Root barrier feasibility check.

Policyholder Name: Mr & Mrs S Brooks
Croftway House, 298 Finchley Road, London, NW3 7AG

Brief history of the Claim

The garage to the left-hand boundary was underpinned by means of a pad and beam system to a depth of approximately 4m and this area is subsequently showing no signs of further damage as a result of foundational movement.

The current damage has manifested in the form of cracking and distortions to floor levels in the area adjacent to the garage area. Site investigations results are shown below. This feasibility check outlines the measures proposed in order to fully mitigate the claim with the identified trees remaining insitu.

Site Investigations.

SOILS LABORATORY RESULTS. **MAT LAB LTD.** 0121 704 3339

Opinions and interpolations expressed herein are outside the scope of UKAS accreditation.

JOB No.:-	49414	INSURANCE COMPANY	Infront Innovation REF:-IFS-RSA-SUB-09-0014492
DATE SAMPLES EXTRACTED:-	17 May 11	ENGINEER:-	John Barrett
CLIENT/INSURED NAME:-	Brooks	FROM :-	Infront Innovation,
ADDRESS:-	Croftway House,	B.H. No. :-	1
	298 Finchley Road,	LOCATION:-	Mid Left Flank Of Garage
	London,	REPORT DATE:-	06 Jun 11
	NW3 7AG		

UKAS TESTING 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"

		ATTERBERG LIMITS.						
DEPTH. M.	M.C. (%)	L.L. (%)	P.L. (%)	P.I. (%)	425um (%)	AV. Filter Paper M.C.(%) & No.	dh (mm)	BRIEF SOIL DESCRIPTION
1.75	26	71	25	46	97	-	0.0	Firm/stiff brown CLAY with rare sand, fine/medium gravel & roots.
2.25	16	-	-	-	-	-	0.0	Moist GRAVEL with much soft brown sandy clay & rare roots.
2.75	30	73	25	48	100	-	0.0	Firm brown slightly sandy CLAY with rare fine gravel & roots.

The subsoil contains firm brown CLAY with occasional sand & roots. Laboratory testing of recovered samples confirmed the Clay to be of Very High plasticity (CV) to a

depth of 2.75m below ground level. The clay content is consistently high across all samples 97 to 100% passing the 425 sieve test.

Atterburg Limits of soil samples provides the means to use Driscoll's assessment of desiccation. This compares the soil's actual moisture content with its liquid and plastic limits: at 50% the onset of desiccation occurred and below 40% the soil sample had attained significant desiccation.

The results here confirm soil dryness consistent with depth. Importantly, and more reliably, Soil Moisture Deficits are shown through the reported suction testing. These echo the results of the other methods indicating the influence of the roots around the critical depth of 2.0 to 2.5 metres.

More recent investigations involved an internal bore hole within the area of damage, to obtain tree roots samples for analysis.

Croftway House, 298 Finchley Road, London, NW3 7AG

Client:	Subsidence Management Services
Client Contact:	Chris McKeague
Claim Number:	200902053990
Client Reference:	IFS-RSA-SUB-09-0014492
Policy Holder:	Mr R & Mrs S Brooks
Report Date:	20 November 2014
Our Ref:	R9396

Intec
Parc Menai, Bangor,
Gwynedd, North Wales
LL57 4FG
Tel: 01248 672652

Sub Sample	Species Identified		Root Diameter	Starch
BH1:				
0.8-2.3m	*Laurus* spp.	1	1 mm	Abundant
0.8-2.3m	*Quercus* spp.	2	1 mm	Abundant

Comments:

1 - Plus 1 other also identified as *Laurus* spp.
2 - Plus 1 other also identified as *Quercus* spp.

Laurus spp. include bay laurel (the bay tree).
Quercus spp. are oaks (both deciduous and evergreen).

The results shown above confirm the presence of oak tree roots within the Bore hole to a maximum depth of 2.3m.

Vegetation and Arborist requirements.

The implicated vegetation is set out below in the initial Arborist report and recommendations.

To date both the Ash and the Acer have been removed, leaving only the Oak remaining within the grounds of the neighbouring property - a block of flats managed by Westfield.

The hedge. TG5 (a type of Hawthorn) is in the PH's garden and this has been reduced and managed by the PH in line with the recommendations.

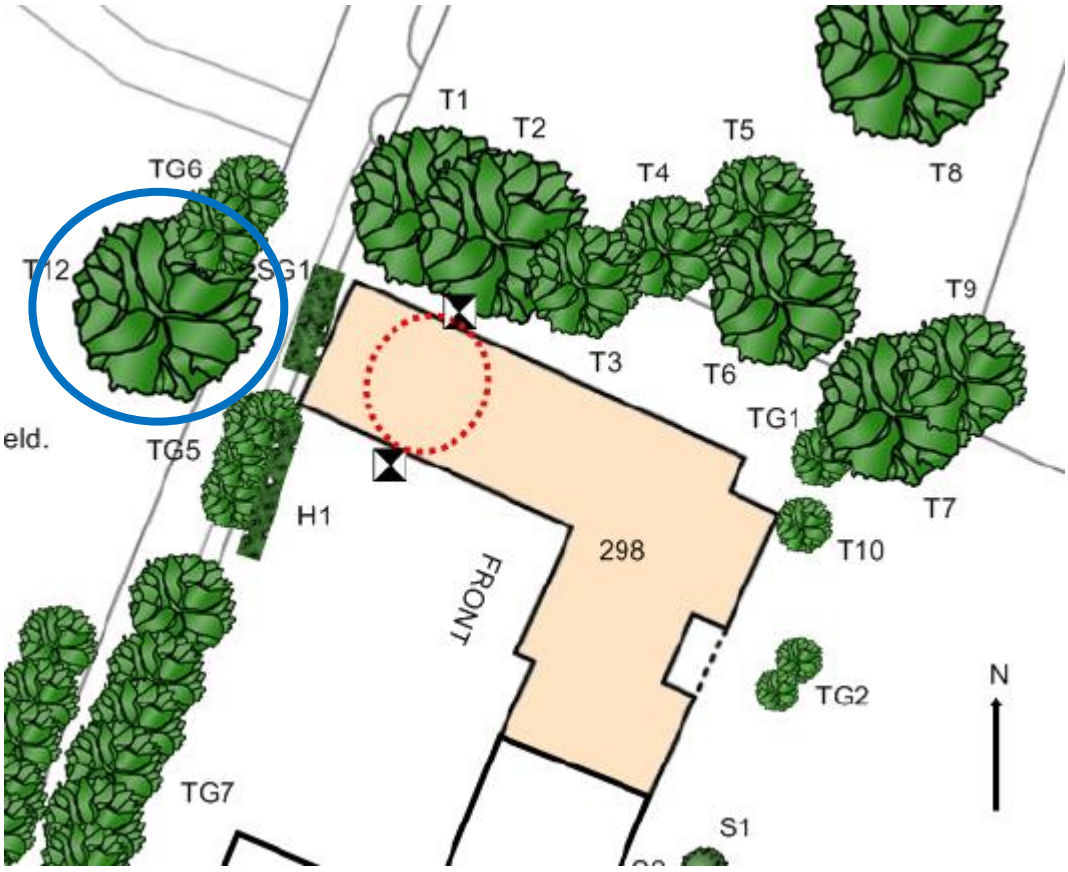
The remaining trees believed to be the cause of the problem are:

Tree species	Current Height	Mature Height	Distance	Water Demand	Owner
T12 Oak	20m	20-22m	4.5	High	Private with TPO

Do any of the trees have TPO's or conservation restrictions: YES ROOT SEVERENCE REQUIRED.

These recommendations may be subject to review following additional site investigations

Tree No.	Species	Age Cat	Approx. Height (m)	Distance to Building (m)	Ownership	Action	Requirement
T1	Ash	3	22	4.6	C - Insured	Remove	Remove and treat stump to inhibit regrowth. Tree has large fruiting bodies all around base of tree.
T2	Acer	3	15	4.6	C - Insured	Remove	Remove and treat stump to inhibit regrowth.
T12	Oak	3	20	4.55	A - Third Party Westfield	Remove	Remove and treat stump to inhibit regrowth.
TG6	Prunus x2 trees. DBH 15-25cm.	1	12	5.17	A - Third Party Westfield	Remove	Remove and treat stump to inhibit regrowth.
TG5	Hawthorn x6	1	6	1.25	B – Local Authority	Maintain as detailed	Remove the 3 closest trees to the front left corner of the property. Do not allow retained vegetation to exceed current dimensions.
Age Cat: 1 = Younger than property; 2 = Similar age to the property; 3 = Significantly older than property and may represent a heave risk							



Monitoring.

Level monitoring stations were installed at the outset of the claim and have continued to show cyclical patterns of movement after the tree removal, indicating the remaining presence of tree roots within the clay soils. Maximum deviations are recorded between 6-8mm, indicating consistent but non progressive levels of movement.

Feasibility Workings for Copper Root Shield

Category of damage (in accordance with table 1 BRE digest 251)	**Cat 1-5**	**3**

Area of Damage	**Main House**	**Porch**	**Garage**	**Outbuilding**
	Yes	**No**	**No**	**No**

Damage is apparent to the rooms directly adjacent to the double garage, namely the entrance, study room, rear utility area and bedroom / toilet area above the converted garage. A separate schedule of works detailing the repairs necessary will be produced for inspection.

Monitoring	**Crack**	**Maximum Upward Variation**	**Maximum Downward Variation**	**Level Monitoring**	**Maximum Downward Variation**	**Minimum Upward Variation**
	Yes	**2mm**	**4mm**	**Yes**	**8mm**	**4mm**

CLAY SOILS

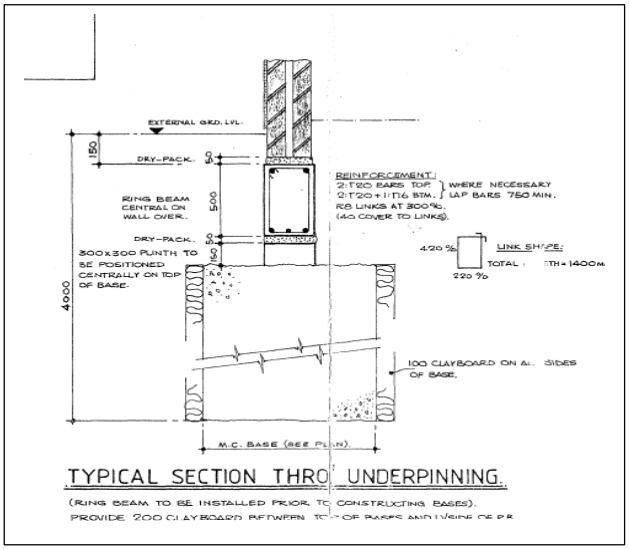
Borehole No & Location	**CLAY**	**PI**	**MC**	**LL**	**% passing 425µm seive**	**Suction**	**Oedometer Strain**
1.Left of garage	Yes	46 –1.75m 48 –2.75m	26 30	71 73	98 100	350 – 400Kpa	None

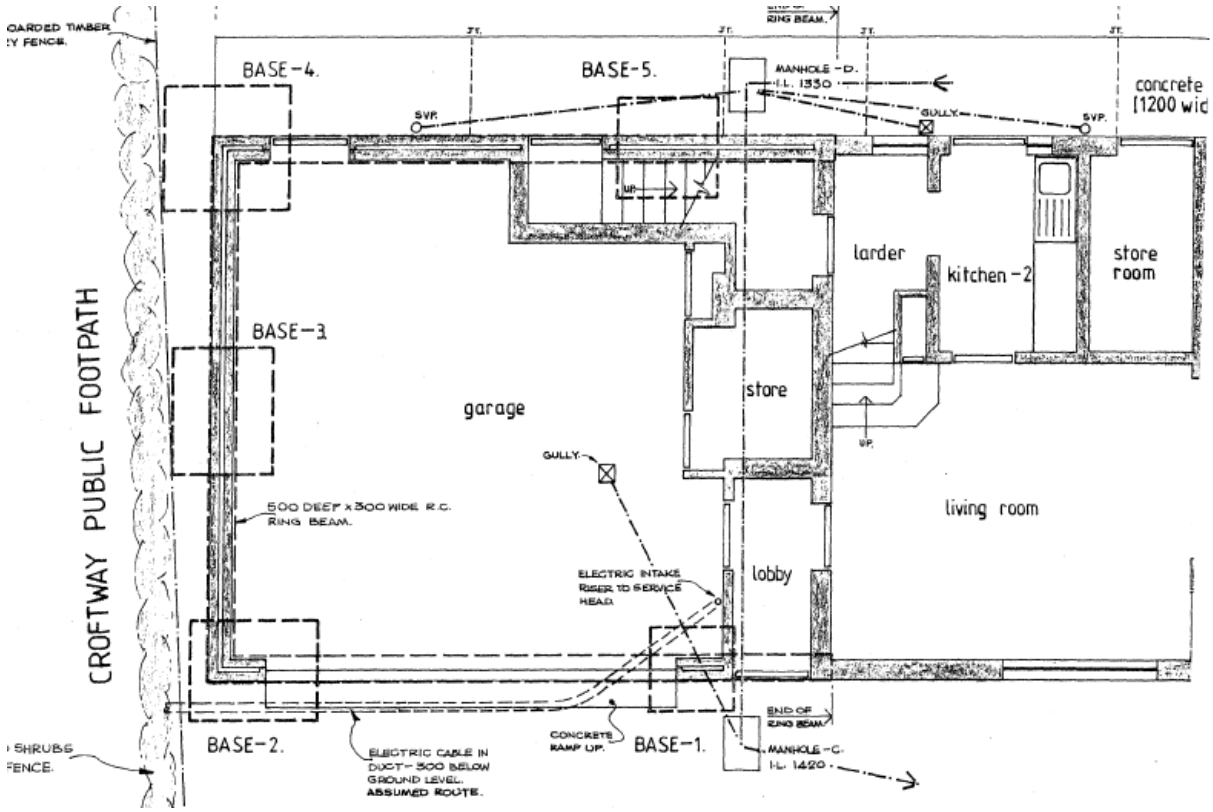
Granular Soils

Borehole No. & Location	**Have drains been repaired?**	**McIntosh Probe readings**	**BGS CHECKS Underlying Bedrock**
	Yes		**Completed: London Clay formation, clay, silt and sand**
			Issue found: None

Has the property been underpinned previously ?
If yes, please state the type, depth and location
Of previous stabilisation works……

Yes Garage. Pad and beam solution





Why have we recommended an intervention technique?

Damage at the property has been investigated, and the affected parts of the building are believed to be suffering from clay shrinkage subsidence.

The location of the identified trees provide the opportunity to implement the intervention techniques detailed below, in order to mitigate against their influence and reduce the foundational movement in order to restore relative stability.

How do Copper Root Barriers work ?

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 domestic 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 type of clay soil, the type and size of vegetation, and on 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.

The water content of a shrinkable clay soil will vary with depth remote from and near to a large tree. Near the ground surface there can be relatively large changes in soil water content between summer

and winter as a result of evaporation from the ground surface and transpiration by the grass. Such variations are normally confined to the top 1-1.5m of the ground, possibly less adjacent to buildings. Where mature trees grow at the same location, then the water-content profiles will vary and the seasonal fluctuations in soil water content are both larger and extend to a greater depth. Soil volume changes and hence ground movements will be greater.

A crack due to differential foundation movement occurring after a tree has reached maturity, there being no cracks up to that time, means it is probable that an exceptionally long dry spell has also had an influence. But cracks will recover when ground moisture contents recover and will not recur to any greater width in future. BRE Cracking in Buildings. The intention of the Bioroot shield is to mitigate against this periodically damaging effect. The solution adopted in this case seeks to decrease water uptake by the trees thereby lessening subsidence risk by conserving soil moisture and reducing clay subsoil shrinkage. This aim is to achieve an impairment to root growth by the focused introduction of a proprietary Bioroot-shield that offers all the benefits of being both flexible and permeable. In addition it works as a biological repellant.

The Copper signal barrier details a cooper foil securely bonded between porous geotextile, releasing copper ions and forming copper carbonate (verdigris) that signals an adverse reaction to roots deflecting them away from the barrier. The presence of copper do not constitute an eco-system burden or impact on groundwater

This solution is multipurpose and ideally suited to the current application. Traditional impervious barriers divert rather stop roots and may block moisture movement. Also roots getting under such barriers can grow back to the surface. Therefore the use of this permeable barrier stops roots either by engaging and constricting them or by chemically inhibiting them.

The benefits of such a shield are its dual protection both physical and biological. The multi layered sheets can be welded together whilst retaining iys flexible qualities, i.e. can be cut and effectively resealed to fit round services and foundations, inert with a 50 year service life expectancy. Equally the solution inhibits root growth on the barrier face which is often problematic with conventional barriers where increased moisture levels can cause root growth to become more prolific on the face of a traditional barrier. Research has shown that the use of the recommended style of copper based screening has greatly reduced the affects of root growth when compared to other traditional physical barrier installations

Following the installation of the shield the trench will be backfilled and compacted mechanically where the originally excavated soil is pre-used. Alternatively dependent upon site conditions backfill using lean mix concrete will utilised on the structure side of the shield. On occaisions some natural settlement is anticipated following completion. In all instances the project envisages a return visit to the property to effect any required maintenance of the surface of the reinstatement routinely programmed within 6 months following completion of the installation.

Specification of Barrier.					
Barrier Type	length	Max Root Depth	Minimum depth to be achieved with barrier	Distance between tree / Vegetation and barrier	shortest distance between barrier and foundation
Copper	7m	2.3m	3m	5m Min	Below garage floor.

Foundations

Type :	As per detail shown above. Pad and beam carrying garage structure and floor
Depth:	As above

Copper geo-textile root barrier to be installed as shown opposite below the garage floor slab in running parallel with the gable end boundary wall

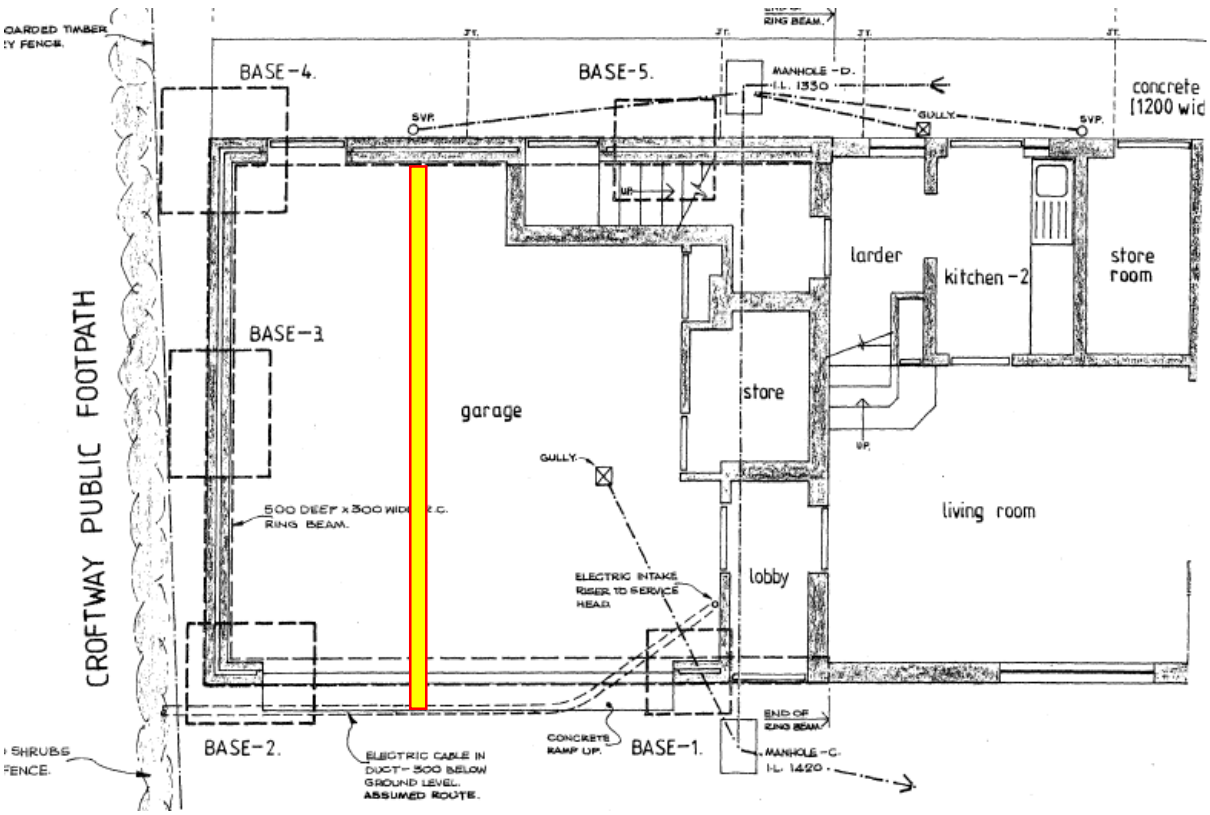
Barrier must maintain minimum 5m distance from tree and achieve 3m depth below ground

Separate method statement and risk assessment to be provided by contractor installing barrier due to tight confined area for working and hand digging to depth.

Machine access will be required to reduce dig soil depth into the garage.

All surfaces for to be reinstated as per existing.


Exact location of barrier below garage floor to be determined on site.
Diagram below for illustration only this is not a up to date layout.
LS06 KWO


CROFTWAY PUBLIC FOOTPATH
BASE-4.
BASE-5.
BASE-3
BASE-2.
BASE-1.
garage
store
lobby
living room
larder
kitchen-2
store room
concrete (1200 wid
MANHOLE-D.
I.L. 1330
SVP.
GULLY.
UP.
RING BEAM.
ELECTRIC INTAKE RISER TO SERVICE HEAD.
CONCRETE RAMP UP.
ELECTRIC CABLE IN DUCT-300 BELOW GROUND LEVEL. ASSUMED ROUTE.
MANHOLE-C.
I.L. 1420
SHRUBS
FENCE.