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 4160A/BH/November 2014

5 Kemplay Road, London, NW3

Structural Report on the Proposed Basement Extension

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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 the house footprint, with an open sunken patio to the rear.

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.

Water levels have been monitored over a period in excess of one year, with fluctuations being associated with periods of heavy rainfall. The records are appended at F.

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 the majority 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 3.3m below the Ground Floor level. Therefore the excavation would be approximately 3.7m below Ground Floor. The highest recorded ground water level is approximately 1.5m 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. However, to minimise any risk of the base of the excavation from softening due to water pressures, the pile wall could extend down into the under-laying Clay, thus forming a cut-off wall. Outer piles could then be withdrawn after the basement has been constructed, to allow natural flow across the site to be re-established.

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 has be checked for buoyancy for each stage of construction, and to provide a good factor of safety, it is proposed to use tension piles. These will limit the spans of the basement slab, for downwards and upwards pressures, as well as providing the resistance to buoyancy.

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. The r.c. ground floor slab will cantilever beyond the r.c. basement walls, to support load-bearing cavity walls, and steel 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.

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)

November 2014

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; install remedial wall ties to No 3 if required.
- 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 remainder of wall and then slab reinforcement; cast upper wall sections, then the Ground Floor slab.
- When concrete has reached working strength, remove falsework, formwork, and propping.
- Erect superstructure

Appendix B - Designer's Risk Assessment Summary

General

The works involve excavations alongside several boundary and Party walls.

Particular Residual Risks

Basement.

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 1.5 – 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 basement slab has achieved working strength, and can be considered to be fully anchored to the tension piles.

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

Superstructure.

The superstructure external walls are to be supported off cantilevered slab edges. Therefore, the concrete must be up to working strength before being fully loaded, and up to at least 50% of working strength before any loads are supported. Cube testing will be required.

Lateral stability of the superstructure must be maintained during construction, until the floor diaphragms are complete and tied into the orthogonal shear walls.

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.

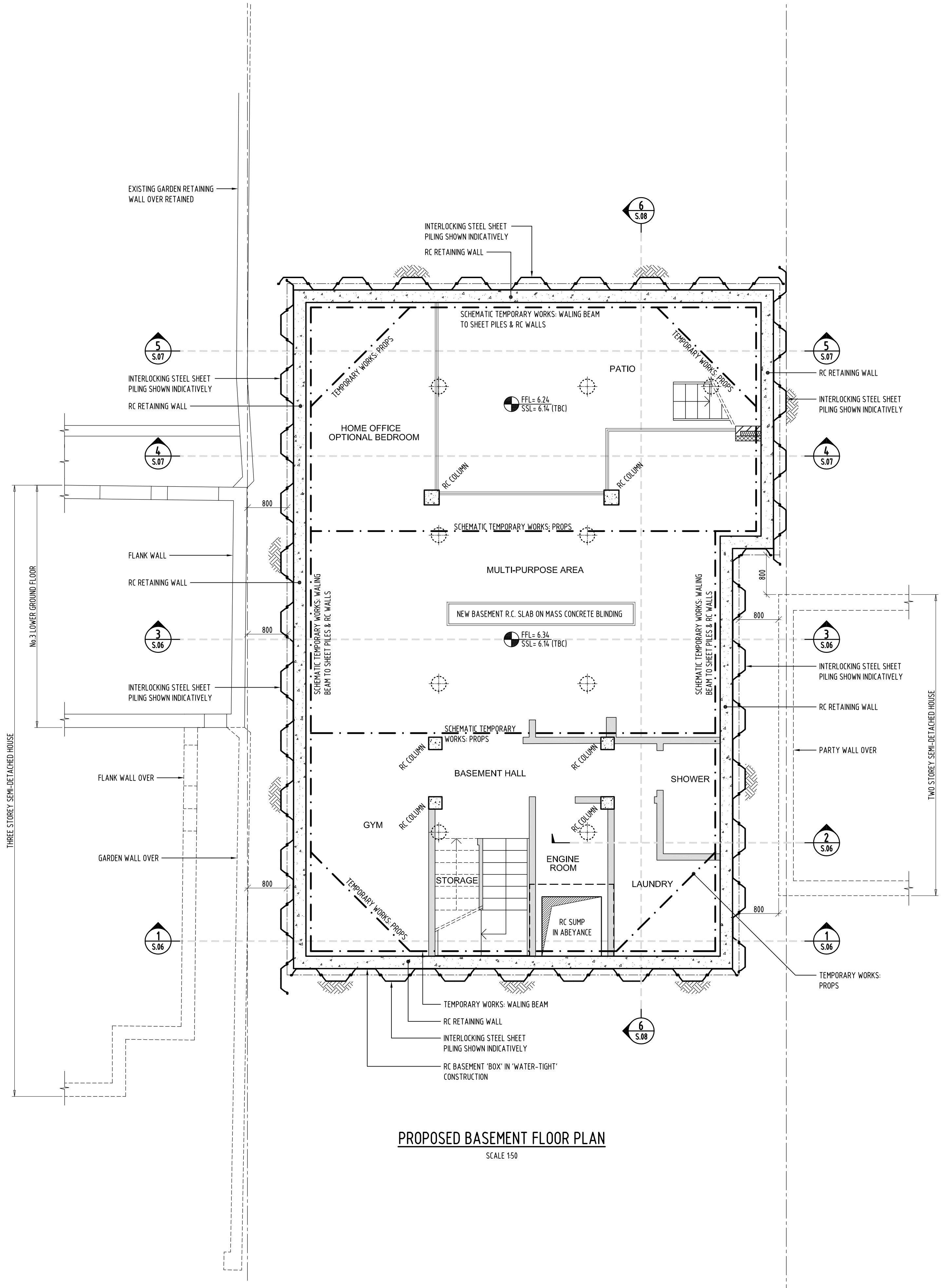
The proposed methodology and sequence of works will be vetted by the design team. The proposed loadings will be agreed with Trigram Partnership.

Appendix E - Concept Drawings

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

As Proposed - Plans - 4160/S/01 revision A – 02 revision A
Sections - 4160/S/06 - 08

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



PROPOSED BASEMENT FLOOR PLAN

SCALE 1:50

NOTES

1. GENERAL:

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

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

1.5 FOR MATERIALS AND WORKMANSHIP GENERALLY REFER TO STRUCTURAL SPECIFICATION.

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

NOTE 'D'

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

LEGEND:

- EXISTING WALL
- NEW REINFORCED CONCRETE WALL
- BRICKWORK / CAVITY / BLOCKWORK } CAVITY WALL
- NEW NON LOAD BEARING PARTITIONS
- LOAD BEARING WALL UNDER
- WALL TO BE DEMOLISHED
- DENOTES STEEL BEAM UNDER
- DJ — NEW DOUBLE JOISTS BOLTED TOGETHER TO STANDARD DETAIL D.52

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DRG STATUS: PLANNING

ARCHITECT: TAG ARCHITECTS

JOB TITLE: 5 KEMPLAY ROAD LONDON, NW3

DRG TITLE: AS PROPOSED BASEMENT FLOOR PLAN

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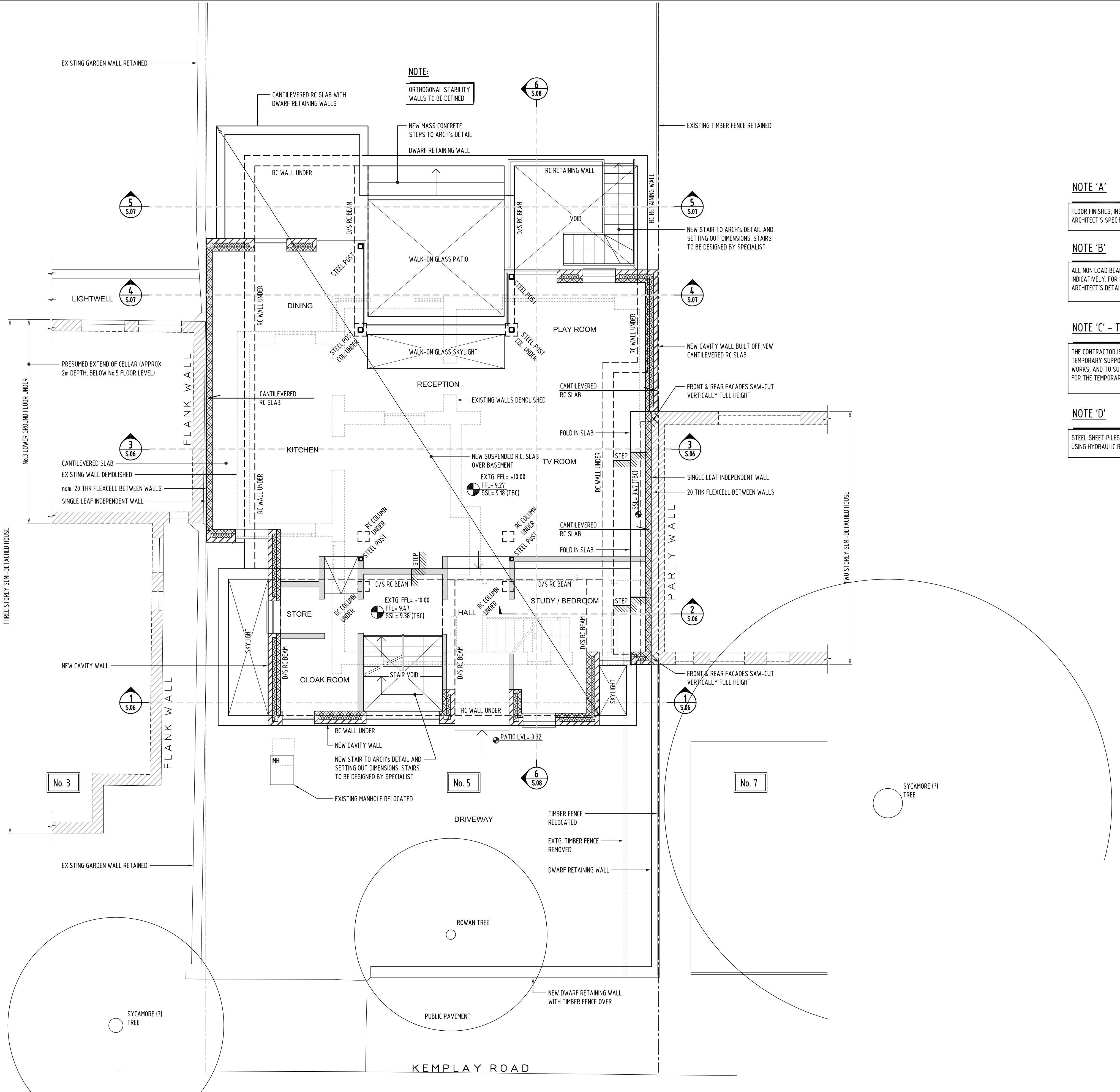

PROPOSED GROUND FLOOR PLAN
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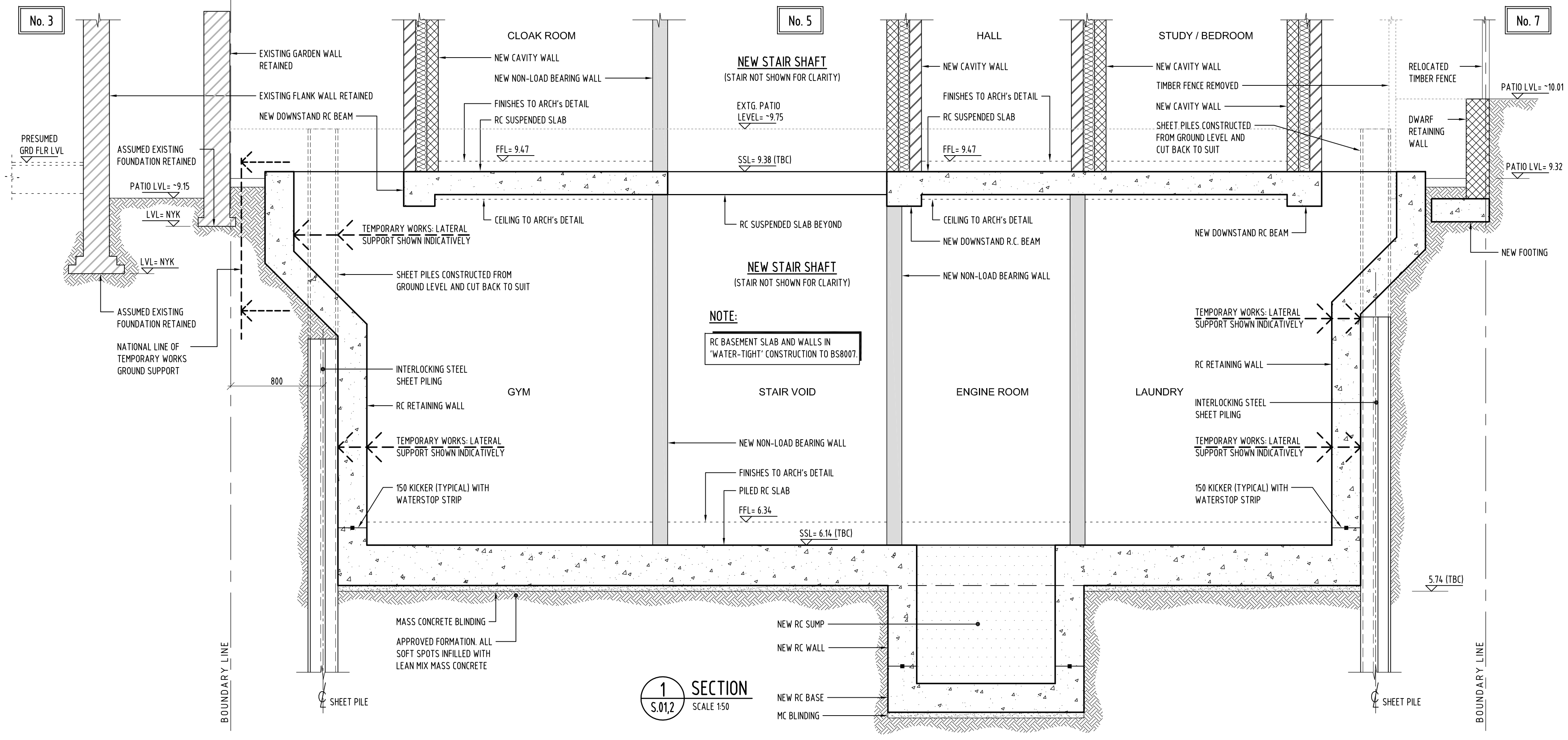

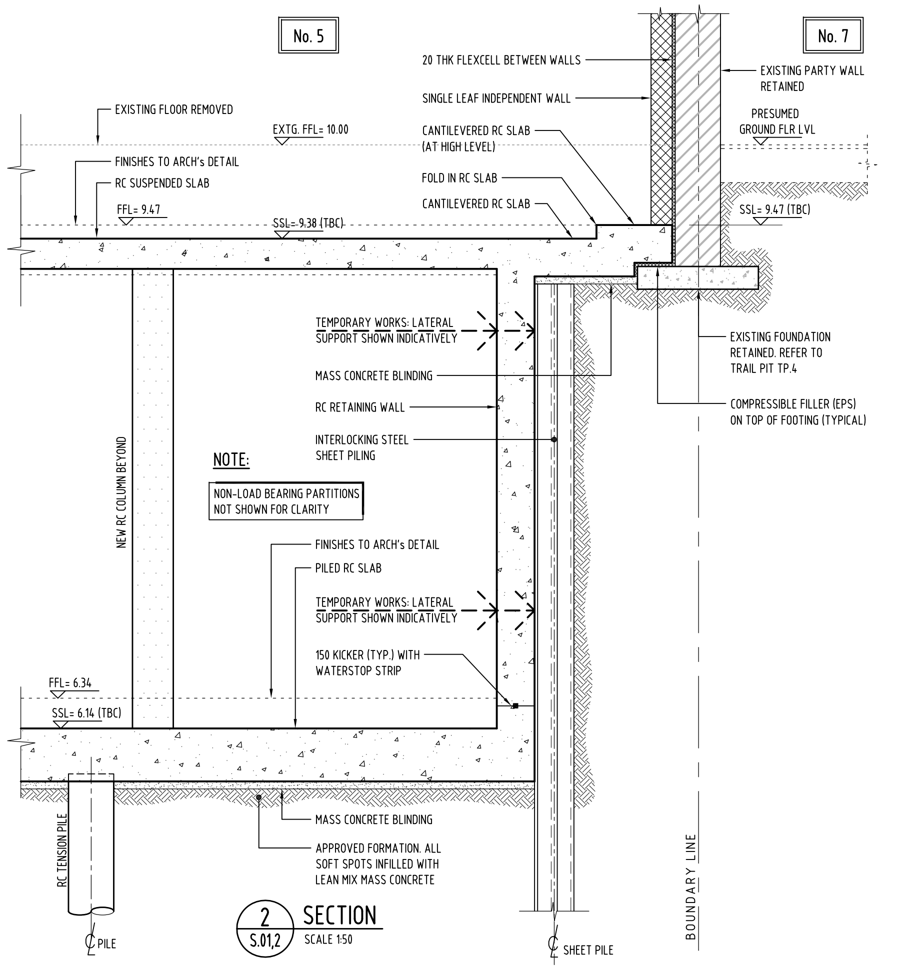

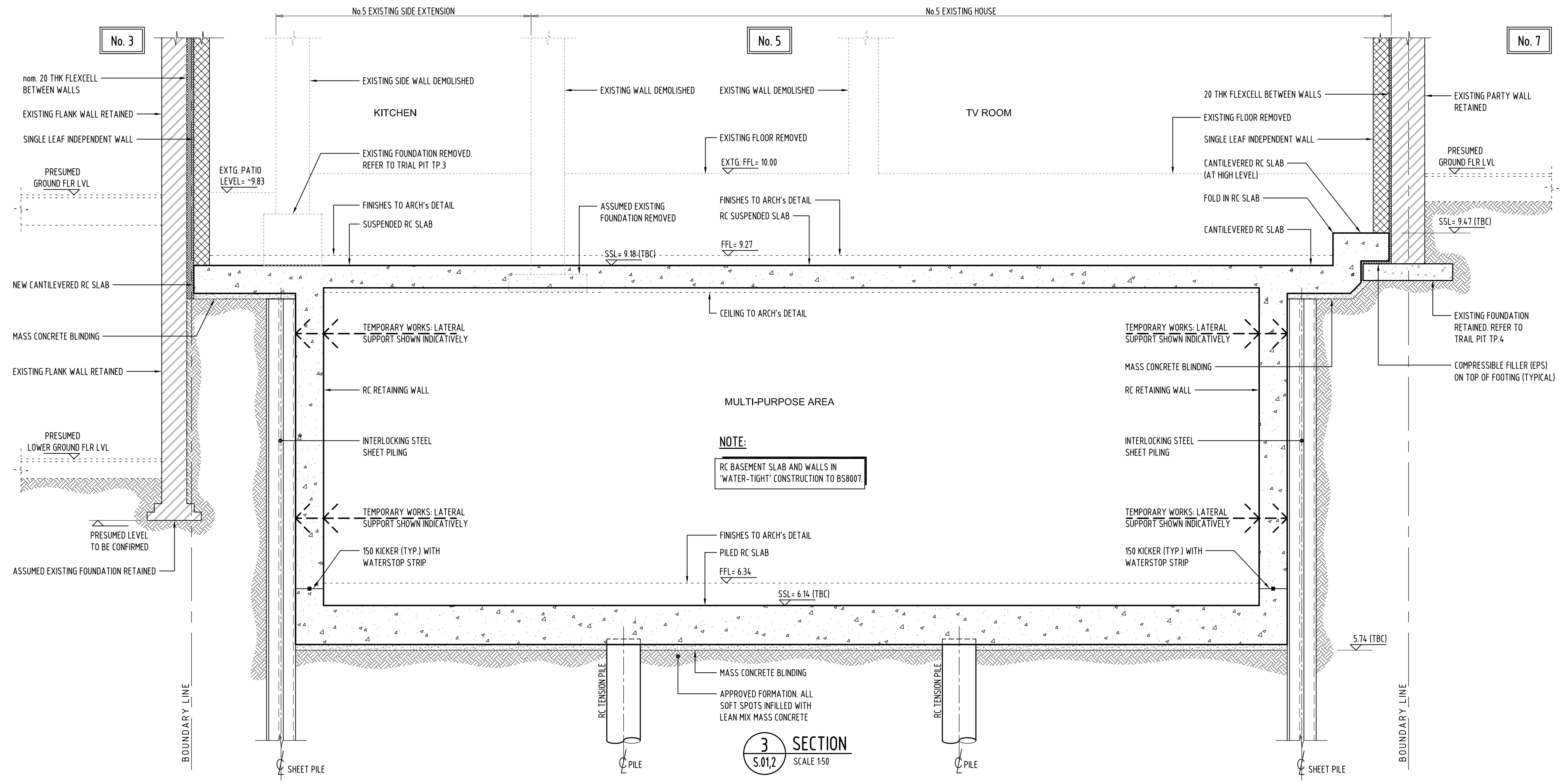

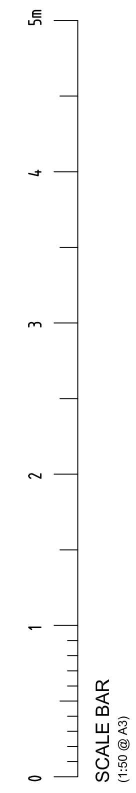

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←----- DENOTES INDICATIVE TEMPORARY PROPPING

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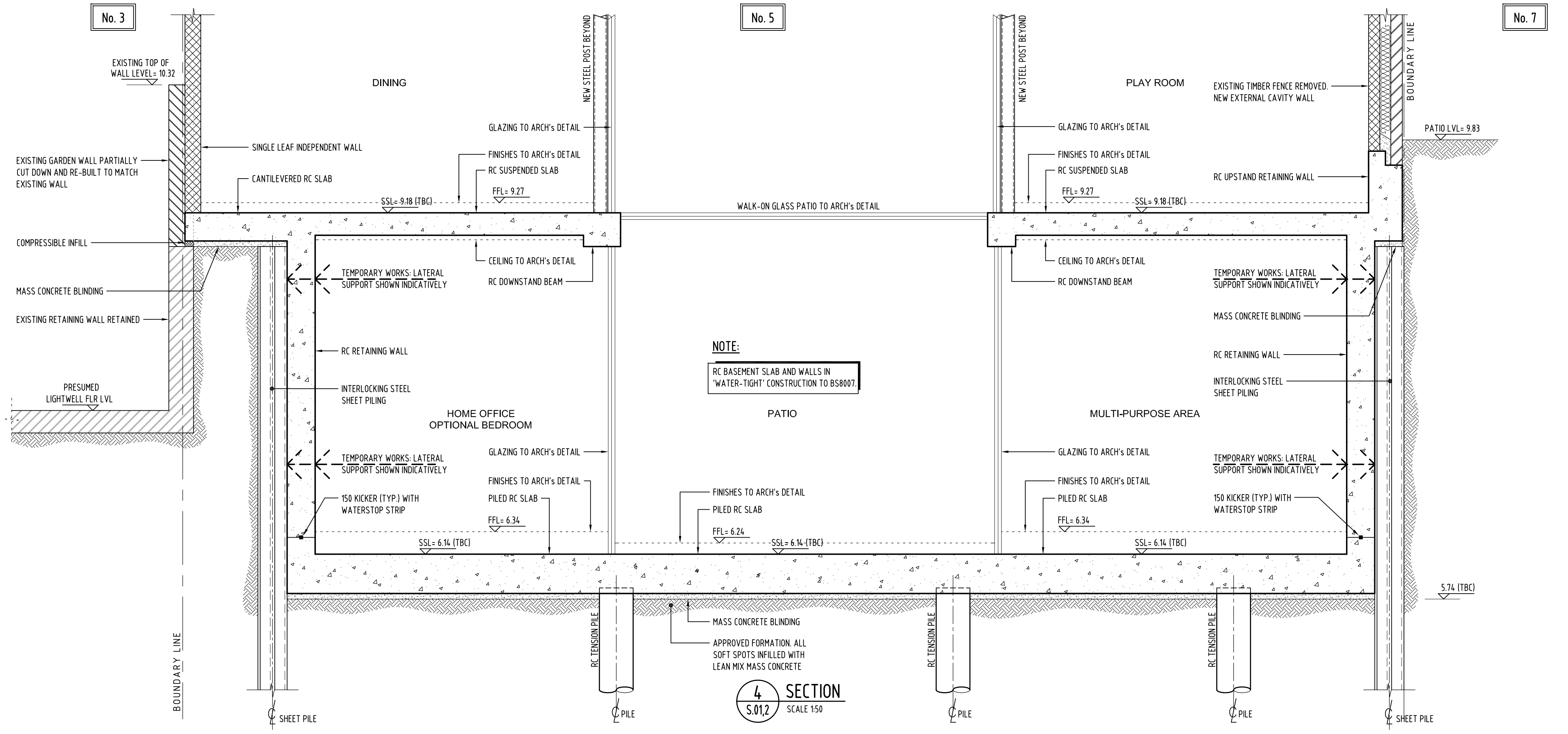

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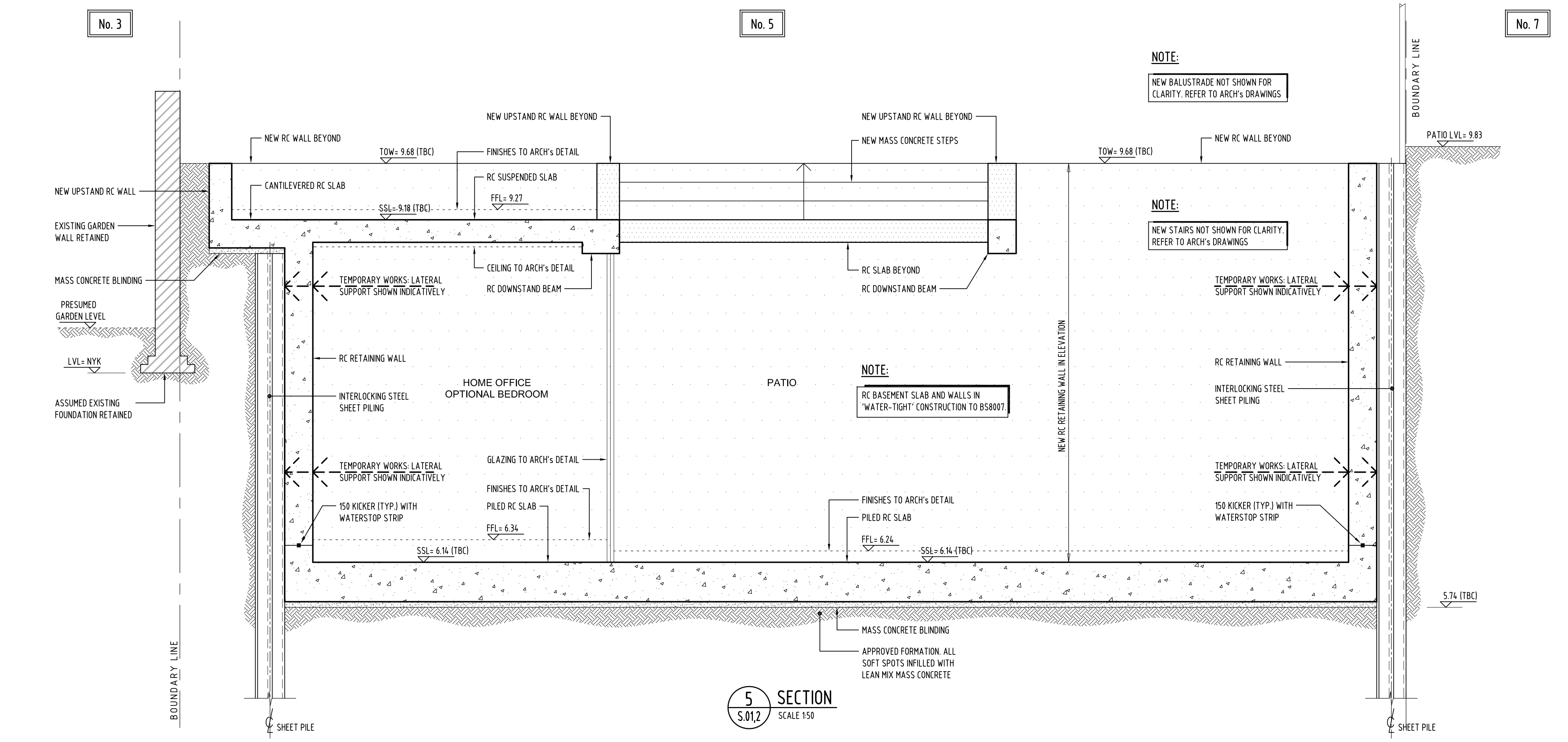

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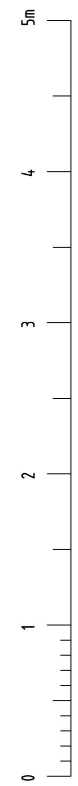

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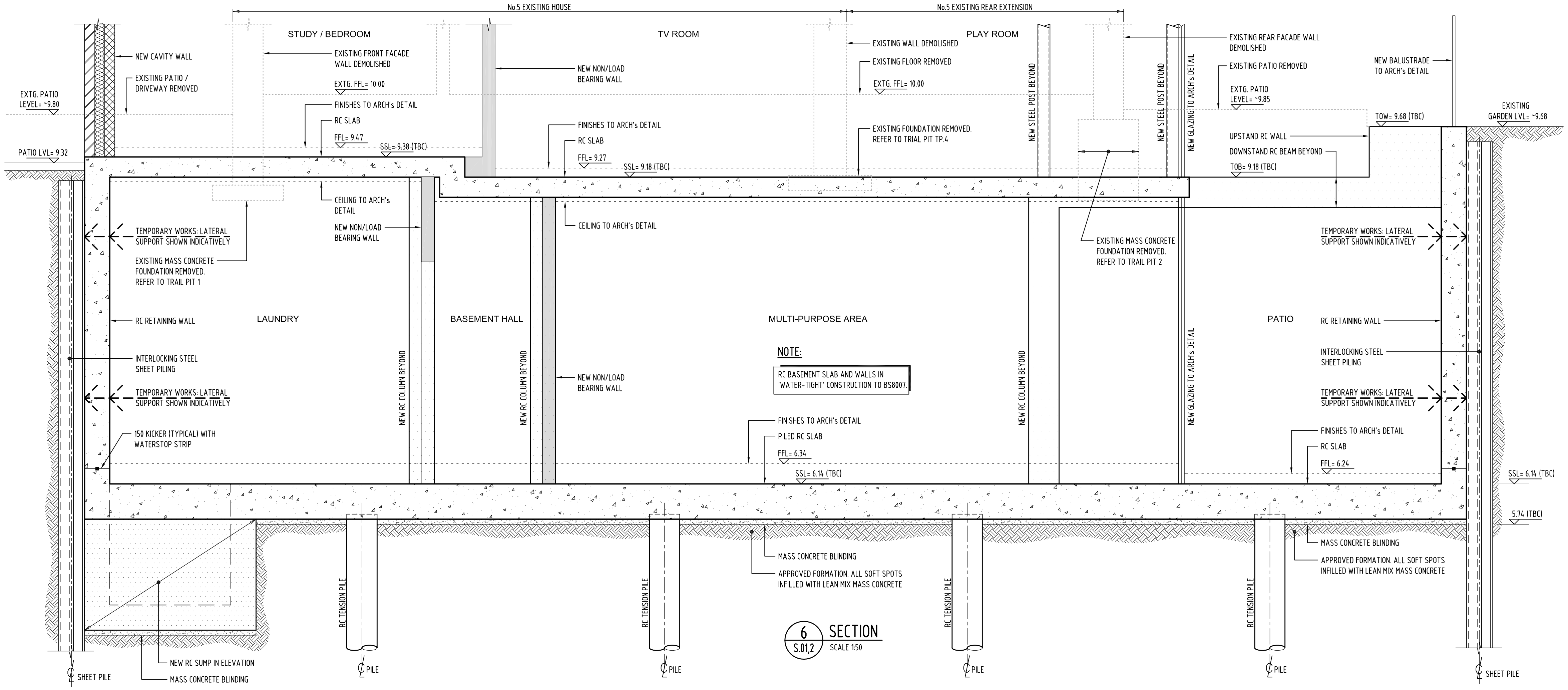

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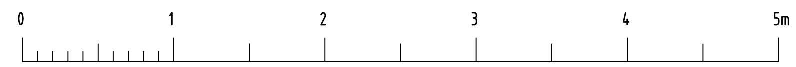

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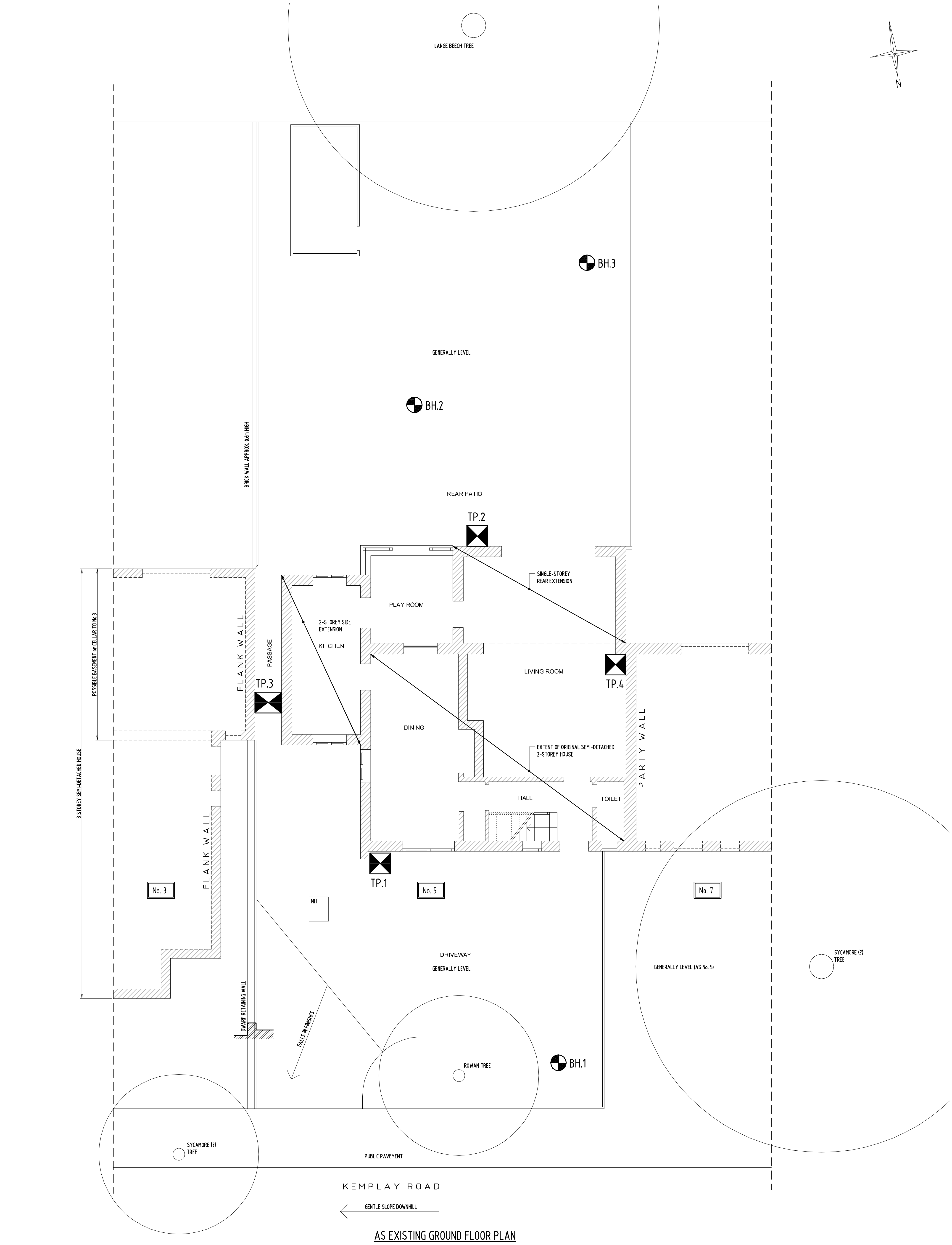
Appendix F - Structural Exposures, Trial Pits and Geotechnical Data

Site Investigation Plans - 4160/SI/01

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

Records of Water Levels.



AS EXISTING GROUND FLOOR PLAN

SCALE 1:50

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

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

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
–	–	–	–

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

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS
HARLING HOUSE
47-51 GREAT SUFFOLK ST.
LONDON SE1 OBS
TEL: 020-7401 8100
FAX: 020-7401 8845

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.

GROUND INVESTIGATION FOR

5 KEMPLAY ROAD
LONDON
NW3 1TA

Job No: 131410

Date September 2013

60 Station Road, Chingford, London E4 7BE Tel: 020 8559 3134 Fax: 020 8559 3135

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

CONTENTS

Subject	Section	Page
Introduction	1	1
Details of Field Work	2	1
General Geology	3	1
Groundwater	4	1
Laboratory testing	5	2
Conclusions	6	2
References	7	2

APPENDICES

Appendix A	Trial Pit / Borehole Location Plan
Appendix B	Trial Pit Sections
Appendix C	Borehole Logs / Shear Strength v Depth Profiles
Appendix D	Moisture Content / Atterberg Limit Results
Appendix E	Contamination Test Results

Report No: 131410

Date: September 2013

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

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 separate 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 - 0.96m.

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 $S0_4$ (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

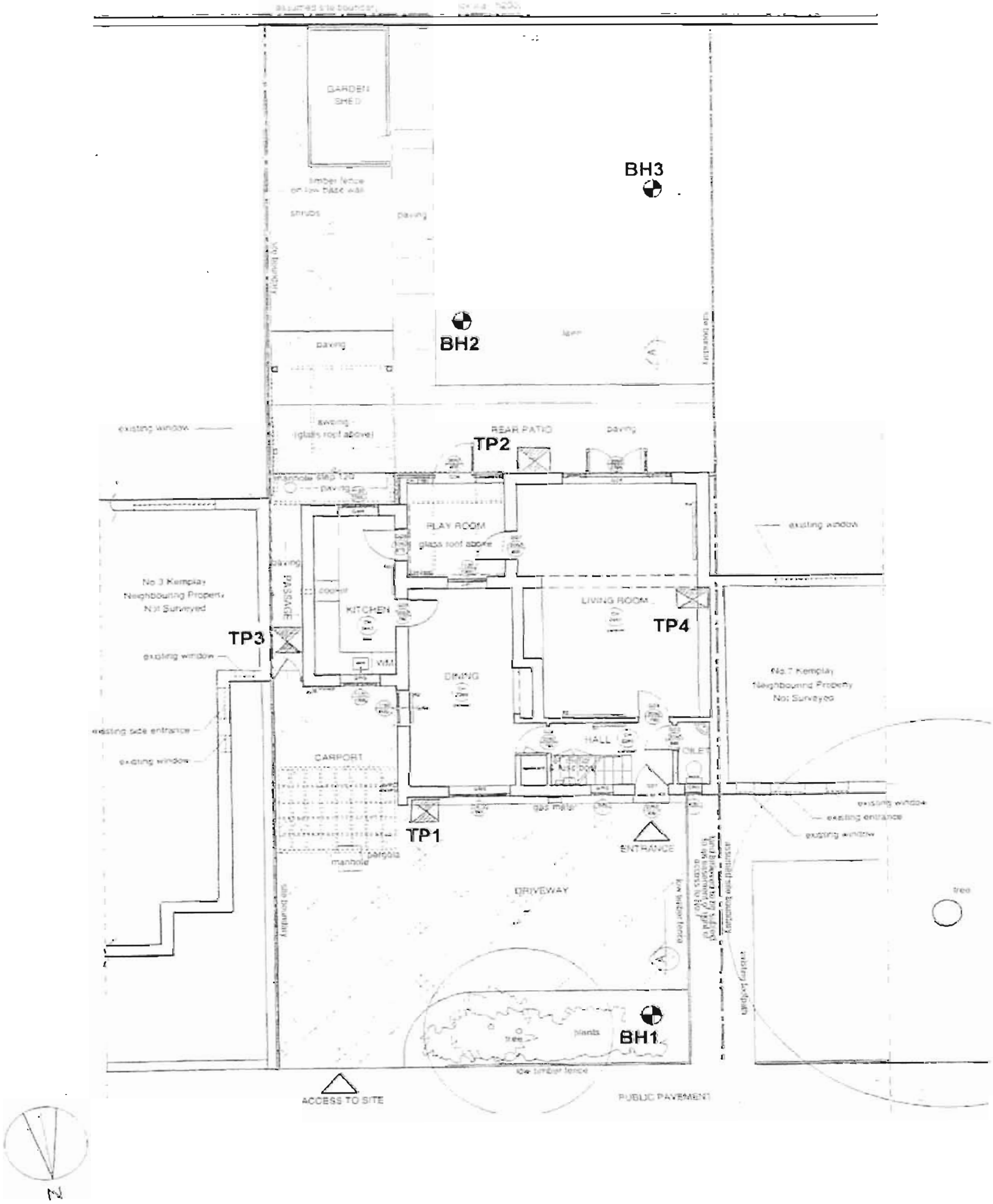
1) British Standard EN ISO 14688-1:2002
2) British Standard 5930: 1999
3) British Standard 1377: Parts 1-9
4) British Geological Survey Sheet 256 (1:50,000 scale) North London
5) NHBC Standards, Chapter 4.2
6) Foundation Design and Construction (M.J. Tomlinson, Fifth Edition)
7) BRE SD1:2005 (Concrete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

Stephen Hudson.

Stephen J. Hudson

APPENDIX A

TRIAL PIT / BOREHOLE LOCATION PLAN

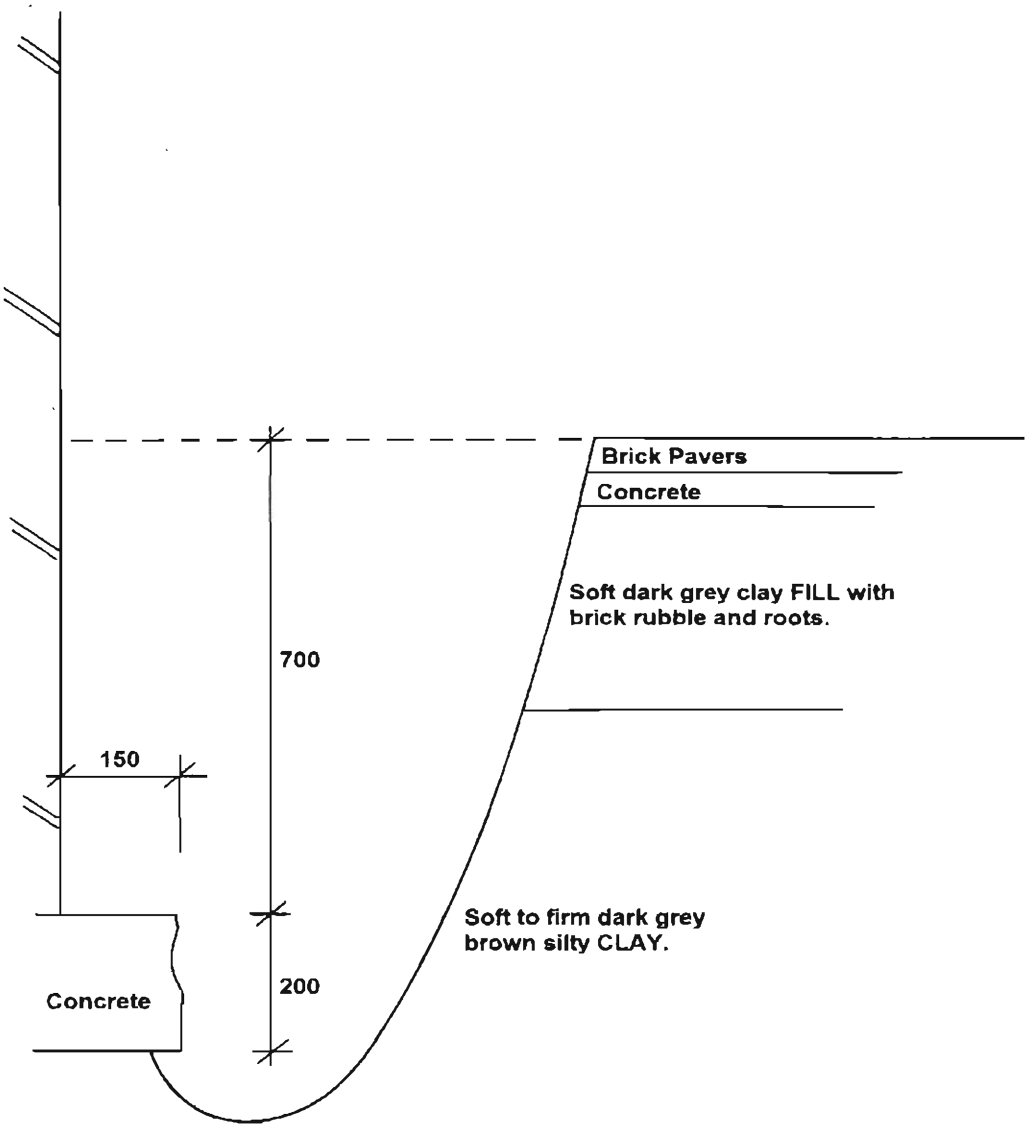


Not to Scale

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

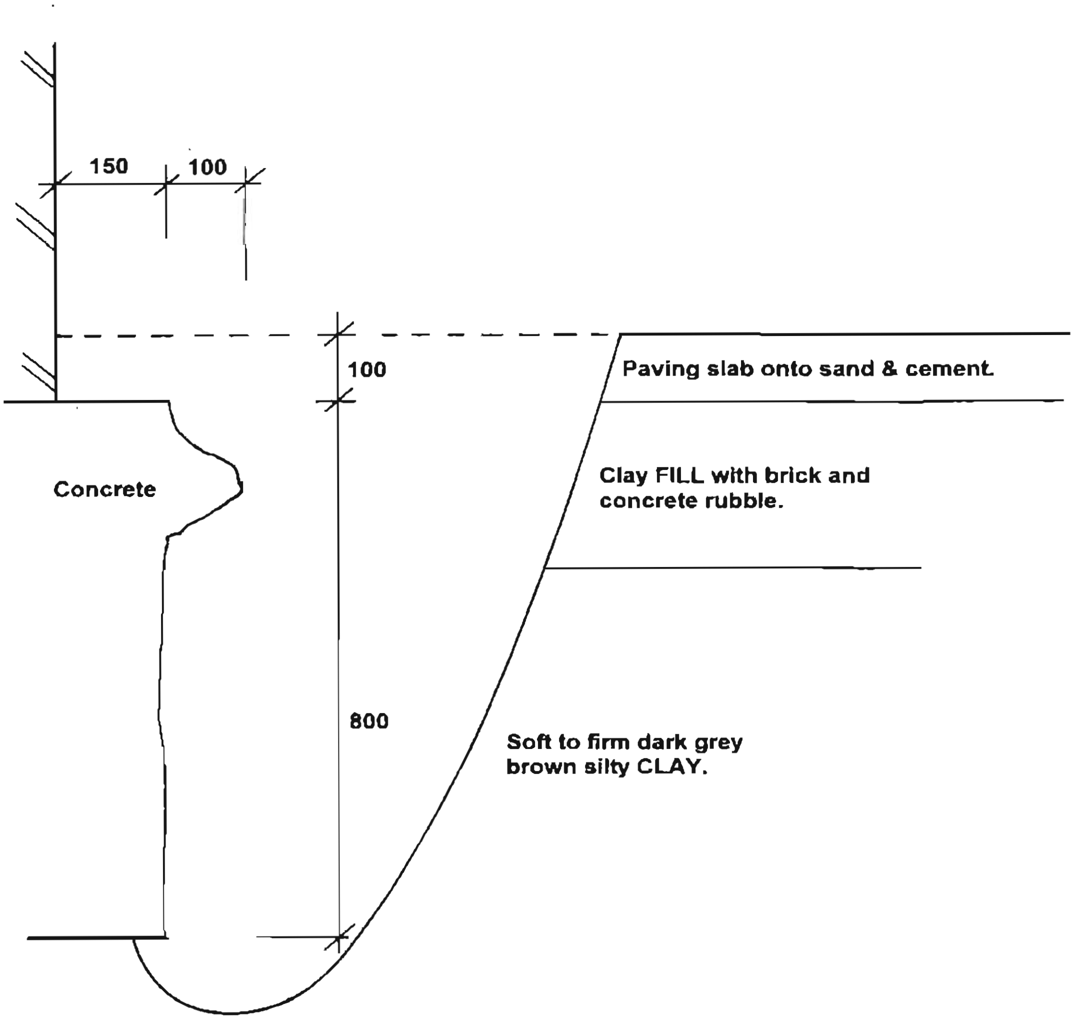
APPENDIX B

TRIAL PIT SECTION



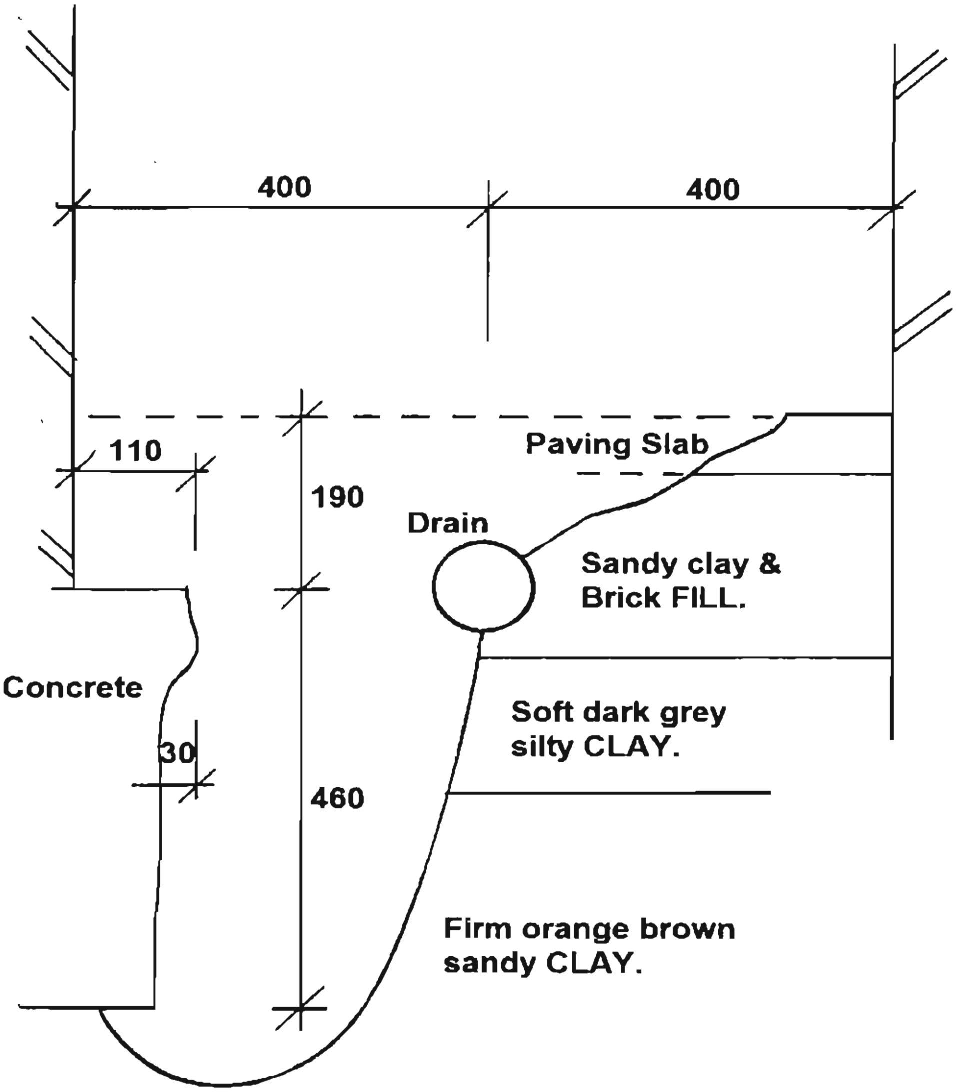
Not to Scale

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



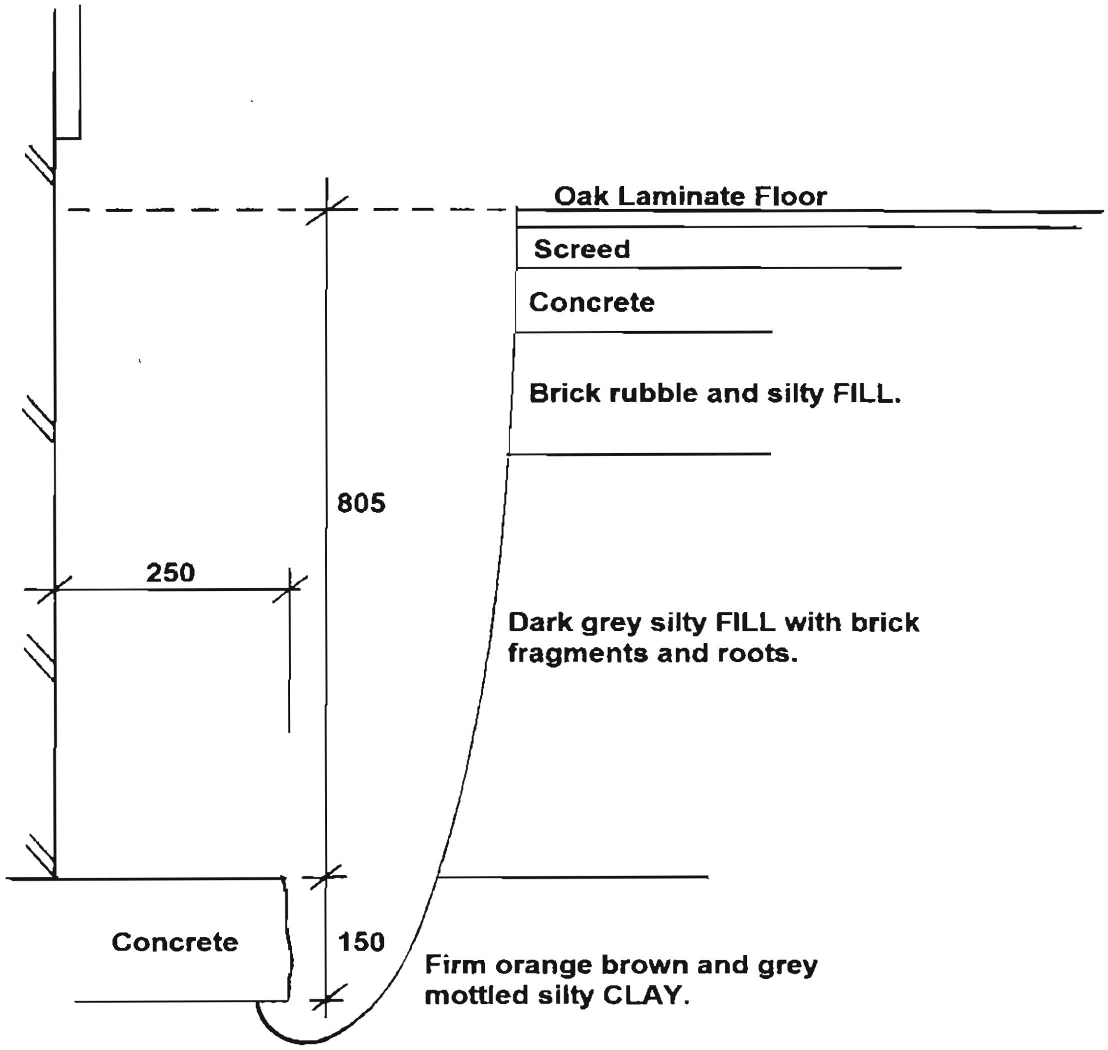
Not to Scale

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

APPENDIX C

BOREHOLE LOGS

BOREHOLE LOG - M R H GEOTECHNICAL

HOLE NO. BH 1
Sheet 1 of 1

CLIENT	SITE
Sarah & Lionel Fournier	5 Kemplay Road, London NW3 1TA

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
17/09/13 - 17/09/13	1:50	GROUND / AS APPENDIX A	SB/PA/SA	SH	131410

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	(150+)		
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 2.63m on 27/09/2013	2.70
3.00	D6	(140)	Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt (1.70)	
3.50	D7	(136)		
4.00	D8	(126)		
				4.40
4.50	D9	(154)	Very stiff bluish grey CLAY (1.80)	
5.00	D10	(154)		
5.50	D11			
6.00	D12	(148)		
				6.20
			Very stiff fissured dark grey CLAY (3.80)	
7.00	D13	(164)		
8.00	D14	(174)		
9.00	D15	(172)	Piezometer installed	
10.00	D16	(172)	Borehole ends	10.00

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 2.63m 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

HOLE NO. BH 2
Sheet 1 of 1

CLIENT: Sarah & Lionel Fournier	SITE: 5 Kemplay Road, London NW3 1TA

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
17/09/13 - 18/09/13	1:50	GROUND / AS APPENDIX A	SB/PA/SA	SH	131410

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m²)
0.50	D1	
1.00	D2	
1.50	D3	(48)
2.00	D4	(68)
2.50	D5	(56)
3.00	D6	(52)
3.50	D7	(58)
4.00	D8	(58)
4.50	D9	(64)
5.00	D10	(70)
5.50	D11	
6.00	D12	(142)
7.00	D13	(156)
8.00	D14	(172)
9.00	D15	(178)
10.00	D16	(176)

DESCRIPTION OF STRATUM (thickness)	DEPTH
Turf over topsoil (0.15)	0.15
Soft to firm dark grey sandy clay with occasional brick fragments. MADE GROUND (0.95)	1.10
Soft to firm olive brown very silty, slightly sandy CLAY (0.60)	1.70
Firm orange brown mottled bluish grey silty, slightly sandy CLAY (0.90) Water standing at 2.20m on 27/09/2013	2.60
Firm pale brown with traces of bluish grey very silty, slightly sandy CLAY (0.80) Water seepage at 3.10m	3.40
Firm orange brown laminated pale brown very silty CLAY (0.40)	3.80
Firm greyish brown with traces of bluish grey very silty CLAY (1.90)	5.70
Stiff grey silty CLAY (0.60)	6.30
Very stiff fissured dark grey CLAY (3.70) 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 27/09/2013

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

HOLE NO.	BH 3
Sheet	1 of 1

CLIENT	SITE
Sarah & Lionel Fournier	5 Kemplay Road, London NW3 1TA

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
18/09/13 - 18/09/13	1:50	GROUND / AS APPENDIX A	SB/PA/SA	SH	131410

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m²)
0.50	D1	
1.00	D2	
1.50	D3	(60)
2.00	D4	(68)
2.50	D5	(74)
3.00	D6	(74)
3.50	D7	(72)
4.00	D8	(80)
4.50	D9	(78)
5.00	D10	(96)
5.50	D11	
6.00	D12	(142)
7.00	D13	(158)
8.00	D14	(166)
9.00	D15	(174)
10.00	D16	(176)

DESCRIPTION OF STRATUM (thickness)	DEPTH
Turf over topsoil (0.10)	0.10
Soft to firm black sandy clay with traces of brick fragments. MADE GROUND (0.60)	0.70
Compacted dark brown clayey sand and brick fragments. MADE GROUND (0.50)	1.20
Firm orange brown with traces of bluish grey silty, slightly sandy CLAY (1.50) Water standing at 2.03m on 27/09/2013	2.70
Firm brown laminated bluish grey silty, slightly sandy CLAY (0.90) Water seepage at 3.40m	3.60
Firm to stiff greyish brown with traces of bluish grey silty CLAY (1.60)	5.20
Stiff grey silty CLAY (1.70)	6.90
Very stiff fissured dark grey CLAY (3.10) 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 27/09/2013

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.

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Appendix C PAGE 4

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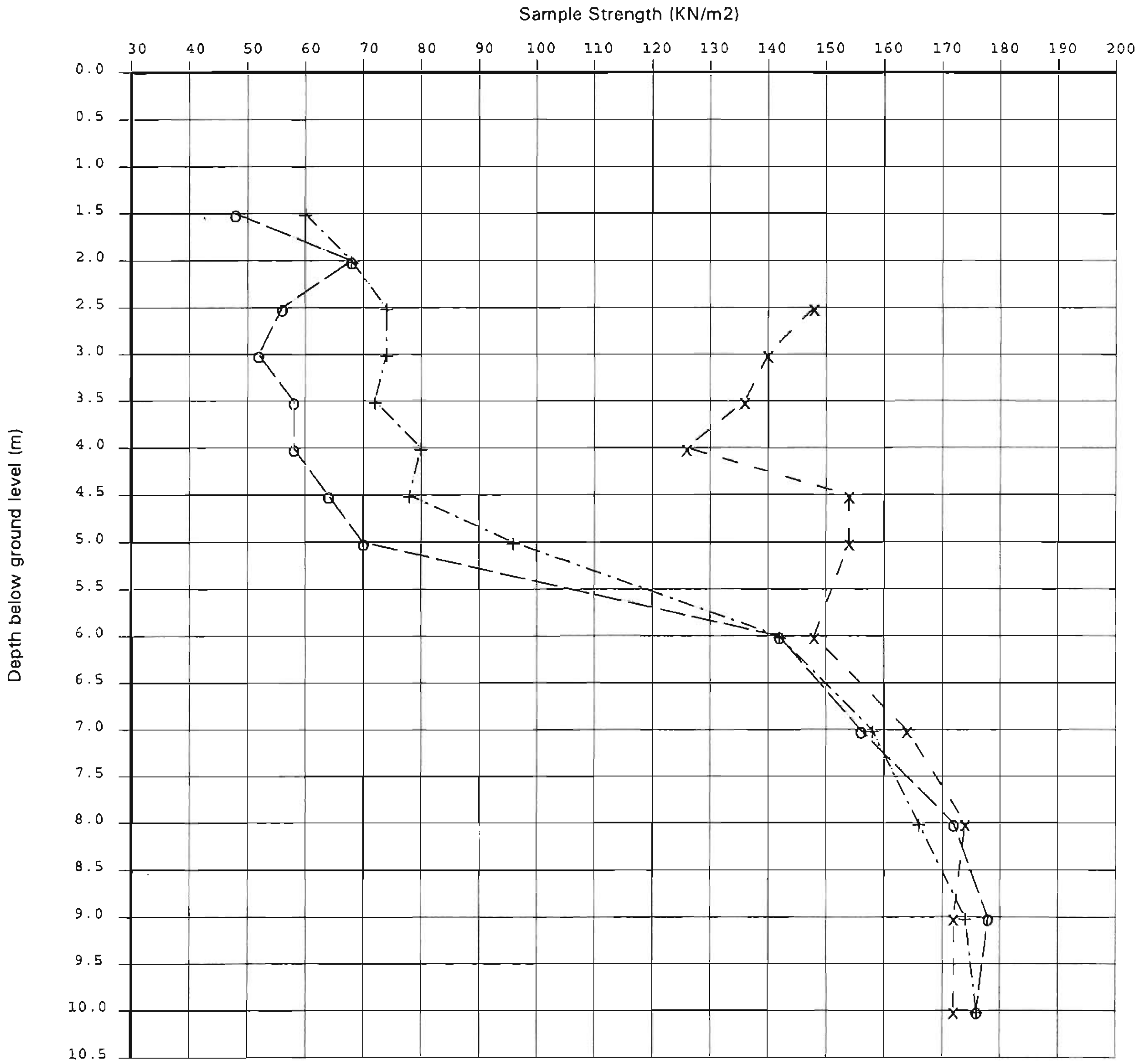
Sample Strength (KN/m2) vs Depth below ground level (m)



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

MRPLOT

APPENDIX D

MOISTURE CONTENT TEST RESULTS
AND
ATTERBERG LIMIT DETERMINATIONS

TEST REPORT.

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Appendix D PAGE 1

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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 1	0.50	D1	16	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	1.00	D2	18	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	1.50	D3	18	47	16	31	0.06	Very stiff brown with traces of orange brown slightly sandy CLAY. CI: CLAY of medium plasticity. (97% passing 425um)
BH 1	2.00	D4	22	-	-	-		Very stiff brown with traces of orange brown slightly sandy CLAY
BH 1	2.50	D5	24	49	21	28	0.11	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	25	-	-	-		Stiff greyish brown with traces of bluish grey slightly sandy CLAY with occasional partings of orange silt
BH 1	4.00	D8	25	58	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	26	-	-	-		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	28	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 1:1990:7.4 & 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 = 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.

TEST REPORT.

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Appendix D PAGE 2

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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 1	10.00	D16	27	-	-	-		Very stiff fissured dark grey CLAY
BH 2	0.50	D1	24	-	-	-		Firm dark grey sandy clay with occasional brick fragments. MADE GROUND
BH 2	1.00	D2	28	-	-	-		Soft to firm dark grey sandy clay with occasional brick fragments. MADE GROUND
BH 2	1.50	D3	30	66	26	40	0.10	Soft to firm olive brown very silty, slightly sandy CLAY. CH: CLAY of high plasticity. (97% passing 425um)
BH 2	2.00	D4	24	-	-	-		Firm orange brown mottled bluish grey silty, slightly sandy CLAY
BH 2	2.50	D5	24	48	20	28	0.14	Firm orange brown silty CLAY. CI: CLAY of medium plasticity. (99% passing 425um)
BH 2	3.00	D6	32	-	-	-		Firm pale brown with traces of bluish grey very silty, slightly sandy CLAY
BH 2	3.50	D7	30	-	-	-		Firm orange brown laminated pale brown very silty CLAY
BH 2	4.00	D8	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	D9	31	-	-	-		Firm greyish brown with traces of bluish grey silty CLAY
BH 2	5.00	D10	31	-	-	-		Firm greyish brown with traces of bluish grey very silty CLAY
BH 2	5.50	D11	30	-	-	-		Firm greyish brown with traces of bluish grey very silty CLAY
BH 2	6.00	D12	30	67	26	41	0.10	Stiff grey silty CLAY. CH: CLAY of high plasticity. (100% passing 425um)
BH 2	7.00	D13	29	-	-	-		Very stiff fissured dark grey CLAY
BH 2	8.00	D14	29	70	26	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 = 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.

TEST REPORT.

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Appendix D PAGE 3

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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 2	9.00	D15	28	-	-	-		Very stiff fissured dark grey CLAY
BH 2	10.00	D16	27	-	-	-		Very stiff fissured dark grey CLAY
BH 3	0.50	D1	29	-	-	-		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 3	2.00	D4	24	48	20	28	0.14	Firm orange brown with traces of bluish grey silty, slightly sandy CLAY. CI: CLAY of medium plasticity. (96% passing 425um)
BH 3	2.50	D5	27	-	-	-		Firm orange brown with traces of bluish grey silty, slightly sandy CLAY
BH 3	3.00	D6	27	61	23	38	0.11	Firm brown laminated bluish grey silty, slightly sandy CLAY. CH: CLAY of high plasticity. (98% passing 425um
BH 3	3.50	D7	31	-	-	-		Firm brown laminated bluish grey silty, slightly sandy CLAY
BH 3	4.00	D8	31	67	26	41	0 12	Firm to stiff greyish brown with traces of bluish grey silty CLAY. CH: CLAY of high plasticity. (100% passing 425um)
BH 3	4.50	D9	30	-	-	-		Firm to stiff greyish brown with traces of bluish grey silty CLAY
BH 3	5.00	D10	30	-	-	-		Firm to stiff greyish brown with traces of bluish grey silty CLAY
BH 3	5.50	D11	30	-	-	-		Stiff grey silty CLAY
BH 3	6.00	D12	29	67	26	41	0.07	Stiff grey silty CLAY. CH: CLAY of high plasticity. (100% passing 425um)
BH 3	7.00	D13	29	-	-	-		Very stiff fissured dark grey CLAY
BH 3	8.00	D14	29	-	-	-		Very stiff fissured dark grey CLAY

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 = 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.

TEST REPORT.

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Appendix D PAGE 4

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 5930:1981:41)
BH 3	9.00	D15	27	-	-	-		Very stiff fissured dark grey CLAY
BH 3	10.00	D16	27	-	-	-		Very stiff fissured dark grey CLAY

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 = 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

SAL

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

3 Crittall Drive
Springwood Industrial Estate
Braintree
Essex
CM7 2RT
Tel : 01376 560120
Fax : 01376 552923

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

UKAS TESTING 1650

mCERTS

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

Issued by :
Sarah Watt-Roy
Project Manager

SAL Reference:	352342
Project Site:	5 Kemplay Road, London, NW3 1TA
Customer Reference:	131410
Soil	Analysed as Soil
MRH ICRCL	

				SAL Reference	352342 001
				Customer Sample Reference	BH1 @ 0.50m
				Date Sampled	18-SEP-2013
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Arsenic	T257	A40	2	mg/kg	**13**
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	**33**
Copper	T257	A40	2	mg/kg	**15**
Lead	T257	A40	2	mg/kg	**15**
Mercury	T245	A40	1.0	mg/kg	<1.0
Nickel	T257	A40	0.5	mg/kg	**14**
Selenium	T257	A40	3	mg/kg	<3
Zinc	T257	A40	2	mg/kg	**42**
Chromium VI	T82	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	**16**
Sulphide	T4	A40	10	mg/kg	<10
Sulphur (total)	T6	A40	0.01	%	**0.01**
Thiocyanate	T220	A40	10	mg/kg	<10
Cyanide(Complex)	T85	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	T277	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 Total PAH
Retained on 2mm is removed before analysis

Method Index

Value	Description
T16	GC/MS
T220	Colorimetry (SD)
T82	ICP/OES (Sim)
T112	ICP/OES (SIM)(Water Extract)
T277	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

T85	Calc
T245	ICP/OES(Aqua Regia Extraction)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T257	A40	2	mg/kg	M	001
Boron (water-soluble)	T82	A40	1	mg/kg	N	001
Cadmium	T257	A40	0.1	mg/kg	M	001
Chromium	T257	A40	0.5	mg/kg	M	001
Copper	T257	A40	2	mg/kg	M	001
Lead	T257	A40	2	mg/kg	M	001
Mercury	T245	A40	1.0	mg/kg	U	001
Nickel	T257	A40	0.5	mg/kg	M	001
Selenium	T257	A40	3	mg/kg	U	001
Zinc	T257	A40	2	mg/kg	M	001
Chromium VI	T82	A40	1	mg/kg	N	001
pH	T7	A40			M	001
SO4(Total)	T102	A40	0.02	%	M	001
SO4(2:1)	T112	A40	10	mg/l	M	001
Sulphide	T4	A40	10	mg/kg	N	001
Sulphur (total)	T6	A40	0.01	%	M	001
Thiocyanate	T220	A40	10	mg/kg	M	001
Cyanide(Complex)	T85	AR	1	mg/kg	M	001
Cyanide(Total)	T4	AR	1	mg/kg	M	001
Cyanide(free)	T4	AR	1	mg/kg	M	001
Phenols(Mono)	T221	AR	0.5	mg/kg	M	001
PAH(total)	T16	AR	0.1	mg/kg	U	001
Moisture	T277	AR	0.1	%	N	001
Moisture @ 105 C	T162	AR	0.1	%	N	001
Retained on 2mm	T2	A40	0.1	%	N	001

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

MRH GEOTECHNICAL

Our Ref: 131410/L
Your Ref: Poss/BH/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 2.03m 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

constructionline

60 Station Road, Chingford, London E4 7BE Tel: 020 8559 3134 Fax: 020 8559 3135

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

5 Kemplay Road, NW3 1TA.
Groundwater Levels.

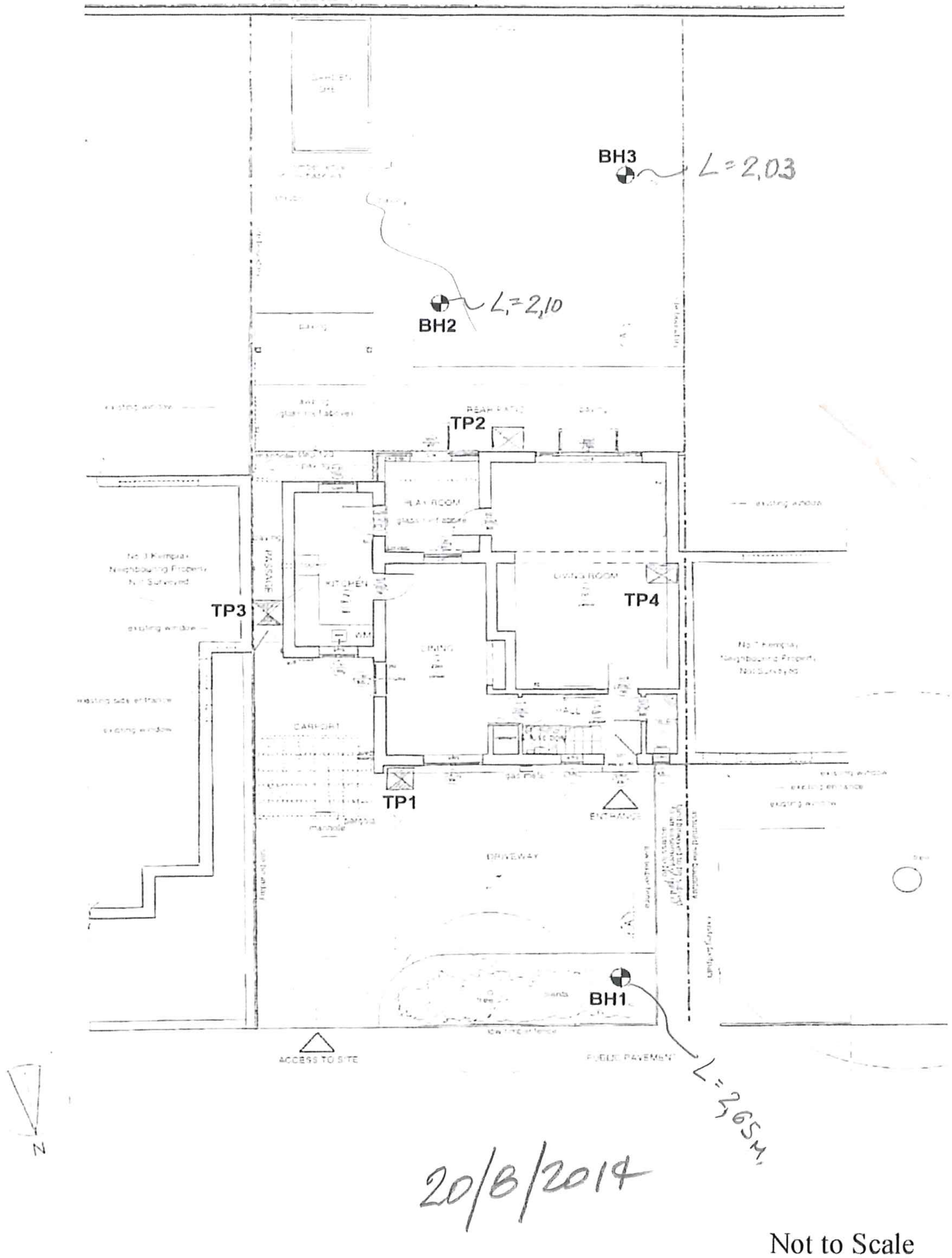
Date:	27/09/2013			
Location	Elevation (m)	Depth to Water (m)	Groundwater Elevation (m)	Below Floor Level (m)
BH1	84.90	2.63	82.27	2.73
BH2	84.58	2.20	82.38	2.62
BH3	84.70	2.03	82.67	2.33
TP4	85.00			

Date:	11/10/2013			
Location	Elevation (m)	Depth to Water (m)	Groundwater Elevation (m)	Below Floor Level (m)
BH1	84.90	2.71	82.19	2.81
BH2	84.58	2.40	82.18	2.82
BH3	84.70	2.23	82.47	2.53
TP4	85.00			

Date:	25/10/2013			
Location	Elevation (m)	Depth to Water (m)	Groundwater Elevation (m)	Below Floor Level (m)
BH1	84.90	2.31	82.59	2.41
BH2	84.58	1.73	82.85	2.15
BH3	84.70	1.61	83.09	1.91
TP4	85.00			
Note:	Heavy rainfall during days preceding the monitoring of the boreholes. Rear garden surface saturated.			

Date:	17/01/2014			
Location	Elevation (m)	Depth to Water (m)	Groundwater Elevation (m)	Below Floor Level (m)
BH1	84.90	1.25	83.65	1.35
BH2	84.58	1.19	83.39	1.61
BH3	84.70	1.20	83.50	1.50
TP4	85.00			
Note:	Heavy rainfall during days preceding the monitoring of the boreholes. Rear garden surface saturated.			

Internal Floor Level at TP4 taken as datum at 85.00m



Not to Scale

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

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.

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Job No	Sheet No.	Rev
4160	01	

Made By	Dates	Chkd
[signature]	NOV 2014	

5 KEMPLAY ROAD NW3
STRUCTURAL CALCULATIONS

These calculations have been prepared in support of a Planning Application for an enlarged basement proposed for a re-built family house.

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		Beam at 2nd	03
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Design Codes and BS's.

Loading	BS 6399
Timber	BS 5268
Masonry	BS 5628
Steel	BS 449
Reinforced Concrete Generally	BS 8110
Basement Slab & Walls	BS 8007

Scheme Calcs

for Superstructure and Ground Floor Slab.

Upper Floors

DL	boards	0.12
	ply	0.12
	joists	0.14
	u/floorheating	0.05
	insulation	0.02
	ceiling	0.15
		0.60
IL		1.5
Partitions		1.0
		3.1 kN/m²

Floor Joists:-

Max span = 3.7 m

$\Rightarrow M_{max} = 3.1 \times 3.7^2/8 = 5.3$ kNm/m width

$\therefore$ for C24, $Z_{req'd} = \frac{5305}{8.25} = 643$ cm³/m width

44x195 C24 @ 400 c/c $\Rightarrow Z = 697$ $\therefore$ ok.

$I = yZ = 6797$ cm⁴/m width

$\therefore \delta_{max} = \frac{5}{384} \times \frac{3.1 \times 3700^4}{10800 \times 6797 \times 10^4}$

$= 10.3$ mm $\equiv 0.0028 \times$ span < 0.003 $\therefore$ ok
< 0.003 $\therefore$ ok.

Reactions $= \frac{3.7}{2} \times 3.1 = 5.7$ kN/m width (ULS)

Front-to-rear Beam at 2nd:-

Span = 4.9 m

Σ Width supported $= \frac{5.6}{2} = 2.8$ m $\Rightarrow$ UDL $= (2.8 \times 3.1) + 0.4$
$= 9.1$ kN/m

$\Rightarrow M_{max} = 9.1 \times 4.9^2/8 = 27.3$ kNm

PTO

TRIGRAM PARTNERSHIP

CONSULTING STRUCTURAL ENGINEERS

Job No	Sheet No.	Rev
4160	2	04

Made By	Dates	Chkd
BM	20/10/2014	

Try 152UC23

$l/r = 4900/37 = 132$

$D/T = 152/7 = 22$ } $p_{bc} \doteq 99\ N/mm^2$

$f_{bc} = M/Z = \frac{27300}{164} = 166 >> 99$

Try 152UC 37

$l/r = 4900/38 = 129$

$D/T = 162/11.5 = 14$ } $p_{bc} = 132\ N/mm^2$

$f_{bc} = \frac{27300}{273} = 100$ ∴ OK.

$\Sigma \delta_{max} = \frac{5}{384} \times \frac{9.1 \times 4900^4}{2.1 \times 10^5 \times 2210 \times 10^4}$

$= 14.7mm \equiv span/333$

$\delta_{IL} \doteq \frac{1.5}{3.1} \times 14.7 = 7.1mm \equiv span/689 << span/360$

$\& << 14$ ∴ OKAY

Reactions $= \frac{4.9}{2} \times 9.1 = 22.3\ kN/(ea)$

TP01

Flat Roof:-

DL	membrane	0.05
	ply/firrings	0.12
		0.06
	joists	0.14
	insulation	0.02
	ceiling	0.15
		0.54 kN/m²
IL	Maintenance access	0.75
		1.3 kN/m²

Joists: span = 3.2m

$\Rightarrow M_{max} = 1.3 \times \frac{3.2^2}{8} = 1.7$ kNm/m width

$\therefore$ for C24, $Z_{req'd} = \frac{1664}{8.25} = 202$ cm³/m width.

44 × 147 C24 @ 400% ⇒ Z = 396 m³/m ∴ OK.

Deflection OKAY by Inspection

Reactions = $\frac{3.2}{2} \times 1.3 = 2.1$ kN/m

44 × 120 C24 @ 400% ⇒ Z = 264 cm³/m > 202

$I = yZ = 6 \times 264 = 1584$ cm⁴/m

$\therefore \delta_{max} = \frac{5}{384} \times \frac{1.3 \times 3200^4}{10800 \times 1584 \times 10^4}$

= 10.4 mm < 14

≡ 0.0032 × span

> 0.003

∴ reduce spacing

For 44 × 120 C24 @ 300%, $\delta_{max} = \frac{3}{4} \times 10.4$

= 7.8 mm

≡ 0.0024 × span

< 0.003

∴ OKAY.

Reactions = 2.1 kN/m width (IL)

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Job No	Sheet No.	Rev
4160	4	06
Made By	Dates	Chkd
BM	20/10/2014	

Monopitch Rafters.

DL

slates, etc	0.75
rafters	0.14
insulation	0.02
ceiling	0.15
	1.06 kN/m² on slope
≡	1.33 kN/m² on plan
IL Maintenance	0.75
	2.1 kN/m² (SLS)

Span on plan = 3.1m ⇒ $M_{max} = 3.1 \times 2.1^2/8 = 1.7$ kNm/m width

∴ for C24, Z req'd = $\frac{1700}{8.25}$ = 207 cm³/m

44 × 120 C24 @ 300 c/c ⇒ Z = 352 cm³/m.

I = yZ = 2112 cm⁴/m.

Slope length ≑ 1.25 × 3.1 = 3.9 m

W = 3.1 × 2.1 = 6.5 kN

∴ $\delta_{max} = \frac{5}{384} \times \frac{6500 \times 3900^3}{10800 \times 2112 \times 10^4}$

= 22mm >> 14

∴ I req'd = $2112 \times \frac{22}{14}$ = 3,319 cm⁴/m width

$I = \frac{bd^3}{12}$ ∴ for b = 3 × 4.4 = 13.2cm /m width

$d \geq \sqrt[3]{\left(\frac{3319 \times 12}{13.2}\right)}$ = 14.4 cm

Use 44 × 145 C24 @ 300 c/c.

Reactions = $\frac{3.1}{2} \times 2.1$ = 3.3 kN/m width (SLS)

Ridge Beam:

Span = 7.6m

EUDL from rafters & joists + self wt

÷ 3.3 + 2.1 + 0.5 = 5.9 kN/m

=> Mmax = 5.9 × 7.6²/8 = 42.6 kNm

Try 203 UC 46:-

L/r = 7600/51 = 149
D/T = 203/11 = 18.5 } Pbc = 105 N/mm²

fbc = M/Z = 42600/450 = 95 < 105 ∴ OK.

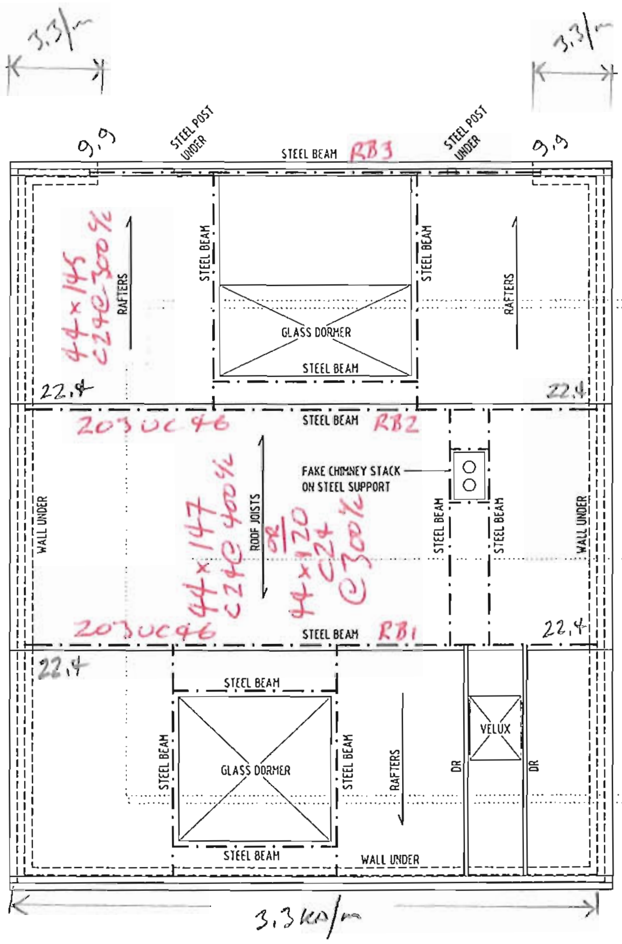
E δmax = 5/384 × (5.9 × 7600⁴)/(2.1 × 10⁵ × 4568 × 10⁴)

= 26.7 mm

E δIL ÷ 0.75/2.1 × 26.7 = 9.5 mm < 14

≡ span/796 << span/360 ∴ OK.

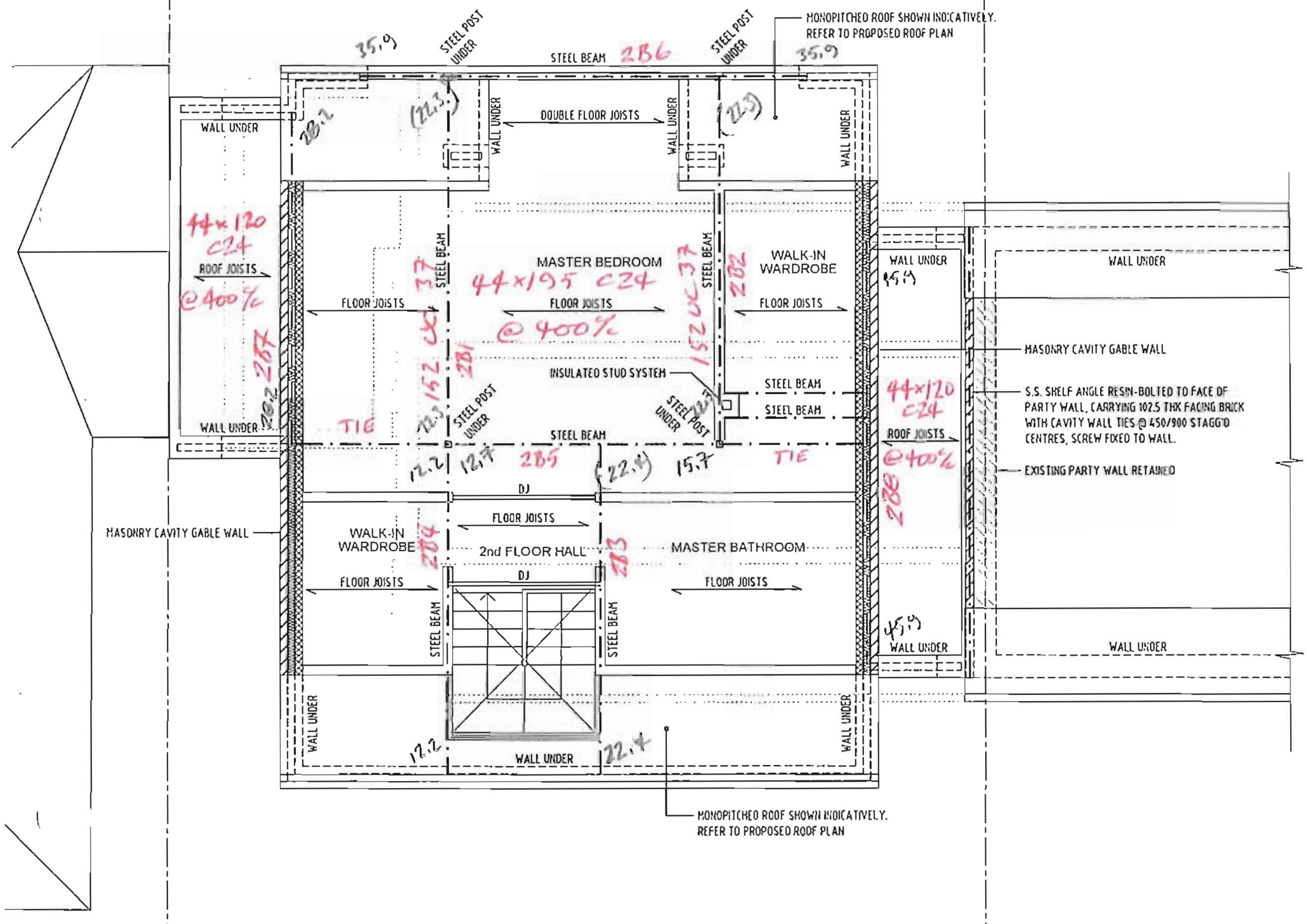
Reactions = 7.6/2 × 5.9 = 22.4 kN (ULS)



PROPOSED ROOF PLAN

SCALE 1:50

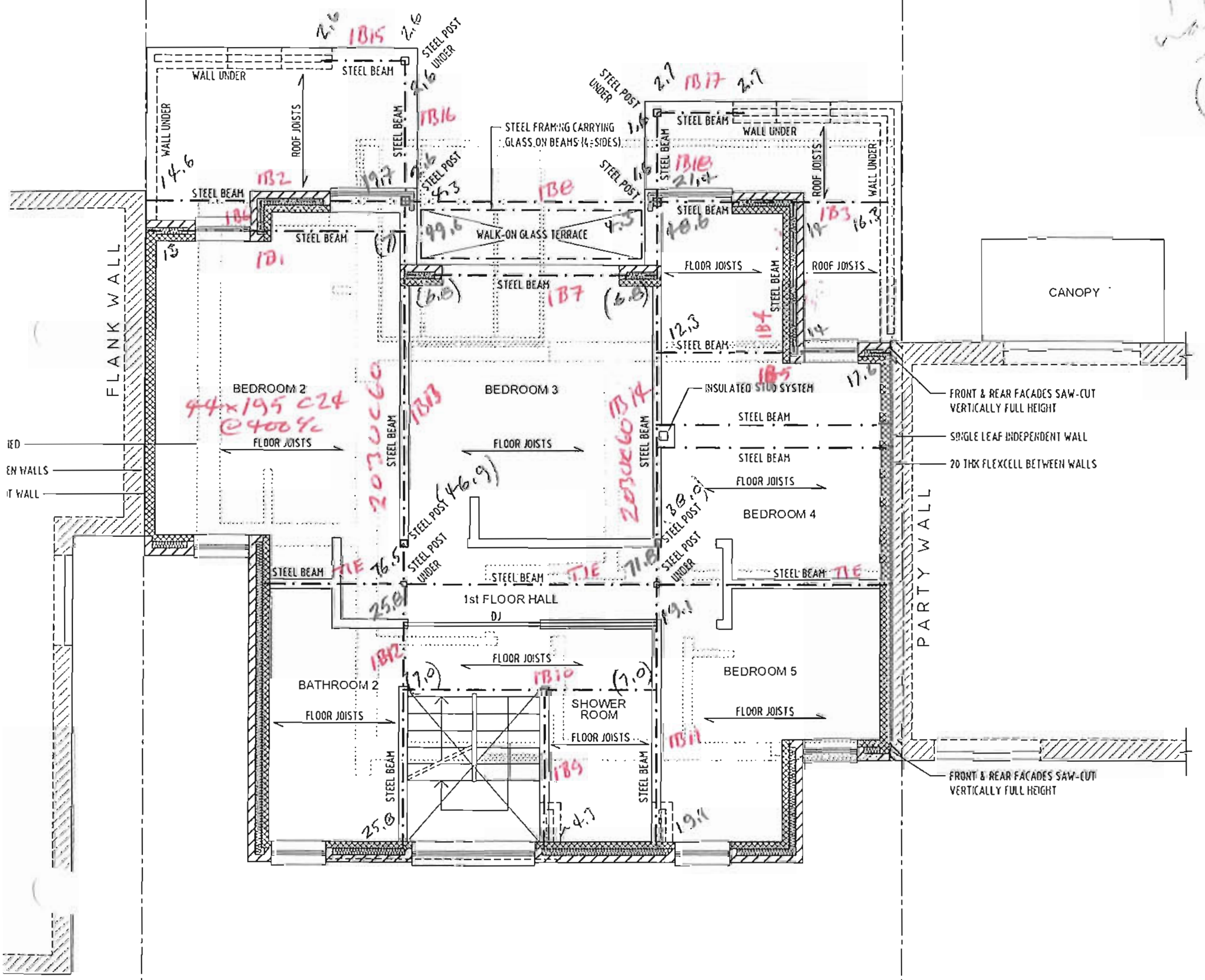
SCALE BAR
(1:50 @ A1)
(1:100 @ A3)



PROPOSED SECOND FLOOR PLAN

SCALE 1:50

SCALE B
(1:50 @ A1)
(1:100 @ A3



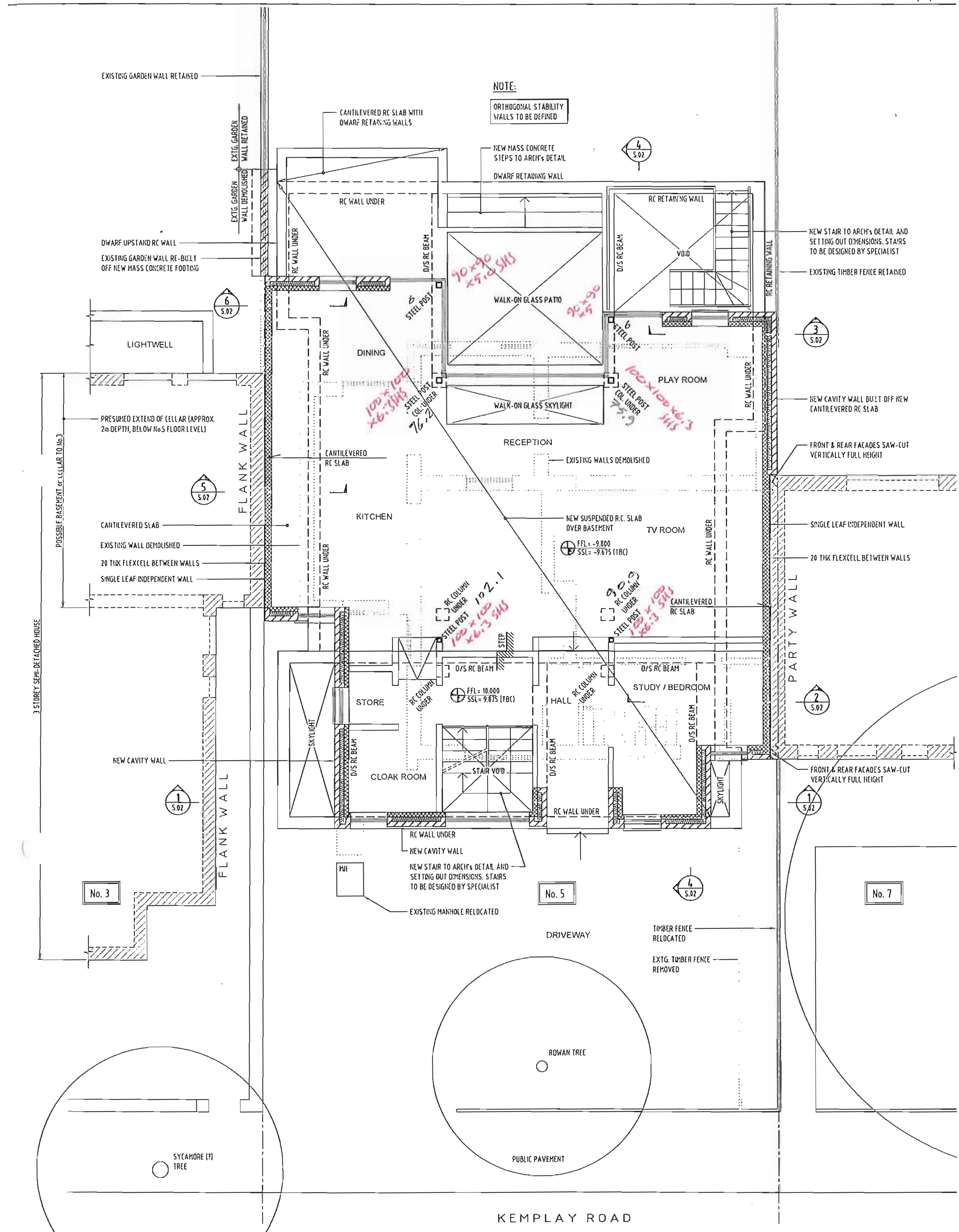
+ loads on (2B7 & 2B8) padstones on walls, at 2nd (1B1 & 1B5) ∴ 1B13 & 14 + stanchions below

check 1B3 & 1B2 for loads from 2B6.

PROPOSED FIRST FLOOR PLAN

SCALE 1:50

SCALE BA
(1:50 @ A1)
(1:100 @ A3)



PROPOSED GROUND FLOOR PLAN

SCALE 1:50

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CONSULTING STRUCTURAL ENGINEERS

Job No	Sheet No.	Rev
4160	12	

Made By	Dates	Chkd
BY	21/10/2014	

Load Take-Down. (See Scheme sizing calcs)

Roof:- Main beams : reactions = 22.4 kN (sls) onto flank walls.

Rafters: 3.3 kN/m onto front & rear walls.

Rear wall beam: span = 6.0m

=> Reactions = $\frac{6}{2} \times 3.3$ = 9.9 kN

2nd Floor:- 3.1 kN/m² inc partitions

Beam	Span	Width Supported	Σ UDL (+0.4 self wt)	Reactions
2B1	4.9m	$\frac{5.6}{2}$ = 2.8m	9.1 kN/m	22.3 kN
2B2	4.9	2.8	9.1	22.3
2B3	4.4	$\frac{5.4}{2}$ = 2.7	8.8 Stone: +1.4	22.4
2B4	4.4	$\frac{4.0}{2}$ = 2.0	6.6	12.2
2B5	3.7	0.4m + Pt Ld.	1.6	3.0 + (22.4 × $\frac{2.1}{3.7}$) = 15.7 & 3.0 + (22.4 × $\frac{1.6}{3.7}$) = 12.7
2B6	6.0	0.4m + Rafters + Pt Lds	4.5	35.9
2B7	4.4	$\frac{2.0}{2}$ = 1.0 floor + Flat roof & Wall	4.8 + Wall 8.0 = 12.8	28.2
2B8	5.6	$\frac{3.4}{2}$ = 1.7 floor + flat roof & Wall.	8.4 + Wall 8.0 16.4	45.9

Flat roofs:

DL	asphalt	0.60
	ply	0.12
	firings	0.08
	joists	0.12
	insulation	0.02
	ceiling	0.15
		1.09
IL	Maintenance	0.75
	Sedum (option)	0.60
		2.44 kN/m²

Span of joists to flat roofs = 1.4m & 1.1m

=> Reactions ≤ $\frac{1.4}{2} \times 2.44$ = 1.7 kN/m (sls)

$M_{max} = 2.44 \times 1.4^2/8 =$ 0.6 kNm/m ∴ Zreq'd = 72cm³/m

44×120 C24 @ 400% => Z = 264 cm³/m ∴ OK.

Deflection okay by inspection.

TP01

Heavy finishes in Master Bathroom:

Allow for 20 stone 0.54
10 bedding 0.24
0.78 kN/m² extra-over typical floor.

∴ extra UDL on 2B3 & 2B8

≑ 3.4/2 × 0.8 = 1.4 kN/m

Cavity Wall:-

102 facing brick 2.0

100 med dense block + plaster 2.0

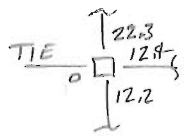
4.0 kN/m²

Ave Ht ≑ 2m ⇒ 8.0 kN/m ave, on 2B7 & 2B8

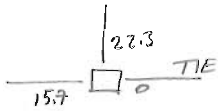
Posts from 1st to 2nd:-

Storey ht ≑ 2.7m

Σ beam reactions = ?



N = 46.9 kN



N = 38.0 kN

ΣMxx = 0.15×12.4 = 1.9 kNm　　0.15×15.7 = 2.4 kNm

ΣMyy Nett = 0.15×10.1 = 1.5 kNm　　0.15×22.3 = 3.3 kNm

(3.4)　　(5.7)

Try 90×90×5.0 SHS Grade 355 Hot Finished

$L/r = \frac{2700}{34.0} = 78 \Rightarrow p_c = 133$ N/mm²

$p_{bc} = 230$

$f_c = N/A = \frac{46900}{1690} = 28$ N/mm²　　$\frac{38000}{1690} = 22$

$f_{bc} = M/Z = \frac{3400}{45} = 76$ N/mm²　　$\frac{5700}{45} = 127$

$\Rightarrow \frac{f_c}{p_c} + \frac{f_{bc}}{p_{bc}} = \frac{28}{133} + \frac{76}{230}$　　$\frac{22}{133} + \frac{127}{230}$

$= 0.21 + 0.33$　　$= 0.17 + 0.55$

$= 0.54$　　$= 0.72 < 1.0$ ∴ OK

< 1.0 ∴ OK

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

Job No	Sheet No.	Rev
4160	3 14	
Made By	**Dates**	**Chkd**
BU	21/10/2014	

Self Wt = 0.4 kN/m, say
Cavity wall ≑ 3.5m × 2.0 = 7.0 kN/m
Stud wall ≑ 2.7 × 0.5 = 1.4 kN/m

1st Floor.

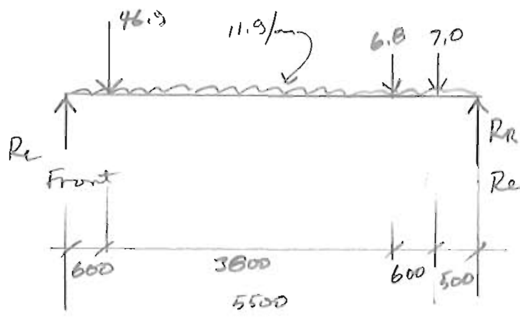
Σ DL + IL = 3.1 kN/m² inc partitions

Beam	Span	Width supported	Σ UDL + self wt	Reactions
1B1	3.8 m	0.4 m + Wall + Pt Ld	1.6 kN/m + 7.0 kN/m on ½ span + 2.1 kN Pt Ld.	$3.0 + \frac{2.1}{2} + (\frac{1}{4} \times 1.7 \times 7)$ = 7.0 kN $3.0 + \frac{2.1}{2} + (\frac{3}{4} \times 1.7 \times 7)$ = 13.0 kN
1B2	3.8	$\frac{2.5}{2}$ = 1.3m + Wall + Pt Ld.	4.4 kN/m + 7.0 + 2.1	$8.4 + \frac{2.1}{2} + (\frac{1}{3} \times 2.2 \times 7)$ = 14.6 kN $8.4 + \frac{2.1}{2} + (\frac{2}{3} \times 2.2 \times 7)$ = 19.7 kN
1B3	3.4	$\frac{1.7}{2}$ = 0.9m + Wall + Pt Ld	3.2 + 7.0 + 14.0 Pt Ld (Part span)	$5.4 + (\frac{1.4}{3.4} \times 14) + (\frac{1}{3} \times 2.2 \times 7)$ = 16.3 kN $5.4 + (\frac{2.0}{3.4} \times 14) + (\frac{2}{3} \times 2.2 \times 7)$ = 21.4 kN
1B4	2.2	$\frac{3.4}{2}$ = 1.7m + Wall	5.7 + 7.0 = 12.7 kN/m	14.0 kN
1B5	3.4	0.4m + Wall + Pt Ld	1.6 + 7.0 (Part) + 14.0 Pt Ld	$2.7 + \frac{14}{2} + (\frac{1}{4} \times 1.5 \times 7)$ = 12.3 kN $2.7 + \frac{14}{2} + (\frac{3}{4} \times 1.5 \times 7)$ = 17.6 kN
1B6	0.5	0.4m + Wall	1.6 + 7.0 = 8.4 kN/m	2.1 kN
1B7	3.7	$\frac{0.9}{2}$ = 0.5m + wall	1.0 + 7.0 (Part)	1.9 + (0.7 × 7) = 6.8 kN
1B8	3.7	$\frac{1.1}{2}$ = 0.6m	2.3 kN/m	4.3 kN
1B9	2.3	$\frac{2.6}{2}$ = 1.3m + stud wall.	4.4 + 1.4 = 5.8 kN/m	6.7 kN
1B10	3.7	0.4m + Pt Ld.	1.6 kN/m + 6.7 kN Pt Ld.	~ 7.0 kN
1B11	3.8	$\frac{5.0}{2}$ = 2.5m + Pt Ld	8.2 kN/m + 7 kN Pt Ld.	$15.6 + \frac{7}{2}$ = 19.1 kN
1B12	3.8	$\frac{5.6}{2}$ = 2.8m + Pt Ld.	9.1 kN/m + 7 kN Pt Ld.	$22.3 + \frac{7}{2}$ = 25.8 kN
1B13	5.5	$\frac{7.4}{2}$ = 3.7m + Pt Ld	11.9 kN/m + 6.8 & 7.0 Pt Lds + 46.9 Col Pt Ld.	PTO
1B14	5.5	$\frac{7.0}{2}$ = 3.5m + Pt Lds	11.3 kN/m + 12.3 & 6.8 Pt Ld + 38.0 Col Pt Ld	PTO
1B15	1.2	$\frac{2.0}{2}$ = 1.0m + Glazing	3.5 + 0.9 = 4.4 kN/m	2.6 kN
1B16	2.1	0.4m + Glazing	1.6 + 0.9 = 2.5 kN/m	2.6 kN
1B17	1.3	$\frac{1.3}{2}$ = 0.7m + Glazing	4.4/m	2.7
1B18	1.3	0.4m + Glazing	2.5/m	1.6

Double Glazing :. say 0.3 kN/m² × 3m = 0.9 kN/m

PTO

1B13:-



See Tedds analysis

$\Rightarrow R_L = 76.5$ kN

$R_R = 49.6$ kN

$M_{max} = 65.0$ kNm (ULS)

Try 203UC46:-

$l/r = 5500/51 = 108$, $D/T = 203/7 = 22$ } $p_{bc} = 134$ N/mm²

$f_{bc} = M/Z = 65000/450 = 144 > p_{bc}$

Try 203UC52:- $f_{bc} = 65000/510 = 127 < 134$ ∴ OK, just.

$I_{xx} = 5259$ cm⁴

From Tedds, for $I = 1 \times 10^6$ mm⁴ $= 100$ cm⁴ $\Rightarrow \delta_{max} = 1045$ mm

∴ for $I = 5259$ cm⁴, $\Sigma\delta_{max} = \frac{1045}{52.59} = 19.9$ mm

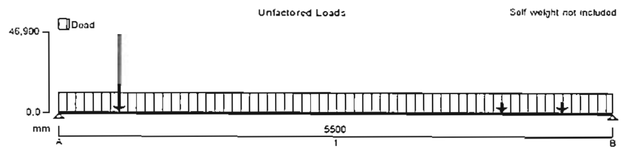
$\delta_{IL} \doteq \frac{1.5}{3.1} \times 19.9 = 9.6$ mm $\doteq$ span/571 < span/360 ∴ OK.

For 203UC60:- $f_{bc} = \frac{65000}{584} = 111$ N/mm² < 134 ∴ OKAY

$\Sigma\delta_{max} = 19.9 \times \frac{5259}{6125} = 17.1$ mm

$\Sigma\delta_{IL} \doteq 8.3$ mm

Tedds	Project: Kemplay Road			Job no: 4160	
	Calcs for: 1B13			Start page no./Revision: 1	
	Calcs by: BH	Calcs date: 21/10/2014	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 = 7860 kg/m^3

Support Conditions:

Support A — Vertically "Restrained" — Rotationally "Free"

Support B — Vertically "Restrained" — Rotationally "Free"

Span Definitions:

Span 1 — Length = 5500 mm — Cross-sectional area = 1000 mm^2 — Moment of inertia = 1.00×10^6 mm^4

LOADING DETAILS

Beam Loads:

Load 1 — UDL Dead load 11.9 kN/m

Load 2 — Point Dead load 46.9 kN at 0.600 m

Load 3 — Point Dead load 6.8 kN at 4.400 m

Load 4 — Point Dead load 7.0 kN at 5.000 m

LOAD COMBINATIONS

Load combination 1

Span 1 — 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A — Max react = -76.5 kN — Min react = -76.5 kN — Max mom = 0.0 kNm — Min mom = 0.0 kNm

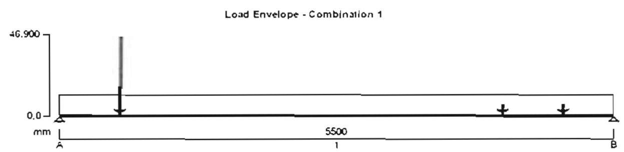
Support B — Max react = -49.6 kN — Min react = -49.6 kN — Max mom = 0.0 kNm — Min mom = 0.0 kNm

Beam Max/Min results - Combination Summary

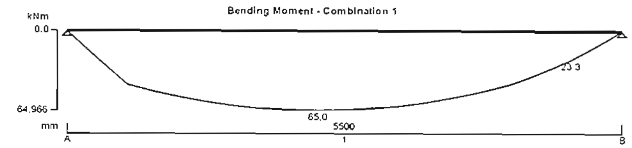
Maximum shear = 76.5 kN — Minimum shear F_{min} = -49.6 kN

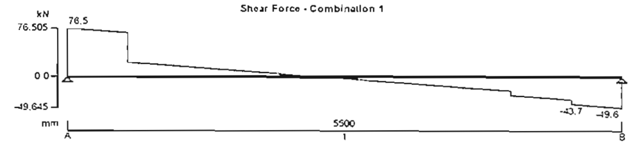
Maximum moment = 65.0 kNm — Minimum moment = 0.0 kNm

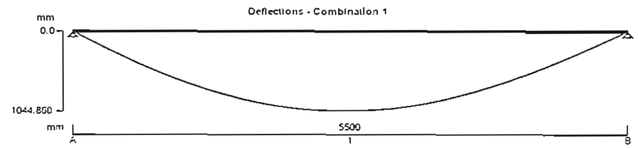
Maximum deflection = 1044.9 mm — Minimum deflection = 0.0 mm



Tedds	Project: Kemplay Road			Job no: 4160	
	Calcs for: 1B13			Start page no./Revision: 2	
	Calcs by: BH	Calcs date: 21/10/2014	Checked by	Checked date	Approved by	Approved date







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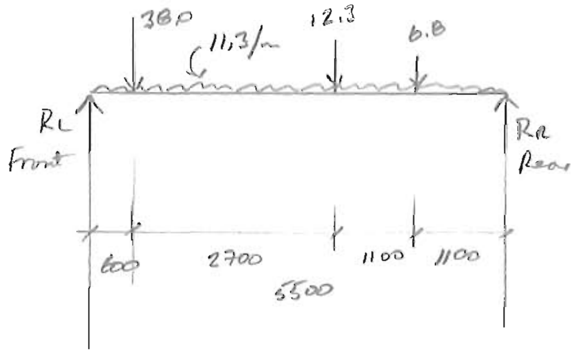
1B14:-



See Tedds analysis

$R_L = 71.8$ kN

$R_R = 48.6$ kN

$M_{max} = 72.4$ kNm

Try 203UC 60:-

$L/r = 5500/52 = 106$ }
$D/T = 210/14 = 15$ } $p_{bc} = 141$ N/mm²

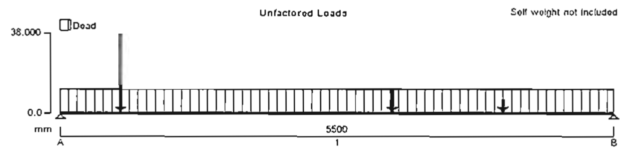
$f_{bc} = M/Z = 72400/584 = 124$ N/mm² ∴ OK.

For $I = 100\,cm^4$, $\Sigma\delta_{max} = 1137$ mm

$I_{xx} = 6125\,cm^4 \Rightarrow \Sigma\delta_{max} = \frac{1137}{61.25} = 18.6$ mm

$\delta_{IL} \doteq \frac{1.5}{3.1} \times 18.6 = 9.0$ mm $\equiv$ span/612 ∴ OK.

Tedds	Project: Kemplay Road			Job no. 4160	
	Calcs for: 1B14			Start page no./Revision: 1	
	Calcs by: BH	Calcs date: 21/10/2014	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 = **7860** kg/m^3

Support Conditions:

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

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

Span Definitions:

Span 1 Length = **5500** mm Cross-sectional area = **1000** mm^2 Moment of inertia = **1.00×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 UDL Dead load **11.5** kN/m

Load 2 Point Dead load **38.0** kN at **0.600** m

Load 3 Point Dead load **12.3** kN at **3.300** m

Load 4 Point Dead load **6.8** kN at **4.400** m

LOAD COMBINATIONS

Load combination 1

Span 1 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-71.8** kN Min react = **-71.8** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

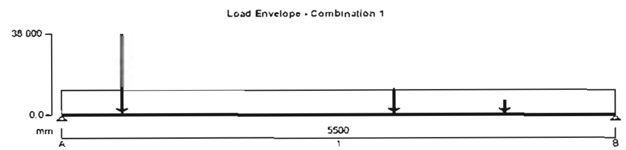
Support B Max react = **-48.6** kN Min react = **-48.6** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

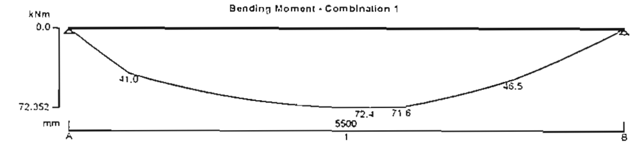
Maximum shear = **71.8** kN Minimum shear F_{min} = **-48.6** kN

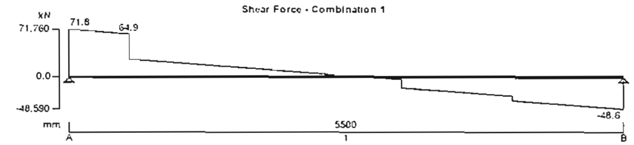
Maximum moment = **72.4** kNm Minimum moment = **0.0** kNm

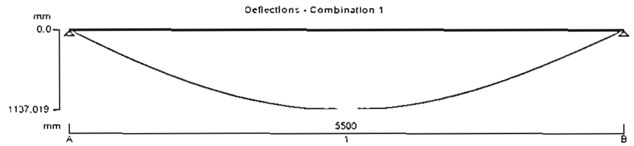
Maximum deflection = **1137.0** mm Minimum deflection = **0.0** mm



Tedds	Project: Kemplay Road			Job no. 4160	
	Calcs for: 1B14			Start page no./Revision: 2	
	Calcs by: BH	Calcs date: 21/10/2014	Checked by	Checked date	Approved by	Approved date

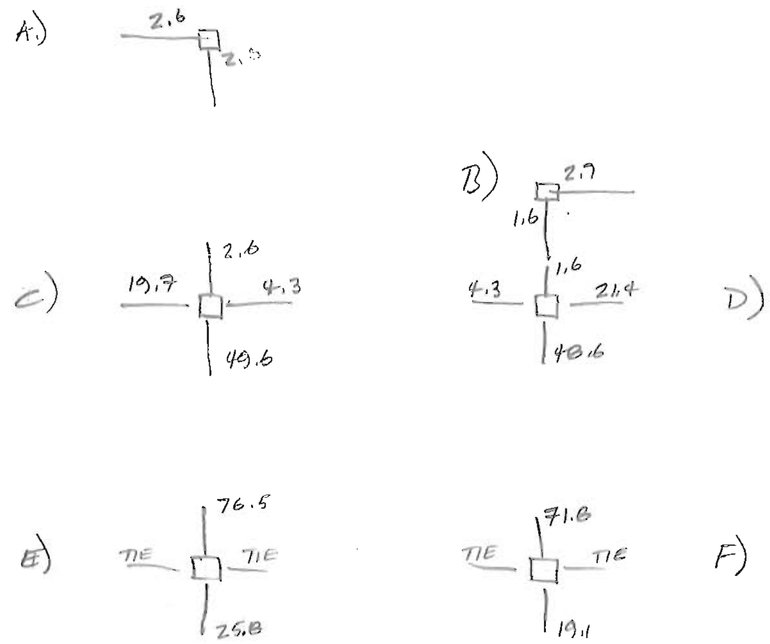






18

Columns from Ground to 1st:-



E) $N = 102.1\,kN$ (SLS)

$M_{nett} \doteq 50.7 \times 0.15$
$= 7.6\,kNm$

Try 90 × 90 × 6.3 SHS Grade 355 Hot Finished

$l/r \doteq \frac{2700}{34} = 79 \Rightarrow$ $p_c = 131\ N/mm^2$
$p_{bc} = 230\ N/mm^2$

$f_c = N/A = \frac{102100}{2090} = 49\ N/mm^2$ $f_{bc} = M/Z = \frac{7600}{53.9} = 141\ N/mm^2$

$\Rightarrow f_c/p_c + f_{bc}/p_{bc} = \frac{49}{131} + \frac{141}{230}$

$= 0.37 + 0.61 = 0.99 < 1.0$
but no spare capacity.

Try 100 × 100 × 5.0 SHS Grade 355 Hot Finished

$l/r = 2700/38 = 71 \Rightarrow$ $p_c = 148$

$f_c = \frac{102100}{1890} = 54$ $f_{bc} = 7600/56.6 = 134$

$\Rightarrow \frac{54}{148} + \frac{134}{230} = 0.36 + 0.58 = 0.95 < 1.0$.

Use 100 × 6.3 SHS

A) Use 90×90×5.0 SHS

B) — 〃 —

C) N = 76.2 kN

$\Sigma M_{nett} = 59.4 \times 0.15$
$= 8.9$ kNm

D) N = 75.9 kN

$\Sigma M_{nett} = 63.0 \times 0.15$
$= 9.5$ kNm

Try 90×90×5.0 SHS Grade 355 Hot Finished

From earlier calcs:- $p_c = 133$ N/mm²

$p_{bc} = 230$ N/mm²

$f_c = \frac{76200}{1690} = 45$ $\frac{75900}{1690} = 45$

$f_{bc} = \frac{8900}{45} = 198$ $\frac{9500}{45} = 211$

By inspection, too small

Try 90×90×6.3 ⇒ $p_c = 131$
$p_{bc} = 230$

$f_c = \frac{76200}{2090} = 36$ $\frac{75900}{2090} = 36$

$f_{bc} = \frac{8900}{53.9} = 165$ $\frac{9500}{53.9} = 176$

$\Rightarrow \frac{f_c}{p_c} + \frac{f_{bc}}{p_{bc}} = \frac{36}{131} + \frac{165}{230}$ $\frac{36}{131} + \frac{176}{230}$

$= 0.27 + 0.72$ $= 0.27 + 0.77$

$= 0.99$ $= 1.04 > 1.0$ ∴ FAILS

Use 100×100×6.3 SHS Grade 355 Hot Finished

E) 100×6.3 SHS

F) — 〃 —

Ground Floor.

RC Slab, with projecting edges carrying cavity walls and single-leaf 'independant' flank walls.

Cavity wall DL ≑ 4 kN/m²

140 med dense block 2.2
+ drylining 0.2
2.4 kN/m²

Support to Independant Walls:

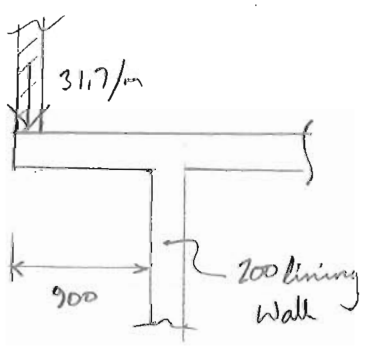
LH boundary: self wt = 2.4 kN/m²
height = 6m
⇒ 14.4 kN/m DL × 1.4 ⇒ 20.2 kN/m (ULS)

wall carries flat roof joists + joists at 1st floor
= 1.7 + 5.7 = 7.4 kN/m × 1.55 ⇒ 11.5

31.7 kN/m (ULS)

RH boundary: similar ∴ 31.7 kN/m (ULS)

Slab cantilever:-



Consider 200 slab:-
20 top cover
⇒ d = 200-20-10 = 170
b = 1000
fcu = 35
fy = 460

Slab self wt ≑ 0.2 × 24 = 4.8 kN/m² × 1.4 ⇒ 6.7 kN/m² ULS.

Finishes:-
timber 0.12
battens 0.06
insulation 0.02
0.2 × 1.6 ⇒ 0.3
IL 1.5 × 1.6 ⇒ 2.4
Σ = 9.4 kN/m² (ULS)

PTO

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

Job No	Sheet No.	Rev
4160	9 22	

Made By	Dates	Chkd
DM	21/10/2014	

$M_{max} = \left(9.4 \times 1.0^2/2\right) + (31.7 \times 0.95)$

$= 4.7 + 30.1 = 34.8$ kNm/m (ULS)

b = 1000
d = 170
fcu = 35
fy = 460

$K = M/bd^2 f_{cu} = 0.034$

$\Rightarrow z = 0.95d = 162$ mm

$\therefore A_s = M/0.95 f_y z = 492$ mm²/m T1

H12@200 ⇒ $A_{s\,prov} = 568$ mm²/m.

$A_{s\,min} = 0.0013 A_c = 260$ mm²/m

$V_{max} = 31.7 + (9.4 \times 0.9) = 40.2$ kN/m (ULS)

$\therefore v = V/bd = 40200/1000 \times 170 = 0.24$ N/mm²

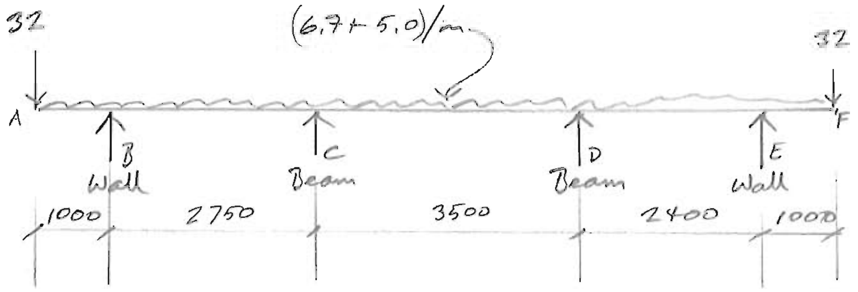
∴ No Links Req'd.

Span/depth = 950/170 = 5.6 < 7 ∴ Deflection OKAY.

Use 200 RC Slab.

TP01

Multi-Span Strip across full width of House:-



(ULS)
Slab DL = 6.7 kN/m²
Σ IL = 5.0

IL =	1.5
Partitions	1.0
ceiling	0.2
Services	0.25
Finishes	0.2
	3.15
	× 1.6
	5.0 kN/m² (ULS)

See Tedds Analysis & Design:-

200 slab OKAY (H10 & H12 @ 150 c/c)

but review shear in slab (not beam).*

Reactions onto supporting beams spanning front-to-rear:-

R_C = 73 kN (ULS)

R_D = 67 kN (ULS)

* 'Slab supported on beams &/or walls':-

BS 8110; Cl 3.5.5.3 ⇒ T 3.17:-

V_{max} = 68.9 kN at cantilever

~ 7 H16/m Top (150 c/c) ⇒ $A_{s prov}$ = 1340 mm²/m

d = 170 $v = V/bd = \frac{68.9}{170} = 0.41$ N/mm²

$100A_s/bd$ = 0.79, d = 170 } ⇒ $v_c = 1.12 \times 0.724 = 0.81$ N/mm²

$v_c > v$ ∴ No LINKS REQD AT CANTILEVERS.

	150	170	175
0.75	0.73		0.71
0.79	0.74	0.724	0.72
1.00	0.81		0.78

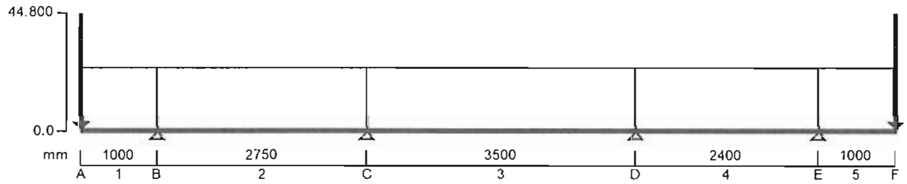
PTO

Tedds	Project				Job no.	
	Millfield Lane				4160	
	Calcs for				Start page no./Revision	
	Gd Floor Slab, full width strip				1 24	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	BH	21/10/2014				

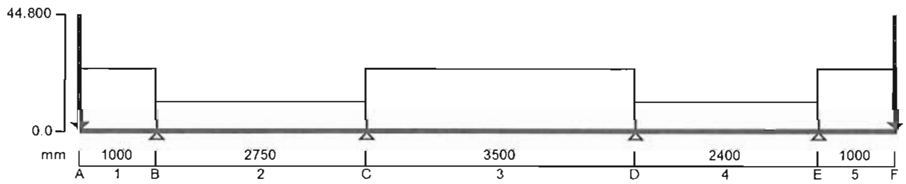
RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.1.12

Load Envelope - Combination 1



Load Envelope - Combination 2



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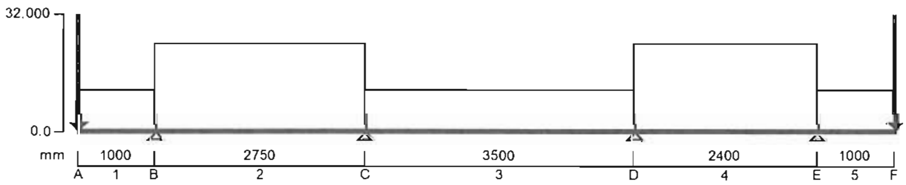

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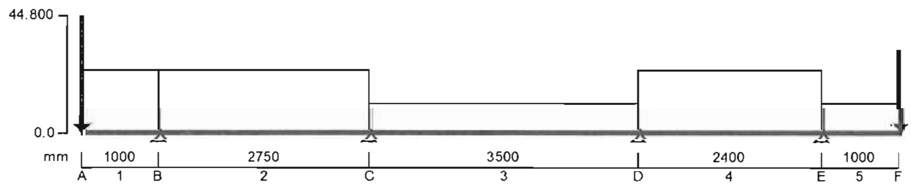
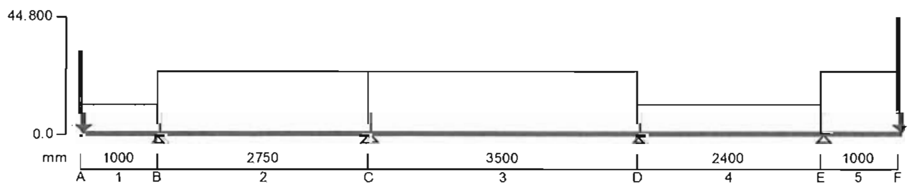
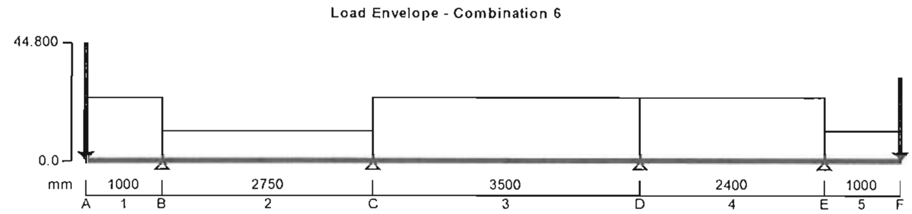
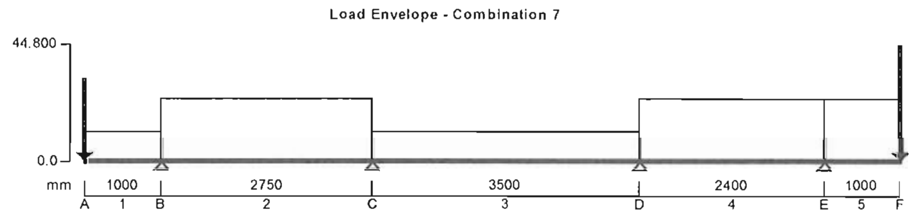
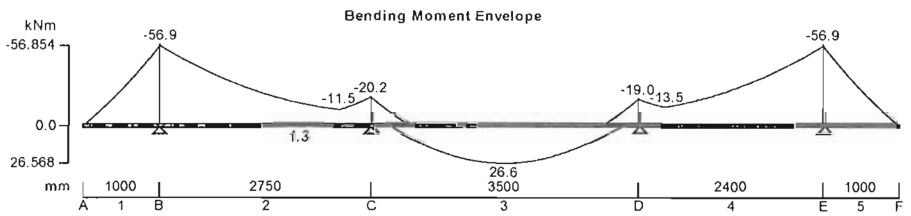


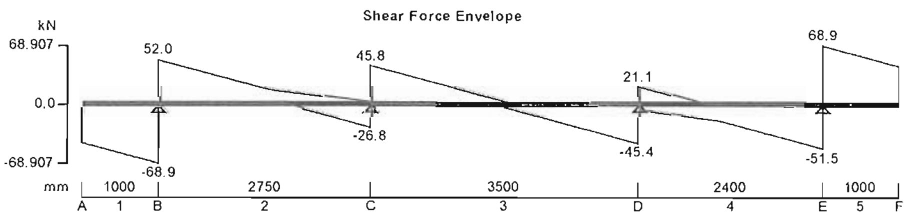
Load Envelope - Combination 5











Support conditions

Support A	Vertically free
	Rotationally free
Support B	Vertically restrained
	Rotationally free
Support C	Vertically restrained
	Rotationally free
Support D	Vertically restrained
	Rotationally free
Support E	Vertically restrained

RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.1.12

Support conditions

Support A	Vertically free
	Rotationally free
Support B	Vertically restrained
	Rotationally free
Support C	Vertically restrained
	Rotationally free
Support D	Vertically restrained
	Rotationally free
Support E	Vertically restrained
	Rotationally free
Support F	Vertically free
	Rotationally free

Analysis results

Maximum moment support A	M_{A_max} = 0 kNm	M_{A_red} = 0 kNm
Maximum moment span 1 at support	M_{s1_max} = 0 kNm	M_{s1_red} = 0 kNm
Maximum moment support B	M_{B_max} = -57 kNm	M_{B_red} = -57 kNm
Maximum moment span 2 at 1799 mm	M_{s2_max} = 1 kNm	M_{s2_red} = 1 kNm
Maximum moment support C	M_{C_max} = -20 kNm	M_{C_red} = -20 kNm
Maximum moment span 3 at 1740 mm	M_{s3_max} = 27 kNm	M_{s3_red} = 27 kNm
Maximum moment support D	M_{D_max} = -19 kNm	M_{D_red} = -19 kNm
Maximum moment span 4 at 668 mm	M_{s4_max} = -11 kNm	M_{s4_red} = -11 kNm
Maximum moment support E	M_{E_max} = -57 kNm	M_{E_red} = -57 kNm
Maximum moment span 5 at support	M_{s5_max} = 0 kNm	M_{s5_red} = 0 kNm
Maximum moment support F	M_{F_max} = 0 kNm	M_{F_red} = 0 kNm
Maximum shear support A	V_{A_max} = -45 kN	V_{A_red} = -47 kN
Maximum shear support A span 1 at 150 mm	$V_{A\_s1\_max}$ = -48 kN	$V_{A\_s1\_red}$ = -48 kN
Maximum shear support B	V_{B_max} = -69 kN	V_{B_red} = -69 kN
Maximum shear support B span 1 at 834 mm	$V_{B\_s1\_max}$ = -65 kN	$V_{B\_s1\_red}$ = -65 kN
Maximum shear support B span 2 at 166 mm	$V_{B\_s2\_max}$ = 48 kN	$V_{B\_s2\_red}$ = 48 kN
Maximum shear support C	V_{C_max} = 46 kN	V_{C_red} = 46 kN
Maximum shear support C span 2 at 2582 mm	$V_{C\_s2\_max}$ = -23 kN	$V_{C\_s2\_red}$ = -23 kN
Maximum shear support C span 3 at 168 mm	$V_{C\_s3\_max}$ = 42 kN	$V_{C\_s3\_red}$ = 42 kN
Maximum shear support D	V_{D_max} = -45 kN	V_{D_red} = -45 kN
Maximum shear support D span 3 at 3350 mm	$V_{D\_s3\_max}$ = -42 kN	$V_{D\_s3\_red}$ = -42 kN
Maximum shear support D span 4 at 150 mm	$V_{D\_s4\_max}$ = 18 kN	$V_{D\_s4\_red}$ = 18 kN
Maximum shear support E	V_{E_max} = 69 kN	V_{E_red} = 69 kN
Maximum shear support E span 4 at 2250 mm	$V_{E\_s4\_max}$ = -48 kN	$V_{E\_s4\_red}$ = -48 kN
Maximum shear support E span 5 at 150 mm	$V_{E\_s5\_max}$ = 65 kN	$V_{E\_s5\_red}$ = 65 kN
Maximum shear support F	V_{F_max} = 0 kN	V_{F_red} = 0 kN
Maximum shear support F span 5 at 850 mm	$V_{F\_s5\_max}$ = 48 kN	$V_{F\_s5\_red}$ = 48 kN
Maximum reaction at support A	R_A = 0 kN	
Maximum reaction at support B	R_B = 121 kN	
Maximum reaction at support C	R_C = 73 kN	
Maximum reaction at support D	R_D = 67 kN	
Maximum reaction at support E	R_E = 120 kN	

Maximum reaction at support F R_F = **0** kN

Rectangular section details

Section width b = **1000** mm Section depth h = **200** mm

Material details

Concrete strength class **C28/35** Char comp cube strength f_{cu} = **35** N/mm²

Modulus of elasticity of conc E_c = **27000** N/mm² Maximum aggregate size h_{agg} = **20** mm

Char yield strength of reinf f_y = **500** N/mm² Char yield str of shear reinf f_{yv} = **500** N/mm²

Nominal cover to top reinf c_{nom_t} = **20** mm Nominal cover to bottom reinf c_{nom_b} = **20** mm

Nominal cover to side reinf c_{nom_s} = **50** mm

Mid span 1

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment M = **40** kNm Depth to tension reinf. d = **168** mm

K = **0.041** K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm z = **160** mm Depth of neutral axis x = **19** mm

Area of tension reinf req'd $A_{s,req}$ = **582** mm² Tension reinf provided 7 × 12ϕ bars

Area of tension reinf prov $A_{s,prov}$ = **792** mm² Minimum area of reinf $A_{s,min}$ = **260** mm²

Maximum area of reinf $A_{s,max}$ = **8000** mm²

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c

Area of shear reinf provided $A_{sv,prov}$ = **1131** mm²/m Minimum area of shear reinf $A_{sv,min}$ = **920** mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **126** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **134** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **244.9** N/mm² Max distance between bars s_{max} = **192** mm

PASS - Satisfies the maximum spacing criteria

Support B

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment M = **57** kNm Depth to tension reinf. d = **166** mm

K = **0.059** K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm z = **154** mm Depth of neutral axis x = **26** mm

Area of tension reinf req'd $A_{s,req}$ = **847** mm² Tension reinf provided 7 × 16ϕ bars

Area of tension reinf prov $A_{s,prov}$ = **1407** mm² Minimum area of reinf $A_{s,min}$ = **260** mm²

Maximum area of reinf $A_{s,max}$ = **8000** mm²

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear - span 1 at 834 mm V = **65** kN Shear stress v = **0.393** N/mm²

Allowable design shear stress v_{max} = **4.733** N/mm²

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7 $v < 0.5v_c$

Design shear resistance req'd v_s = **0.400** N/mm^2 Area of shear reinf req'd $A_{sv,req}$ = **920** mm^2/m

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c Area of shear reinf. prov $A_{sv,prov}$ = **1131** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **125** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Shear - span 2 at 166 mm V = **48** kN Shear stress v = **0.291** N/mm^2

Allowable design shear stress v_{max} = **4.733** N/mm^2

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7 v < 0.5v_c

Design shear resistance req'd v_s = **0.400** N/mm^2 Area of shear reinf req'd $A_{sv,req}$ = **920** mm^2/m

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c Area of shear reinf. prov $A_{sv,prov}$ = **1131** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **125** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **129** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **200.6** N/mm^2 Max distance between bars s_{max} = **234** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9) span_to_depth$_{basic}$ = **7.0** Service stress in tension rein f_s = **200.6** N/mm^2

Modification for tension reinf f_{tens} = **1.327** Modification for comp reinf f_{comp} = **1.112**

Modification for span > 10m f_{long} = **1.000** Allowable span to depth ratio span_to_depth$_{allow}$ = **10.3**

Actual span to depth ratio span_to_depth$_{actual}$ = **6.0**

PASS - Actual span to depth ratio is within the allowable limit

<u>Mid span 2</u>

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment M = **1** kNm Depth to tension reinf. d = **169** mm

K = **0.001** K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm z = **161** mm Depth of neutral axis x = **19** mm

Area of tension reinf req'd $A_{s,req}$ = **18** mm^2 Tension reinf provided 7 × 10ϕ bars

Area of tension reinf prov $A_{s,prov}$ = **550** mm^2 Minimum area of reinf $A_{s,min}$ = **260** mm^2

Maximum area of reinf $A_{s,max}$ = **8000** mm^2

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c

Area of shear reinf provided $A_{sv,prov}$ = **1131** mm^2/m Minimum area of shear reinf $A_{sv,min}$ = **920** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **127** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **136** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **11.0** N/mm^2 Max distance between bars s_{max} = **300** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9)	$span\_to\_depth_{basic}$ = **26.0**	Service stress in tension rein	f_s = **11.0** N/mm^2
Modification for tension reinf	f_{tens} = **2.000**	Modification for comp reinf	f_{comp} = **1.135**
Modification for span > 10m	f_{long} = **1.000**	Allowable span to depth ratio	$span\_to\_depth_{allow}$ = **59.0**
Actual span to depth ratio	$span\_to\_depth_{actual}$ = **16.3**		

PASS - Actual span to depth ratio is within the allowable limit

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment	M = **37** kNm	Depth to tension reinf.	d = **168** mm
	K = **0.037**		K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm	z = **160** mm	Depth of neutral axis	x = **19** mm
Area of tension reinf req'd	$A_{s,req}$ = **532** mm^2	Tension reinf provided	7 × 12ϕ bars
Area of tension reinf prov	$A_{s,prov}$ = **792** mm^2	Minimum area of reinf	$A_{s,min}$ = **260** mm^2
Maximum area of reinf	$A_{s,max}$ = **8000** mm^2		

PASS - Area of reinforcement provided is greater than area of reinforcement required

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars	s = **134** mm	Min dist between bars	s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress	f_s = **224.2** N/mm^2	Max distance between bars	s_{max} = **210** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9)	$span\_to\_depth_{basic}$ = **26.0**	Service stress in tension rein	f_s = **224.2** N/mm^2
Modification for tension reinf	f_{tens} = **1.503**	Modification for comp reinf	f_{comp} = **1.098**
Modification for span > 10m	f_{long} = **1.000**	Allowable span to depth ratio	$span\_to\_depth_{allow}$ = **42.9**
Actual span to depth ratio	$span\_to\_depth_{actual}$ = **16.4**		

PASS - Actual span to depth ratio is within the allowable limit

Support C

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment	M = **20** kNm	Depth to tension reinf.	d = **168** mm
	K = **0.020**		K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm	z = **160** mm	Depth of neutral axis	x = **19** mm
Area of tension reinf req'd	$A_{s,req}$ = **291** mm^2	Tension reinf provided	7 × 12ϕ bars
Area of tension reinf prov	$A_{s,prov}$ = **792** mm^2	Minimum area of reinf	$A_{s,min}$ = **260** mm^2
Maximum area of reinf	$A_{s,max}$ = **8000** mm^2		

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear - span 2 at 2582 mm	V = **23** kN	Shear stress	v = **0.138** N/mm^2
Allowable design shear stress	v_{max} = **4.733** N/mm^2		

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7	v < 0.5v_c		
Design shear resistance req'd	v_s = **0.400** N/mm^2	Area of shear reinf req'd	$A_{sv,req}$ = **920** mm^2/m
Shear reinforcement provided	4 × 6ϕ legs at 100 c/c	Area of shear reinf. prov	$A_{sv,prov}$ = **1131** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing	$s_{vl,max}$ = **126** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Shear - span 3 at 168 mm V = **42** kN Shear stress v = **0.251** N/mm²

Allowable design shear stress v_{max} = **4.733** N/mm²

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7 v < 0.5v_c

Design shear resistance req'd v_s = **0.400** N/mm² Area of shear reinf req'd $A_{sv,req}$ = **920** mm²/m

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c Area of shear reinf. prov $A_{sv,prov}$ = **1131** mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **126** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **134** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **122.7** N/mm² Max distance between bars s_{max} = **300** mm

PASS - Satisfies the maximum spacing criteria

Mid span 3

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment M = **27** kNm Depth to tension reinf. d = **169** mm

K = **0.027** K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm z = **161** mm Depth of neutral axis x = **19** mm

Area of tension reinf req'd $A_{s,req}$ = **380** mm² Tension reinf provided 7 × 10ϕ bars

Area of tension reinf prov $A_{s,prov}$ = **550** mm² Minimum area of reinf $A_{s,min}$ = **260** mm²

Maximum area of reinf $A_{s,max}$ = **8000** mm²

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear reinforcement provided 4 × 6ϕ legs at 100 c/c

Area of shear reinf provided $A_{sv,prov}$ = **1131** mm²/m Minimum area of shear reinf $A_{sv,min}$ = **920** mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **127** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **136** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **230.6** N/mm² Max distance between bars s_{max} = **204** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9) $span\_to\_depth_{basic}$ = **26.0** Service stress in tension rein f_s = **230.6** N/mm²

Modification for tension reinf f_{tens} = **1.672** Modification for comp reinf f_{comp} = **1.098**

Modification for span > 10m f_{long} = **1.000** Allowable span to depth ratio $span\_to\_depth_{allow}$ = **47.7**

Actual span to depth ratio $span\_to\_depth_{actual}$ = **20.7**

PASS - Actual span to depth ratio is within the allowable limit

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[signature]	21/10/2014	

At Internal Supports & Spans:-

$V_{max} = 52.0 kN$ (ULS)

H12 @ 150 c/c => $A_s = 754 mm^2/m$. T & B.

=> $100 A_s / bd = 0.44$, $d = 170$ } $v_c = 1.12 \times 0.594 = 0.67 N/mm^2$

	150	170	175
0.25	0.51		0.49
0.44	0.61	0.594	0.59
0.50	0.64		0.62

$v = V/bd = \frac{52.0 \times 10^3}{10^3 \times 170} = 0.31 N/mm^2$

$v < v_c$ ∴ NO LINKS REQ'D.

TP01

Front-to-Rear Slab strip, spanning onto Basement Columns:-

Max UDL from transverse beam strip = 73 kN/m (ULS)

Span ≤ 5.0m

Consider as simply-supported ⇒ $M_{max} = 73 \times 5^2/8$
= 228.1 kNm (ULS)
mid-span.

b = 1000
h = 250
cover = 20
⇒ d = 250 - 20 - 5 - 10
= 215

$f_{cu} = 35$
$f_y = 460$

$K = M/bd^2 f_{cu} = 0.141 < 0.156$
∴ singly reinforced.

⇒ $z = 0.806\,d = 173$ mm

⇒ $A_s = M/0.95 f_y z = 3017 mm^2$

10H20 B ⇒ $A_{s\,prov} = 3140 mm^2$

Reactions = $\frac{5}{2} \times 73$ = 182.5 kN (ULS)

⇒ $v = V/bd = \frac{182.3}{215} = 0.85 N/mm^2$

$100A_s/bd = \frac{100 \times 3140}{1000 \times 215} = 1.46$, d = 215 ⇒ $v_c = 1.12 \times 0.83 = 0.93 N/mm^2$

	200	215	225
1.00	0.75	0.74	0.73
1.46		0.83	
1.50	0.86	0.84	0.83

Consider Punching Shear at Detailed Design Stage.

Buoyancy Review.

Consider 3m excavation with Water level 1m below GL => 2m head ∴ uplift pressure = 20 kN/m² (SCS).

Stage 1:- Excavation + blinding & 350 slab

=> DL↓ = 0.4 × 24 = 9.6 kN/m² ↓ << Uplift

∴ allow flooding.

Stage 2: Basement slab + perimeter walls

0.2 × 2.7m × 24 => 13 kN/m

Perimeter length = 10.2 + 10.2 + 13.2 + 13.2 = 46.8 m
× 13
= 608 kN

Area ≑ 13.7 × 9.5 = 130 m²
× 9.6
= 1249 kN
+ 608
= 1857 kN ↓

Σ Uplift = 20 × 130 = 2600 kN ↑ ∴ Floatation would occur

For FoS = 1.0, depth of water above U/S of slab = $\frac{1857}{130 \times 10}$ = 1.43 m

For FoS = 1.25, depth = $\frac{(1857 \div 1.25)}{130 \times 10}$ = 1.14 m

∴ ensure flooding can occur if water higher than 1m above U/S of slab.

Stage 3:- Gd Floor slab cast.

DL = 0.2 × 24 = 4.8 kN/m²

Area ≑ 10.7 × 11.5 = 123 m²
× 4.8
= 591 kN
+ 1857
= 2448 kN ↓ < 2600

∴ FLOATATION WILL OCCUR

PTO

For FoS = 1.25, total DL↓ req'd = 1.25 × 2600
= 3250 kN ↓

Σ Available DL = 2248 kN

∴ extra req'd = 3250
− 2248
1002 kN ÷ 130
= 7.7 kN/m²

∴ extra slab thickness req'd = $\frac{7.7}{24}$ = 0.32 m

ie 320 + 350 = 670 mm
TOO THICK TO BE COST EFFECTIVE ∴ CONSIDER NEXT STAGE.

For FoS = 1.25, max depth of water = $\frac{(2248 \div 1.25)}{130 \times 10}$

= 1.38 m.

∴ Allow flooding if WL is 1.0m above SSL.

Stage 4:-

Superstructure. DL = ?

Σ loads applied to Gd Floor slab = ?

See load take-down:-

Σ ≑ (16 × 2.5) + (15 × 2.1) + (21 × 3.4) + (38 × 6.0) + (35 × 10.2)

+ (46 × 6.0) + (30 × 7.0) + 76.2 + 75.9 + 6 + 6 + 102.1 + 90.9

= 1571 kN allow for DL ≑ 50% ave
⇒ 786 kN↓
+ 2248
3034 kN↓

∴ FoS = $\frac{3034}{2600}$ = 1.17 < 1.5 ∴ INSUFFICIENT.

∴ Provide anchorage via Pile Wall.

PTO

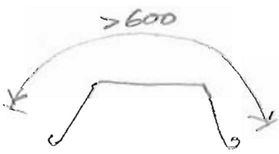
For FoS = 1.5, Σ resistance = 1.5 × 2600
= 3900 kN ↓
− 3034 DL
866 kN ↓ REQUIRED.

Perimeter length ≑ 608m

∴ resistance/m = 866/608 = 1.4 kN/m

Provide 1 deep pile/2.4 ∴ 3.36 kN/pile

coefficient of friction − of granular soils on steel ≥ 0.3, say



Lateral pressure on pile at 3m depth
≑ 0.25 × 3 × 16 = 12 kN/m²

Consider pressure on one side only
∴ resistance = 0.3 × 12 × 0.6m
= 2.16 kN/m embedment

∴ embedment length req'd = 3.36/2.16 = 1.55 m

Provide 1 pile in 4, to extend 2m below excavation.

Basement slab 350 thick cannot span between outer walls, therefore provide anchorage piles on regular grid.

For F.o.S of 1.25 at Stage 3, Σ resistance = 1.25 × 2600
= 3250 kN ↓
Σ DL = − 2248

∴ Extra req'd = 1002 kN

3m × 3m grid ⇒ 9m²/pile 130m²/9 = 14 Nº piles.

For 12 Nº piles, uplift resistance req'd = 1002/12 = 84 kN/pile.

✗ Design basement slab for Nett uplift of 20.0 − 9.6 = 10.4 kN/m² ↑ (SLS)

Tension piles provide 1002kN resistance
$\div 130 = 7.7 \text{ kN/m}^2$
Basement slab DL provides 9.6
17.3 kN/m² < 20

∴ Allow flooding until walls cast (& gd floor slab cast)

Walls provide 608 kN
$\div 130 = 4.7$ kN
$+ 17.3$
22 kN ↓ > 20 kN ↑

∴ FoS = $\frac{22}{20}$ = 1.1 ∴ OK before Gd Flr slab cast.

Design lining walls for Soil, Surcharge and Water pressures.

Alternative Proposal:–

PROVIDE TENSION PILES ON 3m GRID.

Once slab has achieved working strength, pressures will be carried by the piles.
Until then, provision for flooding is still required.

Foundation Loads

As Existing

2-storey house with pitched roof, with side & rear extensions.

Loadings

Roof DL tiles 0.60
rafters 0.14
0.74 kN/m² on slope

≡ 0.93 kN/m² on plan

Attic DL joists 0.12
ceiling 0.15
0.27 kN/m² on plan.

1st Floor DL boards 0.12
joists 0.14
ceiling 0.15
0.41 kN/m²
Partitions 1.0
1.4 kN/m²

Ground Floor – 150 concrete presumed = 3.6 kN/m²
Partitions 1.0
4.6 kN/m²

∴ Σ roof & floor loads = 4.6 + 1.4 + 0.27 + 0.93

= 7.2 kN/m² (SLS) (DL only.)

External Walls:–

Cavity construction, at say, 2 kN/m²

height = 5 m
10 kN/m

Total length = 29.4 m ⇒ 294 kN
inc 2 storey side extⁿ.

Total Footprint area ≑ 74.4 m²
× 7.2
535.7 kN
+ 294
830 kN on 29.4 m of strip footing
⇒ 28 kN/m ave foundation load.

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Single-storey rear extension.

Flat roof DL asphalt 0,60
ply 0,12
firrings 0,06
joists 0,14
ceiling 0,15
1,07 kN/m²

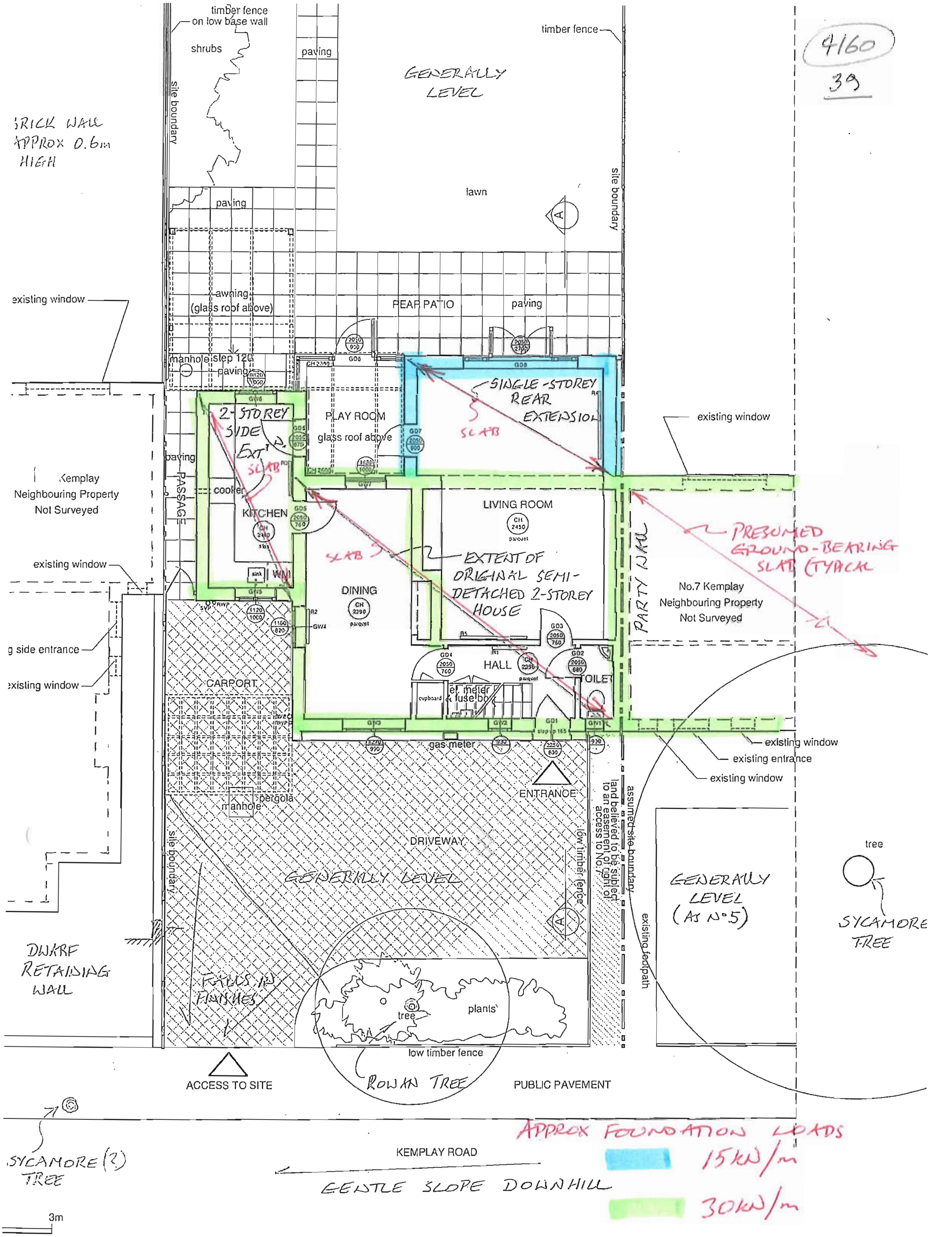
Floor slab presumed to be ground bearing.

External cavity wall : 4kN/m²
× 2,5m height
10 kN/m DL

Total wall length = 10.2m
⇒ 102 kN

Total area = 26.9m²
× 1.07
28.8 kN
+103
∴ Σ = 132 kN on 10.2m
⇒ 13 kN/m ave. (SLS).

TP01



ALL DIMENSIONS TO BE CHECKED ON SITE DO NOT SCALE

DRAWING
GROUND FLOOR - EXISTING

PROJECT
5 KEMPLAY ROAD, NW3

CLIENT

TAG ARCHITECTS

TAG ARCHITECTS
14 BELSIZE CRESCENT, HAMPSTEAD, LONDON NW3 5QU

DATE
01.1

JOB
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Party Wall Loading on Existing Foundation.

Presumed 9" wall at 5 kN/m²

Ave Ht ≑ 8m above Gd Floor ⇒ 40 kN/m DL.

Pitched roof, attic & 1st floor presumed to span front-to-rear.

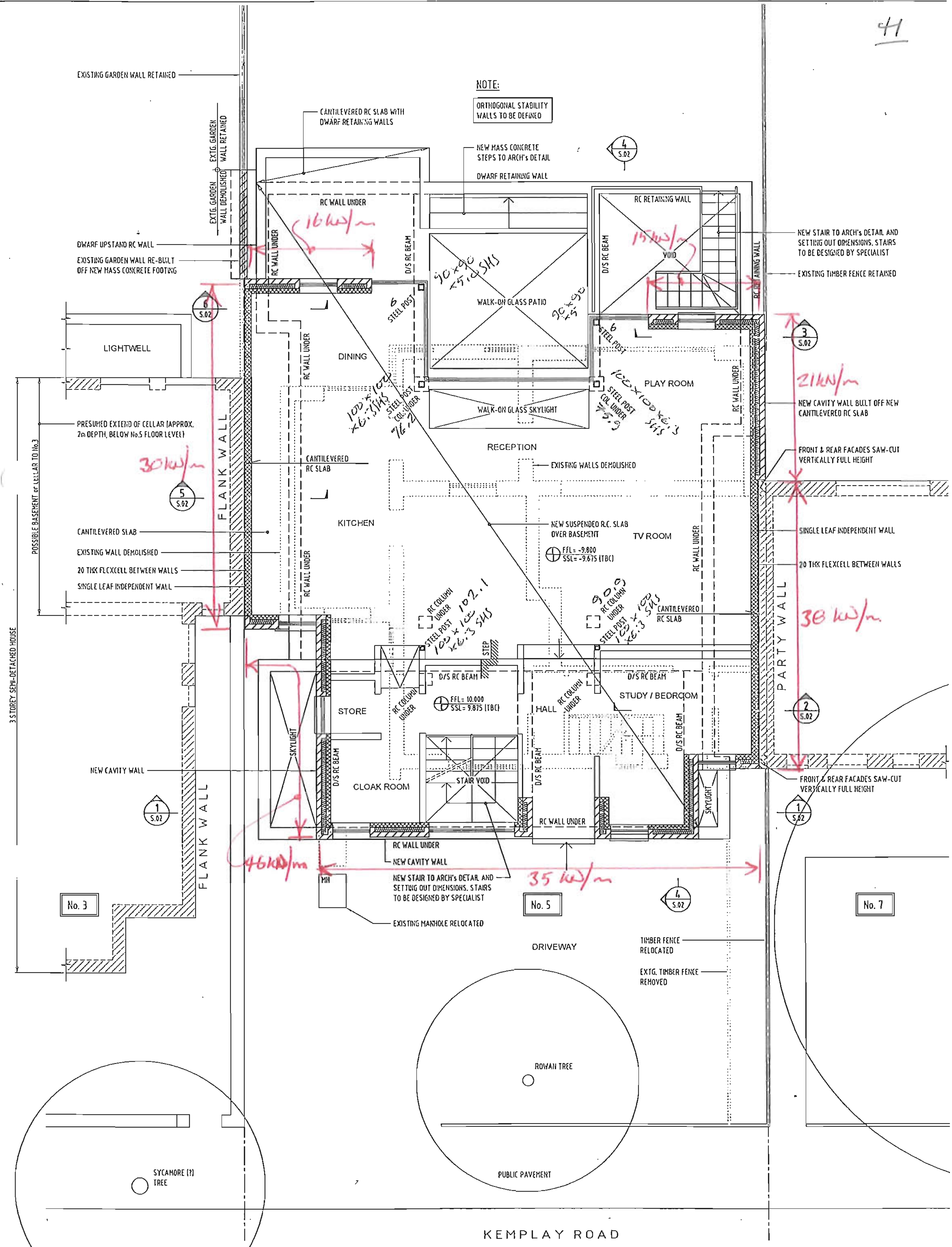
∴ removal of № 5 will not change loading.

If 1st floor does span onto the Party Wall then
& width supported ≑ $\frac{9}{2}$ = 4.5m

DL	0.45
Partitions	1.0
IL	1.5
	2.95 kN/m²
	×4.5
	13 kN/m

∴ Σ Existing = 13 + 40 = 53 kN/m (SLS)

Σ Proposed = 53 − $\frac{13}{2}$ = 47 kN/m. (SLS)



PROPOSED GROUND FLOOR PLAN

SCALE 1:50

SERVICE LOADS ON SLAB

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Made By	**Dates**	**Chkd**
DY	22/10/2014	

As Proposed – Foundation Loads. (SLS)

Wall	Loads Carried kN	Σ Self Wt kN	Total kN	Average kN/m at Gd Flr Lvl.
LH 140 wall	Flat roof 1.7 kN/m 1st floor 5.7 7.4 × 4.5m = 33.3 kN 1B1: 13 + 28.2/2 = 27.1 1B2: 14.6 = 14.6 75 kN	4 kN/m² × 4.5m × 6m = 108 kN 4 × 2.5m × 3m = 30 kN 138 kN	75 + 138 = 213 kN	213 ÷ 7m = 30 kN/m.
LH cavity wall.	RB1: 22.4 kN Joists: 3.1/m × 4.3m = 41.3 kN Joists 41.3 2B7: 28.2 133 kN	4 kN/m² × 6.2m × 6m = 149 kN	149 + 133 = 282 kN	282 ÷ 6.2m = 46 kN/m
RH 140 wall	Flat roof 1.7 kN/m Joists 5.7 7.4 × 5.4m = 37.8 kN 1B5: 17.6 + (45.9 × 6/10) = 45.1 83 kN	4 kN/m² × 6m × 6m = 144 kN	144 + 83 = 227	227 ÷ 6 = 38 kN/m
Front Facade	Rafters: 3.3 kN/m × 8m = 26.4 kN 2B3: 22.4 2B4: 12.2 1B9: 4.3 1B11: 19.1 1B12: 25.8 110 kN	4 kN/m² × 10.3 × 6m = 247 kN	247 + 110 = 357	357 ÷ 10.2 = 35 kN/m
Rear Facade LH side	Joists: ~3.1 kN/m × 2.7m = 8.4 1B15 2.6 11 kN	4 kN/m² × 2.7m × 3m = 32 kN	32 + 11 = 43	43 ÷ 2.7 = 16 kN/m
Rear Facade RH side	Joists: ~1.9 kN/m × 2.5 = 4.8 1B17: 2.7 7.5	4 kN/m² × 2.5m × 3m = 30 kN	30 + 8 = 38	38 ÷ 2.5 = 15 kN/m
RH Flank Cavity Wall	Joists: ~3.1 × 0.6 × 2m = 6.9 kN 1B3: 16.3 + 35.6/3 = 28.2 35 kN	4 kN/m² × 3.5m × 3m = 42 kN	42 + 35 = 77	77 ÷ 3.5 = 21 kN/m

TRIGRAM PARTNERSHIP
CONSULTING STRUCTURAL ENGINEERS

Job No	Sheet No.	Rev
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Made By	Dates	Chkd
TM	22/10/2014	

Gd Floor Slab – loadings onto supporting Walls & Columns:–

Rear LH Zone:

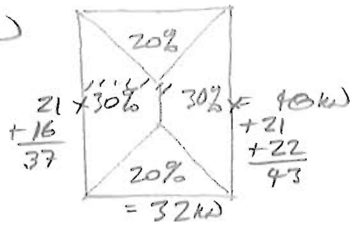
consider as 2-way panel.

ΣDL + LL = 6.7 + 5.0 = 11.7 kN/m² (ULS)

÷1.4   ÷1.6

4.8 + 3.1 = 7.9 kN/m² (SLS)

4m × 5m ⇒ 20m² ⇒ 160 kN



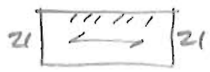
Wall @ 16 kN/m × 2.6m ⇒ 42 kN

⇒ 21 kN to LH & 21 to RH

Rear RH Zone:

Consider as one-way panel 1.5 × 3.5m

⇒ 5.3m² @ 7.9 ⇒ 41 kN



⇒ 21 kN to each side

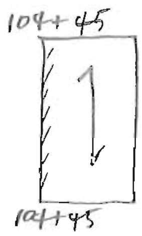
Allow for wall at 15 kN/m × 2.5m = 38 kN

say 22 kN to R & 16 kN to L

Front LH Zone:

Consider as one-way panel 2.5 × 4.5m

⇒ 11.3m² @ 7.9 ⇒ 89 kN



⇒ 45 kN to each edge

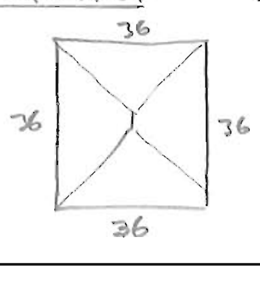
Allow for wall carrying 46 kN/m

⇒ 46 × 4.5/2 = 104 kN to each edge

Front RH Zone:– Consider as 2-way panel 4.0 × 4.5m

⇒ 18m² @ 7.9 ⇒ 142 kN

⇒ 36 kN to each edge.



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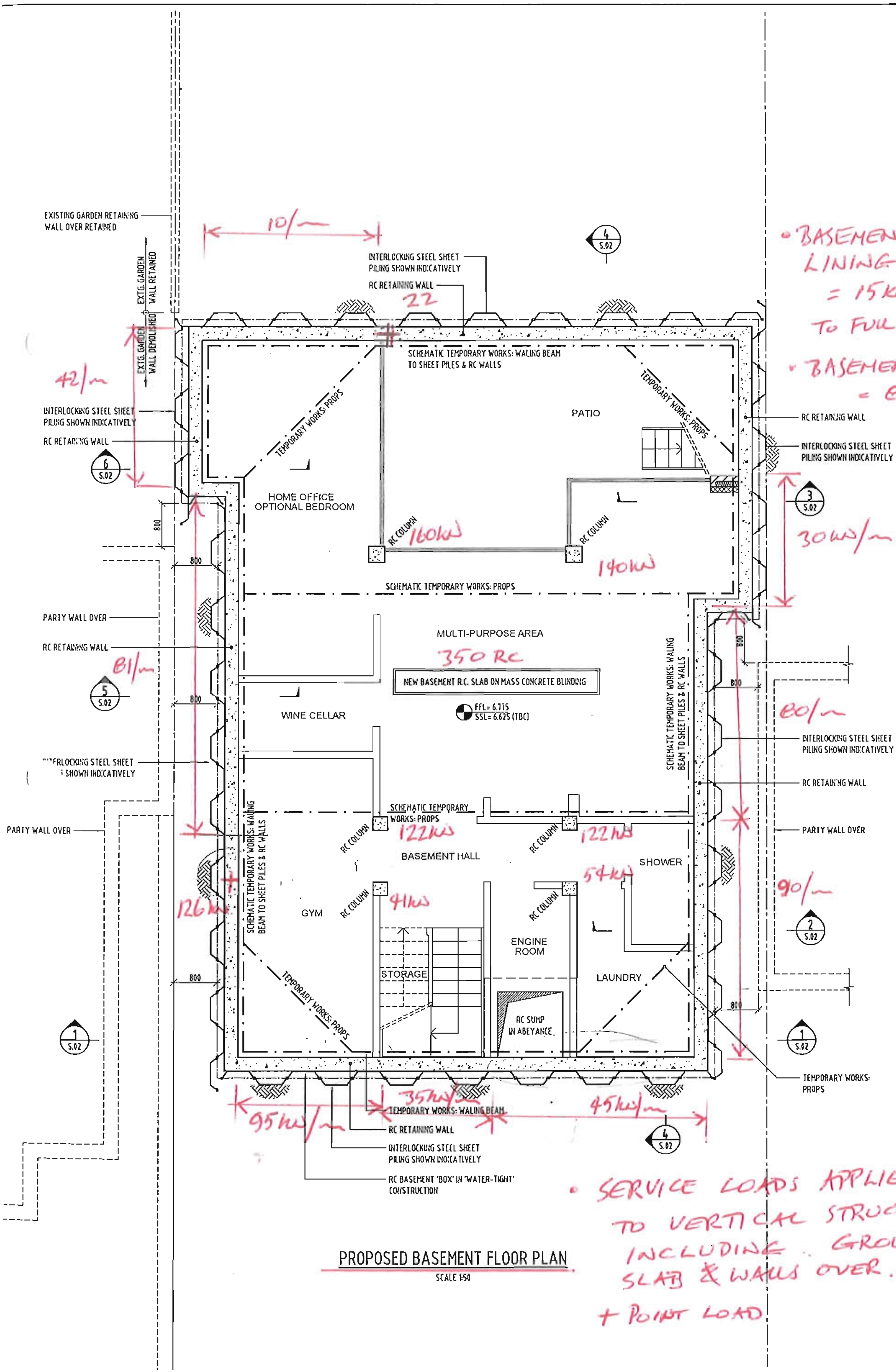

- BASEMENT LINING WALL = 15kN/m TO FULL PERIMETER
- BASEMENT SLAB = 8kN/m²

- SERVICE LOADS APPLIED TO VERTICAL STRUCTURE, INCLUDING GROUND FLOOR SLAB & WALLS OVER. + POINT LOAD

PROPOSED BASEMENT FLOOR PLAN

SCALE 1:50