# 

# Appendices

engineering a better society

12 & 13 Primrose Hill Studios 2210445 Stage 2 – P1

A Proposed Structural Drawings

## elliottwood

engineering a better **society** 

A Elliott Wood Partnership Ltd



SUMP PIT FOR BASEMENT BATHROOM, CAVITY DRAIN, BELOW SLAB PERFORATED DRAIN AND OPEN - COURTYARD DRAINAGE. LOCATION AND SIZE TBC BY OTHERS.

NEW 300mm THK RC (MINIMUM TO MATCH EXISTING WALL OVER) RETAINING WALLS, FORMED IN AN UNDERPINNING SEQUENCE WITH 1.0m WIDE BAYS. ALLOWANCE IS TO BE MADE FOR UNDERPINNING TO BE FORMED IN TWO VERTICAL HITS, WITH A TEMPORARY TOE AT THE BASE OF THE 1ST HIT TO MATCH EXISTING FOUNDATION WIDTH.

NEW 200mm THK RC WALL (CLAD TO ARCHITECT'S DETAILS)

This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

### Do not scale from this drawing.

WHERE CONCRETE IS FORMING PART OF THE BASEMENT CONSTRUCTION OR IN CONTACT WITH SOIL THE MIX IS TO BE DESIGNED FOR DS-3 and AC-2 CONDITIONS. WHERE WATERRPOOF CONRETE IS REQUIRED, A MIX PROPRIETARY MIX ADDITIVE IS TO BE ALLOWED FOR. HYDROPHILIC STRIPS TO BE INSTALLED IN ALL JOINTS IN GROUND.

WHERE VIABLE ALL EXISTING TIMBER JOISTS REMOVED AS PART OF THE WORKS SHOULD BE REINSTATED IN PLACE OF NEW JOISTS.

FOR ALL NEW TIMBER FLOORS AND ROOFS ALLOW FOR DOUBLE NOGGINS AND DOUBLE JOISTS AT ALL BOARDED EDGES, NEW WALL PLATES FIXED TO EXISTING MASONRY WITH RESIN ANCHORS @400cc AND NEW BENT AND TWISTED RESTRAINT STRAPS TO FULL PERIMETER @1200cc INSTALLED INTO MASS CONCRETE POCKET PADSTONES.

ALL PADSTONES ARE TO BE MASS CONCRETE AND FORMED ONSITE ON A LEVEL SURFACE OF MORTAR AND TIGHT DRY PACKED IN AFTER CURING.

WHERE MASONRY IS TO BE DEMOLISHED, WHERE VIABLE, BRICKS SHOULD BE RECLAIMED TO BE INSTALLED AS PART OF THE NEW CLADDING WORKS.

ALL MASONRY IS TO BE APPROPRIATELY TIED WITH STAINLESS STEEL WALL TIES.

FOR ALL NEW MINOR, NON STABILITY SYSTEM ALTERING OPENINGS, ALLOW FOR NEW PRESTRESED CONCRETE LINTELS (3no. 100W x 215Dp).

ALL NON-LOAD BEARING PARTITIONS SHOULD INCORPERATE A 15mm DEFLECTION HEAD AT THEIR TOP.

ALL STEELWORK IS TO BE GRADE S355.

WHERE STEELWORK IS TO BE BUILT INTO MASONRY EXPOSED TO THE WEATHER, ELEMENT IS TO BE GALVANISED.

ALL GLAZING ELEMENTS ARE TO SPECIALIST DESIGN.

ALL SIZES SUBJECT TO CHANGE DURING DETAILED DESIGN.

ALLOWANCE SHOULD BE MADE FOR MAKING GOOD OF RETAINED STRUCTURE. EXTENT OF ALLOWANCE TO BE QUANITIFIED IN DEFECT LOG BY CONTRACTOR FOLLOWING STRIPOUT.

 P1
 05/08/22
 PDu
 WSq
 Preliminary

 rev
 date
 by
 chk
 description

elliottwood

engineering a better **society** 

Elliott Wood Partnership Ltd Central London • Wimbledon • Nottingham Consulting Structural and Civil Engineers (020) 7499 5888 • elliottwood.co.uk

Project No.12 & No.13 Primrose Hill Studios

Drawing title

Proposed Basement Plan

Scale (s)	Date		Drawn
1:100@ A1	August 2022		PDu
Drawing status Preliminary	/	<sup>Status</sup> S2	Revision P1
Project no. 0 2210445-E	riginator Zone Level Type EWP-ZZ-B1-SK	Role - S -(	drg no. 0900

APPROPRIATE ENHANCEMENT TO FACILITATE SKYLIGHT OVER. DETAILS TO BE DISCUSSED AND AGREED WITH HERITAGE CONSULTANT AT DETAIL STAGE	
REPAIR TO DOUBLE DOOR FLAT ARCH. DETAILS TO BE DISCUSSED AND AGREED WITH HERITAGE CONSULTANT AT DETAIL STAGE	
ALLOW FOR 100x100x10 SHS SECTION TO SUPPORT NEW MEZZANINE CONSTRUCTION ABOVE, SUPPORTED OFF BASEMENT CONSTRUCTION. EMBEDDED INTO WALL OR PART OF DOOR CONSTRUCTION.	
ALLOW FOR STEPPED MC UNDERPINNING TO EXISTING WALLS PERPENDICULAR TO BASEMENT WALL	
POSSIBLE TRENCH FOR NEW CABLING SUBJECT TO CONFIRMATION BY M&E CONSULTANT. SEE CIVILS DRAWINGS FOR BELOW GROUND DRAINAGED PROPOSALS.	
250mm THK RC GROUND BEARING SLAB FOR COURTYARD, CAST ON 50mm LEAN MIX BLINDING ON MOT 1 COMPACTED SUBBASE. SUBGRADE TO BE WELL COMPACTED AND SOFT SPOTS REMOVED. CONSIDERATION TO BE MADE FOR DIFFERENTIAL MOVEMENT BETWEEN BASEMENT AND COURTYARD SLAB WITH MOVEMENT JOINT IN FINISHES OR PROVISION FOR CONTINUITY OVER BASEMENT WALL.	
NEW BOX FRAME TO FORM NEW OPENING FORM WITH 203UC86 COLUMNS AND 203UC86 BASE BEAM. BASE BEAM TO BE D49 MESH WRAPPED AND ENCASED IN CONCRETE, 75mm COVER. BASE BEAM FORM ON 1000W x 1000Dp (MINIMUM) MASS CONCRETE STRIP FOUNDATION.	
EXISTING GROUND FLOOR CONSTRUCTION TO BE INSPECTED WITH THE INTENTION TO RETAIN	
NEW NON-LOAD BEARING PARTITIONS TO BE FORMED OF TIMBER STUD OR SFS	
NEW TIMBER STAIRCASE BY OTHERS	
FLAT PLATE OR SMALL RHS COLUMNS RECESSED AND RESIN ANCHORED INTO WALL. NEW UNDERPINNING / FOUNDATION BELOW TO SUPPOT COLUMNS AND INCREASE DEPTH TO FACILITATE M&E TRENCH.	



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications. Do not scale from this drawing. WHERE CONCRETE IS FORMING PART OF THE BASEMENT CONSTRUCTION OR IN CONTACT WITH SOIL THE MIX IS TO BE DESIGNED FOR DS-3 and AC-2 CONDITIONS. WHERE WATERRPOOF CONRETE IS REQUIRED, A MIX PROPRIETARY MIX ADDITIVE IS TO BE ALLOWED FOR. HYDROPHILIC STRIPS TO BE INSTALLED IN ALL JOINTS IN GROUND. WHERE VIABLE ALL EXISTING TIMBER JOISTS REMOVED AS PART OF THE WORKS SHOULD BE REINSTATED IN PLACE OF NEW JOISTS. FOR ALL NEW TIMBER FLOORS AND ROOFS ALLOW FOR DOUBLE NOGGINS AND DOUBLE JOISTS AT ALL BOARDED EDGES, NEW WALL PLATES FIXED TO EXISTING MASONRY WITH RESIN ANCHORS @400cc AND NEW BENT AND TWISTED RESTRAINT STRAPS TO FULL PERIMETER @1200cc INSTALLED INTO MASS CONCRETE POCKET PADSTONES. ALL PADSTONES ARE TO BE MASS CONCRETE AND FORMED ONSITE ON A LEVEL SURFACE OF MORTAR AND TIGHT DRY PACKED IN AFTER CURING. WHERE MASONRY IS TO BE DEMOLISHED, WHERE VIABLE, BRICKS SHOULD BE RECLAIMED TO BE INSTALLED AS PART OF THE NEW CLADDING WORKS. ALL MASONRY IS TO BE APPROPRIATELY TIED WITH STAINLESS STEEL WALL TIES. FOR ALL NEW MINOR, NON STABILITY SYSTEM ALTERING OPENINGS, ALLOW FOR NEW PRESTRESED CONCRETE LINTELS (3no. 100W x 215Dp). ALL NON-LOAD BEARING PARTITIONS SHOULD INCORPERATE A 15mm DEFLECTION HEAD AT THEIR TOP. ALL STEELWORK IS TO BE GRADE S355. WHERE STEELWORK IS TO BE BUILT INTO MASONRY EXPOSED TO THE WEATHER, ELEMENT IS TO BE GALVANISED. ALL GLAZING ELEMENTS ARE TO SPECIALIST DESIGN. ALL SIZES SUBJECT TO CHANGE DURING DETAILED DESIGN. ALLOWANCE SHOULD BE MADE FOR MAKING GOOD OF RETAINED STRUCTURE. EXTENT OF ALLOWANCE TO BE QUANITIFIED IN DEFECT LOG BY CONTRACTOR FOLLOWING STRIPOUT. P1 05/08/22 PDu WSq Preliminary rev date by chk description engineering elliottwood a better society Elliott Wood Partnership Ltd Central London • Wimbledon • Nottingham Consulting Structural and Civil Engineers (020) 7499 5888 • elliottwood.co.uk Project No.12 & No.13 Primrose Hill Studios Drawing title Proposed Ground Floor Plan Scale (s) Drawn Date 1:100@ A1 August 2022 Drawing status Status Revision S2 P1 Preliminary

PDu

Project no. Originator Zone Level Type Role drg no. 2210445-EWP-ZZ-00-SK-S-1000



NEW CATNIC OF BESPOKE LINTEL TO ACHIEVE ARCHITECTS

NEW WALL CONSTRUCTION WITH OPENING TO BE TIED TO EXISTING WALL WITH ANCON STAFIC STARTER SYSTEM WITH - SLEEVED TIES AY 225mm cc. ALLOW FOR 10mm MOVEMENT

This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications. Do not scale from this drawing. WHERE CONCRETE IS FORMING PART OF THE BASEMENT CONSTRUCTION OR IN CONTACT WITH SOIL THE MIX IS TO BE DESIGNED FOR DS-3 and AC-2 CONDITIONS. WHERE WATERRPOOF CONRETE IS REQUIRED, A MIX PROPRIETARY MIX ADDITIVE IS TO BE ALLOWED FOR. HYDROPHILIC STRIPS TO BE INSTALLED IN ALL JOINTS IN GROUND. WHERE VIABLE ALL EXISTING TIMBER JOISTS REMOVED AS PART OF THE WORKS SHOULD BE REINSTATED IN PLACE OF NEW JOISTS. FOR ALL NEW TIMBER FLOORS AND ROOFS ALLOW FOR DOUBLE NOGGINS AND DOUBLE JOISTS AT ALL BOARDED EDGES, NEW WALL PLATES FIXED TO EXISTING MASONRY WITH RESIN ANCHORS @400cc AND NEW BENT AND TWISTED RESTRAINT STRAPS TO FULL PERIMETER @1200cc INSTALLED INTO MASS CONCRETE POCKET PADSTONES. ALL PADSTONES ARE TO BE MASS CONCRETE AND FORMED ONSITE ON A LEVEL SURFACE OF MORTAR AND TIGHT DRY PACKED IN AFTER CURING. WHERE MASONRY IS TO BE DEMOLISHED, WHERE VIABLE, BRICKS SHOULD BE RECLAIMED TO BE INSTALLED AS PART OF THE NEW CLADDING WORKS. ALL MASONRY IS TO BE APPROPRIATELY TIED WITH STAINLESS STEEL WALL TIES. FOR ALL NEW MINOR, NON STABILITY SYSTEM ALTERING OPENINGS, ALLOW FOR NEW PRESTRESED CONCRETE LINTELS (3no. 100W x 215Dp). ALL NON-LOAD BEARING PARTITIONS SHOULD INCORPERATE A 15mm DEFLECTION HEAD AT THEIR TOP. ALL STEELWORK IS TO BE GRADE S355. WHERE STEELWORK IS TO BE BUILT INTO MASONRY EXPOSED TO THE WEATHER, ELEMENT IS TO BE GALVANISED. ALL GLAZING ELEMENTS ARE TO SPECIALIST DESIGN. ALL SIZES SUBJECT TO CHANGE DURING DETAILED DESIGN. ALLOWANCE SHOULD BE MADE FOR MAKING GOOD OF RETAINED STRUCTURE. EXTENT OF ALLOWANCE TO BE QUANITIFIED IN DEFECT LOG BY CONTRACTOR FOLLOWING STRIPOUT. P1 05/08/22 PDu WSq Preliminary rev date by chk description engineering elliottwood a better society Elliott Wood Partnership Ltd Central London • Wimbledon • Nottingham Consulting Structural and Civil Engineers (020) 7499 5888 • elliottwood.co.uk Project No.12 & No.13 Primrose Hill Studios Drawing title Proposed First Floor Plan Scale (s) Drawn Date August 2022 1:100@ A1

PDu

Status Revision S2 P1

Drawing status

Preliminary

Project no. Originator Zone Level Type Role drg no. 2210445-EWP-ZZ-01-SK-S-1100



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

WHERE CONCRETE IS FORMING PART OF THE BASEMENT CONSTRUCTION OR IN CONTACT WITH SOIL THE MIX IS TO BE DESIGNED FOR DS-3 and AC-2 CONDITIONS. WHERE WATERRPOOF CONRETE IS REQUIRED, A MIX PROPRIETARY MIX ADDITIVE IS TO BE ALLOWED FOR. HYDROPHILIC STRIPS TO BE INSTALLED IN ALL JOINTS IN GROUND.

WHERE VIABLE ALL EXISTING TIMBER JOISTS REMOVED AS PART OF THE WORKS SHOULD BE REINSTATED IN PLACE OF NEW JOISTS.

FOR ALL NEW TIMBER FLOORS AND ROOFS ALLOW FOR DOUBLE NOGGINS AND DOUBLE JOISTS AT ALL BOARDED EDGES, NEW WALL PLATES FIXED TO EXISTING MASONRY WITH RESIN ANCHORS @400cc AND NEW BENT AND TWISTED RESTRAINT STRAPS TO FULL PERIMETER @1200cc INSTALLED INTO MASS CONCRETE POCKET PADSTONES.

ALL PADSTONES ARE TO BE MASS CONCRETE AND FORMED ONSITE ON A LEVEL SURFACE OF MORTAR AND TIGHT DRY PACKED IN AFTER CURING.

WHERE MASONRY IS TO BE DEMOLISHED, WHERE VIABLE, BRICKS SHOULD BE RECLAIMED TO BE INSTALLED AS PART OF THE NEW CLADDING WORKS.

ALL MASONRY IS TO BE APPROPRIATELY TIED WITH STAINLESS STEEL WALL TIES.

FOR ALL NEW MINOR, NON STABILITY SYSTEM ALTERING OPENINGS, ALLOW FOR NEW PRESTRESED CONCRETE LINTELS (3no. 100W x 215Dp).

ALL NON-LOAD BEARING PARTITIONS SHOULD INCORPERATE A 15mm DEFLECTION HEAD AT THEIR TOP.

ALL STEELWORK IS TO BE GRADE S355.

WHERE STEELWORK IS TO BE BUILT INTO MASONRY EXPOSED TO THE WEATHER, ELEMENT IS TO BE GALVANISED.

ALL GLAZING ELEMENTS ARE TO SPECIALIST DESIGN.

ALL SIZES SUBJECT TO CHANGE DURING DETAILED DESIGN.

ALLOWANCE SHOULD BE MADE FOR MAKING GOOD OF RETAINED STRUCTURE. EXTENT OF ALLOWANCE TO BE QUANITIFIED IN DEFECT LOG BY CONTRACTOR FOLLOWING STRIPOUT.

 P1
 08/07/22
 PDu
 WSq
 Preliminary

 rev
 date
 by
 chk
 description



No.12 & No.13 Primrose Hill Studios

Drawing title Proposed Roof Plan

Scale (s)	Date	Draw	n
1:100@ A1	July 2022	PD	)u
<sup>Drawing status</sup> Preliminary		Status Revisio	n 1
Project no. Originator 2 2210445-EWP-	<sup>Zone Level Type</sup> ZZ-01-SK	Role drg nc - S - 1200	). )



Section BB

EXISTING LOAD BEARING WALLS AND ROOF PROPOSED TO BE LARGELY RETAINED (SUBJECT TO SITE INSPECTIONS)

NEW SKYLIGHTS OVER STAIRCASE WITH CROSS SPANNING STEELWORK TO TRANSFER PORTALISED STABILITY LOADS OR STRUT ONTO CONCRETE WALL

200mm THK RC WALL ACTING AS DEEP BEAM, WITH RC COLUMNS WITHIN SECTION TO ACT AS WINDPOSTS. CLAD IN ACCORDANCE WITH ARCHITECTS SPECIFICATIONS

NEW CAVITY WALL WITH PARAPET CONSTRUCTION WITH INTERAL 100mm THK BLOCKWORK, RESTRAINED BY 100x100 SHS BOX SECTION WIND POSTS @MAX 2.4m cc. EXTERNAL LEAF TO ARCHITECTS DETAILS BUT ASSUMED LIME MORTAR MASONRY TO MATCH EXISTING. BED JOINT REINFORCEMENT REQUIRED. WIND POSTS RESTRAINED BY CAPPING BEAM.

EXISTING 180mm DIA. COMBINED SEWER AS PER - MSA UNDERGROUND SURVEY DATED 19/07/2021

RC CAPPING BEAM CAST WITHIN BASEMENT WALL - TO RESTRAIN HEAD OF WALL AROUND STAIRCASE VOID.

MINIMUM 300mm THK BASEMENT RC RETAINING WALL COMPLETED IN UNDERPINNING SEQUENCE. ALLOW FOR BEING UNDERTAKEN IN TWO VERTICAL HITS (BASEMENT WALLS DESIGNED FOR AN IMPOSED SURCHARGE LOAD OF 10kPa DUE TO PROXIMITY OF ADJACENT HIGHWAY

NEW 200mm THK RC WALL (CLAD TO ARCHITECT'S DETAILS)

> NON STRUCTURAL BALUSTRADE TO COURTYARD LIGHTWELL TO BASEMENT NEW 150x50 C24 TIMBER ROOF JOISTS @400cc SHEATHED w/ 18mm THK PLY. LIGHTWEIGHT TIMBER STUD OR SFS CONSTRUCTION OVER CONCRETE BALUSTRADE WITH SHS WIND POSTS. CLAD IN ACCORDANCE WITH ARCHITECTS DETAILS. 150mm THK CONCRETE BALUSTRADE TO STAIRCASE FORMING BEAM TO PYNFORD

> > FACILITATE DOORWAY.

NEW CAVITY WALL WITH PARAPET CONSTRUCTION WITH INTERAL 100mm THK BLOCKWORK, RESTRAINED BY 100x100 SHS BOX SECTION WIND POSTS @MAX 2.4m cc. EXTERNAL LEAF TO ARCHITECTS DETAILS BUT ASSUMED LIME MORTAR MASONRY TO MATCH EXISTING. BED JOINT REINFORCEMENT REQUIRED. WIND POSTS RESTRAINED BY CAPPING BEAM.

WITHIN SLAB BUILD UP. DROP IN TOC TO

- 250th RC BASEMENT CAPPING SLAB

RC CAPPING BEAM CAST WITHIN BASEMENT WALL - TO RESTRAIN HEAD OF WALL AROUND STAIRCASE VOID.

CLAY SOILS SO HIGH FLOWS DURING CONSTRUCTION NOT ANTICIPATED. ALLOWANCE FOR SUMP AND PUMP SHOULD BE MADE.

WT

MINIMUM 300mm THK BASEMENT RC RETAINING WALL COMPLETED IN UNDERPINNING SEQUENCE. ALLOW FOR BEING UNDERTAKEN IN TWO VERTICAL HITS (BASEMENT WALLS DESIGNED FOR AN IMPOSED SURCHARGE LOAD OF 10kPa DUE TO PROXIMITY OF ADJACENT HIGHWAY

350mm THK BASEMENT RC RAFT SLAB WITH 500mm - THK EDGE THICKENING AROUND PERIMETER CAST ON LEAN MIX BLINDING

PERMEABLE MOT 3 SUBBASE WITH PERFORATED DRAINAGE PIPES.





Elliott Wood Partnership	Project No. 12 & 13 Primrose Hill Studios				Job no. 2210445	
55 Whitfield Street London	Calcs for         Start page no./Revision           Retaining Wall Temporary Condition (Supporting Wall Over)         1					vision 1
WTT 4AH	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq	Approved date 04/07/2022

#### RETAINING WALL ANALYSIS

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

Tedds calculation version 2.9.11

Retaining wall details	
Stem type	Propped cantilever
Stem height	h <sub>stem</sub> = <b>4000</b> mm
Prop height	h <sub>prop</sub> = <b>3900</b> mm
Stem thickness	t <sub>stem</sub> <b>= 300</b> mm
Angle to rear face of stem	α <b>= 90</b> deg
Stem density	γ <sub>stem</sub> = <b>25</b> kN/m <sup>3</sup>
Toe length	I <sub>toe</sub> = <b>1000</b> mm
Base thickness	t <sub>base</sub> = <b>500</b> mm
Base density	γ <sub>base</sub> = <b>25</b> kN/m <sup>3</sup>
Height of retained soil	h <sub>ret</sub> = <b>4000</b> mm
Angle of soil surface	$\beta = 0 \deg$
Depth of cover	d <sub>cover</sub> = <b>0</b> mm
Retained soil properties	
Soil type	Stiff clay
Moist density	$\gamma_{mr}$ = <b>19</b> kN/m <sup>3</sup>
Saturated density	γ <sub>sr</sub> = <b>19</b> kN/m <sup>3</sup>
Characteristic effective shear resistance angle	<b>∲'</b> r.k <b>= 18</b> deg
Characteristic wall friction angle	$\delta_{r.k}$ = 9 deg
Base soil properties	
Soil type	Stiff or hard glacial clay
Soil density	γ <sub>b</sub> = <b>21</b> kN/m <sup>3</sup>
Characteristic cohesion	c' <sub>b.k</sub> = <b>0</b> kN/m <sup>2</sup>
Characteristic effective shear resistance angle	φ' <sub>b.k</sub> = <b>18</b> deg
Characteristic wall friction angle	δ <sub>b.k</sub> = <b>9</b> deg
Characteristic base friction angle	$\delta_{bb.k} = 12 \text{ deg}$
Loading details	
Variable surcharge load	Surcharge <sub>Q</sub> = <b>10</b> kN/m <sup>2</sup>
Vertical line load at 1175 mm	P <sub>G1</sub> = <b>20</b> kN/m
	P <sub>Q1</sub> = <b>5</b> kN/m

Elliotti Wood Partnership	Project	No. 12 & 13 Prin	nrose Hill Studio	s	Job no. 2210	0445
55 Whitfield Street	Calcs for				Start page no./Re	evision
London	Retaining Wall Temporary Condition (Supporting Wall Over)					2
W11 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022



General arrangement

Calculate retaining wall geometry	
Base length	$I_{base} = I_{toe} + t_{stem} = 1300 \text{ mm}$
Moist soil height	h <sub>moist</sub> = h <sub>soil</sub> = <b>4000</b> mm
Length of surcharge load	I <sub>sur</sub> = I <sub>heel</sub> = <b>0</b> mm
- Distance to vertical component	$x_{sur_v} = I_{base} - I_{heel} / 2 = 1300 \text{ mm}$
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret} = 4500 \text{ mm}$
- Distance to horizontal component	x <sub>sur_h</sub> = h <sub>eff</sub> / 2 = <b>2250</b> mm
Area of wall stem	$A_{stem}$ = $h_{stem} \times t_{stem}$ = <b>1.2</b> m <sup>2</sup>
- Distance to vertical component	$x_{stem}$ = I <sub>toe</sub> + t <sub>stem</sub> / 2 = <b>1150</b> mm
Area of wall base	$A_{\text{base}}$ = $I_{\text{base}} \times t_{\text{base}}$ = 0.65 m <sup>2</sup>
- Distance to vertical component	x <sub>base</sub> = I <sub>base</sub> / 2 = <b>650</b> mm
Design approach 1	

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

Partial factor set	A1
Permanent unfavourable action	γg <b>= 1.35</b>
Permanent favourable action	γ <sub>Gf</sub> = <b>1.00</b>
Variable unfavourable action	γ <sub>Q</sub> = <b>1.50</b>
Variable favourable action	$\gamma_{Qf}=\boldsymbol{0.00}$

Partial factors for soil parameters – Table A.4 - Combination 1Soil parameter setM1

Elliott Wood Partnership	Project	No. 12 & 13 Prir	nrose Hill Stud	ios	Job no. 22	10445
55 Whitfield Street	Calcs for				Start page no /F	Revision
	Retaining V	all Temporary Co	ondition (Suppo	orting Wall Over)		3
WII 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022
Angle of shearing resistance		γ <sub>Φ'</sub> = <b>1.00</b>				
Effective cohesion		γ <sub>c'</sub> = <b>1.00</b>				
Weight density		$\dot{\gamma}_{\gamma} = 1.00$				
0 7					Library item P	artial factors output
<b>Retained soil properties</b>						
Design moist density		$\gamma_{mr}$ ' = $\gamma_{mr}$ / $\gamma$	γ = <b>19</b> kN/m³			
Design saturated density		$\gamma_{sr}$ ' = $\gamma_{sr}$ / $\gamma_{\gamma}$	= <b>19</b> kN/m <sup>3</sup>			
Design effective shear resistar	nce angle	φ' <sub>r.d</sub> = atan(	tan(φ'r.k) / γ <sub>φ'</sub> ) =	<b>18</b> deg		
Design wall friction angle		δ <sub>r.d</sub> = atan(	$\tan(\delta_{r.k}) / \gamma_{\phi'}) = 9$	9 deg		
Base soil properties						
Design soil density		$\gamma_b' = \gamma_b / \gamma_\gamma$	= <b>21</b> kN/m³			
Design effective shear resistar	nce angle	∳' <sub>b.d</sub> = atan	(tan(φ' <sub>b.k</sub> ) / γ <sub>φ'</sub> ) =	<b>18</b> deg		
Design wall friction angle		$\delta_{b.d} = atan($	tan(δ <sub>b.k</sub> ) / γ <sub>φ'</sub> ) =	<b>9</b> deg		
Design base friction angle		$\delta_{bb.d}$ = atan	(tan(δ <sub>bb.k</sub> ) / γ <sub>φ'</sub> )	= <b>12</b> deg		
Design effective cohesion		c' <sub>b.d</sub> = c' <sub>b.k</sub> /	$\gamma_{c'} = 0 \text{ kN/m}^2$			
Using Coulomb theory						
Active pressure coefficient		$K_A = sin(\alpha)$	+ φ' <sub>r.d</sub> )² / (sin(α)	$)^2  imes \sin(lpha - \delta_{r.d})  imes [$	1 + √[sin(¢'r.d	+ δ <sub>r.d</sub> ) ×
		<b>sin(</b> φ' <sub>r.d</sub> - β)	/ (sin( $\alpha$ - $\delta_{r.d}$ ) >	$(\sin(\alpha + \beta))]]^2) = 0$	).483	
Passive pressure coefficient		K <sub>P</sub> = sin(90	) - φ' <sub>b.d</sub> )² / (sin(9	$90 + \delta_{b.d}) \times [1 - \sqrt{s}]$	in(φ' <sub>b.d</sub> + δ <sub>b.d</sub> )	× sin(¢' <sub>b.d</sub> ) /
		(sin(90 + δ	b.d))]] <sup>2</sup> ) = <b>2.359</b>			
Bearing pressure check						
Vertical forces on wall						
Wall stem		$F_{stem} = \gamma_G \times$	A <sub>stem</sub> × γ <sub>stem</sub> =	<b>40.5</b> kN/m		
Wall base		$F_{base} = \gamma_G \times$	$A_{base} \times \gamma_{base} =$	<b>21.9</b> kN/m		
Line loads		$F_{P_v} = \gamma_G \times$	$P_{G1} + \gamma_Q \times P_{Q1}$	= <b>34.5</b> kN/m		
Total		F <sub>total_v</sub> = F <sub>st</sub>	<sub>em</sub> + F <sub>base</sub> + F <sub>P_</sub>	<sub>v</sub> = <b>96.9</b> kN/m		
Horizontal forces on wall						
Surcharge load		$F_{sur_h} = K_A$	× $\cos(\delta_{r.d}) \times \gamma_Q$	× Surcharge <sub>Q</sub> × h <sub>é</sub>	<sub>eff</sub> = <b>32.2</b> kN/n	n
Moist retained soil		$F_{moist_h} = \gamma_G$	$\mathbf{K} \times \mathbf{K}_{A} \times \mathbf{cos}(\delta_{r.d})$	$) \times \gamma_{mr}' \times h_{eff}^2 / 2 =$	<b>123.9</b> kN/m	
Base soil		F <sub>pass_h</sub> = -γα	$Gf \times K_P \times cos(\delta_b)$	$_{.d})  imes \gamma_b'  imes (d_{cover} + 1)$	h <sub>base</sub> ) <sup>2</sup> / 2 = <b>-6</b>	. <b>1</b> kN/m
Total		F <sub>total_h</sub> = F <sub>su</sub>	<sub>ur_h</sub> + F <sub>moist_h</sub> + F	= <sub>pass_h</sub> = <b>150</b> kN/m		
Moments on wall						
Wall stem		M <sub>stem</sub> = F <sub>ste</sub>	m × X <sub>stem</sub> = <b>46.6</b>	6 kNm/m		
Wall base		M <sub>base</sub> = F <sub>bas</sub>	se × Xbase = 14.3	kNm/m		
Surcharge load		M <sub>sur</sub> = -F <sub>sur</sub>	_h × X <sub>sur_h</sub> = -72	<b>.5</b> kNm/m		
Line loads		$M_P$ = ( $\gamma_G \times$	P <sub>G1</sub> + γ <sub>Q</sub> × P <sub>Q1</sub> )	× p1 = <b>40.5</b> kNm/r	m	
Moist retained soil		$M_{moist} = -F_{m}$	noist_h × <b>X</b> moist_h =	<b>-185.9</b> kNm/m		
Total		M <sub>total</sub> = M <sub>ste</sub>	m + M <sub>base</sub> + M <sub>su</sub>	$r + M_P + M_{moist} = -1$	<b>157</b> kNm/m	
Check bearing pressure						
Propping force to stem		F <sub>prop_stem</sub> =	(F <sub>total_v</sub> × I <sub>base</sub> / 2	2 - M <sub>total</sub> ) / (h <sub>prop</sub> +	t <sub>base</sub> ) = <b>50</b> kN	/m
Propping force to base		F <sub>prop_base</sub> =	F <sub>total_h</sub> - F <sub>prop_ste</sub>	<sub>m</sub> = <b>100</b> kN/m		
Moment from propping force		M <sub>prop</sub> = F <sub>pro</sub>	$p_{stem} \times (h_{prop} +$	t <sub>base</sub> ) = <b>220</b> kNm/r	n	
Distance to reaction		$\overline{\mathbf{x}} = (\mathbf{M}_{\text{total}})$	+ M <sub>prop</sub> ) / F <sub>total_v</sub>	<b>= 650</b> mm		

elliott <b>wood</b>	Project				Job no.	
Elliott Wood Partnership		No. 12 & 13 Prin	nrose Hill Studio	os	221	0445
55 Whitfield Street London	Calcs for Retaining Wa	all Temporary Co	ndition (Suppor	ting Wall Over)	Start page no./R	evision 4
W1T 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022
Eccentricity of reaction		$e = x - I_{base}$	₀ / 2 <b>= 0</b> mm			
Loaded length of base		I <sub>load</sub> = I <sub>base</sub> =	• 1300 mm			
Bearing pressure at toe		q <sub>toe</sub> = F <sub>total_v</sub>	/ / I <sub>base</sub> = <b>74.6</b> kľ	N/m <sup>2</sup>		
Bearing pressure at heel		$q_{heel} = F_{total}$	<sub>_v</sub> / I <sub>base</sub> = <b>74.6</b> k	N/m <sup>2</sup>		
Effective overburden pressure		$q = (t_{base} + t_{base})$	$\mathbf{a}_{cover}$ × $\gamma_b$ = 10	.5 KIN/M <sup>2</sup>		
Design effective overburden pro	essure	$\mathbf{q} = \mathbf{q} / \gamma_{\gamma} =$	10.5 KN/m <sup>2</sup>			
Bearing resistance factors		$N_q = Exp(\pi)$	$\times \tan(\phi_{b,d})) \times (ta)$	an(45 deg + $\phi_{b,d}$ )	/ 2))² = 5.258	
		$N_{c} = (N_{q} - 1)$	) × cot( $\phi'_{b,d}$ ) = 1	3.104		
		$N_{\gamma} = 2 \times (N_{0})$	<sub>q</sub> - 1) × tan(¢' <sub>b.d</sub> )	= 2.767		
Foundation shape factors		s <sub>q</sub> = 1				
		$s_{\gamma} = 1$				
Load inclination factors			E	с с	- 0 kN/m	
		$H = F_{sur_h} + V = F_{total_v} = m = 2$	Fmoist_h + Fpass_f = 96.9 kN/m	n <sup>–</sup> ⊏prop_stem <sup>–</sup> ⊏prop	base – U KIN/II	I
		i – [1 – H /	$(1/ + 1) \times c' + 1$	$\propto \cot(d^{1}, \cdot))^{1m} - 1$		
		i – [1 – [1 /		$(\phi_{b,d}) = 1$	- 1	
		i, −i, (1	$(V + 10ad \times C D.d)$	< cot(ψ b.d))]· · · -		
Net ultimate bearing capacity		Ic - Iq - (1 -	$I_q$ / ( $I_c \times I_d I_q$ )	b.d <i>))</i> – 1		
Net utimate bearing capacity	De		i. + a' × N. × s.	. × i₂ + 0.5 × ∞' ×	had v N. v e. v	$k = 93  k N / m^2$
Factor of safety	111	$= C_{D,d} \times \operatorname{Inc} \times \operatorname{Sc} \times$ $= n_{f}/f$	$max(q_{max}, q_{max})$	= <b>1 247</b>		α η <b>- 33 κιν</b> /Π
	PASS - A	llowable bearin		ceeds maximum	applied bea	rina pressure
Decima converse 4			9 /			
Design approach 1						
Partial factors on actions - Ta	able A.3 - Comb	bination 2				
Partial factor set		A2				
Permanent unfavourable action	1	γ <sub>G</sub> = <b>1.00</b>				
Permanent favourable action		γ <sub>Gf</sub> = <b>1.00</b>				
Variable unfavourable action		γ <sub>Q</sub> = 1.30				
Variable favourable action		$\gamma_{Qf} = 0.00$				
Partial factors for soil parame	eters – Table A	.4 - Combination	n 2			
Angle of cheering registered		IVIZ				
		$\gamma_{\phi} = 1.25$				
		$\gamma_{c'} = 1.25$				
weight density		γγ – 1.00			Library item Pa	artial factors output
Potained soil properties					Elbrary tom i t	
Design moist density		····· = ····· / ··	$= 19 \text{ kN}/\text{m}^3$			
Design saturated density		$\gamma_{\rm or} = \gamma_{\rm or} / \gamma$	$= 19 \text{ kNl/m}^3$			
Design effective shear resistan	ce angle	$\gamma sr = \gamma sr \gamma \gamma \gamma$	= 13  km/m			
Design well friction and	oo anyie	$\psi r.a = atan(t)$	$an(\psi \mathbf{k}) / \psi \mathbf{k} = 7$	<b>2</b> dea		
			απ(υτ.κ <i>) / γ</i> φ' <b>) – /</b>	. <b>_</b> ucy		
Base soil properties			<b>64</b> ( ) ( )			
Design soil density		$\gamma_{\rm b}' = \gamma_{\rm b} / \gamma_{\gamma} =$	= <b>21</b> KN/m <sup>3</sup>			
Design effective shear resistan	ce angle	φ' <sub>b.d</sub> = atan(	$\tan(\phi'_{b.k}) / \gamma_{\phi'}) =$	14.6 deg		
Design wall friction angle		ö₀.d = atan(t	tan(δ <sub>b.k</sub> ) / γ <sub>φ'</sub> ) = 7	.2 deg		

Elliott Wood Partnership	Project	No. 12 & 13 Prir	nrose Hill Stud	dios	Job no. 22	10445
55 Whitfield Street London	Calcs for Retaining V	Vall Temporary Co	ondition (Supp	orting Wall Over)	Start page no./F	Revision 5
W1T 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022
Design base friction angle		δ <sub>bb.d</sub> = atan	(tan(δ <sub>bb.k</sub> ) / γ <sub>φ'</sub> )	= <b>9.7</b> deg		
Design effective cohesion		c' <sub>b.d</sub> = c' <sub>b.k</sub> /	$\gamma_{c'} = 0 \text{ kN/m}^2$	C C		
Using Coulomb theory						
Active pressure coefficient		$K_A = sin(\alpha)$	+ φ' <sub>r.d</sub> )² / (sin(α	$(\alpha)^2 \times \sin(\alpha - \delta_{r.d}) \times [$	1 + √[sin( <b>∮'</b> r.d	+ δ <sub>r.d</sub> ) ×
		<b>sin(</b> φ' <sub>r.d</sub> - β)	/ (sin(α - δ <sub>r.d</sub> )	$\times \sin(\alpha + \beta))]]^2) = 0$	0.553	
Passive pressure coefficient		K <sub>P</sub> = sin(90 (sin(90 + δ	) - φ' <sub>b.d</sub> )² / (sin( <sub>b.d</sub> ))]]²) = <b>1.965</b>	90 + δ <sub>b.d</sub> ) × [1 - √[s ;	$in(\phi'_{b.d} + \delta_{b.d})$	× sin(¢' <sub>b.d</sub> ) /
Bearing pressure check						
Vertical forces on wall						
Wall stem		$F_{stem} = \gamma_G \times$	A <sub>stem</sub> × γ <sub>stem</sub> =	<b>30</b> kN/m		
Wall base		$F_{base} = \gamma_G \times$	$A_{base} \times \gamma_{base} =$	<b>16.3</b> kN/m		
Line loads		$F_{P_v} = \gamma_G \times$	P <sub>G1</sub> + γ <sub>Q</sub> × P <sub>Q1</sub>	= <b>26.5</b> kN/m		
Total		$F_{total_v} = F_{st}$	em + Fbase + FP	_v = <b>72.8</b> kN/m		
Horizontal forces on wall						
Surcharge load		$F_{sur_h} = K_A$	× $\cos(\delta_{r.d}) \times \gamma_Q$	$\times$ Surcharge <sub>Q</sub> $\times$ h	<sub>eff</sub> = <b>32.1</b> kN/r	n
Moist retained soil		$F_{moist_h} = \gamma_G$	$\mathbf{K} \times \mathbf{K}_{A} \times \mathbf{cos}(\delta_{r})$	d) × $\gamma_{mr}$ × $h_{eff}^2$ / 2 =	<b>105.5</b> kN/m	
Base soil		F <sub>pass_h</sub> = -γα	$G_{f} \times K_{P} \times cos(\delta)$	b.d) × $\gamma$ b' × (d <sub>cover</sub> +	h <sub>base</sub> )² / 2 <b>= -5</b>	<b>5.1</b> kN/m
Total		F <sub>total_h</sub> = F <sub>su</sub>	ur_h + F <sub>moist_h</sub> +	F <sub>pass_h</sub> = <b>132.5</b> kN/	/m	
Moments on wall						
Wall stem		M <sub>stem</sub> = F <sub>ste</sub>	m × x <sub>stem</sub> = <b>34.</b>	5 kNm/m		
Wall base		$M_{base} = F_{bas}$	$x_{base} = 10.0$	6 kNm/m		
Surcharge load		$M_{sur} = -F_{sur}$	_h × X <sub>sur_h</sub> = -72	2.2 kNm/m		
Line loads		$M_P = (\gamma_G \times$	$P_{G1} + \gamma_Q \times P_{Q1}$	) × p <sub>1</sub> = <b>31.1</b> kNm/	m	
Moist retained soil		$M_{moist} = -F_{m}$	noist_h × X <sub>moist_h</sub> =	= <b>-158.3</b> kNm/m		
Total		M <sub>total</sub> = M <sub>ste</sub>	m + M <sub>base</sub> + M <sub>s</sub>	$_{ur} + M_P + M_{moist} = -$	<b>154.3</b> kNm/m	
Check bearing pressure						
Propping force to stem		F <sub>prop_stem</sub> =	$(F_{total_v} \times I_{base})$	2 - M <sub>total</sub> ) / (h <sub>prop</sub> +	t <sub>base</sub> ) = <b>45.8</b> k	κN/m
Propping force to base		F <sub>prop_base</sub> =	F <sub>total_h</sub> - F <sub>prop_st</sub>	<sub>em</sub> = <b>86.7</b> kN/m	1	
Noment from propping force		$M_{prop} = F_{pro}$	p_stem × (Nprop +	t <sub>base</sub> ) = 201.6 KNm	n/m	
Eccentricity of reaction		$x - (IVI_{total})$	+ $IVI_{prop}$ / $\Gamma_{total}$	<u>v</u> – 650 mm		
			e / Z – U IIIII			
Bearing pressure at toe		$q_{toe} = F_{total}$	v / I <sub>base</sub> = 56 kN	J/m <sup>2</sup>		
Bearing pressure at heel		q <sub>heel</sub> = F <sub>total</sub>	v / I <sub>base</sub> = <b>56</b> k	N/m <sup>2</sup>		
Effective overburden pressure	e	$q = (t_{base} +$	d <sub>cover</sub> ) × γ <sub>b</sub> ' = <b>1</b>	<b>0.5</b> kN/m <sup>2</sup>		
Design effective overburden p	pressure	<b>q'</b> = <b>q</b> / γ <sub>γ</sub> =	<b>10.5</b> kN/m <sup>2</sup>			
Bearing resistance factors		N <sub>q</sub> = Exp(π	$\times$ tan( $\phi'_{b.d}$ )) $\times$	(tan(45 deg + <sub>\phi'b.d</sub>	/ 2)) <sup>2</sup> = <b>3.784</b>	
		$N_{c} = (N_{q} - 1)$	$) \times \cot(\phi'_{b.d}) =$	10.711		
		$N_{\gamma} = 2 \times (N_{\gamma})$	q - 1) × tan(φ' <sub>b.</sub>	d) = <b>1.447</b>		
Foundation shape factors		s <sub>q</sub> = 1				
		$s_{\gamma} = 1$				
Lood inclination fortant		$s_c = 1$	F F		- 0	~
Load inclination factors		$H = F_{sur_h} + V = \Box_{sur_h} + V = \Box_{sur_h} + V = \Box_{sur_h} + V = \Box_{sur_h} + U = \Box_{sur_h} + U = U = U = U = U = U = U = U = U = U$	・「moist_h + 「pass = <b>72 8</b> kN/m	s_h - ⊢prop_stem - ⊢prop	p_base <b>= U</b> KN/n	11
		v – i total_v				

Elliatt Wood Partnarship	Project	o 12 & 13 Prir	nrose Hill Stuc	lios	Job no. 221	0445
55 Whitfield Street	Calcs for				Start page pe /P	ovision
London	Retaining Wall	Temporary Co	ondition (Suppo	orting Wall Over)	Start page no./1	6
W1T 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022
		m = 2				
		i <sub>q</sub> = [1 - H /	$(V + I_{load} \times c'_{b.c})$	$(\times \cot(\phi'_{b.d}))]^m = 1$		
		i <sub>γ</sub> = [1 - Η /	$(V + I_{load} \times c'_{b.d})$	× cot(\(\phi_{b.d}))] <sup>(m + 1)</sup> =	= 1	
		i <sub>c</sub> = i <sub>q</sub> - (1 -	$i_q$ ) / (N <sub>c</sub> × tan(d	(b'b.d)) = <b>1</b>		
Net ultimate bearing capacity						
	n <sub>f</sub> = c'	$_{\text{b.d}}  imes \mathbf{N}_{\text{c}}  imes \mathbf{s}_{\text{c}}  imes \mathbf{i}_{\text{c}}$	$r_{c}$ + q' × N <sub>q</sub> × s <sub>q</sub>	$ imes$ iq + 0.5 $ imes$ $\gamma_{b}'$ $ imes$ l <sub>lo</sub>	$_{ad} \times \mathbf{N}_{\gamma} \times \mathbf{s}_{\gamma} \times \mathbf{i}_{\gamma}$	e = <b>59.5</b> kN/m <sup>2</sup>
Factor of safety		$FoS_{bp} = n_f$	/ max(q <sub>toe</sub> , q <sub>hee</sub>	) = 1.063		
	PASS - All	owable bearin	g pressure ex	ceeds maximum	applied bear	ring pressure
RETAINING WALL DESIGN						
In accordance with EN1992-1	-1:2004 incorpor	ating Corrige	ndum dated J	anuary 2008 and	the UK Natio	nal Annex
incorporating National Amen	dment No.1					
					Tedds calculat	tion version 2.9.11
Concrete details - Table 3.1 -	Strength and de	formation cha	racteristics for	or concrete		
Concrete strength class	inder strength	$f_{\rm rb} = 32  {\rm N/r}$	nm <sup>2</sup>			
Characteristic compressive cut	be strength	$f_{ck} = 32 1 1 7$	N/mm <sup>2</sup>			
Mean value of compressive cyl	inder strength	$f_{cm} = f_{ck} + 8$	N/mm <sup>2</sup> = <b>40</b> N	l/mm <sup>2</sup>		
Mean value of axial tensile stre	ength	f <sub>ctm</sub> = 0.3 N	/mm <sup>2</sup> × (f <sub>ck</sub> / 1	N/mm <sup>2</sup> ) <sup>2/3</sup> = <b>3.0</b> N/	/mm²	
5% fractile of axial tensile strer	ngth	$f_{ctk,0.05} = 0.7$	7 × f <sub>ctm</sub> = <b>2.1</b> N/	mm <sup>2</sup>		
	0					
Secant modulus of elasticity of	concrete	E <sub>cm</sub> = 22 kl	$V/mm^2 \times (f_{cm} / f_{cm})$	10 N/mm²) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab	concrete ble 2.1N	E <sub>cm</sub> = 22 kl γ <sub>C</sub> = <b>1.50</b>	N/mm² × (f <sub>cm</sub> / f	10 N/mm²) <sup>0.3</sup> = <b>33</b> 3	<b>346</b> N/mm²	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie	concrete ble 2.1N nt - cl.3.1.6(1)	E <sub>cm</sub> = 22 kl γc = <b>1.50</b> α <sub>cc</sub> = <b>0.85</b>	N/mm <sup>2</sup> × (f <sub>cm</sub> / f	10 N/mm²) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm²	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s	concrete ble 2.1N nt - cl.3.1.6(1) strength - exp.3.1	$E_{cm} = 22 \text{ kl}$ $\gamma_{c} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{cd}$	N/mm <sup>2</sup> × (f <sub>cm</sub> / <sup>4</sup> <sub>ck</sub> / γ <sub>C</sub> = <b>18.1</b> N	/mm <sup>2</sup> /mm <sup>2</sup>	<b>346</b> N/mm²	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size	concrete ble 2.1N nt - cl.3.1.6(1) strength - exp.3.1	E <sub>cm</sub> = 22 kl γc = <b>1.50</b> $\alpha_{cc}$ = <b>0.85</b> f <sub>cd</sub> = $\alpha_{cc} \times f_{cd}$ h <sub>agg</sub> = <b>20</b> m	N/mm <sup>2</sup> × (f <sub>cm</sub> / · <sub>ck</sub> / γ <sub>C</sub> = <b>18.1</b> N	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1	concrete ble 2.1N int - cl.3.1.6(1) strength - exp.3.1	E <sub>cm</sub> = 22 kl γc = 1.50 $ α_{cc} = 0.85 $ $ f_{cd} = α_{cc} \times f_{c} $ $ h_{agg} = 20 m$ $ ε_{cu2} = 0.003 $	N/mm <sup>2</sup> × (f <sub>cm</sub> / γ <sub>c</sub> <sub>ck</sub> / γ <sub>c</sub> = <b>18.1</b> N nm <b>35</b>	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1	concrete ble 2.1N nt - cl.3.1.6(1) strength - exp.3.1	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{cd}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$	N/mm <sup>2</sup> × (f <sub>cm</sub> / <sup>4</sup> <sub>ck</sub> / γ <sub>C</sub> = <b>18.1</b> N im 35 35	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1t	E <sub>cm</sub> = 22 kl γc = 1.50 $ α_{cc} = 0.85 $ 5 f <sub>cd</sub> = $α_{cc} \times f_{c}$ h <sub>agg</sub> = 20 m $ε_{cu2} = 0.003$ $ε_{cu3} = 0.003$ λ = 0.80	N/mm <sup>2</sup> × (f <sub>cm</sub> / γ <sub>c</sub> = <b>18.1</b> N m 35 35	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.18	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{cd}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$	N/mm <sup>2</sup> × (f <sub>cm</sub> / <sup>4</sup> <sub>ck</sub> / γ <sub>C</sub> = <b>18.1</b> N nm 35 35	/mm²) <sup>0.3</sup> = <b>33</b> : /mm²	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub>	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1t	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$	N/mm <sup>2</sup> × (f <sub>cm</sub> / γ <sub>c</sub> = <b>18.1</b> N m 35 35	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> :	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub>	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1 ight factor	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{cd}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times 100$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $\gamma_{\rm C}$ = <b>18.1</b> N m 35 35 35	/mm <sup>2</sup> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub>	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1t	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times$ $K_{3} = 0.40$	N/mm <sup>2</sup> × ( $f_{cm}$ / $f_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b>	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub>	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1t	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{r}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times$ $K_{3} = 0.40$ $K_{4} = 1.00 \times$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $\gamma_{\rm C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b>	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /ɛcu2) = <b>1.00</b> /ɛcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b>	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times$ $K_{3} = 0.40$ $K_{4} = 1.00 \times$	N/mm <sup>2</sup> × ( $f_{cm}$ / $f_{cm}$ / $f_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b>	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /εcu2) = <b>1.00</b> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1t ight factor	$E_{cm} = 22 \text{ kI}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ for $= \alpha_{cc} \times fr$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times$ $K_{3} = 0.40$ $K_{4} = 1.00 \times$ $f_{yk} = 500 \text{ N}.$	N/mm <sup>2</sup> × ( $f_{cm}$ / $f_{cm}$	/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /ɛcu2) = <b>1.00</b> /ɛcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforce	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1 ight factor reinforcement sement	$E_{cm} = 22 \text{ kI}$ $\gamma c = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_1 = 0.40$ $K_2 = 1.00 \times$ $K_3 = 0.40$ $K_4 = 1.00 \times$ $f_{yk} = 500 \text{ N}$ $E_s = 20000$ $\alpha_s = 1.15$	N/mm <sup>2</sup> × ( $f_{cm}$ / $f_{cm}$ / $f_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b>	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /εcu2) = <b>1.00</b> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforc Partial factor for reinforcing ste	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1t ight factor reinforcement cement el - Table 2.1N	$E_{cm} = 22 \text{ kI}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ fod = $\alpha_{cc} \times fr$ hagg = 20 m $\epsilon_{cu2} = 0.003$ $\epsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_1 = 0.40$ $K_2 = 1.00 \times$ $K_3 = 0.40$ $K_4 = 1.00 \times$ fyk = 500 N. $E_s = 20000$ $\gamma_S = 1.15$ for t = fat / $\gamma_S$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>(</b> 0.6 + 0.0014 (0.6 + 0.0014 /mm <sup>2</sup> <b>10</b> N/mm <sup>2</sup> = <b>435</b> N/mm <sup>2</sup>	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /ε <sub>cu2</sub> ) = <b>1.00</b> /ε <sub>cu2</sub> ) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforc Partial factor for reinforcing ste Design yield strength of reinfor	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1 ight factor reinforcement ement el - Table 2.1N cement	$E_{cm} = 22 \text{ kl}$ $\gamma_{C} = 1.50$ $\alpha_{cc} = 0.85$ $f_{cd} = \alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_{1} = 0.40$ $K_{2} = 1.00 \times$ $K_{3} = 0.40$ $K_{4} = 1.00 \times$ $f_{yk} = 500 \text{ N.}$ $E_{s} = 20000$ $\gamma_{s} = 1.15$ $f_{yd} = f_{yk} / \gamma_{s}$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $^{\circ}$ $_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>(</b> 0.6 + 0.0014 (0.6 + 0.0014 /mm <sup>2</sup> <b>10</b> N/mm <sup>2</sup> = <b>435</b> N/mm <sup>2</sup>	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /εcu2) = <b>1.00</b> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforc Partial factor for reinforcing ste Design yield strength of reinfor	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1 ight factor reinforcement sement el - Table 2.1N cement	E <sub>cm</sub> = 22 kI $\gamma c = 1.50$ $\alpha_{cc} = 0.85$ f <sub>cd</sub> = $\alpha_{cc} \times f_{r}$ $h_{agg} = 20 \text{ m}$ $\epsilon_{cu2} = 0.003$ $\epsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_1 = 0.40$ $K_2 = 1.00 \times$ $K_3 = 0.40$ $K_4 = 1.00 \times$ f <sub>yk</sub> = 500 N/ E <sub>s</sub> = 20000 $\gamma s = 1.15$ f <sub>yd</sub> = f <sub>yk</sub> / $\gamma s$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>36</b> (0.6 + 0.0014) (mm <sup>2</sup> <b>10</b> N/mm <sup>2</sup> = <b>435</b> N/mm <sup>2</sup>	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /ε <sub>cu2</sub> ) = <b>1.00</b> /ε <sub>cu2</sub> ) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforc Partial factor for reinforcing ste Design yield strength of reinfor <b>Cover to reinforcement</b> Front face of stem Rear face of stem	concrete ole 2.1N int - cl.3.1.6(1) strength - exp.3.1 ight factor reinforcement eement el - Table 2.1N cement	E <sub>cm</sub> = 22 kI $\gamma c = 1.50$ $\alpha_{cc} = 0.85$ f <sub>cd</sub> = $\alpha_{cc} \times f_{c}$ $h_{agg} = 20 \text{ m}$ $\varepsilon_{cu2} = 0.003$ $\varepsilon_{cu3} = 0.003$ $\lambda = 0.80$ $\eta = 1.00$ $K_1 = 0.40$ $K_2 = 1.00 \times$ $K_3 = 0.40$ $K_4 = 1.00 \times$ f <sub>yk</sub> = 500 N. E <sub>s</sub> = 20000 $\gamma s = 1.15$ f <sub>yd</sub> = f <sub>yk</sub> / $\gamma s$ $c_{sf} = 40 \text{ mm}$ $c_{sr} = 50 \text{ mm}$	N/mm <sup>2</sup> × (f <sub>cm</sub> / $^{-1}$ $_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>(</b> 0.6 + 0.0014 (0.6 + 0.0014 /mm <sup>2</sup> <b>10</b> N/mm <sup>2</sup> = <b>435</b> N/mm <sup>2</sup> n n	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /εcu2) = <b>1.00</b> /εcu2) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	
Secant modulus of elasticity of Partial factor for concrete - Tab Compressive strength coefficie Design compressive concrete s Maximum aggregate size Ultimate strain - Table 3.1 Shortening strain - Table 3.1 Effective compression zone he Effective strength factor Bending coefficient k <sub>1</sub> Bending coefficient k <sub>2</sub> Bending coefficient k <sub>3</sub> Bending coefficient k <sub>4</sub> <b>Reinforcement details</b> Characteristic yield strength of Modulus of elasticity of reinforc Partial factor for reinforcing ste Design yield strength of reinfor <b>Cover to reinforcement</b> Front face of stem Rear face of stem Top face of base	concrete ole 2.1N ont - cl.3.1.6(1) strength - exp.3.1 ight factor reinforcement sement el - Table 2.1N cement	E <sub>cm</sub> = 22 kI $\gamma_{C}$ = 1.50 $\alpha_{cc}$ = 0.85 f <sub>cd</sub> = $\alpha_{cc} \times f_{r}$ $h_{agg}$ = 20 m $\epsilon_{cu2}$ = 0.003 $\epsilon_{cu3}$ = 0.003 $\lambda$ = 0.80 $\eta$ = 1.00 $K_1$ = 0.40 $K_2$ = 1.00 × $K_3$ =0.40 $K_4$ = 1.00 × $f_{yk}$ = 500 N/ E <sub>s</sub> = 20000 $\gamma_{s}$ = 1.15 $f_{yd}$ = $f_{yk} / \gamma_{s}$ C <sub>sf</sub> = 40 mm c <sub>sr</sub> = 50 mm c <sub>bt</sub> = 50 mm	N/mm <sup>2</sup> × (f <sub>cm</sub> / $^{1}$ $_{ck}$ / $\gamma_{C}$ = <b>18.1</b> N m <b>35</b> <b>35</b> <b>35</b> <b>35</b> <b>(</b> 0.6 + 0.0014 (0.6 + 0.0014 /mm <sup>2</sup> <b>10</b> N/mm <sup>2</sup> = <b>435</b> N/mm <sup>2</sup> n n	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>33</b> /mm <sup>2</sup> /ε <sub>cu2</sub> ) = <b>1.00</b> /ε <sub>cu2</sub> ) = <b>1.00</b>	<b>346</b> N/mm <sup>2</sup>	

Elliottwooo ElliottWood Partnership	Project	Job no. 2210445			
55 Whitfield Street London W1T 4AH	Calcs for Retaining Wal	ll Temporary Co	Start page no./Revision 7		
	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq





#### Check stem design at 2236 mm Depth of section

Tension reinforcement provided

Rectangular section in flexure - Section 6.1

h = **300** mm

Design bending moment combination 1	M = <b>30.4</b> kNm/m
Depth to tension reinforcement	$d = h - c_{sf} - \phi_{sx} - \phi_{sfM} / 2 = 244 \text{ mm}$
	$K = M / (d^2 \times f_{ck}) = 0.016$
	$K' = (2 \times \eta \times \alpha_{cc} / \gamma_{C}) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times K_2))$
	K' = 0.207
	K' > K - No compression reinforcement is required
Lever arm	z = min(0.5 + 0.5 × (1 - 2 × K / ( $\eta \times \alpha_{cc}$ / $\gamma_{c}$ )) <sup>0.5</sup> , 0.95) × d = <b>232</b> mm
Depth of neutral axis	x = 2.5 × (d − z) = <b>31</b> mm
Area of tension reinforcement required	$A_{sfM.req} = M / (f_{yd} \times z) = 301 \text{ mm}^2/\text{m}$

12 dia.bars @ 200 c/c

					1				
Elliott Wood Partnership	Project	No. 12 & 13 Prir	nrose Hill Stud	2210445					
55 Whitfield Street	Calcs for			Start page no./F	Revision				
	Retaining Wa	all Temporary Co	ondition (Suppo	8					
WTT 4An	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq	Approved date 04/07/2022			
Area of tension reinforcement	provided	$A_{sfM.prov} = \pi$	$\times \phi_{sfM}^2$ / (4 $\times$ s	<sub>sfM</sub> ) = <b>565</b> mm²/m					
Minimum area of reinforcemer	nt - exp.9.1N	A <sub>sfM.min</sub> = m	$ax(0.26 \times f_{ctm})$	$f_{yk}$ , 0.0013) × d =	<b>384</b> mm²/m				
Maximum area of reinforceme	nt - cl.9.2.1.1(3)	$A_{sfM.max} = 0$	.04 × h = <b>1200</b>	<b>0</b> mm²/m					
		max(A <sub>sfM.rec</sub>	q, A <sub>sfM.min</sub> ) / A <sub>sfM</sub>	1.prov = <b>0.678</b>					
	PASS - Area o	of reinforcement	t provided is g	greater than area	of reinforce	ment required			
				Lil	brary item: Rectar	ngular single output			
Deflection control - Section	7.4								
Reference reinforcement ratio		$\rho_0 = \sqrt{f_{ck}} / \gamma$	1 N/mm <sup>2</sup> ) / 100	00 = <b>0.006</b>					
Required tension reinforcement	nt ratio	$\rho = A_{sfM.req}$	/ d = <b>0.001</b>						
Required compression reinfore	cement ratio	ρ' <b>= A</b> sfM.2.re	<sub>q</sub> / d <sub>2</sub> = <b>0.000</b>						
Structural system factor - Tabl	e 7.4N	K <sub>b</sub> = <b>1</b>							
Reinforcement factor - exp.7.1	7	K <sub>s</sub> = min(50	00 N/mm² / (f <sub>yk</sub>	$\times  A_{sfM.req}  /  A_{sfM.prov}$	), 1.5) <b>= 1.5</b>				
Limiting span to depth ratio - e	exp.7.16.a	$min(K_s \times K_s)$	₀ × [11 + 1.5 ×	$\sqrt{(f_{ck} / 1 N/mm^2)} \times$	$\rho_0$ / $\rho$ + 3.2 $\times$	√(f <sub>ck</sub> / 1			
		N/mm²) × (	ρ <sub>0</sub> / ρ - 1) <sup>3/2</sup> ], 4	0 × K <sub>b</sub> ) = <b>40</b>					
Actual span to depth ratio		h <sub>prop</sub> / d = <b>1</b>	6						
		PASS	- Span to dep	oth ratio is less th	nan deflectio	n control limit			
Crack control - Section 7.3									
Limiting crack width		w <sub>max</sub> = <b>0.3</b>	mm						
Variable load factor - EN1990	– Table A1.1	ψ2 <b>= 0.6</b>							
Serviceability bending momen	t	M <sub>sls</sub> = <b>19.9</b>	M <sub>sis</sub> = <b>19.9</b> kNm/m						
Tensile stress in reinforcemen	ıt	$\sigma_{s}$ = M <sub>sls</sub> / (	A <sub>sfM.prov</sub> × z) = ŕ	<b>152.1</b> N/mm <sup>2</sup>					
Load duration		Long term							
Load duration factor		$k_{t} = 0.4$							
Effective area of concrete in te	ension	A <sub>c.eff</sub> = min(	(2.5 × (h - d), (l	h - x) / 3, h / 2)					
		A <sub>c.eff</sub> = <b>898</b>	<b>33</b> mm²/m						
Mean value of concrete tensile	e strength	$f_{ct.eff} = f_{ctm} =$	<b>3.0</b> N/mm <sup>2</sup>						
Reinforcement ratio		$\rho_{p.eff} = A_{sfM.}$	prov / A <sub>c.eff</sub> = <b>0.0</b>	06					
Modular ratio		$\alpha_{e} = E_{s} / E_{c}$	m = <b>5.998</b>						
Bond property coefficient		k <sub>1</sub> = <b>0.8</b>							
Strain distribution coefficient		k <sub>2</sub> = <b>0.5</b>							
		k <sub>3</sub> = <b>3.4</b>							
		k <sub>4</sub> = <b>0.425</b>							
Maximum crack spacing - exp	.7.11	$s_{r.max} = k_3 \times$	$c_{sf} + k_1 \times k_2 \times$	$k_4 \times \phi_{sfM} / \rho_{p.eff} = 4$	60 mm				
Maximum crack width - exp.7.8	8	$W_k = S_{r.max}$	< max(σ <sub>s</sub> – k <sub>t</sub> ×	(f <sub>ct.eff</sub> / $\rho_{p.eff}$ ) × (1 +	$-\alpha_{e} \times \rho_{p.eff}$ ), 0.	$6 \times \sigma_s$ ) / E <sub>s</sub>			
		w <sub>k</sub> = <b>0.21</b> n	nm						
		$w_k / w_{max} =$	0.7						
		PASS	- Maximum c	rack width is les	s than limitin	ig crack width			
Check stem design at base of Depth of section	of stem	h = <b>300</b> mr	n						
Rectangular section in flow	ra - Section 6 4								
Design bending moment come	ne - Section 0.1	M = 64 3 k	Nm/m						
Depth to tension reinforcemen	at a contra	$d = b - c_{}$	$d_{er}/2 = 242$ m	nm					
		$K = M / (d^2)$	$(\gamma_{01}, 2 - 242)$						
		$K' = (2 \vee 2)$	$x \alpha_{oo}/v_{o}) \times (1 - 1)$	$\times (8 - K_A)/(2 \vee K_A)$	))×() × (8 - K.)	)/(2 × Ka))			
		κ' = <b>0.207</b>	× αcc/γCJ×(1 - Λ	$x = (0 - (1))(2 \times (2))$	//∧(∧ × (0 - №1)	µ(∠ × №2))			
			K' > K -	No compression	reinforceme	ent is required			

Elliott Wood Partnership	Project	No. 12 & 13 Prir	nrose Hill Stud	Job no. 2210445				
55 Whitfield Street London	Calcs for Retaining Wa	II Temporary Co	ondition (Suppo	orting Wall Over)	Start page no./	Revision 9		
W1T 4AH	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq	Approved date 04/07/2022		
Lovor arm		z = min(0.5)	±05×(1-2)	$\mathbf{K} = \{\mathbf{m} \in \{\mathbf{m}\}$	10.5 0 05) v d	- 230 mm		
Depth of neutral axis		z = 1111(0.5)	(1 - 2) - <b>30</b> mm	× K / (I] × 0.cc / γC)	)**, 0.95) × u	- 230 mm		
Area of tonsion reinforcement r	oquirod	$\Lambda = 2.5 \times (0)$	(f + x - z) = 643	mm²/m				
Tension reinforcement provider	equileu 1	Asr.req - IVI /	$(1y_0 \times 2) = 043$					
Area of tension reinforcement r	provided		(μ/2000/C	= 1005 mm <sup>2</sup> /m				
Minimum area of roinforcement		$A_{\rm sr.prov} = \pi$	$\langle \psi_{sr} \rangle (4 \times 3sr)$	- 1003 mm /m	<b>91</b> mm <sup>2</sup> /m			
Maximum area of reinforcement	t = 0.0211(2)	$A_{\text{sr.min}} - \Pi a$	$X(0.20 \times 1_{ctm} / 1_{y})$	$_{\rm k}, 0.0013) \times 0 - 3$				
	1 - 01.9.2.1.1(3)	$A_{sr.max} - 0.0$	A = 12000	- 0 64				
	PASS - Area of	f reinforcement	Asr.min) / Asr.prov	– 0.04 reater than area	of reinforce	ment required		
	1 400 - 4160 01	reiniorcement	. provided is g	Lil	orary item: Recta	ngular single output		
Deflection control - Section 7	.4							
Reference reinforcement ratio		$\rho_0 = \sqrt{f_{ck}} / \gamma$	1 N/mm²) / 100	0 = <b>0.006</b>				
Required tension reinforcemen	t ratio	$\rho = A_{sr.req} /$	d = <b>0.003</b>					
Required compression reinforce	ement ratio	$\rho' = A_{sr.2.req}$	/ d <sub>2</sub> = <b>0.000</b>					
Structural system factor - Table	e 7.4N	K <sub>b</sub> = <b>1</b>						
Reinforcement factor - exp.7.17	7	$K_s = min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr.req} / A_{sr.prov}), 1.5) = 1.5$						
Limiting span to depth ratio - ex	кр.7.16.a	min(K₅ × Kı	∞ × [11 + 1.5 × <sup>-</sup>	√(f <sub>ck</sub> / 1 N/mm²) ×	ρ₀ / ρ <b>+ 3.2</b> ×	√(f <sub>ck</sub> / 1		
		N/mm²) × (	ρ₀ / ρ <b>- 1)<sup>3/2</sup>], 4</b> (	0 × K <sub>b</sub> ) = <b>40</b>				
Actual span to depth ratio		$h_{prop} / d = 1$	6.1					
		PASS	- Span to dep	th ratio is less th	an deflectio	n control limit		
Crack control - Section 7.3								
Limiting crack width		w <sub>max</sub> = <b>0.3</b>	mm					
Variable load factor - EN1990 -	- Table A1.1	ψ2 <b>= 0.6</b>						
Serviceability bending moment		M <sub>sis</sub> = <b>43</b> kl	Nm/m					
Tensile stress in reinforcement		$\sigma_{s}$ = M <sub>sls</sub> / (	A <sub>sr.prov</sub> × z) = 18	86.1 N/mm²				
Load duration		Long term						
Load duration factor		k <sub>t</sub> = <b>0.4</b>						
Effective area of concrete in ter	nsion	A <sub>c.eff</sub> = min(	(2.5 × (h - d), (h	n - x) / 3, h / 2)				
		A <sub>c.eff</sub> = <b>899</b>	<b>17</b> mm²/m					
Mean value of concrete tensile	strength	$f_{ct.eff} = f_{ctm} =$	<b>3.0</b> N/mm <sup>2</sup>					
Reinforcement ratio		$\rho_{p.eff} = A_{sr.pr}$	ov / A <sub>c.eff</sub> = <b>0.01</b>	1				
Modular ratio		$\alpha_{\rm e} = E_{\rm s} / E_{\rm c}$	m = <b>5.998</b>					
Bond property coefficient		$k_1 = 0.8$						
Strain distribution coefficient		$K_2 = 0.5$						
		$k_3 = 0.425$						
Maximum crack spacing - exp 7	7 11	$\mathbf{x}_4 = 0 \cdot \mathbf{z}_2 \mathbf{z}_3$	Cor + k1 × k2 ×	k4 × φsr / Op off = <b>41</b>	3 mm			
Maximum crack width - exp 7.8			$(\max(\sigma_{0} - k_{1}))$	(f <sub>et off</sub> / Op off) × (1 +	· ((a, X, Op off) 0	6 × σ <sub>2</sub> ) / E <sub>2</sub>		
		wk = 0.231	mm		ate x pp.en/, o	.0 × 03) / L3		
		$w_k / w_{max} =$	0.769					
		PASS	- Maximum cı	ack width is les	s than limitir	ng crack width		
Rectangular section in shear	- Section 6.2							
Design shear force	· · · · · · · · · · · · · · ·	V = 94.9 ki	N/m					
-		C <sub>Rd,c</sub> = 0.18	3 / γc = <b>0.120</b>					
		k = min(1 +	- √(200 mm / d)	), 2) = <b>1.909</b>				
Longitudinal reinforcement ratio	D	ρι = min(A <sub>s</sub>		0.004				

alliatturaad	Project				lob no				
Elliott Wood Partnership		No. 12 & 13 Prir	nrose Hill Stud	2210445					
55 Whitfield Street London	Calcs for Retaining Wa	III Temporary Co	ondition (Suppo	orting Wall Over)	Start page no./R	evision 10			
W1T 4AH	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq	Approved date 04/07/2022			
		v · - 0.03	$5 \text{ N}^{1/2}/\text{mm} \times k^{3/2}$	2 v f .0.5 - 0 522 N	/mm <sup>2</sup>				
Design shear resistance - eyo	6 2a & 6 2h	$V_{\text{Ed.s}} = \max$	$(C_{\text{Dd}} \times k \times (10))$	$\sim 10^{\circ} \text{ mm}^4 \times 0^{\circ} \times 10^{\circ} \text{ mm}^4$	$(1111)^{1/3} V_{min} \times d$				
Design shear resistance - exp.	0.20 0 0.20	V <sub>Rd.c</sub> = 131	3  kN/m		ж) , viiiii)^ u				
			1 722						
		PAS	S - Design sh	ear resistance ex	ceeds desig	n shear force			
Check stem design at prop			5		J				
Depth of section		h = <b>300</b> mr	n						
Bestengular section in flow	a Santian 6.1								
Design bending moment comb	ination 1	M = <b>0</b> k Nm	/m						
Depth to tension reinforcement		$d = b - c_{rr}$	$\phi_{or1} / 2 = 244$ n	nm					
		$K = M / (d^2)$	$(\psi_{s}(t)) = 0.000$						
		K' = (2 × η	× α <sub>cc</sub> /γc)×(1 - λ	× (δ - K <sub>1</sub> )/(2 × K <sub>2</sub> )	)×(λ × (δ - K1),	/(2 × K <sub>2</sub> ))			
		K = 0.207	K'> K -	No comprossion	roinforcomo	nt is roquirod			
l ever arm		$z = \min(0.5)$	(1 - 2)	$\times K / (n \times \alpha - / \alpha - )$	$10.5  0.95 \ \times d =$	= 232 mm			
Depth of neutral axis		z = 1111(0.00)	(-7) = 31  mm	$\times$ IC7 (II $\times$ 0.007 (IC))	, 0.30) ^ u -				
Area of tension reinforcement	equired	Λ = 2.5 × (0	/ (ful x z) = 0 m	$m^2/m$					
Tension reinforcement provide	equireu 4	12 dia bars	/ (Iya × 2) = 0 III : @ 200 c/c						
Area of tension reinforcement	arovided	$\Delta_{ar1}$ and $\pi$	$\times \phi_{or1}^2 / (4 \times s_{or1}^2)$	$(1) = 565 \text{ mm}^2/\text{m}^2$					
Minimum area of reinforcemen	$\mathbf{A}_{\text{or1}} = \mathbf{m}_{\text{in}}$	$\propto \varphi_{\rm sr} + \gamma (1 \times \sigma_{\rm sr})$	f. <sub>*</sub> 0 0013) × d = 1	<b>384</b> mm <sup>2</sup> /m					
Maximum area of reinforcemen	$A_{\rm or1mov} = 0$	$0.4 \times h = 12000$	$m_{\rm wk}^{\rm 2}$ , 0.0010) × 0 = 0						
		max(A <sub>sr1 reg</sub>	. Asr1 min) / Asr1 n	rov = <b>0.678</b>					
	PASS - Area of	f reinforcement	t provided is g	reater than area	of reinforcen	<b>nent required</b> gular single output			
Deflection control - Section 7	.4								
Reference reinforcement ratio		$ ho_0 = \sqrt{f_{ck}} / r_{ck}$	1 N/mm²) / 100	0 = <b>0.006</b>					
Required tension reinforcemen	t ratio	$\rho = A_{sr1.req}$ /	$\rho = A_{sr1.req} / d = 0.000$						
Required compression reinforc	ement ratio	ρ' = A <sub>sr1.2.req</sub> / d <sub>2</sub> = <b>0.000</b>							
Structural system factor - Table	e 7.4N	K <sub>b</sub> = <b>0.4</b>							
Reinforcement factor - exp.7.1	7	$K_s = min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr1.req} / A_{sr1.prov}), 1.5) = 1.5$							
Limiting span to depth ratio - ex	kp.7.16.a	$min(K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} \ / \ 1 \ N/mm^2)} \times \rho_0 \ / \ \rho + 3.2 \times \sqrt{(f_{ck} \ / \ 1 \ N/mm^2)})$							
		N/mm²) × (	ρ₀ / ρ <b>- 1)</b> <sup>3/2</sup> ], 40	0 × K <sub>b</sub> ) = <b>16</b>					
Actual span to depth ratio		(h <sub>stem</sub> - h <sub>prop</sub>	o) / d = <b>0.4</b>						
		PASS	- Span to dep	th ratio is less th	an deflectior	n control limit			
Crack control - Section 7.3									
Limiting crack width		w <sub>max</sub> = <b>0.3</b>	mm						
Variable load factor - EN1990 -	- Table A1.1	ψ2 <b>= 0.6</b>							
Serviceability bending moment		M <sub>sls</sub> = <b>0</b> kN	m/m						
Tensile stress in reinforcement		$\sigma_{s}$ = M <sub>sls</sub> / (	$A_{sr1.prov} \times z) = 0$	<b>.1</b> N/mm <sup>2</sup>					
Load duration		Long term							
Load duration factor		k <sub>t</sub> = <b>0.4</b>							
Effective area of concrete in te	nsion	A <sub>c.eff</sub> = min( A <sub>c.eff</sub> = <b>898</b> 3	(2.5 × (h - d), (h <b>33</b> mm²/m	1 - x) / 3, h / 2)					
Mean value of concrete tensile	strength	$f_{ct.eff} = f_{ctm} =$	<b>3.0</b> N/mm <sup>2</sup>						
Reinforcement ratio		$\rho_{p.eff} = A_{sr1.p}$	orov / A <sub>c.eff</sub> = 0.00	06					

elliott <b>wood</b>	Project			Job no.					
Elliott Wood Partnership		No. 12 & 13 Prir	mrose Hill Stud	2210445					
55 Whitfield Street London	Calcs for Retaining Wa	II Temporary Co	ondition (Suppo	Start page no./F	tevision 11				
W11 4AH	Calcs by DBa	Calcs date 01/06/2022	Checked by PDu	Checked date 15/06/2022	Approved by WSq	Approved date 04/07/2022			
Modular ratio		$\alpha_{\rm e} = E_{\rm s} / E_{\rm c}$	cm = <b>5.998</b>						
Bond property coefficient		k <sub>1</sub> = <b>0.8</b>							
Strain distribution coefficient		k <sub>2</sub> = <b>0.5</b>							
		k <sub>3</sub> = <b>3.4</b>							
		k <sub>4</sub> = <b>0.425</b>							
Maximum crack spacing - exp.7	'.11	$s_{r.max} = k_3 \times$	$c_{sr} + k_1 \times k_2 \times k_2$	$k_4 \times \phi_{sr1} / \rho_{p.eff} = 4$	94 mm				
Maximum crack width - exp.7.8		$W_k = S_{r.max}$	< max(σ <sub>s</sub> – k <sub>t</sub> ×	$(f_{ct.eff} / \rho_{p.eff}) \times (1 +$	$\alpha_{e} \times \rho_{p.eff}$ ), 0.	$6 \times \sigma_s) / E_s$			
		w <sub>k</sub> = <b>0</b> mm							
		$W_k / W_{max} =$	0.001	veele width ie lee	a dhan linaidin				
		PASS	- Maximum ci	rack width is less	s than limitin	g crack width			
Rectangular section in shear	- Section 6.2								
Design shear force		V = 30.9 ki	N/m						
		$C_{Rd,c} = 0.18$	3 / γc = <b>0.120</b>						
		k = min(1 +	- √(200 mm / d	), 2) = 1.905					
Longitudinal reinforcement ratio	)	$\rho_{\rm I} = \min(A_{\rm si})$	$\rho_{\rm I} = \min(A_{\rm sr1, prov} / d, 0.02) = 0.002$						
		$V_{min} = 0.03$	$5 \text{ N}^{1/2}/\text{mm} \times \text{K}^{3/2}$	$^{2} \times f_{ck}^{0.3} = 0.521 \text{ N}$	/mm²				
Design snear resistance - exp.c	Design shear resistance - exp.6.2a & 6.2b			JU N <sup>2</sup> /mm <sup>2</sup> × $\rho_1$ × $r_0$	$(k)^{1/3}$ , $V_{min}$ ) × C				
		$V_{Rd.c} - 127$	.1 KN/III 1 243						
			S - Desian sh	ear resistance ex	ceeds desig	n shear force			
Horizontal reinforcement para	allel to face of s	tem - Section §	9.6						
Minimum area of reinforcement	– cl.9.6.3(1)	A <sub>sx.req</sub> = ma	x(0.25 × Asr.prov	√, 0.001 × t <sub>stem</sub> ) = 3	<b>300</b> mm²/m				
Maximum spacing of reinforcem	nent – cl.9.6.3(2)	) s <sub>sx_max</sub> = 40	0 mm	·					
Transverse reinforcement provi	ded	10 dia.bars	s @ 200 c/c						
Area of transverse reinforcement	nt provided	$A_{sx.prov} = \pi$	$\times \phi_{sx}^2 / (4 \times s_{sx})$	= <b>393</b> mm²/m					
	PASS - Area of	f reinforcement	t provided is g	reater than area	of reinforcer	nent required			
Check base design at toe									
Depth of section		h = <b>500</b> mr	n						
Rectangular section in flexure	e - Section 6.1								
Design bending moment combi	nation 1	M = <b>28.8</b> k	Nm/m						
Depth to tension reinforcement		d = h - c <sub>bb</sub> -	- φ <sub>bb</sub> / 2 <b>= 417</b> r	nm					
		$K = M / (d^2)$	× f <sub>ck</sub> ) = <b>0.005</b>						
		K' = (2 × η K' = <b>0.207</b>	× αcc/γc)×(1 - λ	. × (δ - K <sub>1</sub> )/(2 × K <sub>2</sub> )	)×(λ × (δ - K <sub>1</sub> )	/(2 × K <sub>2</sub> ))			
			K' > K -	No compression	reinforceme	nt is required			
Lever arm		z = min(0.5	5 + 0.5 × (1 - 2	× K / ( $\eta$ × $\alpha_{cc}$ / $\gamma_c$ ))	) <sup>0.5</sup> , 0.95) × d =	= <b>396</b> mm			
Depth of neutral axis		x = 2.5 × (c	d – z) = <b>52</b> mm						
Area of tension reinforcement re	equired	$A_{bb.req} = M$	/ (f <sub>yd</sub> × z) = <b>167</b>	mm²/m					
Tension reinforcement provided	1	16 dia.bars	s @ 200 c/c						
Area of tension reinforcement p	rovided	$A_{bb.prov} = \pi$	$\times \phi_{bb}^2 / (4 \times s_{bb})$	) = <b>1005</b> mm²/m					
Minimum area of reinforcement	- exp.9.1N	$A_{bb.min} = ma$	$ax(0.26 \times f_{ctm} / 1)$	$f_{yk}, 0.0013) \times d = 6$	656 mm²/m				
Maximum area of reinforcement	t - cl.9.2.1.1(3)	$A_{bb.max} = 0.$	04 × h = <b>20000</b>	) mm²/m					
	<b>D400</b>	max(A <sub>bb.req</sub>	, Abb.min) / Abb.pro	ov = 0.652	- f f				
	PASS - Area of	reintorcement	t provided is g	greater than area Lil	ot reinforcer prary item: Rectan	gular single output			

elliottwood	Project	lo 12 & 13 Prir	mrose Hill Stur	lios	Job no.	10445			
EIIIOTT WOOD Partnersnip		0. 12 & 131 11		Start page no./Revision 12					
London	Retaining Wal	I Temporary Co	orting Wall Over)						
W1T 4AH	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date			
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022			
Crack control - Section 7.3									
Limiting crack width		w <sub>max</sub> = <b>0.3</b>	mm						
Variable load factor - EN1990 -	- Table A1.1	ψ <sub>2</sub> = <b>0.6</b>							
Serviceability bending moment		M <sub>sls</sub> = <b>21.2</b>	kNm/m						
Tensile stress in reinforcement		$\sigma_s = M_{sls} / ($	$A_{bb.prov} \times z) = 5$	<b>3.1</b> N/mm <sup>2</sup>					
Load duration		Long term							
Load duration factor		k <sub>t</sub> = <b>0.4</b>							
Effective area of concrete in ter	nsion	A <sub>c.eff</sub> = min	(2.5 × (h - d), (l	h - x) / 3, h / 2)					
		A <sub>c.eff</sub> = <b>149</b>	<b>292</b> mm²/m						
Mean value of concrete tensile	strength	f <sub>ct.eff</sub> = f <sub>ctm</sub> =	<b>3.0</b> N/mm <sup>2</sup>						
Reinforcement ratio	-	$\rho_{p.eff} = A_{bb.p}$	rov / A <sub>c.eff</sub> = <b>0.0</b>	07					
Modular ratio		$\alpha_{\rm e} = E_{\rm s} / E_{\rm c}$	$\alpha_{\rm e} = E_{\rm s} / E_{\rm cm} = 5.998$						
Bond property coefficient		k <sub>1</sub> = <b>0.8</b>	k <sub>1</sub> = <b>0.8</b>						
Strain distribution coefficient	k <sub>2</sub> = <b>0.5</b>	k <sub>2</sub> = <b>0.5</b>							
		k <sub>3</sub> = <b>3.4</b>							
		k <sub>4</sub> = <b>0.425</b>							
Maximum crack spacing - exp.7	7.11	$s_{r.max} = k_3 \times$	$c_{bb} + k_1 \times k_2 \times k_2$	$k_4 \times \phi_{bb} / \rho_{p.eff} = 6$	<b>59</b> mm				
Maximum crack width - exp.7.8		W <sub>k</sub> = S <sub>r.max</sub> >	× max(σ <sub>s</sub> – k <sub>t</sub> ×	$(f_{ct.eff} / \rho_{p.eff}) \times (1 +$	$\alpha_{e} \times \rho_{p.eff}$ ), 0.	$.6 \times \sigma_s) / E_s$			
		w <sub>k</sub> = 0.105	mm						
		w <sub>k</sub> / w <sub>max</sub> =	0.35						
		PASS	- Maximum c	rack width is less	s than limitin	ng crack width			
Rectangular section in shear	- Section 6.2								
Design shear force		∨ = 57.7 kl	N/m						
		$C_{Rd,c} = 0.18$	3 / γc = <b>0.120</b>						
		k = min(1 +	- √(200 mm / d	), 2) <b>= 1.693</b>					
Longitudinal reinforcement ratio	)	ρι = min(A <sub>b</sub>	<sub>b.prov</sub> / d, 0.02)	= 0.002					
		v <sub>min</sub> = 0.03	$5 \text{ N}^{1/2}/\text{mm}  imes \text{k}^{3/2}$	<sup>2</sup> × f <sub>ck</sub> <sup>0.5</sup> = <b>0.436</b> N	/mm²				
Design shear resistance - exp.6	6.2a & 6.2b	V <sub>Rd.c</sub> = max	$(C_{Rd.c} \times k \times (10))$	00 N <sup>2</sup> /mm <sup>4</sup> $\times$ $\rho_{I} \times$ for	ck) <sup>1/3</sup> , Vmin) $ imes$ d				
		V <sub>Rd.c</sub> = <b>181</b>	<b>.8</b> kN/m						
		$V / V_{Rd.c} = 0$	0.317						
		PAS	S - Design sh	ear resistance ex	xceeds desig	yn shear force			
Secondary transverse reinfor	cement to base	- Section 9.3							
Minteres		A 0.0	$P \times A_{hh prov} = 20$	<b>1</b> mm²/m					
Minimum area of reinforcement	t – cl.9.3.1.1(2)	Abx.req - 0.2							
Maximum area of reinforcement Maximum spacing of reinforcen	t – cl.9.3.1.1(2) nent – cl.9.3.1.1(3	Abx.req = $0.2$ 3) $S_{bx_max} = 45$	50 mm						
Maximum area of reinforcement Maximum spacing of reinforcer Transverse reinforcement provi	: – cl.9.3.1.1(2) nent – cl.9.3.1.1(3 ided	3) s <sub>bx_max</sub> = 45 10 dia.bars	50 mm 5 @ 200 c/c						

elliott <b>wood</b>	Project		Job no.			
Elliott Wood Partnership	1	No. 12 & 13 Prim	2210445			
55 Whitfield Street	Calcs for		Start page no./Revision			
London W1T 4AH	Retaining Wal	ll Temporary Co	13			
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	DBa	01/06/2022	PDu	15/06/2022	WSq	04/07/2022



Reinforcement details

12 & 13 Primrose Hill Studios 2210445 Stage 2 – P1

B Suggested Sequence of Works

## elliottwood

engineering a better **society** 

B Elliott Wood Partnership Ltd



#### Stage 1 - Site Setup and Enabling Work

- Erect hoarding, set up delivery zone and traffic control measures.

- Install monitoring systems.

- Demolish existing courtyard walls and slab. The timber joist ground floor is to be carefully removed to facilitate the construction.

- Existing floor joists planned to be stored, inspected and reinstated instead of sourcing new graded timber.



#### Stage 4 - Form Pynford Beam

- Excavate and install Pynford props within existing wall. A plunge column and needle solution may be preferred by the contractor. - Cast RC beam with props cast within beam ensuring starter bars for the slab are protruding along length.

- Install waling cross prop members to restrain underpins during soil mass excavation by forming shored trenches within soil mass.

#### Stage 2 - Underpin (1st Lift)

- Restrain masonry walls at low level and high level with corners braced. Props are to be preloaded.

- Cast new RC wall underpins in hit / multi-miss sequence within shored excavations. A temporary toe is to be incorporated to match the existing foundation width.

- Underpins are to be propped back to central soil mass to maintain stability. All props are to be preloaded.

- Rebar for permanent case waling beam, incorporated in wall profile, is to be included during the casting of the underpins.



#### Stage 5 - Excavate and Basement Slab

- Ensure restraint props are in place prior to complete soil mass excavation with props at both high and low level.

- Install below ground drainage and heave solution (as required).

- Cast basement slab.

- Low level props can be removed once the basement slab has cured to sufficient strength to transfer the horizontal thrust loads through the slab.



#### Stage 3 - Underpin (2nd Lift)

- Form deeper shored excavations to basement formation level, cutting out temporary toe and install 2nd lift of underpinning. - Cast new RC wall underpins in hit / multi-miss sequence with

basement slab toe.

- Underpins are to be propped back to soil mass again so there is a prop at low and high level.

$\backslash$	,	
	[]77,	//
		/

## Stage 6 - Cast Ground Floor Slab

- Cast ground floor slab.
- superstructure works can proceed.

This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications. Do not scale from this drawing.						Drawing title Basement Co	onstruction Sequence		Elliott Wood Partnership Ltd Central London • Wimbledon • Not
	P1	09/06/22	PDu	WSq	Preliminary	Scale	Date	Drawn	Consulting Structural and Civil Eng (020) 7499 5888 • elliottwood co
	rev	date	by	chk	description	NTS	June 2022	PDu	

- A sump and pump are to be installed to remove water ingress into the excavations. All underpins to be formed in a dry excavation.



- Once up to strength props can be removed and remaining

- Timber floor including floorboards reinstated.

ineering etter <b>society</b>	Project 12/13 Primrose Hill Stuc	lios	
td	Drawing status	Status	Revision
I <b>ottingham</b>	Preliminary	S2	P1
ngineers	Project no. Originator Zone Leve	I Type Rol	e drg no.
.co.uk	2210445 - EWP - ZZ - XX	- SK - S	- 3000