PK & Partners
Consulting Engineers

Structural Engineer's Report
Basement Impact Assessment

49 Willow Road, London, NW3 1TS

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Ref: 2136 49 Willow Road BIA
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Revision: C

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Contents

1 Introduction

1.1 This structural report has been prepared to support the planning application for the proposed lower ground floor extension at 49 Willow Road, London NW3. It outlines the structural design philosophy and the anticipated construction methodology for the proposed construction. It considers the site, geology, groundwater and hydrology, environmental considerations, sustainability, structural stability, temporary works, construction access and the boundary aspects in relation to the proposed works.

1.2 This report has been prepared in accordance with 'Camden Planning Guidance - Basements – March 2018' and Camden Local Plan (2017) Policy A5 (Basements)'.

1.3 This report should be read in conjunction with all Architect's and other Consultants' reports, drawings and documentation submitted with the planning application.

2 Description of the Site & Property

Location & Access

2.1 49 Willow Road is located in the London Borough of Camden at the intersection of Willow Road with the north end of Gayton Road. Access to the site is gained from Gayton Road which is connected to Rosslyn Hill or from Willow Road which is linked to Christchurch Hill.

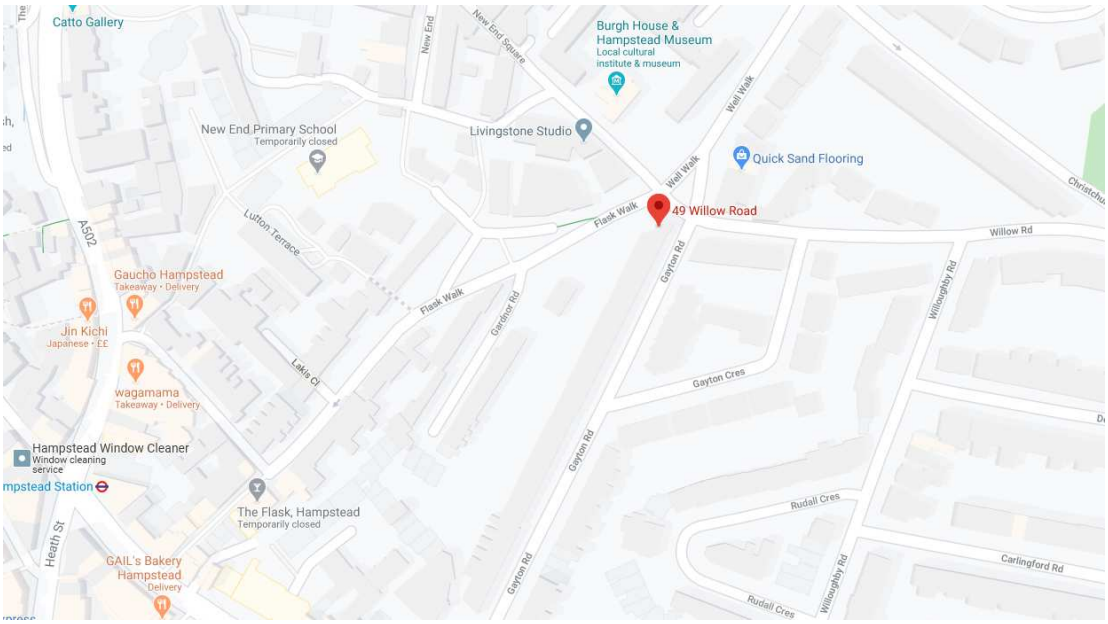

Figure 1: Map showing location of 49 Willow Road.

2.2 The property is bounded by Willow Road to the north, Gayton Road to the east, adjoined by 36 Gayton Road to the south and a single storey garage at Flask Walk to the west (see figure 2 – below).

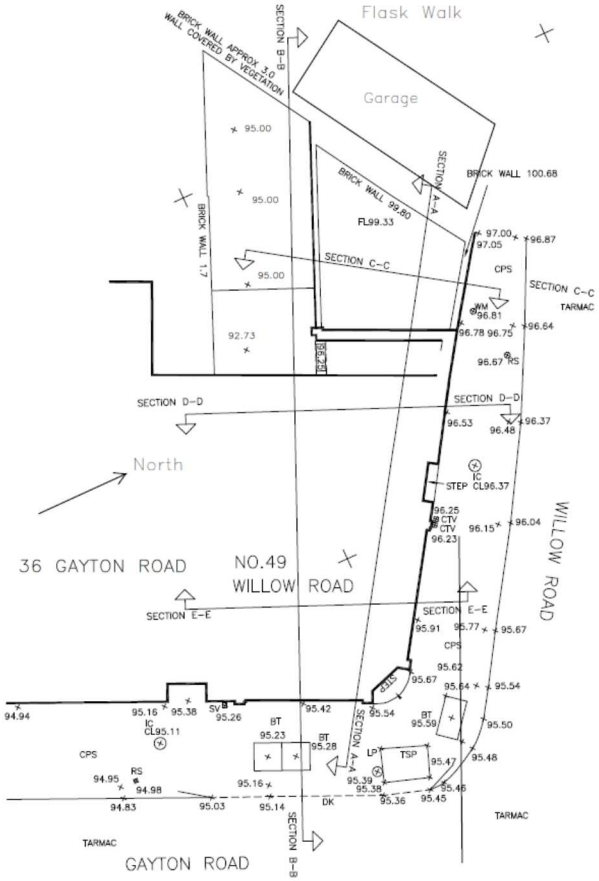

Figure 2: Topographical survey showing surrounding structures.

Ground Conditions

2.3 With reference to the geological survey of London, the sub-soil for the formation of foundations is Claygate which has been confirmed by borehole investigations by GEA. The ground slopes significantly down towards the south east along Willow Road and south west along Gayton Road (see photo 1).

Existing structure and foundations

2.4 The building comprises load bearing masonry, concrete lower ground floor, timber floors to ground and upper floors; and a timber mansard roof. The original building would have been 4 storeys high occupying the lower ground to 2nd floor.

Photo 1: Gayton Road (East) Elevation

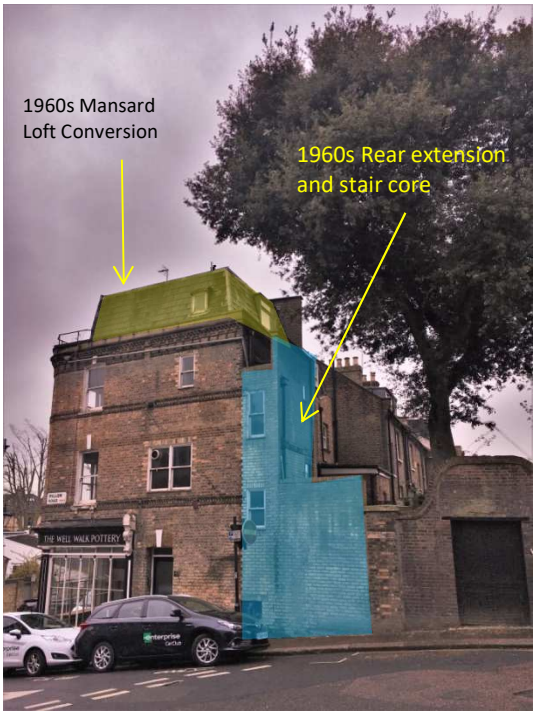

Photo 2: Willow Road (North) Elevation

2.5 The mansard loft extension, the rear ground floor and stair extensions were added in the 1960s, the extents of these are highlighted in photo 2.

2.6 Trial pits have confirmed that the foundations to the original building are masonry spread footing with 3 corbels approximately 450mm to 600mm below the lower ground floor level (photo 3). The mass concrete footings to 1960s extension are founded at a similar depth relative to the floor level (photo 4).

Photo 3: Lower ground floor trial pit

Photo 4: Ground floor trial pit in 1960s extension

3 Description of Local Geology and Hydrology

3.1 The site generally slopes down towards the south east directions and trial pits confirm the subsoil comprises Claygate.

Groundwater

3.2 Boreholes undertaken at the site indicates that groundwater is not present below the lower ground floor although seepage from granular pockets in the Claygate was encountered in borehole 2. It is therefore expected that some seepage will be encountered during the works but the construction of the basement will not adversely affected by groundwater or impede the natural flow of groundwater.

Flood risk assessment

3.3 The site is in Flood Zone 1 with a low probability of flooding. It is not in an area susceptible to fluvial or reservoir flooding. Flood maps confirm that Hampstead ponds are 0.4 miles to the east and the extent of reservoir flooding does not affect the site.

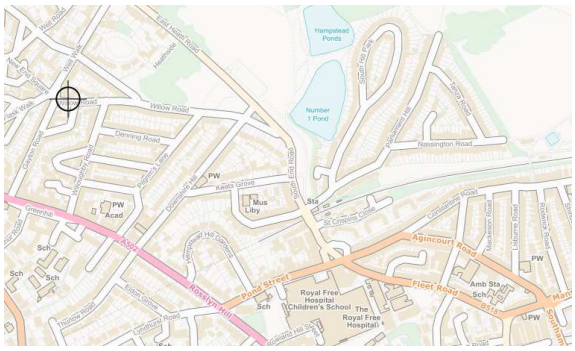

Figure 3: Map of extent of fluvial flooding

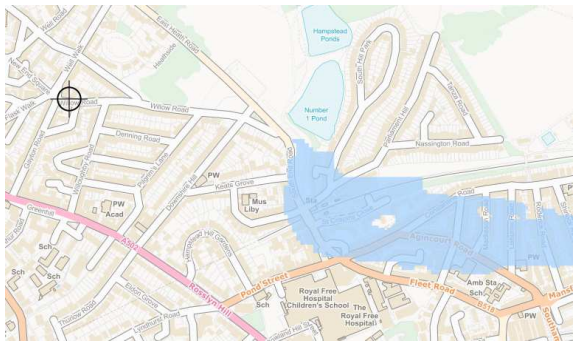

Figure 4: Map of extent of reservoir flooding.

Critical Drainage Areas and SuDs

3.4 The site is within a Critical Drainage Area Group 3_010 for Surface Water Management Plan. It is therefore important that the proposed lower ground floor does not increase the surface water peak run off rate. The proposed extension is contained within the built footprint so the run off rate is not affected by the proposed lower ground floor extension.

Figure 5: Map of extent of surface water flooding.

Sewer flooding prevention

3.5 The foul water in the basement will be pumped to prevent sewer flooding in the basement. The basement sump will have a back-up pump and a 24 storage capacity in case of breakdowns

3.6 A tanking membrane in combination with integral structural waterproofing is to be used to achieve a Grade 3 basement as defined in BS 8102: 2009 'Code of practice for protection of below ground structures against water from the ground'.

4 Environmental Considerations

Ground Contamination

4.1 The site was previously undeveloped prior to the construction of the property and is founded on undisturbed Claygate member. The area has historically been an affluent residential London suburb and therefore the risk of ground contamination is low.

4.2 Samples have been taken for testing and the results confirm that the soils are non-hazardous and inert for the made ground and natural soils respectively for the purposes of waste disposal.

4.3 Spoil arising from excavations or landscaping works will be disposed to licensed landfills that accept inert, non-hazardous or hazardous wastes in accordance with the Environment Agency regulations.

5 Structural Proposal

5.1 The structural design has been undertaken to RIBA stage 4. Drawings showing the proposed lower ground floor structure are included in Appendix A. The following is a brief overview of the proposed works in order to provide context to the drawings. Reference should be made to the Architect's and other Consultant's reports and drawings for more detail.

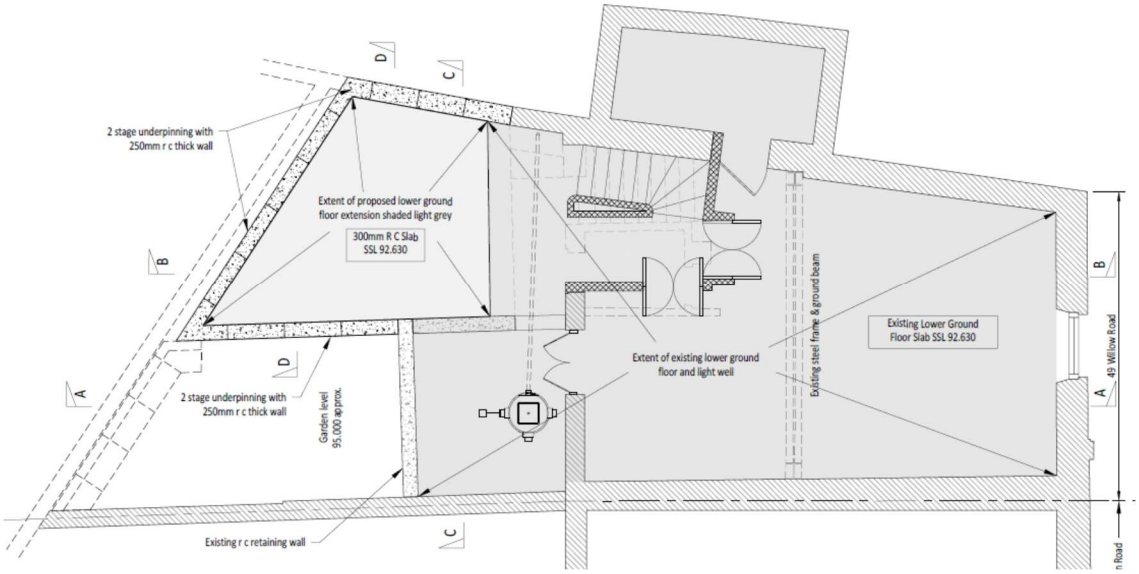

Figure 6: Lower Ground Floor Plan Showing Proposed Extension

5.2 With reference to figure 6 (above), the existing lower ground floor occupies 52.7 m^2 shaded dark grey. It is proposed to excavate below the existing 1960's ground floor extension to enlarge the accommodation by 11.4m^2 (shaded light grey).

Structural scheme

5.3 The permanent lower ground floor structure will be constructed with reinforced concrete walls and slabs. These are a minimum of 250mm and 300mm thick respectively. They are designed as propped cantilevers restrained by the lower ground floor and ground floor slabs. The retaining walls are designed to sustain earth pressure at the rest and a hydrostatic head of water at garden level.

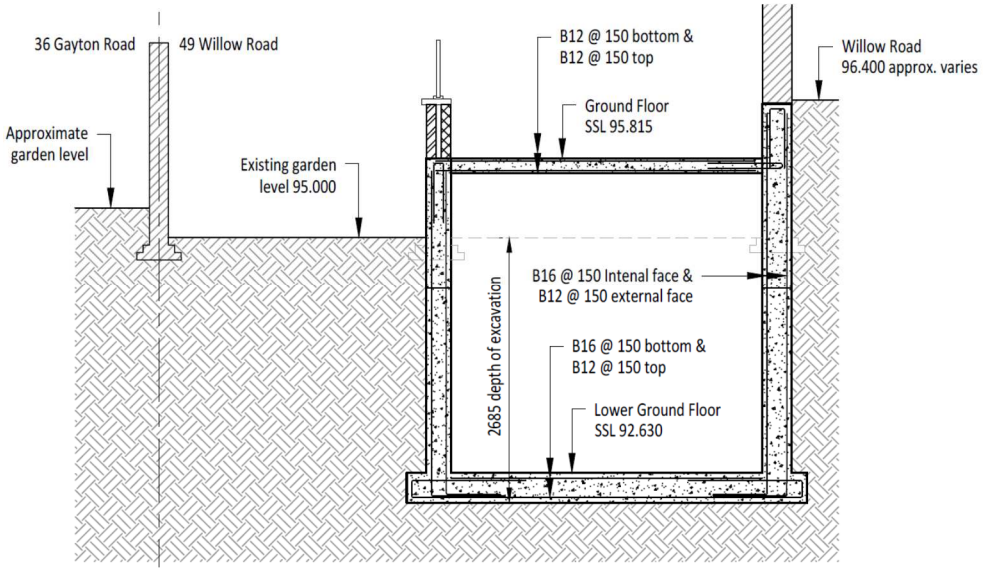

Figure 7: Cross Section of Proposed Extension

5.4 The lower ground floor slab is designed as a fixed base for the retaining walls to ensure that there is sufficient reinforcement and capacity to the overturning moments and to spread the vertical loads from the structure above.

5.5 The ground floor slab acts as a prop for the retaining wall at ground level.

Ground movement and effects on adjoining owners

5.6 The new concrete structure is founded on Claygate which is susceptible to volume changes from changes in pressure and water content. Ground movement assessment has been undertaken by GEA (the geotechnical consultant) to determine the potential short term and long term movements and this indicates that the movement will have negligible impact on the adjacent structures (category 0 in accordance with BRE Digest 251).

5.7 Movement can also occur during construction and it is important to ensure that the soil is supported at all times. This is addressed in section 6 of this report where construction methodology is discussed.

5.8 The Party Wall etc., Act 1996 will apply, notices will be issued to relevant Adjoining Owners accordingly and matters pertaining to the Act will be addressed by the appointed Party Wall Surveyors.

6 Construction Methodology

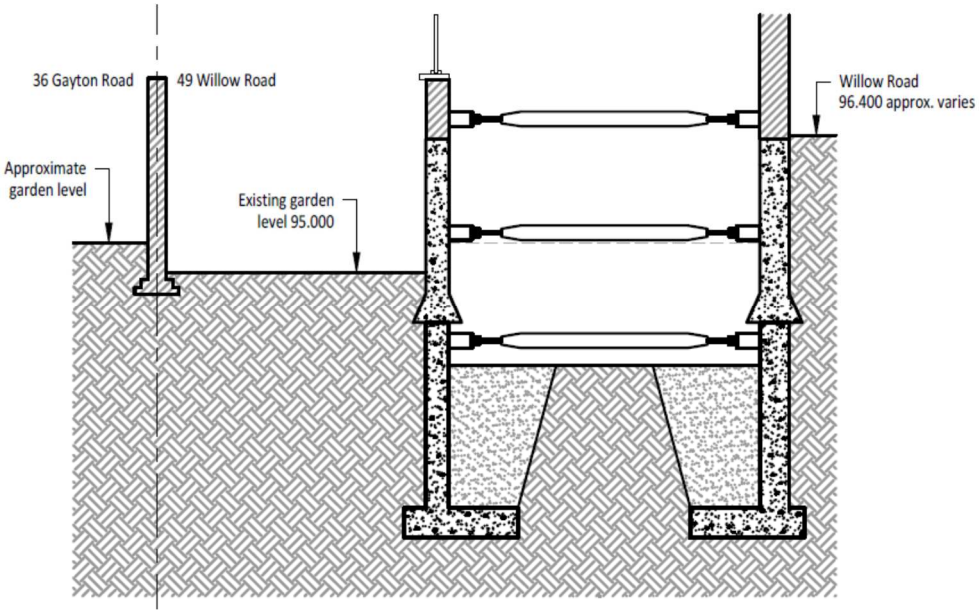

Figure 8: Showing underpinning propped against central earth bund

6.1 The method adopted for the construction of the basement ensures that earth is support at all times during construction to ensure that ground movement is minimised during this phase of the works.

6.2 Drawings showing the proposed construction sequence are included in Appendix B. This sequence is to be developed with the appointed Contractor for construction. The following describes the structural work required to form the basement. All fit out works are to be specified by the Architect and Services Engineer.

Site set up and protection

6.3 On possession of the site the Contractor would undertake site set up including, but not limited, to installing welfare facilities, securing access routes to and from site, installing a conveyor system, protecting existing structures & neighbouring buildings and site clearance.

Demolition and temporary works

6.4 The existing building would be stripped out of all internal finishes and temporary shores will be installed and suitably braced to provide lateral stability.

6.5 Once the walls are braced, the underpinning works will commence.

Underpinning, excavation and spoil removal

6.6 The lower ground floor extension will comprise reinforced concrete underpins installed using conventional 'hit and miss' sequence in accordance with a pre-agreed order prior to the commencement of the works. This traditional method of construction is used to ensure:

6.6.1 Local excavations are supported at all times

6.6.2 Maintain structural integrity and stability of existing structures and adjoining properties.

6.6.3 To allow existing structure to be fully founded on a lower soil strata prior to the main bulk excavation to form the extension.

6.7 Once the underpinning has been completed forming the perimeter walls of the new extension, the Contractor will undertake the bulk excavation for the basement. Props would be installed as excavation progresses to prop the retaining walls. This is a confined site so manual labour would be adopted to undertake this excavation.

6.8 Soil arisings would be stored in the yard at the back of the property. This spoil will removed manually on a wait and load basis to minimise impact on the local traffic.

Basement construction

6.9 Once excavation is complete, the basement slab would be constructed tied to the toes of the reinforced concrete underpins. A reinforced concrete slab would also be cast at ground floor level.

6.10 When the reinforced concrete has achieved the specified 28 day strength, the temporary props would be removed and the landscaping reinstated over the rear garden.

6.11 All work is to be undertaken by a competent Contractor with experience of construction in this form of construction and working on restricted sites and registered with the 'Considerate Contractor Scheme'.

Health and safety on site

6.12 All work is to be in accordance with all H&S legislation and the CDM regulations 2015.

6.13 The contractor will be required to implement measures to ensure the safety of all works and members of the public at all times in accordance with statutory legislation.

Movement monitoring during construction.

6.14 The property will be monitored during the works, targets and monitoring studs will be installed at strategic points within the building prior to the commencement to check that the building movement is not excessive and to safeguard the stability of the building and surrounding area.

6.15 Readings will be taken on the completion of each underpin or subject to a maximum of interval 5 days.

6.16 Trigger levels: will be set as follows:

Movement	Category	Action
0-5mm	Green	No Action required
5-10mm	Amber	Carry out structural review and implement mitigation and/or remedial measure as required
>10mm	Red	Cease works with the exception of necessary works for safety and stability. Review monitoring data and revise method of works.
Tolerances: The measurements shall be accurate to +/- 0.75mm in any direction		

7 Conclusions

7.1 The extended lower ground floor comprises a reinforced concrete sub-structure that resists the permanent lateral earth and water pressures designed to RIBA Stage 4.

7.2 It will be constructed using well established construction techniques that have been successfully implemented in similar ground conditions on many similar developments in the Hampstead area. The method of sequential underpinning in conjunction with temporary props during construction ensures that stability is maintained at all times.

7.3 A full site investigation has been undertaken to identify the site specific ground conditions and allow the detailed design to be completed addressing all the design issues such as the existing foundations, geology, hydrology, groundwater, flooding, structural stability and ground movement.

7.4 The design and works has been developed and undertaken in accordance with relevant codes of practice, the Building Regulations, Party Wall Act 1996, CDM regulations 2015 and all other H&S legislation.

7.5 The proposed works are to be executed by a competent Contractor with experience in the chosen form of construction and working on restricted sites who registered with the Considerate Constructors Scheme.

Author

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APPENDIX A

Structural Drawings

REINFORCED CONCRETE

1. ALL REINFORCED CONCRETE WORKMANSHIP AND MATERIALS TO BS8110, BS8500, BS8102, BS EN 206 BS8007 AND PK & PARTNER & NSCS SPECIFICATIONS.

2. GENERAL CONCRETE AND REINFORCEMENT DATA:

CONCRETE DATA			
MEMBER	MIX	AGGREGATE	28 DAY CUBE
MC FOUNDATIONS	FND 2	20	
RC FOUNDATIONS	RC 40	20	40 N/mm²
COLUMNS	RC 40	10	40 N/mm²
WALLS	RC 40	10	40 N/mm²
SLABS	RC 40	20	40 N/mm²
BEAMS	RC 40	10	40 N/mm²
STRUCTURAL SCREEDS	RC 35	20	35 N/mm²
GROUND BEARING SLABS	RC 35	20	35 N/mm²
BLINDING	GEN1	20	

CONCRETE COVER TO MAIN REINFOCEMENT			
MEMBER	TOP	BOTTOM	SIDES
FOUNDATIONS	50	50	50
COLUMNS	35	35	35
SLABS	25	25	25
WALLS	25	25	25

3. ABBREVIATIONS:

SLABS
T1 = EXTREME TOP OUTER LAYER
T2 = TOP SECOND LAYER
B2 = BOTTOM SECOND LAYER
B1 = EXTREME BOTTOM LAYER OUTER LAYER

WALLS
NF = Near Face
FF = Far Face
EF = Each Face
EW = Each Way

4. ALL STRUCTURAL CONCRETE TO BE REINFORCED AS NOTED ON PK & PARTNERS RC DETAILS AND BAR BENDING SCHEDULES.

5. THE CONTRACTOR TO ALLOW 50MM MIN. GEN 1 CONCRETE BLINDING BENEATH ALL REINFORCED CONCRETE FOUNDATIONS, GROUND BEAMS AND SLABS.

6. ALL EXTERNAL BEAMS, WALLS AND COLUMN FACES TO HAVE MINIMUM 2 COATS RIW LIQUID ASPHALTIC COMPOUND (LAC) OR SIMILAR APPROVED.

7. REFER TO RELEVANT ARCHITECT'S DRAWINGS FOR DETAILS OF FLASHINGS, DPC'S, DPM'S AND CAVITY WALL TRAYS.

8. FOR DETAILS OF ALL SERVICES AND DRAINAGE BELOW FLOOR SLABS, GROUND BEAMS AND FOUNDATIONS REFER TO RELEVANT ARCHITECT'S OR SERVICE ENGINEER'S DRAWINGS AND SPECIFICATIONS.

9. FOR DETAILS AND POSITIONS OF ALL CAST IN FIXINGS, DOVETAILS, INSERTS AND WALL TIES REFER TO ARCHITECT'S DRAWINGS AND SPECIFICATIONS.

10. FOR FIXING DETAILS OF ALL HANDRAILS AND BALUSTRADES REFER TO THE ARCHITECT'S DRAWINGS AND SPECIFICATION.

11. FOR DETAILS OF ALL BUILDERSWORK HOLES AND CAST IN FIXINGS REFER TO RELEVANT SERVICE ENGINEER'S AND SPECIALIST SUBCONTRACTORS DRAWINGS.

12. FOR DETAILS OF ALL FINISHES TO THE REINFORCED CONCRETE REFER TO PK & PARTNERS AND THE ARCHITECTS RELEVANT DRAWINGS AND SPECIFICATIONS.

STRUCTURAL STEELWORK

1. ALL STRUCTURAL STEELWORK TO BE IN ACCORDANCE WITH BS 5950.

2. ALL STEELWORK TO BE GRADE S275 TO BS4360 OR BS EN 10025 UNLESS NOTED OTHERWISE.

3. ALL BOLTS TO BE GRADE 8.8 TO BS 4190 UNLESS NOTED OTHERWISE.

4. ALL SIMPLE CONNECTION END PLATES TO BE 12MM THICK MIN. UNLESS NOTED OTHERWISE.

5. PREPARATION OF STEELWORK:
   I) INTERNAL UNEXPOSED BEAMS - SHOTBLAST SA 2.5 AND APPLY 2 PACK EPOXY ZINC PHOSPHATE 75 MICRONS MIN. DFT.
   II) INTERNAL EXPOSED BEAMS - SHOTBLAST SA 2.5 AND APPLY 2 PACK EPOXY ZINC PHOSPHATE PRIMER 125 MICRONS MIN. DFT.
   III) EXTERNAL EXPOSED BEAMS - SHOTBLAST SA 2.5 AND GALVANIZE IN ACCORDANCE WITH BS EN ISO 1461 HOT DIP GALVANIZE 140 MICRONS MIN. DFT.
   IV) STEELWORK RESULTING IN A CAVITY - SHOTBLAST SA 2.5 AND GALVANIZE IN ACCORDANCE WITH BS EN ISO 1461 HOT DIP GALVANIZE 140 MICRONS MIN. DFT.

6. HOLE DIAMETER FOR ORDINARY BOLTS TO BE 2mm CLEAR OF BOLT DIAMETER.

7. MINIMUM OF 4 NO. M16 GRADE 8.8 BOLTS PER CONNECTION UNLESS NOTED OTHERWISE.

8. ALL CONNECTIONS ARE CONTRACTOR DESIGNED UNLESS NOTED OTHERWISE.

9. ALL WELDS ARE TO BE MINIMUM 6mm FILLET WELDS FULL PROFILE UNLESS NOTED OTHERWISE.

10. ALL STEELWORK BELOW GROUND LEVEL TO HAVE 100mm RC35 CONCRETE CASING REINFORCED WITH D49 WRAPPING MESH.

11. THE CONCRETE ENCASED REGION OF ALL STEELWORK TO BE BRUSH FINISHED, UNPAINTED AND BOUND IN D49 WRAPPING MESH SPOT WELDED TO THE STEEL MEMBER.

12. THE CONTRACTOR IS TO ENSURE THAT ALL FINISHING COATS TO STEELWORK ARE COMPATIBLE WITH THE PREPARATION OF STEELWORK.

13. FOR ALL PAINT FINISHES TO STEELWORK REFER TO ARCHITECT'S DRAWINGS AND SPECIFICATIONS.

14. FOR FIRE PROTECTION OF STEELWORK REFER TO BE TO ARCHITECT'S DRAWINGS AND SPECIFICATIONS.

15. THE CONTRACTOR IS TO ALLOW FOR 250KG OF ADDITIONAL STEELWORK FOR CONTINGENCY.

STRUCTURAL TIMBER

1. ALL STRUCTURAL TIMBER MATERIALS AND WORKMANSHIP TO BE IN ACCORDANCE WITH BS 5268.

2. ALL STRUCTURAL TIMBER GRADE TO BE GRADE C24 TO BS5268 OR EN 338: UNLESS NOTED OTHERWISE.

3. ALL TIMBER SIZES SHOWN ARE BASIC SAWN SECTION SIZES.

4. ALL JOIST HANGERS TO BE GALVANIZED MILD STEEL BY SIMPSON STRONG TIE OR SIMILAR APPROVED AND FIXED IN STRICT ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS.

5. ALL NOGGINS TO BE SOLID TIMBER OF THE SAME SECTION SIZE AS THE JOIST OR STUD SUPPORTED NAILED AND FIXED IN PLACE.

6. THE ENDS OF ALL FLOOR JOISTS/TIMBER WORK BUILT INTO EXTERNAL CAVITY WALLS TO BE PROTECTED AND TREATED WITH ORGANIC WATER SHIELD AND PRESERVATIVE. NO JOISTS/TIMBERWORK TO BE BUILT INTO EXTERNAL SOLID MASONRY WALLS WITHOUT THE PRIOR AGREEMENT OF THE ENGINEER.

7. 30x5 GALVANIZED MILD STEEL STRAPS TO BE PROVIDED AT NOT GREATER THAN 1200mm CENTRES BETWEEN TIMBER JOISTS AND WALLS, RC BEAMS AND STEEL BEAMS.

8. ALL BOLTS & SCREW FIXINGS IN TIMBER TO BE SHERADIZED & BOLTS TO BE GRADE 8.8 UNLESS NOTED OTHERWISE

9. ALL DOUBLE JOISTS ARE TO BE BOLTED TOGETHER WITH SHERADISED M12 BOLTS, DOUBLE SIDE TOOTHED TOOTH PLATE CONNECTORS AND 50mm SQUARE PLATE WASHERS @ 450c/c.

10. SOLID NOGGINS TO BE PLACED UNDER ALL STUD PARTITIONS PERPENDICULAR TO JOISTS. REFER TO RELEVANT PK & PARTNERS DRAWINGS FOR ANY SUPPLEMENTARY STRENGTHENING REQUIREMENTS.

11. PROVIDE DOUBLE JOISTS UNDER ALL STUD PARTITIONS PARALLEL TO JOISTS UNLESS NOTED OTHERWISE.

12. PK & PARTNERS REQUIREMENTS FOR STRUTTING OF SUSPENDED FLOORS AND ROOFS:

STRUTTING TO SUSPENDED TIMBER FLOORS AND ROOFS	
JOIST SPAN (m)	ROWS OF STRUTTING
UP TO 2.5m	1 CENTRE SPAN + BEARINGS
2.5 TO 4.5	2 EQUAL SPANS + BEARINGS
OVER 4.5	3 EQUAL SPANS + BEARINGS

13. THE CONTRACTOR TO ALLOW 25mm MIN SOFT JOINTS TO THE HEADS OF ALL NON-LOADBEARING STUD WALLS. REFER TO THE ARCHITECTS DRAWINGS FOR DETAILS OF ALL MOVEMENT JOINTS.

STRUCTURAL MASONRY

1. ALL MASONRY MATERIALS AND WORKMANSHIP TO BE IN ACCORDANCE WITH BS 5628, BS EN 771-3 AND BS8000.

3. ALL BRICKS TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF:
   BELOW DPC: 50 N/mm² (CLASS B - ENGINEERING)
   ABOVE DPC: 10 N/mm²

3. ALL BLOCKS TO HAVE MINIMUM COMPRESSIVE STRENGTHS OF:
   i) BELOW DPC: 3.6N AERATED LIGHTWEIGHT FOUNDATION BLOCK or 7N SOLID CONCRETE BLOCKS (1960 Kg/m³ DENSITY)

   ii) ABOVE DPC: 3.6N AERATED LIGHTWEIGHT OR 7N CONCRETE BLOCKS - PERIMETER WALLS
   iii) ABOVE DPC: 7N SOLID DENSE CONCRETE BLOCKS (1960 Kg/m³ DENSITY)
   iv) ABOVE DPC: 7N SOLID MEDIUM CONCRETE BLOCKS (1400 Kg/m³ DENSITY)

4. ALL MORTAR TO BE:
   I) BELOW DPC; DESIGNATION I) (SULPHATE RESISTING CEMENT)
   II) ABOVE DPC; DESIGNATION III)

5. ALL BRICKWORK RESTRAINTS TO BE STAINLESS STEEL TO GRADE 304.

6. FOR DETAILS OF ALL BRICK / BLOCK RESTRAINTS REFER TO RELEVANT PK & PARTNERS AND ARCHITECTS DRAWINGS AND SPECIFICATIONS.

7. FOR DAMP PROOF COURSES, CAVITY CLOSURES, INSULATION, LINTELS, CILLS, BRICK / BLOCK SPECIALS AND FLOOR VENTING REFER TO ARCHITECT'S DETAILS.

8. WALL TIES TO BE STAINLESS STEEL PROVIDED AT 225mm CENTRES VERTICALLY AND 900MM CENTRES HORIZONTALLY ALTERNATIVELY STAGGERED (NB: IF CAVITY >75mm TIES TO BE 750 CENTRES HORIZONTALLY) OR AS PER ARCHITECT'S DETAILS.

9. MINIMUM 150MM END BEARING TO ALL LINTELS UNLESS NOTED OTHERWISE.

10. PADSTONES TO BE PROVIDED AS REQUIRED AND TO HAVE A MINIMUM STRENGTH OF C35.

11. FOR DETAILS OF LATERAL RESTRAINT TO ALL NON-LOAD BEARING MASONRY WALLS REFER TO PK & PARTNERS AND THE ARCHITECTS RELEVANT DRAWINGS. THE CONTRACTOR TO ALLOW 25MM MIN MOVEMENT JOINTS TO THE HEADS OF ALL NON-LOADBEARING MASONRY WALLS. REFER TO THE ARCHITECTS DRAWINGS FOR DETAILS OF ALL MOVEMENT JOINTS.

12. HORIZONTAL AND VERTICAL MOVEMENT JOINTS TO BE PROVIDED IN ALL MASONRY WALLS IN STRICT ACCORDANCE WITH THE BRICK AND BLOCK MANUFACTURERS REQUIREMENTS. REFER TO PK & PARTNERS AND THE ARCHITECTS FOR THE LOCATION AND DETAILS FOR ALL MOVEMENT JOINTS.

13. THE CONTRACTOR TO PROVIDE BRC BRICKFORCE BED-JOINT REINFORCEMENT IN THE TOP AND BOTTOM 2 COURSES OF ALL OPENINGS. REINFORCEMENT TO EXTEND 600MM BEYOND ALL JAMBS.

14. FOR VENTING OF ALL SUSPENDED FLOORS, ROOMS, ETC. THROUGH PERIMETER MASONRY WALLS REFER TO THE ARCHITECTS DRAWINGS.

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Project: 49 Willow Road
London
NW3 1TS

Architect: Charlton Brown Architecture

Drawing: General Notes

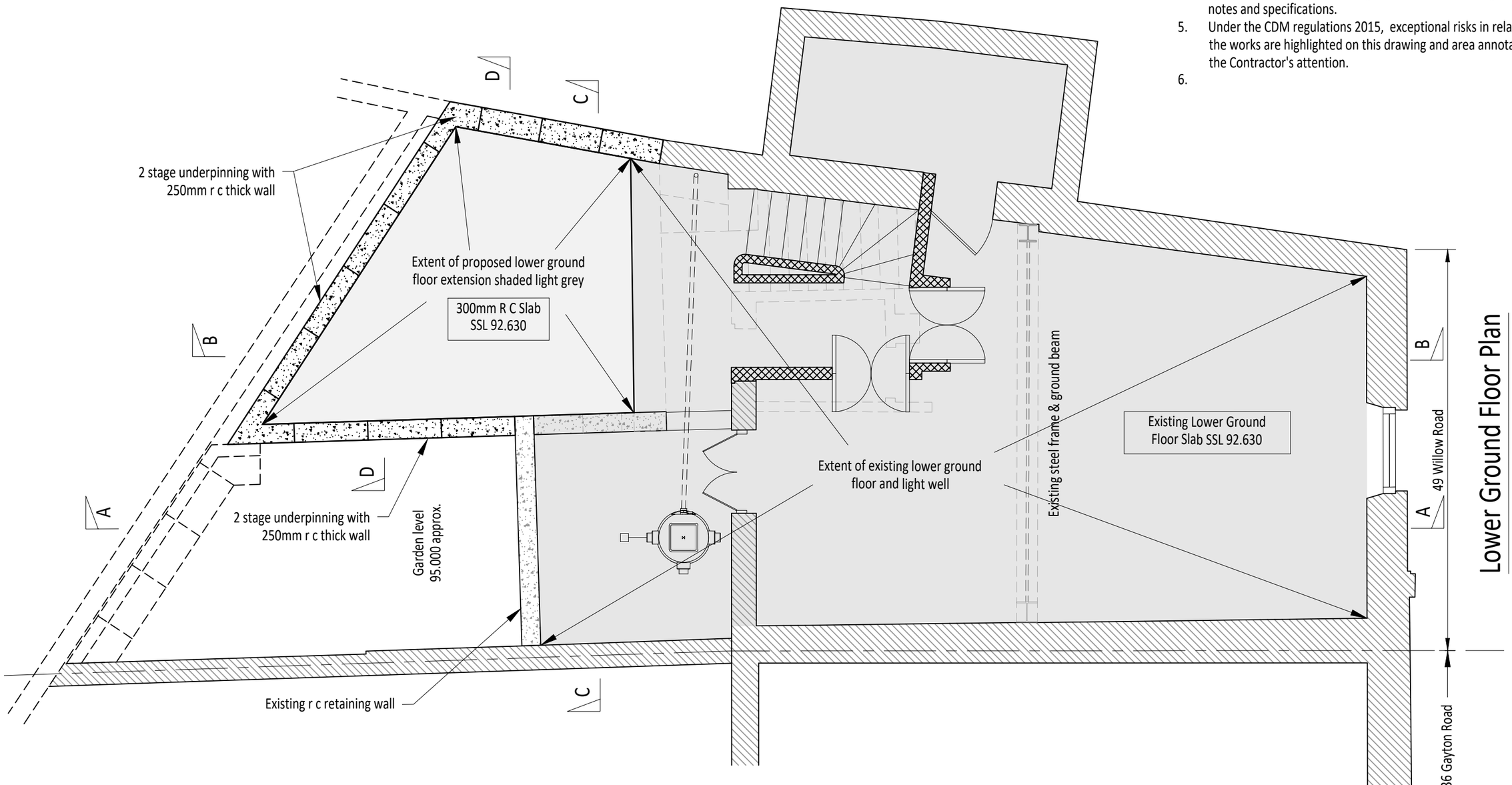
Scale:

Rev:	A				
Date:	19.07.19				
By:	PK				
Reviewed:	PK				

Dwg No: 2136 - 001

REV. A

1. This drawing is to be read in conjunction with all other Architect's and Engineers' drawing.
2. All dimensions are in millimeters unless noted otherwise.
3. Work to figured dimensions only and do not scale from this drawing and refer to the Architect or Engineer if in doubt.
4. Refer to PK & Partners drawing number 2136-001 for general notes and specifications.
5. Under the CDM regulations 2015, exceptional risks in relation to the works are highlighted on this drawing and area annotated for the Contractor's attention.
6.



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Project: 49 Willow Road
London
NW3 1TS

Architect: Charlton Brown Architecture

Drawing: Proposed Lower Ground Floor Structural Layout

Scale: 1:50 @ A3

Rev:	A	B			
Date:	03.06.20	22.07.20			
By:	PK	PK			
Reviewed:	PK	PK			

Dwg No: 2136 - 070

REV. B

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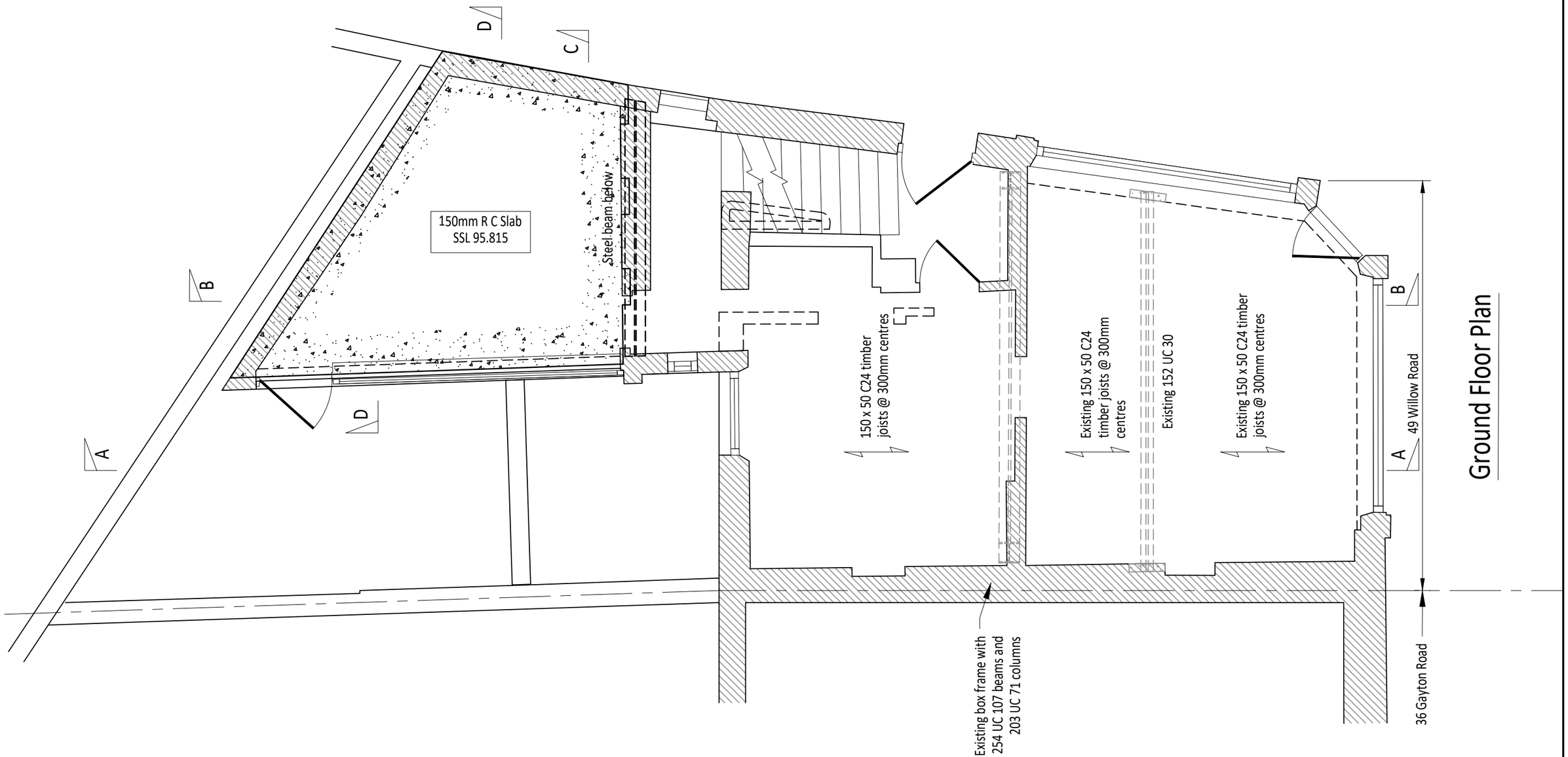

Ground Floor Plan

PK & Partners Consulting Engineers Office 1, Izabella House, 24-26 Regent Place, Birmingham B1 3NJ www.pk-partners.com m: 07788 921 371	
Project:	49 Willow Road London NW3 1TS
Architect:	Charlton Brown Architecture
Drawing:	Proposed Ground Floor Structural Layout
Scale:	1:50 @ A3

Rev:	A	B	C	D	
Date:	03.06.20	22.07.20	23.07.20	11.08.20	
By:	PK	PK	PK	PK	
Reviewed:	PK	PK	PK	PK	

Dwg No: 2136 - 071

REV. D

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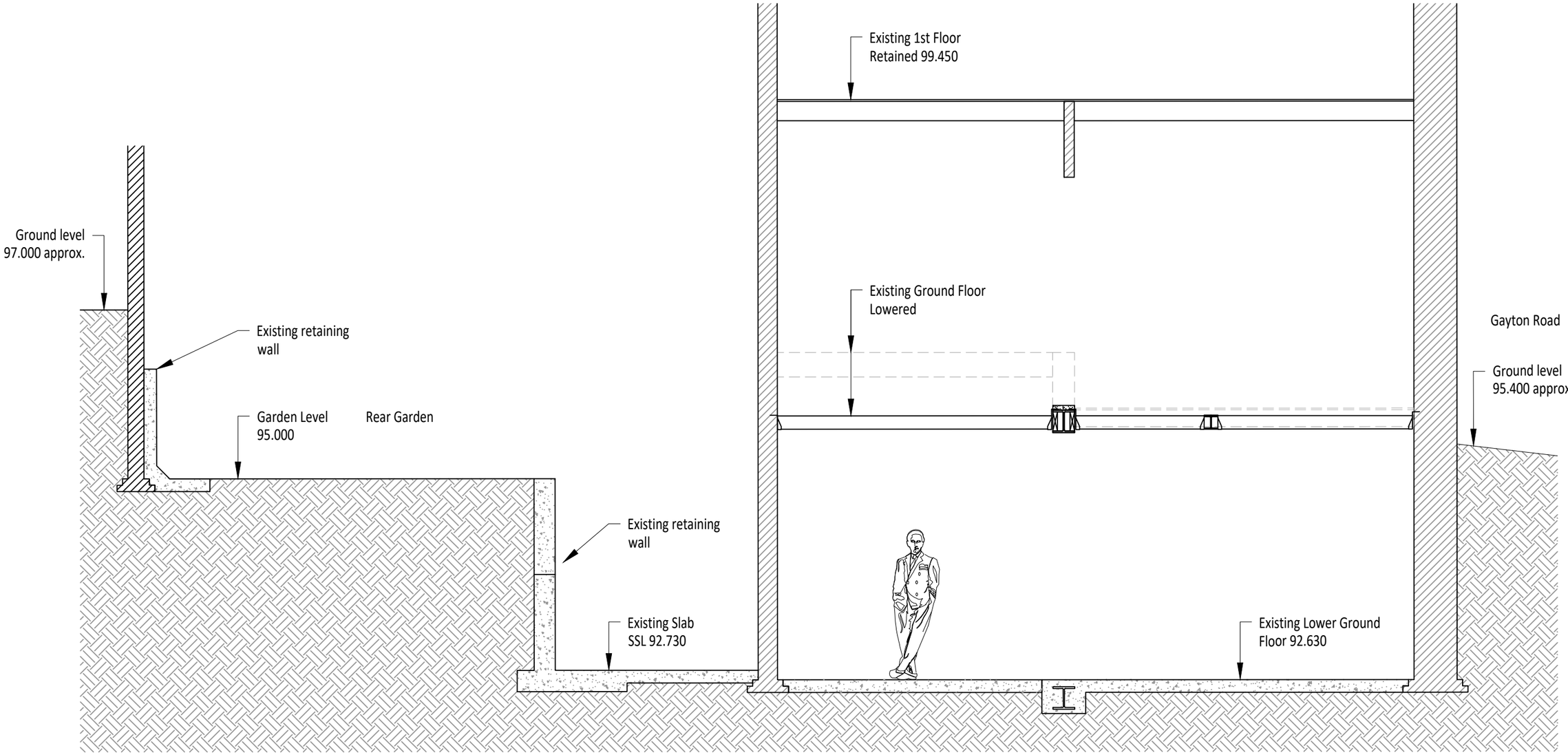
5. Under the CDM regulations 2015, exceptional risks in relation to the works are highlighted on this drawing and area annotated for the Contractor's attention.



Section A - A

PK & Partners
Consulting Engineers
Office 1, Izabella House,
24-26 Regent Place,
Birmingham B1 3NJ
www.pk-partners.com m: 07788 921 371

Project: 49 Willow Road
London
NW3 1TS

Architect: Charlton Brown Architecture

Drawing: Sections A-A
Structural Details

Scale: 1:50; 1:20 @ A3

Rev:	A	B			
Date:	03.06.20	22.07.20			
By:	PK	PK			
Reviewed:	PK	PK			

Dwg No: 2136 - 080

REV. B

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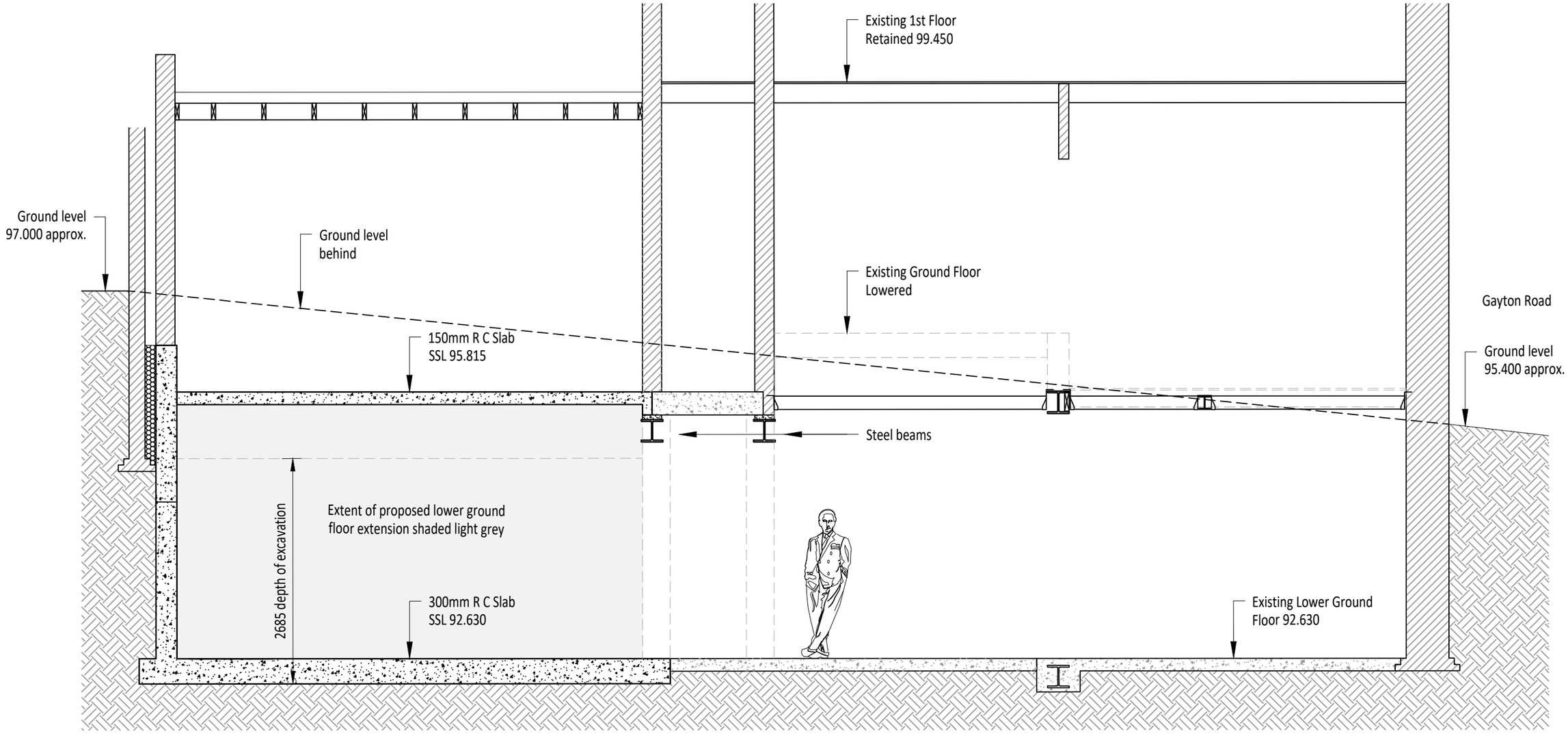

Section B -B

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Birmingham B1 3NJ
www.pk-partners.com m: 07788 921 371

Project: 49 Willow Road
London
NW3 1TS

Architect: Charlton Brown Architecture

Drawing: Sections B-B
Structural Details

Scale: 1:50; 1:20 @ A3

Rev:	A	B	C		
Date:	03.06.20	22.07.20	11.08.20		
By:	PK	PK	PK		
Reviewed:	PK	PK	PK		

Dwg No: 2136 - 081

REV. C

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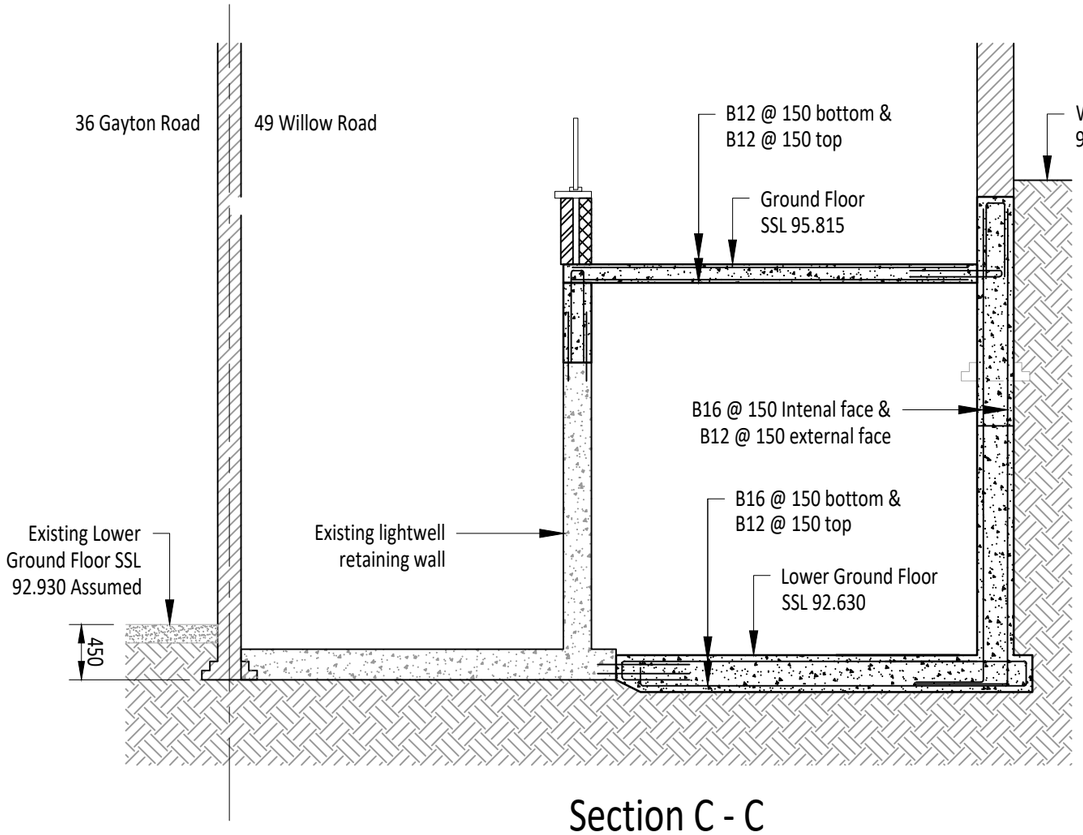
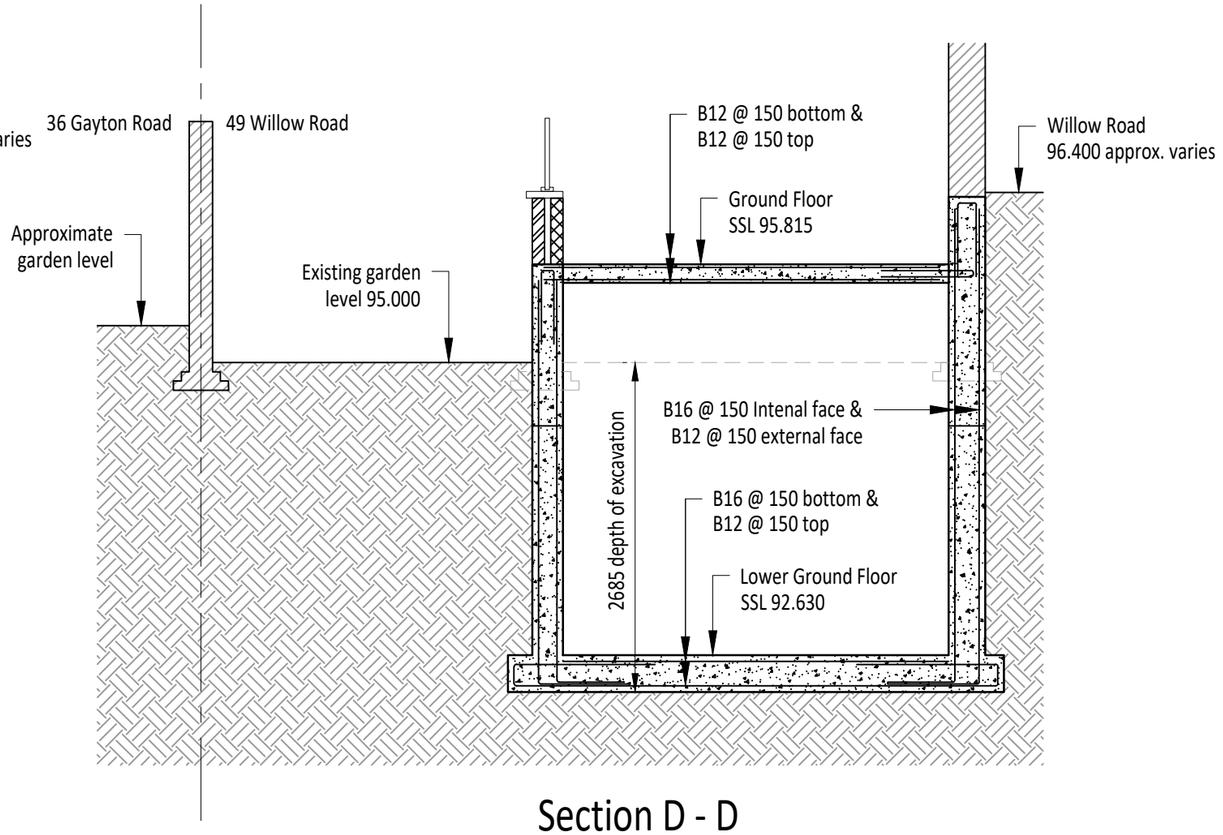


Section C - C



Section D - D

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Consulting Engineers
Office 1, Izabella House,
24-26 Regent Place,
Birmingham B1 3NJ
www.pk-partners.com m: 07788 921 371

Project: 49 Willow Road
London
NW3 1TS

Architect: Charlton Brown Architecture

Drawing: Sections C-C & D-D
Structural Details

Scale: 1:50; 1:20 @ A3

Rev:	A	B	C		
Date:	03.06.20	22.07.20	11.08.20		
By:	PK	PK	PK		
Reviewed:	PK	PK	PK		

Dwg No: 2136 - 082

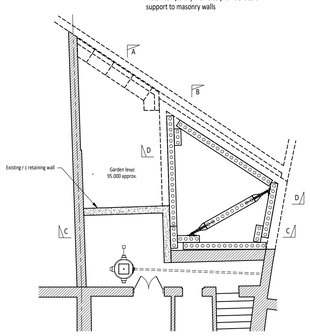
REV. C

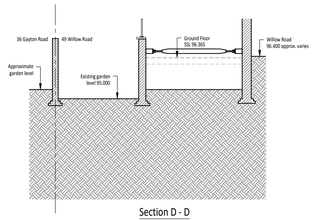
APPENDIX B

Construction Sequence

STEP 1.

- Install temporary works to provide lateral support to masonry walls

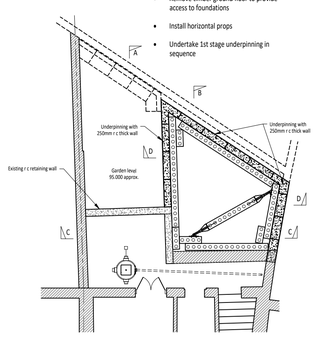


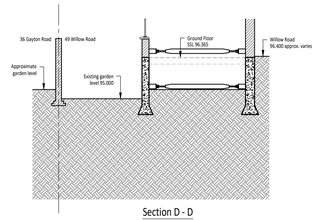


Section D - D

STEP 2.

- Remove timber ground floor to provide access to foundations
- Install horizontal props
- Undertake 1st stage underpinning in sequence

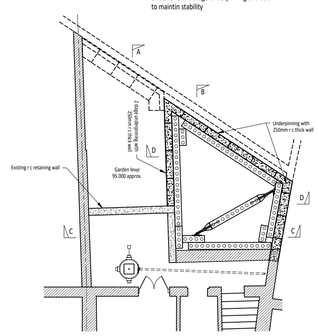


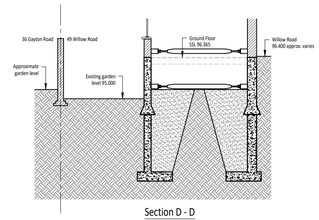


Section D - D

STEP 3.

- Undertake 2nd stage underpinning and back fill to maintin stability

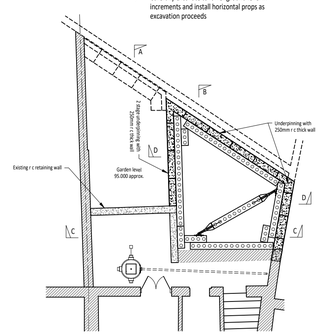


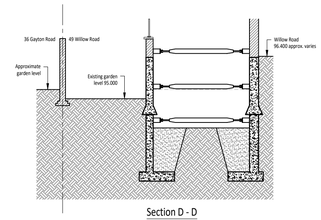


Section D - D

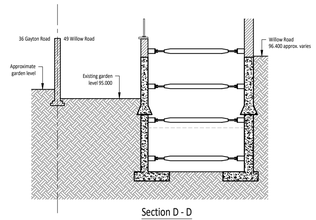
STEP 4.

- Carefully excavate to lower ground level in increments and install horizontal props as excavation proceeds

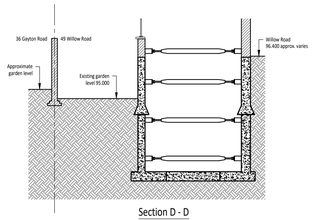




Section D - D



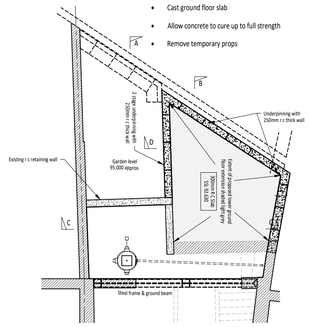
Section D - D

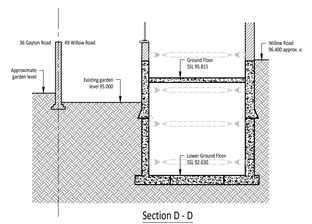


Section D - D

STEP 5.

- Cast lower ground floor slab
- Cast ground floor slab
- Allow concrete to cure up to full strength
- Remove temporary props





Section D - D

NOTES

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REV.	BY	CHK'D	APP'D	DATE	DESCRIPTION
C	PK	PK	PK	11.08.20	Grd Fl level amended
B	PK	PK	PK	22.07.20	Issued for planning submission
A	PK	PK	PK	16.05.20	Issued for information & comments

PK & Partners
Consulting Engineers
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Architect
CHARLTON BROWN ARCHITECTURE

Project
49 WILLOW ROAD
LONDON
NW3 1TS

Drawing
SCHEMATIC LOWER GROUND FLOOR EXTENSION CONSTRUCTION SEQUENCE

DWG. No. 2136-101

REV. C

DRAWN : PK

CHECKED : PK

SCALE : 1:100 @ A1 1:200 @ A3

@ A1

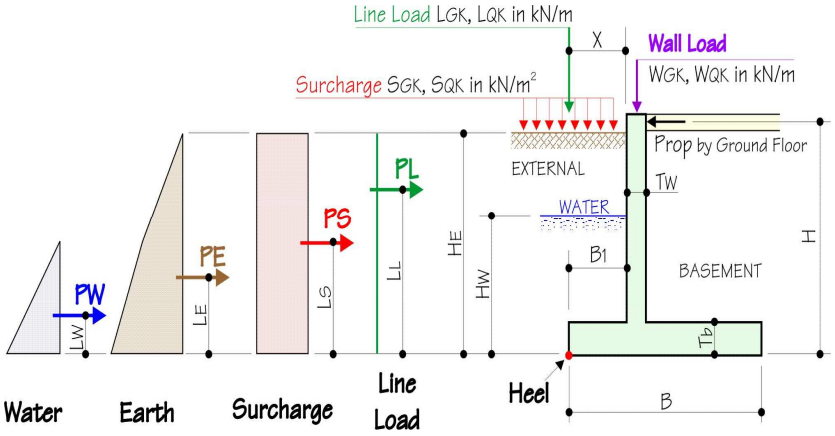
0mm 100mm

APPENDIX C

Calculations

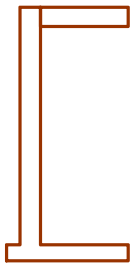
Project	49 Willow Road	REINFORCED CONCRETE COUNCIL	PK & Partners Limited		
Client	Dylan McNeil		Made by	Date	Page
Location	Basement Wall		PK	22-Jul-2020	1
	Basement wall design to BS8110:1997, BS8002:1994. BS 8004:1986 etc.		Checked	Revision	Job No
	Originated from 'RCC61 Basement Wall.xls' v2.1 © 1999-20002 BCA for RCC		PK	A	2136

IDEALISED STRUCTURE and FORCE DIAGRAMS — DESIGN STATUS : VALID



DIMENSION (mm)

H =	3750	B =	1800	Tw =	300
Hw =	2750	Bl =	200	Tb =	250
He =	4500				



Wall Geometry

MATERIAL PROPERTIES

fcu =	35	N/mm²	γm =	1.50	concrete
fy =	460	N/mm²	γm =	1.05	steel
Cover to tension reinforcement (co) =				40	mm
Max. allowable design surface crack width (W) =				0.3	mm (0.2 or 0.3 mm only)
Concrete density =				24.0	kN/m3

SOIL PROPERTIES

Design angle of int'l friction of retained mat'l (Ø) =	25	degree	
Design cohesion of retained mat'l (C) =	0	kN/m2	(Only granular backfill considered, ie "C" = 0)
Density of retained mat'l (q) =	20	kN/m3	
Submerged Density of retained mat'l (qs) =	13.33	kN/m3	(default=2/3 of q), only apply when Hw >0
Design angle of int'l friction of base mat'l (Øb) =	24	degree	= 13.33
Design cohesion of base mat'l (Cb) =	10	kN/m2	ASSUMPTIONS
Density of base mat'l (qb) =	20	kN/m3	a) Wall friction is zero
Allowable gross ground bearing pressure (GBP) =	150	kN/m2	b) Minimum active earth pressure = 0.25qH

LOADINGS (unfactored)

Surcharge load -- live (SQK) =	10	kN/m2	h) Design not intended for walls over 3.5 m high
Surcharge load -- dead (SGK) =	0.01	kN/m2	i)Does **not** include check for temp or shrinkage
Line load -- live (LQK) =	2.5	kN/m	
Line load -- dead (LGK) =	15	kN/m	
Distance of line load from wall (X) =	300	mm	
Wall load -- live (WQK) =	3.5	kN/m	
Wall load -- Dead (WGK) =	22.5	kN/m	

LATERAL FORCES

Ko =	0.58	default Ko = (1-SIN Ø)	0.58
Kac =	1.52	= $2Ko^{0.5}$	

Force (kN)		Lever arm (m)		γ_f	Ultimate Force (kN)
PE =	102.36	LE =	1.583	1.40	143.30
PS(GK) =	0.03	LS =	2.25	1.40	0.04
PS(QK) =	25.98	LS =	2.25	1.60	41.57
PL(GK) =	8.66	LL =	4.25	1.40	12.12
PL(QK) =	1.44	LL =	4.25	1.60	2.31
PW =	37.81	LW =	0.92	1.40	52.94
Total	176.28				252.28

Project	49 Willow Road	REINFORCED CONCRETE COUNCIL	PK & Partners Limited
Client	Dylan McNeil	Made by: PK	Date: 22-Jul-2020	Page: 2
Location	Basement Wall		
	Basement wall design to BS8110:1997, BS8002:1994. BS 8004:198	Checked: PK	Revision: A	Job No: 2136
	Originated from 'RCC61 Basement Wall.xls' v2.1 © 1999-20002 BCA for R		

EXTERNAL STABILITY

STABILITY CHECK : OK

ANALYSIS - Assumptions & Notes

1) Wall idealised as a propped cantilever (i.e. pinned at top and fixed at base)
2) Wall is braced.
3) Maximum slenderness of wall is limited to 15, i.e [0.9*(He-Tb/2)/Tw < 15]
4) Maximum Ultimate axial load on wall is limited to 0.1fcu times the wall cross-sectional area
5) Design Span (Effective wall height) = He - (Tb/2)
6) -ve moment is hogging (i.e. tension at external face of wall)
+ve moment is sagging (i.e. tension at internal face of wall)
7) " Wall MT. " is maximum +ve moment on the wall.
8) Estimated lateral deflections are used for checking the **PΔ** effect .

UNFACTORED LOADS AND FORCES

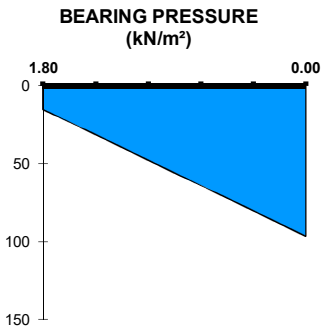
Lateral Force	Force (kN)	Lever arm to base (m)	Base MT. (kNm)	Wall MT. (kNm)	Reaction at Base (kN)	Reaction at Top (kN)	Estimated Elastic Deflection Δ (mm)
PE =	97.25	1.54	-44.28	24.41	68.20	29.04	1.2
PS(GK) =	0.03	2.19	-0.01	0.00	0.01	0.01	0.0
PS(QK) =	25.26	2.19	-8.69	4.66	12.41	12.85	0.2
PL(GK) =	8.66	4.12	2.12	-5.20	-1.77	10.44	0.1
PL(QK) =	1.44	4.12	0.35	-0.87	-0.30	1.74	0.0
PW =	34.45	0.88	-16.15	6.13	30.59	3.86	0.1
Total	167.09		-66.65	29.13	109.15	57.94	1.6

GROUND BEARING FAILURE

LOAD CASE: Wall Load **MAX**
Surcharge **MAX**

Taking moments about centre of base (anticlockwise "+")

Vertical FORCES (kN)		Lever arm (m	Moment (kNm)
Wall load =	26	0.55	14.3
Wall (sw) =	25.20	0.55	13.86
Base =	10.80	0.00	0.00
Earth =	13.67	0.80	10.93
Water =	5.00	0.80	4.00
Surcharge =	2.00	0.80	1.60
Line load =	17.50	0.00	0.00
Σ V =	100.17		Σ Mv = 44.69



MOMENT due to LATERAL FORCES, Mo = -66.65 kNm

RESULTANT MOMENT, M = Mv + Mo = -21.96 kNm

ECCENTRICITY FROM BASE CENTRE, M / V = -0.22 m

MAXIMUM GROSS BEARING PRESSURE = 96.31 kN/m^2 < 150 OK

SLIDING AT BASE (using overall factor of safety instead of partial safety fa F.O.S = 1.50

SUM of LATERAL FORCES, **P** = 109.15 kN

BASE FRICTION, $\mathbf{F_b}$ = - (**V** TANØb + B.Cb) = -62.60 kN

Factor of Safety, F_b / P = 0.57 < 1.50 see below

LATERAL RESISTANCE to be provided by BASEMENT SLAB = 101.13 kN

Project	49 Willow Road	REINFORCED CONCRETE COUNCIL		
Client	Dylan McNeil	Made by	Date	Page
Location	Basement Wall	PK	22-Jul-2020	3
	Basement wall design to BS8110:1997, BS8002:1994. BS 8004:198	Checked	Revision	Job No
	Originated from 'RCC61 Basement Wall.xls' v2.1 © 1999-20002 BCA for RC	PK	A	2136

STRUCTURAL DESIGNS (ultimate)

DESIGN CHECKS : OK

BS8110 reference

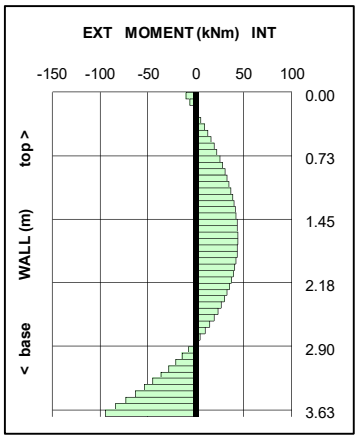
WALL (per metre length)

AXIAL LOAD CAPACITY (Limited to 0.1fcu) = 1050.00 kN > 37.1 OK 3.4.4.1

Lateral Force	Force (kN)	γ_f	Ultimate Force (kN)	Ult. Moment at base (kNm)	Ult. Shear at base (kN)	Ult. Shear at top (kN)
PE =	97.25	1.40	136.14	-61.99	95.49	40.66
PS(GK) =	0.03	1.40	0.04	-0.01	0.02	0.02
PS(QK) =	25.26	1.60	40.42	-13.90	19.86	20.55
PL(GK) =	8.66	1.40	12.12	2.96	-2.48	14.61
PL(QK) =	1.44	1.60	2.31	0.56	-0.47	2.78
PW =	34.45	1.40	48.23	-22.60	42.83	5.41
Total	167.09		239.27	-94.98	155.23	84.03

Design Bending Moments

On INTERNAL face due to lateral forces, M_{int} =	43.34	kNm
On EXTERNAL face due to lateral forces, M_{ext} =	-94.98	kNm
Eccentricity of Axial Loads =	100	mm
LATERAL DEFLECTION "Δ" =	1.6	mm
Due to eccentricity of axial loads, M_{ecc} =	3.7	kNm
Due to **PΔ** effect, M_p =	0.06	kNm
Total Mmt on INTERNAL face (M_{int}+0.5M_{ecc}+M_p) =	45.3	kNm
Total Mmt on EXTERNAL face (M_{ext}+0.5M_{ecc}) =	-96.8	kNm



		EXTERNAL FACE		INTERNAL FACE				
WALL REINFORCEMENT :	Min. As =	390		390		mm^2		Table 3.25
	ϕ =	16		12		mm		
	centres =	150	< 424	150	< 762	mm	OK	3.12.11.2.7(b)
	As =	1340	> 390	754	> 390	mm^2	OK	
MOMENT of RESISTANCE :	d =	252		254		mm		
	z =	233		241		mm		3.4.4.4
	As' =	0		0		mm^2		3.4.4.4
	M_{res} =	137.0	> 96.84	79.7	> 45.26	kNm	OK	

		BASE of WALL			TOP of WALL			
SHEAR RESISTANCE:	As =	1340	ϕ =	12	@150 mm	754	mm^2/m	
	100As/bd =	0.53%	=	0.30%				
	vc =	0.64		0.53		N/mm^2		Table 3.8
	V_{res} =	162.0	> 155.23	134.2	> 84.03	kN	OK	3.5.5.2

CRACK WIDTH to BS8100/8007	X =	82.67	mm	εm =	0.00090		BS8007
Temp & shrinkage effects not included	Acr =	81.04	mm	**W =**	0.16	< 0.30 mm OK	App. B.2

REINFORCEMENT SUMMARY for WALL

	Type	ϕ mm	centres mm	As mm^2	Min. As mm^2	
INTERNAL FACE	T	12	150	754	390	OK
EXTERNAL FACE	T	16	150	1340	390	OK
TRANSVERSE	T	10	150	524	390	OK

Project	49 Willow Road	REINFORCED CONCRETE COUNCIL		
Client	Dylan McNeil	Made by	Date	Page
Location	Basement Wall	PK	22-Jul-2020	4
	Basement wall design to BS8110:1997, BS8002:1994. BS 8004:198	Checked	Revision	Job No
	Originated from 'RCC61 Basement Wall.xls' v2.1 © 1999-20002 BCA for RC	PK	A	2136

OUTER BASE (per metre length) — BS8110 reference

γ_f = 1.50 (ASSUMED)

Ult. Shear = -1.18 kN (AT d from FACE of WALL)

Ult. MT. = -2.41 kNm TENSION - TOP FACE

BOTTOM REINFORCEMENT : — Table 3.25

Min. As =	325	mm^2		
ϕ =	12	mm		
centres =	225	mm	< 624	OK
As =	503	mm^2	> 325	OK

MOMENT of RESISTANCE : — 3.4.4.4

d =	204	mm		
Z =	194	mm		
As' =	0	mm^2		
Mres =	42.68	kNm	> 2.41	OK

SHEAR RESISTANCE: — Table 3.8 — 3.5.5.2

100As/bd =	0.20%			
vc =	0.52	N/mm^2		
Vres =	107.00	kN	> -1.18	OK

CHECK CRACK WIDTH IN ACCORDANCE WITH BS8100/80 Temp & shrinkage effects not included — BS8007

X = 48.51 mm ε_m = -0.00141

Acr = 115.54 mm W = -0.28 mm < 0.30 OK — App. B.2

NO CRACKING

INNER BASE (per metre length)

Ult. Shear = -81.91 kN (AT d from FACE of WALL)

Ult. MT. = 97.57 kNm TENSION - BOTTOM FACE

BOTTOM REINFORCEMENT : — Table 3.25

Min. As =	325	mm^2		
ϕ =	16	mm		
centres =	150	mm	< 271	OK
As =	1340	mm^2	> 325	OK

MOMENT of RESISTANCE : — 3.4.4.4

d =	202	mm		
Z =	183	mm		
As' =	0	mm^2		
Mres =	107.59	kNm	< 97.57	OK

SHEAR RESISTANCE: — Table 3.8 — 3.5.5.2

100As/bd =	0.66%			
vc =	0.73	N/mm^2		
Vres =	147.77	kN	> 81.91	OK

CHECK CRACK WIDTH IN ACCORDANCE WITH BS8100/80 Temp & shrinkage effects not included — BS8007

X = 72.34 mm ε_m = 0.001415

Acr = 81.04 mm W = 0.27 mm < 0.30 OK — App. B.2

REINFORCEMENT SUMMARY for BASE

	Type	ϕ mm	centres mm	As mm^2	Min. As mm^2	
TOP	T	12	150	754	325	OK
BOTTOM	T	16	150	503	325	OK
TRANSVERSE	T	12	150	754	325	OK