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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

August 2024
Issue 231

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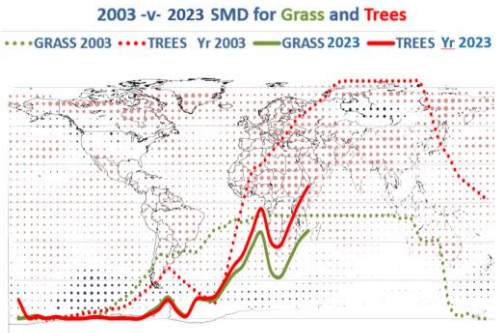
CONTENTS

SMD

The SMD for both trees and grass is well below values recorded in a surge year (2003 in this example) suggesting a surge is unlikely.



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

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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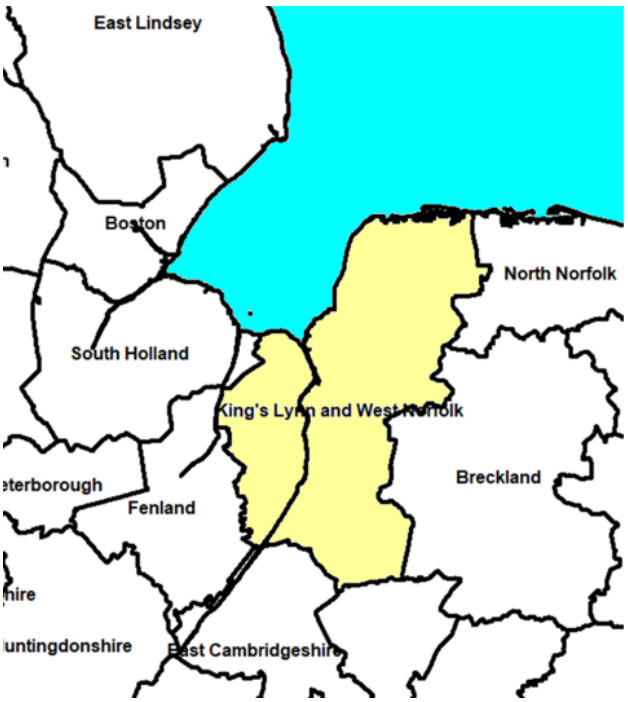
District and Sector Risk

King's Lynn is the subject of the 'Risk by District' series in this month's edition. It has superficial deposits of peat and alluvium overlying clay and chalk – see Page 8.

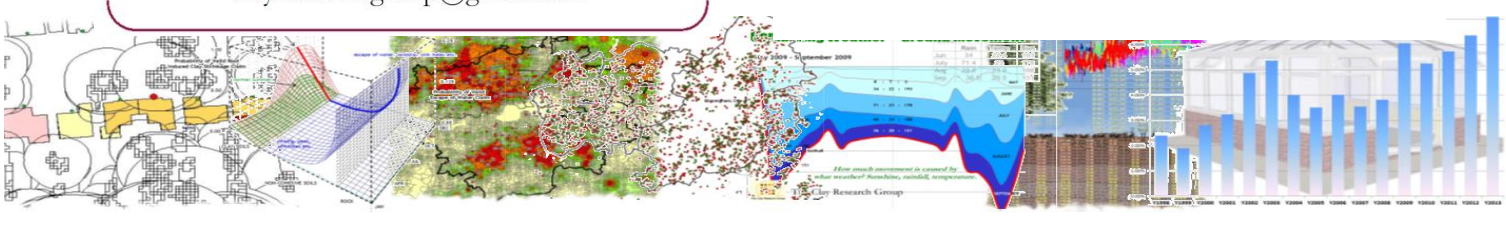


The risk maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

BGS

View the BGS newsletters at https://content.govdelivery.com/accounts/UKBGS/bulletins/3a54171.

The summer issue covers numerous topics but of particular interest may be the inclusion of BGS datasets on the OS data hub, allowing users to combine both maps. Visit https://osdatahub.os.uk/downloads/open.



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Disputes between Insurers and Councils

Thanks to Keiron Hart of Tamla Trees Limited for sending the link to the BBC web site covering several tree topics: https://www.bbc.co.uk/news/articles/c724g0d8wwlo The following is an extract relating to the conflict when council trees are involved:

> *"Simon Martin, the leader of Fareham Borough Council in Hampshire, said trees were increasingly being held responsible for damage to buildings through subsidence and that compensation claims should be "limited to situations such as those where it has been demonstrated that there is no viable alternative to felling a tree and the local authority still refuses consent".*
>
> Simon explained that Fareham Council had no budget for compensation claims and had allowed 135 out of 144 felling applications in two years.
>
> *"The Association of British Insurers said felling was not its default solution to protect homes. In a statement it said: "It is a balance between preserving greenery, while ensuring that homeowners can get competitively priced home insurance, not least because without it their mortgage could be at risk."*

From the following article it can be seen that research is in fact being undertaken by insurers and their agents to provide a faster, environmentally friendly and cheaper solution to the problem of root induced clay shrinkage claims.

Soil Stabilisation using EKS

Allan Tew, Head of Engineering at Innovation Group, is carrying out research into soil stabilisation using ElectroKinetic Stabilisation (EKS) methods. The following illustrate the nature of the problem and the remedial measures undertaken.

Damage to a house, built in 1980, was attributable to root induced clay shrinkage. In this case, a 25m tall oak tree, 25m away from the property. Allan explains: *"In the UK the shrinkage and swelling of clay soils, particularly when influenced by trees, is the single most common cause of foundation movements that damage low rise buildings. Trees are known to cause clay soils to shrink by drawing water through their roots, predominantly during spring and summer. This shrinkage results in both vertical and horizontal ground movements, that when transmitted to a building's foundations, cause damage to the building structure. The amount of shrinkage depends on the characteristics of clay soil, the type and size of vegetation, plus variations in climate. Trees growing under grass cover are forced to compete for their water and to extract water from greater depths than they might otherwise do, as is the case in this instance."*

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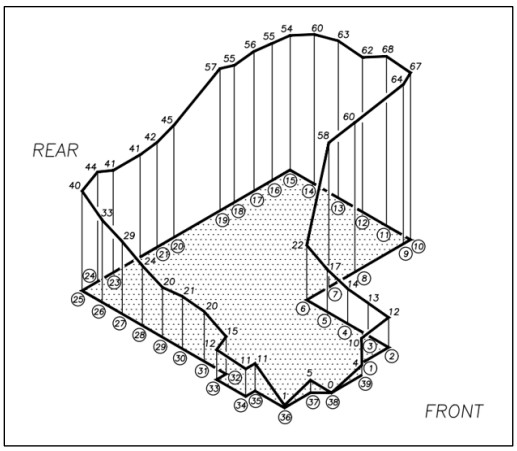
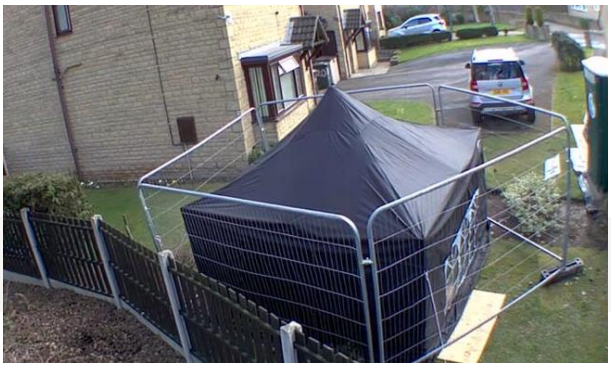
Above, left, electrode array between the house and the trees. Lime is added to the soil to reduce the shrink/swell potential, reduce root activity and moisture change. Below, distortion of building footprint prior to treatment.

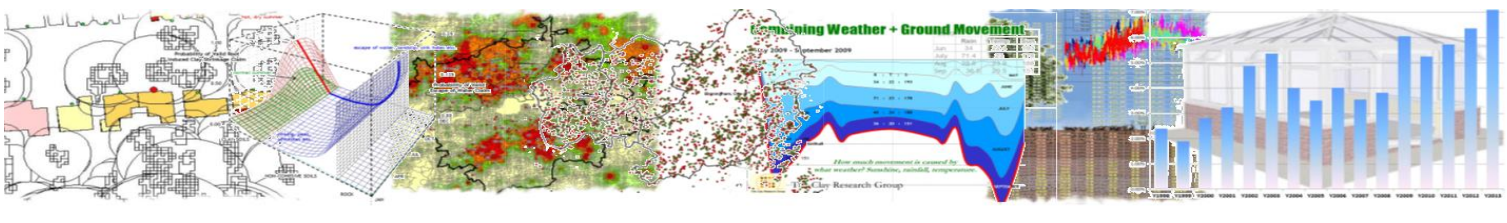


Allan explains the proposed remedy:

"Electrosmosis has proven successful in Geotechnical applications as a result of using the process to introduce an additive into the soil, either through anode/cathode solution or by direct electrolyte replacement. This improves the stability of the soil by a number of processes including cation exchange occurring in the clay mineral content or by cementitious material being deposited in the pore-space. This adaption of Electrosmosis is known as Electrokinetic Stabilisation (EKS).

Electrolysis is powered using solar power and the initial site preparation is relatively straightforward as can be seen below. Trees are retained and costs are significantly less than underpinning.





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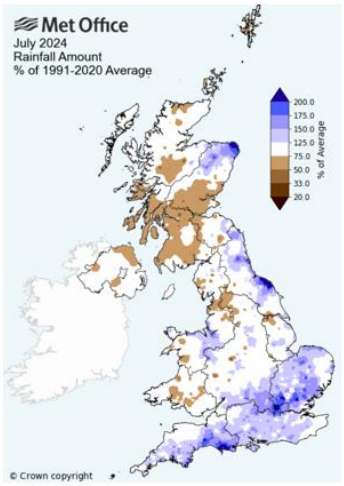
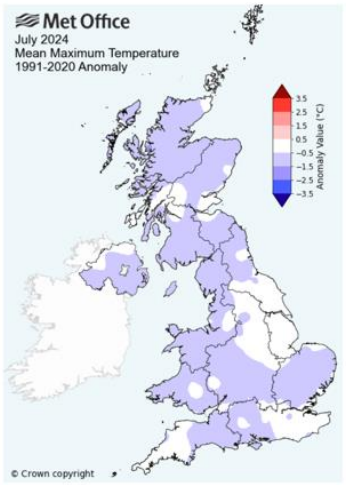
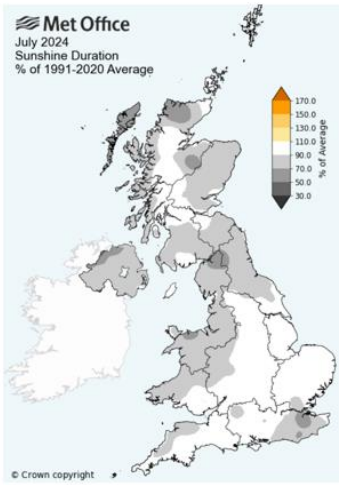
Met Office Anomaly Maps for July 2024

Anomaly maps from the Met Office web site for the month of July 2024 reproduced below.

The month can be summed up as being slightly wetter in the south-east and drier to areas in the north, slightly below average temperature across much of the UK and slightly less sunshine to the south-east than the average for July when compared with the 1991 – 2020 average.



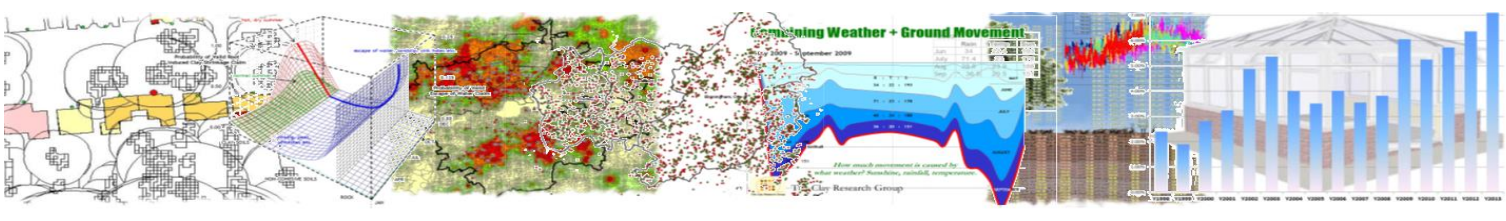




https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps

Trees and Design Action Group

TDAG have a number of presentations listed on their web site at https://www.tdag.org.uk/events.html, and perhaps of specific interest to the subsidence community are the following: **National House Building Council (NHBC) –** TDAG are working with the NHBC and the Arboricultural Association on foundation design for low rise buildings on shrinkable soils with a view to updating NHBC Standards Chapter 4.2 (https://www.nhbc.co.uk/builders/products-and- services/techzone/nhbc-standards). **Tree Law Conference. 17th September, London:** This year's full-day event is a conference of two halves. The morning focuses on hot tree topics such as damage caused by trees, subsidence and heave, planning law and trees and what the Supreme court says on Japanese knot weed. After lunch the afternoon has a Mock Mediation. What really goes on and how does the mediator get the parties to settle. For tickets see: https://www.eventbrite.co.uk/e/tree-law-conference-2024-tickets-815137567407#:~:text=Tree%20Law%20Conference%202024%20Tickets,2024%20at%2009%3A30%20%7C%20Eventbrite



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ChatGPT – is 2024 likely to deliver a surge?

QUESTION TO ChatGPT:

Is 2024 likely to deliver high numbers of subsidence claims?

ChatGPT RESPONSE:

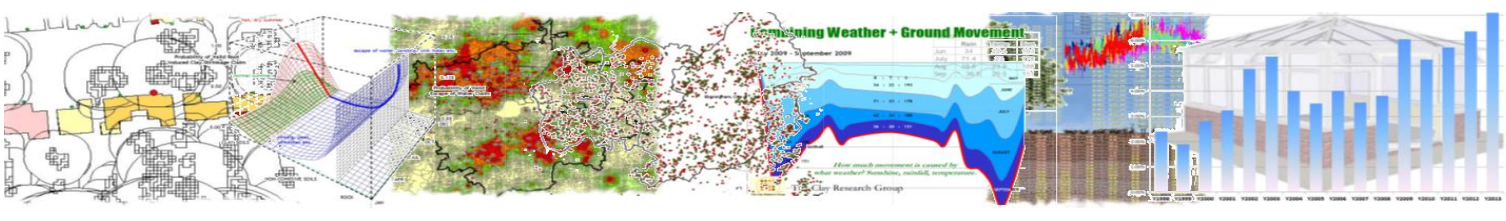
Subsidence claims typically spike during certain conditions, particularly in years with extreme weather patterns. Here are some factors that can influence the likelihood of a high number of subsidence claims in a given year:

1. **Weather Conditions**:
    - **Droughts**: Prolonged periods of dry weather can cause the soil to dry out and shrink, leading to ground movement and potential damage to building foundations.
    - **Heavy Rainfall**: Following a drought, heavy rain can cause the dried-out soil to rapidly swell, leading to instability and further ground movement.
2. **Seasonal Variations**:
    - Typically, subsidence claims are more common during the summer months when higher temperatures can exacerbate soil drying and shrinking.
3. **Geographical Factors**:
    - Regions with clay soils are more susceptible to subsidence because clay soils shrink and swell significantly with changes in moisture levels.
4. **Historical Patterns**:
    - Previous years' data on subsidence claims can provide an indication of potential trends, especially if similar weather conditions are predicted.

Given these factors, to determine if this year is likely to deliver high numbers of subsidence claims, you would need to consider:

- Current and forecasted weather patterns, especially focusing on rainfall and temperature extremes.
- Reports or predictions from meteorological agencies regarding drought conditions or significant rainfall.
- Historical data on subsidence claims in similar conditions.

If there have been recent reports of prolonged dry spells or significant fluctuations in weather conditions, it could indicate a higher likelihood of increased subsidence claims this year.



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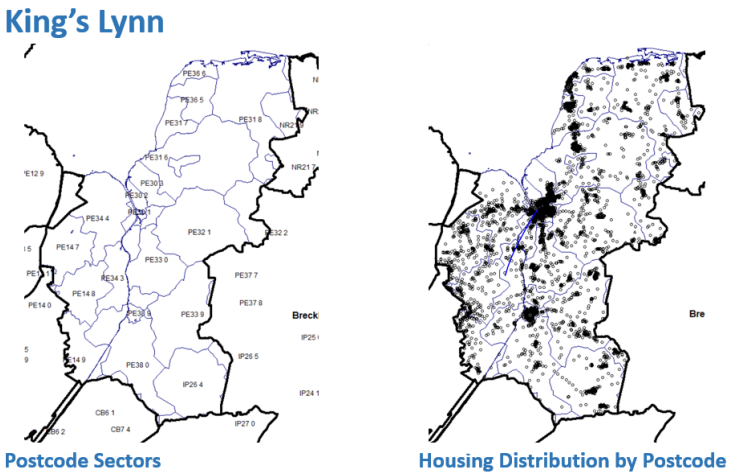
Subsidence Risk Analysis – King's Lynn

King's Lynn is located in the County of Norfolk and occupies an area of 28km^2 with a population of around 43,000.



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.

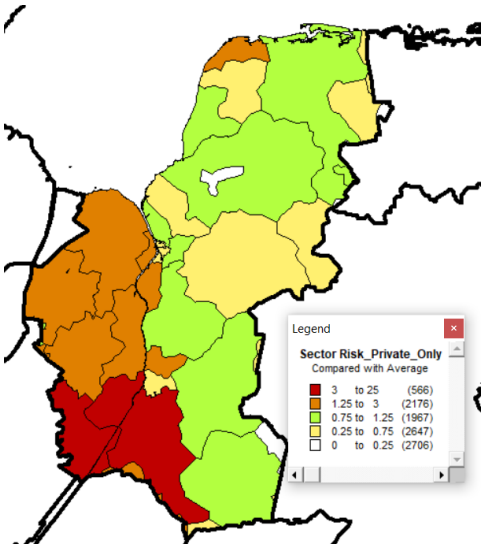
Sector and housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

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.

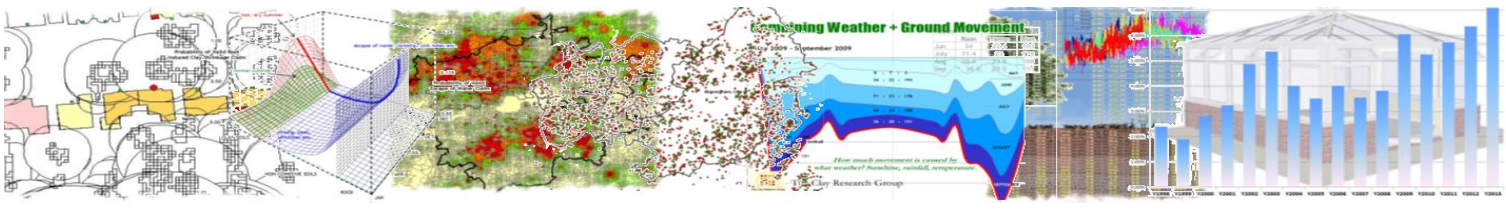
From the sample we hold sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

King's Lynn is rated 139th out of 413 districts in the UK from the sample analysed and is around 1.091x the risk of the UK average, or 0.283 on a normalised 0 - 1 scale.

There is a varied risk across the district as can be seen from the sector map, right. The varied geology (see pages 8 and 9) no doubt accounts for this with peat and clay soils to the west and chalk to the east.



Sector risk compared to UK average from the sample analysed. Private ownership.



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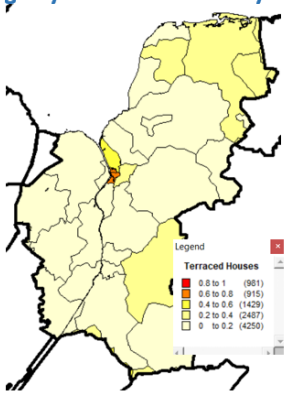
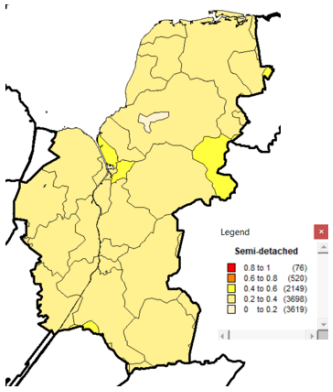
King's Lynn. Properties by Style and Ownership

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 taking out the policy.

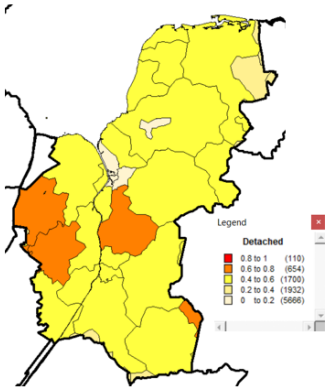
King's Lynn - Distribution by House Type



Terraced



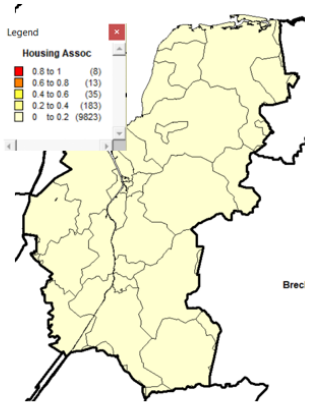
Semi-Detached



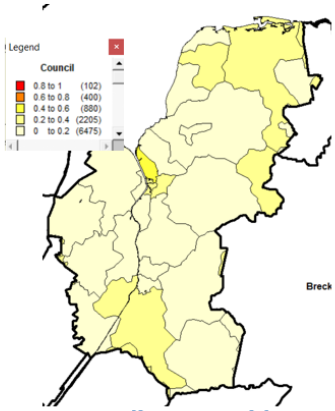
Detached

Distribution by ownership is shown below. Detached private properties are the dominant class across the borough.

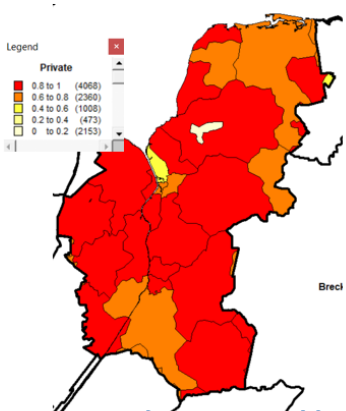
King's Lynn - Distribution by Ownership



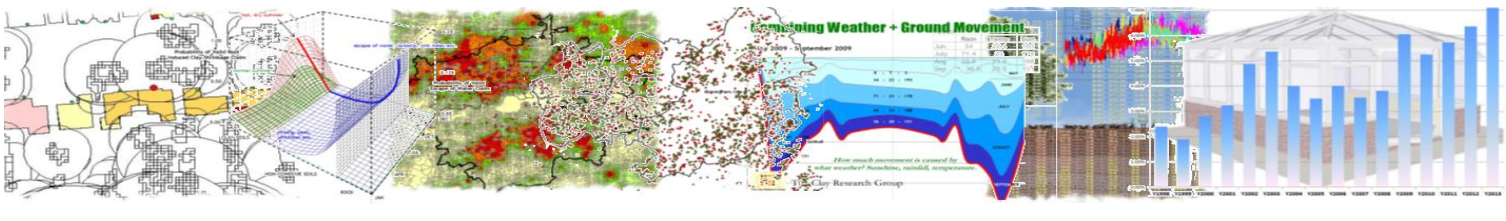
Housing Association



Council Ownership



Private Ownership



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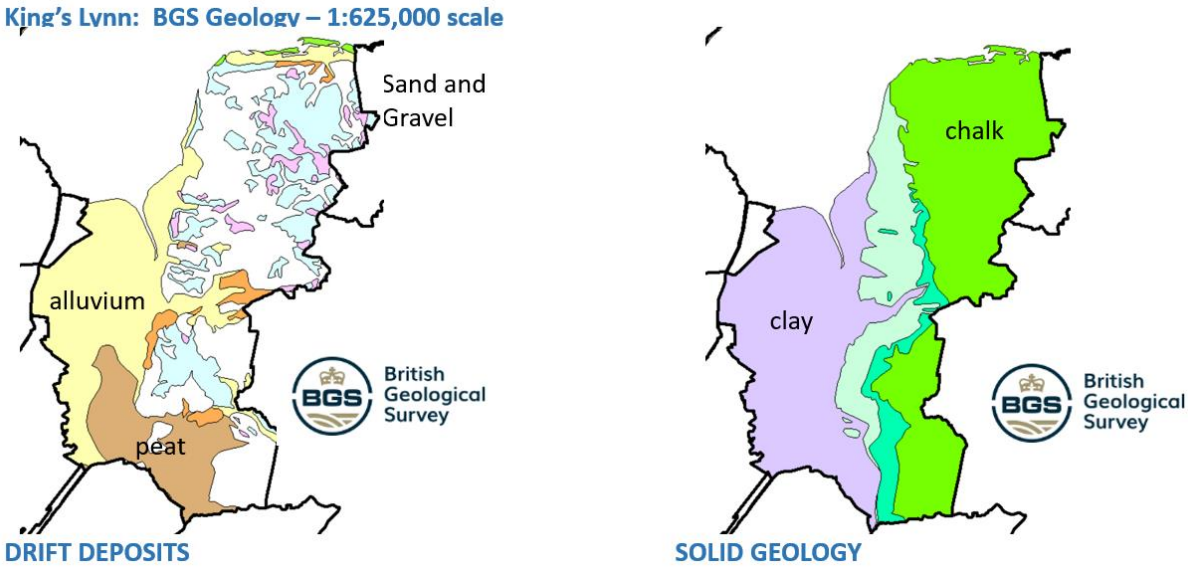
Subsidence Risk Analysis – King's Lynn

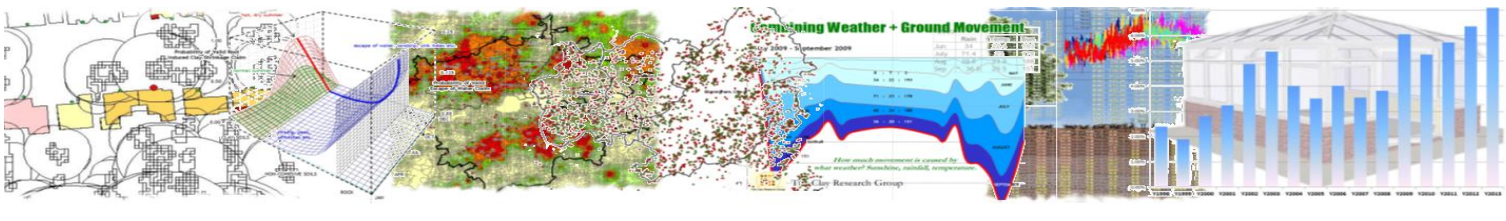
Below, extracts from the British Geological Survey low resolution 1:625,000 scale geological maps showing the solid and drift series. View at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html for more detail.

See page 11 for a seasonal analysis of the sample which reveals that, at district level, there is around a 70% probability of a claim being valid in the summer and, of the valid claims, there is around a 60% chance that the damage will have been caused by clay shrinkage. In the winter, the likelihood of a claim being valid falls to around 60% and of the valid claims there is a 60% chance of the cause being escape of water.

Maps at the foot of the following page plot the seasonal distribution and provide an indication of risk by geological series.



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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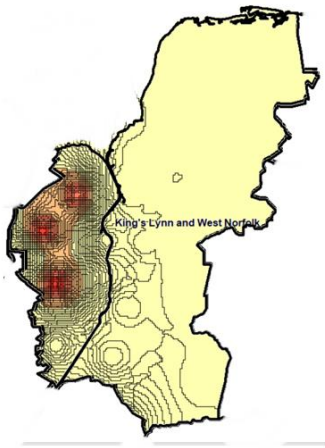
Liability by Geology and Season

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.

King's Lynn – Soil Plasticity Index

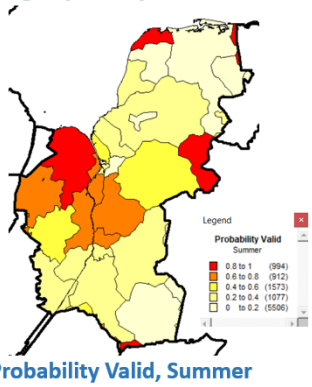
Soil PI Averaged by Sector



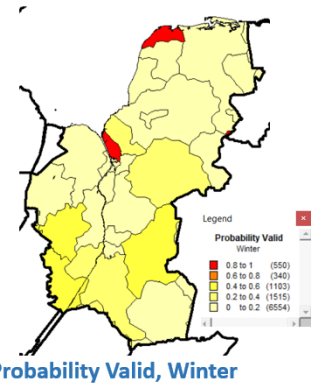
PI Interpolated on 250m CRG grid

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.

King's Lynn – 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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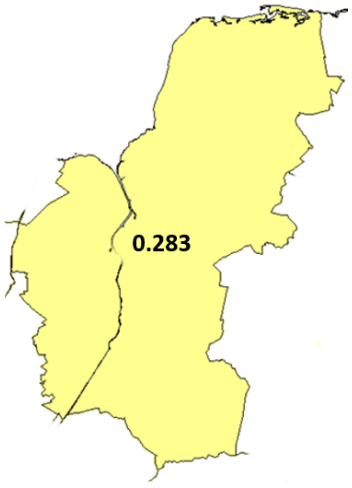
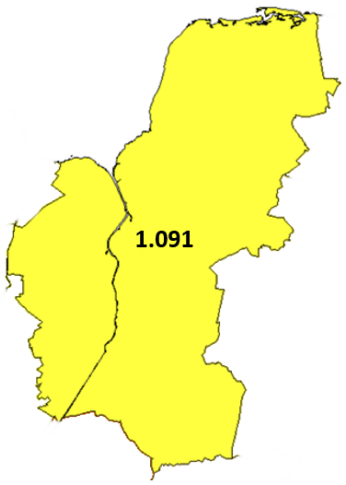
District Risk. EoW and Council Tree Risk.

King's Lynn - Subsidence Risk Relative to UK



Normalised (0 – 1) Scale

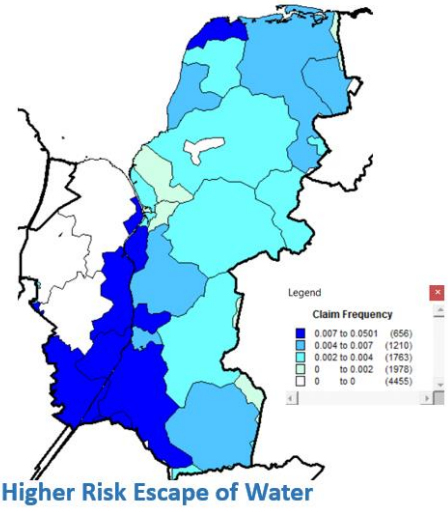


Relative to UK Average

Below, left, mapping the frequency of escape of water claims confirms the presence of non-cohesive soils. The distribution on the map reflects the presence of drift deposits of peat, alluvium sand and gravel. As we would expect, the 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.

King's Lynn



Higher Risk Escape of Water

Claims Involving Council Tree

(2,858 UK claim sample)

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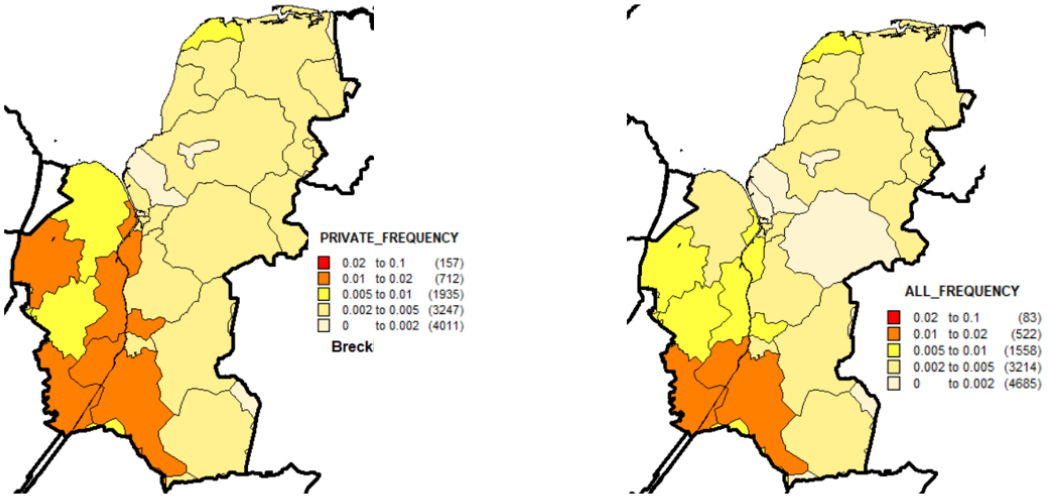
King's Lynn - Frequencies & Probabilities

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 tend to self-insure. The following show the normalised risk, taking account of the private housing population – that is, the rating compared with the average value for each category.

King's Lynn - Sector Risk Compared with UK Average



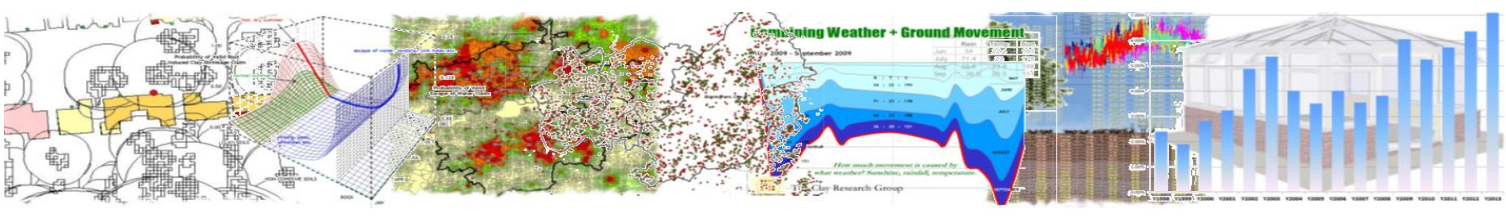
Private Only **All Properties**

On a general note, 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.

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 - King's Lynn

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
King's Lynn and West Nor	0.493	0.205	0.302	0.18	0.42	0.401



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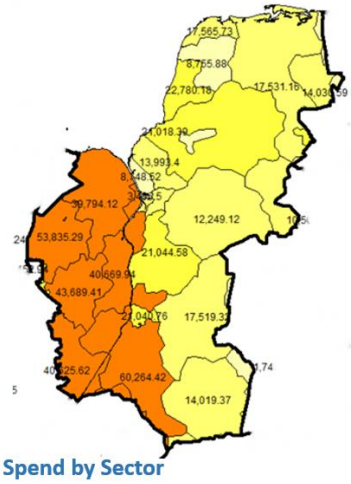
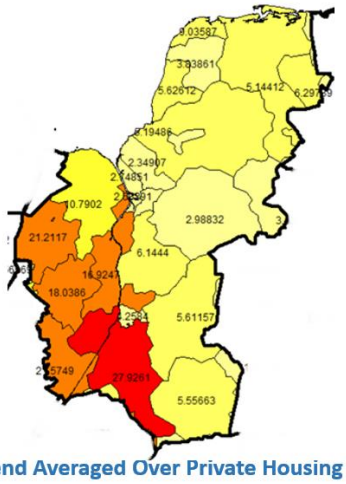
Aggregate Subsidence Claim Spend by Postcode Sector and Household in Normal & Surge Years

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 – King's Lynn



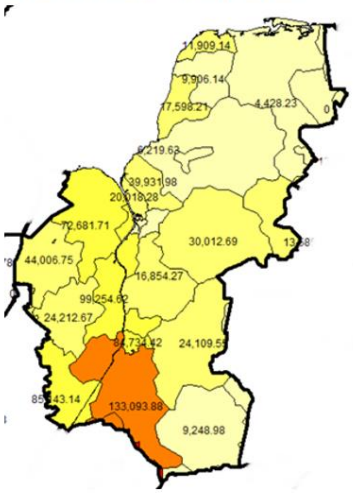
Spend by Sector



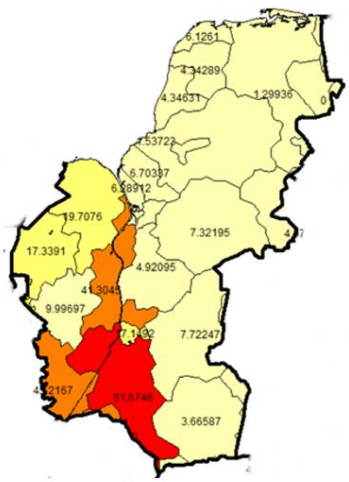
Spend Averaged Over Private Housing Population

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 private 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.

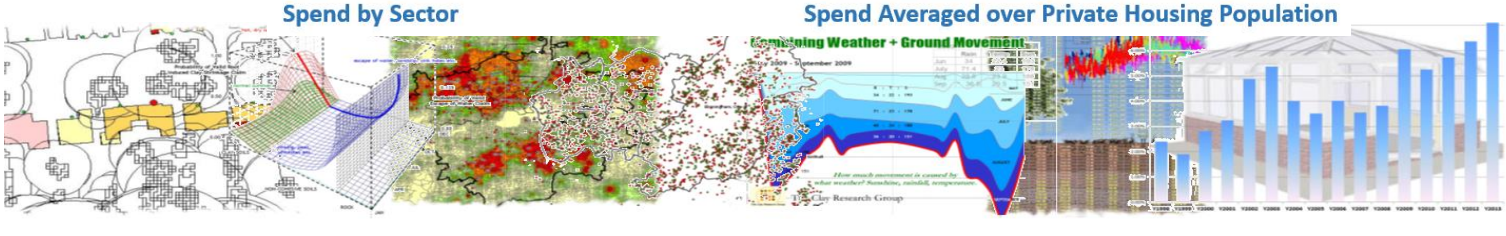
SPEND in SURGE – King's Lynn



Spend by Sector



Spend Averaged over Private Housing Population



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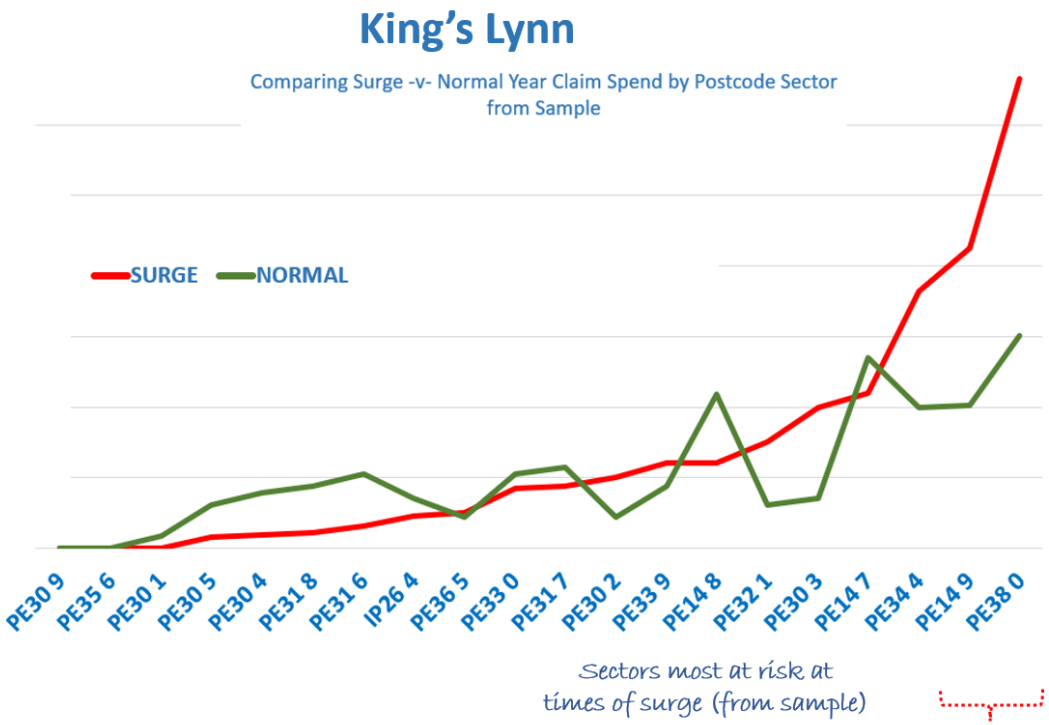

The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

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.