

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



May 2011

The Clay Research Group

CONTENTS

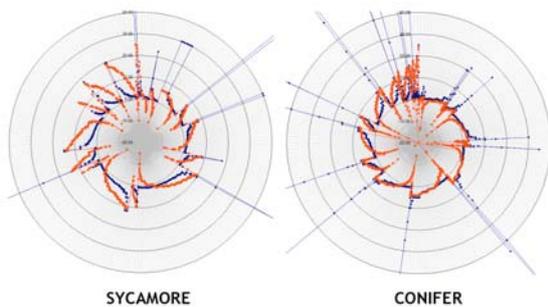
- ⊕ Research Updates & Claims -v- Soil PI
- ⊕ Weather Update
- ⊕ Haringey Study Area
- ⊕ Methyl Blue Spot Test
- ⊕ Aston Conference Agenda

Research Project

A meeting to explore the methodology for extending the Hortlink project to take account of urban street trees takes place at East Malling Research towards the middle of May – more news in the next edition.

Unique Profile

Plotting the tree data in a different way has produced some initially interesting results. Radial graphs show variations between species in a different way to the more usual line graphs or bar charts.



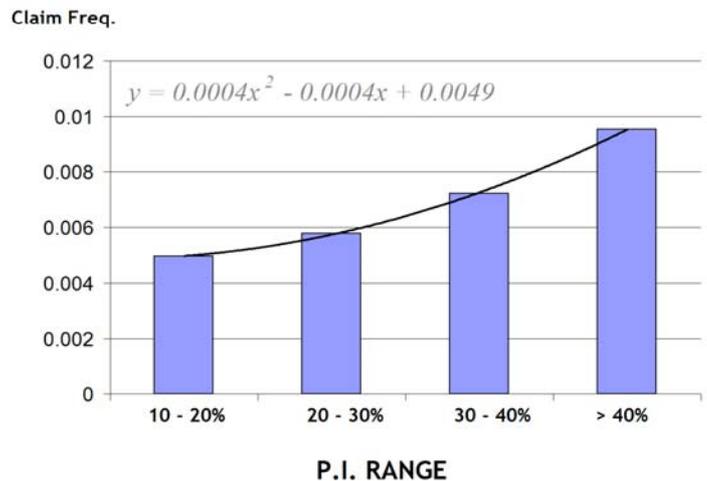
Above the H/D (blue) and H-D (red) values are plotted at the same scale for the Sycamore and Conifer. More profiles next month.

THE CLAY RESEARCH GROUP

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The Relationship between Soil Plasticity Index and Claims Frequency



On Page 5, from a sample of 95,0000 claims, we have plotted the difference in risk between shrinkable cohesive soils and ‘others’ – sand, gravels and so forth. The risk of a claim increases with the shrink/swell characteristics, and houses on clay are 2.4 times more likely (when expressed as frequency data) to experience a subsidence claim than their counterparts.

Subsidence Annual Conference



22nd June 2011

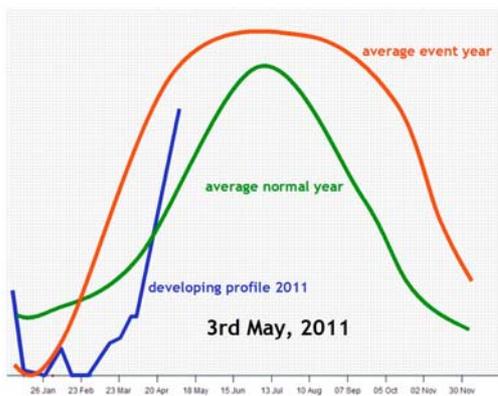
Don't forget to visit the Aston conference this year. The program is appended to the rear of this newsletter with details of how to book.



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DEVELOPING SMD PROFILE

March 2011 has been the driest for 60 years and April has witnessed the highest temperatures in central England for 350 years. As a result, and after a slow start, the SMD for 2011 has taken off at quite a steep incline.



Above, the current SMD plotted against averages for normal and event years.

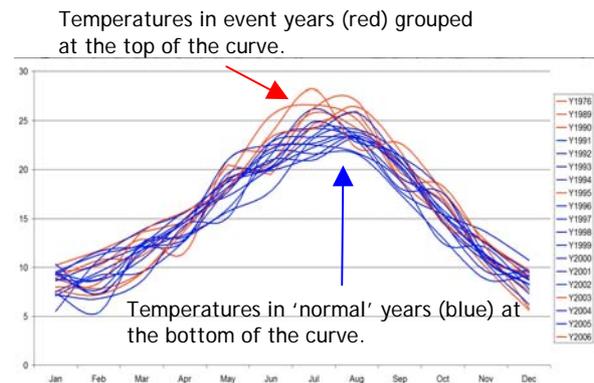
The effect of low rainfall is clearly evident, and temperatures are high. On the face of it, the only thing that could change the possibility of this being an event year will be a prolonged spell of heavy rain sometime in the next few months.

The SMD is tracking 2007. The inherited moisture from January and February helped to suppress the deficit, although it will be recognised that 2007 was threatening to be dry until the rainfall flattened the profile in early May.

Evidence that April – as pleasant as it is at the moment – is a little early to make predictions and reflects the position prior to trees coming into leaf.

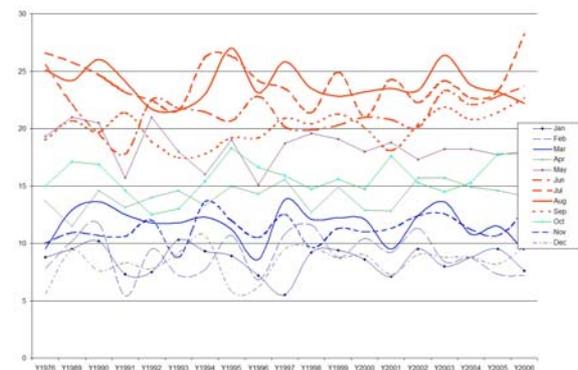
The value at the end of May/beginning of June will be more interesting. It provides the backdrop to the soil conditions as the tree canopy comes into leaf and as root activity commences.

Climatologists at the German Institute of Marine Sciences (see Issue 39) forecast that we are in for a period of changeable weather and long periods of hot, dry weather are likely to be interrupted by heavy rainfall with the possibility of flooding.



'By month' temperatures for a selection of years reveals the difference between event (red), and normal (blue) years.

Plotting the same data in a different way (below) reveals the monthly variations over the same years.



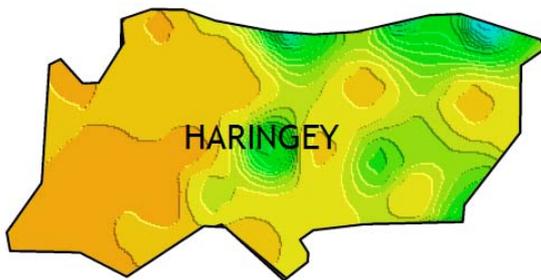
Part of our current work is normalising this 'by month' data to understand which months are most important in terms of triggering an event. The top graph delivers the developing profile, but is there anything in the preceding months that might help in predicting events?

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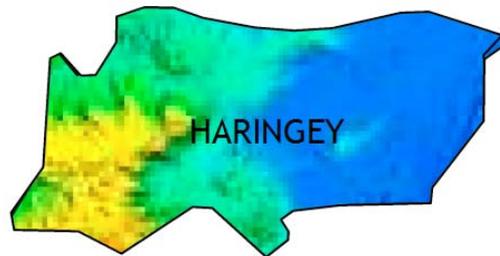


HARINGEY STUDY AREA

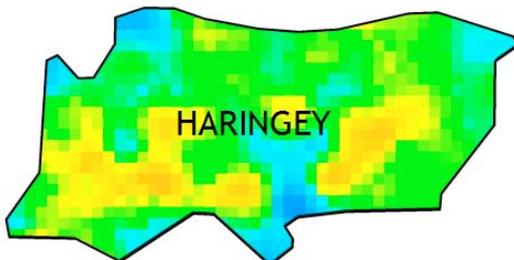
Haringey has a population of around 225,000 and around 76,000 residential properties. The claims data suggests that some of the postcode sectors lying within the Borough are high risk – predominantly those to the west where there are more houses, taller trees (both private and public) and soils with a higher shrink/swell potential. The various datasets are shown below.



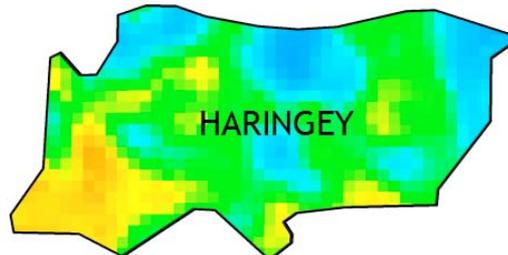
Claims and Geology Topographic



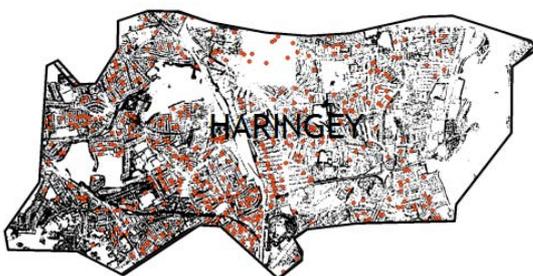
LiDAR Digital Terrain Model



Public Trees by Height



Private Trees by Height



Trees and Claims

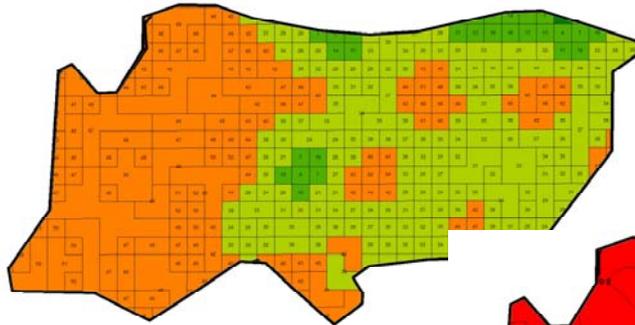


Tree Distribution

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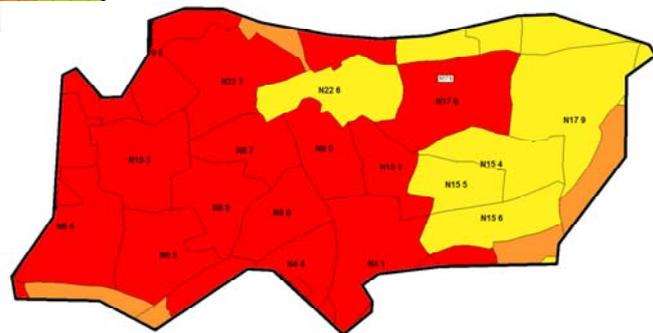


~ BOROUGH of HARINGEY ~ SOILS by PLASTICITY INDEX



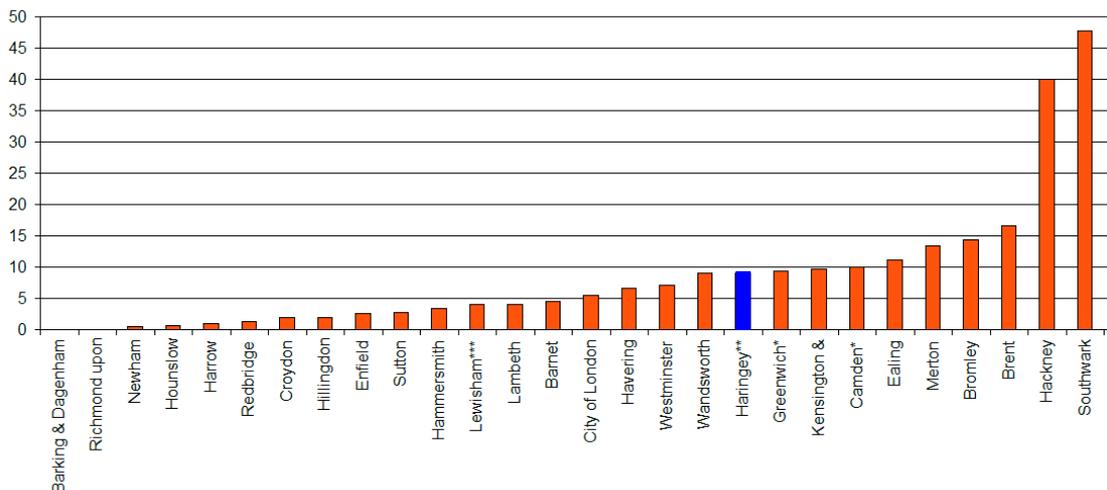
Plot of Soils by PI
(sample from 2mtrs bGL)

Claim Frequency
by
Postcode Sector



Maximum P.I. recorded 55%. Average for the Borough 34%. Haringey record (see “Chainsaw Massacre”, 2007) 10,000 Council trees in the Borough with 112 trees removed over a 3 year period as a result of subsidence. This amounts to 9.1% of the total trees removed, making it one of the moderate risk Boroughs. The average of trees removed for all London Boroughs because of subsidence is 5% of all tree losses. Other reasons are Health & Safety, disease and cabling etc.

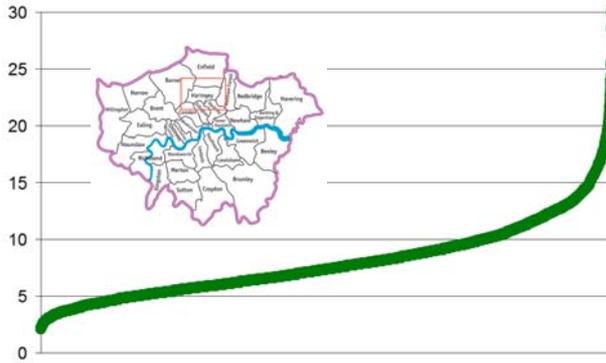
Haringey is rated 10th in the table ‘of all trees felled the percentage removed as a result of subsidence’.



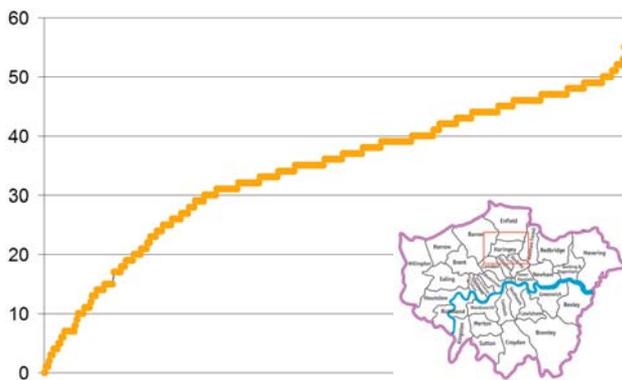
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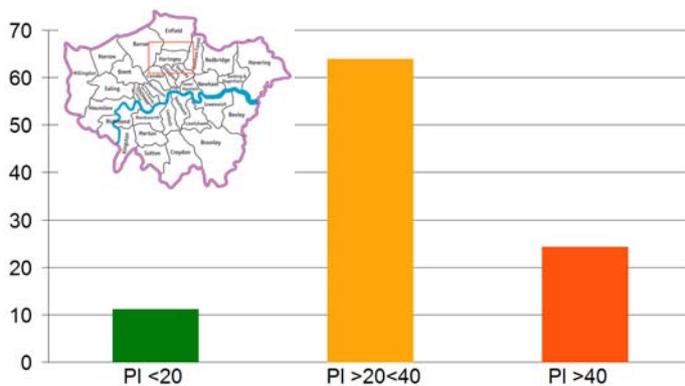
HARINGEY



The distribution of trees in height categories. Maximum tree height 30mtrs, and average tree height, 8mtrs. 77% of trees are under 10mtrs in height. The major proportion are between 5 – 10mtrs tall.

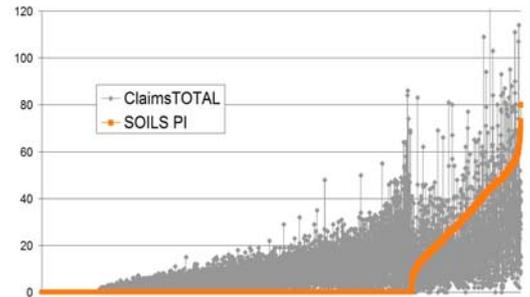


Distribution of soils in terms of their Plasticity Index. The maximum PI is 55% and the average PI is 34%. See bar graph below for breakdown.



POSTCODE SECTOR RISK

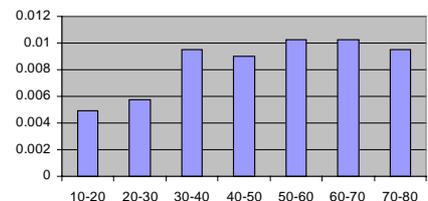
We hold around 95,000 valid claim records at postcode sector level for the UK which, taking an average of 50% repudiation rate, equates to around 6 years worth of data across the industry, including one surge year.



The soil PI (red) over the total of claims by postcode sector (x axis). Just over 20% of the postcode sectors are on a shrinkable clay soil and the frequency of claims increases on clay soils.

The claim frequency (claims/residential dwellings) for sectors with no soils data (i.e. not clay soil) is 0.003, and for soils with shrink swell properties, the frequency is 0.0073. Houses on clay soils are 2.4 times more likely to suffer a subsidence claim, than those that aren't.

For areas where the PI is 40% or greater, the frequency increases to 0.0095 – houses on highly shrinkable clay are 3.16 more likely to suffer damage than houses on non-shrinkable soils.



Breaking the PI ranges to 10% intervals (see above) reveals the distribution levelling out above 40% PI.

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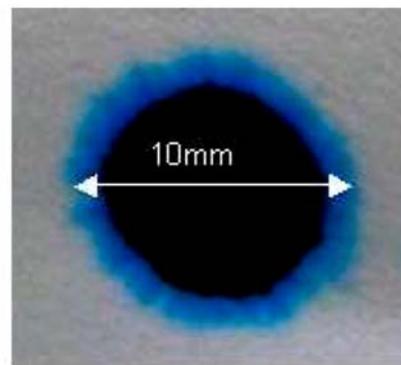
METHYL BLUE SOIL PARTICLE TEST

Clive Bennett from MatLab is in his second year studying for his PhD and has kindly provided an explanation of what is known as the Methyl Blue Spot Test (MBST) test. Briefly, the test provides a better idea of particle size and electrical charge which may lead to an improved understanding of the soil shrink/swell potential.

“It is like coating the surfaces of all the particles with one coat of paint the secret is that the coat is only one molecule thick. If you know how many grams of the blue stuff that has been used up coating the particles and you know the area each molecule covers and its mass then you can calculate the total surface area covered.”



Test not complete



Test Complete

In the spot test the particles in the little droplet of mixture put on the filter paper hold onto the blue stuff until they are completely coated. If they are not completely coated then only pure uncoloured water is released into the filter paper around the droplet. If all the surfaces have been coated then the “free blue stuff” flows out into the filter paper and you see the blue haze appear around the spot.

“That is the proxy of how the surface area is measured but like all things it is not that simple. For a start the molecule is not a cube but has the proportions approx. 1:2:4 but it is believed that it always lies flat against the surface (this is disputed in some of the literature).

Depending on the cation exchange capacity (the magnetic charge say that attracts the blue particles to all the surfaces) the assumption that the layer is just one molecule thick may not be true. Therefore the total amount of blue stuff held by all the particles may depend on the total charge. This may vary from place to place on the surfaces so you may get small areas where the coat is two molecules thick.

Because it is proportional to surface area and maybe also total charge it should be proportional to swell capacity similar to the PI but may be even better.”

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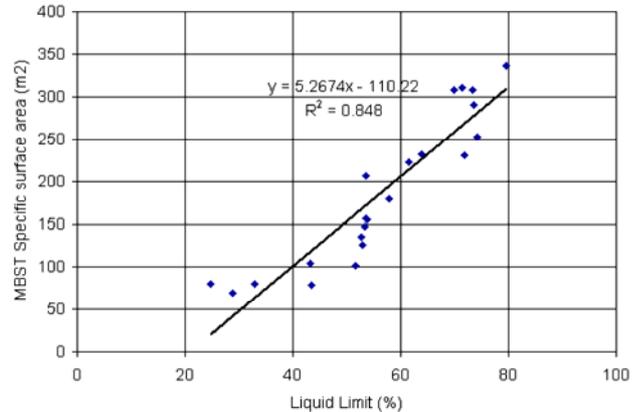


METHYL BLUE SPOT TEST

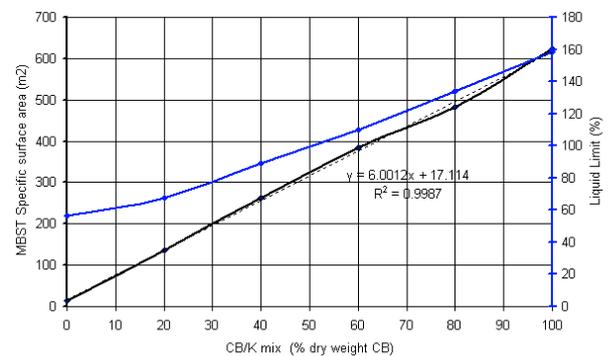
The Methyl Blue Spot Test (MBST) could be a quick method for reasonably uniform clay type samples. The method could be adapted for routine mass testing (cheap) by automating some of the processes and making things a little more simple for the technicians. It could take anywhere between 15 mins to 1.5 hours to carry out the test depending on the soils plasticity. This could be vastly improved by using automated magnetic stirrers whereby one operative could probably oversee 10 to 20 tests or even more continuously and simultaneously.

In the literature there is a difference of opinion of what exactly the MBST test measures i.e. cation exchange capacity or specific surface area - or a combination of the two. Both cation exchange capacity and specific surface area obviously contribute to the swell capacity of a clay. What is clear is that whatever it does measure the amount of methylene blue (MB) required for equilibrium per gram of soil i.e. the MB value (MBV) does appear to be directly related to the soils intrinsic swell capacity. The MBST may well be a better indicator than the plasticity index but further testing is required by measuring intrinsic swell potential by oedometer tests and then statistically determining which test gives a more reliable correlation.

Results below give specific surface area as predicted from the MBST against mixtures of calcium bentonite (CB - "smectite" high swelling clay mineral) and kaolin (K - relatively very low swelling clay mineral). It appears from this that the MB test is a good quantitative and accurate indicator for smectite content (literature indicates the same). The caveat though is that this is calcium bentonite not sodium bentonite. It appears from the very high surface areas recorded, usually associated with sodium bentonite, that the MB has exchanged with calcium ions in the diffuse double layers giving the complete combined interlayer areas. UK soils mostly contain smectite in its calcium form.



The initial results from a number of MBST carried out on a variety of soil samples. The MBST predicted specific surface areas are plotted against their recorded Liquid Limits.



Results below give specific surface area as predicted from the MBST against mixtures of calcium bentonite (CB) ("smectite" high swelling clay mineral) and kaolin (K) (relatively very low swelling clay mineral). It appears from this that the MB test is a good quantitative and accurate indicator for smectite content (literature indicates the same). The caveat though is that this is calcium bentonite not sodium bentonite. It appears from the very high surface areas recorded, usually associated with sodium bentonite, that the MB has exchanged with calcium ions in the diffuse double layers giving the complete combined interlayer areas. UK soils mostly contain smectite in its calcium form.



Presents a One-day Conference on Wednesday 22 June 2011
at Aston University

SUBSIDENCE Topical Issues 2011

09.00 - 10.00	Registration and coffee
10.00 - 10.15	Opening by Chairman: RICHARD ROLLIT, Crawford & Co
10.15 - 10.50	<i>Subsidence - the forgotten peril?</i> Malcolm Cooper, Legal & General Insurance
10.50 - 11.25	<i>Mitigating the Environmental Impacts of Building Subsidence</i> Paul Thompson, Director, Marishal Thompson
11.25 - 11.40	<i>Coffee</i>
11.40 - 12.15	<i>A Realistic General Protocol for Investigation of Tree-Related Subsidence</i> Dr Giles Biddle, OBE, Arboricultural Consultant
12.15 - 12.45	Discussion
12.45 - 14.00	<i>Lunch</i>
14.00 - 14.35	<i>Councils – the root of the problem?</i> Peter Osborne, Director, TreeSubs.
14.35 - 15.10	<i>Planning for City Trees – Putting Subsidence in Context</i> Michael Lawson, Director, OCA
15.10 - 15.25	<i>Tea</i>
15.25 - 16.00	<i>Procurement – a suitable method for selecting the subsidence supplier?</i> Richard Rollit, Crawford & Co
16.00 - 16.30	Discussion
16.30 - 17.00	Tea & Disperse

(Directed by Stephen Plante, The Clay Research Group)

For conference availability: enquiries@astoncpdcentre.co.uk Telephone Enquiries: 0121 250 3818

Fax: 0121 250 3817 Website & Mailing Subscription: <http://www.astoncpdcentre.co.uk>

Our conferences are intended to contribute towards the CPD requirements of the relevant professional institutions.

The views expressed at the conference are personal to the speakers and are not necessarily those of Aston University.

Conference Organiser: Dr M Sadeghzadeh, 07788 947858

Please note the programme is subject to change without prior notice

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correspondence to: Aston CPD Centre, Birmingham Science Park Aston, iBIC, Holt Court South, Jennens Road, Birmingham B7 4EJ

Please reservePlace(s) at the course, (subject to terms & conditions) Subsidence: Topical Issues – 22.6.11

Delegate Name(s): Company:

Address:.....

Post Code: Email Address: Tel:

Have you any dietary, access or other requirements? YES/NO if YES please state

Do you wish to be invoiced? (VAT exempt) YES/NO Purchase Order No:

Invoice address if different from above:

Cost £185 per delegate, VAT exempt, covering attendance, papers, lunch and refreshments during the day.
(Cheques should be made payable to Aston CPD)