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
Electrokinesis Osmosis
Intelligent Systems

Edition 145

June 2017

The Clay Research Group

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Edition 145, June, 2017

Beijing here I come!

Congratulations to Tony Boobier on having his book, "'Analytics for Insurance: The Real Business of Big Data'" translated into Chinese, ready for a launch in Beijing in a couple of months' time.

We understand he is currently well advanced authoring his next book.

How not to fell a tree.

Thanks to Jon Heuch for sending the link below, illustrating the potential dangers of poor tree management.

https://www.youtube.com/watch?v=SCMpeObD4XU.

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

TDAG Draft Discussion Paper

subsidence industry response

Several industry experts have provided feedback on the TDAG draft discussion document mentioned in last month's edition on whether all new properties, built on clay soils, should have a piled foundation to take account of potential planting of vegetation at some future date.

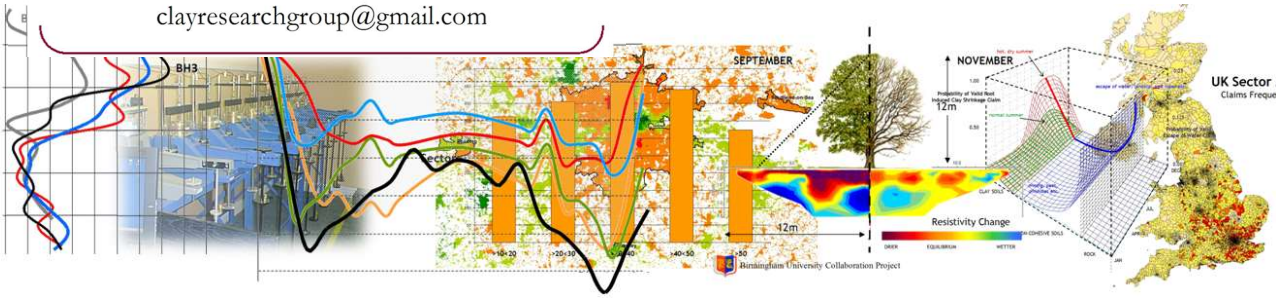
Some interesting views on the TDAG draft and clearly a topic for further discussion. There is little doubt that the approach would significantly reduce the cost and risk for insurers and Third-Party tree owners regarding the subsidence peril, as well as remove the disruption and stress for homeowners whose homes might suffer damage.

At the moment, anyone building a house with a tree in influencing distance or where a site has been cleared of vegetation would expect to incorporate a piled foundation. This approach, led by the NHBC, added to the cost but met with little resistance. It was (and is) regarded as good design practice.

A snapshot of an area in London, chosen at random, illustrates the number of houses that are at potential risk as a result of water abstraction by roots. This small-area analysis of a mature housing stock suggests over 90% of properties have roots in influencing distance.

Further analysis across the clay belt will be published next month to see if this represents a realistic view of the potential exposure.

An improved understanding of the problem in terms of the number of houses within influencing distance of vegetation has far reaching implications relating to foreseeability and risk.



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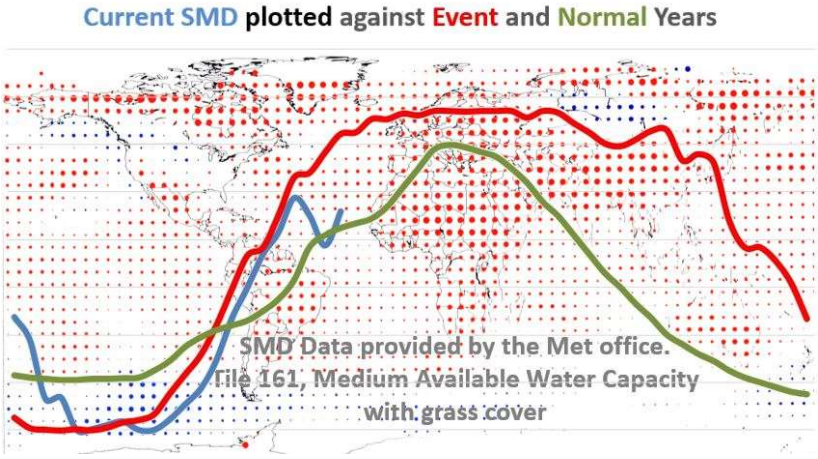
2017 – Event Year? What does the Summer Hold?

What does the summer of 2017 hold? The weather has, until recently at least, been dry as can be seen by the graph of the Soil Moisture Deficit (SMD) below. The Met Office report that April was both warmer and dryer than the 30-year average.

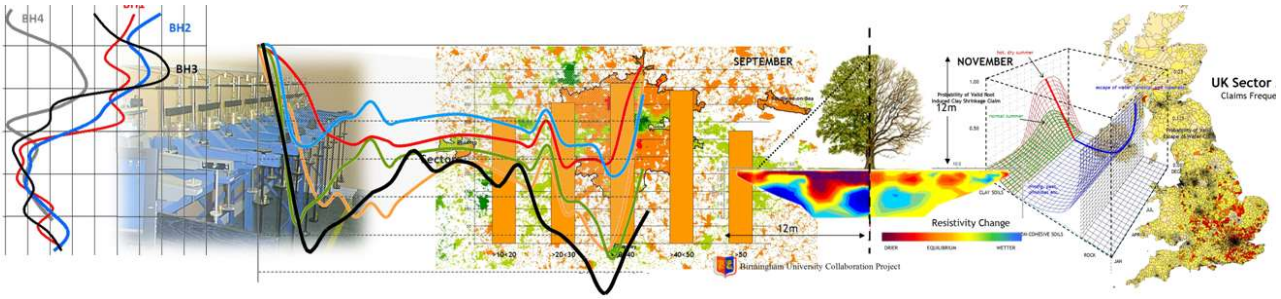
The current SMD (blue) has, until recently, been tracking the profile of an event year (red). However, recent weeks have shown a reduction in the SMD, reflecting intermittent rainfall. There is no assured way to predict what the future holds in terms of weather and claim numbers, and the most reliable indicator in our experience is the SMD at week 22 – the end of May. On that basis, the indications are that 2017 is unlikely to deliver higher than average claim numbers



Met Office Assessment – Jun-July-August

SUMMARY – TEMPERATURE: *For June and June-July-August above-average temperatures are more probable than below-average temperatures. Overall, the probability that the UK-average temperature for June-July-August will fall into the coldest of our five categories is 10% and the probability that it will fall into the warmest of our five categories is 35% (the 1981-2010 probability for each of these categories is 20%)*

SUMMARY – PRECIPITATION: *For June, above-average precipitation is moderately more likely than below-average precipitation. For June-July-August the chances of above- and below-average precipitation are fairly balanced. The probability that UK-average precipitation for June-July-August will fall into the driest of our five categories is between 15% and 20% and the probability that it will fall into the wettest of our five categories is around 20% (the 1981-2010 probability for each of these categories is 20%).*



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TDAG Draft Discussion Document

This edition is almost entirely devoted to discussing the outline draft proposals put forward by Tree Design and Action Group referred to in last month's edition.

We have comments and responses from some of the subsidence industry's senior figures.

It's important to recognise that the TDAG proposals are not solely related to the subsidence problem. In fact, subsidence plays a relatively minor part. Climate change and the environment are the real issues.

TDAG are looking at wider environmental matters, not least of which is the target set by Boris Johnson in his role as Mayor of London to increase tree planting and canopy cover in London by 5%, (i.e. from 20% to 25%), with a delivery date of 2025. One publication covering the methodology is aptly entitled "Measuring Tree Canopy Cover in London", available for download at:

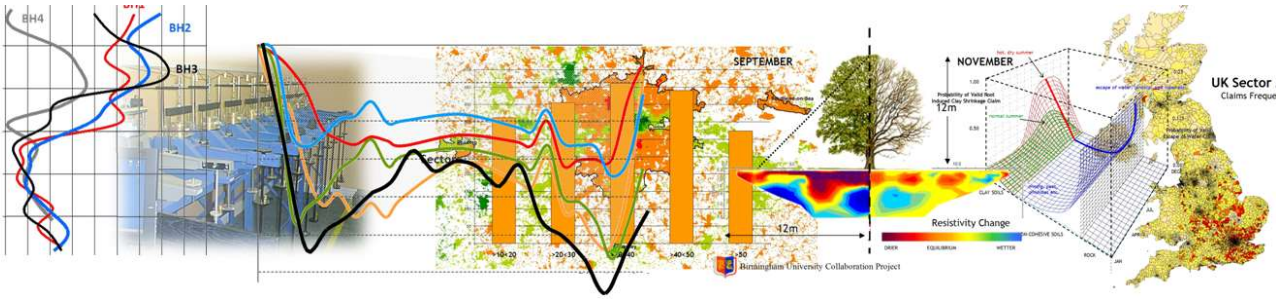
https://www.london.gov.uk/sites/default/files/measuring_tree_canopy_cover_2015.pdf

That said, it is a topic central to the world of domestic subsidence and the responses in this newsletter naturally concentrate on this aspect. The questions for the subsidence industry are how the various topics for discussion affect insurers' risk and what are the perceived benefits and drawbacks.

Respondents have been anonymised on the basis of possible commercial conflicts in future dealings between adjusters/insurers/engineers and those with a responsibility to manage trees and future claims for nuisance. None of the respondents requested anonymity – this was a decision taken by the CRG in the hope of promoting an open discussion, not limited by concerns over commercial relationships.

One final note.

House prices are fragile at the moment, but that aside, the proposals would hit social housing hardest, making it more difficult for councils and housing associations to fund increases in cost of around 10% - assuming our estimate is correct. On this topic (increased cost) we hope to receive advice from ASUC relating to the estimated increase in cost of providing a piled foundation.



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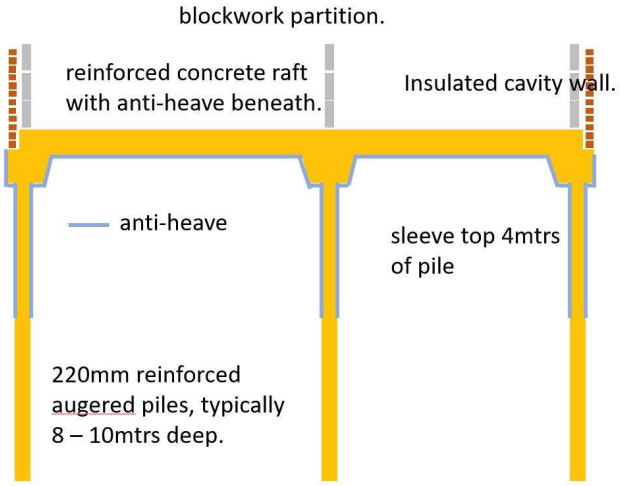
TDAG – Review of Draft Discussion Document

In last month's edition, we asked for comments from the industry regarding the draft discussion document issued by TDAG exploring whether all new homes, on clay soil, should have a piled foundation. From the subsidence perspective, this would enable tree planting close to properties without the associated risk of damage as a result of root induced clay shrinkage.

Below are sketches of a typical foundation arrangement if the scheme were adopted. 8 – 10mtr deep, 220mm diameter augered and sleeved reinforced piles would support a reinforced concrete raft and edge beams. Anti-heave precautions would be required beneath the slab and edge beams and the top 4mtrs of the piles would have to be sleeved.

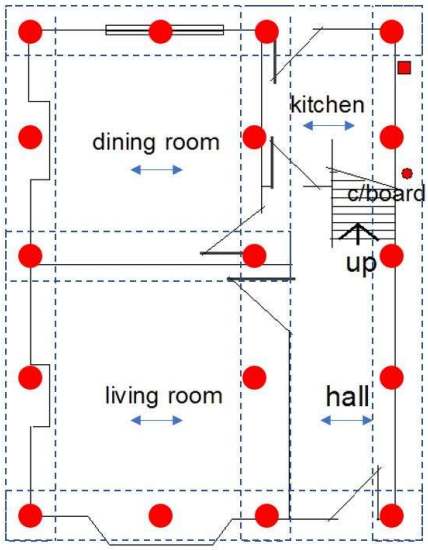


The initial figure, the extra cost of such a foundation taking into account cost savings of a 1m deep traditional foundation, concrete and 'muck away', was initially estimated at around £25k, variable by size of property and layout etc. Members of ASUC have offered to look at costings.

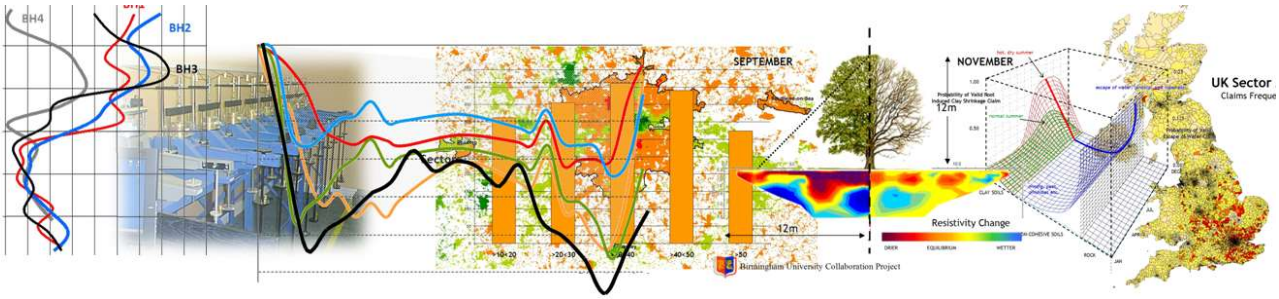
Someone buying a house on a clay soil would be faced with a £25k increase when compared with an identical house on a non-cohesive soil.

Houses elsewhere, not on clay soil, would have a traditional foundation with the design dictated by local geology.

Left, a section through a typical piled raft. Below, a floor plan using a typical semi-detached house as an example.



This is the case today when buying a house where trees have been cleared, or are within influencing distance of vegetation. The contractor complies with NHBC codes that require such a house to have a piled foundation due to the risk of heave.



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Responses to TDAG Draft Proposals

Respondents (see following pages) have recognised the value whilst pointing out some potential drawbacks from the subsidence perspective:

Insurance Premium

It was generally agreed that the suggestion that insurers would offer a reduced premium for subsidence was thought to be a red herring. The current spend on subsidence is around 4% of premium income and it is recognised that even the best designed of schemes can still result in failure, albeit rarely. On balance, we estimate the premium saving would be around £40 p.a. Not enough on its own to make spending £25k attractive. That said, the current regulations require improved foundations when building a house on clay soil near to existing trees, or on sites cleared of vegetation, under the NHBC codes. On balance, It was judged unlikely that homeowners would forego subsidence cover and it wasn't regarded as an attractive proposition simply from a premium saving point of view.

Reduced Claims Incidence

Claim numbers would remain largely unchanged due to the existing, 'pre-piled', housing stock. Any reduction in terms of frequencies would be trivial, even in the longer term. It is doubtful that there is sufficient land available to materially change the balance of risk.

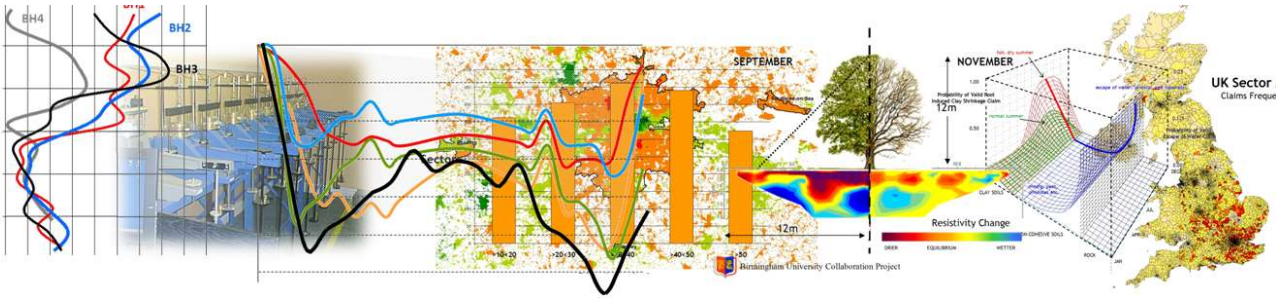
Tree Planting

Just how many houses have roots beneath their foundations? See Page 9 for a view of a mature, unselected (i.e. hasn't been chosen based on risk) area of north west London.

In summary, it appears from this small sample that the majority of houses will fall within the root zone of vegetation at some time in their middle to later years. The risk of subsidence per annum isn't huge. Maybe 4 or 6 houses out of every thousand will suffer damage of varying degree each year, but over say 20 years, that amounts to 80 – 120 properties per thousand.

SUMMARY

The proposals will not change the risk for these older houses, and it is appreciated that subsidence will continue to present a problem for properties on clay soil with vegetation nearby. The current issues around litigation, recoveries and tree root nuisance remain. Any reduction in insurance premium (if any – it would be risky to assume piled houses are immune from subsidence damage) would be trivial. Particularly compared with the increased cost of the property.



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A Few Extracts from Responses:

Senior Subsidence Engineer:

My immediate reaction is "great idea". I don't think new-build is relevant to the subs claims industry - any such claims are usually pushed back to NHBC or the owner in the event of an exclusion applying, e.g. inadequate design/construction. The proposals mean the environment can be enhanced but at a cost of a more expensive building. Will an additional 10% add to the debt burden of buying a house? I don't think so given historic house inflation. Will require legislation to bring it about.

Leading Analyst

Interesting and forward thinking, especially in the present political call for more housing. Authorities already have an obligation under present Codes to demand adequate foundations on clay where trees are nearby - and are already required to allow for tree growth. The issue is whether they can demand deeper foundations for trees and drier ground conditions which haven't yet happened.

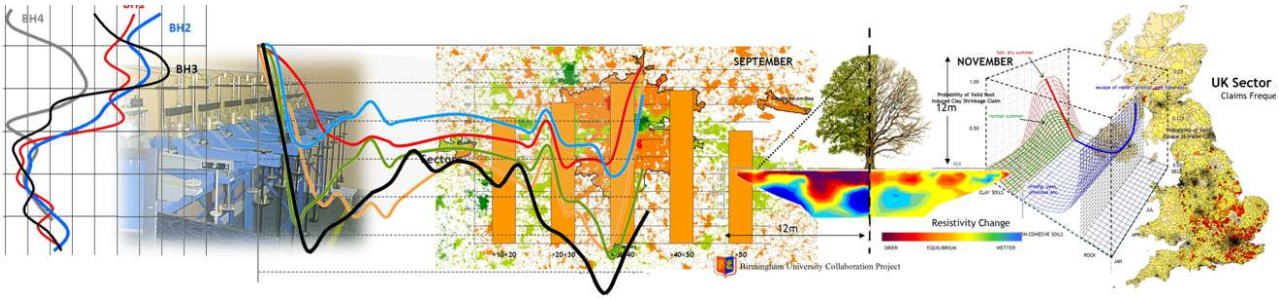
Insurers probably won't be interested in isolation - subsidence is way too far down their agenda. On property alone, the ABI have struggled with the topic of flood defences so I think it unlikely that they will want to take the Authorities in a call for deeper foundations. From a financial point of view, the discount on any premium is negligible compared to the additional cost of foundations.

Perhaps a better (and maybe quicker) way forward would be to invent a new foundation product which reduces the cost of piling to a level where it is no more expensive than traditional footings. Even then, you would probably have the challenge of persuading local authorities and others that it was 'fit for purpose'. Suggest try and get it on the agenda for the Local Government Association for starters.

Researcher and Senior Engineer

On the face of it, I don't think it's a bad idea. There's no good reason why short bored piles should be more expensive than trench-fill. The problem has always been that a small builder might have his own digger, but would have to sub-contract any piling work. If piled foundations were used more commonly, then more small firms would set up to do this kind of work and the cost would come down.

That said, unless large trees have been cleared or retained, then there's no fundamental reason why a 1 – 1.5 m deep trench fill shouldn't perform adequately. On that basis, it would be unreasonable in my view to force the builder to use piles in all instances.



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Senior Arboriculturalist

From my perspective, prescriptive design resolutions are always doomed from the start; they deny:

1. The cost imperative all parties will always be under
2. Innovation and simplicity in solution and design
3. Local and plot specific concerns

They want to crack one nut but there are many nuts……they want a rigid design solution but this atrophies new thinking, they want to save money one end when new build is a tiny, tiny, tiny fraction of the cost of building movement to the historic and existing stock

On design we regularly have to think of new ways to keep large trees with combination solutions such as raised ground beams, suspended floors, deep strips all relating to the design specific parameters of a site, a tree, a related piece of archaeology or a slope

MD of Adjusting Practice

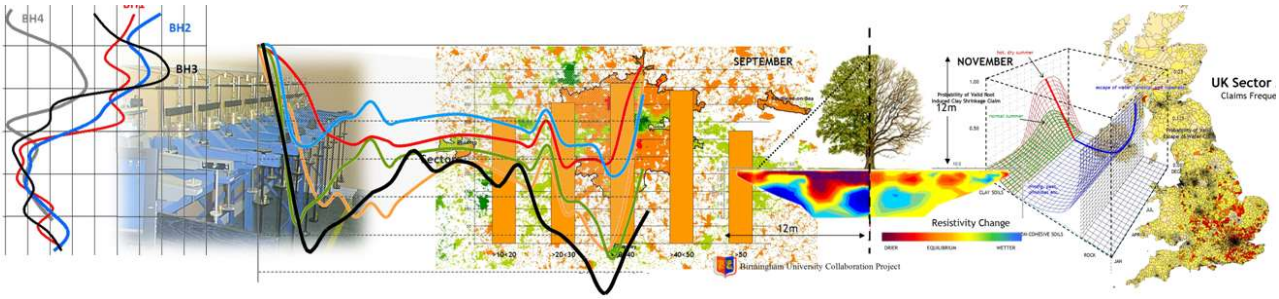
Overall, I think this is a bad idea

1. The idea that we build foundations to cope with possible future planting of trees seems a very costly way to tackle a relatively infrequent problem.

2. Over-engineering the foundations would have a huge environmental impact. The CO^2 generated from concrete production and the disposal of the waste soil would never be recouped by the uncoordinated, occasional planting of a few trees. As such, the proposal would seem to be at odds with the 'Purpose of Building Regulations' i.e. to … promote sustainable development.

3. Even if this proposal is adopted it would take decades before it has any impact on the housing stock and it still wouldn't overcome the problems with trees affecting pavements and services.

4. The proposal seems to avoid the underlying issue that tree planting has to be carried out responsibly; with due consideration of the site/environment and there isn't a quick or easy fix for this.



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Senior Consulting Arboriculturalist

Council's want to increase "canopy cover" in urban areas. Again, an interesting concept but one fraught with difficulties – the amount of cover required to have an appreciable climate difference is much larger than can be achieved and, in most circumstances, it is only possible to tweak it by a few % points.

Worth trying perhaps but let's be realistic as to what can be achieved.

So, if we see where this is coming from – climate change and the desire to encourage trees through environmental services they provide – the issue of foundation type/depth should be clarified with a cost-benefit analysis:

How much is it going to cost to improve foundations?

What are the benefits? Reduced subsidence claims for new houses? A lot of difficult tree surgery works where trees are managed close to houses?

The end result may be that, in some cases, people have trees growing closer to their houses than they might have had…..but with the potential for branch fall, physical damage and wind effect I don't think it will be huge.

What would the typical homebuyer think if they were asked to pay £x more for their new house so that they (or their grandchildren) could have a large oak tree growing over their house….which might shed a branch in a storm. No thank you in most cases!

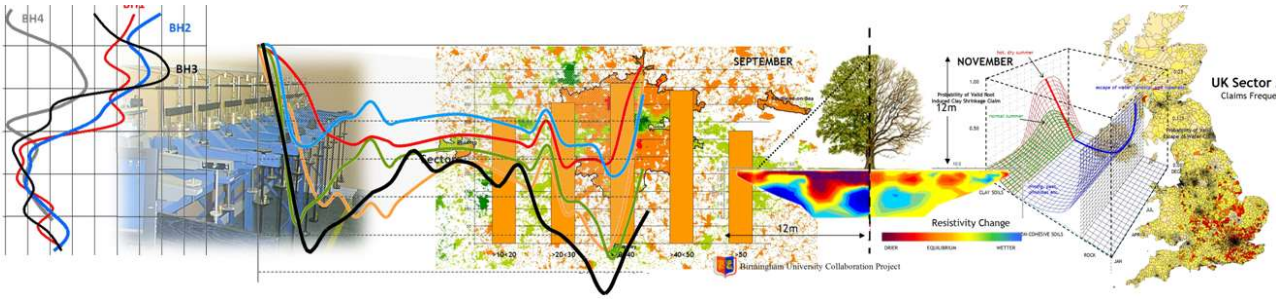
I don't think that it is media attention that has led to a mind-set that people don't want trees growing close to their house. Once they have been through a storm and heard the roar of a large tree in close proximity they are likely to be risk averse. The potential risk of subsidence does reinforce that feeling.

Let's just focus on subsidence for a moment:

Does the public think that every new house should be future proofed for all eventualities? At any cost?

There is of course the financial cost of improved stronger foundations but there is also a carbon cost – how much extra concrete will be required for each house?

… *continued*



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Senior Consulting Arboriculturalist … *continued*

As ever this is a trade-off calculation that economists may be able to advise on, assisted by some data:

i) New houses with improved foundations will not affect subsidence occurring on existing buildings so the total number of claims is not going to be affected for a long time. Will anyone see a change in their policy costs?

ii) New houses on piled rafts – great! But what about extensions, conversions and conservatories where significant numbers of buildings are affected. Will new conservatories require a piled raft to match the house? I am sure there will be many people – I know a few – who would prefer to cut the tree down so that they can have a cheaper conservatory/extension on a shallower foundation. Especially when the tree belongs to a neighbour!

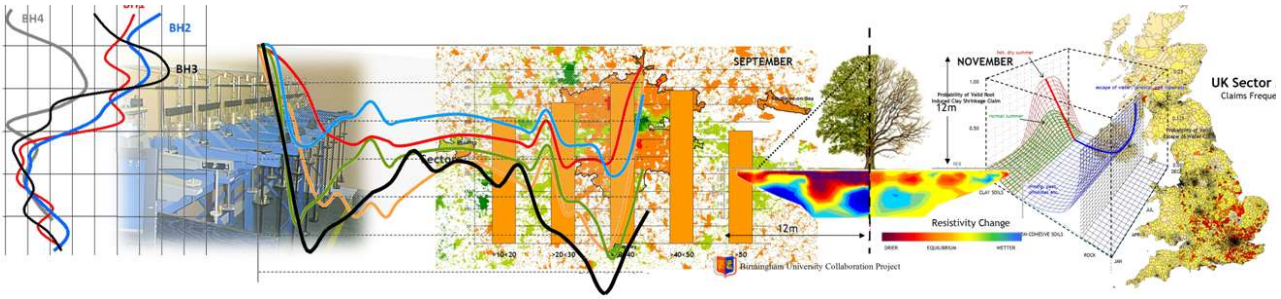
My experience with the trade-off in domestic situations is that house owners prefer cheapness to having a tree; it's not what tree officers want to hear and I understand their argument to some extent but they aren't particularly keen on examining the real economics rather than their sometimes-limited view on what benefits trees provide.

So, what to do? It's all down to planning – real planning, not what we have at the moment which works on a site by site basis, often too late so that the compromises necessitate/allow houses to be crammed into sites on the basis of financial viability so that we end up with houses far too close to large trees.

Peterborough is a classic case where, on clay soil, many, many houses were built and potentially large trees planted and then the situation was left to develop. The tree officer has now got a handle on it and a budget to remove trees on a proactive basis…..but why was this planting done at all? Why not leave aside reasonable space for larger trees…..in parks, in strips, nearby roads and other communal areas?

In around 1982 I was taken around Milton Keynes as a student and the tree/landscape officer proudly showed us all the instant forests they had planted right up to the edge of new houses. Strange that and what is the tree officer there coping with? A subsidence claim file that is mounting and he is more than keen to remove trees in order to reduce liabilities.

I think TDAG have a point worth discussing but it needs to be enhanced with a few facts and development of realistic goals. If modest-sized trees are not being planted in developments as a result of a fear of subsidence that is a different but related issue.



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Senior Industry Figure

The only way to overcome the issue of trees that occupiers may choose to plant in the future would be to make it a planning requirement that you need approval to plant a tree of more than an agreed height when mature.

This is unlikely to happen as, in our experience homeowners aren't worried about 'future proofing' to cater for trees that may, or may not, be planted - something they don't see and does not add value in their eyes.

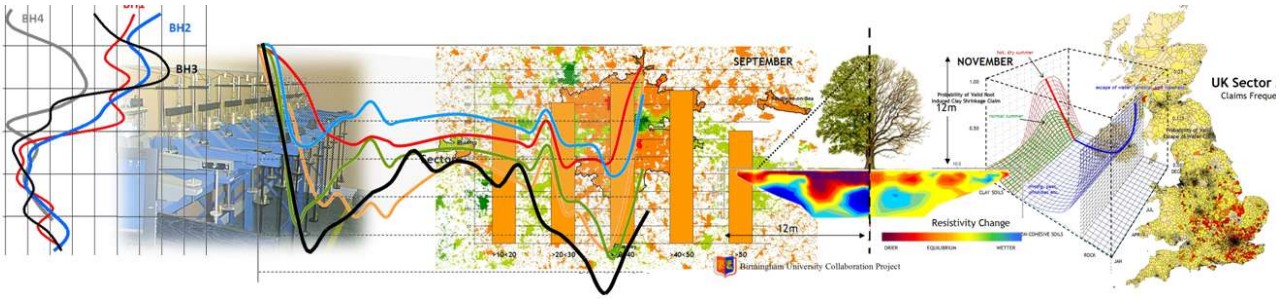
In terms of additional cost of providing a piled foundation, I would suggest £25K is an underestimate and the cost would in any event increase with the size of the building footprint – and why would a homeowner spend this money if they did not have a problem – most, if not all, would want to spend on an upgrade – new kitchen, bathroom etc. Does it add value to the house on sale? I would suggest not.

Most insurers see subsidence as a very low proportion of their claims spend – in the current premium the element for the subsidence risk is just £'s so any discount would be a fraction of the overall premium.

Regarding the suggestion of a surcharge for new low-rise buildings that do not meet future proofing standards is possible, but it would have to be agreed between all parties but at what cost? What is 'future proofing'? It would need legislation.

A huge amount can be done in terms of tree management to reduce risk but it needs to be regular and done correctly.

Regarding the planting of trees for the short term (20 years) and then replacement, it comes down to who pays. Could we really see trees being chopped down every 20 years? Who would monitor – LA? Councils are strapped for cash now and cannot even meet their obligations for health services so I cannot see they would ring-fence funds for trees.



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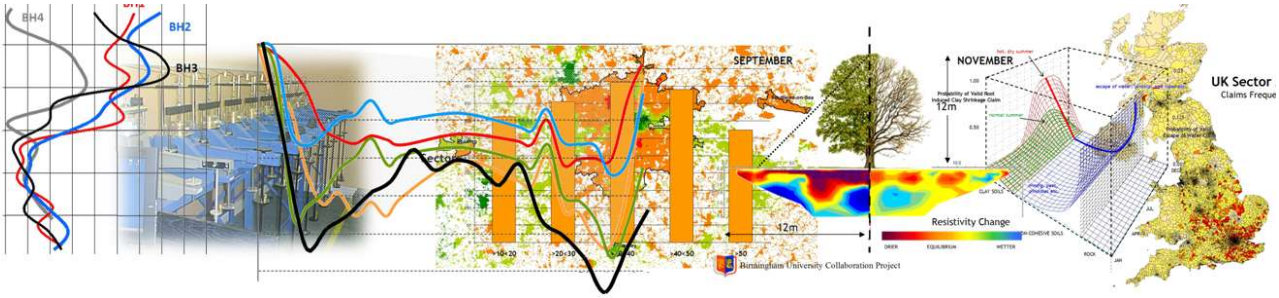
Piling Many to Save the Few. What is the Future Risk?

Below, a fairly typical street scene based on our LiDAR imagery and OS building outlines with modelled root zones superimposed. The coloured areas represent modelled root overlap zones with red representing council trees and green, private trees.

It's an interesting exercise as can be seen by the fact that the great majority of houses fall within the influence of modelled root zones. This is a conservative view because the LiDAR imagery doesn't include vegetation less than 4mtrs tall; it doesn't account for some of the riskiest of tree species, the conifer, small trees or shrubs.

Just how many houses have roots beneath their foundations? Using the above snapshot from an area in north west London, it seems likely that most houses will, at some future date, fall within the root zone of vegetation.

Of the houses in the picture (around 104), only 11 are 'root free', bearing in mind the caveat that this image only takes account of vegetation above 4mtrs in height. Nearly 90% of the mature housing stock from this (unselected) snapshot fall within the modelled root zone of vegetation over 4mtrs high. Of the remaining 10% it is likely some will fall within the root zone of smaller trees and shrubs, rivet hedges, conifers smaller than 4mtrs and garden shrubs etc.



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Piling Many to Save the Few?

The primary objective of the TDAG discussion document is making an environment where more trees can be planted, safely. The subsidence world and domestic insurance concerns are amongst the factors to be considered, but an improved environment is the main objective.

Insurers would benefit from the reduced risk to new housing stock, built to the suggested standard. Root induced clay shrinkage claims account for the majority and are amongst the most expensive to resolve. On the other hand, it is recognised that older houses represent the bulk of the housing stock and this legacy problem will remain unchanged.

Environmentally, the benefits are clear.

The potential losers? Homebuyers paying more for a safer home. The same argument could have been raised when the minimum foundation depth was increased to 1m. Some may have objected when NHBC guidelines were adopted that required piled foundations where trees were nearby, or the site had been cleared of vegetation prior to development.

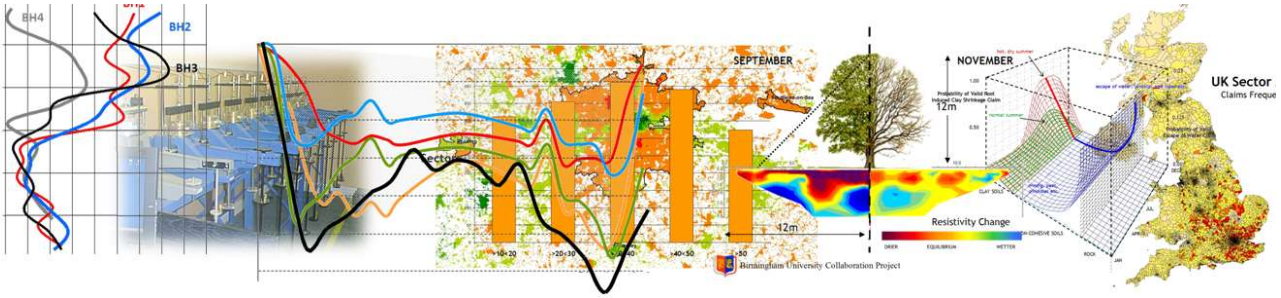
In fact, these have been beneficial, delivering more robust properties with a reduced risk of disruption, cost and stress for the homeowner.

A 3D World - CANVAS

Add a Structure Sensor, screw a wide vision lens into your iPad, add some software, and just walk around the room to build accurate (1 – 2% accuracy) models of internal spaces using the infrared light source. The hardware (sensor and lens, but excluding the iPad) costs just over £300.

The package has the ability to scan a room in minutes, deliver an accurate 3D image that can be imported into a variety of CAD systems, including SketchUp. The claimed accuracy is around 30 – 40mm across an average sized room.

The downside to this application is the cost of submitting the scanned file to the developer's web site for the construction of the image in a CAD format. Also, and as the developers point out, the application is less useful outside the home due to interference with the infrared and is limited by the size of the iPad memory. So, a step in the right direction, but perhaps not quite there just yet.



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Mapping the Subsidence Risk

Continuing on from last month, exploring the benefits of using Geographic Information Systems (GIS) in developing and refining our understanding of risk, the following map plots houses by ownership, distinguishing between social housing and private. Other options include mapping by value, style (terrace, detached etc.,) and so forth.

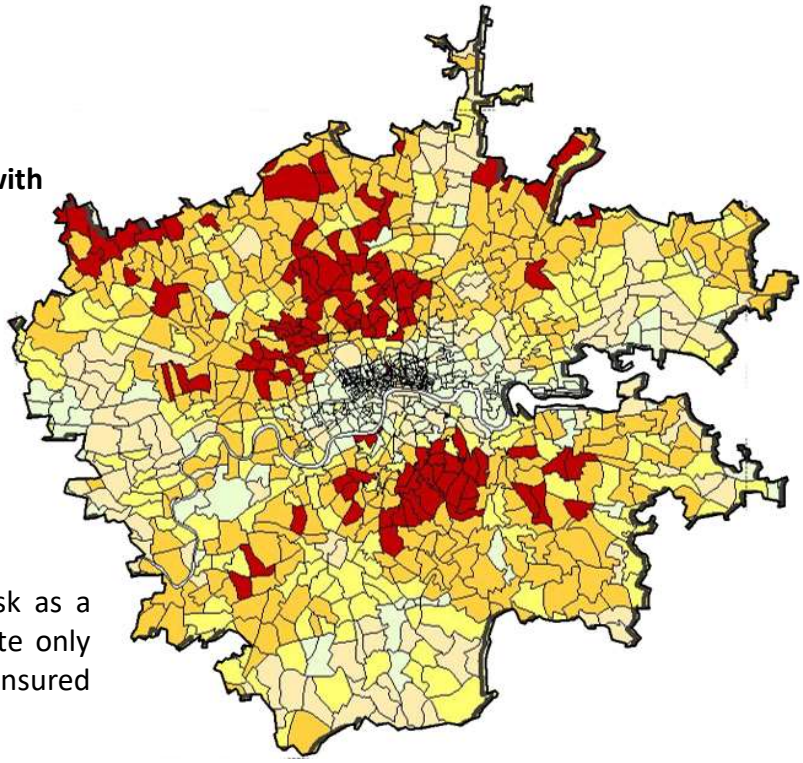
On the following page, the results of actual site investigations are mapped, first by plasticity index and then "% Passing" for cohesive soils. A further refinement is using the derived risk value by geological series – see newsletters 133 and 136 for further information.

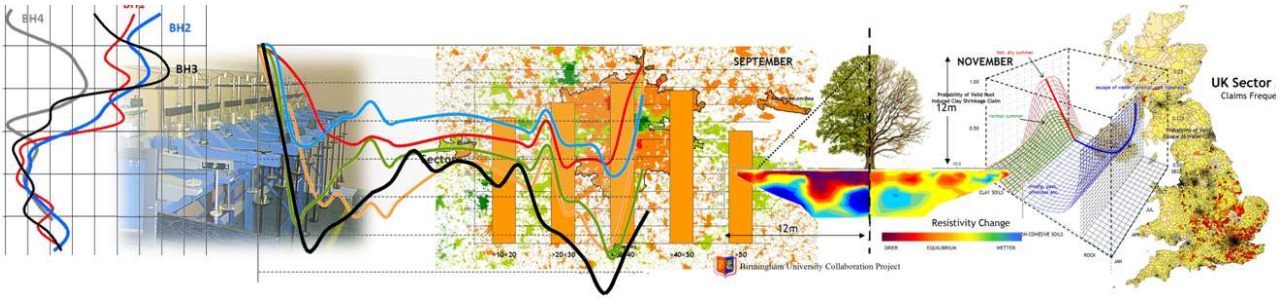
Next month, mapping trees across London in terms of ownership (private and public), height and distance to buildings.

Private Housing Stock Compared with Social Housing by Postcode Sector.

Insurer's subsidence risk is associated with the relative density of private/social housing. Estimates of risk based on claims divided by house numbers to derive frequency need to reflect this.

This example, right, reflects the risk as a function of claims divided by private only housing stock, to cater for self-insured social housing.





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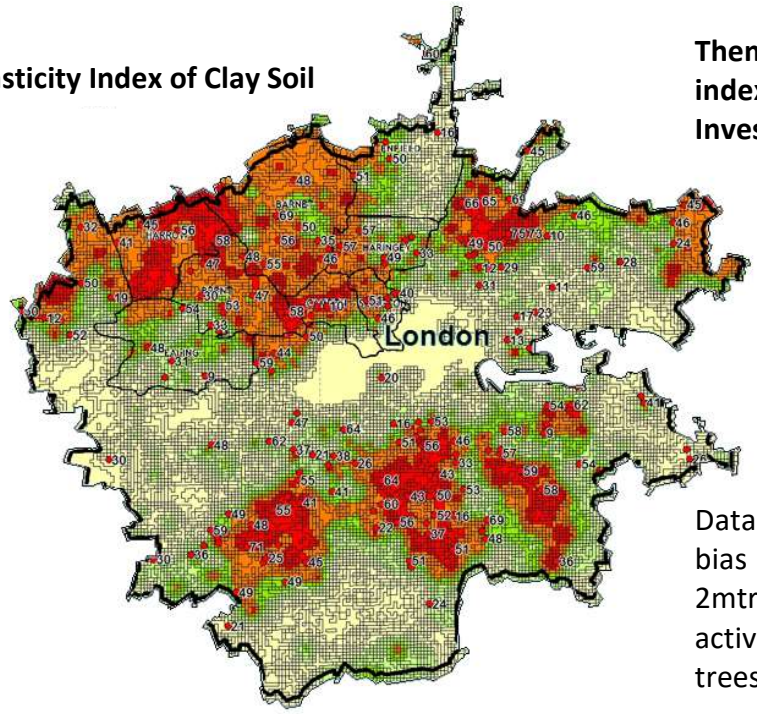
Plasticity Index of Clay Soil



Thematic plot of the plasticity index from the results of site Investigations

Geological map built using the results from site investigations and soils analysis related to claims.

In this example, the PI has been mapped on a 250m grid.

Data has been interpolated with a bias towards results at around 2mtrs – the zone of peak root activity associated with mature trees.

"% Passing" of Clay Soil

Supplementing the above map showing the plasticity index of clays, the 'percentage passing' value contributes another factor towards determining the risk of root induced clay shrinkage.

The data has been mapped on a 250m grid, as above.

Other maps might include the risk factor ascribed to the geological series – see Editions 133 and 136.