Residential

Commercial

Retail

Conservation

Project Number: 2023-192

Address: 56 Gayton Road, London NW3 1TU

Client: Fife Studio

Title: Engineer's Construction Method Statement.

Date: 27th September 2023.

Revision: 01

Prepared by: Chartered Engineer (See end of report for details).

Prepared by:	Nicola Nava	27/09/2023
Checked by:	John Fitzpatrick	27/09/2023

PREAMBLE:

This report has been prepared by Elite Designers on the instruction of Fife Studio, acting on behalf of the client and is for the sole use and benefit of the client.

Elite designers shall not be responsible for any use of the report or its content for any purpose than that it was prepared and provided. If the client wishes to pass copies of the report to other parties, the whole of the report should be copied. No professional liability or warranty is extended to other parties by Elite Designers as a result of permitting the report to be copied or by any other cause without the express written agreement of Elite Designers.

TERMS OF REFERENCE:

We were appointed by the client to prepare a Structural design Statement in support of a planning application for the refurbishment works and underpin construction at 56 Gayton Road, London, NW3 1TU.

Table of Contents

Construction Method Statement

Project information

Client: Fife Studio
Address: 56 Gayton Road, London NW3 1TU.
Nature of Works: Underpinning of existing structure at above address to reduce the lower ground finished floor level as detailed in the drawings provided by Fife Studio.

1.0 ~ Introduction:

Elite designers are a firm of Consulting Structural and Civil Engineers operating from offices in South West London. High end residential refurbishments and developments of all scales have been central to the workload of the practice within central London and the surrounding Greater London area. As a practise we have produced many single and multilevel basements designs to both new and existing buildings. Our general understanding of the development of London, its geology and unique features together with direct experience on many sites puts us in a strong position to advise clients on works to their buildings and in particular the design and construction of their basement.

Furthermore it is assumed that the contractor appointed to carry out the works will be a member of the considerate contractor scheme and will have suitable and relevant experience in basement construction within the London area. The client will also appoint a suitably qualified engineer to develop the design and oversee site construction should the planning application be successful in line with the regulations of the London Borough of Camden.

This report sets out the design philosophy for the proposed works to 56 Gayton Road. It should be read in conjunction with the detailed planning stage structural drawing and calculations attached in appendices which detail both the temporary and permanent design stages of the subterranean development along with all other relevant consultant reports submitted with the application. The aim of the method statement is to ensure safe and proper construction of the proposed works and ensure no adverse effects to existing or neighbouring structures, while also addressing the requirements of all relevant current policies at the time of application submission.

This Structural Engineers Construction Method Statement (CMS) is based on and takes account of all the reports and drawings in the appendices.

While considering the most appropriate method of retaining the soil around the lower ground level in both the temporary & permanent conditions several potential methods were assessed. A feasibility study was undertaken to determine the most appropriate construction method for the site and the proposed works. The first stage of the feasibility was to assess the Architect's proposal and to provide advice on alterations to the project where necessary from a structural point of view to ensure long term stability of the building and minimize the requirements of temporary works during construction. The study allowed for an appraisal of the different potential construction methods available and suggestions were made as to the most suitable from both a time and cost point of view as well as their suitability for the given site conditions.

In this study the merits and shortcomings of sheet piling, bored piling and traditional underpinning techniques were examined. From the conclusion of this study it was felt that at this stage the most appropriate solution would be for a traditional underpinning and retaining wall technique to be employed, this will be discussed further in detail below. The construction sequence will deal with any issues of excavations under or adjacent to an existing property or road while minimising the potential losses of usable floor area. Given the preference to minimise any inconvenience to neighbouring properties and to maximise usable floor area of the proposed development, an underpinning solution would lend itself best to fulfilling all of the aforementioned, and the structural requirements of this development. For these reasons it was decided to detail the proposed solution shown in the appendix A drawings.

Following this a series of calculations were carried out to allow for the production of planning stage drawings. These can be used to prepare preliminary budget costs to the project and can be submitted as a viable proposed engineering solution for planning; in addition they will allow the party wall process to be commenced and will form a solid base for engineering discussion for the proposed solution. These ensure the overall structural integrity of both the existing and neighbouring structures is retained throughout development. The stability of the building in all stages of construction and in the completed stage is provided for by careful sequencing of works to support the new building above the proposed basement works. The addition of a rigid interlocking set of reinforcing underpins which are to sit below the existing ground floor level will further stabilise the building in all directions. These boxes are created by the interaction between the proposed new concrete floors at lower ground floor and the proposed reinforced concrete retaining wall to the perimeter of the development. Above ground floor level it is proposed to introduce a steel frame which will work in tandem with load bearing masonry walls to replace the stability system of the existing structure. Due to this the proposed structure will remain stable. The current system employs a series of internal walls which provide stability in the transverse directions in addition to transferring vertical loads from above to strip footings below.

Due to the nature and makeup of the existing underlying soil types, slope instabilities are not of concern and loading patterns have been checked to ensure they will not occur. This is particularly evident with retaining wall solutions as the size and speed of the excavations under or adjacent to existing structure can be carefully controlled and monitored as necessary to ensure no rotations of the wall segments, individually or as a group can occur. The proposed solution ensures no instabilities are created or allowed to occur within the soil mass during both the construction process and in the permanent state therefore any settlement to the surrounding area will be negligible, following the details laid down in the step by step installation method below, any adverse effects on neighbouring properties will be minimised/mitigated.

2.0~ Existing Structure:

The existing property consists of a five storey structure built around the middle of the 19th Century. The property adjoins no. 55a to the north and no. 57 to the south and is currently used as multiple residential dwelling, consisting of two flats, owned by the same owner, to be amalgamated. The surrounding buildings are of a similar age and construction.

The local topography is reasonably flat and therefore the site is unlikely to be surcharged during periods of heavy rainfall. A more detailed discussion of flooding is assessed below.

The existing building is characterized by a traditional masonry loadbearing structure along the perimeter with solid walls inside. The floors are made of timber joists which direction is likely to be front to back. A three storey outrigger is attached to the main structure at the back. Several downstands hint at the presence of potential hidden steel in the floor build ups. The roof is made of timber joists, approximately flat for both the main structure and the outrigger.

Responsibility for site safety and the implementation of applicable building practices and British Standards are the responsibility of the Main Contractor. This method statement is not exhaustive and assumes the Main Contractor has the competence and relevant experience to undertake building works of this nature.

3.0 ~ Party wall:

Certain parts of these works will require a party wall agreement which will detail allowable construction tolerances and impacts on the neighbouring properties (currently there are no foreseen affects to the integrity of surrounding structures). The works comprise the excavation of a new lower ground floor level within 3m and 6m of adjacent properties therefore, full procedures under The Party Wall etc Act 1996 will be required.

The structural scheme adopted has been designed with due regard to maintaining the structural stability and integrity of neighbouring buildings & structures and surrounding land. The structural form of the basement and the method of construction have been developed to ensure that lateral deflections, and associated ground movements, are kept within acceptable limits during and post construction. An initial assessment of the predicted ground surface movements using the approach set out in CIRIA C850 has indicated that the predicted category of damage to adjacent properties would be category 0/1– very slight.

Which elevations require the party wall agreements should be discussed with a suitably experienced surveyor, but most likely an agreement will be required by both the adjoining properties at 55a and 57 Gayton Road. It will require a surveyor to prepare a fair and impartial party wall agreement which will deal with the right to execute the party wall works, the time and manner of executing any party wall work, and any other matter that arises between the parties connected to the party wall works.

4.0 ~ General descriptions of works:

The existing structure appears to be from the Victorian Age. Bearing structure consists of masonry walls. The property is a residential dwelling with multiple bedrooms set over five floors and the surrounding properties appear to be of similar construction and age.

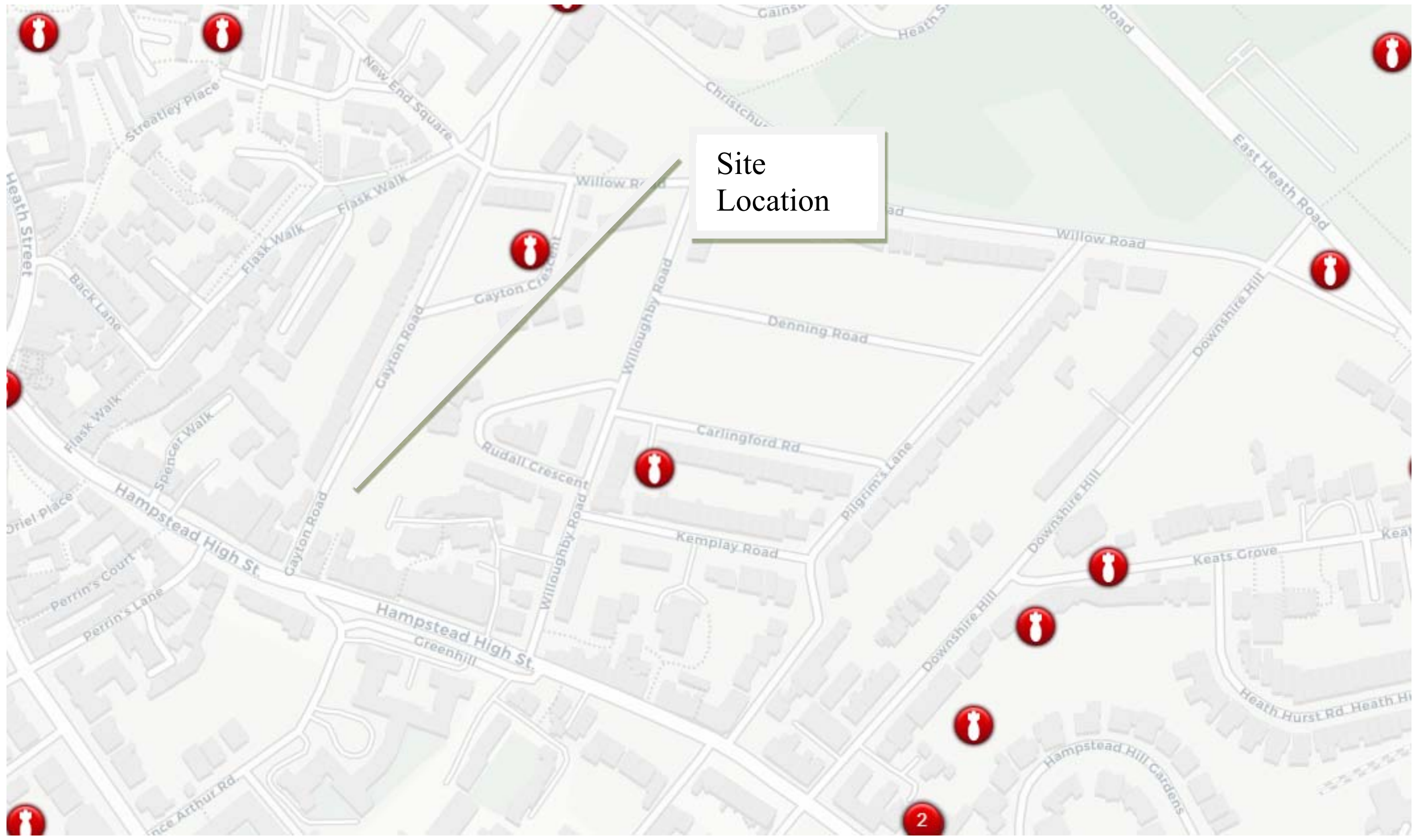
The proposal is to reduce the lower ground finished floor level and to create an even floor throughout the length of the building. Openings on the rear wall, at lower ground floor level, will be created to give direct access the rear lightwell. Underpins would allow to lower the existing finished floor level by a maximum of 415 mm below the existing. The rest of the floors will have minor alterations most likely to involve partitions only.
Any alterations are detailed in the architectural drawings included with the application.

The site is situated on Gayton Road towards the crossroad with Hampstead High Street in the London Borough of Camden. Gayton Road is a residential street consisting of residential houses of similar age and architectural style.

Access for materials and the removal of spoil will be via the front of the property. The exact method in which soil is to be removed from the site will be detailed in the traffic management plan.

5.0 ~ Historic Background:

The site appears to have escaped bomb damage following a review of the WW2 bomb maps. A reproduced extract maps shows two potential strikes sites approximately 300m of the site, but no impact is expected on the basement construction from these.



6.0 ~ Ground Conditions / Geology:

Local knowledge of the area backed up by the results and review of the nearest boreholes scans from British Geological Survey (attached in appendix C) suggest the underlying soil to be significant thicknesses of made ground (around 2m) over assumed firm becoming stiff brown clay (2m to 10m) which lies within the London clay. Water was found well below the lower ground level, however, should the water unexpectedly interfere with the proposed construction of the basement, some local pumping may be required also due to possible seasonal variation in water level. Additional monitoring of the water levels will be carried out to monitor this situation. In line with design standards we need to allow for uplift within the design of the base floor slab. The uplift forces can be easily counteracted by the self weight of the new basement slab itself, recreating the existing conditions.

Given the depths at which the water table appears to be and the proposed depth to which it is planned to excavate, it is unlikely that the construction will project into the water level, however there is likely to be seepages flowing on top of the clay layer. Based on this assumptions, and having considered the minimal excavation planned, it is safe to conclude there will be no adverse effects by the development to the local hydrology of the area.

6.1 Ground Bearing Pressure & Suitability:

Firm to stiff clays are considered to stand up well for the proposed type of construction and can easily assume bearing pressures in excess of 125kN/m^2 which have been assumed in the design of the structure at this stage. We have constructed similar basements using the proposed typical basement retaining wall techniques. In a conservative way the earth pressure coefficient will be assumed as “at rest” for the preliminary design.

6.2 Slope Stability:

The site is on generally level ground and not cut into the side of hills or valleys and therefore slope instability is not considered to be a problem.

7.0 ~ Watercourses and Existing Trees:

7.1 Ground Water

The closest surface water feature is a pond locate within Hampstead Heath. Its presence is not interfering with the current proposed works.

The local area is predominantly residential properties intersected by highways. The current surface water flow regimes can therefore be summarised as follows:

- Rain water falls onto hard standing surfaces and roofs with most discharging directly into the existing drainage system and some being taken up in evaporation.
- Garden, permeable areas and green areas where present will absorb rainfall directly into the ground and discharge back to the local ground water.

The proposals do not materially alter the existing surface water flow path and the existing non permeable surface area.

Subterranean ground water flow paths are most likely to be in an approximate north to south direction with water gently flowing along the top of the Clay down to the Thames. The proposals would appear not to materially affect these potential flows, with water simply flowing around the basement before continuing along its normal flow path.

7.2 Watercourses

The River Thames runs about 7.5 km away to the south of the property. A desk top study and review of the “Lost Rivers of London” indicates that a source of waterways, known as “Westbourne River”, has one of its branches running relatively close to the property, in the range of half a mile to the south, and then forward into the River Thames. Other waters are represented by the “The Tyburn River”, about 1.0 km away.

Considering the distance from the Westbourne River, and the modest excavation to be carried out, it is safe to assume that no adverse effects will be expected.

The substratum is firm clay. These layers are non permeable and some water could be expected on site flowing on top of the clay layer. Seasonal variations in the ground water are to be expected and the contractor will be required to have considered suitable remediation measures during excavations and general basement works.

7.3 Existing Trees:

There are trees reported in proximity of the existing and proposed structure, if required a detailed arboricultural report will deal with the impact of any potential roots in the nearby on this in detail. However, it is expected that construction will not significantly harm the roots since the underpins will follow the current perimeter of the building. The contractor will provide in his method statement measures to be taken to protect the tree (if there is any) from both aerial and subterranean damage. Besides, the planned works consist only in lowering down the basement level by a minimal amount, therefore it is unlikely that the existing trees would impact the construction.

7.4 Flooding:

A review on the environment agency website has shown that the site is not at risk of flooding from the river, sea and nearby reservoirs and it is understood that there has been no history of surcharging of local combined sewer systems in periods of heavy rainfall.

Due to the present hydrological status we would not expect the proposal to have an adverse effect on the ground water flow in the area.

8.0 ~ Description of Proposed Structure

The proposal is to lower the basement level of the building. The lower level will be formed using traditional reinforced concrete underpins. The basement slab will be in reinforced concrete. Structure will be designed with adequate capacity to support both vertical loading from above and surcharges from the adjacent road/neighboring properties and above ground structure as per the current architect’s proposal.
The structure necessary to create the openings in the lower ground rear wall will be made of steel frames, and timber joists will replace the existing where necessary..

The lower ground floor slab structure will be a rigid reinforced concrete slab restraining the underpin and supporting solid walls on top.
The following gives a proposed overall view of the installation sequence of the proposed development.

1. Temporary works to restrain the walls just above lower ground floor slab level will be installed.
2. Traditional underpin can be installed in the standard hit and miss pattern. Minimizing widths of underpinning installation, careful workmanship, and the use of an expanding grout as dry pack on the connection between the new wall and existing foundation will minimize potential settlements.
3. Demolition of the current slab can take place.
4. Excavation to design level can take place.
5. New RC basement slab to be installed.
6. Once cured the line of props can be removed.
7. Once cured the installation of steel frames can commence.

See appendix A with feasibility stage drawings showing further details of the proposed structural solution.

It is recommended these works are carried out by a suitable experienced contractor familiar with this type of construction and the techniques required producing the desired end result.

9.0 ~ Construction Method

In addition to the detailed description of the underpinning sequence given below, reference should be made to the drawing attached in Appendix A which gives a visual representation of the proposed works.

9.1 Traditional underpin concept used for excavation:

Underpin will be formed in reinforced concrete to match the existing thickness of the wall above. They will be used to lower the basement level.

The pins will be constructed in short sections in a hit and miss pattern typical of this type of underpinning, approximately 1.0 m wide and connected with steel dowels in the normal manner for this type of construction. The walls will need to remain back propped until the concrete has sufficiently cured and the permanent structure will be in place.

When forming each cantilevering L-shaped section of wall, an access trench is dug down to the formation level of the base slab. Reinforcement is fixed and the base of the underpin is poured. Following this the wall reinforcement is fixed and the wall shuttered and poured. By using hit and miss sequencing it is possible to work on more than one pin at a time safely up to a maximum of four pins around the perimeter of the building.

9.3 Traditional underpin step by step – method 1: underpins designed as propped top and bottom in both temporary and permanent conditions

i. Mark out datum line to determine various surface heights.
ii. Following sequencing guidance from engineers drawings mark out proposed digging area for current sequence.
iii. Begin digging within marked area to depth of 0.4m, using laser meter to determine appropriate depths.
iv. Install sheeting against the retained earth face, planking and strutting segment made up of two sheets of 18mm plywood across all side of pit, with timber struts of 125mm x 50mm at 500mm centres, reinforced with mini-acrow steel props set at 1m centres as per details on drawings.
v. Install 1m high timber railing guard around pit.
vi. If site manager deems it appropriate, install timber guard to prevent loose material from falling onto workers whilst digging.
vii. Water table should be lower than this level of excavation but if necessary it should be lowered below the level of basement excavation. This is to be achieved through the installation of appropriate submersible pumps to remove water locally from the area being excavated. Should ingress become more than a minor flow, stop digging and back fill immediately. Seek advice from engineer.
viii. In sequences, set between two other sequences (or adjacent to each other) already completed, install dowel bars 800mm long and 12mm diameter at 150mm centres as proposed by engineers in completed underpins either side.
ix. Install shuttering.
x. Pour concrete mix (engineer's specification) into shuttered mould.
xi. Underpin will connect into basement floor slab.
xii. After 48 hours, remove timber shuttering.
xiii. Begin next sequence as directed in accordance with direction of engineers.
xiv. Continue above steps until all the wall sequences have been completed.
xv. Once the shuttering has been removed from the last sequence, the central mass of soil can start to be removed in sections to allow for installation of temporary propping or waling beams.

9.5 Temporary Works:

No Structural works will commence without a detailed temporary works design, drawing and calculation package in place including all necessary method statements.

Structural drawings give proposed acceptable details for the excavations and a proposed sequence for the works. By following this sequence, the extent of temporary supporting works can be minimised.

The depth of construction is approximately 0.4m below the existing level. If the basement is constructed as per the suggested method on drawings, temporary propping for stability, above the existing basement slab, will be required. Concerning the stability of soil below the adjoining properties foundations the contractor is advised to have some sheeting available to deal with any unexpected pockets of poor ground.

9.5 Site set up:

Carefully protect and/or remove any internal or external fixtures and fittings affected by the works, terminate/protect services and temporarily divert all active drainage.

The hoarding and conveyor will be positioned at the front of the property and will be subject to any restrictions imposed by the local governing authority. The layout will be agreed prior to the commencement of any works.

Erect plywood hoarding with vertical standards to an overall maximum height of 2.4m and anchored to the ground. The hoarding will have a plywood roof covering and will be fully secure with a lockable door for access. The hoarding will be painted and the appropriate health and safety notices will be clearly displayed at all times.

Electrically operated lights are to be fitted to the perimeter of the hoarding together with chevron highway reflectors so that it is clearly visible during the hours of darkness.

Provide protection to the public where the conveyor extends over the footpath. Depending on the requirements of the local governing authority. Construct a plywood bulkhead onto the pavement.

Install electrically operated conveyor at basement level to provide mechanised removal of spoil from the working area. The conveyor will be adequately supported and secured to the hoarding using a temporary scaffold structure, will have an incline not greater than 40° and will discharge directly over a metal skip container. The skip container will be used for the temporary storage of excavated material pending its removal from site.

Provide flexible dust sheet protection to the discharge point of the proposed conveyor.

Install temporary electrical and water supplies from Clients permanent connections. These will be retained in a safe condition for the duration of the contract period.

Deliveries, removals and access for operatives will most likely take place in Gayton Road and through the main front entrance. This entrance will be manned throughout operational hours by a Banksman to ensure construction deliveries do not pose a potential risk to pedestrians.
There will be no skips on the road and the spoil will be bagged on site and removed by hand to the Narrow-Bodied Vehicle waiting in the designated area. The NBV will reverse into the designated loading area when collecting the spoil. The vehicle will depart as soon as it is able.

10.0 ~ Potential Ground Movements to Adjoining Properties:

Anticipated movements are expected to be minimal and suppressed by the stiffness of the above structure and those adjoining. The stability of the surrounding building in particular has been considered at his stage of the design and it is suggested that the impact of the proposed structure will be minimal on the stability of the surrounding structures.

The category of movement expected for this element of works would be a category 0-1 of the building damage classification table based on CIRIA C580 guidance (see appendix D).

The Contractor will be required to monitor ground movements during the works to check the validity of the ground movement analysis and the performance of the temporary works and working methods. A 'traffic light' system of green, amber, red trigger values will be set with specific Contractor actions set against each trigger values.

Traffic light	Trigger Value (mm)	Contractor Action
Green	<8	No action required.
Amber	8-12	Notify the CA and Party wall Surveyors. Increase frequency of monitoring. Implement contingency measures if movement continues
Red	>12	Notify the CA and the party wall surveyors. Implement measures to cease movement and stop work.

A suitable experienced contractor familiar with propping techniques and sequential operations should be appointed. The designer has considered the risk to adjoining properties and the proposed foundation system offer an inherently strong foundation to load bearing walls.

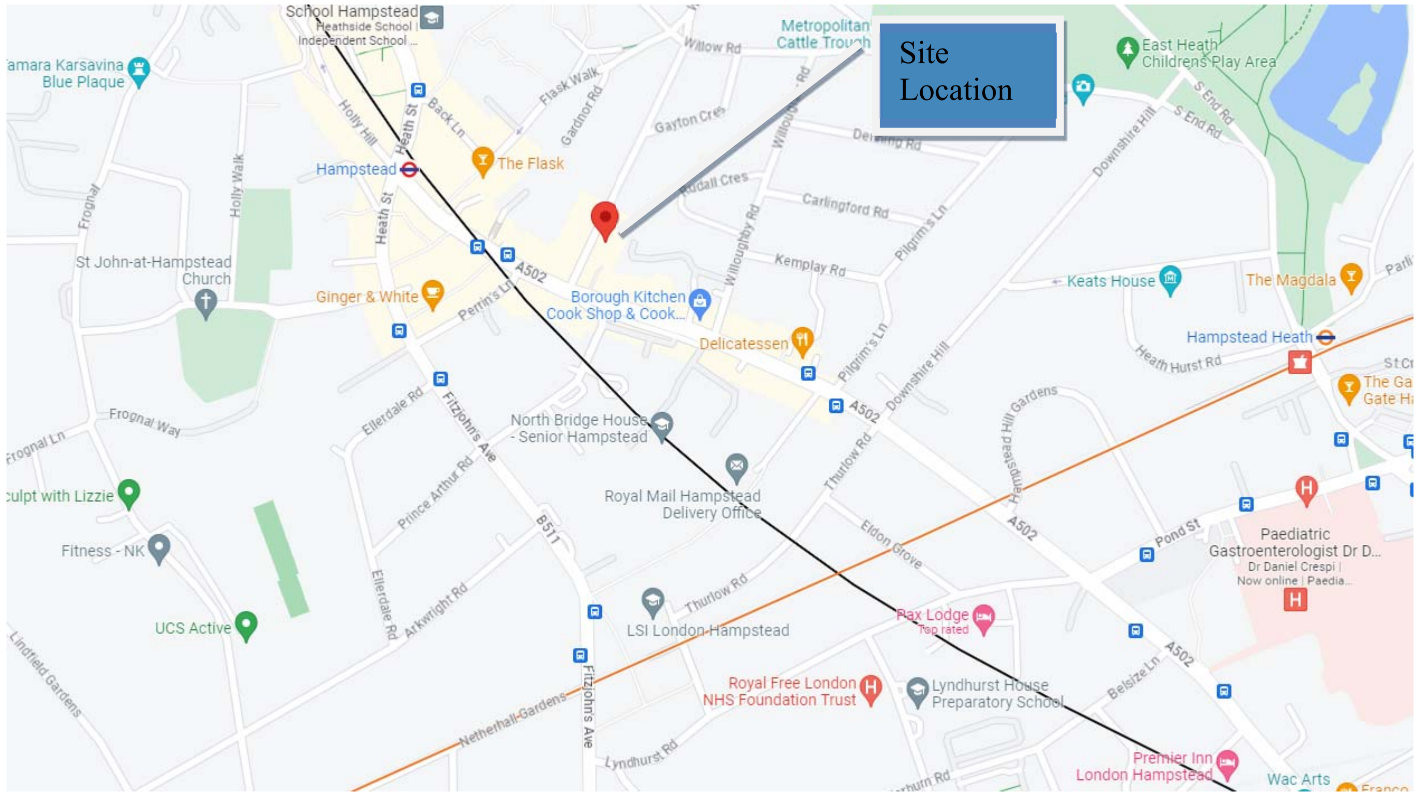
Monitoring of the surrounding building will be carried out during the works to assess possible movements and the findings will be reported to the adjoining surveyors periodically if necessary.

11.0 ~ Underground Structures & Existing services:

A desktop investigation has been carried out in order to establish the positions of any underground utilities, main drainage or infrastructure to ensure no impact on these. Investigations show the positions of services. However; the contractor should carry out works under the assumption that there may be additional unknown service locations, taking all necessary precautions. It is the contractor's responsibility to coordinate any alterations of these incoming services with the appropriate service suppliers. All appropriate measures to be taken for any required alterations.

A drainage survey should be carried out; in addition and all services i.e. gas and electricity are common to the site address only.

A preliminary search shows that the closest underground station to the development is Hampstead (Northern Line); the distance is around 150m away the proposed works, heading far towards different directions and will therefore not have any influence on these structures. It will therefore not be necessary to advise London underground asset protection department to check alignments and agreed works will not affect any existing tunnels or access shafts. No other underground structures, tunnels or vaults are expected in the vicinity of the proposed works.



12.0 ~ Drainage and Ground Water

Where possible, the existing drainage and sewage connections will be maintained. It will be necessary to carry out some works to the drainage locally within the curtilage of the development to allow for the new requirements on both surface and foul water drainage of the new layouts but these will not impact in any way on the neighbouring properties. A sustainable, environmentally friendly and responsible approach will be taken in the design of the surface water for the development. The new drainage layout will be design in accordance with best practice and the SUDS framework directive.

The proposed depth of the new basement is minimal compared to the existing, therefore it is possible that the invert levels will not fall below the existing drainage discharge inverts..

The proposed works will not materially alter the current state of the property, therefore, the expected volume of both foul and surface water is expected to remain at the same levels for a property of this size and so will not have a negative impact.

13.0 ~ Excavation of soil:

The soil will be excavated and removed using small excavators / conveyor belts up to ground level where it will be bagged on site and removed by hand to the Narrow-Bodied Vehicle waiting in the designated area as per the traffic management plan. Public rights of way will be maintained where necessary and the footpaths and street adjacent to the site will be cleaned each evening. The frequency of vehicle movements will be confirmed by the chosen contractor and approved by the council before works commence.

14.0 ~ Waterproofing and Drainage:

Concrete elements where practically possible will be design to BS8007 in order to minimise water ingress. In addition to this a drainage system (cavity type or other) is to be installed in accordance with BS8102 to provide a fully water proof envelope in the event of any water ingress through the concrete.

Sump pumps and drainage will be required to remove any water ingress through the concrete structure and these will need to be designed by a specialist drainage engineer.

15.0 ~ Considerate Contractors Scheme:

The Contractor will be required to demonstrate a positive attitude and commitment toward minimising environmental disturbance to local residents and will be required to be registered to the Considerate Contractors Scheme and adhere to the guidelines set out by the scheme and the Council's Control of Pollution & Noise from Demolition and Construction Sites Code of Practice.

The Underpinning Contractor is to be a registered member of the Association of Specialist Underpinning Contractors.

Impacts on the local amenity will be strictly controlled and managed by the Contractor.

Working hours will be restricted as required by the Local Authority.

The Contractor will be required to provide a Construction Management Plan prior to undertaking the works. The contents of this plan must be agreed with the Local Authority and complied with unless otherwise agreed with the Council.

A letter drop shall be carried out by the contractor to all surrounding properties affected by the development. The letter will advise residents of commencement and duration of the works along with contact details for the project.

Noise, dust and vibration will be controlled by employing Best Practicable Means (BPM) as prescribed in the following legislative documents and the approved code of practice BS 5228:

- The Control of Pollution Act 1972
- The Health & Safety at Work Act 1974
- The Environmental Protection Act 1990
- Construction (Design and Management) Regulations 1994
- The Clean Air Act 1993

General measures to be adopted by the Contractor to reduce noise, dust and vibration include:

- Erection of site hoarding to act as minor acoustic screen.
- Use of super silenced plant where feasible.
- Use of well-maintained modern plant.
- Site operatives to be well trained to ensure that noise minimisation and BPM's are implemented.
- Effective noise and vibration monitoring to be implemented.
- Reducing the need to adopt percussive and vibrating machinery.
- Bored piling techniques to be adopted to reduce piling induced vibration if required.
- Piles to be broken down using non-percussive techniques.
- Vehicles not to be left idling.
- Vehicles to be washed and cleaned effectively before leaving site.
- All loads entering and leaving the site to be covered.
- Measures to be adopted to prevent site runoff of water or mud.
- Water to be used as a dust suppressant.
- Cutting equipment to use water as suppressant or suitable local exhaust ventilation system.
- Skips to be covered.
- Drop heights to be minimised during deconstruction.
- Use of agreed wet cleaning methods or mechanical road sweepers on all roads around site.
- Set up and monitor effective site monitoring of dust emissions.
- Working hours to be restricted as required by the Local Authority.

16.0 ~ Dust:

The BRE 'Control of Dust from Construction and Demolition Activities' 2003, London Councils/GLA Best Practice Guide "Control of dust and emissions from construction and demolition" and Mayor of London's SPG on 'Control of Dust and Emissions' 2014, which gives best practice guidance on the control of dust and vehicle fumes will be implemented and followed where possible.

Stock piles will be minimised and covered/damped down. A water supply/stand pipe will be available on site for dust suppression purposes.

Vehicle movements: Any loads likely to produce dust shall be covered and a wheel wash facilities where necessary will be provided at the exit to the site to prevent tracking of material off site. The contractor will monitor on a daily bases the areas immediately surrounding the site to ensure dust and dirt is minimised.

All personnel working in a dusty area shall, where necessary, wear a dust mask deemed suitable by the HSE (Health and Safety Executive) General dust extraction will be used if required and local extraction used whilst wall chasing.

On completion of demolition and the heavy structural works, the contractor will get a window cleaning company to attend all overlooking neighbouring properties if required.

17.0 ~ Noise

Under the Control of Pollution Act 1974, Part 3, Environmental Protection Act of 1990 and the Noise Regulation Act noise is a recognized form of pollution and as such can be classified as a nuisance.

The Control of Noise (Codes of Practice for Construction and Open Site) Order 1984 gives legal approval for BS 5228, parts 1 & 2, 1984. This provides information on noise and noise control on Construction Sites. Every attempt shall be made to control noise at source.

On site where construction works is in progress everyone has a responsibility to see that activities are carried out in the quietest practicable manner. Where noisy activities are unavoidable the disturbance will be minimised/attenuated by choice of technique, timing, shielding or protection as appropriate.

Where any person is liable to be exposed to noise levels greater than 80 dB (A), he will be informed and provided with suitable ear protection. The most likely protection, in ascending order of attenuation is ear plugs, ear muffs and noise attenuation helmets. Noise will be kept to a minimum at all times and any further restrictions imposed under the terms of the construction contract will be strictly adhered to.

18.0 ~ Vibration

All works involving vibration will be minimized, where possible eradicated by design and the use of controlled mechanical equipment. The contractor will install a monitoring system to surrounding areas and monitor levels. After discussion with party wall surveyors and depending on the activities taking place on site through the job, the monitoring levels will be set accordingly. These will activate an alarm when the limits are reached which will notify site immediately. Works can then cease and be re-assessed.

Any operation involving vibration will have a HAVS risk assessment and procedures put into place to minimize the effects on personnel.

19.0 ~ Demolition, Recycling & Site Hoarding:

Contractors are to adopt the practices outlined within the ICE Demolition Protocol in order to mitigate the impact of the demolition works.

Where practical demolition material should be taken to recycling plants. Demolition work is to take place within the hoarded confines of the site. Materials such as stock bricks, re-usable timbers; steel beams etc are to be recycled where possible.

The Contractor will be required to provide a Site Waste Management Plan describing how site waste is to be minimised and dealt with. To minimise dust and dirt from demolition, it is recommended the following measures shall be implemented:

- Any debris or dust / dirt falling on the street and public highway will be cleared as it occurs by designated cleaners and washed down fully every night.
- Demolished materials are to be removed to a skip placed in front of the site which will be emptied regularly as required.

Building work which can be heard at the boundary of the site should not be carried out on Sundays or bank holidays. It is suggested the contractor allow for this when programming the works. Council working hours and conditions of the planning will strictly beadhered to by the contractor.

20.0 ~ Conclusion:

We do not anticipate any structural damage to adjoining structures or public road as a consequence of these works if carried out in the approved manner as described above by competent contractors. There should not be any impact on the integrity of the adjoining structures. Due to the soil conditions, firm clay, and a safe bearing pressure in excess of 125 kN/m^2; we do not anticipate any significant settlement following the excavation. There will be no slope stability issues as a result of the development. The proposed structure is a traditional underpin solution, this form of construction will provide adequate support to the adjoining gardens, public road and structures and we anticipate no adverse effects on the surrounding properties, considering that the proposed conditions will be essentially the same in terms of loads and structural scheme.

There are trees surrounding the development, however we do not foresee any impact from them to the structure.

Temporary works are deemed necessary for the proposed excavation as the structure has been developed to allow for all loading which may occur during both the construction phases and the permanent load cases.

In the permanent case a steel frame will be designed to create the openings in the rear wall at lower ground floor level but the contractor will need to design a suitable set of temporary works for the installation along with methods statements which the engineer should approve.

It is our opinion that the proposed works can be carried out within a safe and cost-effective manner by a suitable contractor.

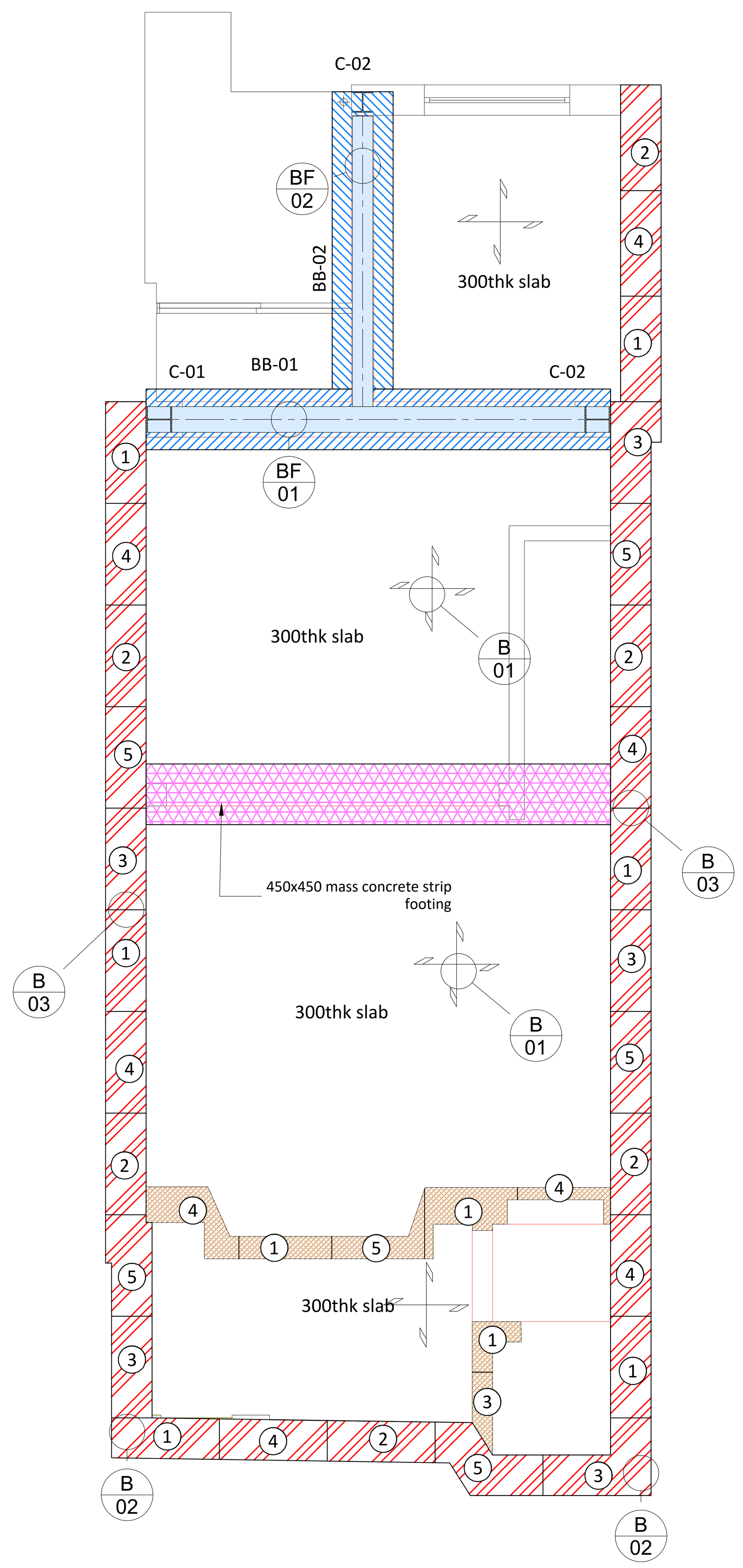
John Fitzpatrick *B (Struct) Eng, CEng, M.I.E.I., M.I.C.E*
Senior Chartered Structural Engineer
Elite Designers Ltd.

Appendix A: Drawings

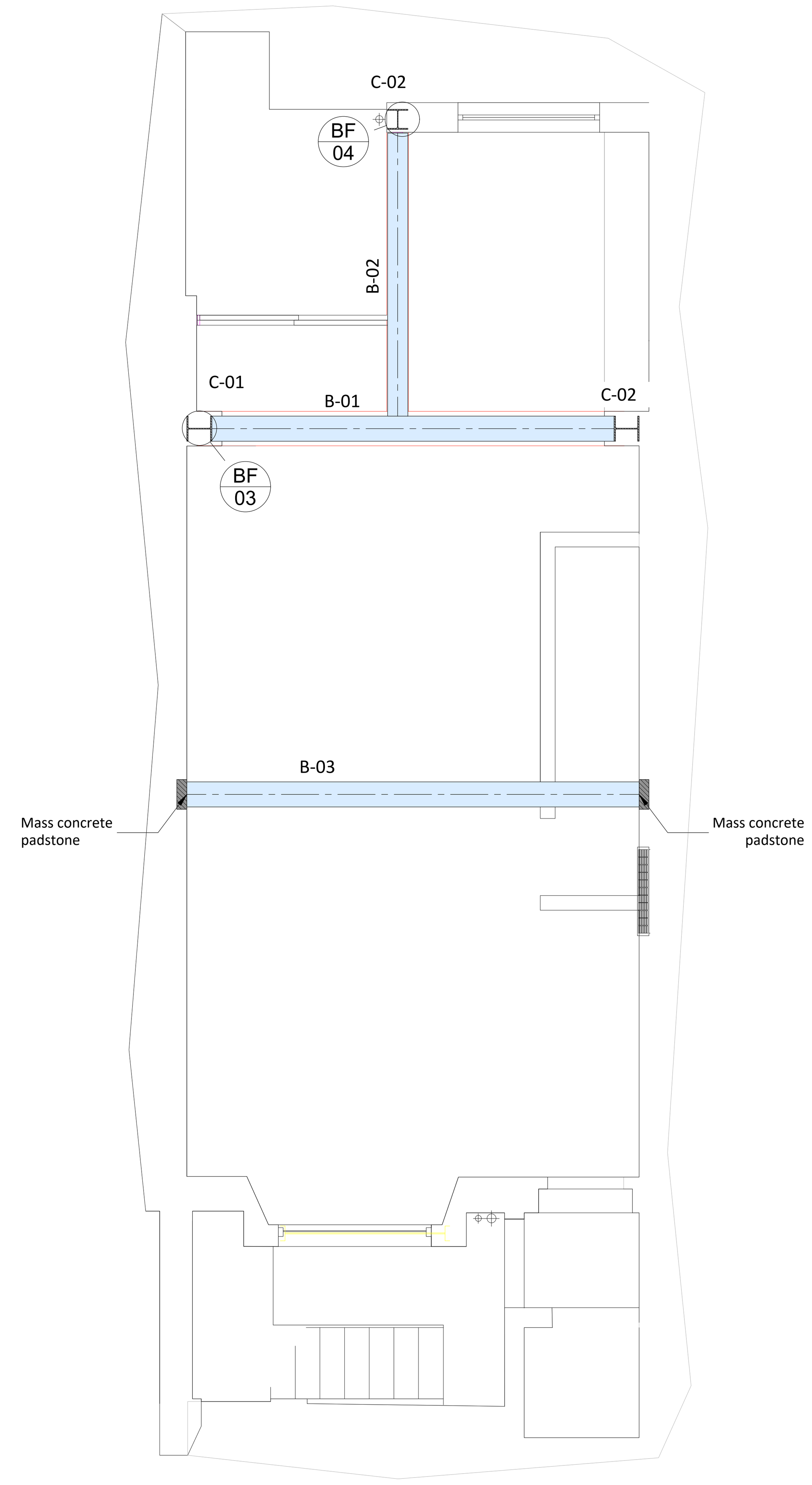
FOUNDATION LEGEND	
	UNDERPINNING TYPE 1
	UNDERPINNING TYPE 2

NOTES:

1. Pins to be constructed in maximum widths of 1m as described in the method statement.
2. When constructing a pin beside a previously cast pin, a sufficient period of time must have passed to allow for full curing of the original. Recommend seven days as concrete will have reached a minimum of 70% of its characteristic strength.
3. A maximum of 4 number pins may be under construction at any one time. This ensures the stability of the building is not compromised.
4. Upon completion of the pin and when it has fully cured it is to be carefully and full dry packed between its top and the overlying brickwork with a high strength expanding grout as per details.
5. Temporary works are the responsibility of the main contractor but sequencing information has been provided as a guide.
6. Individual pins are to be doweled together to ensure wall acts monolithically in its final state. Dowels can be driven into soil adjacent before pins are cast or can be chemically anchored after.



Proposed Foundation
Structure Above
SCALE 1:50



Proposed Lower Ground Floor
Structure Above
SCALE 1:50

Notes:

1. This drawing is to be read in conjunction with all relevant architects, engineers & specialist sub-contractors' drawings and the specification.
2. Any discrepancies between the site conditions and these drawings to be reported to Elite Designers. Dimensions must not be scaled and should be checked on site.
3. All dimensions are in millimetres, levels are in metres a.o.d. (above ordnance datum).
4. Foundations have been designed on a safe increase in bearing pressure of $150kN/m^2$ bearing 200mm into sandy gravel strata.
5. All new steelwork to be grade S355 and be supplied to site blast cleaned to Swedish standard SA2 1/2 painted with high build zinc phosphate alkyd primer to 80 microns after fabrication. Any mechanical damage to coating to be touched up on site in accordance with the specification.
6. All new steel beams to have a minimum of 100mm bearing either end.
7. Lengths of all members are to be verified on site by the Contractor.
8. Catnic type lintels to have a minimum bearing of 150mm either end.
9. All temporary works to ensure the structural stability of all elements in the temporary state during construction are to be the responsibility of the contractor.
10. Cover to reinforcement to be 25mm to all bars unless noted otherwise.
11. Checking the location of the existing services in relation to the elements of the new construction works is the responsibility of the principal contractor. Any discrepancy between the existing services and the new construction works should be reported to Elite Designers before the commencement of the works.
12. The principal contractor is to provide all necessary flexible sleeves or lintels where drainage pipes pass through walls or foundations.
13. The principal contractor is to ensure that at all times the excavations shall remain free from standing water.
14. Movement joints to be positioned @ 6m c/c in blockwork and @ 12m c/c in brickwork.
15. Movement joints to be 15mm hydrocell or similar joint filler with a 15x15mm two part polysulphate sealant.(colour and fire resistance of sealant to be advised by architect).
16. All load bearing blockwork below DPC to be $7N/mm^2$ dense concrete block.
17. Provide Ancon ST1 wall ties in accordance with DD140 @ 450 c/c vertically and @ 900 c/c horizontally, staggered u.n.o.
18. All bolts to be Grade 8.8 M20 unless noted otherwise.
19. All insulation details have been produced to comply with relevant regulations where possible. However, the responsibility for checking the compliance and execution of insulation details lies with the main contractor.
20. Floor joists spanning in excess of 2.5m should be strutted by one or more rows of solid or herringbone strutting as follows:

Joists <2.5m - None required
Joists 2.5 - 4.5m - One row required
Joists >4.5m - Two rows required

21. All beam end reactions shown are unfactored unless noted otherwise.

FOR PLANNING

Rev.	Date	Description	by	ch'd	app
A	29.09.23	ISSUED FOR PLANNING	NN	JGF	NJR

Project
56 Gayton Road
London
NW3 1TU

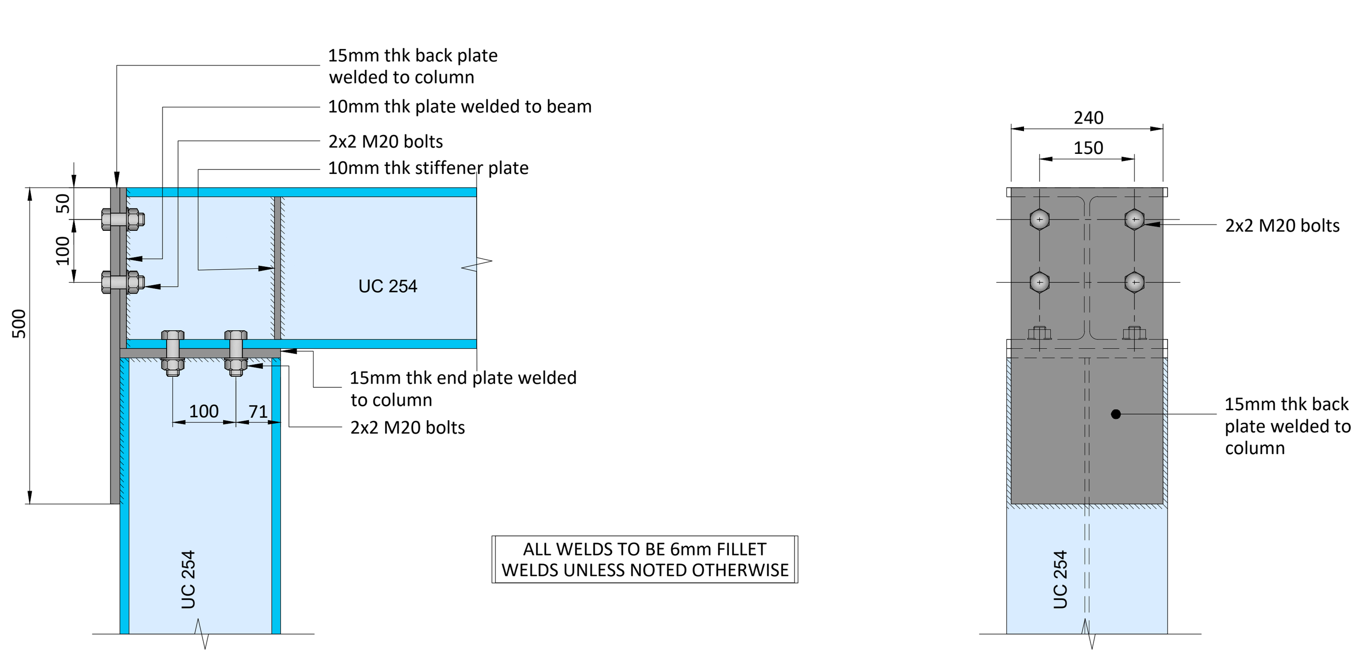
Title
PROPOSED PLANS

C/A
TBC c/o Fife Studio

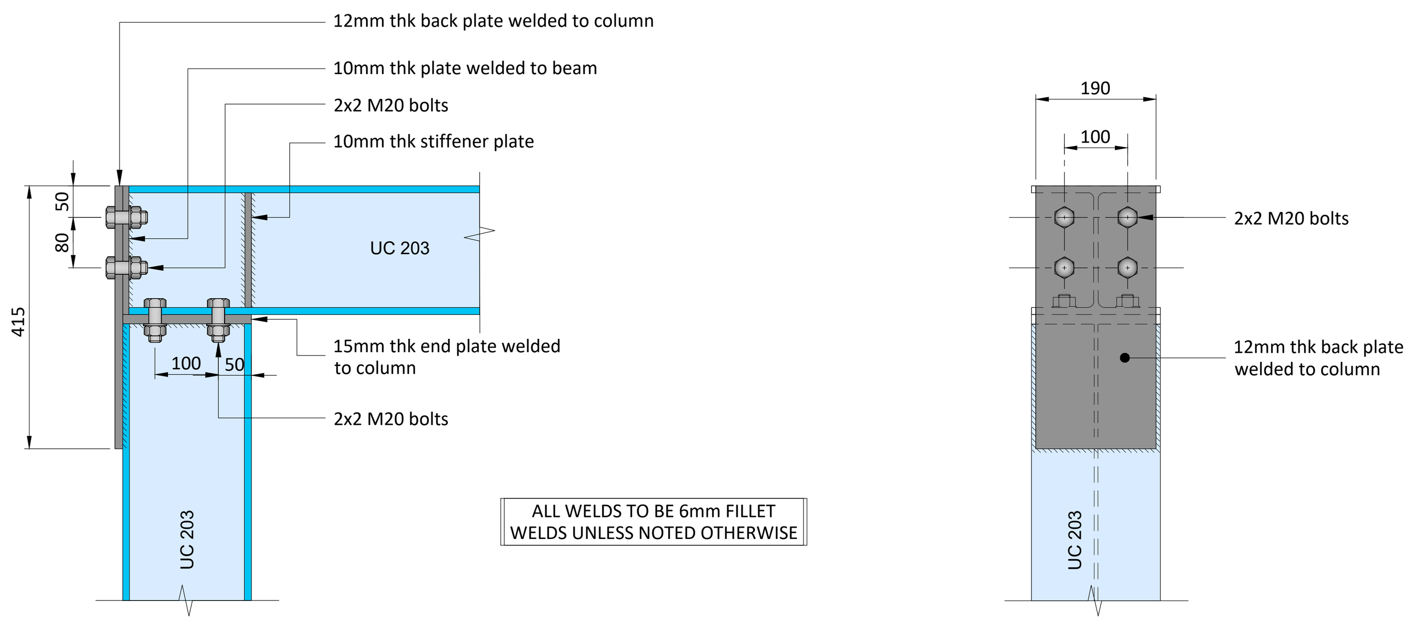
Elite Designers Structural Engineers
3 Princeton Court
53-55 Felsham Road
Putney
London SW15 1AZ
+44 (0)20 8785 4499
elitedesigners.co.uk

Scales (A1)		AS SHOWN
Drawn	OT	10/11/22
Ch'd(Eng.)	SB	10/11/22
Approved	SJM	10/11/22

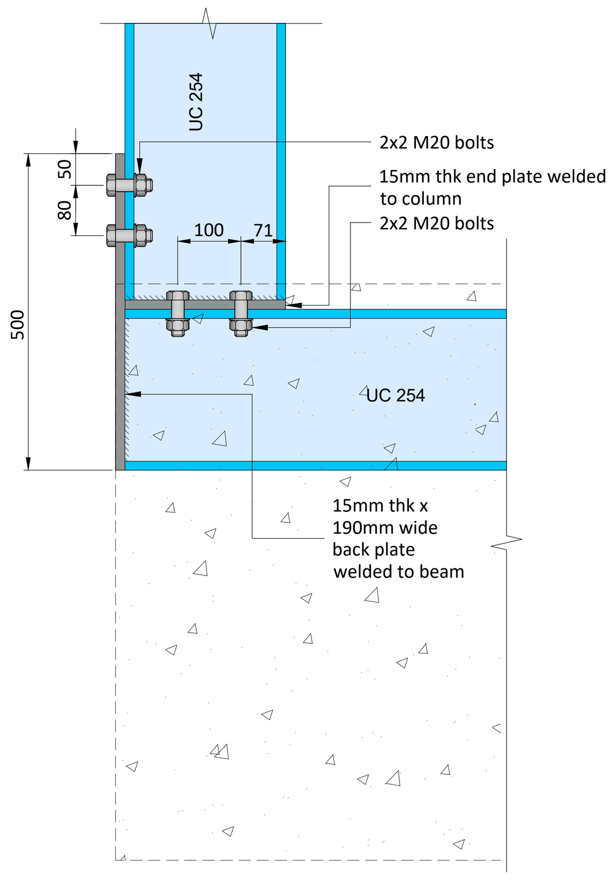
Drg. No. 2023-192- 01
Rev. A



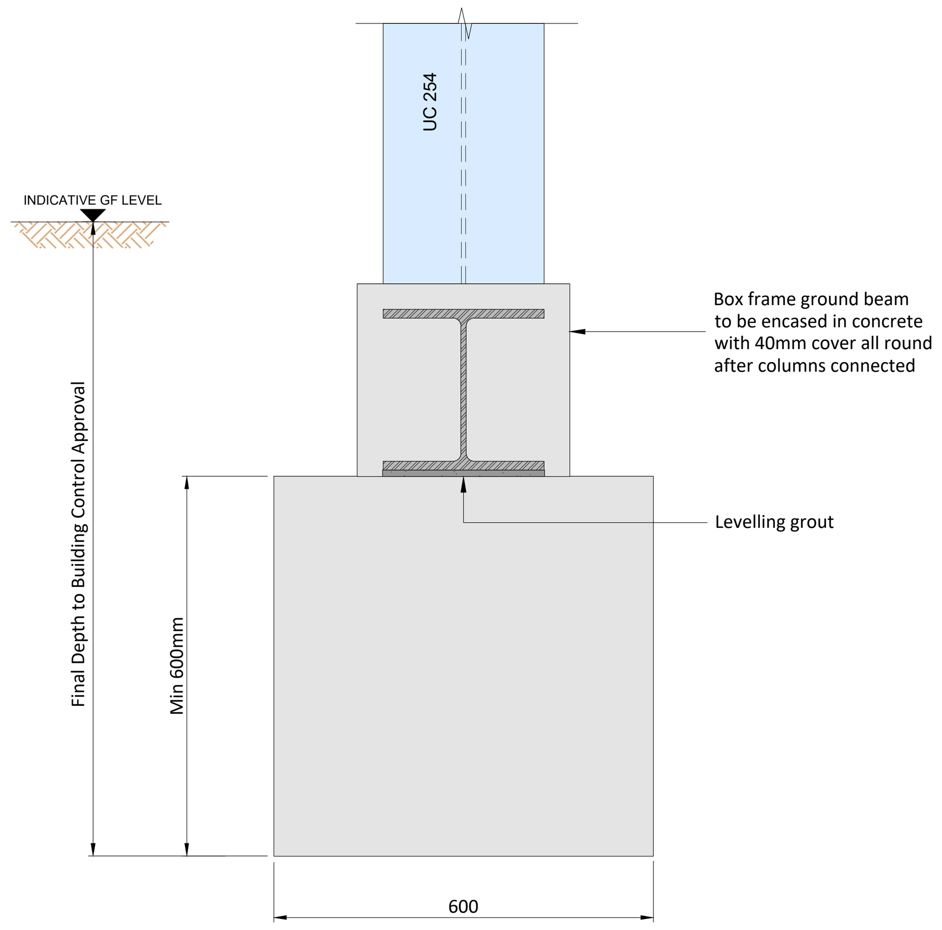
BF 03 BOX FRAME BEAM TO COLUMN DETAIL
Scale: 1:10



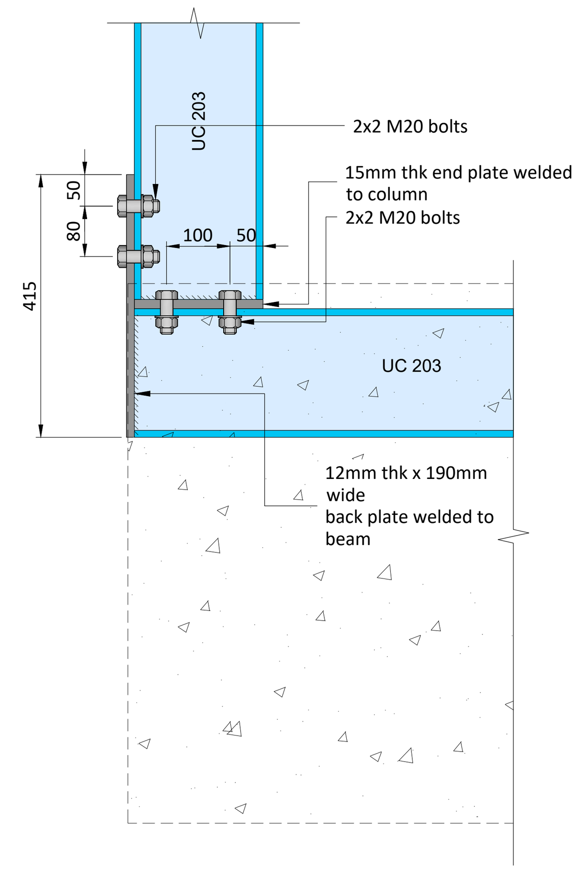
BF 04 BOX FRAME BEAM TO COLUMN DETAIL
Scale: 1:10



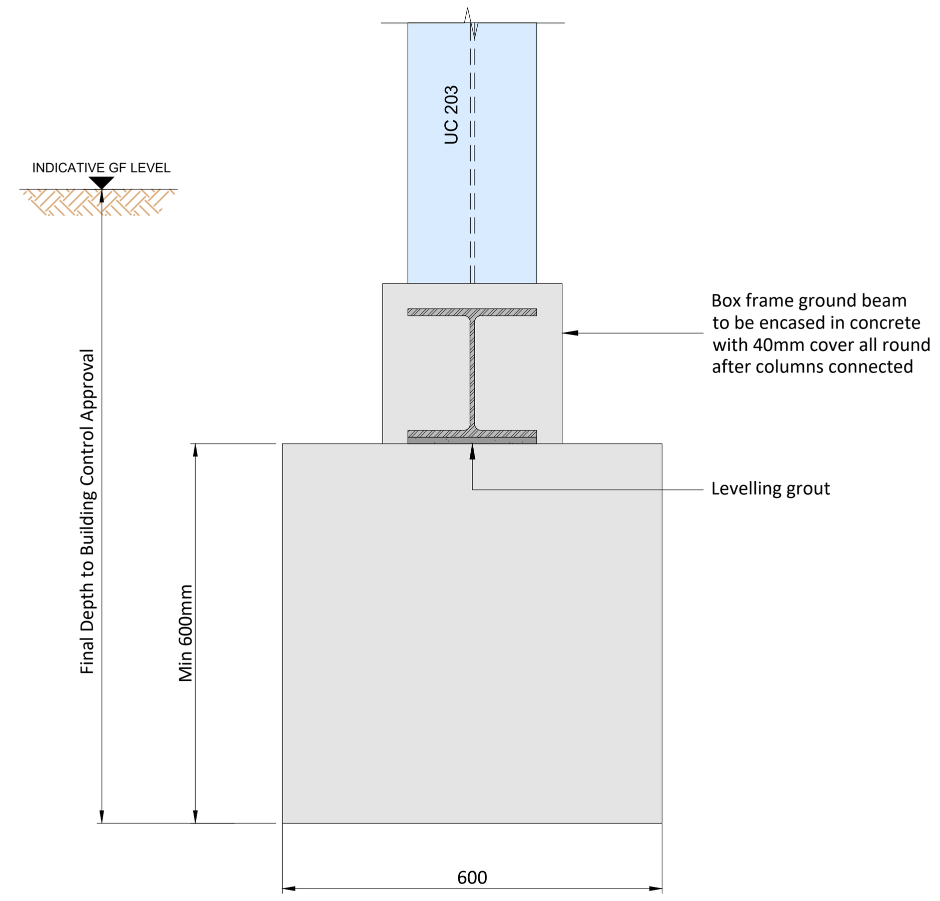
BF 01 BOX FRAME BASE BEAM DETAIL
Scale: 1:10



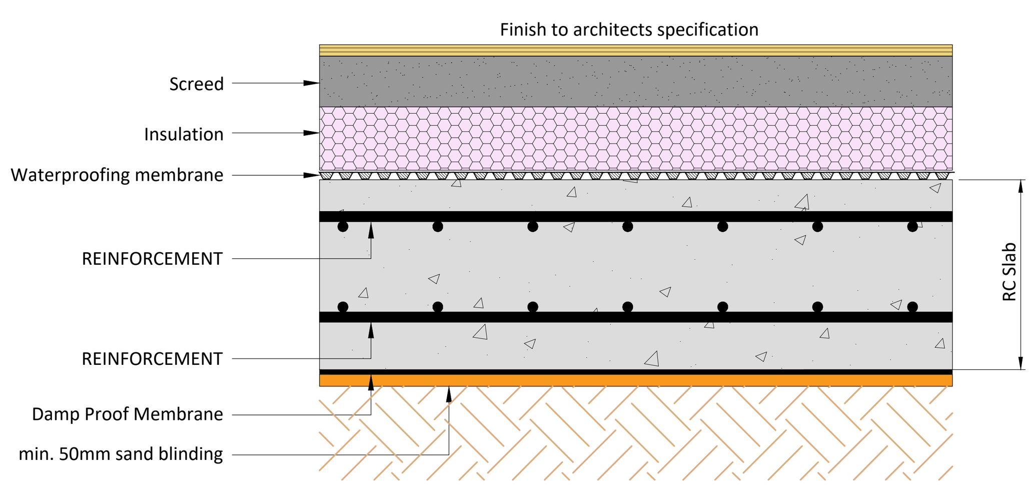
BF 01 BOX FRAME CONCRETE DETAIL
Scale: 1:10



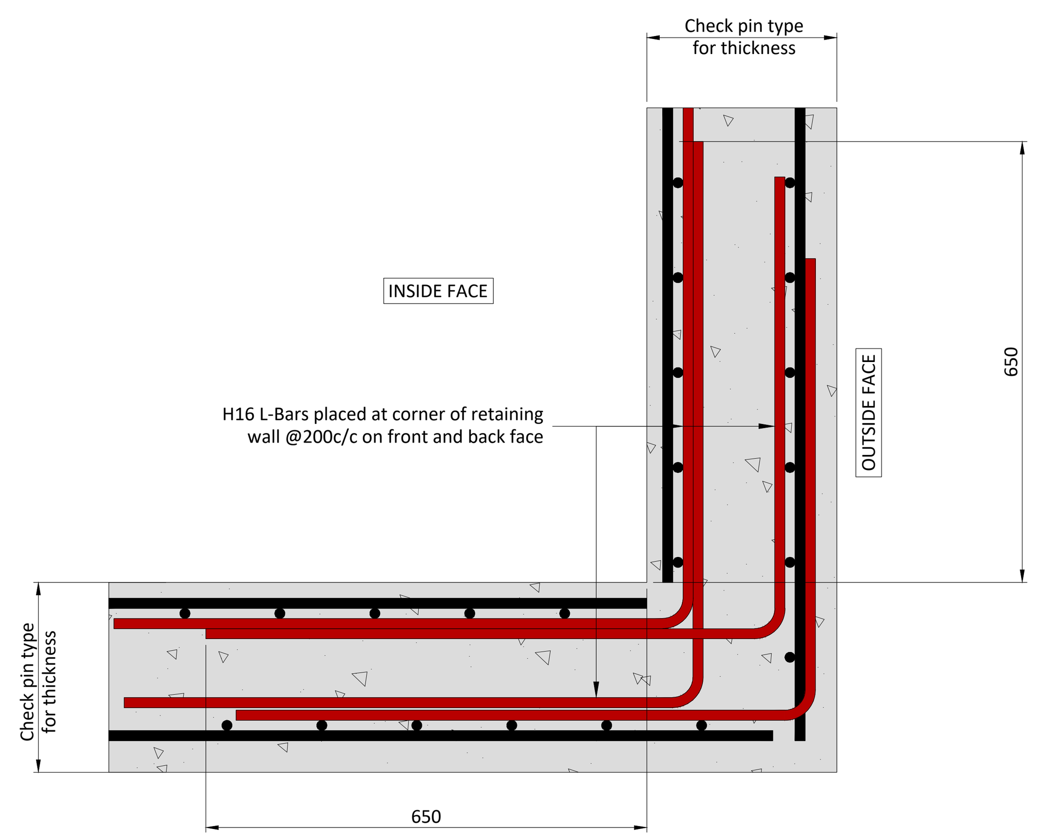
BF 02 BOX FRAME BASE BEAM DETAIL
Scale: 1:10



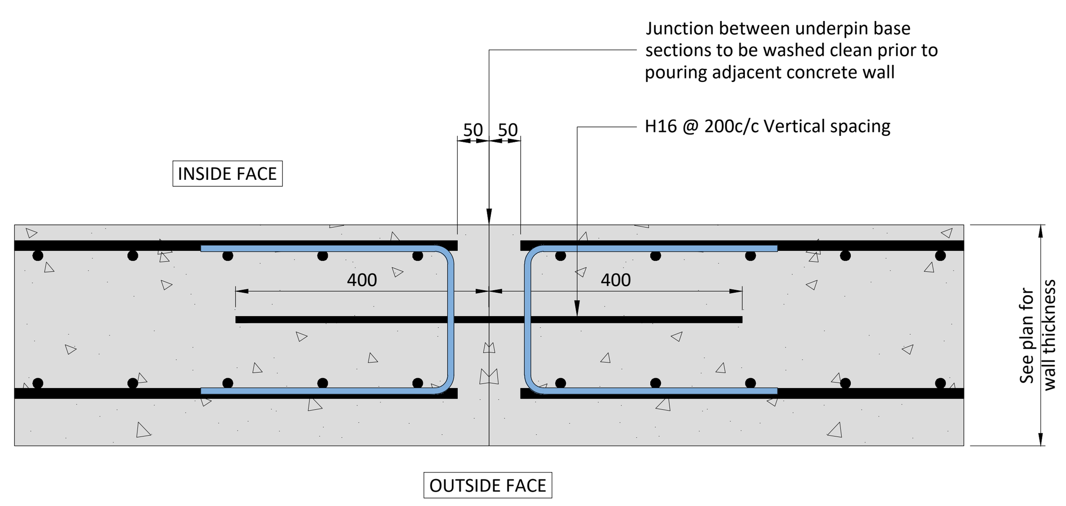
BF 02 BOX FRAME CONCRETE DETAIL
Scale: 1:10



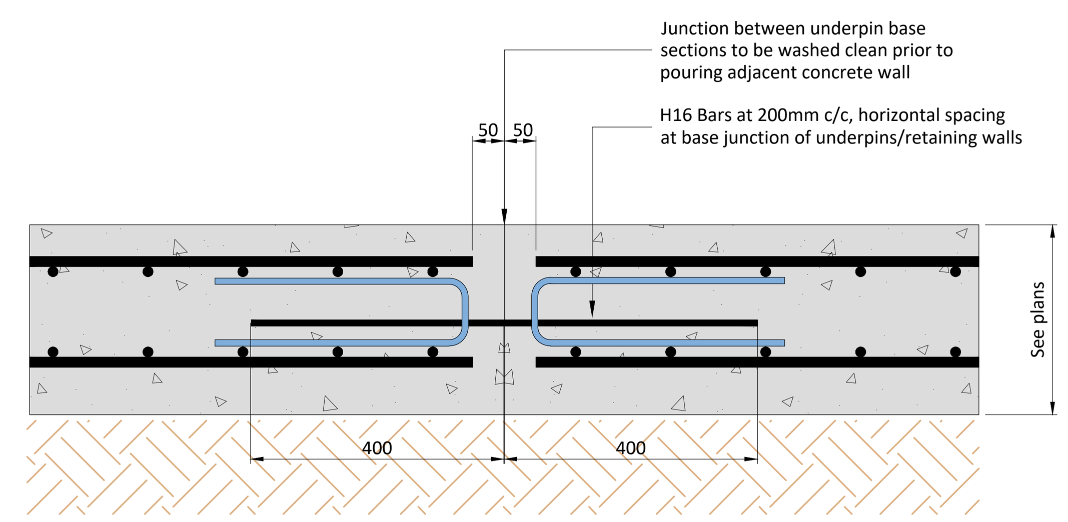
B 01 TYPICAL BASEMENT FLOOR SLAB DETAIL
Scale: 1:10



B 02 TYPICAL UNDERPIN WALL CORNER DETAIL
Scale: 1:10



B 03 TYPICAL RETAINING WALL JUNCTION DETAIL
Scale: 1:10



B 04 TYPICAL UNDERPIN BASE JUNCTION DETAIL
Scale: 1:10

Notes:

1. This drawing is to be read in conjunction with all relevant architects, engineers & specialist sub-contractors' drawings and the specification.
2. Any discrepancies between the site conditions and these drawings to be reported to Elite Designers. Dimensions must not be scaled and should be checked on site.
3. All dimensions are in millimetres, levels are in metres a.o.d. (above ordnance datum).
4. Foundations have been designed on a safe increase in bearing pressure of 150kN/m² bearing 200mm into sandy gravel strata.
5. All new steelwork to be grade S355 and be supplied to site blast cleaned to Swedish standard SA2½ painted with high build zinc phosphate alkyd primer to 80 microns after fabrication. Any mechanical damage to coating to be touched up on site in accordance with the specification.
6. All new steel beams to have a minimum of 100mm bearing either end.
7. Lengths of all members are to be verified on site by the Contractor.
8. Catnic type lintels to have a minimum bearing of 150mm either end.
9. All temporary works to ensure the structural stability of all elements in the temporary state during construction are to be the responsibility of the contractor.
10. Cover to reinforcement to be 25mm to all bars unless noted otherwise.
11. Checking the location of the existing services in relation to the elements of the new construction works is the responsibility of the principal contractor. Any discrepancy between the existing services and the new construction works should be reported to Elite Designers before the commencement of the works.
12. The principal contractor is to provide all necessary flexible sleeves or lintels where drainage pipes pass through walls or foundations.
13. The principal contractor is to ensure that at all times the excavations shall remain free from standing water.
14. Movement joints to be positioned @ 6m c/c in blockwork and @ 12m c/c in brickwork.
15. Movement joints to be 15mm hydrocell or similar joint filler with a 15x15mm two part polysulphate sealant.(colour and fire resistance of sealant to be advised by architect).
16. All load bearing blockwork below DPC to be 7N/mm² dense concrete block.
17. Provide Ancon ST1 wall ties in accordance with DD140 @ 450 c/c vertically and @ 900 c/c horizontally, staggered u.n.o.
18. All bolts to be Grade 8.8 M20 unless noted otherwise.
19. All insulation details have been produced to comply with relevant regulations where possible. However, the responsibility for checking the compliance and execution of insulation details lies with the main contractor.
20. Floor joists spanning in excess of 2.5m should be strutted by one or more rows of solid or herringbone strutting as follows:

Joists <2.5m - None required
Joists 2.5 - 4.5m - One row required
Joists >4.5m - Two rows required

21. All beam end reactions shown are unfactored unless noted otherwise.

FOR PLANNING

Rev.	Date	Description	by	ch'd	app
A	29.09.23	ISSUED FOR PLANNING	NN	JGF	NJR

Project: 56 Gayton Road, London, NW3 1TU

Title: PROPOSED DETAILS

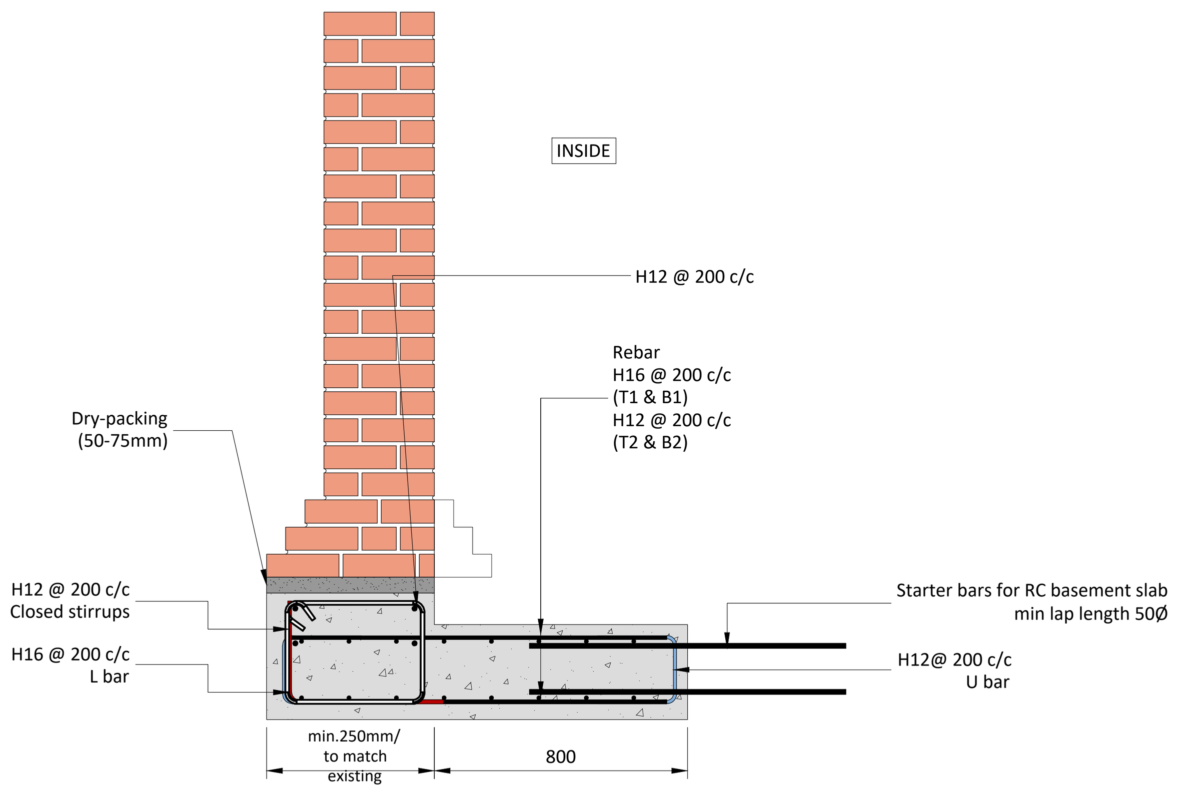
C/A: **TBC c/o Fife Studio**

Elite Designers Structural Engineers
3 Princeton Court
53-55 Felsham Road
Putney
London SW15 1AZ
+44 (0)20 8785 4499
elitedesigners.co.uk

Scales (A1)		AS SHOWN
Drawn	NN	29.09.23
Ch'd(Eng.)	JGF	29.09.23
Approved	NJR	29.09.23

Drg. No. 2023-192- 02

Rev. A



UP 01 **TYPE 1 UNDERPIN**
Scale: 1:20

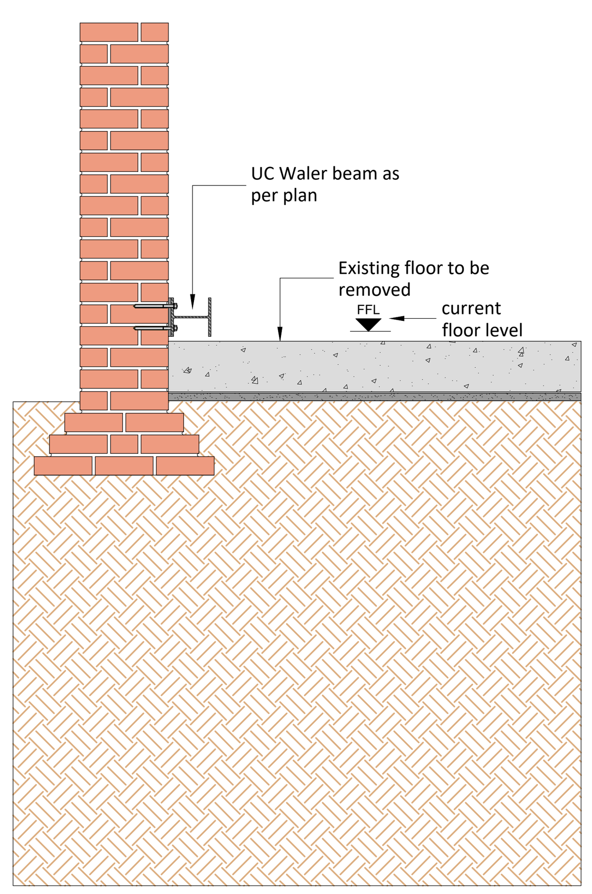
Method 1:
Used in area's where vertical load from existing structure above is present.
As long as each pin is no more that 1000mm wide and carries loading from above then the pin is stable in all temporary conditions without the presence of the basement floor slab.
The existing foundation at ground level will have adequate capacity to span the 1000mm of the excavation necessary for the installation of the pin.

Sequence for Pin installation

- Pins marked 1 can be installed first to a maximum width of 1000mm, but to their full required depth using temporary supports as shown
- Adjacent pins marked 2 can be installed after completion of the installation of number 1 pin but only after the first pins have been allowed to fully cure
- Pins marked 3 can be installed
- Pins marked 4 can be installed
- Finally pins marked 5 can be installed

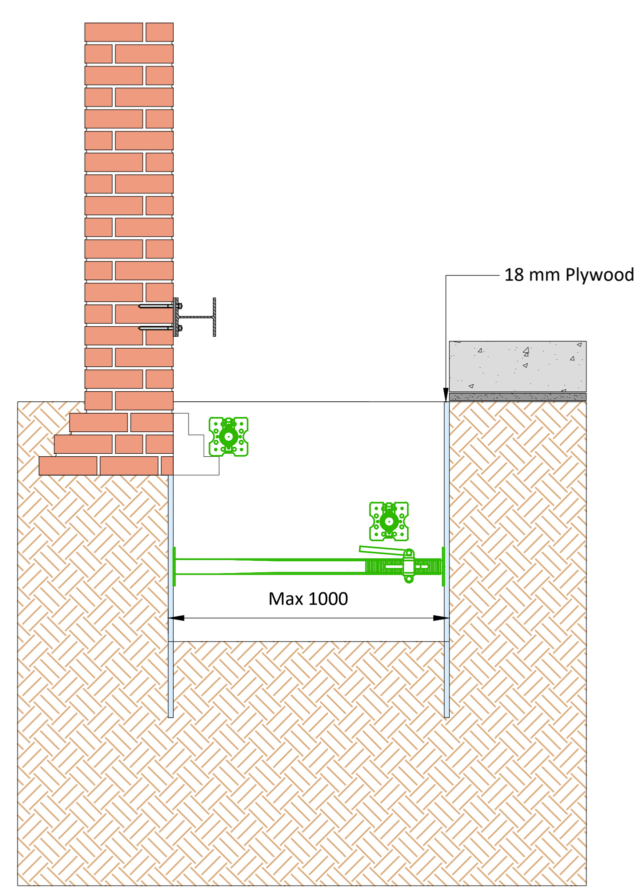
Pin installation notes.

- The sequencing shows a typical underpin profile. Check plans for sizes



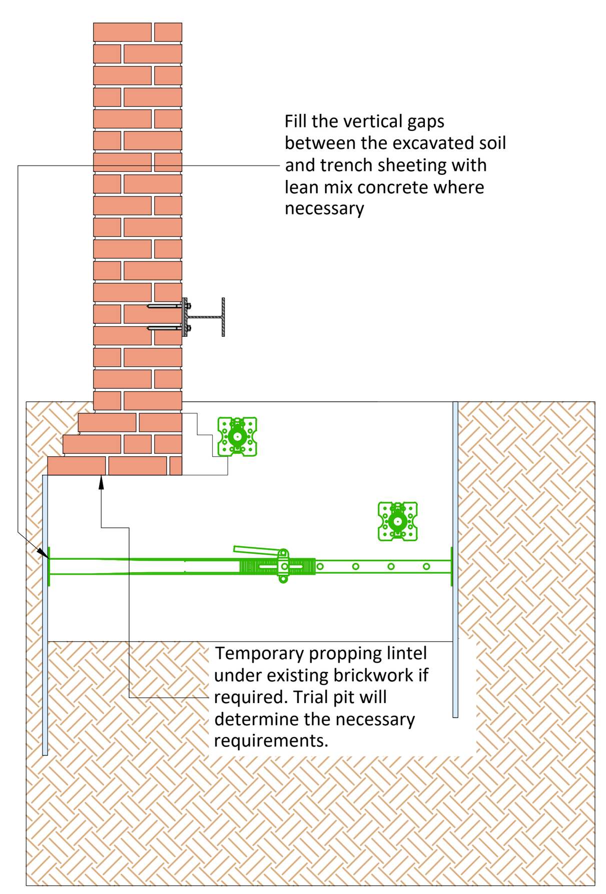
Step 1

Remove existing floor at required locations.



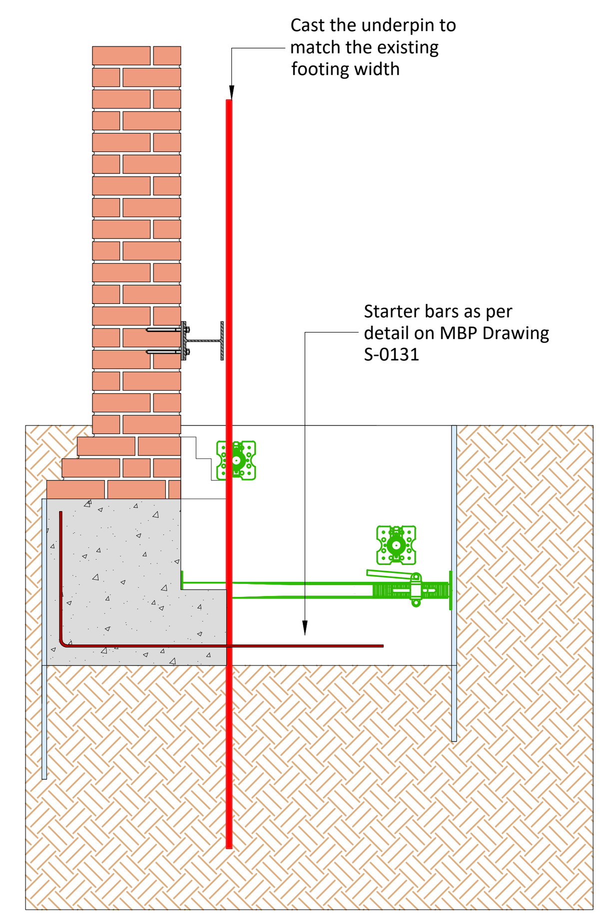
Step 2

Excavate working space to bottom of the underpin.
Temporary support the excavation as per the detail with 3no acrows (max safe working load 17kN)



Step 3

Excavate working space under existing foundation.
Existing foundation at ground level will span over the excavation.
Temporary support the excavation as per the detail.



Step 4

Cast reinforced concrete underpin as per MBP drawing S-0131. Once concrete has been cured, next pin can be excavated.

TYPICAL SEQUENCING FOR CONCRETE UNDERPIN INSTALLATION

Notes:

1. This drawing is to be read in conjunction with all relevant architects, engineers & specialist sub-contractors' drawings and the specification.
2. Any discrepancies between the site conditions and these drawings to be reported to Elite Designers. Dimensions must not be scaled and should be checked on site.
3. All dimensions are in millimetres, levels are in metres a.o.d. (above ordnance datum).
4. Foundations have been designed on a safe increase in bearing pressure of 150kN/m² bearing 200mm into sandy gravel strata.
5. All new steelwork to be grade S355 and be supplied to site blast cleaned to Swedish standard SA2 1/2 painted with high build zinc phosphate alkyd primer to 80 microns after fabrication. Any mechanical damage to coating to be touched up on site in accordance with the specification.
6. All new steel beams to have a minimum of 100mm bearing either end.
7. Lengths of all members are to be verified on site by the Contractor.
8. Catnic type lintels to have a minimum bearing of 150mm either end.
9. All temporary works to ensure the structural stability of all elements in the temporary state during construction are to be the responsibility of the contractor.
10. Cover to reinforcement to be 25mm to all bars unless noted otherwise.
11. Checking the location of the existing services in relation to the elements of the new construction works is the responsibility of the principal contractor. Any discrepancy between the existing services and the new construction works should be reported to Elite Designers before the commencement of the works.
12. The principal contractor is to provide all necessary flexible sleeves or lintels where drainage pipes pass through walls or foundations.
13. The principal contractor is to ensure that at all times the excavations shall remain free from standing water.
14. Movement joints to be positioned @ 6m c/c in blockwork and @ 12m c/c in brickwork.
15. Movement joints to be 15mm hydrocell or similar joint filler with a 15x15mm two part polysulphate sealant.(colour and fire resistance of sealant to be advised by architect).
16. All load bearing blockwork below DPC to be 7N/mm² dense concrete block.
17. Provide Ancon ST1 wall ties in accordance with DD140 @ 450 c/c vertically and @ 900 c/c horizontally, staggered u.n.o.
18. All bolts to be Grade 8.8 M20 unless noted otherwise.
19. All insulation details have been produced to comply with relevant regulations where possible. However, the responsibility for checking the compliance and execution of insulation details lies with the main contractor.
20. Floor joists spanning in excess of 2.5m should be strutted by one or more rows of solid or herringbone strutting as follows:

Joists <2.5m - None required
Joists 2.5 - 4.5m - One row required
Joists >4.5m - Two rows required

21. All beam end reactions shown are unfactored unless noted otherwise.

FOR PLANNING

Rev.	Date	Description	by	ch'd	app
A	29.09.23	ISSUED FOR PLANNING	NN	JGF	NJR

Project
56 Gayton Road
London
NW3 1TU

Title
PROPOSED SEQUENCE AND RC UNDERPIN

C/A
TBC c/o Fife Studio

Elite Designers Structural Engineers
3 Princeton Court
53-55 Felsham Road
Putney
London SW15 1AZ
+44 (0)20 8785 4499
elitedesigners.co.uk

Scales (A1)	AS SHOWN	Drg. No.	Rev.
Drawn NN	29.09.23	2023-192- 03	A
Ch'd(Eng.) JGF	29.09.23		
Approved NJR	29.09.23		

Appendix B: Preliminary Calculations

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.9.22

Retaining wall details

Stem type	Cantilever
Stem height	h_{stem} = **300** mm
Stem thickness	t_{stem} = **500** mm
Angle to rear face of stem	α = **90** deg
Stem density	γ_{stem} = **25** kN/m^3
Toe length	l_{toe} = **800** mm
Base thickness	t_{base} = **300** mm
Base density	γ_{base} = **25** kN/m^3
Height of retained soil	h_{ret} = **300** mm
Angle of soil surface	β = **0** deg
Depth of cover	d_{cover} = **0** mm
Height of water	h_{water} = **0** mm
Water density	γ_w = **9.8** kN/m^3

Retained soil properties

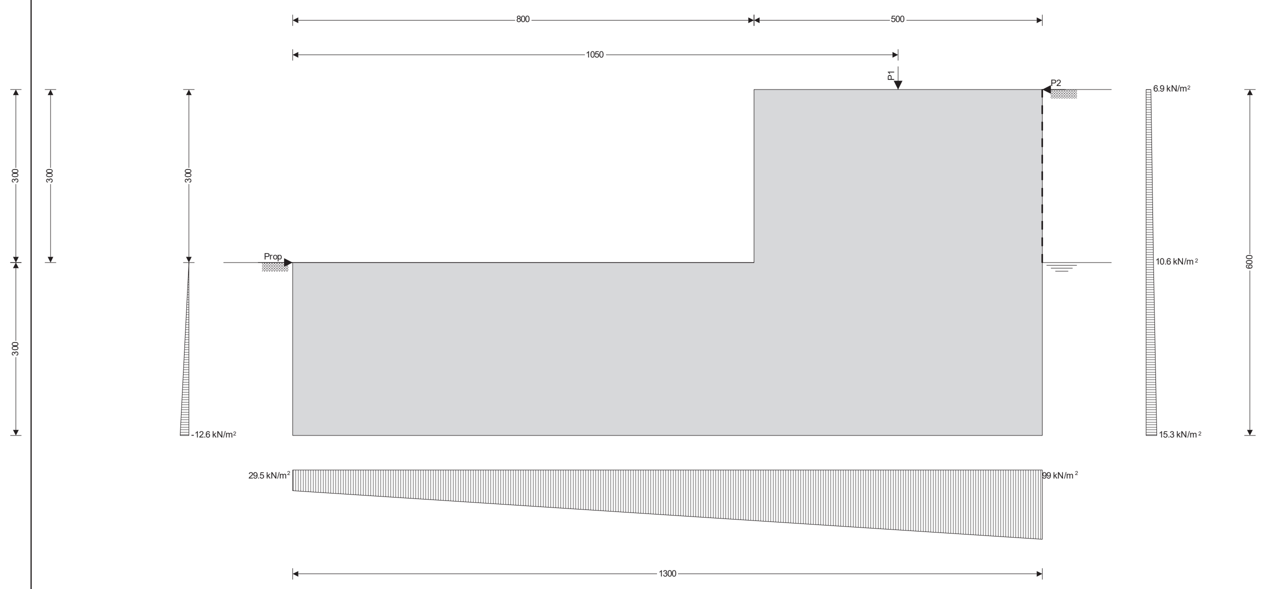
Soil type	Firm clay
Moist density	γ_{mr} = **18** kN/m^3
Saturated density	γ_{sr} = **18** kN/m^3
Characteristic effective shear resistance angle	$\phi'_{r.k}$ = **18** deg
Characteristic wall friction angle	$\delta_{r.k}$ = **0** deg

Base soil properties

Soil type	Firm clay
Soil density	γ_b = **18** kN/m^3
Characteristic effective shear resistance angle	$\phi'_{b.k}$ = **18** deg
Characteristic wall friction angle	$\delta_{b.k}$ = **9** deg
Characteristic base friction angle	$\delta_{bb.k}$ = **18** deg
Presumed bearing capacity	$P_{bearing}$ = **125** kN/m^2

Loading details

Variable surcharge load	Surcharge$_Q$ = **10** kN/m^2
Vertical line load at 1050 mm	P_{G1} = **70** kN/m
Horizontal line load at 300 mm	P_{G2} = **24** kN/m
	P_{Q2} = **6** kN/m



General arrangement - sketch pressures relate to bearing check

Calculate retaining wall geometry

Base length	$l_{base} = l_{toe} + t_{stem}$ = **1300** mm
Saturated soil height	$h_{sat} = h_{water} + d_{cover}$ = **0** mm
Moist soil height	$h_{moist} = h_{ret} - h_{water}$ = **300** mm
Length of surcharge load	$l_{sur} = l_{heel}$ = **0** mm
- Distance to vertical component	$x_{sur\_v} = l_{base} - l_{heel} / 2$ = **1300** mm
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret}$ = **600** mm
- Distance to horizontal component	$x_{sur\_h} = h_{eff} / 2$ = **300** mm
Area of wall stem	$A_{stem} = h_{stem} \times t_{stem}$ = **0.15** m^2
- Distance to vertical component	$x_{stem} = l_{toe} + t_{stem} / 2$ = **1050** mm
Area of wall base	$A_{base} = l_{base} \times t_{base}$ = **0.39** m^2
- Distance to vertical component	$x_{base} = l_{base} / 2$ = **650** mm

Using Coulomb theory

At rest pressure coefficient	$K_0 = 1 - \sin(\phi'_{r.k})$ = **0.691**
Passive pressure coefficient	$K_P = \sin(90 - \phi'_{b.k})^2 / (\sin(90 + \delta_{b.k}) \times [1 - \sqrt{[\sin(\phi'_{b.k} + \delta_{b.k}) \times \sin(\phi'_{b.k}) / (\sin(90 + \delta_{b.k}))]}]^2)$ = **2.359**

Bearing pressure check

Vertical forces on wall

Wall stem	$F_{stem} = A_{stem} \times \gamma_{stem}$ = **3.8** kN/m
Wall base	$F_{base} = A_{base} \times \gamma_{base}$ = **9.8** kN/m
Line loads	$F_{P\_v} = P_{G1}$ = **70** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{P\_v} + F_{water\_v}$ = **83.5** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_0 \times \text{Surcharge}_Q \times h_{eff}$ = **4.1** kN/m
Line loads	$F_{P\_h} = P_{G2} + P_{Q2}$ = **30** kN/m

Elite Designers Ltd 3 Pricenton Court 53-55 Felsham Road	Project 56 Gayton Road				Job no. 2023-192	
	Calcs for Underpin type 1				Start page no./Revision 3	
	Calcs by NN	Calcs date 29/09/2023	Checked by JGF	Checked date 29/09/2023	Approved by NJR	Approved date 29/09/2023

Saturated retained soil — $F_{sat\_h} = K_0 \times (\gamma_{sr} - \gamma_w) \times (h_{sat} + h_{base})^2 / 2 = \mathbf{0.3}$ kN/m

Water — $F_{water\_h} = \gamma_w \times (h_{water} + d_{cover} + h_{base})^2 / 2 = \mathbf{0.4}$ kN/m

Moist retained soil — $F_{moist\_h} = K_0 \times \gamma_{mr} \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base})) = \mathbf{1.7}$ kN/m

Base soil — $F_{pass\_h} = -K_P \times \cos(\delta_{b.k}) \times \gamma_b \times (d_{cover} + h_{base})^2 / 2 = \mathbf{-1.9}$ kN/m

Total — $F_{total\_h} = F_{sur\_h} + F_{P\_h} + F_{sat\_h} + F_{water\_h} + F_{moist\_h} + F_{pass\_h} = \mathbf{34.6}$ kN/m

Moments on wall

Wall stem — $M_{stem} = F_{stem} \times x_{stem} = \mathbf{3.9}$ kNm/m

Wall base — $M_{base} = F_{base} \times x_{base} = \mathbf{6.3}$ kNm/m

Surcharge load — $M_{sur} = -F_{sur\_h} \times x_{sur\_h} = \mathbf{-1.2}$ kNm/m

Line loads — $M_P = P_{G1} \times p_1 - ((P_{G2} + P_{Q2}) \times (p_2 + t_{base})) = \mathbf{55.5}$ kNm/m

Saturated retained soil — $M_{sat} = -F_{sat\_h} \times x_{sat\_h} = \mathbf{0}$ kNm/m

Water — $M_{water} = -F_{water\_h} \times x_{water\_h} = \mathbf{0}$ kNm/m

Moist retained soil — $M_{moist} = -F_{moist\_h} \times x_{moist\_h} = \mathbf{-0.4}$ kNm/m

Total — $M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{sat} + M_{water} + M_{moist} = \mathbf{64.1}$ kNm/m

Check bearing pressure

Propping force — $F_{prop\_base} = F_{total\_h} = \mathbf{34.6}$ kN/m

Distance to reaction — $\bar{x} = M_{total} / F_{total\_v} = \mathbf{767}$ mm

Eccentricity of reaction — $e = \bar{x} - l_{base} / 2 = \mathbf{117}$ mm

Loaded length of base — $l_{load} = l_{base} = \mathbf{1300}$ mm

Bearing pressure at toe — $q_{toe} = F_{total\_v} / l_{base} \times (1 - 6 \times e / l_{base}) = \mathbf{29.5}$ kN/m^2

Bearing pressure at heel — $q_{heel} = F_{total\_v} / l_{base} \times (1 + 6 \times e / l_{base}) = \mathbf{99}$ kN/m^2

Factor of safety — $FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) = \mathbf{1.263}$

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 2.9.22

Concrete details - Table 3.1 - Strength and deformation characteristics for concrete

Concrete strength class — C30/37

Characteristic compressive cylinder strength — $f_{ck} = \mathbf{30}$ N/mm^2

Characteristic compressive cube strength — $f_{ck,cube} = \mathbf{37}$ N/mm^2

Mean value of compressive cylinder strength — $f_{cm} = f_{ck} + 8$ N/mm^2 $= \mathbf{38}$ N/mm^2

Mean value of axial tensile strength — $f_{ctm} = 0.3$ N/mm$^2 \times (f_{ck} / 1$ N/mm$^2)^{2/3} = \mathbf{2.9}$ N/mm^2

5% fractile of axial tensile strength — $f_{ctk,0.05} = 0.7 \times f_{ctm} = \mathbf{2.0}$ N/mm^2

Secant modulus of elasticity of concrete — $E_{cm} = 22$ kN/mm$^2 \times (f_{cm} / 10$ N/mm$^2)^{0.3} = \mathbf{32837}$ N/mm^2

Partial factor for concrete - Table 2.1N — $\gamma_C = \mathbf{1.50}$

Compressive strength coefficient - cl.3.1.6(1) — $\alpha_{cc} = \mathbf{0.85}$

Design compressive concrete strength - exp.3.15 — $f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_C = \mathbf{17.0}$ N/mm^2

Maximum aggregate size — $h_{agg} = \mathbf{20}$ mm

Ultimate strain - Table 3.1 — $\varepsilon_{cu2} = \mathbf{0.0035}$

Shortening strain - Table 3.1 — $\varepsilon_{cu3} = \mathbf{0.0035}$

Effective compression zone height factor — $\lambda = \mathbf{0.80}$

Effective strength factor — $\eta = \mathbf{1.00}$

Elite Designers Ltd 3 Pricenton Court 53-55 Felsham Road	Project 56 Gayton Road				Job no. 2023-192	
	Calcs for Underpin type 1				Start page no./Revision 4	
	Calcs by NN	Calcs date 29/09/2023	Checked by JGF	Checked date 29/09/2023	Approved by NJR	Approved date 29/09/2023

Bending coefficient k_1 — $K_1 = \mathbf{0.40}$

Bending coefficient k_2 — $K_2 = 1.00 \times (0.6 + 0.0014/\varepsilon_{cu2}) = \mathbf{1.00}$

Bending coefficient k_3 — $K_3 = \mathbf{0.40}$

Bending coefficient k_4 — $K_4 = 1.00 \times (0.6 + 0.0014/\varepsilon_{cu2}) = \mathbf{1.00}$

Reinforcement details

Characteristic yield strength of reinforcement — $f_{yk} = \mathbf{500}$ N/mm^2

Modulus of elasticity of reinforcement — $E_s = \mathbf{200000}$ N/mm^2

Partial factor for reinforcing steel - Table 2.1N — $\gamma_S = \mathbf{1.15}$

Design yield strength of reinforcement — $f_{yd} = f_{yk} / \gamma_S = \mathbf{435}$ N/mm^2

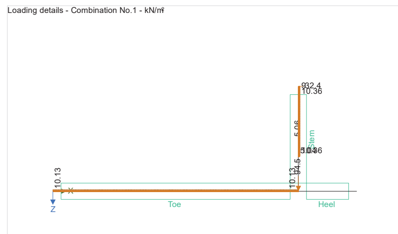
Cover to reinforcement

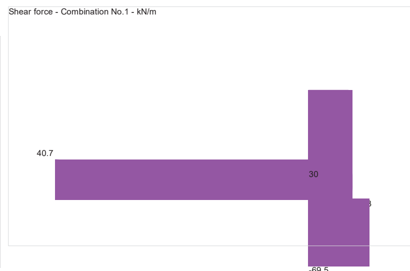
Front face of stem — $c_{sf} = \mathbf{40}$ mm

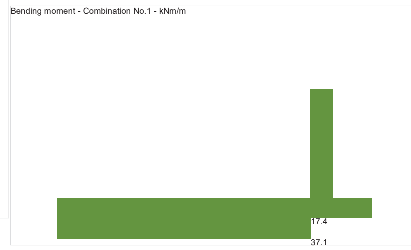
Rear face of stem — $c_{sr} = \mathbf{50}$ mm

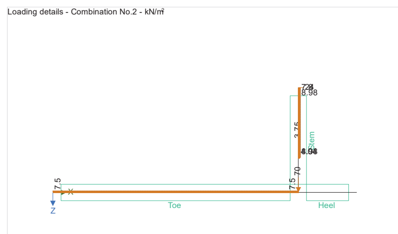
Top face of base — $c_{bt} = \mathbf{50}$ mm

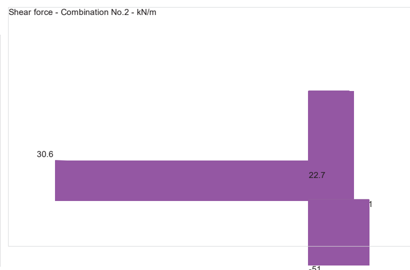
Bottom face of base — $c_{bb} = \mathbf{75}$ mm

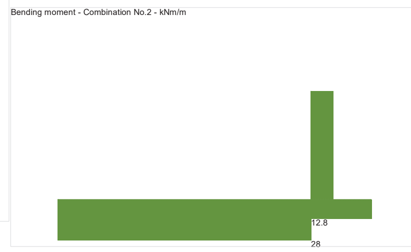












Check stem design at base of stem

Depth of section — $h = \mathbf{500}$ mm

Rectangular section in flexure - Section 6.1

Design bending moment combination 1 — $M = \mathbf{13}$ kNm/m

Depth to tension reinforcement — $d = h - c_{sr} - \phi_{sr} / 2 = \mathbf{442}$ mm

$K = M / (d^2 \times f_{ck}) = \mathbf{0.002}$

$K' = (2 \times \eta \times \alpha_{cc}/\gamma_C) \times (1 - \lambda \times (\delta - K_1)/(2 \times K_2)) \times (\lambda \times (\delta - K_1)/(2 \times K_2))$

$K' = \mathbf{0.207}$

K' > K - No compression reinforcement is required

Lever arm — $z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_C))^{0.5}, 0.95) \times d = \mathbf{420}$ mm

Depth of neutral axis — $x = 2.5 \times (d - z) = \mathbf{55}$ mm

Area of tension reinforcement required — $A_{sr.req} = M / (f_{yd} \times z) = \mathbf{71}$ mm^2/m

Tension reinforcement provided — 16 dia.bars @ 200 c/c

Area of tension reinforcement provided — $A_{sr.prov} = \pi \times \phi_{sr}^2 / (4 \times s_{sr})$ = **1005** mm²/m

Minimum area of reinforcement - exp.9.1N — $A_{sr.min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d$ = **666** mm²/m

Maximum area of reinforcement - cl.9.2.1.1(3) — $A_{sr.max} = 0.04 \times h$ = **20000** mm²/m

$\max(A_{sr.req}, A_{sr.min}) / A_{sr.prov}$ = **0.662**

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

Library item: Rectangular single output

Deflection control - Section 7.4

Reference reinforcement ratio — $\rho_0 = \sqrt{(f_{ck} / 1\ N/mm^2)} / 1000$ = **0.005**

Required tension reinforcement ratio — $\rho = A_{sr.req} / d$ = **0.000**

Required compression reinforcement ratio — $\rho' = A_{sr.2.req} / d_2$ = **0.000**

Structural system factor - Table 7.4N — K_b = **0.4**

Reinforcement factor - exp.7.17 — $K_s = \min(500\ N/mm^2 / (f_{yk} \times A_{sr.req} / A_{sr.prov}), 1.5)$ = **1.5**

Limiting span to depth ratio - exp.7.16.a — $\min(K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} / 1\ N/mm^2)} \times \rho_0 / \rho + 3.2 \times \sqrt{(f_{ck} / 1\ N/mm^2)} \times (\rho_0 / \rho - 1)^{3/2}], 40 \times K_b)$ = **16**

Actual span to depth ratio — h_{stem} / d = **0.7**

PASS - Span to depth ratio is less than deflection control limit

Crack control - Section 7.3

Limiting crack width — w_{max} = **0.3** mm

Variable load factor - EN1990 – Table A1.1 — ψ_2 = **0.6**

Serviceability bending moment — M_{sls} = **8.5** kNm/m

Tensile stress in reinforcement — $\sigma_s = M_{sls} / (A_{sr.prov} \times z)$ = **20.2** N/mm²

Load duration — Long term

Load duration factor — k_t = **0.4**

Effective area of concrete in tension — $A_{c.eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$

$A_{c.eff}$ = **145000** mm²/m

Mean value of concrete tensile strength — $f_{ct.eff} = f_{ctm}$ = **2.9** N/mm²

Reinforcement ratio — $\rho_{p.eff} = A_{sr.prov} / A_{c.eff}$ = **0.007**

Modular ratio — $\alpha_e = E_s / E_{cm}$ = **6.091**

Bond property coefficient — k_1 = **0.8**

Strain distribution coefficient — k_2 = **0.5**

k_3 = **3.4**

k_4 = **0.425**

Maximum crack spacing - exp.7.11 — $s_{r.max} = k_3 \times c_{sr} + k_1 \times k_2 \times k_4 \times \phi_{sr} / \rho_{p.eff}$ = **562** mm

Maximum crack width - exp.7.8 — $w_k = s_{r.max} \times \max(\sigma_s – k_t \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_e \times \rho_{p.eff}), 0.6 \times \sigma_s) / E_s$

w_k = **0.034** mm

w_k / w_{max} = **0.114**

PASS - Maximum crack width is less than limiting crack width

Rectangular section in shear - Section 6.2

Design shear force — V = **45.3** kN/m

$C_{Rd,c} = 0.18 / \gamma_C$ = **0.120**

$k = \min(1 + \sqrt{(200\ mm / d)}, 2)$ = **1.673**

Longitudinal reinforcement ratio — $\rho_l = \min(A_{sr.prov} / d, 0.02)$ = **0.002**

$v_{min} = 0.035\ N^{1/2}/mm \times k^{3/2} \times f_{ck}^{0.5}$ = **0.415** N/mm²

Design shear resistance - exp.6.2a & 6.2b — $V_{Rd.c} = \max(C_{Rd.c} \times k \times (100\ N^2/mm^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$

$V_{Rd.c}$ = **183.3** kN/m

$V / V_{Rd.c}$ = **0.247**

PASS - Design shear resistance exceeds design shear force

Horizontal reinforcement parallel to face of stem - Section 9.6

Minimum area of reinforcement – cl.9.6.3(1) — $A_{sx.req} = \max(0.25 \times A_{sr.prov}, 0.001 \times t_{stem})$ = **500** mm²/m

Maximum spacing of reinforcement – cl.9.6.3(2) — s_{sx_max} = **400** mm

Transverse reinforcement provided — 12 dia.bars @ 200 c/c

Area of transverse reinforcement provided — $A_{sx.prov} = \pi \times \phi_{sx}^2 / (4 \times s_{sx})$ = **565** mm²/m

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

Check base design at toe

Depth of section — h = **300** mm

Rectangular section in flexure - Section 6.1

Design bending moment combination 1 — M = **29.3** kNm/m

Depth to tension reinforcement — $d = h - c_{bb} - \phi_{bb} / 2$ = **217** mm

$K = M / (d^2 \times f_{ck})$ = **0.021**

$K' = (2 \times \eta \times \alpha_{cc}/\gamma_C)\times(1 - \lambda \times (\delta - K_1)/(2 \times K_2))\times(\lambda \times (\delta - K_1)/(2 \times K_2))$

K' = **0.207**

K' > K - No compression reinforcement is required

Lever arm — $z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_C))^{0.5}, 0.95) \times d$ = **206** mm

Depth of neutral axis — $x = 2.5 \times (d – z)$ = **27** mm

Area of tension reinforcement required — $A_{bb.req} = M / (f_{yd} \times z)$ = **327** mm²/m

Tension reinforcement provided — 16 dia.bars @ 200 c/c

Area of tension reinforcement provided — $A_{bb.prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb})$ = **1005** mm²/m

Minimum area of reinforcement - exp.9.1N — $A_{bb.min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d$ = **327** mm²/m

Maximum area of reinforcement - cl.9.2.1.1(3) — $A_{bb.max} = 0.04 \times h$ = **12000** mm²/m

$\max(A_{bb.req}, A_{bb.min}) / A_{bb.prov}$ = **0.325**

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

Library item: Rectangular single output

Crack control - Section 7.3

Limiting crack width — w_{max} = **0.3** mm

Variable load factor - EN1990 – Table A1.1 — ψ_2 = **0.6**

Serviceability bending moment — M_{sls} = **20.7** kNm/m

Tensile stress in reinforcement — $\sigma_s = M_{sls} / (A_{bb.prov} \times z)$ = **99.7** N/mm²

Load duration — Long term

Load duration factor — k_t = **0.4**

Effective area of concrete in tension — $A_{c.eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$

$A_{c.eff}$ = **90958** mm²/m

Mean value of concrete tensile strength — $f_{ct.eff} = f_{ctm}$ = **2.9** N/mm²

Reinforcement ratio — $\rho_{p.eff} = A_{bb.prov} / A_{c.eff}$ = **0.011**

Modular ratio — $\alpha_e = E_s / E_{cm}$ = **6.091**

Bond property coefficient — k_1 = **0.8**

Strain distribution coefficient — k_2 = **0.5**

k_3 = **3.4**

k_4 = **0.425**

Maximum crack spacing - exp.7.11 — $s_{r.max} = k_3 \times c_{bb} + k_1 \times k_2 \times k_4 \times \phi_{bb} / \rho_{p.eff}$ = **501** mm

Maximum crack width - exp.7.8 — $w_k = s_{r.max} \times \max(\sigma_s – k_t \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_e \times \rho_{p.eff}), 0.6 \times \sigma_s) / E_s$

w_k = **0.15** mm

w_k / w_{max} = **0.5**

PASS - Maximum crack width is less than limiting crack width

Rectangular section in shear - Section 6.2

Design shear force — V = **32.6** kN/m

$C_{Rd,c}$ = 0.18 / γ_C = **0.120**

k = min(1 + √(200 mm / d), 2) = **1.960**

Longitudinal reinforcement ratio — ρ_l = min($A_{bb.prov}$ / d, 0.02) = **0.005**

v_{min} = 0.035 $N^{1/2}$/mm × $k^{3/2}$ × $f_{ck}^{0.5}$ = **0.526** N/mm^2

Design shear resistance - exp.6.2a & 6.2b — $V_{Rd.c}$ = max($C_{Rd.c}$ × k × (100 N^2/mm^4 × ρ_l × f_{ck})$^{1/3}$, v_{min}) × d

$V_{Rd.c}$ = **122.7** kN/m

V / $V_{Rd.c}$ = **0.265**

PASS - Design shear resistance exceeds design shear force

Secondary transverse reinforcement to base - Section 9.3

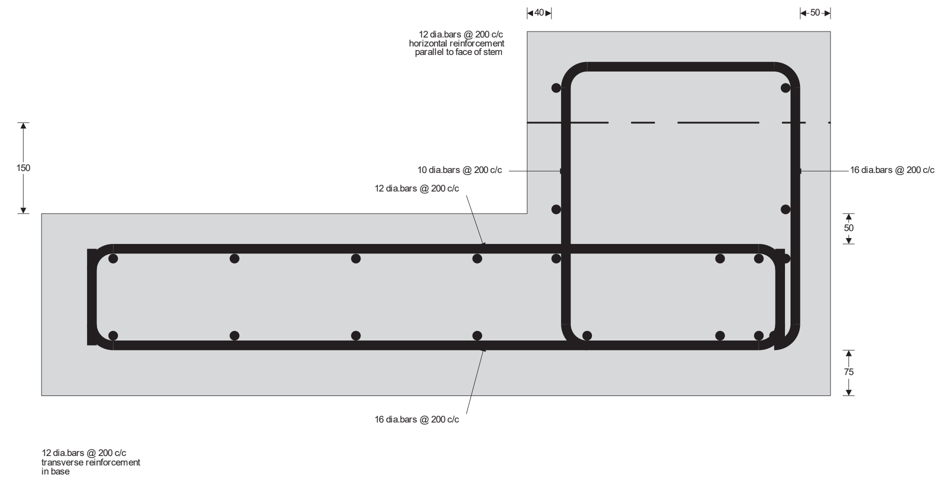
Minimum area of reinforcement – cl.9.3.1.1(2) — $A_{bx.req}$ = 0.2 × $A_{bb.prov}$ = **201** mm^2/m

Maximum spacing of reinforcement – cl.9.3.1.1(3) — s_{bx_max} = **450** mm

Transverse reinforcement provided — 12 dia.bars @ 200 c/c

Area of transverse reinforcement provided — $A_{bx.prov}$ = π × ϕ_{bx}^2 / (4 × s_{bx}) = **565** mm^2/m

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



Reinforcement details

Appendix C: Geotechnical & Services

- **Borehole Outcomes from British Geological Survey**

(2) TQ 28/14 B 8 256/383 B.8.

Rowland Smith Motors Ltd. High Street, Hampstead.

NGR TQ 2664 8566.

Site visited 30th May 1946.
Well not in main building of Rowland Smith, but in garage a few doors along, on site of old Hampstead Brewery.
Now bricked over.
Dried up c.1909 so deeper part filled up and top 150ft used as resevior. (Water used for washing bottles) Brewery closed and bore covered in, before 1932.
Well top at ground level. [illegible]
Manager of garage said that ~~this~~ was a result of building of tube!!!

E.C. May 1946.

Ref. L.M. p.107.

Hampstead. Brewery 1878

		Thickness	Depth
	[? Top soil or made earth]	7 [6]	7
London Clay, 353 feet.	Brown clay	33	40
	Clay with shells	40	80
	[? Clay] shells at 90 feet; claystone and calcareous spar (nodules) at 145-147 feet; and also (with shells and iron-pyrites) at 196-205 feet; shells at 223 feet	about 172	252
	[? Darker clay]	25	277
	[? Clay; shells]	33	310
	[? Rather darker clay]	30	340
	Sandy clay and shells	20	360
Woolwich and Reading Beds, 53 feet.	Clay	about 22	[illegible]
	Clay, reddish	8	[illegible]
	[? Clay, mottled], nodules of iron-pyrites	10	[illegible]
	[? Clay, mottled]	about 7	[illegible]
	Clay and pebbles	6 [5]	413
Thanet Sand, 31 feet.	Clay and sand	18	431
	Grey sand	11 [12]	442
	Flints	2	444
Chalk		156 [155]	600

Perhaps the London Clay should be carried lower. [illegible]

256/383
TQ 28/14

256/383

	ft.	ins.
Made ground	7	0
London Clay	353	0
Woolwich + Reading Beds (Reading Type)	53	0
Thanet Sand	31	0
Upper Chalk	156	0

[illegible] 1976

Rowland Smith Motors, High Street, Hampstead.

TQ 28-14 †

Owner	Licence No.	Nat. Grid Ref.	2665 8569
Occupier	IGS Ref. No. 256/383	Status	Bricked over, dried up. F
Ground Level m OD	ft. OD		
Level of Well Top m OD	315 ft. OD	Aquifer	Chalk
Rest Water Level m bwt	ft. bwt		
(Date) m OD	ft. OD		
Construction			

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type
340	Shaft				
	Bore				

Summary of Geological Section	Thickness	Depth
Top Soil	7	
London Clay	353	
W & R Beds	53	
Thanet Sand	31	
Chalk	156	

Abstraction Rates gph gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

RECEIVED FROM
-7 JUL 2003
ENVIRON. AGENCY

GEOLOGICAL SURVEY OF GREAT BRITAIN

RECORD OF SHAFT OR BORE FOR MINERALS

(For Survey use only)

6-inch Map Registered No. TQ28NE/6

Nat. Grid Reference 2676 8579

1" N.S.Map No.	1" O.S.Map No.	Confidential or not
256		

Name of Shaft or Bore given by Geological Survey:

Name and Number given by owner: Hampstead Brewery

For whom made

Town or Village Hampstead County

Exact site { Attach a tracing from a map, or a sketch-map, if possible.

Purpose for which made Water

Ground Level at shaft/bore relative to O.D. If not ground level give O.D. of beginning of shaft/bore

Made by Date of sinking 1878

Information from Date received

Examined by

SPECIMEN NUMBERS AND ADDITIONAL NOTES

(For Survey use only) Geological Classification	Description of Strata	Thickness Ft.	Thickness In.	Depth Ft.	Depth In.
				600	
	"London Memoir" Vol II.				
	p.107 (In Full)				

HAMPSTEAD. Brewery. 1878.

Communicated by MR. J. W. GROVER.
315 feet above Ordnance Datum.
Shaft 340 feet, the rest bored. Water rose to 325 feet from the surface.

		Thickness.	Depth.
	[? Top soil, or made earth]	7 {6}	7
[London Clay, 353 feet.]	Brown clay	33	40
	Clay with shells	40	80
	[? Clay] shells at 90 feet; claystone and calcareous spar (nodules) at 145–147 feet; and also (with shells and iron-pyrites) at 196–206 feet; shells at 223 feet;	about 172	252
	[? Darker clay]	„ 25	277
	[? Clay: shells]	„ 33	310
	[? Rather darker clay]	30	340
	Sandy clay and shells	20	360
[Woolwich and Reading Beds, 53 feet.]	Clay	about 22	382
	Clay, reddish	„ 8	390
	[? Clay, mottled], nodules of iron-pyrites	10	400
	[? Clay, mottled]	about 7	407
	Clay and pebbles	„ 6 {5}	413
[Thanet Sand, 31 feet.]	Clay and sand	„ 18	431
	Grey sand	„ 11 {12}	442
	Flints	„ 2	444
	Chalk	156 {155}	600

Perhaps the London Clay should be carried lower. In Spon's "Present Practice of Sinking and Boring Wells," Ed. 2, p. 233 (not seen until the above was in print) it is carried down to 408 feet, which seems too low, and the Thanet Sand is not recognized. There are also some differences of detail from the above. {The figures in these brackets are taken from this book.}

(5412) Wt. 12837/PS.154 2m. 10/64 G.W.B.Ltd. Gp.863

Appendix D: Damage category classification from CIRIA C580

Table 6.4 Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989, and Burland, 2001)

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain, ε_{lim} (%)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0 to 0.05
1 Very slight	**Fine cracks that can easily be treated during normal decoration.** Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05 to 0.075
2 Slight	**Cracks easily filled. Redecoration probably required.** Several slight fractures showing inside of building. Cracks are visible externally and **some repointing may be required externally** to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075 to 0.15
3 Moderate	**The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.** Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5 to 15 or a number of cracks >3	0.15 to 0.3
4 Severe	**Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.** Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Services pipes disrupted.	15 to 25, but also depends on number of cracks	>0.3
5 Very severe	**This requires a major repair, involving partial or complete rebuilding.** Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25, but depends on numbers of cracks	

Figure 6.16 shows the ground surface settlement due to excavation in front of walls embedded in coarse-grained soils.

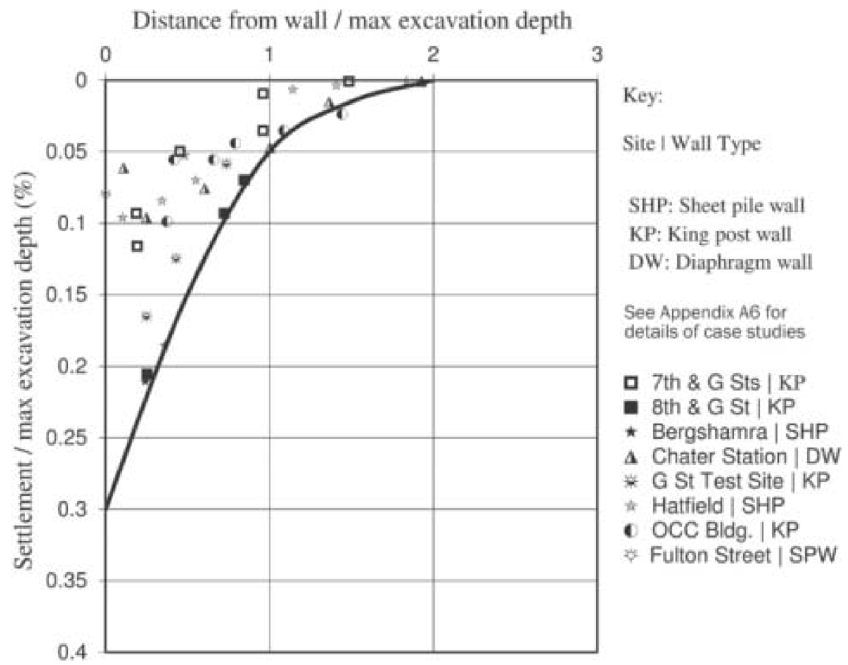


Figure 6.16 Ground surface settlement due to excavation in front of wall in sand