ADDENDUM ARBORICULTURAL REPORT

SUBSIDENCE CLAIM

SUBSIDENCE CLAIM

[redacted]

22A Harley Road, Hampstead, London, NW3 3BN

Prepared for

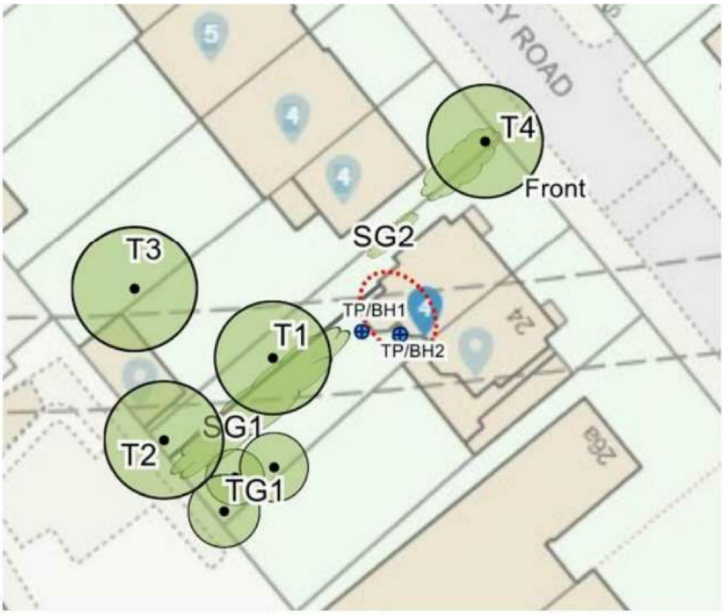
RSA
North Area Claims
17 York Street
Manchester
M2 3RS

15 August 2024

[redacted]

Chartered Loss Adjusters

[redacted]



INTRODUCTION

We have been asked by insurers to comment on movement that has taken place to the above property. This report outlines the arboricultural issues and should be read in conjunction with our Technical Report dated 13/04/2022, the MWA Arboricultural Report dated 06/12/2023 and the site investigations including soil and root testing and level monitoring, which are summarised within this report.

TECHNICAL CIRCUMSTANCES

At the time of our inspection we met with the leaseholder of the basement flat, 22a Harley Road, and her respective purchaser. We were advised that the purchaser recently commissioned a survey which identified a number of issues with possible subsidence at the rear of the house. On reviewing the report [redacted] advised the management company who notified insurers of a possible claim.

PROPERTY

The subject property comprises a basement flat within a four storey multi-occupied semi-detached house of traditional construction with masonry walls surmounted by a hipped, slated roof. To the front of the property is a small grassed garden and the main access staircase. To the right side of this is a pathway leading to the front door to the basement flat. At the rear of the property is a garden comprising paving and grass.

[redacted]

HISTORY & TIMESCALE

We will now instruct site investigations to confirm the cause of the problem and determine any mitigation measures that are required.

Date of Construction 1900

Purchased 1985

Damage First Noticed 23/09/2020

TOPOGRAPHY

The property occupies a level site with no unusual or adverse topographic features.

OBSERVATIONS

Following our initial inspection it was established that the damage to the property was caused by subsidence, believed to be as a result of root induced clay shrinkage. The single storey rear bay and conservatory are the focal point of concern.

INTERNAL DAMAGE

Living Room (5.4 x 4.0 x 2.5) -

Hairline crack over the right corner of the opening through to the kitchen area which appears longstanding and not related to subsidence.

Hairline crack to either side of the archway through to the rear bay area.

1mm wide cracks over both corners of the French doors in the rear bay.

Conservatory (3.5 x 3.1 x 2.5) -

Vertical 3mm wide crack to the right hand side of the conservatory at the junction with the main house.

2mm wide crack to the left hand side of the conservatory alongside the door through to the living room at the same junction.

[redacted]

EXTERNAL DAMAGE

Rear Elevation -

10mm wide crack over the left corner of the arch over the French doors to the rear bay. The arch has slipped and requires re-setting.

Vertical cracks either side of the conservatory at the junction with the main rear elevation up to approximately 2mm width.

Stepped crack over the left corner of the first floor window which did not extend any further upwards or downwards. This appeared longstanding and had been previously repaired and was not consistent with subsidence.

An historic bow in the brickwork both to the rear and left hand elevations at first floor level which is not related to subsidence.

CATEGORY OF DAMAGE

In structural terms, with reference to Table 1, Building Research Establishment[1] Digest 251, the damage is categorised as Moderate (>5 but <15 mm) with maximum crack widths of 10.0mm.

GEOLOGY & SOIL

Reference to the 1:625,000 scale British Geological Survey Map (solid edition) OS Tile number TQNW suggests the underlying geology to be Clay Soils.

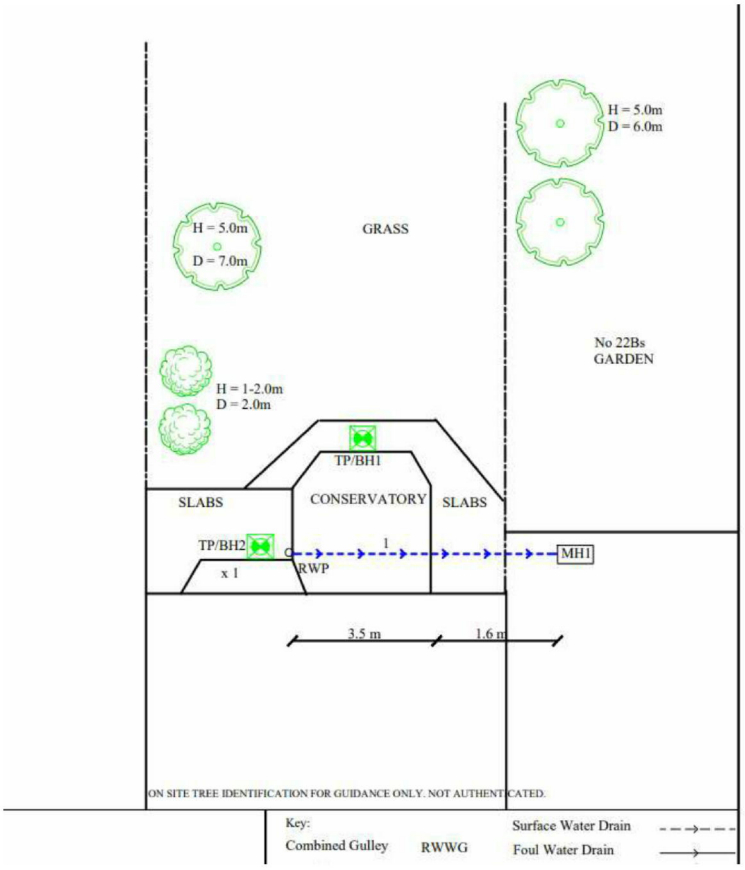
This is further confirmed by the site investigations.

SITE INVESTIGATIONS

Site investigations undertaken 03/05/2022 confirm 370mm to 700mm deep foundations bearing on clay that has high to very high plasticity, meaning it can significantly change in volume due to seasonal variations in moisture content, particularly if influenced by tree roots extracting moisture.

[1] Building Research Establishment, [redacted]

[redacted]



Laboratory tests confirm significant desiccation has occurred where roots were observed, the moisture contents being at or significantly less than 0.5x the Liquid Limit at the depth of observed roots, this indicates abnormal soil drying in the presence of tree roots.

It is notable that the sampling was undertaken at a time of year when soil moisture deficits due to root activity would be low following winter rehydration prior to tree root activity during summer months and we would expect significantly drier soil during summer months when roots are active.

[redacted]

Laboratory Summary Results

Our Ref : [redacted]

Location : 22A Harley Road, Hampstead, London, NW3 3BN
Client: CET Property Assurance (Crawford Claims Management)
Address: [redacted]

Date Sampled: 03/05/2022
Date Received : 05/05/2022
Date Tested : 05/05/2022
Date of Report : 09/05/2022

Sample Ref TP/BH No.	Depth (m)	Type	Moisture Content (%) [1]	Soil Fraction < 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity * Index [5]	Modified * Plasticity Index (%) [6]	Soil * Class [7]	Filter Paper Contact Time (d)	Soil Sample Suction (kPa) [8]	Oedometer Strain [9]	Estimated * Heave Potential (Df) (mm) [10]	In-situ * Shear Vane Strength (kPa) [11]	Organic * Content (%) [12]	pH * Value [13]	Sulphate Content * 2g / 1L: SO3 [14]	2g / 1L: SO4 [15]	* Class [16]
1	U/S 0.38	D	30	<5	66	26	40	0.10	40	CH					93					
	1.0	D	29	<5	72	25	47	0.09	47	CV					107					
	1.5	D	27	<5											129					
	2.0	D	29	<5	72	25	47	0.09	47	CV					> 140					
	2.5	D	30	<5											> 140					
	3.0	D	31	<5	76	27	49	0.08	49	CV					> 140					

Laboratory Testing Results

Our Ref : 454333

Location : 22A Harley Road, Hampstead, London, NW3 3BN
Client: CET Property Assurance (Crawford Claims Management)
Address: Unit 4, Boundary Court, Willow Farm Business Park, Castle Donington, Leicestershire, DE74 2NN

Date Sampled : 03/05/2022
Date Received : 05/05/2022
Date Tested : 05/05/2022
Date of Report : 09/05/2022

Sample Ref TP/BH No.	Depth (m)	Type	Moisture Content (%) [1]	Soil Fraction < 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity * Index [5]	Modified * Plasticity Index (%) [6]	Soil * Class [7]	Filter Paper Contact Time (d)	Soil Sample Suction (kPa) [8]	Oedometer Strain [9]	Estimated * Heave Potential (Df) (mm) [10]	In-situ * Shear Vane Strength (kPa) [11]	Organic * Content (%) [12]	pH * Value [13]	Sulphate Content * 2g / 1L: SO3 [14]	2g / 1L: SO4 [15]	* Class [16]
2	U/S 0.70	D	32	<5	72	27	45	0.11	45	CV					62					
	1.0	D	29	<5	69	23	46	0.12	46	CH					87					
	1.5	D	29	<5											125					
	2.0	D	29	<5	68	24	44	0.12	44	CH					> 140					
	2.5	D	32	<5											> 140					
	3.0	D	32	<5	79	26	53	0.11	53	CV					> 140					

Roots were recovered from depths of up to 3m

ROOTS

The recovered roots were sent for laboratory testing and the results are as follows:

[redacted]

ROOT IDENTIFICATION

22A Harley Road

Client Reference: [redacted]
Report Date: 6 May 2022
Our Ref: [redacted]

Sub Sample	Species Identified		Root Diameter	Starch
TP1:				
USF	Vitaceae spp.	1	15 mm	Abundant
USF	Leguminosae spp.		3 mm	Abundant
USF	either *Quercus* spp. or *Castanea* spp.		1 mm	Absent
BH1:				
to 2.2m	either *Quercus* spp. or *Castanea* spp.	2	<1 mm	Low
to 2.2m	Vitaceae spp.		2 mm	Absent
TP2:				
USF	*Ailanthus* spp.	3	12 mm	Abundant
USF	Vitaceae spp.		3 mm	Low
BH2:				
to 3m	broadleaved species, too decayed for positive identification	4	1 mm	Absent

Comments:

1 - Plus 1 other also identified as Vitaceae spp.
2 - Plus 2 others the same.
3 - Plus 2 others also identified as *Ailanthus* spp.
4 - Plus 3 others the same.

Roots were observed to a depth of 2.2m bgl in TP/BH1 and to 3.0m bgl in TP/BH2, and recovered samples have been positively identified (using anatomical analysis) as Vitaceae spp., Leguminosae spp., either Quercus spp. or Castanea spp. and Ailanthus spp.

The origin of the Vitaceae spp. roots will be the grape of SG1 and are not considered significant to the current damage.

The source of the Leguminosae spp. roots will be T2 False Acacia, the either Quercus spp. or [the related] Castanea spp. roots will emanate from T3 Oak, and the Ailanthus spp. roots will originate from T1 Tree of Heaven.

VEGETATION

There are trees and shrubs nearby, some with roots that may extend beneath the foundations. The following are of particular interest and recommendations have been made to provide a remedy to the damage:-

[redacted]

Table 1 **Current Claim** - Tree Details & Recommendations

Tree No.	Species	Ht (m)	Dia (mm)	Crown Spread (m)	Dist. to building (m)	Age Classification	Ownership
T1	Tree of Heaven	16.5 *	700 *	15.0	7.8	Older than extension(s)	Third Party 22b Harley Road NW3 3BN
Management history		Crown reduced and historically crown lifted.					
Recommendation		Remove (fell) to near ground level and treat stump to inhibit regrowth.					
T2	False Acacia	16.0 *	500 *	16.0	15.0	Older than extension(s)	Third Party 22b Harley Road NW3 3BN
Management history		No significant past management noted.					
Recommendation		Remove (fell) to near ground level and treat stump to inhibit regrowth.					

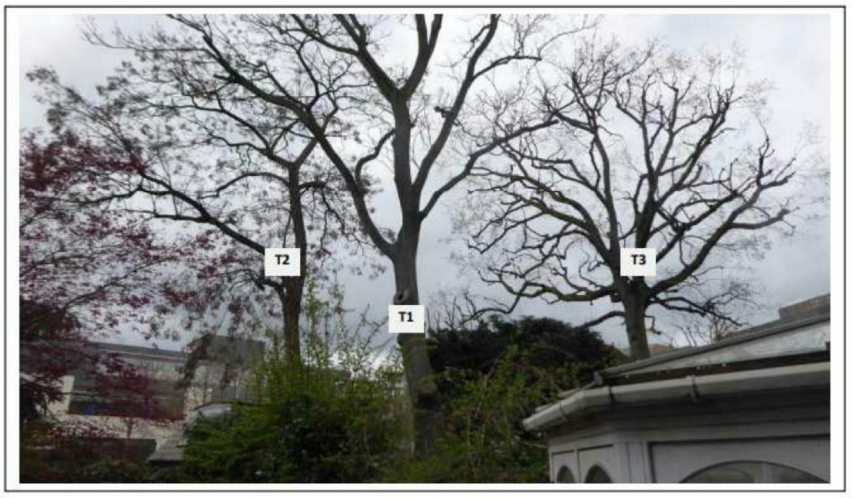
Ms: multi-stemmed * Estimated value

Tree roots can be troublesome in cohesive (clay) soils because they can induce volumetric change. They are rarely troublesome in non-cohesive soils (sands and gravels etc.) other than when they enter drains, in which case blockages can ensue.

Oak T3 is located 18m away from the area of damage and, whilst this tree is well within the maximum recorded tree-to-damage distance for its species, the closer two trees are currently considered to be the more likely main causes of the damage. Also, Oak T3 has recently been reduced in size.

[redacted]

PHOTOGRAPHS



View of T1 Tree of Heaven, T2 False Acacia and T3 Oak

VEGETATION INFLUENCE

According to the standard published work on the subject (Cutler, D.F. and I.B.K. Richardson, (1989) further confirmed by Mercer, Reeves & O'Callaghan (2011) in shrinkable clay soils, Tree of Heaven (Ailanthus) species are capable of causing subsidence damage at distances up to 3m, however data is sparse due to this species being infrequent in urban areas. We have seen cases where this species caused damage at a distance of 12m.

According to the same publications, in shrinkable clay soils, False Acacia (Robinia) species are capable of causing subsidence damage at distances up to 12.4m, with 75% of cases occurring where the tree was within 8.5m and 90% of cases occurring where the tree was within 10.5m. As in this case, we have seen examples where rooting has been confirmed at distances over 15m.

The trees T1 & T2, at 7.8m and 15m, are therefore within their species' potential rooting and influencing distance of the building and would be capable of causing seasonal soil drying beneath foundations. The site investigations confirm significant rooting beneath foundations in any event.

Due to their relatively minor dimensions in comparison to the subject tree(s) and their species' characteristics, respective distances shrubs, climbers, hedges nearby are unlikely to affect soil moisture conditions beneath foundations.

Whilst roots relating to Oak species were recovered from beneath foundations, we do not consider Oak T3 to be a main contributor to the damage at present.

PATTERN OF MOVEMENT

Damage was observed to worsen during late summer 2020 during a time of year when soil moisture deficits due to tree root activity would be reaching their peak.

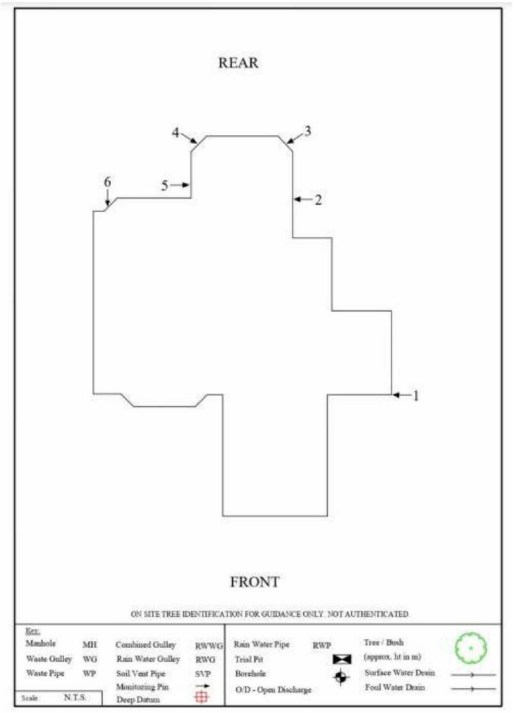
The area of movement and damage is consistent with the locations of the subject trees.

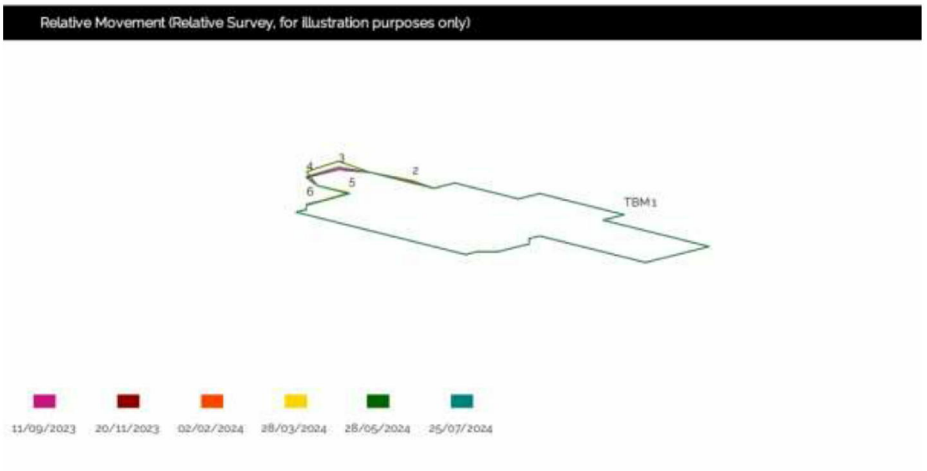
The pattern of movement is entirely consistent with the seasonal, cyclical influence of tree roots on soil moisture, foundations moving down during summer months when roots are active and extracting soil moisture, then returning to recovery and uplift as soil moisture increases during winter when tree roots are inactive.

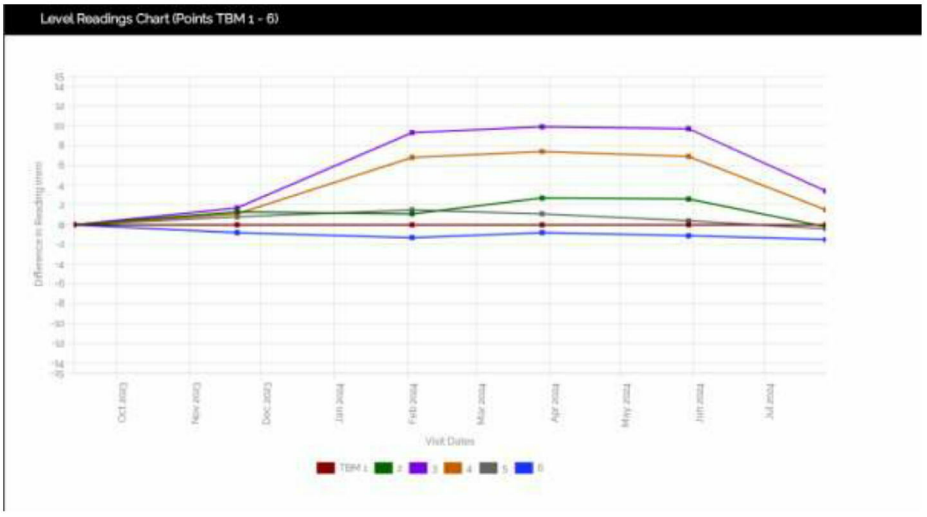
[redacted]

Precise Level Monitoring

The results are as follows:







The level monitoring indicates a clear seasonal and cyclical pattern of movement consistent with root induced clay shrinkage, foundations moving upwards during winter months then downward during summer months, with the greatest amplitude of movement being consistent with the locations of trees T1 & T2.

DISCUSSION

The pattern and nature of the cracks is indicative of an episode of subsidence. The cause of movement is clearly attributable clay shrinkage exacerbated by tree root activity.

The timing of the event, at a time of year when soil moisture deficits due to tree root activity would be reaching their peak.

The presence of shrinkable clay beneath the foundations and the proximity of vegetation where there is damage indicates the shrinkage to be root induced. This is a commonly encountered problem and probably accounts for around 70% of subsidence claims notified to insurers.

Root identification positively implicates Ailanthus T1 & False Acacia T2 in the damage.

MITIGATION OPTIONS

Tree reduction option - Pruning is generally unreliable as a means of controlling water uptake. Whilst the tree remains, even if heavily pruned, damage is likely to continue or worsen, as the roots will continue to extract moisture from beneath foundations of the damaged building. In any event, the tree is sufficiently close to the structure that even heavy pruning is very unlikely to reduce root moisture uptake. There is no linear relationship between foliage volume and the amount of water lost. Being dynamic organisms, trees react to pruning by trying to restore the root to shoot ratio by producing as many leaves as they can. These new leaves are usually juvenile leaves with a larger surface area and generally more pores on the underside, these pores stay open for longer compared to an unpruned tree and increase the degree of water uptake by the roots. Research has shown that even a heavily pruned tree will quickly return to absorbing soil moisture and the seasonal movement

and damage will continue. This is particularly the case with the subject trees due to their size, age and species characteristics, and this species grows back successfully following pruning. These trees are so close to the area of damage that root activity would continue even if the trees were to be heavily pruned.

The publication "CONTROLLING WATER USE OF TREES TO ALLEVIATE SUBSIDENCE RISK" © 2004 BRE on behalf of the Link Consortium for Horticulture Link Project No. 212 concluded that:

• For practical soil moisture conservation, severe crown-reduction 70-90% of crown volume would have to be applied. Reduction of up to 50% crown volume is not consistently effective for decreasing soil drying.

• To ensure a continued decrease in canopy leaf area and maximise the period of soil moisture conservation, crown reductions should be repeated on a regular managed cycle with an interval based on monitoring re-growth.

For trees of the age and proximity of the subject trees, a severe crown reduction would diminish its amenity value and would cause decays in the large pruning cuts that would be required. Also, repeated regular pruning (bi-annually) would be an expensive but not necessarily effective means of controlling above ground growth of the tree that would not be guaranteed to negate root activity beneath foundations.

Therefore, if the trees remain (even in a heavily pruned state) roots beneath foundations will remain active and seasonal subsidence damage is likely to continue to the damaged part of the property (and possibly more extensively in future).

We would also refer to the "Pilot study to determine the feasibility of using existing claims data to determine the impact of tree pruning on subsidence incidents on swelling clay soils" Hipps & Atkinson 2014

Conclusions of that publication are as follows:

"1. Nine cases were studied

2. In three cases pruning eliminated foundation movement

3. In four cases pruning reduced foundation movement

4. In two cases pruning had no effect

Pruning can be used as a reasonable way of minimising risk and preventing first instance of subsidence: (30% linear crown reduction every two years).

Once subsidence damage has occurred pruning is not a consistently reliable means of mitigation.

However, if pruning rather than felling is desirable then 40 – 50% linear crown reduction is required."

In six of the nine cases studied, foundation movement was not remedied by pruning, it was only successful in three of the nine cases.

Also, it is the case that when a building has suffered damage and its structural integrity has been compromised, the property remains at risk therefore (as in the "Delaware" judgement) measures need to be taken to ensure stability in the presence of active tree roots.

[redacted]

Therefore, taking all reasonable tests the insured property is within the likely zone of influence of the subject trees. This is further verified by the fact that Ailanthus (Tree of Heaven) and Leguminous (False Acacia) roots were recovered from the underside of foundations, with further roots being noted to a maximum depth of 3 metres.

Once subsidence damage has occurred pruning is not a consistently reliable means of mitigation.

On page 98 of the BRE publication "Has your house got cracks?" Second Edition Freeman, Driscoll & Littlejohn 2002 it states "Removing the tree altogether will have the greatest and most immediate effect on the levels of desiccation in the soil."

Also, from page 98 "In most cases there is no advantage in a staged reduction in the size of the tree and the tree should be completely removed at the earliest opportunity.

If the subject trees are not removed, then damage will almost certainly continue and worsen. Roots from these trees have almost certainly encroached beneath foundations and caused seasonal soil drying that has led to the damage.

Root pruning option - Root pruning as a form of mitigation is inherently unreliable as the level of excavation required could include many cubic meters of soil to be guaranteed to have removed all roots causing a nuisance, to effect such a remedy might materially make the tree unsafe or so biologically damaged as to destroy the amenity being the subject of the attempted remedy. Also, new roots will immediately seek to colonise the soil subject to the root cutting and the nuisance will recur.

Root barrier option – We have considered the feasibility of installing a root barrier within a deep trench. The excavations sever all roots, and a geotextile membrane provides a physical barrier to root growth and incorporates a repellent which diverts and inhibits roots. The severed roots then die and no longer absorb soil moisture and the clay will then rehydrate, causing foundations to become stable again.

Budget estimates for a root barrier would be in the region of £40,000, this is providing the site is suitable, with access available and with no underground obstructions that would interfere with its installation. However the barrier, to be effective, would need to extend into neighbouring land for which permission must be granted.

If a root barrier is not possible then the only alternative solution would be underpinning.

Underpinning – if the tree remains then the only appropriate solution would be underpinning to stabilise foundations, the cost of which is currently estimated at £80,000

Tree removal – The removal of any trees that are causal or contributory will allow the soil beneath foundations to rehydrate and to recover its original moisture content. Once trees are removed the activity of roots is negated and foundations will stabilize and repairs can be undertaken. If appropriate tree removal is not undertaken then the damage is likely to continue and worsen.

Drains - There are no apparent issues in relation to drains, and soil softening/washing by an escape of water is not considered to be a factor in the damage. This is confirmed by the desiccated condition of the soil.

[redacted]

Heave Potential – The subject trees do not significantly pre-date the construction of the building therefore there would be no risk of adverse soil heave occurring after the trees are removed.

RECOMMENDATIONS

T1 Tree of Heaven - Fell to near ground level (subject to consent being granted under the TPO)
T2 False Acacia – Fell to near ground level (subject to consent being granted under the TPO)

Statutory Controls – The trees are covered by a Tree Preservation Order administered by Camden Council, therefore an application is required and consent needs to be granted prior to any tree works occurring.

The trees are located within 22B Harley Road.

RESERVES

Superstructure repairs [redacted]
Estimated Engineering solutions and superstructure repair [redacted]

Yours faithfully

Chris Davies **Dip.Arb.(RFS), F.Arbor.A**

Arboricultural Consultant - Subsidence Team
Crawford & Company

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