HALL DAVIS CONSULTING ENGINEERS

32 Kylemore Road London NW6 2PT

Basement Impact Assessment

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5/1/2018

Project No. 1084

Appendix

- BGS Borehole – BGS ID: TQ28SE635/A
- Maps
- Retaining walls calculation
- Drawing Nos. 1084/100-101, 1084/CMS/11&12

32 Kylemore Road, London NW6

1.0 Background

Hall Davis were commissioned to prepare this report as a supporting document for the planning application. It details the outline approach that will be taken to safeguard the integrity of the adjacent building, highways and services, in particular with the construction of the lower ground floor structures.

2.0 The Site and Existing Building

The property is located in Kylemore Road, London NW6 which is a residential road situated within the residential area of West Hampstead.
The property is a 3 storey mid-terrace house and is of traditional construction, with load-bearing solid brick walls and party walls and suspended timber floors internally.

3.0 Description of Works

The proposal is to construct a new single storey front lightwell leading off from the existing lower ground floor. The existing lower ground is to be lowered to improve the headroom and comfort for the occupiers. This will result in a general reduction in lower ground floor level of some 850mm.

At the rear the existing wing is to be demolished and a larger extension constructed, to occupy the footprint of the existing plus the surrounding drained hard –paved rear external patio.

Given the age of the property, the existing foundations are likely to consist of masonry corbelled footings. The existing brickwork will be underpinned to approximately 850mm below existing lower ground floor level. This will be achieved using a traditional reinforced concrete underpin with integral reinforced concrete base (toe) which will eventually form part of the concrete base slab. The base slab acts as a prop at the bottom of the wall to resist lateral forces from the retained soil.

Underpinning will be installed in relatively small sections to ensure that the integrity of the structure will not be compromised at any time and any movement kept to an absolute minimum.

4.0 Camden Planning Guidance CPG4 Stages

Camden Planning Guidance CPG4 sets out the assessment requirements, the initial stages being a screening and scooping assessment, the checklist of which are addressed below. These inform the desk study further in subsequent sections.

4.1 Stage1: Screening

Screening Checklist: Subterranean Ground Water Flow

Question 1A: Is the site located directly above an aquifer?
NO. BGS records indicate non water bearing London Clays to significant depths at least 30m below the ground level.

Question 1B: Will the proposed basement Extend beneath the water table?
NO. Local borehole information available to depth beneath the proposed excavation indicates no presence of ground water.

Question 2: Is the site within 100m of a watercourse, well (disused/used) or potential spring line?
NO. The Westbourne River runs to the west side of the property, some 350m west.(Please also refer to the local watercourses map in the appendices).

Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?
NO. The property is located down-stream of the pond chain. (Please also refer to the Pond chain map in the appendices).

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?
NO. There will be no change in the proportion of hard surfaced/paved areas once the proposed basement has been constructed. The new basement is located within the existing boundary lines and will occupy the same amount of hard surfaced areas. It is visible on the existing and proposed floor plans.

Question 5: As part of the site drainage, will more surface water (eg rainwater and run off) than at present be discharged to the ground (eg via soakaways and/or SUDS)?
NO. The same amount of surface water as before construction will be discharged to the ground. The proposed surface water run-off will be similar to existing.

Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the main water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?
NO. The proposed development is not close to any local pond or spring line which is visible on site location map in appendices. In addition, the excavations proposed are less than 1 metre lower than the existing lower ground floor level. Therefore, they will be similar to the original floor levels to the adjacent properties.

Screening Checklist: Slope Stability

Question 1: Does the existing site include slopes, natural or manmade, greater than 7deg, or 1 in 8?
NO. The existing site does not include any slopes greater 1 in 8. The surface is close to flat. This was confirmed by site inspection and OS mapping.

Question 2: Will the proposed re-profiling of the landscaping at site change slopes at the boundary to more than 7deg, or 1 in 8?
NO. Re-profiling of the landscaping is not part of the proposed scope of works as per the architect's proposed drawings. Change in floor level will be at the north and south boundaries and be retained by party wall/boundary wall retaining underpinnings.

Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7deg, or 1 in 8?
NO. The proposed development is not close to railway cutting or any slopes greater than 1 in 8 which is visible on site location map in appendices.
The neighbouring land across the boundary follows the natural topography of between 0 and 7 degrees.

Question 4: Is the site within a wider hillside setting in which the slope is greater than 7deg or 1 in 8?
NO. Natural slope is seen to be between 0 and 7 degrees in accordance with OS mapping contour. Local man-made slope exceeding 10 degrees, due to railway cutting, is more than 150m to the north.

Question 5: Is the London clay the shallowest stratum at the site?
YES. As per local borehole log scan.

Question 6: Will any trees be felled as part of the proposed development, and /or any works proposed within tree protection zones where trees are to be retained?
NO. No trees will be felled and no works are proposed within tree protection zone.

Question 7: Is there a history of seasonal shrink/swell subsidence in the local area, and/or evidence of such effects at the site?
NO. Not apparent to the existing and neighbouring properties. The upper stratum of soil is sandy clay meaning typically less susceptible.

Question 8: Is the site within 100mt of a watercourse?
NO. The Westbourne River approximately 350mt to the west (down slope) of the property.

Question 9: Is the site within an area of previously worked ground?
NO.A small amount of overlying fill indicating rationalising and terracing of the land longitudinally and transversely across the property.

Question 10: Is the site within an aquifer? If so will the proposed basement extend beneath the water table such that dewatering may be required during construction.
NO. BGS records indicate non water bearing London Clays to significant depths at least 30m below ground level

Question 11: Is the site within 50m of the Hampstead Heath ponds?
NO. Ponds are approx. 2Km away as visible on pond location map in the appendices.

Question 12: Is the site within 5m of a highway or pedestrian right of way?
YES. The light well extends to the pedestrian footpath to the highway.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?
NO. The excavations proposed are less than a metre beneath the existing floor level.

Question 14: Is the site over (or within the exclusion zone of) any tunnels e.g. railway lines?
NO. Railways are over ground and 150m to the north as visible on the London underground map in the appendices.

Screening Checklist: Surface Flow and Flooding Impact Identification

Question 1: Is the site in the catchment of the pond in Hampstead Heath?
NO. The property is located downstream of the pond chain.

Question 2: As part of the proposed site drainage, will surface water flows (eg volume of rainfall and peak run-off) be materially changed from the existing route?
NO. Existing drainage routes and rainwater catchment will be unchanged.

Question 3: Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?
NO. The proposed basement will not result in a change in the proportion of hard surfaced/paved external areas. This is also visible on the Architect's proposed plans.

Question 4: The proposed basement result in changes to the profile of the inflows instantaneous and long term) of the surface water being received by adjacent properties downstream watercourses?
NO. The rear extension and front light well will neither increase nor decrease the natural surface water flows.

Question 5: Will the proposed basement development result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?
NO. All hard paved areas will discharge run-off to the existing sewers as currently.

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 a nearby surface water feature?
NO. The site is not in an area known to be at risk from surface water flooding

therefore Flood Risk Assessment is not required. This is visible in EA Flood Mapping in appendices.

4.2 Stage 2: Scoping

The screening assessment identifies the following matters which are required to be justified or discussed further.

- **Stiff sandy clay is the shallowest stratum on the site (the excavations would occur within this clay stratum): We need to assess what are the geotechnical implications.**
- **The site and proposed works occur within 5m of the public highway (the front light well to occupy the front garden): We need to assess the constructional implications.**

These aspects are addressed in stage 4.

4.3 Stage 3: Site Investigations/Ground conditions

The BGS Geological Map for the area indicates that the ground conditions are known to comprise Made Ground on to Clayey Sands, on to London Clay.
A single borehole was previously undertaken at 27 Gladys Road as part of the soil investigation for its new basement proposal. The borehole result was available on Camden Planning Portal and can be summarised as follows:
The existing subsoil are of London Clay with a nominal build up of made ground underlain by Sandy Clay, upon which the original foundations are situated. No ground water was encountered.

4.4 Stage 4: Impact Assessment

4.4.1 Impact to subterranean ground water flow

The local natural watercourse is the Westbourne River (please refer to the local watercourses map in the appendices) and is approximately 350m away from the property to not to be impacted by the proposed excavations, which are not significantly deeper than the original foundation of the property.

Because the property has structural foundations already extending to the depth of the proposed excavations, including an existing lower ground floor, the penetration of the existing structures will not be significantly increased in depth by the proposed works.
The Clay subsoils are relatively impermeable and so any lateral ground water flows would be minimal. As such, the proposed extension is deemed to have no significant effect on the local hydrogeology.

4.4.2 Impact to surface water flow and flooding

With reference to the Environment Agency's Flood Risk map, it can be seen that site lies outside any flood risk zone.
The proposed basement excavation is virtually within the footprint of the existing building and as such, surface water flow and flood risk levels will remain unaffected following the construction of the proposed basement.

4.4.3 Impact on infrastructure, utilities, services and drainage

The basement does not extend beyond the footprint of the existing residential property and therefore will not impact local infrastructure, utilities and services or drainage. On site, investigations will be carried out as construction proceeds to determine the location of any services and drainage on site so that these can be maintained and re-routed as necessary. The implication of the proximity of the light-well to the public highway is addressed in the design of the front retaining wall in section 5.

4.4.4 Impact on adjoining building and structures

4.4.4.1 Stability of Excavations

The principle consideration for the proposed basement works is the effect on adjoining properties during the construction stage. All excavations will be shored during the underpinning sequence and additional horizontal props will be added as the construction of the basement progresses. The main horizontal props will not be removed until at least 28 days after casting the concrete base slab. The proposed underpinning and sequencing of the works is appended to this report.

4.4.4.2 Underpinning

The proposed underpinning is shallow; being approx 800mm below the current lower ground floor level. It is reasonably judged that only a very minor increase in load due to the concrete in place of the soil will be experienced, and with the slight increase in bearing area the difference in ground bearing pressure is zero to negligible. The subsoil are seen to be sandy clays which are considered to have a very low shrinkage potential. In addition the soils at proposed bearing level have been subjected to the existing building loading for over an extended period of time. In consideration of these factors the risk of settlement of the underpins as a result of a vertical applied load is considered to be negligible.

In consideration of the above factors and in accordance with Burland and Potts 'Building Damage Classification' table, we expect the damage to the adjoining building to be of Category 1 ("very slight"). As previously stated, all underpins and excavations will remain propped until the permanent structure is in place and therefore we expect any movements to be negligible.

4.4.5 Suitable construction methods and mitigation measures for developments

As discussed above, the construction will involve excavation and forming concrete underpins in relatively small sections one at a time so that the majority of the existing building remains fully supported by the ground at any one time..

As a precautionary measure, we would recommend that the property and adjoining properties are observed for movement using target monitoring during the basement construction.

4.4.5.1 Monitoring of adjacent structures

It is proposed that the integrity of the adjacent properties is safeguarded by a system of movement monitoring. The contractor shall appoint a specialist survey company to establish monitoring target locations to key elements of the building as required.

The external facades and party walls will be monitored at these positions and the targets shall allow 3D location measurements for the duration of the works, to an accuracy of +/- 1mm.
Readings shall be taken shortly after the start of the excavations then at weekly intervals during the basement construction until the RC are complete and propped after which point the frequency will be reduced to then a final reading 6 month after completion.

All measurements will be plotted graphically and results shall be submitted and circulated to all relevant parties including the appointed Party Wall Surveyors within 24 hours of being measured.

Trigger levels are to be as set out below. In the event of a red value being reached the contractor must immediately stop, make safe the works, notify the Party Wall Surveyors and only recommence when agreed by the appointed Surveyors.

Trigger Levels for movements:

Vertical movement of Party Walls:	Amber +/- 5mm All parties notified
	Red +/- 8mm Work stopped and reviewed
Lateral movement of Party Walls	Amber +/- 5mm All parties notified
	Red +/- 8mm Work stopped and reviewed
Lateral or vertical movement of facades:	Amber +/- 5mm All parties notified
	Red +/- 8mm Work stopped and reviewed

4.4.6 Cumulative impact of basement development in the area

In consideration of all the above points we do not consider that the proposed basement once completed will have any adverse effect on the surrounding area. However, during the works the basement construction will have an impact particularly in terms of soil removal, construction traffic and deliveries. The contractor should proactively manage the works keeping local residents aware of any events that may impact them in good time.

5 Design

Structural calculations have been carried out for the basement wall and these are appended to this report. From our calculations, bearing pressures will be no greater than a maximum 100KN/m^2, which we consider to be an acceptable bearing pressure to control settlements as the soil conditions 4 metres below ground level are expected to be good at this depth and may typically reach 150KN/m2 allowable bearing pressure. We have analysed a typical wall section for the proposed basement and calculate that a 350mm thick reinforced concrete wall and toe that is propped at the base will be sufficient.

The calculations carried out are based on the information available. For the detailed basement design (which would follow once planning permission is obtained) further information will be used to determine the final concrete wall and base widths, reinforcement sizes and other structural details.

6 Site set up and construction methodology

The site set-up will involve installing plywood hoarding around the perimeter of the front garden which will enclose the site and make it safe and prevent anybody accessing the site or basement excavation other than construction workers. There will be a roof on top of the hoarding so that construction dust, dirt and noise are contained as much as possible.

The conveyor used to remove the soil will project out from the hoarding over the footpath to the skip location on the road. The conveyor will also be enclosed to prevent soil escaping and falling onto the footpath. The conveyor will be supported using a timber framework and/or scaffold that is considerately designed to minimise any impact on the public footpath. The skip will also be enclosed by perimeter hoarding to further contain the excavated soil and reduce the visual impactof the skip. The skip will be emptied typically once a day or every other day. A grab lorry will set down alongside the skip to remove the spoil and this operation will take typically 10 minutes. During this period, the contractors banksmen will guide the grab lorry into position and ensure the safe removal of spoil as well as guarding the safety of pedestrians and road users within the vicinity of the site and directing them as appropriate.
Other construction and delivery vehicles will attempt to park on the side of the road adjacent to the site to keep traffic passing as freely as possible. Deliveries would be expected typically every other day.

The construction of the basement will begin with the excavation of the front garden to form the lightwell. The contractor will then progress from front to the rear of the site excavating and underpinning as they progress.

Once all the underpinning work is completed the skip will be removed to allow for a concrete truck that will pump concrete into the basement to form the final basement slab. After 7 days any remaining temporary propping will be removed, the slab and walls will be waterproofed and the main basement contractor will leave site to allow for final fit-out by others. The construction period for the main basement construction from initial site set-up to completion of the waterproofing will take approximately 14 weeks.

APPENDIX

- BGS Borehole – BGS ID: TQ28SE635/A
- Maps
- Retaining wall calculations
- Drawing No. 1084/100-101, 1084/CMS/11&12

Investigation at NETHERWOOD STREET, CAMDEN Report No. 1/575*/JPG TQ/28SE/6859
B/H 1 2510. 8456.

Date of Boring 1-6 August 1969 Type of Boring Shell and Auger

Ground Level 44.97 m. O.D. (Newlyn) Diameter of Borehole 203mm

Scale ft / m	Depth m	Strata	O. D. Level	Description of Soil	Sample No.	Sample Type	'N' Value Blows ft.	Mean Shear Strength KN/m^2
	G.L.		44.97		1	D		
				MADE GROUND consisting of brick fragments, pieces of concrete, gravel and sandy silt	2	D		
10 / 3					3	D		
					4	D		
	5.3		39.67		5	D		
					6	U		117
20 / 6				Stiff brown mottled blue in places fissured silty CLAY with some traces of crystals.	7	D		
					8	U		147
					9	D		
30 / 9					10	D		
					11	U		118
					12	D		
	11.9		33.07	Stiff blue/grey fissured silty CLAY	13	U		174
40 / 12	12.2		32.77		14	D		
				END OF BOREHOLE				
50 / 15								
60 / 18								

Notes

No groundwater encountered

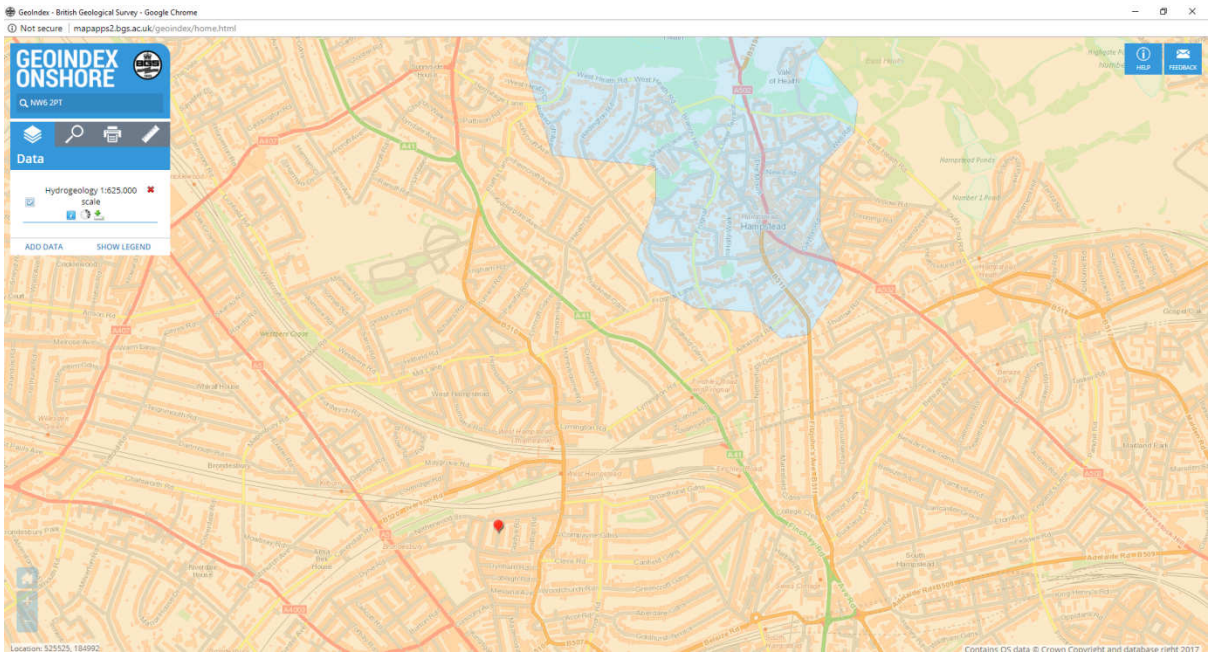
U ... Undisturbed sample
D ... Disturbed sample
W ... Water sample

Scale: 1:100

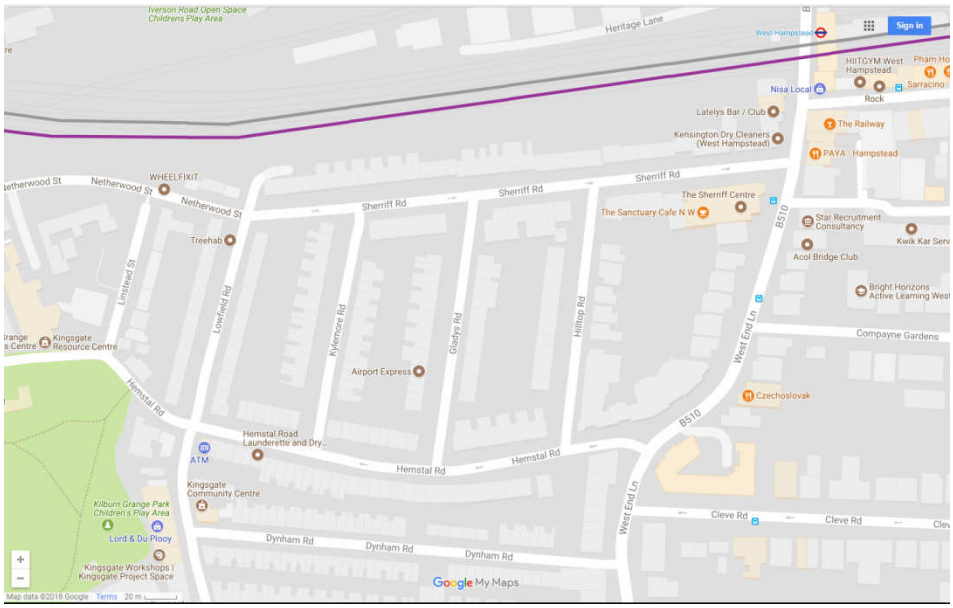
Figure No. 1

Appendix: Maps

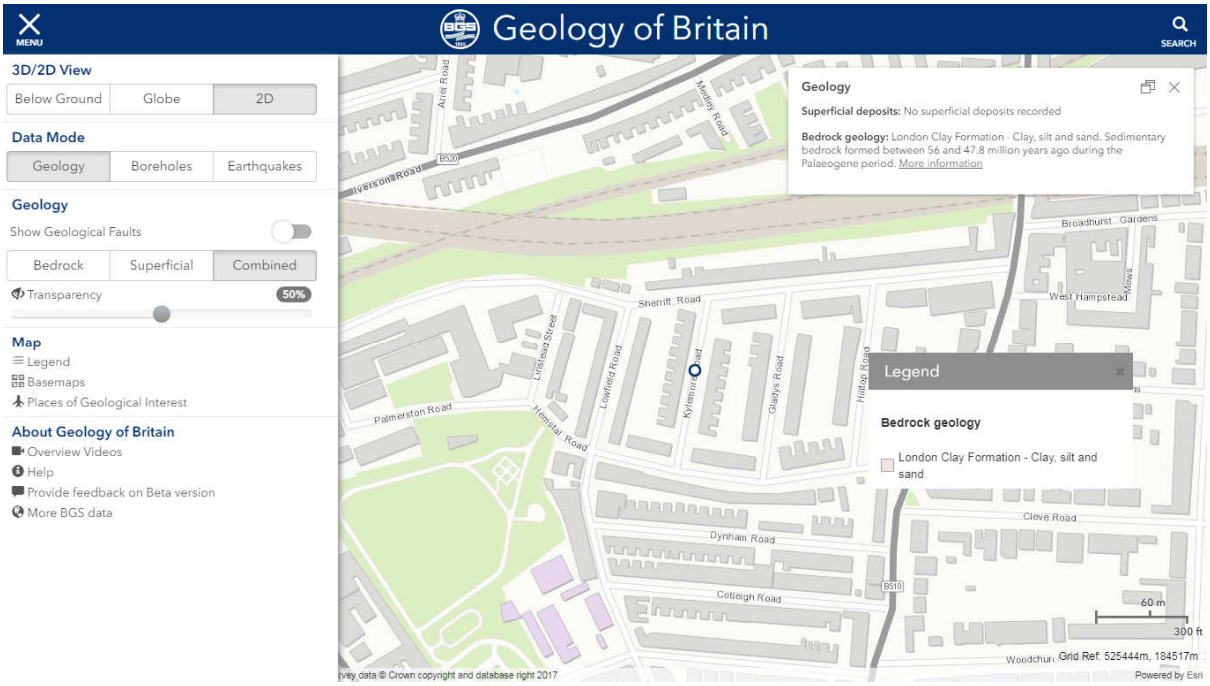
[Figure1]: Flood risk from surface water



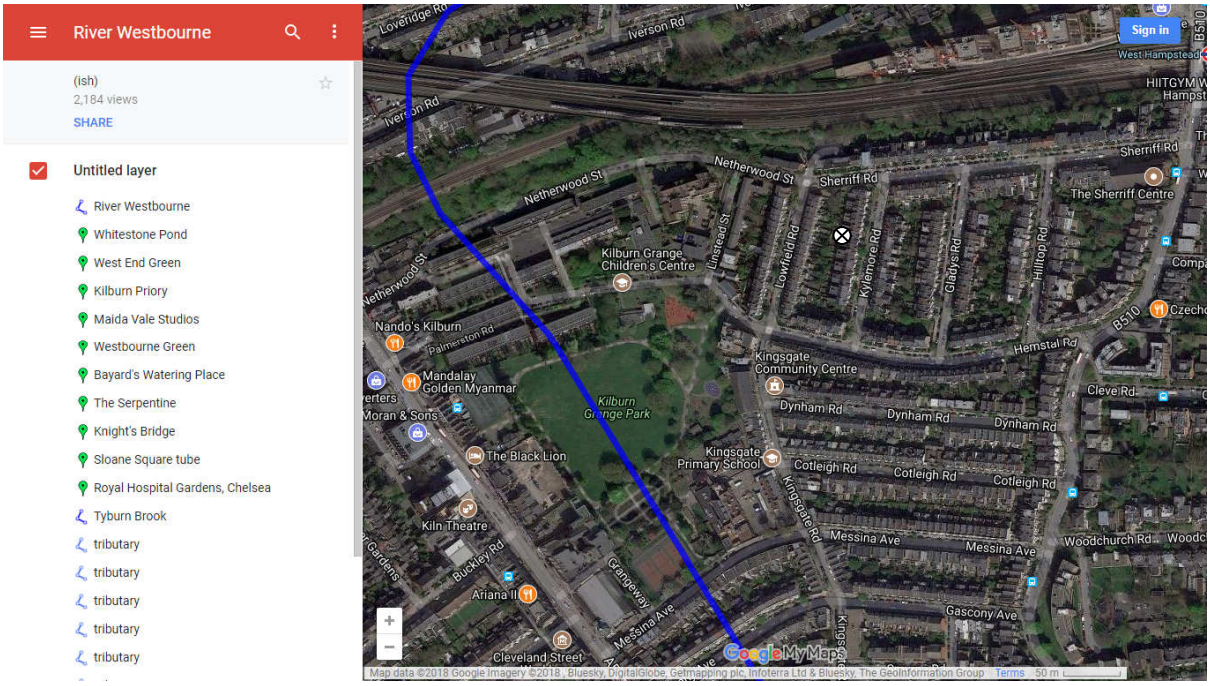
[Figure 2]: Pond Chains on Hampstead Heath



[Figure 3]: London Underground Lines



[Figure 4]: Local Geological Map



[Figure 5]: Local Watercourses (Westbourne River)

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Project				Job no.	
32 Kylemore Road, London NW6				1026	
Calcs for				Start page no./Revision	
Typical Underpinning				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
NM	30/04/2018	HD	30/04/2018		

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 2.3.00

Retaining wall details

Stem type	Cantilever
Stem height	h_{stem} = **850** mm
Prop height	h_{prop} = **850** mm
Stem thickness	t_{stem} = **350** mm
Angle to rear face of stem	α = **90** deg
Stem density	γ_{stem} = **25** kN/m^3
Toe length	l_{toe} = **1700** mm
Heel length	l_{heel} = **150** mm
Base thickness	t_{base} = **350** mm
Base density	γ_{base} = **25** kN/m^3
Height of retained soil	h_{ret} = **850** mm
Angle of soil surface	β = **0** deg
Depth of cover	d_{cover} = **0** mm

Retained soil properties

Soil type	Firm clay
Moist density	γ_{mr} = **18** kN/m^3
Saturated density	γ_{sr} = **18** kN/m^3

Base soil properties

Soil type	Firm clay
Moist density	γ_{mb} = **18** kN/m^3

Loading details

Permanent surcharge load	$Surcharge_G$ = **4** kN/m^2
Variable surcharge load	$Surcharge_Q$ = **1.5** kN/m^2
Vertical line load at 1850 mm	P_{G1} = **50** kN/m

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32 Kylemore Road, London NW6				1026	
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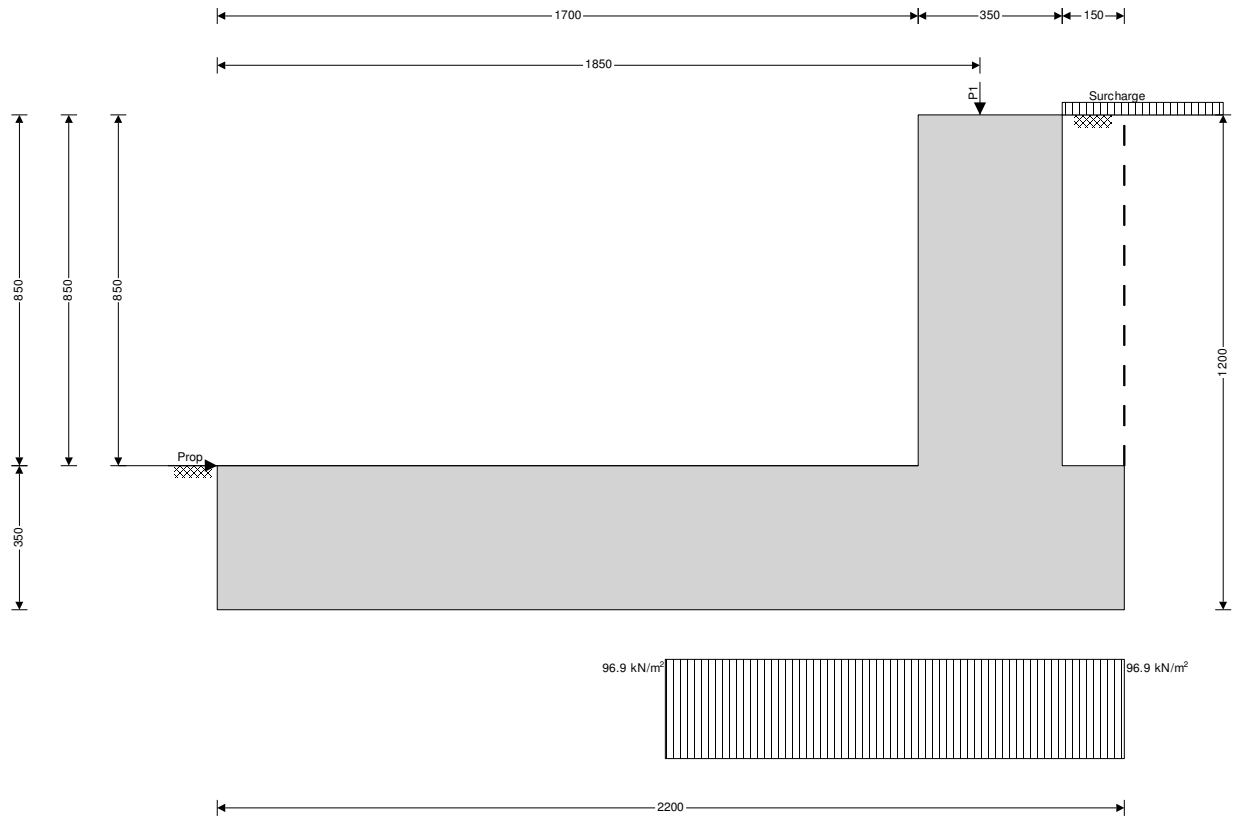
Typical Underpinning				2	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
NM	30/04/2018	HD	30/04/2018		



Calculate retaining wall geometry

Base length	$l_{base} = l_{toe} + t_{stem} + l_{heel} =$ **2200** mm
Moist soil height	$h_{moist} = h_{soil} =$ **850** mm
Length of surcharge load	$l_{sur} = l_{heel} =$ **150** mm
- Distance to vertical component	$x_{sur\_v} = l_{base} - l_{heel} / 2 =$ **2125** mm
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret} =$ **1200** mm
- Distance to horizontal component	$x_{sur\_h} = h_{eff} / 2 =$ **600** mm
Area of wall stem	$A_{stem} = h_{stem} \times t_{stem} =$ **0.298** m²
- Distance to vertical component	$x_{stem} = l_{toe} + t_{stem} / 2 =$ **1875** mm
Area of wall base	$A_{base} = l_{base} \times t_{base} =$ **0.77** m²
- Distance to vertical component	$x_{base} = l_{base} / 2 =$ **1100** mm
Area of moist soil	$A_{moist} = h_{moist} \times l_{heel} =$ **0.128** m²
- Distance to vertical component	$x_{moist\_v} = l_{base} - (h_{moist} \times l_{heel}^2 / 2) / A_{moist} =$ **2125** mm
- Distance to horizontal component	$x_{moist\_h} = h_{eff} / 3 =$ **400** mm

Partial factors on actions - Table A.3 - Combination 1

Permanent unfavourable action	$\gamma_G =$ **1.35**
Permanent favourable action	$\gamma_{Gf} =$ **1.00**
Variable unfavourable action	$\gamma_Q =$ **1.50**
Variable favourable action	$\gamma_{Qf} =$ **0.00**

Partial factors for soil parameters – Table A.4 - Combination 1

Angle of shearing resistance	$\gamma_{\phi'} =$ **1.00**
Effective cohesion	$\gamma_{c'} =$ **1.00**
Weight density	$\gamma_\gamma =$ **1.00**

Soil coefficients

Coefficient of friction to back of wall	K_{fr} = **0.325**
Coefficient of friction to front of wall	K_{fb} = **0.325**
Coefficient of friction beneath base	K_{fbb} = **0.325**
Active pressure coefficient	K_A = **0.333**
Passive pressure coefficient	K_P = **4.977**

Overturning check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_{Gf} \times A_{stem} \times \gamma_{stem}$ = **7.4** kN/m
Wall base	$F_{base} = \gamma_{Gf} \times A_{base} \times \gamma_{base}$ = **19.3** kN/m
Line loads	$F_{P\_v} = \gamma_{Gf} \times P_{G1}$ = **50** kN/m
Moist retained soil	$F_{moist\_v} = \gamma_{Gf} \times A_{moist} \times \gamma_{mr}$ = **2.3** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{P\_v}$ = **79** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff}$ = **3.1** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2$ = **5.8** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h}$ = **8.9** kN/m

Overturning moments on wall

Surcharge load	$M_{sur\_OT} = F_{sur\_h} \times x_{sur\_h}$ = **1.8** kNm/m
Moist retained soil	$M_{moist\_OT} = F_{moist\_h} \times x_{moist\_h}$ = **2.3** kNm/m
Total	$M_{total\_OT} = M_{moist\_OT} + M_{sur\_OT}$ = **4.2** kNm/m

Restoring moments on wall

Wall stem	$M_{stem\_R} = F_{stem} \times x_{stem}$ = **13.9** kNm/m
Wall base	$M_{base\_R} = F_{base} \times x_{base}$ = **21.2** kNm/m
Line loads	$M_{P\_R} = abs(\gamma_{Gf} \times P_{G1}) \times p_1$ = **92.5** kNm/m
Moist retained soil	$M_{moist\_R} = F_{moist\_v} \times x_{moist\_v}$ = **4.9** kNm/m
Total	$M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{moist\_R} + M_{P\_R}$ = **132.5** kNm/m

Check stability against overturning

Factor of safety: $FoS_{ot} = M_{total\_R} / M_{total\_OT}$ = **31.783**

PASS - Maximum restoring moment is greater than overturning moment

Bearing pressure check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem}$ = **10** kN/m
Wall base	$F_{base} = \gamma_G \times A_{base} \times \gamma_{base}$ = **26** kN/m
Surcharge load	$F_{sur\_v} = (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times l_{heel}$ = **1.1** kN/m
Line loads	$F_{P\_v} = \gamma_G \times P_{G1}$ = **67.5** kN/m
Moist retained soil	$F_{moist\_v} = \gamma_G \times A_{moist} \times \gamma_{mr}$ = **3.1** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{sur\_v} + F_{P\_v}$ = **107.8** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff}$ = **3.1** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2$ = **5.8** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h}$ = **8.9** kN/m

Moments on wall

Wall stem	$M_{stem} = F_{stem} \times x_{stem} =$ **18.8** kNm/m
Wall base	$M_{base} = F_{base} \times x_{base} =$ **28.6** kNm/m
Surcharge load	$M_{sur} = F_{sur\_v} \times x_{sur\_v} - F_{sur\_h} \times x_{sur\_h} =$ **0.6** kNm/m
Line loads	$M_P = \gamma_G \times P_{G1} \times p_1 =$ **124.9** kNm/m
Moist retained soil	$M_{moist} = F_{moist\_v} \times x_{moist\_v} - F_{moist\_h} \times x_{moist\_h} =$ **4.3** kNm/m
Total	$M_{total} = M_{stem} + M_{base} + M_{moist} + M_{sur} + M_P =$ **177.1** kNm/m

Check bearing pressure

Propping force	$F_{prop\_base} = F_{total\_h} =$ **8.9** kN/m
Distance to reaction	$\bar{x} = (M_{total} + M_{prop}) / F_{total\_v} =$ **1644** mm
Eccentricity of reaction	$e = \bar{x} - l_{base} / 2 =$ **544** mm
Loaded length of base	$l_{load} = 2 \times (l_{base} - \bar{x}) =$ **1113** mm
Bearing pressure at toe	$q_{toe} =$ **0** kN/m^2
Bearing pressure at heel	$q_{heel} = F_{total\_v} / l_{load} =$ **96.9** kN/m^2
Factor of safety	$FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) =$ **1.032**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

Partial factors on actions - Table A.3 - Combination 2

Permanent unfavourable action	$\gamma_G =$ **1.00**
Permanent favourable action	$\gamma_{Gf} =$ **1.00**
Variable unfavourable action	$\gamma_Q =$ **1.30**
Variable favourable action	$\gamma_{Qf} =$ **0.00**

Partial factors for soil parameters – Table A.4 - Combination 2

Angle of shearing resistance	$\gamma_{\phi'} =$ **1.25**
Effective cohesion	$\gamma_{c'} =$ **1.25**
Weight density	$\gamma_\gamma =$ **1.00**

Soil coefficients

Coefficient of friction to back of wall	$K_{fr} =$ **0.325**
Coefficient of friction to front of wall	$K_{fb} =$ **0.325**
Coefficient of friction beneath base	$K_{fbb} =$ **0.325**
Active pressure coefficient	$K_A =$ **0.333**
Passive pressure coefficient	$K_P =$ **4.977**

Overturning check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_{Gf} \times A_{stem} \times \gamma_{stem} =$ **7.4** kN/m
Wall base	$F_{base} = \gamma_{Gf} \times A_{base} \times \gamma_{base} =$ **19.3** kN/m
Line loads	$F_{P\_v} = \gamma_{Gf} \times P_{G1} =$ **50** kN/m
Moist retained soil	$F_{moist\_v} = \gamma_{Gf} \times A_{moist} \times \gamma_{mr} =$ **2.3** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{P\_v} =$ **79** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff} =$ **2.4** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2 =$ **4.3** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h} =$ **6.7** kN/m

Overturning moments on wall

Surcharge load	$M_{sur\_OT} = F_{sur\_h} \times x_{sur\_h} =$ **1.4** kNm/m

Moist retained soil	$M_{moist\_OT} = F_{moist\_h} \times x_{moist\_h} =$ **1.7** kNm/m
Total	$M_{total\_OT} = M_{moist\_OT} + M_{sur\_OT} =$ **3.2** kNm/m

Restoring moments on wall

Wall stem	$M_{stem\_R} = F_{stem} \times x_{stem} =$ **13.9** kNm/m
Wall base	$M_{base\_R} = F_{base} \times x_{base} =$ **21.2** kNm/m
Line loads	$M_{P\_R} = abs(\gamma_{Gf} \times P_{G1}) \times p_1 =$ **92.5** kNm/m
Moist retained soil	$M_{moist\_R} = F_{moist\_v} \times x_{moist\_v} =$ **4.9** kNm/m
Total	$M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{moist\_R} + M_{P\_R} =$ **132.5** kNm/m

Check stability against overturning

Factor of safety	$FoS_{ot} = M_{total\_R} / M_{total\_OT} =$ **41.983**

PASS - Maximum restoring moment is greater than overturning moment

Bearing pressure check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem} =$ **7.4** kN/m
Wall base	$F_{base} = \gamma_G \times A_{base} \times \gamma_{base} =$ **19.3** kN/m
Surcharge load	$F_{sur\_v} = (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times l_{heel} =$ **0.9** kN/m
Line loads	$F_{P\_v} = \gamma_G \times P_{G1} =$ **50** kN/m
Moist retained soil	$F_{moist\_v} = \gamma_G \times A_{moist} \times \gamma_{mr} =$ **2.3** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{sur\_v} + F_{P\_v} =$ **79.9** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff} =$ **2.4** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2 =$ **4.3** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h} =$ **6.7** kN/m

Moments on wall

Wall stem	$M_{stem} = F_{stem} \times x_{stem} =$ **13.9** kNm/m
Wall base	$M_{base} = F_{base} \times x_{base} =$ **21.2** kNm/m
Surcharge load	$M_{sur} = F_{sur\_v} \times x_{sur\_v} - F_{sur\_h} \times x_{sur\_h} =$ **0.5** kNm/m
Line loads	$M_P = \gamma_G \times P_{G1} \times p_1 =$ **92.5** kNm/m
Moist retained soil	$M_{moist} = F_{moist\_v} \times x_{moist\_v} - F_{moist\_h} \times x_{moist\_h} =$ **3.1** kNm/m
Total	$M_{total} = M_{stem} + M_{base} + M_{moist} + M_{sur} + M_P =$ **131.2** kNm/m

Check bearing pressure

Propping force	$F_{prop\_base} = F_{total\_h} =$ **6.7** kN/m
Distance to reaction	$\bar{x} = (M_{total} + M_{prop}) / F_{total\_v} =$ **1643** mm
Eccentricity of reaction	$e = \bar{x} - l_{base} / 2 =$ **543** mm
Loaded length of base	$l_{load} = 2 \times (l_{base} - \bar{x}) =$ **1114** mm
Bearing pressure at toe	$q_{toe} =$ **0** kN/m^2
Bearing pressure at heel	$q_{heel} = F_{total\_v} / l_{load} =$ **71.7** kN/m^2
Factor of safety	$FoS_{bp} = P_{bearing} / max(q_{toe}, q_{heel}) =$ **1.395**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

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Project				Job no.	
32 Kylemore Road, London NW6				1084	
Calcs for				Start page no./Revision	
Ligthwell Retaining wall				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
NM	30/04/2018	HD	30/04/2018		

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 2.3.00

Retaining wall details

Stem type	Propped cantilever
Stem height	h_{stem} = **3650** mm
Prop height	h_{prop} = **3600** mm
Stem thickness	t_{stem} = **350** mm
Angle to rear face of stem	α = **90** deg
Stem density	γ_{stem} = **25** kN/m^3
Toe length	l_{toe} = **1700** mm
Base thickness	t_{base} = **350** mm
Base density	γ_{base} = **25** kN/m^3
Height of retained soil	h_{ret} = **3650** mm
Angle of soil surface	β = **0** deg
Depth of cover	d_{cover} = **0** mm

Retained soil properties

Soil type	Stiff clay
Moist density	γ_{mr} = **19** kN/m^3
Saturated density	γ_{sr} = **19** kN/m^3

Base soil properties

Soil type	Firm clay
Moist density	γ_{mb} = **18** kN/m^3

Loading details

Permanent surcharge load	$Surcharge_G$ = **2.5** kN/m^2
Variable surcharge load	$Surcharge_Q$ = **10** kN/m^2
Vertical line load at 1850 mm	P_{G1} = **1** kN/m

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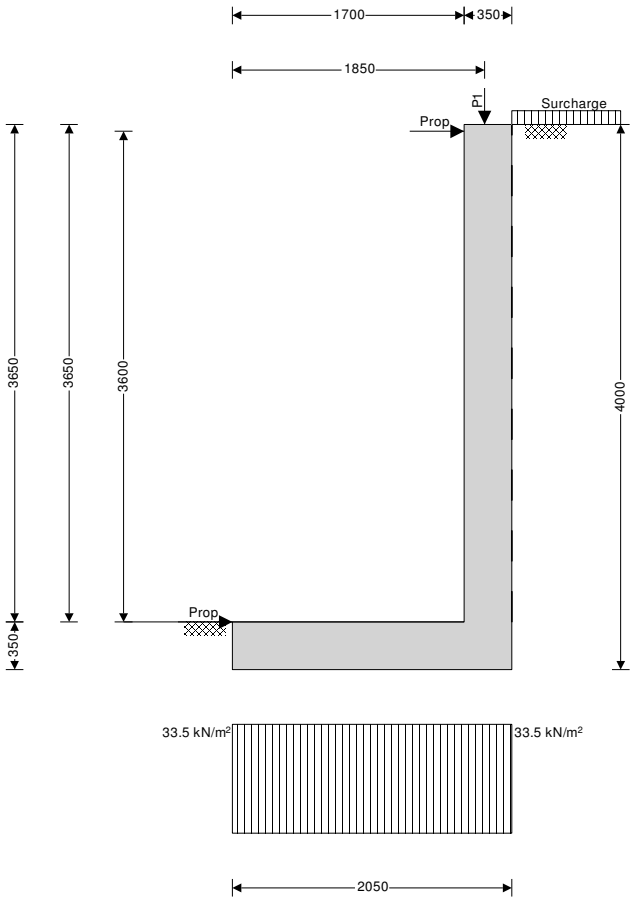
Project	Job no.
32 Kylemore Road, London NW6	1084
Calcs for	**Start page no./Revision**
Ligthwell Retaining wall	2

Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
NM	30/04/2018	HD	30/04/2018		



Calculate retaining wall geometry

Base length	$l_{base} = l_{toe} + t_{stem} =$ **2050** mm
Moist soil height	$h_{moist} = h_{soil} =$ **3650** mm
Length of surcharge load	$l_{sur} = l_{heel} =$ **0** mm
- Distance to vertical component	$x_{sur\_v} = l_{base} - l_{heel} / 2 =$ **2050** mm
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret} =$ **4000** mm
- Distance to horizontal component	$x_{sur\_h} = h_{eff} / 2 =$ **2000** mm
Area of wall stem	$A_{stem} = h_{stem} \times t_{stem} =$ **1.278** m^2
- Distance to vertical component	$x_{stem} = l_{toe} + t_{stem} / 2 =$ **1875** mm
Area of wall base	$A_{base} = l_{base} \times t_{base} =$ **0.717** m^2
- Distance to vertical component	$x_{base} = l_{base} / 2 =$ **1025** mm

Partial factors on actions - Table A.3 - Combination 1

Permanent unfavourable action	$\gamma_G =$ **1.35**
Permanent favourable action	$\gamma_{Gf} =$ **1.00**
Variable unfavourable action	$\gamma_Q =$ **1.50**
Variable favourable action	$\gamma_{Qf} =$ **0.00**

Partial factors for soil parameters – Table A.4 - Combination 1

Angle of shearing resistance	$\gamma_{\phi'} =$ **1.00**
Effective cohesion	$\gamma_{c'} =$ **1.00**
Weight density	$\gamma_\gamma =$ **1.00**

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Soil coefficients

Coefficient of friction to back of wall	K_{fr} = **0.325**
Coefficient of friction to front of wall	K_{fb} = **0.325**
Coefficient of friction beneath base	K_{fbb} = **0.325**
Active pressure coefficient	K_A = **0.333**
Passive pressure coefficient	K_P = **4.977**

Bearing pressure check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem}$ = **43.1** kN/m
Wall base	$F_{base} = \gamma_G \times A_{base} \times \gamma_{base}$ = **24.2** kN/m
Line loads	$F_{P\_v} = \gamma_G \times P_{G1}$ = **1.4** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{P\_v}$ = **68.7** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff}$ = **24.5** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2$ = **68.4** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h}$ = **92.9** kN/m

Moments on wall

Wall stem	$M_{stem} = F_{stem} \times x_{stem}$ = **80.8** kNm/m
Wall base	$M_{base} = F_{base} \times x_{base}$ = **24.8** kNm/m
Surcharge load	$M_{sur} = -F_{sur\_h} \times x_{sur\_h}$ = **-49** kNm/m
Line loads	$M_P = \gamma_G \times P_{G1} \times p_1$ = **2.5** kNm/m
Moist retained soil	$M_{moist} = -F_{moist\_h} \times x_{moist\_h}$ = **-91.2** kNm/m
Total	$M_{total} = M_{stem} + M_{base} + M_{moist} + M_{sur} + M_P$ = **-32** kNm/m

Check bearing pressure

Propping force to stem	$F_{prop\_stem} = \min((F_{total\_v} \times l_{base} / 2 - M_{total}) / (h_{prop} + t_{base}), F_{total\_h})$ = **25.9** kN/m
Propping force to base	$F_{prop\_base} = F_{total\_h} - F_{prop\_stem}$ = **67** kN/m
Moment from propping force	$M_{prop} = F_{prop\_stem} \times (h_{prop} + t_{base})$ = **102.4** kNm/m
Distance to reaction	$\bar{x} = (M_{total} + M_{prop}) / F_{total\_v}$ = **1025** mm
Eccentricity of reaction	$e = \bar{x} - l_{base} / 2$ = **0** mm
Loaded length of base	$l_{load} = l_{base}$ = **2050** mm
Bearing pressure at toe	$q_{toe} = F_{total\_v} / l_{base}$ = **33.5** kN/m^2
Bearing pressure at heel	$q_{heel} = F_{total\_v} / l_{base}$ = **33.5** kN/m^2
Factor of safety	$FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel})$ = **2.985**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

Partial factors on actions - Table A.3 - Combination 2

Permanent unfavourable action	γ_G = **1.00**
Permanent favourable action	γ_{Gf} = **1.00**
Variable unfavourable action	γ_Q = **1.30**
Variable favourable action	γ_{Qf} = **0.00**

Partial factors for soil parameters – Table A.4 - Combination 2

Angle of shearing resistance	$\gamma_{\phi'}$ = **1.25**
Effective cohesion	$\gamma_{c'}$ = **1.25**
Weight density	γ_γ = **1.00**

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Soil coefficients

Coefficient of friction to back of wall	K_{fr} = **0.325**
Coefficient of friction to front of wall	K_{fb} = **0.325**
Coefficient of friction beneath base	K_{fbb} = **0.325**
Active pressure coefficient	K_A = **0.333**
Passive pressure coefficient	K_P = **4.977**

Bearing pressure check

Vertical forces on wall

Wall stem	$F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem}$ = **31.9** kN/m
Wall base	$F_{base} = \gamma_G \times A_{base} \times \gamma_{base}$ = **17.9** kN/m
Line loads	$F_{P\_v} = \gamma_G \times P_{G1}$ = **1** kN/m
Total	$F_{total\_v} = F_{stem} + F_{base} + F_{P\_v}$ = **50.9** kN/m

Horizontal forces on wall

Surcharge load	$F_{sur\_h} = K_A \times (\gamma_G \times Surcharge_G + \gamma_Q \times Surcharge_Q) \times h_{eff}$ = **20.7** kN/m
Moist retained soil	$F_{moist\_h} = \gamma_G \times K_A \times \gamma_{mr} \times h_{eff}^2 / 2$ = **50.7** kN/m
Total	$F_{total\_h} = F_{moist\_h} + F_{sur\_h}$ = **71.3** kN/m

Moments on wall

Wall stem	$M_{stem} = F_{stem} \times x_{stem}$ = **59.9** kNm/m
Wall base	$M_{base} = F_{base} \times x_{base}$ = **18.4** kNm/m
Surcharge load	$M_{sur} = -F_{sur\_h} \times x_{sur\_h}$ = **-41.3** kNm/m
Line loads	$M_P = \gamma_G \times P_{G1} \times p_1$ = **1.9** kNm/m
Moist retained soil	$M_{moist} = -F_{moist\_h} \times x_{moist\_h}$ = **-67.6** kNm/m
Total	$M_{total} = M_{stem} + M_{base} + M_{moist} + M_{sur} + M_P$ = **-28.8** kNm/m

Check bearing pressure

Propping force to stem	$F_{prop\_stem} = \min((F_{total\_v} \times l_{base} / 2 - M_{total}) / (h_{prop} + t_{base}), F_{total\_h})$ = **20.5** kN/m
Propping force to base	$F_{prop\_base} = F_{total\_h} - F_{prop\_stem}$ = **50.8** kN/m
Moment from propping force	$M_{prop} = F_{prop\_stem} \times (h_{prop} + t_{base})$ = **80.9** kNm/m
Distance to reaction	$\bar{x} = (M_{total} + M_{prop}) / F_{total\_v}$ = **1025** mm
Eccentricity of reaction	$e = \bar{x} - l_{base} / 2$ = **0** mm
Loaded length of base	$l_{load} = l_{base}$ = **2050** mm
Bearing pressure at toe	$q_{toe} = F_{total\_v} / l_{base}$ = **24.8** kN/m^2
Bearing pressure at heel	$q_{heel} = F_{total\_v} / l_{base}$ = **24.8** kN/m^2
Factor of safety	$FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel})$ = **4.029**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

DO NOT SCALE

ALL TEMPORARY PROPS TO BE SUPERSLIM SOLDIERS UNO.

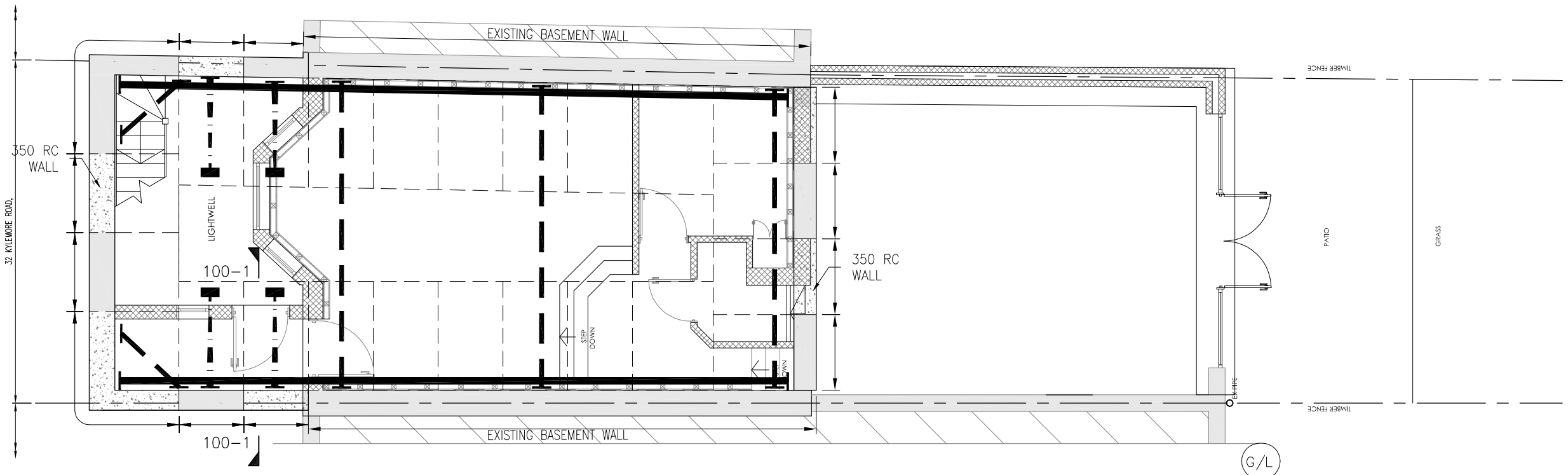
NOTE:
WHERE ON SITE MIX/ BATCHED CONCRETE IS TO BE USED THE CONTRACTOR SHALL:
KEEP A RECORD OF TIME AND SITE MIX QUANTITIES IN RELATION TO THE UNDERPINNING IN WHICH IS TO BE USED.

UNDERPINNING NOTES

1) REPEAT SAME SEQUENCE FOR 2ND STAGE UNDERPINNING.

INDICATES UNDERPINING SEQUENCE

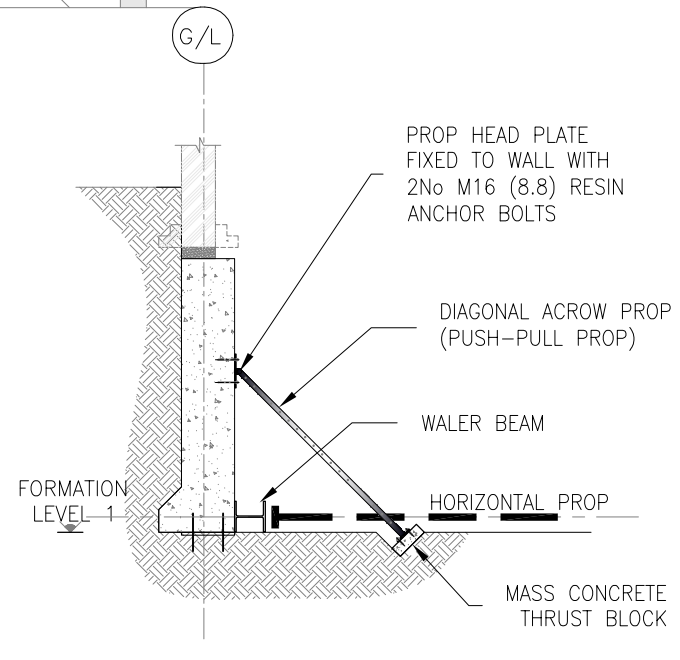
INDICATES DIAGONAL ACROW PROP



PROPOSED BASEMENT SEQUENCE & TEMPORARY WORK PLAN

(SHOWING UNDERPIN UPPER LEVEL & WALING BEAM & PROPS)

Scale 1:75



100–1 TYPICAL SECTION

1ST STAGE SUPPORTING RC WALL

Scale 1:50

ORIGINAL DRAWING A3

NOTES

GENERAL

ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.

DRAWINGS ARE NOT TO BE SCALED.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ARCHITECTS, ENGINEERS AND OTHER SPECIALISTS DRAWINGS.

THE CONTRACTOR IS TO ENSURE THAT ADEQUATE TEMPORARY SUPPORT IS PROVIDED TO THE STRUCTURE DURING THE WORKS.

ALL SETTING–OUT LEVELS & DIMENSIONS SET BY ARCHITECT.

STRUCTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATIONS.

REV.	DESCRIPTION	DRAWN	APPROVED	DATE
P0	PRELIMINARY ISSUE	HA	AH	27-MAR-2018

STATUS: PRELIMINARY

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CLIENT: MR R BERNARD

PROJECT: 32 KYLEMORE ROAD, LONDON, NW6 2PT

DRAWING TITLE: UNDERPINNING SEQUENCE AND TEMPORARY PROPPING UPPER LEVEL

SCALE	DRAWN	CHECKED	DATE
as shown@A3	HA	AH	MAR 2018

DRG No. 1084/100 REV. P0

DO NOT SCALE

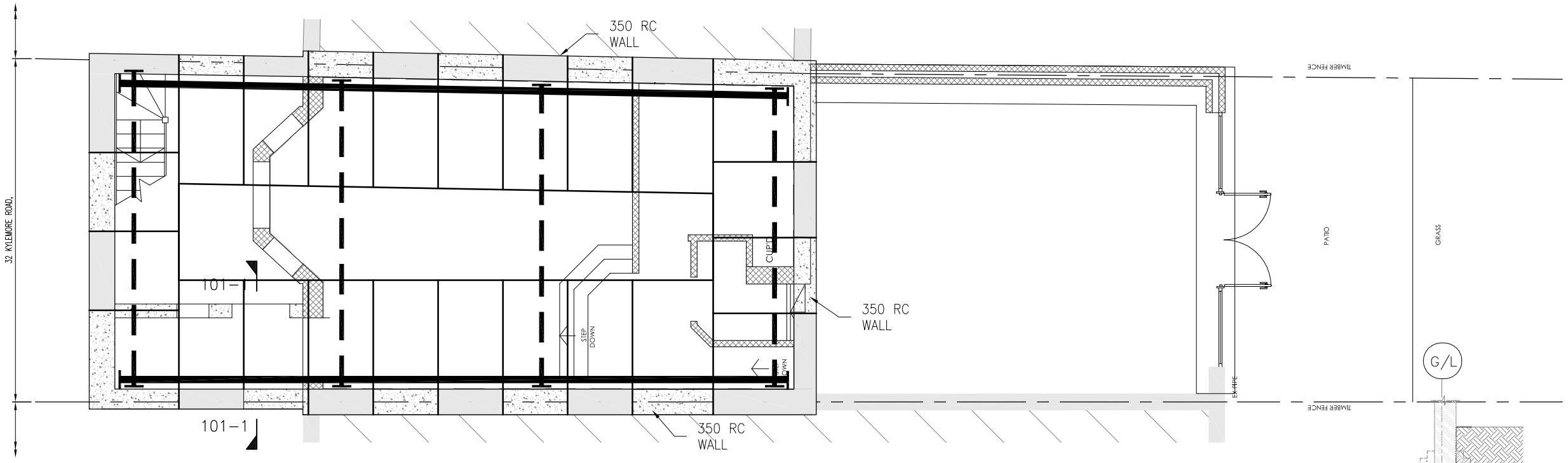
ALL TEMPORARY PROPS TO BE SUPERSLIM SOLDIERS UNO.

NOTE:
WHERE ON SITE MIX/ BATCHED CONCRETE IS TO BE USED THE CONTRACTOR SHALL:
KEEP A RECORD OF TIME AND SITE MIX QUANTITIES IN RELATION TO THE UNDERPINNING IN WHICH IS TO BE USED.

UNDERPINNING NOTES

1) REPEAT SAME SEQUENCE FOR 2ND STAGE UNDERPINNING.

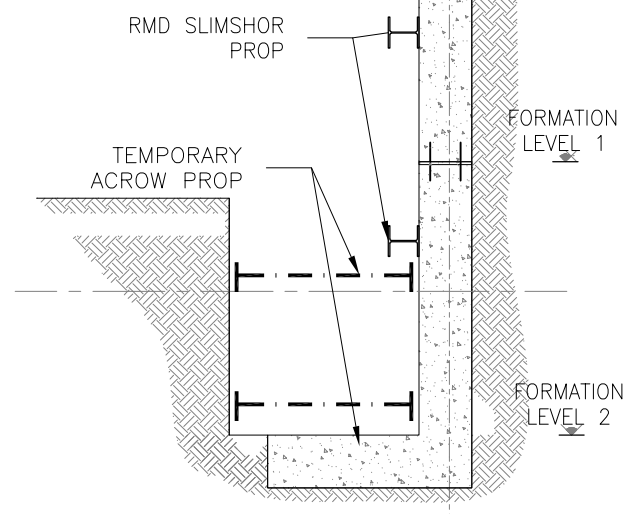
(1) INDICATES UNDERPINING SEQUENCE



PROPOSED BASEMENT SEQUENCE & TEMPORARY WORK PLAN

(SHOWING UNDERPIN LOWER LEVEL & WALING BEAM & PROPS)

Scale 1:75



101–1 TYPICAL SECTION

2ND STAGE SUPPORTING RC WALL

Scale 1:50

ORIGINAL DRAWING A3

NOTES

GENERAL

ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.

DRAWINGS ARE NOT TO BE SCALED.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ARCHITECTS, ENGINEERS AND OTHER SPECIALISTS DRAWINGS.

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ALL SETTING–OUT LEVELS & DIMENSIONS SET BY ARCHITECT.

STRUCTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATIONS.

REV.	DESCRIPTION	DRAWN	APPROVED	DATE
P0	PRELIMINARY ISSUE	HA	AH	27-04-2018

STATUS

PRELIMINARY

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DRAWING TITLE
UNDERPINNING SEQUENCE
AND TEMPORARY PROPPING
LOWER LEVEL

SCALE	DRAWN	CHECKED	DATE
as shown@A3	HA	AH	MAR 2018

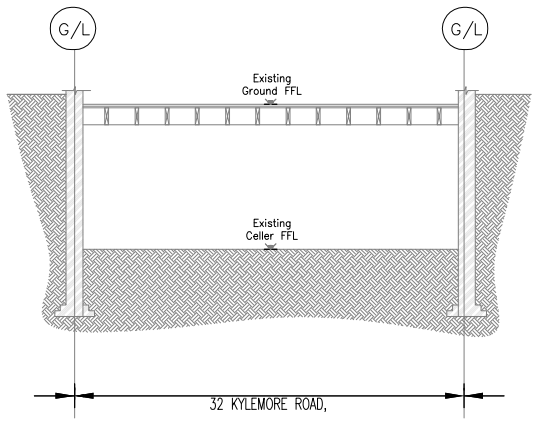
DRG No. 1084/101

REV. P0

DO NOT SCALE

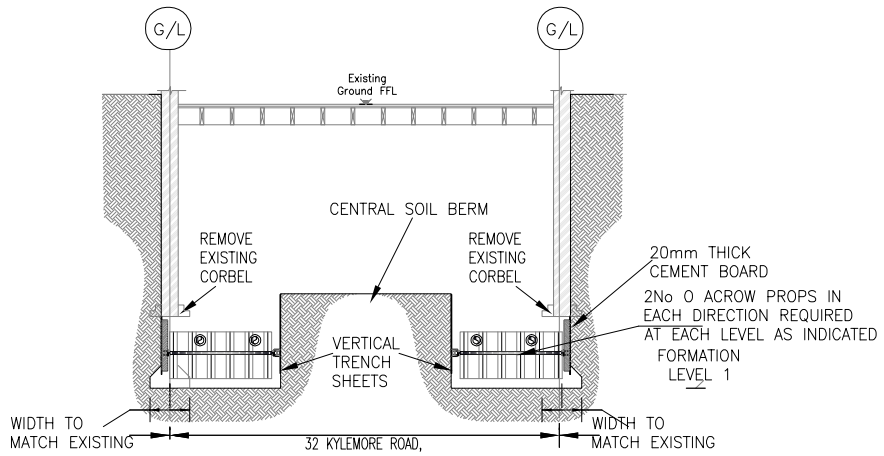
STEP 1

EXISTING CELLER LEVEL.



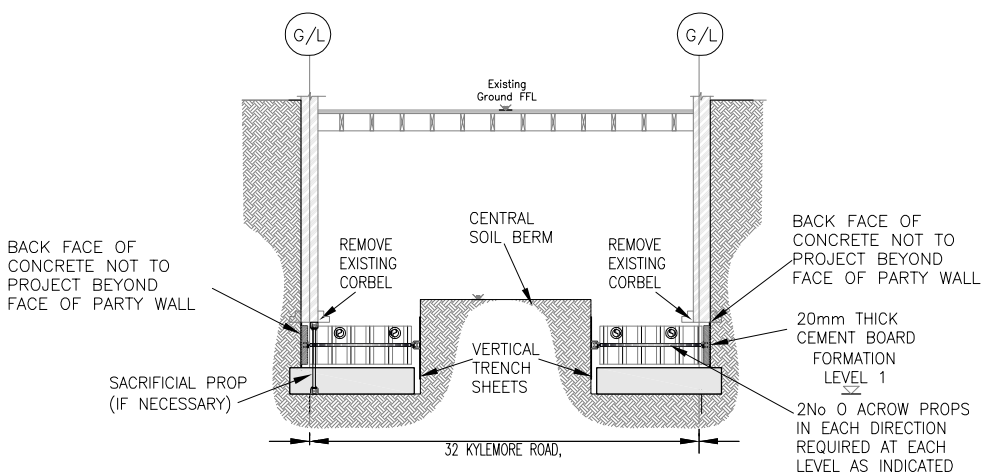
STEP 2

EXCAVATE SOIL FOR UNDERPIN, PLACE TRENCH SHEETS AND (ACROW) PROP SIDES OF EXCAVATION.



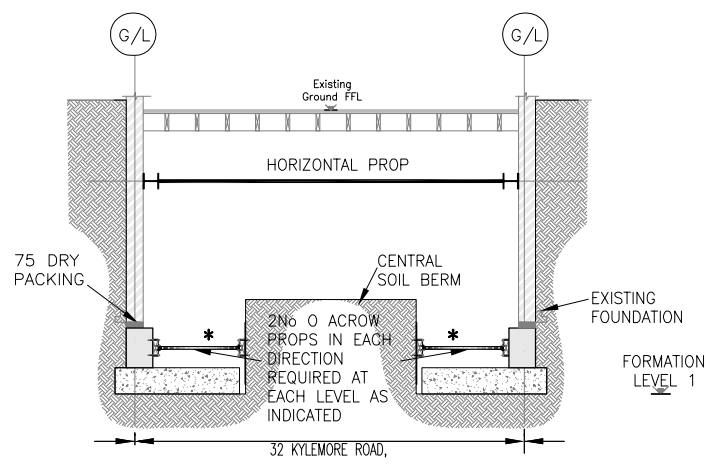
STEP 3

EXCAVATE SOIL TO FORMATION LEVEL 1, TO FORM 1ST PHASE UNDERPIN, PLACE TRENCH SHEETS AND (ACROW) PROP SIDES OF EXCAVATION. FIX REINFORCEMENT FOR THE REINFORCED CONCRETE BASE, SHUTTER AND POUR CONCRETE BASE.



STEP 4

FIX REINFORCEMENT FOR THE CONCRETE WALL, SHUTTER AND POUR REINFORCED CONCRETE WALL. THEN REMOVE SHUTTER AND INSTALL NEW ACROW PROPS BETWEEN FACE OF CONCRETE WALL AND CENTRAL BERM. THEN REMOVE PROPS INSTALLED IN STEP 3.



* ACROW PROPS REPOSITIONED TO AVOID HORIZONTAL PROP. NEW ACROW PROPS INSTALLED IN ADJACENT POSITION BEFORE REMOVING EXISTING ACROW PROPS.

ORIGINAL DRAWING A3

NOTES

GENERAL

ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.

DRAWINGS ARE NOT TO BE SCALED.

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THE CONTRACTOR IS TO ENSURE THAT ADEQUATE TEMPORARY SUPPORT IS PROVIDED TO THE STRUCTURE DURING THE WORKS.

ALL SETTING–OUT LEVELS & DIMENSIONS SET BY ARCHITECT.

STRUCTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATIONS.

REV	DESCRIPTION	DRAWN	APPROVED	DATE
P0	PRELIMINARY ISSUE	HA	AH	17.04.2018

STATUS

PRELIMINARY

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DRAWING TITLE
BASEMENT CONSTRUCTION METHOLOGY (1 OF 2)

SCALE	DRAWN	CHECKED	DATE
as shown@A3	HA	AH	APR 2018

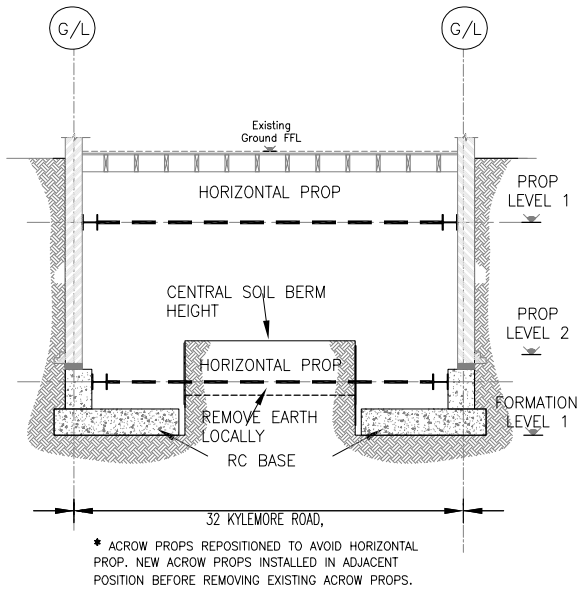
DRG No. 1086/CMS/11

REV. P0

DO NOT SCALE

STEP 5

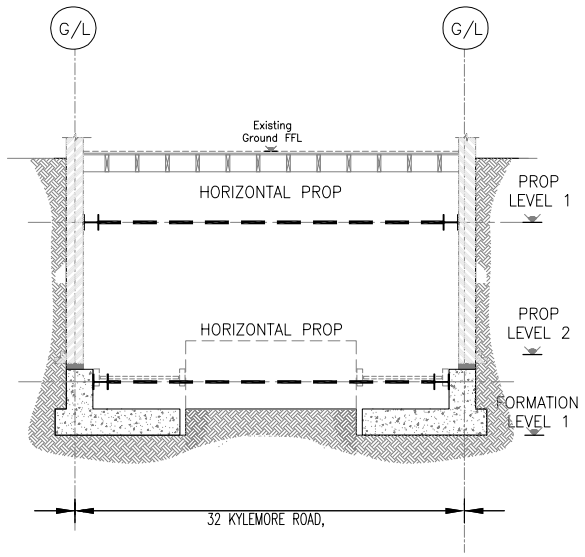
LOWER SOIL MASS OF THE CENTRAL BERM TO JUST BELOW 2ND LEVEL OF HORIZONTAL PROPS AND INSTALL BEAM 2 AND TOP PROPS.



NOTE:
THE CENTRAL BERM IS LEFT AT HIGHER LEVEL ALONG WITH ACROW PROPS BETWEEN HORIZONTAL PROPS.

STEP 6

EXCAVATE REMAINDER OF CENTRAL SOIL BERM TO TOP OF RC UNDERPIN BASE LVL, REMOVE ACROW PROPS.



STEP 7

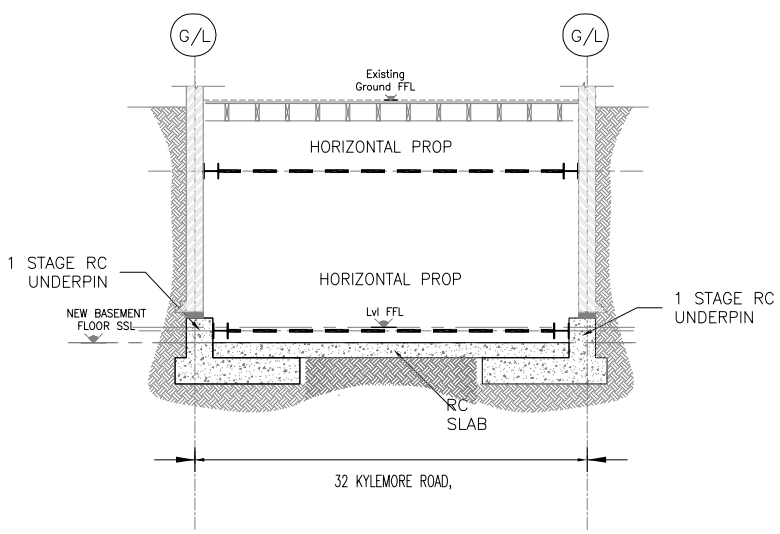
WAIT MIN 48HRS BEFORE STARTING NEXT UNDERPINNING INDICATED ON HALL DAVIS DRAWING 1086/100–101.

STEP 8

REPEAT PROCEDURE 1 TO 6 FOR ALL UNDERPINS INDICATED ON HALL DAVIS DRAWING 1086/100–101.

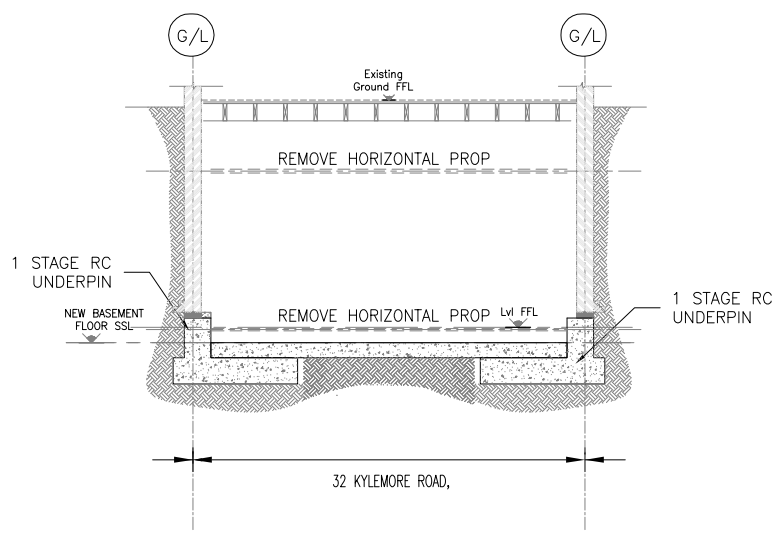
STEP 9

FIX REINFORCEMENT FOR THE REINFORCED CONCRETE SLAB, SHUTTER AND POUR CONCRETE SLAB.



STEP 10

REMOVE PROP.



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ORIGINAL DRAWING A3

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