## Report Contents



## 1.0 Introduction

1.1 This report has been completed by Martin Shortt for Harrison Shortt Structural Engineers Ltd.

Martin Shortt (MIStructE, CEng)

1.2 Harrison Shortt Structural Engineers Ltd. have been appointed by the owners of Frognal Rise House to complete the permanent and temporary works design for the construction of the proposed lower ground floor extension at the above address.

1.3 Access has been gained to all levels of the building and external areas of the property. A preliminary desk study has been completed to establish the ground conditions and history of the building.

1.4 A detailed survey of the site and existing building has been provided by Charlton Brown Architects, the project architects.

1.5 Opening up works have not been completed however we have managed to see elements of the structure.

## 2.0 Existing Building, Site and Ground Conditions

2.1 The existing building is a four storey detached house (including the loft and the basement) that appears to have been constructed in the early 1800s. The building has a single storey garage to the south.

2.2 The building is located on the corner of Lower Terrace and Frognal Rise.

2.3 The building shares boundaries with 14 Lower Terrace to the left and 22 Windmill Hill to the right when viewed from the front.

2.4 The building is constructed with solid brickwork external walls. The internal load bearing walls are brickwork at lower ground floor and timber stud above.

2.5 The lower ground floor is constructed with a concrete slab. The ground floor and above are constructed with timber floor joists.

2.6 The roof is a slate clad traditionally constructed hipped crown roof. The pitched roof joists are supported at mid span by timber purlins supported on timber trusses spanning between the external walls.

2.7 The ground conditions on the site are Made Ground over Bagshot Formation (sand) over Claygate Member (clay with sand lenses) over London Clay. A site investigation has been completed by GEA and noted the fill depth varies between 1.1m and 1.6m deep.

2.8 The building is likely to be founded on corbelled brickwork foundations on Bagshot Formation (sand, sedimentary rock).

2.9 The overall stability of the building is provided by the cellular layout of the masonry walls.

2.10 The results of the desk study can be summarised as follows:

- The site is not in the vicinity of any historic rivers.
- The site has a very low risk of surface water flooding and very low risk of flooding from rivers and the sea.
- The site is not within the vicinity of any London Underground Ltd. infrastructure.
- There was no damage to the building from WWII.

2.11 The building is Grade II listed and is in the Hampstead Conservation Area.

## 3.0 Observations

3.1 he building appears to be in reasonable condition for its age and type. It appears to have been reasonably well built using good quality materials at the time of construction, however, the multiple phases of building has resulted in differential types of juxtaposed construction. This is particularly relevant in terms of foundation conditions where the original part of the building has little or no foundation structure where compounds with later phases, which are much deeper.

3.2 Frognal Rise House is significant as a house of early 19th-century origin, with early 20th-century additions by the well-known architectural practice of Parker and Unwin, which are interesting despite being radically at odds with the original character of the house. It was substantially altered in the 1930s and the survival of all its earlier phases is fragmentary – both internally and externally. Changes from the late 1930s onwards have left the house with many detracting features.

3.3 As seen from the trial hole investigation, the foundations to the original building which were originally minimal have been previously undermined at lower ground floor level as highlighted below:

3.4 These differential types of foundations and undermined original foundations should be improved as part of any considered scheme for the long term future of the building.

## 4.0 Proposed Works

4.1 The proposed works involve the localised remedial works in the existing building.

4.2 A new basement will be constructed to the southern garden side of the building extending to the garage.

4.3 The existing garage is to be extended to the party fence wall to 22 Windmill Hill.

4.4 The new basement will be constructed using contiguous piles around the perimeter to retain the ground. A reinforced concrete liner wall will be constructed inside the piles. The basement floor slab will be constructed with reinforced concrete. The roof of the basement will be constructed with reinforced concrete and will have a garden above.

4.5 A new single storey garden room will be constructed above the garage.

4.6 The original building will be underpinned with shallow mass concrete underpins to address the previous undermining. This will extend to all the existing foundations so the building does not experience differential movement associated with varying foundation depths.

4.7 The building will be underpinned with reinforced concrete where it adjoins the new basement.

## 5.0 Waterproofing and Below Ground Drainage

5.1 The waterproofing strategy is informed by the existing building and ground conditions.

5.2 Groundwater is not likely to be encountered during the excavation as the formation level for the new lower ground extension matches the existing garage level and sits within what is assumed to be made ground, largely above the level of the natural slope of the original ground.

5.3 The reinforced concrete liner walls and lower ground floor slab will provide Type B (structurally integral) protection. A drained cavity will be installed within the liner walls and on top of the slab provide Type C (drained) protection. Type B and C protection are outlined in BS8102:2009.

5.4 The strategy noted above will provide Grade 3 waterproofing protection to the lower ground floor extension as outlined in BS 8102:2009 Table 2.

5.5 The cavity drain system will include a cavity drain sump to collect any water which will then be pumped to the main private drainage system.

5.6 As the basement extension is below the level of the existing drainage the effluent generated at lower ground floor level will need to be pumped up to the main private drainage system. This will prevent any flooding from public sewers in case of backup. It is intended that the existing internal gravity drainage system will be retained above ground floor level.

## 6.0 Party Wall Matters

6.1 The proposed works falls within the scope of the Party Wall etc. Act 1996.

6.2 The procedures under the Act will be dealt with in full by the Employers Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the Act and agree the Party Wall Awards.

6.3 The Contractor will be required to provide the Party Wall Surveyor with appropriate drawings, method statements and other relevant information covering the works that are notifiable under the Act.

6.4 The resolution of matters under the Act and provisions of the Party Wall Awards will protect the interest of all owners.

6.5 The proposed works will be developed so as not to inhibit any works on adjoining properties. This will be verified by the Surveyors as part of the process under the Act.

## 7.0 Hydrogeological Statement

7.1 From published data and our understanding of the site topography and underlying ground conditions gained from basement projects within the area groundwater is not likely to be encountered during the excavation. This has been confirmed by the site investigation.

# 8.0 Construction Method Statement

## 8.1 General Issues

Some of the issues that affect the sequence of works on this project are:

- The stability of the existing building,
- The stability of the adjoining buildings,
- The stability of the adjacent highways,
- Forming sensible access onto the site to minimise disruption to the neighbours,
- Providing a safe working environment.

The proposed works involve the extension of a basement and will involve excavations approximately 1.5 metres deep below garage level.

The undertaking of such projects to existing buildings is specialist work. We will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project. The Contractor will be a member of the Considerate Constructors Scheme.

Once the works commence we will have an ongoing role on site to monitor that the works are being carried out generally in accordance with the design and specification. This role will typically involve fortnightly site visits at the beginning of the Contract with monthly visits thereafter.

## 8.2 Noise, Vibration and Dust

The Contactor shall undertake the works in such a way as to minimise noise, dust and vibration when working close to adjoining buildings in order to protect the amenities of the neighbours.

The breaking out of existing structure shall be carried out by saw cutting where possible to minimise vibration to the adjacent properties and associated construction noise. All demolition and excavation work will be undertaken in a carefully controlled sequence taking into account the requirement to minimise noise, vibration and dust.

The Contractor is to use suitable method of minimising the emission of dust and dirt during the construction works. This will include the use of protective plastic dust sheeting, enclosing conveyors and water spraying where suitable.

## 8.3 Working Hours

The site working hours will be in accordance with the London Borough of Camden regulations as noted below:

## 8.4 Permitted hours of noisy works

- Monday to Friday 8am to 6pm
- Saturday 8am to 1pm
- Sunday No works.
- Public Holidays No works.

## 8.5 Waste Management

The Contractor will provide a recycling and waste management scheme conforming to the current regulations prior to starting works on site. The Contractor should reuse / recycle where possible. Waste should be sorted on site and go to certified waste sites for reclamation.

### 8.6 Stage 1 : Site Set-Up

Erect a fully enclosed painted plywood site hoarding around the perimeter of the site. It is likely that the footpath can remain in use during the works.

The services within the site and footpath should be identified and isolated as necessary.

### 8.7 Stage 2 : Demolition and Enabling Works

The existing garage is to be dismantled and replace as part of the works which will allow access to the site.

Given the scope of the works it is likely that conveyors will be used to move spoil around the site to a skip located in the existing garage location.

### 8.8 Stage 3 : Installation of Piling Mat, Guide Walls and Piles

A piling mat should be installed to allow the piling to be completed.

The guide walls will be constructed to allow the piles to be installed.

The piling around the perimeter of the basement should be competed.

### 8.9 Stage 4 : Underpin Existing Building

Complete the underpinning to the existing building. This will involve the remedial underpinning to address the existing undermined foundations.

### 8.10 Stage 5 : Installation of Temporary Works and Bulk Excavation

Once the piling has been completed the temporary works will be installed at top of the piles. These provide lateral restraint to allow the bulk excavation to be completed.

Complete the bulk excavation to basement formation level.

### 8.11 Stage 6 : Installation of Below Ground Drainage and Basement Floor Slab

The below ground drainage should be installed and basement floor slab constructed.

### 8.12 Stage 7 : Construction of Basement Columns and Basement Roof

Construct the basement columns and slab over the basement.

### 8.13 Stage 8 : Extension of Garage and Construction of Garden Room over Garage

Extend the garage and construct the garden room over the garage.

# 9.0 Drawings


## Notes

- Existing brickwork wall.
- Existing wall. Construction to be confirmed.
- EC09-1 Existing column sections TBC.
- EC09-2 Existing column 100x100 SHS.
- EC09-3 Existing column 100x100 SHS
- EC09-4 Existing column 100x100 SHS (assumed).
- EC09-5 Existing column 152UC.

## Schedule of opening up

| | |
|---|---|
| TP-1 - TP10 | Confirm foundation depth of adjacent walls. |
| OU01 | Remove existing ceiling throughout as noted to expose structure. |
| OU02 | Remove 800x800 square of ceiling. |
| OU03 | Confirm if fireplace present. |

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**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Existing Lower Ground Floor Plan 2024_06_10 1:100 (A3) 3096_E09_I**


## Notes

- Existing brickwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed.
- EJ13 — Existing joists - depth and span direction TBC.
- EJ14 — Existing joists - depth and span direction TBC.
- EB10-1 — Existing beam. Secton size TBC.
- EB10-2 — Existing beam. Secton size TBC.
- EB10-3 — Existing beam. Secton size TBC.
- EB10-4 — Existing beam. Secton size TBC.
- EB10-5 — Existing beam. Secton size TBC.
- EB10-6 — Existing beam. Secton size TBC.
- EB10-7 — Existing beam. Secton size TBC.
- EB10-8 — Existing original RSJ assumed.
- EB10-9 — Existing original RSJ jack arch beam.
- EB10-10 — Existing original RSJ assumed.
- EB10-11 — Existing RSJ over garage doors.
- EB10-12 — Existing 203UC retrofitted beam.

## Schedule of opening up

| | |
|---|---|
| OU4 | Lift floor board if ceiling does not confirm structure from below. |
| OU5 | Remove 300x300mm to confirm if column present. |
| OU6 | Remove 300x300mm square of ceiling. |

2No. boreholes to be agreed on site - refer to GEA report for locations.

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A 1986 B 2483 C 4862 D 4331 E 1400 F 2727 G 6710 H 1556 J

6 4034 5 4941 4 5832 3 2811 2 5849 1

EJ10 EB11-3 OU13 EJ10

EB11-1

EB11-2

EJ11

sloping floor

Arch under

EJ11 OU12 OU11

sloping floor EJ9 EB11-4 EB11-5

OU10 OU08

OU09 EB11-6 EJ10 EJ10

Existing trimmer assumed

OU07

sloping floor EJ9

EJ9 EB11-7

EJ12

Maximum 300x300mm section of finish or ceiling to be removed

## Notes

- Existing brickwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed.
- EJ9 Existing joists - depth and span direction TBC.
- EJ10 Existing joists - depth and span direction TBC.
- EJ11 Existing joists - depth and span direction TBC.
- EJ12 Existing joists - depth and span direction TBC.
- EB11-1 Existing beam. Secton size TBC.
- EB11-2 Existing beam. Secton size TBC.
- EB11-3 Existing beam. Secton size TBC.
- EB11-4 Existing UB254x100.
- EB11-5 Existing UB254x100.
- EB11-6 Existing 200mm flitch beam.
- EB11-7 Existing beam. Secton size TBC.

## Schedule of opening up

| | |
|---|---|
| OU7 | Confirm joists under and beam bearing under. |
| OU8 | Confirm joists under and beam bearing under. |
| OU9 | Confirm downstand beam over. |
| OU10 | Confirm joist span under. |
| OU11 | Confirm beam over. |
| OU12 | Confirm joist span under. |
| OU13 | Confirm structure of flat roof over. |

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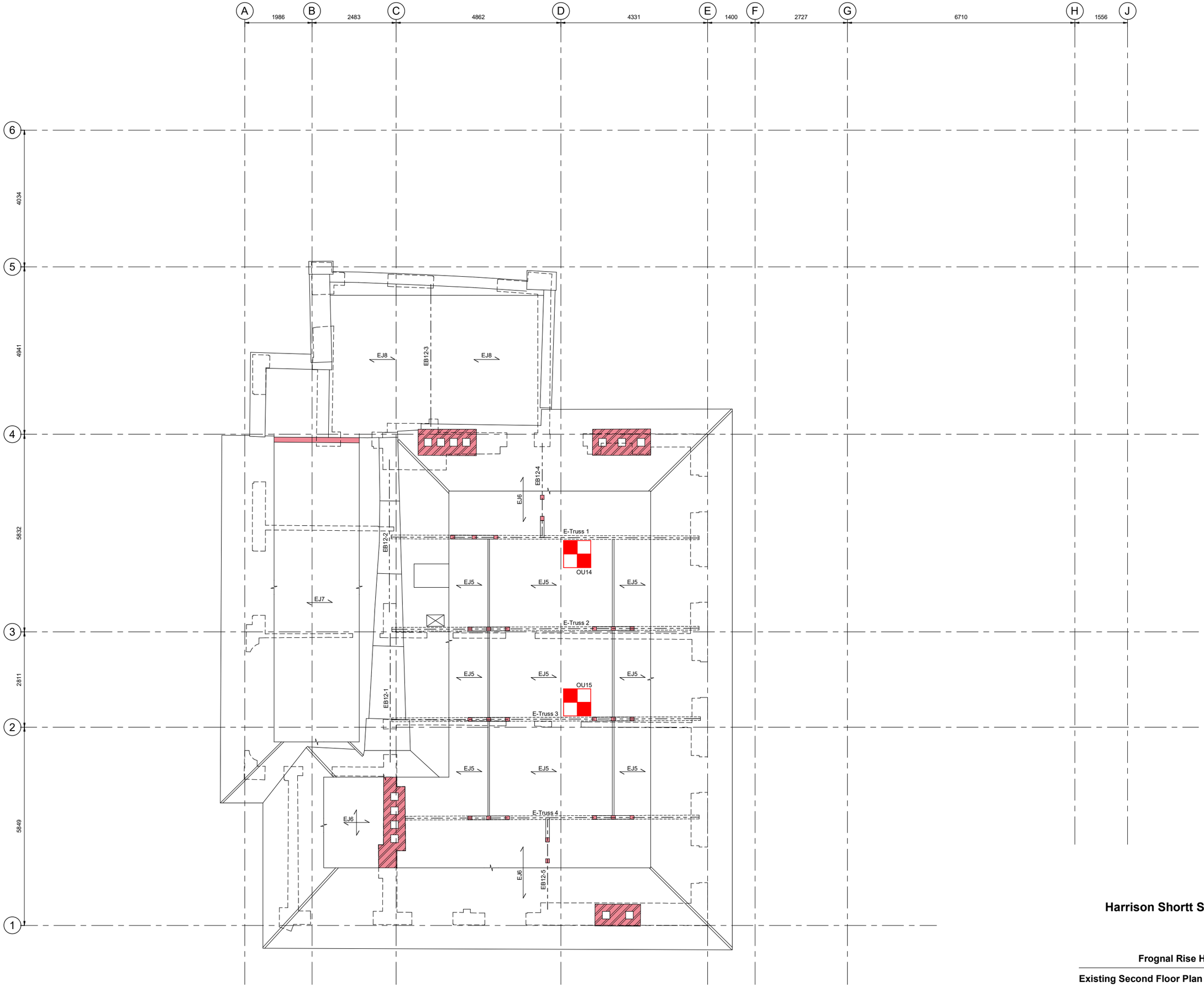
**Existing First Floor Plan 2024_06_10 1:100 (A3) 3096_E11_F**




## Notes

- Existing brickwork wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed.
- EJ5 — Existing joists - 100mm.
- EJ6 — Existing joists - depth and span direction TBC.
- EJ7 — Existing 100x50mm flat roof joists.
- EJ8 — Existing flat roof joist - open ceiling below to confirm.
- E-Truss 1 — Existing timber truss - see section for details.
- E-Truss 2 — Existing timber truss - see section for details.
- E-Truss 3 — Existing timber truss - see section for details.
- E-Truss 4 — Existing timber truss - see section for details.
- EB12-1 — 250x12mm flitch beam.
- EB12-2 — Existing beam. Secton size TBC.
- EB12-3 — Existing beam. Secton size TBC.
- EB12-4 — Existing timber beam to prop purlin over.
- EB12-5 — Existing timber beam to prop purlin over.

## Schedule of opening up

| | |
|---|---|
| OU14 | Remove insulation to expose ceiling joist interface with truss. |
| OU15 | Remove insulation to expose ceiling joist interface with truss. |

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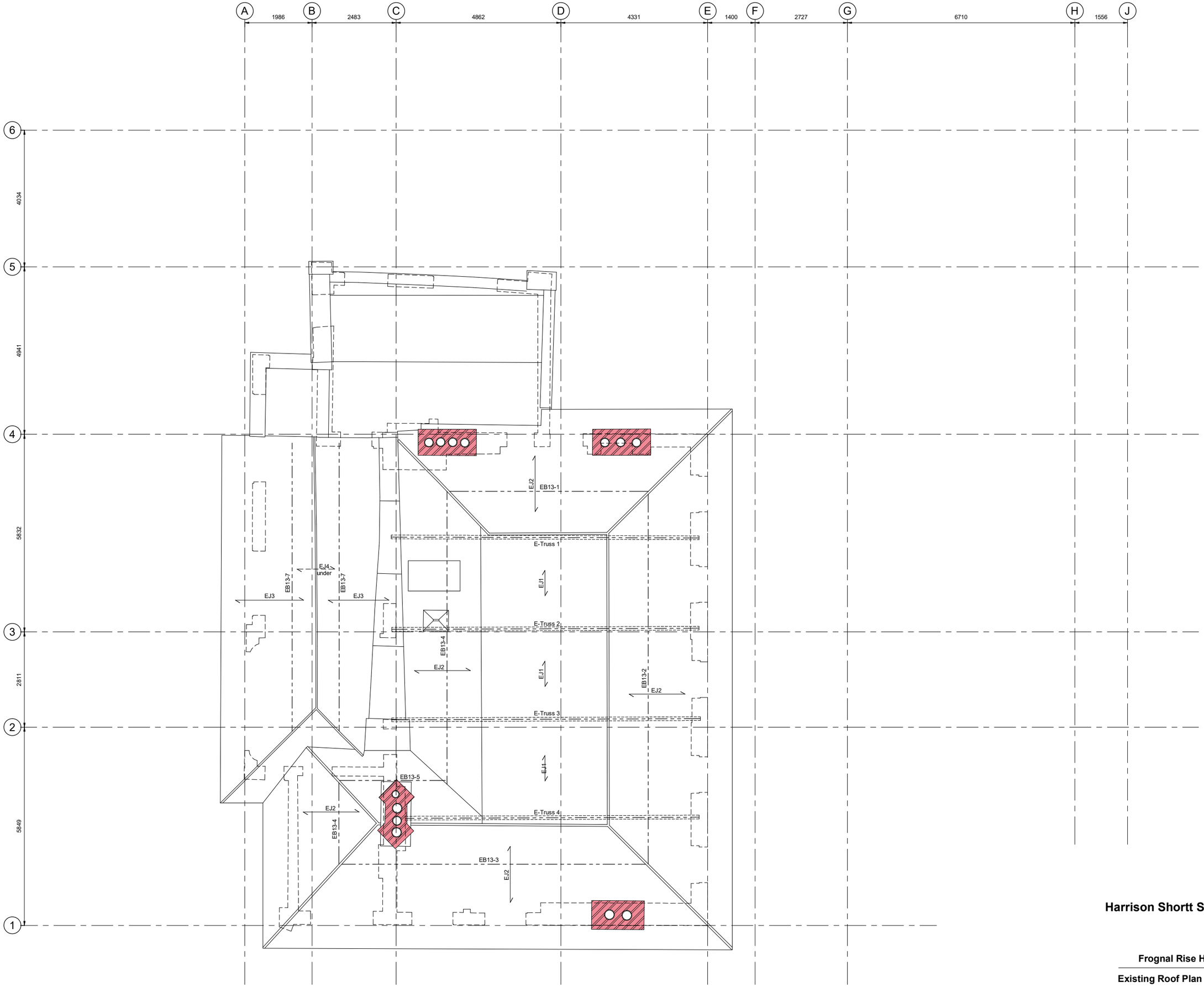
**Existing Second Floor Plan 2024_06_10 1:100 (A3) 3096_E12_E**




## Notes

| | |
|---|---|
| | Existing brickwork wall. |
| | Load bearing walls under shown dashed. |
| EJ1 | Existing 125x50mm flat roof joists. |
| EJ2 | Existing 100x50mm rafters with sarking boards. |
| EJ3 | Existing 100x50mm rafters with sarking boards. |
| EJ4 | Existing collar ties at 1200mm centres. |
| E-Truss 1 | Existing timber truss - see section for details. |
| E-Truss 2 | Existing timber truss - see section for details. |
| E-Truss 3 | Existing timber truss - see section for details. |
| E-Truss 4 | Existing timber truss - see section for details. |
| EB13-1 | Existing timber purlin approx. 150x100mm. |
| EB13-2 | Existing timber purlin approx. 150x100mm. |
| EB13-3 | Existing timber purlin approx. 150x100mm. |
| EB13-4 | Existing timber purlin approx. 150x100mm. |
| EB13-5 | Existing timber purlin approx. 150x100mm. |
| EB13-6 | Existing timber purlin approx. 150x100mm. |
| EB13-7 | Existing timber purlin approx. 150x100mm. |

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**Existing Roof Plan 2024_06_10 1:100 (A3) 3096_E13_D**

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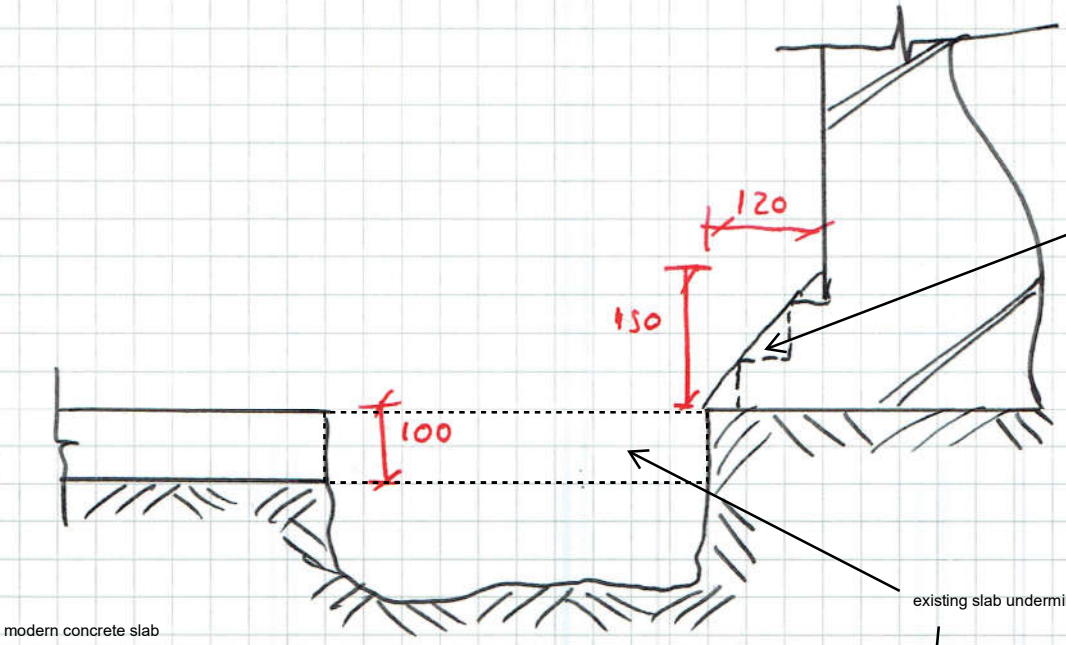
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Trailpit 01** **2025_03_21** **1:10 (A4)** **3096_E31_B**

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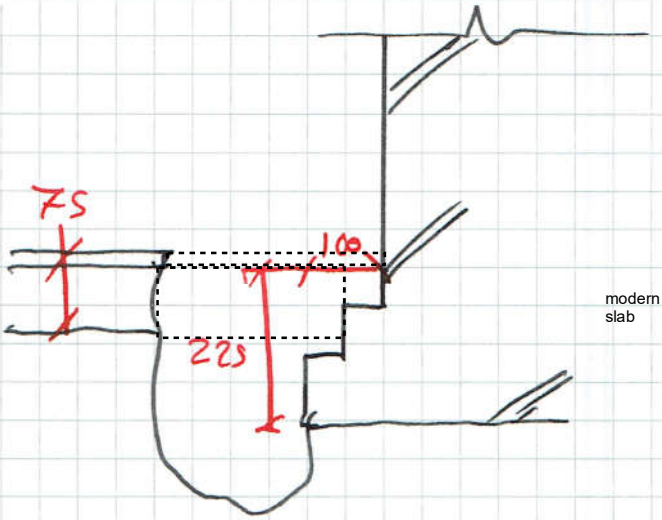
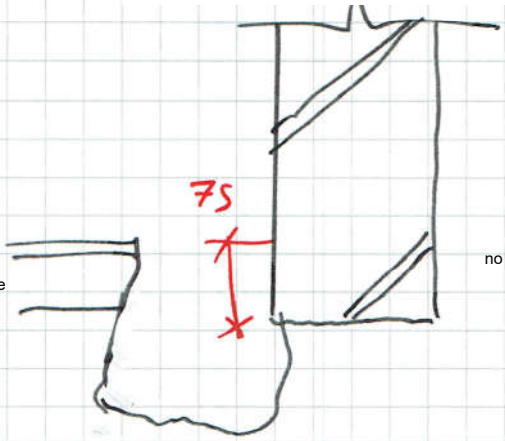
**Trailpit 2** **2025_03_21** **1:10 (A4)** **3096_E32_B**




modern concrete slab




no corbles or concrete foundation

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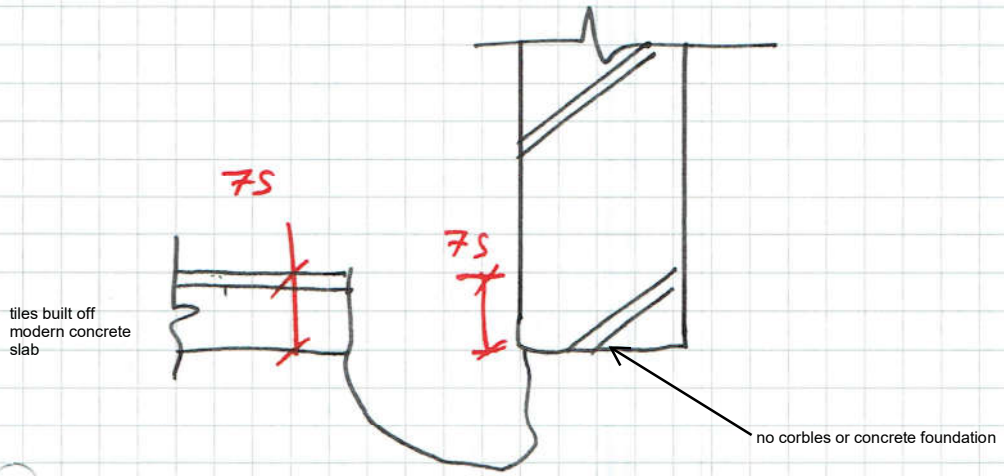
**Trailpit 3** **2025_03_21** **1:10 (A4)** **3096_E33_B**

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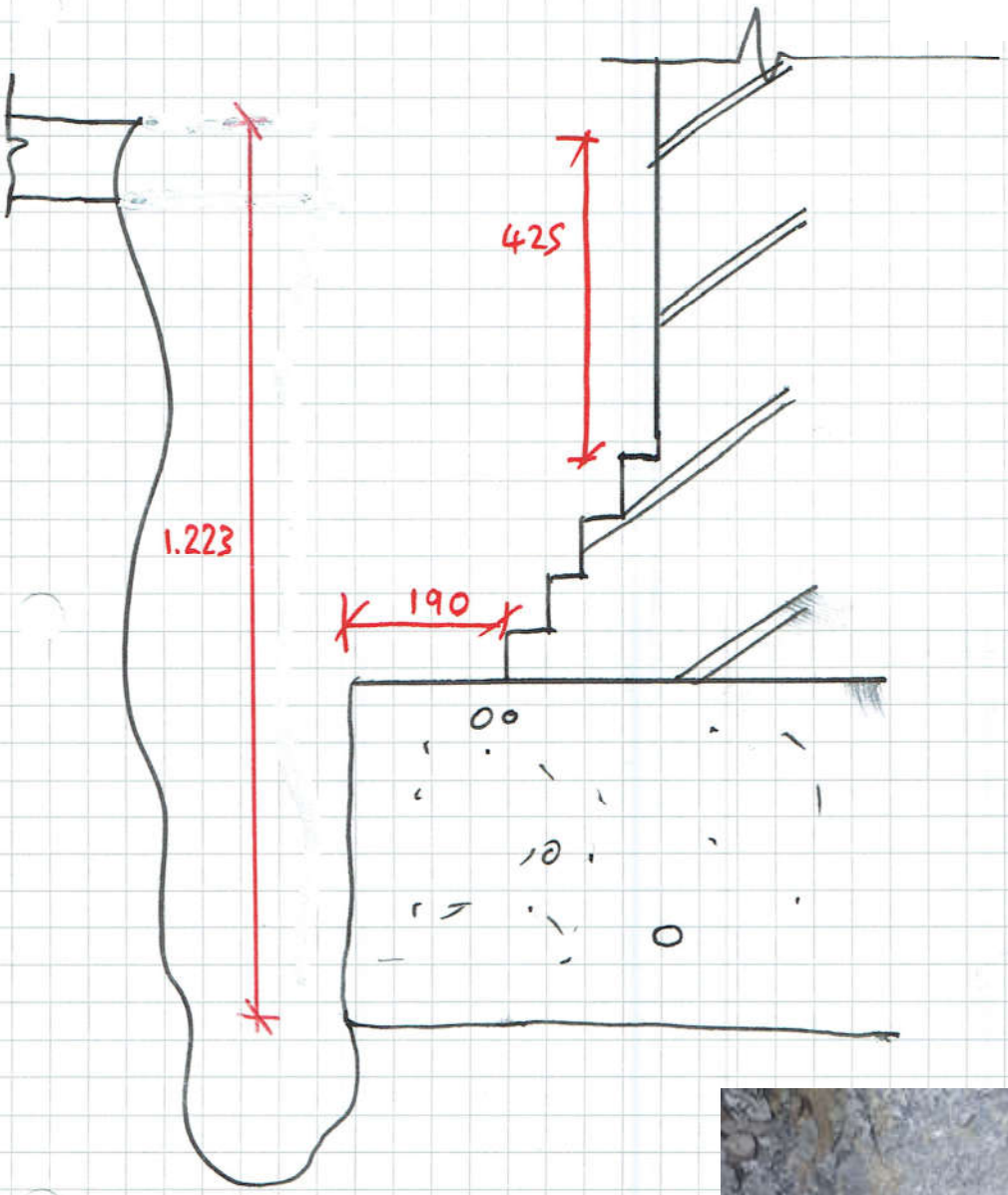
**Trailpit 4  2025_03_21  1:10 (A4)  3096_E34_A**

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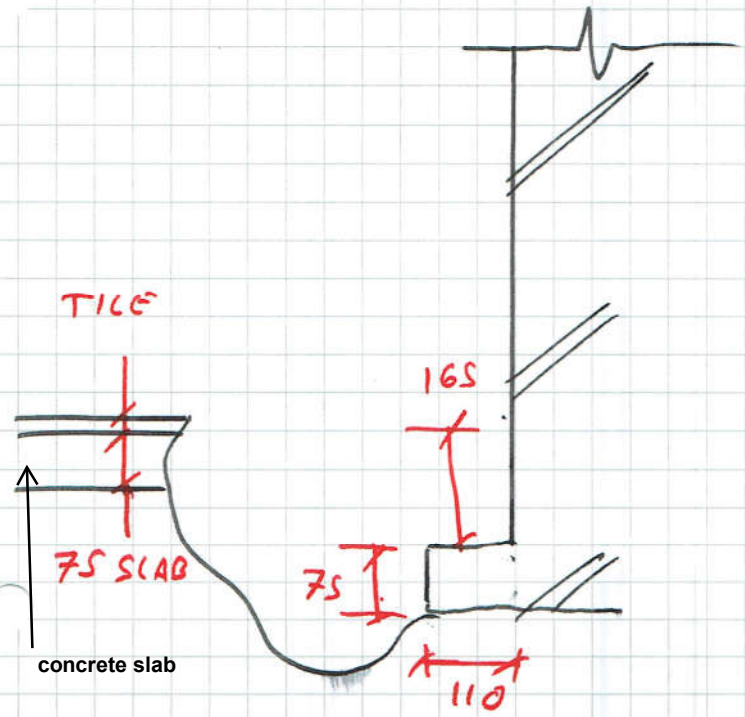
**Trailpit 5  2025_03_21  1:10 (A4)  3096_E35_B**



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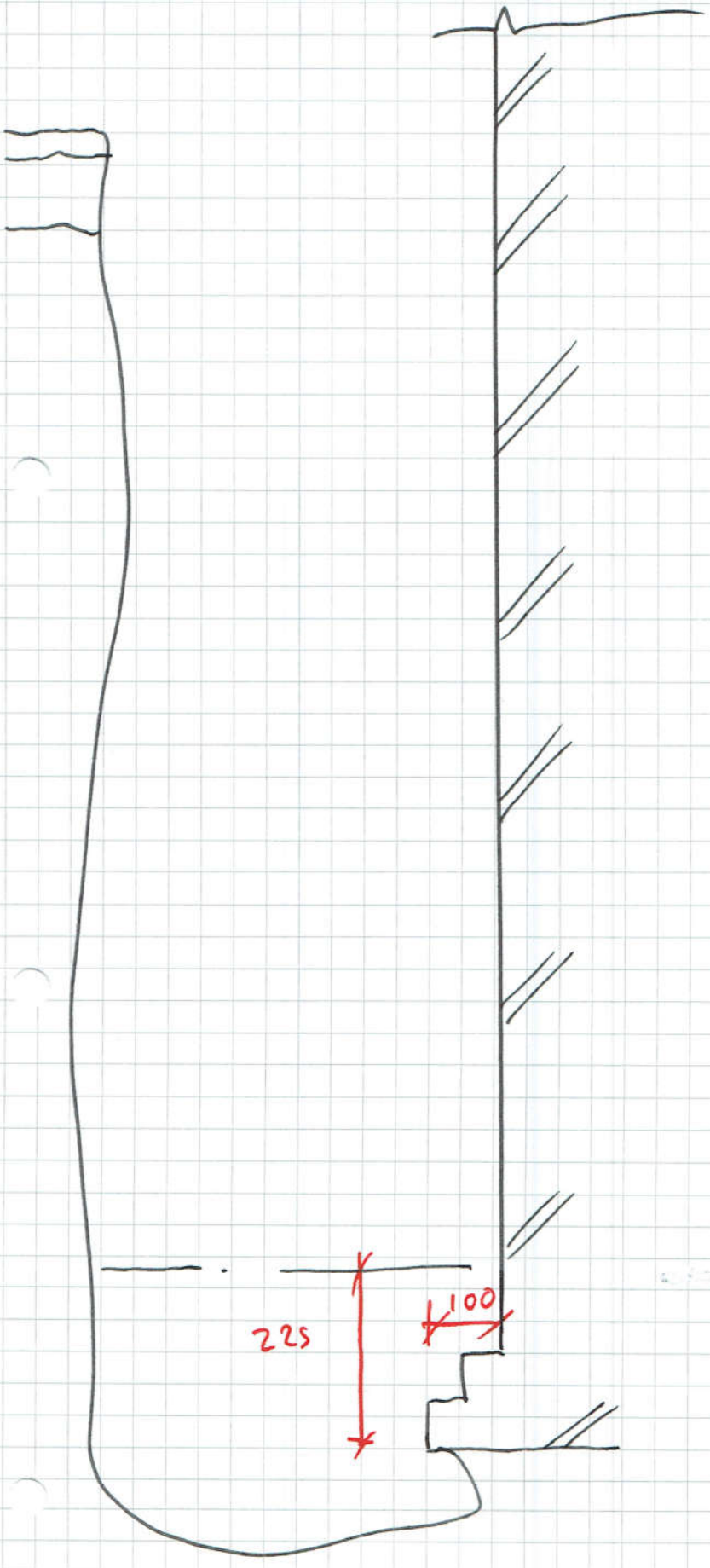
**Trailpit 6  2025_03_21  1:10 (A4)  3096_E36_A**



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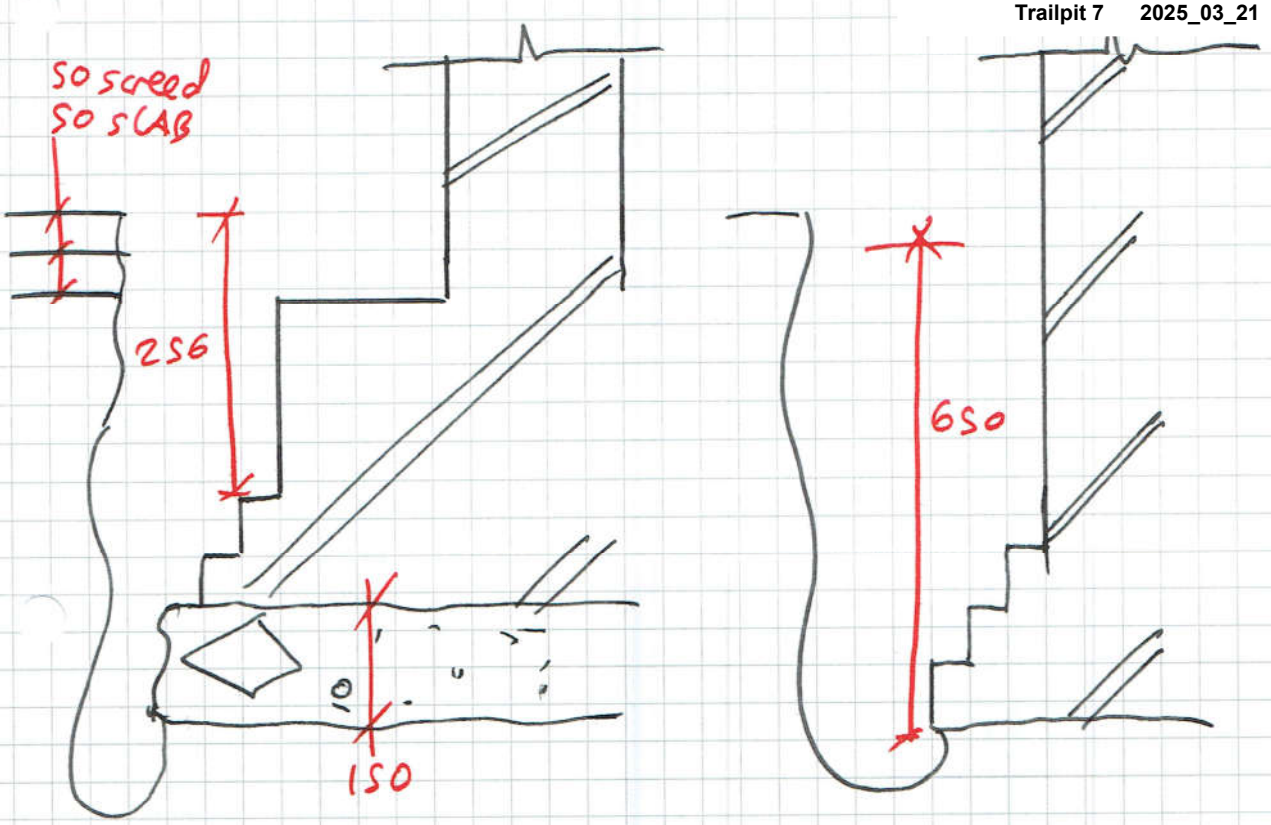
**Trailpit 7  2025_03_21  1:10 (A4)  3096_E37_B**




**rubble bound in cement "roman concrete "**

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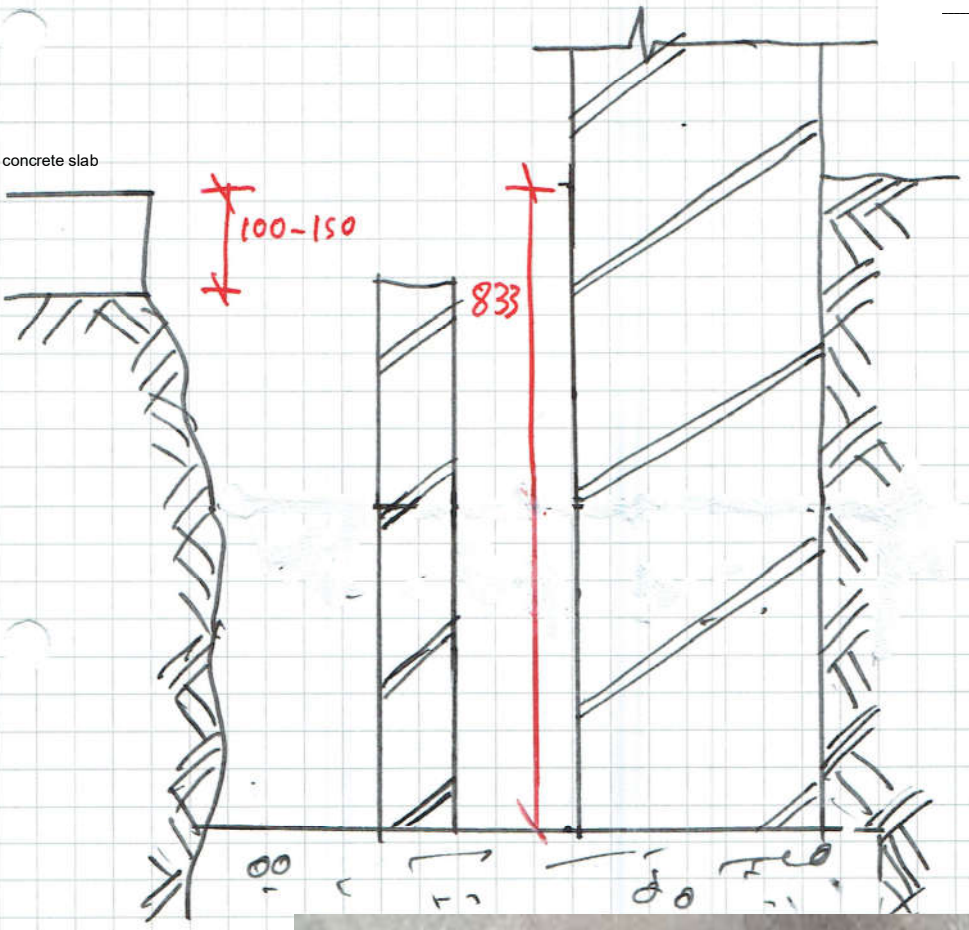
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Trailpit 08** **2025_03_21** **1:10 (A4)** **3096_E38_B**

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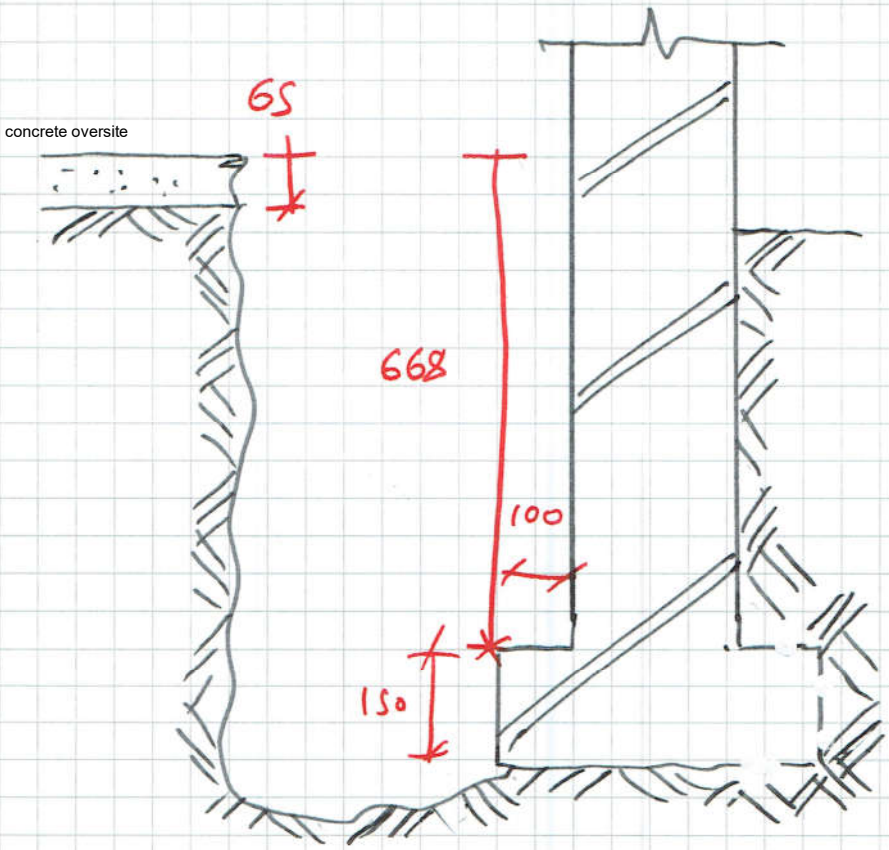
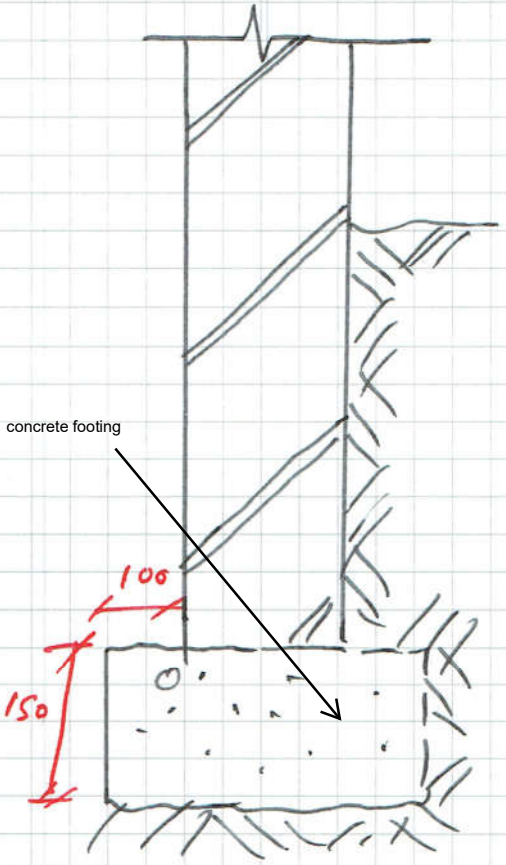
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Trailpit 09** **2025_03_21** **1:10 (A4)** **3096_E39_B**

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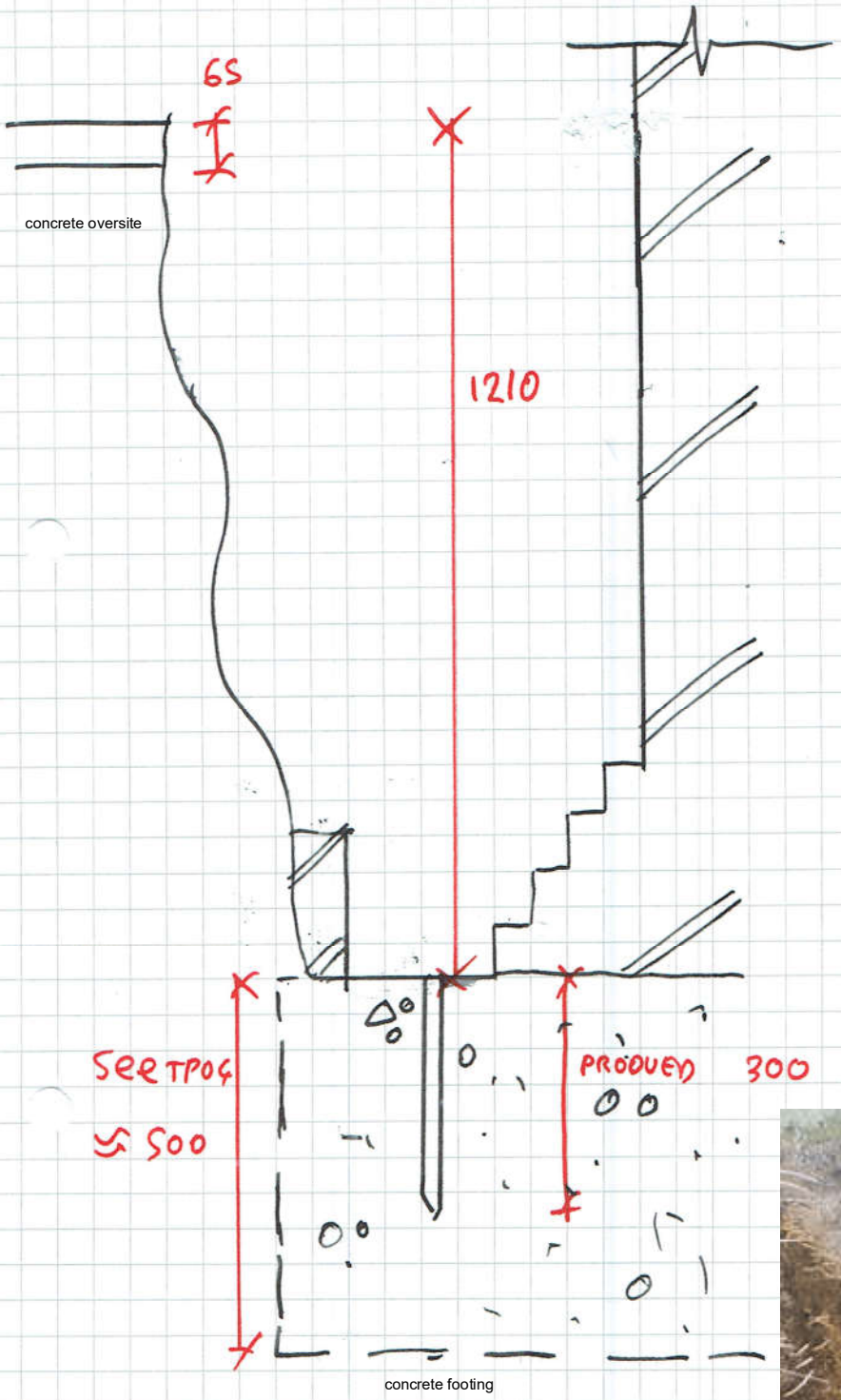
**Trailpit 10** **2025_03_21** **1:10 (A4)** **3096_E40_B**




A 1986 B 2483 C 4862 D 4331 E 1400 F 2727 G 6710 H 1556 J

6 4034 5 4941 4 5832 3 2811 2 5849 1

**NOTES**

New Reinforced Concrete

| | |
|---|---|
| C08-1 | 152 UC 37 |
| C08-2 | 152 UC 37 |
| C08-3 | 152 UC 37 |
| C08-4 | 152 UC 37 |
| C08-5 | 152 UC 37 |

Line load 4
DL 64.7
IL 7.5

Line load 3
DL 157.1
IL 8.0

C08-1
DL 315
IL 26.2

C08-2
DL 419.3
IL 15.7

C08-4
DL 271.9
IL 64.4

275 thick RC slab
Loading
DL: 8.25
Il: 3.0 + 1.5

C08-5
DL 362.5
IL 13.5

C08-3
DL 419.3
IL 15.7

Line load 1
DL 81.5
IL 16.4

Line load 2
DL 110
IL 3.0

[P20] A

[P20] A

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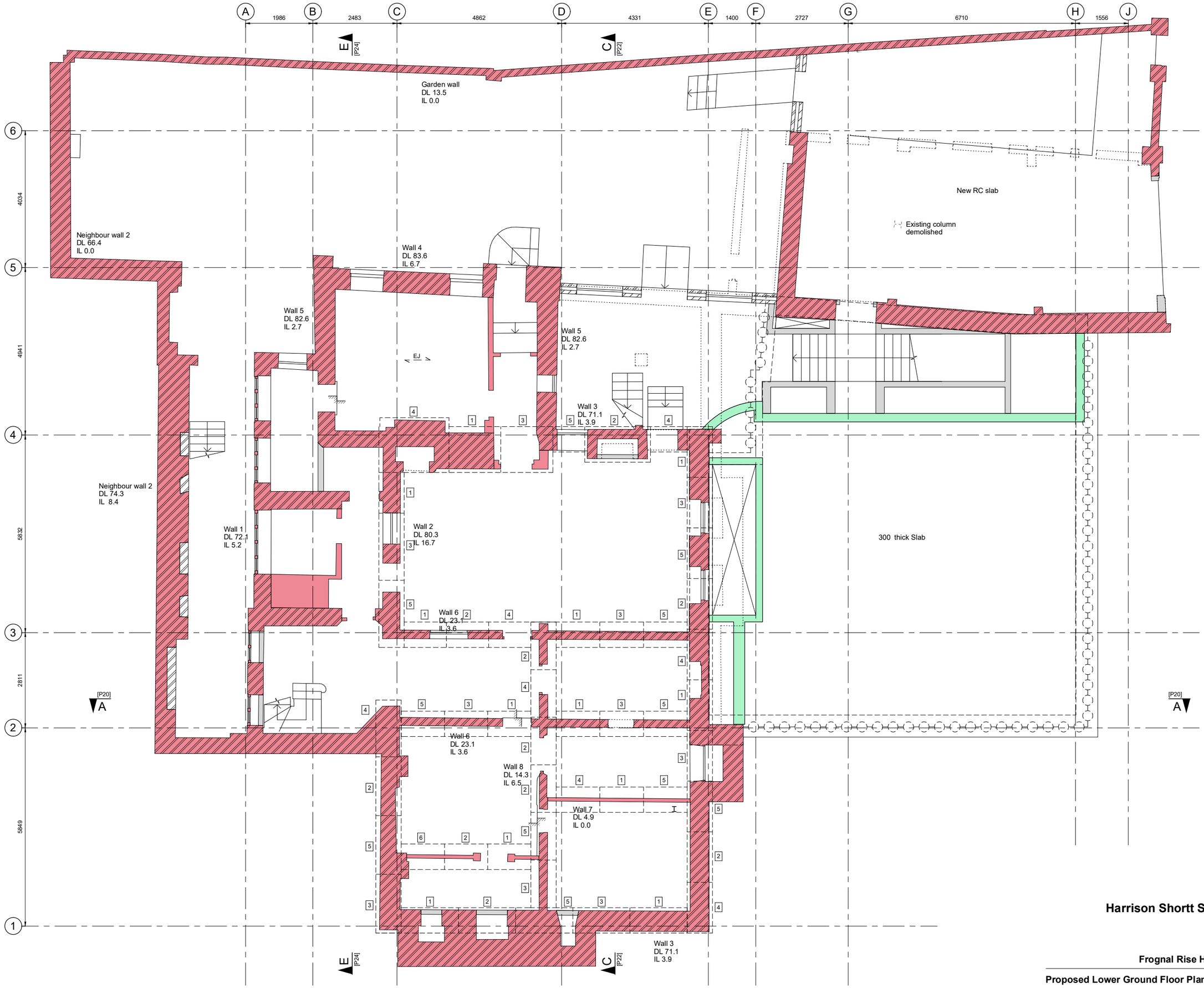
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Basement Plan 2025_03_19 1:100 (A3) 3096_P08_C**




**Notes**

- Existing brickwork wall.
- Existing wall. Construction to be confirmed.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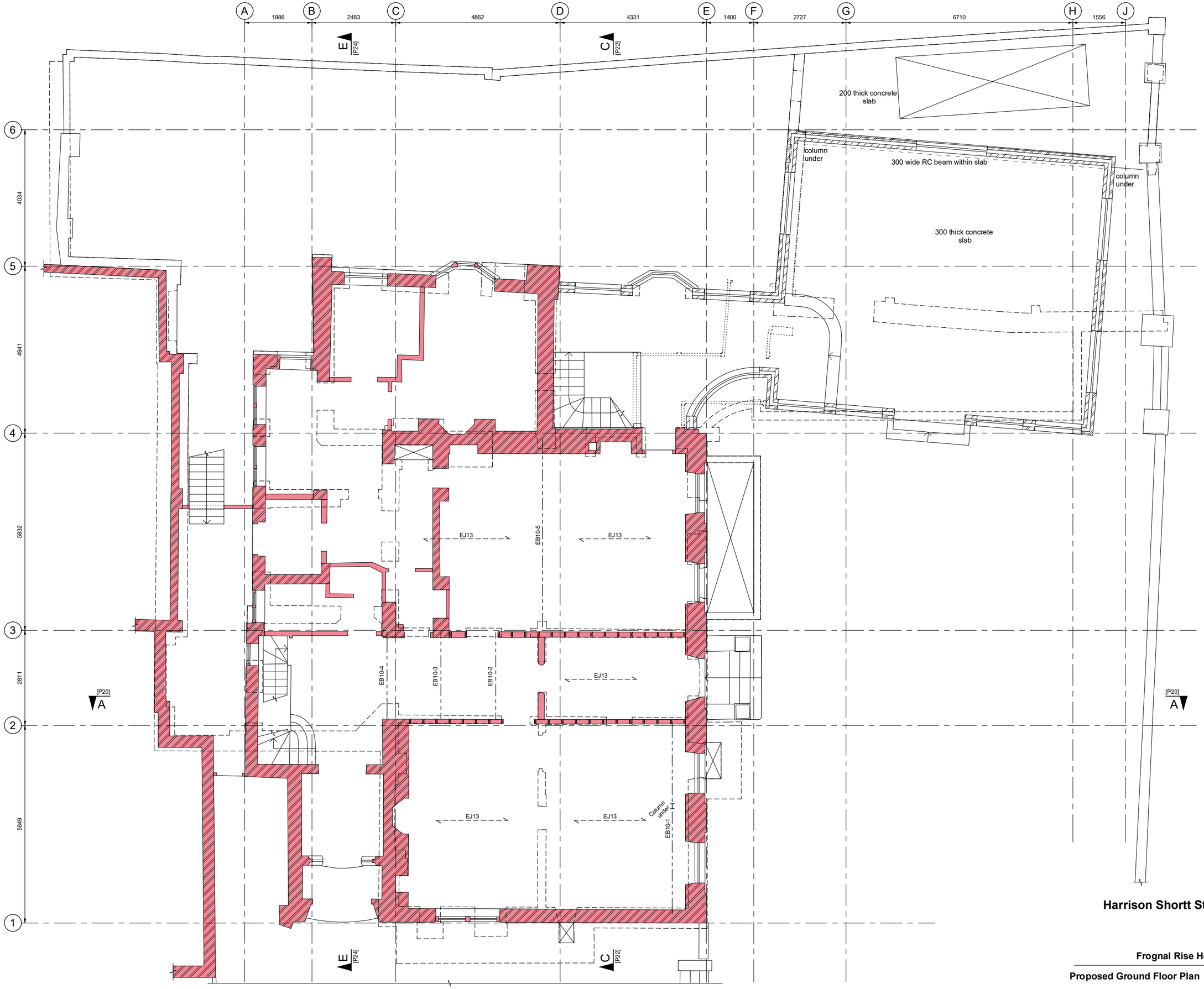
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Lower Ground Floor Plan 2024_06_10 1:100 (A3) 3096_P09_I**




**Notes**

- Existing brickwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed.
- EJ13 — Existing joists - depth and span direction TBC.
- EB10-1 Existing beam. Secton size TBC.
- EB10-2 Existing beam. Secton size TBC.
- EB10-3 Existing beam. Secton size TBC.
- EB10-4 Existing beam. Secton size TBC.
- EB10-5 Existing beam. Secton size TBC.
- EB10-6 Existing beam. Secton size TBC.

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**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Ground Floor Plan 2024_06_10 1:100 (A3) 3096_P10_K**


## Notes

- Existing brickwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed.
- EJ9 Existing joists - depth and span direction TBC.
- EJ10 Existing joists - depth and span direction TBC.
- EJ11 Existing joists - depth and span direction TBC.
- EJ12 Existing joists - depth and span direction TBC.
- EB11-1 Existing beam. Secton size TBC.
- EB11-2 Existing beam. Secton size TBC.
- EB11-3 Existing beam. Secton size TBC.
- EB11-4 Existing UB254x100.
- EB11-5 Existing UB254x100.
- EB11-6 Existing 200mm flitch beam.
- EB11-7 Existing beam. Secton size TBC.

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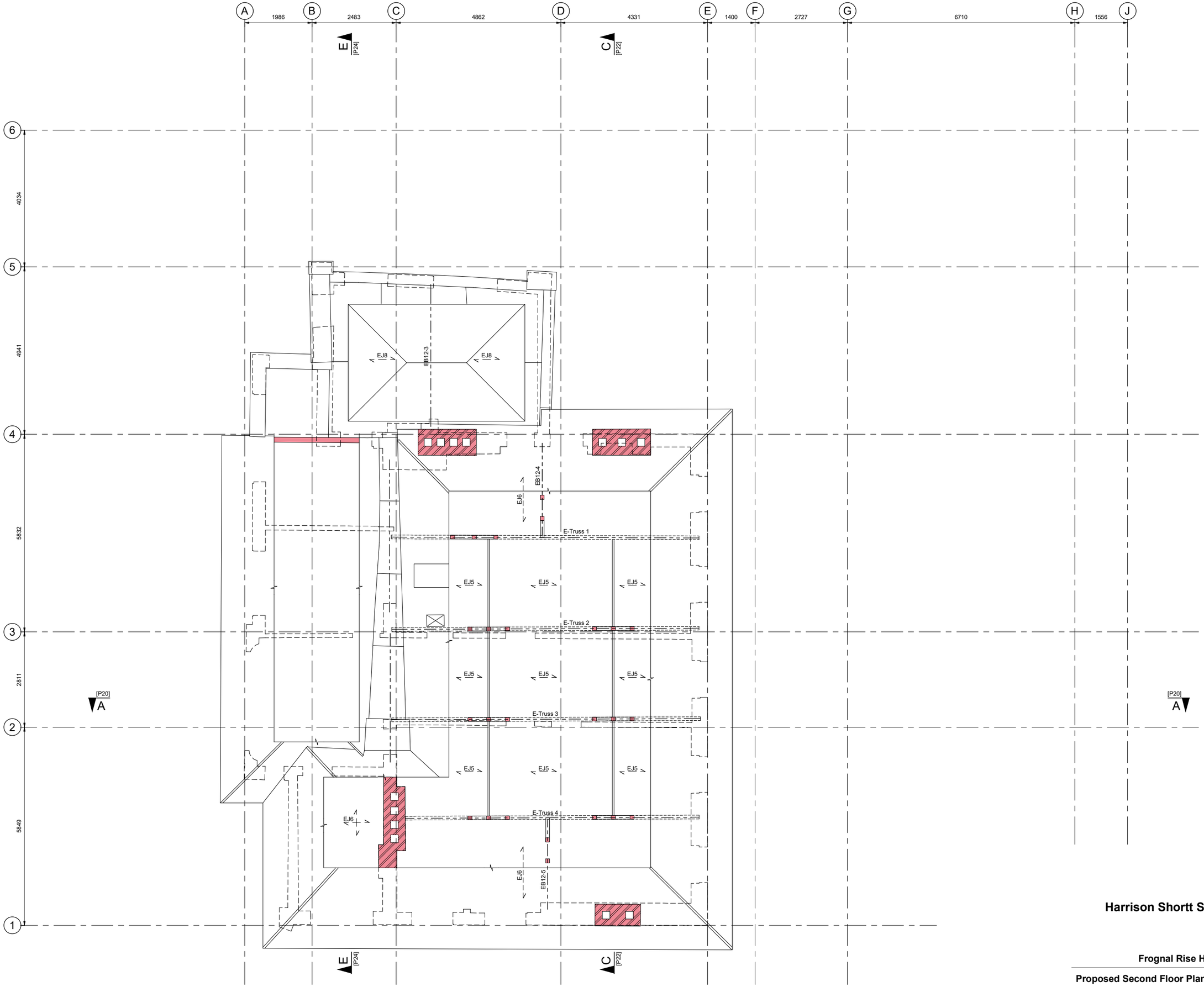
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed First Floor Plan 2024_06_10 1:100 (A3) 3096_P11_F**




**Notes**

| | |
|---|---|
| | Existing brickwork wall. |
| | Existing wall. Construction to be confirmed. |
| | Load bearing walls under shown dashed. |
| EJ5 | Existing joists - 100mm. |
| EJ6 | Existing joists - depth and span direction TBC. |
| EJ7 | Existing 100x50mm flat roof joists. |
| EJ8 | Existing flat roof joist - open ceiling below to confirm. |
| E-Truss 1 | Existing timber truss - see section for details. |
| E-Truss 2 | Existing timber truss - see section for details. |
| E-Truss 3 | Existing timber truss - see section for details. |
| E-Truss 4 | Existing timber truss - see section for details. |
| EB12-1 | 250x12mm flitch beam. |
| EB12-2 | Existing beam. Secton size TBC. |
| EB12-3 | Existing beam. Secton size TBC. |
| EB12-4 | Existing timber beam to prop purlin over. |
| EB12-5 | Existing timber beam to prop purlin over. |

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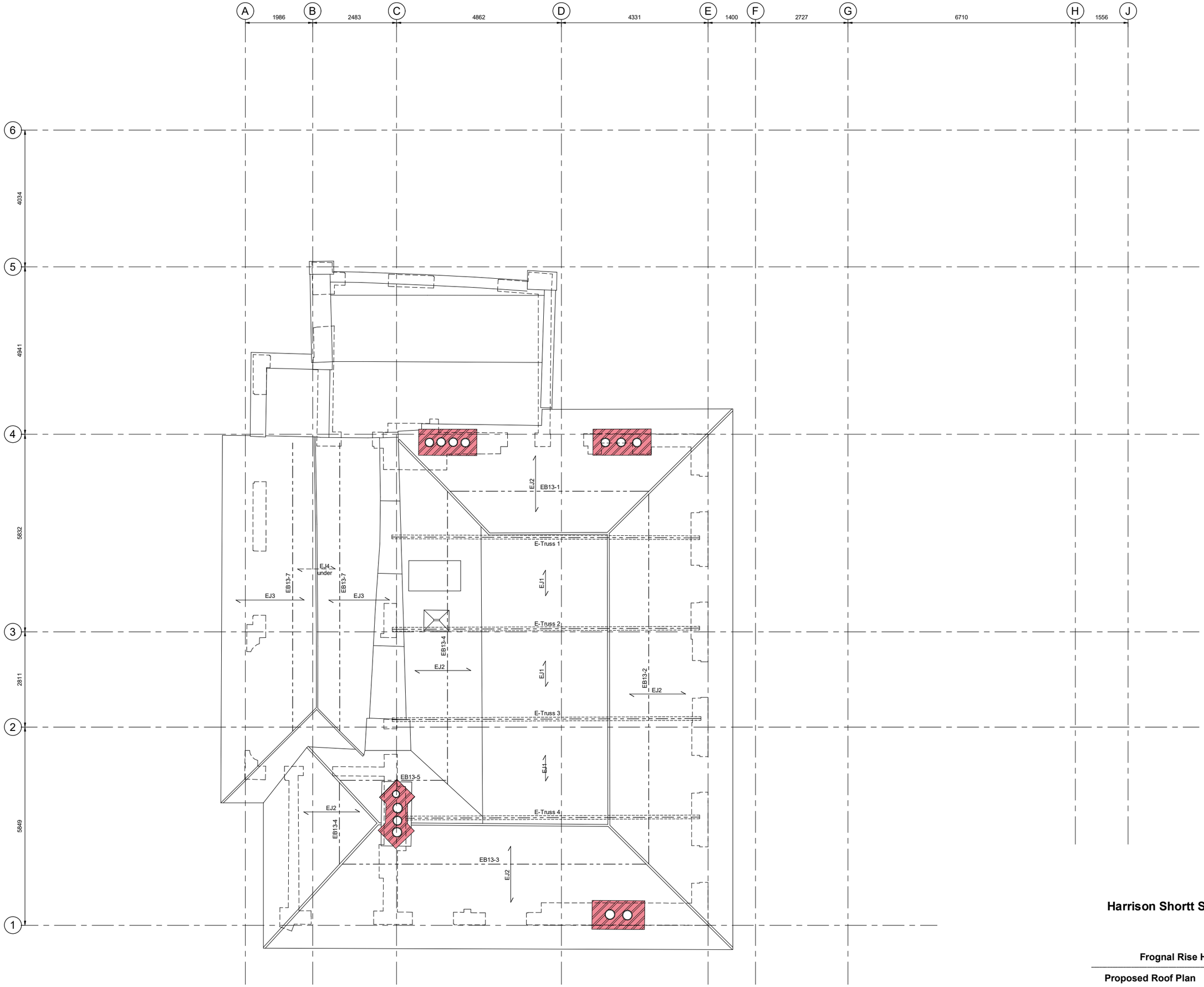
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Second Floor Plan 2024_06_10 1:100 (A3) 3096_P12_I**




## Notes

| | |
|---|---|
| | Existing brickwork wall. |
| | Load bearing walls under shown dashed. |
| EJ1 | Existing 125x50mm flat roof joists. |
| EJ2 | Existing 100x50mm rafters with sarking boards. |
| EJ3 | Existing 100x50mm rafters with sarking boards. |
| EJ4 | Existing collar ties at 1200mm centres. |
| E-Truss 1 | Existing timber truss - see section for details. |
| E-Truss 2 | Existing timber truss - see section for details. |
| E-Truss 3 | Existing timber truss - see section for details. |
| E-Truss 4 | Existing timber truss - see section for details. |
| EB13-1 | Existing timber purlin approx. 150x100mm. |
| EB13-2 | Existing timber purlin approx. 150x100mm. |
| EB13-3 | Existing timber purlin approx. 150x100mm. |
| EB13-4 | Existing timber purlin approx. 150x100mm. |
| EB13-5 | Existing timber purlin approx. 150x100mm. |
| EB13-6 | Existing timber purlin approx. 150x100mm. |
| EB13-7 | Existing timber purlin approx. 150x100mm. |

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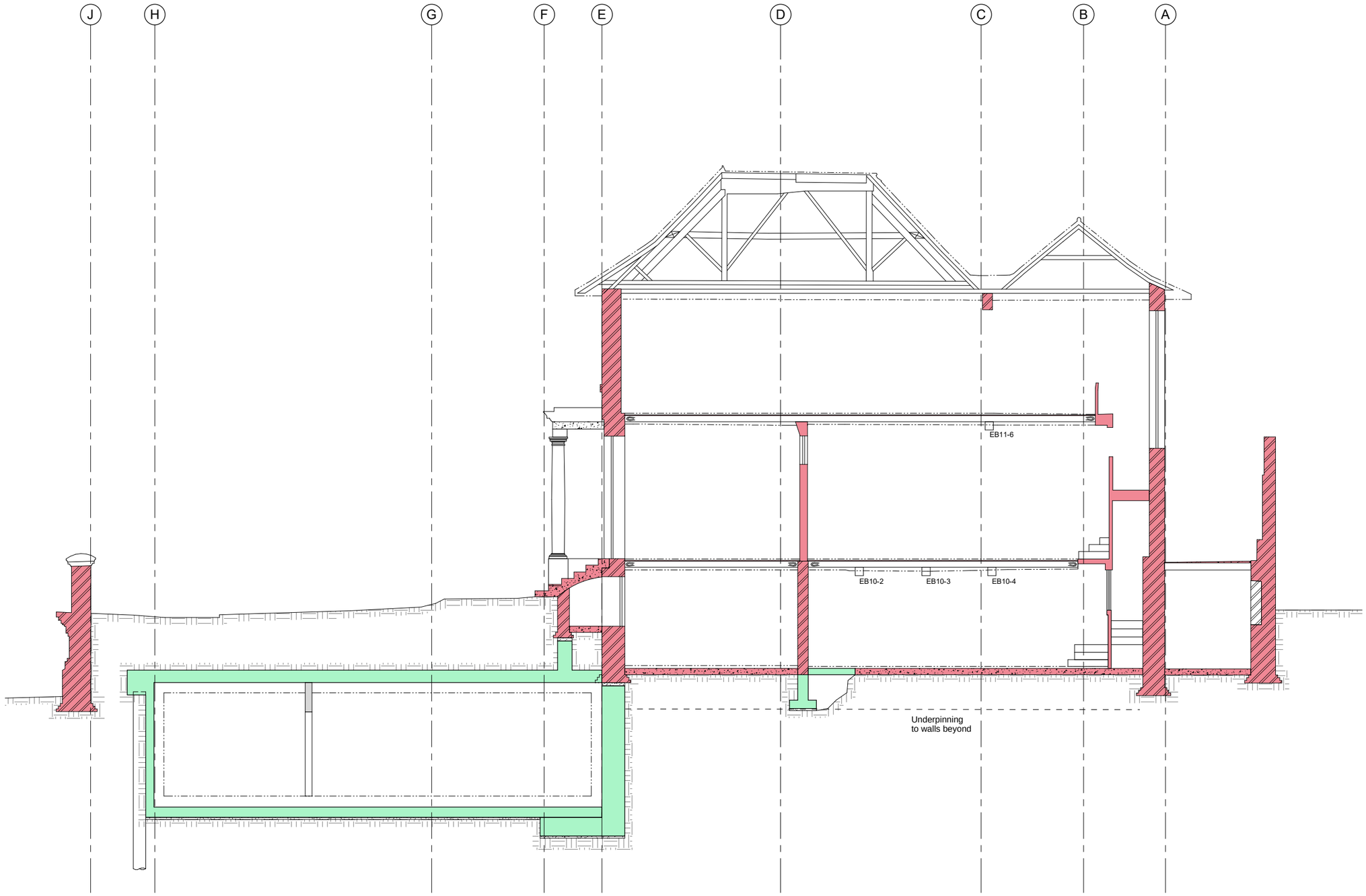
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Roof Plan 2024_06_10 1:100 (A3) 3096_P13_F**




## Notes

- Existing brickwork wall.
- Existing blockwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed
- Existing walls demolished
- New non-load bearing partition constructed with 95x47mm C24 timber studs at 400mm centres blocking at 1200mm centres.
- New brickwork wall
- New medium dense (min 14kN/m^3) blockwork wall and M12 mortar UNO.
- New 100 x 50 Loadbearing timber stud wall with 1 face clad in 12mm plywood
- New Reinforced Concrete

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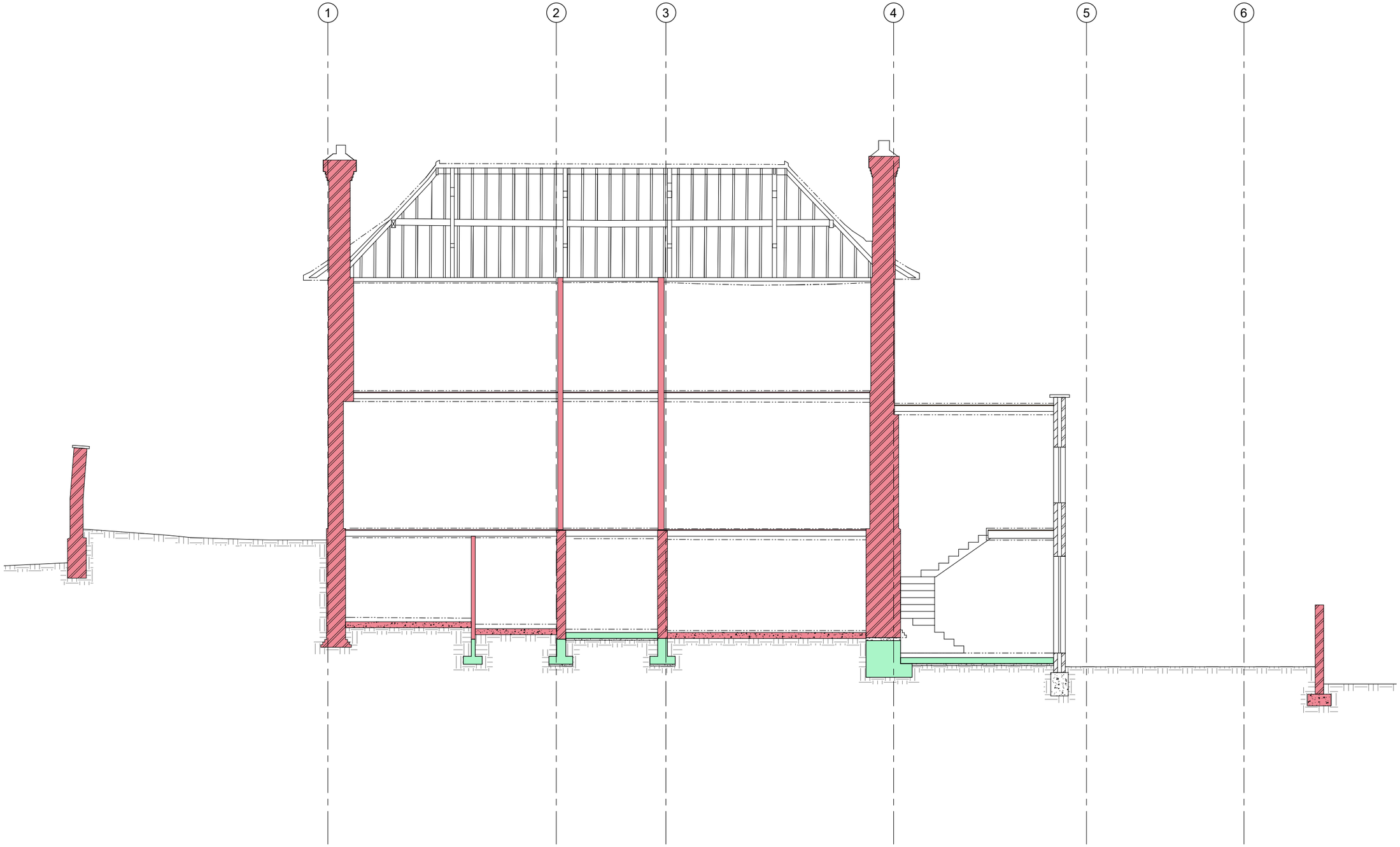
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Section A-A 2024_07_26 1:100 (A3) 3096_P20_K**




## Notes

- Existing brickwork wall.
- Existing blockwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed
- Existing walls demolished
- New non-load bearing partition constructed with 95x47mm C24 timber studs at 400mm centres blocking at 1200mm centres.
- New brickwork wall
- New medium dense (min 14kN/m^3) blockwork wall and M12 mortar UNO.
- New 100 x 50 Loadbearing timber stud wall with 1 face clad in 12mm plywood
- New Reinforced Concrete

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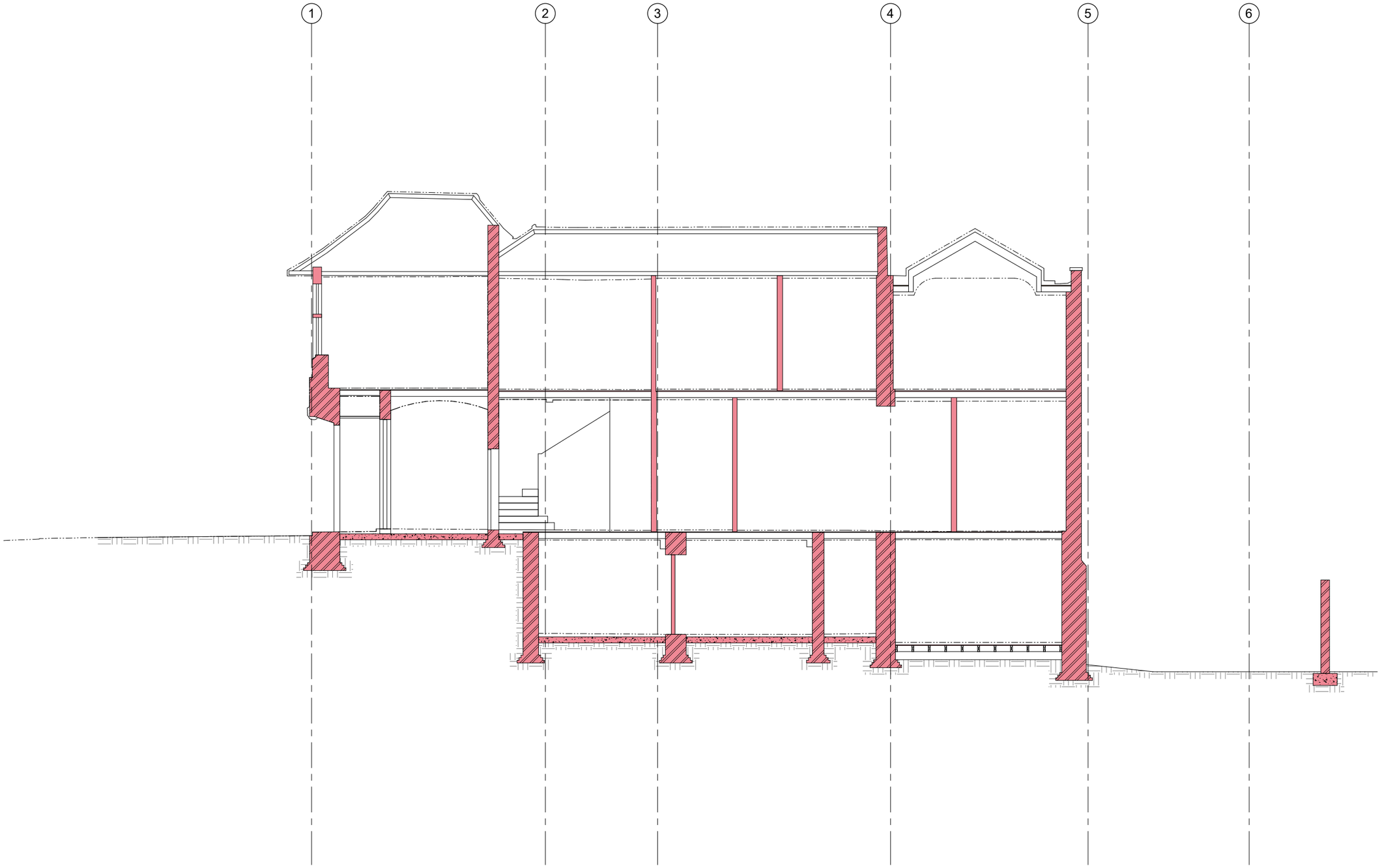
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Section C-C 2025_04_09 1:100 (A3) 3096_P22_A**




## Notes

- Existing brickwork wall.
- Existing blockwork wall.
- Existing timber stud wall.
- Existing wall. Construction to be confirmed.
- Load bearing walls under shown dashed
- Existing walls demolished
- New non-load bearing partition constructed with 95x47mm C24 timber studs at 400mm centres blocking at 1200mm centres.
- New brickwork wall
- New medium dense (min 14kN/m^3) blockwork wall and M12 mortar UNO.
- New 100 x 50 Loadbearing timber stud wall with 1 face clad in 12mm plywood
- New Reinforced Concrete

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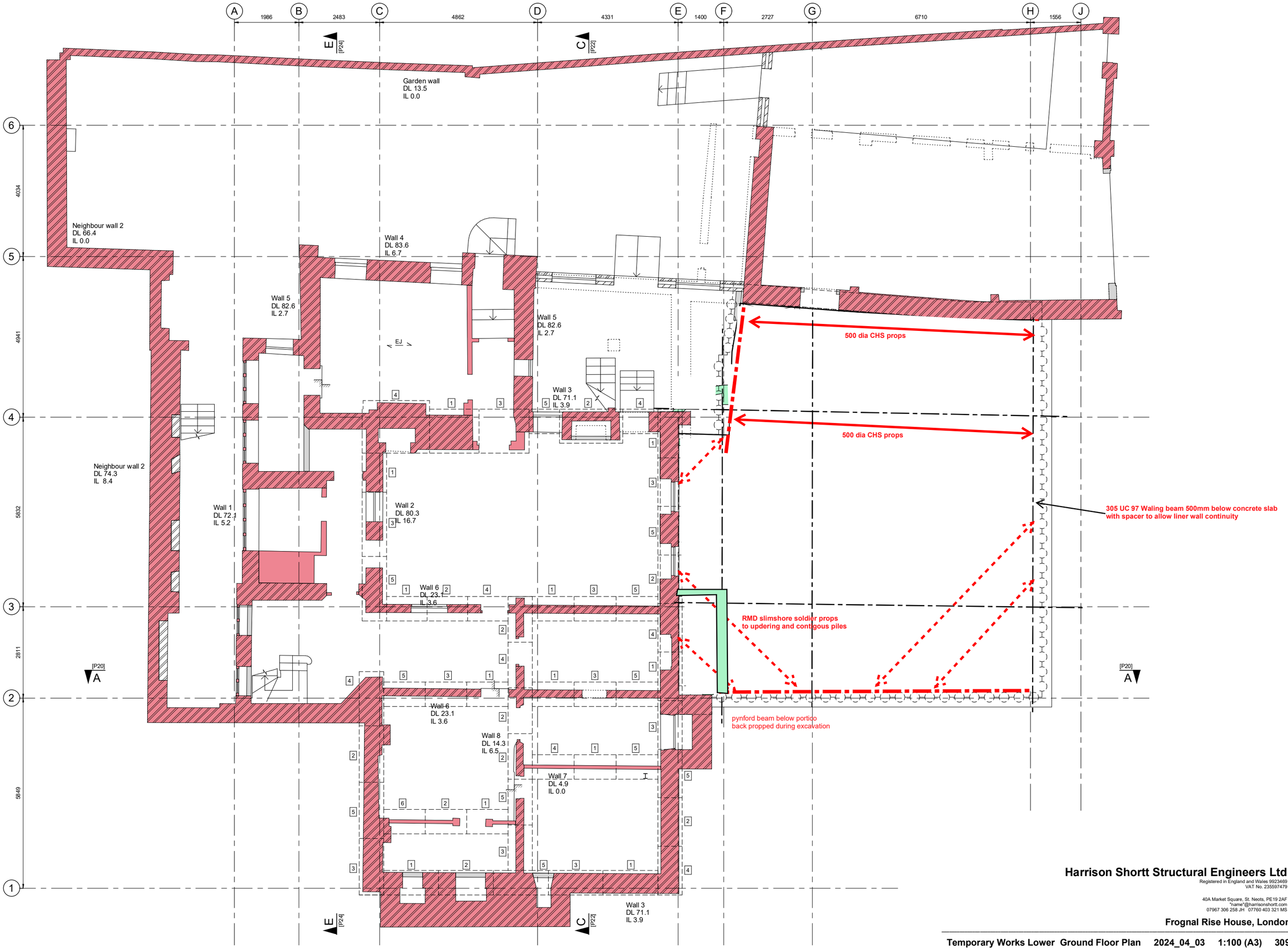
**Frognal Rise House, Lower Terrrace, London NW3 6RE**

**Proposed Section E-E 2025_04_09 1:100 (A3) 3096_P24_A**

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**Frognal Rise House, London, NW3 6RE**

**Temporary Works Lower Ground Floor Plan 2024_04_03 1:100 (A3) 3096_TW09_B**

# 10.0 Calculations

## Calculations Contents



## 1.0 Existing Building and Site

1.1 The existing building is a four storey detached house (including the loft and the basement) that appears to have been constructed in the early 1800s. The building has a single storey garage to the south.

1.2 The building is located on the corner of Lower Terrace and Frognal Rise.

1.3 The building shares boundaries with 14 Lower Terrace to the left and 22 Windmill Hill to the right when viewed from the front.

1.4 The building is constructed with solid brickwork external walls. The internal load bearing walls are brickwork at lower ground floor and timber stud above.

1.5 The lower ground floor is constructed with a concrete slab. The ground floor and above are constructed with timber floor joists.

1.6 The roof is a slate clad traditionally constructed hipped crown roof. The pitched roof joists are supported at mid span by timber purlins supported on timber trusses spanning between the external walls.

1.7 The building is likely to be founded on corbelled brickwork foundations on Bagshot Formation (sand, sedimentary rock).

1.8 The overall stability of the building is provided by the cellular layout of the masonry walls.

1.9 The results of the desk study can be summarised as follows:

- The site is not in the vicinity of any historic rivers.
- The site has a very low risk of surface water flooding and very low risk of flooding from rivers and the sea.
- The site is not within the vicinity of any London Underground Ltd. infrastructure.
- There was no damage to the building from WWII.

1.10 The building is Grade II listed and is in the Hampstead Conservation Area.

## 2.0 Proposed Works

2.1 Construction of a new basement below the front garden formed in reinforced concrete within a retaining wall

2.2 The construction of single storey garden room above the garage on the site of a early twentieth century
The proposed works will be designed to the following design codes:

**BS 5268 : Part 2 : 2002** - Structural Use of Timber. Part 2 : Code of Practice for Permissible Stress Design, Materials and Workmanship.
**BS 5628: Part 1: 2005** - Code of Practice for the Use of Masonry. Part 1 : Structural Use of Unreinforced Masonry.
**BS 5950: Part 1: 2000** - Structural Use of Steelwork. Part 1 : Code of Practice for Rolled Sections and Welded Sections.
**BS 6399: Part 1: 1996** - Loading for Buildings. Part 1 : Code of Practice for Dead and Imposed Loads.
**BS 8110: Part 1: 1997** - Structural Use of Concrete. Part 1 : Code of Practice for Design and Construction.
**Steel Construction Institute - Blue Book** - Steelwork Design Guide to BS 5950-1 : 2001, Volume 1 Section Properties Member Capacities 7th Edition.

## 3.0 Loadings

| | | Dead Load | Imposed Load | SLS | (ULS) |
|---|---|---|---|---|---|
| **A** | Rafters | 0.2 | | | |
| **Pitched Roof** | Battens | 0.1 | | | |
| **(boarded and clay** | Boards | 0.2 | | | |
| **tiles)** | Tiles | 0.32 | | | |
| **(slate roof lighter)** | At 30 degrees | (load/cos30) | | | |
| | Imposed Load | | 0.60 | | |
| | | **0.95** | **0.60** | **1.6 kN/m$^2$** | **(2.3) kN/m$^2$** |
| **B** | Waterproofing membrane | 0.10 | | | |
| **Flat Roof** | Insulation | 0.02 | | | |
| **(general)** | 18mm plywood sheeting | 0.11 | | | |
| | 225x50mm timber floor joists at 400mm c/c | 0.17 | | | |
| | 12.5mm plasterboard ceiling | 0.11 | | | |
| | Finish (decking or similar) | 0.30 | | | |
| | Imposed Load | | 0.75 | | |
| | | **0.81** | **0.75** | **1.6kN/m$^2$** | **(2.3) kN/m$^2$** |
| **C** | 20mm timber floor finishes | 0.11 | | | |
| **Internal Floor** | 225x50mm timber floor joists at 360mm c/c | 0.19 | | | |
| **(typical)** | 19mm lath and plaster ceiling | 0.38 | | | |
| | Insulation | 0.02 | | | |
| | Imposed Load | | 1.5 | | |
| | | **0.7** | **1.5** | **2.2 kN/m$^2$** | **(3.4) kN/m$^2$** |
| **D** | 19mm chip board | 0.1 | | | |
| **Loft Floor** | 100x50mm timber floor joists at #360mm | 0.1 | | | |
| **Storage** | c/c | 0.38 | | | |
| | Lathe and plaster ceiling | | 0.6 | | |
| | Imposed Load | | | | |
| | | **0.58** | **0.6** | **1.2 kN/m$^2$** | **(1.8) kN/m$^2$** |
| **E** | 19mm plaster | 0.38 | | | |
| **9" Brick Wall** | 9" (228.6mm) brickwork | 4.11 | | | |
| | | **4.5** | | **4.5 kN/m$^2$** | **(6.3) kN/m$^2$** |
| **F** | 19mm plaster | 0.38 | | | |
| **13 1/2" Brick Wall** | 9" (342.9mm) brickwork | 6.20 | | | |
| | | **6.6** | | **6.6 kN/m** | **(9.2) kN/m** |
| **G** | 19mm lath and plaster | 0.38 | | | |
| **4" Timber Stud Wall** | 100x50mm timber studs at 360mm c/c | 0.08 | | | |
| | 100x50mm timber blocking at 1200mm c/c | 0.03 | | | |
| | 19mm lath and plaster | 0.38 | | | |
| | | **0.87** | | **0.9 kN/m** | **(1.2) kN/m** |
| **H** | 19mm lath and plaster | 0.38 | | | |
| **4" Brick Nogged** | 100x50mm timber studs at 360mm c/c | 0.08 | | | |
| **Timber Stud Wall** | Brick Noggins 225 @ 360 c/c | 1.13 | | | |
| | 19mm lath and plaster | 0.38 | | | |
| | | **1.97** | | **1.97 kN/m** | **(2.8) kN/m** |
| **J** | 6mm slate cladding lapped | 0.375 | | | |
| **4" Slate Clad Mansard** | 25x40mm battens at 150mm c/c | 0.04 | | | |
| **Wall** | 18mm plywood sheeting | 0.2 | | | |
| | 100x50mm timber studs at 400mm c/c | 0.08 | | | |
| | 100x50mm timber blocking at 1200mm c/c | 0.03 | | | |
| | 12.5mm plasterboard and Skim | 0.28 | | | |
| | | **1.01** | | **1.0 kN/m$^2$** | **(1.4) kN/m** |

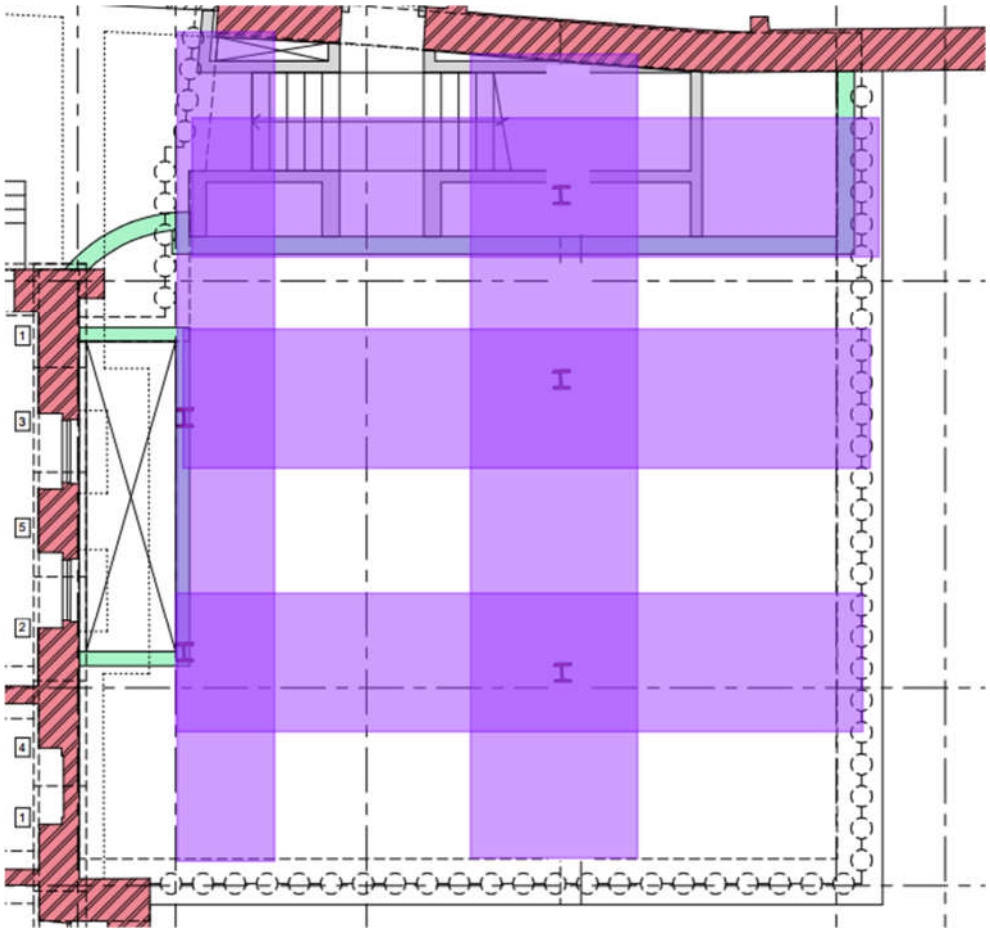
| | | | | | |
|---|---|---|---|---|---|
| **K** | 4" (101.6mm) brickwork | 1.83 | | | |
| **Brick / Block Cavity** | 100mm Insulation | 0.10 | | | |
| **Wall** | 100mm dense concrete blocks | 2.40 | | | |
| | 19mm plaster | 0.38 | | | |
| | | **4.71** | | **4.7 kN/m²** | **(6.6) kN/m²** |
| **L** | 3 Layers 10mm glass | 0.87 | | | |
| **Flat Roof Light** | 2mm interlayer | 0.01 | | | |
| | Imposed Load | | 0.6 | | |
| | | **0.88** | **0.6** | **1.5 kN/m²** | **(2.2) kN/m²** |
| **M** | 3 Layers 10mm glass | 0.87 | | | |
| **Glass Doors** | 2mm interlayer | 0.01 | | | |
| | Framing | 0.2 | | | |
| | | **1.08** | | **1.1 kN/m²** | **(1.5) kN/m²** |
| **N** | Metal deck | 0.09 | | | |
| **Concrete Multideck** | Concrete 130 | 2.28 | | | |
| **floor** | 100mm screed and finish | 2.2 | | | |
| | Partitions | | 1.0 | | |
| | Live load | | 1.5 | | |
| | | **4.57** | **2.5** | **7.07 kN/m²** | **(10.4) kN/m²** |
| **Garden slab** | 1000mm soil | 20 | | | |
| **O** | 150mm insulation | 0.20 | | | |
| | 300mm insitu reinforced concrete slab | 7.2 | | | |
| | 2 x 12.5mm plasterboard ceiling | 0.18 | | | |
| | 2.5mm skim | 0.05 | | | |
| | Services | 0.5 | | | |
| | Planting or Live load | | 3.0 | | |
| | | 28.1 | **3.0** | **31.1 kN/m²** | **(44.1) kN/m²** |
| **Basement Slab** | 300 RC slab | 7.2 | | | |
| **P** | 100mm screed and finish | 2.2 | | | |
| | Partitions | | 1.0 | | |
| | Live load (gym) | | 3.0 | | |
| | | **9.4** | **4.5** | **13.9 kN/m²** | **(20.4) kN/m²** |
| **Existing Jack arching** | Average thickness 750mm brickwork | 12 | | | |
| | 45mm asphalt | 0.99 | | | |
| | Imposed loading | | 1.50 | | |
| | | **13.0** | **1.50** | **14.5 kN/m²** | **(20.6) kN/m²** |

**Assumed Densities**

Asphalt : 22 kN/m$^3$
Brickwork : 18 kN/m$^3$
Clay Tiles : 18 kN/m$^3$
Concrete : 24 kN/m$^3$
Concrete Blockwork (Dense) : 24 kN/m$^3$
Concrete Block (Medium Density) : 14 kN/m$^3$
Glass: 25 kN/m$^3$
Lath and Plaster : 20 kN/m$^3$
Lead – Code 5 : 25.4 kN/m$^2$ (0.25 kN/m2)
Lead – Code 6 : 29.5 kN/m$^3$ (0.30 kN/m2)
PIR Insulation : 60 kg/m$^3$
Plaster : 20 kN/m$^3$
Sand / Cement Render : 22 kN/m$^3$
Sand / Cement Screed : 22 kN/m$^3$
Slate : 25 kN/m$^3$
Stone : 25 kN/m$^3$
Timber : 6 kN/m$^3$

# 4.0 Calculations

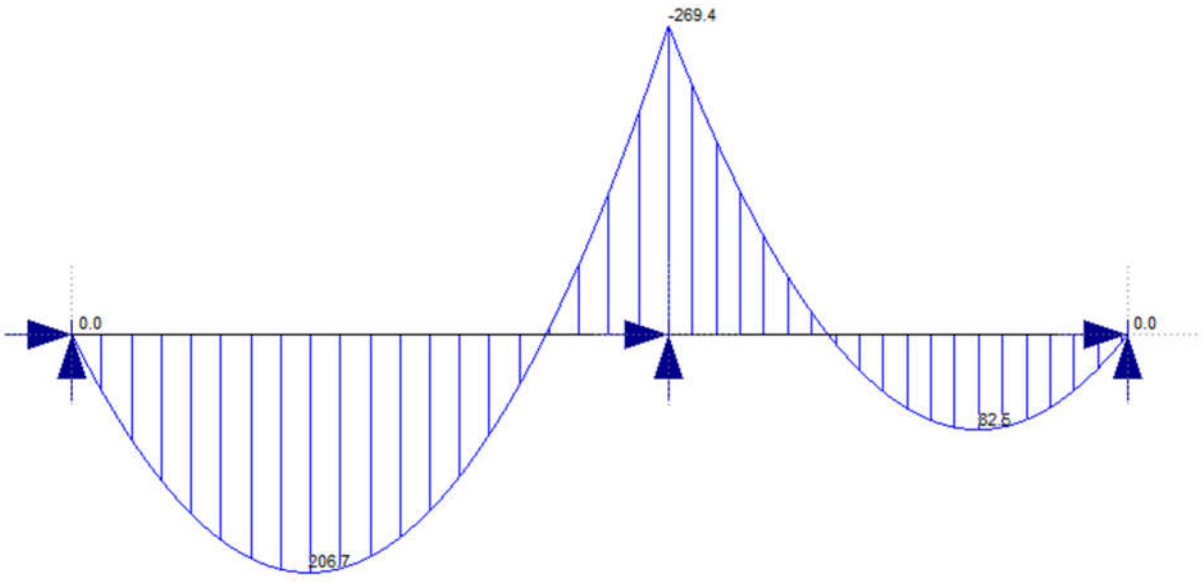
## 4.1 Garden slab



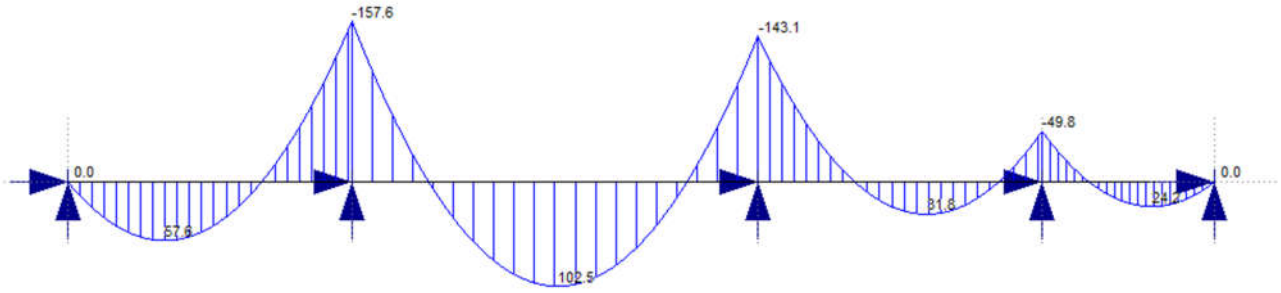
Grid is 4.3 x 5.2

Middle strip = 4.3x0.5 = 2.15 m wide

Slab spanning long direction



Slab spanning short direction



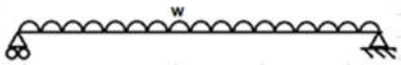

Beam strip checking hoggin moment 75 % hogging = 0.75 x 269.4 = 118.2 within column strip

| | Total Moment | | Column Strip | | Middle strip | |
|---|---|---|---|---|---|---|
| | Hogging | Sagging | Hogging | Sagging | Hogging | Sagging |
| | | | 0.75 | 0.55 | 0.25 | 0.45 |
| Long span | 269.4 | 206.7 | 202.1 | 113.7 | 67.4 | 93.0 |
| Short span | 157.6 | 102.5 | 118.2 | 56.3 | 39.4 | 46.1 |

| | | | | |
|---|---|---|---|---|
| Simple beam check | | | | |
| | | | | |
| span | 5200 | mm | | |
| width | 2150 | mm | | |
| depth | 300 | mm | | |
| cover | 50 | mm | | |
| bar depth | 10 | mm | | |
| extra | 5 | mm | | |
| deff | 240 | mm | | |
| concrete grade | 40 | N/mm^2 | | |
| steel grade | 500 | N/mm^2 | | |
| | | | | |
| span/ depth ratio | 21.66667 | | | |
| Moment | 202.1 | kNm | | |
| | | | | |
| k-M/bd^2fcu | 0.040799 | | | |
| z/d=(0.5-(0.25-k/0.9)^0 | 0.952403 | | | |
| but not less 0.95 | | | | |
| z | 0.228 | | | |
| As=M/0.87 fy z | 0.002038 | | | |
| | 2037.709 | **2038** | mm^2 | |
| | | | | |
| Use bars | 16 | | Area | 201.0619 |
| Spacing | 200 | OR | Number | 0 |
| Area steel | 2161.416 | | | |

## 4.2 Concrete boot lintel over basement window

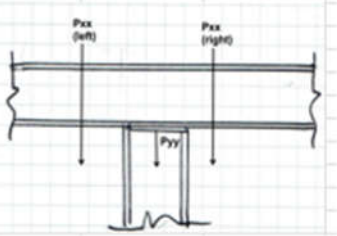
| | dl | il | sls | uls | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UDL | 28.1 | 3 | | | | | | | | | |
| supported width | 2.65 | 2.65 | | | | | | | | | |
| | | | | | | | | | | | |
| UDL | 0.00 | 0.00 | | | | | | | | | |
| supported width | 0.00 | 0.00 | | | | | | | | | |
| | | | | | | | | DL+P43 | IL | SLS | ULS |
| | 0.00 | | | | | | | | | | |
| w | **74.47** | **7.95** | **82.42** | **116.97** | kN/m | | R | **115.4** | **12.3** | **127.7** | **181.3** kN |
| | | | | | | | | | | | |
| Span | 3.1 | | | | | | | | | | |
| | | | | | | | | | | | |
| M | wl^2/8 | | **140.5** | kNm | | | | | | | |




| | | | | | |
|---|---|---|---|---|---|
| span | 3100 | mm | | | |
| width | 200 | mm | | | |
| depth | 1300 | mm | | | |
| cover | 30 | mm | | | |
| bar depth | 10 | mm | | | |
| extra | 5 | mm | | | |
| deff | 1260 | mm | | | |
| concrete grade | 40 | N/mm^2 | | | |
| steel grade | 500 | N/mm^2 | | | |
| | | | | | |
| span/ depth ratio | 2.460317 | | | simple | 20 |
| Moment | 140.5 | kNm | | cantilver | 7 |
| | | | | continous | 27 |
| k-M/bd^2fcu | 0.011062 | | | | |
| z/d=(0.5-(0.25-k/0.9)^0 | 0.987554 | | | | |
| but not less 0.95 | | | | | |
| z | 1.197 | | | | |
| As=M/0.87 fy z | 0.00027 | | | | |
| | 269.8317 | **270** | mm^2 | | |
| | | | | | |
| Use bars | 16 | | Area | 201.0619 | |
| Spacing | 0 | OR | Number | 3 | |
| Area steel | 603.1858 | | | | |
| | | | | | |
| | | | **SHEAR** | | |
| | | | | | |
| 100 As / bv d | 0.047872 | | | | |
| (400 / d )^0.25 | 0.750624 | | | | |
| | | WARNING CHECK IF SHEAR REINFOCEMENT PROVIDED | | | |
| Gamma m | 1.25 | | | | |
| Concrete grade factor | 1.169607 | | | | |
| | | | | | |
| Vc | 0.201468 | N/mm^2 | | | |
| | | | | | |
| Applied Shear | 181.3 | | | | |
| | | | | | |
| v max = V/b/d | 0.697308 | | SHEAR REINFORCEMENT REQUIRED | | |
| | | | | | |
| | | | | | |
| Spacing sv | 200 | | | | |
| As | 18.23778 | | | | |
| | | | | | |
| Link Diamter | 10 | | 78.53981634 | | |

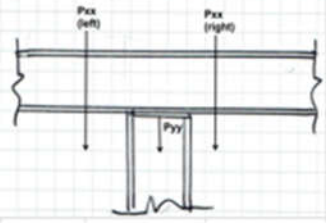
## 4.3 C08-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Height of Column | | | 3 | | | | Factor of safety | DL | 1.4 | |
| | | | | | | | | IL | 1.6 | |
| Primary size column | | | 0.15 | | | | | | | |
| Secondary size Column | | | 0.15 | | | | | | Overturning | Restoring |
| Loading | | | | | | | Excentricity distance | | | 0.9 |
| | | DL | IL | SLS | ULS | | Centroid to Face | Off face | ULS x distance | DL x favourable |
| Pxx | Left | 66.74 | 7.125 | 73.865 | 104.836 | | 0.075 | 0.1 | 18.3463 | 10.51155 |
| | Right | 133.48 | 14.25 | 147.73 | 209.672 | | 0.075 | 0.1 | 36.6926 | 21.0231 |
| Pyy | left | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | Right | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | | | | | | | 36.6926 | | | |
| Load from above | | 0 | 0 | 0 | 0 | | | | | |
| Total Load | | 200.22 | 21.375 | 221.595 | 314.508 | | | | | |
| P | • | Mxx | • | Myy | < | 1 | | | | |
| Pc | | Mbs | | PyZy | | | | | | |
| 314.51 | | 26.18 | | 0.00 | "=" | 0.963 | | | | |
| 565 | | 64.4 | | 25.2 | | | | | | |
| USE | 152 UC 37 | | | | | | | | | |




## 4.4 C08-2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Height of Column | | | 3 | | | | Factor of safety | DL | 1.4 | |
| | | | | | | | | IL | 1.6 | |
| Primary size column | | | 0.15 | | | | | | | |
| Secondary size Column | | | 0.15 | | | | | | Overturning | Restoring |
| Loading | | | | | | | Excentricity distance | | | 0.9 |
| | | DL | IL | SLS | ULS | | Centroid to Face | Off face | ULS x distance | DL x favourable |
| Pxx | Left | 133.48 | 14.25 | 147.73 | 209.672 | | 0.075 | 0.1 | 36.6926 | 21.0231 |
| | Right | 133.48 | 14.25 | 147.73 | 209.672 | | 0.075 | 0.1 | 36.6926 | 21.0231 |
| Pyy | left | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | Right | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | | | | | | | 36.6926 | | | |
| Load from above | | 0 | 0 | 0 | 0 | | | | | |
| Total Load | | 266.96 | 28.5 | 295.46 | 419.344 | | | | | |
| P | • | Mxx | • | Myy | < | 1 | | | | |
| Pc | | Mbs | | PyZy | | | | | | |
| 419.34 | | 15.67 | | 0.00 | "=" | 0.986 | | | | |
| 565 | | 64.4 | | 25.2 | | | | | | |
| USE | 152 UC 37 | | | | | | | | | |

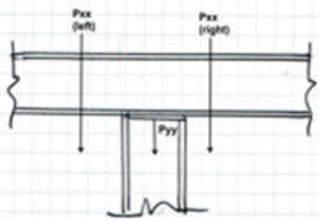



## 4.5 C08-3

**See C09-2 load and length similar**

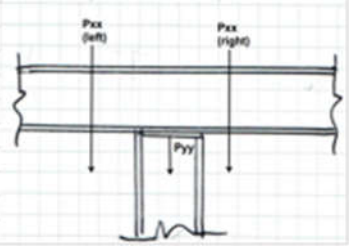
## 4.6 C08-4

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Height of Column | | | 3 | | | | Factor of safety | DL | 1.4 | |
| | | | | | | | | IL | 1.6 | |
| Primary size column | | | 0.15 | | | | | | | |
| Secondary size Column | | | 0.15 | | | | | | Overturning | Restoring |
| Loading | | | | | | | Excentricity distance | | | 0.9 |
| | | DL | IL | SLS | ULS | | Centroid to Face | Off face | ULS x distance | DL x favourabl |
| Pxx | Left | 57.7 | 6.15 | 63.85 | 90.62 | | 0.075 | 0.1 | 15.8585 | 9.08775 |
| | Right | 115.4 | 12.3 | 127.7 | 181.24 | | 0.075 | 0.1 | 31.717 | 18.1755 |
| Pyy | left | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | Right | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 |
| | | | | | | | 31.717 | | | |
| Load from above | | 0 | 0 | 0 | 0 | | | | | |
| Total Load | | 173.1 | 18.45 | 191.55 | 271.86 | | | | | |
| P | • | Mxx | • | Myy | < | 1 | | | | |
| Pc | | Mbs | | PyZy | | | | | | |
| 271.86 | | 22.63 | | 0.00 | "=" | 0.833 | | | | |
| 565 | | 64.4 | | 25.2 | | | | | | |
| USE | 152 UC 37 | | | | | | | | | |



## 4.7 C08-5

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Height of Column | | | 3 | | | | Factor of safety | DL | 1.4 | | |
| | | | | | | | | IL | 1.6 | | |
| Primary size column | | | 0.15 | | | | | | | | |
| Secondary size Column | | | 0.15 | | | | | | | | |
| | | | | | | | | | Overturning | Restoring | |
| Loading | | | | | | | Excentricity distance | | | | 0.9 |
| | | DL | IL | SLS | ULS | | Centroid to Face | Off face | ULS x distance | DL x favourable | |
| Pxx | Left | 115.4 | 12.3 | 127.7 | 181.24 | | 0.075 | 0.1 | 31.717 | 18.1755 | |
| | Right | 115.4 | 12.3 | 127.7 | 181.24 | | 0.075 | 0.1 | 31.717 | 18.1755 | |
| Pyy | left | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 | |
| | Right | 0 | 0 | 0 | 0 | | 0.075 | 0.1 | 0 | 0 | |
| | | | | | | | 31.717 | | | | |
| Load from above | | 0 | 0 | 0 | 0 | | | | | | |
| Total Load | | 230.8 | 24.6 | 255.4 | 362.48 | | | | | | |
| P | * | Mxx | * | Myy | < | 1 | | | | | |
| Pc | | Mbs | | PyZy | | | | | | | |
| 362.48 | | 13.54 | | 0.00 | "=" | 0.852 | | | | | |
| 565 | | 64.4 | | 25.2 | | | | | | | |
| USE | 152 UC 37 | | | | | | | | | | |




## 4.8 House line load Wall 1

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 39.06 | 0 | 350 | 6.2 | 18 |
| | 28.755 | 0 | 450 | 3.55 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 1.7575 | 1.11 | 1.85 | 0.95 | 0.6 |
| Loft | 1.11 | 1.11 | 1.85 | 0.6 | 0.6 |
| First | 0.7 | 1.5 | 1 | 0.7 | 1.5 |
| Ground | 0.7 | 1.5 | 1 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 72.0825 | 5.22 | 77.3025 | 109.2675 | |

## 4.9 House line load Wall 2

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 39.06 | 0 | 350 | 6.2 | 18 |
| | 28.755 | 0 | 450 | 3.55 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 4.465 | 2.82 | 4.7 | 0.95 | 0.6 |
| Loft | 2.82 | 2.82 | 4.7 | 0.6 | 0.6 |
| First | 2.59 | 5.55 | 3.7 | 0.7 | 1.5 |
| Ground | 2.59 | 5.55 | 3.7 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 80.28 | 16.74 | 97.02 | 139.176 | |

## 4.10 House line load Wall 3

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 39.06 | 0 | 350 | 6.2 | 18 |
| | 28.755 | 0 | 450 | 3.55 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 1.425 | 0.9 | 1.5 | 0.95 | 0.6 |
| Loft | 0.9 | 0.9 | 1.5 | 0.6 | 0.6 |
| First | 0.7 | 1.5 | 1 | 0.7 | 1.5 |
| Ground | 0.28 | 0.6 | 0.4 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 71.12 | 3.9 | 75.02 | 105.808 | |

## 4.11 House line load Wall 4

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 40.32 | 0 | 350 | 6.4 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 39.33 | 0 | 575 | 3.8 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 1.14 | 0.72 | 1.2 | 0.95 | 0.6 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 1.4 | 3 | 2 | 0.7 | 1.5 |
| Ground | 1.4 | 3 | 2 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 83.59 | 6.72 | 90.31 | 127.778 | |

## 4.12 House line load Wall 5

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 40.32 | 0 | 350 | 6.4 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 39.33 | 0 | 575 | 3.8 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 2.375 | 1.5 | 2.5 | 0.95 | 0.6 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 0.28 | 0.6 | 0.4 | 0.7 | 1.5 |
| Ground | 0.28 | 0.6 | 0.4 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 82.585 | 2.7 | 85.285 | 119.939 | |

## 4.13 House line load Wall 6

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 16.2 | 0 | 250 | 3.6 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 5.22 | 0 | Timber Stud wall | 6 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 0 | 0 | 0 | 0 | 0 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 1.4 | 3 | 2 | 0.7 | 1.5 |
| Ground | 0.28 | 0.6 | 0.4 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 23.1 | 3.6 | 26.7 | 38.1 | |

## 4.14 House line load Wall 7

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 4.86 | 0 | 100 | 2.7 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 0 | 0 | 0 | 0 | 0 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 0 | 0 | 0 | 0 | 0 |
| Ground | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 4.86 | 0 | 4.86 | 6.804 | |

## 4.15 Wall 8

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 11.25 | 0 | 250 | 2.5 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 0 | 0 | 675 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Ground | 3.045 | 6.525 | 4.35 | 0.7 | 1.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 14.295 | 6.525 | 20.82 | 30.453 | |

## 4.16 Neighbour Wall load 1

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 8.1 | 0 | 250 | 1.8 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 58.32 | 0 | 675 | 4.8 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 3.9 | 1.2 | 2 | 1.95 | 0.6 |
| Loft | 1.2 | 1.2 | 2 | 0.6 | 0.6 |
| First | 1.4 | 3 | 2 | 0.7 | 1.5 |
| Ground | 1.4 | 3 | 2 | 0.7 | 1.5 |
| | 0 | 0 | | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 74.32 | 8.4 | 82.72 | 117.488 | |

## 4.17 Neighbour Wall load 2

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 8.1 | 0 | 250 | 1.8 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 58.32 | 0 | 675 | 4.8 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 0 | 0 | 0 | 0 | 0 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 0 | 0 | 2 | 0 | 0 |
| Ground | 0 | 0 | 0.4 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 66.42 | 0 | 66.42 | 92.988 | |

## 4.18 Garden Wall

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 13.5 | 0 | 250 | 3 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 0 | 0 | 575 | 0 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| Roof | 0 | 0 | 0 | 0 | 0 |
| Loft | 0 | 0 | 0 | 0 | 0 |
| First | 0 | 0 | 0 | 0 | 0 |
| Ground | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | |
| Total | 13.5 | 0 | 13.5 | 18.9 | |

## 4.19 Garden line load 2

| Floors | | | supported width | DL | IL | | |
|---|---|---|---|---|---|---|---|
| Slab | 28.1 | 3 | 1 | 28.1 | 3 | | |
| Wall | 41.28 | 0 | 3.2 | 12.9 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | | | | | | | |
| | DL | IL | SLS | ULS | FOS | DL | 1.4 |
| Total | 110.78 | 3 | 113.78 | 159.892 | | IL | 1.6 |

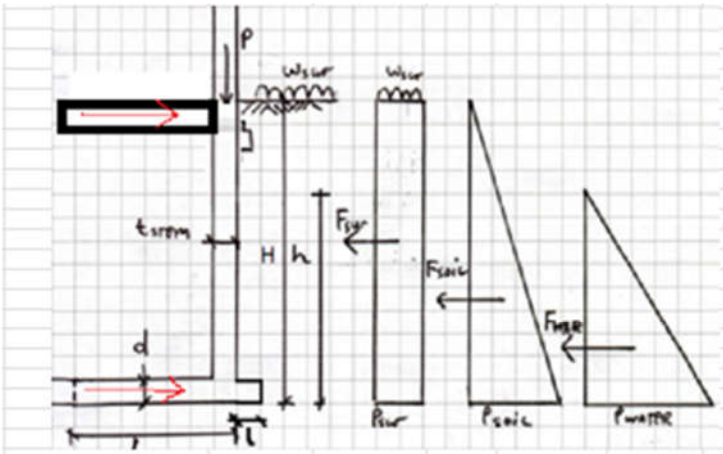
## 4.20 Garden line load 3

| Floors | | | supported width | DL | IL | | |
|---|---|---|---|---|---|---|---|
| Slab | 74.465 | 7.95 | 2.65 | 28.1 | 3 | | |
| Wall | 41.28 | 0 | 3.2 | 12.9 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | | |
| | | | | | | | |
| | DL | IL | SLS | ULS | FOS | DL | 1.4 |
| Total | 157.145 | 7.95 | 165.095 | 232.723 | | IL | 1.6 |

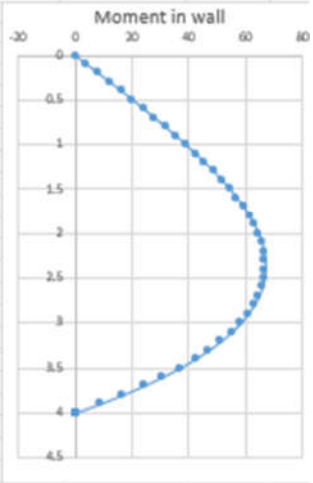
## 4.21 Garage line load

| | DL | IL | Thickness | height | density |
|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 18 |
| | 0 | 0 | 250 | 0 | 18 |
| | 0 | 0 | 350 | 0 | 18 |
| | 0 | 0 | 450 | 0 | 18 |
| | 41.4 | 0 | 575 | 4 | 18 |
| | 0 | 0 | brick Nogged Stud Wall | 0 | 1.97 |
| | 0 | 0 | Timber Stud wall | 0 | 0.87 |
| | | | | | |
| Floors | | | supported width | DL | IL |
| roof | 2.47 | 1.56 | 2.6 | 0.95 | 0.6 |
| | 20.28 | 6.5 | 2.6 | 7.8 | 2.5 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 |
| | | | | | |
| | DL | IL | SLS | ULS | FOS |
| Total | 64.15 | 8.06 | 72.21 | 102.706 | |

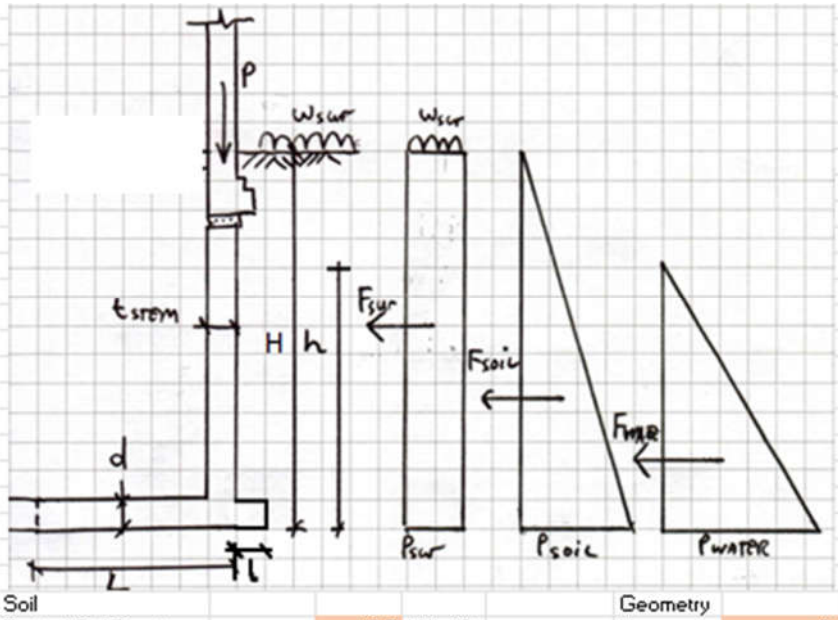
## 4.22 Garden retaining wall




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Soil | | | | | Geometry | | | |
| Typical Soil Density | | 20 | kN/m^3 | | H | 4 | m | |
| Internal Angle of Friction | | 30 | degrees | | t | 0.4 | m | |
| | | | | | d | 0.375 | m | |
| Earth pressure coefficient | | 0.5 | | | L | 5 | m | |
| | | | | | l | 0 | | |
| Ko | 1-sin ϕ | 0.5 | | | | | | |
| Ka | 1- sin ϕ / 1+sin ϕ | 0.33333333 | | | | Surcharge | Soil | Water |
| | | | | | | a | b | c |
| Kp | 1/Ka | 3 | | depth below ground | | 0 | 0 | 1 |
| | | | | Load | | 3.5 | kNm | |
| **Stability** | Pressure | | | Force | | | | |
| Surcharge | Ko w | 1.75 | | P. (H-a) | 7 | | | |
| Soil | ρ Ko (H-b) | 40 | | 0.5 P. (H-b) | 80 | | | |
| Water | ρ(water)(H-c) | 30 | | 0.5 P...r(H-c) | 45 | | | |
| **Total** | | | | | **132** | | | |
| | surcharge | Soil | Water | **TOTAL** | | | | |
| R1 | 3.5 | 26.6666667 | 11.25 | **41.41667** | | | | |
| R2 | 3.5 | 53.3333333 | 33.75 | **90.58333** | | | | |
| Peak Moment | | | | **66.74667** | | | | |
| Factor of Safety | 1.4 | | | | | | | |
| ULS Moement | 93.445333 | #REF! | at junction of stem to base | | | | | |
| t | | 0.4 | | | | | | |
| cover | | 0.05 | | | | | | |
| main bar | | 0.02 | | | | | | |
| de | | 0.335 | | | | | | |
| b | | 1 | | | | | | |
| Fcu | | 40 | | | | | | |
| k | M/fcu/b/d^2 | 0.02081651 | | | | | | |
| Z | de(0.5+(.25-k | 0.31825 | | | | | | |
| As | | 0.00067499 | m^2 | | | | | |
| | | 675 | mm^2 | | | | | |



## 4.23 Dwarf retaining wall below garage

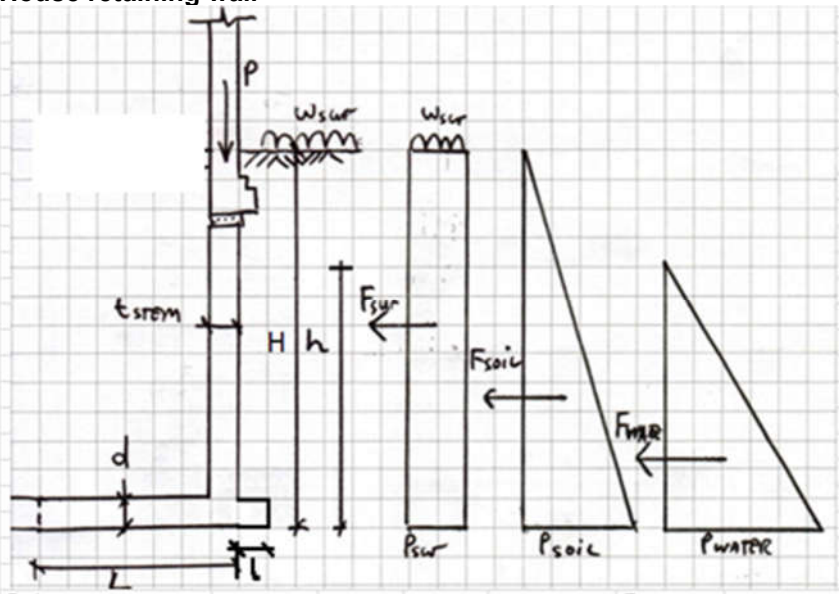



| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil | | | | | Geometry | | | | | |
| Typical Soil Density | | 18.5 | kN/m^3 | | H | 2.1 | m | | | |
| Internal Angle of Friction | | 26 | degrees | | t | 0.575 | m | | | |
| | | | | | d | 0.3 | m | | | |
| Earth pressure coeeficient | | 0.5616 | | | L | 1.25 | m | | | |
| | | | | | l | 0 | | | | |
| Ko | 1-sin ϕ | 0.5616 | | | | | | | | |
| Ka | 1- sin ϕ | 0.3905 | | | Water BGL | 1 | m | | | |
| | 1+sin ϕ | | | | h | 1.1 | | | | |
| Kp | 1/Ka | 2.5611 | | | Wsur | 2.5 | kN/m | | | |
| | | | | | | | | | | |
| **Stability** | Pressure | | | Force | | | Moment | | | |
| Surcharge | Ko w | 1.4041 | | P... H | 2.948551 | | H/2 | 1.05 | F ...H/2 | 3.096 |
| Soil | ρ Ko H | 21.819 | | 0.5 P.. H | 22.91024 | | H/3 | 0.7 | F ...H/3 | 16.037 |
| Water | ρ...g h | 11 | | 0.5 P...r h | 6.05 | | h/3 | 0.3667 | F ...h/3 | 2.2183 |
| **Total** | | | | | **31.909** | | | | | **21.35** |
| | | | | | | | | | | |
| **Restoring** | | | | | | | | | | |
| | Load | | | Lever Arm | | | | | | |
| Party Wall load | P | 72.2 | kN | L-t/2 | 69.4925 | | | | | |
| Weight of Stem | (H-d)*t*24 | 18.63 | kN | L-t/2 | 17.93138 | | | | | |
| Weight of Slab | (D*L)*24 | 9 | | L/2 | 5.625 | | | | | |
| Heel | (.d*l)*24 | 0 | | L+l/2 | 0 | | | | | |
| Heel Soil | l*H*ρ | 0 | | L+l/2 | 0 | | | | | |
| Heel Surcharge | Wsur * l | 0 | 2.5 | L+l/2 | 0 | | | | | |
| | | | | | | | | | | |
| | | **99.83** | | M restore | **93.049** | | FOS | Mr / Mo | **4.4** | |
| | | | | | | | | | | |
| X bar | Mr-Mo | 0.7182 | | Middle Third | 0.416667 | 0.8333333 | | | | |
| | R | | | | | | | | | |
| | | | | | | | | | | |
| e | (L+l)/2-xba | -0.093 | | | | | | | | |
| | | | | | | | | | | |
| Bearing Pressures | | 44.138 | 115.59 | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Concrete Design | | | | | | | | | | |
| Cantilever length | | 1.8 | | | | | | | | |
| **Stability** | Pressure | | | Force | | | Moment | | | |
| Surcharge | Ko w | 1.4041 | | P... H | 2.52733 | | H/2 | 0.9 | F ...H/2 | 2.2746 |
| Soil | ρ Ko H | 18.702 | | 0.5 P.. H | 16.83202 | | H/3 | 0.6 | F ...H/3 | 10.099 |
| Water | ρ...(H-h) | 8 | | 0.5 P...r (H-h) | 3.2 | | (H-h)/3 | 0.2667 | F ...(H-h)/ | 0.8533 |
| **Total** | | | | | **22.559** | | | | | **13.23** |
| Factor of Safety | 1.4 | | | | | | | | | |
| ULS Moement | 18.518 | | | | | | | | | |
| | | | | | | | | | | |
| t | | 0.575 | | | | | | | | |
| cover | | 0.05 | | | | | | | | |
| main bar | | 0.025 | | | | | | | | |
| de | | 0.5075 | | | | | | | | |
| b | | 1 | | | | | | | | |
| Fcu | | 40 | | | | | | | | |
| k | M/fcu/b/d^2 | 0.0018 | | | | | | | | |
| Z | de(0.5+(.2! | 0.4821 | | | | | | | | |
| | | | | | | | | | | |
| As | | 9E-05 | m^2 | | | | | | | |
| | | 88 | mm^2 | | | | | | | |


| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Concrete Design | | | | | | | | | | |
| Cantilever length | | 1.8 | | | | | | | | |
| **Stability** | Pressure | | | Force | | | Moment | | | |
| Surcharge | Ko w | 1.4041 | | P... H | 2.52733 | | H/2 | 0.9 | F ...H/2 | 2.2746 |
| Soil | ρ Ko H | 18.702 | | 0.5 P.. H | 16.83202 | | H/3 | 0.6 | F ...H/3 | 10.099 |
| Water | ρ...(H-h) | 8 | | 0.5 P...r (H-h) | 3.2 | | (H-h)/3 | 0.2667 | F ...(H-h)/ | 0.8533 |
| **Total** | | | | | **22.559** | | | | | **13.23** |
| Factor of Safety | 1.4 | | | | | | | | | |
| ULS Moement | 18.518 | | | | | | | | | |
| | | | | | | | | | | |
| t | | 0.575 | | | | | | | | |
| cover | | 0.05 | | | | | | | | |
| main bar | | 0.025 | | | | | | | | |
| de | | 0.5075 | | | | | | | | |
| b | | 1 | | | | | | | | |
| Fcu | | 40 | | | | | | | | |
| k | M/fcu/b/d^2 | 0.0018 | | | | | | | | |
| Z | de(0.5+(.2! | 0.4821 | | | | | | | | |
| | | | | | | | | | | |
| As | | 9E-05 | m^2 | | | | | | | |
| | | 88 | mm^2 | | | | | | | |

## 4.24 House retaining wall




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil | | | | | Geometry | | | | | |
| Typical Soil Density | | 18.5 | kN/m^3 | | H | 3.6 | m | | | |
| Internal Angle of Friction | | 26 | degrees | | t | 0.45 | m | | | |
| | | | | | d | 0.3 | m | | | |
| Earth pressure coeeficient | | 0.5616 | | | L | 2.5 | m | | | |
| | | | | | l | 0 | | | | |
| Ko | 1-sin ϕ | 0.5616 | | | | | | | | |
| Ka | 1- sin ϕ / 1+sin ϕ | 0.3905 | | | Water BGL | 1 | m | | | |
| | | | | | h | 2.6 | | | | |
| Kp | 1/Ka | 2.5611 | | | Wsur | 2.5 | kN/m | | | |
| **Stability** | Pressure | | | Force | | | Moment | | | |
| Surcharge | Ko w | 1.4041 | | P... H | 5.05466 | | H/2 | 1.8 | F ...H/2 | 9.0984 |
| Soil | ρ Ko H | 37.404 | | 0.5 P.. H | 67.32807 | | H/3 | 1.2 | F ...H/3 | 80.794 |
| Water | ρ...h | 26 | | 0.5 P...h | 33.8 | | h/3 | 0.8667 | F ...h/3 | 29.293 |
| **Total** | | | | | **106.18** | | | | | **119.2** |
| **Restoring** | | | | | | | | | | |
| | Load | | | Lever Arm | | | | | | |
| Party Wall load | P | 97.6 | kN | L-t/2 | 222.04 | | | | | |
| Weight of Stem | (H-d)*t*24 | 26.73 | kN | L-t/2 | 60.81075 | | | | | |
| Weight of Slab | (D*L)*24 | 18 | | L/2 | 22.5 | | | | | |
| Heel | (.d*l)*24 | 0 | | L+l/2 | 0 | | | | | |
| Heel Soil | l*H*ρ | 0 | | L+l/2 | 0 | | | | | |
| Heel Surcharge | Wsur * l | 0 | 2.5 | L+l/2 | 0 | | | | | |
| | | **142.3** | | Mrestore | **305.35** | | FOS | Mr/Mo | **2.6** | |
| X bar | Mr-Mo / R | 1.308 | | Middle Third | 0.833333 | 1.6666667 | | | | |
| e | (L+l)/2-xbar | -0.058 | | | | | | | | |
| Bearing Pressures | | 49.009 | 64.855 | | | | | | | |

# 11.0 Site Investigation

- **Refer to stand alone site investigation report by GEA.**

## 12.0 Summary

12.0 The existing building is a four storey detached house (including the loft and the basement) that appears to have been constructed in the early 1800s. The building has a single storey garage to the south.

12.1 The building is Grade II listed and is in the Hampstead Conservation Area.

12.2 The proposed works involve the refurbishment of the house and construction of a basement to the southern side garden

12.3 The new basement will be constructed using contiguous piles around the perimeter to retain the ground. A reinforced concrete liner wall will be constructed inside the piles. The basement slab will be constructed with reinforced concrete. The roof over basement will be constructed with reinforced concrete and will have a garden above.

12.4 The proposed drainage scheme for the new basement involves a foul pumping station and cavity drain sump. The proposals are relatively straightforward and have been used successfully on many similar projects in London.

12.5 The impact of the new basement on the existing groundwater regime has been assessed. Groundwater is not likely to be encountered and no noticeable effects on the hydrogeological environment in the area are expected.

12.6 The undertaking of such projects to existing buildings is specialist work. We will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project.

12.7 Once the works commence we will have an ongoing role on site to monitor that the works are being carried out generally in accordance with the design and specification. This role will typically involve fortnightly site visits at the beginning of the Contract with monthly visits thereafter.

12.8 If properly undertaken by a suitably experienced Contractor the proposed basement construction can be completed with no significant affect on the structural stability of the adjoining building.