61 REDINGTON ROAD, LONDON. NW3 7RP

BASEMENT IMPACT ASSESSMENT.

STRUCTURAL DESIGN , CONSTRUCTION SEQUENCE AND TEMPORARY WORKS

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1. INTRODUCTION.

Vincent & Rymill, Consulting Engineers, have been appointed by the building owner to prepare a B.I.A. for Planning purposes. The author of this report T. J. Vincent Bsc C.Eng M.I.Struct. E. first worked with The London Basement Company in 2004, designing and detailing such retro fitted basements all over London. Since that time T. J. Vincent has designed over 450 basements, both single and multi storey.

Site Investigation and B.I.A. has been carried out by Messrs Ground and Water, signatory on this report will be F. Williams C.Geol FGS CEnv AGS Cgeol & T. J. Vincent BSc C.Eng M.I.Struct.E.

The property is a large four storey, detached residential property probably constructed around the 1905. The existing building is sited on a sloping site and the lowest storey at the rear of the property is a lower ground floor. The new development seeks to convert the existing 3 residential properties into one family dwelling and a one bedroom flat at lower ground floor. The proposed works will provide a lowered lower ground floor level below the whole footprint of the existing building, including light wells to the front. The lower ground floor will be extended to the rear of the property. The internal super structure will be totally replaced.

Details of the proposals are shown by the relative Griggs Architectural drawings.

The purpose of this report / statement is to provide Structural details as requested by the 'Camden Planning Guidance Basements and Light wells', together with details of the method and sequence of construction.

Site Investigation, Basement Impact Assessment (screening and scoping) and Report for groundwater and land stability has been carried out by Messrs. Ground and Water Ltd, their report GWPR 4656 April 2022v1.02 is appended to the Planning application as a separate document.

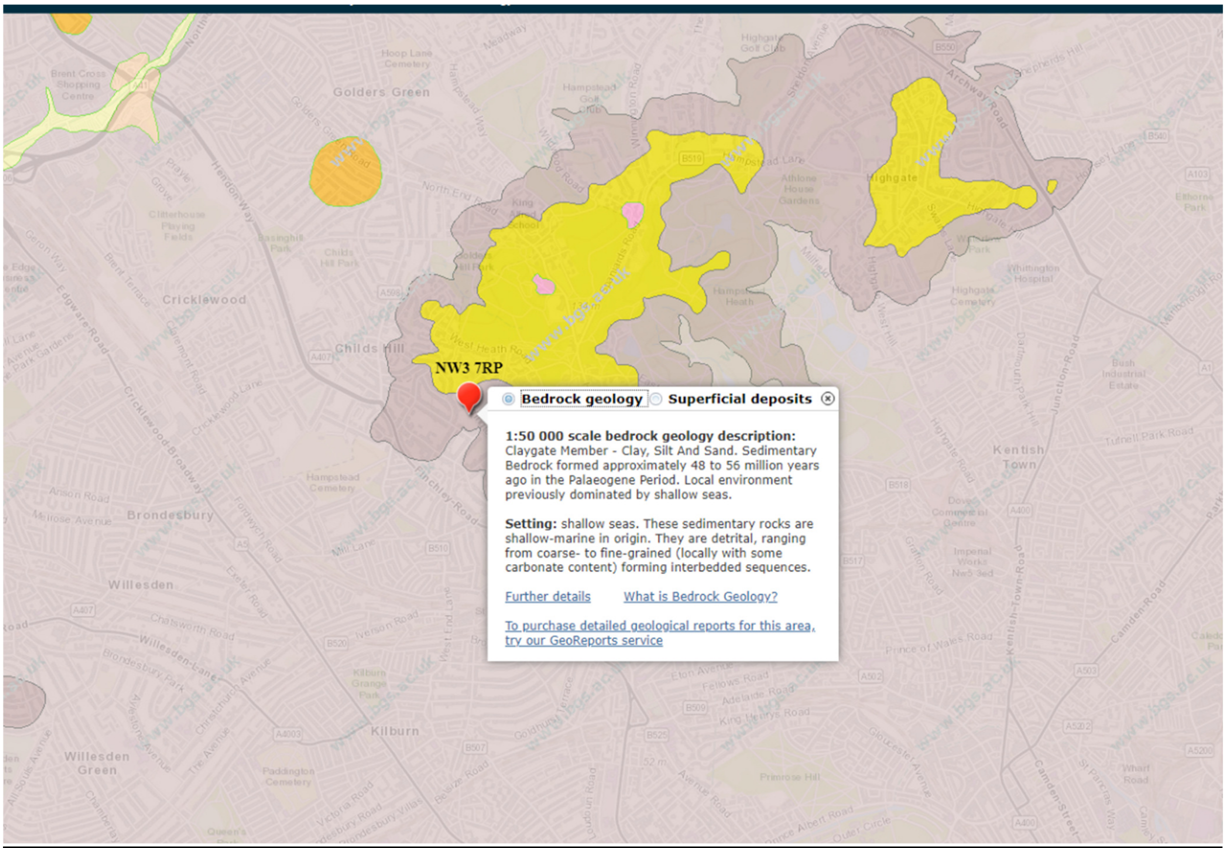
Surface Flow and Flooding Basement Impact Assessment has been carried out by Water Environmental Ltd, their report 22023-RPFRA-01/C01 is appended to the Planning application as a separate document.

2. DESK TOP STUDY

History

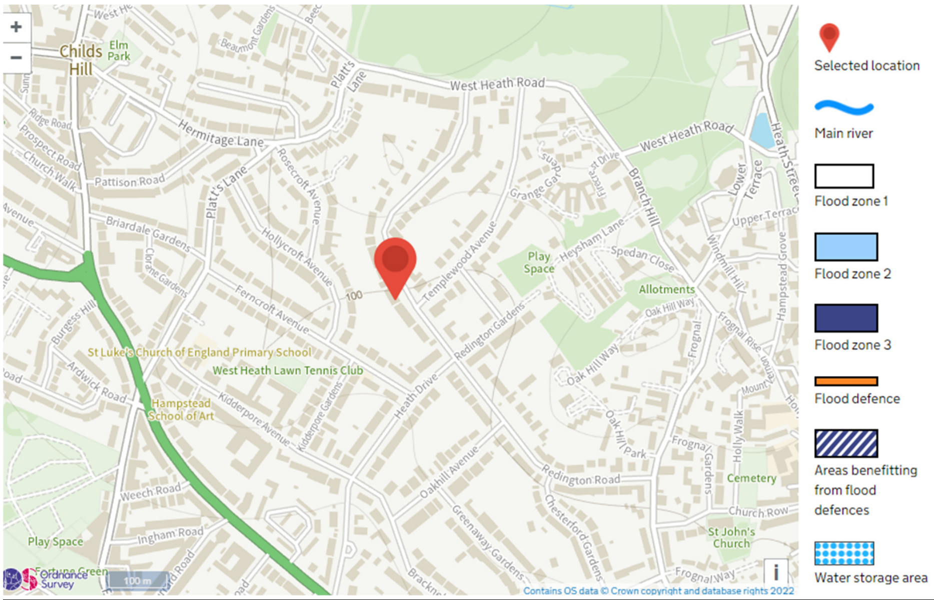
See Heritage Statement document by Heritage Information Ltd.

Geology



British Geological Science Viewer shows the site to be sited over the Claygate Beds.

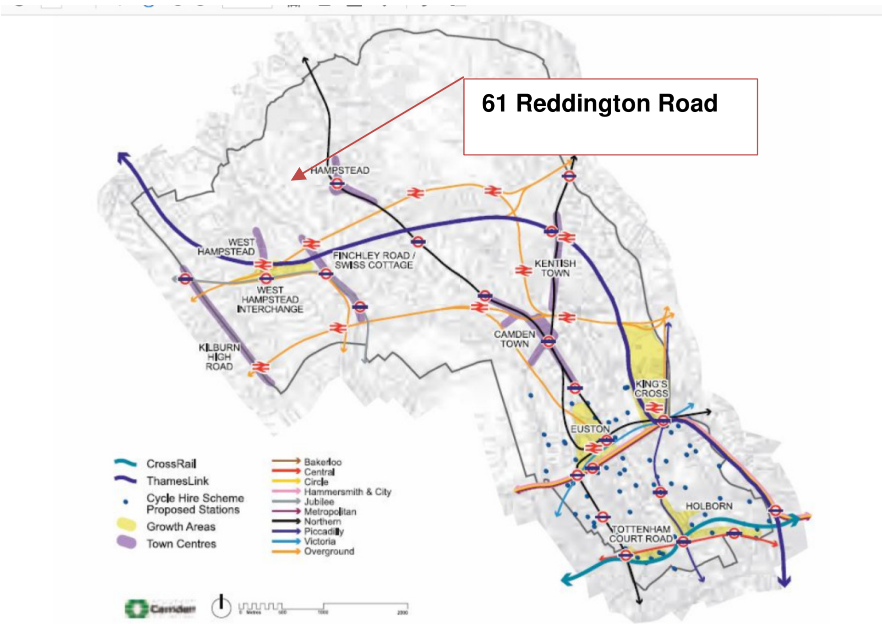
Flood Risk



E.A. map shows the site to not be in a flood risk area, that is the property is located in Flood Zone 1.

For flood risk assessment see Water Environmental Ltd, report 22023-RPFRA-01/C01 appended to the Planning application as a separate document.

Underground / Railway



From Figure 18, Arup Report, No underground or railway routes near the site.

Public Highway and Other Utilities

Only utilities that cross the site are those which serve the dwelling, gas, water, electric. Telecom. The public highway, (back of public footpath) is 9.0m away from any underpinning works. Utilities in the public highway are therefore more than 9.0m away from the works. As the front drive slopes down to the public footpath excavation levels at the front of the building will be at similar level to the public footpath. The utilities in the highway cannot be affected by the works.

3.IMPERMEABLE AREAS

Existing surface water is discharged through drainage connected to the public system.

For surface water statement see Water Environmental Ltd, report 22023-RPFRA-01/C01 'Surface Flow and Flooding Basement Impact Assessment', appended to the Planning application as a separate document.

4.STRUCTURAL DESIGN PRINCIPLES

External Walls

New concrete walls below the property are designed as laterally propped cantilevers in reinforced concrete, the lower ground floor slab acting as the lateral prop at wall base level. The walls will be designed using the soil parameters relative to the site. The walls will be designed for a water table at 1.0m below ground level.

The surcharge load allowed on the external walls of the property will be 10KN/m^2 .

Basement Slab

The slab will be formed in reinforced concrete. It will be designed for uplift due to water pressure below, or as a clear span as appropriate. The basement slab will act as a prop to the base of the basement walls. Lower ground floor slabs will be protected from heave by Cordek.

Design Criteria**.**

Basement walls and bases will be designed using the parameters for the retained soils and bearing soils as indicated by the Site Investigation.. The design is in accordance with BS 8002:1994.

The design will accomodate active and passive earth pressures. Pressure coeficients in the design will adopt ' at rest pressures'.

The wall and base will be designed for the following

1.Vertical loads from walls above.
2. Other external will be designed with a surcharge load of 10.00KN/m^2.

3. The design adopts a water head behind the wall to 1.0m below ground level.

The sub soils at new lower ground floor formation level will be LondonClay, an SBP of 125KN/m^2 will be used in the design to limit differential foundation movements.

Concrete will generally be grade RC35/45 and Sulphate Class DS3 and ACEC class AC-3 in accordance with ‘concrete in aggressive ground’. Reinforcement will be grade 500N/mm^2.

Existing brickwork assumes 7N bricks in a lime mortar, CP.111 gives basic compressive stress for this makeup of 0.45N/mm^2, and therefore allowable bearing stress will be 0.45N/mm^2. Any bearings into existing external or party wall masonry will take account of this allowable stress.

Mortar will be class (ii) or (iii) as required.

<u>Relevant Codes of Practice and British Standards</u>

B.S. 8002	Code of Practise for Earth Retaining Structures
B.S. 8004	Code of Practice For Foundations
B.S. 6031	Code of Practice For Earthworks
B.S. 8110	Structural Use of Concrete
B.S. 5750	Structural Use of Steelwork in Buildings

5.PREDICTION OF DAMAGE TO ADJOINING PROPERTIES

Works to form the new lower ground floor will have the construction sequenced in short sections. Excavations to form the walls and bases all soil faces will be continually temporarily laterally or vertically propped to avoid movement of soil during the construction stage. Permanent works will be designed to resist both pressures from the soils or structural loads from nearby buildings as appropriate.

Strict control of the construction method together with the structural design will limit any potential damage to the adjoining properties to categories 0 (nil) or 1 (slight) of the Burland Scale. Or none, or at worst, ‘aesthetic’ as described by the BRE document for movement in buildings.

Refer also to Ground and Water Ground Movement assessment clause 7.4.3 in their report GWPR 4656 April 2022v1.02.

6.BRIEF METHOD STATEMENT FOR CONSTRUCTION .

The exact sequence of works will be agreed with Main Contractor and Structural Engineer, clauses for a typical Contruction Method Statement for the works could be as follows.

a) The walls to the perimeter of the existing building will be underpinned in reinforced concrete. Underpins will take the vertical loads from the walls and horizontal loads from the earth. During their construction the walls and bases will require laterally propping in the temporary condition; propping will be made against the central earth pudding.
b) Underpinning legs will be excavated in short sections not exceeding 1200mm in width.
c) The sequence of the underpinning will be in the 1, 4, 2, 5, 3 sequence and such that any given underpin will be completed, dry packed, and a minimum period of 48 hours lapsed before an adjacent excavation commenced to form another underpin.
d) In the event that the existing foundations to the wall are found to be unstable, sacrificial steel jacks will be installed underneath the foundation to prop the bottom few courses of bricks. These steel jacks will be left in place and will be incorporated into the concrete stem.
e) Whilst forming the wall and in the event that the vertical soil face is unstable, lateral propping will be provided as required to the excavation and to the sides of the working trench. The front and side faces of the excavation will be propped using a sacrificial inert board and acrow props as appropriate.
f) Concrete for the walls and bases shall be ready mixed delivered to site from an accredited source.
g) Concrete will be chuted from the point of delivery into a 'holding bath' within the working areas and placed by wheelbarrow and /or bucket, or mixed on site. The exact arrangement will be finalised when works commence on site.
h) Concrete will be placed within 30 minutes of batching on site, or delivery by lorry, concrete will be compacted with a mechanical hand held vibrator.
i) Excavation for an underpin section will be excavated in a day, and the concrete to the base poured by the end of the same day.
j) The concrete to the wall of the underpin will be poured the following day. This will be poured up to within 50 – 75mm of the underside of the existing wall foundations.
k) On the following day, the gap between the concrete and the underside of the existing foundation will be dry packed with a mixture of sharp sand and cement (ratio 3 : 1).
l) Once the dry pack has gained sufficient strength, any protrusions of the footings into the site will be carefully trimmed back using hand tools to avoid causing any damage to the foundation. The protrusions will be trimmed back to be flush in-line with the face of the wall above.
m) A minimum of 48 hours will be allowed before adjacent sections will be excavated to form a new underpin.
n) Once all pins are complete a temporary cross propping system will be introduced between the walls to allow bulk excavation will be carried out down to formation level.
o) The below – slab drainage for foul & ground water, sumps and pumps will then be installed. The pumps will discharge the foul / ground water into the sewer system to the front of the properties. The drainage layout will be designed in due course.
p) The basement slab will then be constructed, once cured this will provided the designed propping to the walls and the temporary cross propping can be removed.
q) A cavity drainage layer will be laid to the slabs and walls.

7.CONSTRUCTION SEQUENCE

1. Site set up will include a hoarding to the front garden; placement for skips will either be made within the front garden or on the public highway subject to Camden approval.
2. The site is only accessible from Redington Road, and therefore all site deliveries and operations will take place from here. This entrance will be manned throughout operational hours by a banksman to ensure construction deliveries do not pose a risk to other users of Reddington Road.

3. Construct site hoarding, entrance gates to provide protection to passers-by from site operations. Site accommodation including welfare facilities will be confined to within the site boundary throughout the site works.
4. Terminate / protect any incoming services temporarily divert any active drainage.
5. Install any tree protection measures as necessary.
6. Install enclosed skip to front on property and install conveyor to remove excavated soil to discharge soil into skip.
7. Carry out soft strip to whole building, remove all non-load bearing partitions.
8. Investigate sequence for either providing temporary support works to support existing structure at 1st floor or construct permanent structural works to 1st floor.
9. Once Lower ground floor / ground floor areas are clear of load bearing elements remove suspended part of ground floor to whole building.
10. Construction under the property will commence by taking out the ground floor and reducing ground levels to just above existing foundation formation.
11. Underpins will be carried out in the usual 1, 4, 2, 5, 3 underpinning sequence, the construction sequence for forming the pin is shown on the Vincent & Rymill drawings submitted for planning and attached within this document. Backfilling of the excavation will be made after each pin has been formed.
12. On completion of all underpinning and fixing of the structural steelwork supporting the upper ground floor, cross propping of the pin walls will be erected to allow release of the local pins that may be propped against the central dumpling so the lower ground floor slab can be constructed. The propping will be designed to suit the lateral loads behind the walls but generally takes the form of a series of horizontal props adequately laced and braced set approximately 1.5m from lower ground floor level.
13. Bulk excavation will be carried out down to lower ground floor slab formation level. Muck will continue to be removed from site via the conveyor belt.
14. The below – slab drainage for foul & ground water, sumps and pumps will then be installed. The pumps will discharge the foul / ground water into the sewer system to the front of the properties. The drainage layout will be designed in due course.
15. The lower ground floor slab (ground – bearing slab) will then be constructed.
16. After the new lower ground floor slabs have cured, the cross propping will be removed.
17. A drained – cavity layer will be laid to the slabs and walls.

T. J. Vincent

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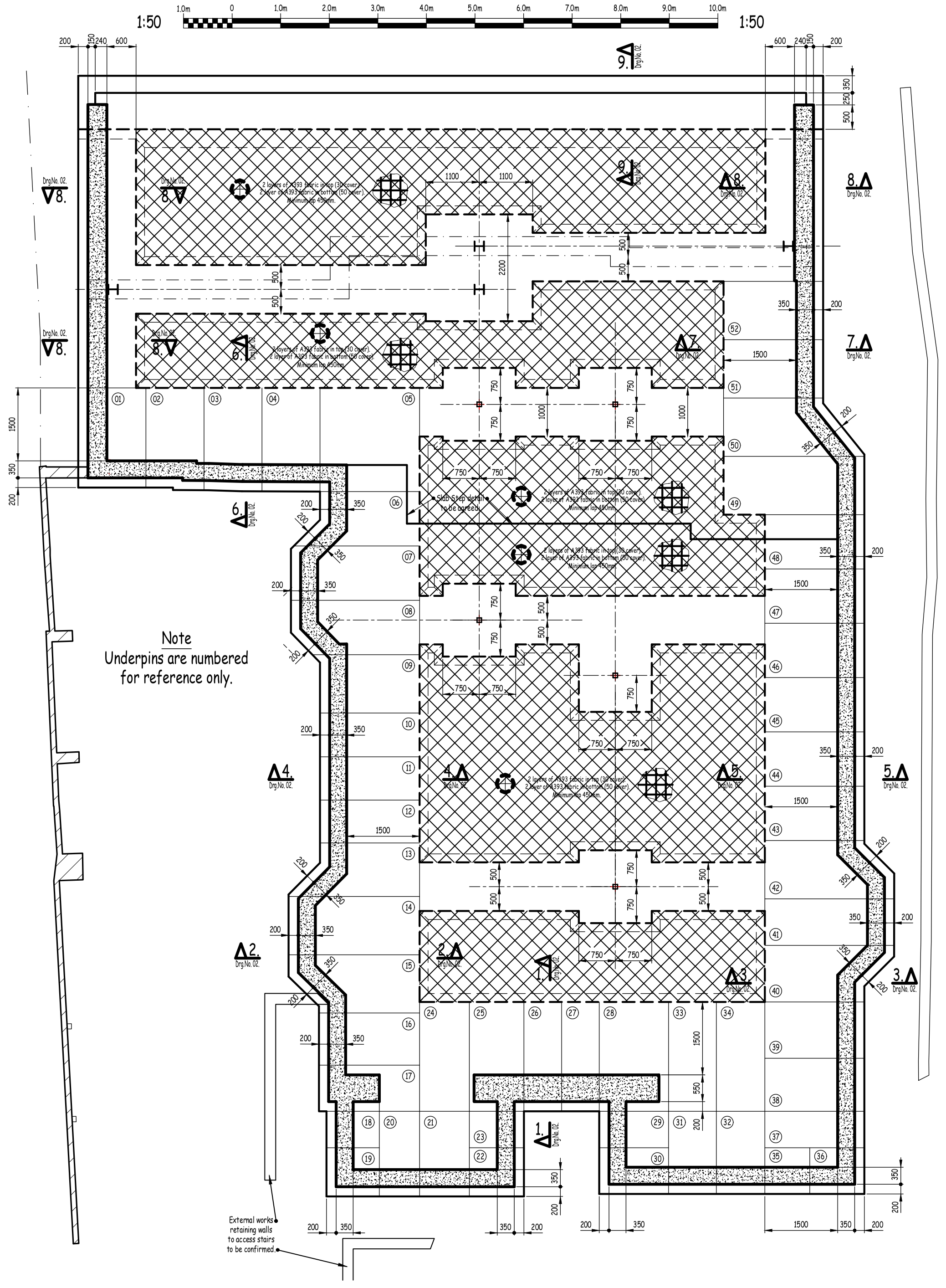
T. J. Vincent BSc C.Eng M.I.Struct E.
23 April 2022

VINCENT
& RYMILL

APPENDIX 1

STRUCTURAL DRAWINGS FOR LOWER GROUND FLOOR



Proposed Lower Ground Floor Plan Showing Proposed Underpinning Arrangement.

(Scale 1:50 at A1)

Underpinning Notes

U1. The underpin numbering is for identification purposes only.

U2. The sequence of underpinning should follow the traditional 1, 4, 2, 5, 3 pattern. The Contractor is to provide drawings marked up, to show their proposed sequence. for the Engineer to approve, a minimum of 14 days before work is commenced.

U3. Underpinning to be a maximum length of 1200mm. subject to the Engineers approval.

U4. Provide corner bars in under pinning stems, to ensure mesh reinforcement is held in place, during concreting.

U5. All reinforced concrete cast on the ground shall be placed on 50mm. GEN 1 concrete mix.

U6. Foundations have been designed to impose a net bearing pressure of $125kN/m^2$. on Sand and Gravel, at depths shown. The bearing strata shall be approved by the Local Authority's Building Inspector, before laying blinding, or casting foundations. Any additional excavation shall be replaced with a GEN 1 concrete mix. But in the event of extensive additional excavation being required, the Engineer must be immediately and fresh instructions obtained.

U7. Concrete mix for foundations shall be a RC35/45 mix with a minimum Ordinary Portland cement content of $320kg/m^3$. and a maximum water/cement ratio of 0.50 Concrete shall for at least 48 hours before dry packing. To DS-3 and ACEC-3.

U8. Concrete cover to the reinforcement shall be as detailed on the drawings but never less than 35mm.

U9. The minimum depth of the underpinning, (measured from the underside of the existing footing, to the underside of the new), shall be 500mm. and shall be formed on a strata, capable of sustaining a permissable net ground pressure of $100kN/m^2$. on sand and gravel.

U10. The underside of the existing wall or foundation shall be trimmed and cleaned of all mud and debris, before dry packing. The dry pack shall be a 1:3 mix and well rammed in horizontal layers, not exceeding 75mm thick. Dry packing shall be left. 24 hours before works are commenced on adjacent underpins.

U11. The central area of excavation shall not be carried out until the perimeter underpinning has been completed.

U12. If necessary backfilling behind retaining walls shall be a 1:20 mix, using Ordinary Portland Cement.

U13. Services The Contractor is to carry out a survey of the property and adjacent areas, to establish the location of obstructions, such as service runs or drains. Any obstructions found are to be brought to the attention of the Architect and Engineer. The Contractor is to allow for any temporary support to the services or obstructions during the underpinning.

U14. Excavations. The excavation shall be to the depth and width shown on the drawings. However where tree roots are encounted, new underpins are to extend 600mm. below the last trace of any root activity. The sides of the excavation, shall be adequately shored and propped to prevent subsidence or slip of the soil faces behind the pin and at formation level shall be undisturbed.

Reinforcement Note

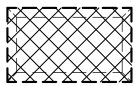
Wall and Foundation reinforcement shall be continuous. If loose bars are used to provide continuity The area of loose bars shall not be less. than the area of reinforcement specified. Laps shall be not less than 45 times the lesser bar diameter.

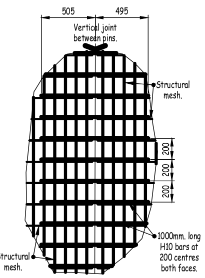
The Contractor shall be responsible for the stability of the existing structure and earthworks on the site, as well as the adjoining sites. All temporary works shall be the responsibility of the Main Contractor.

Tension Lap Lengths for Reinforcement

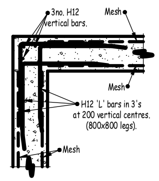
10mm. Ø = 450mm.
12mm. Ø = 540mm.
16mm. Ø = 720mm.
20mm. Ø = 950mm.

Areas Hatched Thus to have Cordex Cellcore HX Under Slab.





Part Elevation on Wall Showing Lacing Reinforcement Between Pins.



Plan Section on Typical Corner Showing Typical Reinforcement.

Notes

1. This drawing remains the copyright of Vincent and Rymill and is not to be copied, altered or changed without permission.
2. All dimensions are in millimetres unless otherwise noted.
3. Do not scale off this drawing.

Structural Steelwork Notes.

1. Generally all structural steel shall be grade S355 and shall be in accordance with the National Specification for Structural Steelwork in all necessary aspects.
2. Steelwork connections shall comprise not less than 4no. M16 grade 8.8 bolts for all other members. Except where otherwise shown on the drawings. Where connection loads are provided by the Engineer. The steelwork contractor shall design connections, which will be subject to comment by the Engineer.
3. Steel beams shall at least have the minimum bearings on masonry walls as shown on the drawings. Where no details of bearings are shown, provide bearings to the full width of the supporting leaf, padstone or 100mm whichever is the greater.
4. Steel columns bases shall be levelled using sawn steel packs, not less than 75mm. square. Allowance shall be made for nominal 25mm. thickness of grout between the column baseplates and foundations/masonry supports. Grout shall take the form of neat cement slurry with a non shrink additive and should be just fluid enough to pour.
5. All structural steelwork shall be blast cleaned to B.S.7079:Part A1 perparation grade SA2.5 and except where specified as galvanised, shall be painted with a suitable good quality high build epoxy zinc phosphate primer. To provide a dry film thickness of not less than 75 microns. A pre-fabrication primer may be used at the fabricators discretion. The Contractor shall ensurethat the primer used is compatible with subsequent coatings specified by others. (e.g. intumescent paint).
6. Steelwork specified as galvanised shall be blast cleaned as above and hot dip galvanised to B.S.729 Minimum coating thickness 85 microns.
7. All steelwork below d.p.c. level or built within the masonry wall cavity, shall be site painted with a compatible high build epoxy zinc phosphate primer, to provide a dry film thickness of not less than 125 microns, to achieve an overall primer coating of 200 microns. i.e. Leighs paints Epigrip C400 Zinc Phosphate Primer/Buildcoat or equal. Steelwork below d.p.c. shall be encased in not lessthan 100mm. of concrete, not weaker than specified on the drawings.
8. Steelwork contractor to coordinate with the Main Contractor to provide adequate bracing during the sequence of erection.
9. Fire protection to steel to Architects details.

Concrete.

1. Generally all structural concrete works to be in accordance with the National Specification for Concrete in all necessary aspects.
2. Concrete mix for foundations shall be a RC35/45 mix with a minimum Ordinary Portland cement content of $320kg/m^3$. and a maximum water/cement ratio of 0.50.
3. All concrete below ground level, (slabs, walls and foundations), to be desined for a design sulphate class of DS-3 and ACEC Class of AC-3.
4. Under no circumstances is concrete to be poured, if expected temperature within the following 24 hour period is expected to be 5°C or less.
5. No admixtures, of any form, to be added to the concrete, without the written permission of the Structural Engineer. It is STRICTLY forbidden to add water to premixed concrete on site.
6. Site batching of concrete to be approved by the Engineer before its use.

Structural Masonry Notes.

1. Refer to Architects drawings and the specification for masonry requirements, in respect of acoustic, thermal insulation and durability requirements. The Engineer shall be notified immediately if conflicts with the structural requirements.
2. Blockwork below ground level to have a minimum compressive strength of $7.3N/mm^2$. and to be set in 1:3 cement:sand mortar. All blockwork to be solid, unless specified otherwise on the drawing and is to comlpy with B.S.5628 Table 4. Requirements for Special Category Manufacture.
3. Brickwork below ground to have a minimum compressive strength of $30N/mm^2$. and is to comply with B.S.5628 Requirements for Special Category of Manufacture.
4. Mortar designation as follows :- Above d.p.c. Mortar Designation III.
   Below d.p.c. Mortar Designation II.
5. Refer to the Architects drawings for details of d.pc.'s, d.p.m.'s waterproofing and insulation.

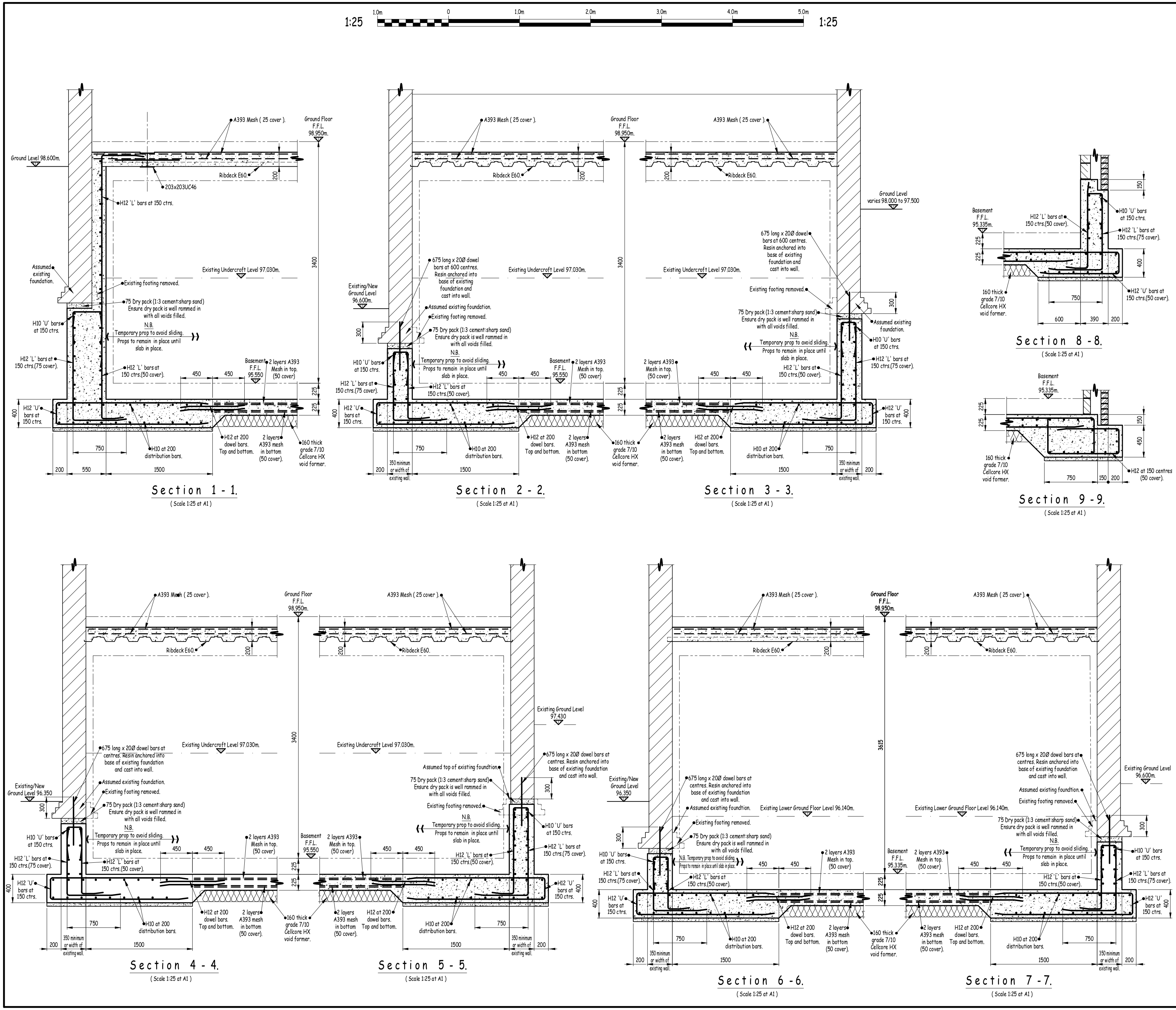
Rev	Details	Date

V&R VINCENT & RYMILL
Consulting Civil & Structural Engineers
Telephone :- (01252) 834242

Job: 61 Redington Road, London NW3 7RP

Title: Proposed Lower Ground Floor Plan Showing Proposed Underpinning Arrangement.

Scale at A1	Date	Job No	Drg No	Rev
1:50 1:25 1:10	April 2022	22D07	01	



Notes

1. For notes see drawing number 21D02 / 01.

Rev	Details	Date

V&R VINCENT & RYMILL

Consulting Civil & Structural Engineers

Telephone :- (01252) 834242

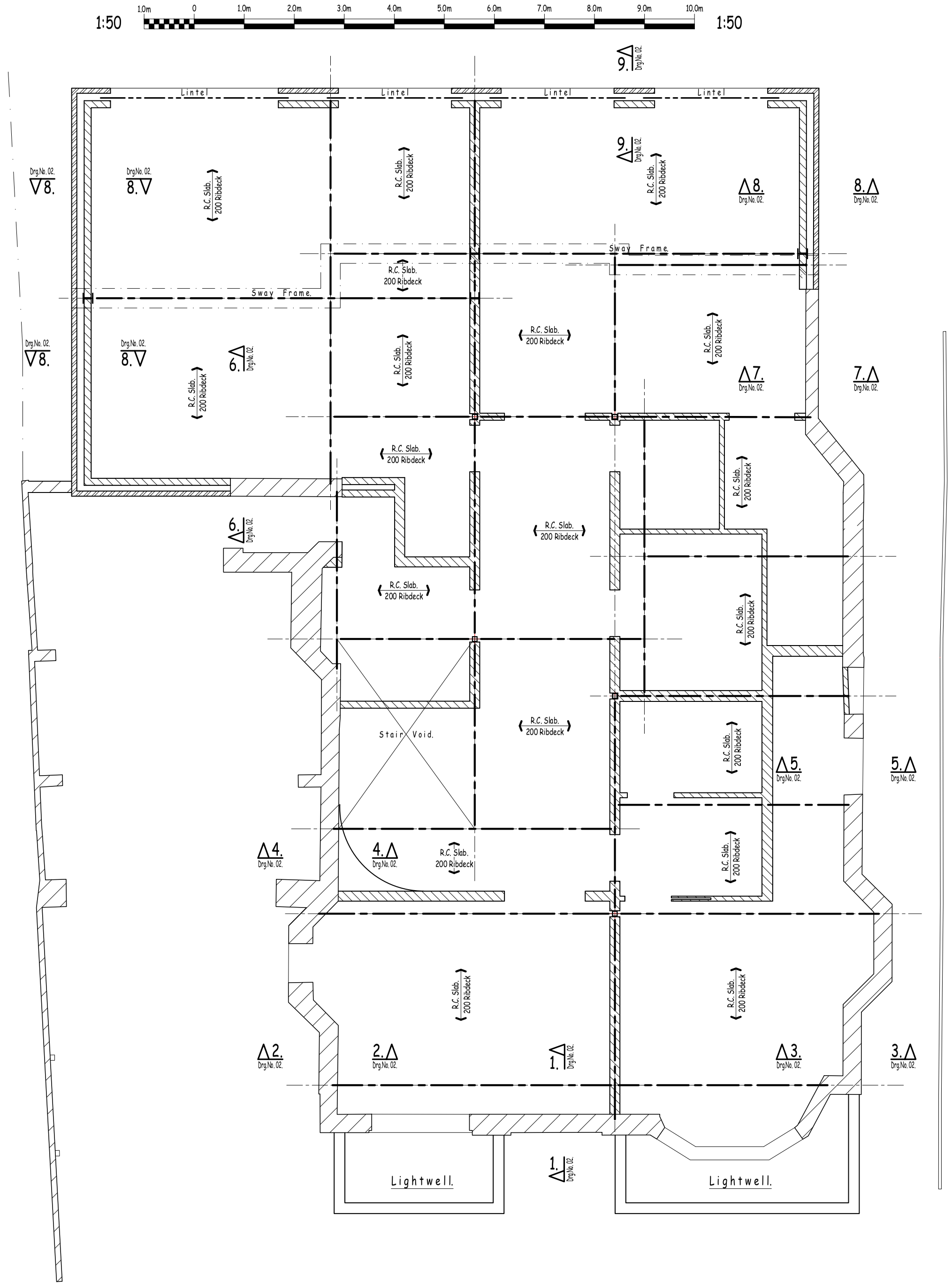
Job

61 Redington Road,
London NW3 7RP

Title

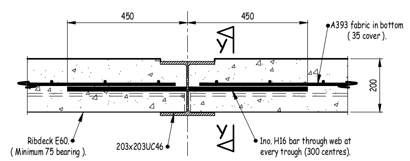
Lower Ground and Ground Floor Sections

Scale at A1	Date	Job No	Drg No	Rev
1:25	April 2022	22D07	02	



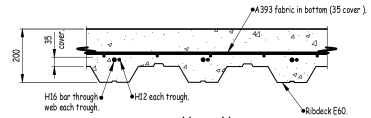
Proposed Lower Ground Floor Plan Showing
Indicative Upper Ground Floor Framing.
Subject to Final Upper Floor Layout.

(Scale 1:50 at A1)



Typical Section Through 200 Ribdeck Slab at 203x203UC46.

(Scale 1:10).



Y - Y

(Scale 1:10).

N.B. Ribdeck E60, 1.0mm. thick decking. To be continuously propped at midspan during placing of concrete.

Notes

1. For notes see drawing number 21D02 / 01.

Rev	Details	Date

V&R VINCENT & RYMILL
Consulting Civil & Structural Engineers
Telephone :- (01252) 834242

Job: 61 Redington Road, London NW3 7RP

Title: Proposed Lower Ground Floor Plan Showing Ground Floor Structure

Scale at A1	Date	Job No	Drg No	Rev
1:50 1:10	April 2022	22D07	03	

APPENDIX 2

STRUCTURAL CALCULATIONS

V&R VINCENT & RYMILL	Project: 61 REDDINGTOPN ROAD LONDON NW3 7RP				Job Ref.: 22D07	
VINCENT & RYMILL	Section: PRELIMINARY STRUCTURAL CALCULATIONS				Sheet no./rev.: 1	
01252 834242 07854 370 181	Calc. by: TV	Date: 27/04/2022	Chk'd by	Date	App'd by	Date

PITCHED ROOF	**KN/m^2**
Tiles	0.70
Felt & battens	0.05
Rafters	0.10
	0.85
40^0 on plan load D. L.	1.10 KN/m^2
40^0 Imposed Load	0.50KN/m^2
	1.60 KN/m^2

CEILING	**KN/m^2**
Ceiling Joists	0.10
Plasterboard	0.15
D. L.	0.25 KN/m^2
I. L. where applicable	0.25 KN/m^2
	0.50 KN/m^2

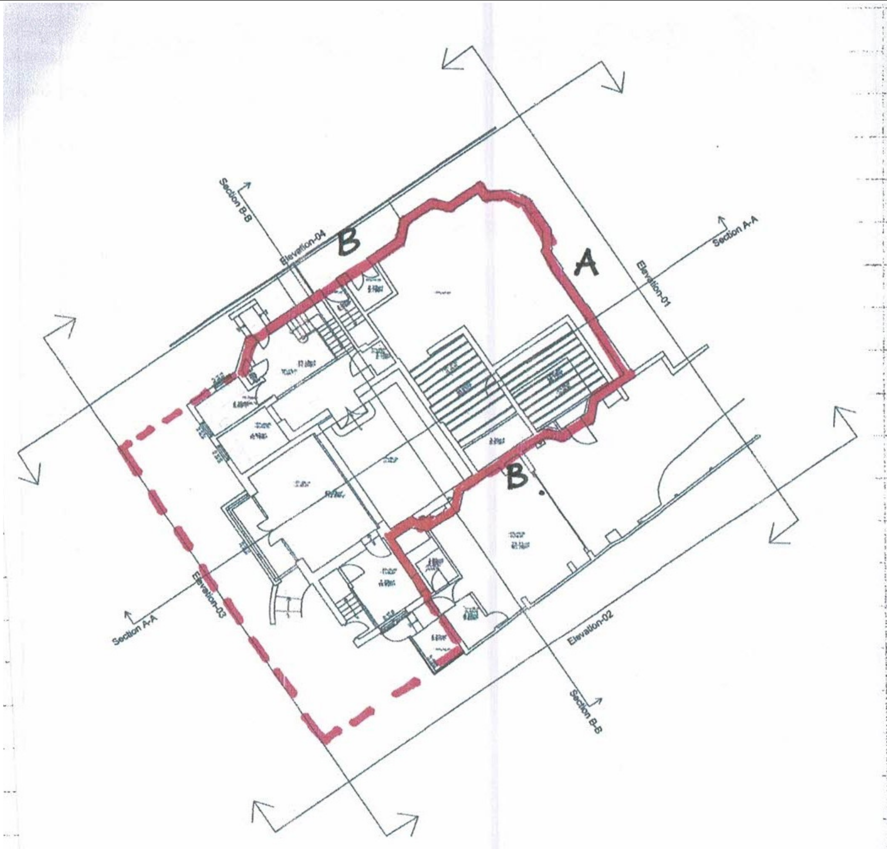
FLAT ROOF	**KN/m^2**
Felt	0.20
Boards	0.25
Joists & firrings	0.15
Ceiling	0.15
D. L.	0.75 KN/m^2
I .L.	0.75 KN/m^2
	1.50 KN/m^2

TIMBER FLOORS	**KN/m^2**
Boards	0.25
Joists	0.10
Ceiling	0.25
D. L.	0.60 KN/m^2
I. L.	1.50 KN/m^2
	2.10 KN/m^2

MASONRY	**KN/m^2**
102 Brick	2.20 KN/m^2
215 BRICK + PLASTER	4.50KN/m^2
330 BRICK + PLASTER	6.70KN/m^2
100 lt. wt blk + (2 x plaster)	1.35 KN/m^2
100 dense blk + (1 x plaster)	1.85 KN/m^2

200 RIBDECK GRD FLR	**KN/m^2**
FINISH	2.20
SLAB	4.20
PART'NS	1.00
	7.50KN/m^2
I. L.	1.50 KN/m^2
	9.00KN/m^2

VINCENT & RYMILL	Project			Job Ref.	
VINCENT & RYMILL 01252 834242 07854 370 181	61 REDDINGTOPN ROAD LONDON NW3 7RP			22D07	
	Section			Sheet no./rev.	
	PRELIMINARY STRUCTURAL CALCULATIONS			2	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	TV	27/04/2022				



Lower Ground Floor

KEY PLAN.

WALL A.

Roof DL = 2×1.05 = 2.10

Roof IL. = 2×0.68 = 1.35

1st & 2nd DL = 2×2×0.6 = 2.40

1st & 2nd IL. = 2×2×1.5 = 6.00

WALL − 6.5 × 4.5×80% = 23.4

27.9 kN/m ~ 7.35 kN/m

WALL B

Roof DL = 1.5×1.05 =

Roof IL = 1.5×0.68 =

1st & 2nd flr DL = 1.5×2×0.6 =

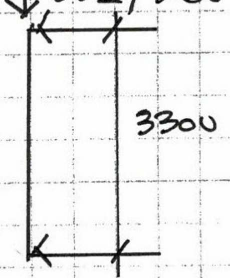
IL = 1.5×2× =

~~WALL~~ = 7×4.5×90% =

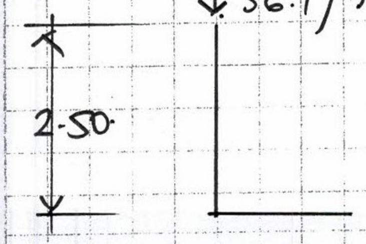
WALL B.
ROOF DL = 1.5 x 1.05 = 1.60
ROOF IL = 1.5 x 0.68 = 1.02
1st & 2nd FLR DL = 1.5 x 2 x 0.6 = 1.80
IL = 1.5 x 2 x 1.5 = 4.50
WALL = 7 x 4.5 x 90% = 28.40
WALL = 2 x 6.5 = 13.00
44.8   5.52 KN/M.

ADD SAY AVERAGE EACH WALL GRD FLR SLAB
SAY DL = 1.5 x 7.5 = 11.3 KN/M
IL = 1.5 x 1.5 = 2.25 KN/M.

CASE 1   FRONT WALL A
↓ 39.2/9.60



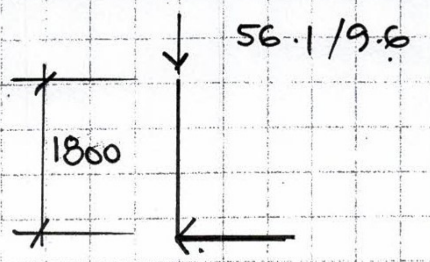
CASE 2   MAX CASE   WALL B.
↓ 56.1/9.6.



VINCENT & RYMILL 01252 834242 07854 370 181	Project 61 REDDINGTOPN ROAD LONDON NW3 7RP	Job Ref. 22D07
	Section PRELIMINARY STRUCTURAL CALCULATIONS	Sheet no./rev. 4

Calc. by	Date	Chk'd by	Date	App'd by	Date
TV	27/04/2022				

CASE 3 – WALL B GENERAL CASE

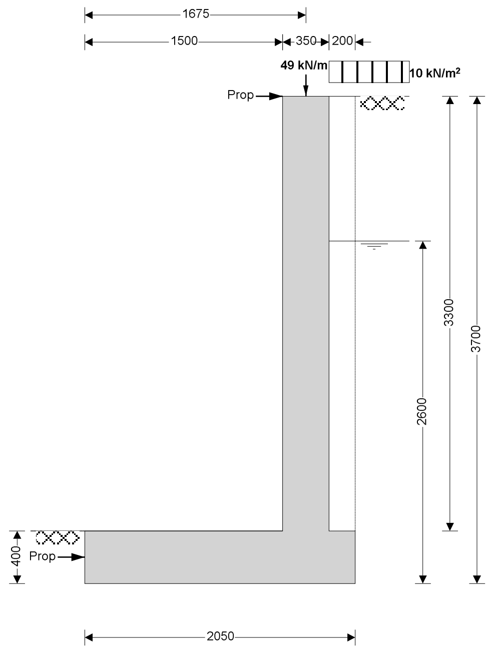


CASE 1 FRONT WALL A

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

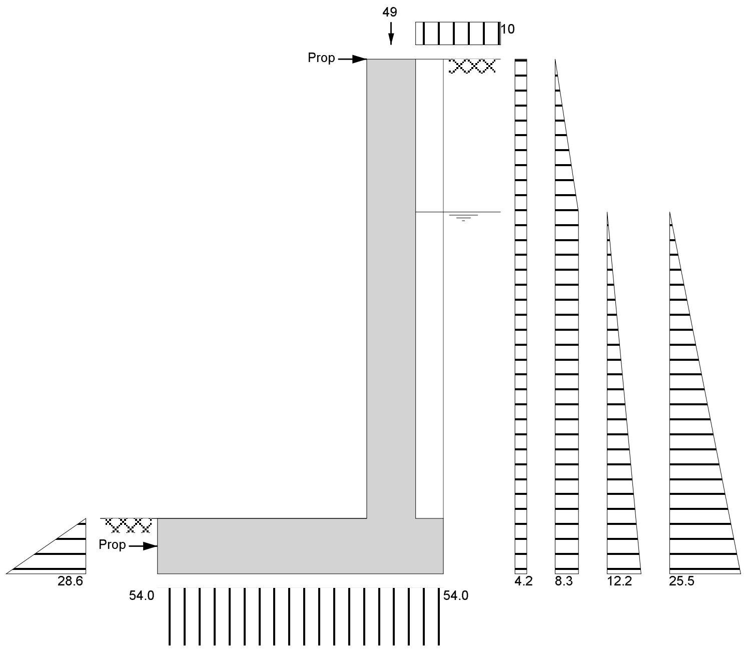
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **3300** mm	Wall stem thickness	t_{wall} = **350** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **200** mm
Overall length of base	l_{base} = **2050** mm	Base thickness	t_{base} = **400** mm
Height of retaining wall	h_{wall} = **3700** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **400** mm
Position of downstand	l_{ds} = **1100** 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} = **2600** 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} = **3700** 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 = **0.0** 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	$P_{bearing}$ = **125** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.419**	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} = **39.3** kN/m	Vertical live load	W_{live} = **9.6** 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} = **51.5** kN/m

Check bearing pressure

Total vertical reaction	R = **110.7** kN/m	Distance to reaction	x_{bar} = **1025** mm
Eccentricity of reaction	e = **0** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **54.0** kN/m^2	Bearing pressure at heel	p_{heel} = **54.0** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall	F_{prop_top} = **16.785** kN/m	Propping force to base of wall	F_{prop_base} = **34.722** kN/m

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.08

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} = **51.5** kN/m

Calculate propping forces to top and base of wall

Propping force to top of wall $F_{prop\_top\_f}$ = **28.977** kN/m Propping force to base of wall $F_{prop\_base\_f}$ = **80.451** 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} = **50** mm

Design of retaining wall toe

Shear at heel V_{toe} = **95.3** kN/m Moment at heel M_{toe} = **89.1** kNm/m

Compression reinforcement is not required

Check toe in bending

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

Area required $A_{s\_toe\_req}$ = **626.8** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.277** 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} = **0.463** 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} = **50** mm

Design of retaining wall heel

Shear at heel V_{heel} = **9.0** kN/m Moment at heel M_{heel} = **1.5** kNm/m

Compression reinforcement is not required

Check heel in bending

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

Area required $A_{s\_heel\_req}$ = **520.0** 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} = **0.026** 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} = **0.463** N/mm^2

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

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

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} = **75** mm Cover in wall c_{wall} = **50** mm

Design of retaining wall stem

Shear at base of stem V_{stem} = **101.2** kN/m Moment at base of stem M_{stem} = **60.1** kNm/m

Compression reinforcement is not required

Check wall stem in bending

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

Area required $A_{s\_stem\_req}$ = **540.9** mm^2/m Area provided $A_{s\_stem\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.376** 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} = **0.534** N/mm^2

v_{stem} < v_{c_stem} - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **29.4** kNm/m

Compression reinforcement is not required

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

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

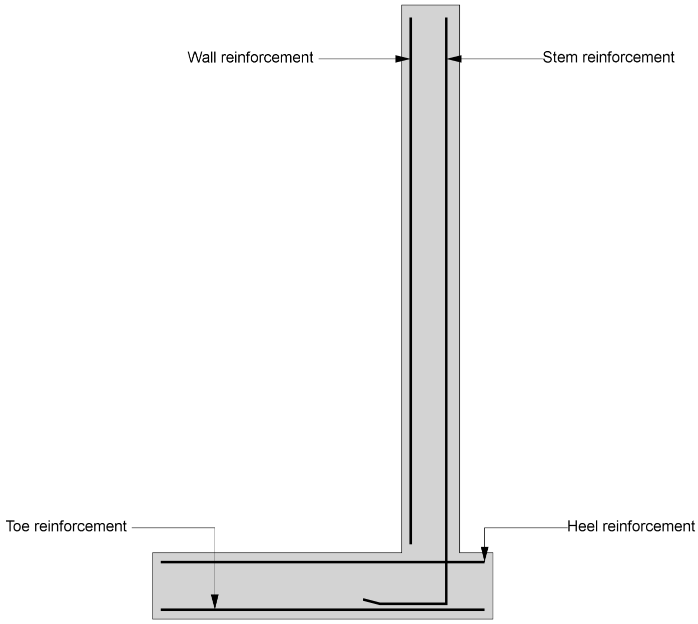
PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **33.90** Actual span/depth ratio $ratio_{act}$ = **12.27**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



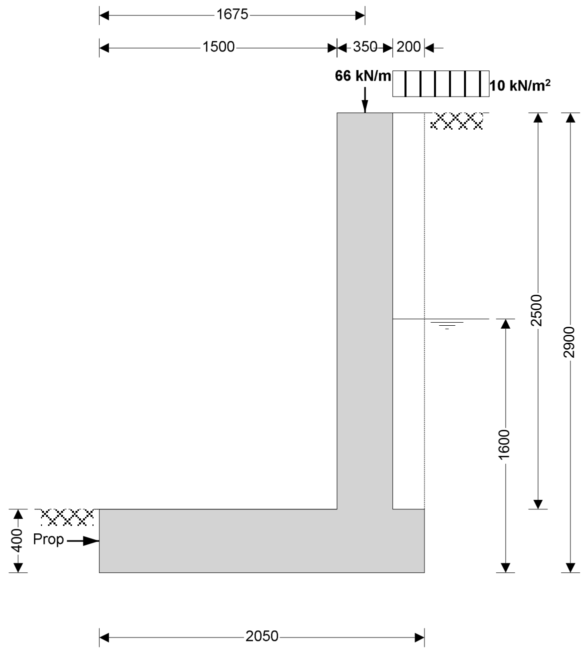
Toe bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Heel bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Wall bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Stem bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

CASE 2

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

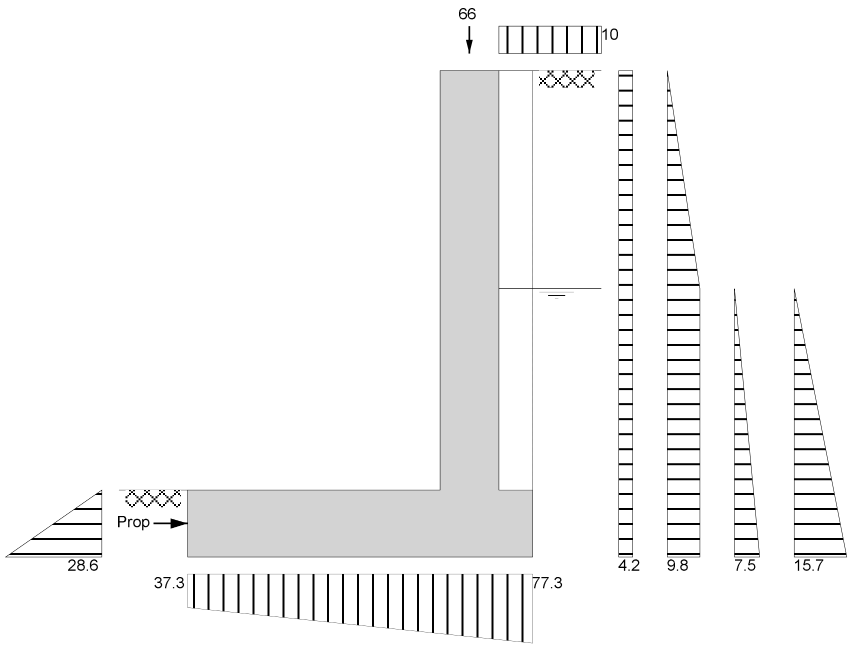
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2500** mm	Wall stem thickness	t_{wall} = **350** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **200** mm
Overall length of base	l_{base} = **2050** mm	Base thickness	t_{base} = **400** mm
Height of retaining wall	h_{wall} = **2900** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **400** mm
Position of downstand	l_{ds} = **1650** 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} = **1600** 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} = **2900** 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 = **0.0** 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	$P_{bearing}$ = **125** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.419**	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} = **56.1** kN/m	Vertical live load	W_{live} = **9.6** 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} = **11.4** kN/m

Check bearing pressure

Total vertical reaction	R = **117.4** kN/m	Distance to reaction	x_{bar} = **1144** mm
Eccentricity of reaction	e = **119** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **37.3** kN/m^2	Bearing pressure at heel	p_{heel} = **77.3** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.08

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} = **11.4** 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} = **50** mm

Design of retaining wall toe

Shear at heel V_{toe} = **108.1** kN/m Moment at heel M_{toe} = **104.9** kNm/m

Compression reinforcement is not required

Check toe in bending

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

Area required $A_{s\_toe\_req}$ = **738.2** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.314** 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} = **0.463** 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} = **50** mm

Design of retaining wall heel

Shear at heel V_{heel} = **5.8** kN/m Moment at heel M_{heel} = **0.7** kNm/m

Compression reinforcement is not required

Check heel in bending

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

Area required $A_{s\_heel\_req}$ = **520.0** 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} = **0.017** 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} = **0.463** N/mm^2

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

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

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} = **75** mm Cover in wall c_{wall} = **50** mm

Design of retaining wall stem

Shear at base of stem V_{stem} = **33.5** kN/m Moment at base of stem M_{stem} = **77.8** kNm/m

Compression reinforcement is not required

Check wall stem in bending

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

Area required $A_{s\_stem\_req}$ = **699.8** mm^2/m Area provided $A_{s\_stem\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.124** 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} = **0.534** N/mm^2

v_{stem} < v_{c_stem} - No shear reinforcement required

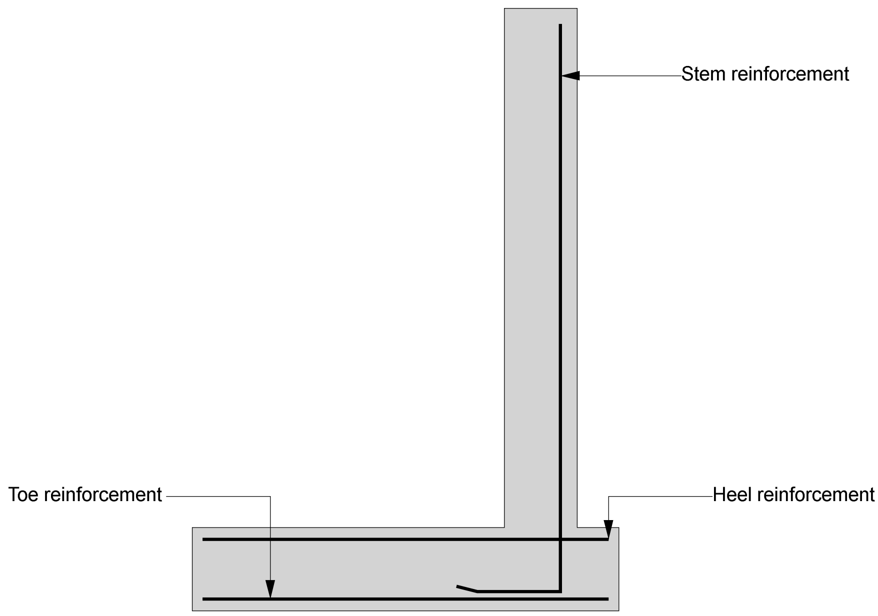
Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **8.80** Actual span/depth ratio $ratio_{act}$ = **9.29**

FAIL - Span to depth ratio is unacceptable

VINCENT & RYMILL 01252 834242 07854 370 181	Project 61 REDDINGTOPN ROAD LONDON NW3 7RP			Job Ref. 22D07	
	Section PRELIMINARY STRUCTURAL CALCULATIONS			Sheet no./rev. 14	
	Calc. by TV	Date 27/04/2022	Chk'd by	Date	App'd by	Date

Indicative retaining wall reinforcement diagram



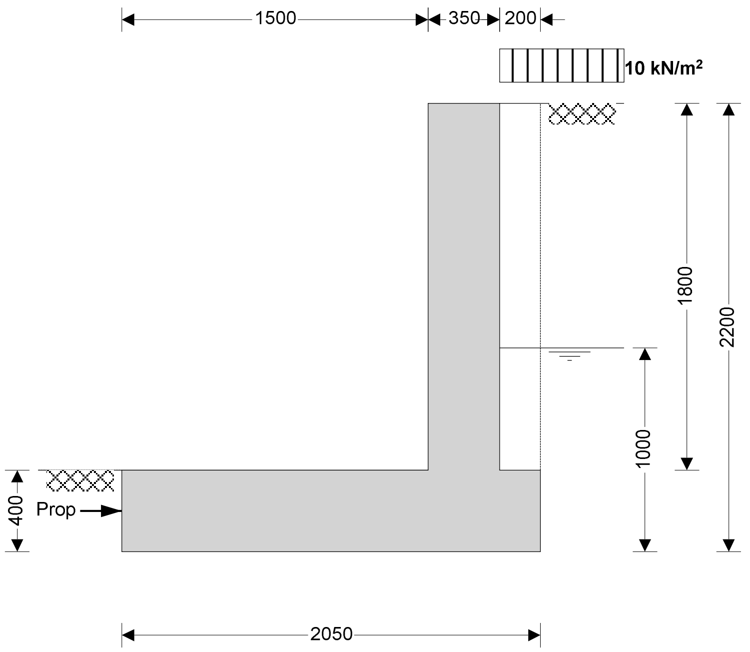
Toe bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Heel bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Stem bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

CASE 3 WALL B GENERAL CASE

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

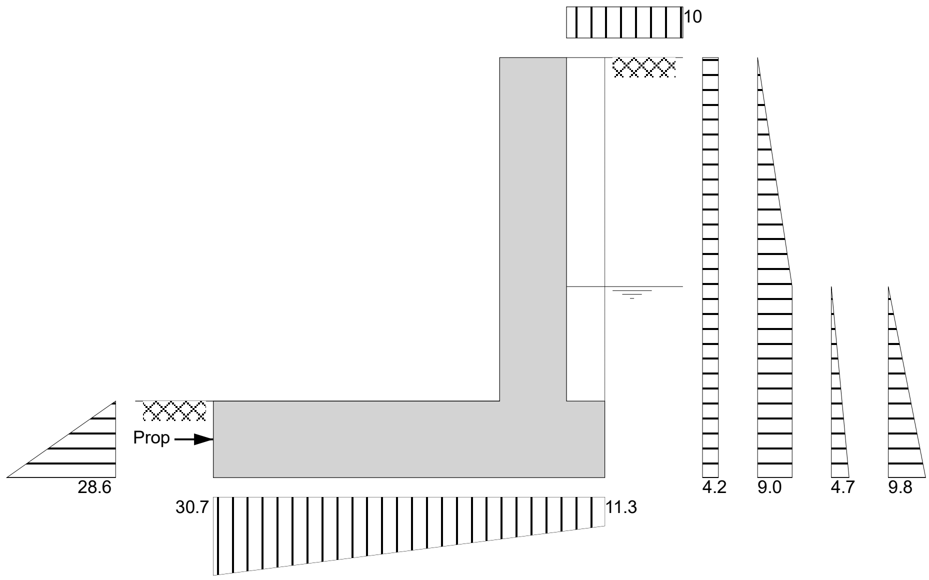
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **1800** mm	Wall stem thickness	t_{wall} = **350** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **200** mm
Overall length of base	l_{base} = **2050** mm	Base thickness	t_{base} = **400** mm
Height of retaining wall	h_{wall} = **2200** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **400** mm
Position of downstand	l_{ds} = **1150** 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} = **1000** 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} = **2200** 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 = **0.0** 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	$P_{bearing}$ = **125** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.419**	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} = **11.4** kN/m

Check bearing pressure

Total vertical reaction	R = **43.1** kN/m	Distance to reaction	x_{bar} = **867** mm
Eccentricity of reaction	e = **158** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **30.7** kN/m^2	Bearing pressure at heel	p_{heel} = **11.3** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.08

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} = **11.4** 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} = **50** mm

Design of retaining wall toe

Shear at heel V_{toe} = **38.9** kN/m Moment at heel M_{toe} = **46.2** kNm/m

Compression reinforcement is not required

Check toe in bending

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

Area required $A_{s\_toe\_req}$ = **520.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.113** 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} = **0.463** 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} = **50** mm

Design of retaining wall heel

Shear at heel V_{heel} = **15.4** kN/m Moment at heel M_{heel} = **4.4** kNm/m

Compression reinforcement is not required

Check heel in bending

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

Area required $A_{s\_heel\_req}$ = **520.0** 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} = **0.045** 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} = **0.463** N/mm^2

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

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

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} = **75** mm Cover in wall c_{wall} = **50** mm

Design of retaining wall stem

Shear at base of stem V_{stem} = **9.1** kN/m Moment at base of stem M_{stem} = **35.6** kNm/m

Compression reinforcement is not required

Check wall stem in bending

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

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

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.034** 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} = **0.534** N/mm^2

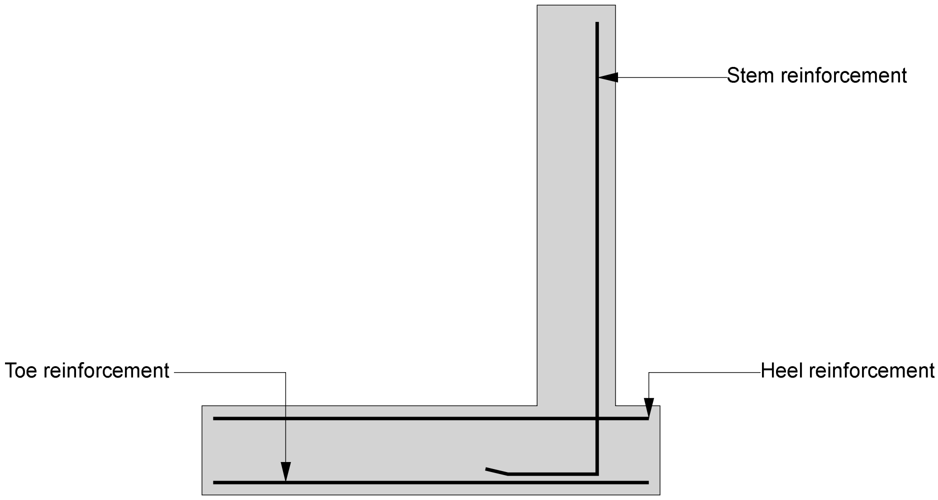
v_{stem} < v_{c_stem} - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **14.00** Actual span/depth ratio $ratio_{act}$ = **6.69**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



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

LOWER GROUND FLKOOR SLAB

FINISH + SWT = 7.4KN/m^2
IMP LOAD = 1.50KN/m^2

1. SPANNING
MAX SPAN = 4.50m

DESIGN LOAD = 12.80KN/m^2

BM ULT = 32.4KN.m

RC SLAB DESIGN (BS8110)

RC SLAB DESIGN (BS8110:PART1:1997)

TEDDS calculation version 1.0.04

CONCRETE SLAB DESIGN (CL 3.5.3 & 4)

SIMPLE ONE WAY SPANNING SLAB DEFINITION

Overall depth of slab h = **225** mm

Cover to tension reinforcement resisting sagging c_b = **35** mm

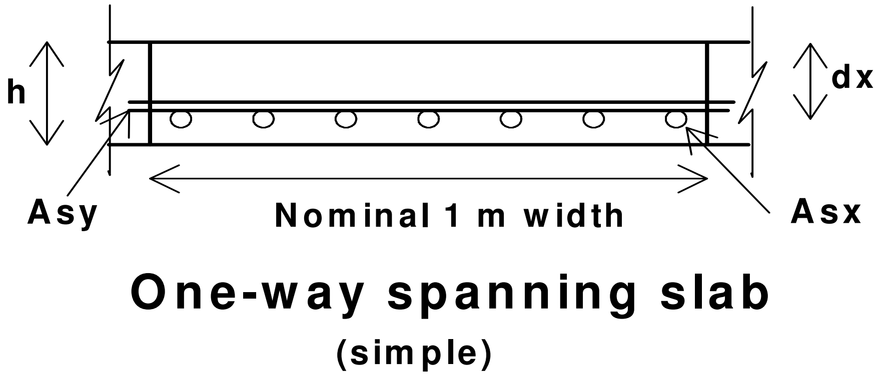
Trial bar diameter D_{tryx} = **10** mm

Depth to tension steel (resisting sagging)

$d_x = h - c_b - D_{tryx}/2$ = **185** mm

Characteristic strength of reinforcement f_y = **500** N/mm^2

Characteristic strength of concrete f_{cu} = **35** N/mm^2



ONE WAY SPANNING SLAB (CL 3.5.4)

MAXIMUM DESIGN MOMENTS IN SPAN

Design sagging moment (per m width of slab) m_{sx} = **32.4** kNm/m

CONCRETE SLAB DESIGN – SAGGING – OUTER LAYER OF STEEL (CL 3.5.4)

Design sagging moment (per m width of slab) m_{sx} = **32.4** kNm/m

Moment Redistribution Factor β_{bx} = **1.0**

Area of reinforcement required

$K_x = abs(m_{sx}) / (d_x^2 \times f_{cu})$ = **0.027**

$K'_x = min (0.156 , (0.402 \times (\beta_{bx} - 0.4)) - (0.18 \times (\beta_{bx} - 0.4)^2))$ = **0.156**

Outer compression steel not required to resist sagging

Slab requiring outer tension steel only - bars (sagging)

$z_x = min ((0.95 \times d_x),(d_x\times(0.5+\sqrt{(0.25-K_x/0.9)})))$ = **176** mm

Neutral axis depth $x_x = (d_x - z_x) / 0.45$ = **21** mm

Area of tension steel required

$A_{sx\_req} = abs(m_{sx}) / (1/\gamma_{ms} \times f_y \times z_x)$ = **424** mm^2/m

Tension steel

Provide 10 dia bars @ 100 centres outer tension steel resisting sagging

$A_{sx\_prov} = A_{sx}$ = **785** mm^2/m

Area of outer tension steel provided sufficient to resist sagging

TRANSVERSE BOTTOM STEEL - INNER

Inner layer of transverse steel

Provide 10 dia bars @ 100 centres

$A_{sy\_prov} = A_{sy}$ = **785** mm^2/m

Check min and max areas of steel resisting sagging

Total area of concrete $A_c = h$ = **225000** mm^2/m

Minimum % reinforcement k = **0.13** %

$A_{st\_min} = k \times A_c$ = **293** mm^2/m

$A_{st\_max} = 4\ \% \times A_c$ = **9000** mm^2/m

Steel defined:

Outer steel resisting sagging A_{sx_prov} = **785** mm^2/m

Area of outer steel provided (sagging) OK

Inner steel resisting sagging A_{sy_prov} = **785** mm^2/m

Area of inner steel provided (sagging) OK

CONCRETE SLAB DEFLECTION CHECK (CL 3.5.7)

Slab span length l_x = **4.500** m

Design ultimate moment in shorter span per m width m_{sx} = **32** kNm/m

Depth to outer tension steel d_x = **185** mm

Tension steel

Area of outer tension reinforcement provided A_{sx_prov} = **785** mm^2/m

Area of tension reinforcement required A_{sx_req} = **424** mm^2/m

Moment Redistribution Factor β_{bx} = **1.00**

Modification Factors

Basic span / effective depth ratio (Table 3.9) $ratio_{span\_depth}$ = **20**

The modification factor for spans in excess of 10m (ref. cl 3.4.6.4) has not been included.

$f_s = 2 \times f_y \times A_{sx\_req} / (3 \times A_{sx\_prov} \times \beta_{bx}) = \mathbf{180.0}$ N/mm^2

$factor_{tens} = \min(2, 0.55 + (477 \text{ N/mm}^2 - f_s) / (120 \times (0.9 \text{ N/mm}^2 + m_{sx} / d_x^2))) = \mathbf{1.890}$

Calculate Maximum Span

This is a simplified approach and further attention should be given where special circumstances exist. Refer to clauses 3.4.6.4 and 3.4.6.7.

Maximum span $l_{max} = ratio_{span\_depth} \times factor_{tens} \times d_x = \mathbf{6.99}$ m

Check the actual beam span

Actual span/depth ratio $l_x / d_x = \mathbf{24.32}$

Span depth limit $ratio_{span\_depth} \times factor_{tens} = \mathbf{37.80}$

Span/Depth ratio check satisfied

CHECK OF NOMINAL COVER (SAGGING) – (BS8110:PT 1, TABLE 3.4)

Slab thickness h = **225** mm

Effective depth to bottom outer tension reinforcement d_x = **185.0** mm

Diameter of tension reinforcement D_x = **10** mm

Diameter of links L_{diax} = **0** mm

Cover to outer tension reinforcement

$c_{tenx} = h - d_x - D_x / 2 = \mathbf{35.0}$ mm

Nominal cover to links steel

$c_{nomx} = c_{tenx} - L_{diax} = \mathbf{35.0}$ mm

Permissable minimum nominal cover to all reinforcement (Table 3.4)

$c_{min} = \mathbf{35}$ mm

Cover over steel resisting sagging OK

2 LAYERS A393 BOTTOM

UPLIFT

SAY AVERAGE MAX = 2 X 10 = 20KN/m^2
MINUS SWT = 13.6KN/m^2

DESIGN BM = 1.4 X 13.6 X 4.5^2 /8 = 48.2KN.m

RC SLAB DESIGN (BS8110)

RC SLAB DESIGN (BS8110:PART1:1997)

TEDDS calculation version 1.0.04

CONCRETE SLAB DESIGN (CL 3.5.3 & 4)

SIMPLE ONE WAY SPANNING SLAB DEFINITION

Overall depth of slab h = **225** mm

Cover to tension reinforcement resisting sagging c_b = **35** mm

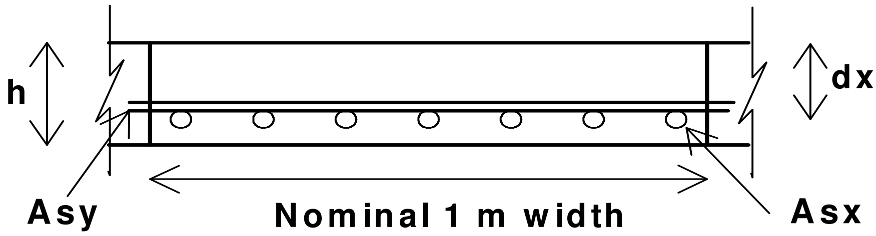
Trial bar diameter D_{tryx} = **10** mm

Depth to tension steel (resisting sagging)

$d_x = h - c_b - D_{tryx}/2$ = **185** mm

Characteristic strength of reinforcement f_y = **500** N/mm^2

Characteristic strength of concrete f_{cu} = **35** N/mm^2



One-way spanning slab
(simple)

ONE WAY SPANNING SLAB (CL 3.5.4)

MAXIMUM DESIGN MOMENTS IN SPAN

Design sagging moment (per m width of slab) m_{sx} = **45.2** kNm/m

CONCRETE SLAB DESIGN – SAGGING – OUTER LAYER OF STEEL (CL 3.5.4)

Design sagging moment (per m width of slab) m_{sx} = **45.2** kNm/m

Moment Redistribution Factor β_{bx} = **1.0**

Area of reinforcement required

$K_x = abs(m_{sx}) / (d_x^2 \times f_{cu})$ = **0.038**

$K'_x = min (0.156 , (0.402 \times (\beta_{bx} - 0.4)) - (0.18 \times (\beta_{bx} - 0.4)^2))$ = **0.156**

Outer compression steel not required to resist sagging

Slab requiring outer tension steel only - bars (sagging)

$z_x = min ((0.95 \times d_x),(d_x \times (0.5+\sqrt{(0.25-K_x/0.9)})))$ = **176** mm

Neutral axis depth $x_x = (d_x - z_x) / 0.45$ = **21** mm

Area of tension steel required

$A_{sx\_req} = abs(m_{sx}) / (1/\gamma_{ms} \times f_y \times z_x)$ = **592** mm^2/m

Tension steel

Provide 10 dia bars @ 100 centres outer tension steel resisting sagging

$A_{sx\_prov} = A_{sx}$ = **785** mm^2/m

Area of outer tension steel provided sufficient to resist sagging

TRANSVERSE BOTTOM STEEL - INNER

Inner layer of transverse steel

Provide 10 dia bars @ 100 centres

$A_{sy\_prov} = A_{sy} =$ **785** mm^2/m

Check min and max areas of steel resisting sagging

Total area of concrete $A_c = h =$ **225000** mm^2/m

Minimum % reinforcement k = **0.13** %

$A_{st\_min} = k \times A_c =$ **293** mm^2/m

$A_{st\_max} = 4 \% \times A_c =$ **9000** mm^2/m

Steel defined:

Outer steel resisting sagging $A_{sx\_prov} =$ **785** mm^2/m

Area of outer steel provided (sagging) OK

Inner steel resisting sagging $A_{sy\_prov} =$ **785** mm^2/m

Area of inner steel provided (sagging) OK

CONCRETE SLAB DEFLECTION CHECK (CL 3.5.7)

Slab span length $l_x =$ **4.500** m

Design ultimate moment in shorter span per m width $m_{sx} =$ **45** kNm/m

Depth to outer tension steel $d_x =$ **185** mm

Tension steel

Area of outer tension reinforcement provided $A_{sx\_prov} =$ **785** mm^2/m

Area of tension reinforcement required $A_{sx\_req} =$ **592** mm^2/m

Moment Redistribution Factor $\beta_{bx} =$ **1.00**

Modification Factors

Basic span / effective depth ratio (Table 3.9) $ratio_{span\_depth} =$ **26**

The modification factor for spans in excess of 10m (ref. cl 3.4.6.4) has not been included.

$f_s = 2 \times f_y \times A_{sx\_req} / (3 \times A_{sx\_prov} \times \beta_{bx}) =$ **251.2** N/mm^2

$factor_{tens} = \min(2, 0.55 + (477 N/mm^2 - f_s) / (120 \times (0.9 N/mm^2 + m_{sx} / d_x^2))) =$ **1.397**

Calculate Maximum Span

This is a simplified approach and further attention should be given where special circumstances exist. Refer to clauses 3.4.6.4 and 3.4.6.7.

Maximum span $l_{max} = ratio_{span\_depth} \times factor_{tens} \times d_x =$ **6.72** m

Check the actual beam span

Actual span/depth ratio $l_x / d_x =$ **24.32**

Span depth limit $ratio_{span\_depth} \times factor_{tens} =$ **36.33**

Span/Depth ratio check satisfied

CHECK OF NOMINAL COVER (SAGGING) – (BS8110:PT 1, TABLE 3.4)

Slab thickness h = **225** mm

Effective depth to bottom outer tension reinforcement $d_x =$ **185.0** mm

Diameter of tension reinforcement $D_x =$ **10** mm

Diameter of links $L_{diax} =$ **0** mm

Cover to outer tension reinforcement

$c_{tenx} = h - d_x - D_x / 2 =$ **35.0** mm

Nominal cover to links steel

$c_{nomx} = c_{tenx} - L_{diax} =$ **35.0** mm

Permissable minimum nominal cover to all reinforcement (Table 3.4)

$c_{min} =$ **35** mm

Cover over steel resisting sagging OK

2 LAYERS A393 TOP

VINCENT
& RYMILL

APPENDIX 3

TEMPORARY WORKS

V&R
VINCENT & RYMILL

Project	61 REDINGTON RD NW3 7RP	Job No. 22D07
		Sheet No. TW1
		Made by: TV.
Portion	TEMPORARY LATERAL PROPPING	Date: APRIL 2022.
		Checked by:

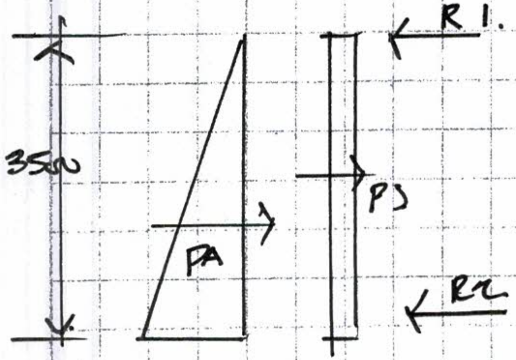
THERE WILL BE TWO TEMPORARY CASES, TO ALLOW REDUCTION OF LEVELS TO FORM LGF SLAB.

1. FRONT WALL & RETURNS.

2. SIDE WALLS.

1. FRONT WALL & LIGHTWELL

WORKS WILL BE SEQUENCED SUCH THAT SUSPENDED CONCRETE GROUND FLOOR SLAB WILL BE IN PLACE PRIOR TO REDUCING LEVELS



$\gamma = 19 kN/m^3 \quad K_0 = 0.5$

$IL = 10 kN/m^2.$

$PA = 19 \times 0.5 \times 3.5^2/2 = 58.2 kN.$

$PS = 0.5 \times 10 \times 3.5 = 17.5 kN$

R1 GROUND SLAB $= (58.2 \times \frac{1}{3}) + (17.5/2) = 28.2 kN/m$

R2 LGF $= (58.2 \times \frac{2}{3}) + (17.5/2) = 47.6 kN/m$

PROPS AT SAY MAX 2.0M C/C.

WALER BM $= 47.6 \times 2^2/8 = 24 kN.m$

Z REQ $= 24/0.18 = 133 cm^3$ — 152UC30 WALER ($Z = 222 > 133$)

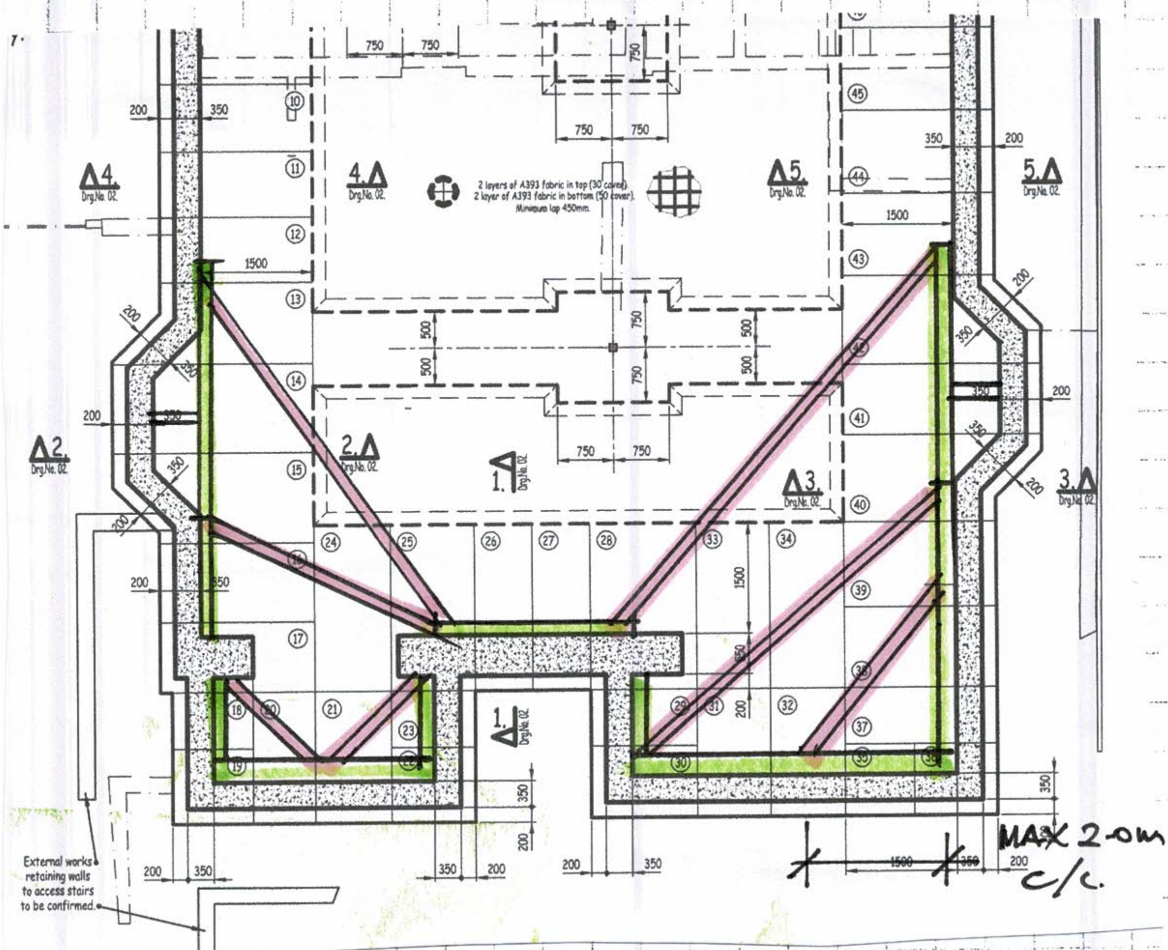
V&R VINCENT & RYMILL

Project	61 REDINGTON RD NW3 7RP	Job No.	22D07
		Sheet No.	TW2.
		Made by:	TV
Portion	TEMPORARY LATERAL PROPPING	Date:	APRIL 2022.
		Checked by:	

PROPS

L MAX = 4.0m MAX LOAD = $2 \times 47.6 \times \sqrt{2} = 134$ KN.

SAFE LOAD TABLES 152 UC30, L = 4.0m
SAFE LOAD = 283KN > 134 OK.



152UC WALER

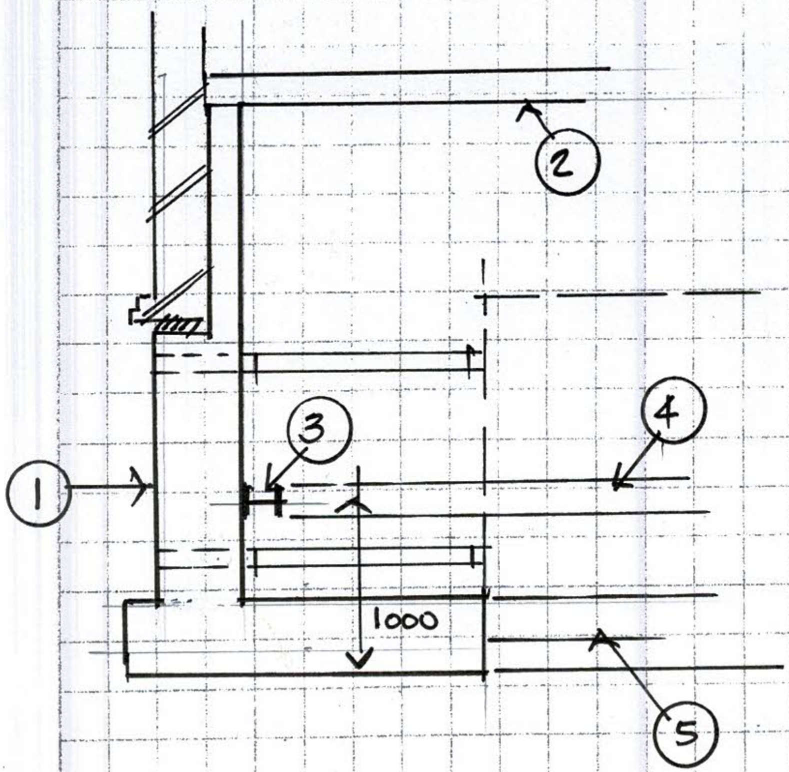
152UC PROPS

V&R
VINCENT
& RYMILL

Project: 61 REDDINGTON ROAD NW3 7RP

Portion: TEMPORARY LATERAL PROPPING

Job No. 22007
Sheet No. TW3
Made by: TV.
Date: APRIL 2021.
Checked by:



1. IN SEQUENCE FORM WALL & BASE IN SEQUENCE KEEP PROPPED AGAINST INTERNAL 'DUMPLING'. COMPLETE WHOLE WALL & BASE.
2. FIX UPPER GROUND STEEL & CONCRETE SLAB TO FORM PROP AT TOP OF WALL
3. FIX 152UC30 WALER 1000 ABOVE FORMATION.
4. TRENCH 'DUMPLING' AT PROP LOCATIONS & FIX PROPS
5. REDUCE LEVELS TO FORMATION & FIX DRAINAGE COMPLETE LGF SLAB.
6. REMOVE PROPS & WALERS

V&R VINCENT & RYMILL

Project	61 REDDINGTON ROAD NW3 7RP	Job No.	22D07
		Sheet No.	TW4
		Made by:	TV.
Portion	TEMPORARY LATERAL PROPPING.	Date:	APRIL 2022
		Checked by:	

2 SIDE WALLS

AVERAGE RETAINED HT 2.0m OR LESS.

WALLS WILL BE PROPPED AGAINST CENTRAL DUMPLING TEMPORARILY. ONCE WALLS COMPLETE & INTERNAL CROSS GROUND BEAMS ARE CAST SLIDING OF WALL CANNOT OCCUR AS GROUND BEAMS WILL ACT AS PROPS.

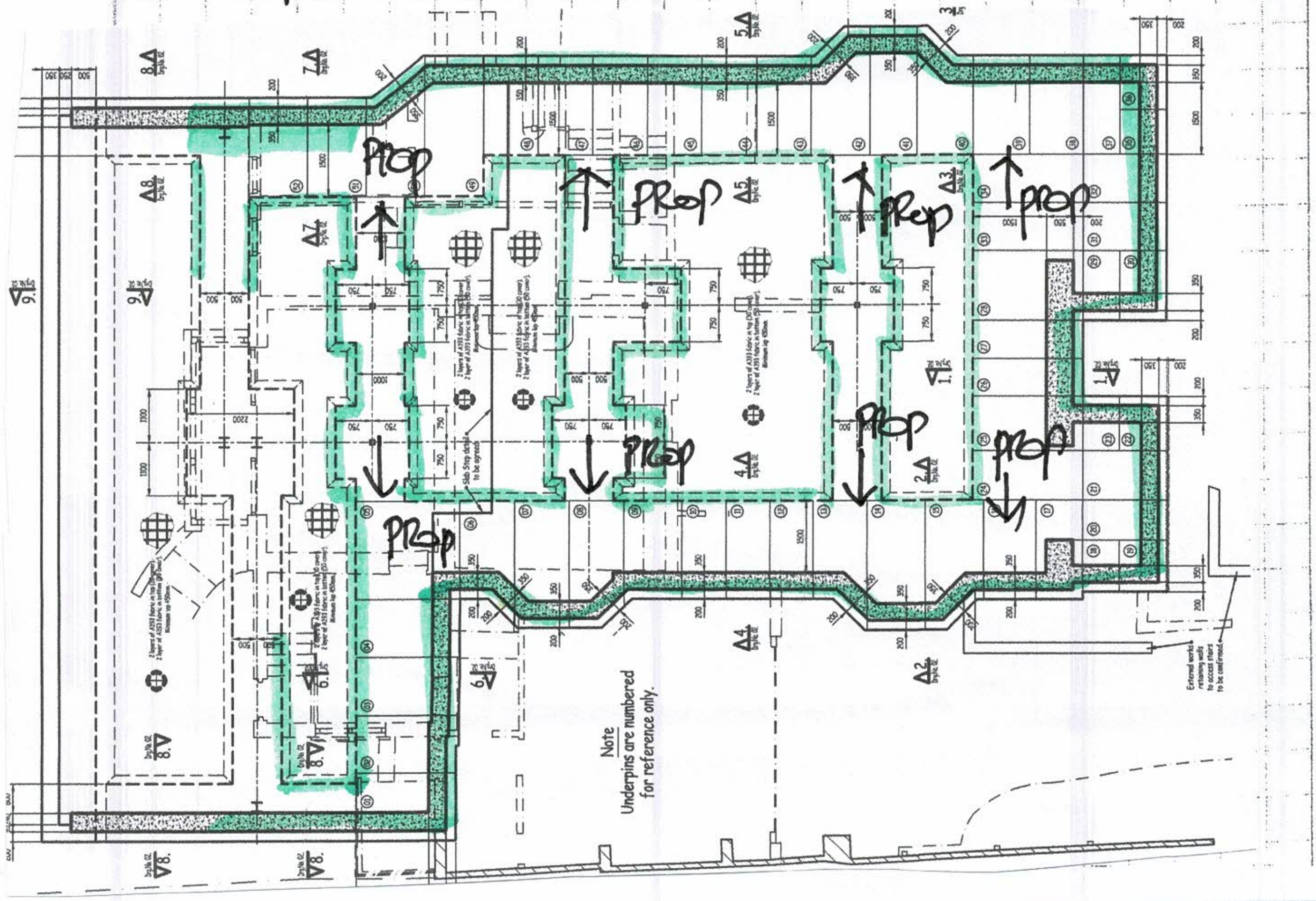
TOTAL LATERAL FORCE /m $= \left(0.5 \times 19 \times 2.0^2/2\right) + \left(0.5 \times 10 \times 2\right)$

$= 29$ kN/m

BASE 2050D × 400W — MAX SPAN HORIZONTALLY = 4.0m

BM MAX $= 29 \times 4.0^2/8 = 58$ kN.m

BY INSPECTION 400×2050 BASE ACTING AS RC BEAM OK.



APPENDIX 4

MOVEMENT MONITORING

V&R VINCENT & RYMILL

61 REDDINGTON ROAD LONDON NW3 7RP
MOVEMENT MONITORING

INTRODUCTION

- Movement monitoring will be carried out by specialist sub- contractor.
- Recommendations of BRE Digest 343 Part 2 'Simple Measuring and monitoring of movement to low rise buildings' shall be followed.
- Movements in three planes (left to right, front to back and verticality) will be measured relative to remote and stable control stations.

EQUIPMENT

- All measurements will be made with suitable EDM equipment.

ACCURACY

- The accuracy (stated standard deviation to ISO 17123-4) in both level and plan position shall be +/- 1mm but this is dependent upon site conditions / weather at the time of survey.

MONITORING STATIONS

- Monitoring points shall be agreed between the party wall surveyors and consulting engineer. The targets to be monitored will be retro reflective targets fixed to the walls with resin adhesive See attached plans / photos for proposed positions.

SURVEY CONTROL

- Minimum of 3 reference points remote from the site. (At least 5.0m away from the site boundary)

PROCEDURE

- Survey equipment shall be set up on firm a base.
- Each location will be measured in turn and readings of distance and angle, and Northing, Easting and height will be recorded.
- Readings will be repeated on both faces of the instrument.

FREQUENCY

- Two sets of baseline readings will be taken before any excavation work commences, with an interval of no less than 5 days between the two sets of readings.
- Frequency of readings during the piling and basement excavation works will be weekly.
- One final reading will be taken 4 weeks after basement works are complete and ground floor and basement floor are in position.

TRIGGER VALUES

Amber Level = 8mm

- At Amber level basement construction work will cease and procedures reviewed by the project Structural Engineer to determine additional safeguards or working practices need to be implemented. Work will not restart until approval of project Engineer. The building owner's surveyor and adjoining owner's surveyor informed of level being reached, monitoring will become more frequent at weekly intervals.

Red Level = 10mm

- Construction works shall cease on site until a thorough review of working practice has been carried out by project Structural Engineer. Any additional temporary works shall be implemented by Contractor
- Works will not recommence until approval has been given by the Project Engineer and both the owner and adjoining owner surveyors.

RESULTS

- The recorded results shall be tabulated and graphically presents in report form and issued to all relative parties
- Monitoring results shall be presented within 24 hours of measuring.
- The contractor will identify trends in movement from the results before amber level is reached and assess the best course of action to take.

NOTE TARGET POSITION ON NOS 59, 61 AND 63 TO BE AGREED AT PARTY WALL PROCESS

APPENDIX 5

DEWATERING OF EXCAVATIONS

GROUNDWATER AND DE-WATERING

Local perched groundwater may be encountered during excavation and a method for dewatering excavations will be confirmed and this will depend on the amount of groundwater and the depth at which it is found.

At this stage groundwater will be considered as either slight or significant.

Slight groundwater will be classified as an amount of water that can be dealt with by up to 30 minutes local pumping at the start of the working day and for a further 30 minutes at another time later that working day.

Significant groundwater is anything that cannot be dealt with by these two 30 minute periods of local dewatering.

Slight groundwater

Slight groundwater will be dealt with as follows:

- Local dewatering using a portable electric pump.
- Refer also to method statement for prevention of loss of fines.

Significant groundwater

In the event that significant groundwater is encountered a specialist dewatering arrangement may be required.

The most likely arrangement will by controlling the water locally to each underpin excavation subject to strict control upon loss of fines in surrounding soils.

Should full time pumping be employed then a control should be in place to ensure pumping is not interrupted whilst site is not manned, see control document as below;

METHOD STATEMENT FOR PREVENTION OF LOSS OF FINES IN GRANULAR SOILS WHILST FORMING EXCAVATIONS IN WATER OR BELOW THE WATER TABLE.

Excavations below the water table:

- All sides of the excavation shall be sheeted with ECO board or similar approved, adequately cross propped and braced.
- All joints in sheeting shall be as closed as possible to avoid water with fines leaking through. A layer of 1000g polythene should be laid behind each joint in the sheeting, lapping each side of the joint by 300mm.
- Tightness of props to be regularly checked.

Groundwater will be dealt with as follows:

- Local dewatering using a portable electric pump, placed in an excavated sump within the excavation. Or placed in another vessel with holes in its walls placed in the exacted sump.
- The pump, or the vessel in which the pump is placed, will be surrounded in geotextile material to filter ground from the groundwater before it enters the pump in order to reduce the migration of any soil / fines.

- The outflow from the pump will be pumped into a settlement container where any soils / fines in suspension will be allowed to settle and any soils / fines that have been removed can be collected.
- The amount of soil / fines removed from the ground will be monitored and recorded.
- The pumped water will be put back into the ground in a part of the site away from the current work area.