zussmanbear

STRUCTURAL ENGINNERING REPORT

METHOD STATEMENT

FOR SUBTERANIAN DEVELOPMENT

36 Reddington Road
London N4 2ED

May 2015

395 St Margarets Road
Richmond
TW7 7BZ
T: 0208 332 1199
T: 0208 744 3988
www.zussmanbear.com

Construction Method Statement for Proposed Subterranean Development
Planning Report

ZUSSMAN BEAR PARTNERSHIP
MAY 2015

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1.00 Introduction & Location

1.1 At Present 36 Reddington Road is a two storey self-contained semi-detached house with a single storey extension and garage to the side. A planning application is being lodged to demolish the existing building and construct a larger house with a single storey basement. The building is surrounded on all three sides by other properties with number 38 Reddington Road on the left, which already has been redeveloped including a double basement construction.

2.0 Structural Description

2.1 The existing building, photographed below is number 36 Reddington Road which is a traditional loadbearing brickwork and timber floor construction. This building will be demolished to allow for the construction of the new house.

2.2 The new house will be constructed as a steel frame with external brick cladding. The lower ground floor construction is as follows;

- Contiguous bored piles.
- Capping beam.
- Reinforced concrete retaining wall.
- Bearing piles supporting slab, lift shaft & steel columns.
- Suspended pile raft slab over compressible material.

2.3 The ground floor construction is as follows;

- Steel frame.
- Precast floor planks spanning between steel frame
- Internal non loadbearing walls.
- Framed lift shaft.

2.4 The first floor construction is as follows;

- Steel frame.
- Precast floor planks spanning between steel frame
- Internal non loadbearing walls.
- Framed lift shaft.

2.5 The loft floor construction is as follows;

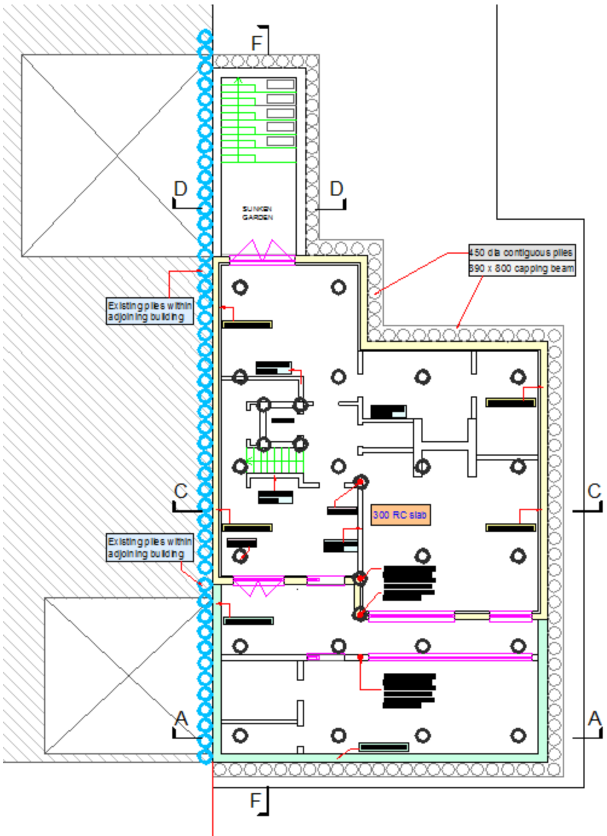
- Steel frame.
- Precast floor planks spanning between steel frame
- Internal loadbearing stud walls.
- Framed lift shaft.

2.6 The roof construction is as follows;

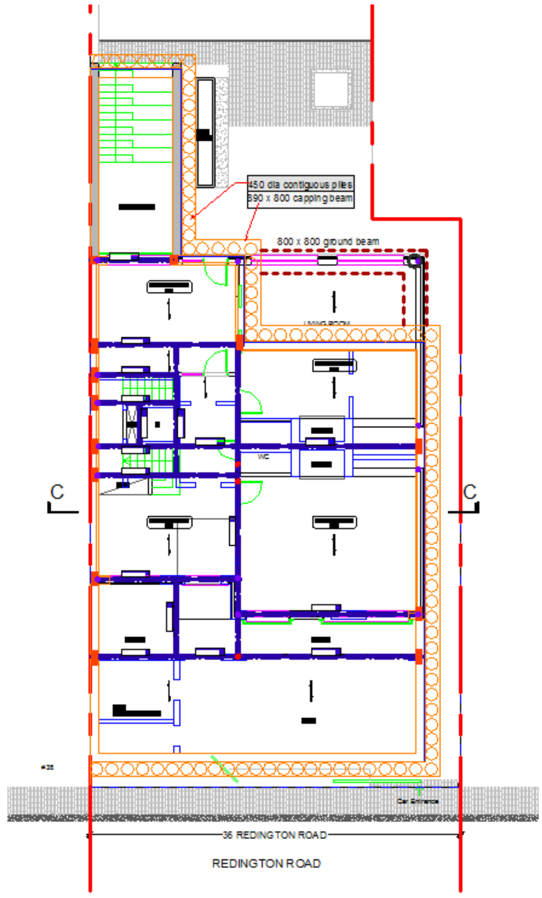
- Timber rafters.
- Loadbearing stud walls supporting rafters and purlins.
- Bracing and ply for stiffness

3.0 Proposed drawings

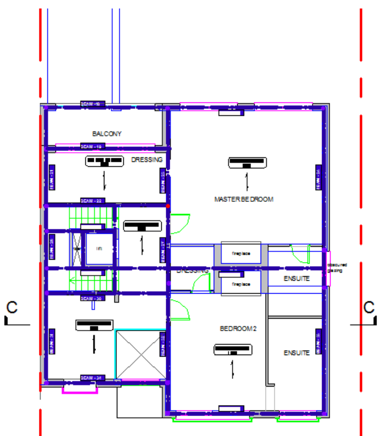
Proposed Floor Plans



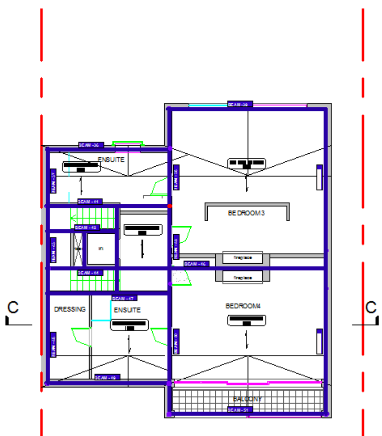
BASEMENT PLAN



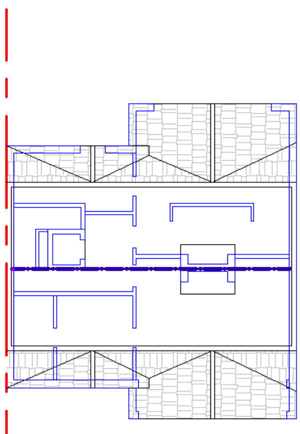
GROUND FLOOR PLAN



FIRST FLOOR PLAN



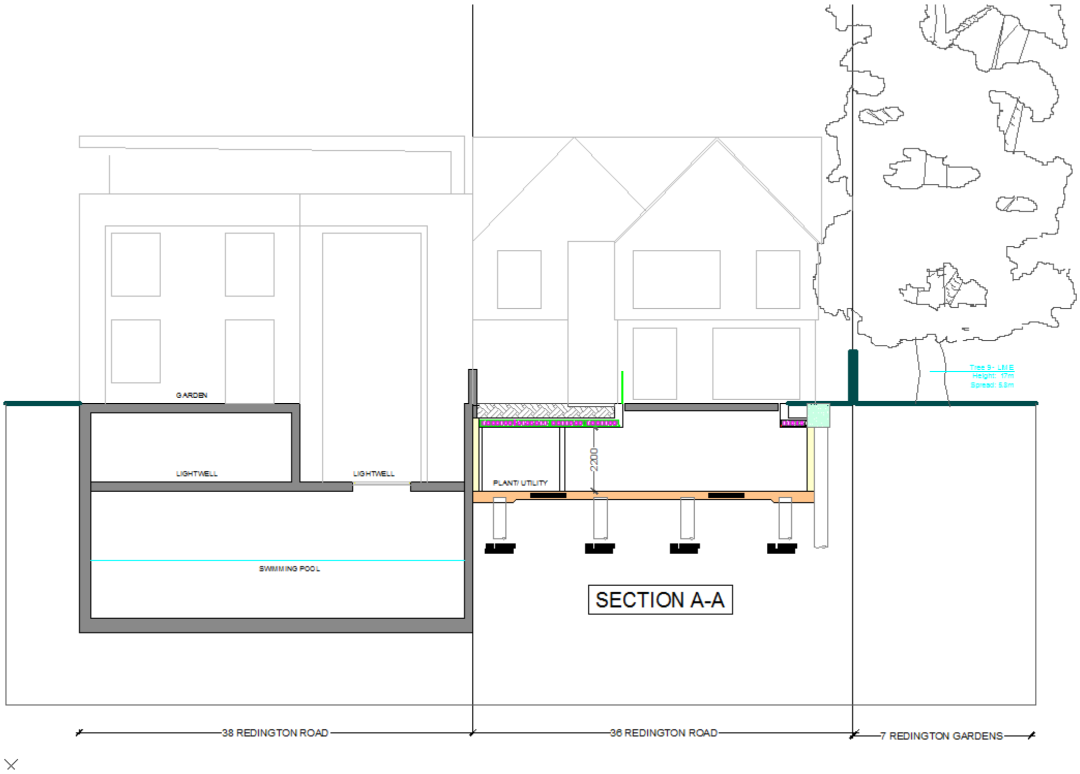
LOFT PLAN

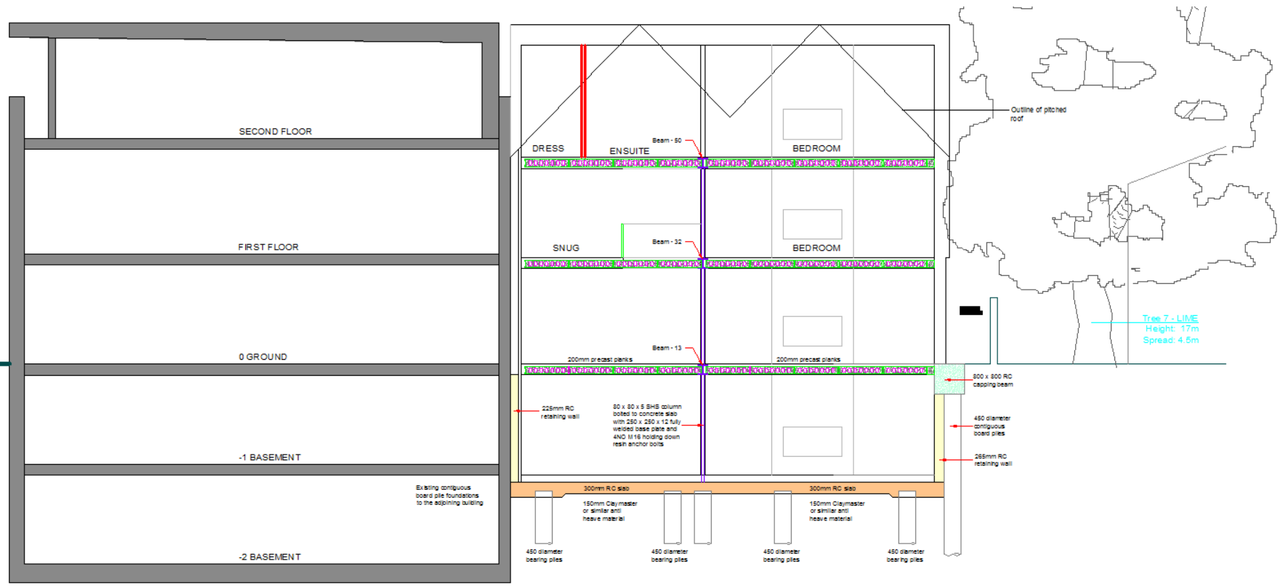


ROOF PLAN

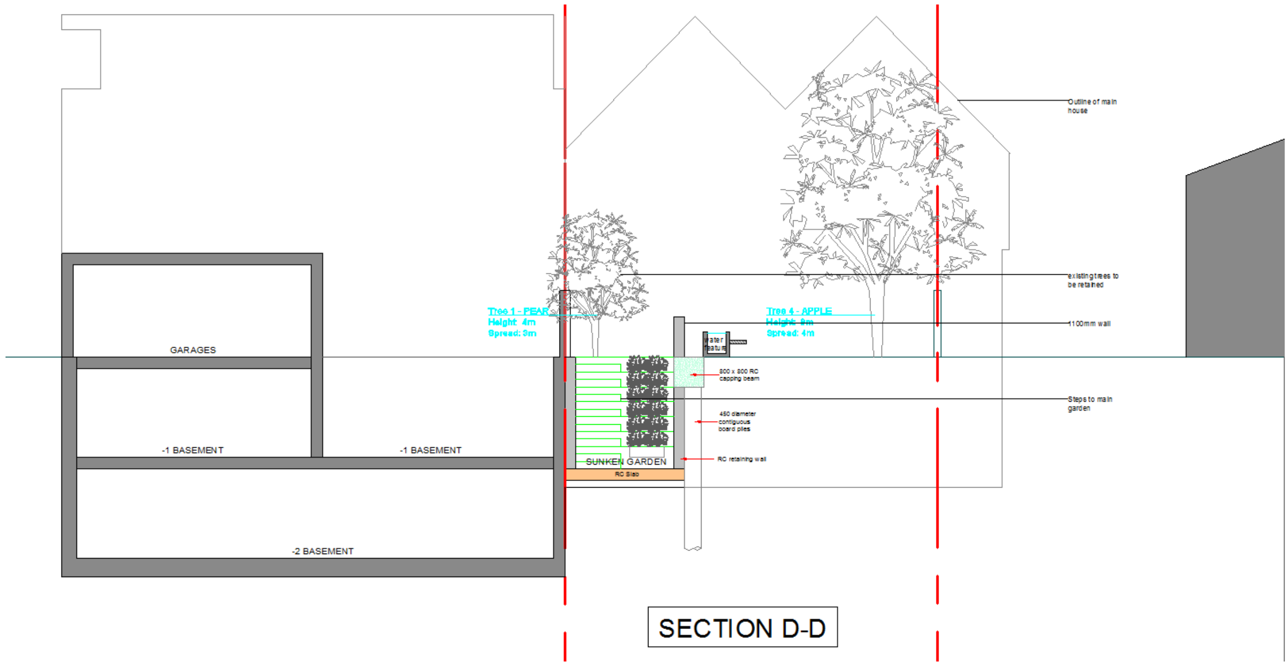
4.0 Proposed drawings

Proposed Sections



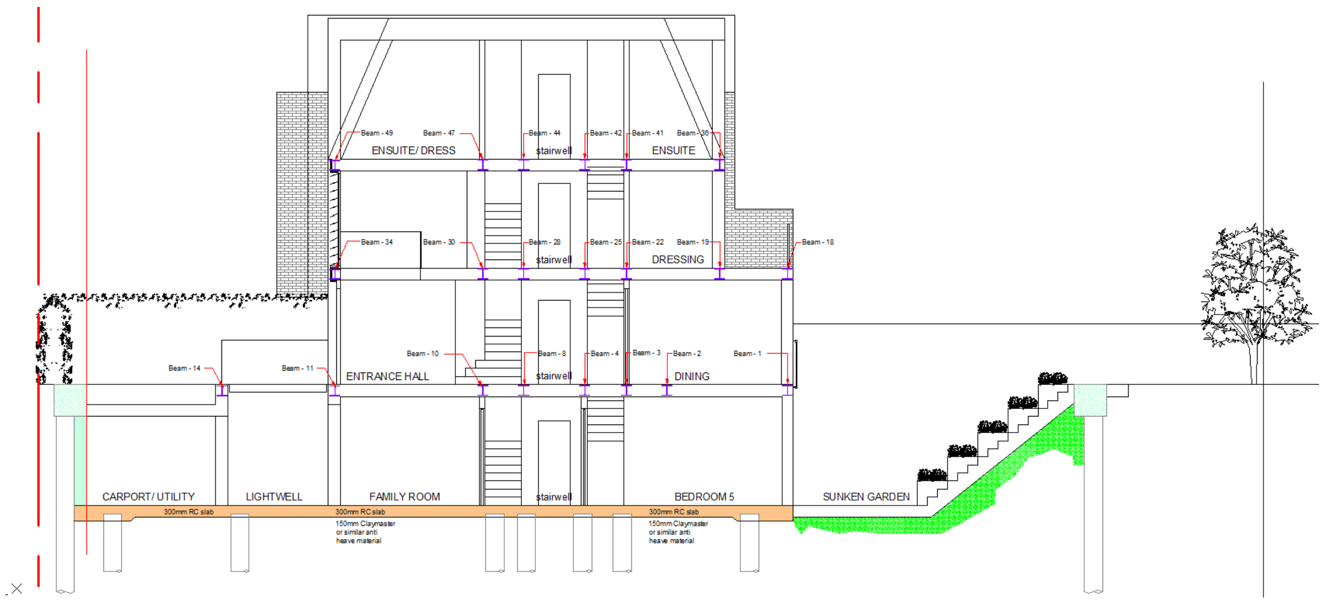


SECTION C-C



GARAGES
-1 BASEMENT
-1 BASEMENT
-2 BASEMENT
Tree 1 - PEAR
Height 4m
Spread: 3m
Tree 4 - APPLE
Spread: 4m
SUNKEN GARDEN
RC Slab
Outline of main house
existing trees to be retained
1100mm wall
800 x 800 RC capping beam
Steps to main garden
450 diameter contiguous board piles
RC retaining wall

SECTION D-D



ENSUITE/ DRESS
stairwell
ENSUITE
DRESSING
ENTRANCE HALL
DINING
CARPORT/ UTILITY
LIGHTWELL
FAMILY ROOM
BEDROOM 5
SUNKEN GARDEN
300mm RC slab
150mm Claymaster or similar anti heave material

5.0 Ground Conditions

5.1 In order to determine and evaluate the design of this construction ground investigation was carried out by Southern Testing Environmental & Geotechnical investigations and the details of this report are attached. The works were carried out between 15 – 23 2014 and the weather conditions during this period was reasonably dry.

5.2 The scope of the investigations comprised excavation of trial pits to examine the presence of tree roots as it was requested by the arboriculturalist and sinking of two 20m deep boreholes using a light percussion 150mm diameter shell and auger boring rig. The ground conditions according to the geology of the area mainly consist of Claygate overlaying London Clay as indeed much of West London.

5.3 Depth of excavation for the basement slab, underpinning and foundation will be around 4.0 m and at these depths the material encountered will consist mainly of silty and sandy clays and ground water will be present as this was struck at around 1.1 m. The results of the Atterberg Limit determination of the spoils confirm high shrink ability factor and there will be swelling of the soil after under the excavation as the overburden weight of the material has been excavated added by the close presence of mature high water demand trees.

Table from Southern testing – Page 6 (Site Investigation report)

13 Soils as Found

The soils encountered are described in detail in the attached exploratory hole logs (Appendix A), but in general comprised a thin covering of made ground over sandy clays (assumed to represent the Claygate Member) over London Clay. A summary is given below.

Depth	Thickness	Soil Type	Description
GL to 0.7m	0.7m	Made Ground	Dark brown to brown silty sandy CLAY with occasional to frequent brick, ash and concrete fragments.
0.7 to 5.1/5.2m	4.5/4.6m	Claygate Member	Variable firm pale brown to brown and bluish grey silty sometimes slightly sandy CLAY. Some more gravelly or sandy clays present.
5.1/5.2 to 20m+	Thickness unproven	London Clay	Firm to stiff /high strength dark brown to grey silty CLAY.

13.1 Visual and Olfactory Evidence of Contamination

No obvious evidence of possible contamination was recorded during the fieldwork other than the presence of superficial made ground; which can contain elevated levels of some contaminants.

14 Groundwater Strikes

Water was struck in the exploratory holes as follows:

BH	Water Strikes
BH1	Groundwater strike at 2.7m depth.
BH2	No groundwater strikes were made.

The shallow trenches were dry.

6.0 Substructure design

6.1 The ground condition seen here generally consists of London Clay with high shrink ability factor and this requires for the substructure to transfer the loads to deeper mediums and for this piling solution will be adopted. The results of the ground investigation has confirmed swelling potential of the London Clay and for this reason the foundations of this building will be designed as a pile raft that will transfer all the vertical loads to a suitable depth beyond the shrinkable zone.

6.2 The Loading from the external elevation cladding and the frame is transferred onto the capping beam which is supported by the contiguous board piles and the retaining walls. The vertical loading is shared by the two elements with the contiguous pile transferring a portion of the load to the ground with the aid of side friction plus end bearing and the retaining wall transfers the other portion of the vertical load directly to the bearing piles placed below the pile raft.

6.3 The Loading from the internal frame system is transferred onto the pile raft. Within the areas of concentrated load individual piles are positioned to minimise eccentric load transfer.

6.4 The reinforced pile raft is designed as a stiff plate sufficiently reinforced to transfer any eccentricity and midspan load directly onto the bearing piles. The underside of the raft has no contact with the ground and compressible material is placed below the raft to allow for ay heave and hydraulic pressure build up.

7.0 Superstructure design

7.1 The superstructure of the building will be a steel frame construction that will be designed to support precast floor planks and the external cladding.

7.2 Steel columns externally will be supported directly over the capping beam and the internal steel columns will be supported directly over the pile raft.

7.3 Steel beams will connect the columns to form a suitable frame and a grillage for each floor. The external beams will support the cavity wall cladding and the internal beams will support the floor structure.

7.4 The advantage of a steel frame design is that the skeleton and the support of the building is constructed with speed and is not reliant upon different trades such as brick and block subcontractors or precast floor manufacturers.

8.0 Construction sequence

The construction sequence has been illustrated in the following drawings.

8.01 Demolition of the existing building

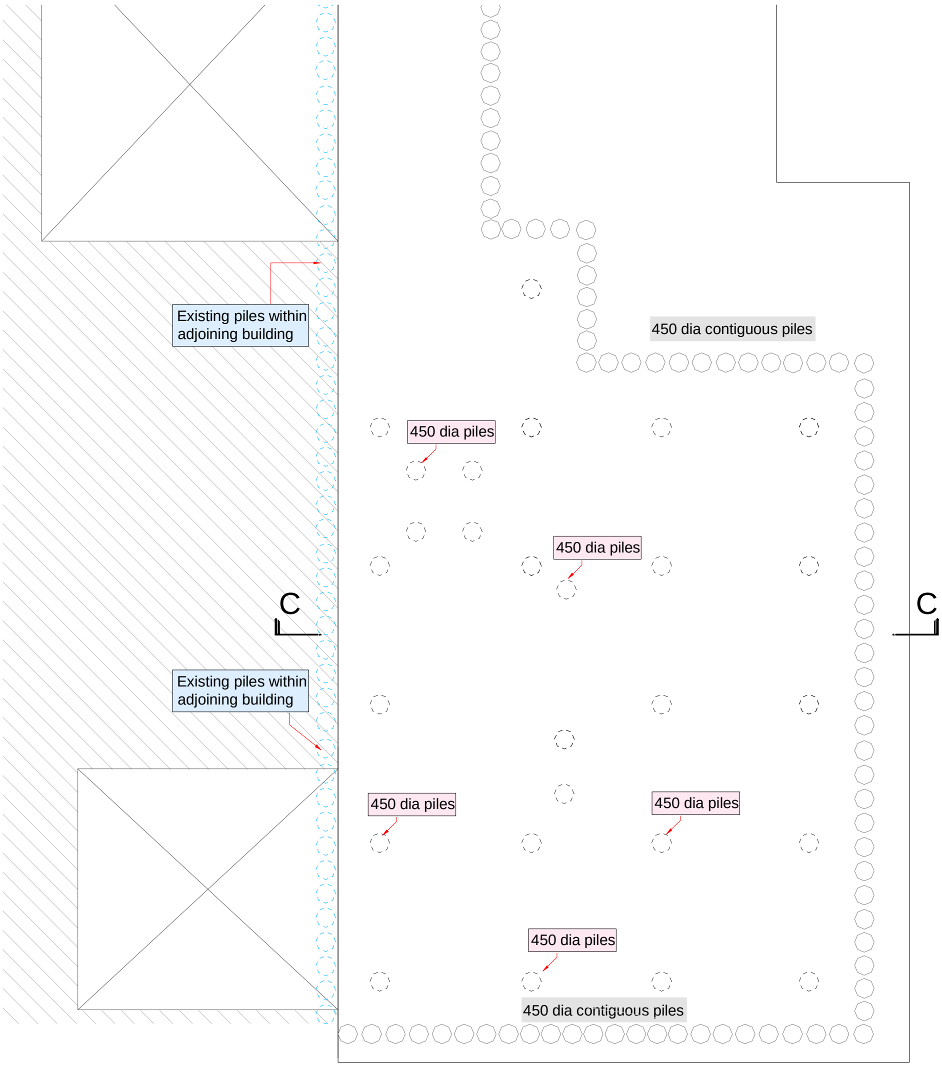
Number 38 Reddington Road was constructed recently as a totally independent structure and does not rely on number 36 for any lateral stability. Therefore with the removal of number 36 there will be no issues with having to prop or restrain number 38. However a comprehensive schedule of conditions will be prepared by the Party wall surveyors.

The demolition of number 36 will commence with careful stripping out of the roof and removal of all the fixture and fittings and any elements attached to number 38 will be removed carefully to ensure no damage is caused to any of the finishes.

After the removal of the roof, the floors will be gradually taken out followed by the internal and external walls. The contractor will ensure that the stability of he building is maintained at all times and the removal of debris is carried out in a orderly and sequential manner o minimise any noise and disturbance to the adjoining owners.

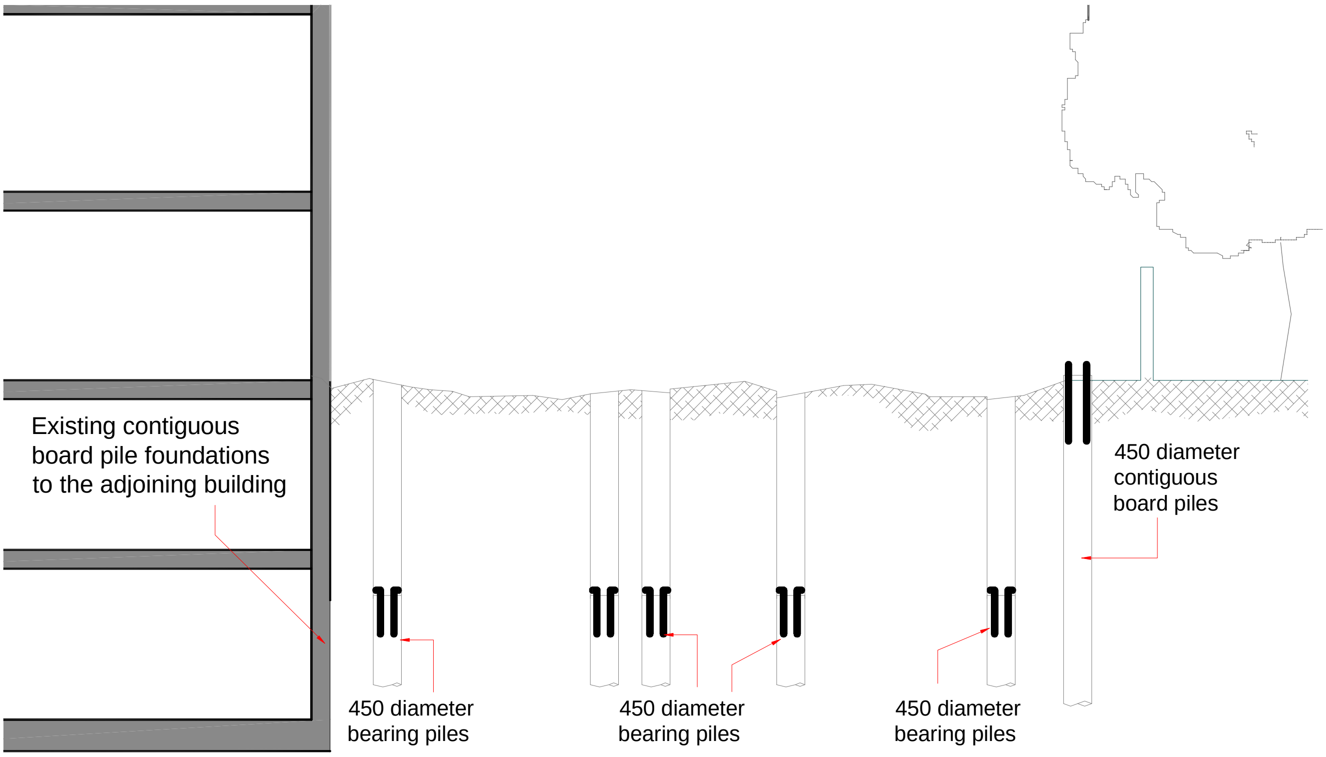
8.10 STAGE-1 Piling

After demolition of the existing building and construction of all the necessary protective elements around the perimeter of the site the piling mat will be provided and the piling contractor will commence installation of both the bearing and contiguous piles. The bearing piles will be poured down to their required cut off level which will be approximately 2.5m below the ground level.



STAGE 1 - Piling

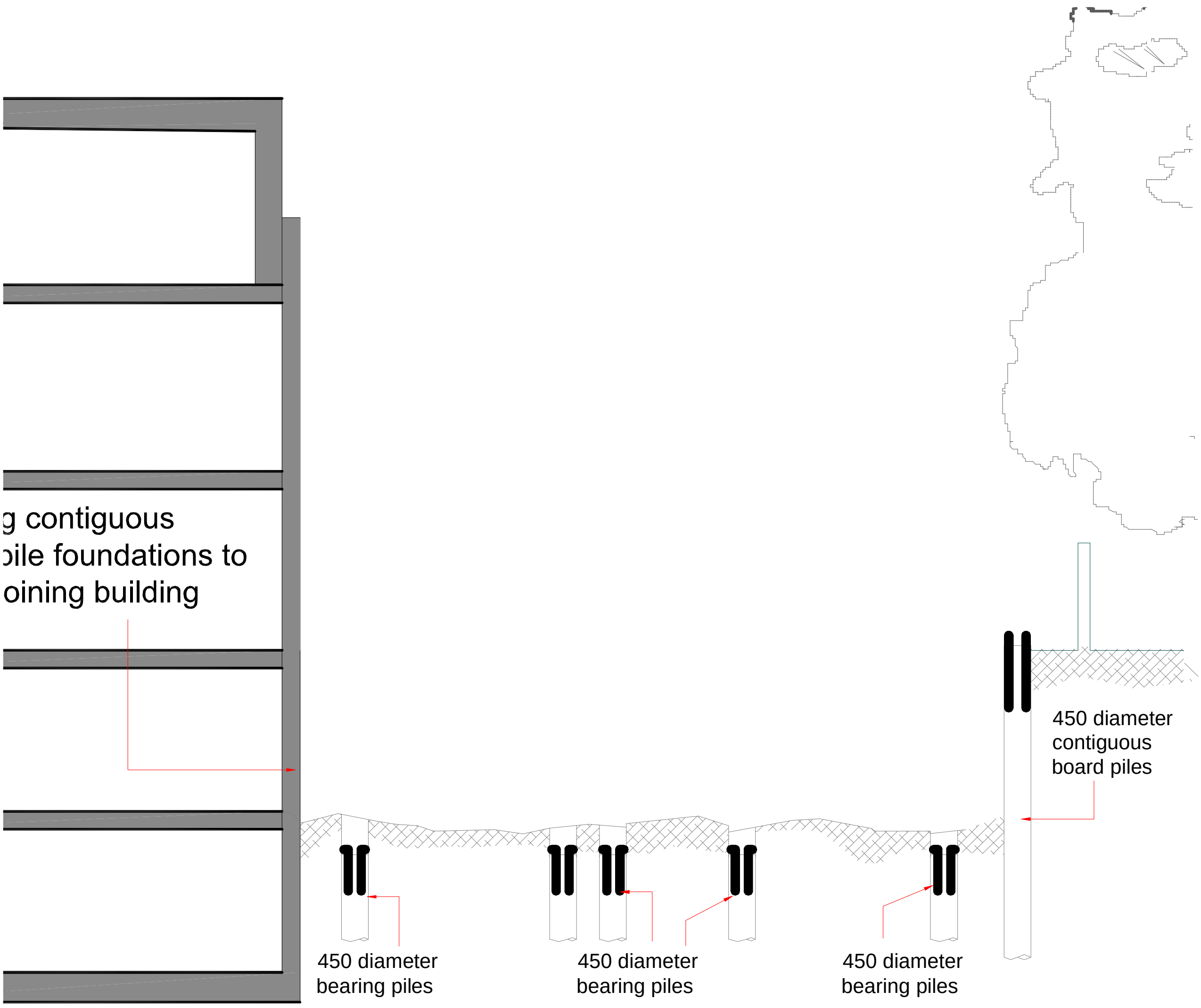
8.10 STAGE-1 Piling



STAGE 1- Piling Section C-C

8.20 STAGE-2 Excavation

After the installation of the piles have been completed excavation of the ground can commence. The contractor will ensure all the necessary provisions for dewatering have been made and as it has been recommended in the site investigations report any ingress of water can be pumped from a pre-constructed sump. The site investigation also confirms that the presence of ground water will not be very significant

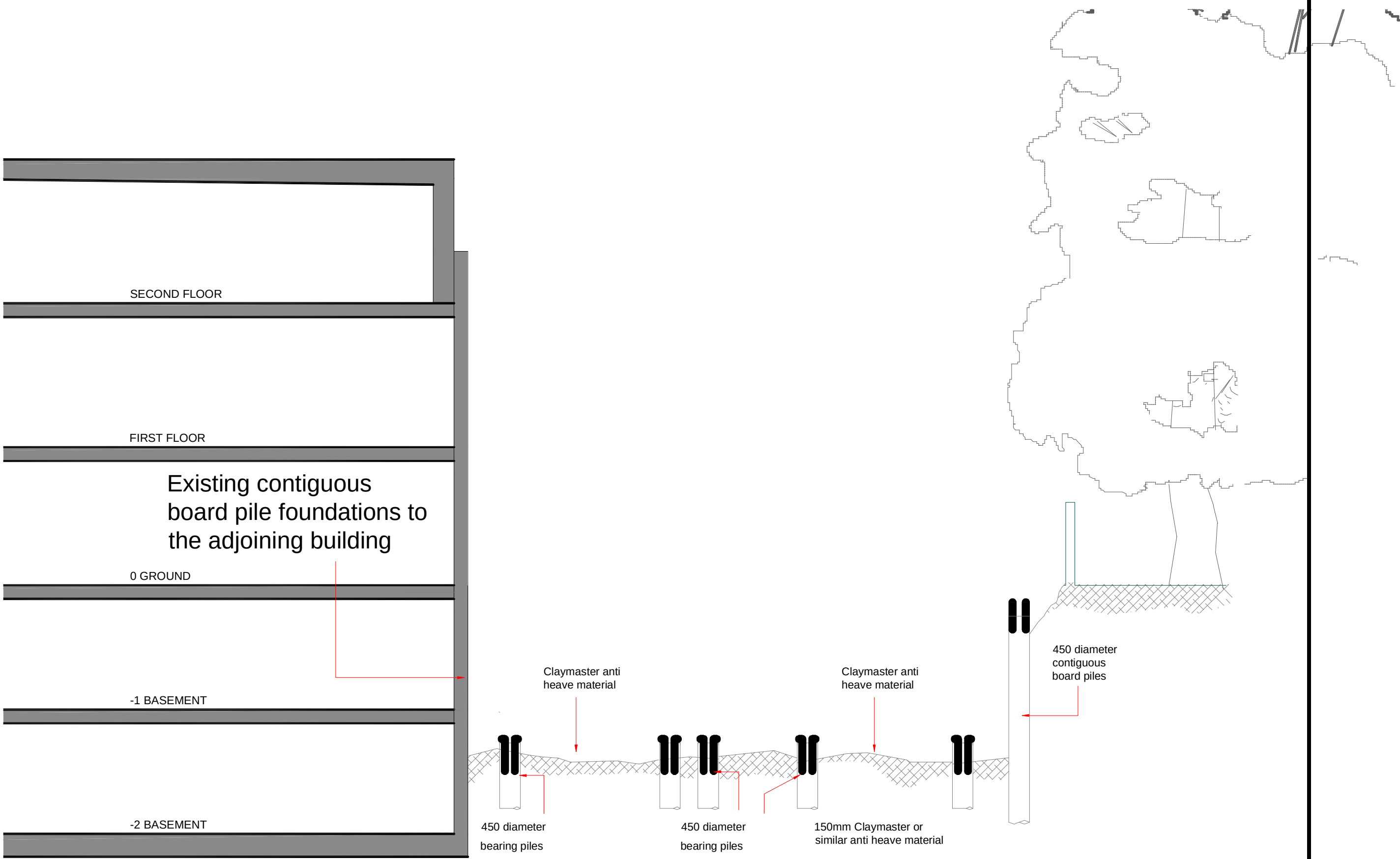


STAGE 2 - Excavation

STAGE-2 Excavation initial stages

8.30 STAGE-3 Excavation

The excavation of the ground will continue down the the required formation level of the basement pile raft. The ground will be levelled and the starter bars from the bearing piles will be prepared to be linked to the basement pile raft. The clay master compressible material will be laid and ground will be ready to receive the concrete for the pile raft slab. It should be noted that the contiguous piles will be designed as cantilever piles; therefore no internal propping or temporary works will be necessary. In addition to this the adjoining building has a double basement with already cast contiguous piles in position and this side of the excavation will also be adequately supported and therefore no internal propping will be necessary on any of the surrounding walls.

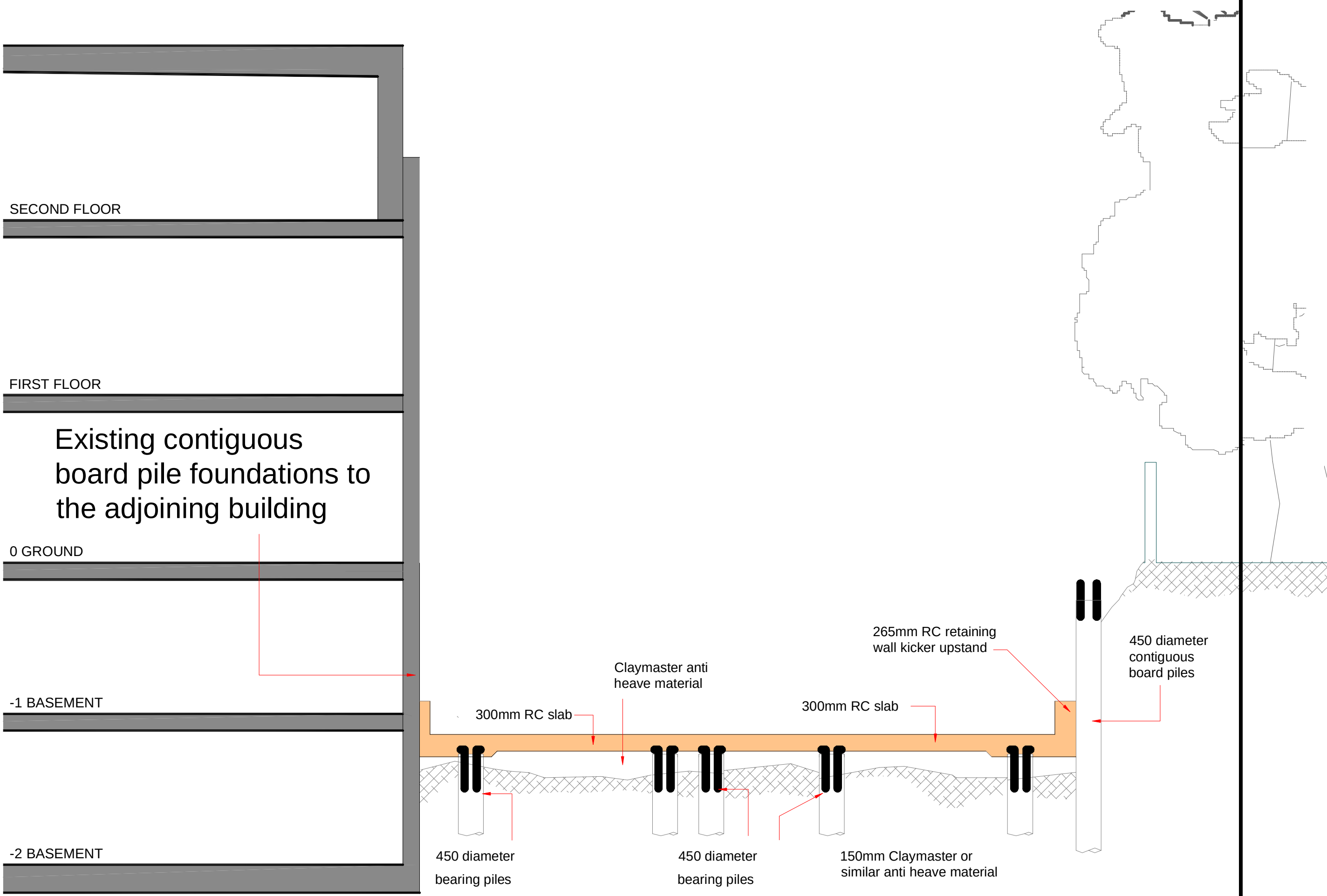


STAGE 3 - Excavation

STAGE-3 Excavation exposing bearing piles

8.40 STAGE-4 Slab construction

All necessary formwok will be cut and prepared and he reinforcing bars will be laid and tied to the bearing pile starter bars. A kicker will be formed around the perimeter of the slab for attachment of formwork for the retaining walls. Sufficient preparations and excavations will be made at ground level for the casting of the capping beam that will be constructed over the contiguous board piles.



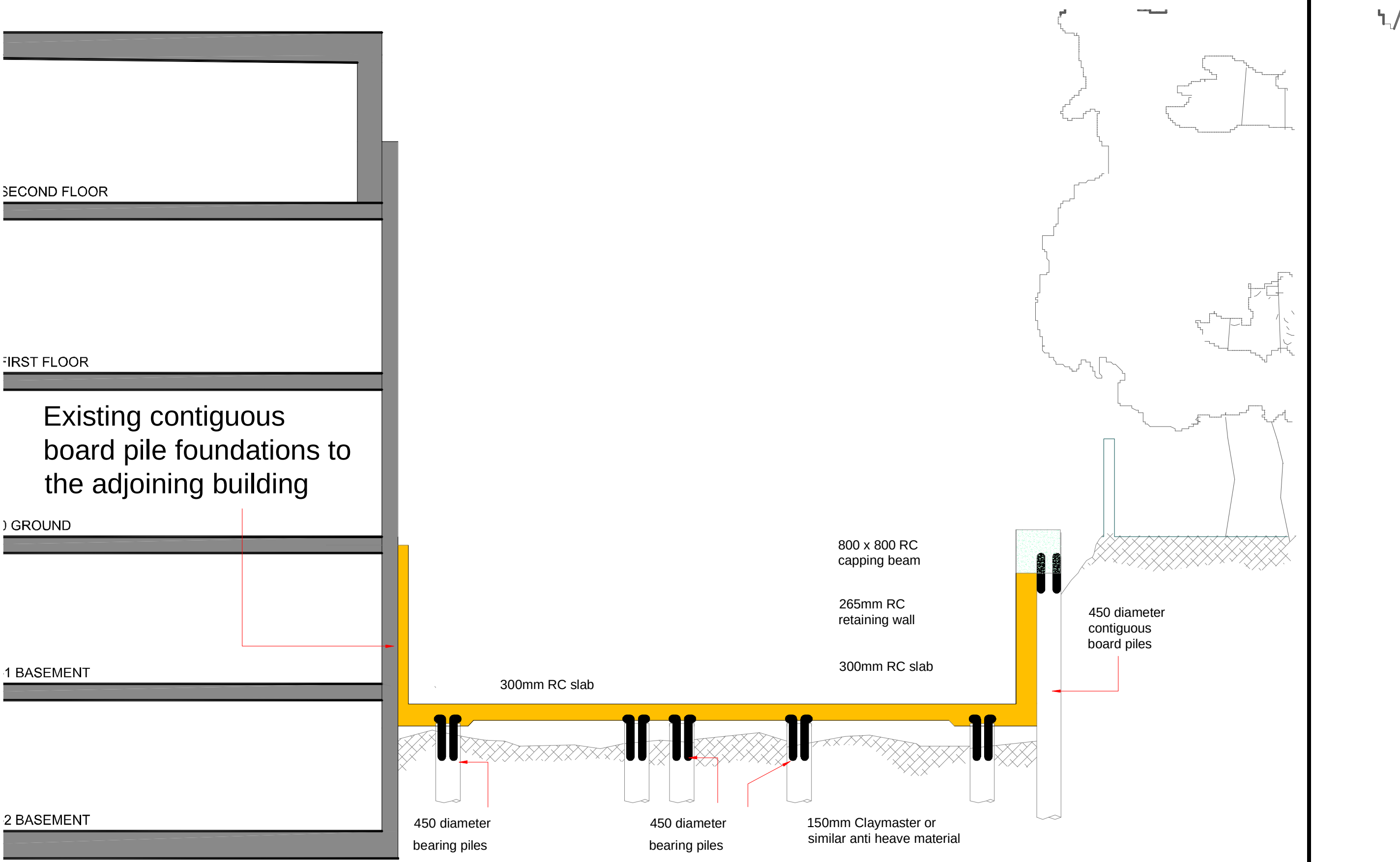
STAGE 4 - Slab construction

STAGE-4 Slab construction reinforcement fixed

STAGE-4 Slab construction concrete poured

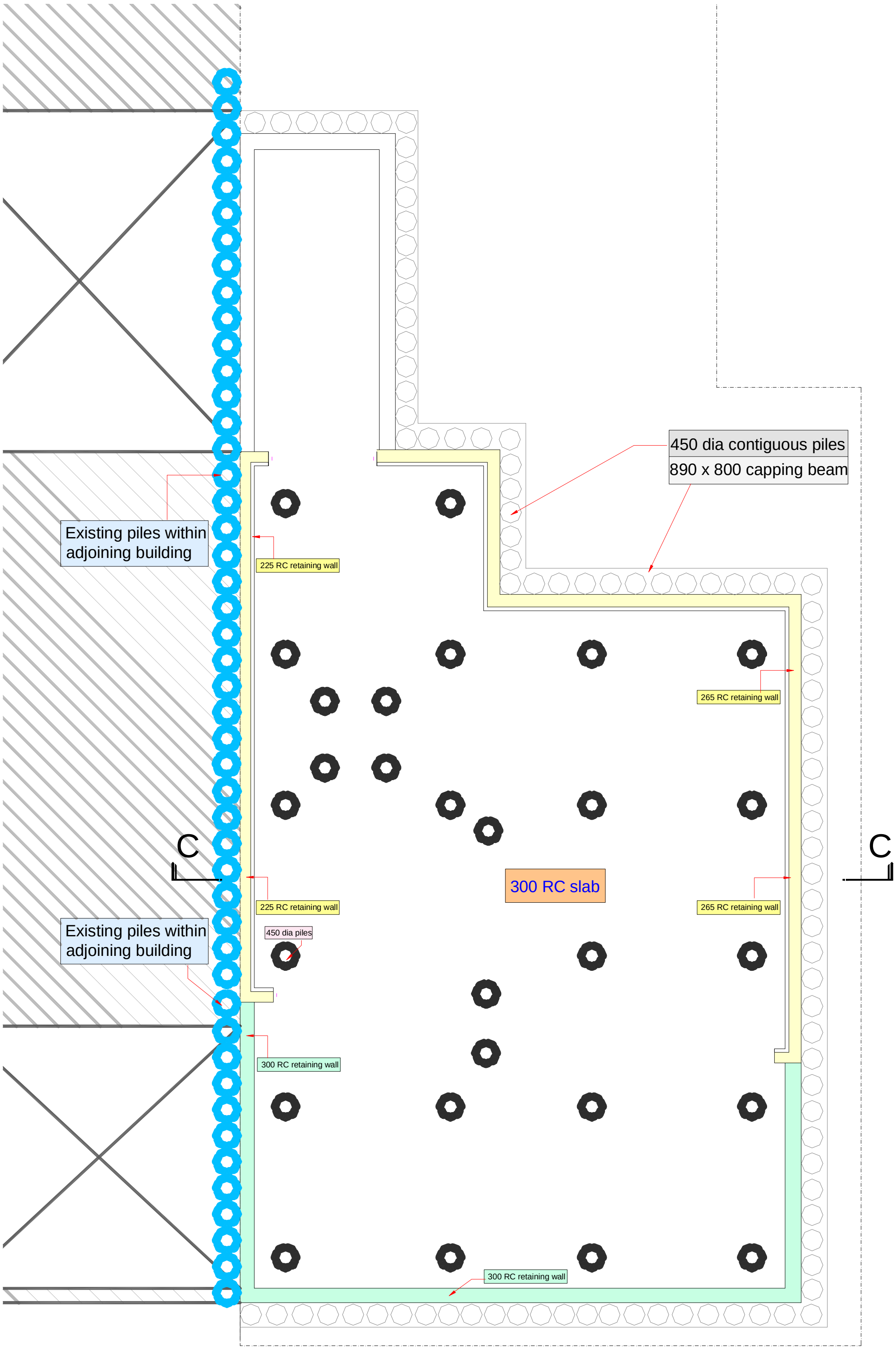
8.50 STAGE-5 Retaining wall and capping beam construction.

Reinforcement will be fixed for both the retaining wall and the capping beam and concrete will be poured to complete the substructure construction. No internal propping will be necessary because as pointed out in clause 8.30 the contiguous piles will be designed as cantilevers in order to allow free and open space within the newly formed basement.



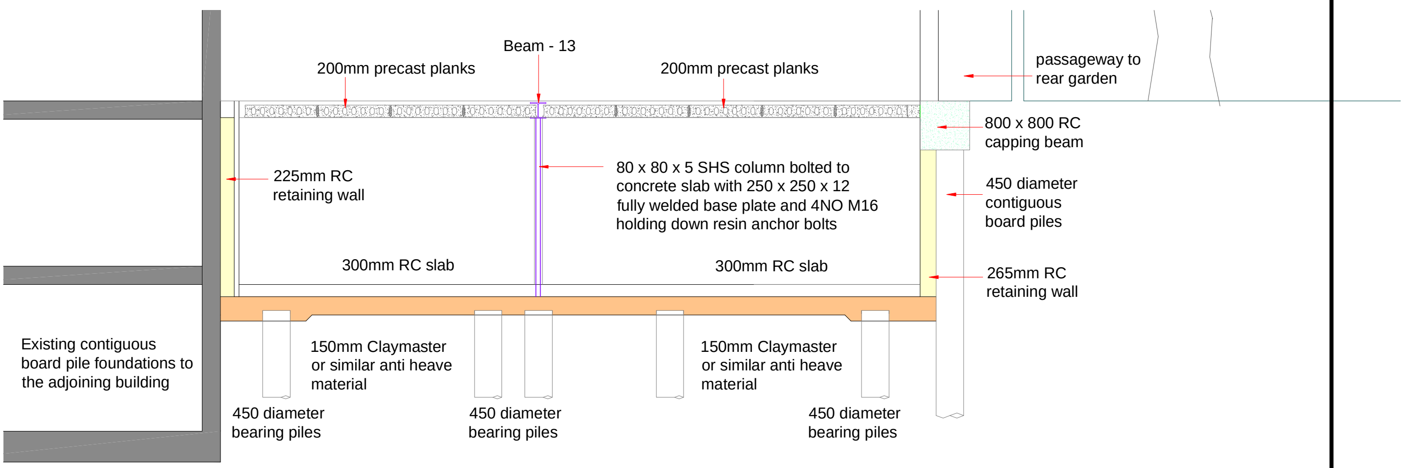
STAGE 5 - Retaining wall & capping beam

8.50 STAGE-5 Retaining wall and capping beam construction.

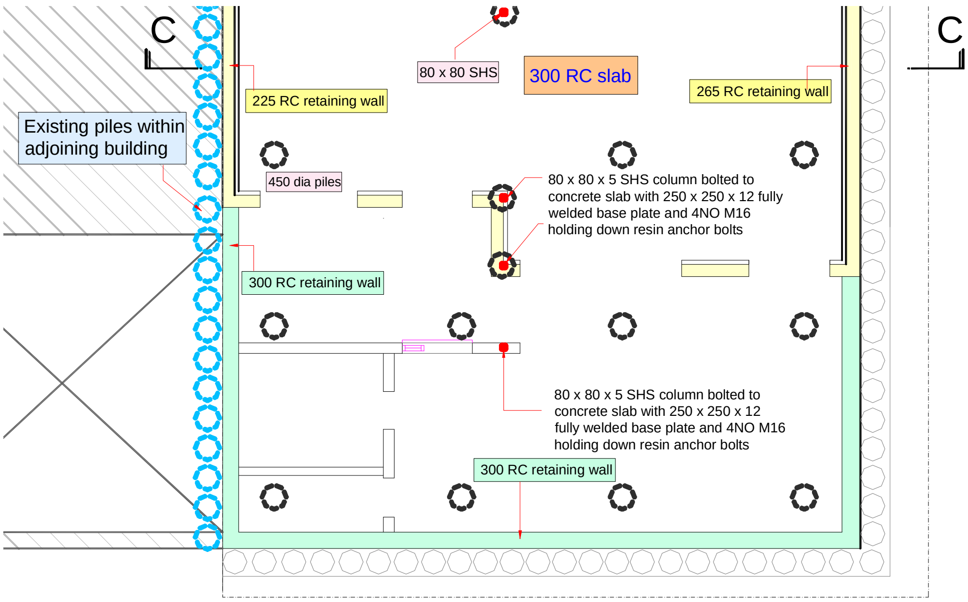


8.60 STAGE-6 Retaining wall and capping beam construction.

Reinforcement will be fixed for both the retaining wall and the capping beam and concrete will be poured to complete the substructure construction. No internal propping will be necessary because as pointed out in clause 8.30 the contiguous piles will be designed as cantilevers in order to allow free and open space within the newly formed basement.

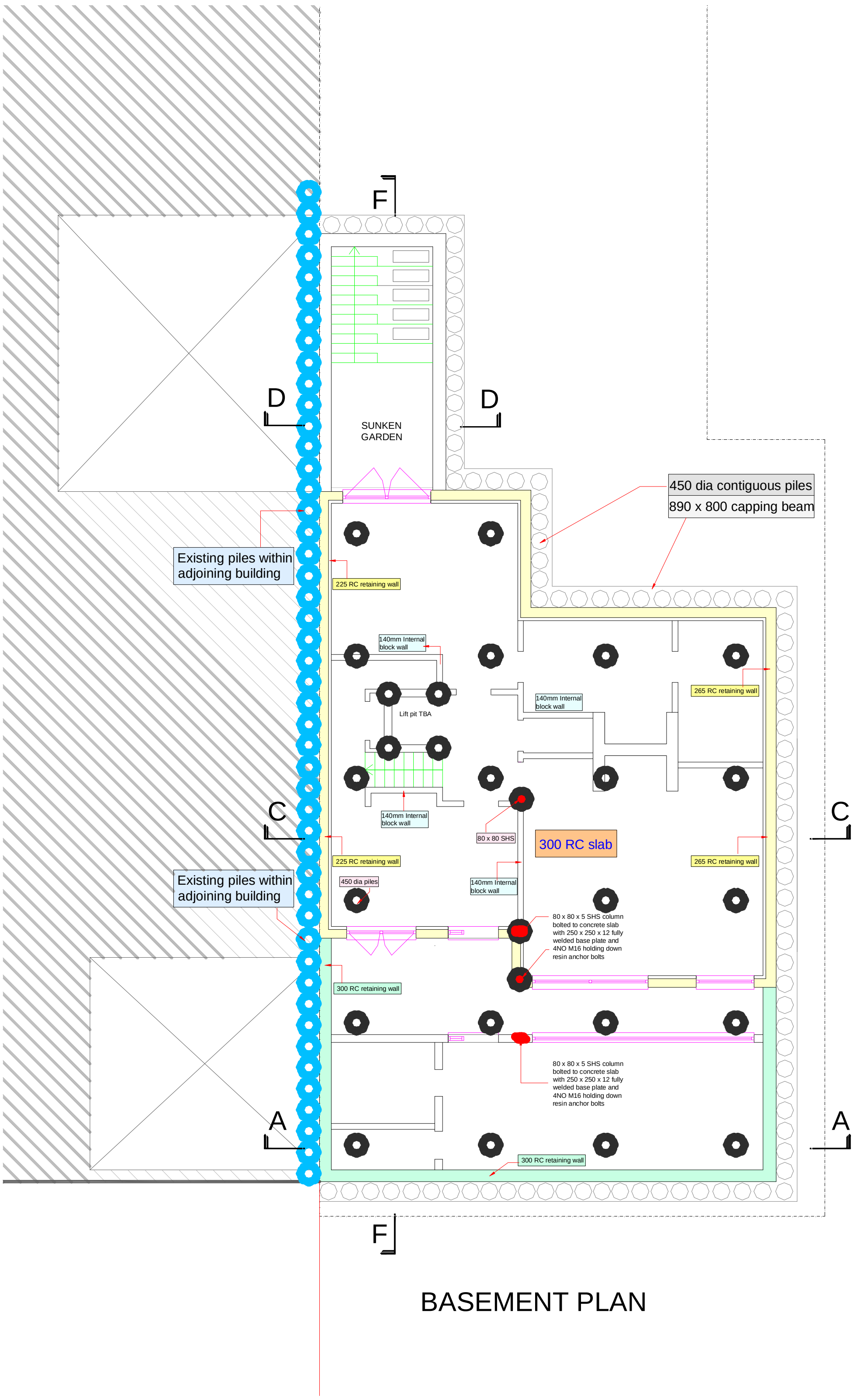


STAGE 6 - Steel
Frame & construction



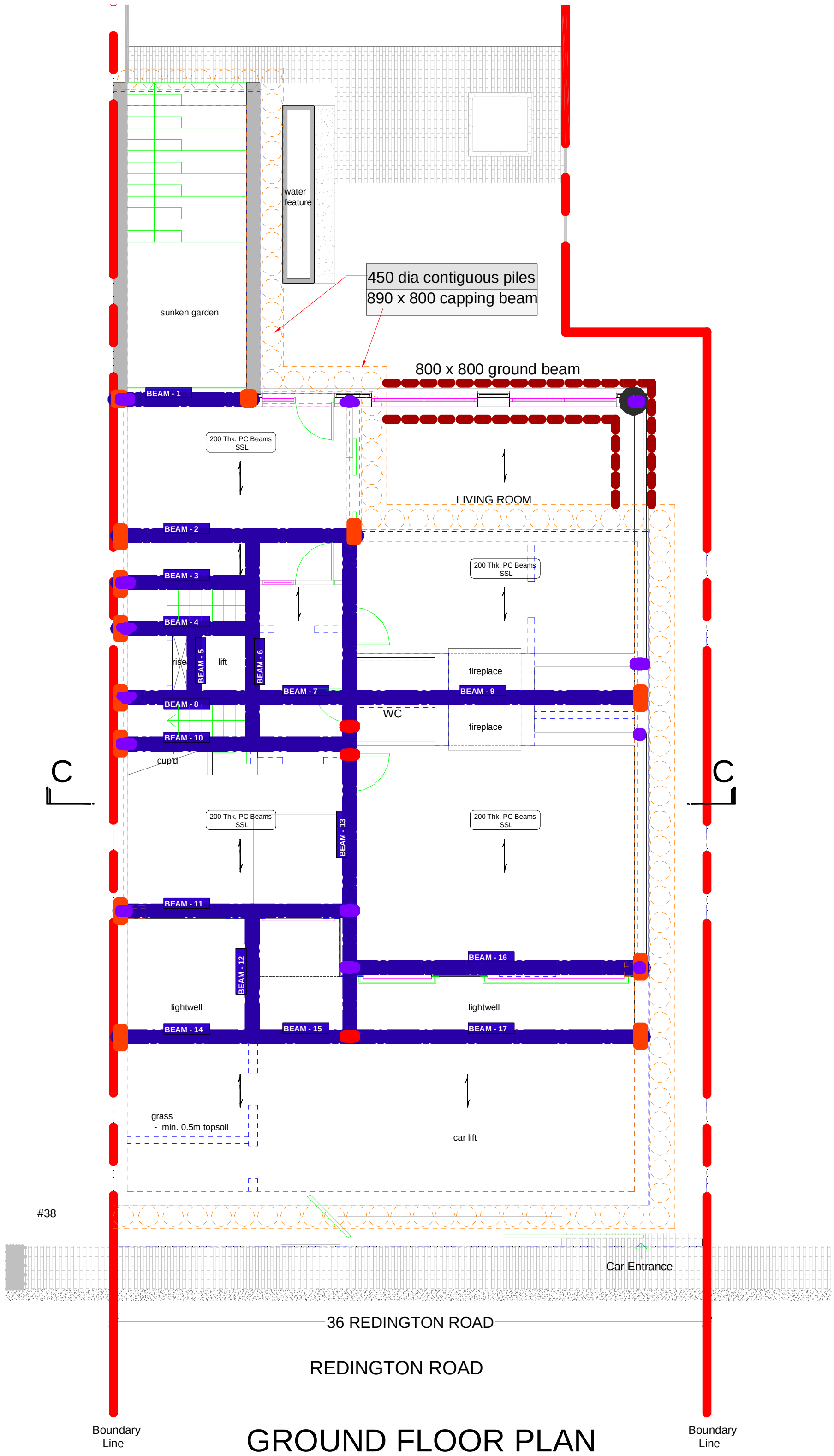
STAGE 6 - Steel
Frame & construction

8.70 STAGE-7 Basement structure completed



BASEMENT PLAN

8.80 STAGE-8 Ground floor structure completed



GROUND FLOOR PLAN

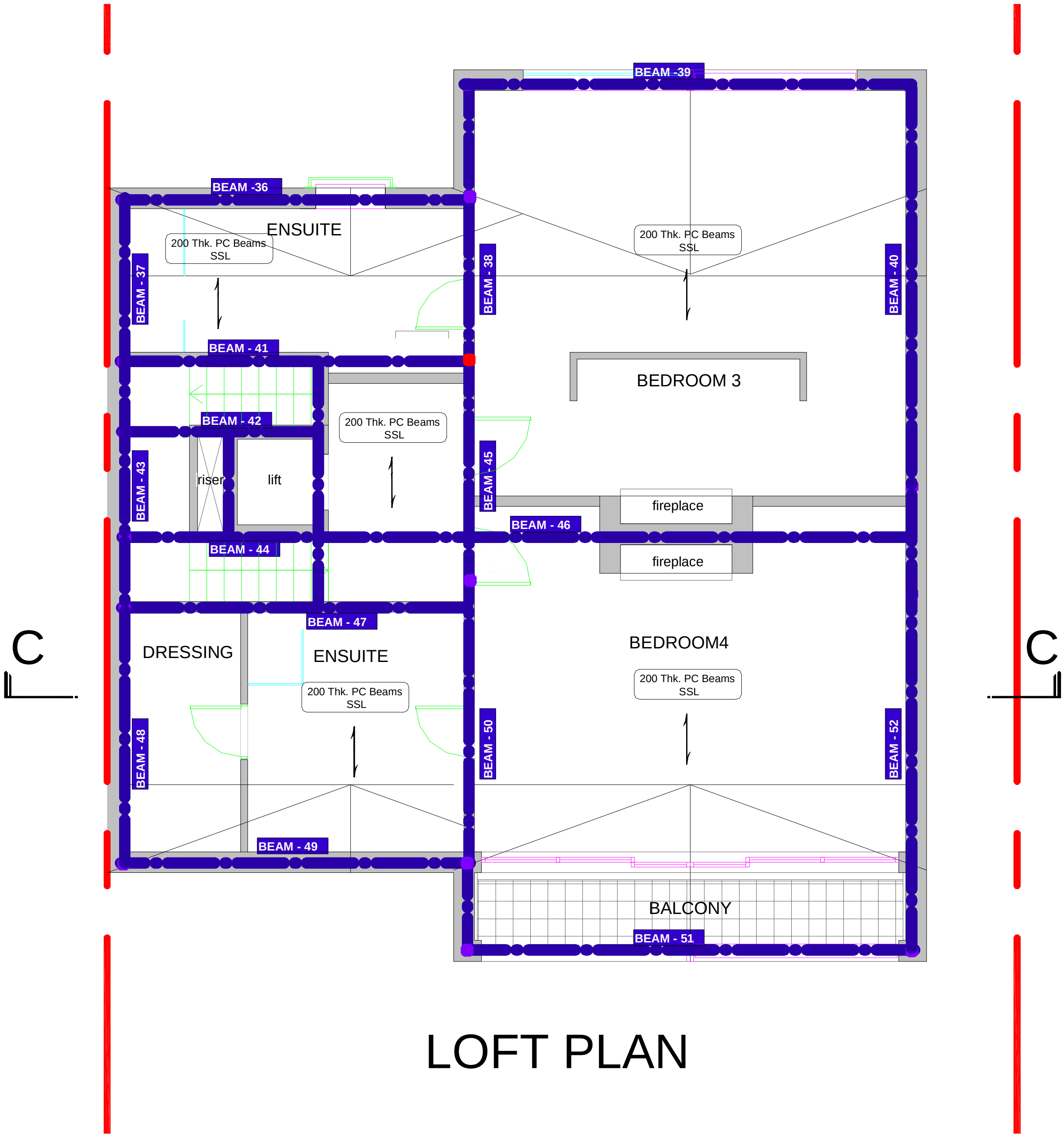
8.80 STAGE-8 Ground floor precast floor on capping beam

8.90 STAGE-9 First floor structure completed

FIRST FLOOR PLAN

8.90 STAGE-9 First floor precast floor over steel frame

8.10 STAGE-10 Second floor, loft and roof completed



LOFT PLAN

9.00 Structural Calculations

The following design codes will be adopted for the structural design

BS8002 Earth Retaining Structures
BS8110 Structural Use of Concrete
BS648 Weight of Building Materials
BS6399 Loadings for Buildings
BS8004 Foundations

Underpinning party walls, worst case will be in temporary condition

Loading

Total area internally to be supported

12 x 12 = 144m2

DL1 = 0.86 x 144 = 120 kN
LL1 = 0.75 x 144 = 108 kN

DL = 0.25 x 24 x 144 x 3 = 2592 kN
LL = 1.5 x 144 x 3 = 684 kN

Total Load = 120+108+2592+684 = 3600kN

Number of internal piles = 22

Loading per pile = 163 kN + basement slab = 10 x 9 = 90 kN
Total per bearing pile = 253 kN

External piles Loading :

DL = 0.86 + 0.75 + 18 + 4.5 = 25 kN per/m x 4 = 100 kN/m + 4.8 x 10 = 148 kN/m

Each pile supporting 148/3 = 50 kN

Contiguous piles each support = 50 kN
Internal bearing piles = 253 kN

Design for internal bearing pile 8m deep

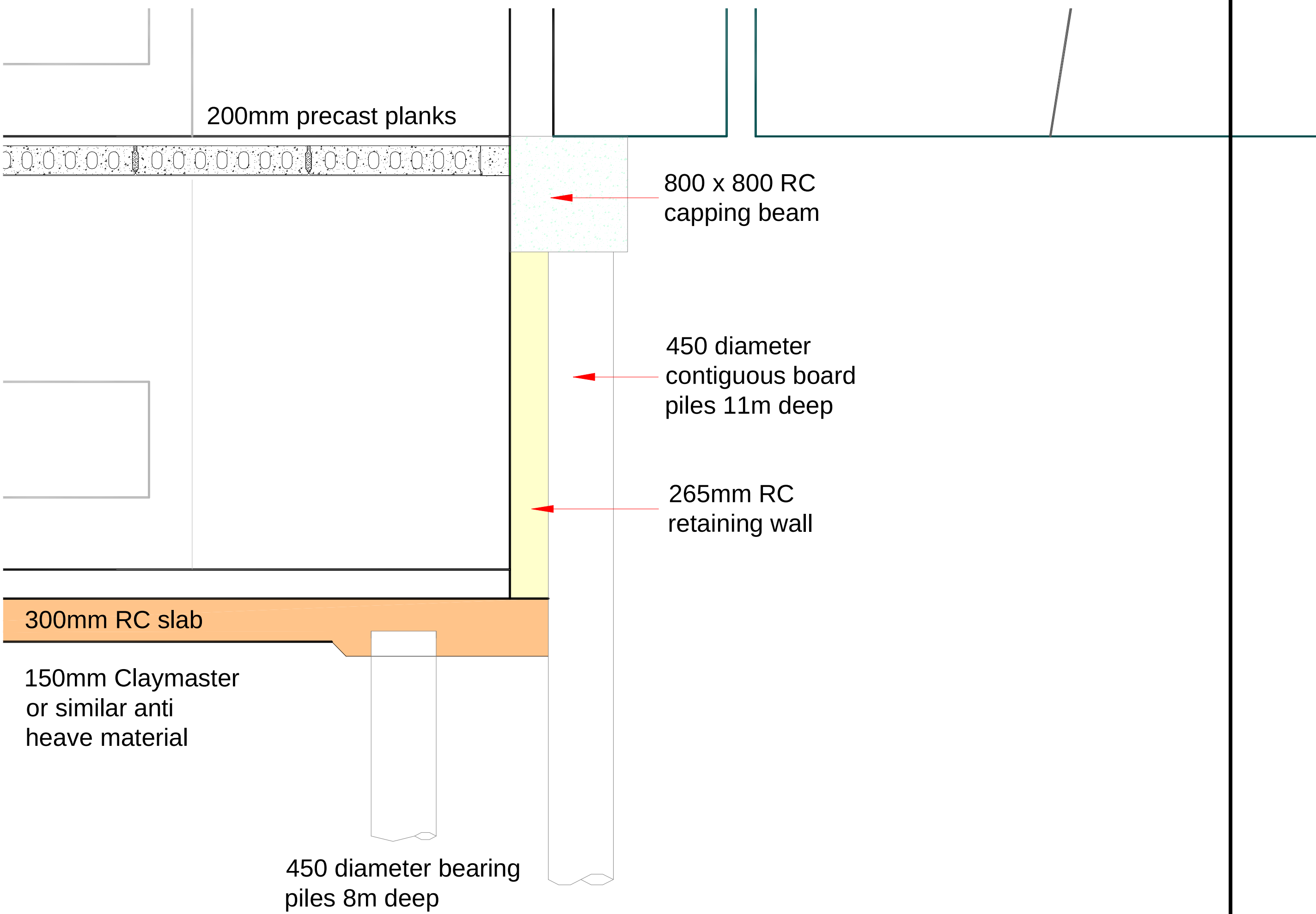
Pile capacity — QS Friction = 0.45 x 80 x 11 = 396 kN
Qb end bearing = 80 x 0.15 = 12 kN

Pile resistance = 396 + 12 = 408 kN

Actual load = 140 kN

Factor of safety 408/140 = 3

Bearing pile specification will be 8m deep 450mm diameter
Contiguous pile specification will be 11m deep 450mm diameter



Suspended slab design

DL = 0.35 x 24 = 8.4 kN/m2
LL = 1.50 1.5 kN/m2

Factored bending moment

8.4 x 1.4 + 1.5 x 1.6 = 21 x 3.5 x 3.5 /8 = 32 kNm

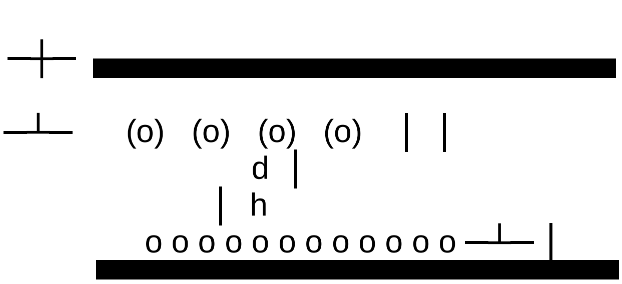
300 slab

Location: Continuous slab

Bending in solid slabs (with comp.steel if reqd.), designed per metre

width, with checks on minimum steel and span/effective-depth ratio

Calculations are based on EN1992-1 2004 Eurocode 2:Design of concrete structures and assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to 0.45d



Design moment - (i.e. factored moment)

Design BM before redistribution Mbef=32 kNm
Section being analysed is considered as continuous.
Section considered has a sagging moment

Materials

Char cylinder compress strength fck=35 N/mm¬2 (concrete)
Char yield strength of reinft fyk=460 N/mm¬2
Max.aggregate size (for bar spc.) hagg=20 mm
Diameter of tension bars dia=12 mm

Diameter of distribution bars diad=10 mm

Durability and cover to reinforcement

Life of structure 50 years
Exposure class XC1
Designed concrete C 35 /45
Minimum cover covern=50 mm
Fixing tolerance tol=10 mm
Nominal cover (Cl. 4.4.1.1(2)) cover=60 mm

Section properties

Overall depth of section h=300 mm
Effective depth of section d=300 mm
Breadth of section b=1000 mm

Main reinforcement

Partial safety factor for steel gams=1.15
Char yield strength of reinft. fyk=fy=460 N/mm¬2
Partial safety factor for conc. gamc=1.5
Char cylinder compress strength fck=35 N/mm¬2 (concrete)
Design yield strength of reinft. fyd=fyk/gams=460/1.15=400 N/mm¬2
It is usual practice in the UK to restrict x/d to 0.45
Limit on factor delta=0.85
Factor K'=0.597*delta-0.18*delta^2-0.209
=0.597*0.85-0.18*0.85^2-0.209
=0.1684
Factor K=M*1E6/(b*d^2*fck)
=32*1E6/(1000*300^2*35)
=0.0102
No compression reinforcement required.
Lever arm z=d/2*(1+SQR(1-3.529*K))
=300/2*(1+SQR(1-3.529*0.0102))
=297.3 mm
Reduce lever arm to z=0.95*d=0.95*300=285 mm
Depth to neutral axis x=2.5*(d-z)=2.5*(300-285)
=37.5 mm
Tension reinforcement required As=M*1E6/(fyd*z)=32*1E6/(400*285)
=280.7 mm¬2
Mean width of the tension zone bt=bw=1000 mm
Mean value axial tensile strength fctm=0.3*fck^(2/3)=0.3*35^(2/3)
=3.21 N/mm¬2
Minimum reinforcement required Asmin=0.26*fctm*bt*d/fyk
=0.26*3.21*1000*300/460
=544.3 mm¬2
Area of tension reinforcement As=Asmin=544.3 mm¬2
Breadth of section bw=1000 mm

Maximum reinforcement permitted Asmax=0.04*bw*h=0.04*1000*300
=12000 mm¬2
Percentage area steel required rho=100*As/(bw*d)
=100*544.3/(1000*300)
=0.1814 %
Distribution steel Asmpr=Asmin=544.3 mm¬2

DESIGN SUMMARY FLEXURE

Overall depth	**300 mm**
Effective depth	**300 mm**
Parameter K	**0.0102**
Parameter K'	**0.1684**
Lever arm ratio z/d	**0.95**
Steel area (tension)	**544.3 mm2/m**
Steel percentage req.	**0.1814 %**
Minimum area of steel	**544.3 mm2/m**
Maximum area of steel	**12000 mm2/m**
Distribution steel	**544.3 mm2/m**

Use B1131 Mesh

British Standard reference	Longitudinal wires			Cross wires		
	size mm	pitch mm	area mm^2 /m	size mm	pitch mm	area mm^2 /m
Square Mesh Fabric						
A 393	10	200	393	10	200	393
A 252	8	200	252	8	200	252
A 193	7	200	193	7	200	193
A 142	6	200	142	6	200	142
A 98	5	200	98	5	200	98
Structural Fabric						
B1131	12	100	1131	8	200	252
B 785	10	100	785	8	200	252
B 503	8	100	503	8	200	252
B 385	7	100	385	7	200	193
B 283	6	100	283	7	200	193
B 196	5	100	196	7	200	193

Spacing of bars - Tension reinforcement

Minimum pitch (sagging moment) pchmn=50 mm
Maximum pitch of bars (<3h) pchmx=400 mm
Calculated pitch of bars pitch=1000*PI*dia^2/(4*As)
=1000*3.142*12^2/(4*544.3)
=207.8 mm
Round spacing (c.to c.of bars) to 200 mm (rounded).
Chosen spacing of tension bars pch=100 mm
Area of tension steel provided Aspr=1000/pch*PI*dia^2/4
=1000/100*3.142*12^2/4
=1131 mm2/m

TENSION (AND DISTRIBUTION)	Diameter of bars	12 mm
REINFORCEMENT	Spacing of bars	100 mm
	Area of steel required	544.3 mm2/m
	Area of steel provided	1130 mm2/m

Deflection

Effective span of slab L=3.5 m
Actual span to depth ratio l'd=L*1000/d=3.5*1000/300
=11.67
Reference reinforcement ratio rho0=(fck^0.5)/10=(35^0.5)/10
=0.5916 %
Basic span effective depth ratio terms (Clause 7.4.2)
N1=1.5*(fck^0.5)*rho0/rho
=1.5*(35^0.5)*0.5916/0.1814
=28.94
N2=3.2*(fck^0.5)*(rho0/rho-1)^1.5
=3.2*(35^0.5)*(0.5916/0.1814-1)^1.5
=64.35
N=11+N1+N2=11+28.94+64.35
=104.3
Factor for simply supported spans k=1.0
Flange beam factor F1=1
Factor for long spans F2=1.0
Tensile steel stress factor F3=500/(fyk*As/Aspr)
=500/(460*544.3/1130)
=2.257 (conservative)
Long spans factor F2 1
Steel stress factor F3 1.5
Allowable l/d ratio 40

10.00 Impact on Roadway and adjoining Buildings

10.10 The construction of this relatively small basement is confined within the boundaries of the main footprint of the house. The depth of excavation and the works is relatively low-level.

10.20 The works will have no effect to any roadway with the exception of skips and hoardings. The works will be carried out in accordance with an approved construction traffic management plan.

10.30 The surrounding buildings are classified as standard residential and there are no listed or historic buildings in the area that requires any special or particular attention. There will be minimal vibration as a result of installation of the piles and these are very unlikely to be felt within the surrounding area.

10.40 The new construction will not be deeper than the adjoining building at number 38 Reddington Road which has a double basement . The next neighbouring property at 7 Reddington Gardens will 5m away from the line of the excavation and with a single basement not being deeper than 3.8m the foundations of this building will not be undermined and no additional surcharge will be required to be taken for the design of the contiguous piles other than ground plus hydraulic pressure from standing water at a depth of 1m.

10.50 The ground which consists of London Clay will provide ample bearing and friction resistance to the piles and settlements expected from this relatively light weight construction will be minimal.

11.00 Conclusion

11.10 This construction is considered to be a simple and standard way of achieving a basement without affecting the surrounding areas.

11.20 A significant amount of data has been gathered including ground investigations borehole results and details of the adjoining building. Standard construction methods and techniques will be used together with traditional materials.

11.30 The construction techniques together with the presence of the contiguous board piles reduce the amount of temporary works and the nature of the underlying geology minimises the risk of ground slip and movement.

11.40 The new construction will be beneath the prevailing groundwater level and a suitable dewatering system will be designed involving sumps and pumps to discharge the water from the excavations. The construction method is controlled and will be undertaken in pre-determined sequences and without the need for large open excavations that could potentially be unstable.

12.50 On the basis of the above we can conclude that the construction of the proposed subterranean works will not affect the structural stability of the surrounding buildings and infrastructure.

12.60 There will be no disturbance to the geology and flow of natural water and there will be no disturbance to any critical utilities.

12.70 The works will not significantly increase the flow of storm water and the existing system will not be placed under any strain as a result of this work.

Peter Zussman BSc CEng MIStructE

Chartered Structural engineer