

## **Cunningham Lindsey**

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Telephone 01622 608810 Facsimile 0845 4252539

Policyholder: [REDACTED]

Subject Property Address:

99, Greencroft Gardens

London

NW6 3PG

### **INSURANCE CLAIM**

### **CONCERNING SUBSIDENCE DAMAGE**

### **ENGINEERING APPRAISAL REPORT**

This report is prepared on behalf of [REDACTED] for the purpose of investigating a claim for subsidence. It is not intended to cover any other aspect of structural inadequacy or building defect that may otherwise have been in existence at the time of inspection.

Date: December 2015

Cunningham Lindsey Ref: MNHPD/KK/7498207

## **INTRODUCTION**

This report has been prepared by our Building Consultant, Mr Yiu-Shan Wong BSc ACIAT C.Build E MCABE MCIQB RMaPS Cert CII, and is being investigated in accordance with our Building Consultancy Services.

Unless stated otherwise all directions are referred to as looking towards the front door from the outside the property.

## **DESCRIPTION OF BUILDING**

The subject property is a semi detached house, converted into individual flats in a residential location on a plot that is level.

The general layout of the site is shown on the attached sketch plan.

There are trees within influencing distance of the property. These include a London Plane tree growing within the rear garden of No.103 (RHS) at least 30m in height and only 25m distance away from the rear of the property and within a Conservation Area. To the front of the property, there are a group of Lime trees approximately 22m in height and only 5m away growing within the policyholders' front garden and a further row of Lime trees approximately 20m in height 7m away grows within the front garden of No.101 (RHS) which are both protected by Tree Preservation Orders.

## **CIRCUMSTANCES OF DISCOVERY OF DAMAGE**

The policyholder and homeowner, [REDACTED] first discovered the damage during routine maintenance over summer/autumn of 2013. It should be noted that the property suffered similar problems in the past and following unsuccessful attempts on mitigation, the property was repaired. However, the structural repairs have since failed and damage has returned to similar areas but more widespread.

## **NATURE AND EXTENT OF DAMAGE**

Description and Mechanism

The damage is recorded throughout the building affecting all the flats at each level, to both the internal and exterior of the building, the worst being located towards the left hand section of the building.

The indicated mechanism of movement is downwards towards the left hand side of both the rear and front of the building.

### Significance

The damage comprised tapering diagonal cracks of at least 4mm in width. Building Research Establishment Digest 251 provides a classification of damage in terms of the ease of repair. Accordingly, the damage seen was slight, category 2 bordering to Moderate.

### Onset and Progression

It appears that damage has returned during the summer/autumn 2013 following previous repairs and shows signs of continual cyclical movement.

The movement is of a cyclical nature with cracks opening in the summer months and closing in the winter period.

## **SITE INVESTIGATIONS**

Reference to the solid and drift geological survey map shows the anticipated subsoil as clay.

The ground investigation was carried out by CET Safehouse Ltd on 11<sup>th</sup> January 2014 for details of the trial pit and borehole locations, together with test results, please refer to the attached CET factual report.

### Trial Pit 1/Borehole 1

The investigation comprised of a trial pit and borehole extended by hand auger, excavated to the front left bay window, where the building had dropped downwards.

The trial pit extended to a depth of 6.0m where the datum was installed and probing down the face of the foundation, revealed the foundation to comprise a 225mm brick corbel before reaching a 300mm strip footing founded at a depth of 1.3m below surface level. The foundation bears directly onto a clay subsoil, which matches the predicted soil given by the solid and drift geological survey map.

### Trial Pit 2/Borehole 2

This was carried out to the rear of the property. These revealed similar results to TP1.

The soil classification is CV, indicating very highly shrinkable clay. Soil Moisture content dropped and Suctions peaked below ground level, indicating a dried out ground with a high capacity to reabsorb moisture and expand. Shear Vane tests were recorded high level throughout the borehole, indicating a stiff ground due to lack of moisture. The boreholes were open and free from standing water on completion. The clay content of the ground will be affected by shrink and swell, as moisture is extracted by tree roots. It is evident from the investigations above that the ground has been depleted of moisture by the tree roots.

Roots were found within both the deep boreholes to a depth of 3.0m below ground level. Root samples retrieved have been independently identified using light microscopy techniques and have

been formally identified as having originated from the Tilia (limes), Platanus (plane), Populus (poplars) and Salix (willows). A starch test confirms that they are live, apart from the Populus & Salix. The Plane roots were discovered at the rear and there is a Plane tree to the rear of a neighbouring property No.103. The Lime roots were discovered at the front and there are Limes tree to the front at the owners property and the neighbouring property No.101.

The results of the site investigation show desiccated highly shrinkable clay with high suction values and identify roots below the foundations. This evidence is convincing that nearby vegetation is affecting the building.

### **ARBORICULTURAL ADVICE**

We first appointed OCA UK Ltd during March 2014 to provide advice and recommendations in relation to the adjacent vegetation. In due course, recommendations were received for the removal of the following:

|    |                     |                        |              |
|----|---------------------|------------------------|--------------|
| T4 | London Plane tree   | 103 Greencroft Gardens | Rear garden  |
| G4 | Group of Lime trees | 101 Greencroft Gardens | Front garden |
| G5 | Group of Lime trees | 99 Greencroft Gardens  | Front garden |

The London Plane is in a Conservation Area whilst the Lime trees have Tree Preservation Orders on them.

The rest of the vegetation which includes G1 Lime, G2 Mixed, G3 Lime, H1 Privet, H2 Privet, T1 Eucalyptus, T2 Apple, T3 Unidentified, T5 Cherry, T6 Sycamore and T7 Silver Birch required no works to be undertaken and so this vegetation can remain to provide continual vegetation cover in the area.

It was clear to say on the level of evidence we have to date which includes root evidence down to 3.0m and identification matching that of Lime trees to the front and London Plane tree to the rear along with the return of damage that the remaining trees identified for removal was still causing movement to the building structure and will now need to be removed to prevent further damage.

### **MONITORING**

A programme of monitoring had been undertaken by CET Safehouse Ltd.

The initial readings were inconclusive, and it appears that we had an issue with the datum which was unstable and giving incorrect results. The datum has since been moved to point 7 of the station which is situated the furthest away from the trees. These have now been corrected and the results have been replotted.

Scientific level monitoring commenced in January 2014 to November 2015. The readings show cyclical movement to both the front and rear of the building, with a maximum downwards movement of 8.1mm and a 7.7mm maximum recovery.

The latest results shows recovery to some of the areas already, which is similar to the reading taken last year, this proves that the ground is definitely been affected by cyclical clay shrinkage subsidence.

The results of the cyclical movement shown in our level monitoring prove that the clay subsoil is still shrinking and swelling on a seasonal basis, bringing about subsidence damage to the building. The ground is being influenced by the water demand of the nearby trees and until these are removed, we can see no way that the building will be afforded stable ground upon which to remain.

#### **CAUSE OF DAMAGE**

The ground investigations have confirmed that the foundations of the building are supported by clay subsoil with a shrink and swell capacity.

The timing of the damage is noted as summer/autumn by the homeowner, which ties in with the period when the trees will be in full leaf and extracting the most moisture from the ground. This would indicate a root exacerbated clay shrinkage subsidence mechanism.

The pattern of damage within the building is indicative of downward movement towards the left-hand side, dipping down to both the front and rear, i.e. tapered diagonal cracks to the walls.

The level monitoring readings clearly demonstrate seasonal cyclical movement, i.e. cracks opening during the growing season of the tree and dryer summer/autumn months, and subsequent closure during the winter/spring months. The only ground conditions which will record closure of crack width monitoring and upwards movement of level monitoring, is that of a clay ground. This is due to the swell of the clay as it re-hydrates during the wetter winter/spring periods, which pushes upwards on the underside of the foundations and lifts the property with its increase in volume. We have recorded crack closure and upward movement, which confirms that the clay content of the building are absorbing moisture during the winter/spring months due to it being depleted of moisture following extraction in the summer/autumn months by these tree roots. This confirms that root exacerbated shrinkage subsidence of the clay content of the ground is occurring; resulting is the damage to the building.

Taking an overview of all the site investigation referred to above, it is my opinion that the cause of damage results from clay shrinkage subsidence brought about by the action of roots from the adjacent trees located within the front garden of the insured's and neighbouring property, and the rear garden of the adjacent property.

## RECOMMENDATIONS

The initial damage first occurred during the summer of 1997 where superstructure repairs in the sum of £10,000.00 were undertaken in 2002 which included superstructure repairs and re-decorations to Flats 1, 2 and along with the communal staircase.

Damage subsequently returned during 2006 and following further investigations, £34,000.00 worth of superstructure repairs were undertaken which included superstructure strengthening repairs and re-decorations to Flats 2,5,6,7 and the communal staircase.

Given that this is a re-occurrence of damage to the property for the third time, which now affects all the flats within the building, it clearly shows that there is on-going pattern of movement and full mitigation must therefore be carried out.

With the offending vegetation to both the front and rear still in place, movement of the building will continue cyclically as proved to be the case here. The damage and overall movement is such that preventing the tree's influence on the clay beneath the foundations, is the only option to stop the subsidence. In order to prevent this from happening, these identified trees must be removed.

The nature, extent and degree of damage are such that, when taking into account the clear seasonal monitoring readings, locally repairing the building alone would not suffice as proved in our previous two attempts. Additional unacceptable cracking would develop in a relatively short period of time, i.e. in only a 1 or 2 year timescale or indeed every growing season.

We therefore recommend that removal of these trees is the optimum solution. Removing the sole cause of the subsidence will allow an enduring repair to the building consisting of superstructure repairs. There is no significant heave risk associated with this action, based on an overall assessment of the site investigation results.

From our searches, we are aware that the property to the Left Hand Side, No.97 has also suffered from subsidence which we oversaw and carried out their investigations have concluded subsidence due to their own trees within their rear gardens and a tree within the front garden of the insured's property.

These trees were protected by Tree Preservation Orders and following initial refusal by the Local Authority for these trees to be removed, it went to Appeal and permission was granted for these trees to be removed.

One of the trees growing within the insured's' front garden had since been removed in summer 2014 to stabilise the property next door. Although this may have mitigated movement next door, our own monitoring results since then proves that the remaining trees to the front are still causing problems to our own insured's address and these will also need to be removed to return stability to the front, whilst removal of the Plane tree to the rear will prevent further movement to the rear section of the building.

The Mitigation Centre of Oriel Services Ltd have been appointed to seek further arboricultural advice from OCA UK Limited to ensure that these trees will be removed, along with the one to the rear as highlighted above.

TPO applications had been submitted in the past and refused by the Local Authority due to insufficient evidence. However, given the latest monitoring results and two failed attempts to undertake structural strengthening repairs, we believe that a further application should now be submitted.

Given the extent of the current damage, should the trees be removed, we anticipate that superstructure strengthening repairs alone should suffice and the costs to repair such damage would amount to approximately £40,000.00.

However, if the vegetation remains again, we are unlikely to accept continual superstructure repairs every few years and given the fact that two previous attempted repairs has already been undertaken and failed, underpinning will need to be considered and the anticipated costs to undertake these works could mount to approximately £180,000.00.

These costs are broken down as follows:

£55,000.00 for superstructure repairs and re-decorations.

£100,000.00 for traditional underpinning

£5,000.00 for removal & storage (ground floor flat to facilitate the underpinning)

£20,000.00 for alternative accommodation/Loss of rent

The split is likely to be 50% for the TPO trees to the front and the other 50% for works to the CA trees to the rear.

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