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

September 2026
Issue 256

The Clay Research Group

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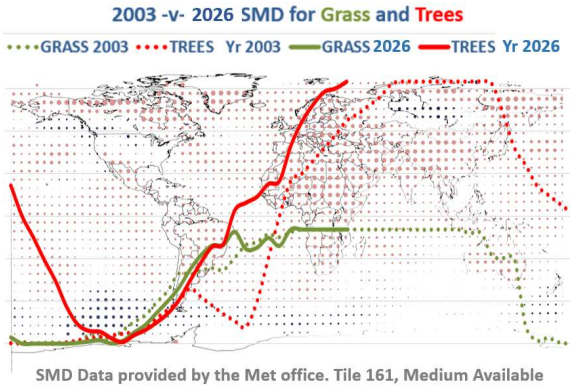
Issue 256, September 2026

SMD Graph



SMD Data provided by the Met office. Tile 161, Medium Available Water Capacity with grass and tree cover

SMD graph for Met Office tile 161 plotting the correlation between the SMD for a surge year (2003) and the current year in soils with medium water capacity.

Claim numbers have risen considerably towards the end of August due to the period of record breaking warm, dry weather.

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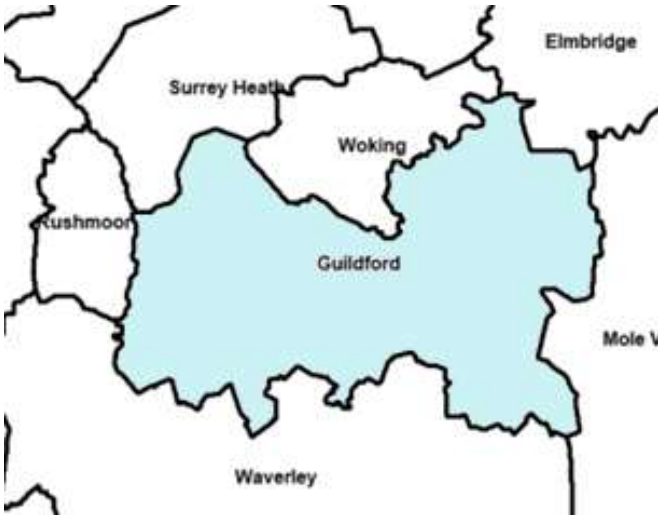
District and Sector Risk

Guildford is situated in West Surrey. It has an area of 271km^2 and a population of around 77,000.

It is the subject of the 'Risk by District' series in this month's edition. Its geology comprises a small area of drift deposits overlying a variable solid geology - see Page 8.



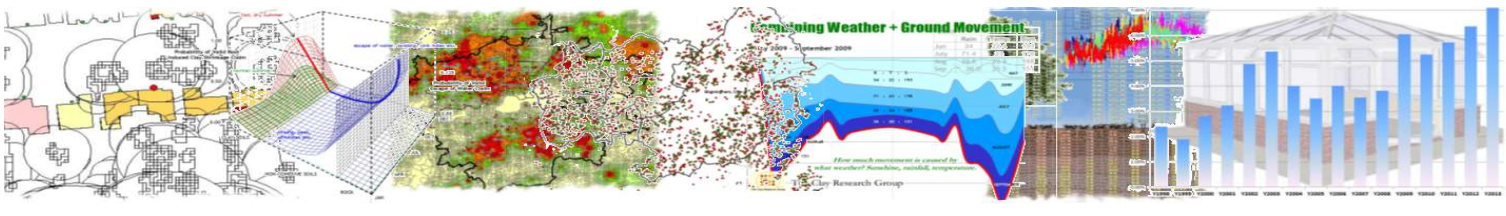
The risk maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

Vegetation VOC Emissions

Perversely, Volatile Organic Compound (VOC) emissions from urban vegetation may contribute substantially to ozone formation in urban regions according to a paper cited in the journal Nature.

https://www.science.org/doi/10.1126/sciadv.aee5583

ChatGPT explains VOC on the following pages.



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What are Volatile Organic Compounds?

Question to ChatGPT

What are Volatile Organic Compounds?

ChatGPT

Response:

Volatile organic compounds (VOCs) are **carbon-containing chemicals that easily evaporate into the air at room temperature**. The term "volatile" means they readily become gases, and "organic" means they contain carbon (though not all carbon-containing compounds are considered VOCs).

Common sources of VOCs
VOCs are found in many everyday products and materials, including:

- Paints, stains, and varnishes
- Cleaning products and disinfectants
- Air fresheners and scented candles
- Gasoline and vehicle exhaust
- Glues, adhesives, and solvents
- New furniture, carpets, and flooring
- Building materials such as plywood and particleboard
- Personal care products like perfumes, nail polish, and hairspray

Examples of VOCs
Some well-known VOCs include:

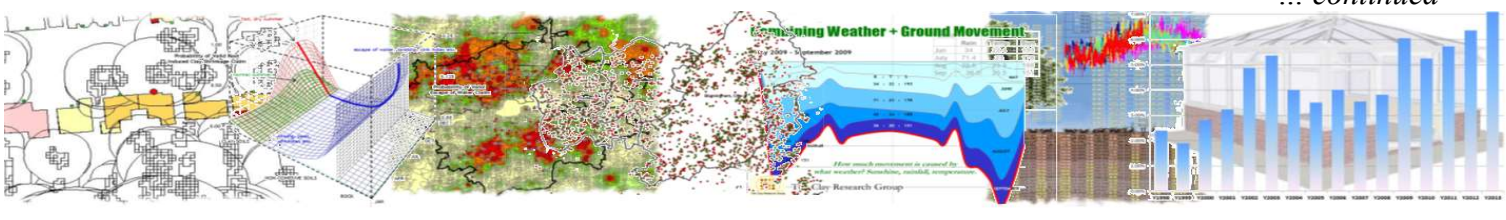
- **Formaldehyde** (often released from pressed wood products)
- **Benzene** (found in gasoline and tobacco smoke)
- **Toluene** (used in paints and adhesives)
- **Xylene** (used in solvents and printing)
- **Acetone** (found in nail polish remover)

Why are VOCs important?
Exposure to VOCs can affect health, depending on the chemical, concentration, and duration of exposure.

Short-term exposure may cause:

- Eye, nose, and throat irritation
- Headaches
- Dizziness
- Nausea
- Worsening of asthma symptoms in some people

... continued



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Long-term exposure to certain VOCs may increase the risk of:

- Liver or kidney damage
- Nervous system effects
- Some cancers (for example, benzene is a known human carcinogen)

Not all VOCs are equally harmful—some have relatively low toxicity, while others can pose significant health risks.

VOCs and indoor air quality

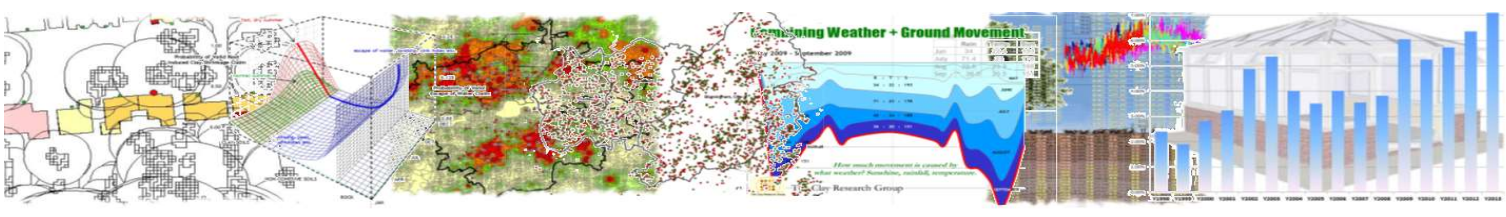
Indoor VOC levels are often **2–5 times higher than outdoor levels**, especially after activities like painting, remodelling, or bringing new furniture into a home. Poor ventilation can make concentrations even higher.

How to reduce VOC exposure

You can lower VOC levels by:

- Choosing **low-VOC or zero-VOC** paints and finishes.
- Ventilating your home well, especially when using paints, cleaners, or solvents.
- Storing chemicals in tightly sealed containers outside living spaces when possible.
- Letting new furniture or carpets "off-gas" in a well-ventilated area before extensive use.
- Avoiding unnecessary use of scented products and air fresheners.
- Maintaining good indoor ventilation with open windows or mechanical ventilation when weather permits.

In short, VOCs are a broad group of chemicals that evaporate easily into the air. Many are harmless at low levels, but some can affect health or contribute to air pollution, making it worthwhile to minimize unnecessary exposure—particularly indoors.



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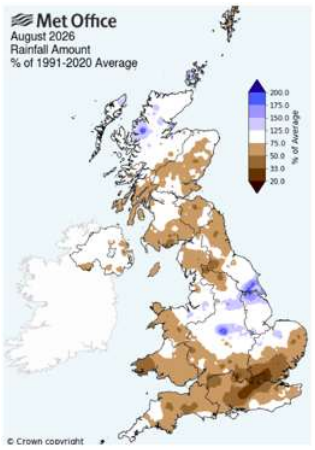
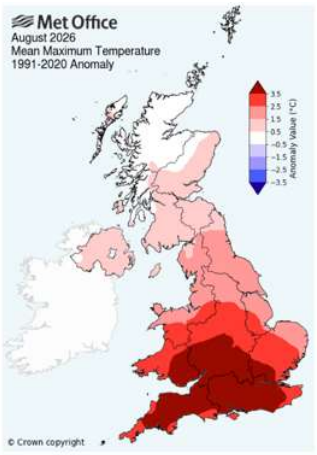
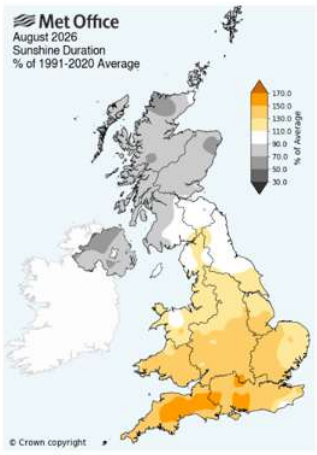
Met Office Anomaly Maps for August 2026

Anomaly maps from the Met Office web site for the month of August 2026 comparing data with the 1991 – 2020 average reproduced below.

Low rainfall in many parts of the country, high temperatures and sunshine duration may lead to high claim numbers and a significant increase in claim costs. ABI data lists an average claim cost for subsidence of £20,000 in the second quarter of 2026.







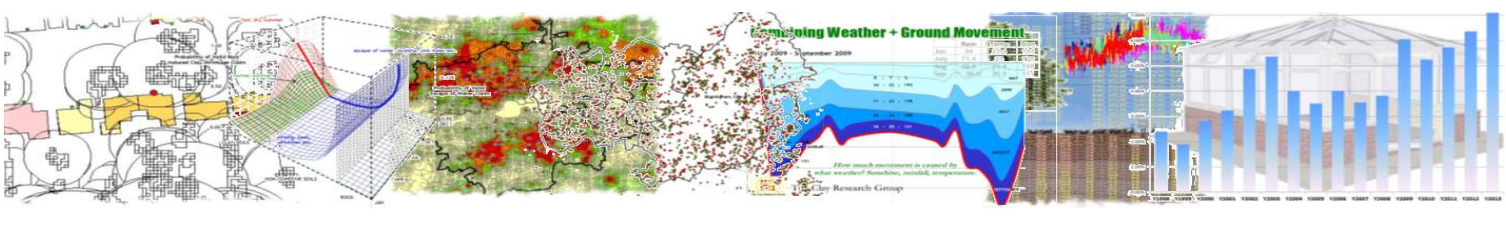
The Met Office report that this summer has been the hottest since records began in 1884 and that *"2026 is going to be renowned for the development of the largest El Niño in living memory"*.

The American newscasting channel, CNN, report the views of Aviva and the BGS.

According to CNN, Aviva considers the risk for London … *"Across many parts of the city, 100% of properties are projected to face possible or probable subsidence risk in 2030, according to data from the British insurance company Aviva. This includes central areas such as Kensington, the City of London and Westminster."*

The BGS view is reported to be *"Subsidence is one of the most damaging geohazards in the UK today," said a spokesperson for the British Geological Survey, or BGS. And experts warn the problem is only going to worsen as humans continue to burn fossil fuels and heat the planet."*

https://www.cnn.com/2026/09/11/climate/london-subsidence-heat-clay-soil-sinking-insurance?Date=20260911&Profile=CNN,CNN+International,CNN+Weather&utm_content=1789114782&utm_medium=social&utm_source=facebook&fbclid=IwdGRjcAUQ0URwZG9mBWZkaWQWUONmSAH1BEnslz8wt1P8ZDagKx95zWV4dG4DYWVtAjExAHNydGMGYXBwX2lkCjY2Mjg1NjgzNzkAAR5kkqhULcR-OeeZrbDVw-hAR7m7mTRAZxvgVx_b0m7nueAqXGiE64S3P_ObaA_aem_yqAqWAMXbhu9NdQLocC2tA



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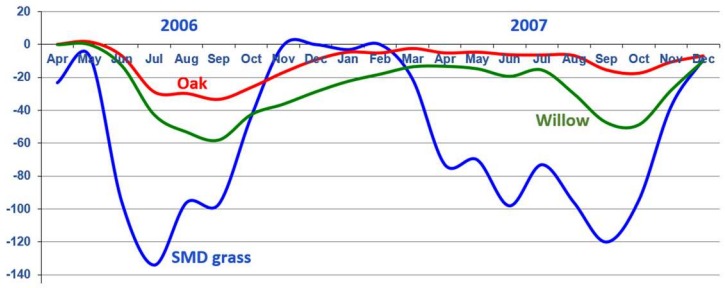
Relationship between SMD and Ground Movement

Below, a graph plotting the relationship between the Soil Moisture Deficit for grass and ground movement for the oak and willow trees recorded at the Aldenham Research Site in 2006 and 2007. Claim numbers for 2006 were 488,100 and for 2007, 37,200. We do not have SMD data for trees for this period, but nonetheless, the relationship with ground movement is of interest. We asked Google AI to comment on the correlation between SMD values for grass and trees and it came up with the following:-

> **"Your correlation is highly statistically significant.** With a sample size of \(360\) and a correlation coefficient of \(0.75\), the probability of this relationship happening by random chance is virtually zero (\(p < 0.0001\)). This represents an exceptionally strong and dependable positive relationship between your two sets of data."



Claims 48,100 37,200

Building the CRG Geological Grid

The CRG geological grid on page 9 has been built using the results of site investigations from actual claims and plotting the shrink/swell potential of clay soils on a 250m grid.

To the right, extracts from investigations from two postcode sectors in Guildford district describing the soil composition and listing Atterberg Limits.

Guildford, Surrey, GU4 7EL — REPORT DATE:- 19 Mar 12 — 2093

NOTE :- Column "dh" below is outside of UKAS accreditation and is an inference based on the heave analysis [dh (Blue) extrapolated] . "N.P." in the plastic limit column = "Non-Plastic"

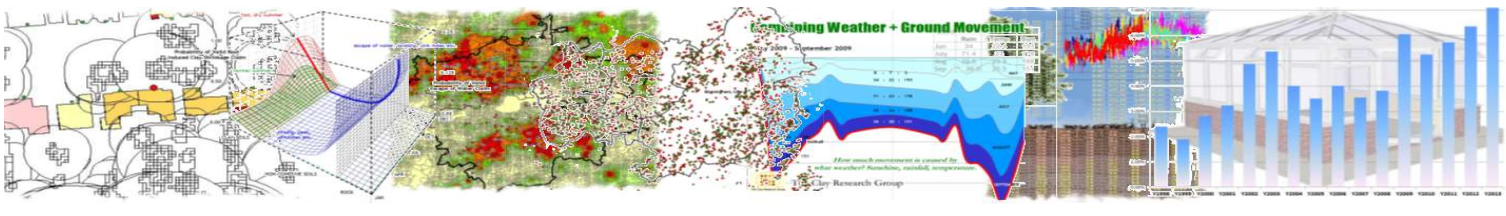
DEPTH M.	M.C. (%)	ATTERBERG LIMITS. L.L. (%)	P.L. (%)	P.I. (%)	425um (%)	AV. Filter Paper M.C.(%) & No.	dh (mm)	BRIEF SOIL DESCRIPTION
1.10	28	76	26	50	99	-	0.0	Firm brown CLAY with rare fine/medium gravel & grey veinings.
1.75	29	-	-	-	-	-	0.0	Firm/stiff brown CLAY with rare grey veinings.
2.25	29	75	26	49	100	-	0.0	Firm/stiff brown CLAY with rare sand, fine gravel & grey veinings.
2.75	30	-	-	-	-	-	0.0	Firm/stiff brown CLAY with rare fine gravel & grey veinings.
3.25	32	80	29	51	100	-	0.0	Firm/stiff brown CLAY with rare fine gravel & grey veinings.
3.75	33	-	-	-	-	-	0.0	Firm/stiff brown CLAY with rare fine gravel & grey veinings.

The top extract reveals a clay soil with index properties averaging 50% whereas the lower data reveals a predominantly sandy soil with some clay content, classified as non-plastic.

Ash Vale, Aldershott, GU12 5EA

NOTE :- Column "dh" below is outside of UKAS accreditation and is an inference based on the heave analysis [dh (Blue) extrapolated] . "N.P." in the plastic limit column = "Non-Plastic"

DEPTH M.	M.C. (%)	ATTERBERG LIMITS. L.L. (%)	P.L. (%)	P.I. (%)	425um (%)	AV. Filter Paper M.C.(%) & No.	dh (mm)	BRIEF SOIL DESCRIPTION
0.71	31	35	21	14	99	-	0.0	Very soft mottled brown/grey/dark brown sandy CLAY with rare fine/medium gravel.
1.25	27	-	-	-	-	-	0.0	Very soft brown/grey sandy CLAY with rare fine/medium gravel.
1.75	22	-	N.P.	-	97	-	0.0	Moist grey SAND with rare fine gravel.
2.25	21	-	-	-	-	-	0.0	Moist grey SAND.
2.75	23	-	N.P.	-	100	-	0.0	Moist grey slightly clayey SAND.
3.25	24	-	-	-	-	-	0.0	Moist grey slightly clayey SAND.
3.75	24	-	N.P.	-	100	-	0.0	Moist grey SAND.



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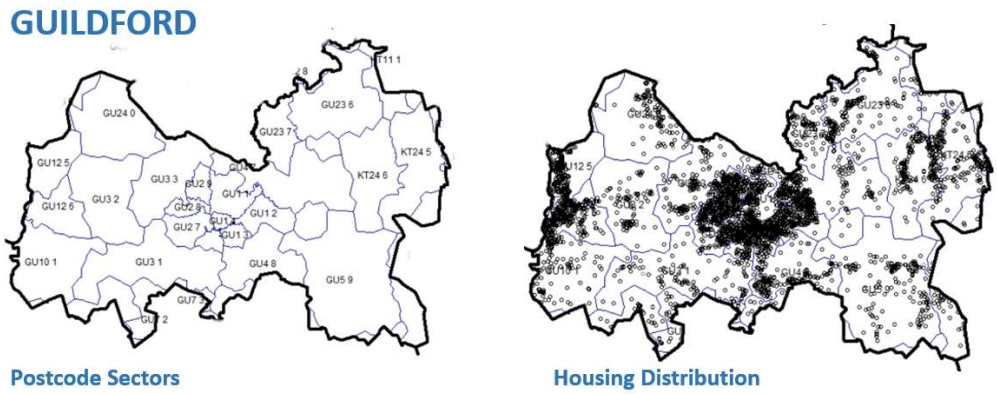
Subsidence Risk Analysis – Guildford

Guildford is situated in West Surrey. It has an area of 271km^2 and a population of around 77,000.

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?

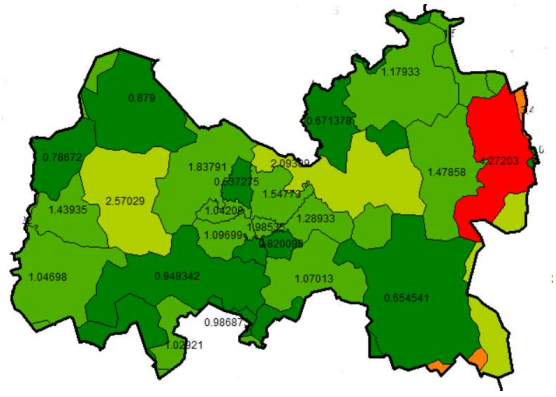


Distribution of postcode sectors and housing stock using full postcode as a proxy. Each sector covers around 3,000 houses on average across the UK and full postcodes include around 15 – 20 houses on average, although there are large variations.

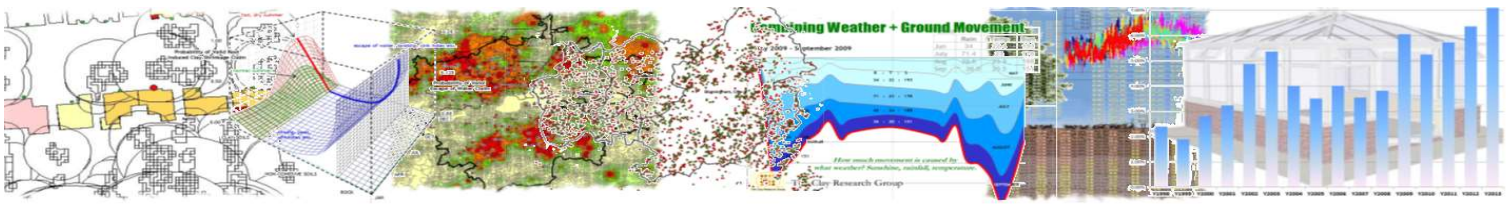
Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.

In terms of risk, Guildford is rated 89th out of 413 districts in the UK from the sample analysed and is around 1.389x the risk of the UK average, or 0.36 on a normalised 0 - 1 scale.

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



Sector risk compared to UK average from the sample analysed.



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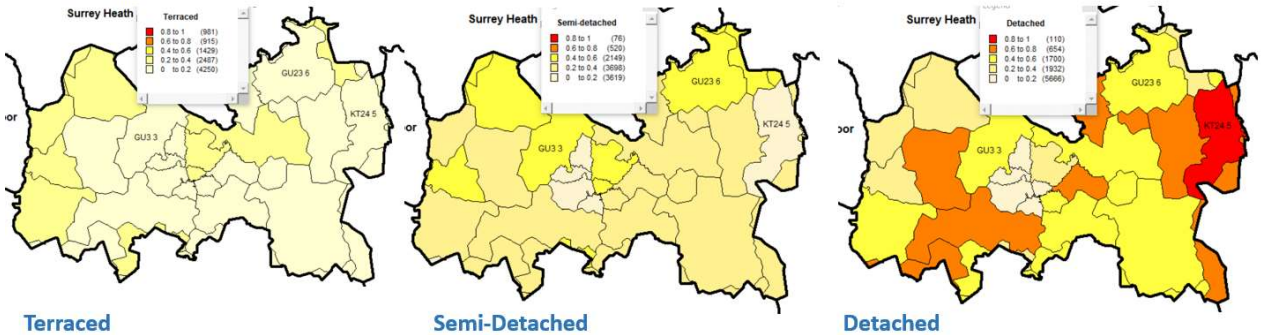
Guildford - Properties by Style and Ownership

Below, the general distribution of properties by style of construction, distinguishing between terraced, semi-detached and detached. Unfortunately, the more useful data – property age - is missing at sector level.

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 taking out the policy.

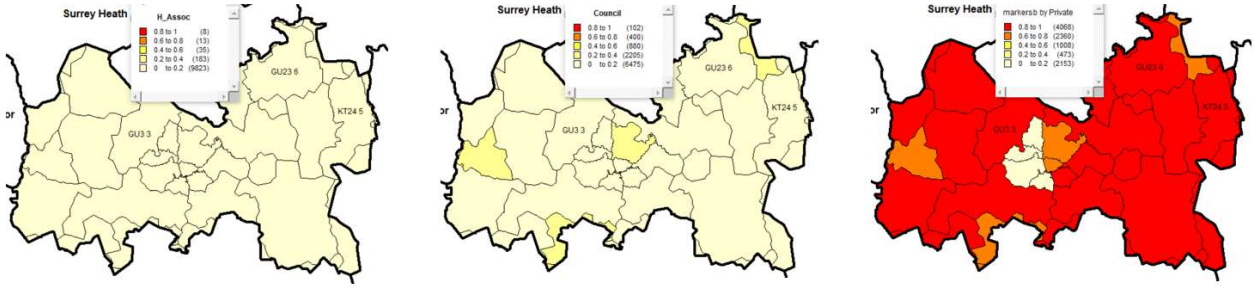
GUILDFORD - Distribution by House Type



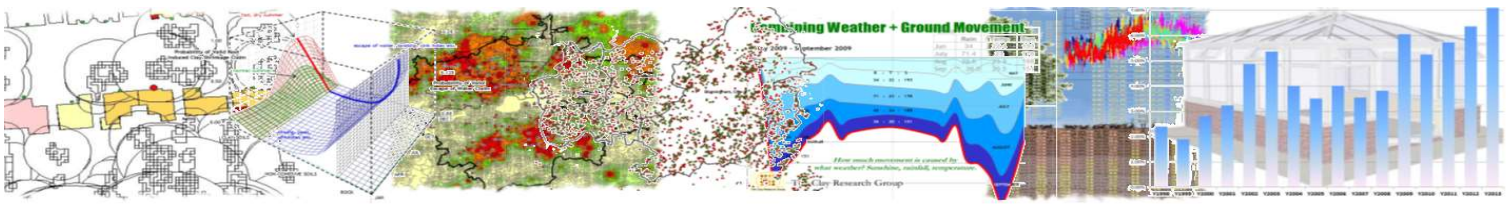
Terraced Semi-Detached Detached

Distribution by ownership is shown below. The maps suggest predominantly detached houses in private ownership.

GUILDFORD - Distribution by Ownership



Housing Association Council Ownership Private Ownership



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Subsidence Risk Analysis – Guildford

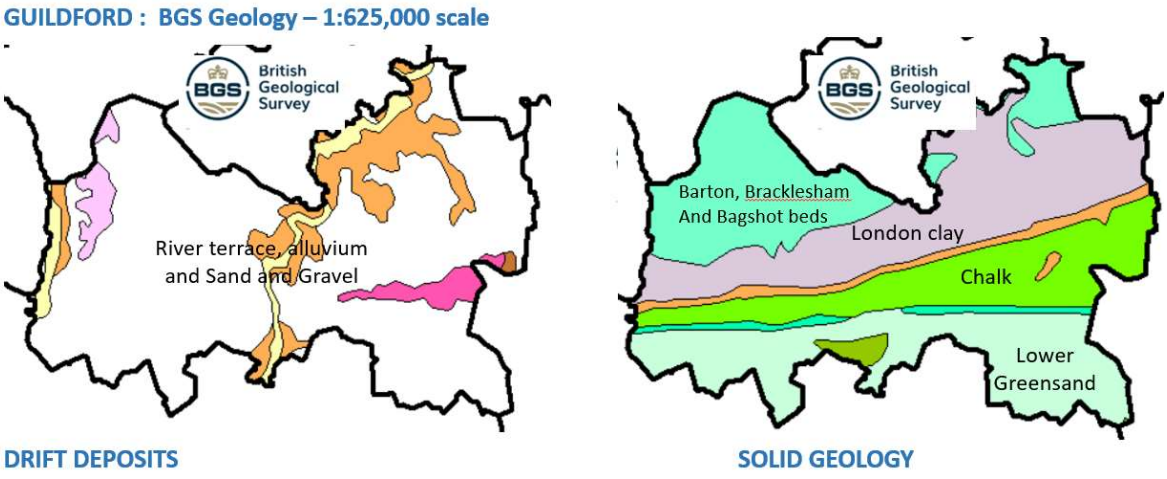
Below, extracts from the British Geological Survey low resolution 1:625,000 scale geological maps showing the solid and drift series. View at:

http://mapapps.bgs.ac.uk/geologyofbritain/home.html

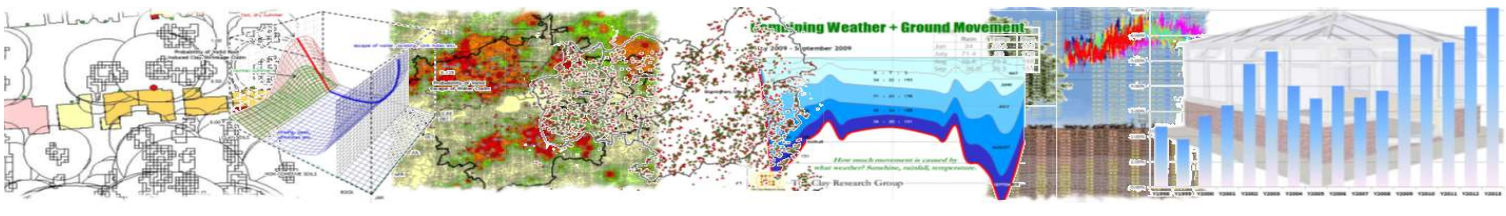
See page 11 for a seasonal analysis of the sample which reveals that, at district level, from the sample held, there was around a 76% probability of a claim being valid in the summer and, of the valid claims, there is a 85% probability that the damage will have been caused by clay shrinkage.

In the winter, the likelihood of a claim being valid is around 31%, and of the valid claims, around 87% were attributable to an escape of water.

The geology comprises small areas of drift deposits overlying a variable solid geology.



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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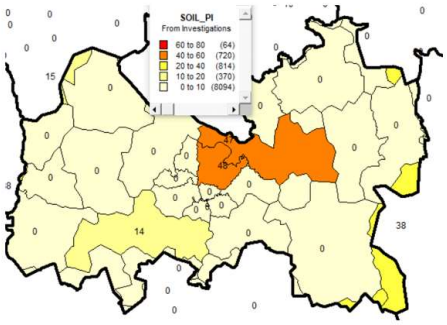
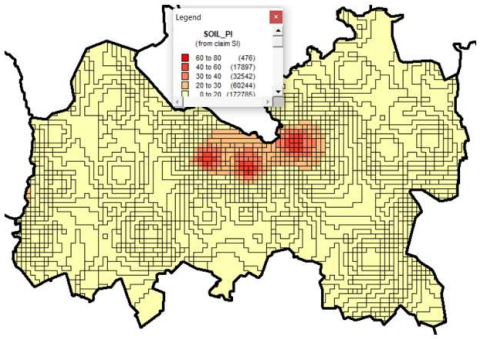
Liability by Geology and Season

Below, the average PI by postcode sector (left) derived from site investigations undertaken associated with claims and interpolated to develop the CRG 250m grid (right).

GUILDFORD – Soil Plasticity Index



Soil PI Averaged by Sector

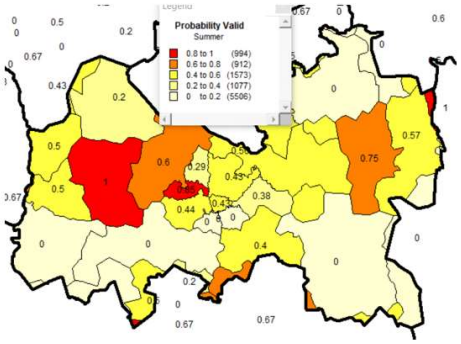


PI Interpolated on 250m CRG grid

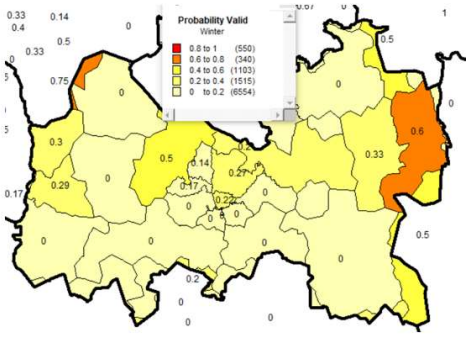
Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

The maps below show the seasonal difference from the sample used. Combining the risk maps by season and reviewing the table on page 11 is perhaps the most useful way of assessing the potential liability, likely cause and geology using the values listed.

GUILDFORD – by season



Probability Valid, Summer



Probability Valid, Winter

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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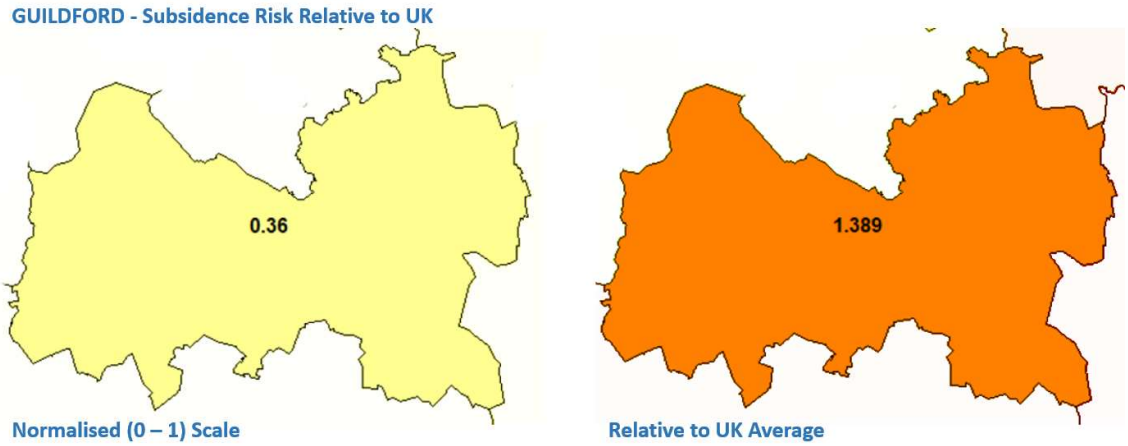
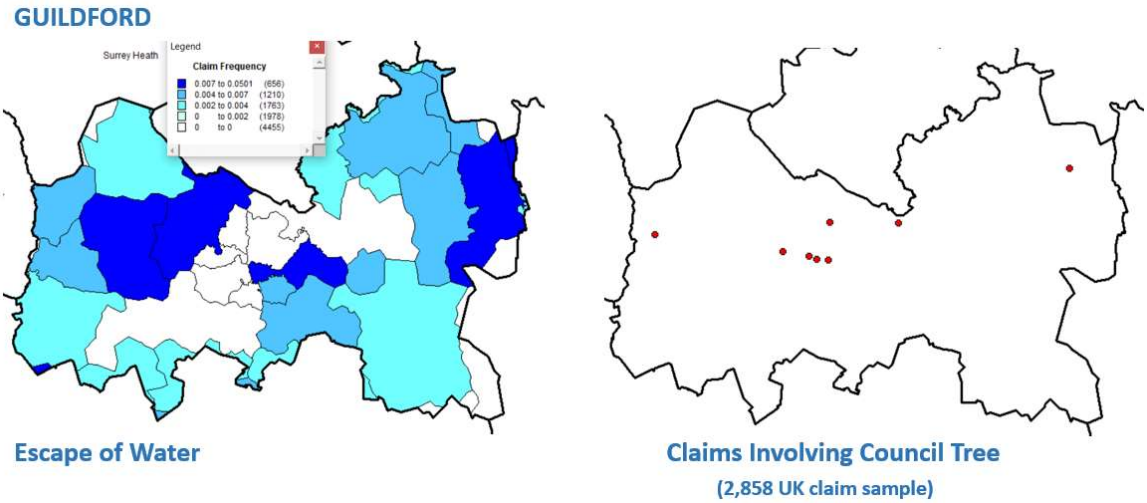
District Risk. EoW and Council Tree Risk.

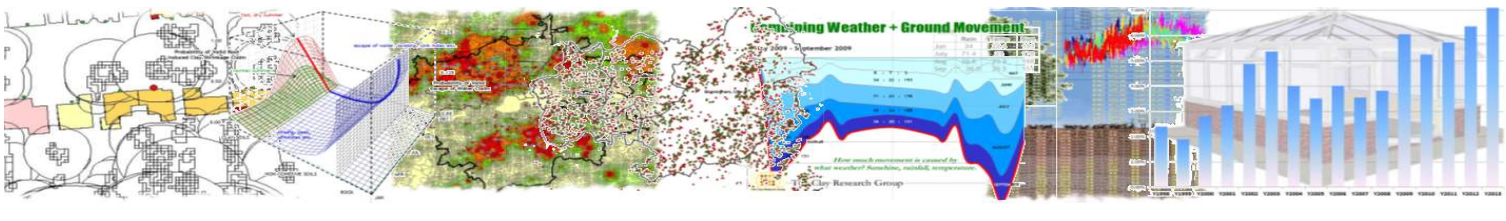


Below, left, mapping the frequency of escape of water claims reflecting the nature of the underlying soil.

As we would expect, the 1:50,000 scale BGS map provides a more detailed picture. The CRG 1:250 grid reflects claims 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.





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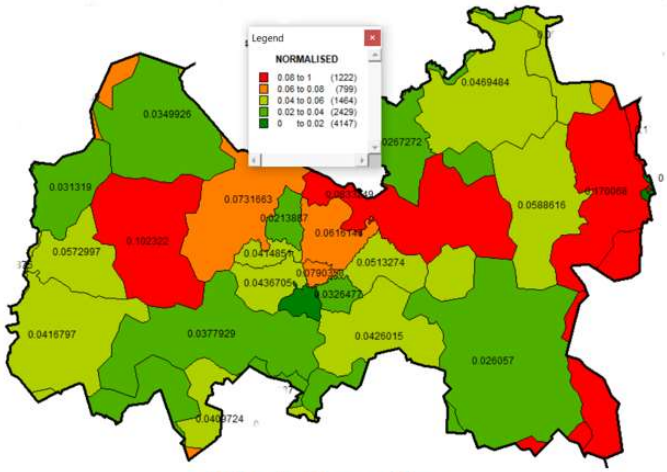
Guildford - Frequencies & Probabilities

Below, mapping the risk of subsidence by ownership. Claims frequency that includes council and housing association properties delivers a misleading value of risk as they self-insure. The following show the normalised risk for the private housing population.

GUILDFORD - Sector Risk Compared with UK Average



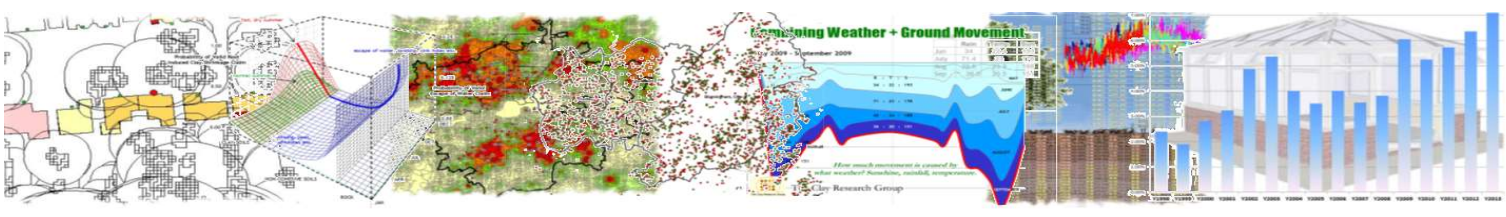
Private Properties

To reiterate, a 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.

In this case, the values reflect the presence and influence of the underlying geology with non-shrinkable soils accounting for a higher proportion of Escape of Water claims throughout the year.

Liability by Season - GUILDFORD

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Guildford	0.625	0.137	0.238	0.08	0.37	0.55



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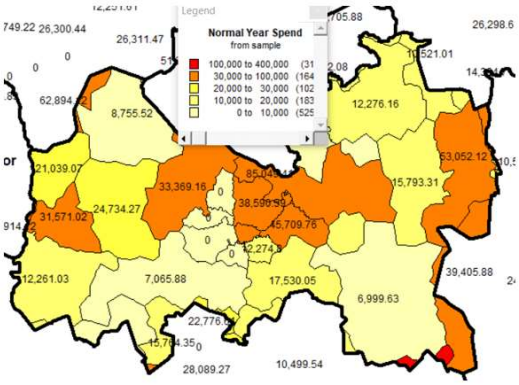
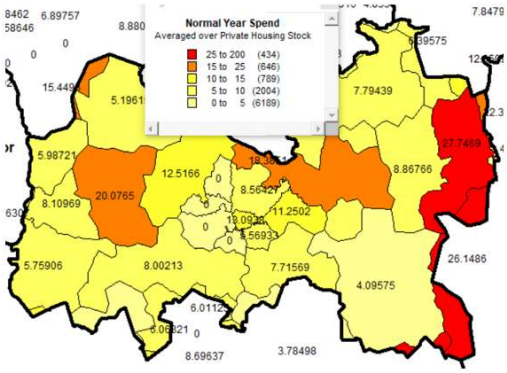
Aggregate Subsidence Claim Spend by Postcode Sector and Household in Normal & Surge Years

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 of course.

NORMAL YEAR SPEND – GUILDFORD



Spend by Sector

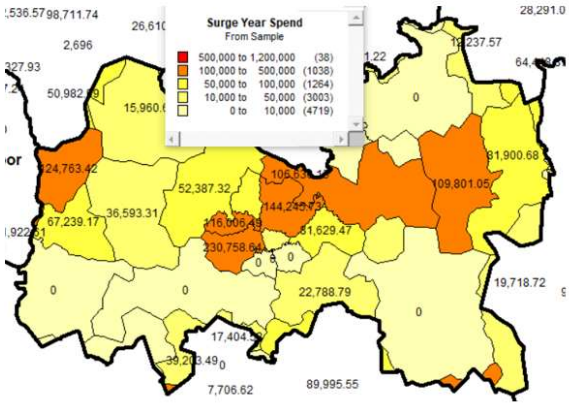


Spend Averaged Over Private Housing Population

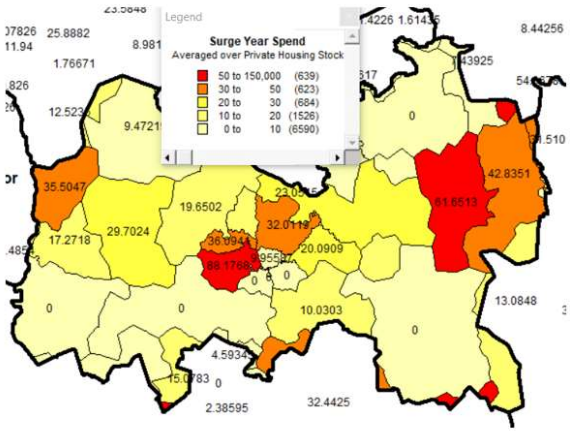
The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across private housing population to derive a notional premium per house for the subsidence peril.

In this case, the absence of any distinct difference between surge and normal years reflects the geology.

SPEND in SURGE – GUILDFORD



Spend by Sector



Spend Averaged over Private Housing Population