ADDENDUM ARBORICULTURAL REPORT

SUBSIDENCE CLAIM

Crawford Reference: 1779439

22 Russet Glade, Reading, Berks, RG4 8UJ

Prepared for

RSA - Nationwide

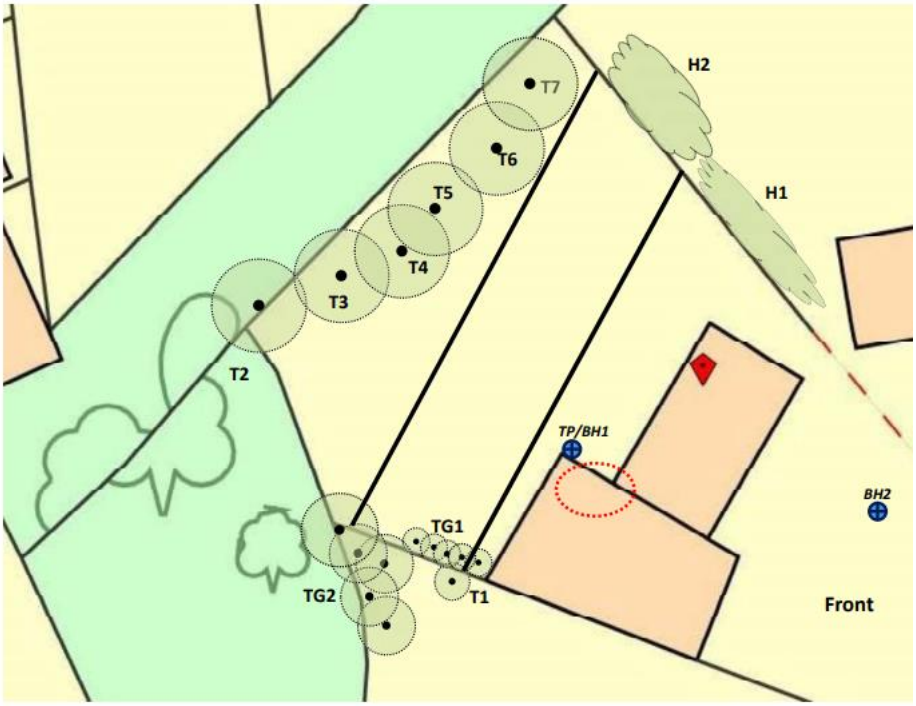
26 November 2024

Crawford Claims Solutions – Subsidence

Cartwright House,

Tottle Road,

Riverside Business Park, Nottingham, NG2 1RT



Plan not to scale – indicative only

Approximate areas of damage

Site Plan – TG2 breakdown

Plan not to scale – indicative only

Approximate areas of damage

A = Cherry identified as T8 in TPO
B = Oak not believed to be in TPO as smaller than 3
C = Oak identified as T7 in TPO
D = Oak not believed to be in TPO as smaller than 3
E = Sycamore – no Sycamore in TPO

INTRODUCTION

We have been asked by RSA - Nationwide to comment on movement that has taken place to the above property. We are instructed to describe the damage, establish a likely cause and list any mitigation or remedial measures required to stabilise the property.

Our report does not constitute a full structural survey of the property and it has been prepared specifically in connection with the present insurance claim and should not be relied on as a statement of structural adequacy. It does not deal with the general condition of the building, decorations, timber rot or infestation etc. All locations are identified as if viewing from the front of the building.

The report is made on behalf of Crawford & Company and by receiving the report and acting on it, the client - or any third party relying on it - accepts that no individual is personally liable in contract, tort or breach of Statutory duty. We have not commented on any part of the building that is covered or inaccessible.

PROPERTY

Two storey detached house of traditional construction with brick walls surmounted by a pitched tiled roof. The property was extended to the right hand side pre purchase, we believe sometime in the late 1980's. The extension is constructed off solid concrete floor, cavity brick work walls and enclosed by a mixture of pitched tiled and flat felted roofs. It is this extension which forms the focus of the claim.

HISTORY

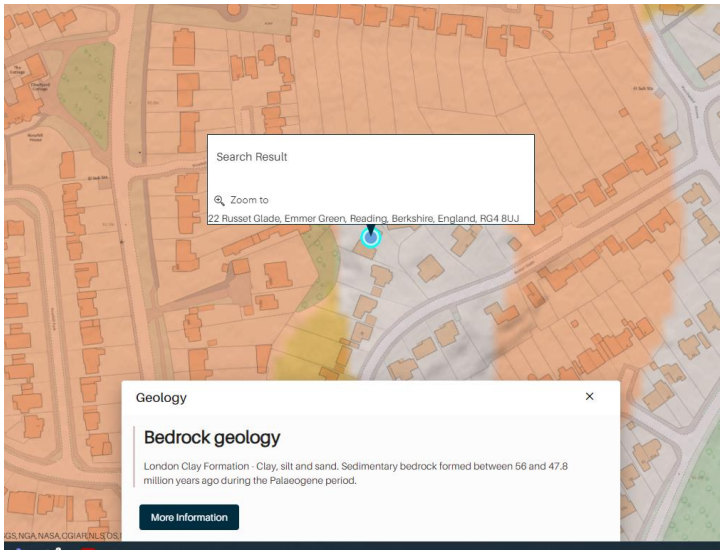
Date of Construction	Circa 1982
Date Damage First Noticed	21 January 2019

TOPOGRAPHY

The property occupies a site sloping from rear down to the front

GEOLOGY & SOIL

Reference to the 1:625,000 scale British Geological Survey Map (solid edition) suggests the underlying geology to be London Clay. The presence of shrinkable clay soil has also been confirmed in the site investigations.



OBSERVATIONS

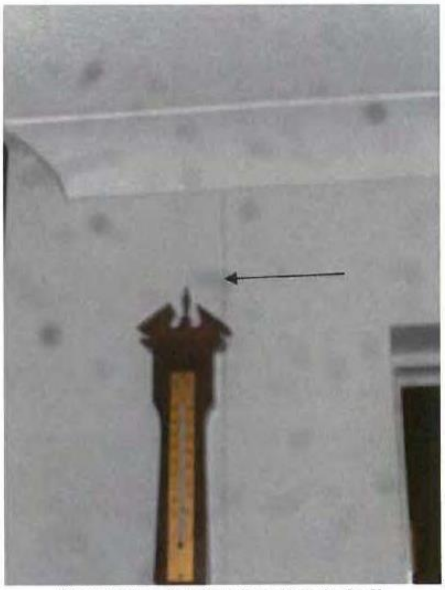
Following our initial inspection it was established that the damage to the property was caused by subsidence, believed to be as a result of root induced clay shrinkage. The main area of damage affects the rear right hand extension. Photographs of the initial damage reported are attached as an appendix to this report.

INTERNAL DAMAGE

Tapering diagonal and vertical cracks to the rear extension above and below window openings up to approximately 5mm in width. Pulling to paper and distortion to door openings rendering them unusable.

Cracking at extension junction in hall.

Cracking at extension junction in front reception.



Crack at extension junction in hall.

Crack at extension junction in bedroom.

EXTERNAL DAMAGE

A Tapering vertical crack was noted to the junction of the rear extension and the main house up to approximately 10mm in width.

Crack at junction of extension on right side.

Cracking at junction of extension on left side.

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 mm.

SITE INVESTIGATIONS

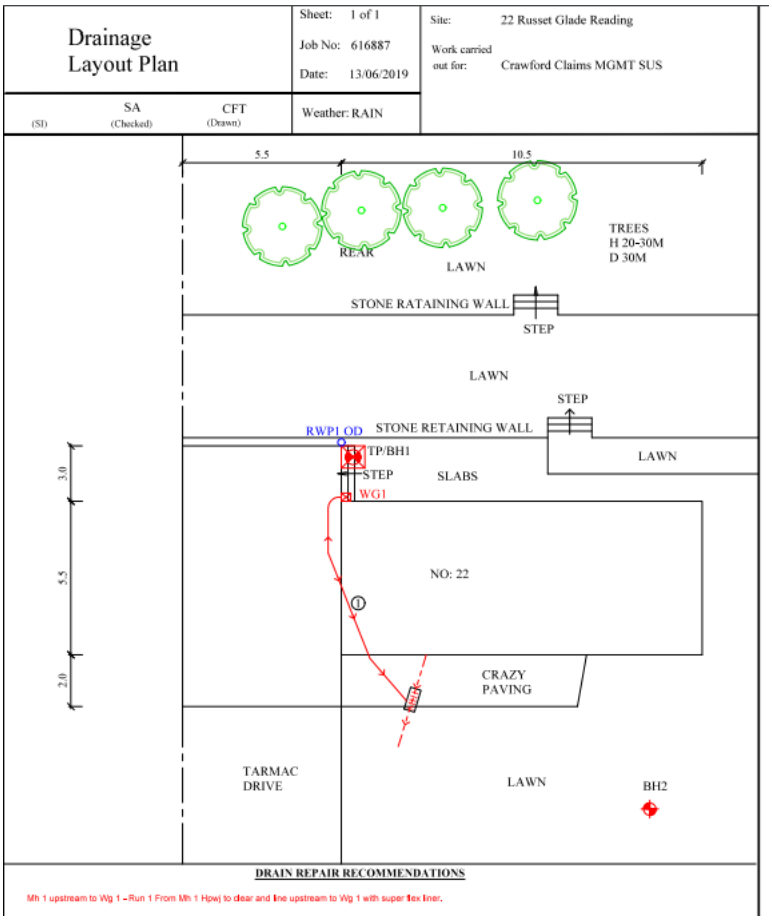
The following investigations were undertaken to identify the cause of movement on 13/06/2019.

The following investigations were undertaken to identify the cause of movement. Two trial holes were excavated to expose the foundations of the Rear left (TH1) and a remote borehole to the front right (BH2). Boreholes were carried out through the base of the trial holes to confirm the soil profile at depth and provide soil and root samples for laboratory testing. Soil samples were retrieved from the excavations and wrapped in clingfilm before being bagged and deposited with a testing laboratory the same day. The laboratory had instructions to carry out Atterberg testing to confirm the plasticity index (PI) and shrinkage potential of the clay soil. See site plan for location and the table below for details.

TH/BH No.	Depth of Foundation	Depth of Borehole	Max. depth of Roots	PI Range	Shrinkage Potential
TH/BH1	0.65m	3m	2.6m	38-45%	Med/High
BH2	N/A	3m	1.4m	30*35%	Med

[1] Building Research Establishment, Garston, Watford. Tel: 01923.674040

Foundation depth(s) confirmed at 650mm bearing onto clay soil that has medium to high plasticity, meaning it can significantly shrink and seal seasonally due to fluctuations in moisture content.



Laboratory tests confirm (significant) desiccation has occurred in BH1 where roots were observed to 2.6m depth, the moisture contents being at or significantly less than 0.4x the Liquid Limit, this indicates abnormal soil drying in the presence of tree roots.

The Sample Soil Suction is indicative of severe desiccation and we refer to the following:
From BRE Digest 412 “Desiccation in Clay Soils” 1996:

Table 1 Severity of desiccation related to excess suction

Severity of desiccation	Excess suction kPa
Very slight	0 – 50
Slight	50 – 100
Moderate	100 – 250
Severe	250 – 500
Very severe	500+

Laboratory Summary Results

Our Ref : 616887 — Date Sampled: 13/06/2019

Location : 22 Russet Glade, Reading — Date Received : 21/06/2019

Client: Crawford Claims Management — Date Tested : 24/06/2019

Address: Cartwright House, Tottle Road, Riverside Business Park, NG2 1RU — Date of Report : 01/07/2019

Sample Ref TP/BH No	Sample Ref 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 (h)	Soil Sample Suction (kPa) (8)	Oedometer Strain (9)	Estimated Heave Potential (DM) (mm) (10)	In situ * Shear Vane Strength (kPa) (11)	Organic * Content (%) (12)	pH * Value (13)	Sulphate Content * (g/l) SO3 (14)	Sulphate Content * (g/l) SO4 (15)	* Class (16)
1	1.0/5.0 0.65	D	25	<5	69	24	45	0.03	45	CH	168	995			> 130					
	1.0	D	24	<5	66	28	38	-0.11	38	CH	168	1110			> 130					
	1.5	D	23	<5							168	1360			> 130					
	2.0	D	21	<5	65	20	45	0.03	45	CH	168	1420			> 130					
	2.5	D	21	<5							168	1270			> 130					
	3.0	D	19	<5	61	17	44	0.05	44	CH	168	1440			> 130					

Laboratory Testing Results

Our Ref : 616887 — Date Sampled : 13/06/2019

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BH2	1.0	D	28	<5	60	25	35	0.09	35	CH					90					
	1.5	D	29	<5											93					
	2.0	D	25	<5	53	23	30	0.07	30	CH					105					
	2.5	D	29	<5											100					
	3.0	D	30	<5	59	26	33	0.12	33	CH					99					

Roots were recovered from depths of up to 2.6m

ROOTS

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

EPSL ***European Plant Science Laboratory***	Sheet: 1 of 1 Job No: **616887** Date: **10/07/2019** Order No: **1396044** EPSL Ref: **R31713**	Site: **22 Russett Glade,** Work carried out for: **Crawford Claims MGMT SUS**

Certificate of Analysis

The following work was commissioned by CET on behalf of their client. Root samples were obtained in sealed packets from the above site with no reference given as to the types of tree or shrub from which they may have originated.
The results were as follows -

Trial pit/ Borehole number	Root diameter (mm)	Tree, shrub or climber from which root originates	Result of starch test
TP1 (USF)	1.5 mm	Quercus spp. 2 roots	Positive
BH1 (to 2.6m)	1.5 mm	Quercus spp. 3 roots	Positive

Quercus spp. are oaks (both deciduous and evergreen).

ROOT IDENTIFICATION

22 Russet Glade,

Client Reference: SU1901097/1779439
Report Date: 17 June 2024
Our Ref: R58040

Sub Sample	Species Identified		Root Diameter	Starch
BH1:				
1-1.8m	*Quercus* spp.	1	1.5 mm	Moderate
1-1.8m	probably *Quercus* spp.	2	<1 mm	Low

Comments:

1 - Plus 1 other also identified as *Quercus* spp.
2 - Five juvenile roots all the same.

Quercus spp. are oaks (both deciduous and evergreen).

Roots retrieved from the beneath the foundations of the property in the area of subsidence damage were submitted to a botanist for identification, which confirmed the roots from Quercus (Oak).

Based on the above, the root identified will have emanated from TG2 Oak & T2 Oak noted in the MWA report.

The roots tested positive for starch meaning they were recently alive and active and will be having an influence on soil moisture at rooting depth.

DRAINS

The CCTV drainage survey completed at the time of the investigations has revealed some accidental damage to the underground drainage. The soil type and pattern of movement are not consistent with damage which could be attributed to escape of water from damaged drains. The damage to the drains is therefore attributed to the ground movement also affecting the foundations of the property. Therefore, leaking drains can be dismissed as a possible cause of the subsidence damage affecting the property. Whilst leaking drains are not a factor in the movement to the property it would be prudent to repair them, and we have requested this work is carried out.

The desiccated condition of the soil indicates that soil softening due to an escape of water is not a factor in the damage.

VEGETATION

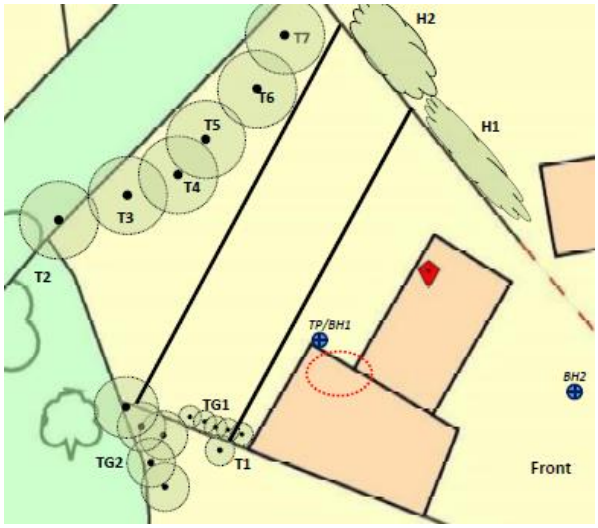
There are trees and shrubs nearby, some with roots that may extend beneath the foundations. The following are of particular interest and recommendations have been made to provide a remedy to the damage:-

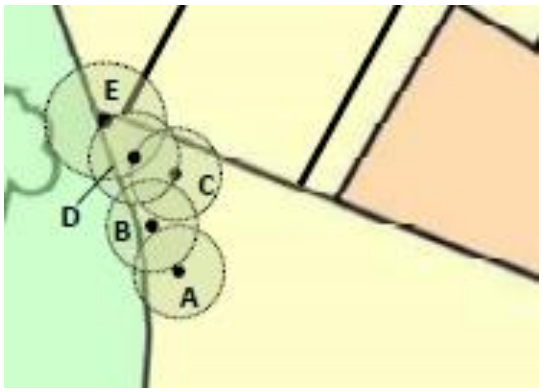
There are several trees and shrubs nearby, some with roots that may extend beneath the house foundations. The following are of particular interest:-

Tree No.	Species	Ht. (m)	Dia. (mm)	Crown Spread (m)	Dist. to building (m)	Age Classification	Ownership
TG1	Cypress	4.5	Ave 150	2	0.5	Younger than extension	Policy Holder
Management history		No recent management noted.					
Recommendation		Remove (fell) all stems within 3m of the building; maintain the remaining trees at no more than their current dimensions by periodic pruning.					
TG2	Mixed species group including Prunus, Acer, Oak	Ave 16*	Ave 200*	6	Ave 6.5	Older than property	3rd Party: 24 Russet Glade RG4 8UJ
Management history		No recent management noted. A = cherry B = oak C = oak D = oak E = sycamore					
Recommendation		Remove (fell) to near ground level. Owner to physically remove any regrowth (no chemical treatment due to translocation risk).					
T1	Ash	6	150*	4*	2.5*	Younger than extension	3rd Party: 24 Russet Glade RG4 8UJ
Management history		No recent management noted.					
Recommendation		Remove (fell) to near ground level and treat stump to inhibit regrowth.					
T2	Oak	18.5*	750*	18*	22*	Older than property	3rd Party: 23-26 Tower Close RG4 8UU
Management history		No recent management noted.					
Recommendation		Reduce crown by 30%. Prune on a triennial cycle to maintain at broadly reduced dimensions.					

Removed January 2020

Removed October 2023





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.

MWA (Arboricultural Consultants) were appointed to provide their recommendations in relation to necessary tree management works to be undertaken in order to return long stability to the property. It is their opinion that the TG2 inclusive of Oaks and T2 Oak are judged to be exerting the principal vegetative influence in respect of the current damage and are, by virtue of its size and proximity, having a significant influence on soil volumes below the insured property due to localised moisture abstraction.

PHOTOGRAPHS

View of TG1 and TG2

View of trees on upper terrace

View of H1 and H2 from upper terrace

View of the trees growing on the upper terrace from the front of the property.

View of TG2

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, Oak (Quercus) species are capable of causing subsidence damage at distances up to 30m, with 75% of cases occurring where the tree was within 13m and 90% of cases occurring where the tree was within 18m.

The subject Oak trees in TG2 at only 6.5m or so distance, are therefore well within the species' potential rooting and influencing distance of the building and would be capable of causing seasonal soil drying beneath foundations.

Oak tree T2 at 22m distance is also capable of causing soil drying beneath foundations.

The site investigations confirm significant rooting of Oak beneath foundations in any event.

Irrespective of the root identification, the roots of T1, TG1 and other elements of TG2 will be present below the foundations, Cypress in TG1 and Cherry and Sycamore in TG2 are also well within their species' normal influencing distances 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)

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.

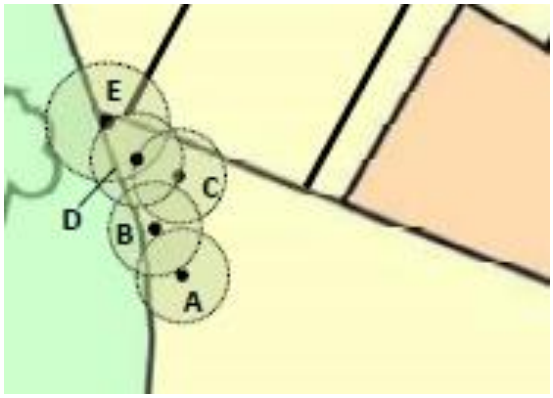
DNA TESTING

As per recommendations to obtain and provide DNA testing evidence we have undertaken the required investigations and found the following:

Tree TG2 C generated the same DNA fingerprint as the roots and so can be considered to be the source of the roots.

Trees T2, T3, T5, T7, T10, TG2 T2 and TG2 B & D generated different DNA fingerprints and did not match the roots. Please see 'Forest Research Oak DNA Results 27.06.24' excel report for further details.

DNA Testing carried out by the Genetic Conservation Group, Forest Research, Roslin



While comprehensive DNA testing can lead to very specific identification, and can therefore be justified in a small proportion of cases, there are pitfalls. What of natural grafting of roots, when a group of two or more trees of the same species can 'share' one root network? Due to the proximity

and locations of Oak trees in TG2 it is almost certain that there would be root grafting therefore DNA testing is unlikely to be entirely conclusive.

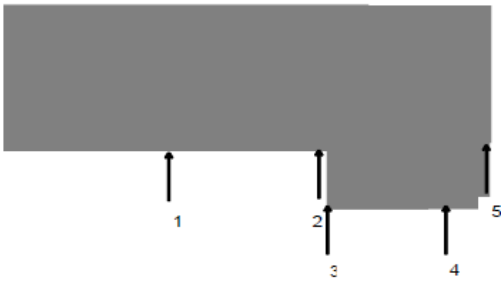
Oak T2 is considerably further than Oaks in TG2 and this tree has been recommended for crown reduction at present.

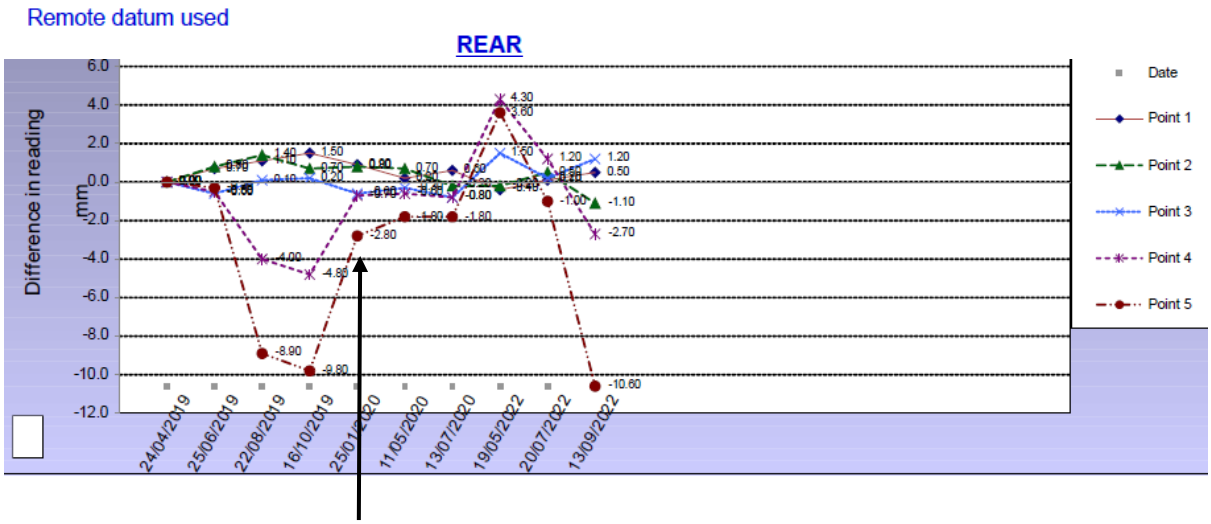
Even if DNA tests confirmed only 1 of the Oaks in TG2, the others are still well within the species' normal influencing distances and would still need to be considered for removal.

PATTERN OF MOVEMENT

Level monitoring clearly shows evidence of cyclical seasonal movement consistent with root induced clay shrinkage, with downward movement during the summer and corresponding upward movement over the subsequent winter. The movement which is focused at point 5 and shows movement of up to 14mm, is located in the area of subsidence damage affecting the property.

The pattern of movement is not uniform around the property so 'nominal clay shrinkage' can be discounted as a cause; nearby vegetation is seen to be the source of the ongoing localised movement to the left rear.





TG1 Cypress removed Jan 2020

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.

The level monitoring indicates a cyclical pattern of movement which shows both downwards movement during the drier summer months; when trees are in leaf and actively demanding moisture from the ground; and subsequent recovery and upward movement during the wetter winter months when the trees lose leaf and become dormant. Patterns of movement such as those observed at the risk address are consistent with clay shrinkage subsidence and are only consistent with the effects of shrinking and swelling of clay soils exacerbated by the presence of roots.

Level monitoring clearly shows evidence of cyclical seasonal movement consistent with root induced clay shrinkage, with downward movement during the summer and corresponding upward movement over the subsequent winter.

CRACK MONITORING

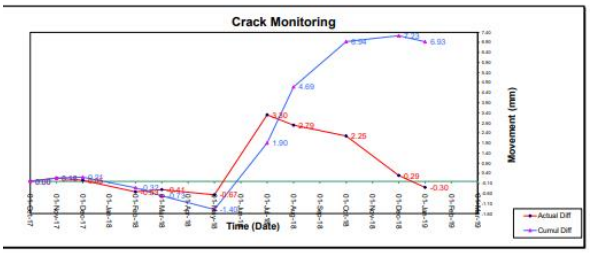
The crack monitoring also confirms a seasonal pattern of cracks opening during summer months when roots are active and closing during winter when trees are dormant:

Location: TT1 - Main Bedroom RH wall

Date	Actual Diff	Cumulative Diff	Actual Reading
10-Oct-17	0.00	0.00	85.24
13-Nov-17	0.16	0.16	85.40
15-Dec-17	0.05	0.21	85.45
16-Feb-18	-0.53	-0.32	84.92
21-Mar-18	-0.41	-0.73	84.51
25-May-18	-0.67	-1.40	83.84
23-Jul-18	3.30	1.90	87.14
21-Aug-18	2.79	4.69	89.93
04-Oct-18	2.25	6.94	92.18
12-Dec-18	0.29	7.23	92.47
17-Jan-19	-0.30	6.93	92.17

Initial crack width = 5mm

Stud Arrangement

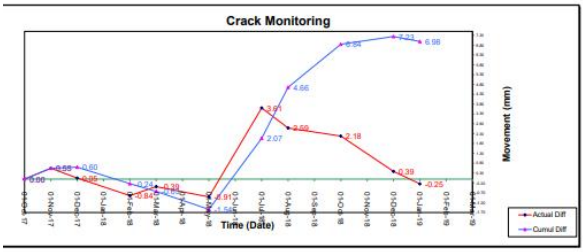


Job no. 174966
Location: TT2 - Main Bedroom LH wall at coving level

Date	Actual Diff	Cumulative Diff	Actual Reading
10-Oct-17	0.00	0.00	69.08
13-Nov-17	0.55	0.55	69.63
15-Dec-17	0.05	0.60	69.68
16-Feb-18	-0.84	-0.24	68.84
21-Mar-18	-0.39	-0.63	68.45
25-May-18	-0.91	-1.54	67.54
23-Jul-18	3.61	2.07	71.15
21-Aug-18	2.59	4.66	73.74
04-Oct-18	2.18	6.84	75.92
12-Dec-18	0.39	7.23	76.31
17-Jan-19	-0.25	6.98	76.06

Initial crack width = 5mm

Stud Arrangement

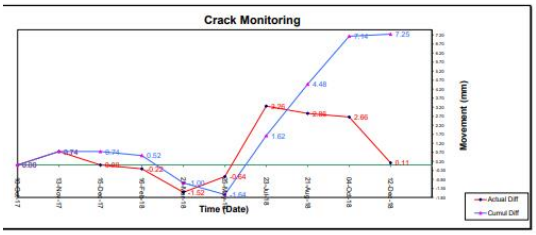


Job no. 174966
Location: TT3 - Right Hand Flank wall - external

Date	Actual Diff	Cumulative Diff	Actual Reading
10-Oct-17	0.00	0.00	98.10
13-Nov-17	0.74	0.74	98.84
15-Dec-17	0.00	0.74	98.84
16-Feb-18	-0.22	0.52	98.62
21-Mar-18	-1.52	-1.00	97.10
25-May-18	-0.64	-1.64	96.46
23-Jul-18	3.26	1.62	99.72
21-Aug-18	2.86	4.48	102.58
04-Oct-18	2.66	7.14	105.24
12-Dec-18	0.11	7.25	105.35

Initial crack width = 10mm

Stud Arrangement



DISCUSSION

The results of the site investigations confirm that the cause of subsidence damage to the property is root-induced clay shrinkage. The clay is plastic and thus will shrink and swell with changes in moisture content. Roots have extracted moisture below the depth of the footings, thus causing differential foundation movement to occur. This is supported by the following investigation results:-

- Our initial site inspection and professional engineering opinion has identified damage to the property consistent with subsidence caused by root induced clay shrinkage.
- Atterberg limit testing indicates that the soil is plastic and hence will shrink and swell with changes in moisture content.
- The pattern of movement shown by level monitoring readings indicates upward recovery of a desiccated clay soil and the movement is not uniform around the property so 'nominal clay shrinkage' can be discounted as a cause.
- Crack monitoring also confirms a seasonal pattern of crack opening during summer and closure during winter.
- Roots were found to the underside of the foundation and were identified as Quercus. Starch was present which indicates that the roots were alive at the time of retrieval.
- An expert Arboricultural report has confirmed that nearby vegetation is the cause of the subsidence related damage to the property and identified tree management works required to stabilise the property.

As per the recommendations of the Arboricultural Report the Oak, Cherry and Sycamore require removal. The implicated trees (Oak and Cherry in TG2 and Oak T2) benefit from Tree Preservation Orders and an application should be made to allow the recommended works to be carried out. The additional recommended tree works did not benefit from any statutory protection and have been implemented.

Localised superstructure repairs shall proceed once all required tree management works have been completed and monitoring confirms stability of the property at a cost of circa £20,000. Should consent not be granted or third parties refuse to allow the required tree reduction works to be carried out a root barrier or partial underpinning to the property will be required to arrest the movement, with costs rising over £120,000 for underpinning or £250,000 for a piled raft. The root barrier has been quoted at £82,734.91 + VAT.

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

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."

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.

We would also refer to the comments made by Dr Biddle on page 5 of Arboriculture Research Note 108/92/EXT 'Tree Roots and Foundations', specifically "*Greatest benefits will be achieved if the building is near the outer limits of influence of the tree; pruning a large tree which is only a few metres from a building will probably have little benefit. If reducing the amplitude of movement is unacceptable, complete felling may be needed*".

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 Oak roots were recovered from the underside of foundations, with further roots being noted to a maximum depth of 2.6 metres.

From Dr Biddle's comments it would appear that even an eminent proponent of pruning as a remedy to subsidence appears to agree that in instances where species, such as Oak, are growing within close proximity to damaged properties, felling is the only appropriate action.

Oak T2 is nearer to the outer limits of its zone of influence and crown reduction pruning has therefore been considered in accordance with "Hortlink" and BRE IP7/06.

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.

A root barrier has been considered and the quote is £82,734.91 plus VAT, dependant on there being no adverse site factors such as underground obstructions that would prevent its successful installation.

To be effective, the root barrier would need to extend into neighbouring land, providing consent can be obtained from the landowners.

Firstly, the site investigations have been undertaken at a lower patio level which is the same reduced height as the affected extension. The extension extends back as far as the embankment which is terraced at lower level with gabion baskets. The only location for a barrier would be the upper terrace, above the borehole location by between 1-2m in height. The retained height increases towards the left-hand side of the property and there are a further row of gabions which define the boundary between the insured and neighbouring property. The neighbours retaining wall appears to be a standard 9” masonry wall and the barrier would need to be extended behind this. Because of the relative depth of roots at this location, estimated, 3.6-4.6m, we would need a long reach excavator to form the trench required. It would simply be unsafe to form a trench to that sort of depth behind the neighbour’s wall as the plant would surcharge the wall and cause failure. To this end, the only solution in the neighbouring garden would be to use a compact barrier technique.

Aerial plan indicating proposed size and alignment of barrier

NOTE: Costs have increased substantially but the site is far more complex and difficult to navigate that first envisaged and this is coupled with the fact that the site investigation has been completed at 1m-2m lower than ground level around the building and hence the barrier now needs to be much deeper than originally anticipated when the desktop assessment was completed. The only viable alternative would be a piled raft option from within the building which would extend to the rear extension, back of the main house and garage area. The costs would be anticipated to be in the region of £250,000.00+VAT plus additional reinstatement costs as the property is large and extended into many different areas.

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 £120,000 or a piled raft option at approximately £250,000 + VAT.

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 apparent issues in relation to drains, however 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.

Heave Potential – Based on stem diameters of around 200mm, the Oak and other trees in TG2 are around 25-40 years old, the house and extension were 1980's (31 or more years old) so the trees in TG2 do not appear to be significantly older than the house or extension. They must have been present at the time of construction to be included in the TPO (Oak 3 in TG2 is T7 of the TPO and Cherry 1 in TG2 is TPO T8.)

However, we do not think that trees in TG2 were in place long enough to have caused a persistent moisture deficit prior to construction, particularly due to the changes in ground level, the risk address being lower than the land where the trees are located, therefore there should be no risk of heave if trees in TG2 are removed.

The structure has stood the test of time since construction and the trees in TG2 will have grown considerably since the 1980's, Oak roots to 2.6m depth, some may have come from the older Oak that is proposed for pruning.

Based on the above, removing trees in TG2 should cause no adverse heave issues.

In any event, if a root barrier was to be installed or if the building was to be underpinned, root severance would occur and this would have a similar effect on root activity ceasing and soil moisture levels increasing as removing the trees completely.

RECOMMENDATIONS

TG2 Oak and Cherry - Fell to near ground level (subject to consent being granted under the TPO)

T2 Oak – Reduce crown by 30%, reducing height from 18.5m to 12m and reducing crown spread from 22m to 15m (subject to consent being granted under the TPO)

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

The trees are located within 24 Russet Glade (TG2) and within 23-26 Tower Close (T2).

RESERVES

Superstructure repairs - **£20,000**

Estimated Engineering solutions and superstructure repairs –
Underpinning **£120,000**
Piled Raft **£250,000**

Root Barrier **- £82,734.91 + VAT** plus associated enabling and reinstatement costs

Yours faithfully

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

Arboricultural Consultant - Subsidence Team
Crawford & Company

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