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Consulting Structural Engineers

CA5982.06A

OCT 2021

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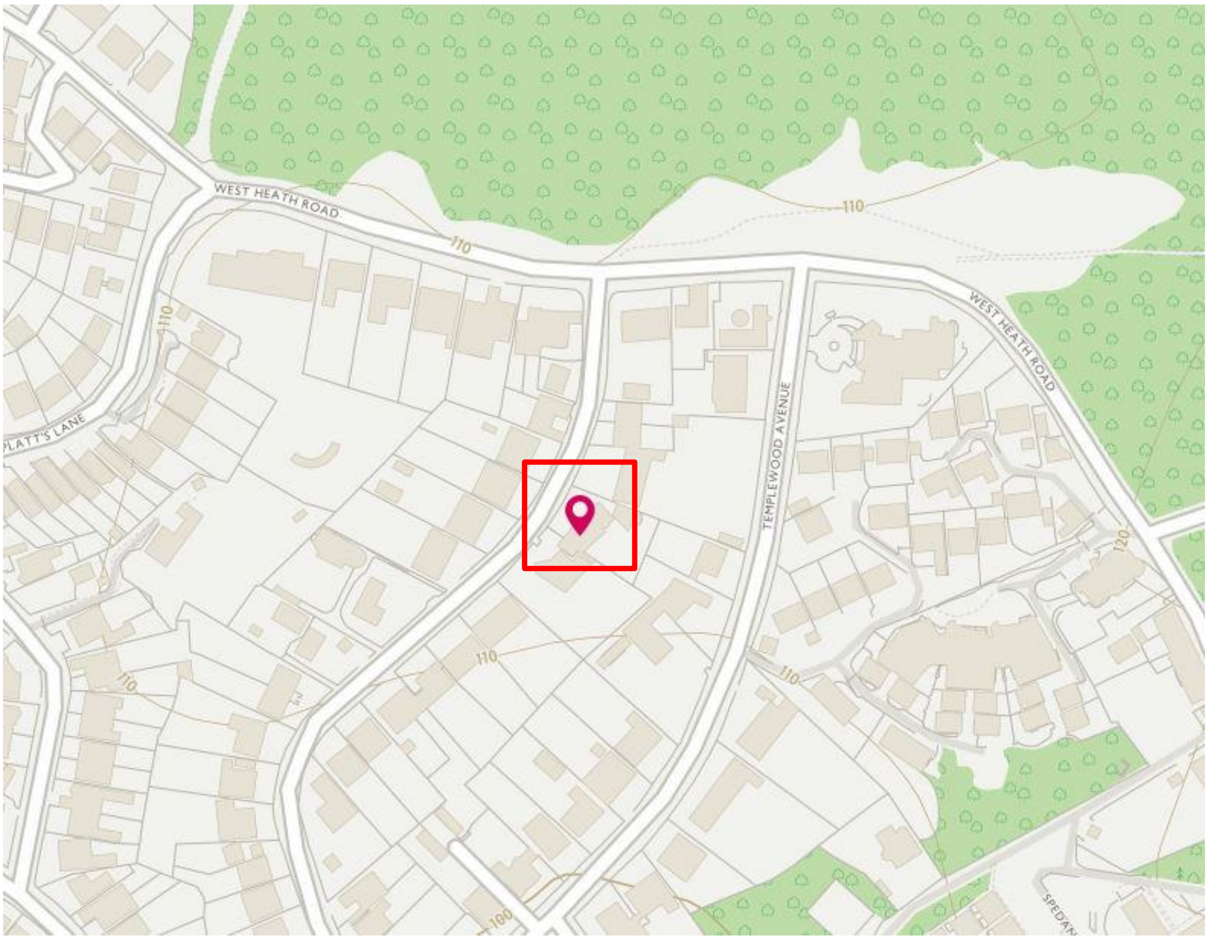
Basement Impact Assessment (BIA)



68A Redington Road, London, NW3 7RS

CONTENTS

1 Introduction

1.1 The following Basement Impact Assessment has been prepared by Cooper Associates to be included in the planning application, for the proposed subterranean development at 68A Redington Road, London, NW3 7RS.

1.2 This application intends to underpin the existing rear utility room down to the same level as the existing basement. The existing upper floor will also be altered as part of the overall refurbishment of the building, to provide an improved residential space.

1.3 This structural report describes the investigation for and construction method of the deeper basement.

1.4 This report should read in conjunction with the Architects drawings and any other documents accompanying the application.

1.5 This Basement Impact Assessment has been prepared by Marcus Marinos Beng MSc and checked by Martin Cooper Eur Ing Bsc Ceng MICE MIStructE, Director at Cooper Associates.

COOPER ASSOCIATES

Cooper Associates are a practise of Structural Engineers who have been operating in excess of 30 years. Over the past 20 years we have gained considerable experience in designing basement extensions, by underpinning existing properties. We have prepared many Basement Impact Statements and Construction Method Statements as part of planning applications, within the various London Boroughs.

2 Existing Structure

2.1 Sixty-eight A Redington Road is an existing three story detached property that has only ever been used for residential accommodation.

2.2 Cooper Associates inspection of the property revealed that this existing building comprises loadbearing external and party solid brick walls and suspended timber floors and roof structure. The suspended ground floor is an RC slab/beam and block solid floor.

2.3 The existing floor joists and existing lintels will be exposed and inspected as part of this project.

3 Site and Ground Conditions

3.1 The site address is 68A Redington Road, London, NW3 7RS and has the following grid reference "TQ 25749 86255".

3.2 Access to the building is provided directly off the pavement of Redington Road. There is no access to the site from the rear or the sides of the property.

3.3 The property is located approximately 800 metres from Hampstead Underground Station and more than 700 metres from the nearest underground tunnel, Northern Line (See Appendix C). The proposed works will not affect these.

3.4 The site is not in a known area affected by Radon (See Appendix B).

3.5 There is no known significant infrastructure below or within 100m of this site.

3.6 *Bomb Sight* world war 2 map shows that bombs did not fall on the property or around the site.

3.7 The property is in flood zone 1, an area with a low probability of flooding. It is not affected by other sources of flooding. (See Appendix D)

3.8 This project will not impede access to existing flood defences.

3.9 Bore holes in the area (provided by the British Geological survey) show that the first 0.9 metres include made up ground before firm Clay is found. The new foundations will be cast on this layer. The borehole found very stiff Clay at 4.5m below ground level. The Borehole logs can be seen in Appendix A.

4 Proposed works

4.1 A preliminary structural design has been carried out for the superstructure and the basement construction. The proposed works include underpinning the existing rear utility room down to the same level as the existing basement. The scope of these particular works is shown in the appendix (7.7). The full scope of the proposed alterations to the building can be seen in the Architects drawings.

4.2 There is no risk to the stability of the existing or the adjacent buildings during or as a result of these works, as the working procedures that are to be adopted have been established and used successfully over the last decade or more.

4.3 The underpinning works are undertaken by excavating and concreting one 1000mm long strip of basement wall at a time and after curing, drypacking tightly, with an expanding drypack (Conbex 100 or similar). Further curing time is allowed before an adjacent bay is constructed – as will be described in more detail in this report. Hence the risk of long term differential movement between the basement and the neighbour’s foundations is negligible.

4.4 The proposed works are sufficiently away from the neighbours property’s and we are thus able to state that the neighbours will have no damage. The project falls within Category 0 of the Burland Scale. This is defined as hairline cracks of less than about 0.1 mm which are classed as ‘negligible. No action required’ and forms part of the BRE Digest 251. A Party Wall Award will be in place before the works commence. This will record any existing damage and will identify any fresh damage, in the event that any did occur.

BRE Digest 251 – Table 1: Classification of visible damage to walls with particular reference to ease of repair of plaster and brickwork or masonry. Crack width is one factor in assessing category of damage and should not be used on its own as a direct measure of it.	
Category of damage	Description of typical damage
0	**Hairline cracks of less than about 0.1 mm which are classed as negligible. No action required.**
1	Fine cracks which can be treated easily using normal decoration. Damage generally restricted to internal wall finishes; cracks rarely visible in external brickwork. Typical crack widths up to 1 mm.
2	Cracks easily filled. Recurrent cracks can be masked by suitable linings. Cracks not necessarily visible externally; some external repointing may be required to ensure weather-tightness. Doors and windows may stick slightly and require easing and adjusting. Typical crack widths up to 5 mm.
3	Cracks which require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weather-tightness often impaired. Typical crack widths are 5 to 15 mm, or several of, say, 3 mm.
4	Extensive damage which requires breaking-out and replacing sections of walls, especially over doors and windows. Windows and door frames distorted, floor sloping noticeably*. Walls leaning or bulging noticeably*, some loss of bearing in beams. Service pipes disrupted. Typical crack widths are 15 to 25 mm, but also depends on number of cracks.
5	Structural damage which requires a major repair job, involving partial or complete rebuilding. Beams lose bearing, walls lean badly and require shoring. Windows broken with distortion. Danger of instability. Typical crack widths are greater than 25 mm, but depends on number of cracks.

4.5 A monitoring company will be appointed and their reflective targets will be established on site, prior to the works commencing. Independent readings (every month) will be taken over the following months to establish a set of base readings. Readings will be taken weekly during the underpinning phase and on a monthly basis thereafter till the completion of the structural works at the basement. Amber and red triggers deflection allowances will be agreed prior to the works commencing:

- Amber Trigger: Review works on site and propose ways to mitigate the movement (check / improve drypacking – add additional horizontal props – or as appropriate)

- Red Trigger: As above, in conjunction with the neighbours Engineers / Party wall surveyors. Consider stopping works in the immediate area subject to positively identify and rectify the cause of the movement.

4.6 The area that will be underpinned is in an area that is predominantly level as it forms part of the existing basement and thus there is no risk of slope instability beyond the site. The proposed method of construction avoids any risk of slope instability within the site.

4.7 Any utilities and other infrastructure immediately adjacent to or through the construction will be exposed, adequately supported and be reinstated (using appropriate specialist subcontractors where necessary) as part of the works. The construction of each underpin is done in short sections which avoids damage or movement of the adjacent structures.

4.8 The reinforced concrete walls and bases will be constructed using concrete classed as grade C35A (according to BS8007). This is accepted as a watertight concrete mix. Used in conjunction with an internal drainage system (Delta or similar), they will be two lines of waterproofing which is in accordance with BS8102.

4.9 Although the rear utility room is being underpinned, water flow only exists because of rainwater. Surface water is already being collected by an existing drainage system. The rear basement will only be deepened locally and down to the level of the other basement level, the amount of roof area and hardstanding will not increase in the amount of surface water that has to be collected, by the new drainage system.

4.10 Flood resilient building materials and fittings will be used. All service ducts / gaps etc., to accommodate utilities such as gas, electricity and telephone cables to the lower ground floor level, will be sealed with silicone.

4.11 According to BCA Technical Guidance Note 21: The Building Regulations 2010 – England & Wales Requirement A3 – Disproportionate Collapse the new building is part of consequence class 2A. All steel connection details will be designed to have a minimum horizontal tying force of 75KN as per (BS5950-1). The new structure will thus be designed robustly and will comply with the disproportionate collapse requirements.

5 Construction method

5.1 A Chartered Structural Engineer has been appointed to supervise the construction throughout its duration.

5.2 It is intended that the basement will be constructed by a specialist contractor who is experienced in this form of construction and is capable of successfully dealing with the issues that a basement construction presents. At all times during the construction, works are to be supervised by a competent supervisor that will be appointed by the main contractor. They will be a member of the Considerate Constructors Scheme.

5.3 Party wall agreements will be prepared for the adjacent neighbours on all sides (as necessary), in order to protect their interests.

5.4 Detailed temporary works drawings (and construction sequence requirements) will be designed by a Charted Structural Engineer.

5.5 A method will be agreed with the Contractor – based on a 1:3:5:2:4 hit and miss construction sequence for the construction of the new wall lengths. See Appendix F

5.6 Sump pumps will be available during the excavations to remove any water due to ponding.

5.7 Individually, a void for a section of wall will be excavated; a maximum of 1000 wide and reinforcement (to our design) will be installed. Reinforcing starter bars will be driven into the ground on each side. Shutters will be constructed to retain the wet concrete. Once the concrete is cast, leaving a 50 mm gap between the top of the concrete and the underside of the cleaned brick footing, the gap will be drypacked, but only after a minimum of 24 hours has been allowed for the concrete to cure. A further 48 hours must elapse before any further excavation can be carried out, within two bays of this new footing. A limit of 20% of the building can be undermined at any one time.

6 Executive Summary

6.1 A chartered Civil and Structural Engineer has been appointed to the design team.

6.2 The property has been inspected and a desk study has been carried out by the Structural Engineer; reports have been prepared.

6.3 A site investigation including trial holes, to expose the existing foundations, will be undertaken before any works commence.

6.4 A design has been prepared and a construction sequence has been produced, in report form to show that the basement can be constructed in a safe manner.

6.5 Consideration has been given to the effects of groundwater, drainage and flooding, together with trees and the existing structure, within our structural report.

6.6 Detailed drawings that show how the basement can be constructed safely, will be prepared before any basement works commence.

6.7 Ground movement and potential damage has been considered and categorised based on the Burland Scale.

6.8 The subterranean development has no adverse impact on surface water, ground water flows and site levels.

Prepared by:

Eur Ing Martin Cooper Bsc Ceng MICE MIStructE

Cooper Associates.

7 Appendix

7.1 Appendix A -Borehole Log

GROUND ENGINEERING
Geo-Environmental Specialists
01733 566566

Site:	378 FINCHLEY ROAD, LONDON NW3
BOREHOLE	BH1
Date:	06/06/06
Hole Size:	150mm dia to 20.00m
Ground Level:	83.34m. O.D.

Samples and in-situ Tests

Depth m	Type	Blows	(Date) Casing
0.20-0.70	B1		
1.00-1.50	B2		
1.15-1.45	S	N12	0.90
1.75	D1		
2.00-2.40	U1	38	1.20 ▼s
2.03	W1		
2.45	D2		
2.75	D3		
3.00-3.40	U2	48	1.20
3.45	D4		
3.75	D5		
4.00-4.40	U3	55	1.20
4.45	D6		
4.75	D7		
5.00-5.40	U4	55	1.20
5.45	D8		
6.00	D9		
6.50-6.90	U5	60	1.20
6.95	D10		
7.50	D11		
8.00-8.40	U6	62	1.20
8.45	D12		
9.00	D13		
9.50-9.90	U7	70	1.20
9.95	D14		

Inst.: BENEATH INSTALLATION

Description of Strata	Depth m	O.D. Level m
MADE GROUND - CONCRETE	0.20	83.14
MADE GROUND - Firm, friable, dark brown/brown/grey mottled slightly gravelly, sandy CLAY with occasional brick, concrete, coal and ash fragments	1.10	82.24
Stiff brown/orange brown/light grey mottled CLAY with occasional selenite crystals. Becoming fissured below 2.50m (WEATHERED LONDON CLAY)	3.60	79.74
Very stiff, closely fissured to stiff, brown/orange brown CLAY with occasional selenite crystals (WEATHERED LONDON CLAY)	5.50	77.84
Stiff, becoming very stiff below 7.00m, closely fissured, dark grey CLAY with occasional silt and fine sand seams (LONDON CLAY)	10.00	73.34

REMARKS
1. Breaking out concrete from 0.00m to 0.20m for 0.50 hours
2. Excavating a pit from 0.20m to 1.00m for 1 hour
3. Borehole cased to 1.20m depth
4. Fibrous live roots observed to 1.75m depth
5. Standpipe installed to 4.00m depth

Project No 10575
Scale 1:50
Page 1/2

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
W - Water Sample
S/C - SPT Spoon/Cone
▽ Water Strike
▼ Water Rise
N - SPT Blows for 0.3m
* - Blows for quoted penetration
V - Vane Shear Test Cohesion ( ) kPa
▼c Level on completion
c▼w Level casing withdrawn
▼s Standpipe Level

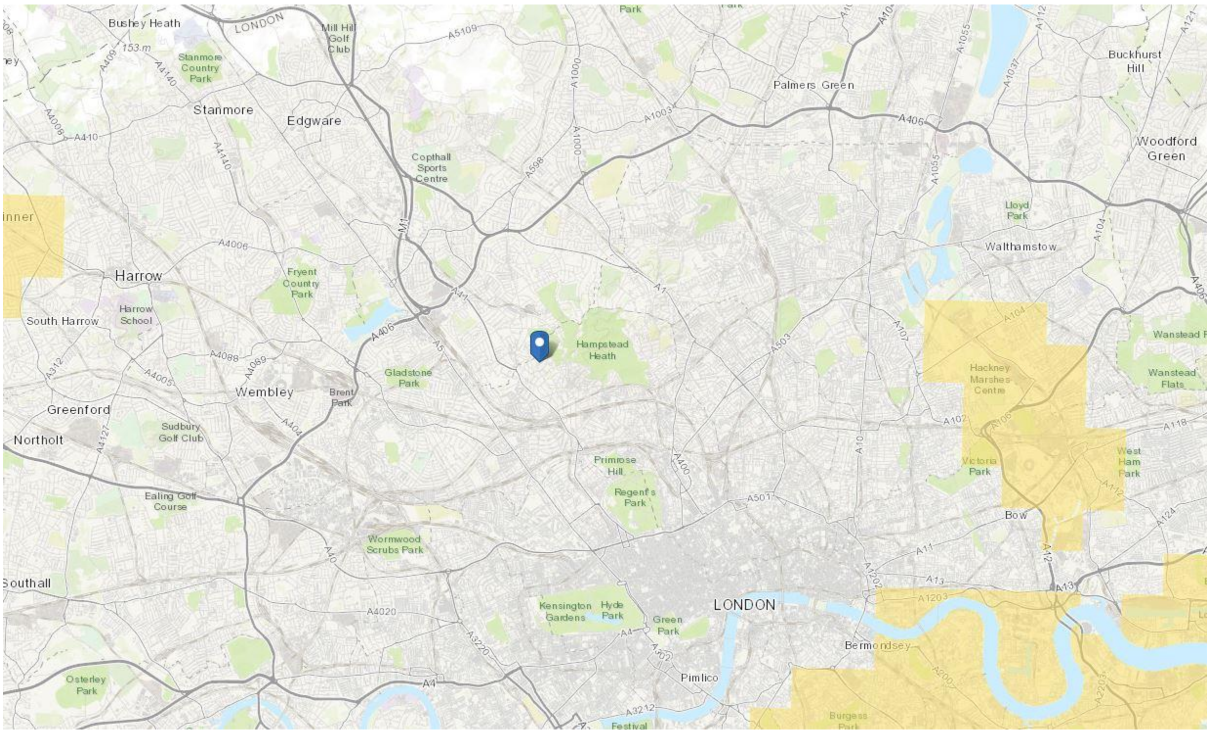
Groundwater Strikes

No	Struck (Depth m)	Rose to (Depth m)	Rate	Cased	Sealed

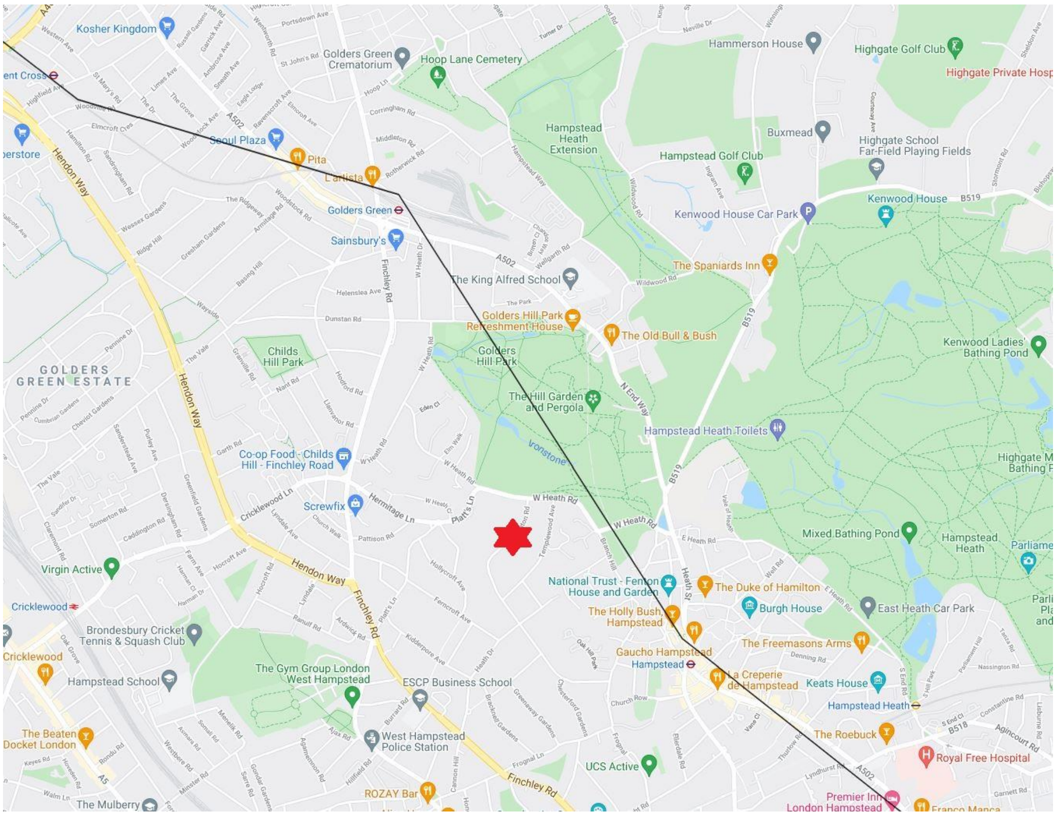
Groundwater Observations

Date	Hole (Depth m)	Casing (Depth m)	Water (Depth m)
06/06/06	20.00	1.20	dry
06/06/06	20.00	0.00	dry
20/07/06	4.00	0.00	2.03

7.2 Appendix B - Radon affected sites map



7.3 Appendix C - London Underground lines nearby.



7.4 Appendix D – *Flood map for planning*

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**525684/186195**	**15 Jul 2021 18:43**

Your selected location is in flood zone 1, an area with a low probability of flooding.

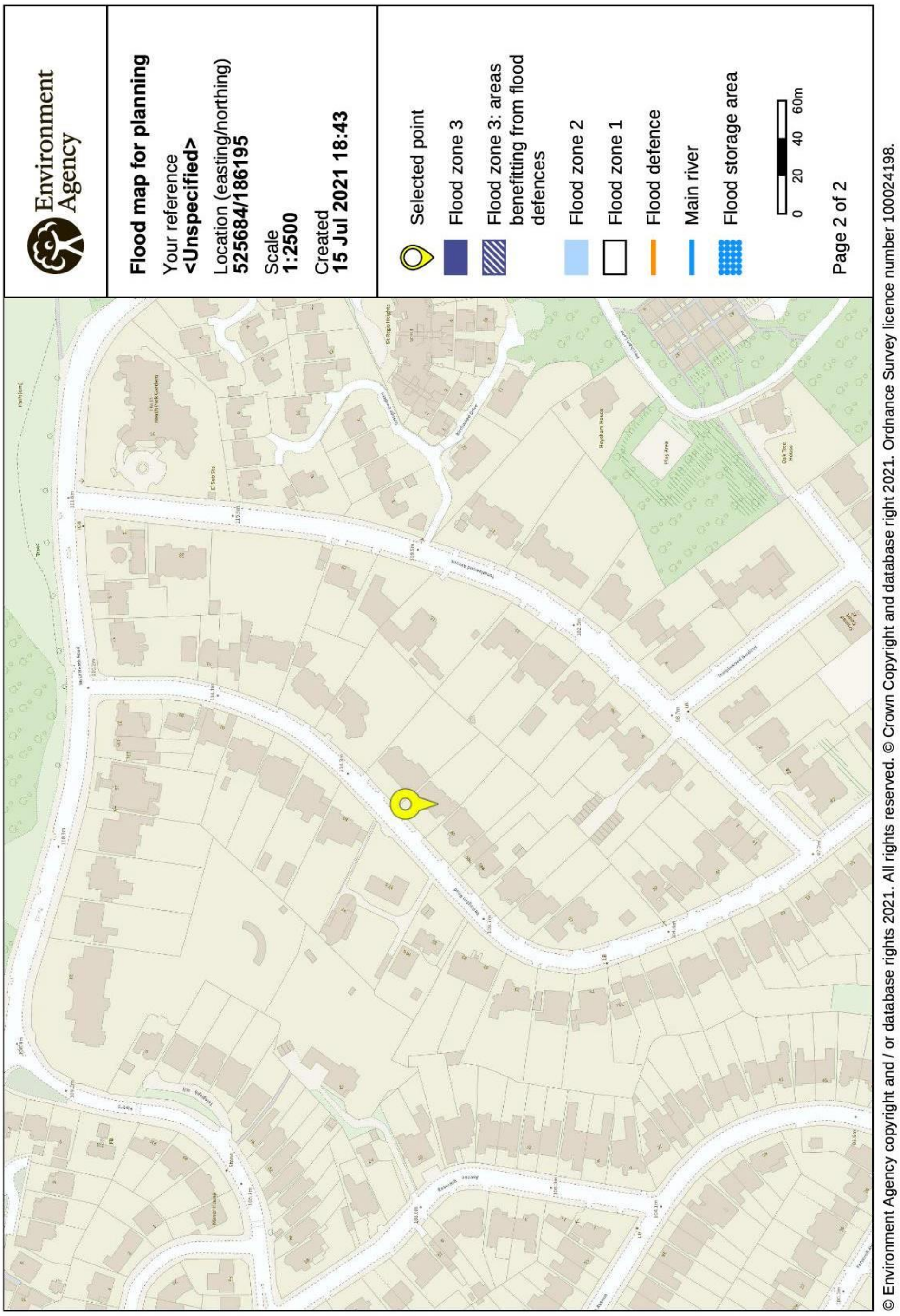
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.


Environment Agency
Flood map for planning
Your reference
<Unspecified>
Location (easting/northing)
525684/186195
Scale
1:2500
Created
15 Jul 2021 18:43
Selected point
Flood zone 3
Flood zone 3: areas benefitting from flood defences
Flood zone 2
Flood zone 1
Flood defence
Main river
Flood storage area
0 20 40 60m
Page 2 of 2
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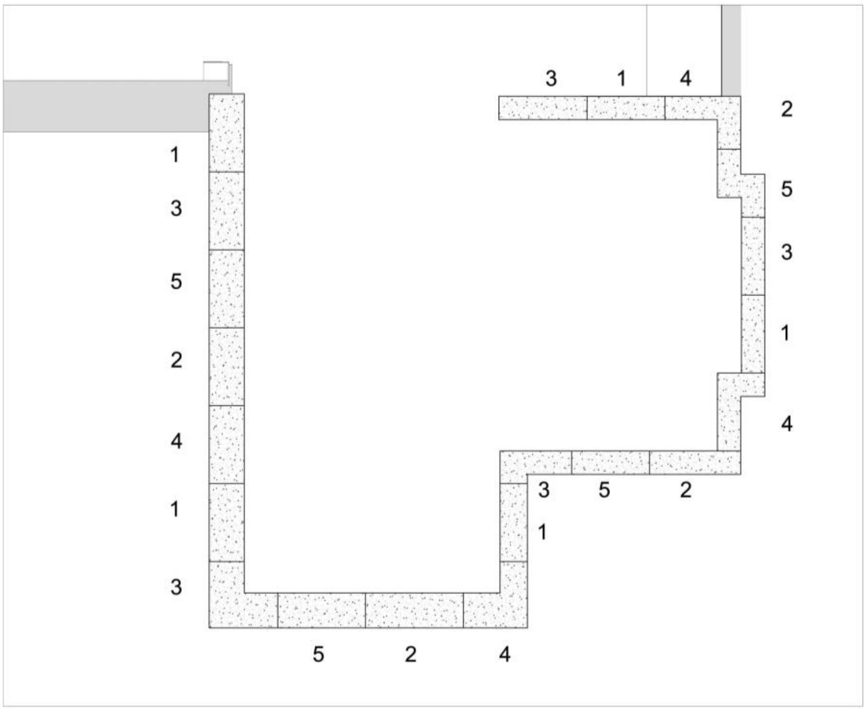
7.5 Appendix E – Hit and miss sequence

Hit & Miss sequence

Max 20% of the wall length can be excavated at any one time.

72 hours should elapse before a bay adjacent to a cast wall is excavated. A minimum of two unexcavated bays should be maintained between any two 'working' bays.

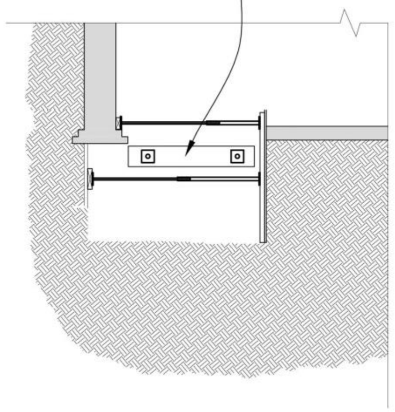


Proposed Lower Ground Floor - Hit and miss sequence

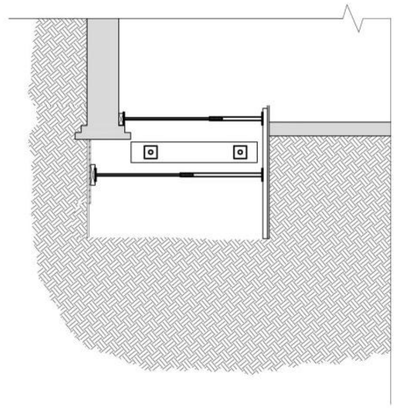
7.6 Appendix F – Temporary works: Typical Section

Typical underpinning sequence

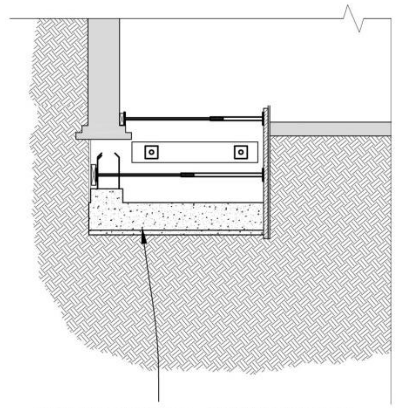
Contractor to saw cut the existing ground bearings slab adjacent to the wall and then to carefully demolish the existing ground bearing slab locally using a mechanical breaker.
Excavate to form a maximum 1.2m wide shaft to underpin the existing foundations as per the underpin sequence.
Prop in both directions using pairs of Acrow Props onto 50 x 225 timbers onto 25mm ply sheets.



Stage 1 - Dig Shaft

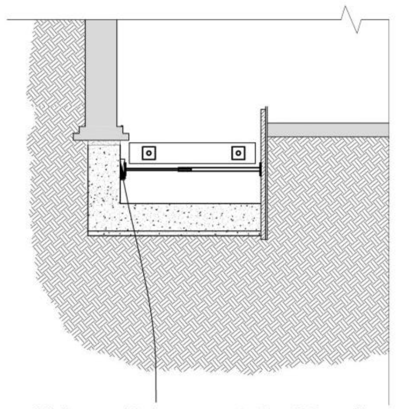


Stage 2 - Dig Shaft



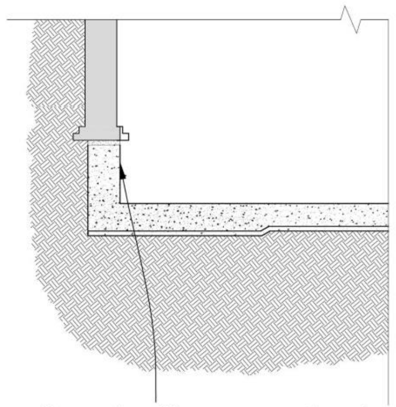
Cast the RC base - Reinforcement as per Engineers drawings.

Stage 3 - Cast the RC base



Minimum 48 hours cast the RC wall. Minimum 24 hours after, drypack to the existing foundations as per the Engineers specification.

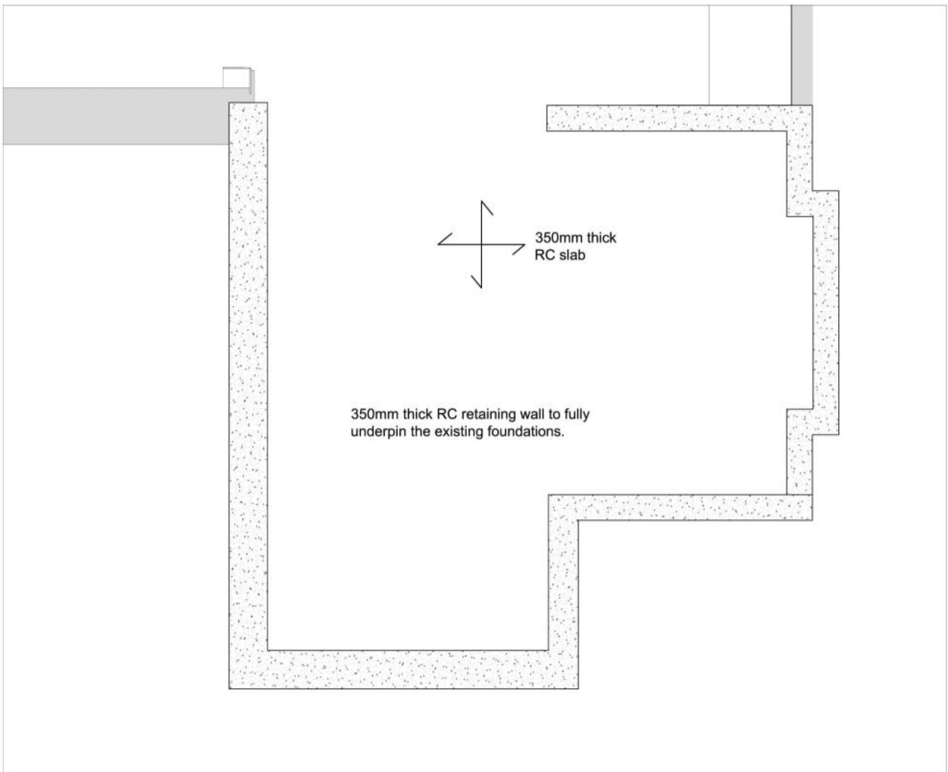
Stage 4 - Cast the RC wall



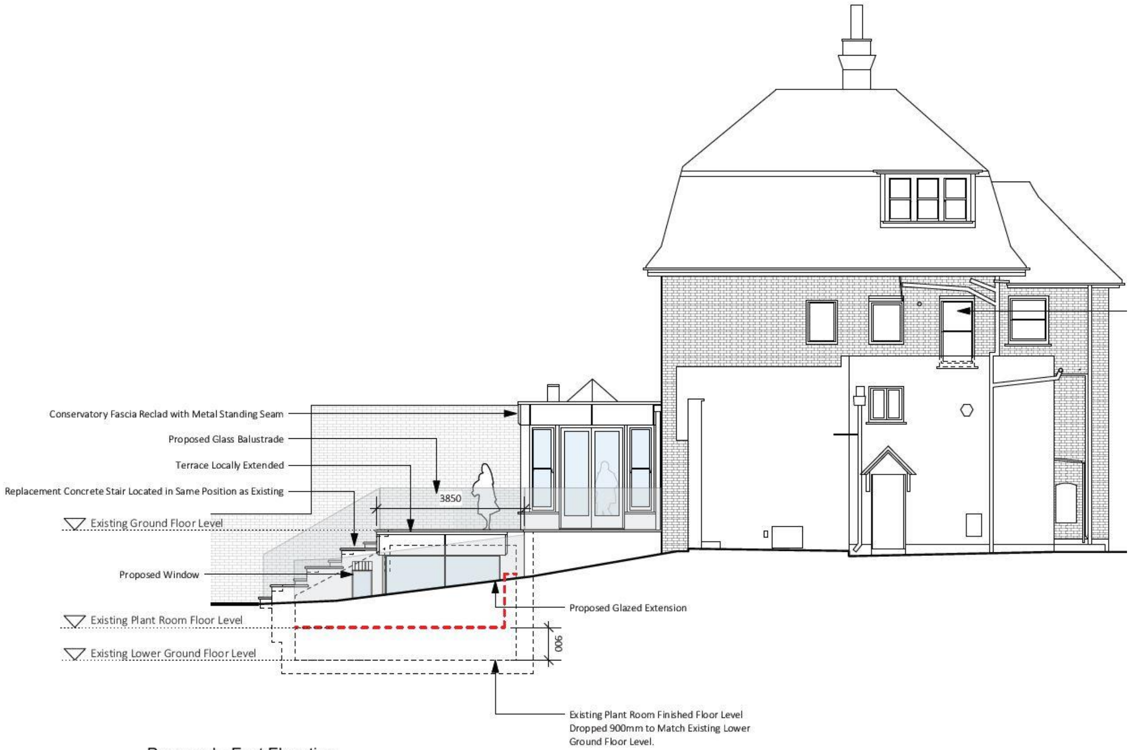
After casting all bases, remove the soil and cast the RC ground bearing slab. Then,remove the existing projecting brick foundation and make good.

Stage 5 - Cast the RC ground slab

7.7 Appendix G – Permanent works



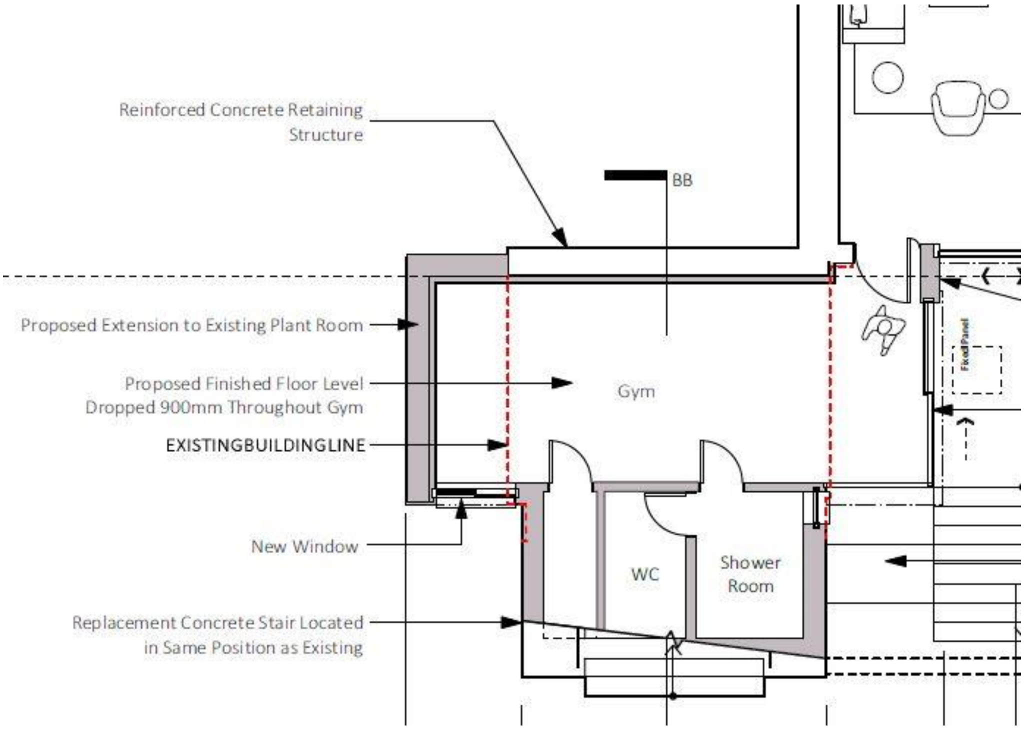
Proposed Lower Ground Floor (Foundations)



Proposed - East Elevation

ABOVE – Plant room only is being reduced in depth by 900 mm's to match the existing internal floor level and the adjacent courtyard level.

BELOW – bottom right shows the small area of plant room that is going to be reduced in level.



Door to the existing plant room.

The internal level is to be reduced to match the external lower patio paver area.

7.8 Appendix H – RC retaining wall/underpin calculation

RETAINING WALL ANALYSIS

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

Analysis summary

Description	Unit	Capacity	Applied	F o S	Result
Bearing pressure	kN/m^2	100	40.2	2.485	PASS

Design summary

Description	Unit	Provided	Required	Utilisation	Result
Stem p0 rear face - Flexural reinforcement	mm^2/m	565.5	442.8	0.78	PASS
Stem p0 - Shear resistance	kN/m	138.9	29.2	0.21	PASS
Base bottom face - Flexural reinforcement	mm^2/m	565.5	405.2	0.72	PASS
Base - Shear resistance	kN/m	131.1	32.8	0.25	PASS
Transverse stem reinforcement	mm^2/m	392.7	350.0	0.89	PASS
Transverse base reinforcement	mm^2/m	392.7	113.1	0.29	PASS

Retaining wall details

Stem type; Cantilever
Stem height; h_{stem} = **1000** 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} = **1500** mm
Base thickness; t_{base} = **350** mm
Base density; γ_{base} = **25** kN/m^3
Height of retained soil; h_{ret} = **1000** 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
Characteristic effective shear resistance angle; $\phi'_{r.k}$ = **18** deg
Characteristic wall friction angle; $\delta_{r.k}$ = **9** deg

Base soil properties

Soil type; Stiff clay
Soil density; γ_b = **19** kN/m^3
Characteristic effective shear resistance angle; $\phi'_{b.k}$ = **18** deg
Characteristic wall friction angle; $\delta_{b.k}$ = **9** deg
Characteristic base friction angle; $\delta_{bb.k}$ = **12** deg
Presumed bearing capacity; $P_{bearing}$ = **100** kN/m^2

Loading details

Variable surcharge load; $Surcharge_Q$ = **20** kN/m^2
Vertical line load at 1675 mm; P_{G1} = **25** kN/m

Calculate retaining wall geometry

Base length; l_{base} = **1850** mm
Moist soil height; h_{moist} = **1000** mm
Length of surcharge load; l_{sur} = **0** mm
Vertical distance; x_{sur_v} = **1850** mm
Effective height of wall; h_{eff} = **1350** mm
Horizontal distance; x_{sur_h} = **675** mm
Area of wall stem; A_{stem} = **0.35** m^2; Vertical distance; x_{stem} = **1675** mm
Area of wall base; A_{base} = **0.648** m^2; Vertical distance; x_{base} = **925** mm

Using Coulomb theory

At rest pressure coefficient; K_0 = **0.691**; Passive pressure coefficient; K_P = **2.359**

Bearing pressure check

Vertical forces on wall

Total; $F_{total\_v} = F_{stem} + F_{base} + F_{P\_v}$ = **49.9** kN/m

Horizontal forces on wall

Total; $F_{total\_h} = F_{sur\_h} + F_{moist\_h} + F_{pass\_h}$ = **27.5** kN/m

Moments on wall

Total; $M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{moist}$ = **53.7** kNm/m

Check bearing pressure

Propping force; F_{prop_base} = **27.5** kN/m
Bearing pressure at toe; q_{toe} = **13.7** kN/m^2; Bearing pressure at heel; q_{heel} = **40.2** kN/m^2
Factor of safety; FoS_{bp} = **2.485**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

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

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

Concrete strength class; C35/45
Char.comp.cylinder strength; f_{ck} = **35** N/mm^2; Mean axial tensile strength; f_{ctm} = **3.2** N/mm^2
Secant modulus of elasticity; E_{cm} = **34077** N/mm^2; Maximum aggregate size; h_{agg} = **20** mm
Design comp.concrete strength; f_{cd} = **19.8** N/mm^2; Partial factor; γ_C = **1.50**

Reinforcement details

Characteristic yield strength; f_{yk} = **500** N/mm^2; Modulus of elasticity; E_s = **200000** N/mm^2
Design yield strength; f_{yd} = **435** N/mm^2; Partial factor; γ_S = **1.15**

Cover to reinforcement

Front face of stem; c_{sf} = **40** mm; Rear face of stem; c_{sr} = **75** mm
Top face of base; c_{bt} = **50** mm; Bottom face of base; c_{bb} = **75** mm

Check stem design at base of stem

Depth of section; h = **350** mm

Rectangular section in flexure - Section 6.1

Design bending moment; M = **13.2** kNm/m; K = **0.005**; K' = **0.207**

K' > K - No compression reinforcement is required

Tens.reinforcement required; $A_{sr.req}$ = **118** mm^2/m
Tens.reinforcement provided; 12 dia.bars @ 200 c/c; Tens.reinforcement provided; $A_{sr.prov}$ = **565** mm^2/m

Min.area of reinforcement; $A_{sr.min}$ = **449** mm^2/m; Max.area of reinforcement; $A_{sr.max}$ = **14000** mm^2/m

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

Library item: Rectangular single summary

Deflection control - Section 7.4

Limiting span to depth ratio; 16 Actual span to depth ratio; 3.7

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

Crack control - Section 7.3

Limiting crack width; w_{max} = **0.3** mm; Maximum crack width; w_k = **0.083** mm

PASS - Maximum crack width is less than limiting crack width**Rectangular section in shear - Section 6.2**

Design shear force; V = **29.2** kN/m; Design shear resistance; $V_{Rd.c}$ = **141.6** kN/m

PASS - Design shear resistance exceeds design shear force

Horizontal reinforcement parallel to face of stem - Section 9.6

Min.area of reinforcement; $A_{sx.req}$ = **350** mm^2/m; Max.spacing of reinforcement; s_{sx_max} = **400** mm

Trans.reinforcement provided; 10 dia.bars @ 200 c/c; Trans.reinforcement provided; $A_{sx.prov}$ = **393** mm^2/m

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

Check base design at toe

Depth of section; h = **350** mm

Rectangular section in flexure - Section 6.1

Design bending moment; M = **20.2** kNm/m; K = **0.008**; K' = **0.207**

K' > K - No compression reinforcement is required

Tens.reinforcement required; $A_{bb.req}$ = **181** mm^2/m

Tens.reinforcement provided; 12 dia.bars @ 200 c/c; Tens.reinforcement provided; $A_{bb.prov}$ = **565** mm^2/m

Min.area of reinforcement; $A_{bb.min}$ = **449** mm^2/m; Max.area of reinforcement; $A_{bb.max}$ = **14000** mm^2/m

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

Library item: Rectangular single summary

Crack control - Section 7.3

Limiting crack width; w_{max} = **0.3** mm; Maximum crack width; w_k = **0.18** mm

PASS - Maximum crack width is less than limiting crack width**Rectangular section in shear - Section 6.2**

Design shear force; V = **32.8** kN/m; Design shear resistance; $V_{Rd.c}$ = **141.6** kN/m

PASS - Design shear resistance exceeds design shear force

Secondary transverse reinforcement to base - Section 9.3

Min.area of reinforcement; $A_{bx.req}$ = **113** mm^2/m; Max.spacing of reinforcement; s_{bx_max} = **450** mm

Trans.reinforcement provided; 10 dia.bars @ 200 c/c; Trans.reinforcement provided; $A_{bx.prov}$ = **393** mm^2/m

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