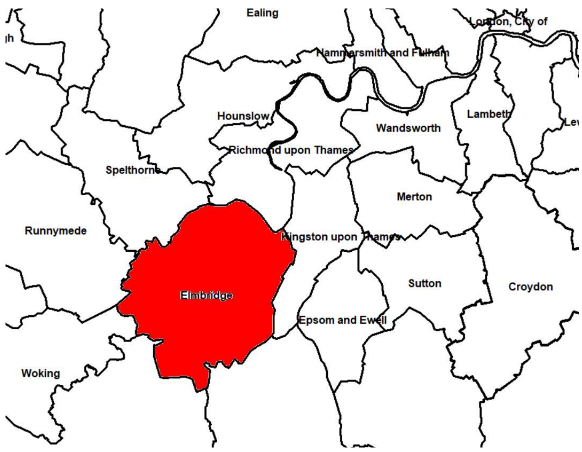
www.theclayresearchgroup.org
clayresearchgroup@gmail.com

District and Sector Risk

Elmbridge, Surrey, is the topic of the District Risk series in this month's edition.



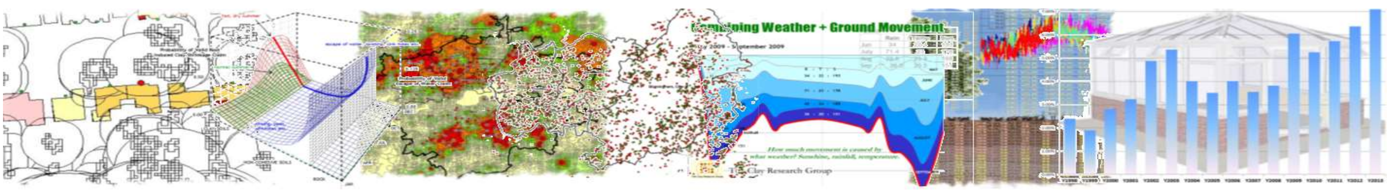
The maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

Some Good News - Claim Costs Falling?

According to figures published by the Association of British Insurers, the average claim cost for the subsidence peril in 1988 was around £5,677.

It reached £9,600 last year which seems, on the face of it at least, quite depressing until we take inflation into account.

If the average claim cost in 1988 was £5,677, the cost in 2022 would be £13,924 taking into account inflation. So, although 2022 was expensive, it was in fact £4,000 cheaper than it might have been. Inflation data provided by The Bank of England.



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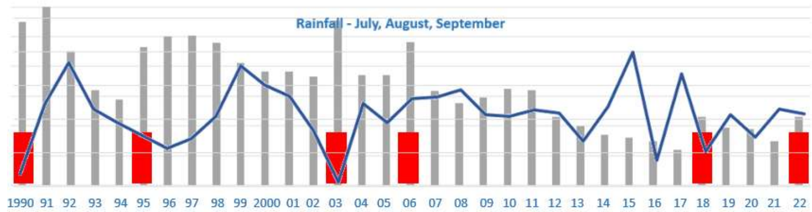
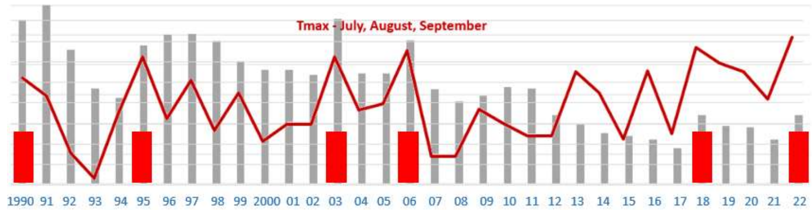
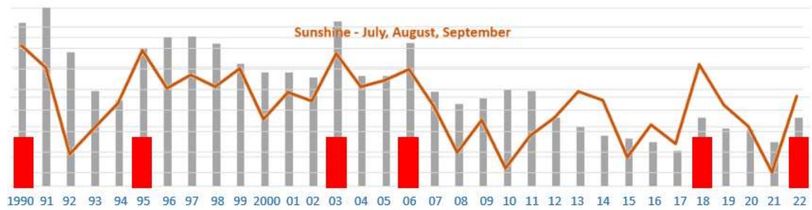
Claims -v- Weather

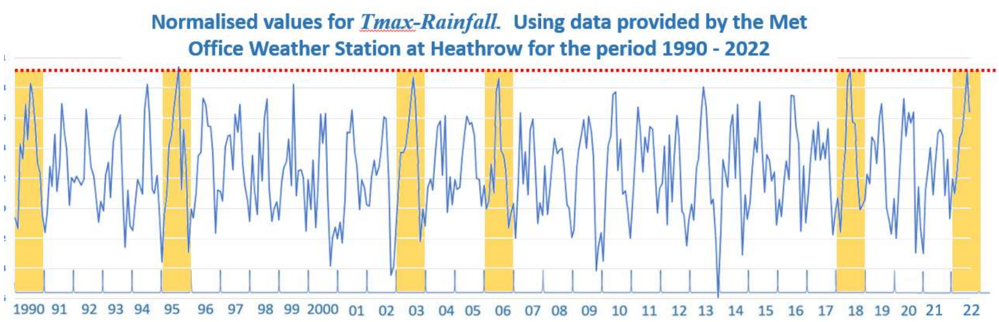
Below, three charts superimposing profiles for the respective weather elements (rainfall, maximum temperature and sunshine) for the sum of the month's values for July, August, and September onto a bar chart (grey) plotting subsidence claims for the period 1990 to 2022. For all weather elements the highest correlation with claims occurs in July and August.



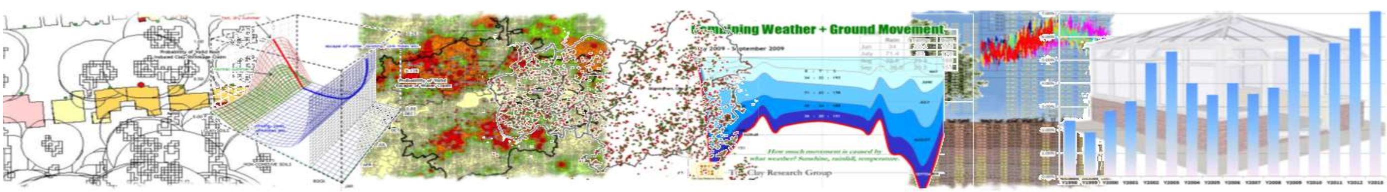




High temperatures and hours of sunshine coincide in most surge years as we would expect. Hours of sunshine diminish over the term, broadly following the claim notification profile.



Above, using the formula *temperature – rainfall,* identifies all of the surge years -1990, 1995, 2003, 2006, 2018 and 2022. Unfortunately, as claims tend to peak in August the exercise has no predictive power but it does reveal links between weather elements that trigger subsidence events.



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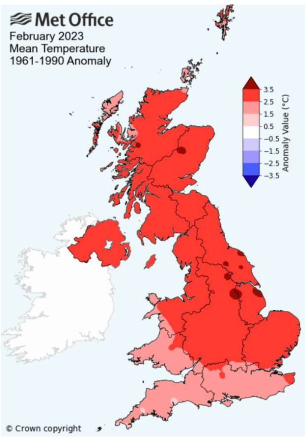
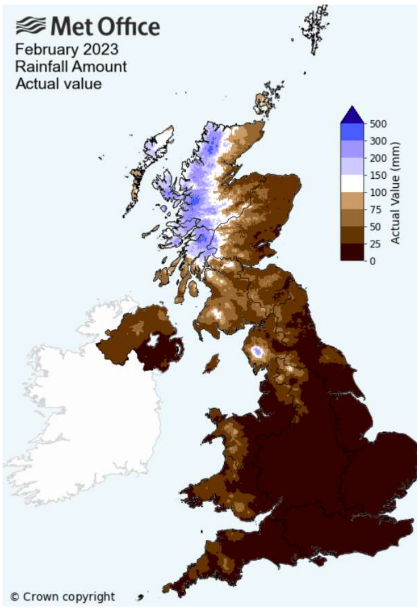
Met Office Rainfall Map for February 2023

Met Office data confirms that February 2023 received only 20% of the UK average rainfall. This, on top of a drier than average 2022, may suggest an increased risk of subsidence claims for the coming year.



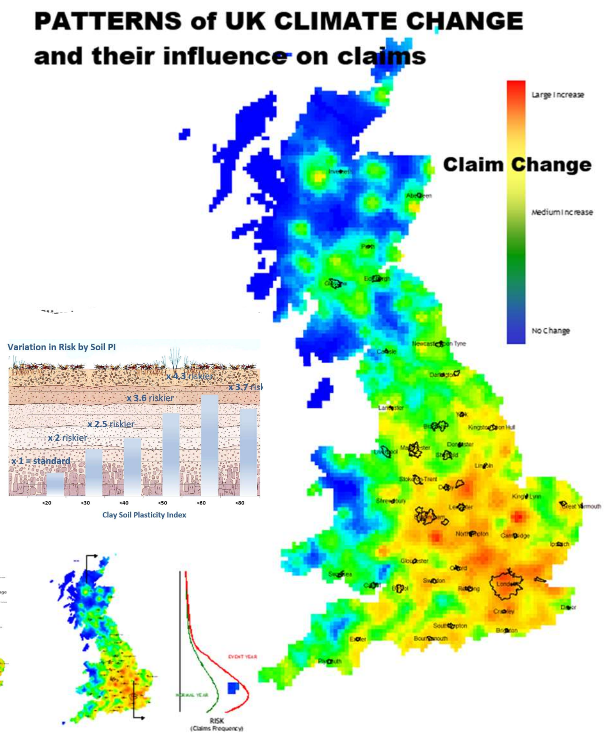
Temperatures were warmer across the UK looking at the 1961-1990 anomaly map, left, showing average hours of sunshine.

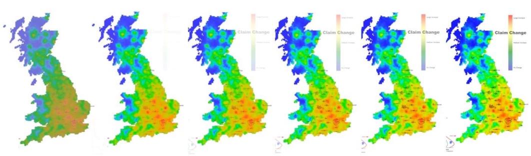


Climate Change

The figure, right, is reproduced from an earlier edition of the CRG newsletter and shows the pattern of potential changes in subsidence risk across the UK on a 250m grid taking into account possible risk modifications linked to climate change related to the underlying geology, with clay soils being the most vulnerable to change.

The degree of change is linked to the soil PI, based on claims analysis.





2010 2020 2030 2040 2050 2060

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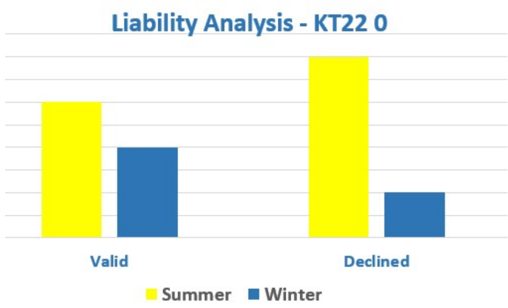
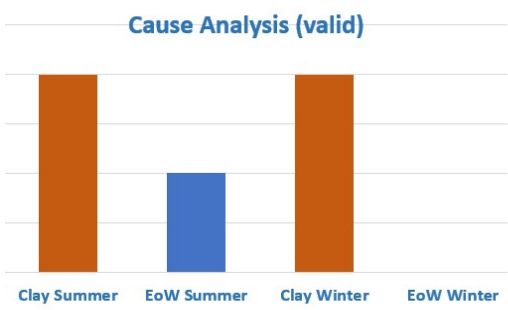
ELMBRIDGE Area Sector Level Sample.
Using Past Claims Data to Infer Geology and Derive Probability of Cause and Liability





KT22 0 – Outcropping London clay with higher claim numbers in both the summer and winter months but with less influence given the low housing population.

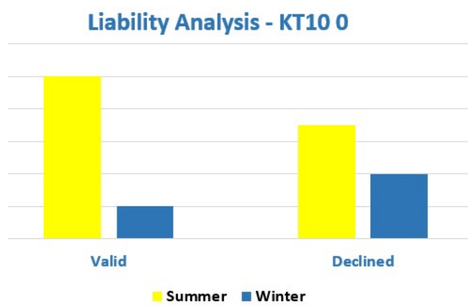
Perhaps perversely given the geology, there are claims relating to escape of water in the summer months but these sometimes relate to older properties with shallow, stepped brick footings bearing onto made ground.

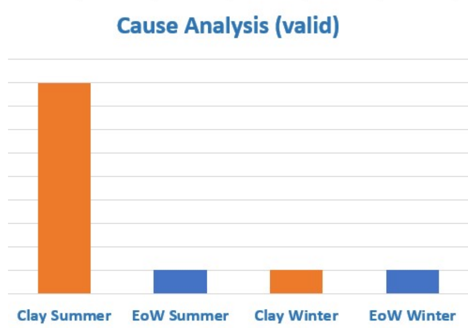
Although the district is rated above the average in terms of subsidence risk, this reflects the predominantly lower risk across the UK.

KT10 0 – comprises predominantly outcropping London clay as indicated by the lower graph, right.

In the summer the probability of a claim being valid is around 60%, and 30% in the winter.

Claim numbers are quite low and the rating reflects a frequency calculation using claims/total house count.





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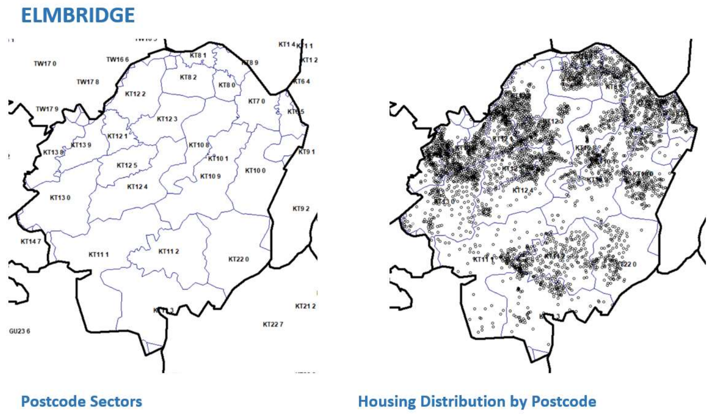
Subsidence Risk Analysis – ELMBRIDGE

Elmbridge is situated in Surrey and occupies an area of 96.35km^2 with around 53,000 households and a population of around 136,600.



Distribution of housing stock using full postcode as a proxy. Each sector covers around 2,000 houses on average across the UK and full postcodes include around 15 – 20 houses on average, although there are large variations.

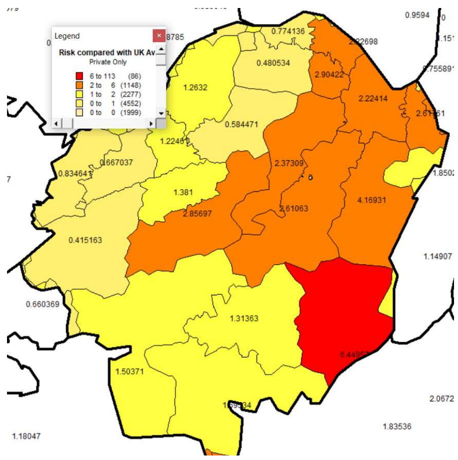
Sector and housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.

From the sample we hold, sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

Elmbridge is rated 52nd out of 413 districts in the UK from the sample analysed and is around 1.68x the risk of the UK average, or 0.43 on a normalised 0 - 1 scale.

There is an increased risk to the east of the borough as can be seen from the sector map, right, which corresponds with outcropping London clay.



Elmbridge district is rated around 1.68 times the UK average risk for domestic subsidence claims from the sample analysed. Above, risk by sector.

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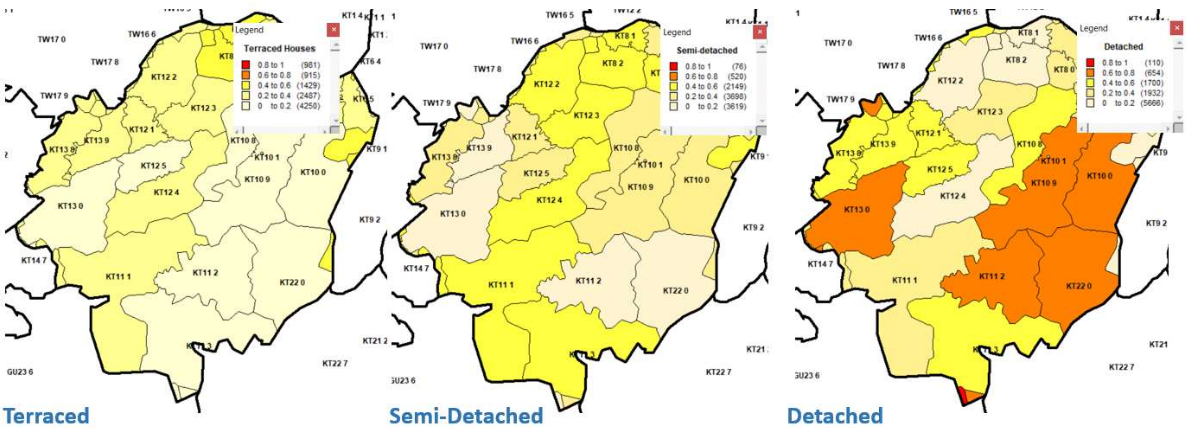
ELMBRIDGE - Properties by Style and Ownership

Below, the general distribution of properties by style of construction, distinguishing between terraced, semi-detached and detached. Unfortunately, the more useful data is missing at sector level – property age. Risk increases with age of property and the model can be further refined if this information is provided by the homeowner at the time of application.

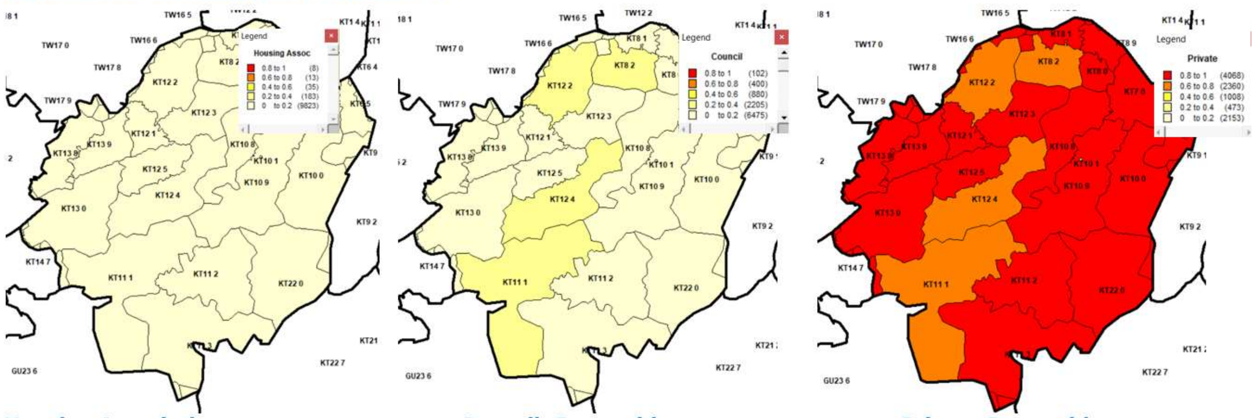
ELMBRIDGE - Distribution by House Type



Terraced Semi-Detached Detached

Distribution by ownership is shown below. Privately owned, terraced properties are the dominant class and are spread across the borough. See page 10 for distribution of risk by ownership.

ELMBRIDGE - Distribution by Ownership



Housing Association Council Ownership Private Ownership

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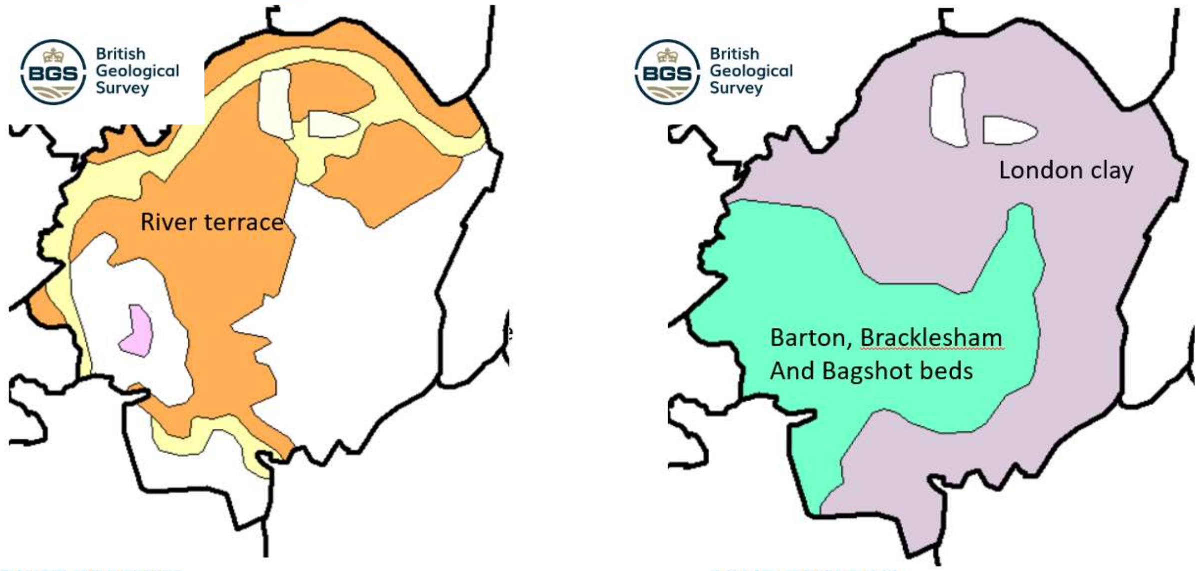
Subsidence Risk Analysis – ELMBRIDGE

Below, extracts from the British Geological Survey low resolution 1:625,000 scale geological maps showing the solid and drift series. View at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html for more detail.

See page 10 for a seasonal analysis of the sample which reveals that, at district level, there is a greater than 60% probability of a claim being valid in the summer and of the valid claims, there is around a 50% chance that the cause will be clay shrinkage.

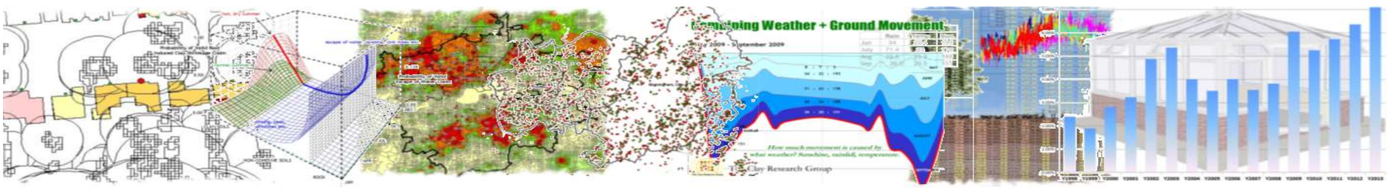
In the winter the likelihood of a claim being valid is around 60% - and if valid, there is around a 50% probability the cause will be due to an escape of water. Maps at the foot of the following page plot the seasonal distribution.

ELMBRIDGE : BGS Geology – 1:625,000 scale



DRIFT DEPOSITS **SOLID GEOLOGY**

Above, extracts from the 1:625,000 series British Geological Survey maps. Working at postcode sector level and referring to the 1:50,000 series delivers far greater benefit when assessing risk.



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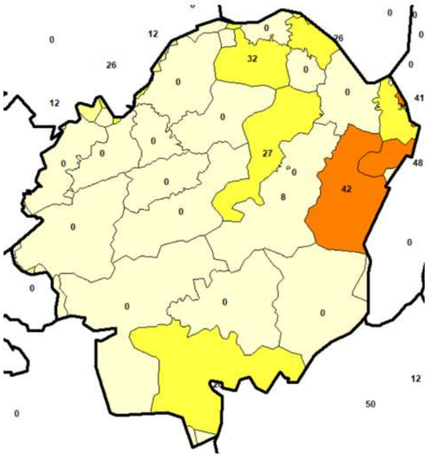
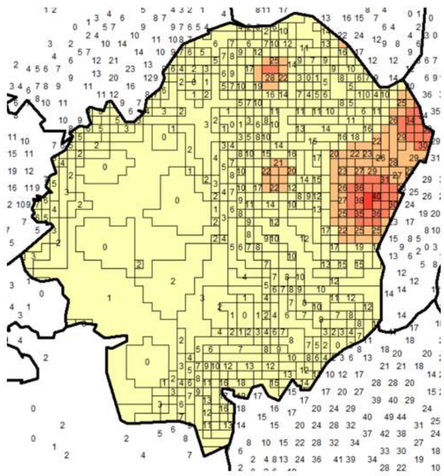
Liability by Geology and Season

Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The higher the PI values, the darker red the CRG grid.

ELMBRIDGE – Soil Plasticity Index



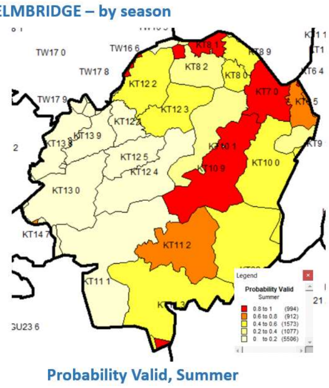
Soil PI Averaged by Sector



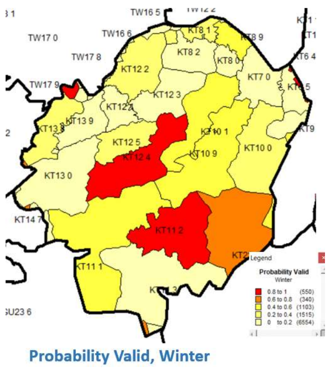
PI Interpolated on 250m CRG grid

Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

ELMBRIDGE – by season



Probability Valid, Summer

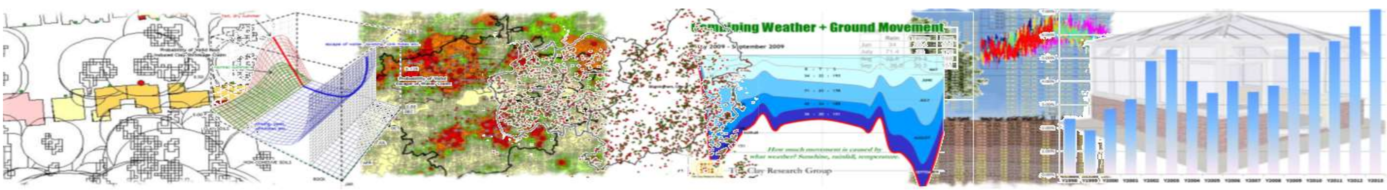


Probability Valid, Winter

The maps, left, show the seasonal difference from the sample used.

Combining the risk maps by season and reviewing the table on page 10 is perhaps the most useful way of assessing the potential liability, likely cause and geology using the values listed.

The ‘claim by cause’ distribution and the risk posed by the soil types is illustrated at the foot of the following page. A high frequency risk can be the product of just a few claims in an area with a low housing density of course and claim count should be used to identify such anomalies.



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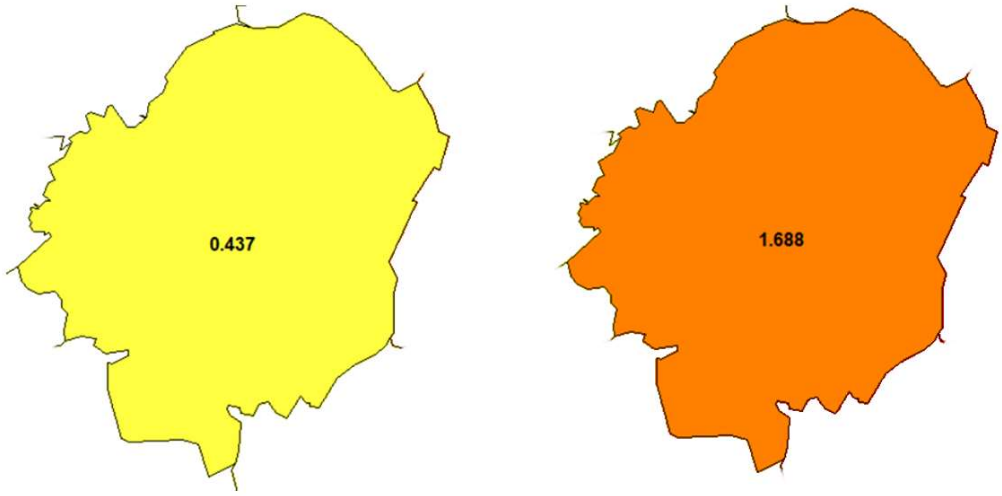
District Risk -v- UK Average. EoW and Council Tree Risk.

ELMBRIDGE - Subsidence Risk Relative to UK

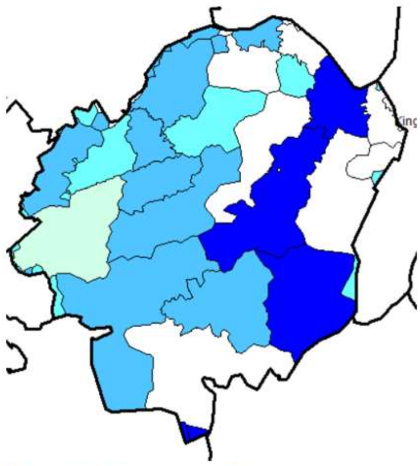


Normalised (0 – 1) Scale | Relative to UK Average

Below, left, mapping the frequency of escape of water claims confirms the presence of non-cohesive soils - deposits of River Terrace and alluvium, sands and gravels etc. As we would expect, the 50,000 scale BGS map provides a more detailed picture and the CRG 1:250 grid reflects claim experience.

Below right, map plotting claims where damage has been attributable to vegetation in the ownership of the local authority from a sample of around 2,858 UK claims.

ELMBRIDGE



Higher Risk Escape of Water

Claims Involving Council Tree
(2,858 UK claim sample)

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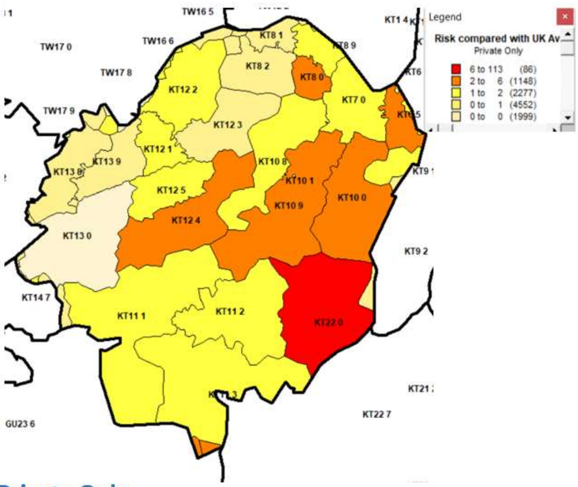
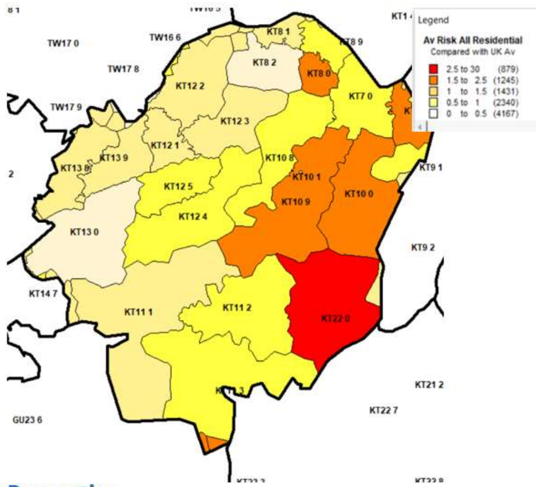
ELMBRIDGE - Frequencies & Probabilities

Below, mapping the total housing stock by ownership reveals the importance of understanding claims frequency relating to the number of properties at risk. Left, claims frequency for private ownership only reveals an increased risk compared with claims frequency for the total housing stock with council and housing association properties included.

ELMBRIDGE - Sector Risk Compared with UK Average



Private Only



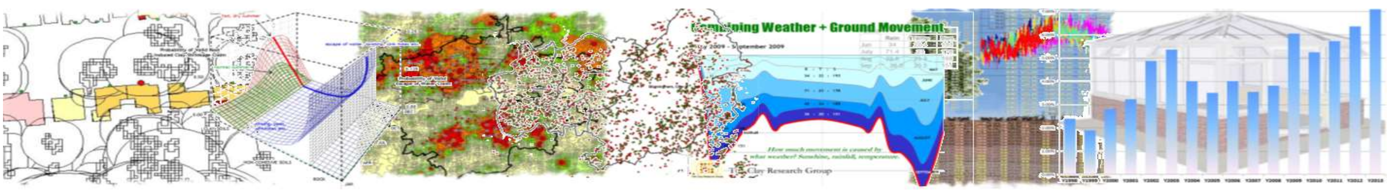
All Properties

On a general note, the reversal of rates for valid-v-declined by season is a characteristic of the underlying geology. For clay soils, the probability of a claim being declined in the summer is usually low, and in the winter, it is high.

Valid claims in the summer are likely to be due to clay shrinkage, and in the winter, escape of water. For non-cohesive soils, sands gravels etc., the numbers tend to be fairly steady throughout the year.

Liability by Season - ELMBRIDGE

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Elmbridge	0.324	0.294	0.382	0.33	0.30	0.37



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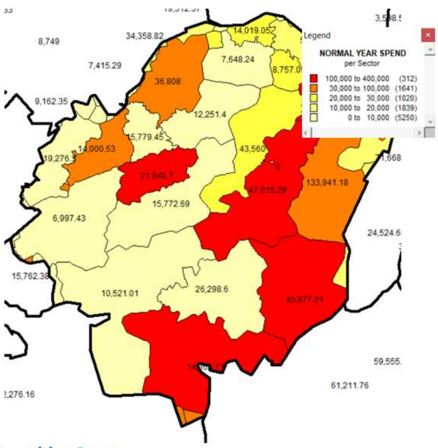
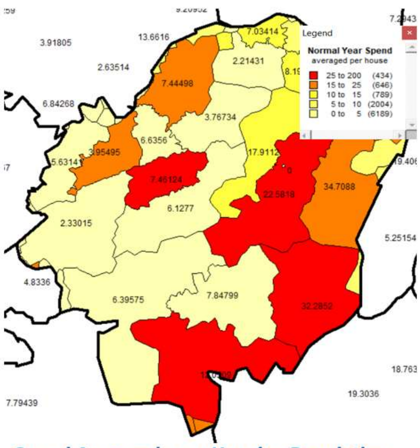
Aggregate Subsidence Claim Spend by Postcode Sector and Household in Surge & Normal Years

The maps below show the aggregated claim cost from the sample per postcode sector for both normal (top) and surge (bottom) years. The figures will vary by the insurer's exposure, claim sample and distribution.

NORMAL YEAR SPEND – ELMBRIDGE



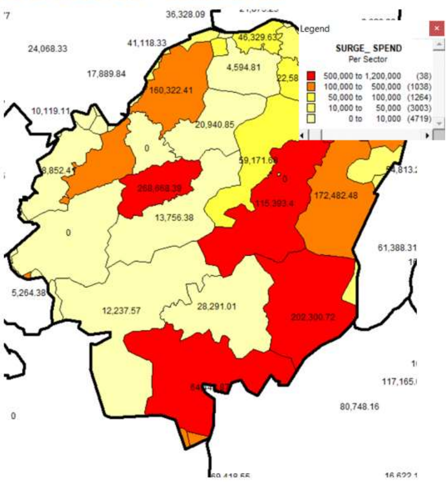
Spend by Sector



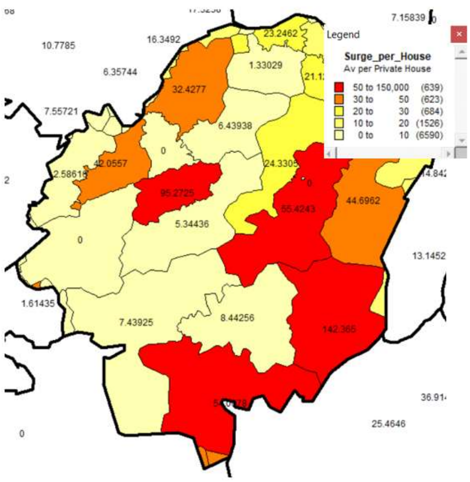
Spend Averaged over Housing Population

It will also be a function of the distribution of vegetation and age and style of construction of the housing stock. The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across housing population to derive a notional premium per house for the subsidence peril. The figures can be distorted by a small number of high value claims.

SPEND in SURGE – ELMBRIDGE



Spend by Sector



Spend Averaged over Private Housing Population

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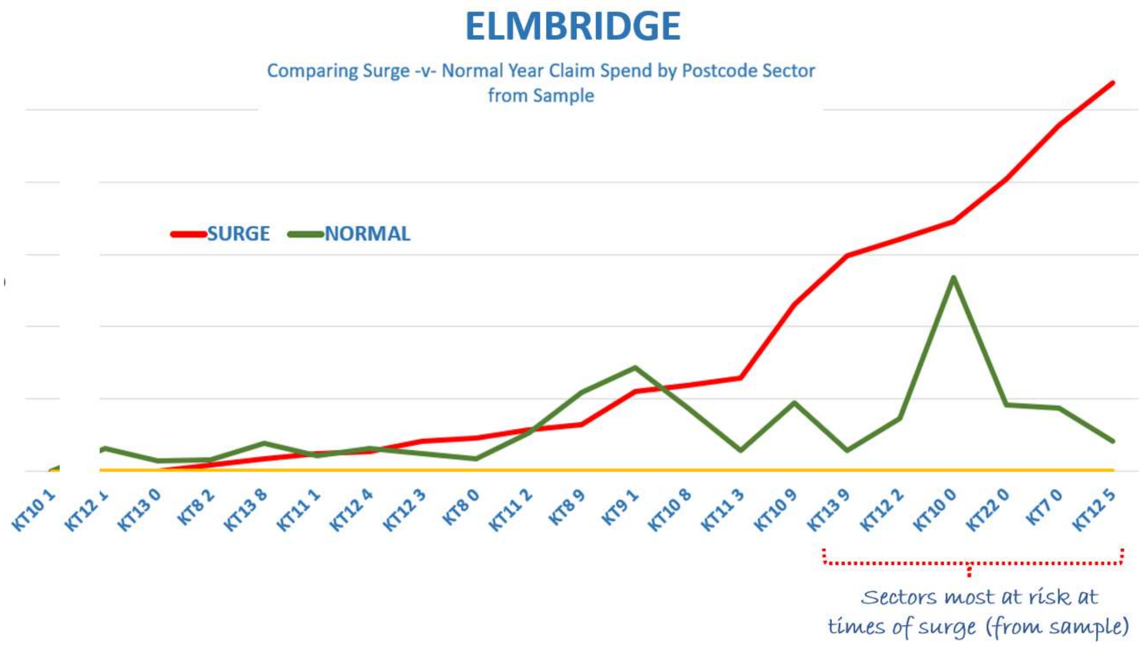

The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

It is of course the case that a single expensive claim (a sinkhole for example) can distort the outcome using the above approach. With sufficient data it would be possible to build a street level model.

In making an assessment of risk, housing distribution and count by postcode sector play a significant role. One sector may appear to be a higher risk than another based on frequency, whereas basing the assessment on count may deliver a different outcome. This can also skew the assessment of risk related to the geology, making what appears to be a high-risk series less or more of a threat than it actually is.

The models comparing the cost of surge and normal years are based on losses for surge of just over £400m, and for normal years, £200m.