TRIGRAM
PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

5 Kemplay Road
London
NW3

Subterranean Construction Method Statement and Structural Report on the Proposed Basement Extension.

Consulting Engineers

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Job No 4160/BH/December 2013

5 Kemplay Road, London, NW3

Structural Report on the Proposed Basement Extension

Contents

1. Introduction

The property, 5 Kemplay Road, comprises a semi-detached residence on two floors, built in the 1950's. The property has been previously modified, with the extensions being added to the side and to the rear in the 1990's.

It is proposed to create a larger house, with a new basement under part of the footprint.

No. 7 Kemplay Road forms the other half of the block, and is on the right. To the left is No. 3, an older house.

2. Site Investigation

A visual inspection of the property has allowed the general structural form to be ascertained.

2.1 Soils Investigation.

A borehole investigation of the underlying strata, to 10m depth, has been carried out in the front and rear gardens. The under-laying soils comprise a maximum depth of 1.2m of Fill, over sandy or silty Clay (Claygate deposits), over London Clay at depth. Ground water piezometers were installed in the three boreholes. Seepage from sandy and silty layers has resulted in water levels recorded approximately 2.0 – 2.6m below ground level.

The investigation also included trial pits to enable the depth and form of the foundations of the property and to the various boundary walls to be ascertained. This was also done in order to more fully define the proposed Works, in advance of the start of the Works on site.

2.2 Slopes and Stability.

The ground generally falls from the SW to the NE. The pair of semi-detached houses was built on a level platform cut into the slope, with a difference of level approximately 0.5m across the width of both properties. The slope is therefore less than 7^{o}.

Although the site lays within a zone designated to have the potential for landslides, the actual location of the site has slopes less than 7^{o} (1 in 8), therefore the potential for a slide to occur is negligible.

2.3 Tunnels.

The Northern line tunnel is in the vicinity, and is located approximately 350m to the West of the site.

2.4 Water Courses.

The site lays on the water-shed to the south of the Hampstead Heath Extension catchment. The Tyburn's catchment lies a similar distance to the south. The nearest part of the Hampstead Heath catchment lies approximately 400m to the East North East. The nearest of the ponds is approximately 500m to the North East. There are no known water courses either above or below ground in the vicinity of the property.

3. Re-Development Scheme

It is proposed to replace the existing house with a larger house on three floors, with a basement under part of the house.

The use of the property will be retained as 'residential' therefore the imposed loadings on the suspended floors will remain as existing.

4. Basement Construction

The proposed Basement level will be approximately 2.7m below the Ground Floor level. Therefore the excavation would be approximately 3.2m below Ground Floor. The highest recorded ground water level is approximately 2.0m below the existing Ground Floor level.

The Interpretive Site Investigation Report recommends that any excavations must be fully supported. It is therefore proposed to safe-guard nearby properties by constructing the new basement within a fully-supported excavation. 'Silent' piling techniques will be used to install interlocking steel sheet piles to all four sides. These would be hydraulically pushed into the ground, so would not cause vibrations in the ground.

The pile walls would be propped to minimise any deflection movements during excavation, and thus the soils below existing foundations would not be disturbed. As the pile walls would not be designed as vertical cantilevers, they would not have to extend significantly below the depth of the excavation. Therefore they would not need to extend much below the water level. Any tendency to interrupt any water flow could be minimised by stopping every fourth sheet at the level of the excavation, thus creating deliberate gaps in the wall, so that it would be 'permeable'.

The excavation will need to be kept free from water, so sumps and pumps will be required to remove water from within the piled walls, prior to the excavation being progressed. Structural blinding concrete will be cast, to protect the formation, and to 'cap' any inflows due to the small hydraulic head across the lines of the pile walls.

Within the pile walls, it is proposed to form the new basement in reinforced concrete, in water-tight construction, comprising the basement slab, lining walls, and the ground floor slab. The side walls would be cast against the piled wall on all sides, with the profile of the pile wall being infilled with proprietary LDPS void fillers by Messrs Cellcore.

The basement slab and walls will be designed in water-tight concrete construction (to BS8007) for water pressures. It will be checked for buoyancy for each stage of construction.

The ground floor slab will act as a transfer structure, supporting the internal load-bearing walls of the superstructure.

5. Superstructure Construction

The proposed new house will comprise 2nd floor, 1st floor, and Ground Floor. It will occupy the full width of the site but new foundations would be offset from, and parallel to the side boundaries. Where the superstructure extends to the rear of the basement, the r.c. ground floor slab will cantilever beyond mass concrete trench footings to support load-bearing cavity walls, and stanchions

The upper floors and roof will be of traditional construction, supported on an orthogonal grid of beams and walls, with stanchions internally towards the rear.

Lateral stability will be ensured by using the floors as diaphragms supported by a symmetric arrangement of full-height walls in orthogonal directions. There will be clear separation open 'joints' to both the left and right sides, adjacent to the flank walls of No. 3 and 7.

6. Adjacent and Adjoining Buildings

The house is half of a pair of semi-detached houses (No. 5 & 7) on two floors, with a pitched roof. The site investigation trial pits revealed the foundations to comprise (reinforced?) concrete strip footings at approximately 0.95m below the Ground Floor Level.

The nearest adjacent property (No.3) lies to the East, extending up to the boundary line. This is an older residential property on three storeys. There is understood to be a cellar below the rear half of No. 3. No. 5's side extension flank wall is approximately 0.8m from this boundary, with concrete footings at approximately 0.65m below the external ground level.

The proposed forms of construction for the basement have been chosen to minimise the risk of induced settlement. The temporary and permanent works will be designed to support lateral ground pressures, including those due to surcharges from walls parallel and perpendicular to the supported excavation. Some cracking may nevertheless occur, but should be category 0-1 (BRE categories), so would be cosmetic and repairable using normal decorating techniques. Such repairs would be the responsibility of the Building Owner, and be covered by Party Wall Awards.

The rear boundary garden wall is approximately 12m from the back of the existing house. The wall is of traditional brick construction, and is likely to have stepped brick footings at relatively shallow depth. The ground level is similar on both sides of the wall.

The rear left hand side boundary garden wall is also of traditional construction, probably on relatively shallow stepped brick footings. The rear right hand boundary garden wall is contemporary with the semi-detached houses. It is of brick construction, probably on concrete footings.

7. Trees

7.1 Effects of the Building on the Trees.

There is a semi-mature rowan tree in the front garden. This is approximately 5m from the proposed basement excavation. A tree root protection zone can be created around the tree, and still have sufficient space to construct the works.

There are mature trees in the public footpath (in front of No. 3), a second in the front garden of No. 7, and another beyond the rear boundary wall. The nearest is approximately 6m from the nearest corner of the proposed basement. A root protection zone can be established for this tree too. The other trees are much further from the property.

7.2 Effects of the Trees on the Building.

The proposed works should not have any detrimental effect on the health or stability of the trees.

The existing properties show no signs of foundations movements. The new foundations will be founded at an even greater depth, therefore there will be no risk of subsidence due to seasonal moisture movement.

8. Existing and Proposed Buried Services

Within the front roadway it is presumed that there may be the following buried services.

- Mains water supply
- Mains electric supply
- Foul drainage
- Surface water drainage
- Gas and cable TV

Services entries and drains will be very similar to those currently serving the property. The new basement will not have any effect on the services.

9. Monitoring

It is proposed that line and level measurements will be taken on the adjacent and adjoining properties during construction of the works, until the basement walls are fully supported and restrained by the new basement and ground floor slabs.

10. Indicative Construction Sequence

A proposed sequence for the construction of the works is appended. The Main Contractor will be responsible for defining the construction sequence, and for the design of all temporary works, though these will be vetted by the Design Team prior to implementation.

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11. Conclusion

We confirm that by following these measures, the proposed basement extension can be constructed with no detrimental effect to the structural integrity or stability of the house or the existing structures (buildings, buried services, or the tree) adjoining or adjacent to the house.

This Report was prepared by:

Bruce Huxtable CEng, MICE, MIStructE, MSt, BSc (Hons)

December 2013

Appendix A - Indicative Construction Sequence for Subterranean Extension

- Install level and plumb monitoring points on adjoining and adjacent buildings' facades.
- Demolish the rear and side extensions, including shallow foundations. Backfill with compacted granular fill.
- Saw-cut the front rear facades from top to bottom, flush to the No 5 face of the Party Wall.
- Demolish the house from top down, protecting the Party Wall.
- Remove the existing ground floor in a zone adjacent to the Party Wall, the side pathway for access trenches, and all existing footings on the lines of the new basement perimeter.
- Install interlocking steel sheet piles as temporary ground support walls.
- Excavate to 0.8m depth and install upper level of walings and props.
- Excavate to 0.75m above formation level, and install lower walings and props.
- Excavate to formation level and cast structural blinding.
- Excavate for sump, installing local ground supports, blinding, and thus construct the r.c chamber.
- Fix reinforcement and cast basement slab, remove lower props and walings.
- Cast r.c basement walls to a lap length below the upper walings; re-locate upper propping.
- Erect falsework and formwork; fix slab reinforcement; and cast Ground Floor slab.
- When concrete has reached working strength, remove falsework, formwork, and propping.
- Excavate and pour mass concrete trench footings
- Cast r.c. ground floor slab
- Erect superstructure

Appendix B - Designer's Risk Assessment Summary

General

The works involve excavations alongside several boundary and Party walls.

Particular Residual Risks

Full ground support will be necessary during the excavation of the basement, and all other excavations.

Several forms of construction are required, including 'silent' piling. The timing of the insertion and removal of lateral supports will inform the general excavation and the construction of the permanent works.

The ground water level is known to be 2.0 – 2.6m below ground level.
The excavations will therefore need to be kept free from water. Temporary sumps and pumping will be required.

The basement 'box' would potentially be buoyant, if the ground water level were to rise to 1.5m below ground level. Therefore, provision of openings in the outer walls should be made, to allow the basement to flood, should the ground water level rise significantly before the ground floor slab were cast. No such risk exists once the ground floor slab has been cast.

Uplift pressures and heave movements are time-dependant. Therefore the programming of the works should take this into account.

Appendix C - Piling Specification

The general specification will be supplemented with a project-specific piling specification, in accordance with the ICE Specification for Piling and Embedded Retaining Walls.

The main contractor will produce a layout drawing defining the pile walls and working spaces, to take account of the particular site features. This will also define any protection to the Party wall, etc. This will be reviewed in principle by the design team.

Appendix D - Temporary Works Specification

The main contractor will be responsible for the design of all temporary works supports for vertical loads; lateral soil pressures; and for the overall stability of the various structures.

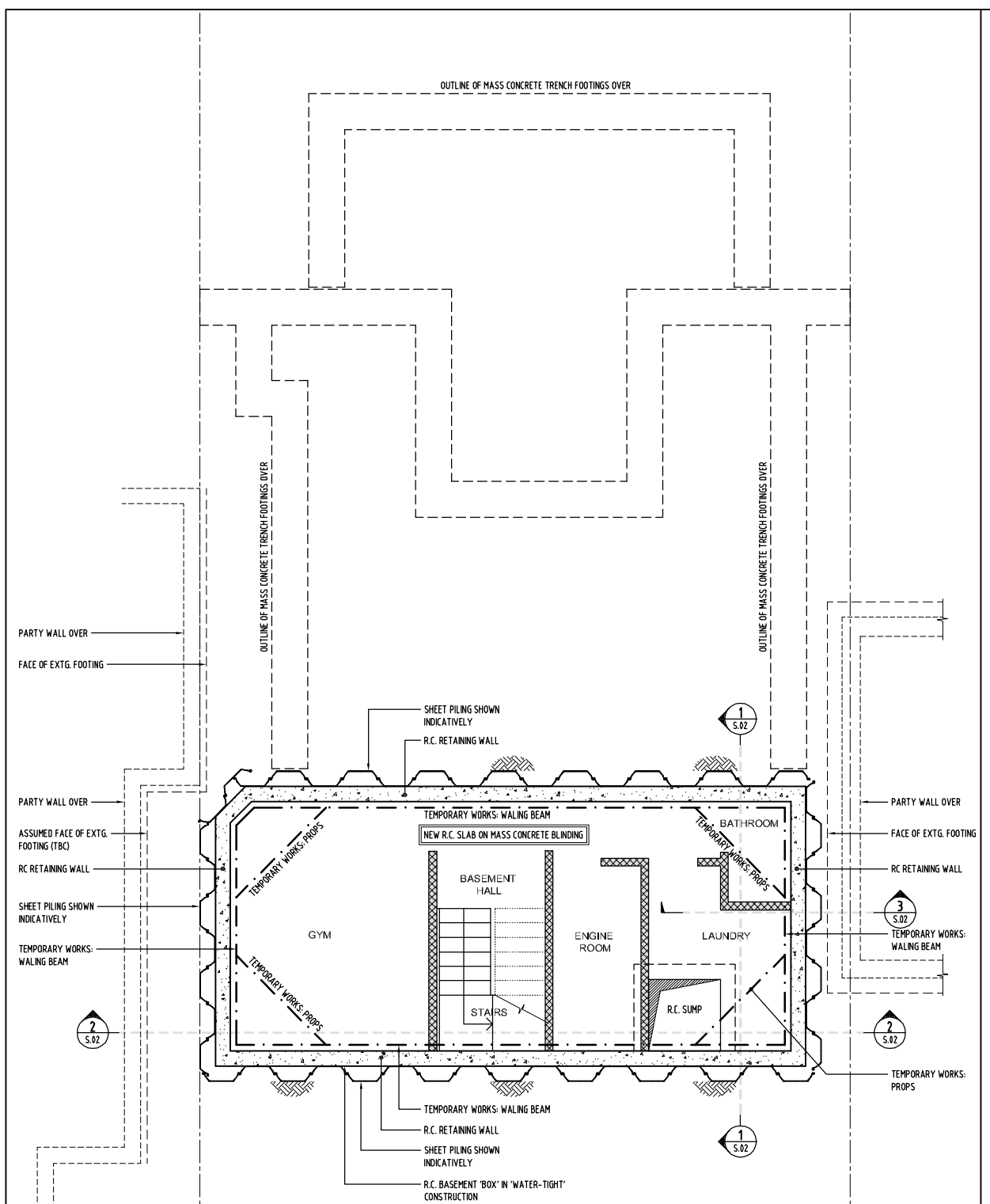
The proposed methodology and sequence of works will be vetted by the design team. The proposed loadings will be agreed with Trigram Partnership.

Appendix E - Concept Drawings

As Existing - Plans & Sections – refer to Site Investigations drawings.

As Proposed - Plans & Sections 4160/S/01 – 02

Temporary Works: Schematic Ground Support - Refer to 4160/S/01



AS PROPOSED BASEMENT FLOOR PLAN

SCALE 1:50

SCALE BAR 0 1 2 3 4 5m
(1:50 @ A1)
(1:100 @ A3)

LEGEND:

- EXISTING WALL
- REINFORCED CONCRETE WALL
- NEW WALL
- LOAD BEARING WALL UNDER
- WALL TO BE DEMOLISHED

NOTE 'A'

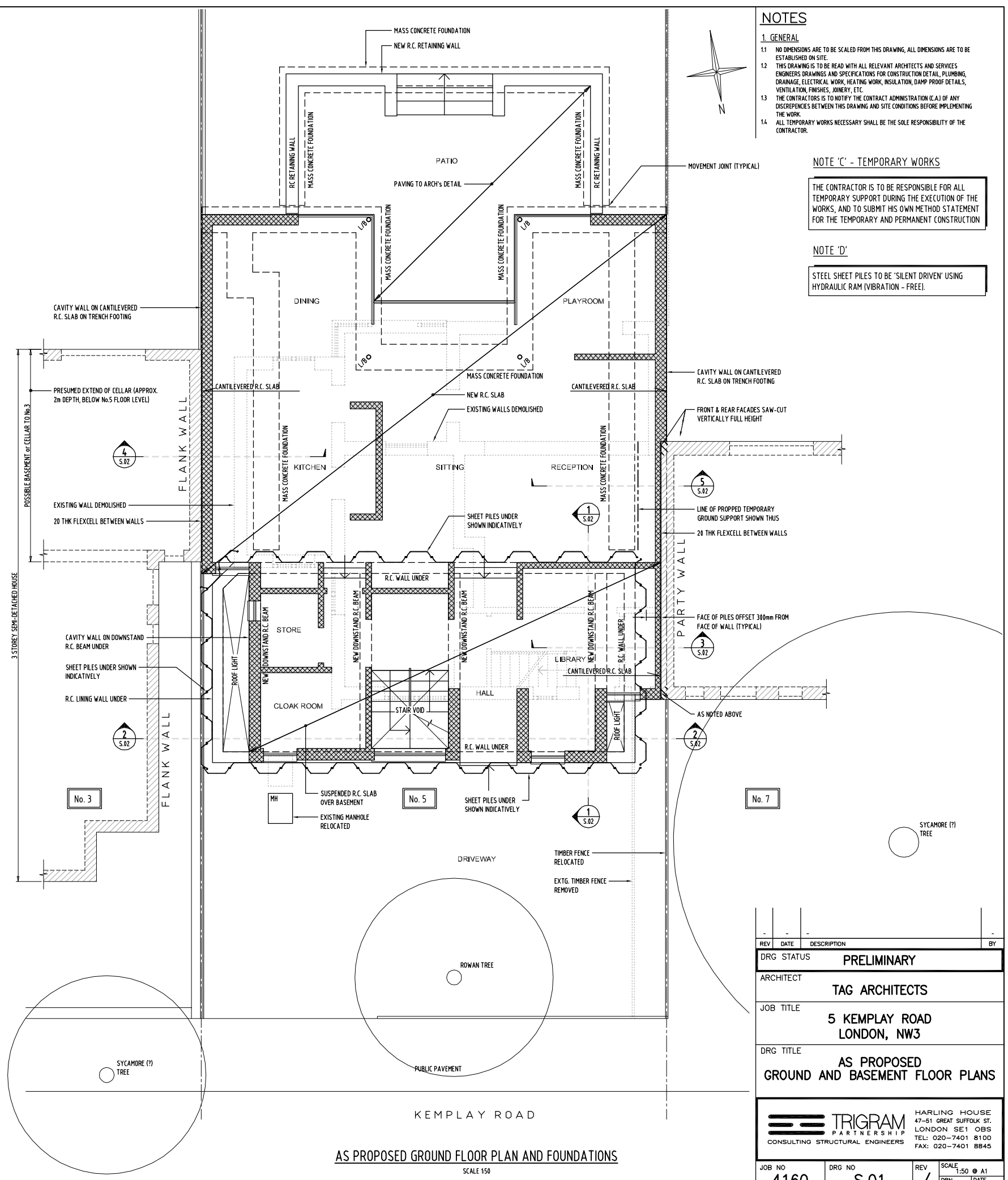
FLOOR FINISHES, INSULATIONS, DPM & ETC... TO ARCHITECT'S SPECIFICATIONS AND DETAILS

NOTE 'B'

ALL NON LOAD BEARING STUD WALLS SHOWN INDICATIVELY. FOR SETTING OUT REFER TO ARCHITECT'S DETAILS

NOTE 'C' - TEMPORARY WORKS

THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL TEMPORARY SUPPORT DURING THE EXECUTION OF THE WORKS, AND TO SUBMIT HIS OWN METHOD STATEMENT FOR THE TEMPORARY AND PERMANENT CONSTRUCTION



AS PROPOSED GROUND FLOOR PLAN AND FOUNDATIONS

SCALE 1:50

NOTES

1 GENERAL

1.1 NO DIMENSIONS ARE TO BE SCALED FROM THIS DRAWING, ALL DIMENSIONS ARE TO BE ESTABLISHED ON SITE.

1.2 THIS DRAWING IS TO BE READ WITH ALL RELEVANT ARCHITECTS AND SERVICES ENGINEERS DRAWINGS AND SPECIFICATIONS FOR CONSTRUCTION DETAIL, PLUMBING, DRAINAGE, ELECTRICAL WORK, HEATING WORK, INSULATION, DAMP PROOF DETAILS, VENTILATION, FINISHES, JOINERY, ETC.

1.3 THE CONTRACTORS IS TO NOTIFY THE CONTRACT ADMINISTRATION (C.A.) OF ANY DISCREPENCIES BETWEEN THIS DRAWING AND SITE CONDITIONS BEFORE IMPLEMENTING THE WORK.

1.4 ALL TEMPORARY WORKS NECESSARY SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

NOTE 'C' - TEMPORARY WORKS

THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL TEMPORARY SUPPORT DURING THE EXECUTION OF THE WORKS, AND TO SUBMIT HIS OWN METHOD STATEMENT FOR THE TEMPORARY AND PERMANENT CONSTRUCTION

NOTE 'D'

STEEL SHEET PILES TO BE 'SILENT DRIVEN' USING HYDRAULIC RAM (VIBRATION - FREE).

REV	DATE	DESCRIPTION	BY
-	-	-	-

DRG STATUS: PRELIMINARY

ARCHITECT: TAG ARCHITECTS

JOB TITLE: 5 KEMPLAY ROAD LONDON, NW3

DRG TITLE: AS PROPOSED GROUND AND BASEMENT FLOOR PLANS

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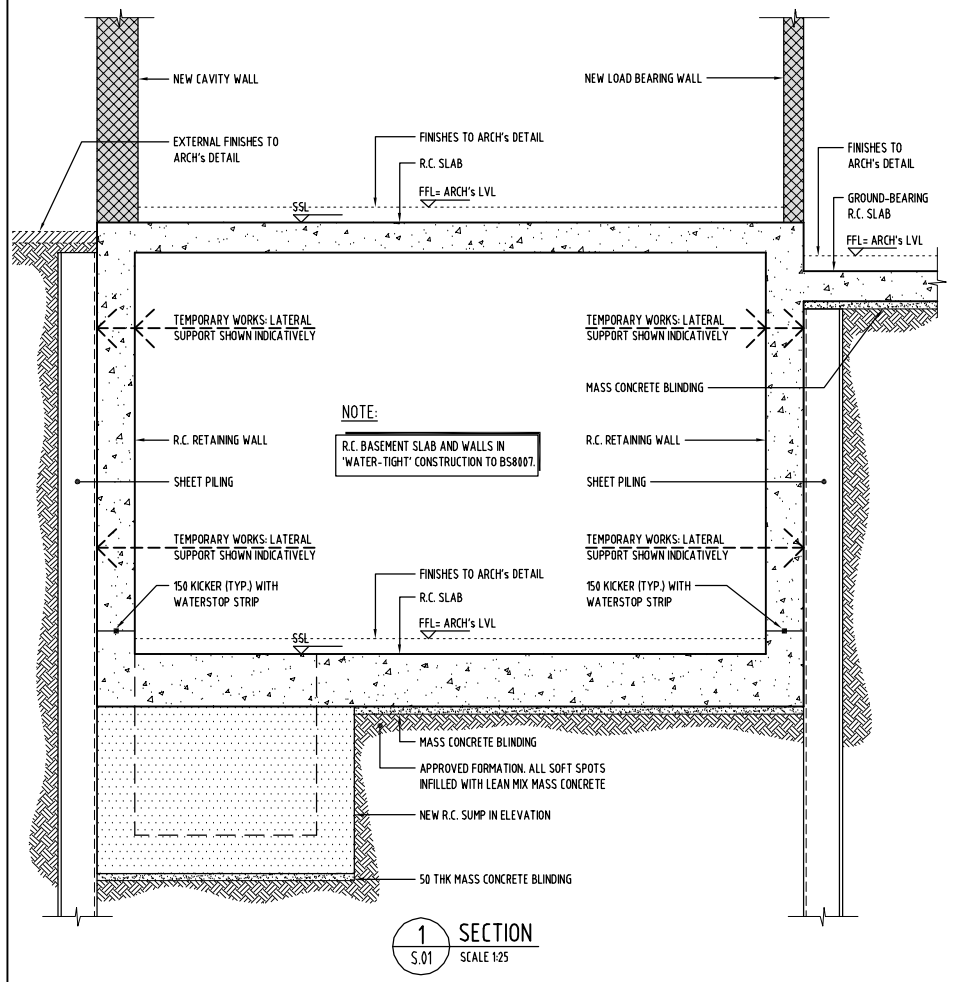

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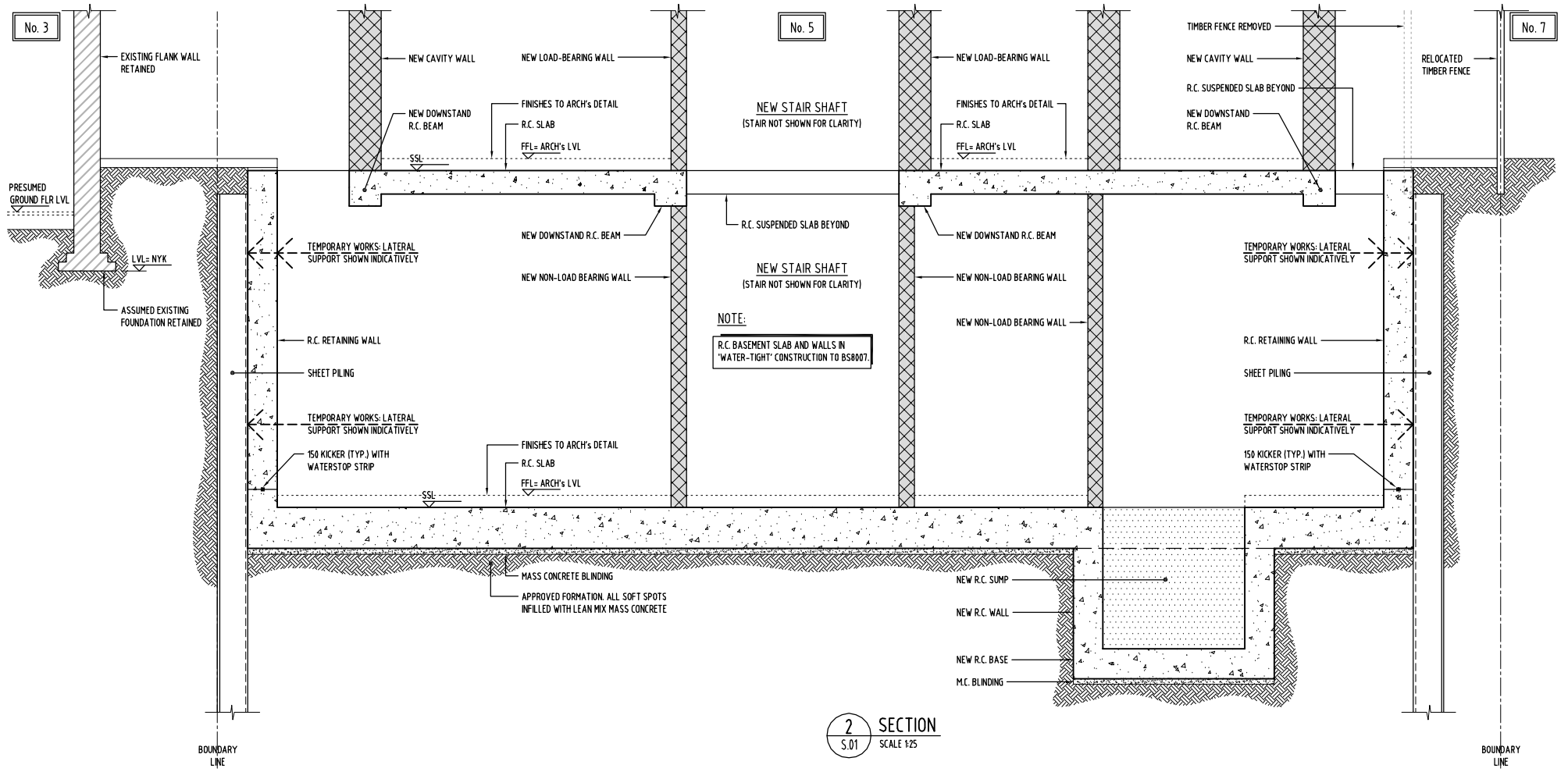

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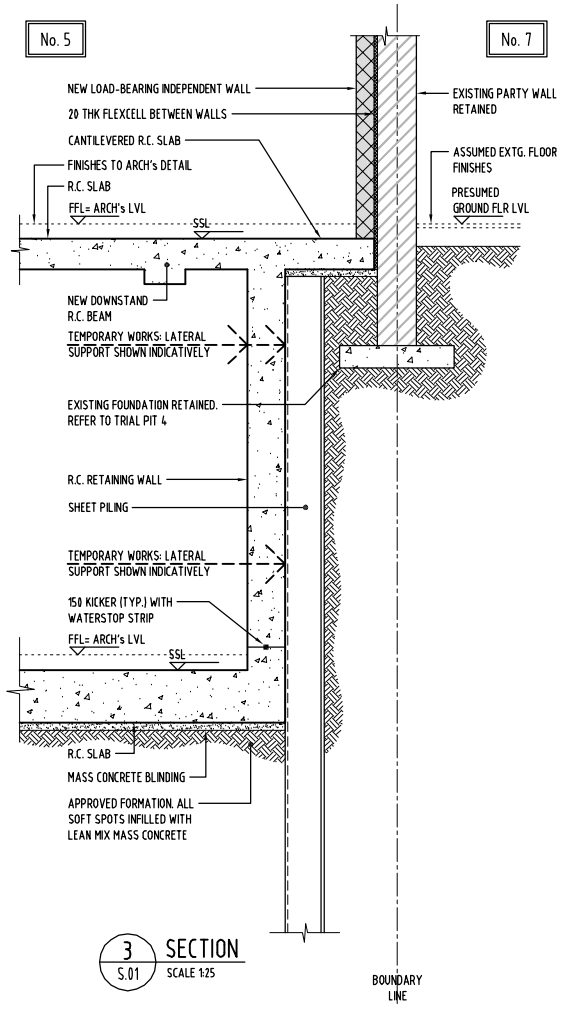

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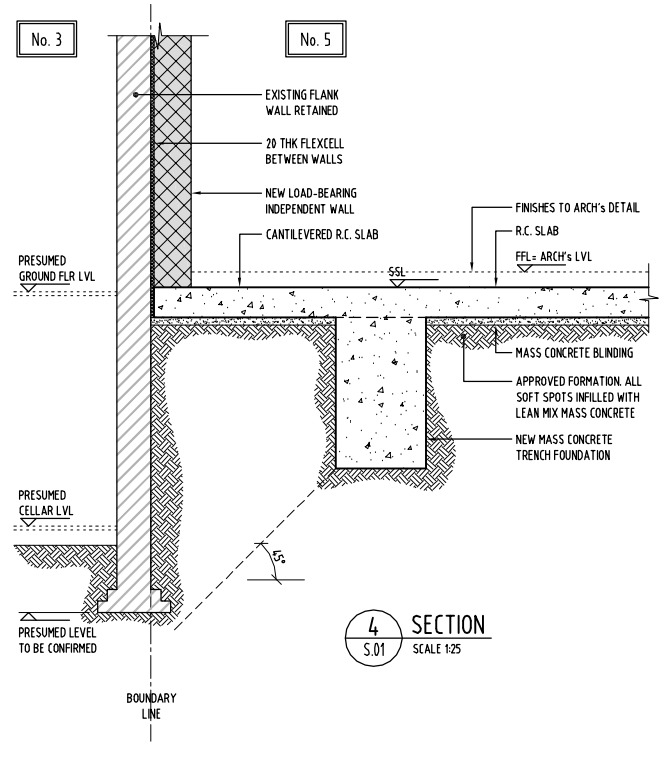

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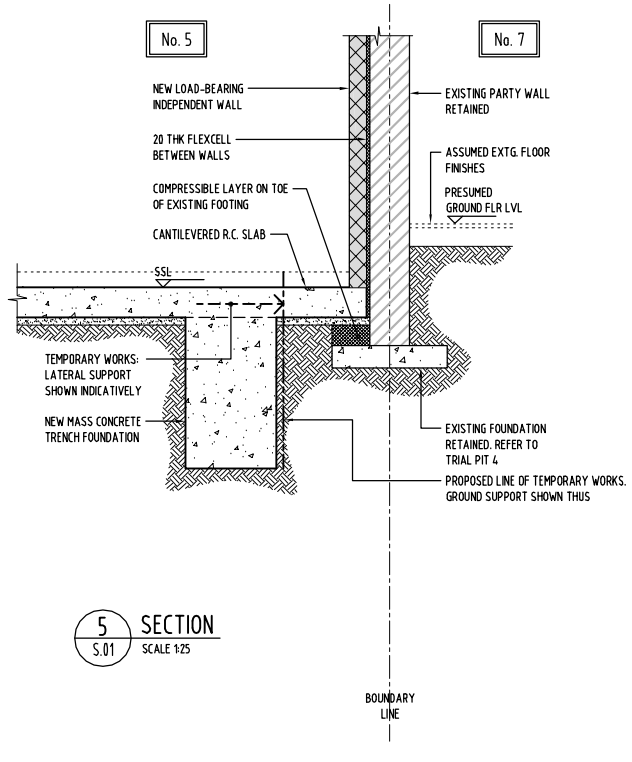

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NOTES

1. GENERAL:
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REV	DATE	DESCRIPTION	BY
-	-	-	-

DRG STATUS: PRELIMINARY

ARCHITECT: TAG ARCHITECTS

JOB TITLE: 5 KEMPLAY ROAD LONDON, NW3

DRG TITLE: AS PROPOSED SECTIONS AND DETAILS SHEET 1

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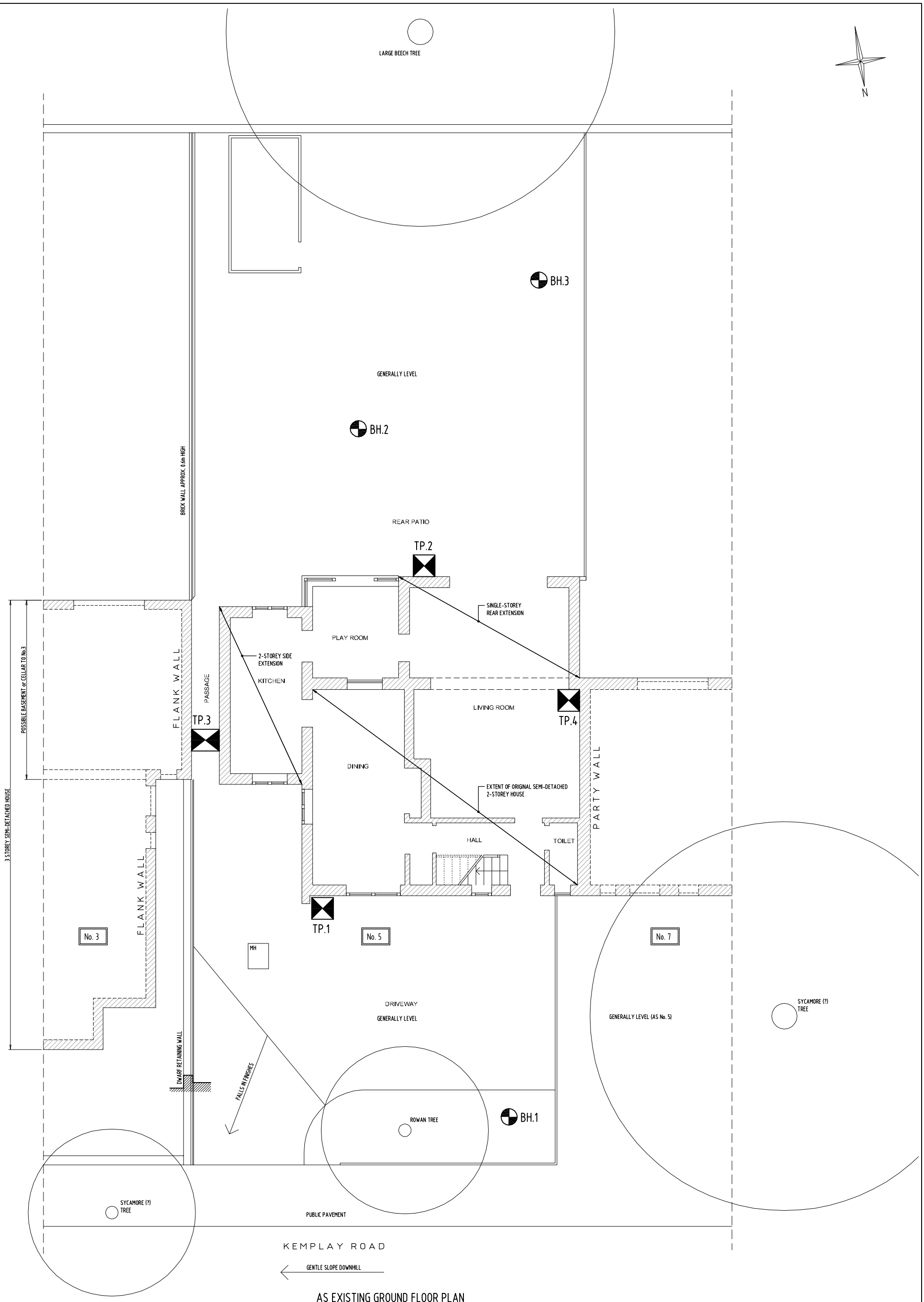
JOB NO	DRG NO	REV	SCALE	DRN	DATE
4160	S.02	/	1:25 @ A1	IP	NOV/13

Appendix F - Structural Exposures, Trial Pits and Geotechnical Data

Site Investigation Plans - 4160/SI/01

Interpretive Soils Investigation Report, by Messrs MRH, dated November 2013 and letter dated 4th December 2013.



AS EXISTING GROUND FLOOR PLAN

SCALE 1:50

NOTES

1. GENERAL:
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KEY

TP – DENOTES TRIAL PIT REQUIRED FOR SITE INVESTIGATION;
1. TRIAL PIT TO BE APPROX. 0.6x0.6m., DUG TO THE UNDERSIDE OF EXISTING FOUNDATIONS AND NO DEEPER UNLESS INSTRUCTED BY THE ENGINEER. RECORDS SHOULD INCLUDE FOUNDATION CROSS SECTION WHERE APPLICABLE.
2. CONTRACTOR TO BACKFILL TRIAL PIT WITH COMPACTED EXCAVATED MATERIAL. EXCESS SPOIL TO BE REMOVED FROM SITE. PITS ARE TO BE REINSTATED TO ORIGINAL CONDITION.

BH – BORE HOLE TO 10.0m DEPTH

REV	DATE	DESCRIPTION	BY
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DRG STATUS: PRELIMINARY

ARCHITECT: TAG ARCHITECTS

SCALE BAR 0 1 2 3 4 5m
(1:50 @ A1)
(1:100 @ A3)

JOB TITLE: 5 KEMPLAY ROAD
LONDON, NW3

DRG TITLE: AS EXISTING GROUND FLOOR PLAN

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JOB NO	DRG NO	REV	SCALE	DRN	DATE
4160	SI.01	/	1:50 @ A1	IP	NOV/13

CONSULTANCY, SITE INVESTIGATION
CONSTRUCTION MATERIALS TESTING,
CONTAMINATED LAND SURVEYS, DESK
STUDIES, RISK ASSESSMENT

MRH
GEOTECHNICAL

GROUND INVESTIGATION FOR

5 KEMPLAY ROAD
LONDON
NW3 1TA

Job No: LI1410

Date September 2013

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Director: S.J. Hudson BSc Associates: S. Corrigall MSc MSc CIC FGS S. Brooks BEng (Hons)
Consultants: E.J. Murray BSc, PhD, CEng, FGS, CGeol, FGS, MaPS D.W. Rix BSc, MSc, CEng, MICE A.M. Hutchings MIAT

CONTENTS

APPENDICES

Report No: 131410

Date: September 2013

REPORT ON A GROUND INVESTIGATION AT 5 KEMPLAY ROAD, LONDON NW3 1EA

1 INTRODUCTION

1.1 This report has been prepared for Trigram Partnership, Consulting Structural Engineers, who are acting on behalf of Sarah and Lionel Fournier.

1.2 Our brief for the investigation was to:

a) Excavate four trial pits, backfill and make good
b) Construct three boreholes with associated soil sampling and in situ testing
c) Laboratory testing of soil samples for classification
d) Carry out one suite of contamination analysis
e) Undertake a Desk Study of the site history (see seperate report)

2 DETAILS OF FIELD WORK

2.1 The fieldwork comprised the construction of four trial pits and three independent boreholes at the positions indicated in appendix A.

2.2 Details of the trial pit excavations and exposed foundation profiles are given in appendix B.

2.3 Soil samples were recovered at regular intervals during the drilling operations, sealed in inert, airtight containers and transported to the laboratory for testing and detailed descriptions.

2.4 Water level observations were made during the drilling works and noted on the borehole logs.

2.5 The fieldwork was carried out on the 17th, 18th and 27th September 2013.

3 GENERAL GEOLOGY AND REVEALED STRATA

3.1 The boreholes proved Made Ground to depths of between 0.25m (BH 1), 1.10m (BH 2) and 1.20m (BH 3).

3.2 Borehole 1 then penetrated very stiff slightly sandy Clay, becoming stiff very silty Clay at 2.40m, with a slight sand content from 2.70m. The borehole was extended and penetrated very stiff Clay from a depth of 4.40m.

3.3 With regard to boreholes 2 and 3, the Made Ground was underlain by a series of soft to firm, becoming firm Clays with varying silt and sand contents. Stiff silty Clay was noted at depths of 5.70m (BH 2) and 5.20m (BH 3).

3.4 Details of the boreholes, sample depths, in situ test results and revealed stratum are given in appendix C.

3.5 The 1:50,000 scale geological map indicates the natural deposits of area to be near a boundary of Bagshot and Claygate deposits with London Clay of the Eocene age at depth.

4 GROUNDWATER

4.1 Borehole 1 remained dry throughout the construction period, while water seepage's were noted at depths of 3.10m and 3.40m in boreholes 2 and 3 respectively.

4.2 On the 27th September 2013, water levels of 2.63m (BH 1), 3.10m (BH 2) and 3.40m (BH 3) were recorded.

5 LABORATORY TESTING

5.1 The recovered soil samples were tested for moisture levels, together with fourteen Atterberg Limit determinations.

5.2 The results and detailed sample descriptions are tabulated in appendix D, categorising the Clay elements to be of medium to high plasticity (Plasticity Index 28% - 44%).

5.3 This is indicative of a moderately high susceptibility to moisture related cyclic volume change. From a study of the test data, a degree of desiccation is indicated in borehole 1 to a depth of 2.00, with a recovery in moisture levels from 2.50m.

6 CONCLUSIONS

6.1 The findings of the trial pits indicate the exposed foundations to be based at depths of between 0.65m - 0.90m.

6.2 The boreholes proved Natural Ground at depths of between 0.25m - 1.20m.

6.3 With regard to proposed foundation designs regarding the project, plots of the Shear Strengths versus Depth profiles are given in appendix C (Page 4).

6.4 However, note should be made of the relatively high water table which would limit the depth of open excavations without the use of shoring and pumping.

6.5 The results of the contamination analysis carried out in borehole 1 at a depth of 0.50m form appendix E, showing the material tested to be suitable for a residential development.

6.6 The SO_4 (2:1) content of 16 mg/l and corresponding pH value of 7.3 would categorise the site as DS-1 in accordance with BRE recommendations.

7 REFERENCES

1) British Standard EN ISO 14688-1:2002
2) British Standard 5930: 1999
3) British Standard 1377: Parts 1-9
4) British Geological Survey Sheet 256 (1:50,000 scale) North London
5) NHBC Standards, Chapter 4.2
6) Foundation Design and Construction (M.J. Tomlinson, Fifth Edition)
7) BRE SD1:2005 (Concrete in aggressive ground)

Stephen J. Hudson

APPENDIX A

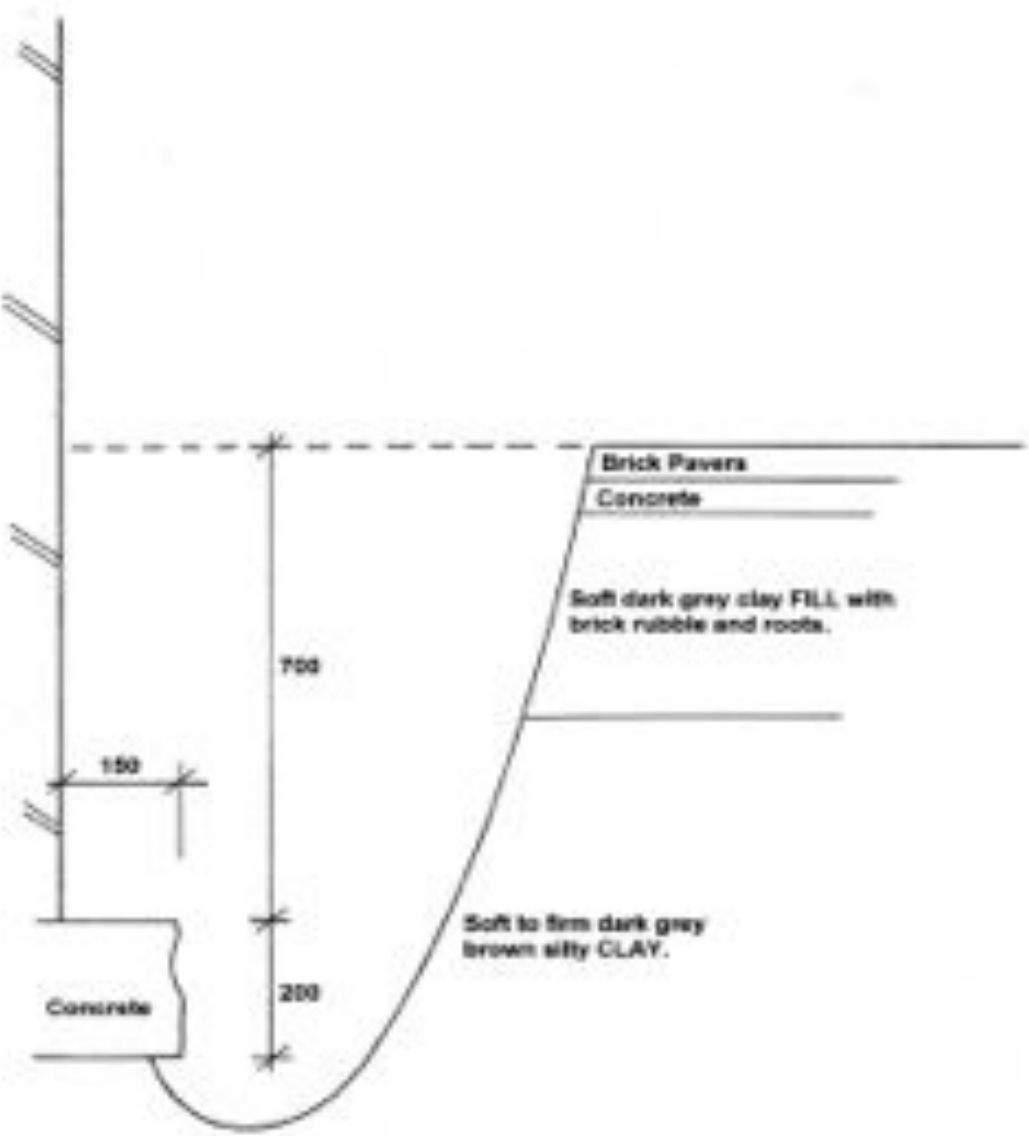
TRIAL PIT / BOREHOLE LOCATION PLAN

Not to Scale

		Appendix A	
Title:	Trial Pit & Borehole Location Plan.	Job No:	131410
	5 Kemplay Road, London, NW3 1TA.	Date:	October 2013

APPENDIX B

TRIAL PIT SECTION



Not to Scale

		Appendix B	
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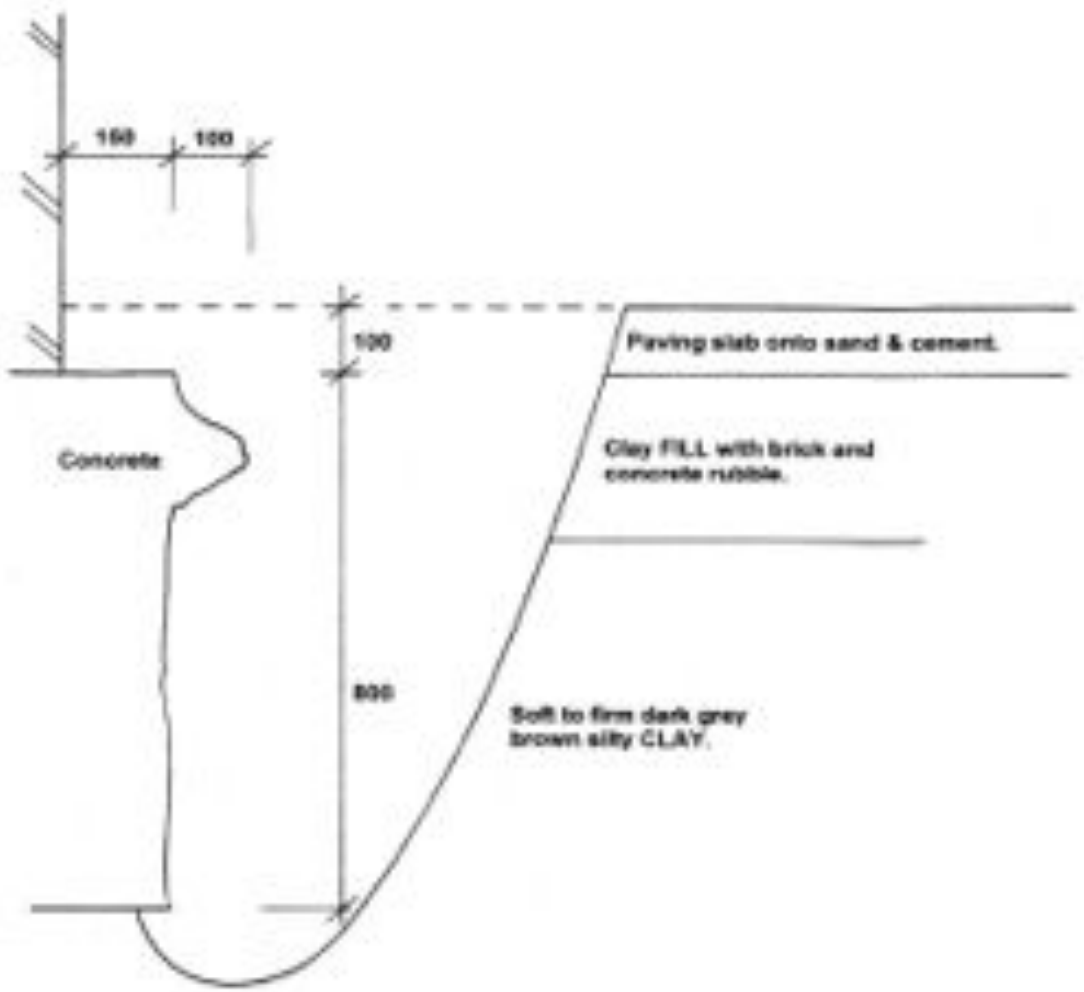
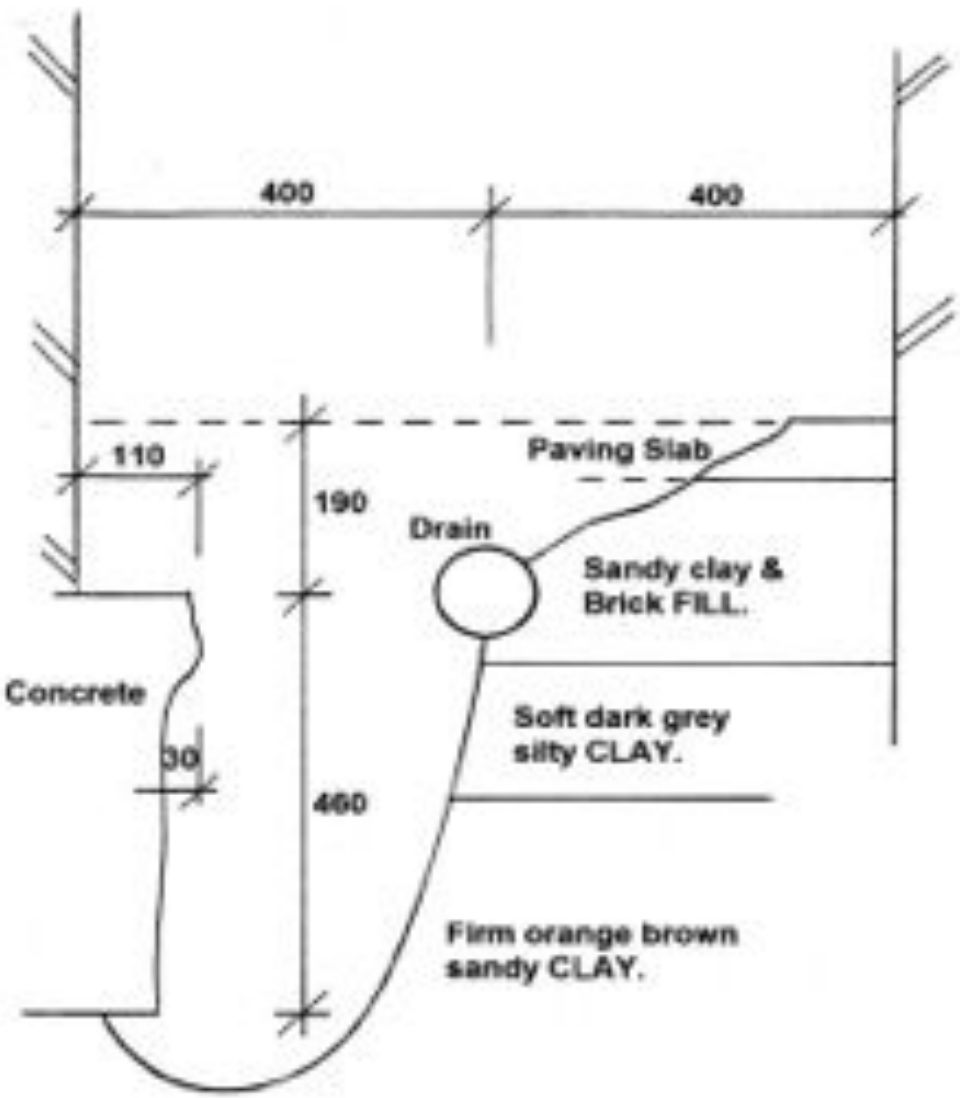
	5 Kemplay Road, London, NW3 1TA	Date:	October 2013



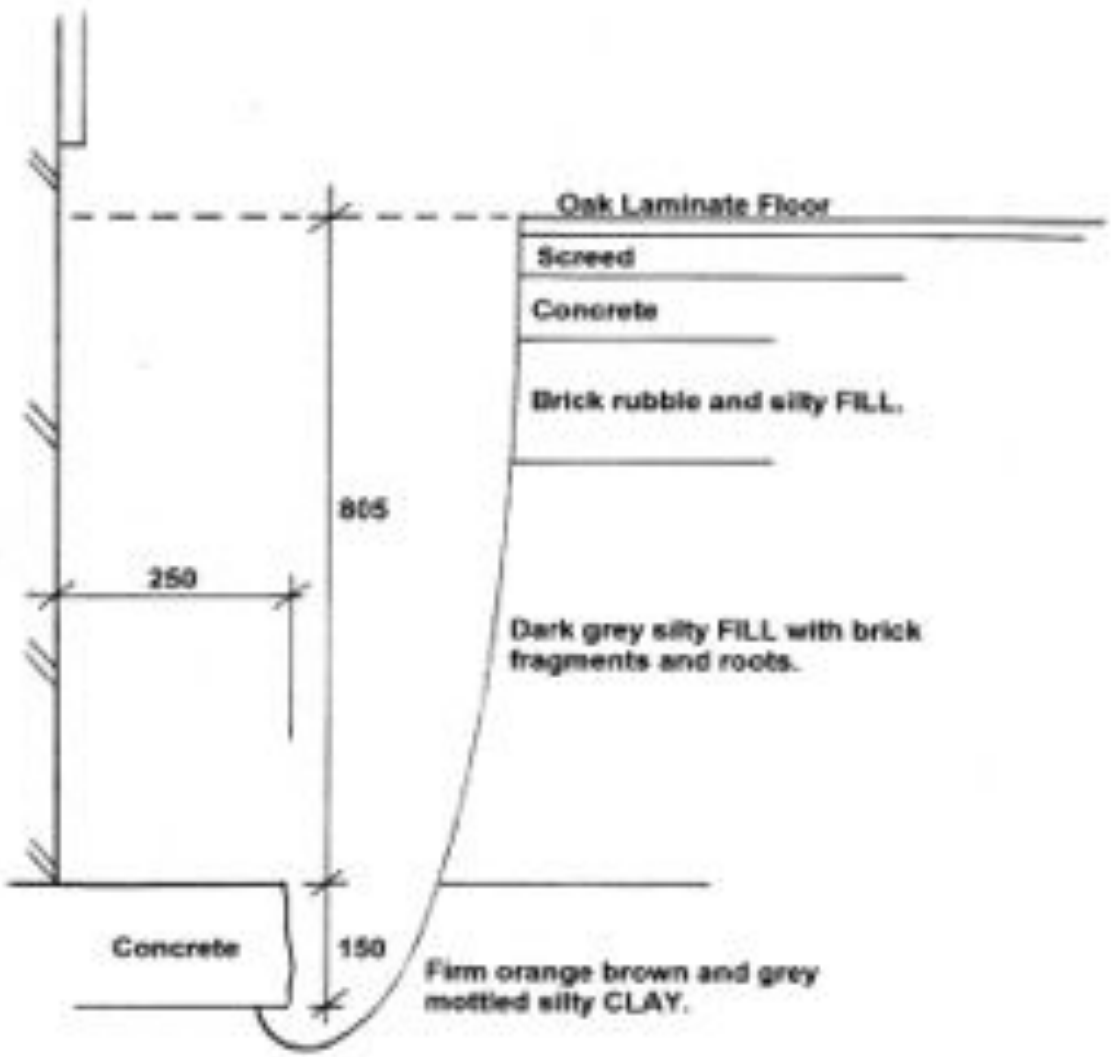
Not to Scale

		Appendix B	
Title:	Trial Pit 2 5 Kemplay Road, London, NW3 1TA	Job No:	131410
		Date:	October 2013



Not to Scale

		Appendix B	
Title:	Trial Pit 3	Job No:	131410
	5 Kemplay Road, London, NW3 1TA	Date:	October 2013



Both foundations similar.

Not to Scale

		Appendix B	
Title:	Trial Pit 4 5 Kemplay Road, London, NW3 1TA	Job No:	131410
		Date:	October 2013

APPENDIX C

BOREHOLE LOGS

BOREHOLE LOG - M R H GEOTECHNICAL

HOLE NO.	BH 1
Sheet 1 of 1	

CLIENT	SITE
[illegible]	[illegible] Road, London [illegible]

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
17/09/13 - 17/09/13	1:50	GROUND / AS APPENDIX A	SB/RA/SA	SB	131413

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m²)	DESCRIPTION OF STRATUM (thickness)	DEPTH
			Turf over topsoil (0.25)	0.25
0.50	D1	(150+)	Very stiff brown with traces of orange brown slightly sandy CLAY (2.15)	
1.00	D2	(150+)		
1.50	D3	(160+)		
2.00	D4	(150+)	Traces of root activity evident to a depth of 2.20m	2.40
2.50	D5	(148)	Stiff brown very silty CLAY (0.30)	
			Water standing at 2.53m on 27/09/2013	2.70
			Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt (1.70)	
3.00	D6	(140)		
3.50	D7	(136)		
4.00	D8	(128)		4.40
4.50	D9	(154)	Very stiff bluish grey CLAY (1.80)	
5.00	D10	(160)		
5.50	D11			
6.00	D12	(148)		6.20
			Very stiff fissured dark grey CLAY (3.80)	
7.00	D13	(164)		
8.00	D14	(176)		
9.00	D15	(170)		
			Piezometer installed	
10.00	D16	(172)	Borehole ends	10.00

Columns also headed: Standpipe / Piezo; LEGEND

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-	-	-	-	-	Dry on completion Water standing at 2.53m on 27/09/2013

BORING METHOD AND REMARKS

Mechanical auger
Piezometer installed

KEY: D = Disturbed Sample B = Bulk Sample
U = Undisturbed Sample W = Water Sample
All dimensions are in metres unless otherwise stated

BOREHOLE LOG - M R H GEOTECHNICAL

CLIENT: Sarah & Lionel Fournier			SITE: 8 Wempley Road, London [illegible]		HOLE NO. BH 2	Sheet 1 of 1
DATE OF FIELDWORK: 27/09/11 - 28/09/11	SCALE: 1:50	LEVEL/POSITION: GROUND / SEE APPENDIX A	OPERATOR: [illegible]	LOGGED BY: [illegible]	JOB NO. [illegible]	

SAMPLE RECORD DEPTH	TYPE	SPT N (Cu kN/m²)	Standpipe/Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH
				Turf over topsoil (0.10)	0.10
0.50	D1			Soft to firm dark grey sandy clay with occasional brick fragments. MADE GROUND (1.00)	
1.00	D2				1.10
1.50	D3	(48)		Soft to firm olive brown very silty, slightly sandy CLAY (0.60)	1.70
2.00	D4	(44)		Firm orange brown mottled bluish grey silty, slightly sandy CLAY (0.90) Water standing at 2.20m on 27/09/2011	
2.50	D5	(56)			2.60
3.00	D6	(52)		Firm pale brown with traces of bluish grey very silty, slightly sandy CLAY (0.80) Water seepage at 3.10m	
3.50	D7	(58)		Firm orange brown laminated pale brown very silty CLAY (0.40)	3.40
4.00	D8	(66)		Firm greyish brown with traces of bluish grey very silty CLAY (1.90)	3.80
4.50	D9	(66)			
5.00	D10	(70)			
5.50	D11				5.70
6.00	D12	(148)		Stiff grey silty CLAY (0.60)	6.30
7.00	D13	(156)		Very stiff fissured dark grey CLAY (3.70)	
8.00	D14	(170)			
9.00	D15	(178)			
10.00	D16	(176)		Piezometer installed Borehole ends	10.00

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
3.10	-	-	-	-	Water seepage at 3.10m Water standing at 2.20m on 27/09/2011

BORING METHOD AND REMARKS

Mechanical auger

Piezometer installed

KEY: D = Disturbed Sample, B = Bulk Sample, U = Undisturbed Sample, W = Water Sample

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - M R H GEOTECHNICAL

CLIENT: Sarah & Lionel [illegible]			SITE: [illegible] Templar Road, London [illegible]	HOLE NO. BH 3	Sheet 1 of 1
DATE OF FIELDWORK: 19/08/14 - 26/08/14	SCALE: 1:50	LEVEL/POSITION: GROUND / AS APPENDIX A	OPERATOR: SB/PA/SA	LOGGED BY: SB	JOB NO. [illegible]

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu kN/m²)	DESCRIPTION OF STRATUM (thickness)	DEPTH
			Turf over topsoil (0.10)	0.10
0.50	D1		Soft to firm black sandy clay with traces of brick fragments MADE GROUND (0.60)	0.70
1.00	D2		Compacted dark brown clayey sand and brick fragments MADE GROUND (0.50)	1.20
1.50	D3	(46)	Firm orange brown with traces of bluish grey silty, slightly sandy CLAY (1.50)	
2.00	D4	(44)	Water standing at 2.03m on 27/08/2014	
2.50	D5	(78)		2.70
3.00	D6	(76)	Firm brown laminated bluish grey silty, slightly sandy CLAY (0.70)	
3.50	D7	(72)	Water seepage at 3.40m	3.40
4.00	D8	(80)	Firm to stiff greyish brown with traces of bluish grey silty CLAY (1.80)	
4.50	D9	(76)		
5.00	D10	(86)		5.20
5.50	D11		Stiff grey silty CLAY (1.70)	
6.00	D12	(140)		6.90
7.00	D13	(148)	Very stiff fissured dark grey CLAY (3.10)	
8.00	D14	(160)		
9.00	D15	(174)		
10.00	D16	(178)	Piezometer installed Borehole ends	10.00

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
3.40	-	-	-	-	Water seepage at 3.40m Water standing at 2.03m on 27/08/2014

BORING METHOD AND REMARKS

Mechanical auger

KEY: D = Disturbed Sample; B = Bulk Sample; U = Undisturbed Sample; W = Water Sample

All dimensions are in metres unless otherwise stated

TEST REPORT.

ISSUED BY : M R H GEOTECHNICAL

Appendix C PAGE 4

Contract Job No.

5 Kemplay Road, London NW3 1TA 131410

Sample Strength (KN/m2) vs Depth below ground level (m)

Key to Data Points	x : BH 1	o : BH 2	+ : BH 3					

APPENDIX D

MOISTURE CONTENT TEST RESULTS AND ATTERBERG LIMIT DETERMINATIONS

TEST REPORT.

ISSUED BY : M R H GEOTECHNICAL LTD

Appendix D PAGE 1

Contract Job No.

5 Kemplay Road, London NW3 1TA 131410

SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Trial Pit No.	Depth (m)	Sample	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Description (BS 5930:1981/99)
BH 1	1.00	D1	16	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	1.50	D2	18	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	1.50	D3	19	47	16	31	0.06	Very stiff brown with traces of orange brown slightly sandy CLAY. CI: CLAY of medium plasticity. (47% passing 425um)
BH 1	2.00	D4	23	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	2.50	D5	24	44	21	23	0.13	Stiff brown very silty CLAY. CI: CLAY of medium plasticity. (100% passing 425um)
BH 1	3.00	D6	25	-	-	-		Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt
BH 1	3.50	D7	26	-	-	-		Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt
BH 1	4.00	D8	25	59	21	37	0.11	Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt. CH: CLAY of high plasticity. (100% passing 425um)
BH 1	4.50	D9	24	-	-	-		Very stiff bluish grey CLAY
BH 1	5.00	D10	27	63	24	39	0.08	Very stiff bluish grey CLAY. CH: CLAY of high plasticity. (100% passing 425um)
BH 1	5.50	D11	28	-	-	-		Very stiff bluish grey CLAY
BH 1	6.00	D12	28	-	-	-		Very stiff bluish grey CLAY
BH 1	7.00	D13	26	68	25	43	0.07	Very stiff fissured dark grey CLAY. CH: CLAY of high plasticity. (100% passing 425um)
BH 1	8.00	D14	27	-	-	-		Very stiff fissured dark grey CLAY
BH 1	9.00	D15	27	-	-	-		Very stiff fissured dark grey CLAY

METHOD OF PREPARATION : BS 1377:PART 1:1990:9.4 & PART 2:1990:8.3

METHOD OF TEST : BS 1377:PART 2:1990:4.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, S = Slotted, J = Jar, M = Mazac, SPT = Split Spoon Sample, P = Thin Piston

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

MRHGEOTE

TEST REPORT.

ISSUED BY : M R M GEOTECHNICAL LTD

Appendix D PAGE 2

Contract Job No.
5 Kemplay Road, London NW3 1TA 131410

SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m	Sample No.	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Description (BS 5930:1981,6.2)
BH 1	10.10	D14	27	-	-	-		Very stiff fissured dark grey CLAY
BH 2	0.50	D5	29	-	-	-		Firm dark grey sandy clay with occasional brick fragments. MADE GROUND
BH 2	1.00	D6	28	-	-	-		Soft to firm dark grey sandy clay with occasional brick fragments. MADE GROUND
BH 2	1.50	D7	60	66	26	40	0.10	Soft to firm olive brown very silty, slightly sandy CLAY. CH- CLAY of high plasticity. 100% passing 425um
BH 2	2.00	D8	24	-	-	-		Firm orange brown mottled bluish grey silty, slightly sandy CLAY
BH 2	2.50	D9	24	48	20	28	0.14	Firm orange brown silty CLAY. CI- CLAY of medium plasticity. 100% passing 425um
BH 2	3.00	D10	32	-	-	-		Firm pale brown with traces of bluish grey very silty, slightly sandy CLAY
BH 2	3.50	D11	30	-	-	-		Firm orange brown laminated pale brown very silty CLAY
BH 2	4.00	D12	31	68	27	41	0.10	Firm greyish brown with traces of bluish grey very silty CLAY. CH- CLAY of high plasticity. 100% passing 425um
BH 2	4.50	D13	31	-	-	-		Firm greyish brown with traces of bluish grey silty CLAY
BH 2	5.00	D14	31	-	-	-		Firm greyish brown with traces of bluish gray very silty CLAY
BH 2	5.50	D15	30	-	-	-		Firm greyish brown with traces of bluish grey very silty CLAY
BH 2	6.00	D16	30	67	26	41	0.10	Stiff grey silty CLAY. CH- CLAY of high plasticity. 100% passing 425um
BH 2	7.00	D17	29	-	-	-		Very stiff fissured dark grey CLAY
BH 2	8.00	D18	29	73	28	44	0.07	Very stiff fissured dark grey CLAY. CH/CV- CLAY of high to very high plasticity. 100% passing 425um

METHOD OF PREPARATION : BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Waxed, ATC = Split Spoon Sample, C = Core Cutter

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

TEST REPORT.

ISSUED BY : M R M GEOTECHNICAL LTD

Appendix D PAGE 3

Contract Job No.

5 Kemplay Road, London NW3 1TA 131410

SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m	Sample	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Description BS 5930:1981,6.2
BH 2	0.00	D14	28	-	-	-		Very stiff fissured dark grey CLAY
BH 2	10.10	D16	27	-	-	-		Very stiff fissured dark grey CLAY
BH 3	0.50	D1	19	-	-	-		Soft to firm black sandy clay with traces of brick fragments. MADE GROUND
BH 3	1.00	D2	17	-	-	-		Compacted dark brown clayey sand and brick fragments. MADE GROUND
BH 3	1.50	D3	27	-	-	-		Firm orange brown with traces of bluish grey silty, slightly sandy CLAY
BH 4	2.00	D4	34	69	33	36	1.16	Firm orange brown with traces of bluish grey silty, slightly sandy CLAY. CI- CLAY of medium plasticity. (96% passing 425um)
BH 4	2.50	D5	29	-	-	-		Firm orange brown with traces of bluish grey silty, slightly sandy CLAY
BH 5	1.00	D6	27	61	28	33	0.96	Firm brown laminated bluish grey silty, slightly sandy CLAY. CH- CLAY of high plasticity. (96% passing 425um)
BH 5	3.00	D7	31	-	-	-		Firm brown laminated bluish grey silty, slightly sandy CLAY
BH 6	4.00	D8	31	67	26	41	0.98	Firm to stiff greyish brown with traces of bluish grey silty CLAY. CH- CLAY of high plasticity. (100% passing 425um)
BH 6	4.50	D9	30	-	-	-		Firm to stiff greyish brown with traces of bluish grey silty CLAY
BH 7	5.00	D10	32	-	-	-		Firm to stiff greyish brown with traces of bluish grey silty CLAY
BH 7	6.50	D11	33	-	-	-		Stiff grey silty CLAY
BH 8	6.00	D12	44	87	33	41	1.07	Stiff grey silty CLAY. CH- CLAY of high plasticity. (100% passing 425um)
BH 8	7.50	D13	23	-	-	-		Very stiff fissured dark grey CLAY
BH 9	8.00	D14	29	-	-	-		Very stiff fissured dark grey CLAY

METHOD OF PREPARATION : BS 1377:PART 1:1990:7.4 & PART 2:1990:4.3

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

MRMSCT

TEST REPORT.

ISSUED BY : M R M GEOTECHNICAL LTD

Appendix D PAGE 4

Contract Job No.

6 Kemplay Road, London NW3 1TA 131410

SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Description (BS 5930:1981,41)
BH 3	4.50	D12	27	-	-	-		Very stiff fissured dark grey CLAY
BH 3	13.50	D19	29	-	-	-		Very stiff fissured dark grey CLAY

METHOD OF PREPARATION : BS 1377:PART 1:1990:7.4 & PART 2:1990:8.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE PIT : U = Undisturbed, B = Bulk, D = Disturbed, P = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

APPENDIX E

CONTAMINATION TEST RESULTS

Scientific Analysis Laboratories Ltd
Unit 3 Orbital Drive
Springwood Industrial
Estate
Braintree
Essex
CM7 2XT
Tel : 01376 560126
Fax : 01376 552620

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Report Number: 352342-1

Date of Report: 09-Oct-2013

Customer: MRH Geotechnical
60 Station Road
Chingford
London
E4 7BE

Customer Contact: Mr Steve Brooks

Customer Job Reference: 131410
Customer Site Reference: 5 Kemplay Road, London, NW3 1TA
Date Job Received at SAL: 26-Sep-2013
Date Analysis Started: 27-Sep-2013
Date Analysis Completed: 08-Oct-2013

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

1656

Report checked and authorised by :
Sarah Watt-Roy
Project Manager

Issued by :
Sarah Watt-Roy
Project Manager

SAL Reference:	352342
Project Site:	5 [illegible] Road, London, [illegible]
Customer Reference:	131410
Soil	Analysed as Soil
MCERTS	

				SAL Reference	352342 001
				Customer Sample Reference	BH1 @ 1.00m
				Date Sampled	10-SEP-2013
Determinand	Method	Test Sample	LOD	Units	
Arsenic	T257	A40	2	mg/kg	15
Boron (water soluble)	T82	A40	1	mg/kg	<1
Cadmium	T257	A40	0.1	mg/kg	<0.1
Chromium	T257	A40	0.5	mg/kg	30
Copper	T257	A40	2	mg/kg	18
Lead	T257	A40	2	mg/kg	16
Mercury	T245	A40	1.0	mg/kg	<1.0
Nickel	T257	A40	0.5	mg/kg	18
Selenium	T257	A40	3	mg/kg	<3
Zinc	T257	A40	2	mg/kg	40
Chromium VI	T6	A40	1	mg/kg	<1
pH	T7	A40			7.3
SO4(Total)	T102	A40	0.02	%	<0.02
SO4(2:1)	T112	A40	10	mg/l	18
Sulphide	T4	A40	10	mg/kg	<10
Sulphur (total)	T6	A40	0.01	%	0.01
Thiocyanate	T129	A40	10	mg/kg	<10
Cyanide(Complex)	T4	AR	1	mg/kg	<1
Cyanide(Total)	T4	AR	1	mg/kg	<1
Cyanide(free)	T4	AR	1	mg/kg	<1
Phenols(Mono)	T221	AR	0.5	mg/kg	<0.5
PAH(total)	T16	AR	0.1	mg/kg	<0.1
Moisture	T27	AR	0.1	%	14
Moisture @ 105 C	T162	AR	0.1	%	16
Retained on 2mm	T2	A40	0.1	%	<0.1

Index to symbols used in 352342-1

Value	Description
AR	As Received
A40	Assisted dried < 40C
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except [illegible]
Retained on 2mm is removed before analysis

Method Index

Value	Description
T16	GC/MS
T129	Colorimetry (IC)
T82	ICP/OES (Sim)
T112	ICP/OES (SIM)(Water Extract)
T27	Grav (1 Dec) (40 C)
T221	Colorimetry (CE)
T6	ICP/OES
T102	ICP/OES (HCl extract)
T162	Grav (1 Dec) (105 C)
T2	Grav
T7	Probe
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T4	Colorimetry

[illegible]	[illegible]
[illegible]	[illegible]

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T257	A40	2	mg/kg	M	[illegible]
Boron (water soluble)	T82	A40	1	mg/kg	N	[illegible]
Cadmium	T257	A40	0.1	mg/kg	M	[illegible]
Chromium	T257	A40	0.8	mg/kg	M	[illegible]
Copper	T257	A40	2	mg/kg	M	[illegible]
Lead	T257	A40	2	mg/kg	M	[illegible]
Mercury	T245	A40	1.0	mg/kg	U	[illegible]
Nickel	T257	A40	0.8	mg/kg	M	[illegible]
Selenium	T257	A40	3	mg/kg	U	[illegible]
Zinc	T257	A40	2	mg/kg	M	[illegible]
Chromium VI	T82	A40	1	mg/kg	N	[illegible]
pH	T7	A40			M	[illegible]
SO4(Total)	T102	A40	0.02	%	M	[illegible]
SO4(2:1)	T172	A40	10	mg/l	M	[illegible]
Sulphide	T4	A40	10	mg/kg	N	[illegible]
Sulphur (total)	T6	A40	0.01	%	M	[illegible]
Thiocyanate	T220	A40	10	mg/kg	M	[illegible]
Cyanide(Complex)	T6	AR	1	mg/kg	M	[illegible]
Cyanide(Total)	T4	AR	1	mg/kg	M	[illegible]
Cyanide(Free)	T4	AR	1	mg/kg	M	[illegible]
Phenols(Mono)	T221	AR	2.0	mg/kg	M	[illegible]
PAH(total)	T16	AR	0.1	mg/kg	U	[illegible]
Moisture	T277	AR	0.1	%	N	[illegible]
Moisture @ 105 C	T162	AR	0.1	%	N	[illegible]
Retained on 2mm	T2	A40	0.1	%	N	[illegible]

CONSULTANCY, SITE INVESTIGATION CONSTRUCTION MATERIALS TESTING, CONTAMINATED LAND SURVEYS, DESK STUDIES, RISK ASSESSMENT.

MRH GEOTECHNICAL

Our Ref: 131410/L
Your Ref: Pres Bld/SM

Trigram Partnership
Consulting Structural Engineers
Harling House
47-51 Great Suffolk Street
London
SE1 0BS

4th December 2013

Dear Sirs,

Re:. 5 Kemplay Road, London NW3 1TA

Further to our Geotechnical Report dated September 2013 and your subsequent queries, we would comment as follows:

1) The boreholes proved Claygate Beds to depths of between 3.60m - 5.70m

2) On the 27th September 2013, water levels of 2.63m, 2.20m and 2.01m were recorded in boreholes 1, 2 and 3 respectively.

3) Due to the unstable nature of Claygate beds when in an open excavation scenario with ground water present, item 6.4 of our report recommended that shoring and provision of groundwater pumping should be considered to prevent collapsing.

4) There are various methods of construction which comprise:

a) Excavation supported by watertight Sheet Piles

b) Excavation supported by a Diaphragm Wall (Utilising Bentonite)

c) Excavation supported by a watertight Contiguous Bored Pile Wall

However, the overall design will depend upon the practicality of access, costs and the guarantee that no adjacent structures will suffer settlements during the excavation operations.

We trust you find the above satisfactory. If however you have any further queries, please do not hesitate to contact us.

Yours faithfully

Stephen Hudson

Stephen Hudson
MRH Geotechnical Limited

Appendix G - Structural Scheme Calculations

The loadings for the main structural elements have been assessed, and the elements sized for the purposes of validating the proposed structural concepts. These calculations are here appended.

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

Job No.	Sheet No.	Rev.
9-16	01	

Made By	Dated	Chkd
QM	Dec 2013	

5 KEMPLAY ROAD, NW3
STRUCTURAL CALCULATIONS

Scheme Calculations in Support of Concept Proposals.

Proposed Basement.

The r.c. 'box' will support the superstructure, via the ground floor slab acting as a transfer structure.
Ground pressures will be supported by the walls generally acting as propped cantilevers, one section will ~~and~~ be designed as a cantilevered r.c. wall.

The r.c. 'box' will be designed to BS8007 using service loads & lower permissible steel stresses.

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Made By	Dated	Chkd.
DW	12/3/03	

Buoyancy: Depth to U/S of basement slab
= 3.2m

Allow for water @ ¾ x depth = 2.4m
in OB below GL.
Standpipe recorded ground water 2m² below GL

∴ Max water pressure = 2.4 x 10 = 24 kN/m²

Plan area of basement = 9.8 x 4.6m
= 45.1m²

∴ Total Uplift = 45.1 x 24 = 1082 kN

Consider 350 slab & 250 lining walls:-

⇒ DL = (45.1 x 0.35 x 24) + [(2 x (9.8 + 4.6)) x 3.2 x 0.25 x 24]
= 379 + 553 = 932 kN < Uplift
∴ Buoyant.

Consider 250 ground floor slab:-

DL = 45.1 x 0.25 x 24 = 271 kN

∴ ΣDL = 271 + 932 = 1203 kN

∴ FoS Buoyancy = 1203/1082 = 1.11 > 1.0
< 1.5

Consider Superstructure:-

Roof	DL, say	0.8
2nd	DL, say	0.7
1st	DL, say	0.7
		2.2 kN/m²

Partition walls @ 1.0 kN/m² ave (external walls excluded)

2nd	1.0
1st	1.0
	4.2 kN/m²

∴ Extra DL = 45.1 x 4.2 = 189 kN

⇒ ΣDL = 189 + 1203 = 1392

⇒ FoS = 1392/1082 = 1.29 < 1.5

P70

TP06

TRIGRAM PARTNERSHIP
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Job No.	Sheet No.	Rev
4160	03	

Made By	Date	Chkd
JH	11/2013	

Consider external walls (front & 2 sides, only)
@, say 24 kN/m²

Height = 6m
Length = 4.6 + 9.8 + 8.6 = 19.0m

∴ Extra W = 2 × 19 × 6 = 228 kN

∴ ΣW = 228 + 1392 = 1620 kN

⇒ FoS = 1620/1102 = 1.50 ∴ OK

Summary: For the 'permanent' condition, the completed house would have a Factor of Safety for Buoyancy of 1.50, under Dead Loads alone, for a 3/4 height head of water.
During construction, until the ground floor slab has been cast, it should be considered as 'buoyant'.

Consider the known Water Level:

The highest recorded water level was 2.0m below GL! ∴ Consider 0.5m higher:-

∴ Max water pressure = (3.2 − 1.5) × 10
(1.7m head) = 17.0 kN/m²

∴ Σ Uplift = 17.0 × 44.1m²
= 767 kN

∴ For slab & walls alone,

FoS buoyancy = 933/767 = 1.22 > 1.0

For 2.0m head, Σ uplift = 20 × 45.1 = 902 kN

⇒ FoS = 933/902 = 1.03 < 1.5

Summary: During construction, until the Ground floor slab has been cast, provision to ballast or float the basement 'box' must be made, if the ground water level were to rise higher than, say, 1.5m below the ground level.

TPOC

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Made By	Dated	Chkd.
JH	12/2013	

Basement slab :- 9.8 x 4.6 m

No internal load-bearing walls

consider as one-way spanning simply supported

Span : 4.4 m (c/c of walls)

limit span/depth = 20, ⇒ d = 0.22 m

cover = 40 ∴ h ≥ 220 + 40 + 16 + 16/2
= 284 mm

Try h = 350 mm
d = 350 - 40 - 16 - 8
= 286 mm

For water at 3/4 depth = 2.4 m, pressure = 24 kN/m² (LL)

⇒ M max = 24 × 4.4²/8 = 58.1 kNm/m wide *

b = 1000
h = 350
d = 286
f_{cu} = 40
f_y = 130

$K = M/bd^2 f_{cu} = 0.018$

⇒ z = 0.95 d = 272 mm

⇒ $A_{s\,req'd} = M/0.95 f_y z$

= 1730 mm²/m Top, Mid-Span

H16 @ 100% ⇒ $A_{s\,prov}$ = 2010 mm²/m ∴ OK.

[$A_{s\,min}$ = 0.0035 A_c = 1225 mm²/m ie 613 mm²/m Each Way, Top & Bot]

* In reality this will be reduced by the Moment at the base of the outer walls (PTO).

$M_{midspan}$ = 58 - 29 = 29 kNm/m (SLS)

∴ $A_{s\,req'd}$ = 863 mm²/m

H12 @ 125% ⇒ $A_{s\,prov}$ = 905 mm²/m ∴ OKAY

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

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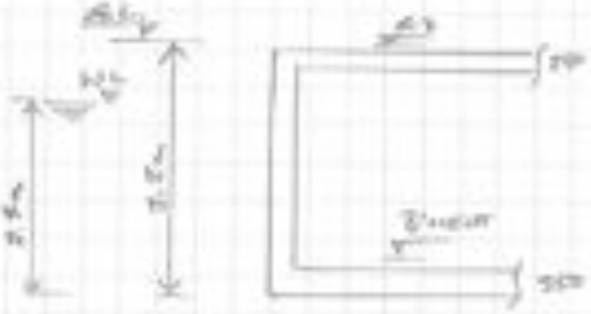
4160	4	05

Made By	Date	Chkd
TW	12/2012	

Basement Walls:-

Consider soil density = 18 kN/m³

and K_a = 0.33



Simplify to:-

Surcharge - allow 10kN/m² for 'construction' loading

1. Max pressures:-

soil: 3.2 × 0.33 × 18 = 19.0 kN/m²

water: 2.4 × 10 = 24.0

surcharge: 10 × 0.33 = 3.3

2. Forces:-

F_1 = $\frac{19.0}{2}$ × 3.2 = 30.4 kN/m

F_2 = $\frac{24.0}{2}$ × 2.4 = 28.8

F_3 = 3.3 × 3.2 = 10.6

Consider Propped Cantilever:-

See Tedds analysis:-

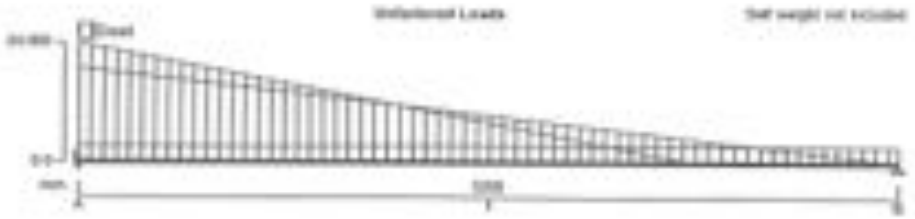
Max -ve = -29.2 kN/m @ wall (SLS)

Max +ve = +12.6

V_{max} base = 66.3 kN/m

V_{max} top = 13.5

P.T.O.



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm² Material density = **7860** kg/m³

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Restrained"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **3200** mm Cross-sectional area = **1000** mm² Moment of inertia = **1.00×10⁶** mm⁴

LOADING DETAILS

Span 1 loads:

Load 1 UDL Dead load **3.3** kN/m from **0.000** m to **3.200** m

Load 2 VDL Dead load **19.0** kN/m at **0.000** m to **0.0** kN/m at **3.200** m

Load 3 VDL Dead load **24.0** kN/m at **0.000** m to **0.0** kN/m at **2.400** m

LOAD COMBINATIONS

Load combination 1

Span 1 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-56.3** kN Min react = **-56.3** kN Max mom = **-29.2** kNm Min mom = **-29.2** kNm

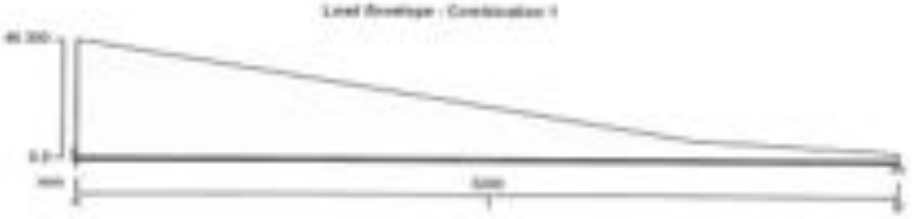
Support B Max react = **-13.5** kN Min react = **-13.5** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

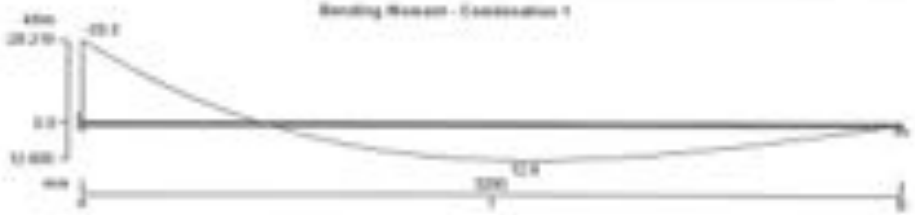
Maximum shear = **56.3** kN Minimum shear F_{min} = **-13.5** kN

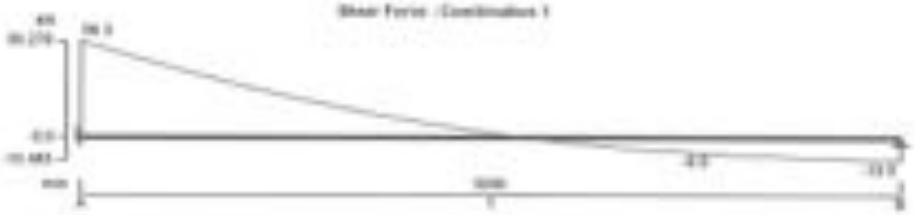
Maximum moment = **12.6** kNm Minimum moment = **-29.2** kNm

Maximum deflection = **50.7** mm Minimum deflection = **0.0** mm



Tedds	Project: 5 Kemplay Road, NW3				Job no. 4160 / 07	
	Calcs for: Scheme: basement wall (propped)				Start page no./Revision: 2	
	Calcs by: BH	Calcs date: 05/12/2013	Checked by:	Checked date:	Approved by:	Approved date:





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Made By	Date	Chkd
BV	12/2013	

Wall height = 3.2 - 0.3 = 2.9m (between ℄'s of slabs)

Limit l/h of, say, 20 ⇒ $d_{min} = \frac{2900}{20} = 145$

Cover = 40 ∴ h_{min} = 145 + 40 + 12 + 6
= 203mm

Try h = 250

⇒ d = 250 - 40 - 12 - 6 = 192mm

A) M = -29.2 kNm/m (ULS) :-

b = 1000
h = 250
d = 192
f_{cu} = 40
f_y = 130

$K = M/bd^2 f_{cu} = 0.020$

⇒ z = 0.95d = 182mm

∴ $A_{s,req'd} = M/0.95 f_y z$

= 1299 mm²/m VERT, OUTER FACE, BOTTOM OF WALL

H16 @150 c/c ⇒ $A_{s,prov}$ = 1340 mm²/m.

B) M = + 12.6

⇒ $A_{s,req'd}$ = 560 mm²/m VERT, INNER FACE, MID-HEIGHT

H12 @150 c/c ⇒ $A_{s,prov}$ = 754 mm²/m.

C) $A_{s,min}$ = 0.0025 A_c = 875 mm²/m ie 438 mm²/m Each Way, Each Face

∴ Provide H10 @150 c/c Horiz, each face

⇒ $A_{s,prov}$ = 523 mm²/m

D) Shear:- $v = V/bd = \frac{56.2 \times 10^3}{1000 \times 192} = 0.29$ N/mm² (ULS)

$100 A_s/bd = \frac{100 \times 1340}{1000 \times 192} = 0.70$, $d = 192$ } T33 ⇒ $v_c = 1.17 \times 0.67$
= 0.78 N/mm²

$v < v_c$ ∴ No links req'd

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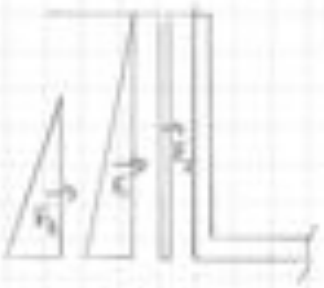
JW	12/2015	

Cantilevered Wall:-



	(SLS)		(SLS)
		Lever Arm	Moment
F_1 =	30.4 kN/m	1.07 m	32.5 kNm/m
F_2 =	28.8	0.8	23.0
F_3 =	10.6	Lb m	17.0
V_{max} =	69.8 kN/m		M_{max} = 72.5 kNm/m

b = 1000
h = 250
d = 192
f_{cu} = 40
f_y = 130

$K = M/bd^2 f_{cu} = 0.049$

$\Rightarrow z = 0.94d = 180$ mm

$\therefore A_{s,req'd} = M/0.95 f_y z$

$= 3761$ mm²/m (= 1.3 % A_c)

H20 @ 100% $\Rightarrow A_{s,prov} = 3140$ mm²/m

is Heavily reinforced

$\therefore$ Consider as a propped cantilever

& provide a horizontally spanning beam at the top of the wall.

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Made By	Dated	Chkd.
TB	12/2013	

Basement Wall Surcharges from Buildings:

N°7:- Consider Party Wall:-

Wall DL: 9" brick @ 20 kN/m³
+ finishes = 5 kN/m²

height = 6.5 m
= 33 kN/m (DL)

Consider a loaded width supported by the wall = $\frac{4.8}{2}$ = 2.4 m

Roof	DL	1.0
	IL	0.75
		1.75
Attic	DL	0.30
	IL	0.25
		0.55
1st	DL	0.6
	IL	1.5
	Partitions	1.0
		3.1

Σ = 6.4 kN/m² × 2.4 m = 15.0 kN/m
+ Self Wt 33
46 kN/m (UL)

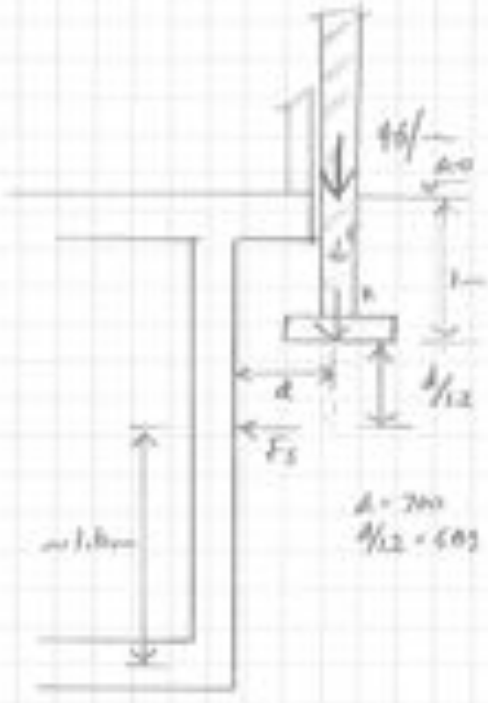
(Allows for 1 m ϕ wall = 6.2 kN
= 18 + 3
= 21 kN/m — NOT ADDITIONAL)

Allows for 1 m ϕ wall = 5 kN/m

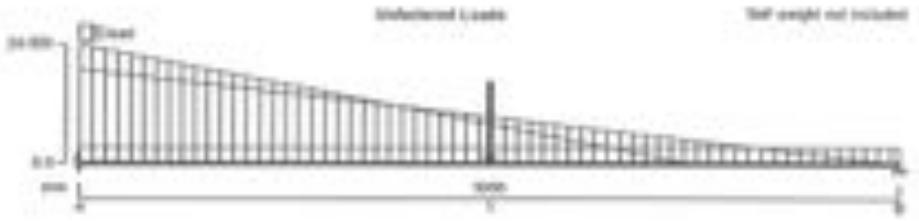
∴ Σ Line load on Footing = 51 kN/m
= F1

$F_s = K_a n = 0.33 \times 51$
= 16.8 kN/m
acting 1.6 m above 'base'.

See Toddy analysis



Tedds	Project: 5 Kemplay Road, NW3				Job no: 4160 / 11	
	Calcs for: Scheme: surcharged basement wall (propped)				Start page no./Revision: 1	
	Calcs by: BH	Calcs date: 05/12/2013	Checked by:	Checked date:	Approved by:	Approved date:



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = 1

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7850** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Restrained"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **3200** mm Cross-sectional area = **1000** mm^2 Moment of inertia = **1.00×10^6** mm^4

LOADING DETAILS

Span 1 loads:

Load 1 Point Dead load **16.8** kN at **1.600** m

Load 2 UDL Dead load **3.3** kN/m from **0.000** m to **3.200** m

Load 3 VDL Dead load **19.0** kN/m at **0.000** m to **0.0** kN/m at **3.200** m

Load 4 VDL Dead load **24.0** kN/m at **0.000** m to **0.0** kN/m at **2.400** m

LOAD COMBINATIONS

Load combination 1

Span 1 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

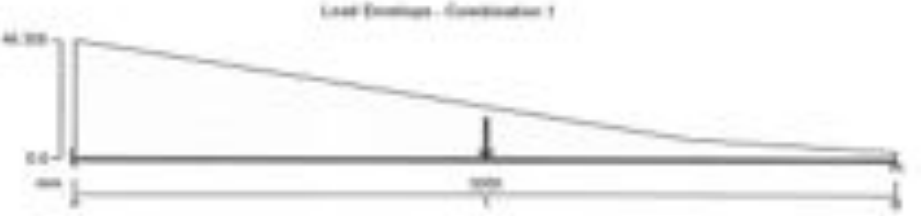
Support A	Max react = **47.8** kN	Min react = **47.8** kN	Max mom = **-39.3** kNm	Min mom = **-39.3** kNm
Support B	Max react = **-18.7** kN	Min react = **-18.7** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

Maximum shear = **47.8** kN Minimum shear F_{min} = **-18.7** kN

Maximum moment = **20.8** kNm Minimum moment = **-39.3** kNm

Maximum deflection = **75.7** mm Minimum deflection = **0.0** mm



Tedds	Project: 5 Kemplay Road, NW3				Job no: 4160 /12
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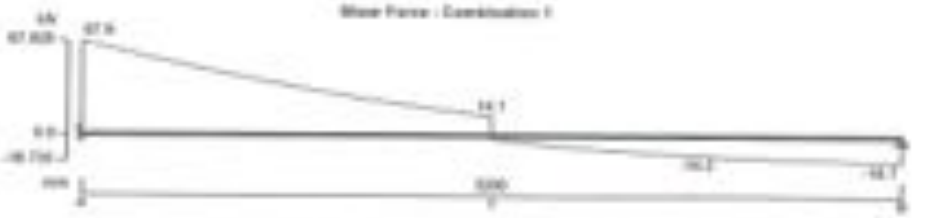
	Calcs by: BH	Calcs date: 05/12/2013	Checked by	Checked date	Approved by	Approved date



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BH	12/2012	

$M_{max\ -ve}$ = -39.7 kNm/m (ULS)

$M_{max\ +ve}$ = 20.8 kNm/m

$V_{max\ base}$ = 62.8 kN/m

$V_{max\ top}$ = 18.7 kN/m

A) M = -39.7 kNm/m

b = 1000
h = 200
d = 192
f_{cu} = 40
f_y = 120

$K = M/bd^2 f_{cu}$ = 0.027

$\Rightarrow z = 0.95d$ = 182 mm

$\therefore A_{s\,req'd} = M/0.95 f_y z$ = 1748 mm²/m

H16 @ 100% $\Rightarrow A_{s\,prov}$ = 2010 mm²/m

VERT, OUTER FACE, BASE

B) M = +20.8 $\Rightarrow A_{s\,req'd}$ = 925 mm²/m

H12 @ 100% $\Rightarrow A_{s\,prov}$ = 830 mm²/m

VERT, MIDPT, INNER FACE

c) V_{max} = 62.8 × 1.4 = 94.3 kN/m (ULS)

$\Rightarrow v = V/bd$ = 0.49 N/mm²

$100A_s/bd = 100 \times 2010/1000 \times 192 = 1.05$

d = 192

73.9 $\Rightarrow v_c = 1.17 \times 0.77$ = 0.90 N/mm²

$v < v_c$ ∴ NO LINKS REQ'D.

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CONSULTING STRUCTURAL ENGINEERS

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Made By	Date	Chkd
BM	12/2013	

General Foundations:-

Σ DL + IL of superstructure = ?

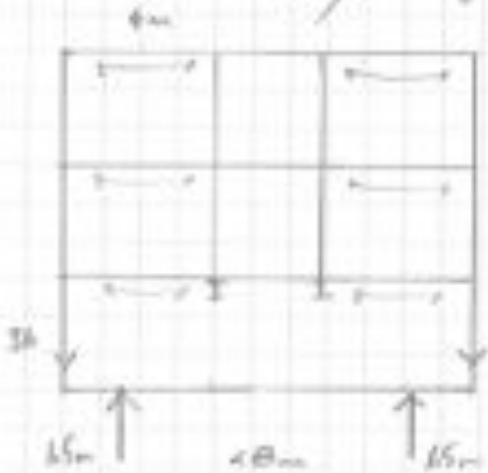
Roof DL 1.0
IL 0.75
1.75 kN/m²

2nd Floor DL 0.75
IL 1.50
Partitions 1.00
Services 0.25
3.5 kN/m²

1st Floor:
as 2nd: 3.5 kN/m²
Σ = 9 kN/m² (OK!)

Outer Walls: cavity wall DL = 2.0 kN/m²
height = 9m
18 kN/m

Consider strip footings carrying cantilevered slab:-



Supported width = 9/2 = 2m
∴ Σ load on cantilever
= (2 × 9) + 18
= 36 kN/m (OK)

Ground Floor RC slab:-

Consider 250 slab
∴ DL = 0.25 × 24
= 6 kN/m²

∴ Reaction into footings
= 36 + (4.5 × 6) = 63 kN/m (OK!)

∴ for 100 kN/m² safe bearing capacity,
750 wide footings OKAY

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

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Made By	Date	Chkd
DB	12/2013	

<u>RC Slab</u>

M cantilever ≈ ?

length ≈ 1500

$l/d = 7 \therefore d_{min} = 214$ mm

top cover = 20 ⇒ h = 214 + 20 + 10 + 10
= 254 mm

Try h = 250
d = 250 − 20 − 10 − 10
= 210 ⇒ SW = 0.21 × 24 = 5.0 kN/m² × 1.4
= 7.0 kN/m² (ULS)

IL	75 screed	1.8
	finishes	1.2
	Domestic	1.5
	Partitions	1.0
		5.5 kN/m² × 1.6 ⇒ 8.8 kN/m² (ULS)

Σ = 15.8 kN/m (ULS)

36 × 1.5
= 54 kN/m

$\therefore M_{max,-ve} \approx (54 \times 1.5) + (15.8 \times \frac{1.5^2}{2})$
≈ 81 + 18 = −99 kNm

b = 1000
h = 250
d = 210
$f_{cu} = 35$
$f_y = 460$

Design to BS8110:-

$K = M/bd^2 f_{cu} = 0.064$

⇒ z = 0.92d = 194 mm

$\therefore A_{s\,req'd} = M/0.95 f_y z = 1168$ mm²/m Top

<u>H16 @ 150</u> ⇒ $A_{s\,prov}$ = 1340 mm²/m ∴ ok

<u>Check Shear:-</u>

$v = V/bd$ V = 54 + (1.5m × 15.8) = 141 kN/m (ULS)

⇒ $v = \frac{141 \times 10^3}{1000 \times 210} = 0.67$ N/mm²

$100A_s/bd = 0.64$, d = 210 } T3.9 ⇒ v_c = 1.12 × 0.64 = 0.72 N/mm²

$0.5v_c < v < (0.4 + v_c)$

∴ Use Nominal Links.

pto

$A_{sw} = 0.4\, b_w\, s_v / 0.95 f_{yv}$

$b_w = 1000$
$s_v = 0.75 d \Rightarrow 150\%$ ⇒ $A_{sw} = 0.4 \times 1000 \times 150 / 0.95 \times 460$
$f_{yv} = 460$
$= 137 mm^2/m$

Links H8 @ 300 horiz $\%_c$
150 max $\%_c$ ⇒ $A_{s\,prov} = 168 mm^2/m$ ∴ ok

Check Deflection :-

Span/depth $= 1500/210 = 7.14$

$M/bd^2 = 99 \times 10^3/1000 \times 210^2 = 2.24 N/mm^2$
Service Stress $= \frac{1168}{1340} \times 288 = 251 N/mm^2$
} T3.11 ⇒ Tension Mod Factor $= 1.16$

∴ Permissible Span/depth $= 7 \times 1.16 = B.1$
∴ 7.14 ok

∴ 250 slab OKAY.