Job Number: 170901

CROFT STRUCTURAL ENGINEERS

Croft Structural Engineers
Clock Shop Mews
Rear of 60 Saxon Road
London SE25 5EH

T: 020 8684 4744
E: enquiries@croftse.co.uk
W: www.croftse.co.uk

Basement Impact Assessment

Property Details
51 Lancaster Grove
London
NW3 4HB

Client Information:
The Basement Design Studio
Suite 17
Maple Court
Grove Park
White Waltham
Berkshire
SL6 3LW

Structural Design Reviewed by	**Above Ground Drainage Reviewed by**
Chris Tomlin MEng CEng MIStructE	Phil Henry BEng MEng MICE
Hydrogeology Report	**Land Stability Report**
(Separate Report) Francis Williams CGeol	(Separate Report) Francis Williams CGeol

Revision	Date	Comment
-	Dec'17	First Issue

Contents

CROFT STRUCTURAL ENGINEERS

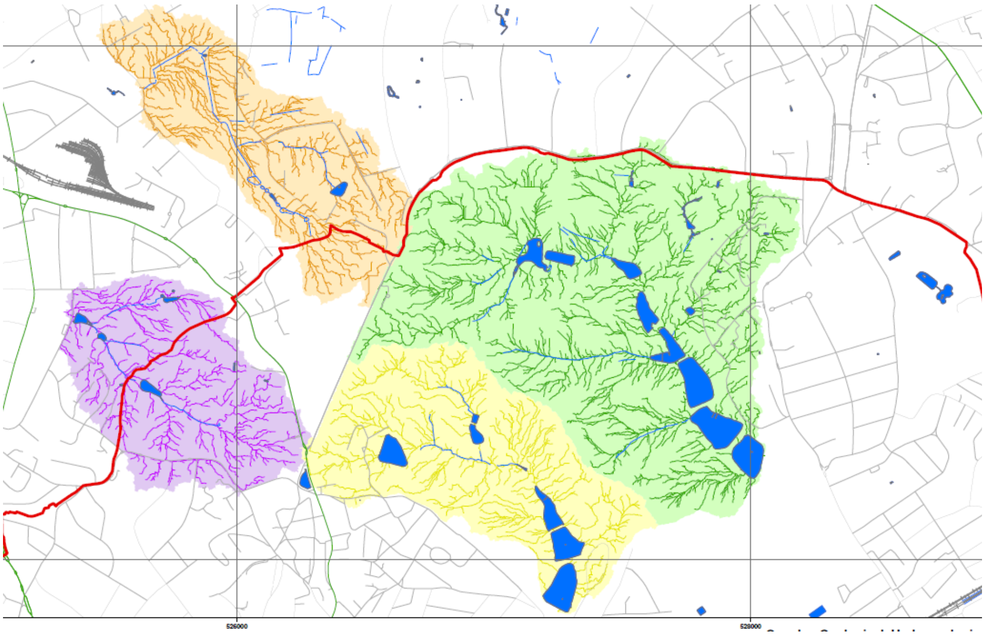
Executive (non-technical) Summary

	The London Borough of Camden requires a Basement Impact Assessment (BIA) to be prepared for developments that include basements and lightwells. This document forms the main part of the BIA and gives details on the impact of surface water flow. The scheme design for the proposed subterranean structure is also included. This document should be used in conjunction with the Groundwater BIA (Nov 2017, Ref. GWPR228351). These is separate reports and are referred to, where relevant, within this document. This BIA follows the requirements contained within Camden Council's planning guidance CGP4 – Basements and Lightwells (2015). In summary, the council will only allow basement construction to proceed if it does not: • cause harm to the built or natural environment and local amenity • result in flooding • lead to ground instability. In order to comply with the above clauses, a BIA must undertake five stages detailed in CPG 4. This report has been produced in line with Camden planning guidance and associated supporting documents such as CPG1, DP23, DP26, DP25 and DP27. Technical information from 'Camden geological, hydrogeological and hydrological study - Guidance for subterranean development', Issue 01, November 2010 (GSD, hereafter) was also used and is referred to in this assessment.
Existing Property	The existing property is a four-storey + basement detached residential property. Superstructure is built from traditional building materials (brickwork and timber) and the existing basement is built of reinforced concrete. There is a car park space at the front and a large garden at the back. In 2007 a part basement was constructed
Proposed Developmen t	The proposed development involves the extension of the existing basement. This will include a front and a rear lightwell. An approximate outline of the construction area is shown below. In addition to the basement area, this also includes areas that are likely to be temporarily occupied for construction purposes.

	 *Figure 1: Aerial view with approx. site area indicated*
Stage 1 – Screening	Screening identified areas of concern and concluded a requirement to proceed to a scoping stage for the potential impacts relating to Land Stability, Hydrogeology, Surface Water and Flooding
Stage 2 – Scoping	The Scoping stage identified the potential impacts and set the parameters required for further study of the areas of concern highlighted in the Screening phase. A desk survey was completed by an engineer. The information from this was utilised to formulate the requirement for a ground, geology and hydrogeology investigation.
Stage 3 – Site Investigation and Study	A structural engineer inspected the building to determine the current condition of the property. Visual inspections were completed of the adjacent properties to determine if there were signs of structural movement. The neighbouring land has not been excavated on, but an engineer has assessed the age of the adjacent properties and considered the type of foundations used for that period and assumed these in the design. A ground investigation with deep boreholes has been completed.

	Soils of the London Clay Formation were encountered underlying the Made Ground .The soils comprised a grey-brown and orange-brown mottled (locally sandy) silty clay. Sand is fine to medium grained. Rare selenite crystals and claystone fragments noted throughout, claystone band noted from 6.50m bgl in BH1. Laboratory testing was undertaken on the soil samples. Ground water has been measured over repeat visits to determine water levels and flows. • No water present in the boreholes.
Stage 4 – Impact Assessment	**Land Stability** The Geologist has concluded that the basement will not make the area unstable. The movement assessment of the basement and its construction 'Negligible' to 'Slight' on the Burland scale. In terms of building damage assessment and with reference to Table 2.5 of C580 (after Burland et al, 1977), the 'Description of typical damage' given the calculated movements it was likely that the damage assessment for the adjacent properties fell into Category 1 'Very Slight Damage' to Category 0, 'Negligible Damage'. Calculations for the potential damage at each property can be seen within Appendix G of the 51 Lancaster Grove, London Ground Investigation Report. **Hydrogeology** No groundwater was encountered during the investigation. Return site visits conducted on the 27th October and 3rd November 2017 by a Ground and Water Limited Technician, to measure groundwater levels, revealed a dry borehole in the well installed to 5.00m bgl in BH1. Therefore, it was considered **unlikely** that the basement would be constructed below the groundwater level and the cumulative effects of basements in groundwater is not a consideration at this site. However, significant perched groundwater was likely to be encountered during construction, especially after a period of excessive rainfall. In relation to the basement, once constructed, the Made Ground will act as a slightly porous medium for water to migrate and additional drainage should be considered as the London Clay Formation will act as a barrier for groundwater migration. **Drainage & Surface Water Flow** The lightwells formed to the front and rear of the north-western basement extension will create new area of hardstanding. **Draining these lightwells, possibly via sumps, will need to be taken into account in final design.** Soakaway construction within the cohesive soils of the London Clay Formation is unlikely to prove satisfactory due to negligible to low anticipated infiltration rates. Therefore an alternative method of surface water disposal is required.

1. Screening Stage

	This stage identifies any areas for concern that should be investigated further.
Land Stability	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351)
Subterranean Flow	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351)
Surface Flow and Flooding	The questions below are taken from the Camden CPG 4 – Basements and Lightwells.
	Question 1: Is the site within the catchment of the pond chains on Hampstead Heath?  *Figure 2: Extract from Figure 14 of the GSD (site lies to the south of the shaded areas)* **No**. The site lies outside the areas denoted by Figure 14 of the GSD (extract shown below)

	Question 2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route? **No** – The surface water that flows from the proposed development will be routed the same way as before: water is and will be collected from hard surfaced areas and enter the existing drainage system.
	Question 3. Will the proposed basement development result in a change to the hard surfaced /paved external areas? **No.** The amount of hard standing will remain unchanged
	Question 4. Will the proposed basement result in changes to the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses? **No**. Surface water that is received by adjacent properties and downstream watercourses is not from the site. This is will remain the case with the proposed development.
	Question 5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses? **No**. Collected surface water will be from building roofs and paving, as before. The quality of the water received downstream will therefore not change.
	Question 6 : Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature? The potential sources of flooding are summarised below:

Potential Source	**Potential Flood Risk at site?**	**Justification**
Fluvial flooding	No	EA Flood Mapping Shows Flood Zone 1. Distance from nearest surface watercourse >1km
Tidal flooding	No	Site location is 'inland' and topography > 40mAOD.

CROFT STRUCTURAL ENGINEERS

	Flooding from rising / high groundwater	No	The site is located on low permeability London Clay.
	Surface water (pluvial) flooding	No	51 Lancaster Grove London NW3 4HB is not on the flood street list and maps from 1975 or 2002
	Flooding from infrastructure failure	Yes	Drainage at or near the site could potentially become blocked or cracked and overflow or leak. Drainage of the basement terrace areas may rely on pumping.
	Flooding from reservoirs, canals and other artificial sources	No	There are no reservoirs, canals or other artificial sources in the vicinity of the site that could give rise to a flood risk.
	Examination of the Environment Agency records showed that the site was not situated within a floodplain or flood warning area. Figure 15 the Camden Geological, Hydrogeological and Hydrological Study revealed that Lancaster Grove immediately south of the site suffered surface water flooding in 1975 (see Figure 14 of this report). Lancaster Drive ~120m to the west was affected by flooding in 2002. A flood risk assessment is not required for this site.		

2. Scoping Stage	
	This stage identifies the potential impacts of the areas of concern highlighted in the Screening phase.
Land Stability	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351)
Subterranean Flow	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351)
Surface Flow & Flooding	Conceptual Model The lightwells formed to the front and rear of the north-western basement extension will create new area of hardstanding. **Draining these lightwells, possibly via sumps, will need to be taken into account in final design.** Soakaway construction within the cohesive soils of the London Clay Formation is unlikely to prove satisfactory due to negligible to low anticipated infiltration rates. Therefore an alternative method of surface water disposal is required.

3. Site Investigation and Desk Study

This section identifies the relevant features of the site and its immediate surroundings, providing further scoping where required.

Desk Study and Walkover Survey

Site & Existing Property

Figure 3 - Front facade

A structural engineer from Croft visited the property on 08 Sep 2017.

The site comprises a four storey residential property with a rear garden. Paving is present to the front and rear of the property. A significant portion of the rear garden is soft-landscaped. The building is approximately 120 years old and is built from traditional building materials (brickwork and timber.

The property is fully detached. At the left-hand side of the property the next-door house is positioned at 1.2m off the side wall.

The land within the site boundary is relatively flat.

Figure 4 - Rear garden view (looking towards rear of building)

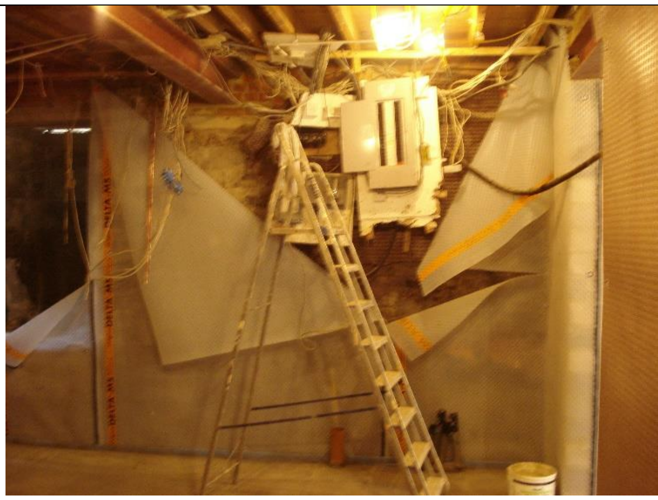
During the Engineers' site visit a couple of structural and non-structural defects have been noted; the main building appeared to be in good condition.

	Second floor, rear façade wall - horizontal and diagonal hairline cracks on the parapet wall. They might be caused by thermal movement due to the radiator thermal source.

	Second floor Hair line cracks at the junction between walls and ceiling
	First floor Vertical Crack at the junction with the rear wall. Stains of water leaks on the other side of the wall are present.

In 2007 designs were undertaken for a part basement to half the house by MMP. The part basement was constructed at some point after that.

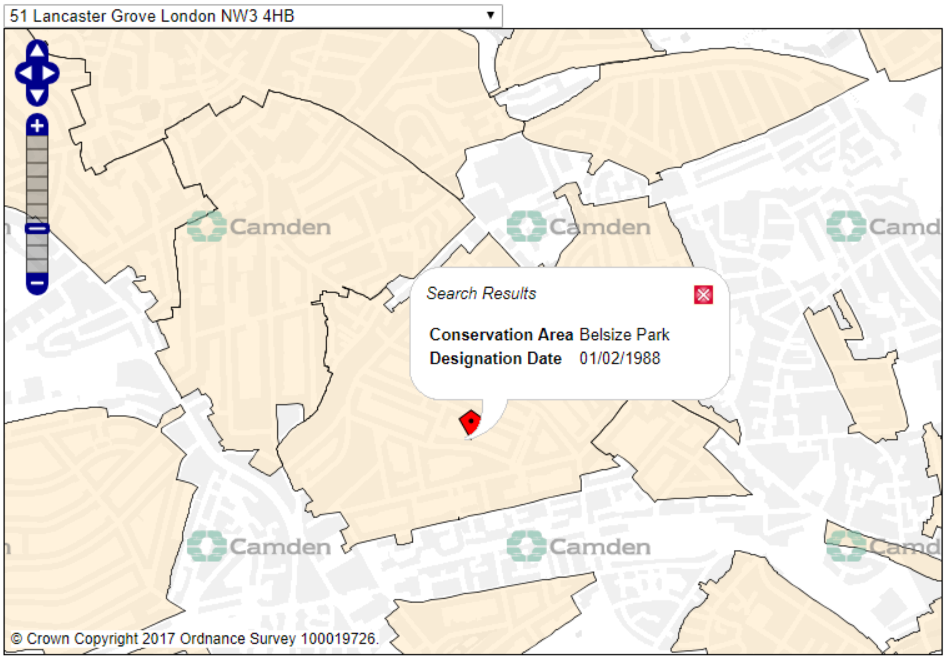
The basement design studio has no data on the existing foundations from the previous works.

	Adjacent Basement Photos
We have the designs from MMP that have assumed Victorian footings. No trial pits were completed at that time. The photo's do suggest that MMP's assumption was correct.	
	
Existing foundations can be seen in the photo to be around 600mm below the steelwork. This would place the existing footings around 600mm Below ground level.	

<u>Trees and Vegetation</u>

The front garden is populated on the edges with shrubs and small plants. The rear garden has herbs, shrubs on the edges and trees at the rear in the garden. This is described in more detail later in this section.

	Site Drainage Rain water pipes discharge into the existing sewer.
Proposed Development	The proposed development involves the extension of the existing basement. This will include a front and a rear lightwell. An approximate outline of the construction area is shown below. In addition to the basement area, this also includes areas that are likely to be temporarily occupied for construction purposes.  *Figure 5: Aerial view with approx. site area indicated* Croft Structural Engineers Ltd has extensive knowledge of constructing new basements. Over the last 10 years Croft Structural Engineers has been involved in the design of over 500 basements in and around London. The method to be utilised at 51 Lancaster Grove is: 1. Excavate front to allow for start of underpinning. 2. Safely and securely support the existing building above 3. Slowly work from the front to the rear inserting narrow cantilevered retaining walls sequentially using well developed and understood underpinning methods. 4. Prop across the width of the basement, excavate central soil "dumpling"

	5. Place reinforcement and cast basement slab 6. Waterproof internal space with a drained cavity system. For further details of the architectural design, refer to the Architects drawings.
Listed Buildings and Conservation Areas	The existing building is not listed. Data from Historic England shows that there are no listed buildings close by. The site is in the Belsize Park conservation area. 
Local topography & external features	Lancaster Grove is a public road, which runs past the front of the property. The area surrounding the property is relatively flat. Landscaping is made of hard surface at the front of the property and partial at the rear, the rest of the garden is green surface. Two drains collection points are present at the rear of the house discharging surface water collected from the building into the existing sewer. The walk over survey has confirmed that there are no surface water features (natural or man-made) within the site or on the adjacent sites.
Geology	Refer to the Ground Investigation report and the Hydrogeological and Land Stability assessment. the Groundwater BIA (Nov 2017,Ref. GWPR228351)

Highways & public footpaths	The site is not within 5m of the public highway.
London Underground and Network Rail	The site is more than 50m away from the nearest national rail line and the nearest subterranean train line. These are unlikely to be affected by the new basement.
UK Power Networks	There are no significant items of electrical infrastructure (such as pylons or substations) in the immediate vicinity.
Proximity of Trees	There are trees close by, in the neighbouring land, and in the rear garden. The closest tree is more than 15m away from the outline of the proposed basement. BS 5837: 2005 *Trees in relation to construction* estimates the root protection area (RPA) equivalent to a circle with a radius12 times the stem diameter. Based on the diameter of the tree as being 400mm, the diameter of this circle would be 4.8m. These would not be affected by a basement that is 15m away.

CROFT STRUCTURAL ENGINEERS

Adjacent Properties

The external facades of the neighbouring properties have been inspected.

Figure 6: Plan view of site (approx. area outlined in red) and the surrounding properties

Descriptions of the properties below are given in an anti-clockwise order starting from the neighbouring land to the north.

49 Lancaster Grove – Property to Left

Property age: mid-Victorian (~150 years old)

Property use: residential

Number of storeys: the property three storeys high above ground level.

Is a basement present? : NO. A search on Camden Council's website show that there is no basement present.

	 Figure 7: Front view of 49 Lancaster Grove Structural Defects Noted: None noted Structural assessment of ongoing movement: from observing the external façade of the building, there were no visible signs of movement.
53 Lancaster Grove – Property to Right	Property age: mid-Victorian (~150 years old) Property use: residential Number of storeys: the property is three storeys high above ground level. Is a basement present? : No. A search on Camden Council's website show that there is no basement present.

Figure 8: Front of 53 Lancaster grove

Structural Defects Noted: None noted

Structural assessment of ongoing movement: from observing the external façade of the building, there were no visible signs of movement.

Monitoring, Reporting and Investigation

The ground investigation report, which has data from initial site investigations and data from subsequent monitoring, is available as a separate report.

Ground Investigation

Ground Investigation Brief	The ground investigation was completed by [Ground & Water Ltd]. Groundwater BIA (Nov 2017,Ref. GWPR228351) From the Scoping Stage, Croft considered that their brief should cover: • One trial pit to confirm the extent of the existing foundations. The purpose is to consider the effect of the works on the neighbouring properties and the find the ground conditions below the site. • Two borehole to a depth of 6.5m below ground level (i.e. more than twice the depth of the proposed basement).

	• Stand pipe to be inserted to monitor ground water; record initial strike and the water level after 1 month. • Site testing to determine insitu soil parameters. SPT testing to be undertaken. • Laboratory testing to confirm soil make up and properties. • The Historic maps and walk over survey did not highlight any significant contamination sources, therefore no site test of the ground has been requested. • Factual report on soil conditions. • Interpretative reports • Calculation of bearing pressures from SPT. • Indication of Ø (angle of friction) from SPT. • Indication of soil type Refer to the ground investigation report by Ground & Water Ltd, which is submitted as a separate document. Data relevant to land stability and subterranean flow is examined separate documents.

Land Stability	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351) for land stability issues addressed to Stage 3.
Subterranean Flow	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351) for hydrogeological issues addressed to Stage 3.
Surface Flow & Flooding	A walk over survey has confirmed that there are no surface water features, either within or close to the site. The survey has also confirmed that the site is covered with hard surfaces. Rainwater from these surfaces is likely to flow in the direction of the slope of the surrounding area. This will be towards Lancaster Road, which is drained by gullies. Refer to the Ground & Water BIA dated Nov'2017 (appended)for additional information on issues relating to surface water and flooding.

4. Basement Impact Assessment

Subterranean Flow	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351): conclusions are stated in the Executive Summary.
Land Stability	Refer to the Groundwater BIA (Nov 2017,Ref. GWPR228351): conclusions are stated in the Executive Summary.
Conservation and Listed Buildings	If the property is in a conservation area, or it is listed then management plan for demolition and construction may be needed. This is not included in this BIA document and is not within Croft Structural Engineer's brief.
Surface water flow and flooding	There is a risk of flooding due to the failure of the pumping system, but this can be reduced to acceptable levels with appropriate design and installation measures. Measures to mitigate this risk are described later under 'Initial Design Considerations'.

Flood Risk Assessment

Examination of the Environment Agency records showed that the site was not situated within a floodplain or flood warning area. Figure 15 the Camden Geological, Hydrogeological and Hydrological Study revealed that Lancaster Grove immediately south of the site suffered surface water flooding in 1975 (see Figure 14 of this report). Lancaster Drive ~120m to the west was affected by flooding in 2002.

Refer to the Ground & Water BIA dated Nov'2017 (separate document):

Drainage Assessment	
Hard standing	Existing Hard Standing = 154 m^2 Proposed Hardstanding = 154 m^2 Percentage Increase in hard standing = 0 %
SUDS Assessment	SUDS is currently achieved by the permeable landscaping in the rear garden. There is no increase in hard-standing; additional SUDS proposals would therefore be out of proportion to the changes in surface water drainage.

Ground Movement Assessment & Predicted Damage Category	
	The design and construction methodology aim to limit damage to the existing building on the site, and to the neighbouring buildings, to Category 2 or lower as set out in Table 2.5 of CIRIA report C580. For this development, suitable temporary propping during the construction phase will limit the amount of movement due to the basement works. This is described in the Basement Method Statement (appended). The ground movement assessment is contained within the Ground & Water BIA dated Nov'2017 (appended)

CROFT STRUCTURAL ENGINEERS

Mitigation Measures Ground Movement

A method statement, appended, has been formulated with Croft's experience of over 500 basements completed without error. As mentioned previously, the procedures described in this statement will mitigate the impacts that the construction of the basement will have on nearby properties.

The works must be carried out in accordance with the Party Wall Act and condition surveys will be necessary at the beginning and the end of the works. The Party Wall Approval procedure will reinforce the use of the proposed method statement and, if necessary, require it to be developed in more detail with more stringent requirements than those required at planning stage.

It is not expected that any cracking will occur in nearby structures during the works. However, Croft's experience advises that there is a risk of movement to the neighbouring property.

To reduce the risk to the development:

- Employ a reputable firm that has extensive knowledge of basement works.
- Employ suitably qualified consultants Croft Structural Engineers has completed over 500 basements in the last five years.
- Provide method statements for the contractors to follow
- Investigate the ground this has now been done.
- Record and monitor the properties close by. This is completed by a condition survey under the Party Wall Act, before and after the works are completed. Refer to the end of the appended Basement Construction Method Statement.

With the measures listed above, the maximum level of cracking anticipated is 'Hairline' cracking. This can be repaired with normal decorative works. Under the Party Wall Act, minor damage, although unwanted, can be tolerated it is permitted to occur to a neighbouring property as long as repairs are suitability undertaken to rectify this. To mitigate this risk, the Party Wall Act is to be followed and a Party Wall Surveyor will be appointed.

Monitoring of Structures

In order to safeguard the existing structures during underpinning and new basement construction, movement monitoring is to be undertaken.

Risk Assessment

Monitoring Level proposed	Type of Works.
Monitoring 4 Visual inspection and production of condition survey by Party Wall Surveyors at the beginning of the works and at the end of the works. Visual inspection of existing party wall during the works. Inspection of the footing to ensure that the footings are stable and adequate. Vertical monitoring movement by standard optical equipment Lateral movement between walls by laser measurements	New basements greater than 2.5m and shallower than 4m deep in gravels Basements up to 4.5m deep in clays Underpinning works to grade I listed building

Before the works begin, a detailed monitoring report is required to confirm the implementation of the monitoring. The items that this should cover are:

- Risk Assessment to determine level of monitoring
- Scope of Works
- Applicable standards
- Specification for Instrumentation
- Monitoring of Existing cracks
- Monitoring of movement
- Reporting
- Trigger Levels using a RED / AMBER / GREEN System

Recommend levels are shown within the proposed monitoring statement (appended).

Basement Design & Construction Impacts and Initial Design Considerations

Foundation type

Reinforced concrete cantilevered retaining walls will form the new foundation of the property.

The design of the retaining walls was calculated using software by TEDDS. The software is specifically designed for retaining walls and ensures that the construction is kept to a limit to prevent damage to the adjacent property.

The overall stability of the walls is designed using K_a & K_p values, while the design of the wall structure uses K_0 values. This approach minimises the level of movement from the concrete affecting the adjacent properties.

The investigations highlight that water is not present. The walls are designed to resist the hydrostatic pressure. The design of the walls considers long term scenarios. It is possible that a water main may break causing a local high water table. To account for this, the wall is designed for water 1m from the top of the wall.

The design also considers floatation as a risk. The design has accounted for the weight of the building and the uplift forces from the water. The weight of the building is greater than the uplift, resulting in a stable structure.

Intended use of structure and user requirements

Family/domestic use
(1 dwelling)

Loading Requirements (EC1-1)

	UDL kN/m²	Concentrated Load kN
Domestic Single Dwellings	1.5	2.0

Part A3 Progressive collapse

Number of Storeys 4+basement

Is the Building Multi Occupancy? No

Class 2A	5 storey single occupancy houses

Change of use

To NHBC guidance compliance is only required to other floors if a material change of use occurs to the property.

	<table><tr><td>**Initial Building Class**</td><td>2A</td></tr><tr><td>**Proposed Building Class**</td><td>2A</td></tr><tr><td>**If class has changed material change has occurred**</td><td>No</td></tr></table>
Lateral Stability	The above ground structure will be transfer the loads to the ground by shear masonry walls and masonry piers. The retaining walls will resist the lateral pressures below ground level.
Stability Design	The cantilevered walls are suitable for carrying the lateral loading applied from above.
Lateral Actions	Below ground level, the reinforced concrete retaining walls are designed to carry the lateral loading applied from above. The lateral earth pressure exerts a horizontal force on the retaining walls. The retaining walls will be checked for resistance to the overturning force this produces. Lateral forces will be applied from: • Soil loads • Hydrostatic pressures • Surcharge loading from behind the wall This produce retaining wall thrust. This will be restrained by the opposing retaining wall.
Retained soil Parameters	Design overall stability to K_a & K_p values. Lateral movement necessary to achieve K_a mobilisation is height/500 (from Tomlinson). This is tighter than the deflection limits of the concrete wall.
Water Table	**Has a soil investigation been carried out?** Yes Known water table from boreholes Design temporary condition for water table level, If deeper than basement ignore. Design permanent condition for water table level: If deeper than existing, design reinforcement for water table at full basement depth to allow for local failure of water mains, drainage and storm water. Global uplift forces can be ignored when the water table is lower than the basement. BS8102 only indicates guidance.

Additional loading requirements	**Surcharge Loading** The following will be applied as surcharge loads to the front/ front lightwell retaining walls: • 10kN/m^2 if within 45° of road • 100kN point loads if under road or within 1.5m • 5kN/m^2 if within 45° of Pavement • Garden Surcharge 2.5kN/m^2 + 1 m of soil (if present above basement ceiling) 20kN/m^2 • Surcharge for adjacent property 1.5kN/m^2 + 4kN/m^2 for concrete ground bearing slab Highways loading: The basement is within 5m of the pavement but not within 5m of the public highway. Adjacent Properties: All adjacent property footings within 45° to have additional geotechnical engineers input. A line at 45° from the base of the neighbours' wall footing would be intersected by the basement retaining wall. This should be accounted for in the design. The appended calculations show the design of one of the most heavily loaded retaining wall. The most critical parameters have been used for this.
Mitigation Measures - Internal Flooding	As described in previous sections, there are no significant risks of flooding besides those that are inherit in the construction of all subterranean structures, such as flooding due to unexpected failure of the drainage, water mains, etc. Croft would recommend the following measures to reduce these risks: • A pumping mechanism will be installed for the proposed basement. There is a likelihood that this may fail and allow excess water to accumulate. If this were to occur, the build-up of water would be gradual and noticeable before it becomes a significant life-threatening hazard. • Install a dual pumping system to maintain operation in the event of a failure. This should include a battery backup and a suitable alarm system for warning purposes. • To reduce the impact of surface water flooding, sustainable drainage systems such as on-site attenuation should be considered at detailed design stage.

Mitigation Measures - Drainage and Damp-proofing	The design of drainage and damp-proofing is not within the scope of this assessment and would not normally be expected to be part of the structural engineer's remit at detailed design stage. A common and anticipated detailed design stage approach is to use internal membranes (Delta or similar). These will be integral to the waterproofing of the basement. Any water from this will enter a drainage channel below the slab. This will be pumped and discharged into the exiting sewer system. It is recommended that a waterproofing specialist is employed to ensure all the water proofing requirements are met. The waterproofing specialist must name their structural waterproofer. The structural waterproofer must inspect the structural details and confirm that he is happy with the robustness. Due to the segmental construction nature of the basement, it is not possible to water proof the joints. All waterproofing must be made by the waterproofing specialist. He should review the structural engineer's design stage details and advise if water bars and stops are necessary. The waterproofing designer must not assume that the structure is watertight. To help reduce water flow through the joints in the segmental pins, the following measures should be applied: • All faces should be cleaned of all debris and detritus • Faces between pins should be needle hammered to improve key for bonding • All pipe work and other penetrations should have puddle flanges or hydrophilic strips
Mitigation Measures - Localised Dewatering	Monitor water levels 1 month prior to starting on site and throughout the construction process. Localised dewatering to pins may be necessary.

Temporary Works	Walls are designed to be temporarily stable. Temporary propping details will be required for the ground and this must be provided by the contractor. Their details should be forwarded to the design stage engineer. Particular attention should be paid to point loads from above. Critical areas where point loads are present from above include: Cross walls Chimney Stacks Door openings To demonstrate the feasibility of the works, a proposed basement construction method statement is appended. The land stability BIA expressed concern over groundwater that might by present during construction, in particular the potential for this to wash away fines in the soil. The majority of the basement will be excavated within the London Clay. Any groundwater seepage will be slow due to the low permeability of the clay. The groundwater in this soil can therefore be suitably controlled [eg. by sump pumping]. Full height excavations will be necessary to form the front light-well. This might involve exposing sand and gravel above the clay. The highest level of water is not much greater than the top level of the clay. Groundwater is therefore unlikely to cause significant removal of sands. However, it would be prudent to limit the size of the underpins in this area to reduce the likelihood of this. This is proposed in the land stability BIA. Segmental retaining wall construction is shown in drawing SL-10 [Appendix C]. Groundwater monitoring is proposed. Before excavation of the front light-well if the groundwater level is recorded as exceptionally high [ie close to the ground surface], then excavation in this area should be postponed until the groundwater level falls below the top of the clay.

Noise and Nuisance Control	The contractor is to follow the good working practices and guidance laid down in the 'Considerate Constructors Scheme'. The hours of working will be limited to those allowed; 8am to 6pm Monday to Friday and Saturday Morning 8am to 1pm. None of the practices cause undue noise that one would typically expect from a construction site (a conveyor belt typically runs at around 70dB). The site has car parking to the front to which the skip will be stored. The site will be hoarded with 8' site hoarding to prevent access. The hours of working will further be defined within the Party Wall Act. The site is to be hoarded to minimise the level of direct noise from the site. The ground floor slab is not being removed, minimising the vibration and sound to adjacent properties. Working in the basement generally requires hand tools to be used. The level of noise generally will be no greater than that of digging of soil. The noise is reduced and muffled by the works being undertaken underground. The level of noise from basement construction works is lower than typical ground level construction due to this.
CTMP	The council may require a Construction Traffic Management Plan (CTMP) to be produced. This is outside the brief of the Basement Impact Assessment and is not covered within Croft's brief. A CTMP would normally be required if the site is, or is adjacent to a listed building or is in a conservation area. This site is under conservation area.

Appendix A: Structural Calculations

CPG4 section 5 highlights that other permits and requirements will be necessary after planning. Item 5.1 highlights that Building Regulations will be required. As part of the building control pack full calculations must be undertaken and provided at detailed design stage once planning permission is granted. The calculations must be completed to a recognised Standard (BS or Euro Codes). The calculations must take into account the findings of this report and the recommendations of the auditors.

The design must resist:

- Vertical loads from the proposed works and adjacent properties
- Lateral loads from wind, soil water and adjacent properties
- Loadings in the temporary condition
- All other applied loads on the building
- Uplift forces from hydrostatic effects and soil heave

The final proposed scheme must:

- Provide stability in the temporary condition to all forces
- Provide stability to all forces in the permanent condition

As part of the planning Croft structural engineers has considered some of the pertinent parts of the basement structure to ensure that it can be constructed. The following calculations are not a full set of calculations for the final design which must be provided for building regulations. The structural calculations we consider pertinent and included in this appendix for this development are:

1. Front basement foundation & retaining wall with highways loading as necessary

2. Party Wall foundation and retaining wall

CROFT STRUCTURAL ENGINEERS

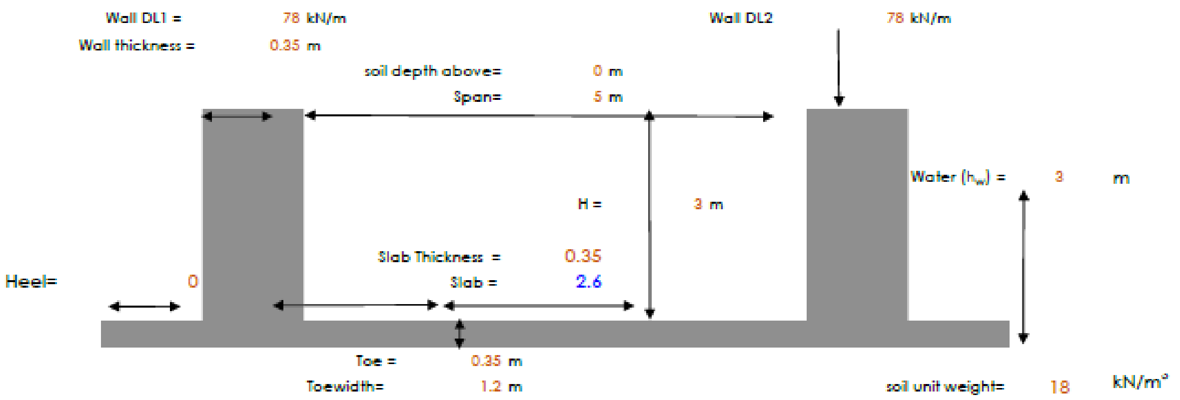
Engineering Information Sheet

CROFT STRUCTURAL ENGINEERS
Clock Shop Mews
Rear of 60 Saxon Road
London SE25 5EH
T: 020 8684 4744
W: www.croftse.co.uk

Project: 51 Lancaster Grove		Section	Sheet
Date: Sep-17	Rev	Date	Description
By: LI			
Checked			
Job No: 170901	Status		Rev

Ref

Uplift and Heave Calculations



Uplift Calc

Total Dead Load

Slab=	22.75 kN/m	= slab thickness x slab weight x 25kN/m^3
Toe and heel =	27.125 kN/m	= (heel length + wall thickness + toe length) x slab thickness x 25kN/m^3 x 2No
RC Wall =	52.5 kN/m	= wall height above (from base) x wall thickness x 25kN/m^3 x 2No
Weight above wall =	156 kN/m	= Wall DL1 + Wall DL2
Total Dead load =	258.375 kN/m	

Total Uplift Force= 171 kN/m = (wall thickness + span + wall thickness) x h_w x 10kN/m^3

F.o.S.= **1.51 No Global Uplift**

Slab Uplift

Slab = 8.75 kN/m   Uplift = 30 kN/m   = h_w x 10kN/m^3

Service Moment = -66.4 kNm/m

Factored Design moment= -78.5 kNm/m
Factored Design shear = -62.8 kN/m

Global Heave

Weight of building = 258.375 kN/m
Weight of soil removed = 307.8

% change = 16%   place 16% of Slab area as heave protection
width of heave protection = 0.92 m   place 0.92 m of Slab area as heave protection

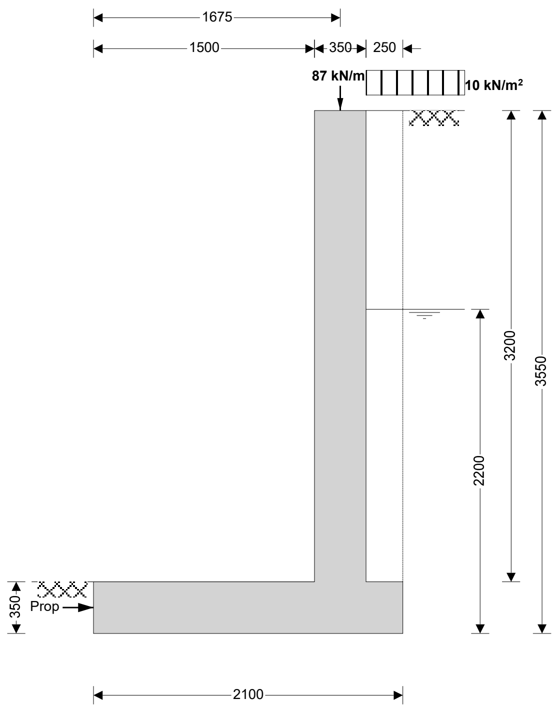
SIDE WALL LOAD RUN DOWN AND DESIGN

Loading

Dead load SW GF wall	DL1=7kN/m^2×4.05m=**28.350**kN/m
Dead load SW FF wall	DL2=7kN/m^2×3.20m=**22.400**kN/m
Dead load SW SF wall	DL3=7kN/m^2×3.20m=**22.400**kN/m
Dead load ground floor	DL4=0.65kN/m^2×5.00m/2=**1.625**kN/m
Dead load first floor	DL5=0.65kN/m^2×5.00m/2=**1.625**kN/m
Dead load roof	DL6=0.95kN/m^2×3.00m/2=**1.425**kN/m
Live load ground floor	LL1=1.50kN/m^2×5.00m/2=**3.750**kN/m
Live load first floor	LL2=1.50kN/m^2×5.00m/2=**3.750**kN/m
Live load first floor	LL3=0.60kN/m^2×5.00m/2=**1.500**kN/m
Total Dead Load	TDL=DL1+DL2+DL3+DL4+DL5+DL6=**77.825**kN/m
Total Live Load	TLL=LL1+LL2+LL3 =**9.000**kN/m

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **3200** mm	Wall stem thickness	t_{wall} = **350** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **250** mm
Overall length of base	l_{base} = **2100** mm	Base thickness	t_{base} = **350** mm

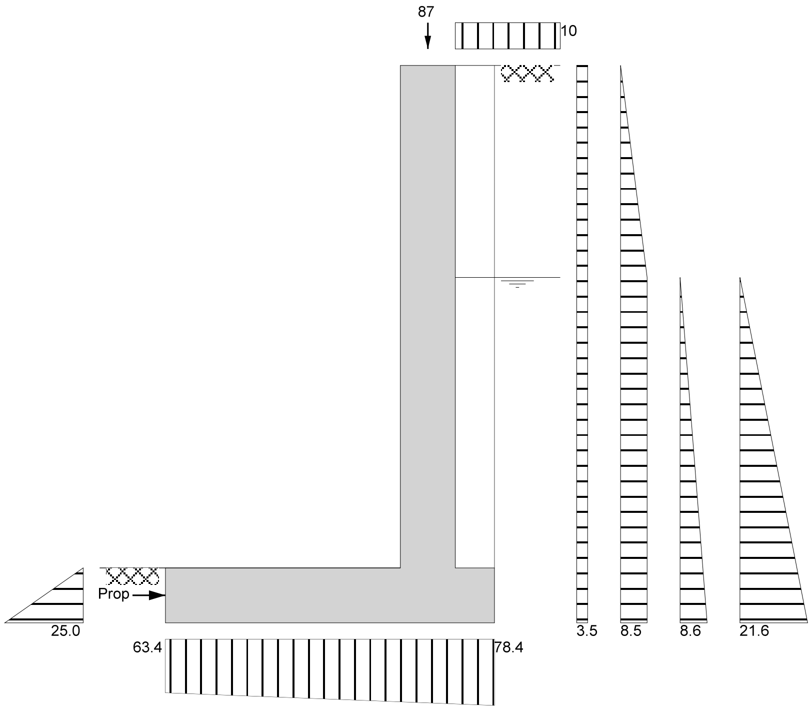
Height of retaining wall	h_{wall} = **3550** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **350** mm
Position of downstand	l_{ds} = **0** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **2200** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **3550** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **100** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **10.0** kN/m^2		
Vertical dead load	W_{dead} = **77.8** kN/m	Vertical live load	W_{live} = **9.0** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **1675** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **19.5** kN/m

Check bearing pressure

Total vertical reaction	R = **148.9** kN/m	Distance to reaction	x_{bar} = **1087** mm
Eccentricity of reaction	e = **37** mm		

Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **63.4** kN/m^2 Bearing pressure at heel p_{heel} = **78.4** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **19.5** kN/m

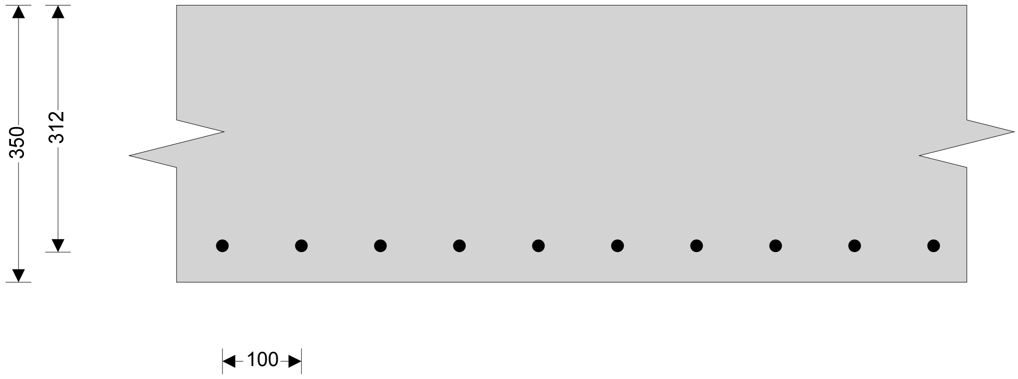
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **30** mm



Design of retaining wall toe

Shear at heel V_{toe} = **168.4** kN/m Moment at heel M_{toe} = **178.5** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $A_{s\_toe\_req}$ = **1390.3** mm^2/m Area provided $A_{s\_toe\_prov}$ = **2011** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.540** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.679** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

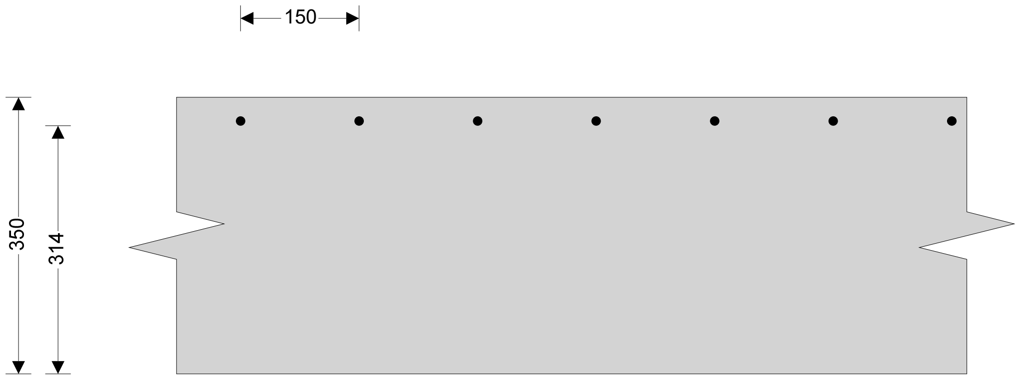
Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in heel c_{heel} = **30** mm



Design of retaining wall heel

Shear at heel V_{heel} = **22.0** kN/m Moment at heel M_{heel} = **6.2** kNm/m

Compression reinforcement is not required

Check heel in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_heel\_req}$ = **455.0** mm^2/m Area provided $A_{s\_heel\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress v_{heel} = **0.070** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_heel} = **0.488** N/mm^2

$v_{heel} < v_{c\_heel}$ - No shear reinforcement required

<u>Design of reinforced concrete retaining wall stem (BS 8002:1994)</u>

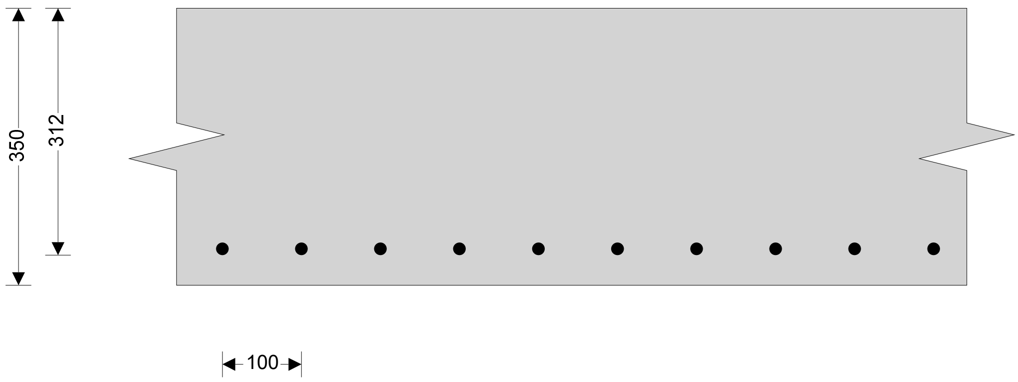
Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **30** mm Cover in wall c_{wall} = **30** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **44.2** kN/m Moment at base of stem M_{stem} = **145.8** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $A_{s\_stem\_req}$ = **1130.5** mm²/m Area provided $A_{s\_stem\_prov}$ = **2011** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.142** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.679** N/mm²

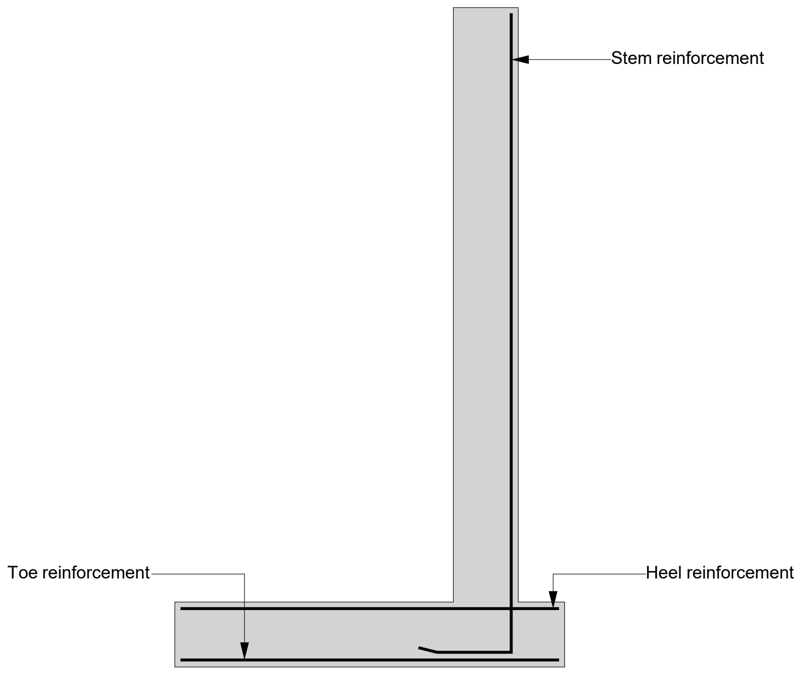
$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **10.90** Actual span/depth ratio $ratio_{act}$ = **10.26**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram

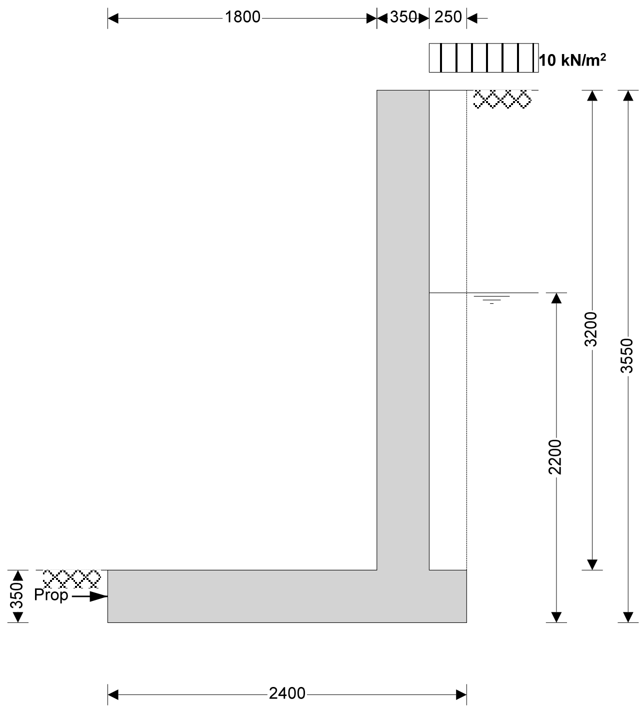


Toe bars - 16 mm dia.@ 100 mm centres - (2011 mm^2/m)
Heel bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Stem bars - 16 mm dia.@ 100 mm centres - (2011 mm^2/m)

RC WALL FRONT LIGHT-WELL

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **3200** mm	Wall stem thickness	t_{wall} = **350** mm
Length of toe	l_{toe} = **1800** mm	Length of heel	l_{heel} = **250** mm
Overall length of base	l_{base} = **2400** mm	Base thickness	t_{base} = **350** mm
Height of retaining wall	h_{wall} = **3550** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **350** mm
Position of downstand	l_{ds} = **0** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **2200** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **3550** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **100** kN/m^2

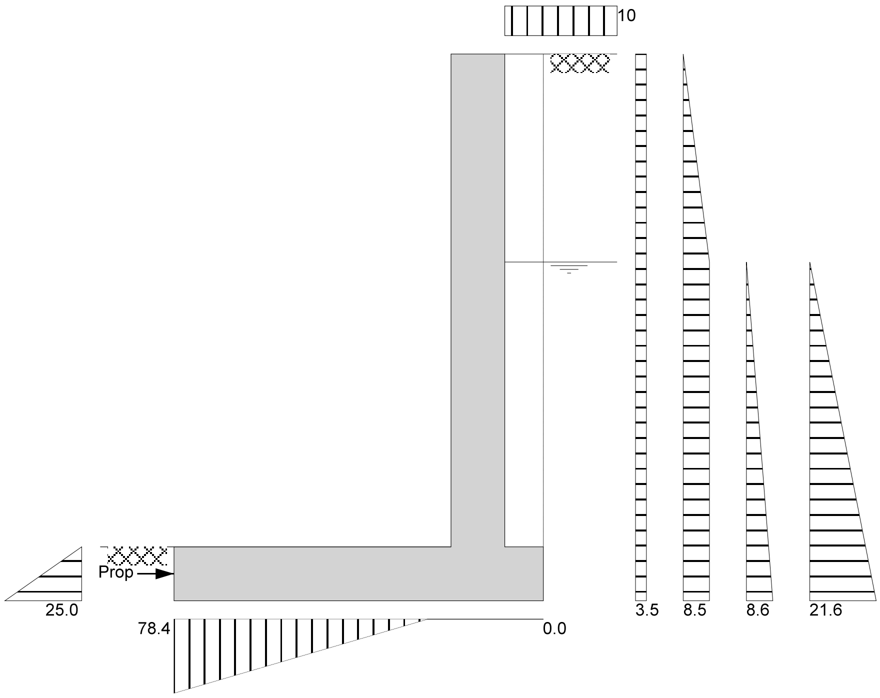
Using Coulomb theory

Active pressure	K_a =**0.369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **10.0** kN/m^2

Vertical dead load	W_{dead} = **0.0** kN/m	Vertical live load	W_{live} = **0.0** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **0** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **44.8** kN/m

Check bearing pressure

Total vertical reaction	R = **64.5** kN/m	Distance to reaction	x_{bar} = **549** mm
Eccentricity of reaction	e = **651** mm		

Reaction acts outside middle third of base

Bearing pressure at toe	p_{toe} = **78.4** kN/m^2	Bearing pressure at heel	p_{heel} = **0.0** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **44.8** kN/m

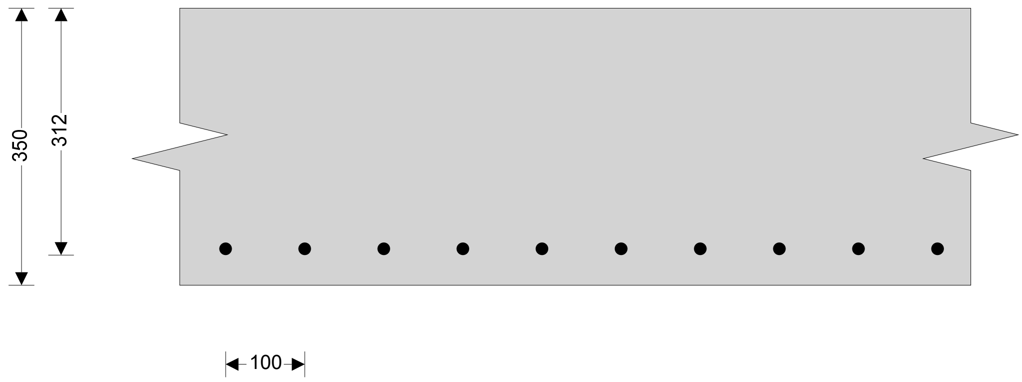
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **30** mm



Design of retaining wall toe

Shear at heel V_{toe} = **20.8** kN/m Moment at heel M_{toe} = **22.6** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $A_{s\_toe\_req}$ = **455.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **2011** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.067** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.679** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

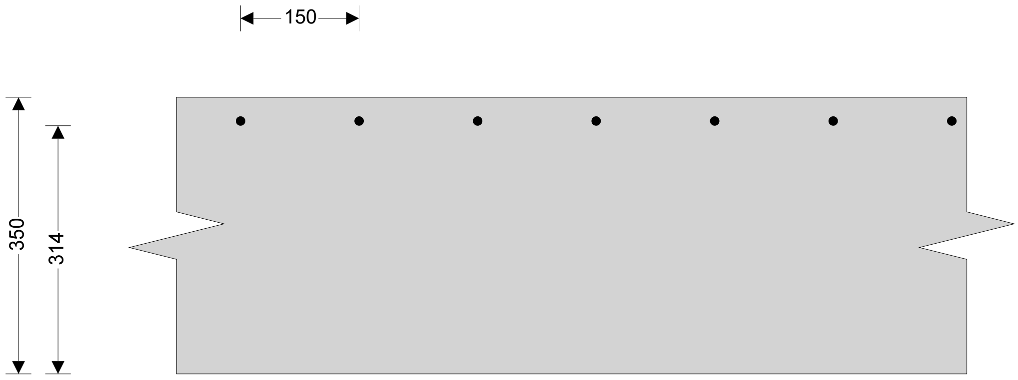
Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in heel c_{heel} = **30** mm



Design of retaining wall heel

Shear at heel V_{heel} = **29.0** kN/m Moment at heel M_{heel} = **8.9** kNm/m

Compression reinforcement is not required

Check heel in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_heel\_req}$ = **455.0** mm^2/m Area provided $A_{s\_heel\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress v_{heel} = **0.092** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_heel} = **0.488** N/mm^2

v_{heel} < v_{c_heel} - No shear reinforcement required

<u>Design of reinforced concrete retaining wall stem (BS 8002:1994)</u>

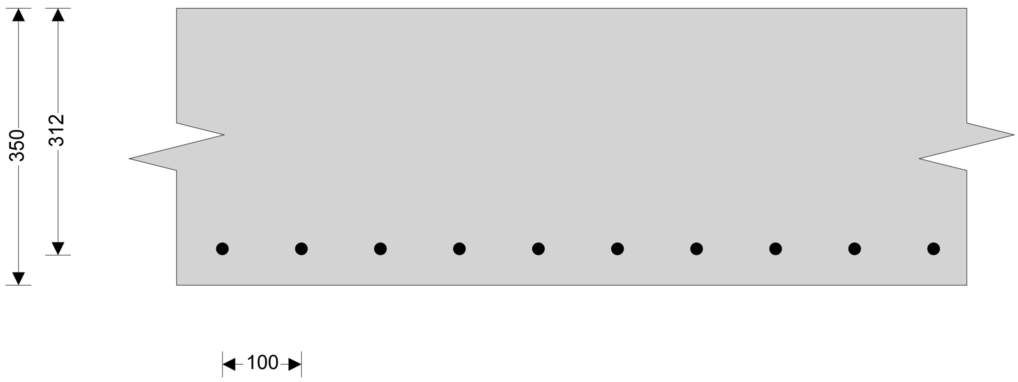
Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **30** mm Cover in wall c_{wall} = **30** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **8.7** kN/m Moment at base of stem M_{stem} = **145.8** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $A_{s\_stem\_req}$ = **1130.5** mm^2/m Area provided $A_{s\_stem\_prov}$ = **2011** mm^2/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.028** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.679** N/mm^2

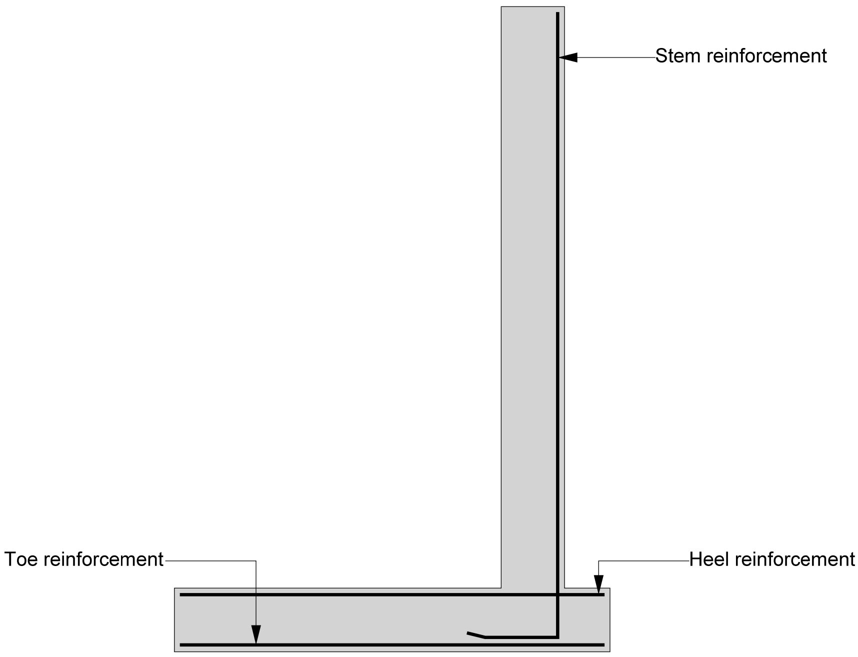
$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **10.90** Actual span/depth ratio $ratio_{act}$ = **10.26**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 100 mm centres - (2011 mm^2/m)
Heel bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Stem bars - 16 mm dia.@ 100 mm centres - (2011 mm^2/m)

INTERNAL WALL MASS CONCRETE PIN

Loading

Dead load SW GF wall	DL1=7kN/m^2×4.05m=**28.350**kN/m
Dead load SW FF wall	DL2=7kN/m^2×3.20m=**22.400**kN/m
Dead load SW SF wall	DL3=7kN/m^2×3.20m=**22.400**kN/m
Dead load ground floor	DL4=0.65kN/m^2×5.00m/2=**1.625**kN/m
Dead load first floor	DL5=0.65kN/m^2×5.00m/2=**1.625**kN/m
Dead load roof	DL6=0.95kN/m^2×3.00m/2=**1.425**kN/m
Live load ground floor	LL1=1.50kN/m^2×5.00m/2=**3.750**kN/m
Live load first floor	LL2=1.50kN/m^2×5.00m/2=**3.750**kN/m
Live load first floor	LL3=0.60kN/m^2×5.00m/2=**1.500**kN/m
Basement retaining wall	DL7 = 300mm * 25kN/m^3 * 2m = **15.000**kN/m
Total Dead Load	TDL=DL1+DL2+DL3+DL4+DL5+DL6+ DL7=**92.825**kN/m
Total Live Load	TLL=LL1+LL2+LL3 =**9.000**kN/m
Mass concrete bearing stress	σ = (TDL + TLL) / 1.1m = **92.568**kN/m^2

CROFT STRUCTURAL ENGINEERS

`

Appendix B: Construction Sequence and Plans

Job Number: 170901

CROFT STRUCTURAL ENGINEERS

Croft Structural Engineers
Clock Shop Mews
Rear of 60 Saxon Road
London SE25 5EH

T: 020 8684 4744
E: enquiries@croftse.co.uk
W: www.croftse.co.uk

Basement Method Statement

Site Details:
51 Lancaster Grove
London
NW3 4HB

Client Details:
The Basement Design Studio

Revision	Date	Comment
-	Dec'2017	First Issue

CROFT STRUCTURAL ENGINEERS

Contents

CROFT STRUCTURAL ENGINEERS

51 Lancaster Grove

1. Basement Formation Suggested Method Statement

1.1. This method statement provides an approach that will allow the basement design to be correctly considered during construction. The statement also contains proposals for the temporary support to be provided during the works. The Contractor is responsible for the works on site and the final temporary works methodology and design on this site and any adjacent sites.

1.2. This method statement has been written by a Chartered Engineer. The sequencing has been developed using guidance from ASUC (Association of Specialist Underpinning Contractors).

1.3. This method has been produced to allow for improved costings and for inclusion in the Party Wall Award. Final site conditions need there to be flexibility in the method statement: Should the site staff require alterations to the Method statement this is allowed once an alternative methodology, of the changes is provided, and an Addendum to the Party Wall Award will be required.

1.4. Contact Party Wall Surveyors to inform them of any changes to this method statement.

1.5. On this project, the cantilever pins are designed to be inherently stable without lateral support to the top of the wall. However, temporary props will be provided near the head and will provide support until the concrete has gained sufficient strength. The base benefits from propping. This is provided in the final condition by the ground slab. In the temporary condition, the edge of the slab is buttressed against the soil in the middle of the property. Also the skin friction between the concrete base and the soil provides further resistance. The central soil mass is to be removed in 1/3 portions and cross propping subsequently added as the central soil ass is removed

1.6. The local geological drift sheets show the ground to be Made ground over London Clay

1.7. The bearing pressures have been limited to 100kN/m^2 in refer of soil report

1.8. No Ground water encountered during investigation

1.9. The structural waterproofer (not Croft) must comment on the proposed design and ensure that he is satisfied that the proposals will provide adequate waterproofing.

1.1. Provide engineers with concrete mix, supplier, delivery and placement methods two weeks prior to the first pour. Site mixing of concrete should not be employed apart from in small sections (less than 1m^3). The contractor must provide a method on how to achieve site mixing to the correct specification. The contractor must undertake toolbox talks with staff to ensure site quality is maintained.

CROFT STRUCTURAL ENGINEERS

2. Enabling Works

2.1. The site is to be hoarded with ply board sheets, at least 2.2m high, to prevent unauthorised public access.

2.2. Licences for skips and conveyors should be posted on the hoarding.

2.3. Provide protection to public where conveyor extends over footpath. Depending on the requirements of the local authority, construct a plywood bulkhead over the pavement. Hoarding to have a plywood roof covering over the footpath, night-lights and safety notices.

2.4. Dewater: Water is expected. This is likely to be perched water. This is to be dealt with by localised pumping. Typically achieved by a small sump pump in a bucket.

2.5. On commencement of construction, the contractor will determine the foundation type, width and depth. Any discrepancies will be reported to the structural engineer in order that the detailed design may be modified as necessary.

3. Basement Sequencing

3.1. Begin by placing cantilevered walls numbered noted on drawing SL-10. (Cantilevered walls to be placed in accordance with Section 4.)

3.2. Insert steel over or leave pocket in the cantilevered wall to support steel.

3.2.1. Dry pack to steelwork. Ensure a minimum of 24 hours from casting cantilevered walls to dry-packing.

3.3. Erect conveyor at front of existing basement to remove the spoil soil .

3.4. Continue cantilevered wall formation around perimeter of basement following the numbering sequence on the drawings.

3.4.1. Excavation for the next numbered sequential sections of underpinning shall not commence until at least 8 hours after drypacking of previous works. Excavation of adjacent pin to not commence until 48 hours after drypacking. (24hours possible due to inclusion of Conbextra 100 cement accelerator to dry pack mix). No more than

3.4.2. wall to be propped as excavation progresses. Steelwork to support floor to be inserted as works progress.

3.5. Excavate and cast floor slab

3.5.1. Excavate 1/3 of the middle section of basement floor. As excavation proceeds, place Slimshore raking props at a maximum of 2.5m c/c to the ground (cast sacrificial thrust blocks below formation level as required.

3.5.2. Continue excavating the next 1/3 and prop then repeat for the final 1/3.

3.5.3. Place below-slab drainage. Croft recommends that all drainage is encased in concrete below the slab and cast monolithically with the slab. Placing drainage on pea shingle below the slab allows greater penetration for water ingress.

3.5.4. Place reinforcement for basement slab. Ensure that concrete can be cast around raking props to allow for their subsequent removal.

3.5.5. Building Control Officer and Engineer are to be informed five working days before reinforcement is ready and invited for inspection.

3.5.6. Once inspected, pour concrete.

3.6. Provide structure to ground floor and water proofing to retaining walls as required. It is recommended to leave 3-4 weeks between completion of the basement and installing drained cavity. This period should be used to locate and fill any localised leakage of the basement

4. Cantilevered Walls

4.1. Excavate first section of retaining wall (no more than 1000mm wide).

4.2. Excavation of pins involves working in confined spaces and the following measures should be applied:

- Operatives must wear a harness and there must be a winch above the excavation.
- An attendant must be present at all times, at ground level, while excavation is occupied.
- A rescue plan must be produced prior to the works as well as a task-specific risk and method statement.

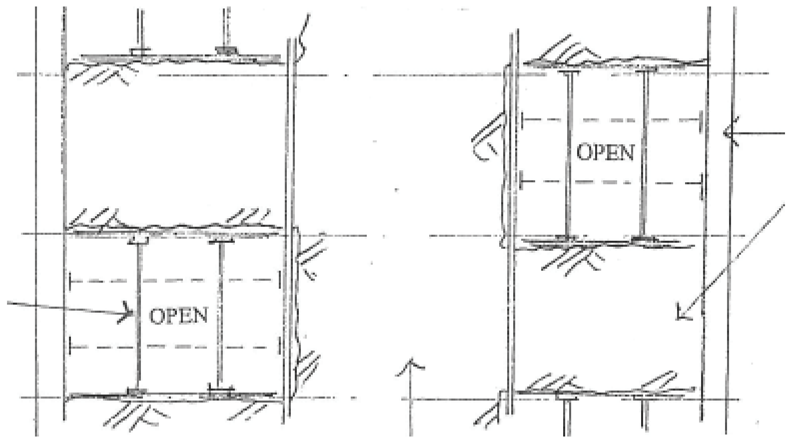


Figure 1 – Schematic Plan view of soil propping

Figure 2 Propping examples

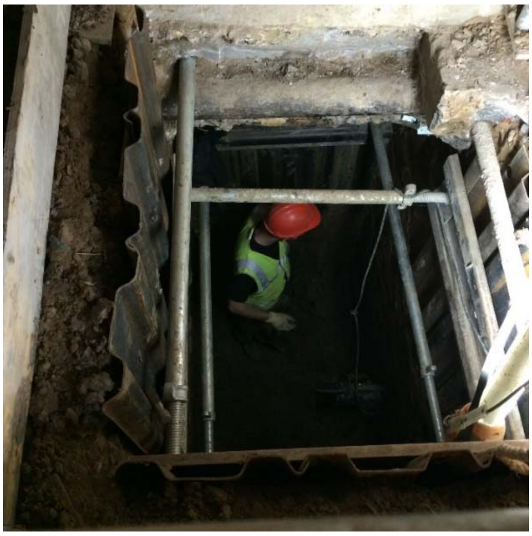


Figure 3 Examples of excavations of pins

Figure 4 Examples of completed walls and back propping to central soil mass

4.3. Back propping of rear face: Rear face to be propped in the temporary conditions with a minimum of 2 trench sheets. Trench sheets are to extend over entire height of excavation. Trench sheets can be placed in short sections as the excavation progresses.

Figure 5 Example of trench sheet back propping

4.3.1. If the ground is stable, trench sheets can be removed as the wall reinforcement is placed and the shuttering is constructed.

4.3.2. Where trench sheets are left in a slight over spill may occur past the neighbours boundary wall line. Where this slight over spill is not allowed by the Party Wall Surveyors then cement particle board should be used as noted below.

4.3.3. Where soft spots are encountered, leave in trench sheets or alternatively back prop with precast lintels or sacrificial boards. If the soil support to the ends of the lintels is insufficient, then brace the ends of the PC lintels with 150x150 C24 timbers and prop with Acrows diagonally back to the ground.

4.3.4. Prior to casting, place layer of DPM between trench sheeting (or PC lintels) and new concrete. The lintels are to be cut into the soil by 150mm either side of the pin. A site stock of a minimum of 10 lintels should be present to prevent delays due to ordering.

4.4. Excavate base. Concrete heels to be excavated. If soil over is unstable, prop top with PC lintel and sacrificial prop.

4.5. Local Authority inspection to be carried out for approval of excavation base.

4.6. Place blinding.

4.7. Place reinforcement for retaining wall base and stem. Drive H16 Bars U-bars into soil along centre line of stem to act as shear ties to adjacent wall underpin.

4.8. Site supervisor to inspect and sign off works before proceeding to next stage.

4.9. Concrete Testing:

4.9.1. For first 3 pins take 4 cubes and test at 7 days then at 14 days and inform engineer of results. Test last cube at 28 days. If cube test results are low then action into concrete specification and placement method must be considered.

4.9.2. If results are good from first three pins, then from the 4th pin onwards take 2 cubes of concrete from every third pin and store for testing. Test one at 28 days. If result is low, test second cube. Provide results to client and design team on request or if values are below those required.

4.9.3. Ensure that concrete is of sufficient strength check engineer's specifications

4.9.4. A record of dates for the concrete pouring of each pin must be kept on site.

4.9.5. The location of where cubes were taken and their reference number must be recorded.

4.10. Horizontal temporary prop to base of wall to be inserted. Alternatively cast base against soil.

4.11. After 24 hours, the temporary wall shutters can be removed.

4.12. Site supervisor to inspect and sign off for proceeding to the next stage. A record will be kept of the sequence of construction, which will be in strict accordance with recognised industry procedures.

5. Approval

5.1. Building Control Officer/Approved Inspector to inspect pin bases and reinforcement prior to casting concrete.

5.2. Contractor to keep list of dates of pins inspected and cast.

5.3. One month after the work is completed, the contractor is to contact Adjoining Party Wall Surveyor to attend site and complete final condition survey and to sign off works.

6. Basement Temporary Works Design Lateral Propping

This calculation has been provided for the trench sheet and prop design of standard underpins in the temporary condition. There are gaps left between the sheeting and as such no water pressure will occur. Any water present will flow through the gaps between the sheeting and will be required to be pumped out.

Trench sheets should be placed at regular centres to deal with the ground. It is expected that the soil between the trench sheeting will arch. Looser soil will require tighter centres. It is typical for underpins to be placed at 1200c/c in this condition the highest load on a trench sheet is when 2 No.s trench sheets are used. It is for this design that these calculations have been provided.

Soil and ground conditions are variable. Typically one finds that, in the temporary condition, clays are more stable and the C_u (cohesive) values in clay reduce the risk of collapse. It is this cohesive nature that allows clays to be cut into a vertical slope. For these calculations, weak sand and gravels have been assumed. The soil properties are:

CROFT STRUCTURAL ENGINEERS

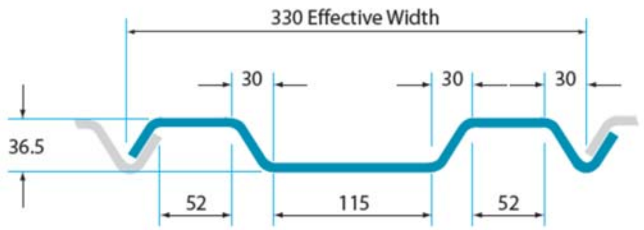
Trench Sheet Design

Soil Depth	Dsoil = 3000mm
Surcharge	sur = 10kN/m^2
Soil Density	□ = 20kN/m^3
Angle of Friction	□ = 25□

	k_a = (1 - sin(□)) / (1 + sin(□))	= **0.406**
	k_p = 1 / k_a	= **2.464**
Soil pressure bottom	soil = k_a * □□*□□Dsoil	= **21.916**kN/m^2
Surcharge pressure	surcharge = sur * k_a	= **4.059** kN/m^2

STANDARD LAP

The overlapping trench sheeting profile is designed primarily for construction work and also temporary deployment.



Technical Information

Effective width per sheet (mm)	330
Thickness (mm)	3.4
Depth (mm)	35
Weight per linear metre (kg/m)	10.8
Weight per m² (kg)	32.9
Section modulus per metre width (cm³)	48.3
Section modulus per sheet (cm³)	15.9
I value per metre width (cm⁴)	81.7
I value per sheet (cm⁴)	26.9
Total rolled metres per tonne	92.1

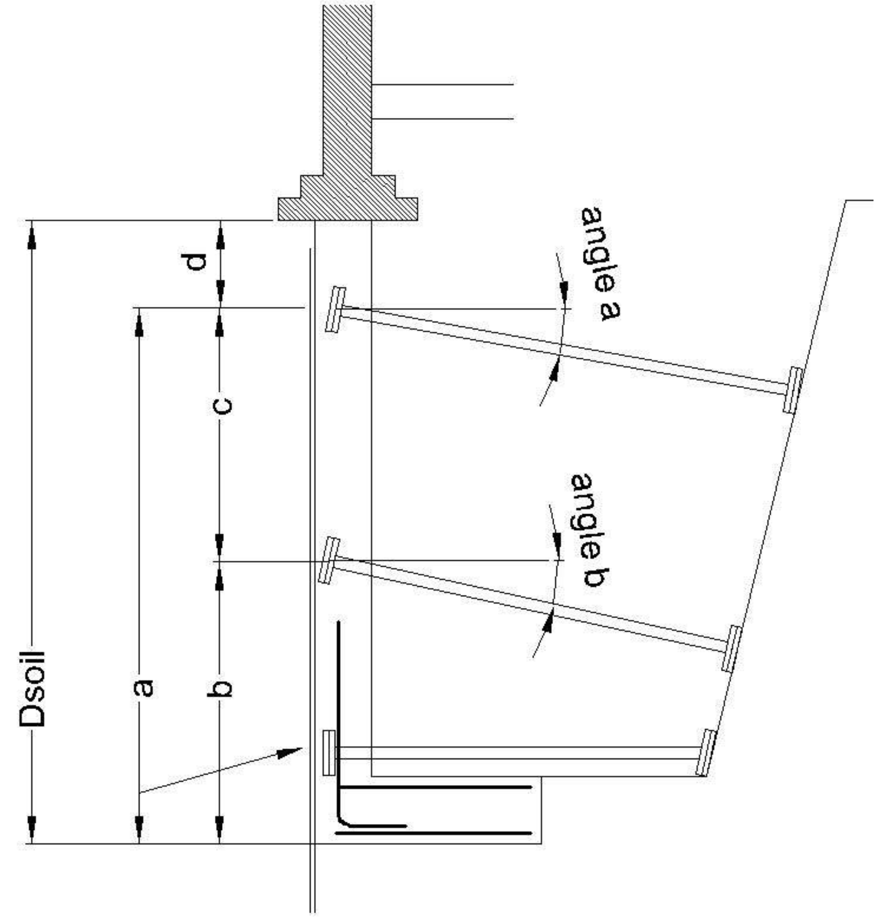
Sxx = 15.9 cm^3

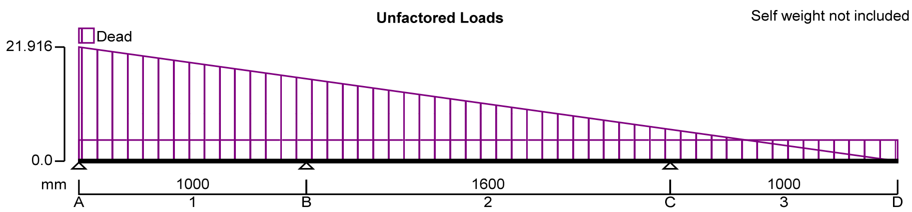
py = 275N/mm^2

Ixx = 26.9cm^4

A = (1m * 32.9kg/m^2) / (7750kg/m^3) = **4245.161**mm^2

CROFT STRUCTURAL ENGINEERS





CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **3**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A	Vertically **"Restrained"**	Rotationally **"Free"**
Support B	Vertically **"Restrained"**	Rotationally **"Free"**
Support C	Vertically **"Restrained"**	Rotationally **"Free"**
Support D	Vertically **"Free"**	Rotationally **"Free"**

Span Definitions:

Span 1	Length = **1000** mm	Cross-sectional area = **4245** mm^2	Moment of inertia = **269.□10^3** mm^4
Span 2	Length = **1600** mm	Cross-sectional area = **4245** mm^2	Moment of inertia = **269.□10^3** mm^4
Span 3	Length = **1000** mm	Cross-sectional area = **4245** mm^2	Moment of inertia = **269.□10^3** mm^4

LOADING DETAILS

Beam Loads:

Load 1 UDL Dead load **4.1** kN/m

Load 2 VDL Dead load **21.9** kN/m to **0.0** kN/m

<u>LOAD COMBINATIONS</u>

<u>Load combination 1</u>

Span 1 1.4□Dead

Span 2 1.4□Dead

Span 3 1.4□Dead

<u>CONTINUOUS BEAM ANALYSIS - RESULTS</u>

<u>Support Reactions - Combination Summary</u>

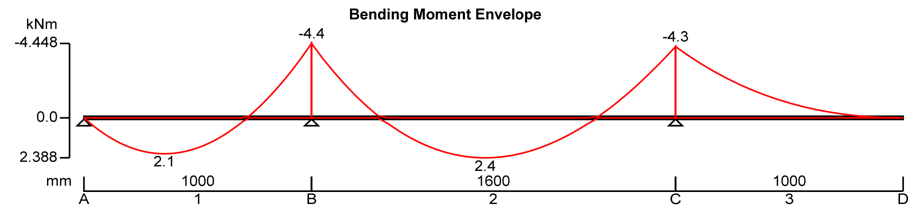
Support A	Max react = **-12.3** kN	Min react = **-12.3** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support B	Max react = **-38.5** kN	Min react = **-38.5** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support C	Max react = **-24.8** kN	Min react = **-24.8** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support D	Max react = **0.0** kN	Min react = **0.0** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm

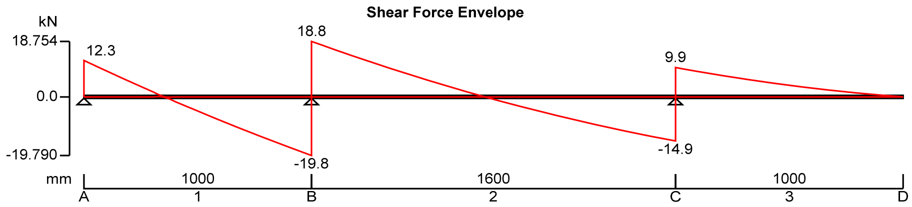
<u>Beam Max/Min results - Combination Summary</u>

Maximum shear = **18.8** kN Minimum shearF_{min} = **-19.8** kN

Maximum moment = **2.4** kNm Minimum moment = **-4.4** kNm

Maximum deflection = **17.1** mm Minimum deflection = **-0.1** mm





Number of sheets Nos = 3

Moment M_allowable = Sxx * py * Nos = **13.118**kNm

Deflection D = / Nos = **5.699**mm

Acro Load Acro = R_{max_B} / 2 = -19.272kN

Safe working loads for Acrow Props — loads given in kN

For normal purposes 1 kilo Newton (kN) = 100 kg	Height	m ft	2.0 6.6	2.25 7.4	2.5 8.2	2.75 9.0	3.0 9.8	3. 10
TABLE A Props loaded concentrically and erected vertically	Prop size 1 or 2		35	35	35	34	27	23
	Prop size 3					34	27	23
	Prop size 4							32
TABLE B Props loaded concentrically and erected 1½° max. out of vertical	Prop size 1 or 2 or 3		35	32	26	23	19	17
	Prop size 4							24
TABLE C Props loaded 25 mm eccentricity and erected 1½° max. out of vertical	Prop size 1 or 2 or 3		17	17	17	17	15	13
	Prop size 4							17
TABLE D Props loaded concentrically and erected 1½° out of vertical and laced with scaffold tubes and fittings	Prop size 3					35	33	32
	Prop size 4							35

Acrow Props A or B are acceptable placed 0.5m from top, middle and 1m from bottom

Cross Props

Props should be placed a third up the wall measured from the bottom slab.

Surcharge	sur = 10kN/m^2
Soil Density	□ = 20kN/m^3
Angle of Friction	□ = 25□
Soil Depth	Dsoil = 3000mm
	k_a = (1 - sin(□)) / (1 + sin(□)) = **0.406**
	k_p = 1 / k_a = **2.464**
1 - sin(□)	= **0.577**

Soil force bottomsoilforce = k_a * □□*□□ Dsoil * Dsoil / 2 = **36.527**kN/m

Surcharge Force Surchargeforce = k_a * sur * Dsoil = **12.176**kN/m

Place Props every other pin spacing = 2m

Propforce Propforce = spacing * (soilforce + Surchargeforce) = **97.406**kN

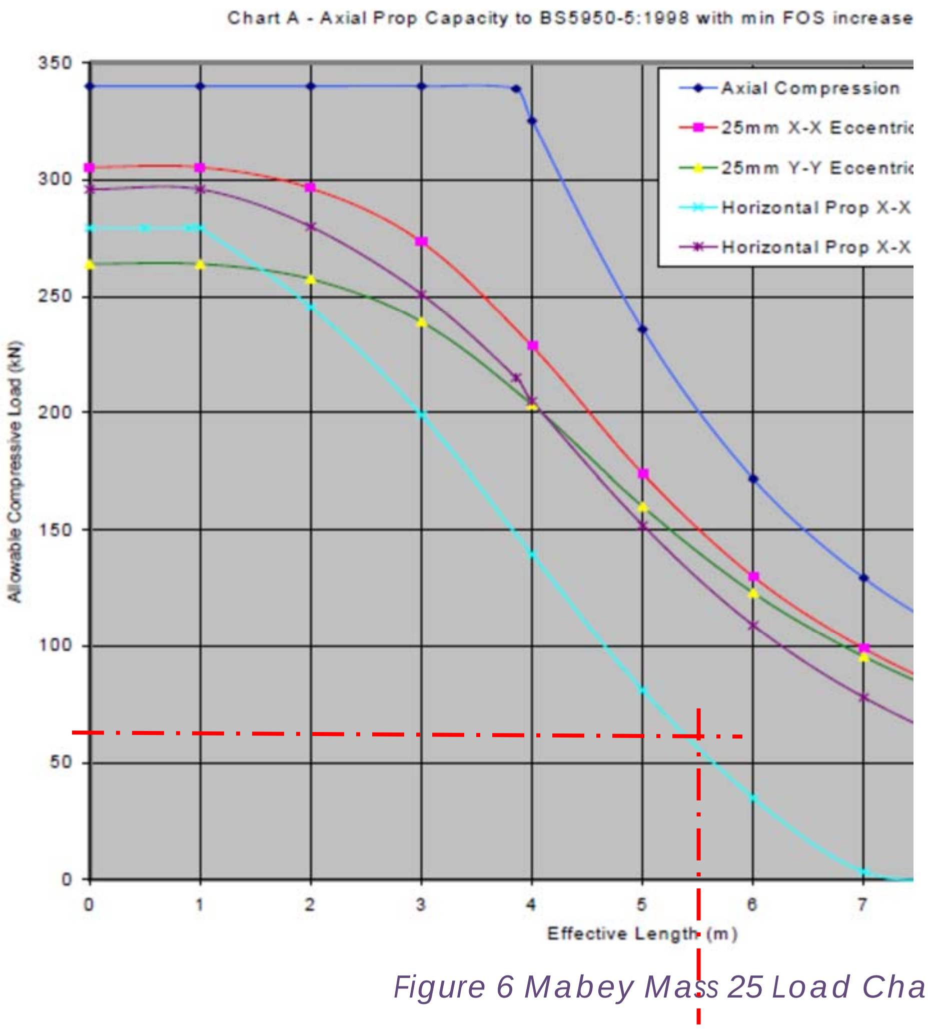


Figure 6 Mabey Mass 25 Load Chart

CROFT STRUCTURAL ENGINEERS

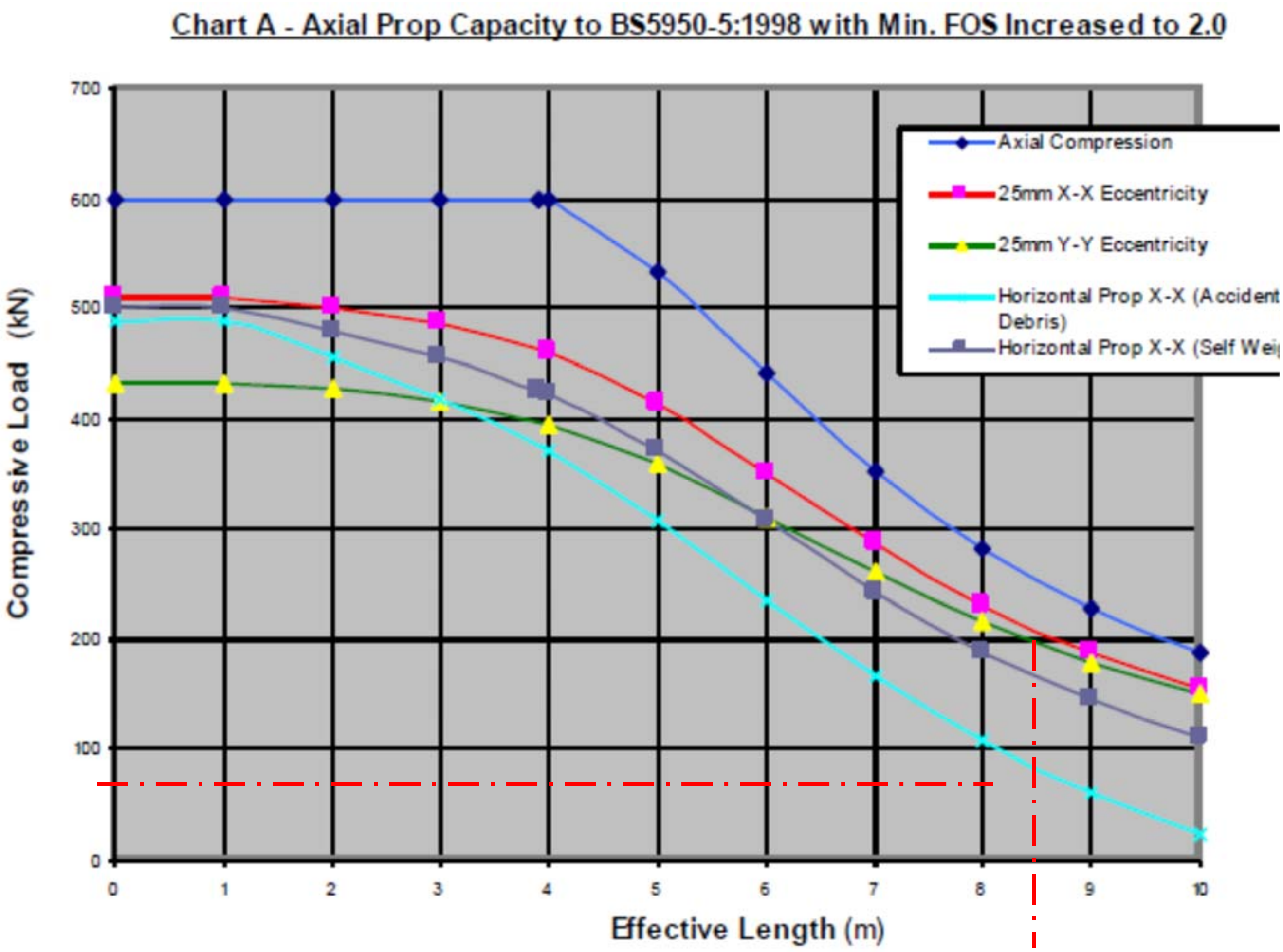


Figure 7 Mabey Mass 50 Load Chart

Provide Mabey Mass 50 at 2m Centres at 1/3 the height of the wall.

CROFT STRUCTURAL ENGINEERS

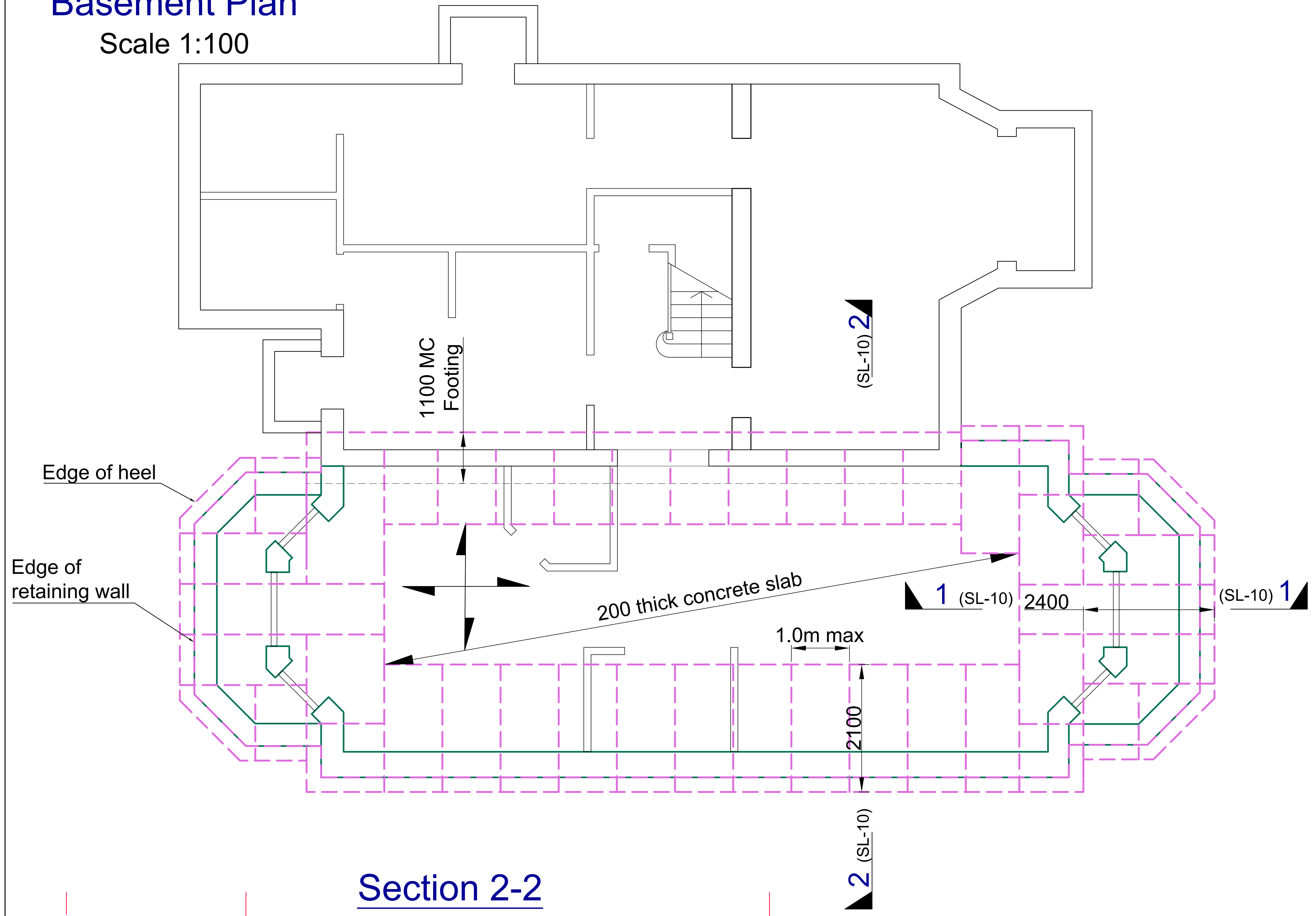
Appendix C: Structural Drawings

1:100 Basement Plan on A3 Showing Neighbouring basements if present
1:100 Ground Floor plan on A3 Showing Neighbouring property
1:50 Section on A3 Including section through Neighbouring Footings

Tree Plan on A3

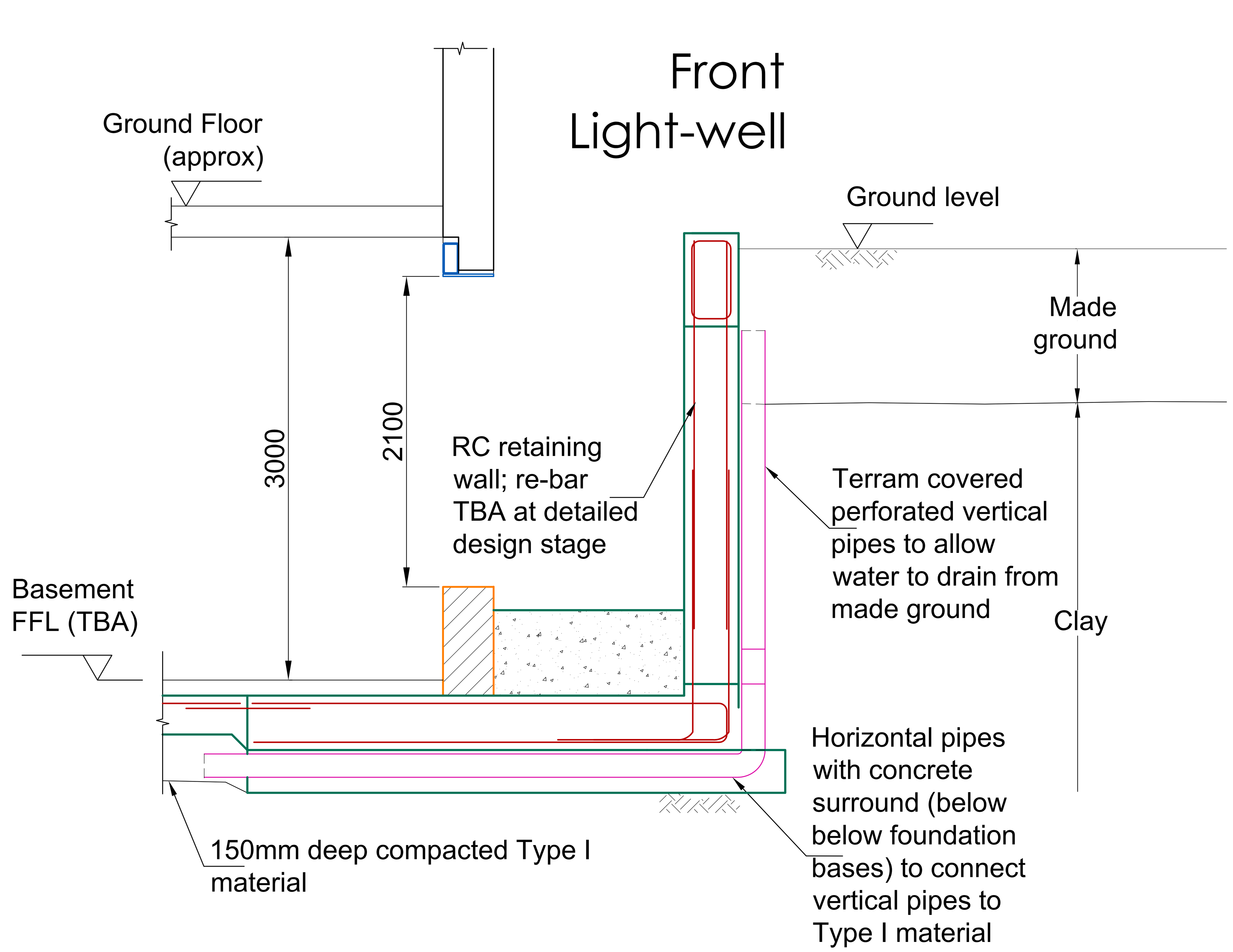
Basement Plan

Scale 1:100



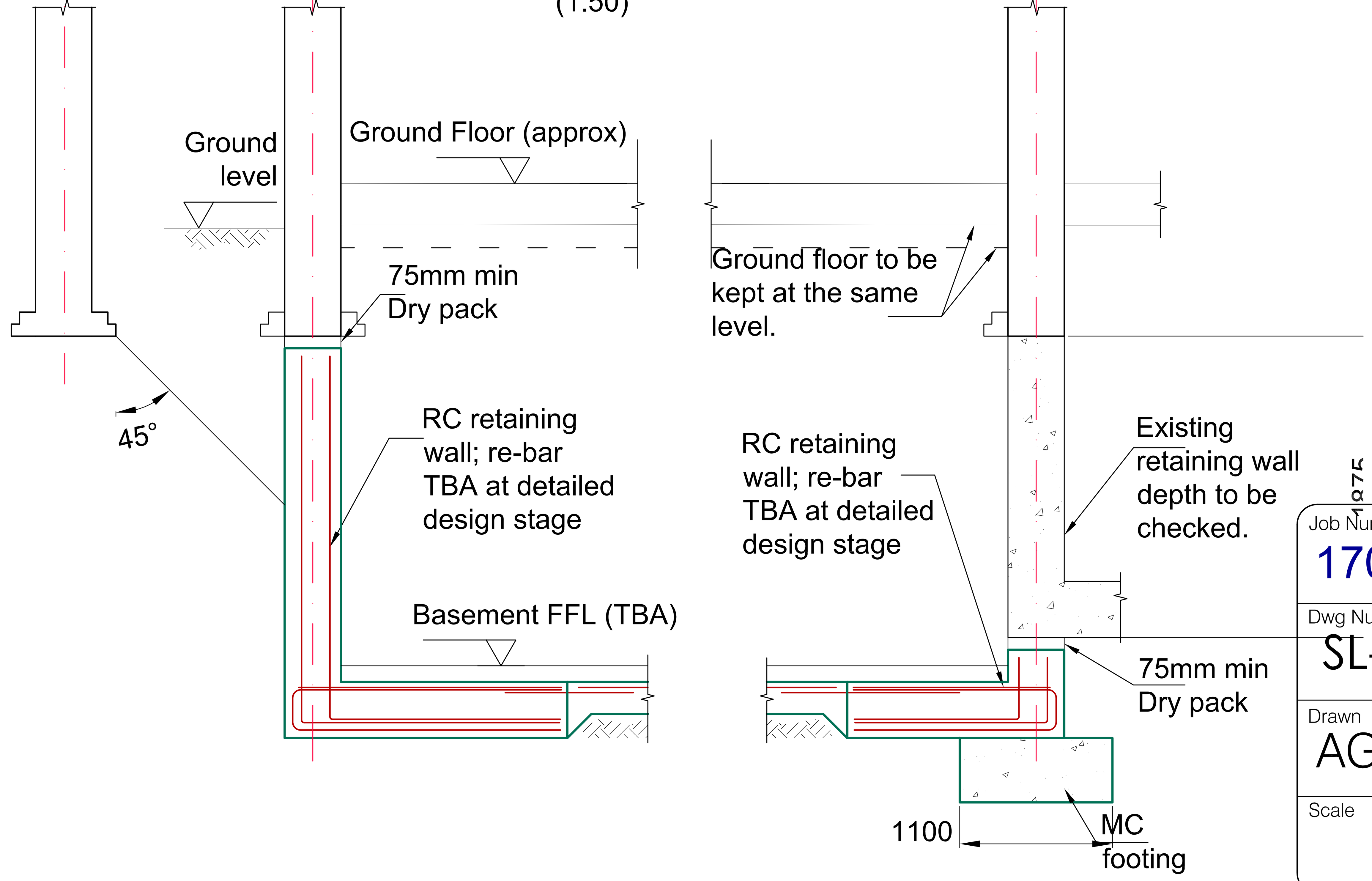
Section 1-1

(1:50)



Section 2-2

(1:50)



- PLANING ISSUE -
NOT FOR CONSTRUCTION

Rev	Date	Amendments
1	3.11/2017	Dimensions to footings added for Geotec assessment
-	25/09/2017	First issue for comment

Job Number 170901	Date Sept '17
Dwg Number SL-10	Rev 1
Drawn AG	Ch'kd CT
Scale As shown @ A3	

Client: Basement Design Studio

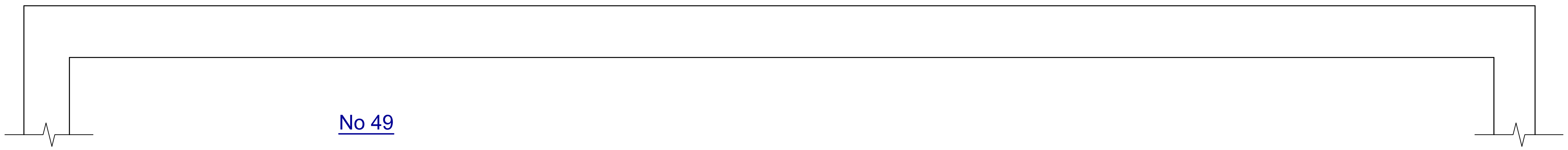
Project: 51 Lancaster Grove

Title : Basement Plan and Sections

Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
www.croftse.co.uk

Ground Floor Plan

Scale 1:50



- PLANING ISSUE -
NOT FOR CONSTRUCTION

Rev	Date	Amendments
-	25/09/2017	First issue for comment

Job Number: 170901	Date: Sept '17
Dwg Number: SL-20	Rev: -
Drawn: AG	Ch'kd: CT
Scale: As shown @ A3	

Client: Basement Design Studio

Project: 51 Lancaster Grove

Title : Ground Floor Plan

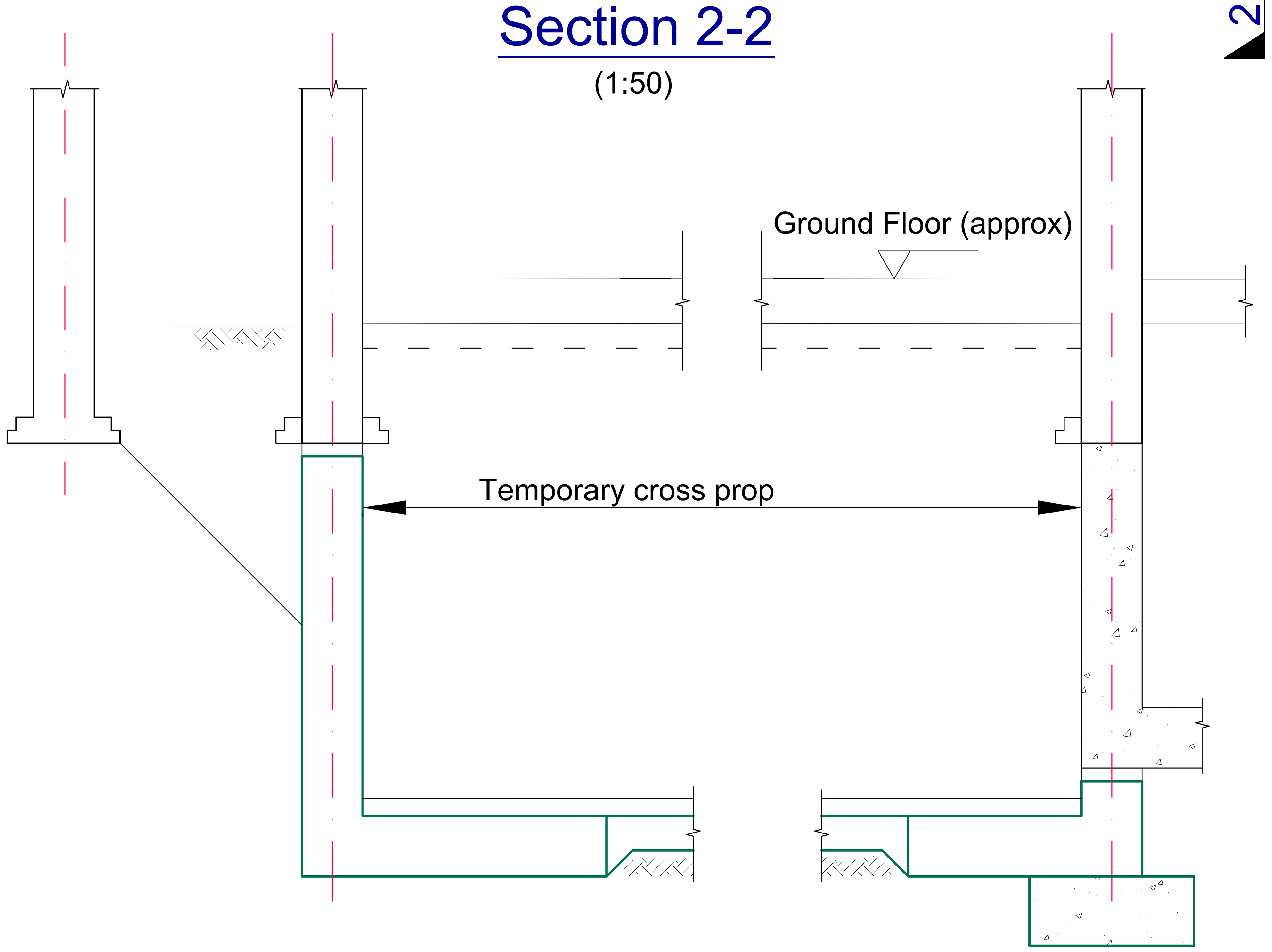
Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
www.croftse.co.uk

Basement Plan

Scale 1:100

Section 2-2

(1:50)



- PLANING ISSUE -
NOT FOR CONSTRUCTION

Rev	Date	Amendments
-	3.11.17	First issue for comment

Job Number: 170901	Date: Nov 17
Dwg Number: TW-30	Rev: -
Drawn: AG	Ch'kd: CT
Scale: As shown @ A3	

Client: Basement Design Studio

Project: 51 Lancaster Grove

Title : Temporary Works Propping and Pin sequencing

Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
www.croftse.co.uk