3rd ADDENDUM TECHNICAL REPORT

Crawford Reference: SU1404491

4B Hampstead Hill Gardens
Hampstead
London
NW3 2PL

prepared for

RSA
3rd Floor
Bowling Mill
Dean Clough
Halifax
HX3 5WA

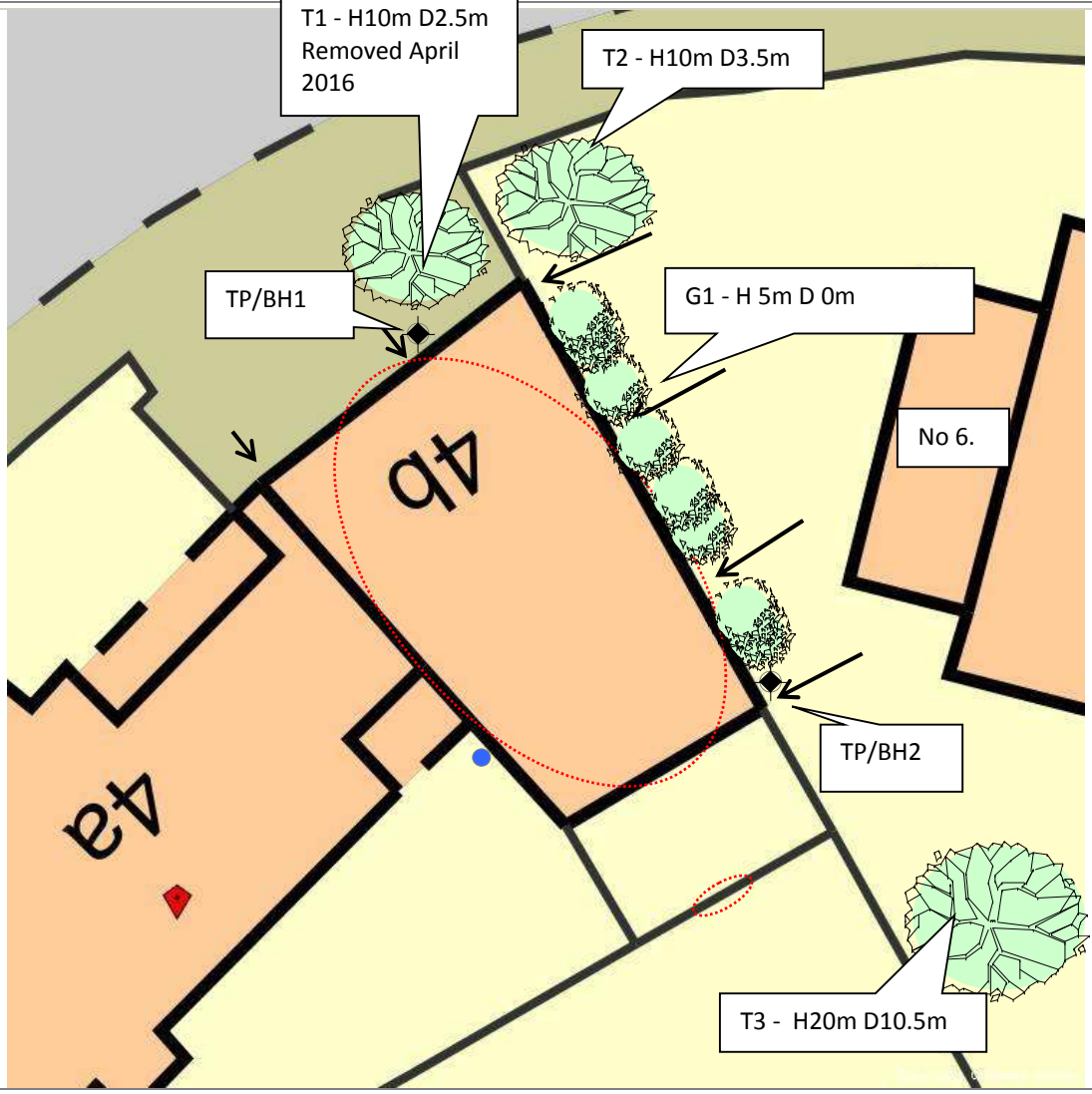
Crawford and Company
Cartwright House,
Tottle Road,
Riverside Business Park,
Nottingham, NG2 1RT
Tel: 0115 943 8260
Fax: 0121 200 0309
E Mail subsidence@crawco.co.uk

SUBSIDENCE CLAIM

DATE 28 October 2016

Site Plan	This plan is Not to Scale

This plan is diagrammatic only and has been prepared to illustrate the general position of the property and its relationship to nearby trees etc. The boundaries are not accurate, and do not infer or confer any rights of ownership or right of way. Position of utilities is only indicative and contractors must satisfy themselves regarding actual location before commencing works.



Key:

	Tree: Deciduous		Tree: Conifer		Shrub
	Hedge		Area of Damage		Bore Hole
	Trial Hole		Trial & Bore Hole		Level Monitoring
	Rain Water Manhole		Rain Water Gulley		Rain Water Pipe
	Waste Water Manhole		Waste Water Gulley		Toilet Pipe
	Rain Water Drain		Waste Water Drain		Electricity Cable
	Water Supply Pipe		Gas Supply Pipe		Incoming Gas Pipe
	Incoming Water		Incoming Electrics		

INTRODUCTION

We have been instructed by insurers to investigate a claim for subsidence at the above property. The area of damage, timescale and circumstances are outlined in our initial Technical Report. This report should be read in conjunction with that report.

To establish the cause of damage, further investigations have been undertaken and these are described below.

INVESTIGATIONS

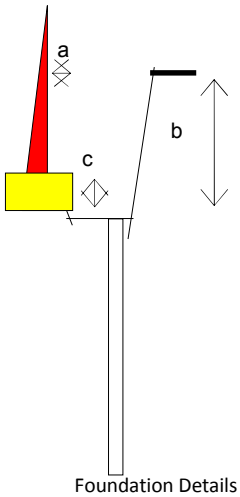
The following investigations were undertaken to identify the cause of movement.

TRIAL HOLES

Trial holes were excavated to expose the foundations - see site plan for location and the diagram below for details.

Trial Hole 1 revealed a concrete footing founded at a depth of 0.35m below ground level which bears onto MADE GROUND: Medium compact, dark brown/orange, silty clay with occasional clinker and brick fragments. Roots of live appearance to 3mm and 20mm diameter.

Trial Hole 2 revealed a concrete footing founded at a depth of 0.98m below ground level which bears onto firm, moist, brown/orange, grey veined, silty CLAY with partings of orange silt and fine sand. Roots of live and dead appearance to 1mm diameter.



Foundation Details

No.	Borehole Depth	Footing (a)	Underside (b)	Thickness (c)
TH1	2.30 m.	120 mm.	350 mm.	300 mm.
TH2	3.00 m.	250 mm.	980 mm.	290 mm.

AUGERED BOREHOLES

A 50mm diameter hand auger was sunk - see site plan for location(s). Borehole 1 confirmed the continuation of the subsoil encountered within the trial pit to 0.8m where we encountered firm, mid brown/orange, grey veined, silty CLAY with partings of orange silt and fine sand, with roots to a depth of 2m below ground level. The borehole remained dry and open upon completion.

Borehole 2 confirmed the continuation of the clay subsoil encountered within the trial pit, with roots to a depth of 2.6m below ground level. The borehole remained dry and open upon completion.

In-situ shear vane testing confirmed the clay subsoil to be stiff in nature.

SOIL SAMPLES

Moisture Content
Values ranged from 23% to 28% over the depth of Borehole 1
Values ranged from 27% to 35% over the depth of Borehole 2

Atterberg Limits
Results indicate that the clay subsoil can be classified as a very high plasticity clay in accordance with the Casagrande chart.

Suction Tests
Suction tests on disturbed samples is a recognised method of assessing clay desiccation. The results in Borehole 1 indicate evidence of very severe desiccation between a depth of 1m and 2m particularly when compared with the results in Borehole 2. This is coincident with the reduction in moisture content. Borehole 2 indicates evidence of severe desiccation between a depth of 1m and 1.5m coincident with the reduction in moisture content. The results suggest there is a much greater clay shrinkage effect to borehole 1, located towards the front left corner of the property.

ROOTS

Roots were retrieved from the trial hole and have been submitted to a botanist for identification.

Roots in Borehole 1 were identified as the Species Carpinus which are hornbeams.

Roots in Borehole 2 were identified as the Species Carpinus which are hornbeams and Leguminosae which include laburnum, robinia (false acacia or locust), broom, the pagoda tree and the climber wisteria. .

Starch was present which indicates that the roots were alive at the time of retrieval.

DRAINS

A CCTV survey of drainage in the vicinity of damage was carried out at the time of initial sit investigations. This revealed no defects. As such, an escape of water can be discounted as a potential cause.

ARBORICULTURAL REPORT

2 x Hornbeam trees T1 and T2 and a wisteria within been identified as the cause of the damage to the property.

T1 Hornbeam was removed 8th April 2016

MONITORING

The movement recorded is cyclical with the property moving upward and downward through wet and dry periods. This sort of movement only occurs when a clay shrinkage effect is in operation.

Following the removal of T1 ongoing seasonal movement has been recorded confirming the influence of the remaining tree T2. The movement is pronounced on points 1, 2, 3 toward the front and left flank of the property, which are the points closest to the nearby Hornbeam tree, T2. The Hornbeam tree T2 is therefore considered to be the primary cause of the recent movement with the wisteria seen as a secondary cause.

The movement is not uniform around the property so nominal clay shrinkage can be discounted as a cause; the movement is prominent nearest the remaining tree.

DISCUSSION

The results of the site investigations confirm that the cause of subsidence 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. The nearby vegetation T1 is considered to be the primary cause of subsidence movement. This is supported by the following investigation results :-

- The foundations are at a depth of 0.35 and 0.98m which is below the level that nominal seasonal movement would occur.
- The moisture content profile indicates a reduction in moisture content between a depth of 1m and 2m which is indicative of desiccation at this level. This is also co-incident with the depth of root activity.
- Atterberg limit testing indicates that the soil has a very high plasticity and hence will shrink and swell with changes in moisture content.
- Suction tests indicate severe to very severe desiccation between a depth of 1m and 3m coincident with the depth of root activity.
- Roots were found to a depth of 2.6m.
- Shear vane readings indicate an increase in shear strength of the clay between a depth of 1m and 2.5m indicating desiccation at this depth.
- Level monitoring between January 2015 and October 2016 has shown cyclical movement, especially nearest the Hornbeam tree T2.
- No other cause has been identified.

RECOMMENDATION

The cause of the movement needs to be dealt with first. From the results of the site investigation, we are satisfied that the main cause of movement to the property, Hornbeam T2**,** can be removed.

Provided the tree management is approved and works are carried out expeditiously, we anticipate that superstructure repairs and decorations only will be required. If tree management is not carried out, it may be necessary to consider a much more costly and disruptive scheme of stabilisation, such as underpinning. Budget estimates are presently as follows :-

Superstructure repairs and decorations - £10,000

Underpinning & Repairs - £140,000

Yours faithfully,

Crawford and Company
Specialist Property Services - Subsidence Division
subsidence@crawco.co.uk

28 October 2016