Geotechnical, Ground Movement and Basement Impact Assessment

of

11 Fitzjohn's Avenue

Camden

NW3 5JY

for

Fitzjohn's Avenue Hampstead Ltd

LBH4424 Ver 2.0

December 2016

LBH WEMBLEY

Geotechnical & Environmental

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Foreword-Guidance Notes

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THIRD PARTY INFORMATION

The report may present an opinion on the disposition, configuration and composition of soils, strata and any contamination within or near the site based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

DRAWINGS

Any plans or drawings provided in this report are not meant to be an accurate base plan, but are used to present the general relative locations of features on, and surrounding, the site.

1. Introduction

1.1 Background

It is proposed to re-configure the existing building and extension at this site as a series of residential units. As part of this re-development a single storey basement is proposed beneath the entire footprint of the existing buildings and extending partially into the garden.

1.2 Brief

LBH WEMBLEY Geotechnical & Environmental have been appointed to carry out a Basement Impact Assessment (BIA) for submission to London Borough of Camden in order to satisfy the specific requirements of Camden Planning Policy DP27 on Basements and Lightwells and Supplementary Planning Guidance CPG4 on Basements and Lightwells.

This report is to be submitted in support of new planning application.

1.3 Report Structure

The report commences with the findings of a ground investigation, followed by a discussion of geotechnical design issues. There follows the results of ground movement analyses undertaken using the soil model derived from the results of the ground investigation and the construction proposals outlined in the Structural Engineers Report by Blue Engineering.

Finally, an assessment of the potential damage to the neighbouring structures is made.

1.4 Documents Consulted

The following documents have been consulted during the preparation of this document:

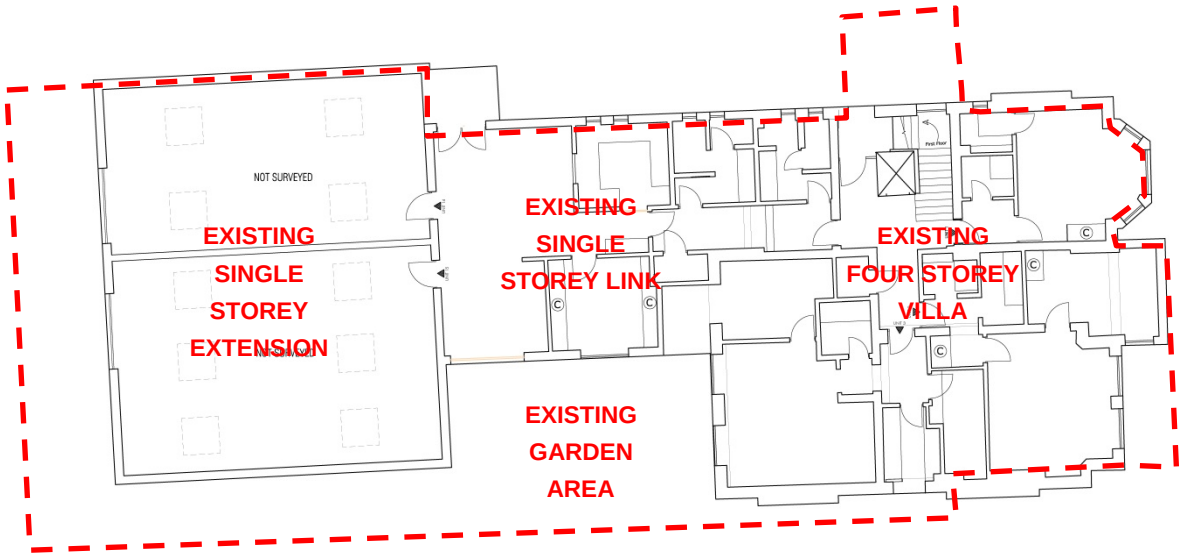
1. Proposed Drawings of 11 Fitzjohn's Avenue, by Bchitecture, dated May 2016, refs: 230, 231, 232, 237, 238, 239, 240 and 241.

2. Existing Drawings, by Bchitecture, dated April 2016, refs: 100/A, 101/A, 102/A, 103/A.

3. Camden Planning Guidance 4, Basements and Lightwells, 2015

4. Camden Development Policies DP27 – Basements and Lightwells, 2010

5. London Borough of Camden Geological, Hydrogeological and Hydrological Study, by Ove Arup & Partners Limited, dated 18th November 2010, Issue 01



Plan of Existing Buildings - showing extent of proposed basement

2. The Site

2.1 Site Location

The site is situated on the gentle lower southern slopes of Hampstead Hill approximately 200m east of Finchley Road Station. The site may also be located approximately by postcode NW3 5JY or by National Grid Reference 526570, 184760.

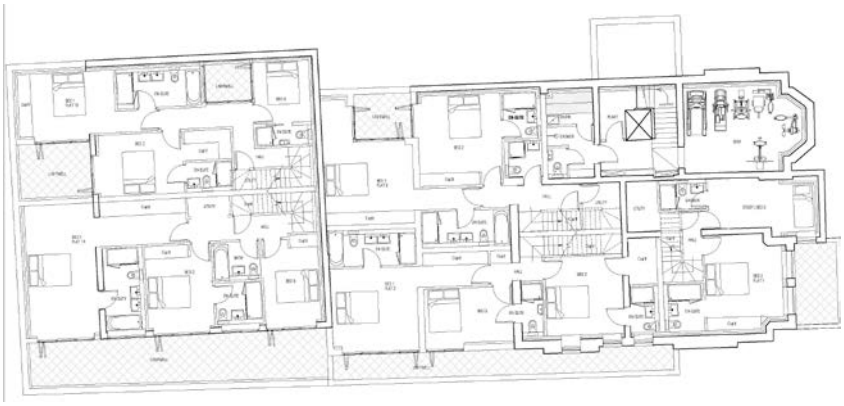
2.2 Site Description

The site is rectangular in shape, measuring approximately 50m by 16m, and contains an apparently disused four storey Victorian detached villa with a large single storey extension to the rear that was used as an activity room for the residents of the former care home and a small remaining area of rear garden.

The surrounding area is residential in nature, with the properties either side being of a similar age and construction. A new single storey basement is currently being constructed at the neighbouring property to the south, No.9 Fitzjohn's Avenue, whilst No.13 Fitzjohn's to the north doesn't currently have a basement.

There are a number of semi-mature trees (including silver birch and ash) located within the rear garden of the property, with some additional semi-mature trees (including ash) along the eastern boundary wall of the site, fronting onto Fitzjohn's Avenue.

2.3 Proposed Basement



Proposed Basement Layout

It is proposed to construct a single level basement (approximately 3.5m deep) beneath the entire building footprint and extending into the garden.

3. Desk Study

3.1 Site History

During the nineteenth century the site was agricultural land, with the existing villa and the surrounding area being developed by the end of the century. The rear extension had been constructed by the early 1990's, since when the property appears to have been used as a care home.

3.2 Geological Information

The British Geological Survey (BGS) records that the site is underlain by London Clay Formation. No superficial deposits are recorded. Archive water well records suggest that the London Clay extends to some 80m overlying almost 10m of Woolwich & Reading Beds and less than 5m of Thanet Sand, below which the Upper Chalk Formation is present.

3.3 Hydrogeological / Hydrological Information

The London Clay Formation is classified as Unproductive Strata.

The nearest surface water feature is the now culverted River Tyburn, located some 50m to the east of the site.

The site is not indicated to be at risk of flooding from rivers or sea. However Fitzjohn's Avenue has been identified as a street at risk of surface water flooding in the London Borough of Camden Strategic Flood Risk Assessment and a flood risk assessment is hence required.

4. Screening Assessment

4.1 Purpose and Methodology

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding

4.2 Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	**NO**	The site is underlain by London Clay Formation. No superficial deposits are recorded.
Will the proposed basement extend beneath the water table surface?	**NO**	No groundwater is present within the London Clay Formation.
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**YES**	The headwaters of the River Tyburn pass some 50m to the east of the site.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**YES**	The proposed site layout will slightly increase the amount of hardstanding
Will more surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS)?	**NO**	There is no drainage discharged into the ground.
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the mean water level in any local pond?	**NO**	There are no nearby ponds.

4.3 Screening Checklist for Stability

Question	Response	Justification
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	**NO**	The site is level.
Does the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees?	**NO**	No re-profiling of the site is planned.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	**NO**	The neighbouring roads and the school grounds to the rear are flat-lying.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**NO**	No. Figure 16 of the CGHHS shows the site to be in an area of zero to seven degrees slope.
Is London Clay the shallowest strata at the site?	**YES**	Carried forward to scoping
Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?	**YES**	A single tree in the rear garden will be felled
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**NO**	No evidence of cracks or building movements was evident upon visiting the site and no effects were noted in any of the adjacent and surrounding buildings.
Is the site within 100m of a watercourse of a potential spring line?	**YES**	The headwaters of the River Tyburn pass some 50m to the east of the site.
Is the site within an area of previously worked ground?	**NO**	No. Figure 2 of the CGHHS shows the site not to be in an area of worked ground.
Is the site within an aquifer?	**NO**	The London Clay Formation is classified as Unproductive Strata.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**NO**	No water table is expected to be present.
Is the site within 50m of the Hampstead Heath ponds?	**NO**	The Hampstead Heath ponds are over 2km to the north of the site.
Is the site within 5m of a highway or pedestrian right of way?	**YES**	
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**YES**	
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**NO**	No exclusion zones are located near the site

4.4 Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	**NO**	The site is outside of the catchment areas of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**NO**	Surface water flows will be disposed of by the existing means.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**YES**	The proposed site layout will result in a small increase to the proportion of hard to soft surfaced areas.
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**NO**	All drainage is to the sewer as per existing.

5. Scoping Assessment

Where the checklist is answered with a "yes" or "unknown" to any of the questions posed in the flowcharts, these matters are carried forward to the scoping stage of the BIA process.

The scoping produces a statement which defines further the matters of concern identified in the screening stage. This defining should be in terms of ground processes, in order that a site specific BIA can be designed and executed (Section 6.3 of the CGHHS).

The issues identified from the checklists as being of concern in the previous sections are as follows:

- **Is the site within 100m of a watercourse, well (used/disused) or potential spring line?**
  The guidance advises that flow from a spring, well or watercourse may increase or decrease if the groundwater flow regime which supports that water feature is affected by a proposed basement. If the flow is diverted, it may result in the groundwater flow finding another location to issue from with new springs forming or old springs being reactivated.
  A secondary impact is on the quality of the water issuing or abstracted from the spring or water well respectively.
- **London Clay is the shallowest strata at the site.**
  The guidance advises that of the at-surface soil strata present in LB Camden, the London Clay is the most prone to seasonal shrink-swell (subsidence and heave).

- **Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?**
  The guidance advises that the soil moisture deficit associated with felled tree will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect the slope stability. Additionally the binding effect of tree roots can have a beneficial effect on stability and the loss of a tree may cause loss of stability.

- **The site is within 5m of a highway or pedestrian right of way.**
  The guidance advises that excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
  The guidance advises that excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**
  The guidance advises that the sealing off of the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas underlain by an aquifer, this may impact upon the groundwater flow or levels. In areas of non-aquifer (i.e. on the London Clay), this may mean changes in the degree of wetness which in turn may affect stability.
  The guidance advises that a change in the in proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent

properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

The assessment of potential impacts is informed by an intrusive ground investigation and all the above issues are to be carried forward for impact assessment.

The screening assessment has identified no groundwater issues and given the impermeable geology no potential cumulative hydrogeological effects are identified.

The site is at risk of surface water flooding, and will require a flood risk assessment.

6. Ground Conditions

6.1 Exploratory Work

In early September 2016 an intrusive site investigation was undertaken comprising two cable percussion boreholes constructed to a depth of 15m using a cable percussion rig. From these boreholes samples were taken for laboratory testing.

A series of structural trial pits were constructed in September 2016 to expose the party wall and existing building foundations and the details of these have been recorded by the structural engineers.

The borehole records, trial pit logs and test results are included in the Appendices to this report.

The intrusive investigation has confirmed that, beneath a limited thickness of made ground, the London Clay Formation is present.

6.2 Made Ground

Beneath the existing paving slabs, made ground was encountered to a maximum depth of around 1m depth in the boreholes and trial pits.

The made ground was found to consist of dirty brown clayey sandy soil with stones, brick and concrete fragments. A layer of domestic ashy material was found within BH2.

6.3 London Clay Formation

Directly beneath the made ground, soils representative of the London Clay Formation were encountered. These soils comprised firm to stiff, becoming stiff to very stiff, orange-brown and mottled grey silty clay. The upper zone of brown weathered clay was found to pass down into typical unweathered grey clay at approximately 6m depth.

The results of the plasticity index testing have confirmed the stratum to be of high shrinkability.

No claystones were encountered in the boreholes, but can be expected to be present within the strata.

6.4 Groundwater

No groundwater was encountered during the borehole investigation. Groundwater standpipes were installed in both boreholes to permit future monitoring for the presence of any groundwater.

It is noted that the site lies within an area that is at potential risk of surface water flooding and that some trapped perched water was apparently noted in the foundation trial pits.

7. Geotechnical Assessment

The proposed development includes the excavation of a basement to a depth of approximately 3.5m underneath the entire house and extension, and extending into the garden and into an area where an existing single storey link building is to be demolished.

It is envisaged to construct the new basement using conventional underpinning with the structural loads being supported by the new underpinning.

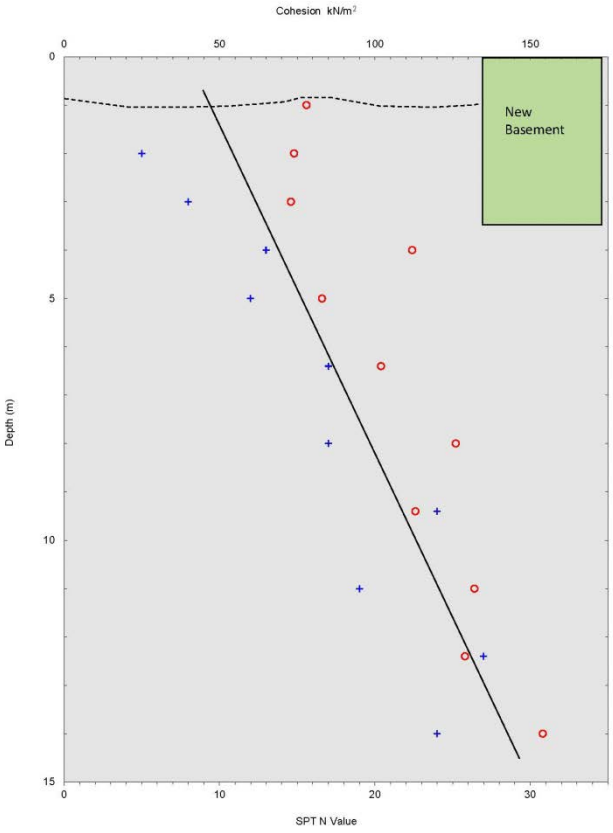
7.1 Selected Values for Geotechnical Design

Made Ground

A thickness of up to approximately 1m of made ground is expected. A nominal bulk unit weight of 17 kN/m^3 is ascribed to this material.

London Clay

The London Clay extends to some 80m depth. A bulk unit weight of this material has been taken to be 18 kN/m^3. The plot of undrained cohesion versus depth shown here suggests a design average undrained cohesion of 45 kN/m^2 at the surface of the Clay (approximately +63.5 mOD) increasing by approximately 7kN/m^2 per m depth. (NB. Red Circles denote Triaxial Compression Test results and blue crosses denote in-situ Standard Penetration Test results)



Groundwater

The London Clay is assumed to be saturated, with an assumed piezometric surface at 1m depth.

7.2 Basement Construction

It is anticipated that the basement construction will by-pass the near-surface soils and extend down into the London Clay Formation.

A key factor in the design of the new basement construction will be the need to preserve the stability of the adjacent buildings and highway at all times, both during excavation and construction and in the permanent situation.

Due to the access restrictions at the site, it is envisaged that the new basement will be supported in both the temporary and permanent situations by underpinning beneath the existing property, designed to apply a net allowable bearing pressure of 150kN/m^2.

Whilst in the areas to the side of the buildings and to the rear of the extension, where the basement walls will not be constructed beneath the existing buildings, these could potentially be constructed by open excavation and the casting of the retaining walls.

7.3 Basement Waterproofing

Groundwater is not present within the soils at this site. However, there is the potential for surface water to collect around the basement structure in the long term. Hence, the basement should be fully waterproofed and it will be necessary for the basement to be designed to withstand hydrostatic pressures in accordance with the guidance provided in BS8102:2009, Code of Practice for the Protection of Below-Ground Structures against Water from the Ground. A ground water table at 1m depth should be assumed for the purposes of hydrostatic design.

7.4 Basement Floor Slab

Although the analysis set out later in this report predicts potential post-construction heave movements of up to -26mm, it is noted that the present engineering design is for ground bearing flooring. In this case care will need to be taken to ensure that the basement floor is indeed capable of successfully re-distributing the heave forces without cracking and of accommodating an overall potential post construction upwards movement of some -15mm.

In the area of proposed tension piles at the rear of the basement, it should be noted that if the floor is to be ground bearing here also these piles will be subject to full heave forces rather than hydrostatic uplift only.

7.5 Effect of trees

A tree is to be removed in the rear garden to allow the basement to extend into the rear garden some 2m.

Where foundations are constructed within the zone of influence of existing or proposed trees, or trees that are to be removed, there will be a potential for heave / shrinkage of the clay soils to occur and this will need to be taken account of in the design of the structure and foundations. The NHBC guidance for building near trees in high shrinkable soils should be followed to allow for future growth and where trees are removed, excavations should be carefully inspected in order to identify any areas of existing desiccation that could potentially result in additional forces being exerted on the structure as a result of possible future swelling of the clay.

7.6 Foundation Concrete

The results of chemical analyses carried out on selected samples of the soils encountered indicate soluble sulphate concentrations falling within Class DS-2 as defined by BRE Special Digest 1 (2005). The recommendations of that guidance for Class DS-2 sulphate conditions should therefore be followed, assuming an Aggressive Chemical Environment for Concrete (ACEC) site classification of AC-1s for static groundwater.

7.7 Hydrological and Hydrogeological Effects

7.7.1 Impact on Groundwater Flow

Given the absence of groundwater, the proposed development is not expected to have any significant impounding effect upon groundwater.

7.7.2 Impact of Infiltration

The site is currently partially hard surfaced, with some soft landscaping at the front, side and rear gardens. The proposed basement will lead to a slight reduction in soft landscaping, particularly at the side of the property. It is therefore envisaged that there will be some negative effect upon infiltration and a slight increase in the amount of rainfall or run-off to be collected and discharged.

7.7.3 Impact on Surface Water Flooding and Surface Water Flow

Given the impermeability of the soils, the new development is not expected to have any substantial effect upon the risk of surface water flooding or surface water flow other than a slight loss of potential flood water storage in the present garden area that is to be developed.

8. Basement Impact Assessment

The screening assessment has identified that, while there are no groundwater issues, there are potential stability issues associated with the development of this site and it is necessary to demonstrate that the proposed basement excavations will not have any significant adverse impacts on the structural stability of the adjacent properties or highway, finally there is the potential for surface water flooding to affect the site.

The results of plasticity index testing have confirmed the London Clay beneath the site to be of high shrinkability. A single tree is to be felled to allow for the construction of the new basement; however the depth of proposed construction will obviate concerns regarding seasonal movements.

A key factor in the design of the new basement construction will be the need to preserve the stability of the adjacent buildings and highway at all times, both during excavation and construction and in the permanent situation. Underpinning is anticipated to be carried out beneath the existing structures, whilst the stability of the neighbouring structures will be maintained through preserving lateral and vertical earth support.

A study of service plans does not indicate the presence of any particularly sensitive services running beneath the pavements adjacent to the site.

8.1 Construction methodology

A draft Construction Method Statement is being prepared by the Structural Engineer that envisages the use of conventional underpinning construction techniques in conjunction with a ground bearing floor slab beneath the buildings, with open excavation and in-situ cast concrete retaining walls, and the addition of bored cast-in-situ tension piles to resist hydrostatic uplift.

8.2 Ground movement

A ground movement assessment has been undertaken and is presented in the section below.

8.3 Monitoring

A structural monitoring plan will need to be developed and agreed with the neighbours. This will need to be sufficiently robust to enable mitigation to be effectively implemented in the event of agreed trigger values for vertical and horizontal movement being exceeded at agreed monitoring positions. During the actual basement excavation stage both start of shift and end of shift measurements will be necessary in order for movements to be checked and, in the event of any adverse movement, for the contingency plan to be effected sufficiently quickly to prevent the excessive movement to either the neighbouring properties.

The plan should set out what emergency measures or mitigation may be required to be implemented in the event of an exceedance and will demonstrate the availability of the required resources to implement this mitigation. The plan will also identify exactly who will have the responsibility for implementing the plan.

8.4 Residual Impacts

Given the mitigation measures afforded by the construction methodology that has been described, it is concluded that the proposed basement development will have no residual unacceptable impacts upon the surrounding structures, infrastructure and environment.

9. Ground Movement Assessment

9.1 Ground Model

Excavation of the basement will result in unloading of the clay leading to theoretical heave movement of the underlying soil in both the short and long term. An analysis has been carried for a modelled situation, based on a soil model devised from both published information on the London Clay and the results of the ground investigation. The soil layers of this model are detailed in the table below.

Analysis Layer:	Upper Boundary (m OD)	Thickness (m)	Average C_u (kN/m^2)	Soil Stiffness (kN/m^2)	
				E_u	E'
London Clay	+61.0	2.00	65	29250	16250
London Clay	+59.0	2.00	80	36000	20000
London Clay	+57.0	3.00	90	40500	22500
London Clay	+54.0	4.00	115	51750	28750
London Clay	+50.0	5.00	140	63000	35000
London Clay	+45.0	5.00	175	78750	43750
London Clay	+40.0	5.00	210	94500	52500
London Clay	+35.0	5.00	245	110250	61250
Assumed Rigid	+30.0				

The Undrained Modulus of Elasticity (Eu) has been based upon an empirical relationship of Eu = 450 x Cu, and the Drained Modulus of Elasticity (E') has been based upon an empirical relationship of 250 x Cu.

Poisson's Ratios of 0.5 and 0.1 have been used for short term (undrained) and long term (drained) conditions respectively.

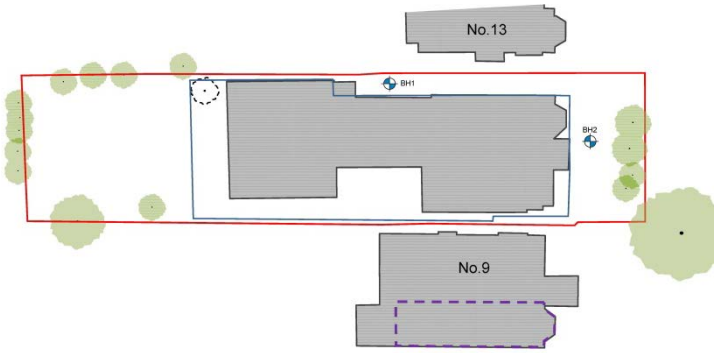
9.2 Method of Analysis

The analysis, undertaken using the SAPPER programme, uses classic modified Boussinesq elasticity theory, assuming uniform (fully flexible) loading/unloading of rectangular areas applied to a semi-infinite elastic half-space, using the above parameters for stratified homogeneity and with the introduction of an assumed rigid boundary at +30mOD.

The analysis calculates the theoretical Boussinesq elastic stress decrease due to the applied net unloadings (over the given unloaded areas) at the mid-level of each of the 8 No. soil layers defined above.

Short-term and long-term heave movements are then calculated at each calculation point for each stratum, using the given values of Stiffness Moduli and Poisson's Ratio over the whole area of the site on a 1m by 1m grid.

9.1 Neighbouring Structures



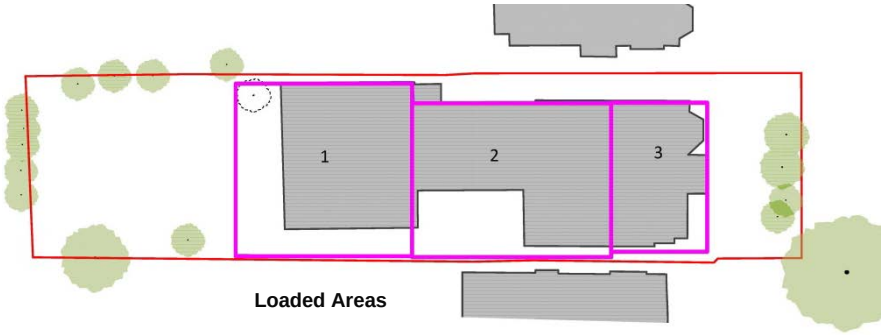
The neighbouring structure to the south (No.9) already has recently had a partial basement constructed at a similar level to that which is proposed, albeit this is being constructed on the opposite side of the building (blue dashed line). The proposed basement wall (blue solid line) will be extending up to the boundary wall, hence No.9 may potentially be affected by direct loss of support, along with potentially being affected by some mild long term uplift movements due to soil unloading.

The neighbouring property to the north (No.13) is some distance away and, while it should not suffer any direct loss of support it may again be potentially affected by some mild long term uplift movements due to the soil unloading.

9.2 Loading / Unloading

Due to the irregular shape of the proposed excavation, a number of rectangular load areas have been modelled.

When considering the ground movements associated with the proposed development, the maximum excavation depth is envisaged to be 3.5m, and is envisaged to result in unloading of approximately -62kN/m2.



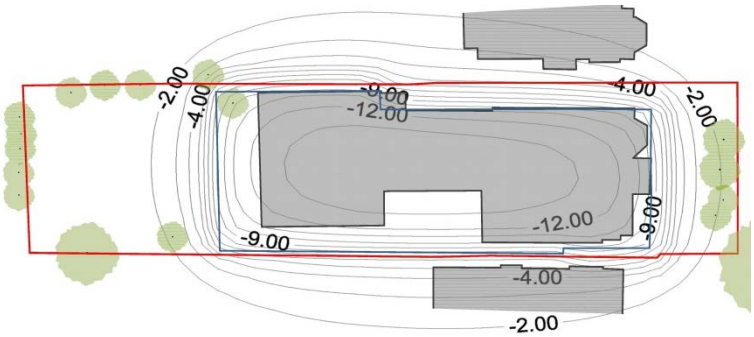
Loaded Areas

Areas	X1	Y1	X2	Y2	Loading (kN/m^2)
1	21.5	19	37	36	-62
2	37	19	54	34	-62
3	54	18	62.5	34	-62

Loaded Areas Co-ordinates and Loading Values

9.2.1 Short Term Heave Movements due to Excavation

The potential effect of the planned basement excavations has been considered applying a net unloading of approximately -62kN/m^2 soil unloading in the basement area.



Theoretical Short Term Heave Movements due to Excavation

The analysis suggests that, by the time basement excavation is complete, up to -13mm of heave is likely to have taken place within the centre of the basement area.

Outside the site, the analysis suggests that by the time basement construction is complete less than -6mm of heave beneath the neighbouring properties.

9.3 Long Term Movements

Within the area of the existing villa there will be no significant new loading to counteract the soil unloading due to excavation. Within parts of the rear basement extension there is an area that will be subjected to the loading of a new storey, but for the most part again there will be no meaningful new construction loading to resist the long term heave movements.

The analysis suggests that, following completion of the new construction, long term heave movement of up to -26 mm, could be expected to occur on a similar pattern to the above, with an average of about -15mm expected within the building area.

9.1 Impact on neighbouring structures

There will be some degree of short and long term global heave movements due to the weight of soil that is to be removed during the basement excavation. This movement could proceed for several decades and although it will be principally evident within the central area of the site it may be also expected to potentially affect the surrounding ground.

The neighbouring structure to the south (No.9) already has recently had a partial basement constructed at a similar level to that which is proposed, albeit this is being constructed on the opposite side of the building. The proposed basement wall will be extending up to the boundary wall, hence No.9 may potentially be affected by direct loss of support, along with potentially being affected by some mild long term uplift movements due to soil unloading.

The neighbouring property to the north (No.13) is some distance away and, while it should not suffer any direct loss of support it may again be potentially affected by some mild long term uplift movements due to the soil unloading.

The Camden Planning Guidance (CPG4) states that "*the design and construction methodology should aim to limit damage to the existing building on the site and to all adjoining buildings to Category 1 … and should never be more than Category 2"*.

The ground settlements behind a conventionally underpinned wall cannot be modelled. However, it can be stated that, provided horizontal movements can be adequately limited by good workmanship and temporary propping, the scale of damage due to soil (and wall) yielding will be minimised.

Broadly speaking, it is assessed that if overall lateral ground movements can be limited to less than 5mm, Burland scale Category 1 (Very Slight) damage to No. 9 and No. 13 can be expected for the situation at this site.

Additionally, it is concluded that there will be no significant risk to the integrity of the adjacent highways or to the services that have been identified as lying beneath these and the pavements.

APPENDIX

SITE PLAN SHOWING INVESTIGATION POSITIONS

BOREHOLE LOGS

TRIAXIAL TEST RESULTS

SPT/CU PLOTS

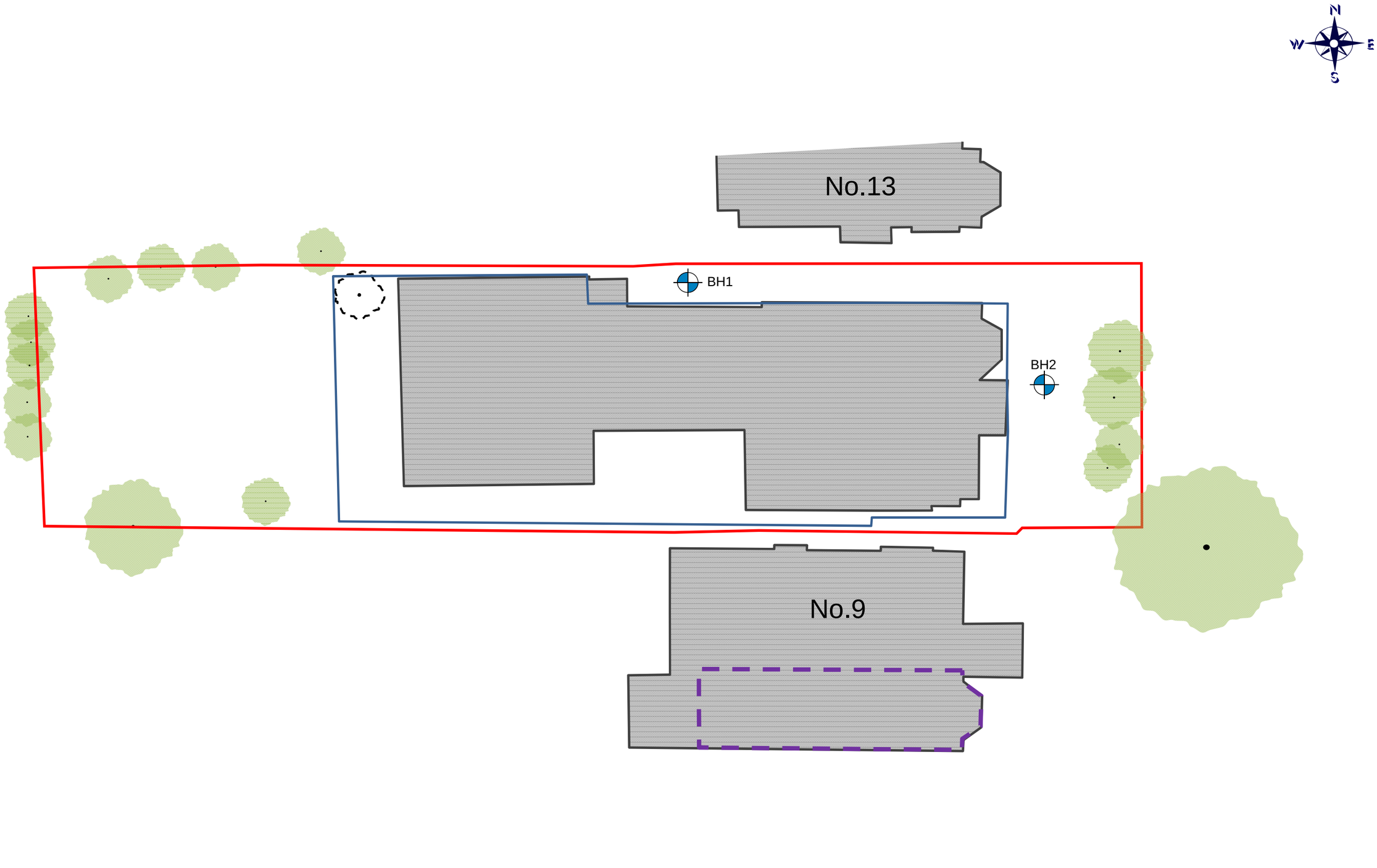
SULPHATE ANALYSES

INDEX PROPERTIES

PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY
CLIENT: Fitzjohns Avenue Hampstead Ltd

LBH4424

SITE PLAN



PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY LBH4424

CLIENT: Fitzjohns Avenue Hampstead Ltd

BOREHOLE No 1

METHOD OF BORING: Cable percussion - 150 mm dia - cased to 1.50m

Period: 06/09/16

GROUND WATER				
Strike at	Inflow rate	Sealed at	Date	06/09/2016
	Non-encountered		Time	
			BH Depth	15.00
			Casing Depth	1.50
			Water Level	DRY

REMARKS: 1 Hours breaking out surfacing and digging inspection pit to check for presence of buried services.
50mm diameter standpipe installed to 8m depth with response zone between 1m and 8m depth, bentonite seal installed from ground level to 1m depth

Ground level = +64.5mOD

Samples No	Samples Type	Depth m	SPT N	Legend	Depth m	Description
					0.20	MADE GROUND (paving slab over sand and concrete sub-base)
					0.40	MADE GROUND (brick fill)
1	D	1.50				firm to stiff orange-brown silty CLAY with scattered black pebbles
2	U	2.00-2.45			2.20	
3	D	2.50				stiff orange-brown / grey mottled silty CLAY with scattered traces of dead roots
	SPT	3.30	8			
4	D	3.45				
5	U	4.00-4.45			4.30	
6	D	4.50				Stiff becoming very stiff grey silty CLAY with abundant crystals
	SPT	5.30	12			
7	D	5.45				
8	U	6.50-6.95			6.80	
9	D	7.00				Very stiff grey silty CLAY
	SPT	8.30	17			
10	D	8.45				
11	U	9.50-9.95				
12	D	10.00				

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY LBH4424

CLIENT: Fitzjohns Avenue Hampstead Ltd

BOREHOLE No 1

METHOD OF BORING: Cable percussion - 150 mm dia - cased to 1.50m

Period: 06/09/16

GROUND WATER				
Strike at	Inflow rate	Sealed at	Date	06/09/2016
Non-encountered			Time	
			BH Depth	15.00
			Casing Depth	1.50
			Water Level	DRY

REMARKS: 1 Hours breaking out surfacing and digging inspection pit to check for presence of buried services.
50mm diameter standpipe installed to 8m depth with response zone between 1m and 8m depth, bentonite seal installed from ground level to 1m depth

Samples No	Samples Type	Depth m	SPT N	Legend	Depth m	Description
						Very stiff grey silty CLAY
	SPT	11.30	19			
13	D	11.45				
14	U	12.50-12.95				
15	D	12.95				
	SPT	14.30	24			
16	D	14.45				
					15.00	

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY LBH4424

CLIENT: Fitzjohns Avenue Hampstead Ltd

BOREHOLE No 2

METHOD OF BORING: Cable percussion - 150 mm dia - cased to 1.50m

Period: 07/09/16

GROUND WATER			Date	07/09/2016
Strike at	Inflow rate	Sealed at	Time	
Non-encountered			BH Depth	15.00
			Casing Depth	1.50
			Water Level	DRY

REMARKS: 1 Hours breaking out surfacing and digging inspection pit to check for presence of buried services.
50mm diameter standpipe installed to 8m depth with response zone between 1m and 8m depth, bentonite seal installed from ground level to 1m depth
2 Hours moving equipment and casing between positions due to limited access Ground level = +65.0mOD

Samples No	Samples Type	Depth m	SPT N	Depth m	Description
				0.20	MADE GROUND (paving slab over sand and concrete sub-base)
				0.35	MADE GROUND (brick fill)
1	D	0.90		0.80	MADE GROUND (firm dirty brown silty clay with roots and brick fragments)
2	U	1.10-1.55		1.10	MADE GROUND (black ashy sand)
3	D	1.55		1.70	Firm to stiff orange-brown silty CLAY with scattered black pebbles
	SPT	2.30	10		Stiff orange-brown / grey mottled silty CLAY with scattered traces of dead roots
4	D	2.45			
5	U	3.00-3.45			
6	D	3.45			
	SPT	4.30	13		
7	D	4.45			
8	U	5.00-5.45		5.30	
9	D	5.45			Stiff becoming very stiff grey silty CLAY with abundant crystals
	SPT	6.80	17		
10	D	6.95			
11	U	8.00-8.45		8.30	
12	D	8.45			Very stiff grey silty CLAY
	SPT	9.80	24		
13	D	9.95			

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY LBH4424

CLIENT: Fitzjohns Avenue Hampstead Ltd

BOREHOLE No 2

METHOD OF BORING: Cable percussion - 150 mm dia - cased to 1.50m

Period: 07/09/16

GROUND WATER				
Strike at	Inflow rate	Sealed at	Date	07/09/2016
Non-encountered			Time	
			BH Depth	15.00
			Casing Depth	1.50
			Water Level	DRY

REMARKS: 1 Hours breaking out surfacing and digging inspection pit to check for presence of buried services.
50mm diameter standpipe installed to 8m depth with response zone between 1m and 8m depth, bentonite seal installed from ground level to 1m depth
2 Hours moving equipment and casing between positions due to limited access

Samples No	Samples Type	Depth m	SPT N	Legend	Depth m	Description
						Very stiff grey silty CLAY
14	U	11.00-11.45				
15	D	11.45				
	SPT	12.80	27			
16	D	12.95				
17	U	14.00-14.45				
18	D	14.45				
					15.00	

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

PROJECT: 11 Fitzjohn's Avenue, Camden, NW3 5JY

CLIENT: Fitzjohns Avenue Hampstead Ltd

Project No LBH4424

SPT RESULTS

Borehole No	Depth at Start of Test (m)	Spoon or Sone	Blow for each successive 75mm penetration						Water Level (m)	Is Hole Blowing?	N Value
BH1	3.00	S	1	1	2	2	2	2	DRY	-	8
	5.00	S	1	2	2	3	3	4	DRY	-	12
	8.00	S	2	3	4	4	4	5	DRY	-	17
	11.00	S	3	3	4	5	5	5	DRY	-	19
	14.00	S	3	4	5	6	6	7	DRY	-	24
BH2	2.00	S	1	2	2	3	2	3	DRY	-	10
	4.00	S	2	2	3	3	3	4	DRY	-	13
	6.50	S	2	3	4	4	4	5	DRY	-	17
	9.50	S	3	4	6	5	6	7	DRY	-	24
	12.50	S	4	4	6	7	7	7	DRY	-	27

Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure
Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No.	Project Name	Programme	
21560	11 Fitzjohn's Avenue	Samples received	08/09/2016
		Schedule received	09/09/2016
Project No.	Client	Project started	09/09/2016
LBH4424	LBH Wembley	Testing Started	21/09/2016

Hole No.	Sample				Soil Description	Test Type	Density		w	Length	Diameter	σ3	At failure				Remarks
	Ref	Top	Base	Type			bulk	dry					Axial strain	σ1 - σ3	cu	Mode	
							Mg/m3		%	mm	mm	kPa	%	kPa	kPa		
BH1	-	2.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	UU	1.98	1.54	29	198	102	40	10	147	74	C	
BH1	-	4.00	-	U	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite	UU	1.88	1.43	32	198	102	80	7.1	223	112	B	
BH1	-	6.50	-	U	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite	UU	2.00	1.56	28	198	102	130	4.0	204	102	B	
BH1	-	9.50	-	U	High strength fissured dark grey silty CLAY	UU	2.05	1.63	26	198	102	190	4.0	226	113	B	
BH1	-	12.50	-	U	High strength fissured dark grey silty CLAY	UU	2.01	1.57	28	198	102	250	6.6	258	129	B	
BH2	-	1.10	-	U	High strength slightly fissured brown, orange brown and reddish brown slightly sandy slightly gravelly silty CLAY (gravel is fmc and sub-angular to sub-rounded)	UU	1.84	1.45	27	198	102	22	4.5	157	78	B	
BH2	-	3.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	UU	1.98	1.53	29	198	102	60	12	147	73	C	
BH2	-	5.00	-	U	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite	UU	1.94	1.47	32	198	102	100	5.6	166	83	B	
BH2	-	8.00	-	U	High strength fissured dark grey silty CLAY with scattered traces of selenite	UU	2.02	1.61	26	198	102	160	6.6	251	126	B	
BH2	-	11.00	-	U	High strength fissured dark grey silty CLAY	UU	2.05	1.62	27	198	102	220	7.6	263	132	B	
BH2	-	14.00	-	U	Very high strength fissured dark grey silty CLAY	UU	2.03	1.58	28	198	102	280	8.1	307	154	B	

Legend
UU - single stage test (single and multiple specimens) σ3 Cell pressure Mode of failure ; B - Brittle
UUM - Multistage test on a single specimen σ1 - σ3 Maximum corrected deviator stress P - Plastic
suffix R - remoulded or recompacted cu Undrained shear strength, ½ (σ1 - σ3) C - Compound

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: james@k4soils.com

Checked and Approved
Initials: J.P
Date: 22/09/2016

2519 Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr) MSF-5-R7b

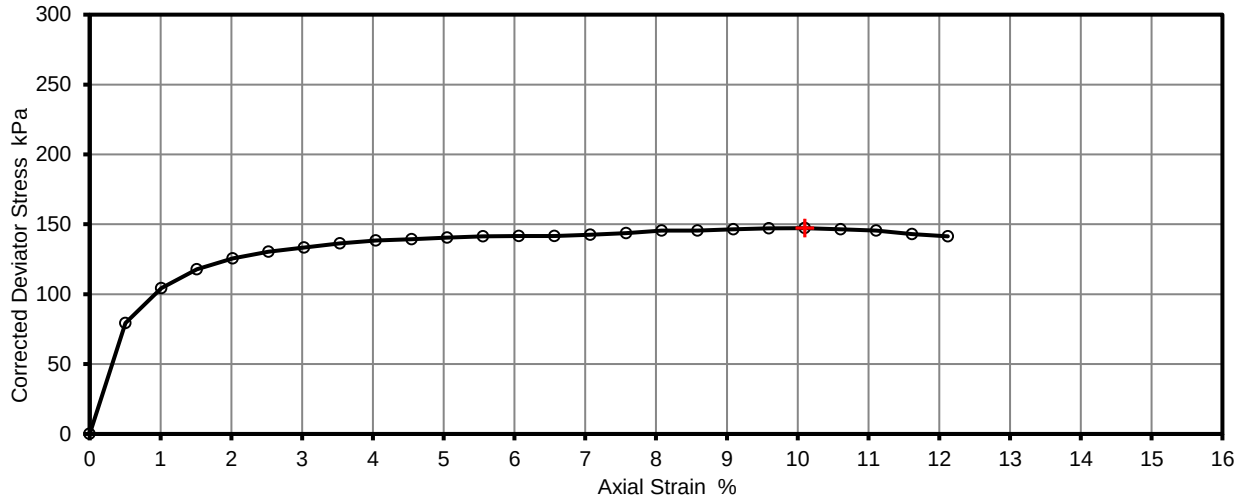
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560
				Borehole/Pit No.	BH1
Site Name	11 Fitzjohn's Avenue			Sample No.	-
Project No.	LBH4424	Client	LBH Wembley	Depth	2.00 m
Soil Description	Medium strength fissured brown mottled blue grey silty CLAY			Sample Type	U
				Samples received	08/09/2016
				Schedules received	09/09/2016
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016

Remarks

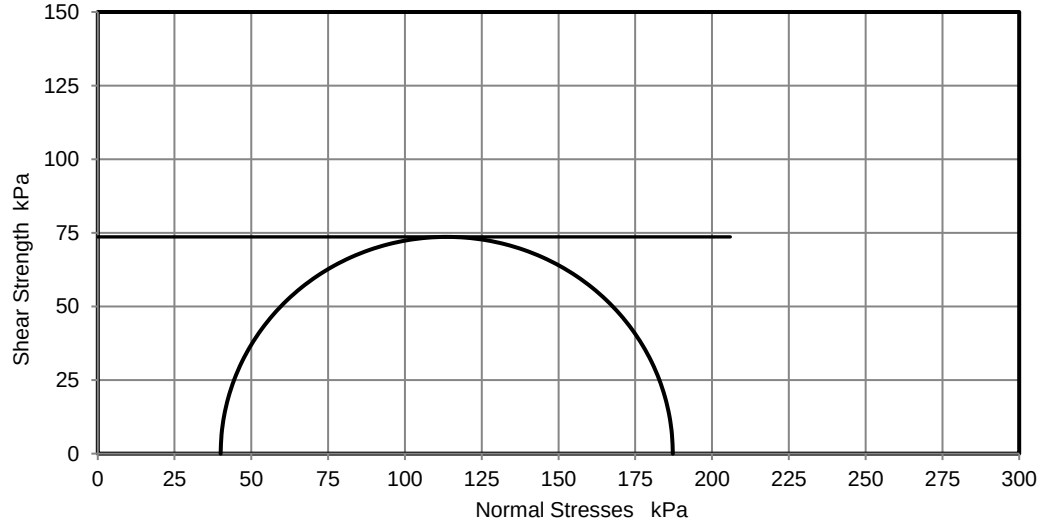
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.98	Mg/m3
Moisture Content	29	%
Dry Density	1.54	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	40	kPa
Axial Strain	10.1	%
Deviator Stress, (σ1 - σ3)f	147	kPa
Undrained Shear Strength, cu	74	kPa ½(σ1 - σ3)f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

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Checked and Approved
Initials: J.P
Date 22/09/2016

UKAS TESTING 2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

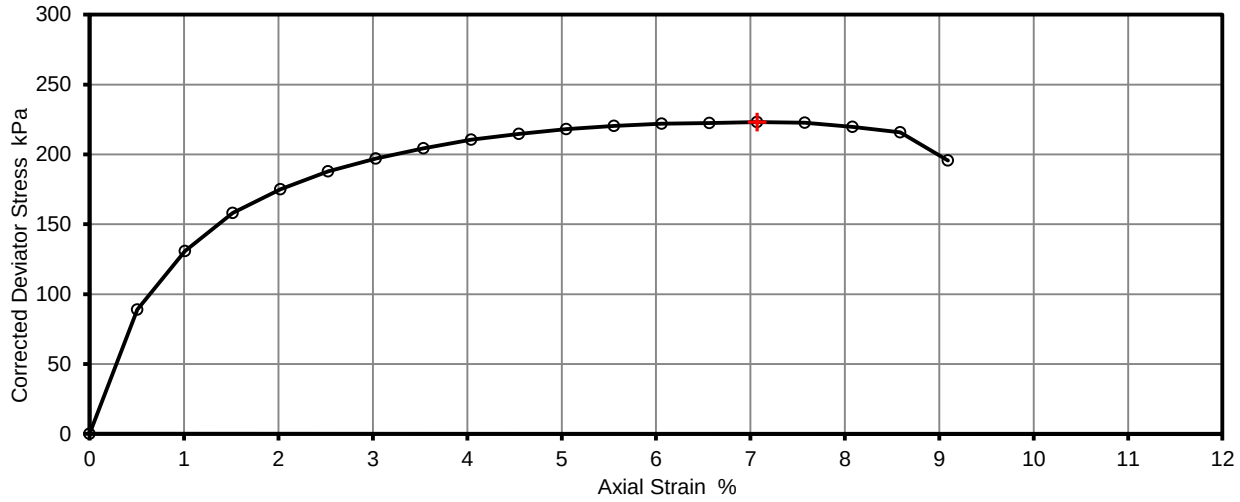
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH1	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	4.00	m
Soil Description	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

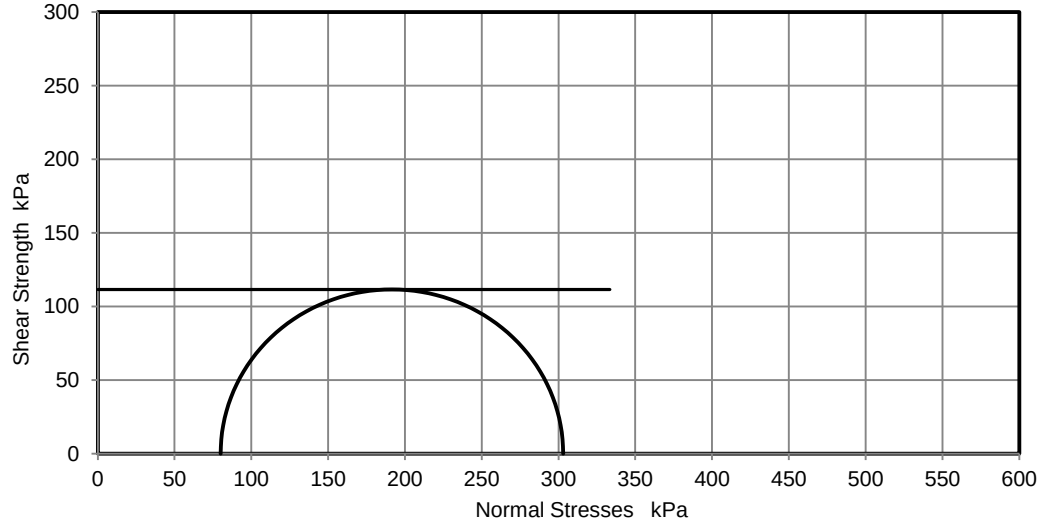
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.88	Mg/m3
Moisture Content	32	%
Dry Density	1.43	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	80	kPa
Axial Strain	7.1	%
Deviator Stress, (σ1 - σ3)f	223	kPa
Undrained Shear Strength, cu	112	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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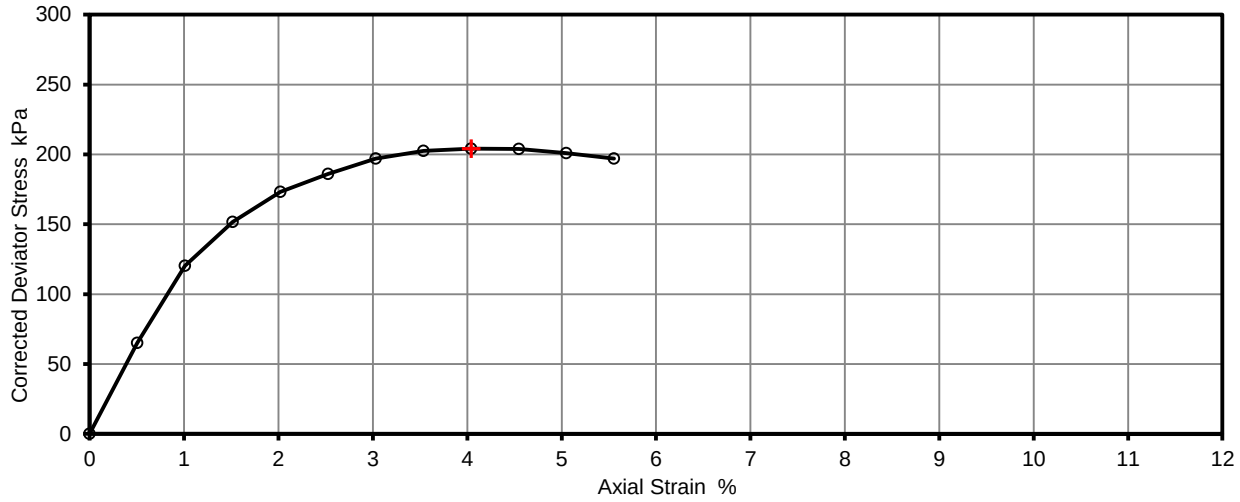
K4 SOILS	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21560	
				Borehole/Pit No.	BH1	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	6.50	m
Soil Description	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	20/09/2016	

Remarks

Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.00	Mg/m3
Moisture Content	28	%
Dry Density	1.56	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	130	kPa
Axial Strain	4.0	%
Deviator Stress, (σ1 - σ3)f	204	kPa
Undrained Shear Strength, cu	102	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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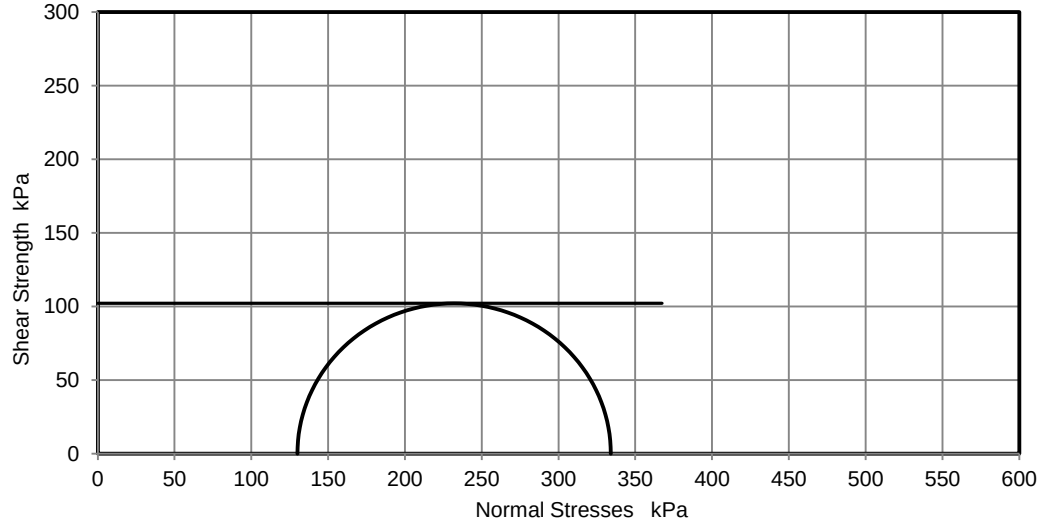

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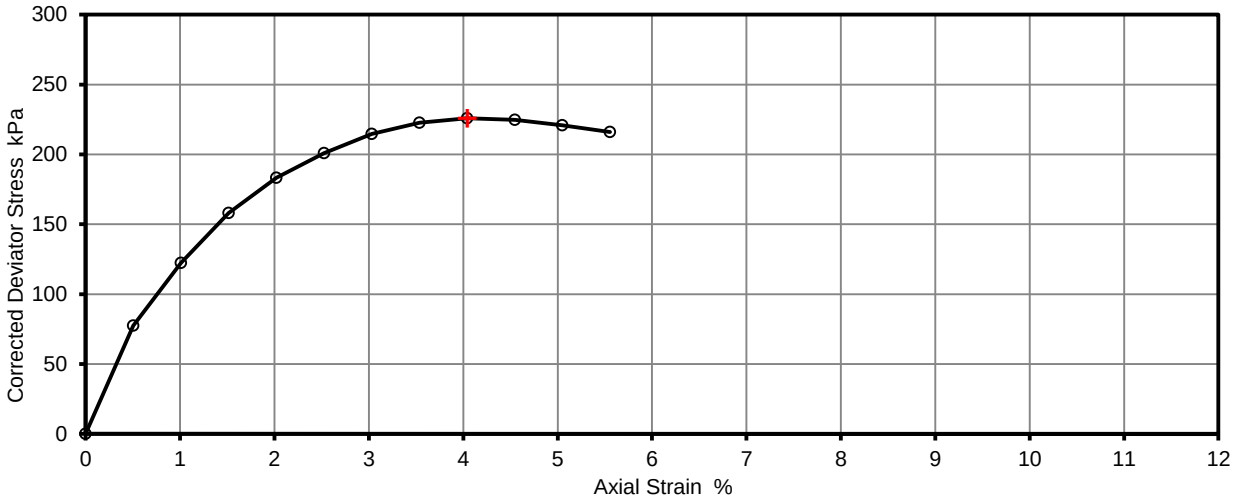
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH1	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	9.50	m
Soil Description	High strength fissured dark grey silty CLAY			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.05	Mg/m3
Moisture Content	26	%
Dry Density	1.63	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	190	kPa
Axial Strain	4.0	%
Deviator Stress, (σ1 - σ3)f	226	kPa
Undrained Shear Strength, cu	113	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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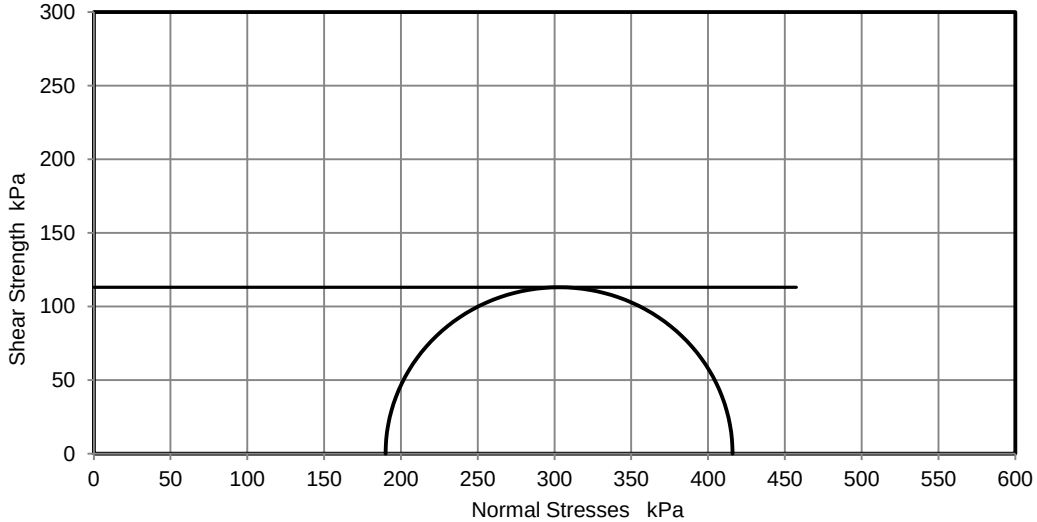

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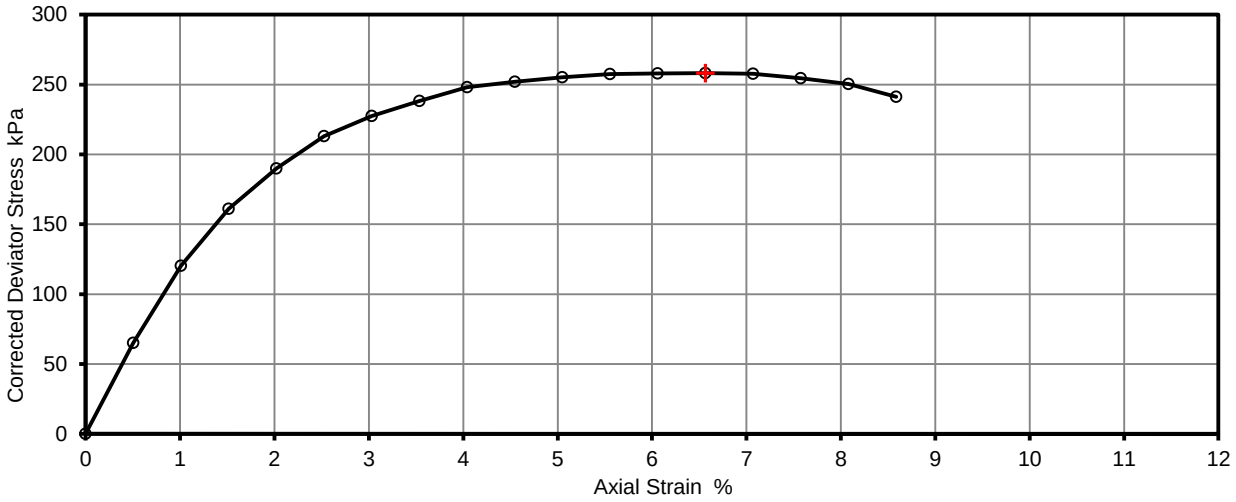
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560
				Borehole/Pit No.	BH1
Site Name	11 Fitzjohn's Avenue			Sample No.	-
Project No.	LBH4424	Client	LBH Wembley	Depth	12.50 m
Soil Description	High strength fissured dark grey silty CLAY			Sample Type	U
				Samples received	08/09/2016
				Schedules received	09/09/2016
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016

Remarks

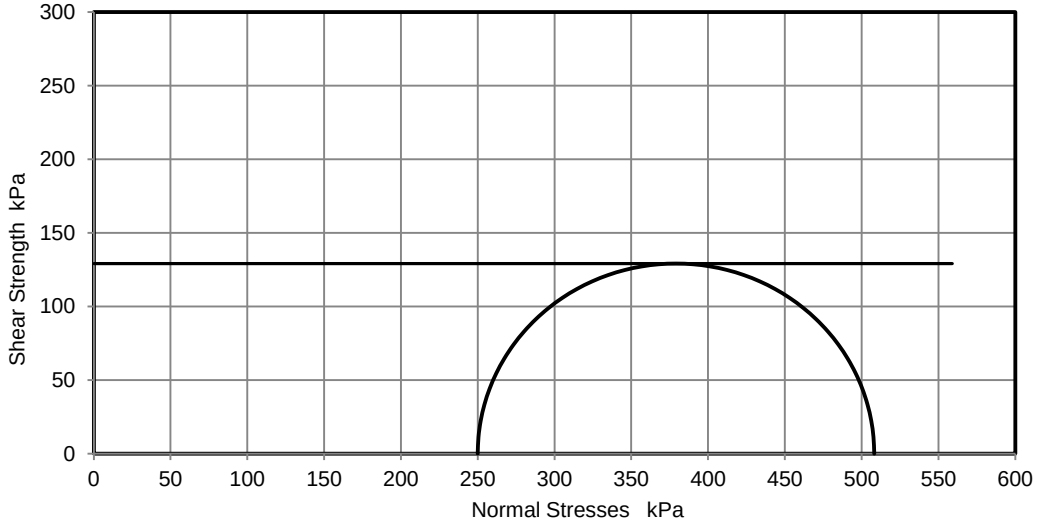
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.01	Mg/m3
Moisture Content	28	%
Dry Density	1.57	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	250	kPa
Axial Strain	6.6	%
Deviator Stress, (σ1 - σ3)f	258	kPa
Undrained Shear Strength, cu	129	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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UKAS TESTING
2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

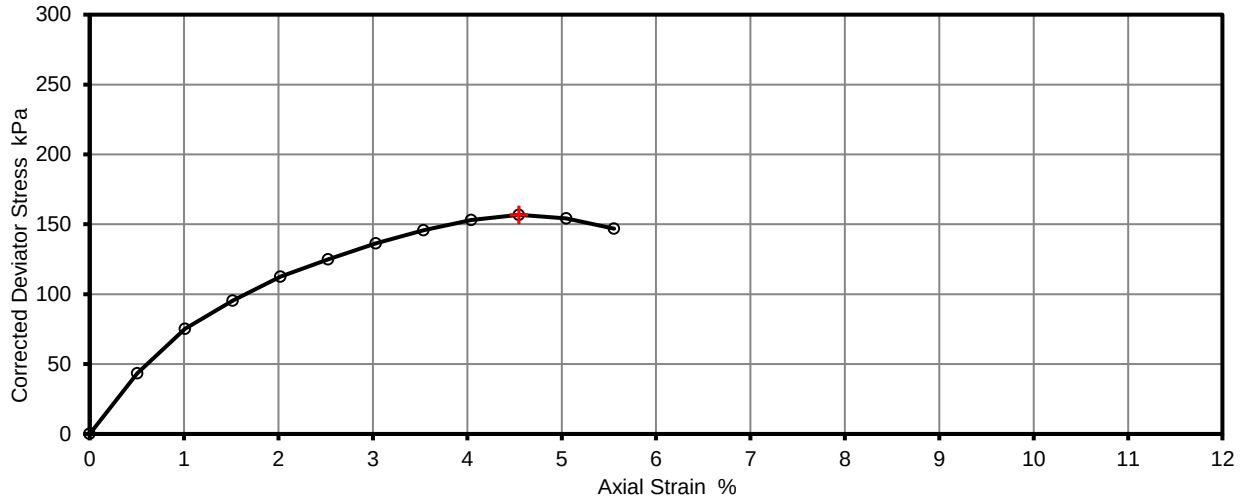
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560
				Borehole/Pit No.	BH2
Site Name	11 Fitzjohn's Avenue			Sample No.	-
Project No.	LBH4424	Client	LBH Wembley	Depth	1.10 m
Soil Description	High strength slightly fissured brown, orange brown and reddish brown slightly sandy slightly gravelly silty CLAY (gravel is fmc and sub-angular to sub-rounded)			Sample Type	U
				Samples received	08/09/2016
				Schedules received	09/09/2016
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016

Remarks

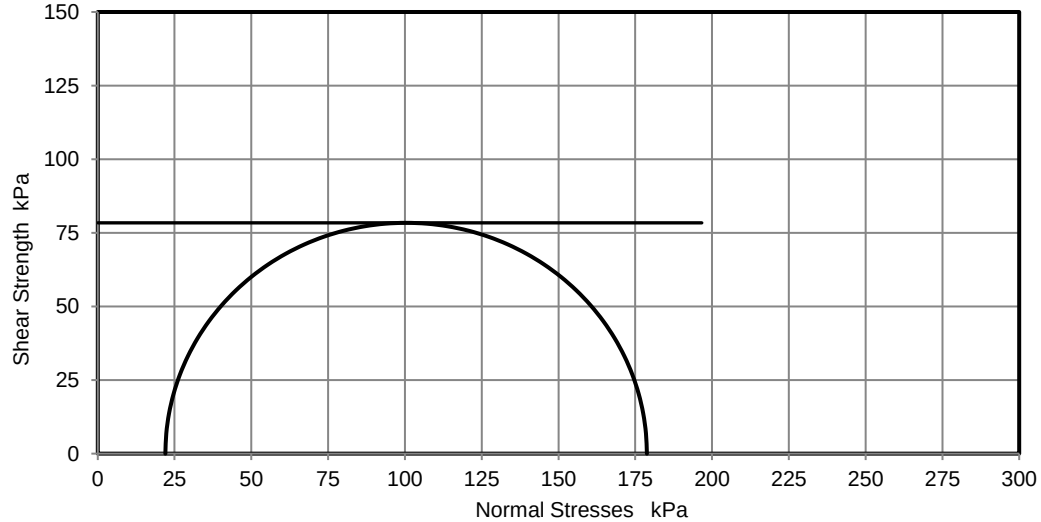
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.84	Mg/m3
Moisture Content	27	%
Dry Density	1.45	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	22	kPa
Axial Strain	4.5	%
Deviator Stress, (σ1 - σ3)f	157	kPa
Undrained Shear Strength, cu	78	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved
Initials: J.P
Date 22/09/2016

UKAS TESTING
2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

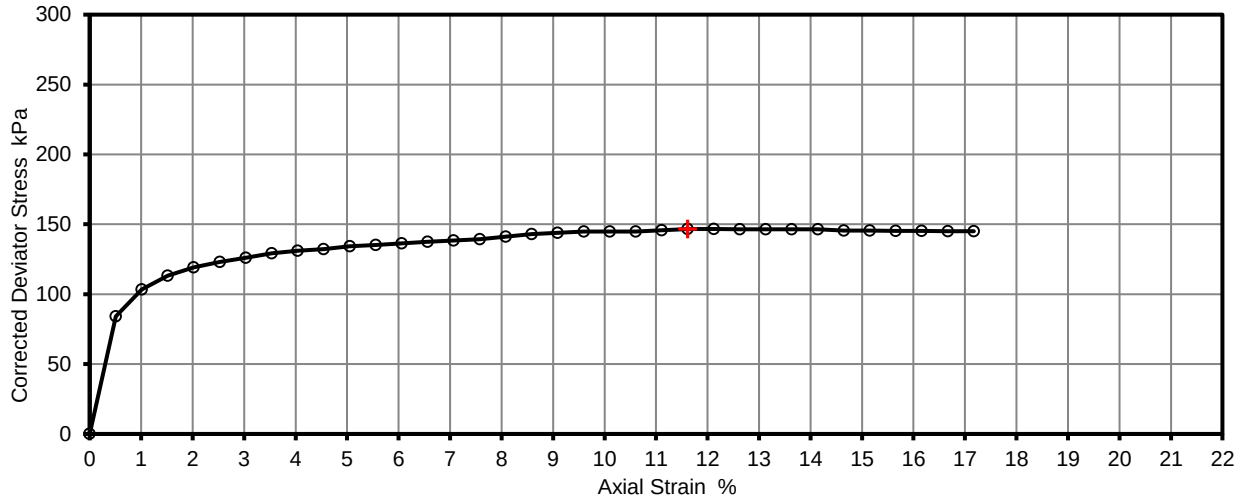
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH2	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	3.00	m
Soil Description	Medium strength fissured brown mottled blue grey silty CLAY			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

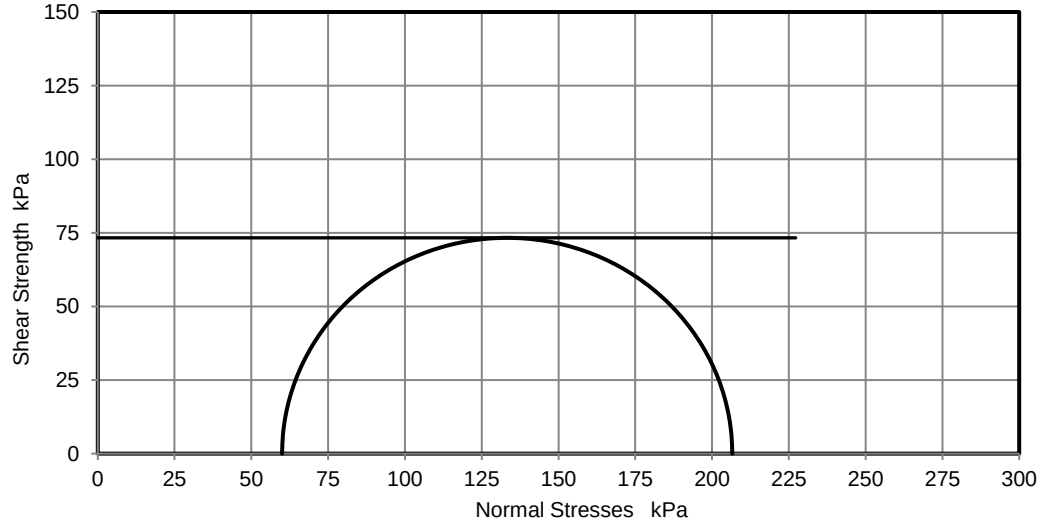
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.98	Mg/m3
Moisture Content	29	%
Dry Density	1.53	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	60	kPa
Axial Strain	11.6	%
Deviator Stress, (σ1 - σ3)f	147	kPa
Undrained Shear Strength, cu	73	kPa ½(σ1 - σ3)f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



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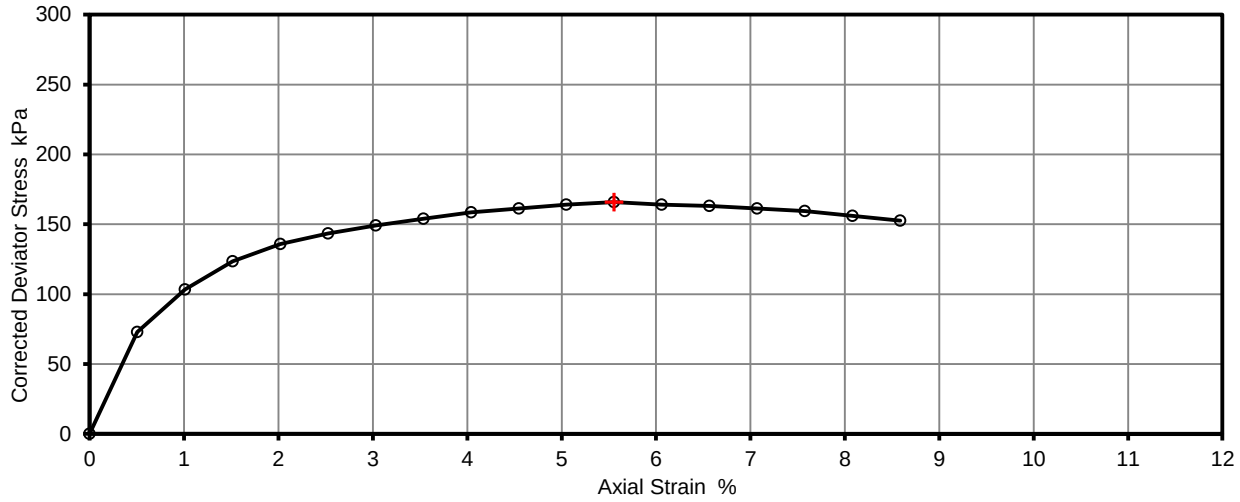
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH2	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	5.00	m
Soil Description	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

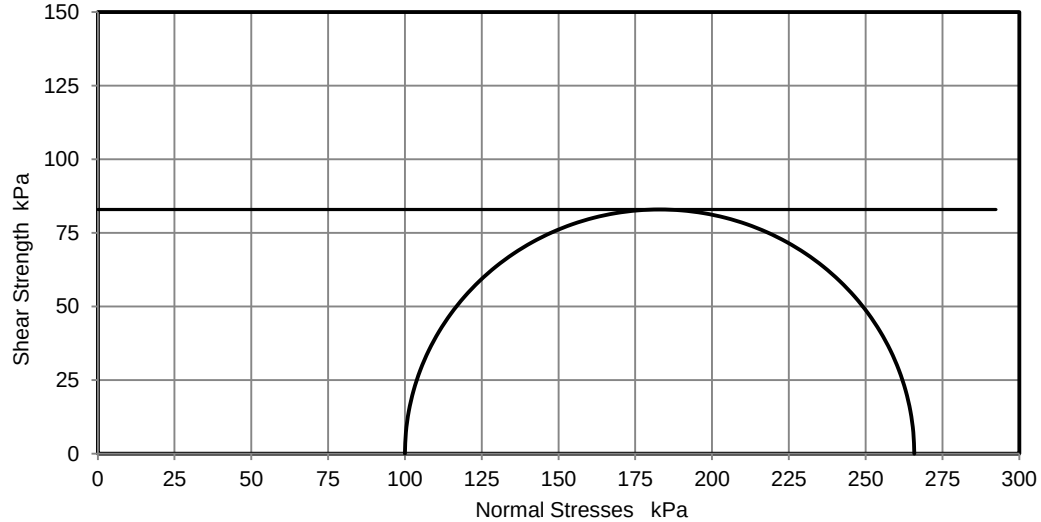
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.94	Mg/m3
Moisture Content	32	%
Dry Density	1.47	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	100	kPa
Axial Strain	5.6	%
Deviator Stress, (σ1 - σ3)f	166	kPa
Undrained Shear Strength, cu	83	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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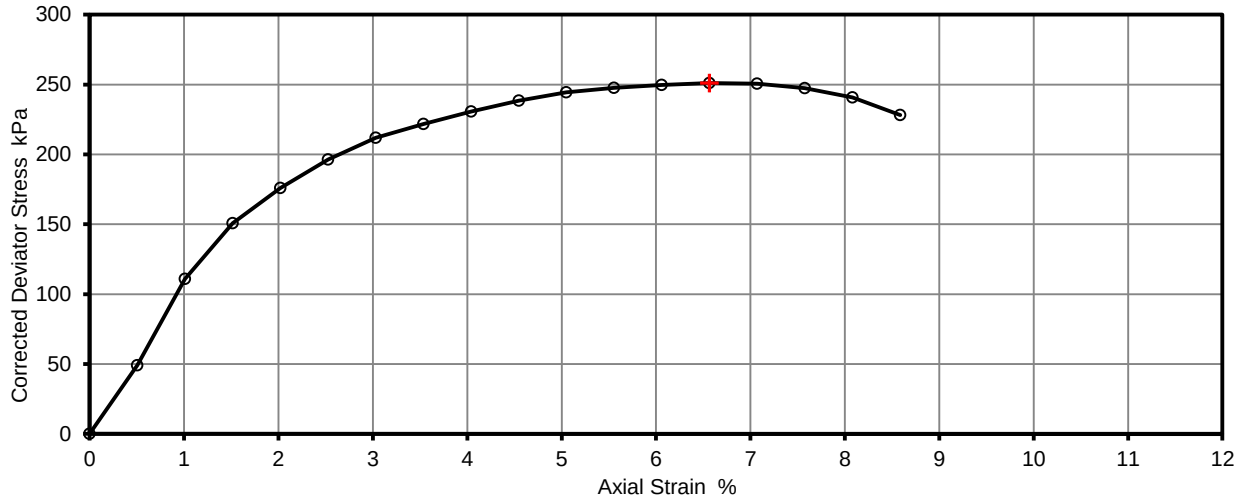
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560
				Borehole/Pit No.	BH2
Site Name	11 Fitzjohn's Avenue			Sample No.	-
Project No.	LBH4424	Client	LBH Wembley	Depth	8.00 m
Soil Description	High strength fissured dark grey silty CLAY with scattered traces of selenite			Sample Type	U
				Samples received	08/09/2016
				Schedules received	09/09/2016
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016

Remarks

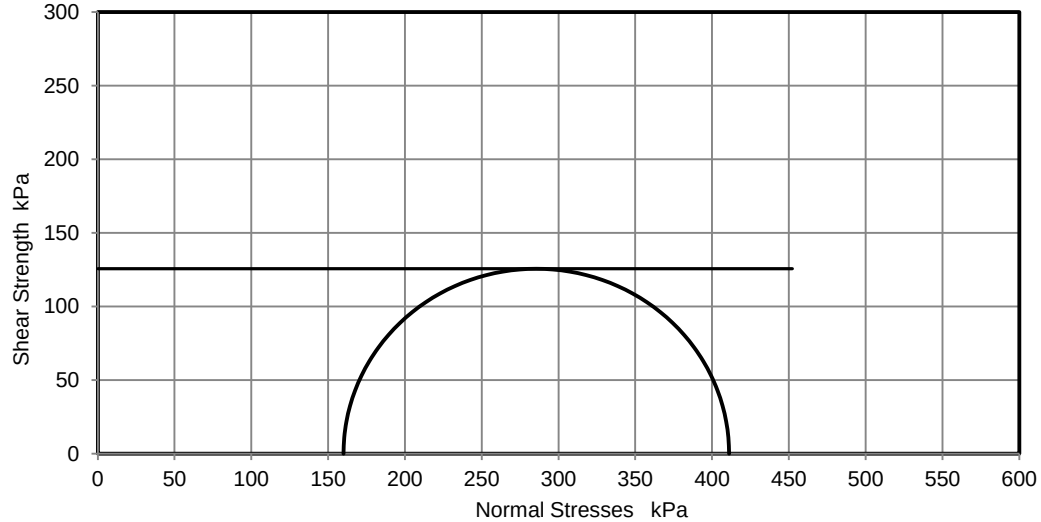
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.02	Mg/m3
Moisture Content	26	%
Dry Density	1.61	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	160	kPa
Axial Strain	6.6	%
Deviator Stress, (σ1 - σ3)f	251	kPa
Undrained Shear Strength, cu	126	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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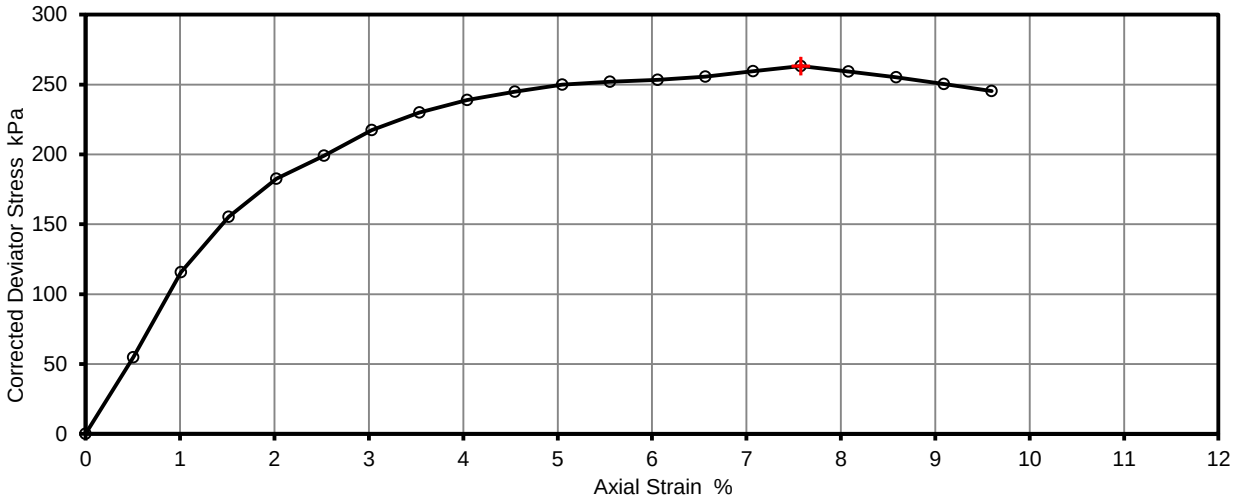
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH2	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	11.00	m
Soil Description	High strength fissured dark grey silty CLAY			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

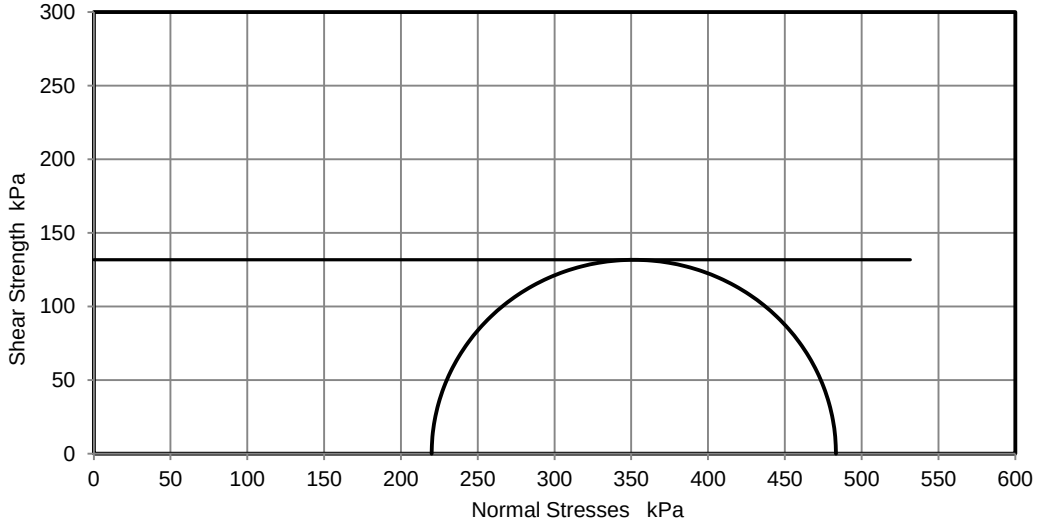
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.05	Mg/m3
Moisture Content	27	%
Dry Density	1.62	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	220	kPa
Axial Strain	7.6	%
Deviator Stress, (σ1 - σ3)f	263	kPa
Undrained Shear Strength, cu	132	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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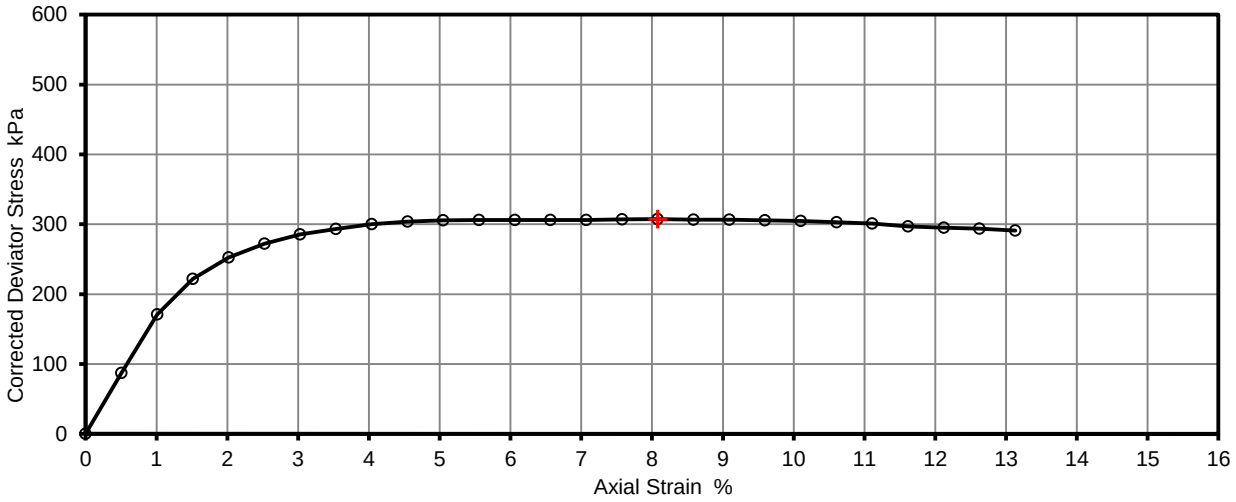
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	21560	
				Borehole/Pit No.	BH2	
Site Name	11 Fitzjohn's Avenue			Sample No.	-	
Project No.	LBH4424	Client	LBH Wembley	Depth	14.00	m
Soil Description	Very high strength fissured dark grey silty CLAY			Sample Type	U	
				Samples received	08/09/2016	
				Schedules received	09/09/2016	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/09/2016	

Remarks

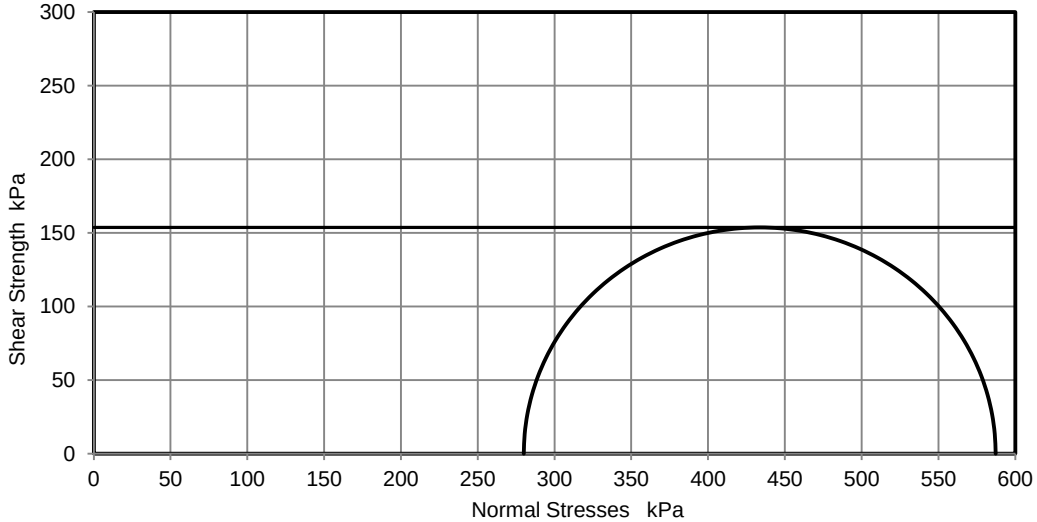
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.03	Mg/m3
Moisture Content	28	%
Dry Density	1.58	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	280	kPa
Axial Strain	8.1	%
Deviator Stress, (σ1 - σ3)f	307	kPa
Undrained Shear Strength, cu	154	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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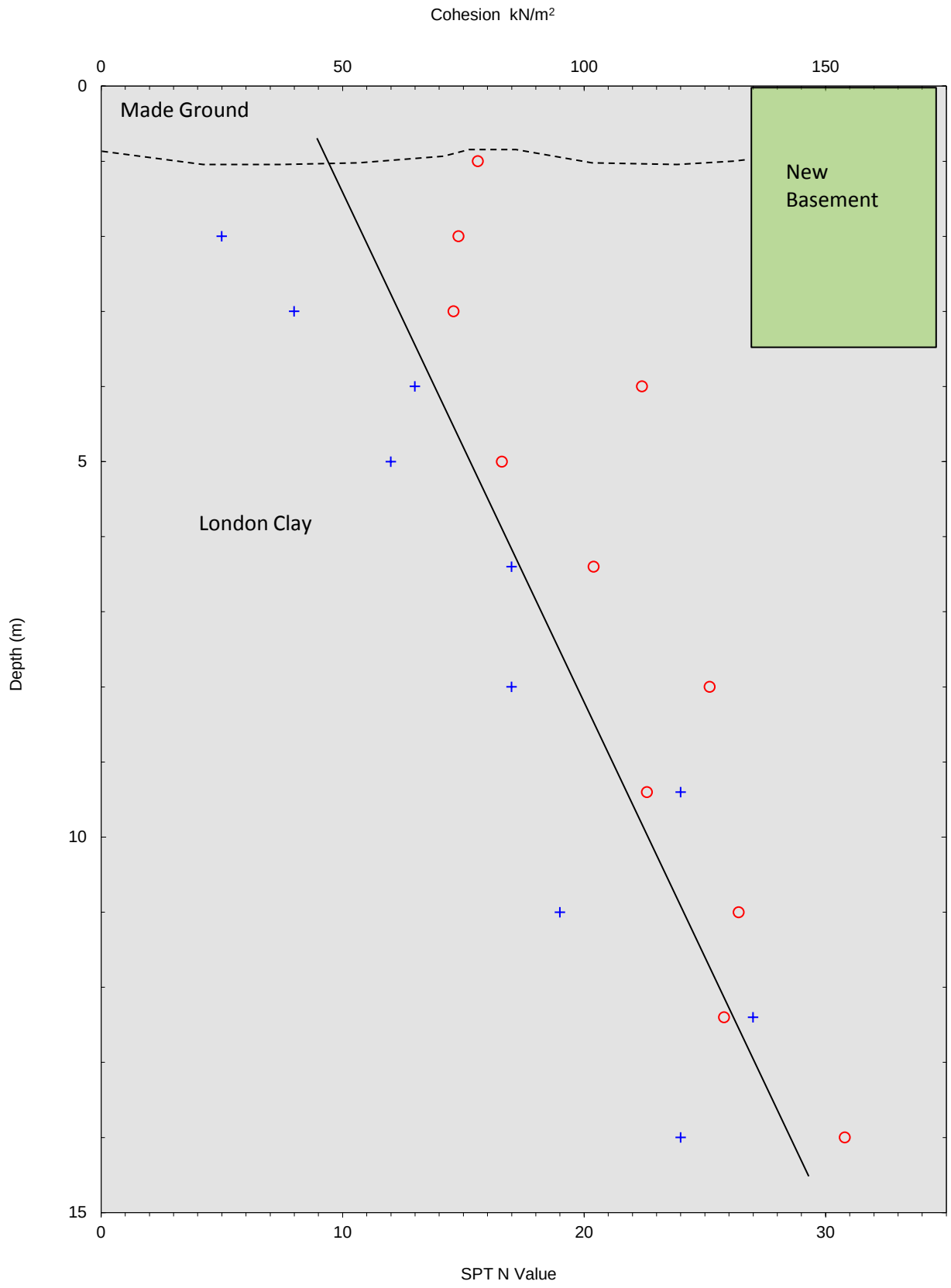
UKAS TESTING 2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

PROJECT:	11 Fitzjohn's Avenue, Camden, NW3 5JY	**SPT & COHESION / DEPTH GRAPH**
CLIENT:	Fitzjohns Avenue Hampstead Ltd	



Cohesion = 5 N

o = Cohesion

+ = SPT

Project No. LBH4424	**LBH WEMBLEY Geotechnical & Environmental**

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
21560	11 Fitzjohn's Avenue	Samples received	08/09/2016
		Schedule received	09/09/2016
Project No.	Client	Project started	09/09/2016
LBH4424	LBH Wembley	Testing Started	21/09/2016

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top	Base	Type		%	g/l	g/l		
BH1	-	2.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	100	0.44	0.53	8.02	
BH1	-	6.50	-	U	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite	100	0.59	0.70	8.08	
BH2	-	3.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	100	0.19	0.23	7.96	
BH2	-	8.00	-	U	High strength fissured dark grey silty CLAY with scattered traces of selenite	100	0.49	0.58	8.02	

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Date: 22/09/2016

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
21560	11 Fitzjohn's Avenue	Samples received	08/09/2016
		Schedule received	09/09/2016
Project No.	Client	Project started	09/09/2016
LBH4424	LBH Wembley	Testing Started	21/09/2016

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH1	-	2.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	31	100	76	28	48	
BH1	-	6.50	-	U	High strength fissured brown mottled blue grey silty CLAY with scattered traces of selenite	29	100	73	26	47	
BH2	-	3.00	-	U	Medium strength fissured brown mottled blue grey silty CLAY	31	99	89	33	56	
BH2	-	8.00	-	U	High strength fissured dark grey silty CLAY with scattered traces of selenite	26	100	68	23	45	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

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