Ground and Project Consultants Ltd

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Langley House
1 Meole Hall Gardens
Shrewsbury
SY3 9JS

16 June 2015

Pawel Rogalewicz
Croft Structural Engineers
Clock Shop Mews,
Rear of 60 Saxon Rd,
London
SE25 5EH

Dear Pawel

156 Goldhurst Terrace, NW6 3HP Camden, London: Review and assessment of Geotechnical aspects of BIA.

I have reviewed the geotechnical aspects of the BIA and in particular those elements which relate to the assessment of Land Stability as per CPG4.

The documents reviewed are as follows:

- Basement Structural Method Statement
- BGS Online Geological Maps
- OS Topographical Maps
- LBC Camden background data

Proposed Development

156 Goldhurst Terrace is a three Storey high multi occupancy property located in Camden. The structure is load bearing masonry external walls with internal masonry/stud walls, timber floors spanning from front to back and timber roof. The proposed works constitutes a new basement development to the ground floor flat.

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CPG4 Screening Exercise

The Structural Method Statement report by Croft has gone through the land stability screening exercise for the proposed development. The screening exercise is developed below as part of the review process as per the guidance in CPG4 as follows:

Question	**Answer**	**Action/ Comment**
Question 1: Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approximately 1 in 8)	No. The gradients in the area assessed from OS data suggest slopes of around 2°.	None
Question 2: Will the proposed reprofiling of landscaping at site change slopes at the property boundary to more than 7deg? (approximately 1 in 8)	No. There are no significant changes in surface profile planned.	None
Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No.	None
Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7°? (approximately 1 in 8)	No	None
Question 5: Is the London Clay the shallowest strata at the site?	No: But the ground investigation reveals London Clay at around 2m bgl, overlain by a thin layer of Head Deposits and Made Ground.	Take forward to Impact Assessment

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Question 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	No trees are to be felled	The basement design and construction will take into account the impact on local trees.
Question 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Croft note that subsidence may be an issue at the front of the property possibly due to the close proximity to trees. The London Clay and Head Deposits are shrinkable.	Take forward to Scoping and Impact assessment.
Question 8: Is the site within 100m of a watercourse or a potential spring line?	There is a watercourse marked on the Arup map (Figure 11: Watercourses) close to the site, which is presumably culverted.	Take forward to Scoping and Impact assessment.
Question 9: Is the site within an area of previously worked ground?	This is unlikely, the historical maps show the area has been residential for 120 years. A thin layer of Made Ground was encountered in the ground investigation, most likely associated with the original house construction.	None
Question 10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No: the site is located on London Clay overlain by a thin cover of head deposits. London Clay is classed as an unproductive strata (rock layers with low permeability and negligible significance for water supply or	If groundwater is encountered then adjustments to working methods will be required to minimise the potential for settlement. Inflows should be minimised by

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	river base flow). The site is not within a source protection zone of a public water supply. .	reducing working faces and inflows should be able to be dealt with by sump pumping. This is further discussed in the Impact Assessment.
Question 11: Is the site within 50m of the Hampstead Heath ponds?	No.	None
Question 12: Is the site within 5m of a highway or pedestrian right of way?	Yes. The site is within 5.5m of the footpath.	Croft will apply a 10kN/m^2 surcharge loading. Health Safety and environmental measures will be required to be integrated into the building contractors methods of working
Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes, Croft propose that the Party wall will be underpinned. Existing footings have been exposed at two locations as brick founded on Head deposits.	This is also further discussed in detail in the Impact Assessment of this report.
Question 14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No. The nearest underground line is understood to be 100m from the site	None

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Summary of Topography, Hydrogeology and Geology

The property is located on gently sloping ground below the base of Hampstead Heath. Its elevation estimated from the OS map is approximately 28mAOD. The OS map shows that the ground surface falls gently to the SE over a gradient of around 1 in 40 (i.e. less than 2^{o}). The approximate National Grid Ref for the property is TQ 259841.

The available geological mapping (Ref 1.) indicates that the site lies on London Clay which typically comprises a stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. The geological map (North London 256) indicates a 'propensity' for Head Deposits to be present reasonably close by (~600m) to the north, west and a little further to the east of the site. Typically they are thin (<2m) and consist of soft, ocherous brown silty clay with blue-grey mottling in places and angular, frost-shattered fragments of flint occur sporadically throughout. The base of the London Clay is likely to occur some depth below the property.

The London Clay is classified by the Environment Agency as unproductive strata (rock layers with low permeability and negligible significance for water supply or river base flow). The site is not within a source protection zone of a public water supply.

Ground Investigation

Fieldwork was undertaken in April 2014 and comprised the drilling of two window sample boreholes (WS1 and WS2) to a depth of 6.00m bgl and the hand excavation of two trial pit for foundation exposures (TP/FE1 and TP/FE2). A Heavy Dynamic Probe (HDP) (DP1) was undertaken adjacent to WS1 to 10.10m bgl. A gas and groundwater monitoring well was installed in WS1 to 5m depth.

The Ground Investigation work at site and subsequent laboratory testing revealed a thin (approx. 1m) layer of made ground overlying a thin layer of Head deposits. These overlie London Clay at a depth of 2.1 to 2.2m bgl. Trial holes excavated to reveal the foundation indicated that the house is formed of brickwork founded on a thin layer of crushed brick in one location onto the Head Deposit at just over 1m bgl. Note that the Head Deposits may represent alluvium from the tributary to the River Westbourne. (see Screening and mitigation section).

The Borehole was drilled to 6.00m with a corresponding and adjacent Dynamic Probe (DP) hole to 10.1m bgl. The window sample technique does not give good quality samples so a visual/hand vane estimate of shear strength was not carried out. The dynamic probe results have been assessed and converted to SPT N vales and further translated to qualitative assessments of undrained shear strength. This indicates quite low strength for London Clay with a marked improvement indicated by higher blow counts at around 8m. Moisture content values are slightly wet of plastic limit suggestive of a firm to stiff consistency. The low

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strength suggested from the DP may be due to disturbance during drilling and its proximity to BH1 (if drilled after the window sample borehole).

CPG4 Scoping Exercise and Impact Assessment

The areas taken forward from the screening for further consideration are presented and discussed below:

5. London Clay: The investigation has shown that London Clay is present at 2m below ground level and will form the formation level and founding strata to the basement. Note that a thin layer of Head Deposits is present immediately above the London Clay and forms the current founding strata for the house. An appropriate level of investigation has been carried out, with 2 boreholes, a dynamic probe, two trial pits for foundation exposure and associated laboratory testing.

6. Trees: No trees are to be removed as part of the basement development. The design and construction will need to manage and minimise root damage and impacts to the tree above ground.

7. Shrink/ Swell: The basement will be formed in London Clay which is known for its shrink and swell potential. Some signs of past subsidence have been noted potentially due to the presence of trees. The basement formation level is at 3.5m bgl. This is well below the seasonal variation in moisture content and therefore it is not envisaged that shrink or swell will present an issue to the design, construction or serviceability of the basement. The basement construction and related underpinning works will need to be sensitive to the past subsidence. The use of hit and miss techniques, good ground support and good workmanship will contribute to the minimisation of construction related settlement.

8. Watercourse: the property is in the vicinity of a lost river of London'. This is likely to be a tributary of River Westbourne, itself a small River Thames tributary in London, primarily sourced from Whitestone Pond, Hampstead Heath. It appears from the Arup Figure 11 that this runs close to the east of the property. The "river" (likely to be a small stream) will be culverted, probably at some depth. No Made ground was noted below the superficial deposits at the property to suggest culverting. However construction and excavation works should be cognisant of the remote possibility of encountering the culvert.

9. Worked Ground: The investigation revealed a minor presence of made ground associated with the original house construction. This is considered not to be significant to the basement construction but its presence will need to be accounted for in terms of ground support during underpinning works.

12. Highway/Pavement: The design has accounted for Highway Loading.

13. Depth of Basement: The depth is not a significant increase and underpinning is proposed for the party walls.

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Conclusions

The assessment of ground conditions and CPG4 considerations has been carried out in a satisfactory manner. The site is not considered to be at risk of slope instability and ground movements are likely to be minimal with appropriate structural design and good construction practice.

This review has been completed by Jon Smithson, a Chartered Geologist with over 30 years' experience.

Yours Faithfully

Jon Smithson

BSc (Hons), MSc, FGS, CGeol