Appendix A Field Work

Appendix A.1 Engineers Logs

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 1

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests

Depth	Type	Result	Hand Pen.
0.20 - 0.20	D		
0.70 - 0.70	D		
1.20 - 1.20	D		500.0
1.70 - 1.70	D		400.0
2.20 - 2.20	D		250.0
2.70 - 2.70	D		250.0
3.20 - 3.20	D		250.0
3.70 - 3.70	D		200.0
4.20 - 4.50	D		325.0
4.70 - 5.00	D		300.0

Strata Details

Elev.	Legend	Depth	Thick	Description
		0.06	0.06	CONCRETE
			0.55	MADE GROUND Dark brown sandy silt with brick gravel and roots
		0.60		
			0.50	MADE GROUND Orange brown and dark brown silty clay with brick, ash, gravel and roots
		1.10		
			2.80	Orange brown stiff silty CLAY with roots occasional fine to medium sub-rounded gravel from 3.40-3.90m bgl
		3.90		
			1.10	Firm orange brown grey mottled silty CLAY
		5.00		End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

Stable

General Remarks:

Roots observed to 2.10m bgl. Well installed to 5.00m bgl

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 2

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests

Depth	Type	Result	Hand Pen.
0.20 - 0.20	D		
0.70 - 0.70	D		
1.00 - 1.00	D		150.0
1.50 - 1.50	D		125.0
2.00 - 2.00	D		175.0
2.50 - 2.50	D		175.0
3.00 - 3.00	D		200.0
3.50 - 3.50	D		225.0
3.70 - 3.70	D		
4.20 - 4.50	D		
4.70 - 5.00	D		

Strata Details

Elev.	Legend	Depth	Thick	Description
		0.04	0.04	CONCRETE
		0.95	0.91	MADE GROUND Dark brown and brown sandy silty / silty clay with brick, concrete, ash and roots
		3.90	2.95	Orange brown and brown grey mottled silty CLAY with occasional dark brown flecks, roots and gravel from 3.60m bgl
		5.00	1.10	Orange brown and grey mottled silty CLAY
				End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

Stable

General Remarks:

Roots observed to 1.50m bgl

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 3

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth (Thick)	Description
0.20 - 0.20	D					0.60 (0.60)	MADE GROUND Dark brown sandy silt with brick, ash and gravel
0.70 - 0.70	D					1.10 (0.50)	Orange brown sandy silty CLAY
1.20 - 1.20	D		150.0				Orange brown and grey mottled occasional dark brown fleck silty CLAY
1.70 - 1.70	D		200.0				
2.20 - 2.20	D		250.0			2.70 (1.60)	
2.70 - 2.70	D		250.0				Firm orange brown and grey mottled silty CLAY with occasional selenite from 4.20m bgl
3.20 - 3.20	D		275.0				
3.70 - 3.70	D		300.0				
4.20 - 4.50	D		350.0			5.00 (2.30)	
4.70 - 5.00	D		300.0				End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

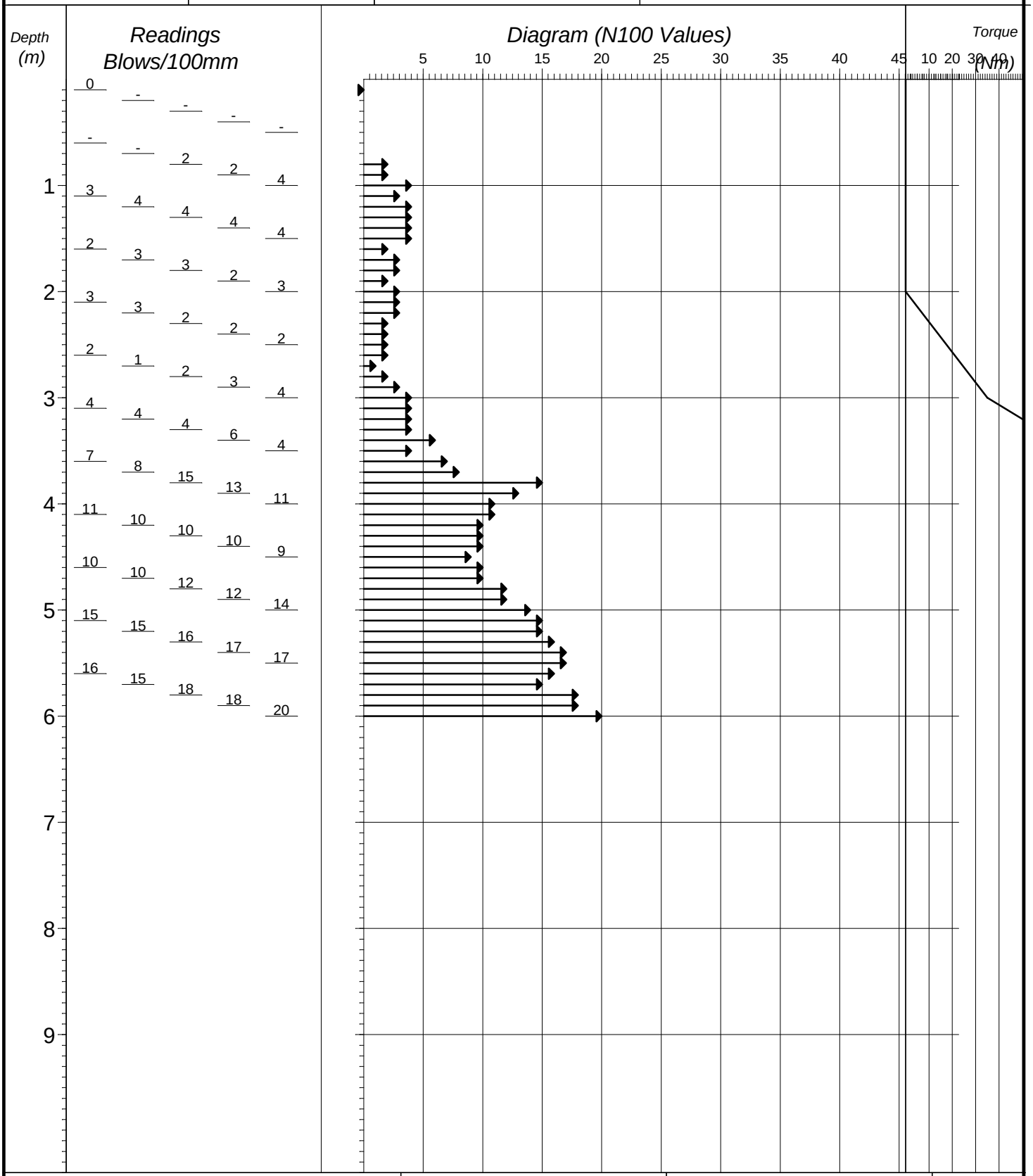
Stable

General Remarks:

No roots observed. Well installed to 5.00m bgl

DYNAMIC PROBING

Probe No	**DP 1**		
Client	**Drawing and Planning Limited**	Sheet 1 of 1	
Site	**Sumatra Road**	*Location No*	**13291**
E -	*N* -	*Level* -	*Date* **01/11/2012**



Fall Height	**750**	*Cone Diameter*	**50**	*Logger*
Hammer Wt	**63.50**	*Final Depth*	**5.900**	**Soils**
Probe Type	**DPSH**	*Log Scale*	1:50	

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

Trial Pit: TP 1

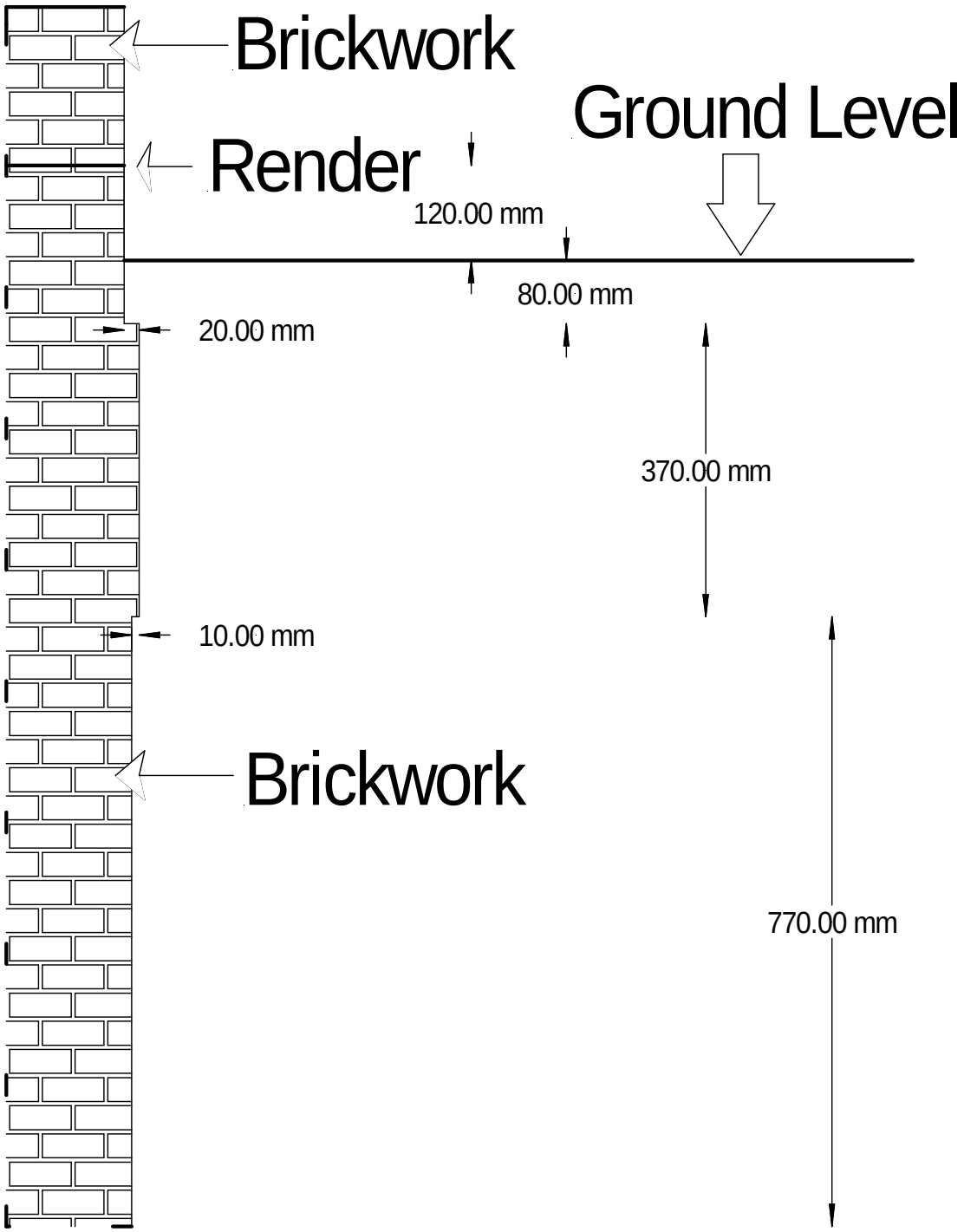
Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant:	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth (Thick)	Description
						0.06 (0.06)	CONCRETE
						0.18 (0.12)	MADE GROUND Brick rubble
						1.04	MADE GROUND Brown to dark brown sandy silty clay with brick, gravel, ash and old drain fragments
1.00 -	D						
						1.22	End of Trial Pit at 1.22 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:	Stability:	General Remarks:
Dry	Stable	No roots observed



Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 3**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Section TP1A	Ref: **J13291**

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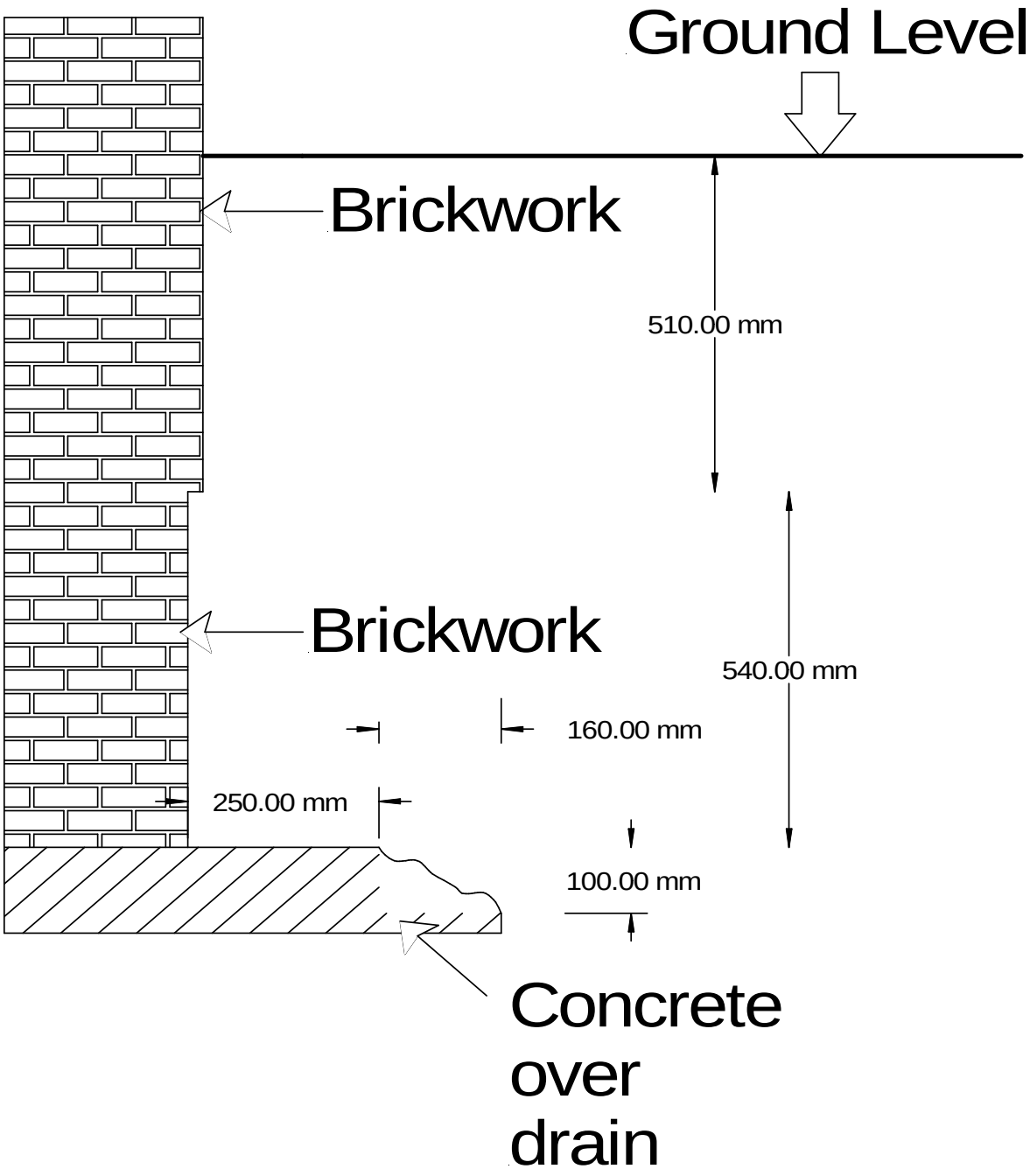

Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 4**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Section TP1B	Ref: **J13291**

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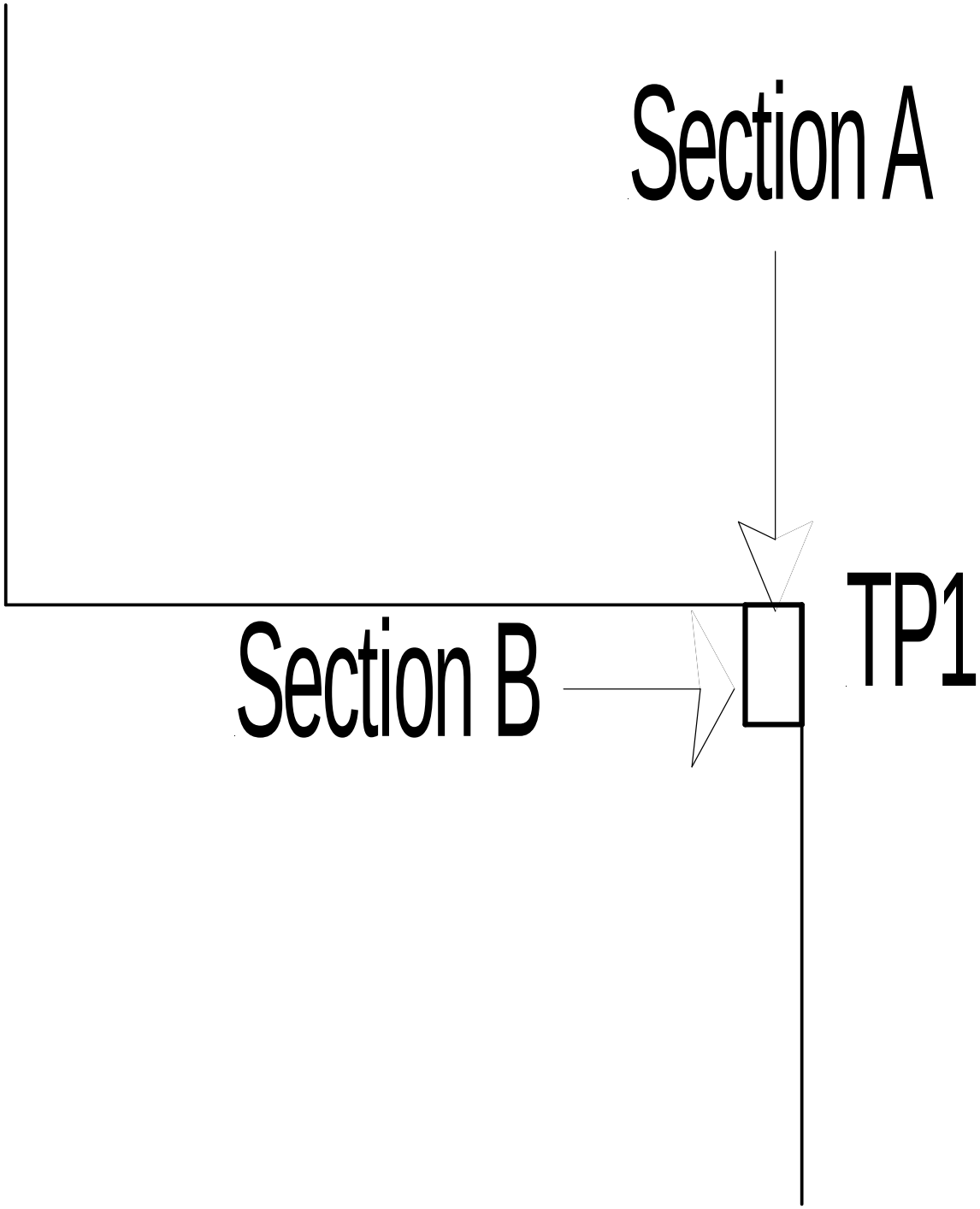

Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 5**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Plan TP1	Ref: **J13291**

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Appendix A.2 Site Walkover

Figure 1. View of the property from 159 Sumatra Road.

Figure 2. Detail of underpinning to the party wall with 159 Sumatra Road.

Figure 3. Detail of the underpinning between 159 Sumatra road and rear wall.

Figure 4. Detail of underpinning to the party wall with 165 Sumatra Road.

Figure 5. Detail of the crack at the corner between 165 and 163 Sumatra Road.

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N Blow Counts	Inferred Cohesive Strength
DP1	LC[1] 1.10 – 6.00 Silty CLAY	3 - >50	Very low to very high (C_u = 15 – >250kPa)

Note: [1] Ground conditions inferred past the base of windowless sampler boreholes.

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
LC	27 - 35	37 - 48	100	37 - 48	CH - CV	Medium to high	Medium to high

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System
The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.
(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

Appendix B.3 Geotechnical In-Situ and Laboratory Results

Project Name:	Sumatra Road			**Samples Received:**	08/11/2012
				Project Started:	09/11/2012
Client:	Soils Ltd			**Testing Started:**	27/11/2012
Project No:	J13291	**Our job/report no:**	13642	**Date Reported:**	28/11/2012

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
WS1	D	2.20	Dark brown and occasional grey CLAY	27	65	24	41	100	CH
WS2	D	2.50	Dark brown and occasional grey CLAY	35	77	29	48	100	CV
WS3	D	1.70	Dark brown CLAY	27	60	23	37	100	CH
WS3	D	2.20	Dark brown CLAY	27	66	27	39	100	CH
WS3	D	2.70	Dark brown and occasional brown and grey CLAY	31	72	27	45	100	CV

UKAS TESTING 2519

Summary of Test Results

BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.

BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.

BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

Checked and Approved

Initials: K.P

Date: 28/11/2012

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

All samples connected with this report ,incl any on 'hold' will be stored and disposed off according to Company policy.Acopy of this policy is available on request.

Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 851105
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 12-11705

Site Reference:	Sumatra Road
Project / Job Ref:	J13291
Order No:	None Supplied
Sample Receipt Date:	09/11/2012
Sample Scheduled Date:	09/11/2012
Report Issue Number:	1
Reporting Date:	15/11/2012

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

Soil Analysis Certificate						
QTS Environmental Report No: 12-11705	**Date Sampled**	01/11/12	01/11/12			
Soils Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Sumatra Road	**TP / BH No**	WS1	WS3			
Project / Job Ref: J13291	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	2.70	3.20			
Reporting Date: 15/11/2012	**QTSE Sample No**	55349	55350			

Determinand	Unit	MDL	Accreditation					
pH	pH Units	N / a	MCERTS	8.1	8.2			
Total Sulphate as SO_4	mg/kg	< 200	NONE	403	508			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	NONE	0.09	0.13			
Total Sulphur	mg/kg	< 200	NONE	< 200	< 200			
Ammonium as NH_4	mg/kg	< 0.5	NONE	1.1	1.3			
W/S Chloride (2:1)	mg/kg	< 10	NONE	13	11			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 4	NONE	< 4	< 4			
W/S Magnesium	mg/kg	< 10	NONE	57	77			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Stone content is classified as material greater than 10mm in diameter
Subcontracted analysis (S)

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 12-11705	
Soils Ltd	
Site Reference: Sumatra Road	
Project / Job Ref: J13291	
Order No: None Supplied	
Reporting Date: 15/11/2012	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
55349	WS1	None Supplied	2.70	19.8	Brown clay
55350	WS3	None Supplied	3.20	16.6	Brown clay

Insufficient sample I/S
Unsuitable Sample U/S

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 12-11705
Soils Ltd
Site Reference: Sumatra Road
Project / Job Ref: J13291
Order No: None Supplied
Reporting Date: 15/11/2012

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	AR	Asbestos Screening	Visual screening of samples for fibrous material	E024
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E021
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by turbidimeter	E020
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E023
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	D	Phosphorus	Determination of phosphorus by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	AR	Sulphide	Determination of sulphide by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia, potassium iodide/iodate followed by ICP-OES	E002
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E009
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E009
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E010
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E009
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	EPH (with florisil cleanup)	Determination of acetone/hexane extractable hydrocarbons with florisil cleanup step by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001

Key

D Dried
AR As Received

Appendix C Software Output

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Active side	Passive side
1	0.00	1 MG	1 MG
2	-1.00	2 vwLCF	2 vwLCF
3	-3.50	3 wLCF	3 wLCF

SOIL PROPERTIES

-- Soil type -- No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	MG	16.00a	2800	0.658	NC	1.000	1.000	15.00u
		19.00b			(0.490)	(2.389)	(2.476)	
2	vwLCF	16.00a	8300	1.316	OC	1.000	1.000	40.00u
		19.00b			(0.490)	(2.389)	(2.476)	
3	wLCF	17.00a	50000	1.251	OC	1.000	1.000	70.00u
		20.00b			(0.490)	(2.389)	(2.476)	
4	Concrete	22.00a	2.10E+7	0.500	OC	1.000	1.000	8500u
		23.00b			(0.490)	(2.389)	(2.476)	

Note: (a) and (b) are Bulk Densities above and below the water table

Additional soil parameters associated with Ka and Kp

		--- parameters for Ka ---			--- parameters for Kp ---		
------- Soil type ------- No.	Description	Soil friction angle	Wall adhesion coeff.	Back-fill angle	Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	MG	0.00	0.500	0.00	0.00	0.667	0.00
2	vwLCF	0.00	0.500	0.00	0.00	0.667	0.00
3	wLCF	0.00	0.500	0.00	0.00	0.667	0.00
4	Concrete	0.00	0.500	0.00	0.00	0.667	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Active side	Passive side
Initial water table elevation	-2.00	-2.00

Automatic water pressure balancing at toe of wall : Yes

Water press. profile no.	Active side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Passive side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	
1	1	-2.00	-2.00	0.0	1	-3.80	-3.80	0.0	MC
2	1	0.00	0.00	0.0	1	-3.80	-3.80	0.0	WC

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -3.80
Maximum finite element length = 0.20 m
Youngs modulus of wall E = 2.1000E+07 kN/m2
Moment of inertia of wall I = 2.2500E-03 m4/m run
E.I = 47250 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/ anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre- stress /strut kN	Tension allowed
1	-0.10	1.00	0.002000	2.000E+08	3.00	0.00	0	No
2	-1.75	1.00	0.002000	2.000E+08	3.00	0.00	0	No
3	-3.50	1.00	0.002000	2.000E+08	3.00	0.00	0	No
4	-3.60	1.00	0.400000	2.100E+07	3.00	0.00	0	Yes
5	-0.15	1.00	0.300000	2.100E+07	3.00	0.00	0	Yes

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- kN/m2 ----- Near edge	Far edge	Equiv. soil type	Partial factor/ Category
1	0.00	0.00(A)	10.00	10.00	0.00	=	N/A	1.00 -
2	0.00	0.00(A)	10.00	10.00	2.00	=	N/A	1.00 -

Note: A = Active side, P = Passive side
Limit State Categories P/U = Permanent Unfavourable
P/F = Permanent Favourable
Var = Variable (unfavourable)

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 0.00
2	Install strut or anchor no.1 at elevation -0.10
3	Apply surcharge no.2 at elevation 0.00
4	Excavate to elevation 0.00 on PASSIVE side Toe of berm at elevation -1.90 Width of top of berm = 0.10 Width of toe of berm = 2.00
5	Install strut or anchor no.2 at elevation -1.75
6	Excavate to elevation -1.90 on PASSIVE side
7	Apply water pressure profile no.1 (Mod. Conserv.)
8	Excavate to elevation -1.90 on PASSIVE side Toe of berm at elevation -3.80 Width of top of berm = 0.10 Width of toe of berm = 2.00
9	Install strut or anchor no.3 at elevation -3.50
10	Excavate to elevation -3.80 on PASSIVE side
11	Install strut or anchor no.4 at elevation -3.60
12	Remove strut or anchor no.3 at elevation -3.50
13	Fill to elevation -3.40 on PASSIVE side with soil type 4
14	Install strut or anchor no.5 at elevation -0.15
15	Remove strut or anchor no.1 at elevation -0.10
16	Remove strut or anchor no.2 at elevation -1.75

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: Serviceability Limit State
All loads and soil strengths are unfactored

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.00

Parameters for undrained strata:
Minimum equivalent fluid density = 5.00 kN/m3
Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 10.00 m

Width of excavation on active side of wall = 1.00 m
Width of excavation on passive side of wall = 3.00 m

Distance to rigid boundary on active side = 3.80 m

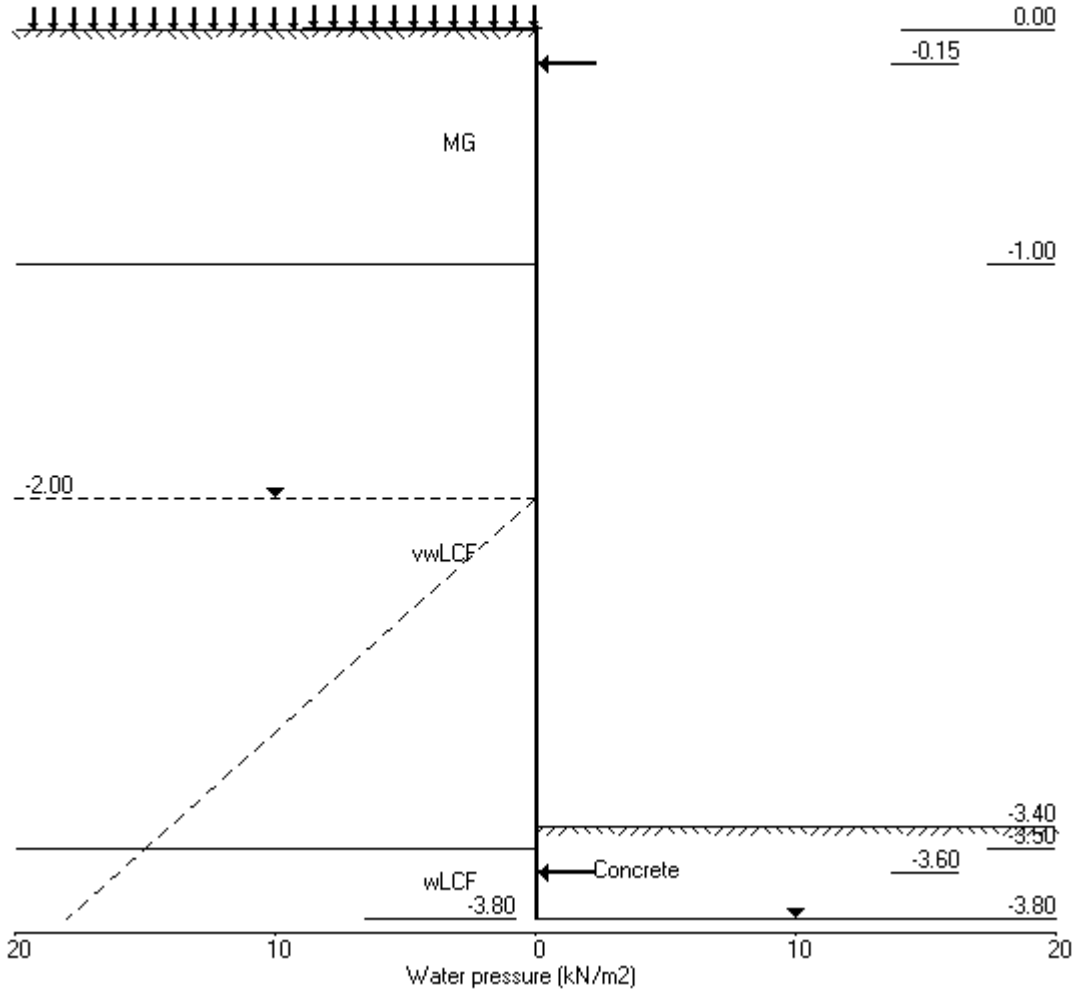
Distance to rigid boundary on passive side = 3.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 0.00	No	No	No
2	Install strut no.1 at elev. -0.10	No	No	No
3	Apply surcharge no.2 at elev. 0.00	No	No	No
4	Excav. to elev. 0.00 on PASSIVE side	No	No	No
5	Install strut no.2 at elev. -1.75	No	No	No
6	Excav. to elev. -1.90 on PASSIVE side	No	No	No
7	Apply water pressure profile no.1	No	No	No
8	Excav. to elev. -1.90 on PASSIVE side	No	No	No
9	Install strut no.3 at elev. -3.50	No	No	No
10	Excav. to elev. -3.80 on PASSIVE side	No	No	No
11	Install strut no.4 at elev. -3.60	No	No	No
12	Remove strut no.3 at elev. -3.50	No	No	No
13	Fill to elev. -3.40 on PASSIVE side	No	No	No
14	Install strut no.5 at elev. -0.15	No	No	No
15	Remove strut no.1 at elev. -0.10	No	No	No
16	Remove strut no.2 at elev. -1.75	No	No	No
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.16 Remove strut no.2 at elev. -1.75



Units: kN,m

Stage No. 1 Apply surcharge no.1 at elevation 0.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.00	-0.000	-1.44E-16	0.0	-0.0	
2	-0.10	0.00	-0.000	-1.44E-16	0.0	0.0	
3	-0.15	0.00	-0.000	-1.44E-16	0.0	0.0	
4	-0.28	0.00	-0.000	-1.44E-16	0.0	0.0	
5	-0.40	0.00	-0.000	-1.45E-16	0.0	0.0	
6	-0.60	0.00	-0.000	-1.45E-16	0.0	0.0	
7	-0.80	0.00	0.000	-1.46E-16	0.0	0.0	
8	-1.00	0.00	0.000	-1.47E-16	0.0	0.0	
9	-1.20	0.00	0.000	-1.48E-16	0.0	0.0	
10	-1.40	0.00	0.000	-1.49E-16	0.0	0.0	
11	-1.58	0.00	0.000	-1.51E-16	0.0	0.0	
12	-1.75	0.00	0.000	-1.52E-16	0.0	0.0	
13	-1.90	0.00	0.000	-1.52E-16	0.0	0.0	
14	-2.00	0.00	0.000	-1.52E-16	0.0	-0.0	
15	-2.20	0.00	0.000	-1.51E-16	0.0	-0.0	
16	-2.40	0.00	0.000	-1.49E-16	0.0	-0.0	
17	-2.60	0.00	0.000	-1.45E-16	0.0	-0.0	
18	-2.80	0.00	0.000	-1.38E-16	0.0	-0.0	
19	-3.00	0.00	0.000	-1.27E-16	0.0	-0.0	
20	-3.20	0.00	0.000	-1.13E-16	0.0	-0.0	
21	-3.40	0.00	0.000	-1.00E-16	0.0	-0.0	
22	-3.50	0.00	0.000	-9.65E-17	0.0	-0.0	
23	-3.60	0.00	0.000	-9.47E-17	0.0	-0.0	
24	-3.80	0.00	0.000	-9.41E-17	0.0	-0.0	

(continued)

Stage No.1 Apply surcharge no.1 at elevation 0.00

Node no.	Y coord	ACTIVE side	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	0.00	37.13	0.00	0.00a	5164
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05		5164
3	-0.15	Total>	2.40	0.75m	39.53	1.58	1.58		5164
4	-0.28	Total>	4.40	1.38m	41.53	2.90	2.90		5164
5	-0.40	Total>	6.40	2.00m	43.53	4.21	4.21		5164
6	-0.60	Total>	9.60	3.00m	46.73	6.32	6.32		5164
7	-0.80	Total>	12.80	4.00m	49.93	8.42	8.42		2110
8	-1.00	Total>	16.00	5.00m	53.13	10.53	10.53		2110
		Total>	16.00	5.00m	115.04	21.06	21.06		6254
9	-1.20	Total>	19.20	6.00m	118.24	25.27	25.27		6254
10	-1.40	Total>	22.40	7.00m	121.44	29.48	29.48		6254
11	-1.58	Total>	25.20	7.88m	124.24	33.16	33.16		6254
12	-1.75	Total>	28.00	8.75m	127.04	36.85	36.85		6254
13	-1.90	Total>	30.40	9.50m	129.44	40.01	40.01		6254
14	-2.00	Total>	32.00	10.00m	131.04	42.11	42.11		6254
15	-2.20	Total>	35.80	11.00m	134.84	46.48	46.48		6254
16	-2.40	Total>	39.60	12.00m	138.64	50.85	50.85		6254
17	-2.60	Total>	43.40	13.00m	142.44	55.22	55.22		6254
18	-2.80	Total>	47.20	14.00m	146.24	59.59	59.59		6254
19	-3.00	Total>	51.00	15.00m	150.04	63.96	63.96		6254
20	-3.20	Total>	54.80	16.00m	153.84	68.32	68.32		6254
21	-3.40	Total>	58.60	17.00m	157.64	72.69	72.69		6254
22	-3.50	Total>	60.50	17.50m	159.54	74.88	74.88		6254
		Total>	60.50	17.50m	233.82	71.92	71.92		37677
23	-3.60	Total>	62.50	18.00m	235.82	74.17	74.17		37677
24	-3.80	Total>	66.50	19.00m	239.82	78.67	78.67		37677

Node no.	Y coord	PASSIVE side	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	0.00	37.13	0.00	0.00a	5616
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05		5616
3	-0.15	Total>	2.40	0.75m	39.53	1.58	1.58		5616
4	-0.28	Total>	4.40	1.38m	41.53	2.90	2.90		5616
5	-0.40	Total>	6.40	2.00m	43.53	4.21	4.21		5616
6	-0.60	Total>	9.60	3.00m	46.73	6.32	6.32		5616
7	-0.80	Total>	12.80	4.00m	49.93	8.42	8.42		2478
8	-1.00	Total>	16.00	5.00m	53.13	10.53	10.53		2478
		Total>	16.00	5.00m	115.04	21.06	21.06		7346
9	-1.20	Total>	19.20	6.00m	118.24	25.27	25.27		7346
10	-1.40	Total>	22.40	7.00m	121.44	29.48	29.48		7346
11	-1.58	Total>	25.20	7.88m	124.24	33.16	33.16		7346
12	-1.75	Total>	28.00	8.75m	127.04	36.85	36.85		7346
13	-1.90	Total>	30.40	9.50m	129.44	40.01	40.01		7346
14	-2.00	Total>	32.00	10.00m	131.04	42.11	42.11		7346
15	-2.20	Total>	35.80	11.00m	134.84	46.48	46.48		7346
16	-2.40	Total>	39.60	12.00m	138.64	50.85	50.85		7346
17	-2.60	Total>	43.40	13.00m	142.44	55.22	55.22		7346
18	-2.80	Total>	47.20	14.00m	146.24	59.59	59.59		7346
19	-3.00	Total>	51.00	15.00m	150.04	63.96	63.96		7346
20	-3.20	Total>	54.80	16.00m	153.84	68.32	68.32		7346
21	-3.40	Total>	58.60	17.00m	157.64	72.69	72.69		7346

(continued)

Stage No.1 Apply surcharge no.1 at elevation 0.00

Node no.	Y coord	PASSIVE side						
		Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	60.50	17.50m	159.54	74.88	74.88	7346
		Total>	60.50	17.50m	233.82	71.92	71.92	44251
23	-3.60	Total>	62.50	18.00m	235.82	74.17	74.17	44251
24	-3.80	Total>	66.50	19.00m	239.82	78.67	78.67	44251

Note: 0.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 3 Apply surcharge no.2 at elevation 0.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
3	0.00	0.00	-0.10	112.125	n/a	-0.18	0.18

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.95	0.000	-5.86E-05	0.0	-0.0	
2	-0.10	1.93	0.000	-5.86E-05	0.2	0.0	2.5
		1.93	0.000	-5.86E-05	-2.3	0.0	
3	-0.15	1.92	0.000	-5.85E-05	-2.2	-0.1	
4	-0.28	1.89	0.000	-5.79E-05	-1.9	-0.4	
5	-0.40	1.86	0.000	-5.67E-05	-1.7	-0.6	
6	-0.60	1.81	0.000	-5.35E-05	-1.3	-0.9	
7	-0.80	1.77	0.000	-4.93E-05	-1.0	-1.1	
8	-1.00	1.73	0.000	-4.42E-05	-0.6	-1.3	
		1.14	0.000	-4.42E-05	-0.6	-1.3	
9	-1.20	1.04	0.000	-3.85E-05	-0.4	-1.4	
10	-1.40	0.95	0.000	-3.25E-05	-0.2	-1.5	
11	-1.58	0.88	0.000	-2.71E-05	-0.1	-1.5	
12	-1.75	0.83	0.000	-2.17E-05	0.1	-1.5	
13	-1.90	0.78	0.000	-1.70E-05	0.2	-1.4	
14	-2.00	0.76	0.000	-1.40E-05	0.3	-1.4	
15	-2.20	0.72	0.000	-8.20E-06	0.4	-1.3	
16	-2.40	0.69	0.000	-2.72E-06	0.6	-1.2	
17	-2.60	0.68	0.000	2.26E-06	0.7	-1.1	
18	-2.80	0.67	0.000	6.64E-06	0.9	-1.0	
19	-3.00	0.67	0.000	1.03E-05	1.0	-0.8	
20	-3.20	0.67	0.000	1.31E-05	1.1	-0.6	
21	-3.40	0.68	0.000	1.49E-05	1.3	-0.3	
22	-3.50	0.69	0.000	1.55E-05	1.3	-0.2	
		-4.57	0.000	1.55E-05	1.3	-0.2	
23	-3.60	-4.47	0.000	1.58E-05	0.9	-0.1	
24	-3.80	-4.27	0.000	1.60E-05	0.0	0.0	

At elev.-0.10 Strut force = 2.5 kN/strut = 2.5 kN/m run

(continued)

Stage No.3 Apply surcharge no.2 at elevation 0.00

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	2.00	0.00	39.13	1.98	1.98	1738
2	-0.10	Total>	3.60	0.50m	40.73	3.02	3.02	1738
3	-0.15	Total>	4.40	0.75m	41.53	3.54	3.54	1738
4	-0.28	Total>	6.40	1.38m	43.53	4.84	4.84	1738
5	-0.40	Total>	8.40	2.00m	45.53	6.15	6.15	1738
6	-0.60	Total>	11.60	3.00m	48.73	8.23	8.23	1738
7	-0.80	Total>	14.80	4.00m	51.93	10.32	10.32	1738
8	-1.00	Total>	17.99	5.00m	55.13	12.41	12.41	1738
		Total>	17.99	5.00m	117.03	22.63	22.63	5153
9	-1.20	Total>	21.19	6.00m	120.23	26.79	26.79	5153
10	-1.40	Total>	24.38	7.00m	123.42	30.96	30.96	5153
11	-1.58	Total>	27.17	7.88m	126.21	34.61	34.61	5153
12	-1.75	Total>	29.97	8.75m	129.01	38.27	38.27	5153
13	-1.90	Total>	32.36	9.50m	131.40	41.40	41.40	5153
14	-2.00	Total>	33.95	10.00m	132.99	43.49	43.49	5153
15	-2.20	Total>	37.74	11.00m	136.78	47.84	47.84	5153
16	-2.40	Total>	41.52	12.00m	140.56	52.18	52.18	5153
17	-2.60	Total>	45.30	13.00m	144.34	56.54	56.54	5153
18	-2.80	Total>	49.08	14.00m	148.12	60.89	60.89	5153
19	-3.00	Total>	52.86	15.00m	151.90	65.25	65.25	5153
20	-3.20	Total>	56.64	16.00m	155.68	69.61	69.61	5153
21	-3.40	Total>	60.42	17.00m	159.46	73.97	73.97	5153
22	-3.50	Total>	62.31	17.50m	161.35	76.15	76.15	5153
		Total>	62.31	17.50m	235.63	70.86	70.86	31042
23	-3.60	Total>	64.29	18.00m	237.61	73.15	73.15	31042
24	-3.80	Total>	68.27	19.00m	241.59	77.72	77.72	31042

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	0.03	0.03	2179
2	-0.10	Total>	1.60	0.50m	38.73	1.09	1.09	2179
3	-0.15	Total>	2.40	0.75m	39.53	1.63	1.63	2179
4	-0.28	Total>	4.40	1.38m	41.53	2.96	2.96	2179
5	-0.40	Total>	6.40	2.00m	43.53	4.29	4.29	2179
6	-0.60	Total>	9.60	3.00m	46.73	6.42	6.42	2179
7	-0.80	Total>	12.80	4.00m	49.93	8.55	8.55	2179
8	-1.00	Total>	16.00	5.00m	53.13	10.67	10.67	2179
		Total>	16.00	5.00m	115.04	21.49	21.49	6460
9	-1.20	Total>	19.20	6.00m	118.24	25.75	25.75	6460
10	-1.40	Total>	22.40	7.00m	121.44	30.01	30.01	6460
11	-1.58	Total>	25.20	7.88m	124.24	33.73	33.73	6460
12	-1.75	Total>	28.00	8.75m	127.04	37.44	37.44	6460
13	-1.90	Total>	30.40	9.50m	129.44	40.62	40.62	6460
14	-2.00	Total>	32.00	10.00m	131.04	42.73	42.73	6460
15	-2.20	Total>	35.80	11.00m	134.84	47.12	47.12	6460
16	-2.40	Total>	39.60	12.00m	138.64	51.49	51.49	6460
17	-2.60	Total>	43.40	13.00m	142.44	55.86	55.86	6460
18	-2.80	Total>	47.20	14.00m	146.24	60.22	60.22	6460
19	-3.00	Total>	51.00	15.00m	150.04	64.58	64.58	6460
20	-3.20	Total>	54.80	16.00m	153.84	68.93	68.93	6460
21	-3.40	Total>	58.60	17.00m	157.64	73.29	73.29	6460

(continued)

Stage No.3 Apply surcharge no.2 at elevation 0.00

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	60.50	17.50m	159.54	75.46	75.46	6460
		Total>	60.50	17.50m	233.82	75.42	75.42	38917
23	-3.60	Total>	62.50	18.00m	235.82	77.61	77.61	38917
24	-3.80	Total>	66.50	19.00m	239.82	81.99	81.99	38917

Units: kN,m

Stage No. 4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
4	0.00	0.00	-0.10	13.188	n/a	-0.23	0.23

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.95	0.000	-5.88E-05	0.0	-0.0	
2	-0.10	1.93	0.000	-5.88E-05	0.2	0.0	2.5
		1.93	0.000	-5.88E-05	-2.3	0.0	
3	-0.15	1.92	0.000	-5.88E-05	-2.2	-0.1	
4	-0.28	1.89	0.000	-5.82E-05	-1.9	-0.4	
5	-0.40	1.86	0.000	-5.69E-05	-1.7	-0.6	
6	-0.60	1.81	0.000	-5.38E-05	-1.3	-0.9	
7	-0.80	1.77	0.000	-4.95E-05	-1.0	-1.1	
8	-1.00	1.73	0.000	-4.44E-05	-0.6	-1.3	
		1.14	0.000	-4.44E-05	-0.6	-1.3	
9	-1.20	1.04	0.000	-3.87E-05	-0.4	-1.4	
10	-1.40	0.95	0.000	-3.27E-05	-0.2	-1.5	
11	-1.58	0.88	0.000	-2.72E-05	-0.1	-1.5	
12	-1.75	0.82	0.000	-2.17E-05	0.1	-1.5	
13	-1.90	1.02	0.000	-1.71E-05	0.2	-1.5	
		0.78	0.000	-1.71E-05	0.2	-1.5	
14	-2.00	0.76	0.000	-1.40E-05	0.3	-1.4	
15	-2.20	0.72	0.000	-8.17E-06	0.4	-1.4	
16	-2.40	0.69	0.000	-2.65E-06	0.6	-1.3	
17	-2.60	0.67	0.000	2.35E-06	0.7	-1.1	
18	-2.80	0.66	0.000	6.75E-06	0.9	-1.0	
19	-3.00	0.66	0.000	1.04E-05	1.0	-0.8	
20	-3.20	0.67	0.000	1.32E-05	1.1	-0.6	
21	-3.40	0.68	0.000	1.51E-05	1.3	-0.3	
22	-3.50	0.69	0.000	1.56E-05	1.3	-0.2	
		-4.58	0.000	1.56E-05	1.3	-0.2	
23	-3.60	-4.48	0.000	1.59E-05	0.9	-0.1	

(continued)

Stage No.4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
24	-3.80	-4.28	0.000	1.61E-05	0.0	0.0	
At elev.-0.10 Strut force =				2.5 kN/strut =		2.5 kN/m run	

ACTIVE side

Node no.	Y coord		Water press. kN/m2	Vertic -al kN/m2	Effective stresses Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>		2.00	0.00	39.13	1.98	1.98	1746
2	-0.10	Total>		3.60	0.50m	40.73	3.02	3.02	1746
3	-0.15	Total>		4.40	0.75m	41.53	3.54	3.54	1746
4	-0.28	Total>		6.40	1.38m	43.53	4.84	4.84	1746
5	-0.40	Total>		8.40	2.00m	45.53	6.15	6.15	1746
6	-0.60	Total>		11.60	3.00m	48.73	8.23	8.23	1746
7	-0.80	Total>		14.80	4.00m	51.93	10.32	10.32	1746
8	-1.00	Total>		17.99	5.00m	55.13	12.40	12.40	1746
		Total>		17.99	5.00m	117.03	22.63	22.63	5176
9	-1.20	Total>		21.19	6.00m	120.23	26.79	26.79	5176
10	-1.40	Total>		24.38	7.00m	123.42	30.96	30.96	5176
11	-1.58	Total>		27.17	7.88m	126.21	34.61	34.61	5176
12	-1.75	Total>		29.97	8.75m	129.01	38.26	38.26	5176
13	-1.90	Total>		32.36	9.50m	131.40	41.40	41.40	5176
14	-2.00	Total>		33.95	10.00m	132.99	43.49	43.49	5176
15	-2.20	Total>		37.74	11.00m	136.78	47.83	47.83	5176
16	-2.40	Total>		41.52	12.00m	140.56	52.18	52.18	5176
17	-2.60	Total>		45.30	13.00m	144.34	56.53	56.53	5176
18	-2.80	Total>		49.08	14.00m	148.12	60.89	60.89	5176
19	-3.00	Total>		52.86	15.00m	151.90	65.25	65.25	5176
20	-3.20	Total>		56.64	16.00m	155.68	69.61	69.61	5176
21	-3.40	Total>		60.42	17.00m	159.46	73.97	73.97	5176
22	-3.50	Total>		62.31	17.50m	161.35	76.15	76.15	5176
		Total>		62.31	17.50m	235.63	70.85	70.85	31179
23	-3.60	Total>		64.29	18.00m	237.61	73.14	73.14	31179
24	-3.80	Total>		68.27	19.00m	241.59	77.72	77.72	31179

PASSIVE side

Node no.	Y coord		Water press. kN/m2	Vertic -al kN/m2	Effective stresses Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>		0.00	0.00	29.37b	0.03	0.03	2183
2	-0.10	Total>		1.60	0.50m	30.63b	1.09	1.09	2183
		Total>		1.60	0.50m	14.85b	1.09	1.09	2183
3	-0.15	Total>		2.40	0.75m	15.15b	1.63	1.63	2183
		Total>		2.40	0.75m	14.63b	1.63	1.63	2183
4	-0.28	Total>		4.40	1.38m	15.37b	2.96	2.96	2183
		Total>		4.40	1.38m	14.65b	2.96	2.96	2183
5	-0.40	Total>		6.40	2.00m	15.35b	4.29	4.29	2183
		Total>		6.40	2.00m	14.47b	4.29	4.29	2183
6	-0.60	Total>		9.60	3.00m	15.53b	6.42	6.42	2183
		Total>		9.60	3.00m	14.50b	6.42	6.42	2183
7	-0.80	Total>		12.80	4.00m	15.50b	8.55	8.55	2183
		Total>		12.80	4.00m	14.53b	8.55	8.55	2183

(continued)

Stage No.4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total	Coeff. of
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
8	-1.00	Total>	16.00	5.00m	15.47b	10.67	10.67	2183
		Total>	16.00	5.00m	115.04	21.49	21.49	6471
9	-1.20	Total>	19.20	6.00m	118.24	25.75	25.75	6471
		Total>	19.20	6.00m	99.51b	25.75	25.75	6471
10	-1.40	Total>	22.40	7.00m	102.21b	30.01	30.01	6471
		Total>	22.40	7.00m	39.54b	30.01	30.01	6471
11	-1.58	Total>	25.20	7.88m	40.46b	33.73	33.73	6471
		Total>	25.20	7.88m	39.55b	33.73	33.73	6471
12	-1.75	Total>	28.00	8.75m	40.45b	37.44	37.44	6471
		Total>	28.00	8.75m	39.63b	37.44	37.44	6471
13	-1.90	Total>	30.40	9.50m	40.37b	40.37	40.37p	6471
		Total>	30.40	9.50m	99.23b	40.62	40.62	6471
14	-2.00	Total>	32.00	10.00m	100.45b	42.73	42.73	6471
		Total>	32.00	10.00m	100.85b	42.73	42.73	6471
15	-2.20	Total>	35.80	11.00m	104.23b	47.12	47.12	6471
		Total>	35.80	11.00m	104.64b	47.12	47.12	6471
16	-2.40	Total>	39.60	12.00m	108.04b	51.49	51.49	6471
		Total>	39.60	12.00m	108.44b	51.49	51.49	6471
17	-2.60	Total>	43.40	13.00m	111.84b	55.86	55.86	6471
		Total>	43.40	13.00m	112.24b	55.86	55.86	6471
18	-2.80	Total>	47.20	14.00m	115.64b	60.23	60.23	6471
		Total>	47.20	14.00m	146.24	60.23	60.23	6471
19	-3.00	Total>	51.00	15.00m	150.04	64.58	64.58	6471
20	-3.20	Total>	54.80	16.00m	153.84	68.94	68.94	6471
21	-3.40	Total>	58.60	17.00m	157.64	73.29	73.29	6471
22	-3.50	Total>	60.50	17.50m	159.54	75.46	75.46	6471
		Total>	60.50	17.50m	233.82	75.43	75.43	38980
23	-3.60	Total>	62.50	18.00m	235.82	77.62	77.62	38980
24	-3.80	Total>	66.50	19.00m	239.82	82.00	82.00	38980

Note: 12.34a Soil pressure at active limit
40.37p Soil pressure at passive limit
107.64b Passive limit reduced because of berm

Units: kN,m

Stage No. 6 Excavate to elevation -1.90 on PASSIVE side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
6	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.33	0.000	-2.79E-04	0.0	-0.0	
2	-0.10	2.98	0.000	-2.79E-04	0.3	0.0	5.1
		2.98	0.000	-2.79E-04	-4.8	0.0	
3	-0.15	3.48	0.000	-2.79E-04	-4.6	-0.2	
4	-0.28	4.73	0.000	-2.78E-04	-4.1	-0.8	
5	-0.40	5.98	0.000	-2.75E-04	-3.4	-1.2	
6	-0.60	7.97	0.000	-2.69E-04	-2.0	-1.8	
7	-0.80	9.97	0.000	-2.61E-04	-0.3	-2.0	
8	-1.00	11.97	0.000	-2.53E-04	1.9	-1.9	
		21.34	0.000	-2.53E-04	1.9	-1.9	
9	-1.20	25.26	0.000	-2.46E-04	6.6	-1.0	
10	-1.40	29.17	0.000	-2.46E-04	12.0	0.8	
11	-1.58	32.59	0.000	-2.54E-04	17.4	3.4	
12	-1.75	36.00	0.000	-2.73E-04	23.5	7.0	50.3
		36.00	0.000	-2.73E-04	-26.9	7.0	
13	-1.90	38.90	0.001	-2.89E-04	-21.3	3.4	
		24.52	0.001	-2.89E-04	-21.3	3.4	
14	-2.00	24.13	0.001	-2.94E-04	-18.8	1.4	
15	-2.20	23.34	0.001	-2.93E-04	-14.1	-1.9	
16	-2.40	22.53	0.001	-2.80E-04	-9.5	-4.3	
17	-2.60	21.71	0.001	-2.59E-04	-5.1	-5.7	
18	-2.80	20.89	0.001	-2.33E-04	-0.8	-6.3	
19	-3.00	20.06	0.001	-2.07E-04	3.3	-6.0	
20	-3.20	19.23	0.001	-1.84E-04	7.2	-5.0	
21	-3.40	18.38	0.001	-1.67E-04	11.0	-3.2	
22	-3.50	17.94	0.001	-1.61E-04	12.8	-2.0	
		-40.39	0.001	-1.61E-04	12.8	-2.0	
23	-3.60	-41.90	0.001	-1.58E-04	8.7	-0.9	
24	-3.80	-44.92	0.001	-1.56E-04	0.0	0.0	

At elev.-0.10 Strut force = 5.1 kN/strut = 5.1 kN/m run
At elev.-1.75 Strut force = 50.3 kN/strut = 50.3 kN/m run

(continued)

Stage No.6 Excavate to elevation -1.90 on PASSIVE side

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	Total>	2.00	0.00	39.13	2.33	2.33	126494
2	-0.10	Total>	3.60	0.50m	40.73	2.98	2.98	2024
3	-0.15	Total>	4.40	0.75m	41.53	3.48	3.48	2024
4	-0.28	Total>	6.40	1.38m	43.53	4.73	4.73	2024
5	-0.40	Total>	8.40	2.00m	45.53	5.98	5.98	2024
6	-0.60	Total>	11.60	3.00m	48.73	7.97	7.97	2024
7	-0.80	Total>	14.80	4.00m	51.93	9.97	9.97	2024
8	-1.00	Total>	17.99	5.00m	55.13	11.97	11.97	2024
		Total>	17.99	5.00m	117.03	21.34	21.34	6000
9	-1.20	Total>	21.19	6.00m	120.23	25.26	25.26	6000
10	-1.40	Total>	24.38	7.00m	123.42	29.17	29.17	6000
11	-1.58	Total>	27.17	7.88m	126.21	32.59	32.59	6000
12	-1.75	Total>	29.97	8.75m	129.01	36.00	36.00	6000
13	-1.90	Total>	32.36	9.50m	131.40	38.90	38.90	6000
14	-2.00	Total>	33.95	10.00m	132.99	40.82	40.82	6000
15	-2.20	Total>	37.74	11.00m	136.78	44.83	44.83	6000
16	-2.40	Total>	41.52	12.00m	140.56	48.83	48.83	6000
17	-2.60	Total>	45.30	13.00m	144.34	52.86	52.86	6000
18	-2.80	Total>	49.08	14.00m	148.12	56.91	56.91	6000
19	-3.00	Total>	52.86	15.00m	151.90	61.00	61.00	6000
20	-3.20	Total>	56.64	16.00m	155.68	65.11	65.11	6000
21	-3.40	Total>	60.42	17.00m	159.46	69.24	69.24	6000
22	-3.50	Total>	62.31	17.50m	161.35	71.31	71.31	6000
		Total>	62.31	17.50m	235.63	41.73	41.73	36145
23	-3.60	Total>	64.29	18.00m	237.61	43.39	43.39	36145
24	-3.80	Total>	68.27	19.00m	241.59	46.71	46.71	36145

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	99.04	14.38	14.38	7111
14	-2.00	Total>	1.60	0.50m	100.64	16.69	16.69	7111
15	-2.20	Total>	5.41	1.50m	104.45	21.49	21.49	7111
16	-2.40	Total>	9.26	2.50m	108.30	26.31	26.31	7111
17	-2.60	Total>	13.15	3.50m	112.19	31.15	31.15	7111
18	-2.80	Total>	17.11	4.50m	116.15	36.03	36.03	7111
19	-3.00	Total>	21.15	5.50m	120.19	40.94	40.94	7111
20	-3.20	Total>	25.25	6.50m	124.29	45.88	45.88	7111
21	-3.40	Total>	29.43	7.50m	128.47	50.86	50.86	7111

(continued)

Stage No.6 Excavate to elevation -1.90 on PASSIVE side

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
22	-3.50	Total>	31.55	8.00m	130.59	53.37	53.37	7111
		Total>	31.55	8.00m	204.87	82.12	82.12	42836
23	-3.60	Total>	33.78	8.50m	207.10	85.29	85.29	42836
24	-3.80	Total>	38.28	9.50m	211.60	91.63	91.63	42836

Units: kN,m

Stage No. 7 Apply water pressure profile no.1 (Mod. Conserv.)

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
7	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.36	0.000	-2.85E-04	0.0	-0.0	
2	-0.10	3.00	0.000	-2.85E-04	0.3	0.0	4.3
		3.00	0.000	-2.85E-04	-4.0	0.0	
3	-0.15	3.50	0.000	-2.85E-04	-3.8	-0.2	
4	-0.28	4.75	0.000	-2.84E-04	-3.3	-0.6	
5	-0.40	5.99	0.000	-2.82E-04	-2.6	-1.0	
6	-0.60	7.98	0.000	-2.77E-04	-1.2	-1.4	
7	-0.80	9.98	0.000	-2.71E-04	0.6	-1.5	
8	-1.00	11.97	0.000	-2.65E-04	2.8	-1.1	
		21.34	0.000	-2.65E-04	2.8	-1.1	
9	-1.20	25.23	0.000	-2.62E-04	7.4	-0.1	
10	-1.40	29.12	0.000	-2.66E-04	12.8	1.9	
11	-1.58	32.51	0.000	-2.78E-04	18.2	4.6	
12	-1.75	35.88	0.000	-3.02E-04	24.2	8.3	52.5
		35.88	0.000	-3.02E-04	-28.3	8.3	
13	-1.90	38.74	0.001	-3.22E-04	-22.7	4.5	
		24.19	0.001	-3.22E-04	-22.7	4.5	
14	-2.00	23.75	0.001	-3.29E-04	-20.3	2.3	
15	-2.20	23.49	0.001	-3.32E-04	-15.6	-1.3	
16	-2.40	23.21	0.001	-3.21E-04	-10.9	-3.9	
17	-2.60	22.92	0.001	-3.01E-04	-6.3	-5.6	
18	-2.80	22.62	0.001	-2.75E-04	-1.7	-6.4	
19	-3.00	22.32	0.001	-2.49E-04	2.8	-6.3	
20	-3.20	22.01	0.001	-2.24E-04	7.2	-5.3	
21	-3.40	21.69	0.001	-2.06E-04	11.6	-3.4	
22	-3.50	21.52	0.001	-2.00E-04	13.7	-2.1	
		-43.49	0.001	-2.00E-04	13.7	-2.1	
23	-3.60	-45.04	0.001	-1.97E-04	9.3	-1.0	
24	-3.80	-48.13	0.001	-1.95E-04	0.0	0.0	

At elev.-0.10 Strut force = 4.3 kN/strut = 4.3 kN/m run
At elev.-1.75 Strut force = 52.5 kN/strut = 52.5 kN/m run

(continued)

Stage No.7 Apply water pressure profile no.1 (Mod. Conserv.)

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	Total>	2.00	0.00	39.13	2.36	2.36	3970
2	-0.10	Total>	3.60	0.50m	40.73	3.00	3.00	3970
3	-0.15	Total>	4.40	0.75m	41.53	3.50	3.50	3970
4	-0.28	Total>	6.40	1.38m	43.53	4.75	4.75	3970
5	-0.40	Total>	8.40	2.00m	45.53	5.99	5.99	3970
6	-0.60	Total>	11.60	3.00m	48.73	7.98	7.98	3970
7	-0.80	Total>	14.80	4.00m	51.93	9.98	9.98	3970
8	-1.00	Total>	17.99	5.00m	55.13	11.97	11.97	2467
		Total>	17.99	5.00m	117.03	21.34	21.34	7312
9	-1.20	Total>	21.19	6.00m	120.23	25.23	25.23	7312
10	-1.40	Total>	24.38	7.00m	123.42	29.12	29.12	7312
11	-1.58	Total>	27.17	7.88m	126.21	32.51	32.51	7312
12	-1.75	Total>	29.97	8.75m	129.01	35.88	35.88	7312
13	-1.90	Total>	32.36	9.50m	131.40	38.74	38.74	7312
14	-2.00	Total>	33.95	10.00m	132.99	40.64	40.64	7312
15	-2.20	Total>	37.74	11.00m	136.78	44.59	44.59	7312
16	-2.40	Total>	41.52	12.00m	140.56	48.54	48.54	7312
17	-2.60	Total>	45.30	13.00m	144.34	52.51	52.51	7312
18	-2.80	Total>	49.08	14.00m	148.12	56.50	56.50	7312
19	-3.00	Total>	52.86	15.00m	151.90	60.52	60.52	7312
20	-3.20	Total>	56.64	16.00m	155.68	64.57	64.57	7312
21	-3.40	Total>	60.42	17.00m	159.46	68.65	68.65	7312
22	-3.50	Total>	62.31	17.50m	161.35	70.69	70.69	7312
		Total>	62.31	17.50m	235.63	38.00	38.00	44048
23	-3.60	Total>	64.29	18.00m	237.61	39.48	39.48	44048
24	-3.80	Total>	68.27	19.00m	241.59	42.47	42.47	44048

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	99.04	14.55	14.55	8376
14	-2.00	Total>	1.60	0.50m	100.64	16.89	16.89	8376
15	-2.20	Total>	4.81	1.50m	103.85	21.10	21.10	8376
16	-2.40	Total>	8.06	2.50m	107.10	25.33	25.33	8376
17	-2.60	Total>	11.35	3.50m	110.39	29.59	29.59	8376
18	-2.80	Total>	14.71	4.50m	113.75	33.88	33.88	8376
19	-3.00	Total>	18.15	5.50m	117.19	38.20	38.20	8376
20	-3.20	Total>	21.65	6.50m	120.69	42.56	42.56	8376
21	-3.40	Total>	25.23	7.50m	124.27	46.96	46.96	8376

(continued)

Stage No.7 Apply water pressure profile no.1 (Mod. Conserv.)

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
22	-3.50	Total>	27.05	8.00m	126.09	49.17	49.17	8376
		Total>	27.05	8.00m	200.37	81.49	81.49	50456
23	-3.60	Total>	28.98	8.50m	202.30	84.52	84.52	50456
24	-3.80	Total>	32.88	9.50m	206.20	90.60	90.60	50456

Units: kN,m

Stage No. 8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
8	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.36	0.000	-2.87E-04	0.0	-0.0	
2	-0.10	3.01	0.000	-2.87E-04	0.3	0.0	3.9
		3.01	0.000	-2.87E-04	-3.6	0.0	
3	-0.15	3.51	0.000	-2.87E-04	-3.5	-0.2	
4	-0.28	4.75	0.000	-2.86E-04	-3.0	-0.6	
5	-0.40	6.00	0.000	-2.84E-04	-2.3	-0.9	
6	-0.60	7.99	0.000	-2.79E-04	-0.9	-1.2	
7	-0.80	9.98	0.000	-2.74E-04	0.9	-1.2	
8	-1.00	11.97	0.000	-2.70E-04	3.1	-0.8	
		21.34	0.000	-2.70E-04	3.1	-0.8	
9	-1.20	25.22	0.000	-2.69E-04	7.8	0.2	
10	-1.40	29.10	0.000	-2.74E-04	13.2	2.3	
11	-1.58	32.48	0.000	-2.88E-04	18.6	5.1	
12	-1.75	35.84	0.000	-3.14E-04	24.6	8.9	53.2
		35.84	0.000	-3.14E-04	-28.7	8.9	
13	-1.90	38.69	0.001	-3.36E-04	-23.1	5.0	
		24.07	0.001	-3.36E-04	-23.1	5.0	
14	-2.00	23.61	0.001	-3.44E-04	-20.7	2.8	
15	-2.20	23.30	0.001	-3.48E-04	-16.0	-0.9	
16	-2.40	22.97	0.001	-3.38E-04	-11.4	-3.6	
17	-2.60	22.61	0.001	-3.19E-04	-6.8	-5.4	
18	-2.80	22.26	0.001	-2.94E-04	-2.3	-6.3	
19	-3.00	21.89	0.001	-2.68E-04	2.1	-6.3	
20	-3.20	23.76	0.001	-2.43E-04	6.6	-5.5	
		24.93	0.001	-2.43E-04	6.6	-5.5	
21	-3.40	27.81	0.001	-2.23E-04	11.9	-3.6	
		28.68	0.001	-2.23E-04	11.9	-3.6	

(continued)

Stage No.8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
22	-3.50	30.14	0.001	-2.17E-04	14.9	-2.3	
		-46.94	0.001	-2.17E-04	14.9	-2.3	
23	-3.60	-48.66	0.001	-2.14E-04	10.1	-1.0	
24	-3.80	-52.08	0.001	-2.11E-04	0.0	0.0	

At elev.-0.10 Strut force = 3.9 kN/strut = 3.9 kN/m run
At elev.-1.75 Strut force = 53.2 kN/strut = 53.2 kN/m run

Node no.	Y coord	ACTIVE side					
		Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	Total>	2.00	0.00	39.13	2.36	2.36	3365
2	-0.10	Total>	3.60	0.50m	40.73	3.01	3.01	3365
3	-0.15	Total>	4.40	0.75m	41.53	3.51	3.51	3365
4	-0.28	Total>	6.40	1.38m	43.53	4.75	4.75	3365
5	-0.40	Total>	8.40	2.00m	45.53	6.00	6.00	3365
6	-0.60	Total>	11.60	3.00m	48.73	7.99	7.99	3365
7	-0.80	Total>	14.80	4.00m	51.93	9.98	9.98	3365
8	-1.00	Total>	17.99	5.00m	55.13	11.97	11.97	3365
		Total>	17.99	5.00m	117.03	21.34	21.34	9974
9	-1.20	Total>	21.19	6.00m	120.23	25.22	25.22	7547
10	-1.40	Total>	24.38	7.00m	123.42	29.10	29.10	7547
11	-1.58	Total>	27.17	7.88m	126.21	32.48	32.48	7547
12	-1.75	Total>	29.97	8.75m	129.01	35.84	35.84	7547
13	-1.90	Total>	32.36	9.50m	131.40	38.69	38.69	7547
14	-2.00	Total>	33.95	10.00m	132.99	40.58	40.58	7547
15	-2.20	Total>	37.74	11.00m	136.78	44.50	44.50	7547
16	-2.40	Total>	41.52	12.00m	140.56	48.43	48.43	7547
17	-2.60	Total>	45.30	13.00m	144.34	52.37	52.37	7547
18	-2.80	Total>	49.08	14.00m	148.12	56.33	56.33	7547
19	-3.00	Total>	52.86	15.00m	151.90	60.32	60.32	7547
20	-3.20	Total>	56.64	16.00m	155.68	64.35	64.35	7547
21	-3.40	Total>	60.42	17.00m	159.46	68.39	68.39	7547
22	-3.50	Total>	62.31	17.50m	161.35	70.43	70.43	7547
		Total>	62.31	17.50m	235.63	36.39	36.39	45464
23	-3.60	Total>	64.29	18.00m	237.61	37.79	37.79	45464
24	-3.80	Total>	68.27	19.00m	241.59	40.63	40.63	45464

Node no.	Y coord	PASSIVE side					
		Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total	Coeff. of
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total> 0.00	0.00		79.36b	14.61	14.61	8611
14	-2.00	Total> 1.60	0.50m		80.64b	16.97	16.97	8611
		Total> 1.60	0.50m		39.37b	16.97	16.97	8611
15	-2.20	Total> 4.81	1.50m		40.63b	21.20	21.20	8611
		Total> 4.81	1.50m		39.38b	21.20	21.20	8611
16	-2.40	Total> 8.06	2.50m		40.62b	25.46	25.46	8611
		Total> 8.06	2.50m		39.39b	25.46	25.46	8611
17	-2.60	Total> 11.35	3.50m		40.61b	29.75	29.75	8611
		Total> 11.35	3.50m		39.40b	29.75	29.75	8611
18	-2.80	Total> 14.71	4.50m		40.60b	34.08	34.08	8611
		Total> 14.71	4.50m		39.41b	34.08	34.08	8611
19	-3.00	Total> 18.15	5.50m		40.59b	38.43	38.43	8611
		Total> 18.15	5.50m		39.41b	38.43	38.43	8611
20	-3.20	Total> 21.65	6.50m		40.59b	40.59	40.59p	8611
		Total> 21.65	6.50m		39.42b	39.42	39.42p	8611
21	-3.40	Total> 25.23	7.50m		40.58b	40.58	40.58p	8611
		Total> 25.23	7.50m		39.71b	39.71	39.71p	8611
22	-3.50	Total> 27.05	8.00m		40.29b	40.29	40.29p	8611
		Total> 27.05	8.00m		200.37	83.33	83.33	51875
23	-3.60	Total> 28.98	8.50m		202.30	86.45	86.45	51875
24	-3.80	Total> 32.88	9.50m		206.20	92.70	92.70	51875

Note: 12.34a Soil pressure at active limit
40.29p Soil pressure at passive limit
40.29b Passive limit reduced because of berm

Units: kN,m

Stage No. 10 Excavate to elevation -3.80 on PASSIVE side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
10	0.00	-3.60		More than one strut			

*** Warning - Weak strata at or below toe of wall:
Active limit (active side) > Passive limit (passive side)
19.00kN/m2 > 0.00kN/m2 at elev. -3.80

The above pressures include water pressure.

*** Warning - Failure and flow of soil BELOW the toe of the wall may occur if the wall is not toed in to a firm stratum. It may occur even when acceptable factors of safety and displacements have been calculated.

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.61	-0.000	-3.67E-04	0.0	-0.0	
2	-0.10	3.19	0.000	-3.67E-04	0.3	0.0	0.9
		3.19	0.000	-3.67E-04	-0.6	0.0	
3	-0.15	3.66	0.000	-3.67E-04	-0.4	-0.0	
4	-0.28	4.82	0.000	-3.67E-04	0.1	-0.0	
5	-0.40	5.99	0.000	-3.67E-04	0.8	0.0	
6	-0.60	7.95	0.000	-3.67E-04	2.2	0.3	
7	-0.80	9.90	0.000	-3.70E-04	3.9	0.9	
8	-1.00	11.85	0.000	-3.76E-04	6.1	1.9	
		20.99	0.000	-3.76E-04	6.1	1.9	
9	-1.20	24.74	0.000	-3.88E-04	10.7	3.6	
10	-1.40	28.46	0.000	-4.08E-04	16.0	6.2	
11	-1.58	31.69	0.001	-4.37E-04	21.3	9.5	
12	-1.75	34.88	0.001	-4.80E-04	27.1	13.7	74.3
		34.88	0.001	-4.80E-04	-47.2	13.7	
13	-1.90	37.58	0.001	-5.13E-04	-41.7	7.0	
14	-2.00	39.36	0.001	-5.24E-04	-37.9	3.1	
15	-2.20	43.07	0.001	-5.23E-04	-29.7	-3.7	
16	-2.40	46.79	0.001	-4.96E-04	-20.7	-8.7	
17	-2.60	50.55	0.001	-4.53E-04	-10.9	-11.9	

(continued)

Stage No.10 Excavate to elevation -3.80 on PASSIVE side

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
18	-2.80	54.37	0.001	-4.00E-04	-0.4	-13.0	
19	-3.00	58.25	0.001	-3.47E-04	10.8	-12.0	
20	-3.20	62.19	0.001	-3.03E-04	22.9	-8.7	
21	-3.40	66.17	0.001	-2.79E-04	35.7	-2.8	
22	-3.50	68.17	0.001	-2.77E-04	42.4	1.1	49.8
		22.78	0.001	-2.77E-04	-7.4	1.1	
23	-3.60	23.96	0.001	-2.79E-04	-5.0	0.5	
24	-3.80	26.30	0.001	-2.80E-04	0.0	0.0	

At elev.-0.10 Strut force = 0.9 kN/strut = 0.9 kN/m run
At elev.-1.75 Strut force = 74.3 kN/strut = 74.3 kN/m run
At elev.-3.50 Strut force = 49.8 kN/strut = 49.8 kN/m run

ACTIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	2.00	0.00	39.13	2.61	2.61	8039
2	-0.10	Total>	3.60	0.50m	40.73	3.19	3.19	8039
3	-0.15	Total>	4.40	0.75m	41.53	3.66	3.66	8039
4	-0.28	Total>	6.40	1.38m	43.53	4.82	4.82	8039
5	-0.40	Total>	8.40	2.00m	45.53	5.99	5.99	2041
6	-0.60	Total>	11.60	3.00m	48.73	7.95	7.95	2041
7	-0.80	Total>	14.80	4.00m	51.93	9.90	9.90	2041
8	-1.00	Total>	17.99	5.00m	55.13	11.85	11.85	2041
		Total>	17.99	5.00m	117.03	20.99	20.99	6049
9	-1.20	Total>	21.19	6.00m	120.23	24.74	24.74	6049
10	-1.40	Total>	24.38	7.00m	123.42	28.46	28.46	6049
11	-1.58	Total>	27.17	7.88m	126.21	31.69	31.69	6049
12	-1.75	Total>	29.97	8.75m	129.01	34.88	34.88	6049
13	-1.90	Total>	32.36	9.50m	131.40	37.58	37.58	6049
14	-2.00	Total>	33.95	10.00m	132.99	39.36	39.36	6049
15	-2.20	Total>	37.74	11.00m	136.78	43.07	43.07	6049
16	-2.40	Total>	41.52	12.00m	140.56	46.79	46.79	6049
17	-2.60	Total>	45.30	13.00m	144.34	50.55	50.55	6049
18	-2.80	Total>	49.08	14.00m	148.12	54.37	54.37	6049
19	-3.00	Total>	52.86	15.00m	151.90	58.25	58.25	6049
20	-3.20	Total>	56.64	16.00m	155.68	62.19	62.19	6049
21	-3.40	Total>	60.42	17.00m	159.46	66.17	66.17	6049
22	-3.50	Total>	62.31	17.50m	161.35	68.17	68.17	6049
		Total>	62.31	17.50m	235.63	22.78	22.78	36441
23	-3.60	Total>	64.29	18.00m	237.61	23.96	23.96	36441
24	-3.80	Total>	68.27	19.00m	241.59	26.30	26.30	36441

PASSIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.10 Excavate to elevation -3.80 on PASSIVE side

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22	-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
23	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
24	-3.80	0.00	0.01	0.00	0.00	0.00	0.00	0.0

Units: kN,m

Stage No. 12 Remove strut or anchor no.3 at elevation -3.50

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
12	0.00	-3.60		More than one strut			

*** Warning - Weak strata at or below toe of wall:
Active limit (active side) > Passive limit (passive side)
19.00kN/m2 > 0.00kN/m2 at elev. -3.80

The above pressures include water pressure.

*** Warning - Failure and flow of soil BELOW the toe of the wall may occur if the wall is not toed in to a firm stratum. It may occur even when acceptable factors of safety and displacements have been calculated.

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.64	-0.000	-3.79E-04	0.0	-0.0	
2	-0.10	3.22	0.000	-3.79E-04	0.3	0.0	0.6
		3.22	0.000	-3.79E-04	-0.3	0.0	
3	-0.15	3.68	0.000	-3.79E-04	-0.1	0.0	
4	-0.28	4.83	0.000	-3.79E-04	0.4	0.0	
5	-0.40	5.99	0.000	-3.79E-04	1.1	0.1	
6	-0.60	7.94	0.000	-3.81E-04	2.5	0.5	
7	-0.80	9.89	0.000	-3.84E-04	4.3	1.1	
8	-1.00	11.83	0.000	-3.91E-04	6.4	2.2	
		20.93	0.000	-3.91E-04	6.4	2.2	
9	-1.20	24.66	0.000	-4.04E-04	11.0	3.9	
10	-1.40	28.37	0.001	-4.26E-04	16.3	6.6	
11	-1.58	31.58	0.001	-4.57E-04	21.5	10.0	
12	-1.75	34.75	0.001	-5.02E-04	27.3	14.2	77.3
		34.75	0.001	-5.02E-04	-50.0	14.2	
13	-1.90	37.42	0.001	-5.36E-04	-44.6	7.1	
14	-2.00	39.19	0.001	-5.46E-04	-40.7	2.9	
15	-2.20	42.88	0.001	-5.43E-04	-32.5	-4.5	
16	-2.40	46.58	0.001	-5.12E-04	-23.6	-10.1	
17	-2.60	50.32	0.001	-4.62E-04	-13.9	-13.8	

(continued)

Stage No.12 Remove strut or anchor no.3 at elevation -3.50

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
18	-2.80	54.14	0.001	-3.99E-04	-3.4	-15.6	
19	-3.00	58.03	0.001	-3.34E-04	7.8	-15.1	
20	-3.20	61.99	0.001	-2.76E-04	19.8	-12.4	
21	-3.40	66.01	0.001	-2.35E-04	32.6	-7.2	
22	-3.50	68.04	0.001	-2.23E-04	39.3	-3.6	
		21.99	0.001	-2.23E-04	39.3	-3.6	
23	-3.60	23.37	0.001	-2.20E-04	41.6	0.5	46.5
		23.37	0.001	-2.20E-04	-4.9	0.5	
24	-3.80	26.12	0.001	-2.21E-04	0.0	0.0	

At elev.-0.10 Strut force = 0.6 kN/strut = 0.6 kN/m run
At elev.-1.75 Strut force = 77.3 kN/strut = 77.3 kN/m run
At elev.-3.60 Strut force = 46.5 kN/strut = 46.5 kN/m run

ACTIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	2.00	0.00	39.13	2.64	2.64	9675
2	-0.10	Total>	3.60	0.50m	40.73	3.22	3.22	9675
3	-0.15	Total>	4.40	0.75m	41.53	3.68	3.68	9675
4	-0.28	Total>	6.40	1.38m	43.53	4.83	4.83	9675
5	-0.40	Total>	8.40	2.00m	45.53	5.99	5.99	1994
6	-0.60	Total>	11.60	3.00m	48.73	7.94	7.94	1994
7	-0.80	Total>	14.80	4.00m	51.93	9.89	9.89	1994
8	-1.00	Total>	17.99	5.00m	55.13	11.83	11.83	1994
		Total>	17.99	5.00m	117.03	20.93	20.93	5911
9	-1.20	Total>	21.19	6.00m	120.23	24.66	24.66	5911
10	-1.40	Total>	24.38	7.00m	123.42	28.37	28.37	5911
11	-1.58	Total>	27.17	7.88m	126.21	31.58	31.58	5911
12	-1.75	Total>	29.97	8.75m	129.01	34.75	34.75	5911
13	-1.90	Total>	32.36	9.50m	131.40	37.42	37.42	5911
14	-2.00	Total>	33.95	10.00m	132.99	39.19	39.19	5911
15	-2.20	Total>	37.74	11.00m	136.78	42.88	42.88	5911
16	-2.40	Total>	41.52	12.00m	140.56	46.58	46.58	5911
17	-2.60	Total>	45.30	13.00m	144.34	50.32	50.32	5911
18	-2.80	Total>	49.08	14.00m	148.12	54.14	54.14	5911
19	-3.00	Total>	52.86	15.00m	151.90	58.03	58.03	5911
20	-3.20	Total>	56.64	16.00m	155.68	61.99	61.99	5911
21	-3.40	Total>	60.42	17.00m	159.46	66.01	66.01	5911
22	-3.50	Total>	62.31	17.50m	161.35	68.04	68.04	5911
		Total>	62.31	17.50m	235.63	21.99	21.99	35609
23	-3.60	Total>	64.29	18.00m	237.61	23.37	23.37	35609
24	-3.80	Total>	68.27	19.00m	241.59	26.12	26.12	35609

PASSIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.12 Remove strut or anchor no.3 at elevation -3.50

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22	-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
23	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
24	-3.80	0.00	0.01	0.00	0.00	0.00	0.00	0.0

Units: kN,m

Stage No. 13 Fill to elevation -3.40 on PASSIVE side with soil type 4

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
13	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.65	-0.000	-3.79E-04	0.0	-0.0	
2	-0.10	3.22	0.000	-3.79E-04	0.3	0.0	0.6
		3.22	0.000	-3.79E-04	-0.3	0.0	
3	-0.15	3.68	0.000	-3.79E-04	-0.1	0.0	
4	-0.28	4.82	0.000	-3.79E-04	0.4	0.0	
5	-0.40	5.99	0.000	-3.79E-04	1.1	0.1	
6	-0.60	7.94	0.000	-3.81E-04	2.5	0.5	
7	-0.80	9.89	0.000	-3.84E-04	4.3	1.1	
8	-1.00	11.83	0.000	-3.91E-04	6.4	2.2	
		20.93	0.000	-3.91E-04	6.4	2.2	
9	-1.20	24.66	0.000	-4.04E-04	11.0	3.9	
10	-1.40	28.37	0.001	-4.26E-04	16.3	6.6	
11	-1.58	31.58	0.001	-4.57E-04	21.5	10.0	
12	-1.75	34.75	0.001	-5.02E-04	27.3	14.2	77.3
		34.75	0.001	-5.02E-04	-50.0	14.2	
13	-1.90	37.42	0.001	-5.36E-04	-44.6	7.1	
14	-2.00	39.19	0.001	-5.46E-04	-40.7	2.9	
15	-2.20	42.87	0.001	-5.43E-04	-32.5	-4.5	
16	-2.40	46.58	0.001	-5.12E-04	-23.6	-10.1	
17	-2.60	50.32	0.001	-4.61E-04	-13.9	-13.8	
18	-2.80	54.14	0.001	-3.99E-04	-3.4	-15.6	
19	-3.00	58.03	0.001	-3.34E-04	7.8	-15.1	
20	-3.20	61.99	0.001	-2.76E-04	19.8	-12.4	
21	-3.40	66.01	0.001	-2.34E-04	32.6	-7.2	
22	-3.50	67.54	0.001	-2.23E-04	39.2	-3.6	
		21.50	0.001	-2.23E-04	39.2	-3.6	
23	-3.60	22.38	0.001	-2.20E-04	41.4	0.4	46.1
		22.38	0.001	-2.20E-04	-4.7	0.4	
24	-3.80	24.15	0.001	-2.21E-04	0.0	0.0	

At elev.-0.10 Strut force = 0.6 kN/strut = 0.6 kN/m run
At elev.-1.75 Strut force = 77.3 kN/strut = 77.3 kN/m run
At elev.-3.60 Strut force = 46.1 kN/strut = 46.1 kN/m run

(continued)

Stage No.13 Fill to elevation -3.40 on PASSIVE side with soil type 4

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	Total>	2.00	0.00	39.13	2.65	2.65	35737
2	-0.10	Total>	3.60	0.50m	40.73	3.22	3.22	1987
3	-0.15	Total>	4.40	0.75m	41.53	3.68	3.68	1987
4	-0.28	Total>	6.40	1.38m	43.53	4.82	4.82	1987
5	-0.40	Total>	8.40	2.00m	45.53	5.99	5.99	1987
6	-0.60	Total>	11.60	3.00m	48.73	7.94	7.94	1987
7	-0.80	Total>	14.80	4.00m	51.93	9.89	9.89	1987
8	-1.00	Total>	17.99	5.00m	55.13	11.83	11.83	1987
		Total>	17.99	5.00m	117.03	20.93	20.93	5890
9	-1.20	Total>	21.19	6.00m	120.23	24.66	24.66	5890
10	-1.40	Total>	24.38	7.00m	123.42	28.37	28.37	5890
11	-1.58	Total>	27.17	7.88m	126.21	31.58	31.58	5890
12	-1.75	Total>	29.97	8.75m	129.01	34.75	34.75	5890
13	-1.90	Total>	32.36	9.50m	131.40	37.42	37.42	5890
14	-2.00	Total>	33.95	10.00m	132.99	39.19	39.19	5890
15	-2.20	Total>	37.74	11.00m	136.78	42.87	42.87	5890
16	-2.40	Total>	41.52	12.00m	140.56	46.58	46.58	5890
17	-2.60	Total>	45.30	13.00m	144.34	50.32	50.32	5890
18	-2.80	Total>	49.08	14.00m	148.12	54.14	54.14	5890
19	-3.00	Total>	52.86	15.00m	151.90	58.03	58.03	5890
20	-3.20	Total>	56.64	16.00m	155.68	61.99	61.99	5890
21	-3.40	Total>	60.42	17.00m	159.46	66.01	66.01	19852
22	-3.50	Total>	62.31	17.50m	161.35	68.04	68.04	19852
		Total>	62.31	17.50m	235.63	22.00	22.00	119588
23	-3.60	Total>	64.29	18.00m	237.61	23.38	23.38	119588
24	-3.80	Total>	68.27	19.00m	241.59	26.15	26.15	119588

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	0.00	0.00a	54139361

(continued)

Stage No.13 Fill to elevation -3.40 on PASSIVE side with soil type 4

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	54139361
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	54139361
24	-3.80	Total>	8.86	2.00m	21054.86	2.00	2.00a	54139361

Note: 2.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 15 Remove strut or anchor no.1 at elevation -0.10

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
15	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.64	-0.000	-3.79E-04	0.0	-0.0	
2	-0.10	3.22	0.000	-3.79E-04	0.3	0.0	
3	-0.15	3.68	0.000	-3.79E-04	0.5	0.0	0.6
		3.68	0.000	-3.79E-04	-0.1	0.0	
4	-0.28	4.82	0.000	-3.79E-04	0.4	0.0	
5	-0.40	5.99	0.000	-3.79E-04	1.1	0.1	
6	-0.60	7.94	0.000	-3.80E-04	2.5	0.5	
7	-0.80	9.89	0.000	-3.84E-04	4.2	1.2	
8	-1.00	11.83	0.000	-3.91E-04	6.4	2.2	
		20.93	0.000	-3.91E-04	6.4	2.2	
9	-1.20	24.66	0.000	-4.04E-04	11.0	3.9	
10	-1.40	28.37	0.001	-4.26E-04	16.3	6.7	
11	-1.58	31.58	0.001	-4.57E-04	21.5	10.0	
12	-1.75	34.75	0.001	-5.02E-04	27.3	14.2	77.3
		34.75	0.001	-5.02E-04	-50.0	14.2	
13	-1.90	37.42	0.001	-5.36E-04	-44.6	7.1	
14	-2.00	39.19	0.001	-5.46E-04	-40.7	2.9	
15	-2.20	42.88	0.001	-5.43E-04	-32.5	-4.5	
16	-2.40	46.58	0.001	-5.12E-04	-23.6	-10.1	
17	-2.60	50.32	0.001	-4.62E-04	-13.9	-13.8	
18	-2.80	54.14	0.001	-3.99E-04	-3.5	-15.6	
19	-3.00	58.03	0.001	-3.34E-04	7.8	-15.2	
20	-3.20	61.99	0.001	-2.76E-04	19.8	-12.4	
21	-3.40	66.01	0.001	-2.34E-04	32.6	-7.2	
22	-3.50	67.54	0.001	-2.23E-04	39.2	-3.6	
		21.50	0.001	-2.23E-04	39.2	-3.6	
23	-3.60	22.38	0.001	-2.20E-04	41.4	0.4	46.1
		22.38	0.001	-2.20E-04	-4.6	0.4	
24	-3.80	24.02	0.001	-2.21E-04	0.0	0.0	

At elev.-0.15 Strut force = 0.6 kN/strut = 0.6 kN/m run
At elev.-1.75 Strut force = 77.3 kN/strut = 77.3 kN/m run
At elev.-3.60 Strut force = 46.1 kN/strut = 46.1 kN/m run

(continued)

Stage No.15 Remove strut or anchor no.1 at elevation -0.10

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	2.00	0.00	39.13	2.64	2.64	5348
2	-0.10	Total>	3.60	0.50m	40.73	3.22	3.22	5348
3	-0.15	Total>	4.40	0.75m	41.53	3.68	3.68	5348
4	-0.28	Total>	6.40	1.38m	43.53	4.82	4.82	5348
5	-0.40	Total>	8.40	2.00m	45.53	5.99	5.99	5348
6	-0.60	Total>	11.60	3.00m	48.73	7.94	7.94	5348
7	-0.80	Total>	14.80	4.00m	51.93	9.89	9.89	5348
8	-1.00	Total>	17.99	5.00m	55.13	11.83	11.83	2058
		Total>	17.99	5.00m	117.03	20.93	20.93	6101
9	-1.20	Total>	21.19	6.00m	120.23	24.66	24.66	6101
10	-1.40	Total>	24.38	7.00m	123.42	28.37	28.37	6101
11	-1.58	Total>	27.17	7.88m	126.21	31.58	31.58	6101
12	-1.75	Total>	29.97	8.75m	129.01	34.75	34.75	6101
13	-1.90	Total>	32.36	9.50m	131.40	37.42	37.42	6101
14	-2.00	Total>	33.95	10.00m	132.99	39.19	39.19	6101
15	-2.20	Total>	37.74	11.00m	136.78	42.88	42.88	6101
16	-2.40	Total>	41.52	12.00m	140.56	46.58	46.58	6101
17	-2.60	Total>	45.30	13.00m	144.34	50.32	50.32	6101
18	-2.80	Total>	49.08	14.00m	148.12	54.14	54.14	6101
19	-3.00	Total>	52.86	15.00m	151.90	58.03	58.03	6101
20	-3.20	Total>	56.64	16.00m	155.68	61.99	61.99	6101
21	-3.40	Total>	60.42	17.00m	159.46	66.01	66.01	6101
22	-3.50	Total>	62.31	17.50m	161.35	68.04	68.04	6101
		Total>	62.31	17.50m	235.63	22.00	22.00	36754
23	-3.60	Total>	64.29	18.00m	237.61	23.38	23.38	36754
24	-3.80	Total>	68.27	19.00m	241.59	26.15	26.15	1418852

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	0.00	0.00a	69447635

(continued)

Stage No.15 Remove strut or anchor no.1 at elevation -0.10

Node no.	Y coord	PASSIVE side						
		Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	69447635
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	69447635
24	-3.80	Total>	8.86	2.00m	21054.86	2.13	2.13	6.28E+08

Note: 1.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 16 Remove strut or anchor no.2 at elevation -1.75

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
16	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	4.25	-0.000	-1.05E-03	0.0	0.0	
2	-0.10	3.59	-0.000	-1.05E-03	0.4	0.0	
3	-0.15	3.65	0.000	-1.05E-03	0.6	0.0	27.8
		3.65	0.000	-1.05E-03	-27.2	0.0	
4	-0.28	4.63	0.000	-1.04E-03	-26.7	-3.3	
5	-0.40	5.64	0.000	-1.03E-03	-26.1	-6.6	
6	-0.60	7.34	0.001	-9.96E-04	-24.8	-11.7	
7	-0.80	9.06	0.001	-9.36E-04	-23.1	-16.5	
8	-1.00	10.80	0.001	-8.57E-04	-21.1	-20.9	
		17.87	0.001	-8.57E-04	-21.1	-20.9	
9	-1.20	21.11	0.001	-7.60E-04	-17.2	-24.8	
10	-1.40	24.48	0.001	-6.49E-04	-12.7	-27.8	
11	-1.58	27.53	0.001	-5.43E-04	-8.1	-29.6	
12	-1.75	30.69	0.001	-4.31E-04	-3.0	-30.6	
13	-1.90	33.49	0.001	-3.34E-04	1.8	-30.7	
14	-2.00	35.39	0.001	-2.69E-04	5.2	-30.3	
15	-2.20	39.48	0.001	-1.45E-04	12.7	-28.5	
16	-2.40	43.69	0.002	-3.17E-05	21.0	-25.2	
17	-2.60	48.03	0.002	6.39E-05	30.2	-20.1	
18	-2.80	52.47	0.001	1.33E-04	40.3	-13.0	
19	-3.00	56.96	0.001	1.69E-04	51.2	-3.9	
20	-3.20	61.48	0.001	1.62E-04	63.0	7.5	
21	-3.40	65.96	0.001	1.00E-04	75.8	21.4	
		-3626.38	0.001	1.00E-04	75.8	21.4	
22	-3.50	68.06	0.001	6.67E-05	-102.1	10.8	
		24.64	0.001	6.67E-05	-102.1	10.8	
23	-3.60	29.62	0.001	5.45E-05	-99.4	0.8	-92.5
		29.62	0.001	5.45E-05	-6.9	0.8	
24	-3.80	39.41	0.001	5.29E-05	0.0	0.0	

At elev.-0.15 Strut force = 27.8 kN/strut = 27.8 kN/m run
At elev.-3.60 Strut force = -92.5 kN/strut = -92.5 kN/m run

(continued)

Stage No.16 Remove strut or anchor no.2 at elevation -1.75

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	2.00	0.00	39.13	4.25	4.25	18226
2	-0.10	Total>	3.60	0.50m	40.73	3.59	3.59	18226
3	-0.15	Total>	4.40	0.75m	41.53	3.65	3.65	1966
4	-0.28	Total>	6.40	1.38m	43.53	4.63	4.63	1966
5	-0.40	Total>	8.40	2.00m	45.53	5.64	5.64	1966
6	-0.60	Total>	11.60	3.00m	48.73	7.34	7.34	1966
7	-0.80	Total>	14.80	4.00m	51.93	9.06	9.06	1966
8	-1.00	Total>	17.99	5.00m	55.13	10.80	10.80	1966
		Total>	17.99	5.00m	117.03	17.87	17.87	5827
9	-1.20	Total>	21.19	6.00m	120.23	21.11	21.11	5827
10	-1.40	Total>	24.38	7.00m	123.42	24.48	24.48	5827
11	-1.58	Total>	27.17	7.88m	126.21	27.53	27.53	5827
12	-1.75	Total>	29.97	8.75m	129.01	30.69	30.69	5827
13	-1.90	Total>	32.36	9.50m	131.40	33.49	33.49	5827
14	-2.00	Total>	33.95	10.00m	132.99	35.39	35.39	5827
15	-2.20	Total>	37.74	11.00m	136.78	39.48	39.48	5827
16	-2.40	Total>	41.52	12.00m	140.56	43.69	43.69	5827
17	-2.60	Total>	45.30	13.00m	144.34	48.03	48.03	5827
18	-2.80	Total>	49.08	14.00m	148.12	52.47	52.47	5827
19	-3.00	Total>	52.86	15.00m	151.90	56.96	56.96	5827
20	-3.20	Total>	56.64	16.00m	155.68	61.48	61.48	5827
21	-3.40	Total>	60.42	17.00m	159.46	65.96	65.96	5827
22	-3.50	Total>	62.31	17.50m	161.35	68.56	68.56	24260
		Total>	62.31	17.50m	235.63	25.14	25.14	146147
23	-3.60	Total>	64.29	18.00m	237.61	30.62	30.62	146147
24	-3.80	Total>	68.27	19.00m	241.59	41.41	41.41	146147

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	3692.34	3692.34	3.85E+08

(continued)

Stage No.16 Remove strut or anchor no.2 at elevation -1.75

Node no.	Y coord	PASSIVE side						
		Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	65795192
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	65795192
24	-3.80	Total>	8.86	2.00m	21054.86	2.00	2.00a	65795192

Note: 2.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: Serviceability Limit State
All loads and soil strengths are unfactored

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			
2	0.00	0.00		No analysis at this stage			
3	0.00	0.00	-0.10	112.125	n/a	-0.18	0.18
4	0.00	0.00	-0.10	13.188	n/a	-0.23	0.23
5	0.00	0.00		No analysis at this stage			

All remaining stages have more than one strut - FoS calculation n/a

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment Calculated		Bending moment Factored		Shear force Calculated		Shear force Factored	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m	kN/m	kN/m	kN/m
1	0.00	0.000	-0.000	0	-0	0	-0	0	0	0	0
2	-0.10	0.000	-0.000	0	0	0	0	0	-5	1	-6
3	-0.15	0.000	-0.000	0	-0	0	-0	1	-27	1	-37
4	-0.28	0.000	-0.000	0	-3	0	-4	0	-27	1	-36
5	-0.40	0.000	-0.000	0	-7	0	-9	1	-26	1	-35
6	-0.60	0.001	-0.000	0	-12	1	-16	2	-25	3	-33
7	-0.80	0.001	0.000	1	-16	2	-22	4	-23	6	-31
8	-1.00	0.001	0.000	2	-21	3	-28	6	-21	9	-29
9	-1.20	0.001	0.000	4	-25	5	-33	11	-17	15	-23
10	-1.40	0.001	0.000	7	-28	9	-37	16	-13	22	-17
11	-1.58	0.001	0.000	10	-30	13	-40	22	-8	29	-11
12	-1.75	0.001	0.000	14	-31	19	-41	27	-50	37	-67
13	-1.90	0.001	0.000	7	-31	10	-41	2	-45	2	-60
14	-2.00	0.001	0.000	3	-30	4	-41	5	-41	7	-55
15	-2.20	0.001	0.000	0	-29	0	-39	13	-33	17	-44
16	-2.40	0.002	0.000	0	-25	0	-34	21	-24	28	-32
17	-2.60	0.002	0.000	0	-20	0	-27	30	-14	41	-19
18	-2.80	0.001	0.000	0	-16	0	-21	40	-3	54	-5
19	-3.00	0.001	0.000	0	-15	0	-20	51	0	69	0
20	-3.20	0.001	0.000	8	-12	10	-17	63	0	85	0
21	-3.40	0.001	0.000	21	-7	29	-10	76	0	102	0
22	-3.50	0.001	0.000	11	-4	15	-5	42	-102	57	-138
23	-3.60	0.001	0.000	1	-1	1	-1	42	-99	56	-134
24	-3.80	0.001	0.000	0	-0	0	-0	0	0	0	0

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
no.	max.	elev.	min.	elev.	max.	min.	max.	elev.	min.	elev.	max.	min.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	kN/m
1	0	-1.40	-0	-3.20	0	-0	0	-0.10	0	0.00	0	0
2	No calculation at this stage											
3	0	-0.10	-1	-1.58	0	-2	1	-3.50	-2	-0.10	2	-3
4	0	-0.10	-1	-1.58	0	-2	1	-3.50	-2	-0.10	2	-3
5	No calculation at this stage											
6	7	-1.75	-6	-2.80	9	-9	23	-1.75	-27	-1.75	32	-36
7	8	-1.75	-6	-2.80	11	-9	24	-1.75	-28	-1.75	33	-38
8	9	-1.75	-6	-3.00	12	-9	25	-1.75	-29	-1.75	33	-39
9	No calculation at this stage											
10	14	-1.75	-13	-2.80	19	-18	42	-3.50	-47	-1.75	57	-64
11	No calculation at this stage											
12	14	-1.75	-16	-2.80	19	-21	42	-3.60	-50	-1.75	56	-67
13	14	-1.75	-16	-2.80	19	-21	41	-3.60	-50	-1.75	56	-67
14	No calculation at this stage											
15	14	-1.75	-16	-2.80	19	-21	41	-3.60	-50	-1.75	56	-67
16	21	-3.40	-31	-1.90	29	-41	76	-3.40	-102	-3.50	102	-138

Maximum and minimum displacement at each stage

Stage	Displacement				Stage description
no.	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	-3.80	-0.000	0.00	Apply surcharge no.1 at elev. 0.00
2	No calculation at this stage				Install strut no.1 at elev. -0.10
3	0.000	-2.60	0.000	0.00	Apply surcharge no.2 at elev. 0.00
4	0.000	-2.60	0.000	0.00	Excav. to elev. 0.00 on PASSIVE side
5	No calculation at this stage				Install strut no.2 at elev. -1.75
6	0.001	-3.80	0.000	0.00	Excav. to elev. -1.90 on PASSIVE side
7	0.001	-3.80	0.000	0.00	Apply water pressure profile no.1
8	0.001	-3.80	0.000	0.00	Excav. to elev. -1.90 on PASSIVE side
9	No calculation at this stage				Install strut no.3 at elev. -3.50
10	0.001	-3.80	-0.000	0.00	Excav. to elev. -3.80 on PASSIVE side
11	No calculation at this stage				Install strut no.4 at elev. -3.60
12	0.001	-3.80	-0.000	0.00	Remove strut no.3 at elev. -3.50
13	0.001	-3.80	-0.000	0.00	Fill to elev. -3.40 on PASSIVE side
14	No calculation at this stage				Install strut no.5 at elev. -0.15
15	0.001	-3.80	-0.000	0.00	Remove strut no.1 at elev. -0.10
16	0.002	-2.40	-0.000	0.00	Remove strut no.2 at elev. -1.75

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

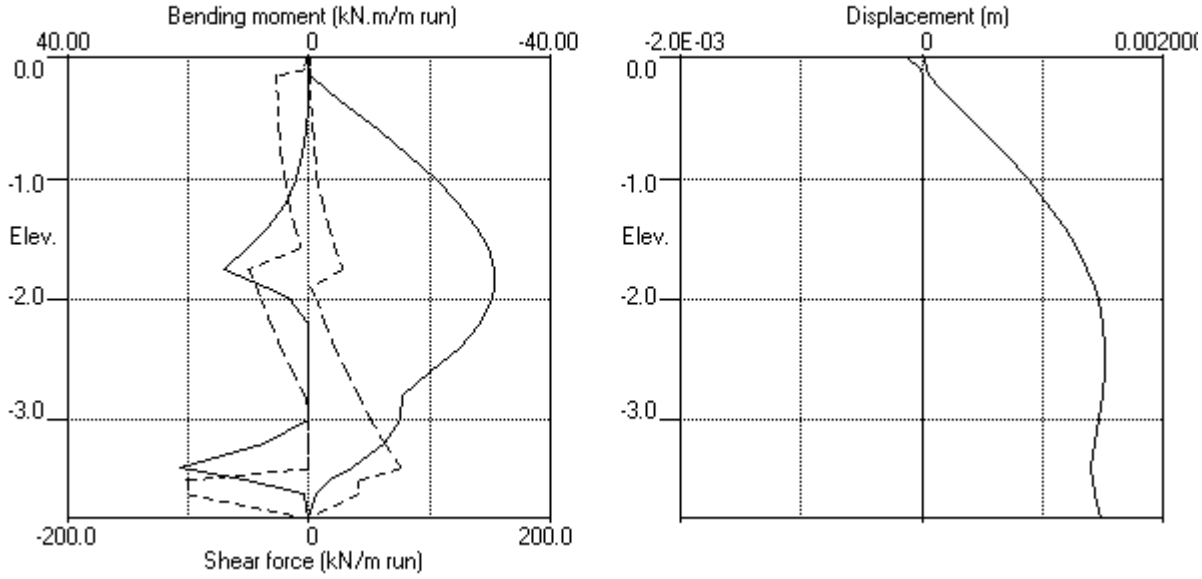
Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev.-0.10			Strut no. 2 at elev.-1.75			Strut no. 3 at elev.-3.50		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut
3	2	2	3	---	---	---	---	---	---
4	2	2	3	---	---	---	---	---	---
6	5	5	7	50	50	68	---	---	---
7	4	4	6	52	52	71	---	---	---
8	4	4	5	53	53	72	---	---	---
10	1	1	1	74	74	100	50	50	67
12	1	1	1	77	77	104	---	---	---
13	1	1	1	77	77	104	---	---	---
15	---	---	---	77	77	104	---	---	---

Stage no.	Strut no. 4 at elev.-3.60			Strut no. 5 at elev.-0.15		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut
12	47	47	63	---	---	---
13	46	46	62	---	---	---
15	46	46	62	1	1	1
16	-93	-93	-125	28	28	38

Units: kN,m

Bending moment, shear force, displacement envelopes



Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Active side	Passive side
1	0.00	1 MG	1 MG
2	-1.00	2 vwLCF	2 vwLCF
3	-3.50	3 wLCF	3 wLCF

SOIL PROPERTIES

-- Soil type -- No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	MG	16.00a	2800	0.658	NC	1.000	1.000	15.00u
		19.00b			(0.490)	(2.389)	(2.476)	
2	vwLCF	16.00a	8300	1.316	OC	1.000	1.000	40.00u
		19.00b			(0.490)	(2.389)	(2.476)	
3	wLCF	17.00a	50000	1.251	OC	1.000	1.000	70.00u
		20.00b			(0.490)	(2.389)	(2.476)	
4	Concrete	22.00a	2.10E+7	0.500	OC	1.000	1.000	8500u
		23.00b			(0.490)	(2.389)	(2.476)	

Note: (a) and (b) are Bulk Densities above and below the water table

Additional soil parameters associated with Ka and Kp

		--- parameters for Ka ---			--- parameters for Kp ---		
------- Soil type ------- No.	Description	Soil friction angle	Wall adhesion coeff.	Back-fill angle	Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	MG	0.00	0.500	0.00	0.00	0.667	0.00
2	vwLCF	0.00	0.500	0.00	0.00	0.667	0.00
3	wLCF	0.00	0.500	0.00	0.00	0.667	0.00
4	Concrete	0.00	0.500	0.00	0.00	0.667	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Active side	Passive side
Initial water table elevation	-2.00	-2.00

Automatic water pressure balancing at toe of wall : Yes

Water press. profile no.	Active side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Passive side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	
1	1	-2.00	-2.00	0.0	1	-3.80	-3.80	0.0	MC
2	1	0.00	0.00	0.0	1	-3.80	-3.80	0.0	WC

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -3.80
Maximum finite element length = 0.20 m
Youngs modulus of wall E = 2.1000E+07 kN/m2
Moment of inertia of wall I = 2.2500E-03 m4/m run
E.I = 47250 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/ anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre- stress /strut kN	Tension allowed
1	-0.10	1.00	0.002000	2.000E+08	3.00	0.00	0	No
2	-1.75	1.00	0.002000	2.000E+08	3.00	0.00	0	No
3	-3.50	1.00	0.002000	2.000E+08	3.00	0.00	0	No
4	-3.60	1.00	0.400000	2.100E+07	3.00	0.00	0	Yes
5	-0.15	1.00	0.300000	2.100E+07	3.00	0.00	0	Yes

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge kN/m2 Near edge	Surcharge kN/m2 Far edge	Equiv. soil type	Partial factor/ Category
1	0.00	0.00(A)	10.00	10.00	0.00	=	N/A	1.00 Var
2	0.00	2.00(A)	10.00	7.00	10.00	=	N/A	1.00 Var

Note: A = Active side, P = Passive side
Limit State Categories P/U = Permanent Unfavourable
P/F = Permanent Favourable
Var = Variable (unfavourable)

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 0.00
2	Install strut or anchor no.1 at elevation -0.10
3	Apply surcharge no.2 at elevation 0.00
4	Excavate to elevation 0.00 on PASSIVE side Toe of berm at elevation -1.90 Width of top of berm = 0.10 Width of toe of berm = 2.00
5	Install strut or anchor no.2 at elevation -1.75
6	Excavate to elevation -1.90 on PASSIVE side
7	Apply water pressure profile no.1 (Mod. Conserv.)
8	Excavate to elevation -1.90 on PASSIVE side Toe of berm at elevation -3.80 Width of top of berm = 0.10 Width of toe of berm = 2.00
9	Install strut or anchor no.3 at elevation -3.50
10	Excavate to elevation -3.80 on PASSIVE side
11	Install strut or anchor no.4 at elevation -3.60
12	Remove strut or anchor no.3 at elevation -3.50
13	Fill to elevation -3.40 on PASSIVE side with soil type 4
14	Install strut or anchor no.5 at elevation -0.15
15	Remove strut or anchor no.1 at elevation -0.10
16	Remove strut or anchor no.2 at elevation -1.75

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: Serviceability Limit State
All loads and soil strengths are unfactored

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.00

Parameters for undrained strata:
Minimum equivalent fluid density = 5.00 kN/m3
Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 10.00 m

Width of excavation on active side of wall = 1.00 m
Width of excavation on passive side of wall = 3.00 m

Distance to rigid boundary on active side = 3.80 m

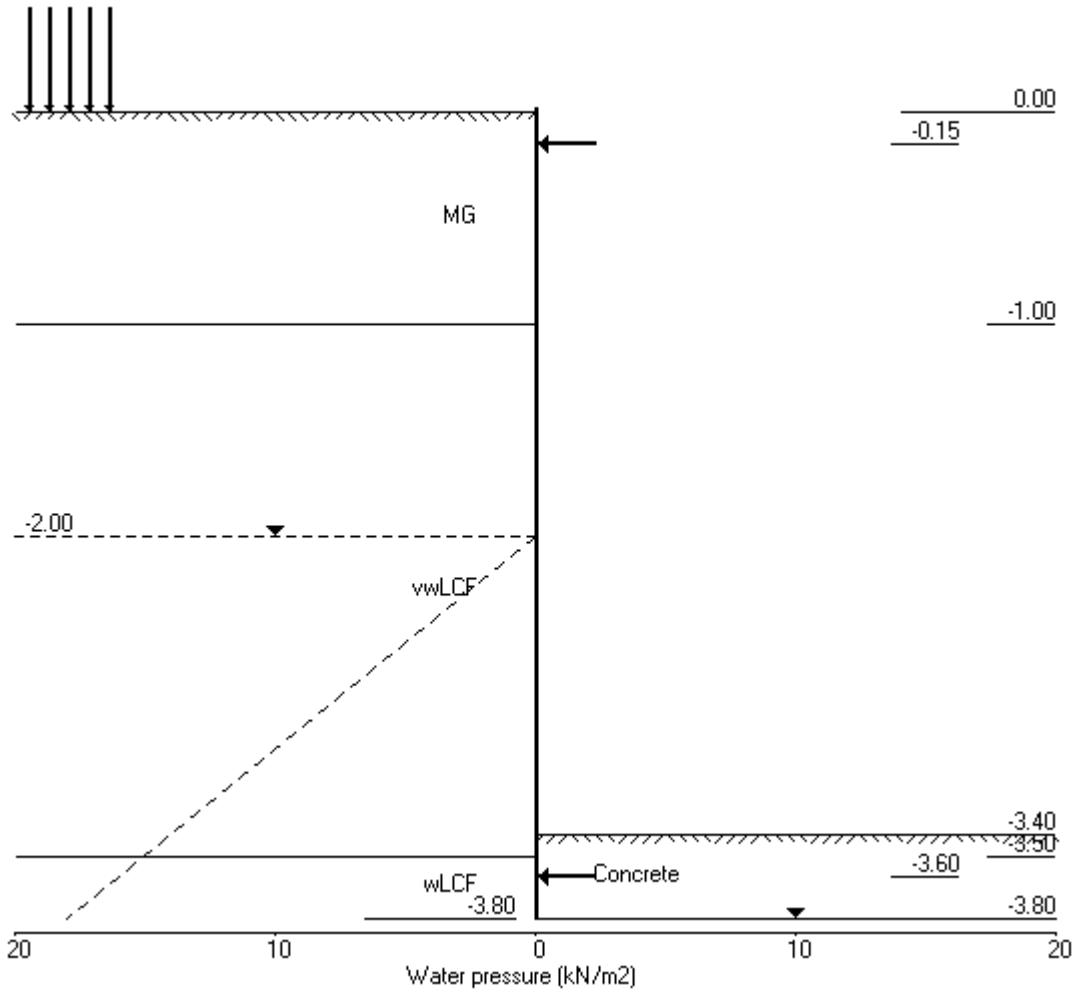
Distance to rigid boundary on passive side = 3.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 0.00	Yes	Yes	Yes
2	Install strut no.1 at elev. -0.10	Yes	Yes	Yes
3	Apply surcharge no.2 at elev. 0.00	Yes	Yes	Yes
4	Excav. to elev. 0.00 on PASSIVE side	Yes	Yes	Yes
5	Install strut no.2 at elev. -1.75	Yes	Yes	Yes
6	Excav. to elev. -1.90 on PASSIVE side	Yes	Yes	Yes
7	Apply water pressure profile no.1	Yes	Yes	Yes
8	Excav. to elev. -1.90 on PASSIVE side	Yes	Yes	Yes
9	Install strut no.3 at elev. -3.50	Yes	Yes	Yes
10	Excav. to elev. -3.80 on PASSIVE side	Yes	Yes	Yes
11	Install strut no.4 at elev. -3.60	Yes	Yes	Yes
12	Remove strut no.3 at elev. -3.50	No	No	No
13	Fill to elev. -3.40 on PASSIVE side	Yes	Yes	Yes
14	Install strut no.5 at elev. -0.15	Yes	Yes	Yes
15	Remove strut no.1 at elev. -0.10	Yes	Yes	Yes
16	Remove strut no.2 at elev. -1.75	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.16 Remove strut no.2 at elev. -1.75



Units: kN,m

Stage No. 1 Apply surcharge no.1 at elevation 0.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.00	-0.000	-1.44E-16	0.0	-0.0	
2	-0.10	0.00	-0.000	-1.44E-16	0.0	0.0	
3	-0.15	0.00	-0.000	-1.44E-16	0.0	0.0	
4	-0.28	0.00	-0.000	-1.44E-16	0.0	0.0	
5	-0.40	0.00	-0.000	-1.45E-16	0.0	0.0	
6	-0.60	0.00	-0.000	-1.45E-16	0.0	0.0	
7	-0.80	0.00	0.000	-1.46E-16	0.0	0.0	
8	-1.00	0.00	0.000	-1.47E-16	0.0	0.0	
9	-1.20	0.00	0.000	-1.48E-16	0.0	0.0	
10	-1.40	0.00	0.000	-1.49E-16	0.0	0.0	
11	-1.58	0.00	0.000	-1.51E-16	0.0	0.0	
12	-1.75	0.00	0.000	-1.52E-16	0.0	0.0	
13	-1.90	0.00	0.000	-1.52E-16	0.0	0.0	
14	-2.00	0.00	0.000	-1.52E-16	0.0	-0.0	
15	-2.20	0.00	0.000	-1.51E-16	0.0	-0.0	
16	-2.40	0.00	0.000	-1.49E-16	0.0	-0.0	
17	-2.60	0.00	0.000	-1.45E-16	0.0	-0.0	
18	-2.80	0.00	0.000	-1.38E-16	0.0	-0.0	
19	-3.00	0.00	0.000	-1.27E-16	0.0	-0.0	
20	-3.20	0.00	0.000	-1.13E-16	0.0	-0.0	
21	-3.40	0.00	0.000	-1.00E-16	0.0	-0.0	
22	-3.50	0.00	0.000	-9.65E-17	0.0	-0.0	
23	-3.60	0.00	0.000	-9.47E-17	0.0	-0.0	
24	-3.80	0.00	0.000	-9.41E-17	0.0	-0.0	

(continued)

Stage No.1 Apply surcharge no.1 at elevation 0.00

Node no.	Y coord	ACTIVE side	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	0.00	37.13	0.00	0.00a	5164
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05		5164
3	-0.15	Total>	2.40	0.75m	39.53	1.58	1.58		5164
4	-0.28	Total>	4.40	1.38m	41.53	2.90	2.90		5164
5	-0.40	Total>	6.40	2.00m	43.53	4.21	4.21		5164
6	-0.60	Total>	9.60	3.00m	46.73	6.32	6.32		5164
7	-0.80	Total>	12.80	4.00m	49.93	8.42	8.42		2110
8	-1.00	Total>	16.00	5.00m	53.13	10.53	10.53		2110
		Total>	16.00	5.00m	115.04	21.06	21.06		6254
9	-1.20	Total>	19.20	6.00m	118.24	25.27	25.27		6254
10	-1.40	Total>	22.40	7.00m	121.44	29.48	29.48		6254
11	-1.58	Total>	25.20	7.88m	124.24	33.16	33.16		6254
12	-1.75	Total>	28.00	8.75m	127.04	36.85	36.85		6254
13	-1.90	Total>	30.40	9.50m	129.44	40.01	40.01		6254
14	-2.00	Total>	32.00	10.00m	131.04	42.11	42.11		6254
15	-2.20	Total>	35.80	11.00m	134.84	46.48	46.48		6254
16	-2.40	Total>	39.60	12.00m	138.64	50.85	50.85		6254
17	-2.60	Total>	43.40	13.00m	142.44	55.22	55.22		6254
18	-2.80	Total>	47.20	14.00m	146.24	59.59	59.59		6254
19	-3.00	Total>	51.00	15.00m	150.04	63.96	63.96		6254
20	-3.20	Total>	54.80	16.00m	153.84	68.32	68.32		6254
21	-3.40	Total>	58.60	17.00m	157.64	72.69	72.69		6254
22	-3.50	Total>	60.50	17.50m	159.54	74.88	74.88		6254
		Total>	60.50	17.50m	233.82	71.92	71.92		37677
23	-3.60	Total>	62.50	18.00m	235.82	74.17	74.17		37677
24	-3.80	Total>	66.50	19.00m	239.82	78.67	78.67		37677

Node no.	Y coord	PASSIVE side	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	0.00	37.13	0.00	0.00a	5616
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05		5616
3	-0.15	Total>	2.40	0.75m	39.53	1.58	1.58		5616
4	-0.28	Total>	4.40	1.38m	41.53	2.90	2.90		5616
5	-0.40	Total>	6.40	2.00m	43.53	4.21	4.21		5616
6	-0.60	Total>	9.60	3.00m	46.73	6.32	6.32		5616
7	-0.80	Total>	12.80	4.00m	49.93	8.42	8.42		2478
8	-1.00	Total>	16.00	5.00m	53.13	10.53	10.53		2478
		Total>	16.00	5.00m	115.04	21.06	21.06		7346
9	-1.20	Total>	19.20	6.00m	118.24	25.27	25.27		7346
10	-1.40	Total>	22.40	7.00m	121.44	29.48	29.48		7346
11	-1.58	Total>	25.20	7.88m	124.24	33.16	33.16		7346
12	-1.75	Total>	28.00	8.75m	127.04	36.85	36.85		7346
13	-1.90	Total>	30.40	9.50m	129.44	40.01	40.01		7346
14	-2.00	Total>	32.00	10.00m	131.04	42.11	42.11		7346
15	-2.20	Total>	35.80	11.00m	134.84	46.48	46.48		7346
16	-2.40	Total>	39.60	12.00m	138.64	50.85	50.85		7346
17	-2.60	Total>	43.40	13.00m	142.44	55.22	55.22		7346
18	-2.80	Total>	47.20	14.00m	146.24	59.59	59.59		7346
19	-3.00	Total>	51.00	15.00m	150.04	63.96	63.96		7346
20	-3.20	Total>	54.80	16.00m	153.84	68.32	68.32		7346
21	-3.40	Total>	58.60	17.00m	157.64	72.69	72.69		7346

(continued)

Stage No.1 Apply surcharge no.1 at elevation 0.00

Node no.	Y coord	PASSIVE side						
		Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	60.50	17.50m	159.54	74.88	74.88	7346
		Total>	60.50	17.50m	233.82	71.92	71.92	44251
23	-3.60	Total>	62.50	18.00m	235.82	74.17	74.17	44251
24	-3.80	Total>	66.50	19.00m	239.82	78.67	78.67	44251

Note: 0.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 3 Apply surcharge no.2 at elevation 0.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
3	0.00	0.00	-0.10	93.125	n/a	-0.18	0.18

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.09	-0.000	-4.95E-05	0.0	-0.0	
2	-0.10	-0.01	0.000	-4.95E-05	0.0	0.0	0.5
		-0.01	0.000	-4.95E-05	-0.5	0.0	
3	-0.15	-0.02	0.000	-4.95E-05	-0.5	-0.0	
4	-0.28	-0.04	0.000	-4.94E-05	-0.5	-0.1	
5	-0.40	-0.04	0.000	-4.91E-05	-0.5	-0.1	
6	-0.60	-0.02	0.000	-4.83E-05	-0.5	-0.2	
7	-0.80	0.06	0.000	-4.71E-05	-0.5	-0.3	
8	-1.00	0.19	0.000	-4.54E-05	-0.5	-0.4	
		-0.20	0.000	-4.54E-05	-0.5	-0.4	
9	-1.20	-0.10	0.000	-4.34E-05	-0.5	-0.5	
10	-1.40	0.03	0.000	-4.10E-05	-0.5	-0.6	
11	-1.58	0.17	0.000	-3.86E-05	-0.5	-0.7	
12	-1.75	0.32	0.000	-3.58E-05	-0.4	-0.8	
13	-1.90	0.46	0.000	-3.33E-05	-0.4	-0.8	
14	-2.00	0.55	0.000	-3.14E-05	-0.3	-0.9	
15	-2.20	0.74	0.000	-2.76E-05	-0.2	-0.9	
16	-2.40	0.93	0.000	-2.36E-05	-0.0	-0.9	
17	-2.60	1.11	0.000	-1.97E-05	0.2	-0.9	
18	-2.80	1.28	0.000	-1.58E-05	0.4	-0.9	
19	-3.00	1.44	0.000	-1.24E-05	0.7	-0.8	
20	-3.20	1.59	0.000	-9.52E-06	1.0	-0.6	
21	-3.40	1.72	0.000	-7.49E-06	1.3	-0.4	
22	-3.50	1.78	0.000	-6.86E-06	1.5	-0.2	
		-5.01	0.000	-6.86E-06	1.5	-0.2	
23	-3.60	-5.00	0.000	-6.52E-06	1.0	-0.1	
24	-3.80	-4.97	0.000	-6.31E-06	0.0	-0.0	

At elev.-0.10 Strut force = 0.5 kN/strut = 0.5 kN/m run

(continued)

Stage No.3 Apply surcharge no.2 at elevation 0.00

Node no.	Y coord	ACTIVE side	Effective stresses: Vertic-al	Active limit	Passive limit	Earth pressure	Total earth pressure	Coeff. of subgrade reaction
		Water press.						
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	0.09	0.09	63753
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05	1823
3	-0.15	Total>	2.40	0.75m	39.54	1.57	1.57	1823
4	-0.28	Total>	4.41	1.38m	41.54	2.88	2.88	1823
5	-0.40	Total>	6.43	2.00m	43.56	4.21	4.21	1823
6	-0.60	Total>	9.70	3.00m	46.83	6.36	6.36	1823
7	-0.80	Total>	13.02	4.00m	50.15	8.57	8.57	1823
8	-1.00	Total>	16.38	5.00m	53.52	10.83	10.83	1823
		Total>	16.38	5.00m	115.42	21.17	21.17	5403
9	-1.20	Total>	19.79	6.00m	118.83	25.54	25.54	5403
10	-1.40	Total>	23.24	7.00m	122.28	29.94	29.94	5403
11	-1.58	Total>	26.27	7.88m	125.31	33.81	33.81	5403
12	-1.75	Total>	29.31	8.75m	128.35	37.69	37.69	5403
13	-1.90	Total>	31.92	9.50m	130.96	41.02	41.02	5403
14	-2.00	Total>	33.66	10.00m	132.70	43.24	43.24	5403
15	-2.20	Total>	37.72	11.00m	136.76	47.83	47.83	5403
16	-2.40	Total>	41.78	12.00m	140.82	52.42	52.42	5403
17	-2.60	Total>	45.82	13.00m	144.86	57.00	57.00	5403
18	-2.80	Total>	49.84	14.00m	148.88	61.56	61.56	5403
19	-3.00	Total>	53.85	15.00m	152.89	66.11	66.11	5403
20	-3.20	Total>	57.83	16.00m	156.87	70.64	70.64	5403
21	-3.40	Total>	61.79	17.00m	160.83	75.15	75.15	5403
22	-3.50	Total>	63.76	17.50m	162.80	77.41	77.41	5403
		Total>	63.76	17.50m	237.08	71.39	71.39	32547
23	-3.60	Total>	65.83	18.00m	239.15	73.69	73.69	32547
24	-3.80	Total>	69.96	19.00m	243.28	78.27	78.27	32547

Node no.	Y coord	PASSIVE side	Effective stresses: Vertic-al	Active limit	Passive limit	Earth pressure	Total earth pressure	Coeff. of subgrade reaction
		Water press.						
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	0.00	0.00a	66417
2	-0.10	Total>	1.60	0.50m	38.73	1.06	1.06	2231
3	-0.15	Total>	2.40	0.75m	39.53	1.59	1.59	2231
4	-0.28	Total>	4.40	1.38m	41.53	2.92	2.92	2231
5	-0.40	Total>	6.40	2.00m	43.53	4.25	4.25	2231
6	-0.60	Total>	9.60	3.00m	46.73	6.38	6.38	2231
7	-0.80	Total>	12.80	4.00m	49.93	8.51	8.51	2231
8	-1.00	Total>	16.00	5.00m	53.13	10.63	10.63	2231
		Total>	16.00	5.00m	115.04	21.37	21.37	6612
9	-1.20	Total>	19.20	6.00m	118.24	25.64	25.64	6612
10	-1.40	Total>	22.40	7.00m	121.44	29.90	29.90	6612
11	-1.58	Total>	25.20	7.88m	124.24	33.63	33.63	6612
12	-1.75	Total>	28.00	8.75m	127.04	37.36	37.36	6612
13	-1.90	Total>	30.40	9.50m	129.44	40.56	40.56	6612
14	-2.00	Total>	32.00	10.00m	131.04	42.68	42.68	6612
15	-2.20	Total>	35.80	11.00m	134.84	47.09	47.09	6612
16	-2.40	Total>	39.60	12.00m	138.64	51.49	51.49	6612
17	-2.60	Total>	43.40	13.00m	142.44	55.89	55.89	6612
18	-2.80	Total>	47.20	14.00m	146.24	60.28	60.28	6612
19	-3.00	Total>	51.00	15.00m	150.04	64.67	64.67	6612
20	-3.20	Total>	54.80	16.00m	153.84	69.05	69.05	6612
21	-3.40	Total>	58.60	17.00m	157.64	73.43	73.43	6612

(continued)

Stage No.3 Apply surcharge no.2 at elevation 0.00

Node no.	Y coord	PASSIVE side						
		Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	60.50	17.50m	159.54	75.62	75.62	6612
		Total>	60.50	17.50m	233.82	76.41	76.41	39831
23	-3.60	Total>	62.50	18.00m	235.82	78.68	78.68	39831
24	-3.80	Total>	66.50	19.00m	239.82	83.24	83.24	39831

Note: 0.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
4	0.00	0.00	-0.10	12.875	n/a	-0.23	0.23

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.09	-0.000	-4.97E-05	0.0	-0.0	
2	-0.10	-0.01	0.000	-4.97E-05	0.0	0.0	0.5
		-0.01	0.000	-4.97E-05	-0.5	0.0	
3	-0.15	-0.02	0.000	-4.97E-05	-0.5	-0.0	
4	-0.28	-0.04	0.000	-4.95E-05	-0.5	-0.1	
5	-0.40	-0.04	0.000	-4.92E-05	-0.5	-0.1	
6	-0.60	-0.02	0.000	-4.84E-05	-0.5	-0.2	
7	-0.80	0.06	0.000	-4.72E-05	-0.5	-0.3	
8	-1.00	0.19	0.000	-4.56E-05	-0.5	-0.4	
		-0.20	0.000	-4.56E-05	-0.5	-0.4	
9	-1.20	-0.10	0.000	-4.36E-05	-0.5	-0.5	
10	-1.40	0.03	0.000	-4.11E-05	-0.5	-0.6	
11	-1.58	0.17	0.000	-3.87E-05	-0.5	-0.7	
12	-1.75	0.32	0.000	-3.59E-05	-0.4	-0.8	
13	-1.90	0.64	0.000	-3.33E-05	-0.4	-0.8	
		0.46	0.000	-3.33E-05	-0.4	-0.8	
14	-2.00	0.55	0.000	-3.14E-05	-0.3	-0.9	
15	-2.20	0.74	0.000	-2.76E-05	-0.2	-0.9	
16	-2.40	0.92	0.000	-2.36E-05	-0.0	-1.0	
17	-2.60	1.10	0.000	-1.96E-05	0.2	-0.9	
18	-2.80	1.27	0.000	-1.57E-05	0.4	-0.9	
19	-3.00	1.43	0.000	-1.23E-05	0.7	-0.8	
20	-3.20	1.58	0.000	-9.43E-06	1.0	-0.6	
21	-3.40	1.72	0.000	-7.38E-06	1.3	-0.4	
22	-3.50	1.78	0.000	-6.76E-06	1.5	-0.2	
		-5.02	0.000	-6.76E-06	1.5	-0.2	
23	-3.60	-5.01	0.000	-6.41E-06	1.0	-0.1	

(continued)

Stage No.4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
24	-3.80	-4.98	0.000	-6.20E-06	0.0	-0.0	

At elev.-0.10 Strut force = 0.5 kN/strut = 0.5 kN/m run

ACTIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	37.13	0.09	0.09	1746
2	-0.10	Total>	1.60	0.50m	38.73	1.05	1.05	1746
3	-0.15	Total>	2.40	0.75m	39.54	1.57	1.57	1746
4	-0.28	Total>	4.41	1.38m	41.54	2.88	2.88	1746
5	-0.40	Total>	6.43	2.00m	43.56	4.21	4.21	1746
6	-0.60	Total>	9.70	3.00m	46.83	6.36	6.36	1746
7	-0.80	Total>	13.02	4.00m	50.15	8.57	8.57	1746
8	-1.00	Total>	16.38	5.00m	53.52	10.83	10.83	1746
		Total>	16.38	5.00m	115.42	21.17	21.17	5176
9	-1.20	Total>	19.79	6.00m	118.83	25.54	25.54	5176
10	-1.40	Total>	23.24	7.00m	122.28	29.93	29.93	5176
11	-1.58	Total>	26.27	7.88m	125.31	33.80	33.80	5176
12	-1.75	Total>	29.31	8.75m	128.35	37.68	37.68	5176
13	-1.90	Total>	31.92	9.50m	130.96	41.01	41.01	5176
14	-2.00	Total>	33.66	10.00m	132.70	43.24	43.24	5176
15	-2.20	Total>	37.72	11.00m	136.76	47.83	47.83	5176
16	-2.40	Total>	41.78	12.00m	140.82	52.42	52.42	5176
17	-2.60	Total>	45.82	13.00m	144.86	56.99	56.99	5176
18	-2.80	Total>	49.84	14.00m	148.88	61.56	61.56	5176
19	-3.00	Total>	53.85	15.00m	152.89	66.11	66.11	5176
20	-3.20	Total>	57.83	16.00m	156.87	70.64	70.64	5176
21	-3.40	Total>	61.79	17.00m	160.83	75.15	75.15	5176
22	-3.50	Total>	63.76	17.50m	162.80	77.40	77.40	5176
		Total>	63.76	17.50m	237.08	71.39	71.39	31179
23	-3.60	Total>	65.83	18.00m	239.15	73.68	73.68	31179
24	-3.80	Total>	69.96	19.00m	243.28	78.26	78.26	31179

PASSIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	29.37b	0.00	0.00a	2183
2	-0.10	Total>	1.60	0.50m	30.63b	1.06	1.06	2183
		Total>	1.60	0.50m	14.85b	1.06	1.06	2183
3	-0.15	Total>	2.40	0.75m	15.15b	1.59	1.59	2183
		Total>	2.40	0.75m	14.63b	1.59	1.59	2183
4	-0.28	Total>	4.40	1.38m	15.37b	2.92	2.92	2183
		Total>	4.40	1.38m	14.65b	2.92	2.92	2183
5	-0.40	Total>	6.40	2.00m	15.35b	4.25	4.25	2183
		Total>	6.40	2.00m	14.47b	4.25	4.25	2183
6	-0.60	Total>	9.60	3.00m	15.53b	6.38	6.38	2183
		Total>	9.60	3.00m	14.50b	6.38	6.38	2183
7	-0.80	Total>	12.80	4.00m	15.50b	8.51	8.51	2183
		Total>	12.80	4.00m	14.53b	8.51	8.51	2183

(continued)

Stage No.4 Excavate to elevation 0.00 on PASSIVE side
Toe of berm at elevation -1.90
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total	Coeff. of
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
8	-1.00	Total>	16.00	5.00m	15.47b	10.63	10.63	2183
		Total>	16.00	5.00m	115.04	21.37	21.37	6471
9	-1.20	Total>	19.20	6.00m	118.24	25.64	25.64	6471
		Total>	19.20	6.00m	99.51b	25.64	25.64	6471
10	-1.40	Total>	22.40	7.00m	102.21b	29.91	29.91	6471
		Total>	22.40	7.00m	39.54b	29.91	29.91	6471
11	-1.58	Total>	25.20	7.88m	40.46b	33.64	33.64	6471
		Total>	25.20	7.88m	39.55b	33.64	33.64	6471
12	-1.75	Total>	28.00	8.75m	40.45b	37.36	37.36	6471
		Total>	28.00	8.75m	39.63b	37.36	37.36	6471
13	-1.90	Total>	30.40	9.50m	40.37b	40.37	40.37p	6471
		Total>	30.40	9.50m	99.23b	40.56	40.56	6471
14	-2.00	Total>	32.00	10.00m	100.45b	42.68	42.68	6471
		Total>	32.00	10.00m	100.85b	42.68	42.68	6471
15	-2.20	Total>	35.80	11.00m	104.23b	47.09	47.09	6471
		Total>	35.80	11.00m	104.64b	47.09	47.09	6471
16	-2.40	Total>	39.60	12.00m	108.04b	51.49	51.49	6471
		Total>	39.60	12.00m	108.44b	51.49	51.49	6471
17	-2.60	Total>	43.40	13.00m	111.84b	55.89	55.89	6471
		Total>	43.40	13.00m	112.24b	55.89	55.89	6471
18	-2.80	Total>	47.20	14.00m	115.64b	60.28	60.28	6471
		Total>	47.20	14.00m	146.24	60.28	60.28	6471
19	-3.00	Total>	51.00	15.00m	150.04	64.67	64.67	6471
20	-3.20	Total>	54.80	16.00m	153.84	69.05	69.05	6471
21	-3.40	Total>	58.60	17.00m	157.64	73.43	73.43	6471
22	-3.50	Total>	60.50	17.50m	159.54	75.62	75.62	6471
		Total>	60.50	17.50m	233.82	76.41	76.41	38980
23	-3.60	Total>	62.50	18.00m	235.82	78.69	78.69	38980
24	-3.80	Total>	66.50	19.00m	239.82	83.24	83.24	38980

Note: 0.00a Soil pressure at active limit
40.37p Soil pressure at passive limit
107.64b Passive limit reduced because of berm

Units: kN,m

Stage No. 6 Excavate to elevation -1.90 on PASSIVE side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
6	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.46	-0.000	-2.70E-04	0.0	-0.0	
2	-0.10	1.01	0.000	-2.70E-04	0.1	0.0	3.0
		1.01	0.000	-2.70E-04	-2.9	0.0	
3	-0.15	1.51	0.000	-2.70E-04	-2.9	-0.1	
4	-0.28	2.77	0.000	-2.69E-04	-2.6	-0.5	
5	-0.40	4.04	0.000	-2.67E-04	-2.2	-0.8	
6	-0.60	6.10	0.000	-2.63E-04	-1.2	-1.1	
7	-0.80	8.22	0.000	-2.58E-04	0.3	-1.2	
8	-1.00	10.39	0.000	-2.54E-04	2.1	-1.0	
		19.89	0.000	-2.54E-04	2.1	-1.0	
9	-1.20	24.01	0.000	-2.51E-04	6.5	-0.1	
10	-1.40	28.15	0.000	-2.55E-04	11.7	1.7	
11	-1.58	31.79	0.000	-2.65E-04	17.0	4.2	
12	-1.75	35.42	0.000	-2.87E-04	22.9	7.7	50.3
		35.42	0.000	-2.87E-04	-27.4	7.7	
13	-1.90	38.52	0.000	-3.06E-04	-21.8	4.0	
		24.21	0.000	-3.06E-04	-21.8	4.0	
14	-2.00	23.93	0.001	-3.12E-04	-19.4	1.9	
15	-2.20	23.36	0.001	-3.13E-04	-14.7	-1.5	
16	-2.40	22.76	0.001	-3.01E-04	-10.1	-4.0	
17	-2.60	22.14	0.001	-2.81E-04	-5.6	-5.5	
18	-2.80	21.50	0.001	-2.56E-04	-1.2	-6.2	
19	-3.00	20.83	0.001	-2.30E-04	3.0	-6.0	
20	-3.20	20.14	0.001	-2.07E-04	7.1	-5.0	
21	-3.40	19.42	0.001	-1.89E-04	11.0	-3.2	
22	-3.50	19.04	0.001	-1.84E-04	13.0	-2.0	
		-40.83	0.001	-1.84E-04	13.0	-2.0	
23	-3.60	-42.43	0.001	-1.81E-04	8.8	-0.9	
24	-3.80	-45.63	0.001	-1.79E-04	-0.0	-0.0	

At elev.-0.10 Strut force = 3.0 kN/strut = 3.0 kN/m run
At elev.-1.75 Strut force = 50.3 kN/strut = 50.3 kN/m run

(continued)

Stage No.6 Excavate to elevation -1.90 on PASSIVE side

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	Total>	0.00	0.00	37.13	0.46	0.46	121265
2	-0.10	Total>	1.60	0.50m	38.73	1.01	1.01	2025
3	-0.15	Total>	2.40	0.75m	39.54	1.51	1.51	2025
4	-0.28	Total>	4.41	1.38m	41.54	2.77	2.77	2025
5	-0.40	Total>	6.43	2.00m	43.56	4.04	4.04	2025
6	-0.60	Total>	9.70	3.00m	46.83	6.10	6.10	2025
7	-0.80	Total>	13.02	4.00m	50.15	8.22	8.22	2025
8	-1.00	Total>	16.38	5.00m	53.52	10.39	10.39	2025
		Total>	16.38	5.00m	115.42	19.89	19.89	6002
9	-1.20	Total>	19.79	6.00m	118.83	24.01	24.01	6002
10	-1.40	Total>	23.24	7.00m	122.28	28.15	28.15	6002
11	-1.58	Total>	26.27	7.88m	125.31	31.79	31.79	6002
12	-1.75	Total>	29.31	8.75m	128.35	35.42	35.42	6002
13	-1.90	Total>	31.92	9.50m	130.96	38.52	38.52	6002
14	-2.00	Total>	33.66	10.00m	132.70	40.57	40.57	6002
15	-2.20	Total>	37.72	11.00m	136.76	44.82	44.82	6002
16	-2.40	Total>	41.78	12.00m	140.82	49.07	49.07	6002
17	-2.60	Total>	45.82	13.00m	144.86	53.32	53.32	6002
18	-2.80	Total>	49.84	14.00m	148.88	57.58	57.58	6002
19	-3.00	Total>	53.85	15.00m	152.89	61.86	61.86	6002
20	-3.20	Total>	57.83	16.00m	156.87	66.14	66.14	6002
21	-3.40	Total>	61.79	17.00m	160.83	70.43	70.43	6002
22	-3.50	Total>	63.76	17.50m	162.80	72.57	72.57	6002
		Total>	63.76	17.50m	237.08	42.27	42.27	36155
23	-3.60	Total>	65.83	18.00m	239.15	43.93	43.93	36155
24	-3.80	Total>	69.96	19.00m	243.28	47.25	47.25	36155

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	99.04	14.31	14.31	7112
14	-2.00	Total>	1.60	0.50m	100.64	16.64	16.64	7112
15	-2.20	Total>	5.41	1.50m	104.45	21.46	21.46	7112
16	-2.40	Total>	9.26	2.50m	108.30	26.31	26.31	7112
17	-2.60	Total>	13.15	3.50m	112.19	31.18	31.18	7112
18	-2.80	Total>	17.11	4.50m	116.15	36.09	36.09	7112
19	-3.00	Total>	21.15	5.50m	120.19	41.02	41.02	7112
20	-3.20	Total>	25.25	6.50m	124.29	46.00	46.00	7112
21	-3.40	Total>	29.43	7.50m	128.47	51.01	51.01	7112

(continued)

Stage No.6 Excavate to elevation -1.90 on PASSIVE side

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
22	-3.50	Total>	31.55	8.00m	130.59	53.53	53.53	7112
		Total>	31.55	8.00m	204.87	83.10	83.10	42846
23	-3.60	Total>	33.78	8.50m	207.10	86.35	86.35	42846
24	-3.80	Total>	38.28	9.50m	211.60	92.88	92.88	42846

Units: kN,m

Stage No. 7 Apply water pressure profile no.1 (Mod. Conserv.)

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
7	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.49	-0.000	-2.76E-04	0.0	-0.0	
2	-0.10	1.03	0.000	-2.76E-04	0.1	0.0	2.2
		1.03	0.000	-2.76E-04	-2.1	0.0	
3	-0.15	1.53	0.000	-2.76E-04	-2.1	-0.1	
4	-0.28	2.79	0.000	-2.75E-04	-1.8	-0.3	
5	-0.40	4.05	0.000	-2.74E-04	-1.4	-0.5	
6	-0.60	6.11	0.000	-2.71E-04	-0.4	-0.7	
7	-0.80	8.23	0.000	-2.68E-04	1.1	-0.7	
8	-1.00	10.39	0.000	-2.66E-04	2.9	-0.3	
		19.88	0.000	-2.66E-04	2.9	-0.3	
9	-1.20	23.98	0.000	-2.67E-04	7.3	0.8	
10	-1.40	28.10	0.000	-2.75E-04	12.5	2.7	
11	-1.58	31.71	0.000	-2.90E-04	17.8	5.4	
12	-1.75	35.30	0.000	-3.16E-04	23.6	9.0	52.4
		35.30	0.000	-3.16E-04	-28.8	9.0	
13	-1.90	38.36	0.001	-3.39E-04	-23.3	5.1	
		23.88	0.001	-3.39E-04	-23.3	5.1	
14	-2.00	23.55	0.001	-3.47E-04	-20.9	2.9	
15	-2.20	23.52	0.001	-3.51E-04	-16.2	-0.8	
16	-2.40	23.45	0.001	-3.42E-04	-11.5	-3.6	
17	-2.60	23.35	0.001	-3.23E-04	-6.8	-5.4	
18	-2.80	23.23	0.001	-2.98E-04	-2.2	-6.3	
19	-3.00	23.09	0.001	-2.72E-04	2.5	-6.3	
20	-3.20	22.93	0.001	-2.47E-04	7.1	-5.3	
21	-3.40	22.73	0.001	-2.29E-04	11.6	-3.4	
22	-3.50	22.62	0.001	-2.23E-04	13.9	-2.2	
		-43.93	0.001	-2.23E-04	13.9	-2.2	
23	-3.60	-45.56	0.001	-2.19E-04	9.4	-1.0	
24	-3.80	-48.83	0.001	-2.17E-04	-0.0	-0.0	

At elev.-0.10 Strut force = 2.2 kN/strut = 2.2 kN/m run
At elev.-1.75 Strut force = 52.4 kN/strut = 52.4 kN/m run

(continued)

Stage No.7 Apply water pressure profile no.1 (Mod. Conserv.)

Node no.	Y coord	ACTIVE side	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	0.00	37.13	0.49	0.49	3970
2	-0.10	Total>	1.60	0.50m	0.50m	38.73	1.03	1.03	3970
3	-0.15	Total>	2.40	0.75m	0.75m	39.54	1.53	1.53	3970
4	-0.28	Total>	4.41	1.38m	1.38m	41.54	2.79	2.79	3970
5	-0.40	Total>	6.43	2.00m	2.00m	43.56	4.05	4.05	3970
6	-0.60	Total>	9.70	3.00m	3.00m	46.83	6.11	6.11	3970
7	-0.80	Total>	13.02	4.00m	4.00m	50.15	8.23	8.23	3970
8	-1.00	Total>	16.38	5.00m	5.00m	53.52	10.39	10.39	2467
		Total>	16.38	5.00m	5.00m	115.42	19.88	19.88	7312
9	-1.20	Total>	19.79	6.00m	6.00m	118.83	23.98	23.98	7312
10	-1.40	Total>	23.24	7.00m	7.00m	122.28	28.10	28.10	7312
11	-1.58	Total>	26.27	7.88m	7.88m	125.31	31.71	31.71	7312
12	-1.75	Total>	29.31	8.75m	8.75m	128.35	35.30	35.30	7312
13	-1.90	Total>	31.92	9.50m	9.50m	130.96	38.36	38.36	7312
14	-2.00	Total>	33.66	10.00m	10.00m	132.70	40.39	40.39	7312
15	-2.20	Total>	37.72	11.00m	11.00m	136.76	44.59	44.59	7312
16	-2.40	Total>	41.78	12.00m	12.00m	140.82	48.78	48.78	7312
17	-2.60	Total>	45.82	13.00m	13.00m	144.86	52.97	52.97	7312
18	-2.80	Total>	49.84	14.00m	14.00m	148.88	57.17	57.17	7312
19	-3.00	Total>	53.85	15.00m	15.00m	152.89	61.38	61.38	7312
20	-3.20	Total>	57.83	16.00m	16.00m	156.87	65.61	65.61	7312
21	-3.40	Total>	61.79	17.00m	17.00m	160.83	69.84	69.84	7312
22	-3.50	Total>	63.76	17.50m	17.50m	162.80	71.95	71.95	7312
		Total>	63.76	17.50m	17.50m	237.08	38.53	38.53	44048
23	-3.60	Total>	65.83	18.00m	18.00m	239.15	40.02	40.02	44048
24	-3.80	Total>	69.96	19.00m	19.00m	243.28	43.01	43.01	44048

Node no.	Y coord	PASSIVE side	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10		0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15		0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28		0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40		0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60		0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80		0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00		0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20		0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40		0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58		0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75		0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90		0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	0.00	99.04	14.49	14.49	8376
14	-2.00	Total>	1.60	0.50m	0.50m	100.64	16.84	16.84	8376
15	-2.20	Total>	4.81	1.50m	1.50m	103.85	21.07	21.07	8376
16	-2.40	Total>	8.06	2.50m	2.50m	107.10	25.33	25.33	8376
17	-2.60	Total>	11.35	3.50m	3.50m	110.39	29.62	29.62	8376
18	-2.80	Total>	14.71	4.50m	4.50m	113.75	33.94	33.94	8376
19	-3.00	Total>	18.15	5.50m	5.50m	117.19	38.29	38.29	8376
20	-3.20	Total>	21.65	6.50m	6.50m	120.69	42.68	42.68	8376
21	-3.40	Total>	25.23	7.50m	7.50m	124.27	47.10	47.10	8376

(continued)

Stage No.7 Apply water pressure profile no.1 (Mod. Conserv.)

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
22	-3.50	Total>	27.05	8.00m	126.09	49.33	49.33	8376
		Total>	27.05	8.00m	200.37	82.47	82.47	50456
23	-3.60	Total>	28.98	8.50m	202.30	85.59	85.59	50456
24	-3.80	Total>	32.88	9.50m	206.20	91.84	91.84	50456

Units: kN,m

Stage No. 8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	FoS for toe elev. = -3.80 Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Toe elev. for FoS = 1.000 Wall Penetr -ation
8	0.00	-1.90		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.50	-0.000	-2.77E-04	0.0	-0.0	
2	-0.10	1.04	0.000	-2.77E-04	0.1	0.0	1.9
		1.04	0.000	-2.77E-04	-1.8	0.0	
3	-0.15	1.54	0.000	-2.77E-04	-1.7	-0.1	
4	-0.28	2.79	0.000	-2.77E-04	-1.4	-0.3	
5	-0.40	4.06	0.000	-2.76E-04	-1.0	-0.4	
6	-0.60	6.12	0.000	-2.74E-04	0.0	-0.5	
7	-0.80	8.23	0.000	-2.72E-04	1.4	-0.4	
8	-1.00	10.39	0.000	-2.71E-04	3.3	0.1	
		19.88	0.000	-2.71E-04	3.3	0.1	
9	-1.20	23.97	0.000	-2.74E-04	7.7	1.1	
10	-1.40	28.08	0.000	-2.83E-04	12.9	3.2	
11	-1.58	31.68	0.000	-3.00E-04	18.1	5.9	
12	-1.75	35.26	0.000	-3.28E-04	24.0	9.6	53.2
		35.26	0.000	-3.28E-04	-29.2	9.6	
13	-1.90	38.30	0.001	-3.52E-04	-23.7	5.6	
		23.75	0.001	-3.52E-04	-23.7	5.6	
14	-2.00	23.41	0.001	-3.62E-04	-21.3	3.4	
15	-2.20	23.32	0.001	-3.68E-04	-16.7	-0.4	
16	-2.40	23.20	0.001	-3.60E-04	-12.0	-3.3	
17	-2.60	23.04	0.001	-3.42E-04	-7.4	-5.2	
18	-2.80	22.86	0.001	-3.18E-04	-2.8	-6.2	
19	-3.00	22.65	0.001	-2.91E-04	1.8	-6.3	
20	-3.20	24.78	0.001	-2.66E-04	6.5	-5.5	
		25.96	0.001	-2.66E-04	6.5	-5.5	
21	-3.40	28.99	0.001	-2.46E-04	12.0	-3.7	
		29.86	0.001	-2.46E-04	12.0	-3.7	

(continued)

Stage No.8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
22	-3.50	31.39	0.001	-2.40E-04	15.1	-2.3	
		-47.48	0.001	-2.40E-04	15.1	-2.3	
23	-3.60	-49.28	0.001	-2.37E-04	10.2	-1.1	
24	-3.80	-52.88	0.001	-2.34E-04	-0.0	-0.0	

At elev.-0.10 Strut force = 1.9 kN/strut = 1.9 kN/m run
At elev.-1.75 Strut force = 53.2 kN/strut = 53.2 kN/m run

Node no.	Y coord	ACTIVE side	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	0.50	0.50	3368
2	-0.10	Total>	1.60	0.50m	38.73	1.04	1.04	3368
3	-0.15	Total>	2.40	0.75m	39.54	1.54	1.54	3368
4	-0.28	Total>	4.41	1.38m	41.54	2.79	2.79	3368
5	-0.40	Total>	6.43	2.00m	43.56	4.06	4.06	3368
6	-0.60	Total>	9.70	3.00m	46.83	6.12	6.12	3368
7	-0.80	Total>	13.02	4.00m	50.15	8.23	8.23	3368
8	-1.00	Total>	16.38	5.00m	53.52	10.39	10.39	3368
		Total>	16.38	5.00m	115.42	19.88	19.88	9984
9	-1.20	Total>	19.79	6.00m	118.83	23.97	23.97	7544
10	-1.40	Total>	23.24	7.00m	122.28	28.08	28.08	7544
11	-1.58	Total>	26.27	7.88m	125.31	31.68	31.68	7544
12	-1.75	Total>	29.31	8.75m	128.35	35.26	35.26	7544
13	-1.90	Total>	31.92	9.50m	130.96	38.30	38.30	7544
14	-2.00	Total>	33.66	10.00m	132.70	40.32	40.32	7544
15	-2.20	Total>	37.72	11.00m	136.76	44.50	44.50	7544
16	-2.40	Total>	41.78	12.00m	140.82	48.66	48.66	7544
17	-2.60	Total>	45.82	13.00m	144.86	52.83	52.83	7544
18	-2.80	Total>	49.84	14.00m	148.88	57.00	57.00	7544
19	-3.00	Total>	53.85	15.00m	152.89	61.18	61.18	7544
20	-3.20	Total>	57.83	16.00m	156.87	65.37	65.37	7544
21	-3.40	Total>	61.79	17.00m	160.83	69.57	69.57	7544
22	-3.50	Total>	63.76	17.50m	162.80	71.68	71.68	7544
		Total>	63.76	17.50m	237.08	36.88	36.88	45447
23	-3.60	Total>	65.83	18.00m	239.15	38.29	38.29	45447
24	-3.80	Total>	69.96	19.00m	243.28	41.12	41.12	45447

Node no.	Y coord	PASSIVE side	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.8 Excavate to elevation -1.90 on PASSIVE side
Toe of berm at elevation -3.80
Width of top of berm = 0.10
Width of toe of berm = 2.00

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	79.36b	14.55	14.55	8608
14	-2.00	Total>	1.60	0.50m	80.64b	16.92	16.92	8608
		Total>	1.60	0.50m	39.37b	16.92	16.92	8608
15	-2.20	Total>	4.81	1.50m	40.63b	21.18	21.18	8608
		Total>	4.81	1.50m	39.38b	21.18	21.18	8608
16	-2.40	Total>	8.06	2.50m	40.62b	25.47	25.47	8608
		Total>	8.06	2.50m	39.39b	25.47	25.47	8608
17	-2.60	Total>	11.35	3.50m	40.61b	29.79	29.79	8608
		Total>	11.35	3.50m	39.40b	29.79	29.79	8608
18	-2.80	Total>	14.71	4.50m	40.60b	34.14	34.14	8608
		Total>	14.71	4.50m	39.41b	34.14	34.14	8608
19	-3.00	Total>	18.15	5.50m	40.59b	38.53	38.53	8608
		Total>	18.15	5.50m	39.41b	38.53	38.53	8608
20	-3.20	Total>	21.65	6.50m	40.59b	40.59	40.59p	8608
		Total>	21.65	6.50m	39.42b	39.42	39.42p	8608
21	-3.40	Total>	25.23	7.50m	40.58b	40.58	40.58p	8608
		Total>	25.23	7.50m	39.71b	39.71	39.71p	8608
22	-3.50	Total>	27.05	8.00m	40.29b	40.29	40.29p	8608
		Total>	27.05	8.00m	200.37	84.36	84.36	51857
23	-3.60	Total>	28.98	8.50m	202.30	87.57	87.57	51857
24	-3.80	Total>	32.88	9.50m	206.20	94.00	94.00	51857

Note: 12.34a Soil pressure at active limit
40.29p Soil pressure at passive limit
40.29b Passive limit reduced because of berm

Units: kN,m

Stage No. 10 Excavate to elevation -3.80 on PASSIVE side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
10	0.00	-3.60		More than one strut			

*** Warning - Weak strata at or below toe of wall:
Active limit (active side) > Passive limit (passive side)
19.00kN/m2 > 0.00kN/m2 at elev. -3.80

The above pressures include water pressure.

*** Warning - Failure and flow of soil BELOW the toe of the wall may occur if the wall is not toed in to a firm stratum. It may occur even when acceptable factors of safety and displacements have been calculated.

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.06	-0.000	-4.15E-04	0.0	-0.0	
2	-0.10	1.54	-0.000	-4.15E-04	0.1	0.0	-0.0
3	-0.15	2.01	-0.000	-4.15E-04	0.2	0.0	
4	-0.28	3.19	-0.000	-4.15E-04	0.5	0.1	
5	-0.40	4.36	0.000	-4.16E-04	1.0	0.2	
6	-0.60	6.30	0.000	-4.17E-04	2.1	0.5	
7	-0.80	8.29	0.000	-4.20E-04	3.5	1.0	
8	-1.00	10.36	0.000	-4.26E-04	5.4	1.9	
		19.79	0.000	-4.26E-04	5.4	1.9	
9	-1.20	23.69	0.000	-4.38E-04	9.8	3.4	
10	-1.40	27.59	0.000	-4.57E-04	14.9	5.9	
11	-1.58	30.99	0.001	-4.85E-04	20.0	8.9	
12	-1.75	34.37	0.001	-5.25E-04	25.7	12.9	72.6
		34.37	0.001	-5.25E-04	-46.8	12.9	
13	-1.90	37.23	0.001	-5.56E-04	-41.5	6.3	
14	-2.00	39.13	0.001	-5.65E-04	-37.6	2.3	
15	-2.20	43.06	0.001	-5.60E-04	-29.4	-4.4	
16	-2.40	47.00	0.001	-5.31E-04	-20.4	-9.4	
17	-2.60	50.97	0.001	-4.85E-04	-10.6	-12.5	
18	-2.80	54.98	0.001	-4.30E-04	-0.0	-13.5	

(continued)

Stage No.10 Excavate to elevation -3.80 on PASSIVE side

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
19	-3.00	59.04	0.001	-3.75E-04	11.4	-12.4	
20	-3.20	63.15	0.001	-3.30E-04	23.6	-8.9	
21	-3.40	67.28	0.001	-3.05E-04	36.6	-2.9	
22	-3.50	69.34	0.001	-3.03E-04	43.5	1.1	50.8
		22.82	0.001	-3.03E-04	-7.4	1.1	
23	-3.60	23.99	0.001	-3.05E-04	-5.0	0.5	
24	-3.80	26.30	0.002	-3.06E-04	0.0	-0.0	

At elev.-0.10 The strut is slack
At elev.-1.75 Strut force = 72.6 kN/strut = 72.6 kN/m run
At elev.-3.50 Strut force = 50.8 kN/strut = 50.8 kN/m run

Node no.	Y coord	ACTIVE side: Effective stresses: Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	37.13	1.06	1.06	4383
2	-0.10	Total>	1.60	0.50m	38.73	1.54	1.54	4383
3	-0.15	Total>	2.40	0.75m	39.54	2.01	2.01	4383
4	-0.28	Total>	4.41	1.38m	41.54	3.19	3.19	4383
5	-0.40	Total>	6.43	2.00m	43.56	4.36	4.36	4093
6	-0.60	Total>	9.70	3.00m	46.83	6.30	6.30	4093
7	-0.80	Total>	13.02	4.00m	50.15	8.29	8.29	4093
8	-1.00	Total>	16.38	5.00m	53.52	10.36	10.36	2064
		Total>	16.38	5.00m	115.42	19.79	19.79	6119
9	-1.20	Total>	19.79	6.00m	118.83	23.69	23.69	6119
10	-1.40	Total>	23.24	7.00m	122.28	27.59	27.59	6119
11	-1.58	Total>	26.27	7.88m	125.31	30.99	30.99	6119
12	-1.75	Total>	29.31	8.75m	128.35	34.37	34.37	6119
13	-1.90	Total>	31.92	9.50m	130.96	37.23	37.23	6119
14	-2.00	Total>	33.66	10.00m	132.70	39.13	39.13	6119
15	-2.20	Total>	37.72	11.00m	136.76	43.06	43.06	6119
16	-2.40	Total>	41.78	12.00m	140.82	47.00	47.00	6119
17	-2.60	Total>	45.82	13.00m	144.86	50.97	50.97	6119
18	-2.80	Total>	49.84	14.00m	148.88	54.98	54.98	6119
19	-3.00	Total>	53.85	15.00m	152.89	59.04	59.04	6119
20	-3.20	Total>	57.83	16.00m	156.87	63.15	63.15	6119
21	-3.40	Total>	61.79	17.00m	160.83	67.28	67.28	6119
22	-3.50	Total>	63.76	17.50m	162.80	69.34	69.34	6119
		Total>	63.76	17.50m	237.08	22.82	22.82	36863
23	-3.60	Total>	65.83	18.00m	239.15	23.99	23.99	36863
24	-3.80	Total>	69.96	19.00m	243.28	26.30	26.30	36863

Node no.	Y coord	PASSIVE side: Effective stresses: Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.10 Excavate to elevation -3.80 on PASSIVE side

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22	-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
23	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
24	-3.80	0.00	0.01	0.00	0.00	0.00	0.00	0.0

Units: kN,m

Stage No. 12 Remove strut or anchor no.3 at elevation -3.50

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
12	0.00	-3.60		More than one strut			

*** Warning - Weak strata at or below toe of wall:
Active limit (active side) > Passive limit (passive side)
19.00kN/m2 > 0.00kN/m2 at elev. -3.80

The above pressures include water pressure.

*** Warning - Failure and flow of soil BELOW the toe of the wall may occur if the wall is not toed in to a firm stratum. It may occur even when acceptable factors of safety and displacements have been calculated.

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.18	-0.000	-4.43E-04	0.0	-0.0	
2	-0.10	1.65	-0.000	-4.43E-04	0.1	0.0	-0.0
3	-0.15	2.11	-0.000	-4.43E-04	0.2	0.0	
4	-0.28	3.28	-0.000	-4.43E-04	0.6	0.1	
5	-0.40	4.43	0.000	-4.44E-04	1.1	0.2	
6	-0.60	6.36	0.000	-4.45E-04	2.1	0.5	
7	-0.80	8.32	0.000	-4.48E-04	3.6	1.0	
8	-1.00	10.37	0.000	-4.55E-04	5.5	2.0	
		19.82	0.000	-4.55E-04	5.5	2.0	
9	-1.20	23.66	0.000	-4.66E-04	9.8	3.5	
10	-1.40	27.53	0.000	-4.86E-04	14.9	5.9	
11	-1.58	30.91	0.001	-5.14E-04	20.1	9.0	
12	-1.75	34.25	0.001	-5.55E-04	25.8	13.0	75.2
		34.25	0.001	-5.55E-04	-49.4	13.0	
13	-1.90	37.08	0.001	-5.85E-04	-44.1	6.0	
14	-2.00	38.96	0.001	-5.93E-04	-40.3	1.8	
15	-2.20	42.86	0.001	-5.85E-04	-32.1	-5.5	
16	-2.40	46.77	0.001	-5.50E-04	-23.1	-11.0	
17	-2.60	50.73	0.001	-4.96E-04	-13.4	-14.7	
18	-2.80	54.73	0.001	-4.30E-04	-2.8	-16.3	

(continued)

Stage No.12 Remove strut or anchor no.3 at elevation -3.50

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
19	-3.00	58.80	0.001	-3.62E-04	8.5	-15.7	
20	-3.20	62.93	0.001	-3.02E-04	20.7	-12.8	
21	-3.40	67.11	0.001	-2.59E-04	33.7	-7.4	
22	-3.50	69.20	0.001	-2.47E-04	40.5	-3.7	
		21.97	0.001	-2.47E-04	40.5	-3.7	
23	-3.60	23.36	0.001	-2.44E-04	42.8	0.5	47.7
		23.36	0.001	-2.44E-04	-4.9	0.5	
24	-3.80	26.12	0.002	-2.45E-04	0.0	-0.0	

At elev.-0.10 The strut is slack
At elev.-1.75 Strut force = 75.2 kN/strut = 75.2 kN/m run
At elev.-3.60 Strut force = 47.7 kN/strut = 47.7 kN/m run

Node no.	Y coord	ACTIVE side: Water press. kN/m2	Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	Total>	0.00	0.00	37.13	1.18	1.18	3924
2	-0.10	Total>	1.60	0.50m	38.73	1.65	1.65	3924
3	-0.15	Total>	2.40	0.75m	39.54	2.11	2.11	3924
4	-0.28	Total>	4.41	1.38m	41.54	3.28	3.28	3924
5	-0.40	Total>	6.43	2.00m	43.56	4.43	4.43	3924
6	-0.60	Total>	9.70	3.00m	46.83	6.36	6.36	3924
7	-0.80	Total>	13.02	4.00m	50.15	8.32	8.32	3924
8	-1.00	Total>	16.38	5.00m	53.52	10.37	10.37	3924
		Total>	16.38	5.00m	115.42	19.82	19.82	11632
9	-1.20	Total>	19.79	6.00m	118.83	23.66	23.66	6123
10	-1.40	Total>	23.24	7.00m	122.28	27.53	27.53	6123
11	-1.58	Total>	26.27	7.88m	125.31	30.91	30.91	6123
12	-1.75	Total>	29.31	8.75m	128.35	34.25	34.25	6123
13	-1.90	Total>	31.92	9.50m	130.96	37.08	37.08	6123
14	-2.00	Total>	33.66	10.00m	132.70	38.96	38.96	6123
15	-2.20	Total>	37.72	11.00m	136.76	42.86	42.86	6123
16	-2.40	Total>	41.78	12.00m	140.82	46.77	46.77	6123
17	-2.60	Total>	45.82	13.00m	144.86	50.73	50.73	6123
18	-2.80	Total>	49.84	14.00m	148.88	54.73	54.73	6123
19	-3.00	Total>	53.85	15.00m	152.89	58.80	58.80	6123
20	-3.20	Total>	57.83	16.00m	156.87	62.93	62.93	6123
21	-3.40	Total>	61.79	17.00m	160.83	67.11	67.11	6123
22	-3.50	Total>	63.76	17.50m	162.80	69.20	69.20	6123
		Total>	63.76	17.50m	237.08	21.97	21.97	36888
23	-3.60	Total>	65.83	18.00m	239.15	23.36	23.36	36888
24	-3.80	Total>	69.96	19.00m	243.28	26.12	26.12	36888

Node no.	Y coord	PASSIVE side: Water press. kN/m2	Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.12 Remove strut or anchor no.3 at elevation -3.50

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22	-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
23	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
24	-3.80	0.00	0.01	0.00	0.00	0.00	0.00	0.0

Units: kN,m

Stage No. 13 Fill to elevation -3.40 on PASSIVE side with soil type 4

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
13	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.18	-0.000	-4.43E-04	0.0	-0.0	
2	-0.10	1.65	-0.000	-4.43E-04	0.1	0.0	-0.0
3	-0.15	2.11	-0.000	-4.43E-04	0.2	0.0	
4	-0.28	3.28	-0.000	-4.44E-04	0.6	0.1	
5	-0.40	4.43	0.000	-4.44E-04	1.1	0.2	
6	-0.60	6.36	0.000	-4.45E-04	2.1	0.5	
7	-0.80	8.32	0.000	-4.49E-04	3.6	1.0	
8	-1.00	10.37	0.000	-4.55E-04	5.5	2.0	
		19.82	0.000	-4.55E-04	5.5	2.0	
9	-1.20	23.66	0.000	-4.66E-04	9.8	3.5	
10	-1.40	27.53	0.000	-4.86E-04	14.9	5.9	
11	-1.58	30.90	0.001	-5.14E-04	20.1	9.0	
12	-1.75	34.25	0.001	-5.55E-04	25.8	13.0	75.2
		34.25	0.001	-5.55E-04	-49.4	13.0	
13	-1.90	37.08	0.001	-5.85E-04	-44.1	6.0	
14	-2.00	38.96	0.001	-5.93E-04	-40.3	1.8	
15	-2.20	42.86	0.001	-5.85E-04	-32.1	-5.5	
16	-2.40	46.77	0.001	-5.50E-04	-23.1	-11.0	
17	-2.60	50.73	0.001	-4.96E-04	-13.4	-14.7	
18	-2.80	54.73	0.001	-4.30E-04	-2.9	-16.3	
19	-3.00	58.80	0.001	-3.62E-04	8.5	-15.8	
20	-3.20	62.93	0.001	-3.02E-04	20.7	-12.8	
21	-3.40	67.11	0.001	-2.59E-04	33.7	-7.4	
22	-3.50	68.70	0.001	-2.47E-04	40.5	-3.7	
		21.49	0.001	-2.47E-04	40.5	-3.7	
23	-3.60	22.38	0.001	-2.44E-04	42.7	0.4	47.3
		22.38	0.001	-2.44E-04	-4.7	0.4	
24	-3.80	24.15	0.002	-2.44E-04	0.0	-0.0	

At elev.-0.10 The strut is slack
At elev.-1.75 Strut force = 75.2 kN/strut = 75.2 kN/m run
At elev.-3.60 Strut force = 47.3 kN/strut = 47.3 kN/m run

(continued)

Stage No.13 Fill to elevation -3.40 on PASSIVE side with soil type 4

Node no.	Y coord	ACTIVE side						
			Effective stresses			Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	1.18	1.18	5608
2	-0.10	Total>	1.60	0.50m	38.73	1.65	1.65	5608
3	-0.15	Total>	2.40	0.75m	39.54	2.11	2.11	5608
4	-0.28	Total>	4.41	1.38m	41.54	3.28	3.28	5608
5	-0.40	Total>	6.43	2.00m	43.56	4.43	4.43	5608
6	-0.60	Total>	9.70	3.00m	46.83	6.36	6.36	5608
7	-0.80	Total>	13.02	4.00m	50.15	8.32	8.32	2108
8	-1.00	Total>	16.38	5.00m	53.52	10.37	10.37	2108
		Total>	16.38	5.00m	115.42	19.82	19.82	6249
9	-1.20	Total>	19.79	6.00m	118.83	23.66	23.66	6249
10	-1.40	Total>	23.24	7.00m	122.28	27.53	27.53	6249
11	-1.58	Total>	26.27	7.88m	125.31	30.90	30.90	6249
12	-1.75	Total>	29.31	8.75m	128.35	34.25	34.25	6249
13	-1.90	Total>	31.92	9.50m	130.96	37.08	37.08	6249
14	-2.00	Total>	33.66	10.00m	132.70	38.96	38.96	6249
15	-2.20	Total>	37.72	11.00m	136.76	42.86	42.86	6249
16	-2.40	Total>	41.78	12.00m	140.82	46.77	46.77	6249
17	-2.60	Total>	45.82	13.00m	144.86	50.73	50.73	6249
18	-2.80	Total>	49.84	14.00m	148.88	54.73	54.73	6249
19	-3.00	Total>	53.85	15.00m	152.89	58.80	58.80	6249
20	-3.20	Total>	57.83	16.00m	156.87	62.93	62.93	6249
21	-3.40	Total>	61.79	17.00m	160.83	67.11	67.11	19891
22	-3.50	Total>	63.76	17.50m	162.80	69.20	69.20	19891
		Total>	63.76	17.50m	237.08	21.99	21.99	119826
23	-3.60	Total>	65.83	18.00m	239.15	23.38	23.38	119826
24	-3.80	Total>	69.96	19.00m	243.28	26.15	26.15	119826

Node no.	Y coord	PASSIVE side						
			Effective stresses			Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	0.00	0.00a	54243732

(continued)

Stage No.13 Fill to elevation -3.40 on PASSIVE side with soil type 4

Node no.	Y coord	PASSIVE side						
		Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	54243732
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	54243732
24	-3.80	Total>	8.86	2.00m	21054.86	2.00	2.00a	54243732

Note: 2.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 15 Remove strut or anchor no.1 at elevation -0.10

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
15	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	1.18	-0.000	-4.43E-04	0.0	-0.0	
2	-0.10	1.65	-0.000	-4.43E-04	0.1	0.0	
3	-0.15	2.11	-0.000	-4.43E-04	0.2	0.0	-0.0
4	-0.28	3.28	-0.000	-4.44E-04	0.6	0.1	
5	-0.40	4.43	0.000	-4.44E-04	1.1	0.2	
6	-0.60	6.36	0.000	-4.45E-04	2.1	0.5	
7	-0.80	8.32	0.000	-4.49E-04	3.6	1.0	
8	-1.00	10.37	0.000	-4.55E-04	5.5	2.0	
		19.82	0.000	-4.55E-04	5.5	2.0	
9	-1.20	23.66	0.000	-4.66E-04	9.8	3.5	
10	-1.40	27.53	0.000	-4.86E-04	14.9	5.9	
11	-1.58	30.90	0.001	-5.14E-04	20.1	9.0	
12	-1.75	34.25	0.001	-5.55E-04	25.8	13.0	75.2
		34.25	0.001	-5.55E-04	-49.4	13.0	
13	-1.90	37.08	0.001	-5.85E-04	-44.1	6.0	
14	-2.00	38.96	0.001	-5.93E-04	-40.3	1.8	
15	-2.20	42.86	0.001	-5.85E-04	-32.1	-5.5	
16	-2.40	46.77	0.001	-5.50E-04	-23.1	-11.0	
17	-2.60	50.73	0.001	-4.96E-04	-13.4	-14.7	
18	-2.80	54.73	0.001	-4.30E-04	-2.8	-16.3	
19	-3.00	58.80	0.001	-3.62E-04	8.5	-15.8	
20	-3.20	62.93	0.001	-3.02E-04	20.7	-12.8	
21	-3.40	67.11	0.001	-2.59E-04	33.7	-7.4	
22	-3.50	68.70	0.001	-2.47E-04	40.5	-3.7	
		21.49	0.001	-2.47E-04	40.5	-3.7	
23	-3.60	22.38	0.001	-2.44E-04	42.7	0.4	47.3
		22.38	0.001	-2.44E-04	-4.6	0.4	
24	-3.80	24.15	0.002	-2.44E-04	0.0	-0.0	

At elev.-0.15 Strut force = -0.0 kN/strut = -0.0 kN/m run
At elev.-1.75 Strut force = 75.2 kN/strut = 75.2 kN/m run
At elev.-3.60 Strut force = 47.3 kN/strut = 47.3 kN/m run

(continued)

Stage No.15 Remove strut or anchor no.1 at elevation -0.10

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	37.13	1.18	1.18	5330
2	-0.10	Total>	1.60	0.50m	38.73	1.65	1.65	5330
3	-0.15	Total>	2.40	0.75m	39.54	2.11	2.11	5330
4	-0.28	Total>	4.41	1.38m	41.54	3.28	3.28	5330
5	-0.40	Total>	6.43	2.00m	43.56	4.43	4.43	5330
6	-0.60	Total>	9.70	3.00m	46.83	6.36	6.36	5330
7	-0.80	Total>	13.02	4.00m	50.15	8.32	8.32	5330
8	-1.00	Total>	16.38	5.00m	53.52	10.37	10.37	2157
		Total>	16.38	5.00m	115.42	19.82	19.82	6394
9	-1.20	Total>	19.79	6.00m	118.83	23.66	23.66	6394
10	-1.40	Total>	23.24	7.00m	122.28	27.53	27.53	6394
11	-1.58	Total>	26.27	7.88m	125.31	30.90	30.90	6394
12	-1.75	Total>	29.31	8.75m	128.35	34.25	34.25	6394
13	-1.90	Total>	31.92	9.50m	130.96	37.08	37.08	6394
14	-2.00	Total>	33.66	10.00m	132.70	38.96	38.96	6394
15	-2.20	Total>	37.72	11.00m	136.76	42.86	42.86	6394
16	-2.40	Total>	41.78	12.00m	140.82	46.77	46.77	6394
17	-2.60	Total>	45.82	13.00m	144.86	50.73	50.73	6394
18	-2.80	Total>	49.84	14.00m	148.88	54.73	54.73	6394
19	-3.00	Total>	53.85	15.00m	152.89	58.80	58.80	6394
20	-3.20	Total>	57.83	16.00m	156.87	62.93	62.93	6394
21	-3.40	Total>	61.79	17.00m	160.83	67.11	67.11	6394
22	-3.50	Total>	63.76	17.50m	162.80	69.20	69.20	24298
		Total>	63.76	17.50m	237.08	21.99	21.99	146376
23	-3.60	Total>	65.83	18.00m	239.15	23.38	23.38	146376
24	-3.80	Total>	69.96	19.00m	243.28	26.15	26.15	146376

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	0.00	0.00a	3.80E+08

(continued)

Stage No.15 Remove strut or anchor no.1 at elevation -0.10

Node no.	Y coord	PASSIVE side						
			Effective stresses			Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	kN/m2	kN/m3
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	65895734
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	65895734
24	-3.80	Total>	8.86	2.00m	21054.86	2.00	2.00a	65895734

Note: 2.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Stage No. 16 Remove strut or anchor no.2 at elevation -1.75

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
16	0.00	-3.40		More than one strut			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	2.74	-0.000	-1.09E-03	0.0	0.0	
2	-0.10	2.02	-0.000	-1.09E-03	0.2	0.0	
3	-0.15	2.09	-0.000	-1.09E-03	0.3	0.0	26.4
		2.09	-0.000	-1.09E-03	-26.1	0.0	
4	-0.28	3.09	0.000	-1.09E-03	-25.8	-3.2	
5	-0.40	4.09	0.000	-1.08E-03	-25.3	-6.4	
6	-0.60	5.77	0.000	-1.04E-03	-24.3	-11.4	
7	-0.80	7.51	0.001	-9.86E-04	-23.0	-16.1	
8	-1.00	9.36	0.001	-9.08E-04	-21.3	-20.6	
		16.83	0.001	-9.08E-04	-21.3	-20.6	
9	-1.20	20.21	0.001	-8.13E-04	-17.6	-24.5	
10	-1.40	23.75	0.001	-7.03E-04	-13.2	-27.5	
11	-1.58	26.97	0.001	-5.97E-04	-8.8	-29.5	
12	-1.75	30.30	0.001	-4.86E-04	-3.8	-30.6	
13	-1.90	33.25	0.001	-3.88E-04	1.0	-30.8	
14	-2.00	35.27	0.001	-3.24E-04	4.4	-30.5	
15	-2.20	39.55	0.001	-1.98E-04	11.9	-28.9	
16	-2.40	43.97	0.002	-8.28E-05	20.3	-25.7	
17	-2.60	48.50	0.002	1.54E-05	29.5	-20.7	
18	-2.80	53.11	0.001	8.85E-05	39.7	-13.8	
19	-3.00	57.77	0.001	1.28E-04	50.7	-4.8	
20	-3.20	62.44	0.001	1.24E-04	62.8	6.5	
21	-3.40	67.05	0.001	6.74E-05	75.7	20.4	
		-3524.43	0.001	6.74E-05	75.7	20.4	
22	-3.50	69.21	0.001	3.49E-05	-97.0	10.3	
		24.54	0.001	3.49E-05	-97.0	10.3	
23	-3.60	29.41	0.001	2.32E-05	-94.3	0.7	-87.5
		29.41	0.001	2.32E-05	-6.8	0.7	
24	-3.80	38.99	0.001	2.16E-05	0.0	-0.0	

At elev.-0.15 Strut force = 26.4 kN/strut = 26.4 kN/m run
At elev.-3.60 Strut force = -87.5 kN/strut = -87.5 kN/m run

(continued)

Stage No.16 Remove strut or anchor no.2 at elevation -1.75

Node no.	Y coord	ACTIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	Total>	0.00	0.00	37.13	2.74	2.74	18226
2	-0.10	Total>	1.60	0.50m	38.73	2.02	2.02	18226
3	-0.15	Total>	2.40	0.75m	39.54	2.09	2.09	1966
4	-0.28	Total>	4.41	1.38m	41.54	3.09	3.09	1966
5	-0.40	Total>	6.43	2.00m	43.56	4.09	4.09	1966
6	-0.60	Total>	9.70	3.00m	46.83	5.77	5.77	1966
7	-0.80	Total>	13.02	4.00m	50.15	7.51	7.51	1966
8	-1.00	Total>	16.38	5.00m	53.52	9.36	9.36	1966
		Total>	16.38	5.00m	115.42	16.83	16.83	5827
9	-1.20	Total>	19.79	6.00m	118.83	20.21	20.21	5827
10	-1.40	Total>	23.24	7.00m	122.28	23.75	23.75	5827
11	-1.58	Total>	26.27	7.88m	125.31	26.97	26.97	5827
12	-1.75	Total>	29.31	8.75m	128.35	30.30	30.30	5827
13	-1.90	Total>	31.92	9.50m	130.96	33.25	33.25	5827
14	-2.00	Total>	33.66	10.00m	132.70	35.27	35.27	5827
15	-2.20	Total>	37.72	11.00m	136.76	39.55	39.55	5827
16	-2.40	Total>	41.78	12.00m	140.82	43.97	43.97	5827
17	-2.60	Total>	45.82	13.00m	144.86	48.50	48.50	5827
18	-2.80	Total>	49.84	14.00m	148.88	53.11	53.11	5827
19	-3.00	Total>	53.85	15.00m	152.89	57.77	57.77	5827
20	-3.20	Total>	57.83	16.00m	156.87	62.44	62.44	5827
21	-3.40	Total>	61.79	17.00m	160.83	67.05	67.05	5827
22	-3.50	Total>	63.76	17.50m	162.80	69.71	69.71	24260
		Total>	63.76	17.50m	237.08	25.04	25.04	146147
23	-3.60	Total>	65.83	18.00m	239.15	30.41	30.41	146147
24	-3.80	Total>	69.96	19.00m	243.28	40.99	40.99	146147

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total earth pressure	Coeff. of subgrade reaction
		Water press. kN/m2	Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	21046.00	3591.48	3591.48	3.85E+08

(continued)

Stage No.16 Remove strut or anchor no.2 at elevation -1.75

Node no.	Y coord	PASSIVE side						
		Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
22	-3.50	Total>	2.20	0.50m	21048.20	0.50	0.50a	65795005
23	-3.60	Total>	4.41	1.00m	21050.41	1.00	1.00a	65795005
24	-3.80	Total>	8.86	2.00m	21054.86	2.00	2.00a	65795005

Note: 2.00a Soil pressure at active limit
123.45p Soil pressure at passive limit

Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: Serviceability Limit State
All loads and soil strengths are unfactored

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80: Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000: Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			
2	0.00	0.00		No analysis at this stage			
3	0.00	0.00	-0.10	93.125	n/a	-0.18	0.18
4	0.00	0.00	-0.10	12.875	n/a	-0.23	0.23
5	0.00	0.00		No analysis at this stage			

All remaining stages have more than one strut - FoS calculation n/a

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 10.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 3.80 from wall
Passive side 3.00 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment Calculated		Bending moment Factored		Shear force Calculated		Shear force Factored	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m	kN/m	kN/m	kN/m
1	0.00	0.000	-0.000	0	-0	0	-0	0	0	0	0
2	-0.10	0.000	-0.000	0	0	0	0	0	-3	0	-4
3	-0.15	0.000	-0.000	0	-0	0	-0	0	-26	0	-35
4	-0.28	0.000	-0.000	0	-3	0	-4	1	-26	1	-35
5	-0.40	0.000	-0.000	0	-6	0	-9	1	-25	1	-34
6	-0.60	0.000	-0.000	0	-11	1	-15	2	-24	3	-33
7	-0.80	0.001	0.000	1	-16	1	-22	4	-23	5	-31
8	-1.00	0.001	0.000	2	-21	3	-28	5	-21	7	-29
9	-1.20	0.001	0.000	3	-24	5	-33	10	-18	13	-24
10	-1.40	0.001	0.000	6	-28	8	-37	15	-13	20	-18
11	-1.58	0.001	0.000	9	-29	12	-40	20	-9	27	-12
12	-1.75	0.001	0.000	13	-31	18	-41	26	-49	35	-67
13	-1.90	0.001	0.000	6	-31	8	-42	1	-44	1	-60
14	-2.00	0.001	0.000	3	-31	5	-41	4	-40	6	-54
15	-2.20	0.001	0.000	0	-29	0	-39	12	-32	16	-43
16	-2.40	0.002	0.000	0	-26	0	-35	20	-23	27	-31
17	-2.60	0.002	0.000	0	-21	0	-28	29	-13	40	-18
18	-2.80	0.001	0.000	0	-16	0	-22	40	-3	54	-4
19	-3.00	0.001	0.000	0	-16	0	-21	51	0	69	0
20	-3.20	0.001	0.000	7	-13	9	-17	63	0	85	0
21	-3.40	0.001	0.000	20	-7	27	-10	76	0	102	0
22	-3.50	0.001	0.000	10	-4	14	-5	43	-97	59	-131
23	-3.60	0.001	0.000	1	-1	1	-1	43	-94	58	-127
24	-3.80	0.002	0.000	0	-0	0	-0	0	-0	0	-0

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
no.	max.	elev.	min.	elev.	max.	min.	max.	elev.	min.	elev.	max.	min.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	kN/m
1	0	-1.40	-0	-3.20	0	-0	0	-0.10	0	0.00	0	0
2	No calculation at this stage											
3	0	-0.10	-1	-2.40	0	-1	1	-3.50	-0	-1.40	2	-1
4	0	-0.10	-1	-2.40	0	-1	1	-3.50	-0	-1.40	2	-1
5	No calculation at this stage											
6	8	-1.75	-6	-2.80	10	-8	23	-1.75	-27	-1.75	31	-37
7	9	-1.75	-6	-2.80	12	-9	24	-1.75	-29	-1.75	32	-39
8	10	-1.75	-6	-3.00	13	-9	24	-1.75	-29	-1.75	32	-39
9	No calculation at this stage											
10	13	-1.75	-14	-2.80	17	-18	43	-3.50	-47	-1.75	59	-63
11	No calculation at this stage											
12	13	-1.75	-16	-2.80	18	-22	43	-3.60	-49	-1.75	58	-67
13	13	-1.75	-16	-2.80	18	-22	43	-3.60	-49	-1.75	58	-67
14	No calculation at this stage											
15	13	-1.75	-16	-2.80	18	-22	43	-3.60	-49	-1.75	58	-67
16	20	-3.40	-31	-1.90	27	-42	76	-3.40	-97	-3.50	102	-131

Maximum and minimum displacement at each stage

Stage	Displacement				Stage description
no.	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	-3.80	-0.000	0.00	Apply surcharge no.1 at elev. 0.00
2	No calculation at this stage				Install strut no.1 at elev. -0.10
3	0.000	-3.80	-0.000	0.00	Apply surcharge no.2 at elev. 0.00
4	0.000	-3.80	-0.000	0.00	Excav. to elev. 0.00 on PASSIVE side
5	No calculation at this stage				Install strut no.2 at elev. -1.75
6	0.001	-3.80	-0.000	0.00	Excav. to elev. -1.90 on PASSIVE side
7	0.001	-3.80	-0.000	0.00	Apply water pressure profile no.1
8	0.001	-3.80	-0.000	0.00	Excav. to elev. -1.90 on PASSIVE side
9	No calculation at this stage				Install strut no.3 at elev. -3.50
10	0.002	-3.80	-0.000	0.00	Excav. to elev. -3.80 on PASSIVE side
11	No calculation at this stage				Install strut no.4 at elev. -3.60
12	0.002	-3.80	-0.000	0.00	Remove strut no.3 at elev. -3.50
13	0.002	-3.80	-0.000	0.00	Fill to elev. -3.40 on PASSIVE side
14	No calculation at this stage				Install strut no.5 at elev. -0.15
15	0.002	-3.80	-0.000	0.00	Remove strut no.1 at elev. -0.10
16	0.002	-2.60	-0.000	0.00	Remove strut no.2 at elev. -1.75

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Strut forces at each stage (horizontal components)

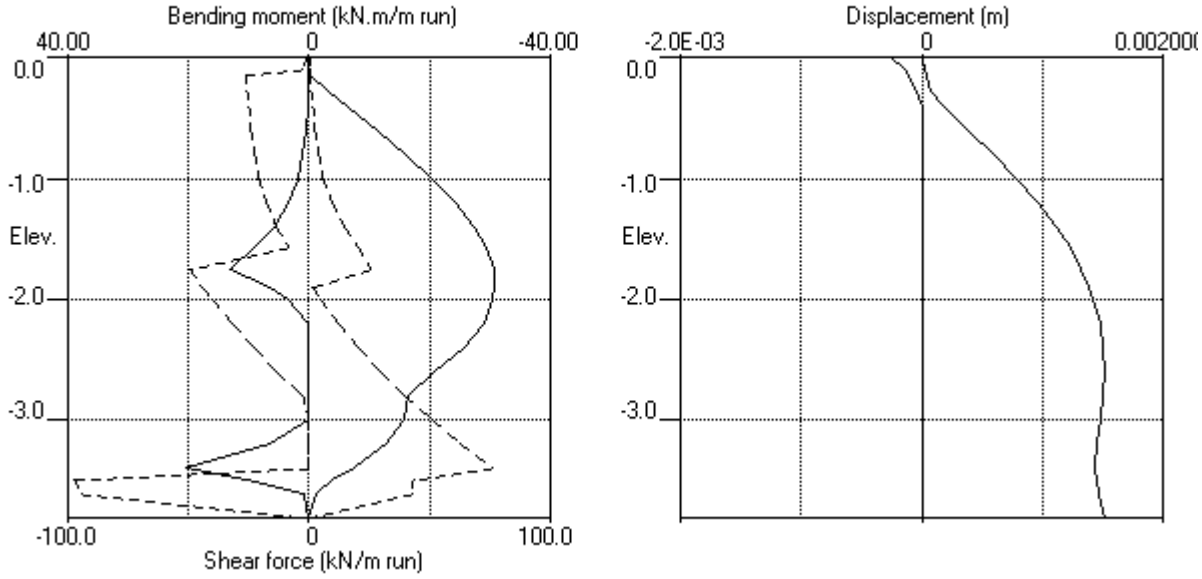
Stage no.	Strut no. 1 at elev.-0.10			Strut no. 2 at elev.-1.75			Strut no. 3 at elev.-3.50		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut
3	0	0	1	---	---	---	---	---	---
4	0	0	1	---	---	---	---	---	---
6	3	3	4	50	50	68	---	---	---
7	2	2	3	52	52	71	---	---	---
8	2	2	3	53	53	72	---	---	---
10	slack	slack	slack	73	73	98	51	51	69
12	slack	slack	slack	75	75	101	---	---	---
13	slack	slack	slack	75	75	102	---	---	---
15	---	---	---	75	75	102	---	---	---

Stage no.	Strut no. 4 at elev.-3.60			Strut no. 5 at elev.-0.15		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut
12	48	48	64	---	---	---
13	47	47	64	---	---	---
15	47	47	64	-0	-0	-0
16	-88	-88	-118	26	26	36

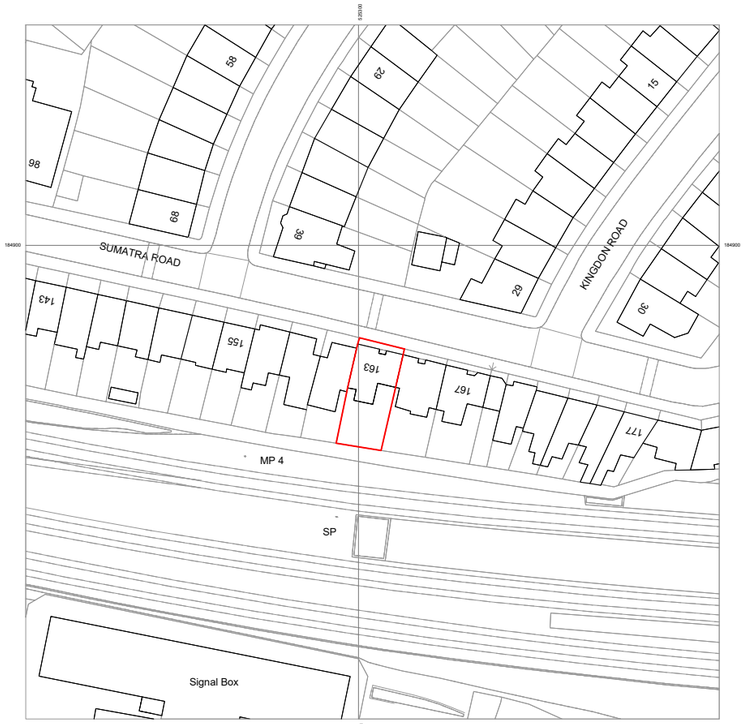
* Indicates that the total force shown is the sum of the force in the strut plus a force applied at the same elevation which may represent temperature load or other forces which are part of the strut load. Force components are listed in the detailed results for individual stages.

Units: kN,m

Bending moment, shear force, displacement envelopes



Appendix D Information Provided by the Client



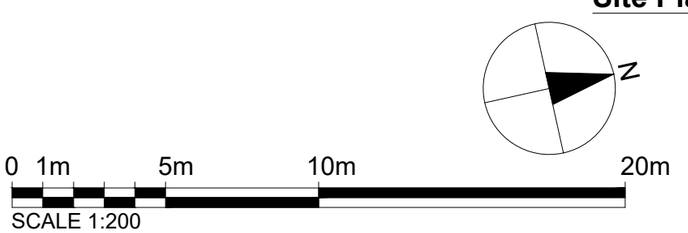
OS Map

KEY

1 Entrance
2 Lightwell
3 Bins
4 Cycle Storage
5 Garden
6 Roof lights

Property Boundary

Site Plan



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Local Authority All work is to be carried out to the requirements, and to the satisfaction of the Local Authority. These drawings are for planning purposes only.

Discrepancies Any discrepancies to be brought to the attention of Drawing And Planning Ltd. Immediately.

REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Location Plans

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-L101	1:1250 / 1:200

DRAWINGANDPLANNING
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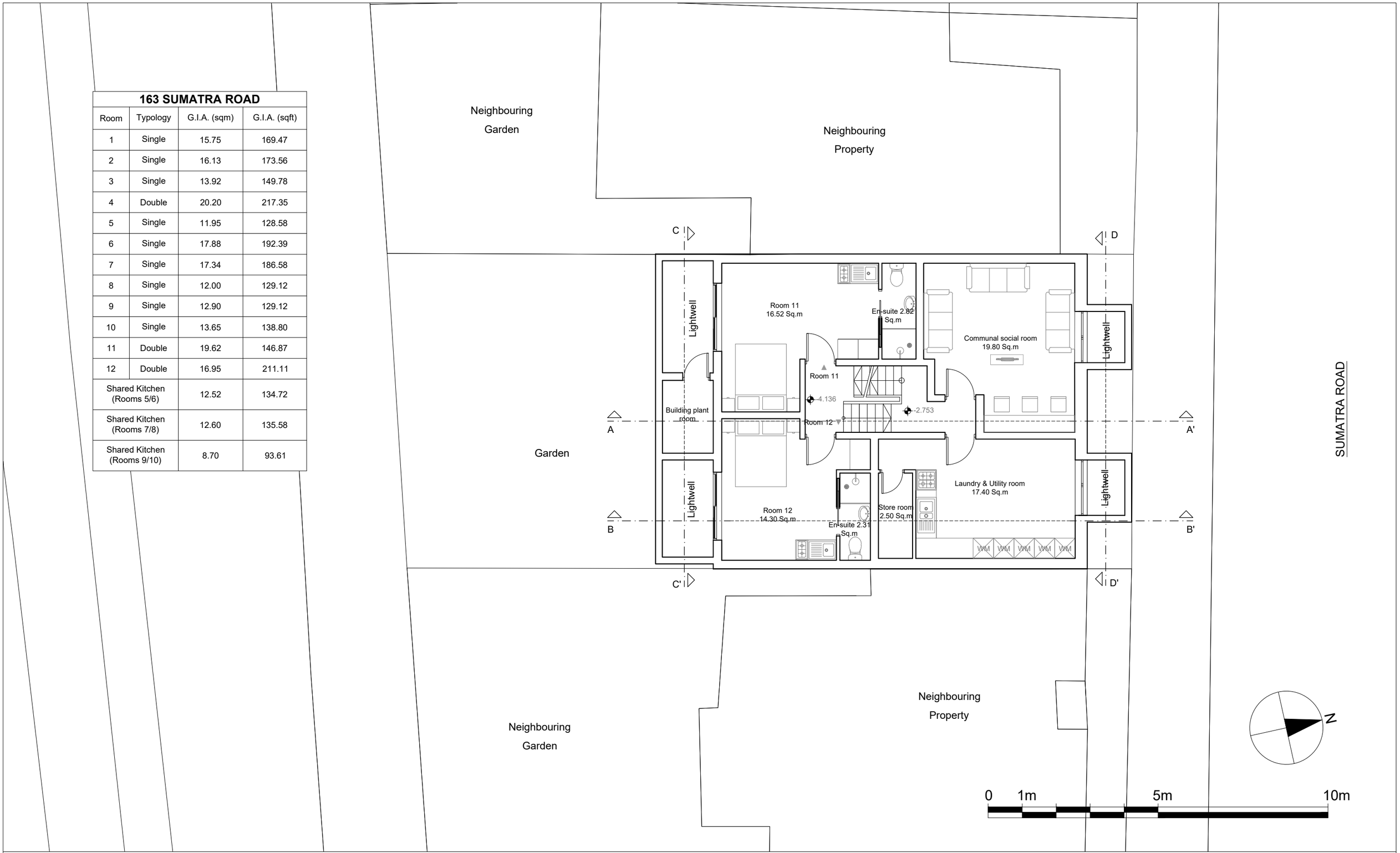
0208 202 3665

163 SUMATRA ROAD			
Room	Typology	G.I.A. (sqm)	G.I.A. (sqft)
1	Single	15.75	169.47
2	Single	16.13	173.56
3	Single	13.92	149.78
4	Double	20.20	217.35
5	Single	11.95	128.58
6	Single	17.88	192.39
7	Single	17.34	186.58
8	Single	12.00	129.12
9	Single	12.90	129.12
10	Single	13.65	138.80
11	Double	19.62	146.87
12	Double	16.95	211.11
Shared Kitchen (Rooms 5/6)		12.52	134.72
Shared Kitchen (Rooms 7/8)		12.60	135.58
Shared Kitchen (Rooms 9/10)		8.70	93.61



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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Basement

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P100	1:100

DRAWINGANDPLANNING
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0208 202 3665

163 SUMATRA ROAD			
Room	Typology	G.I.A. (sqm)	G.I.A. (sqft)
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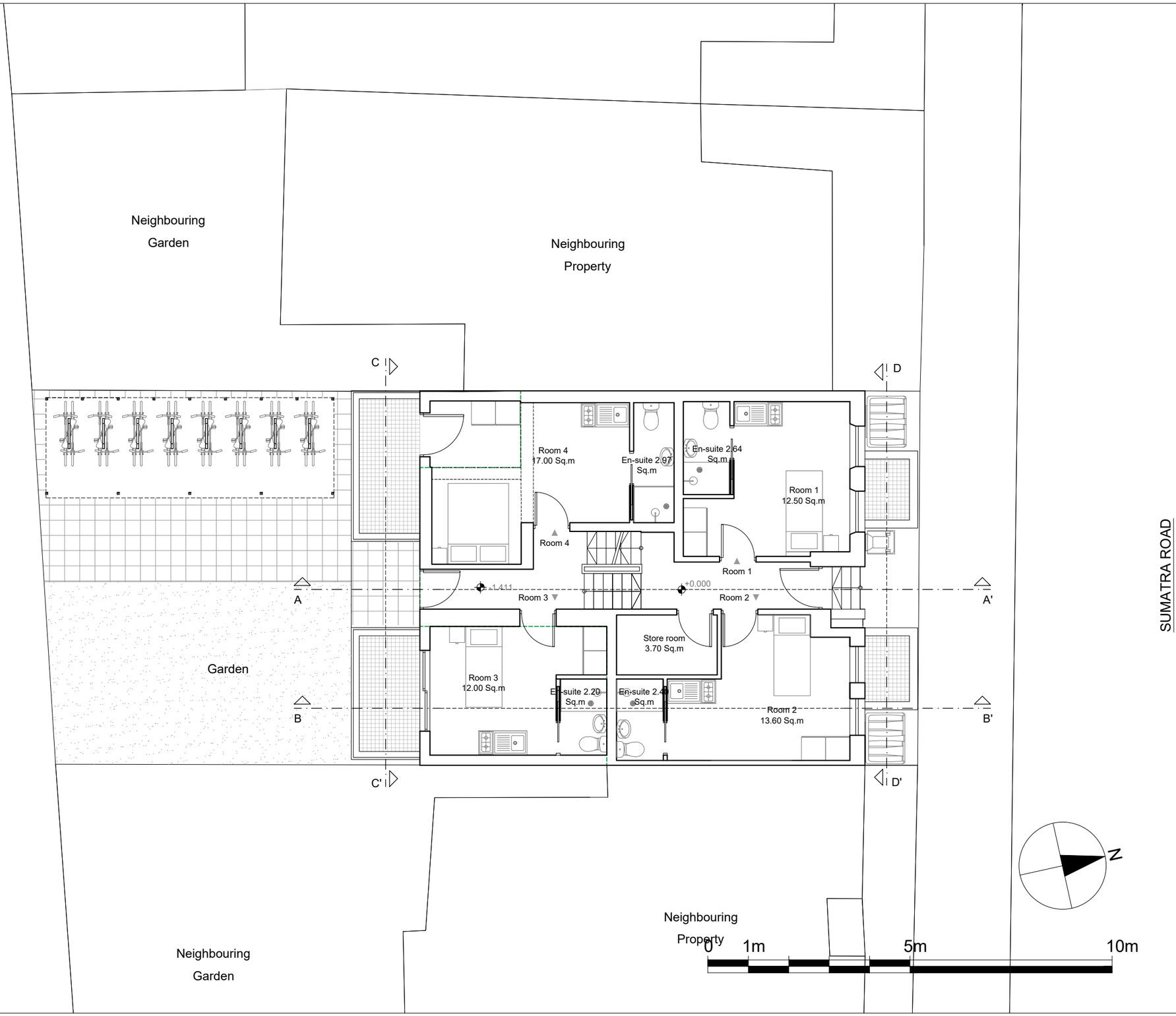

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Ground Floor

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P101	1:100

DRAWINGANDPLANNING
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163 SUMATRA ROAD			
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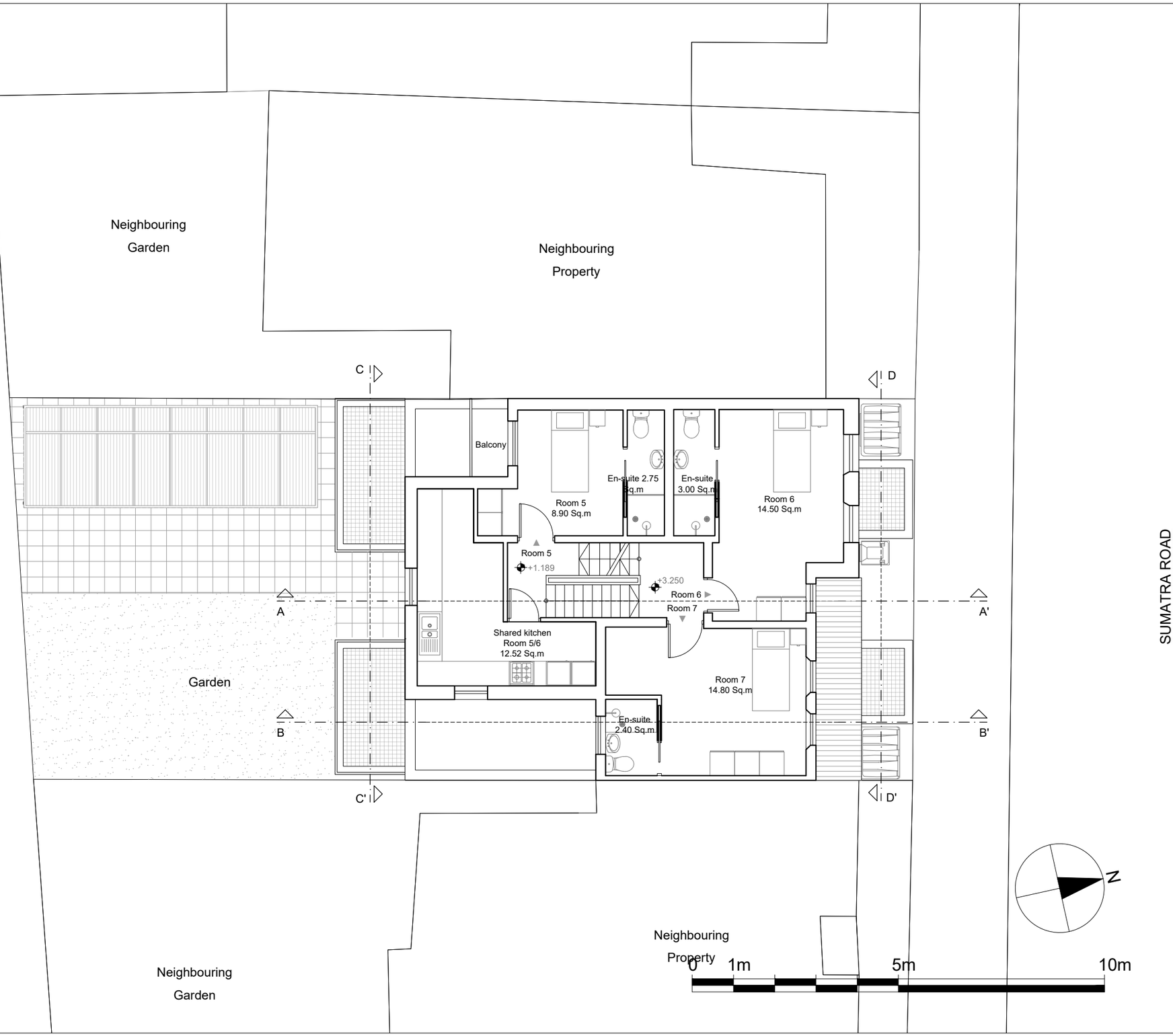

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - First Floor

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P102	1:100

DRAWINGANDPLANNING
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0208 202 3665

163 SUMATRA ROAD			
Room	Typology	G.I.A. (sqm)	G.I.A. (sqft)
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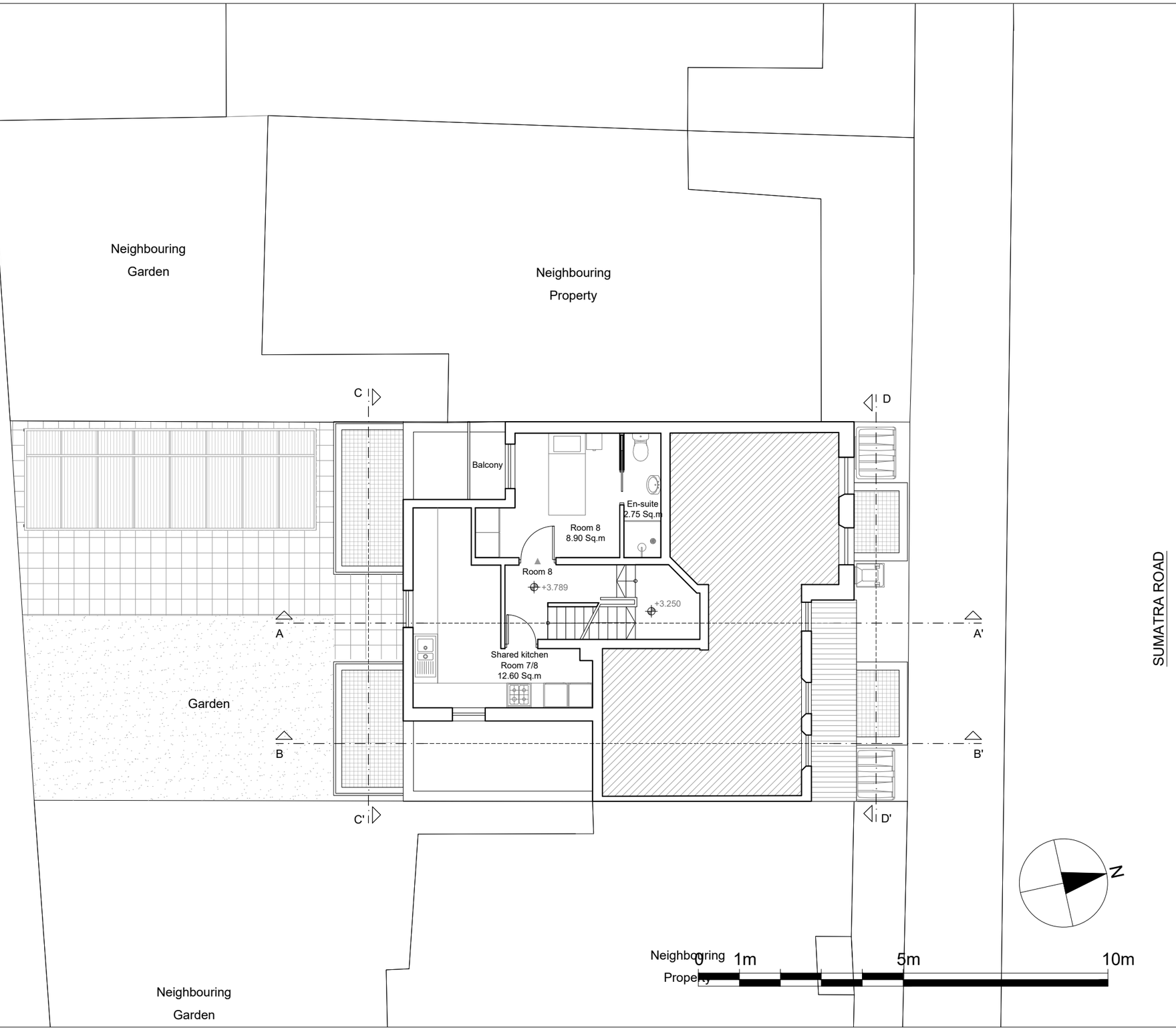

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Second Floor

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P103	1:100

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163 SUMATRA ROAD			
Room	Typology	G.I.A. (sqm)	G.I.A. (sqft)
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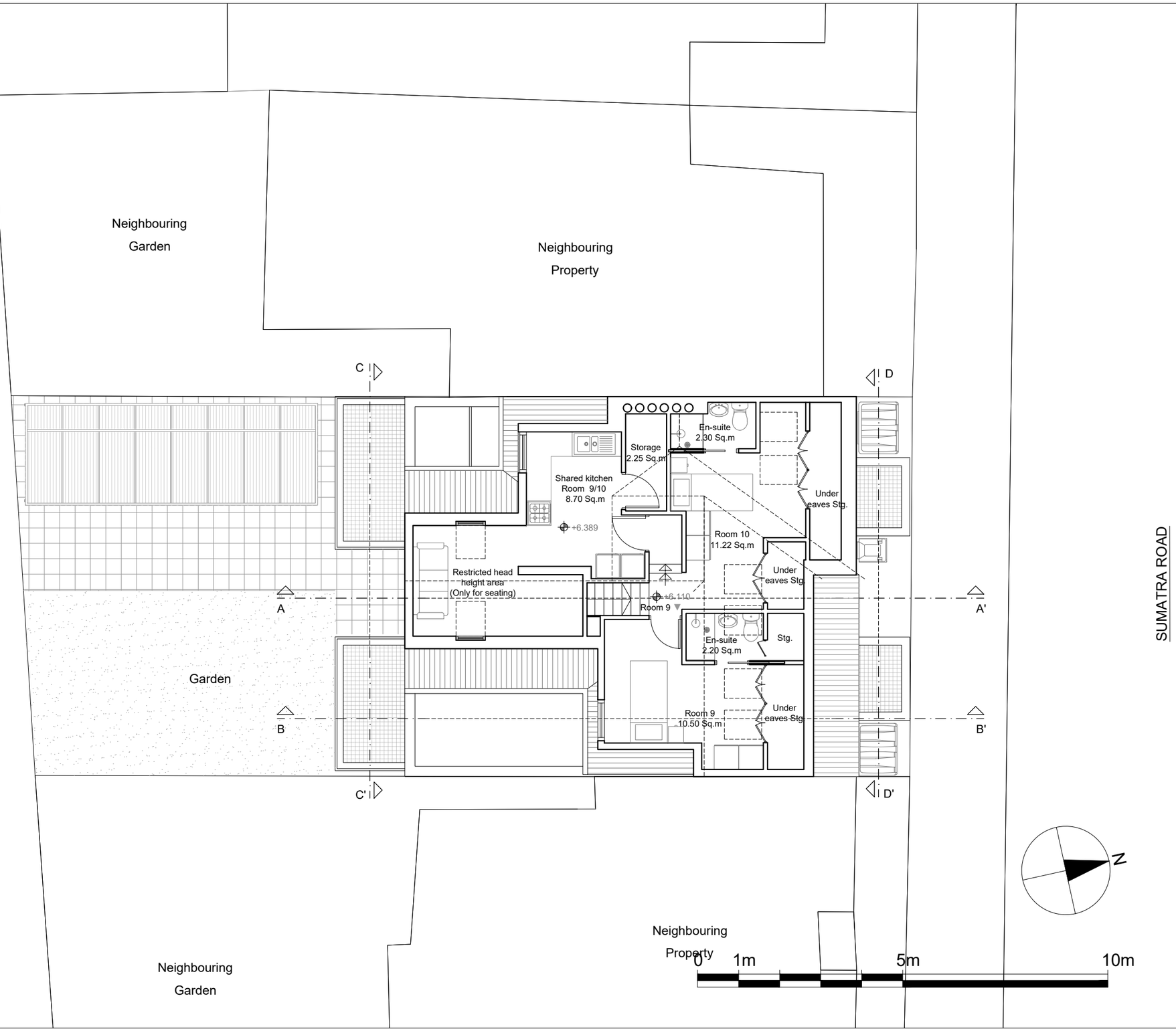

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Loft Plan

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P104	1:100

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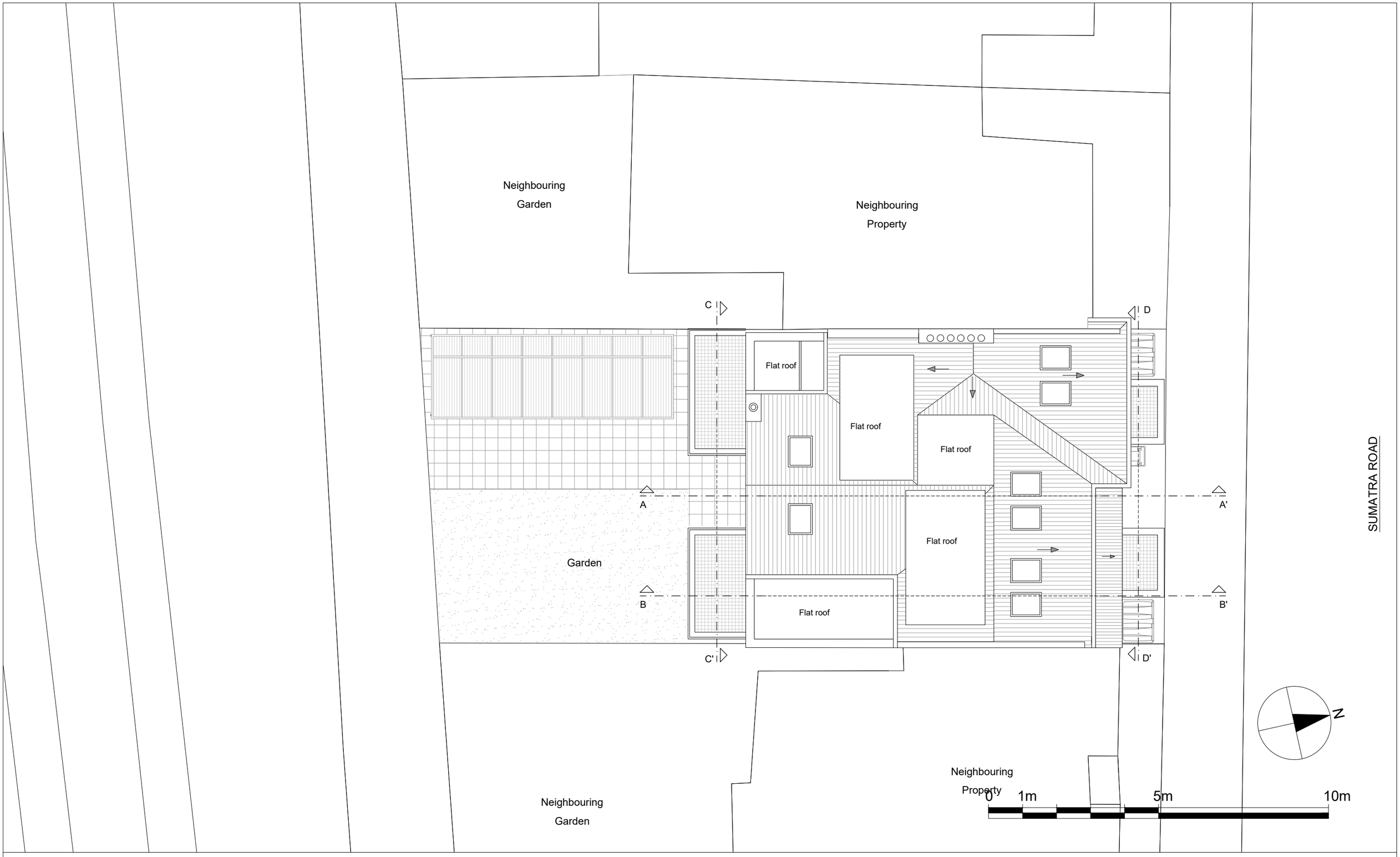

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Roof Plan

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-P105	1:100

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed-Front Elevation

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-E101	1:100

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed-Rear Elevation

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-E102	1:100

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0 1m 5m 10m

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Section AA'

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-S101	1:100

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Section BB'

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-S102	1:100

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0 1m 5m 10m

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Section CC'

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-S103	1:100

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0 1m 5m 10m

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REVISIONS

REV	DATE	DESCRIPTION	BY	CH

PROJECT TITLE
163 Sumatra Road

DRAWING TITLE
Proposed - Section DD'

CLIENT
Jeremy Stein

DATE	REVISION	DRAWING No.	SCALE @ A3
June 2020	/	SMROD-S104	1:100

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0208 202 3665

ENGINEER'S CONSTRUCTION NOTES

GENERAL
To be read in conjunction with all Engineers' drawings and method statement and with all architectural and services drawings and specifications. Seek instructions in the event of any conflict.
The structural designs shown are to be set out to suit the conditions of the site and existing works if any and the Architect's proposals.
Do not scale - please ask for information.
Some notes may not apply.

DEMOLITION AND TEMPORARY WORKS
Demolition to be carried out in accordance with BS 6187 and Health and Safety Executive Guidance Notes GS29/1, 3 and 4.
Openings in existing buildings to be formed according to the recommendations of BRE Good Building Guide no. 20 "Removing Internal Load Bearing Walls in Older Dwellings".
The Contractor is to be responsible for the stability and structural integrity of the Works. Design, supply and maintain during the execution of the Works all shoring, strutting, needling and other temporary works as may be necessary.

FOUNDATIONS
Concrete to foundations to be grade 30. Use sulphate resisting cement below d.p.c./d.p.m. if recommended by Building Control officer.
Excavation and filling to be in accordance with BS 8000:Part 1.

LINTELS
Lintels in external walls if not specified on the drawing to be Catnic or similar proprietary pressed steel lintels as recommended by their manufacturer for use in the particular situation and loading. Bearing as recommended by manufacturer (normally 150).
Internal lintels to be Supreme Concrete Ltd prestressed lintels with 150 minimum bearing.

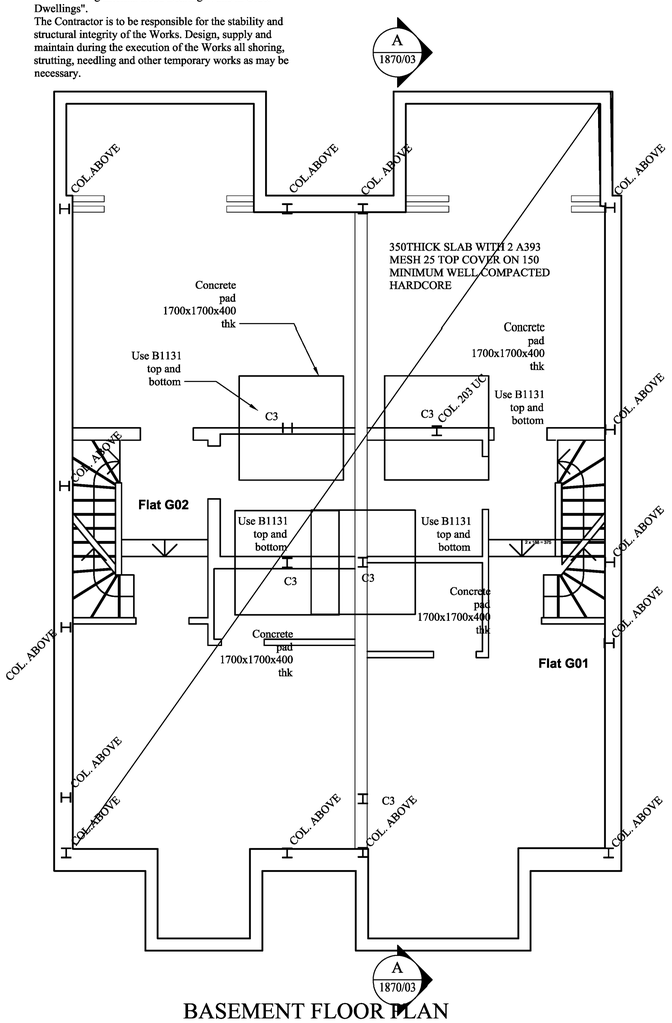
MASONRY
Blocks: 3.5 N lightweight blocks unless noted otherwise, to conform with the insulation value specified by the Architect.
Facing bricks to be as specified by the Architect.
Common bricks to be clay fletton bricks with a compressive strength of 20 N/mm2 or more unless specified otherwise.
All new blocks and bricks to be manufactured under 'special' manufacturing control to BS 5628 : part 1 : 1992 clause 27.2.1.2.
Mortar generally to be one of the following:
1 : 1 : 5 to 6 cement : lime : sand, or
1 : 4 to 5 masonry cement : sand, or
1 : 5 to 6 cement : sand with plasticizer,
unless otherwise stated.
Close cavity with d.p.c. and ties at all openings in cavity walls.

STEEL FINISHES
Galvanizing or other finishes specified to be in accordance with the NSSS section 10.

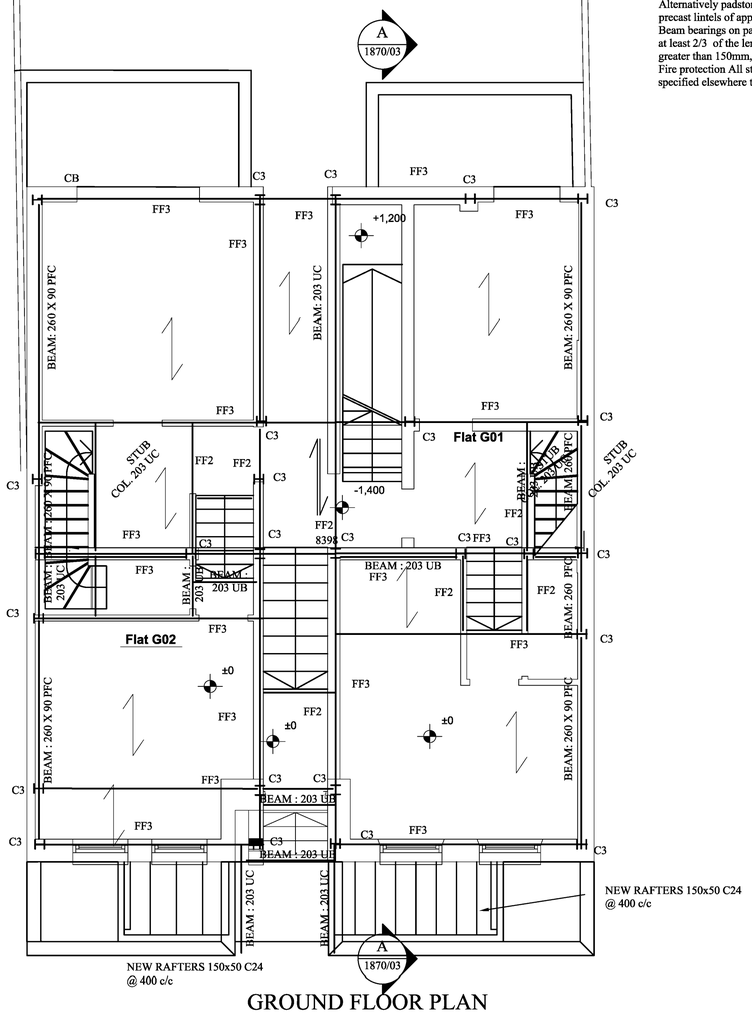
STRAPS
Walls to be strapped to floors using 30 x 5 galvanized mild steel straps at 2,000mm max. centres with noggins between joists if they run parallel to the wall, and packing between last joist and the wall. Strap to be hooked type, turned over a whole block.
All new wall plates at eaves to be strapped down to walls using 30 x 5 galvanized mild steel straps at 2,000mm max. centres screwed securely to masonry with four 50mm no. 10 screws, and fully nailed to timber.

STRUCTURAL STEELWORK
All steelwork to be in accordance with BS 5950 and the National Structural Steelwork Specification.
Grade S275 structural steel to be BS EN 10025 S275 JR.
Grade S355 structural steel to be BS EN 10025 S355 J0.
All members to be grade S275 unless noted otherwise, except for structural hollow sections which are generally to be hot formed BS EN 10210 S355 J2H or 'Celcius'. Cold formed hollow sections not permitted unless specified as such on the drawings.
Connections: All bolts to be grade 8.8, minimum 16mm diameter, in holes 2mm bigger than nominal bolt size, unless otherwise stated.
Welds to be minimum 4mm fillet welds around the full perimeter of the parts to be connected. All welds to be shop welds, but site welds may be used with prior agreement of the Engineer and Building Control Officer and may be subject to testing at Contractor's expense.
Double beams to be bolted together using M16 bolts at 1,500mm max centres with steel tube spacers.
Padstones to be grade 30 concrete. At Contractor's option and with the approval of the CA and Building Control officer padstones may be constructed from 35N/mm2 engineering bricks and 1:3 mortar, in which case the height of the padstone is to be made at least 50% more than that specified. Alternatively padstones may be cut carefully using an angle grinder from precast lintels of appropriate size.
Beam bearings on padstones to be full width of padstone if up to 150mm, or at least 2/3 of the length of the padstone in the direction of the beam span if greater than 150mm, unless otherwise specified on the drawings.
Fire protection All steel to be protected from fire to 30 minute standard or as specified elsewhere to the satisfaction of the CA and Building Control.

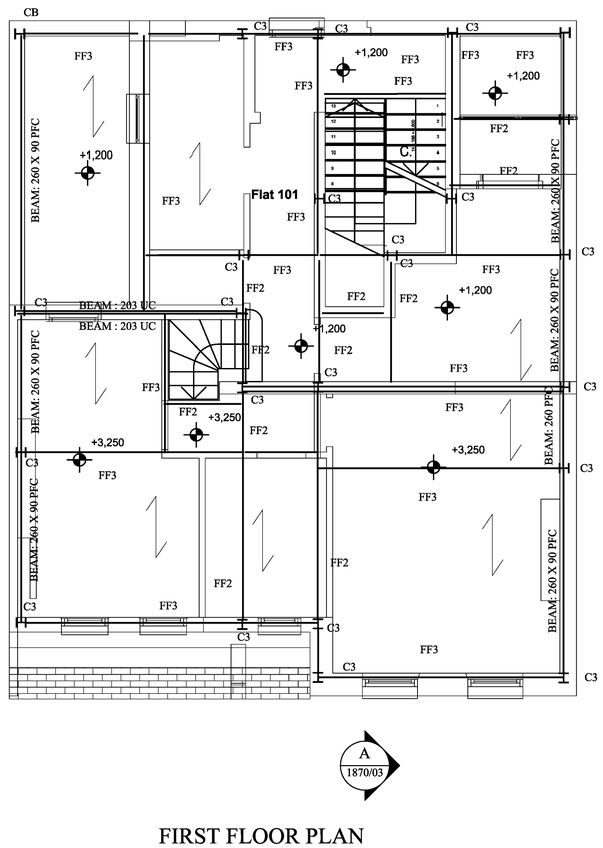
REINFORCED CONCRETE
Blinding concrete to be Designated Mix GEN1.
Reinforced concrete to be Designated Mix RC35 in accordance with BS 8500-2.
Cover to all steel 40.
Vibrate concrete to expel all air.
Top of slabs to be fine-tamped.
All reinforced concrete work is to be in accordance with the requirements of BS 8110.



BASEMENT FLOOR PLAN
SCALE 1:50



GROUND FLOOR PLAN
SCALE 1:50



FIRST FLOOR PLAN
SCALE 1:50

KEY

COMFLOOR 80 1.2 THICK WITH 130MM THICK SLAB, WITH A252 MESH AND CONCRETE C30.

COLUMN	DESCRIPTION
C1	203x203x71 UC
C2	203x203x46 UC
C3	152x152x37 UC
C4	100x100x6.3 SHS
CB	COLUMN BELOW

FOR WALL POSITION PLEASE REFER TO ARCHITECT DRAWINGS.
( ) -BEAMS TO HAVE A MOMENT CONNECTION 25kNm.

STEEL FRAME TO BE CONSTRUCTED AT AN EARLY STAGE TO ACT AS TEMPORARY SUPPORT TO PARTY-WALL AND EXISTING WALLS TO BE RETAINED. FOUNDATION PADS TO BE CONSTRUCTED BELOW FORMATION LEVEL TO ALLOW STEEL COLUMNS TO BE INSTALLED AND STEEL FRAME ERECTED PRIOR TO COMMENCEMENT OF GENERAL CONSTRUCTION

KEY

COMFLOOR 80 1.2 THICK WITH 130MM THICK SLAB, WITH A252 MESH AND CONCRETE C30.

STEEL BEAM SCHEDULE				
REF.	SIZE	COMMENTS	UDL (kN)	Moment (M)
FF1	200x100x10 RHS +	Plate underneath	85 kN	
FF2	203x133UB 30 Gr 355	Plate underneath	40 kN	
FF3	203x203UC 71 Gr 355	Plate underneath	100 kN	
FF4	203x203UC 46 Gr 355	Plate underneath	75 kN	M1=37kNm
FF5 FF6	203x203UC 52 Gr 355	Plate underneath	105 kN	
FF7	203x203UC 46 Gr 355			
FF8	203x133UB 30 Gr 355			

STEEL CONECTIONS BY STEEL CONTRACTOR
RP DESIGNS TO SEE DETAILS BEFORE MANUFACTURING

R= 60kN Ultimate shear reaction BS unless otherwise stated

Timber stud 100x50 C16 @ 400 c/c double up joists underneath or Metsec steel studwall

PRELIMINARY

Rev	Date	By	Details
-	-	-	-

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drawing@rp-designs.co.uk / rnara99388@hotmail.com

SITE	163 SUMATRA ROAD LONDON NW6 1PN
PROJECT	NEW REBUILT HOUSE
TITLE	BASEMENT, GROUND AND FIRST FLOOR PLAN
SCALE ON A1	1:50
BY	JB
Chkd by	
DATE	22/07/2019
DRWG No.	1817-S01
REV	-

ENGINEER'S CONSTRUCTION NOTES

GENERAL
To be read in conjunction with all Engineers' drawings and method statement and with all architectural and services drawings and specifications. Seek instructions in the event of any conflict.
The structural designs shown are to be set out to suit the conditions of the site and existing works if any and the Architect's proposals.
Do not scale - please ask for information.
Some notes may not apply.

DEMOLITION AND TEMPORARY WORKS
Demolition to be carried out in accordance with BS 6187 and Health and Safety Executive Guidance Notes GS29/1, 3 and 4.
Openings in existing buildings to be formed according to the recommendations of BRE Good Building Guide no. 20 "Removing Internal Load Bearing Walls in Older Dwellings".
The Contractor is to be responsible for the stability and structural integrity of the Works. Design, supply and maintain during the execution of the Works all shoring, strutting, needling and other temporary works as may be necessary.

FOUNDATIONS
Concrete to foundations to be grade 30. Use sulphate resisting cement below d.p.c./d.p.m. if recommended by Building Control officer.
Excavation and filling to be in accordance with BS 8000:Part 1.

LINTELS
Lintels in external walls if not specified on the drawing to be Catnic or similar proprietary pressed steel lintels as recommended by their manufacturer for use in the particular situation and loading. Bearing as recommended by manufacturer (normally 150).
Internal lintels to be Supreme Concrete Ltd prestressed lintels with 150 minimum bearing.

MASONRY
Blocks: 3.5 N lightweight blocks unless noted otherwise, to conform with the insulation value specified by the Architect.
Facing bricks to be as specified by the Architect.
Common bricks to be clay flettton bricks with a compressive strength of 20 N/mm2 or more unless specified otherwise.
All new blocks and bricks to be manufactured under 'special' manufacturing control to BS 5628 : part 1 : 1992 clause 27.2.1.2.
Mortar generally to be one of the following:
1 : 1 : 5 to 6 cement : lime : sand, or
1 : 4 to 5 masonry cement : sand, or
1 : 5 to 6 cement : sand with plasticizer,
unless otherwise stated.
Close cavity with d.p.c. and ties at all openings in cavity walls.

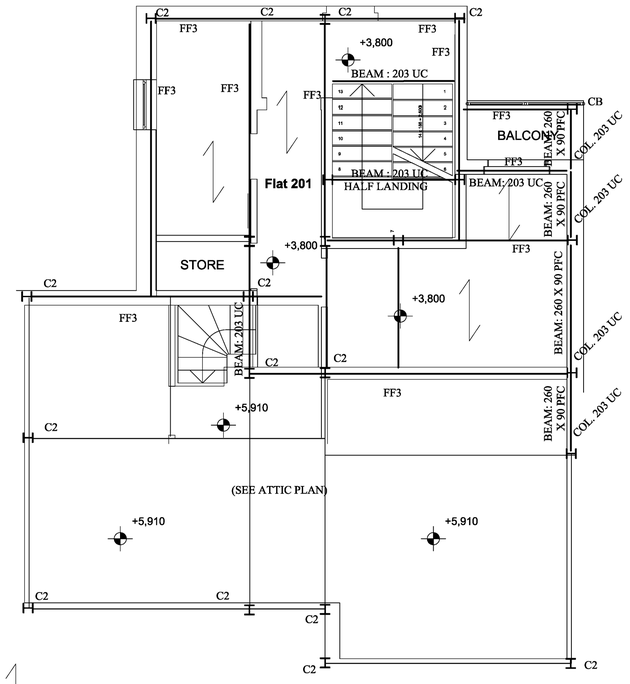
STEEL FINISHES
Galvanizing or other finishes specified to be in accordance with the NSSS section 10.

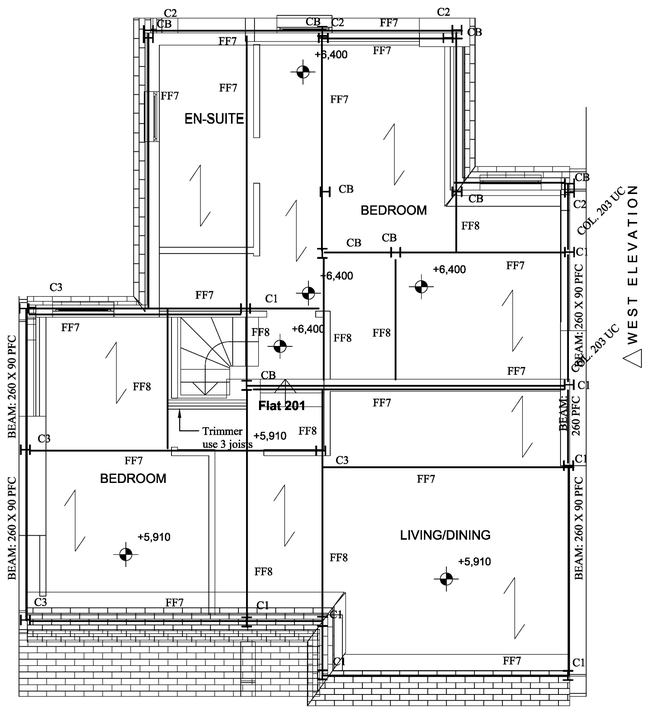
STRAPS
Walls to be strapped to floors using 30 x 5 galvanized mild steel straps at 2,000mm max. centres with noggins between joists if they run parallel to the wall, and packing between last joist and the wall. Strap to be hooked type, turned over a whole block.
All new wall plates at eaves to be strapped down to walls using 30 x 5 galvanized mild steel straps at 2,000mm max. centres screwed securely to masonry with four 50mm no. 10 screws, and fully nailed to timber.

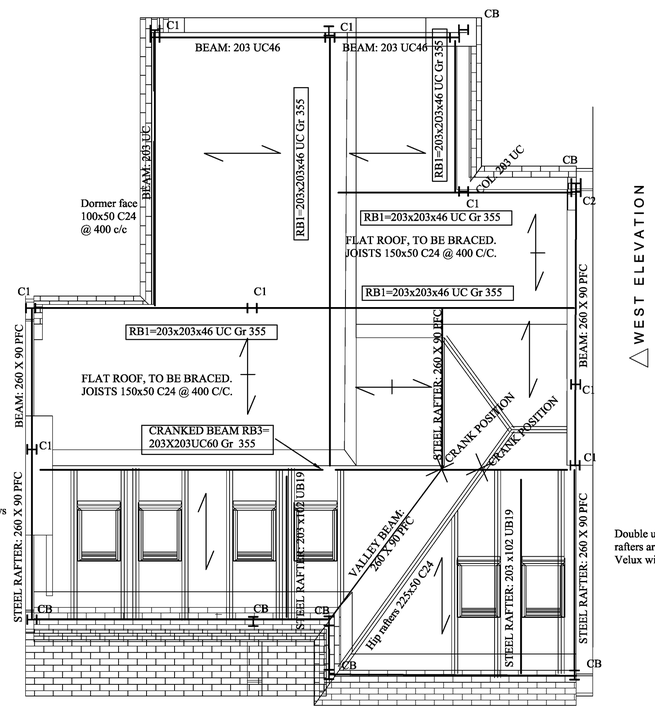
STRUCTURAL STEELWORK
All steelwork to be in accordance with BS 5950 and the National Structural Steelwork Specification.
Grade S275 structural steel to be BS EN 10025 S275 JR.
Grade S355 structural steel to be BS EN 10025 S355 J0.
All members to be grade S275 unless noted otherwise, except for structural hollow sections which are generally to be hot formed BS EN 10210 S355 J2H or 'Celcius'. Cold formed hollow sections not permitted unless specified as such on the drawings.
Connections: All bolts to be grade 8.8, minimum 16mm diameter, in holes 2mm bigger than nominal bolt size, unless otherwise stated.
Welds to be minimum 4mm fillet welds around the full perimeter of the parts to be connected. All welds to be shop welds, but site welds may be used with prior agreement of the Engineer and Building Control Officer and may be subject to testing at Contractor's expense.
Double beams to be bolted together using M16 bolts at 1,500mm max centres with steel tube spacers.
Padstones to be grade 30 concrete. At Contractor's option and with the approval of the CA and Building Control officer padstones may be constructed from 35N/mm2 engineering bricks and 1:3 mortar, in which case the height of the padstone is to be made at least 50% more than that specified. Alternatively padstones may be cut carefully using an angle grinder from precast lintels of appropriate size.
Beam bearings on padstones to be full width of padstone if up to 150mm, or at least 2/3 of the length of the padstone in the direction of the beam span if greater than 150mm, unless otherwise specified on the drawings.
Fire protection All steel to be protected from fire to 30 minute standard or as specified elsewhere to the satisfaction of the CA and Building Control.

STRUCTURAL TIMBER
All timber grade C16 unless otherwise stated.
Multiple members to be bolted together using M12 bolts at 800 max centres, 50 alternately from top and bottom, with 50mm plate washers both sides.
Joists may be notched over bearing, maximum depth of notch 1/3 joist depth unless otherwise specified on the drawing.
Provide solid blocking to joists at bearings unless built in to masonry, and one row at mid span for spans between 2,500mm and 4,500mm, or two rows equally spaced for spans greater than 4,500mm. Blocking to be 50mm x min. 3/4 joist depth or use an approved purpose made proprietory bracing system.
Notches in joists to be no deeper than 1/8 joist depth, and should not be closer to the support than 0.07 of the span, nor further away than 0.25 of the span.
Holes in joists should be no greater in diameter than 1/4 the depth of the joist, should be drilled at the middle of the joist depth, and should be at least 3 diameters (centre to centre) apart, and should only be located between 1/4 and 2/5 of the span from the support.
Joist hangers for masonry support should be of the hooked restraint type (or provide separate straps as specified) and of the correct size. Timber to timber connections to be made using correct size steel hangers. All steel connectors must be fully nailed in all available holes using the manufacturer's recommended nails e.g. 30mm square twisted sherardized nails.
Studs in load bearing studwork to be 100 x 50 C16 studs at 400 max centres, 50 x 100 C16 head and foot plates and noggins at max 1200 vertical centres to suit plasterboard size.

A 1870/03







Double up rafters around Velux windows

Double up rafters around Velux windows

A 1870/03

SECOND FLOOR PLAN
SCALE 1:50

COMFLOOR 80 1.2 THICK WITH 130MM THICK SLAB, WITH A252 MESH AND CONCRETE C30.

STEEL FRAME TO BE CONSTRUCTED AT AN EARLY STAGE TO ACT AS TEMPORARY SUPPORT TO PARTY-WALL AND EXISTING WALLS TO BE RETAINED.
FOUNDATION PADS TO BE CONSTRUCTED BELOW FORMATION LEVEL TO ALLOW STEEL COLUMNS TO BE INSTALLED AND STEEL FRAME ERECTED PRIOR TO COMMENCEMENT OF GENERAL CONSTRUCTION

KEY

Timber floor, Joists 50x200 @ 400 c/c, C24, estimated load 2.32kN/m².

COMFLOOR 80 1.2 THICK WITH 130MM THICK SLAB, WITH A252 MESH AND CONCRETE C30.

STEEL BEAM SCHEDULE				
REF.	SIZE	COMMENTS	U Shear	Moment M
FF1	200x100x10 RHS +	Plate underneath	85 kN	
FF2	203x133UB 30 Gr 355	Plate underneath	40 kN	
FF3	203x203UC 71 Gr 355	Plate underneath	100 kN	
FF4	203x203UC 46 Gr 355	Plate underneath	75 kN	M1=37kNm
FF5 FF6	203x203UC 52 Gr 355	Plate underneath	105 kN	
FF7	203x203UC 46 Gr 355			
FF8	203x133UB 30 Gr 355			

STEEL CONECTIONS BY STEEL CONTRACTOR
RP DESIGNS TO SEE DETAILS BEFORE MANUFACTURING

R= 60kN Ultimate shear reaction BS unless otherwise stated

Timber stud 100x50 C16 @ 400 c/c double up joists underneath or Metsec steel studwall

A 1870/03

ROOF PLAN
SCALE 1:50

FOR WALL POSITION PLEASE REFER TO ARCHITECT DRAWINGS
( ) ..BEAMS TO HAVE A MOMENT CONNECTION 15KNM.

NEW RAFTERS 150x50 C24 @ 400 c/c

A 1870/03

COLUMN	DESCRIPTION
C1	203x203x71 UC
C2	203x203x46 UC
C3	152x152x37 UC
C4	100x100x6.3 SHS
CB	COLUMN BELOW

FOR WALL POSITION PLEASE REFER TO ARCHITECT DRAWINGS
( ) ..BEAMS TO HAVE A MOMENT CONNECTION 25KNm.

PRELIMINARY

Rev	Date	By	Details

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SITE	163 SUMATRA ROAD LONDON NW6 1PN				
PROJECT	NEW REBUILT HOUSE				
TITLE	SECOND FLOOR, ATTIC AND ROOF PLAN				
SCALE ON A1	1:50	BY	JB	DATE	22/07/2019
DRWG No.	1817-S02			REV	- A

ENGINEER'S CONSTRUCTION NOTES

GENERAL
To be read in conjunction with all Engineers' drawings and method statement and with all architectural and services drawings and specifications. Seek instructions in the event of any conflict.
The structural designs shown are to be set out to suit the conditions of the site and existing works if any and the Architect's proposals.
Do not scale - please ask for information.
Some notes may not apply.

DEMOLITION AND TEMPORARY WORKS
Demolition to be carried out in accordance with BS 6187 and Health and Safety Executive Guidance Notes GS29/1, 3 and 4.
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The Contractor is to be responsible for the stability and structural integrity of the Works. Design, supply and maintain during the execution of the Works all shoring, strutting, needling and other temporary works as may be necessary.

FOUNDATIONS
Concrete to foundations to be grade 30. Use sulphate resisting cement below d.p.c./d.p.m. if recommended by Building Control officer.
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LINTELS
Lintels in external walls if not specified on the drawing to be Catnic or similar proprietary pressed steel lintels as recommended by their manufacturer for use in the particular situation and loading. Bearing as recommended by manufacturer (normally 150).
Internal lintels to be Supreme Concrete Ltd prestressed lintels with 150 minimum bearing.

MASONRY
Blocks: 3.5 N lightweight blocks unless noted otherwise, to conform with the insulation value specified by the Architect.
Facing bricks to be as specified by the Architect.
Common bricks to be clay fletton bricks with a compressive strength of 20 N/mm2 or more unless specified otherwise.
All new blocks and bricks to be manufactured under 'special' manufacturing control to BS 5628 : part 1 : 1992 clause 27.2.1.2.
Mortar generally to be one of the following:
1 : 1 : 5 to 6 cement : lime : sand, or
1 : 4 to 5 masonry cement : sand, or
1 : 5 to 6 cement : sand with plasticizer,
unless otherwise stated.
Close cavity with d.p.c. and ties at all openings in cavity walls.

STEEL FINISHES
Galvanizing or other finishes specified to be in accordance with the NSSS section 10.

STRAPS
Walls to be strapped to floors using 30 x 5 galvanized mild steel straps at 2,000mm max. centres with noggins between joists if they run parallel to the wall, and packing between last joist and the wall. Strap to be hooked type, turned over a whole block.
All new wall plates at eaves to be strapped down to walls using 30 x 5 galvanized mild steel straps at 2,000mm max. centres screwed securely to masonry with four 50mm no. 10 screws, and fully nailed to timber.

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Beam bearings on padstones to be full width of padstone if up to 150mm, or at least 2/3 of the length of the padstone in the direction of the beam span if greater than 150mm, unless otherwise specified on the drawings.
Fire protection All steel to be protected from fire to 30 minute standard or as specified elsewhere to the satisfaction of the CA and Building Control.

REINFORCED CONCRETE
Blinding concrete to be Designated Mix GEN1.
Reinforced concrete to be Designated Mix RC35 in accordance with BS 8500-2.
Cover to all steel 40.
Vibrate concrete to expel all air.
Top of slabs to be fine-tamped.
All reinforced concrete work is to be in accordance with the requirements of BS 8110.

STRUCTURAL TIMBER
All timber grade C16 unless otherwise stated.
Multiple members to be bolted together using M12 bolts at 800 max centres, 50 alternately from top and bottom, with 50mm plate washers both sides.
Joists may be notched over bearing, maximum depth of notch 1/3 joist depth unless otherwise specified on the drawing.
Provide solid blocking to joists at bearings unless built in to masonry, and one row at mid span for spans between 2,500mm and 4,500mm, or two rows equally spaced for spans greater than 4,500mm. Blocking to be 50mm x min. 3/4 joist depth or use an approved purpose made proprietory bracing system.
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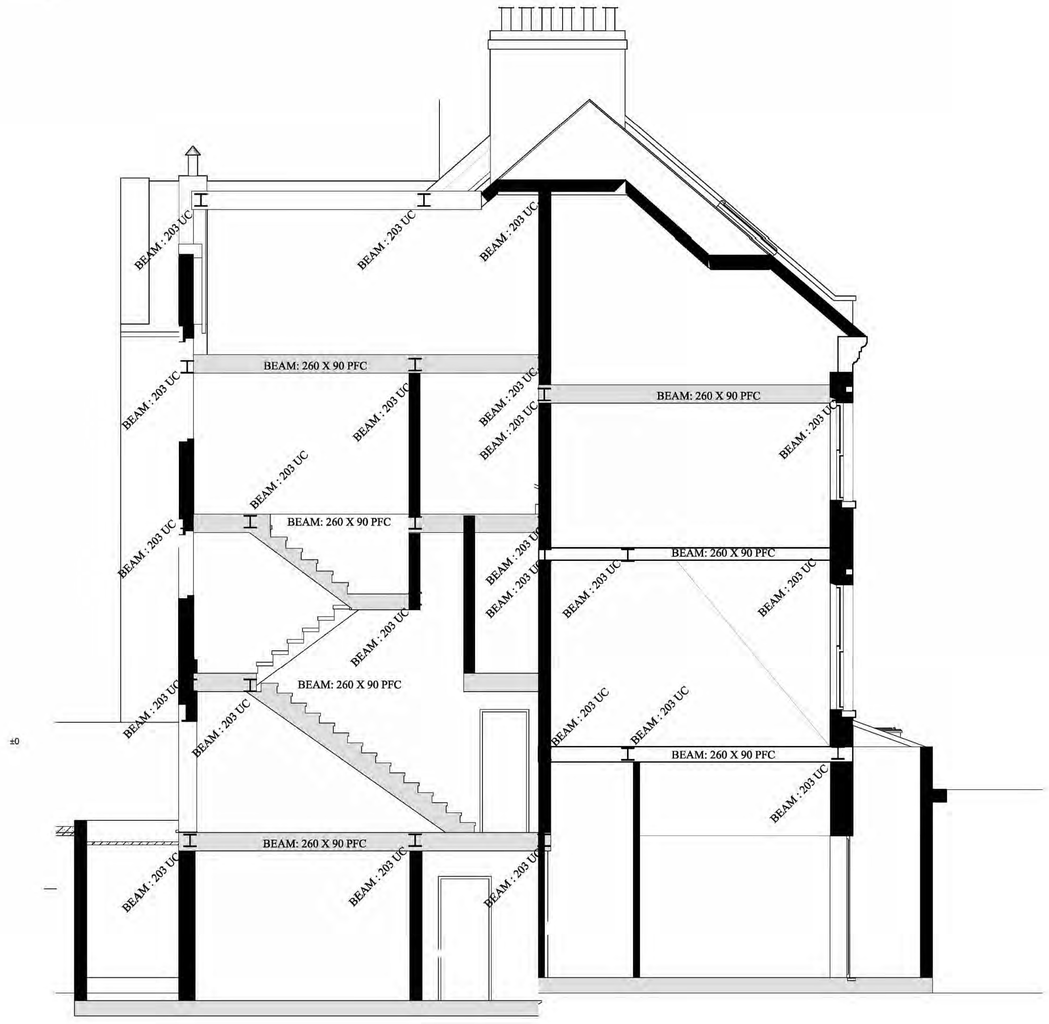
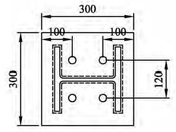
Studs in load bearing studwork to be 100 x 50 C16 studs at 400 max centres, 50 x 100 C16 head and foot plates and noggins at max 1200 vertical centres to suit plasterboard size.

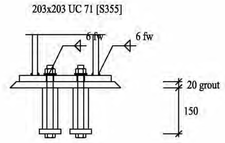


SECTION A-A
SCALE 1:50

STEEL FRAME TO BE CONSTRUCTED AT AN EARLY STAGE TO ACT AS TEMPORARY SUPPORT TO PARTY-WALL AND EXISTING WALLS TO BE RETAINED. FOUNDATION PADS TO BE CONSTRUCTED BELOW FORMATION LEVEL TO ALLOW STEEL COLUMNS TO BE INSTALLED AND STEEL FRAME ERECTED PRIOR TO COMMENCEMENT OF GENERAL CONSTRUCTION

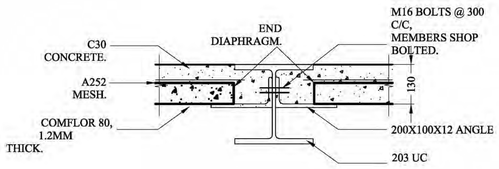


Base-Plate 300 x 300 x 20 mm (14 kg)
With 4 No. 24 mm holes
For 20 mm Grade 8.8 Bolts.

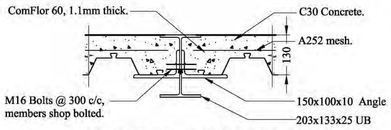


Washers 70 x 70 x 15 mm thick with 50 mm Void
All Plates S 275

BASEPLATE
Scale 1:10@A1



TYPICAL INTERNAL
PRIMARY BEAM
Scale 1:10@A1



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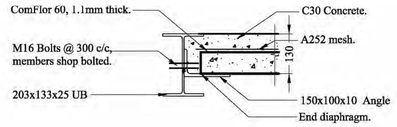
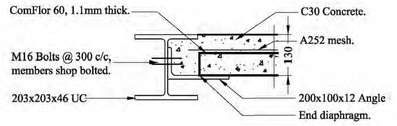
SECONDARY BEAM
Scale 1:10@A1





TYPICAL EXTERNAL
PRIMARY BEAMS
Scale 1:10@A1

PRELIMINARY

Rev	Date	By	Details
-	-	-	-

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drawing@rp-designs.co.uk / rnara99388@hotmail.com

SITE	163 SUMATRA ROAD LONDON NW6 1PN
PROJECT	NEW REBUILT HOUSE
TITLE	SECTION
SCALE ON A1	1:50
BY	JB
Chkd by	
DATE	22/07/2019
DRWG No.	1817-S03
REV	A

Martin Redston Associates
Consulting Civil & Structural Engineers

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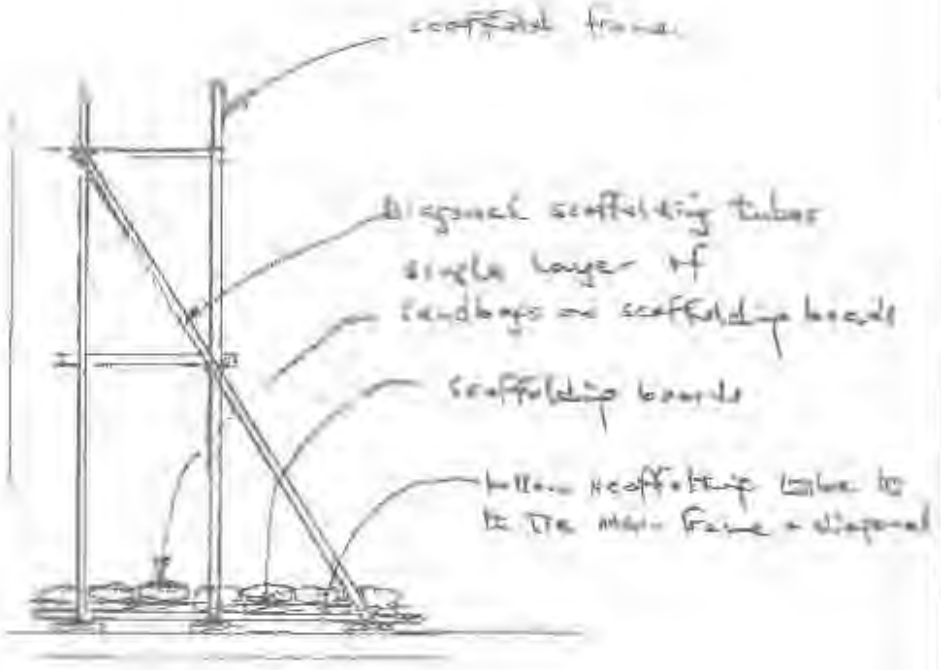
Date 19th/02/18	Sheet No. 11-22
Eng. SS	
Job No. 18-072	

163 Sumatra Road
West London



Bottom Section of Scaffolding

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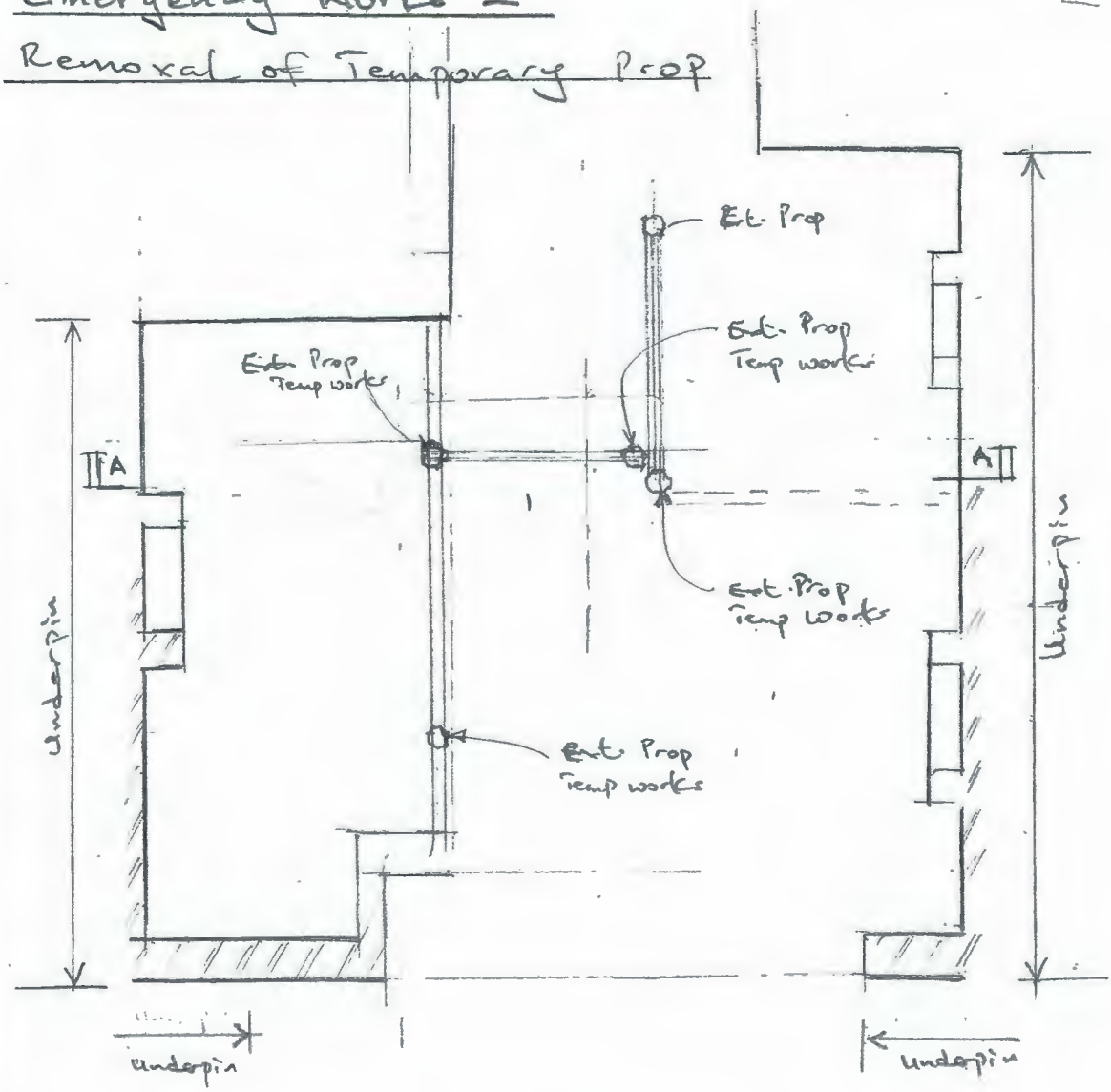
Date May-18	Sheet No. TW - 200
Eng. SG	
Job No. 18-165	

163 Sumatra Road
London

Emergency Works 2

Removal of Temporary Prop



Ground Floor Plan

Existing Props (Temp works) Location

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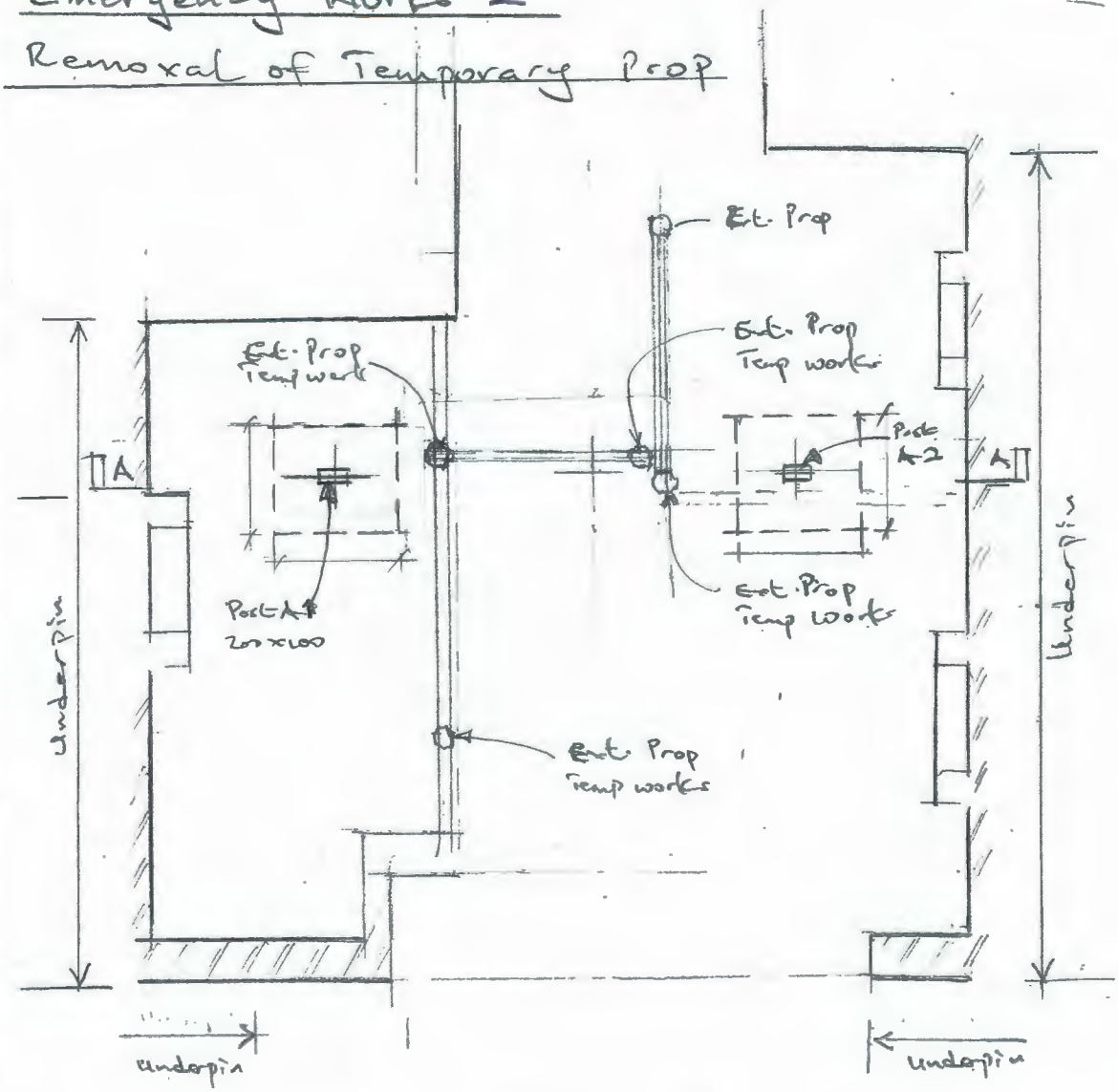
Web: www.redstonassociates.co.uk

Date	May-18	Sheet No.
Eng.	SG	TH-201
Job No.	18.165	

163 Sumatra Road
London

Emergency Works 2

Removal of Temporary Prop



Ground Floor Plan

(showing sequence to Remove Temp works Post)

STAGE 1.

Sequence of works

1. Excavate Pad Foundation trench with trench support to basement formation level for both Post A1 and Post A2
2. Cast concrete base
3. Install 200 x 100 RHS Post A1 & Post A 3

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Date May-18	Sheet No.
Eng. SG	TW-202
Job No. 18-165	

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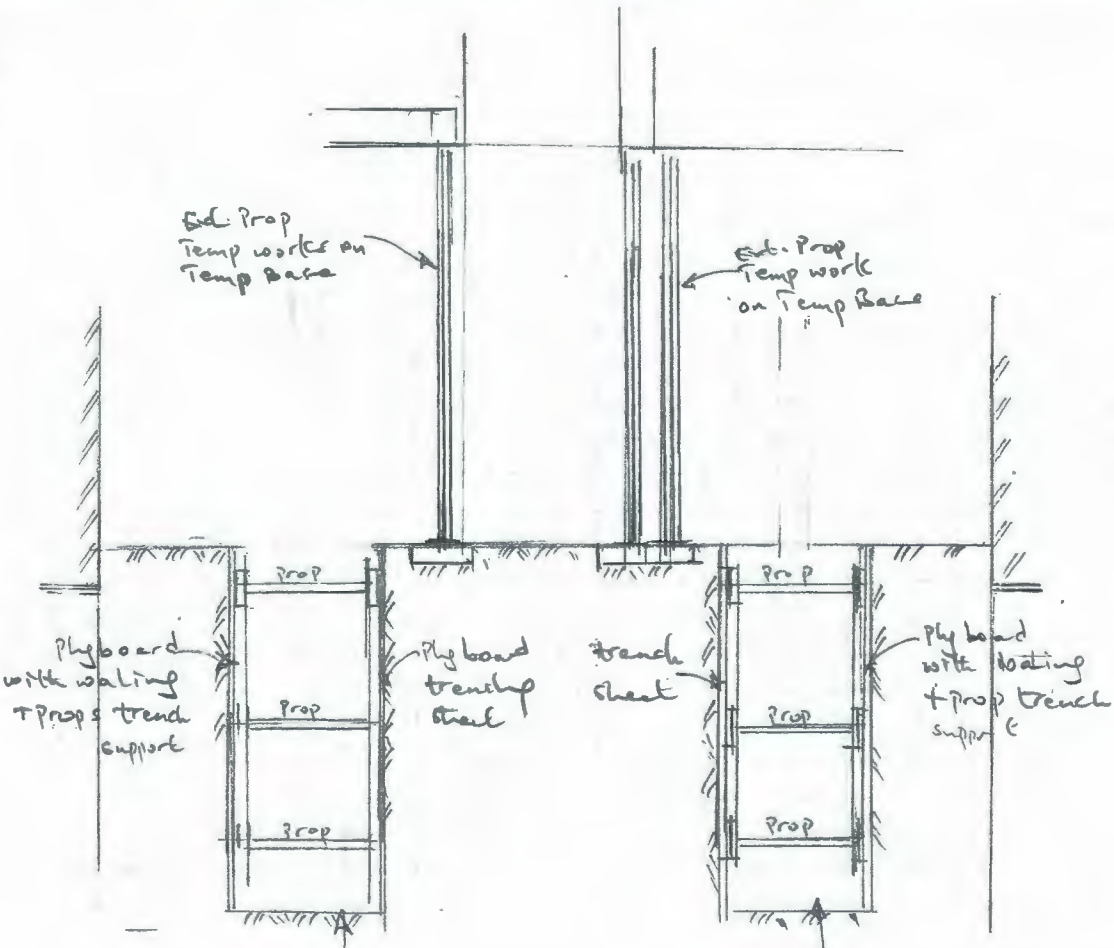

Section A-A

STAGE 1

1 Excavate Pad Foundation trench with trench support to basement formation level for both 200 x 100 RHS Post A1 & Post A2

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Date May-18	Sheet No.
Eng. SG	TW-203
Job No. 18-165	

163 Sumatra Road
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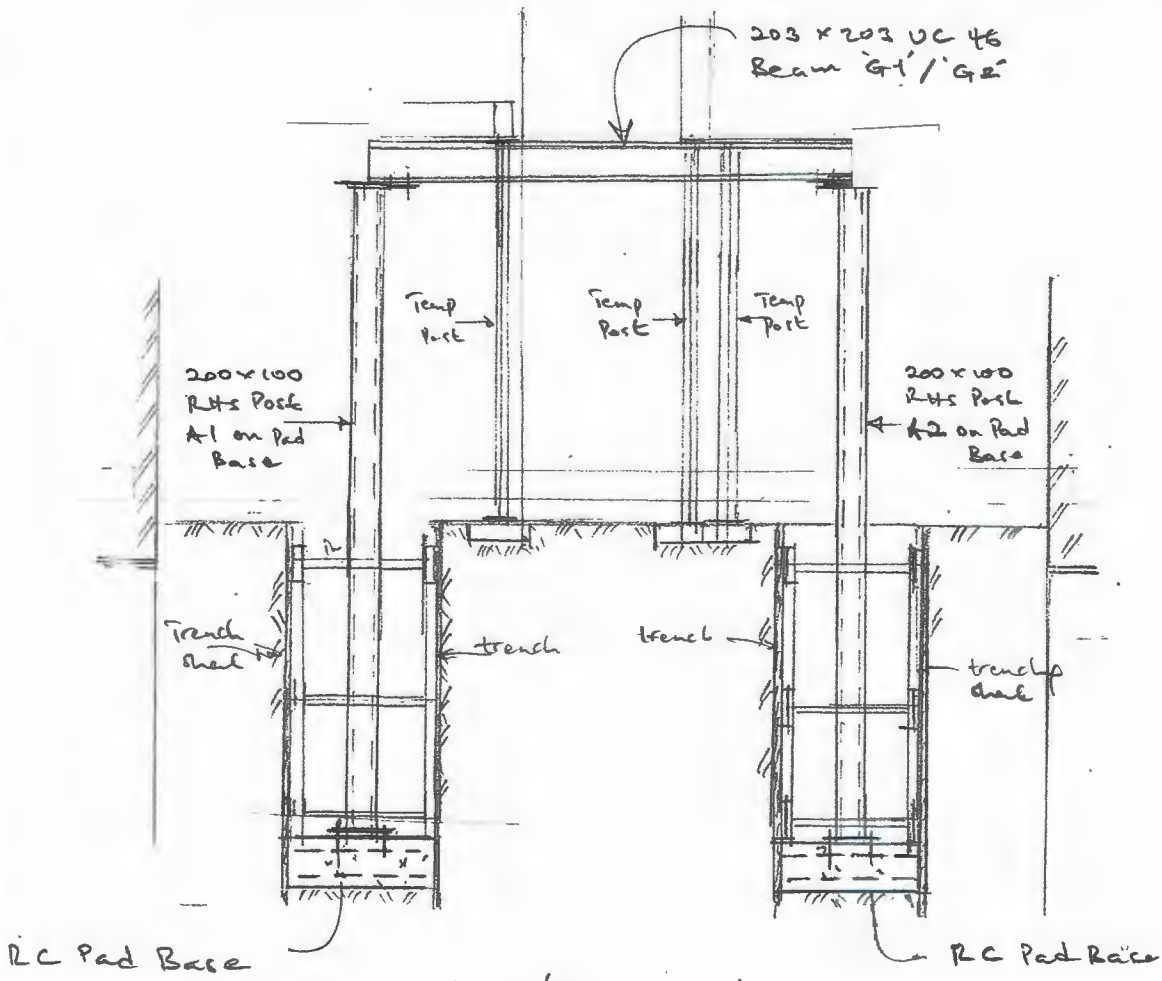

Section A-A

STAGE 2

2, Cast RC concrete base in trench

3, Install 200 x 100 RHS Post A1 & Post A2. to Ground floor ceiling level.

4, Install 203 UC Beam G1 / G2 to temporary support existing structure

5, Remove temporary post in location to 203 UC Beam

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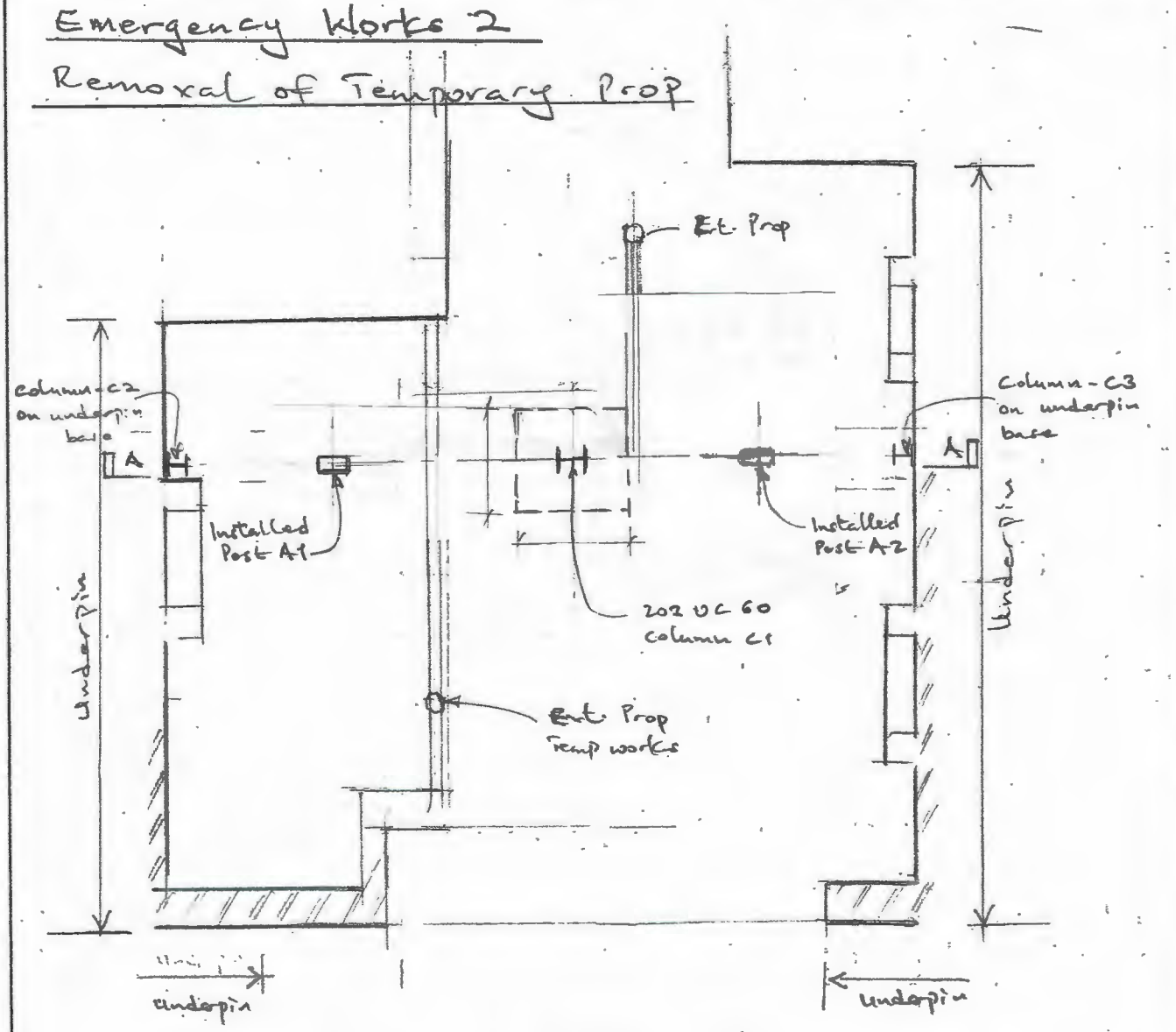
Date	May-18	Sheet No.
Eng.	SG	TW-204
Job No.	18-165	

163 Sumatra Road
London

Emergency Works 2

Removal of Temporary Prop



Ground Floor Plan

(showing sequence to Remove Temp works Post)

STAGE 3

6, Ensure 203 UC 46 Beam G1/G2 is properly supporting structure above and stable before removing the Temp works post in location of 203 UC 46 beam G1/G2.

7. Infill (Backfill) 200x100 RHS Post A1 & A2 trench.

8. Excavate Pad foundation trench with trench support to basement formation level for 203 UC Column C1

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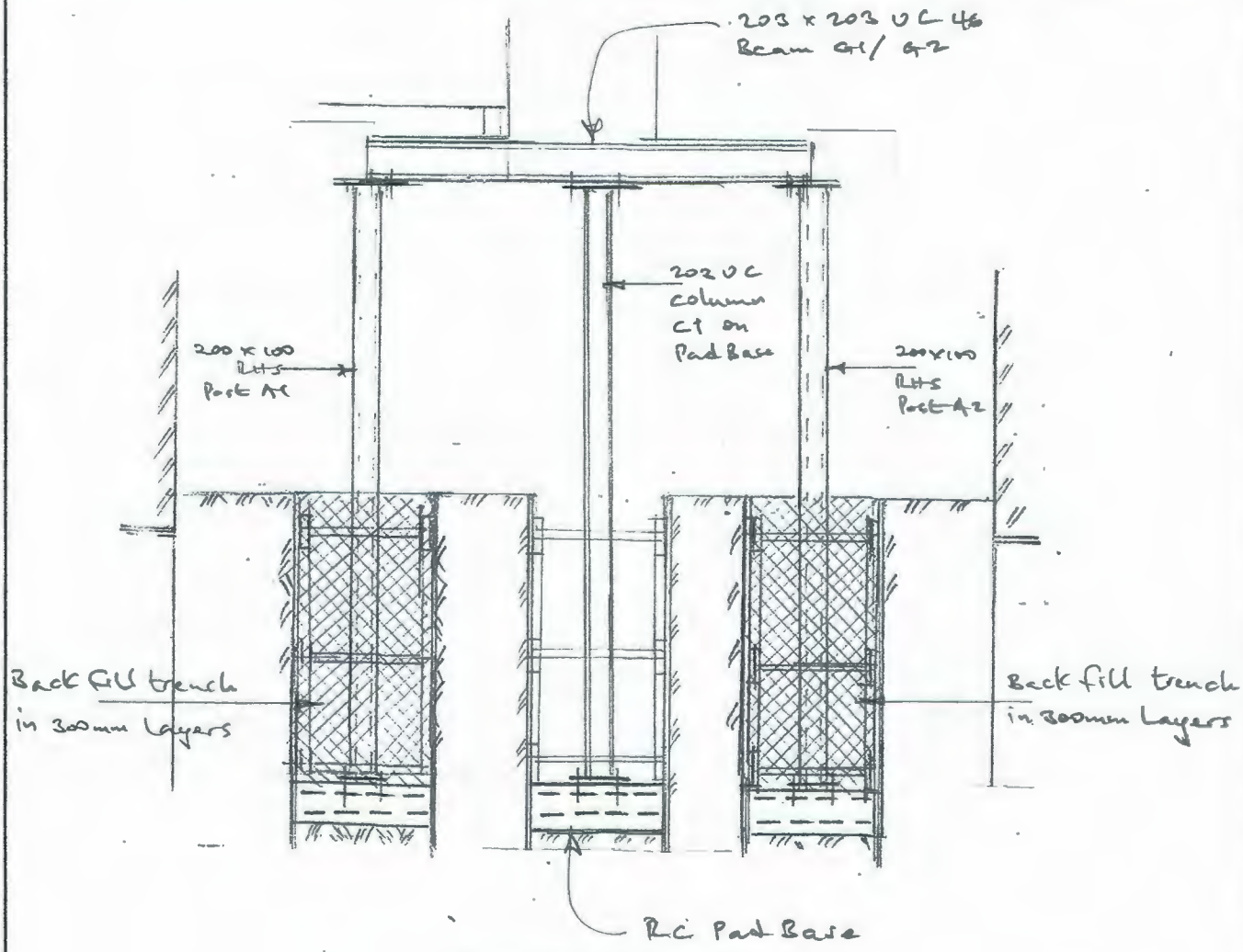
Date May - 18	Sheet No. TW-205
Eng. SG	
Job No. 18-165	

163 Sumatra Road
London



Section A-A

STAGE 3

6, Backfill Installed 200 x 100 RHS Post A1 & Post A2 trench.

7, Ensure that 203 UC 46 Beam G1/ G2 installed on 200 x 100 Post A1 and Post A2 is properly supporting structure above and stable.

8, Excavate Pad foundation trench with trench support to basement formation level for 203 UC column C1

9, Cast concrete base

10, Install 203 UC 46 column C1 on Pad base to underside of 203 UC Beam G1/ G2 with fixings.

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Date May-18	Sheet No.
Eng. SG	TH-206
Job No. 18-165	

163 Sumatra Road
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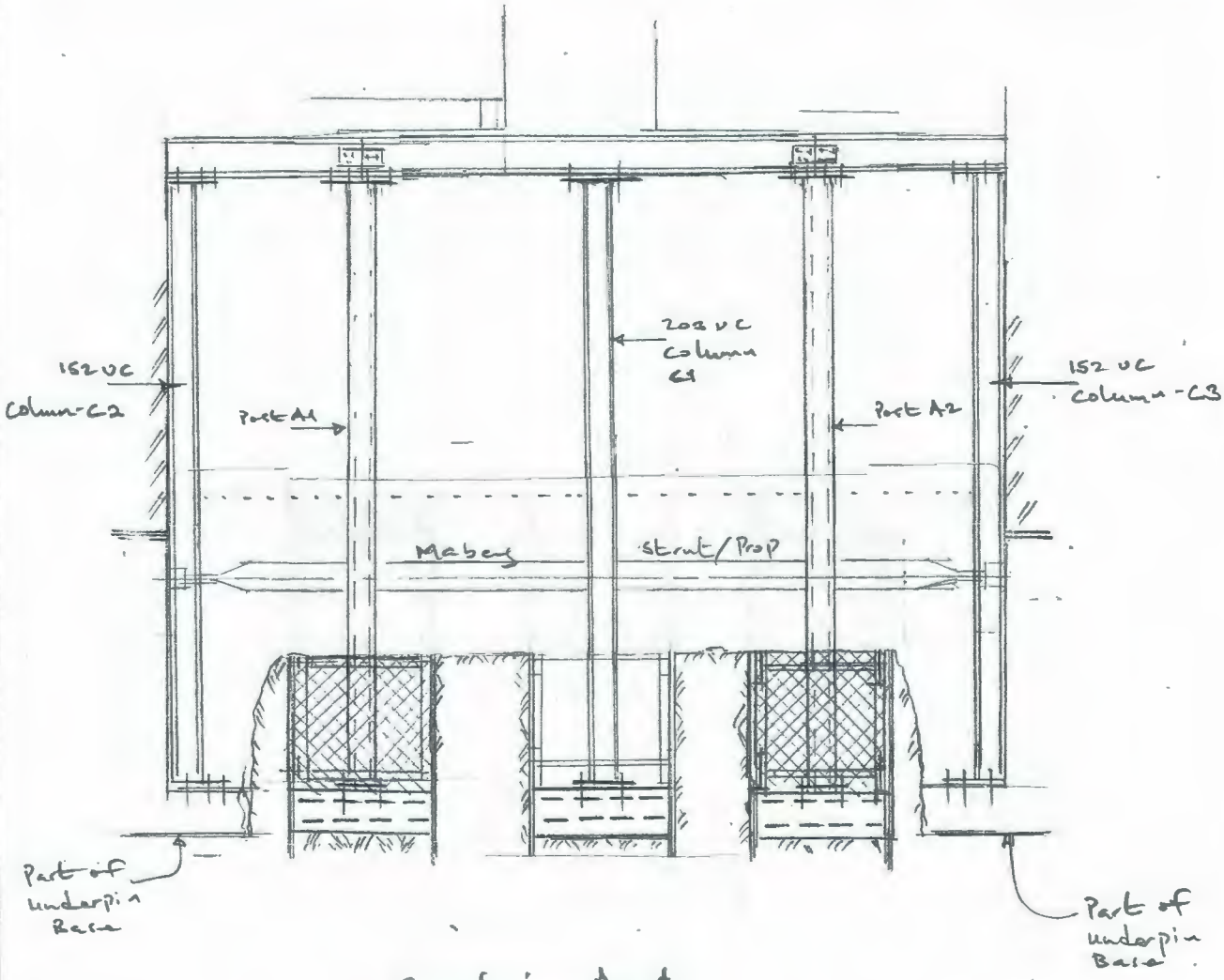


Section A-A

STAGE 4

11, Reduce level of earth in basement and install Mabey strut.

12, Then remove earth in location for column-C2 and column-C3 at already underpin party wall.

13, Install column-C2 and column-C3 on underpin base to ground floor ceiling level.

14 Install Beam G1 on column C2 and 203 UC Beam G1/G2

15, Install Beam G2 on column C3 and 203 UC Beam G1/G2

16, Ensure Beams are properly installed on column and stable.

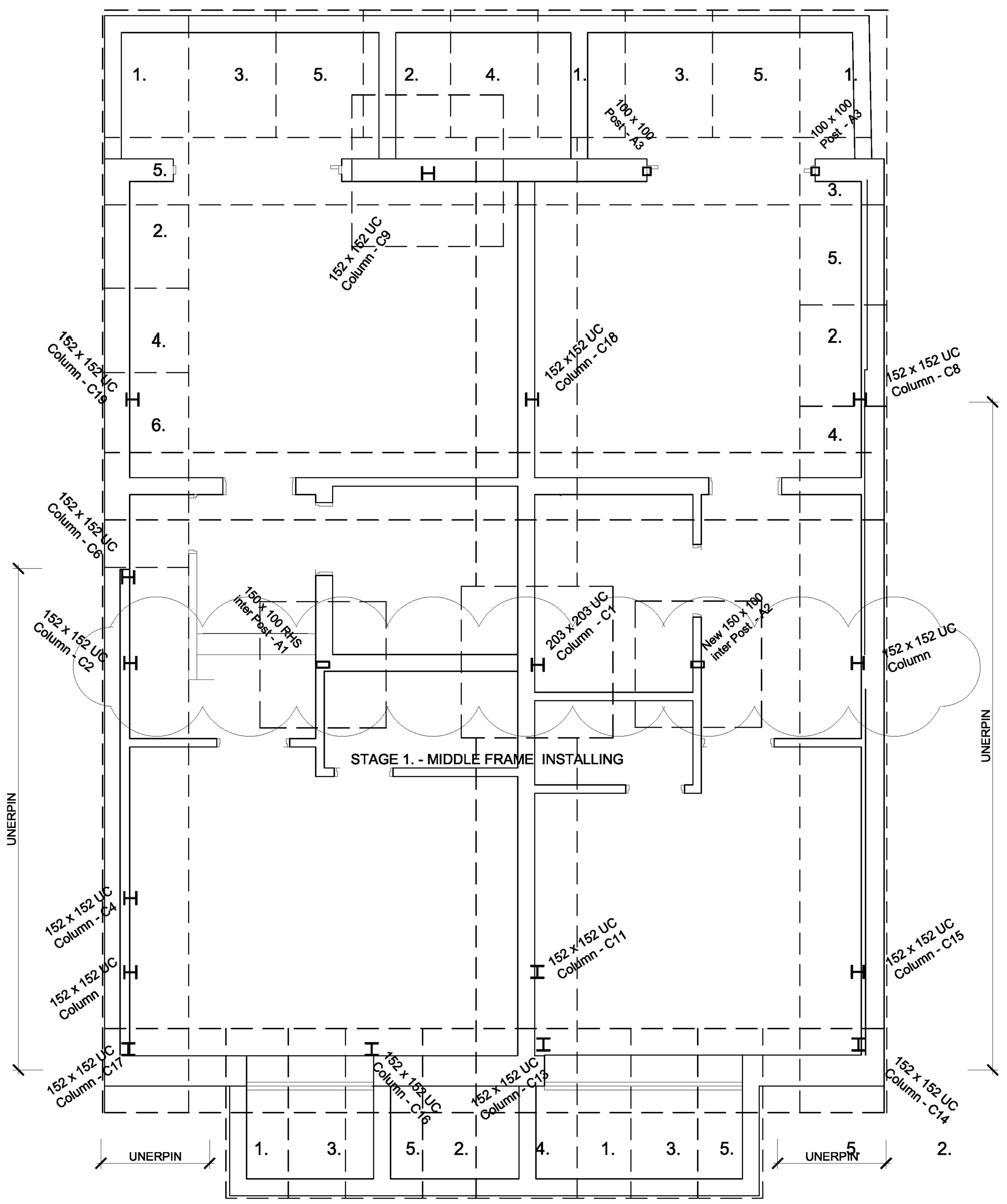
17, Continue perimeter underpin to party wall.

EXCAVATION FOR REINFORCED CONCRETE RETAINING WALLS

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH ADJACENT EXISTING STRUCTURE.
2. CAST NEW CONCRETE BASE AND ALLOW 24 HOURS TO CURE. STARTER BARS TO EXTEND 40d ABOVE BASE FOR LAPPING PURPOSES (SEE DETAILS FOR BAR SIZES).
3. VERTICAL & HORIZONTAL REINFORCEMENT TO BE CONSTRUCTED IN ACCORDANCE WITH DESIGN INFORMATION AND ANY REINFORCEMENT SCHEDULES PROVIDED BY THE ENGINEER.
4. SHUTTERING & PROPPING TO BE DESIGNED BY CONTRACTOR.
5. CAST NEW CONCRETE WALL ENSURING GROUND BEHIND NEW FOUNDATION & WALL IS FULLY BACKFILLED AND COMPACTED. CHECK AT REGULAR INTERVALS TO ENSURE THIS DURING CONSTRUCTION.
6. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS BETWEEN OPERATIONS.
7. WHEN ADJACENT SECTIONS ARE OPENED UP THE EXPOSED CONCRETE SURFACES SHOULD BE THOROUGHLY CLEANED OF ALL LOOSE MATERIAL & SCABBLED TO FORM A GOOD KEY.
8. ALL REASONABLE CARE IS TO BE TAKEN TO PREVENT INJURIES TO PERSONS WORKING NEAR EXPOSED BARS ETC. (THREADED COUPLERS WOULD BE SUITABLE).
9. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.
10. TRIAL PIT TO BE EXCAVATED TO CONFIRM EXISTANCE OF ANY EXISTING STRUCTURE.
11. REINFORCEMENT SHALL BE TO BS-8110 WITH MAIN BARS TO BE GRADE 460 (HIGH YIELD).
12. READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT THAT HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.
13. NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 DEGREES C.

SEQUENCE OF UNDERPINNING

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH BENEATH EXISTING FOOTING.
2. HACK AWAY TO PROVIDE LEVEL SOFFIT TO EXISTING BRICK FOOTING AND THOROUGHLY CLEAN BEFORE UNDERPINNING.
3. CAST NEW CONCRETE TO WITHIN 75mm OF SOFFIT OF EXISTING FOOTING AND ALLOW 24 HOURS TO CURE.
4. RAM IN DRY PACK MORTAR BETWEEN NEW AND EXISTING FOOTINGS.
5. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS FROM TIME OF DRY PACKING.
6. WHEN ADJACENT SECTIONS ARE OPENED UP THE EXPOSED CONCRETE SURFACES SHOULD BE THOROUGHLY CLEANED OF ALL LOOSE MATERIAL AND SCRABBLED TO FORM A GOOD KEY.
7. UNDERPINNING TO BE 1500mm WIDE UNLESS NOTED OTHERWISE.
8. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.
9. DRY PACK - 3 : 1 SAND CEMENT.
10. WHEN LOWERING FLOORS IN BASEMENTS, ALL WALLS MUST BE UNDERPINNED BEFORE DIGGING OUT FLOOR .
11. CONTRACTOR TO CAREFULLY INSPECT ALL EXISTING MASONRY PRIOR TO UNDERPINNING EACH BAY IN SEQUENCE. REPORT ANY ANOMALIES TO ENGINEER FOR ADVICE AND REASSESSMENT OF SCHEME.
12. UNDERPINNING SECTIONS TO BE CAST IN NUMERICAL ORDER. SEE FOUNDATION PLAN FOR DETAILS.
13. TANKING REQUIRED, TO CONTRACTORS SPECIFICATION. ALL OTHER WATERPROOFING AND DRAINAGE TO ARCHITECTS SPECIFICATION.



STAGE 1. - MIDDLE FRAME INSTALLING

SEQUENCE
INTALL INTER 150 X 100 RHS POST ON PAD
INTLL CORNER COLUMNS ON NEW PAD
INTALL NEW 203 BEAMS ABOVE
REMOVE TEMP POST INLINE OF FRAME
INSTALL MID 203 UC COLUMN ON PAD
COMPLETE UNDERPIN.

FOUNDATION PLAN

Scale 1:50 @ A1 & 1:100 @ A3

EXCAVATION FOR REINFORCED CONCRETE RETAINING WALLS

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH ADJACENT EXISTING STRUCTURE.
2. CAST NEW CONCRETE BASE AND ALLOW 24 HOURS TO CURE. STARTER BARS TO EXTEND 40d ABOVE BASE FOR LAPPING PURPOSES (SEE DETAILS FOR BAR SIZES).
3. VERTICAL & HORIZONTAL REINFORCEMENT TO BE CONSTRUCTED IN ACCORDANCE WITH DESIGN INFORMATION AND ANY REINFORCEMENT SCHEDULES PROVIDED BY THE ENGINEER.
4. SHUTTERING & PROPPING TO BE DESIGNED BY CONTRACTOR.
5. CAST NEW CONCRETE WALL ENSURING GROUND BEHIND NEW FOUNDATION & WALL IS FULLY BACKFILLED AND COMPACTED. CHECK AT REGULAR INTERVALS TO ENSURE THIS DURING CONSTRUCTION.
6. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS BETWEEN OPERATIONS.
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8. ALL REASONABLE CARE IS TO BE TAKEN TO PREVENT INJURIES TO PERSONS WORKING NEAR EXPOSED BARS ETC. (THREADED COUPLERS WOULD BE SUITABLE).
9. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.
10. TRIAL PIT TO BE EXCAVATED TO CONFIRM EXISTANCE OF ANY EXISTING STRUCTURE.
11. REINFORCEMENT SHALL BE TO BS-8110 WITH MAIN BARS TO BE GRADE 460 (HIGH YIELD).
12. READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT THAT HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.
13. NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 DEGREES C.

REINFORCED CONCRETE NOTES

1. ALL DIMENSIONS TO BE VERIFIED ON SITE.
2. READ IN CONJUNCTION WITH ARCHITECT'S DRAWINGS.
3. REINFORCED CONCRETE BEAM TO BE CAST IN GRADE 35 N/mm2 CONCRETE AND REINFORCED IN ACCORDANCE WITH DESIGN INFORMATION AND REINFORCEMENT SCHEDULES, PROVIDED BY THE ENGINEER - MIN CEMENT CONTENT 330 kg/m2 .
4. READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT, WHICH HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.
5. NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 O C.
6. REINFORCEMENT SHALL BE: (TO BS 8110).
7. PLAIN BARS (i.e. LINKS) TO BS 4449, GRADE 250 (MILD STEEL).
8. ALL OTHER MAIN BARS TO BE GRADE 460 (HIGH YIELD).
9. REINFORCEMENT TO BE FIXED ADEQUATELY USING TYING WIRE OR STEEL CLIPS.
10. CONCRETE COVER TO BE MIN 35 mm COVER, UNLESS STATED OTHERWISE ON DRAWING.
11. UNLESS NOTED OTHERWISE ON DRAWINGS, ALL REINFORCEMENT IS TO BE LAPPED 40d (WHERE d IS THE DIAMETER OF THE LARGER BAR).
12. AT THIS FOUNDATION DEPTH, TREE ROOTS ARE TO BE EXPECTED. SLAB DESIGNED WITH THIS CONSIDERATION.
13. ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.
14. ALL WATERPROOFING AND DRAINAGE TO ARCHITECT'S SPECIFICATION.
15. NO WORK IS TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS.

SEQUENCE OF UNDERPINNING

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH BENEATH EXISTING FOOTING.
2. HACK AWAY TO PROVIDE LEVEL SOFFIT TO EXISTING BRICK FOOTING AND THOROUGHLY CLEAN BEFORE UNDERPINNING.
3. CAST NEW CONCRETE TO WITHIN 75mm OF SOFFIT OF EXISTING FOOTING AND ALLOW 24 HOURS TO CURE.
4. RAM IN DRY PACK MORTAR BETWEEN NEW AND EXISTING FOOTINGS.
5. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS FROM TIME OF DRY PACKING.
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7. UNDERPINNING TO BE 1500mm WIDE UNLESS NOTED OTHERWISE.
8. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.
9. DRY PACK - 3 : 1 SAND CEMENT.
10. WHEN LOWERING FLOORS IN BASEMENTS, ALL WALLS MUST BE UNDERPINNED BEFORE DIGGING OUT FLOOR .
11. CONTRACTOR TO CAREFULLY INSPECT ALL EXISTING MASONRY PRIOR TO UNDERPINNING EACH BAY IN SEQUENCE. REPORT ANY ANOMALIES TO ENGINEER FOR ADVICE AND REASSESSMENT OF SCHEME.
12. UNDERPINNING SECTIONS TO BE CAST IN NUMERICAL ORDER. SEE FOUNDATION PLAN FOR DETAILS.
13. TANKING REQUIRED, TO CONTRACTORS SPECIFICATION. ALL OTHER WATERPROOFING AND DRAINAGE TO ARCHITECTS SPECIFICATION.

Preliminary
DRAFT SCHEME
FOR PRICING ONLY

Rev	Date	Description	App
A	24.05.18	Revised after project meeting	SG

Title
FOUNDATION PLAN

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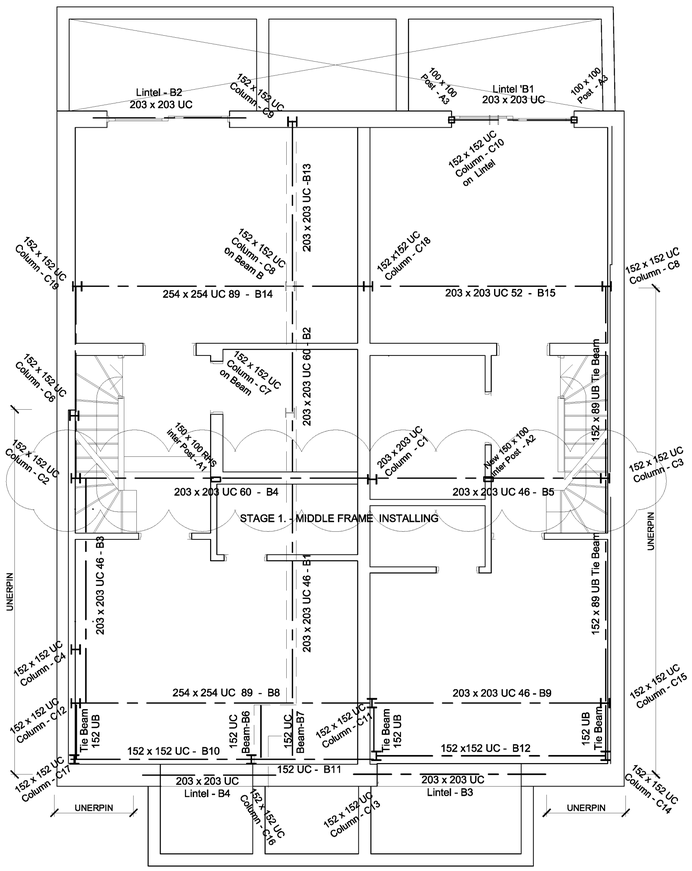
Date 19th April 2018
Eng. SG
Scale 1/50@A1
Job No. 18.165
Sheet No. 1
Rev A
Project. 163 Sumatra Road, London NW6 1PN



STAGE 1. - MIDDLE FRAME INSTALLING

SEQUENCE
INTALL INTER 150 X 100 RHS POST ON PAD
INTLL CORNER COLUMNS ON NEW PAD
INTALL NEW 203 BEAMS ABOVE
REMOVE TEMP POST INLINE OF FRAME
INSTALL MID 203 UC COLUMN ON PAD
COMPLETE UNDERPIN.

BASEMENT FLOOR PLAN

(Showing Floor Structure above.)

Scale 1:50 @ A1 & 1:100 @ A3

EXCAVATION FOR REINFORCED CONCRETE RETAINING WALLS

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH ADJACENT EXISTING STRUCTURE.

2. CAST NEW CONCRETE BASE AND ALLOW 24 HOURS TO CURE. STARTER BARS TO EXTEND 450 ABOVE BASE FOR LAPPING PURPOSES (SEE DETAILS FOR BAR SIZES).

3. VERTICAL & HORIZONTAL REINFORCEMENT TO BE CONSTRUCTED IN ACCORDANCE WITH DESIGN INFORMATION AND ANY REINFORCEMENT SCHEDULES PROVIDED BY THE ENGINEER.

4. SHUTTERING & PROPPING TO BE DESIGNED BY CONTRACTOR.

5. CAST NEW CONCRETE WALL ENSURING GROUND BEHIND NEW FOUNDATION & WALL IS FULLY BACKFILLED AND COMPACTED. CHECK AT REGULAR INTERVALS TO ENSURE THIS DURING CONSTRUCTION.

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8. ALL REASONABLE CARE IS TO BE TAKEN TO PREVENT INJURIES TO PERSONS WORKING NEAR EXPOSED BARS ETC. (THREADED COUPLERS WOULD BE SUITABLE).

9. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.

10. TRIAL PIT TO BE EXCAVATED TO CONFIRM EXISTANCE OF ANY EXISTING STRUCTURE.

11. REINFORCEMENT SHALL BE TO BS-8110 WITH MAIN BARS TO BE GRADE 460 (HIGH YIELD).

12. READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT THAT HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.

13. NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 DEGREES C

SEQUENCE OF UNDERPINNING

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH BENEATH EXISTING FOOTING.

2. HACK AWAY TO PROVIDE LEVEL SOFFIT TO EXISTING BRICK FOOTING AND THOROUGHLY CLEAN BEFORE UNDERPINNING.

3. CAST NEW CONCRETE TO WITHIN 75mm OF SOFFIT OF EXISTING FOOTING AND ALLOW 24 HOURS TO CURE.

4. RAM IN DRY PACK MORTAR BETWEEN NEW AND EXISTING FOOTINGS.

5. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS FROM TIME OF DRY PACKING.

6. WHEN ADJACENT SECTIONS ARE OPENED UP THE EXPOSED CONCRETE SURFACES SHOULD BE THOROUGHLY CLEANED OF ALL LOOSE MATERIAL AND SCRABBLED TO FORM A GOOD KEY.

7. UNDERPINNING TO BE 1500mm WIDE UNLESS NOTED OTHERWISE.

8. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMINT CONC. GRADE 35.

9. DRY PACK - 3 : 1 SAND CEMENT.

10. WHEN LOWERING FLOORS IN BASSMENTS, ALL WALLS MUST BE UNDERPINNED BEFORE DIGGING OUT FLOOR.

11. CONTRACTOR TO CAREFULLY INSPECT ALL EXISTING MASONRY PRIOR TO UNDERPINNING EACH BAY IN SEQUENCE. REPORT ANY FAILINGS TO ENGINEER FOR ADVICE AND REASSESSMENT OF SCHEME.

12. UNDERPINNING SECTIONS TO BE CAST IN NUMERICAL ORDER, SEE FOUNDATION PLAN FOR DETAILS.

13. TANKING REQUIRED, TO CONTRACTORS SPECIFICATION. ALL OTHER WATERPROOFING AND DRAINAGE TO ARCHITECTS SPECIFICATION.

REINFORCED CONCRETE NOTES

ALL DIMENSIONS TO BE VERIFIED ON SITE.

READ IN CONJUNCTION WITH ARCHITECTS DRAWINGS.

REINFORCED CONCRETE BEAM TO BE CAST IN GRADE 35 N/mm2 CONCRETE AND REINFORCED IN ACCORDANCE WITH DESIGN INFORMATION AND REINFORCEMENT SCHEDULES, PROVIDED BY THE ENGINEER - MIN CEMENT CONTENT 330 kg/m2 .

READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT THAT HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.

NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 O C.

REINFORCEMENT SHALL BE; (TO BS 8110).

PLAIN BARS (i.e. LINKS) TO BS 4449, GRADE 250 (MILD STEEL).

ALL OTHER MAIN BARS TO BE GRADE 460 (HIGH YIELD).

REINFORCEMINT TO BE FIXED ADEQUATELY USING TYING WIRE OR STEEL CLIPS.

CONCRETE COVER TO BE MIN 35 mm COVER, UNLESS STATED OTHERWISE ON DRAWING.

UNLESS NOTED OTHERWISE ON DRAWINGS, ALL REINFORCEMENT IS TO BE LAPPED 40d (WHERE d IS THE DIAMETER OF THE LARGER BAR).

AT THIS FOUNDATION DEPTH, TREE ROOTS ARE TO BE EXPECTED. SLAB DESIGNED WITH THIS CONSIDERATION.

ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.

ALL WATERPROOFING AND DRAINAGE TO ARCHITECT'S SPECIFICATION.

NO WORK IS TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS.

Preliminary
DRAFT SCHEME
FOR PRICING ONLY

Rev	Date	Description	App
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A	24.05.18	Revised after project meeting	SG

Title
BASEMENT FLOOR PLAN

Martin Redston Associates
Consulting Civil & Structural Engineers
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Tel: 020-7837 5377 Fax: 020-7837 3211
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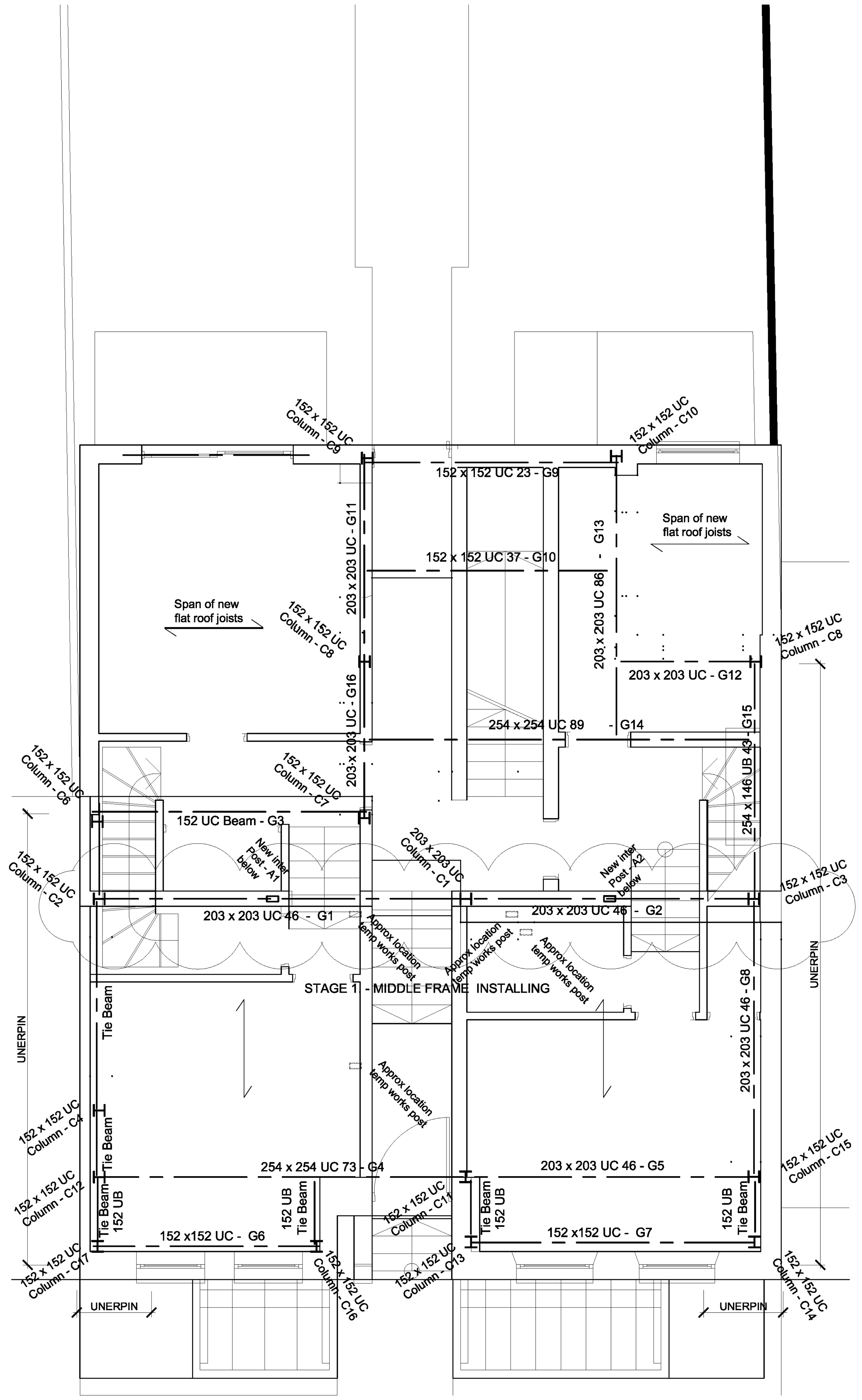
Tel: 020-8959 1666 Fax: 020-8906 8503

Date	Sheet No.	Rev
19th April 2018	2	A
Eng. SG	Scale 1/50@A1	
Job No. 18.185		

Project: 163 Sumatra Road
London NW6 1PN



STAGE 1. - MIDDLE FRAME INSTALLING

SEQUENCE
INTALL INTER 150 X 100 RHS POST ON PAD
INTLL CORNER COLUMNS ON NEW PAD
INTALL NEW 203 BEAMS ABOVE
REMOVE TEMP POST INLINE OF FRAME
INSTALL MID 203 UC COLUMN ON PAD
COMPLETE UNDERPIN.

GROUND FLOOR PLAN

(Showing First Floor Structure above.)

Scale 1:50 @ A1 & 1:100 @ A3

GENERAL NOTES

1.
ALL DIMENSIONS TO BE VERIFIED ON SITE.

2.
READ IN CONJUNCTION WITH ARCHITECT'S DRAWINGS.

3.
ALL STEELWORK DESIGNED TO BS 5950 FABRICATED TO BS 5950.

4.
ALL STEEL MEMBERS TO BE GRADE 43 STEEL.

5.
APPLY 2 COATS OF RED OXIDE PRIMER TO ALL STEEL PRIOR TO ERECTION.

6.
ALL STEEL BEAMS TO HAVE 1 HOUR FIRE RESISTANCE CAPABILITY MIN (e.g. 12.5 mm PLASTERBOARD AND 7mm SKIM).

7.
ALL PLATE WELDING TO BE 6mm FILLET WELDS. ALL CRANKS TO BE FULL STRENGTH BUTT WELDS TO BE CARRIED OUT IN WORKSHOP.

8.
ALL BLACK BOLTS TO BE GRADE 8.8.

9.
ALL TIMBERWORK DESIGNED TO BS 5268.

10.
DOUBLE JOISTS TO BE BOLTED TOGETHER WITH M-12 BOLTS + 63mm dia. TP CONNECTORS AND WASHER PLATE @ 450 c/c.

11.CONNECTIONS:
TIMBER/BRICK: BAT SPH HANGER WHEN THERE IS A MINIMUM OF 675mm OF BRICKWORK ABOVE, IF NOT USE MAXI SPEEDY HANGERS.
TIMBER/TIMBER: BAT JIFFY HANGER OR FRAMING ANCHOR.
ALLOW FOR BAT M305 STRAPS @ 1200 c/c FOR RESTRAINT.

12.ALL TEMPORARY PROPPING BYTHE CONTRACTOR.
15.NEW BRICKWORK TO BE 35N/mmsq, IN 1:1:6 MORTAR.
13.ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.

14.ALL WATERPROOFING AND DRAINAGE TO ARCHITECT'S SPECIFICATION.
16.NO WORK TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS
17.ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.

18.NO WORK TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS.

19.ANY BEAMS, JOISTS HANGERS, OR OTHER STRUCTURAL WORKS ATTACHED TO PARTY WALL MAY BE SUBJECT TO PARTY WALL AGREEMENT.

20.FLOOR JOISTS STRAPPED TO MAIN BRICK WALLS IN ACCORDANCE WITH A3 DISPROPOTIONATE COLLAPSE GUIDELINES.

21. ALL STUD WORK TO BE RESTRAINT AT HIGHER LEVEL.

22. ROOF HOLDING STRAPS TO BE PROVIDED AT MAXIMUM 2m CENTRES.

REINFORCED CONCRETE NOTES

1.
ALL DIMENSIONS TO BE VERIFIED ON SITE.

2.
READ IN CONJUNCTION WITH ARCHITECT'S DRAWINGS.

3.
REINFORCED CONCRETE BEAM TO BE CAST IN GRADE 35 N/mm2 CONCRETE AND REINFORCED IN ACCORDANCE WITH DESIGN INFORMATION AND REINFORCEMENT SCHEDULES, PROVIDED BY THE ENGINEER - MIN CEMENT CONTENT 330 kg/m2 .

4.
READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT, WHICH HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.

5.
NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 O C.

6.
REINFORCEMENT SHALL BE: (TO BS 8110).

7.
PLAIN BARS (i.e. LINKS) TO BS 4449, GRADE 250 (MILD STEEL).

8.
ALL OTHER MAIN BARS TO BE GRADE 460 (HIGH YIELD).

9.
REINFORCEMENT TO BE FIXED ADEQUATELY USING TYING WIRE OR STEEL CLIPS.

10. CONCRETE COVER TO BE MIN 35 mm COVER, UNLESS STATED OTHERWISE ON DRAWING.

11.
UNLESS NOTED OTHERWISE ON DRAWINGS, ALL REINFORCEMENT IS TO BE LAPPED 40d (WHERE d IS THE DIAMETER OF THE LARGER BAR).

12.
AT THIS FOUNDATION DEPTH, TREE ROOTS ARE TO BE EXPECTED. SLAB DESIGNED WITH THIS CONSIDERATION.

13.
ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.

14.
ALL WATERPROOFING AND DRAINAGE TO ARCHITECT'S SPECIFICATION.

15.
NO WORK IS TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS.

Preliminary
DRAFT SCHEME
FOR PRICING ONLY

Rev	Date	Description	App
A	24.05.18	Revised after project meeting	SG

Title
GROUND FLOOR PLAN

Martin Redston Associates
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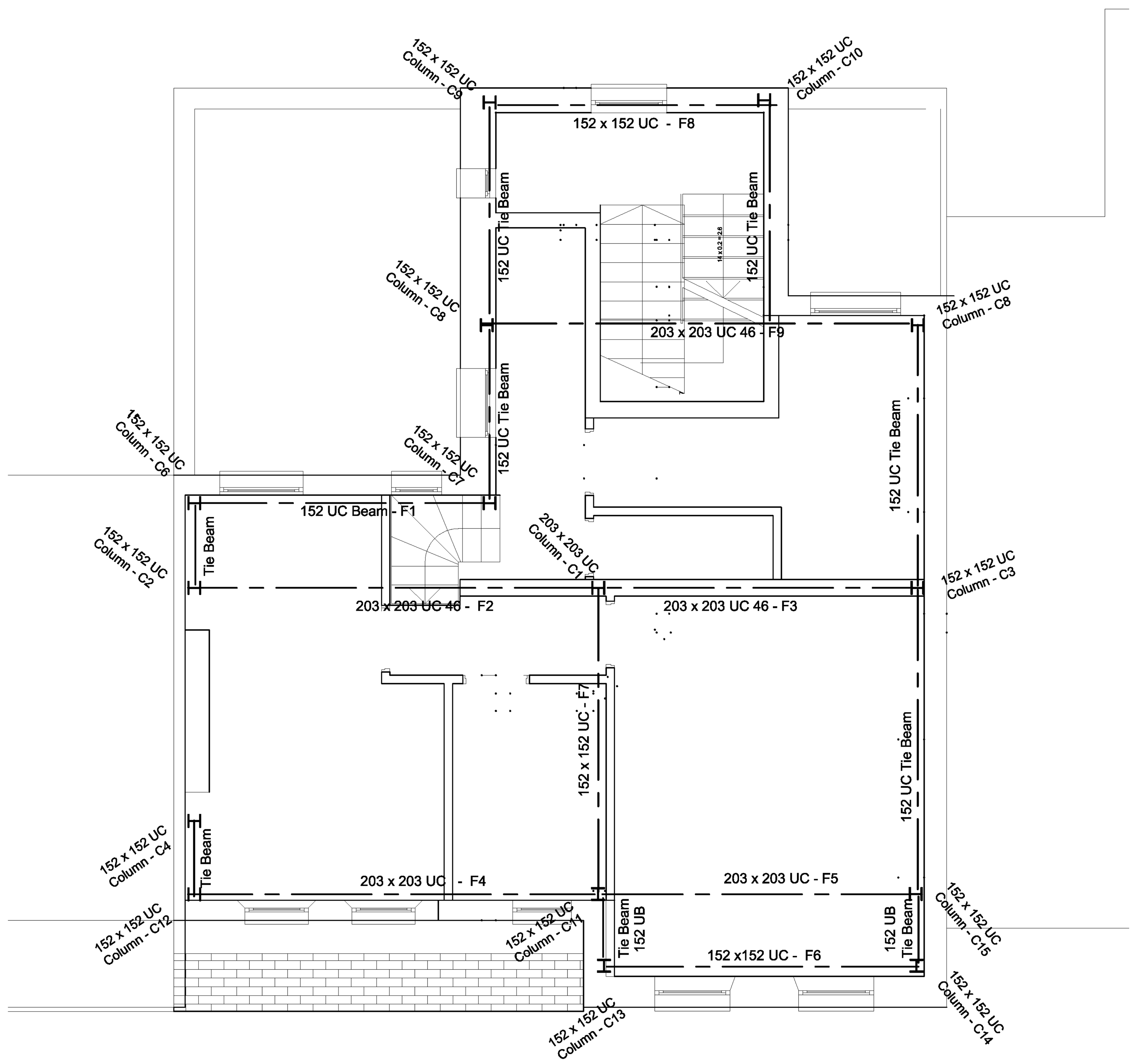
Date 19th April 2018		Sheet No. 3
Eng. SG	Scale 1/50@A1	Rev A
Job No. 18.165		

Project. 163 Sumatra Road
London NW6 1PN



FIRST FLOOR PLAN

(Showing Second Floor Structure above.)

Scale 1:50 @ A1 & 1:100 @ A3

Preliminary
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Rev	Date	Description	App
A	24.05.18	Revised after project meeting	SG

Title
FIRST FLOOR PLAN

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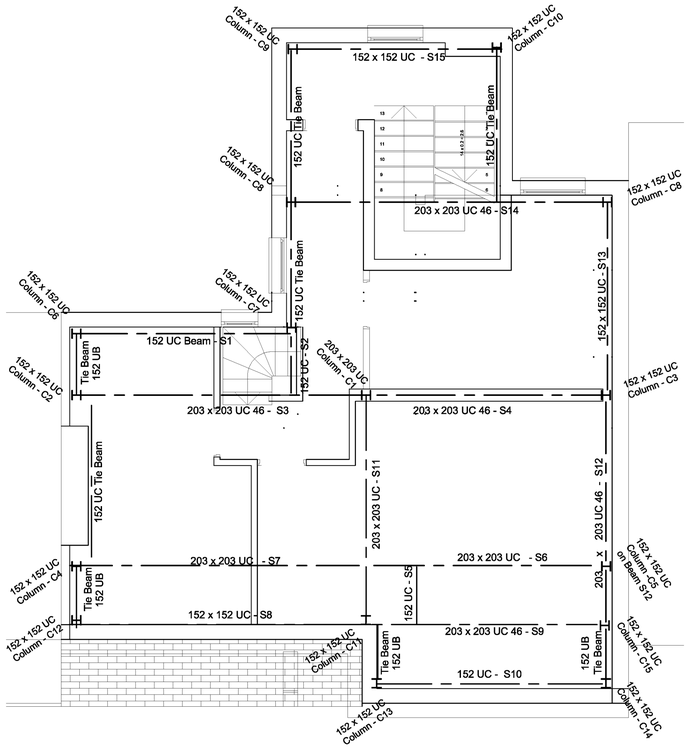
Date 19th April 2018 | Sheet No. 4 | Rev A
Eng. SG | Scale 1:50@A1
Job No. 18.166
Project. 163 Sumatra Road London NW6 1PN



SECOND FLOOR PLAN

(Showing ATTIC Structure above.)

Scale 1:50 @ A1 & 1:100 @ A3

GENERAL NOTES

1.
ALL DIMENSIONS TO BE
VERIFIED ON SITE.

2.
READ IN CONJUNCTION WITH
ARCHITECT'S DRAWINGS.

3.
ALL STEEL WORK DESIGNED TO
BS 5950 FABRICATED TO BS 5950.

4.
ALL STEEL MEMBERS TO BE
GRADE 43 STEEL.

5.
APPLY 2 COATS OF RED OXIDE
PRIMER TO ALL STEEL PRIOR TO ERECTION.

6.
ALL STEEL BEAMS TO HAVE 1
HOUR FIRE RESISTANCE CAPABILITY MIN
(e.g. 12.5 mm PLASTERBOARD AND 7mm SKIM).

7.
ALL PLATE WELDING TO BE 6mm
FILLET WELDS. ALL CHANGE TO BE FULL
STRENGTH BUTT WELDS TO BE CARRIED
OUT IN WORKSHOP.

8.
ALL BLACK BOLTS TO BE GRADE 8.8.

9.
ALL TIMBERWORK DESIGNED TO BS 5268.

10.
DOUBLE JOISTS TO BE BOLTED
TOGETHER WITH M-12 BOLTS @ 450mm dp.
TP CONNECTORS AND WASHER PLATE @ 450 c/c.

11.CONNECTIONS:
TIMBER/BRICK: BAT TPH HANGER WHEN
TIMBER IS A MINIMUM OF
675mm OF BRICKWORK
ABOVE, IF NOT USE MAXI
SPEEDY HANGERS.
TIMBER/TIMBER: BAT ZIPPY HANGER OR
FRAMING ANCHOR.
ALLOW FOR BAT MOST STRAPS @ 1200 c/c
FOR RESTRAINT.

12.ALL TEMPORARY PROPPING BY/TO CONTRACTOR.

13. ALL WORKS TO BE APPROVED BY THE
BUILDING CONTROL OFFICER.

14. NO WORK TO COMMENCE ON SITE PRIOR
TO BUILDING CONTROL APPROVAL OF
STRUCTURAL DETAILS

15.NEW BRICKWORK TO BE 350N/mmsq.
NEW BLOCKWORK TO BE 10N/mmsq SET
IN 1:1: 6 MORTAR.

16.ALL WATERPROOFING AND
DRAINAGE TO ARCHITECTS SPECIFICATION.

17.ALL WORKS TO BE APPROVED BY
THE BUILDING CONTROL OFFICER.

18.NO WORK TO COMMENCE ON SITE
PRIOR TO BUILDING CONTROL APPROVAL
OF STRUCTURAL DETAILS.

19.ANY BEAMS, JOISTS HANGERS, OR
OTHER STRUCTURAL WORKS ATTACHED
TO PARTY WALL MAY BE SUBJECT TO PARTY
WALL AGREEMENT.

20.FLOOR JOISTS STRAPPED TO MAIN BRICK
WALLS IN ACCORDANCE WITH A3
DISPROPORTIONATE COLLAPSE GUIDELINES.

21. ALL STUD WORK TO BE RESTRAINT
AT HIGHER LEVEL.

22. ROOF HOLDING STRAPS TO BE PROVIDED
AT MAXIMUM 2m CENTRES.

Preliminary
DRAFT SCHEME
FOR PRICING ONLY

Rev	Date	Description	App
–	–	–	–
A	24.05.18	Revised after project meeting	SG

Title
SECOND FLOOR PLAN

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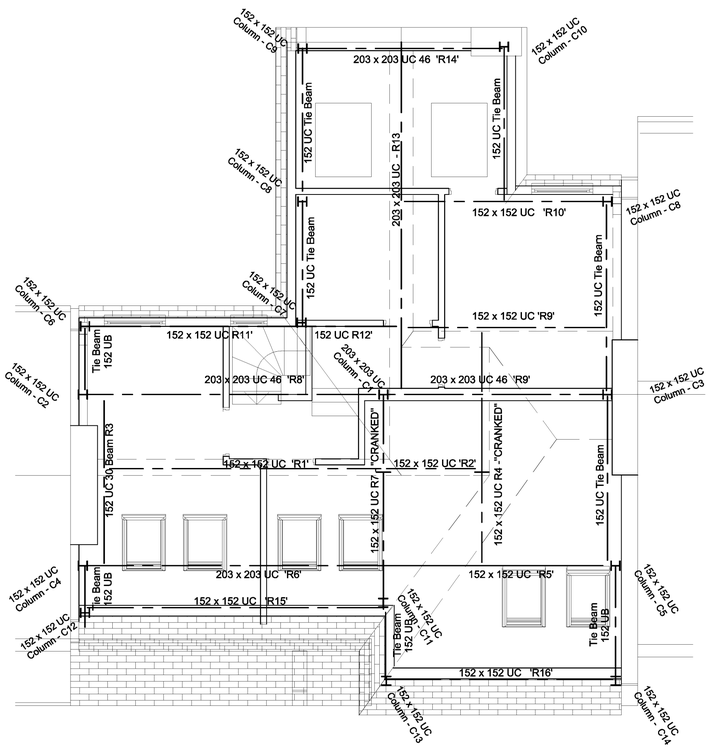
Date: 19th April 2018		Sheet No.	Rev
Eng. SG	Scale 1/50@A1	5	A
Job No. 16.165			
Project: 163 Sumatra Road London NW6 1PN			



LOFT FLOOR PLAN

(Showing ROOF Structure above.)

Scale 1:50 @ A1 & 1:100 @ A3

EXCAVATION FOR REINFORCED CONCRETE RETAINING WALLS

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH ADJACENT EXISTING STRUCTURE.

2. CAST NEW CONCRETE BASE AND ALLOW 24 HOURS TO CURE. STARTER BARS TO EXTEND 450 ABOVE BASE FOR LAPPING PURPOSES (SEE DETAILS FOR BAR SIZES).

3. VERTICAL & HORIZONTAL REINFORCEMENT TO BE CONSTRUCTED IN ACCORDANCE WITH DESIGN INFORMATION AND ANY REINFORCEMENT SCHEDULES PROVIDED BY THE ENGINEER.

4. SHUTTERING & PROPPING TO BE DESIGNED BY CONTRACTOR.

5. CAST NEW CONCRETE WALL ENSURING GROUND BEHIND NEW FOUNDATION & WALL IS FULLY BACKFILLED AND COMPACTED. CHECK AT REGULAR INTERVALS TO ENSURE THIS DURING CONSTRUCTION.

6. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS BETWEEN OPERATIONS.

7. WHEN ADJACENT SECTIONS ARE OPENED UP THE EXPOSED CONCRETE SURFACES SHOULD BE THOROUGHLY CLEANED OF ALL LOOSE MATERIAL & SCARIFIED TO FORM A GOOD KEY.

8. ALL REASONABLE CARE IS TO BE TAKEN TO PREVENT INJURIES TO PERSONS WORKING NEAR EXPOSED BARS ETC. (TRIPLADED COUPLERS WOULD BE SUITABLE).

9. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.

10. TRIAL PIT TO BE EXCAVATED TO CONFIRM EXISTANCE OF ANY EXISTING STRUCTURE.

11. REINFORCEMENT SHALL BE TO BS-8110 WITH MAIN BARS TO BE GRADE 460 (HIGH YIELD).

12. READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT THAT HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.

13. NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 DEGREES C.

SEQUENCE OF UNDERPINNING

1. WORKING IN STRIPS NOT EXCEEDING 1M LONG EXCAVATE TO REQUIRED DEPTH BENEATH EXISTING FOOTING.

2. HACK AWAY TO PROVIDE LEVEL SOFFIT TO EXISTING BRICK FOOTING AND THOROUGHLY CLEAN BEFORE UNDERPINNING.

3. CAST NEW CONCRETE TO WITHIN 75mm OF SOFFIT OF EXISTING FOOTING AND ALLOW 24 HOURS TO CURE.

4. RAM IN DRY PACK MORTAR BETWEEN NEW AND EXISTING FOOTINGS.

5. NEVER EXCAVATE TWO ADJACENT STRIPS WITHOUT ALLOWING 3 DAYS FROM TIME OF DRY PACKING.

6. WHEN ADJACENT SECTIONS ARE OPENED UP THE EXPOSED CONCRETE SURFACES SHOULD BE THOROUGHLY CLEANED OF ALL LOOSE MATERIAL AND SCRABBLED TO FORM A GOOD KEY.

7. UNDERPINNING TO BE 1500mm WIDE UNLESS NOTED OTHERWISE.

8. ALL NEW CONCRETE BELOW GROUND TO BE SULPHATE RESISTING CEMENT CONC. GRADE 35.

9. DRY PACK - 3 : 1 SAND CEMENT.

10. WHEN LOWERING FLOORS IN BASEMENTS, ALL WALLS MUST BE UNDERPINNED BEFORE DIGGING OUT FLOOR.

11. CONTRACTOR TO CAREFULLY INSPECT ALL EXISTING MASONRY PRIOR TO UNDERPINNING EACH BAY IN SEQUENCE. REPORT ANY ANOMALIES TO ENGINEER FOR ADVICE AND REASSESSMENT OF SCHEME.

12. UNDERPINNING SECTIONS TO BE CAST IN NUMERICAL ORDER. SEE FOUNDATION PLAN FOR DETAILS.

13. TANKING REQUIRED, TO CONTRACTORS SPECIFICATION. ALL OTHER WATERPROOFING AND DRAINAGE TO ARCHITECTS SPECIFICATION.

REINFORCED CONCRETE NOTES

1.
ALL DIMENSIONS TO BE VERIFIED ON SITE.

2.
READ IN CONJUNCTION WITH ARCHITECT'S DRAWINGS.

3.
REINFORCED CONCRETE BEAM TO BE CAST IN GRADE 35 N/mm2 CONCRETE AND REINFORCED IN ACCORDANCE WITH DESIGN INFORMATION AND REINFORCEMENT SCHEDULES, PROVIDED BY THE ENGINEER - MIN CEMENT CONTENT 350 kg/m3 .

4.
READY MIX CONCRETE MUST BE OBTAINED FROM A PLANT, WHICH HOLDS A CURRENT CERTIFICATE OF ACCREDITATION UNDER THE QUALITY SCHEME FOR READY MIX CONCRETE.

5.
NO CONCRETE IS TO BE PLACED WHEN THE AMBIENT AIR TEMPERATURE IS LESS THAN 5 O C.

6.
REINFORCEMENT SHALL BE: (TO BS 8110).

7.
PLAIN BARS (i.e. LINKS) TO BS 4449, GRADE 250 (MILD STEEL).

8.
ALL OTHER MAIN BARS TO BE GRADE 460 (HIGH YIELD).

9.
REINFORCEMNT TO BE FIXED ADEQUATELY USING TYING WIRE OR STEEL CLIPS.

10. CONCRETE COVER TO BE: MIN 25 mm COVER, UNLESS STATED OTHERWISE ON DRAWING.

11.
UNLESS NOTED OTHERWISE ON DRAWINGS,
ALL REINFORCEMENT IS TO BE LAPPED 40d
(WHERE d IS THE DIAMETER OF THE LARGER BAR).

12.
AT THIS FOUNDATION DEPTH, TREE ROOTS ARE TO BE EXPECTED. SLAB DESIGNED WITH THIS CONSIDERATION.

13.
ALL WORKS TO BE APPROVED BY THE BUILDING CONTROL OFFICER.

14.
ALL WATERPROOFING AND DRAINAGE TO ARCHITECT'S SPECIFICATION.

15.
NO WORK IS TO COMMENCE ON SITE PRIOR TO BUILDING CONTROL APPROVAL OF STRUCTURAL DETAILS.

Preliminary
DRAFT SCHEME
FOR PRICING ONLY

Rev	Date	Description	App
A	24.05.18	Revised after project meeting	SG

Title
ROOF PLAN

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Date 19th April 2018		Sheet No.	Rev.
Eng. SG	Scale 1/2@A1	6	A
Job No. 18.105			
Project. 163 Sumatra Road London NW6 1PN			

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163 Sumatra Road, NW6 1PN Underpinning Report

Prepared by:
Drawing and Planning Ltd
Mercham House
25 – 27 The Burroughs
London NW4 4AR

Issue Date: Friday, 13 January 2017

This document should be checked in conjunction with the drawing SMTRD-UP001

Drawing and Planning Ltd.
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INTRODUCTION

Situation

The property is located in the London Borough of Camden, concretely in the West Hampstead ward.

Description of the property

The property dates back ca. 1900. It features a sunken lower ground floor and a staggering of the floors between levels (i.e. the rear slabs are not aligned with the front slabs). With ground, first and second floor. There are 5 bedrooms.

The property span is 8.9 m and the existing GIA is 186 sqm.

The condition of the structure is good. The roof is air and watertight. At the moment the property has been stripped out, including some windows and doors which have been consequently boarded.

UNDERPINNING

Scope

To underpin the flank walls of the property to allow the removal of the ground for the excavation of the basement.

The pins have been excavated to a depth of 3.8 from Ground Floor Level.

Description of the procedure

The pins are elements of reinforced concrete with drypack mortar at the top. This mortar transmits the load from the existing walls to the pin. The width of these elements is roughly 1000 mm.

The excavation started at the West Side flank wall. The excavation of the East Side started simultaneously while the workers finished with the underpinning of the opposite side.

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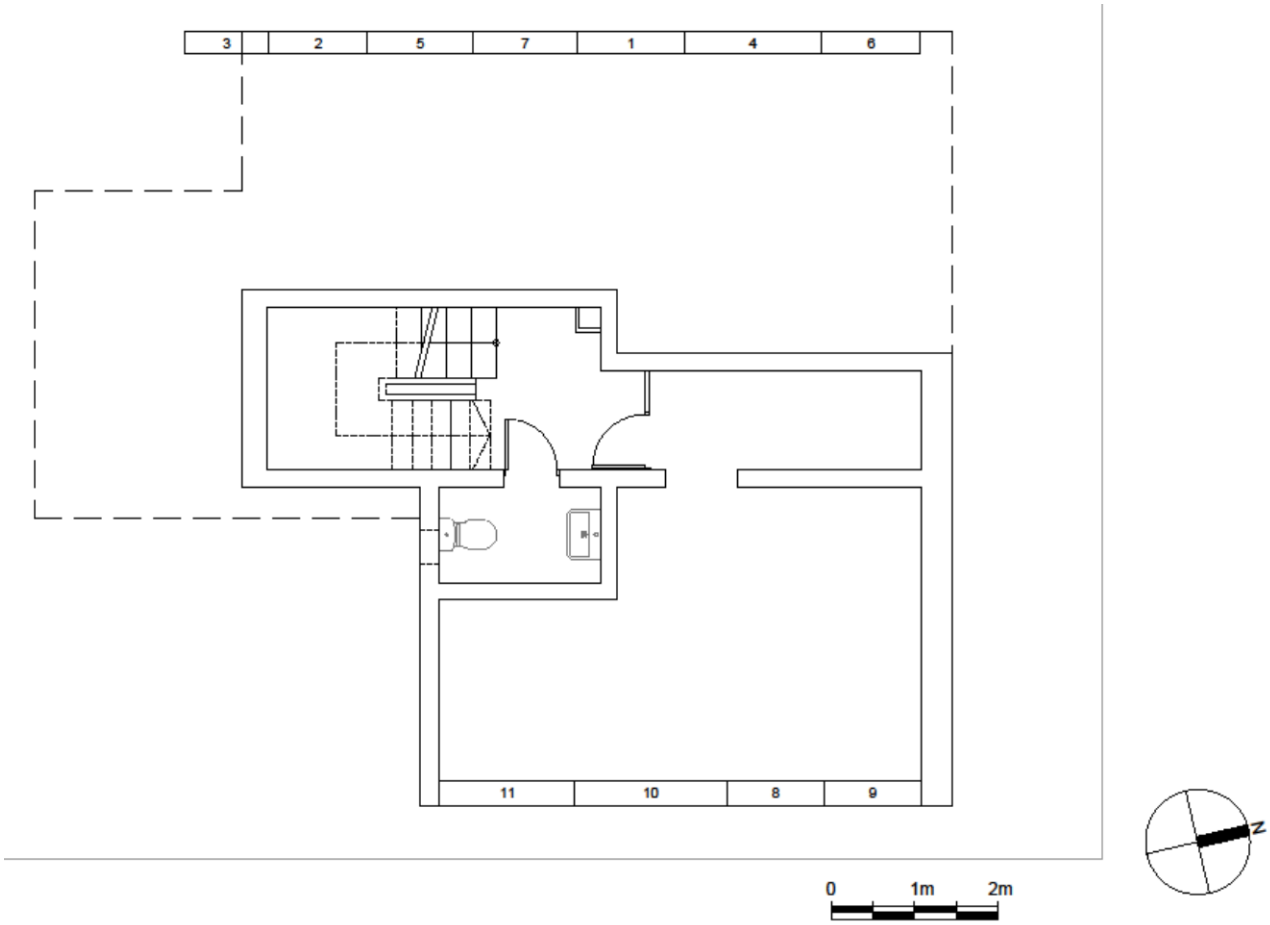

Figure 1 Underpinning sequence

Date of the works

The works were carried out between the 10th of October 2016 and the 15th of December of the same year.

Contractor

The appointed contractor was OBS Basements, based at 21 Jacobs Court, RH10 3SG, Crawley

Checking Engineer

A Checking Engineer was appointed before the end of the design stage to oversee the works. He has visited the site in 4 occasions throughout the works.
The details are: Martin Redston, Redston Associates, 4 Edward Square, N1 0SP, London

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Email: info@drawingandplanning.com

ANNEXES

I Letter from the Building Control Inspector

salus
Building Compliance without Complexity

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Tel: 0208 457 2938
e: hendon@salusa.co.uk
@Salusai London
www.linkedin.com/company/salusai

Our Ref:H43863/SM/JT
(please quote our reference on all correspondence)
Date: 13 January 2017

Francisco Berenguer
Drawing and Planning
Mercham House
25-27 The Burrough
London
NW4 4AR

Dear Francisco,

Re: New basement, extension and internal alterations to ground, first and second floor at 163 Sumatra Road, West Hampstead, London, NW6 1PN

I refer to the above and your request of confirmation of the underpinning.

The following inspections of the underpinning were carried out and the following noted:

11th October 2016

Called Francisco 1/2 hour before to meet on site. B, G, 1st, 2nd floor terraced house. Very deep pin for inspection and discussion. Hole is 2.8m deep, 1m x 1m and held by temp props. A363 mesh to go at toe then 1m deep concrete to be poured, then another mesh and concrete over. Estimate another 6 pins along this RHS wall (as viewed from street). Advised to continue with the wall and to take photos - Francisco to visit every week, SE will also inspect this excavation before pours. Asked for call when 1st pin dug at next wall. NI excavations.

16th November

Met architect - basement wall right hand side underpinning is complete. Seen 1 pad left hand side 2.5 m deep into London clay. Pad is 1m below an original underpinning - engineer is also inspecting.

If you require any further clarification or assistance on any of the above please do not hesitate to contact me.

Yours sincerely

Steve Moore
Managing Associate
steve.moore@salusai.co.uk

Constructionline
acai

www.salusai.co.uk

NATIONAL COVERAGE - REGIONAL EXPERTS

Paul Meadows BSc, CBuildE, FCABE, MIFireE, MRICS | Paul Morris CBuildE, MCABE, Assoc RICS | Stuart Power BEng (Hons), MRICS, CBuildE, FCABE, MIFireE
Company Number: 4522351 **Registered Office:** Primea House, Marina Court, Maple Drive, Hinckley Leicestershire LE10 3BF (Head Office)

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II Email from the checking engineer

163 Sumatra Underpinning

Martin Redston <martin@redstonassociates.co.uk> **12 January 2017 at 19:18**
To: Francisco Berenguer <francisco@drawingandplanning.com>

Martin Redston Associates

Consulting Civil & Structural Engineers

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martin@redston.org

6 Hale Lane London NW7 3NX
Tel: 020 8959 1666 Fax: 020 8906 8503

Dear Francisco,

163 Sumatra Road NW6

I am writing to confirm that I visited the property on a fortnightly basis to inspect the underpinning works as they proceeded. As far as can be ascertained on this occasional basis the work was implemented in a reasonable manner, with sequencing rules followed adequately. Drypacking between the new concrete and original masonry appeared to be well compacted and concrete cured adequately.

Regards

Martin Redston

Martin Redston BSc, CEng, MICE.
Principal

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Martin Redston Associates is the trading name of Martin Redston Associates Ltd.
Company number 05990582, Registered in England.

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III Pictures

2016-10-11

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2016-10-21

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2016-10-25

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2016-10-28

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2016-11-02

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2016-11-08

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2016-11-11

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2016-11-16 The excavation starts for the East Side underpinning

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2016-11-23

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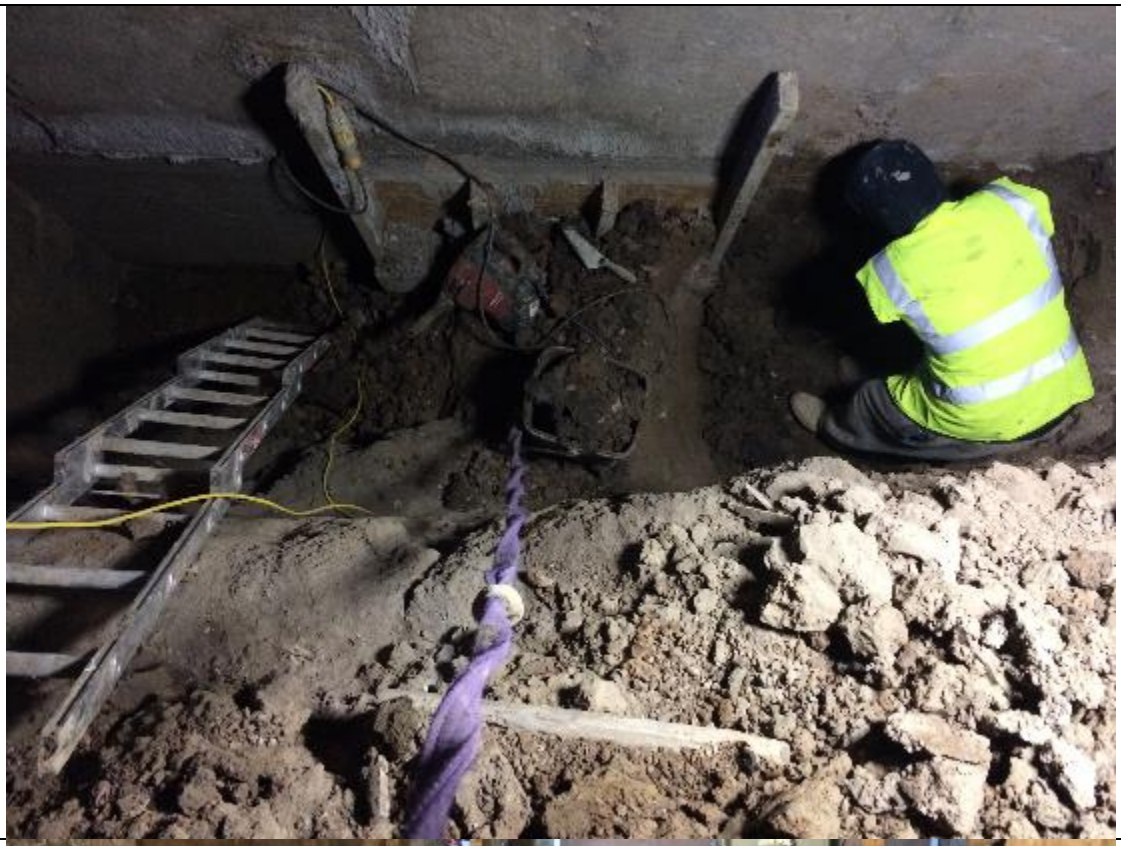
2016-11-30



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2016-12-07

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2016-12-15

Project	163 Sumatra Road
Location	Basement
Reference	
Title	Additional Information after DVT BIA queries 16th September 2019

Revision	B
Date Issued	January 6, 2020
Number of Sheets	
Client	JS
Issued to	JS/DVT
Issued by	GH
Issued for	**INFORMATION ONLY (NOT FOR CONSTRUCTION)**

Comment

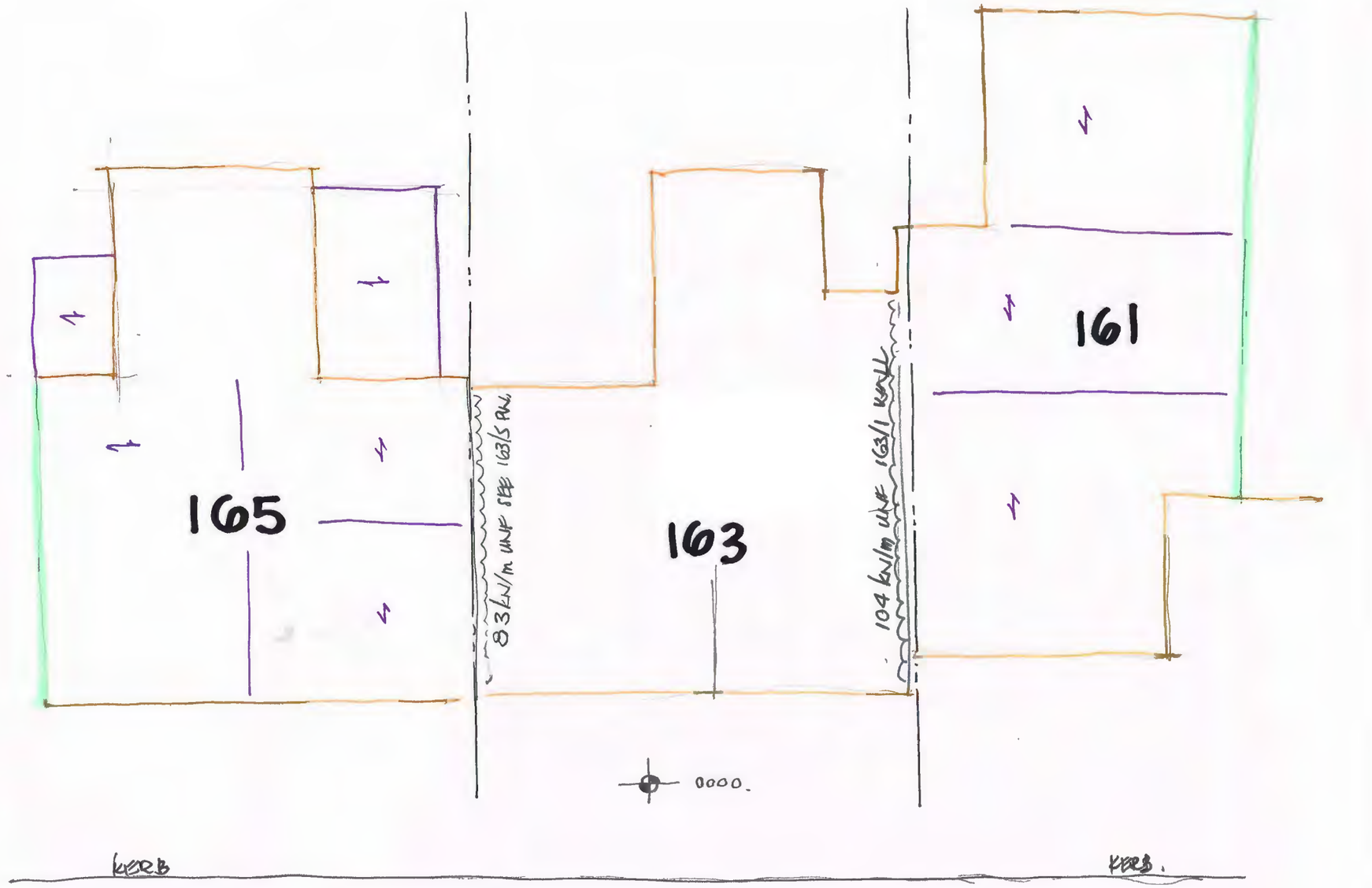
rev A - Ground bearing pressure for permanent load case added, rev B - Q&A sheet, temp works sketches and program added.

GLEN HADDON
CONSULTING STRUCTURAL ENGINEER

email glen.haddon@gmail.com
tel 0207 274 3452/mob 07508 094 407

Wall Ty			UDL (u/s founds)	GBP on 600 four				
A			53.88	89.80	2 storey 9" wall no windows, floors			
B	Orange		43.39	72.31	two storey 9" wall, windows, floors			
C	Green	PW	62.96	104.94	party wall, no basement			
D	Purple	PW	56.54	94.24	internal 4" with floors and roof			

Scale Bar
0 1 2 3 4 5



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London SE5 9LL
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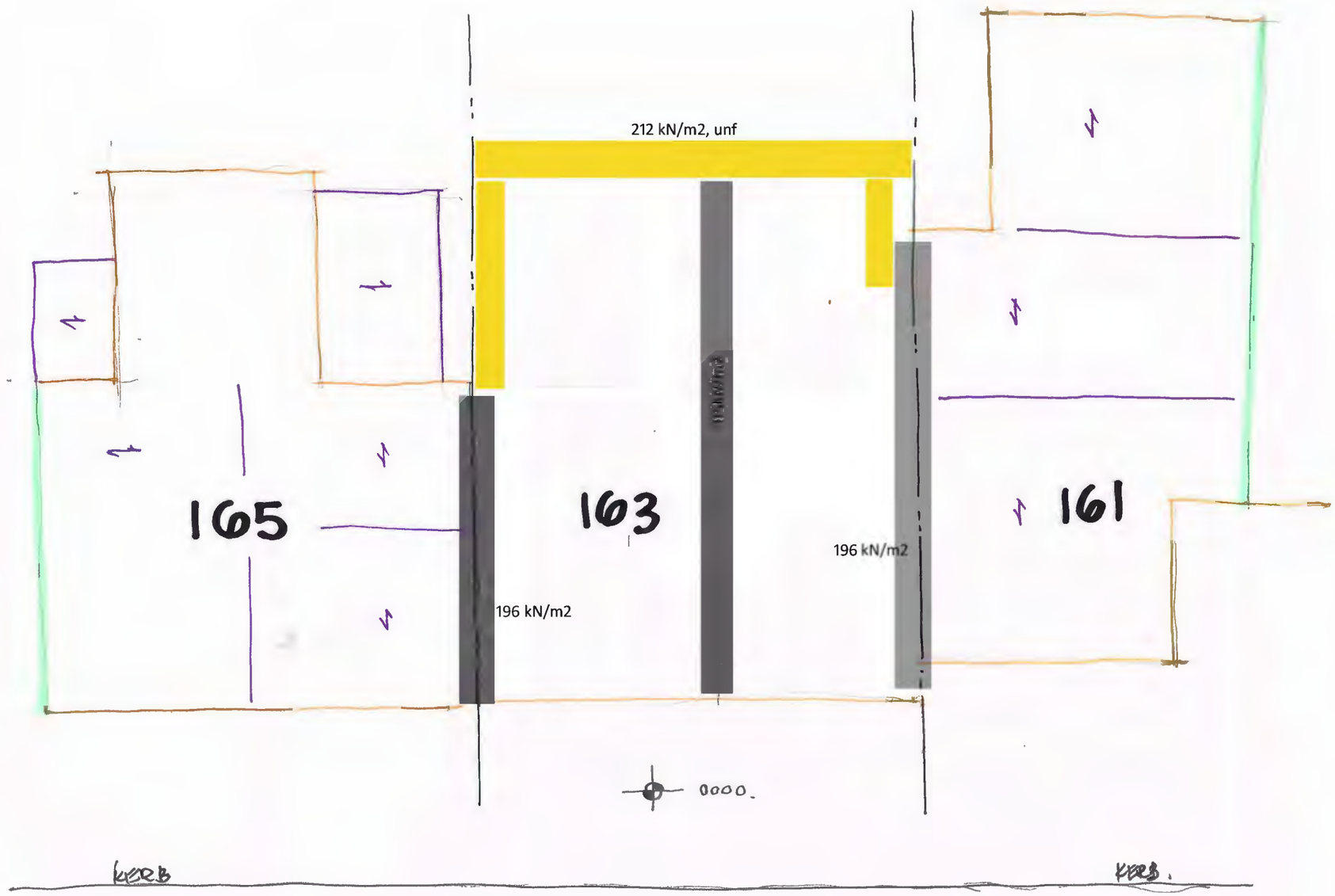
Job:	

LOADS AT FOUNDATION LEVEL (EXISTING)

Wall Ty			UDL (u/s founds)	GBP on 600 four				
A			53.88	89.80	2 storey 9" wall no windows, floors			
B	Orange		43.39	72.31	two storey 9" wall, windows, floors			
C	Green	PW	62.96	104.94	party wall, no basement			
D	Purple	PW	56.54	94.24	internal 4" with floors and roof			

Scale Bar
0 1 2 3 4 5



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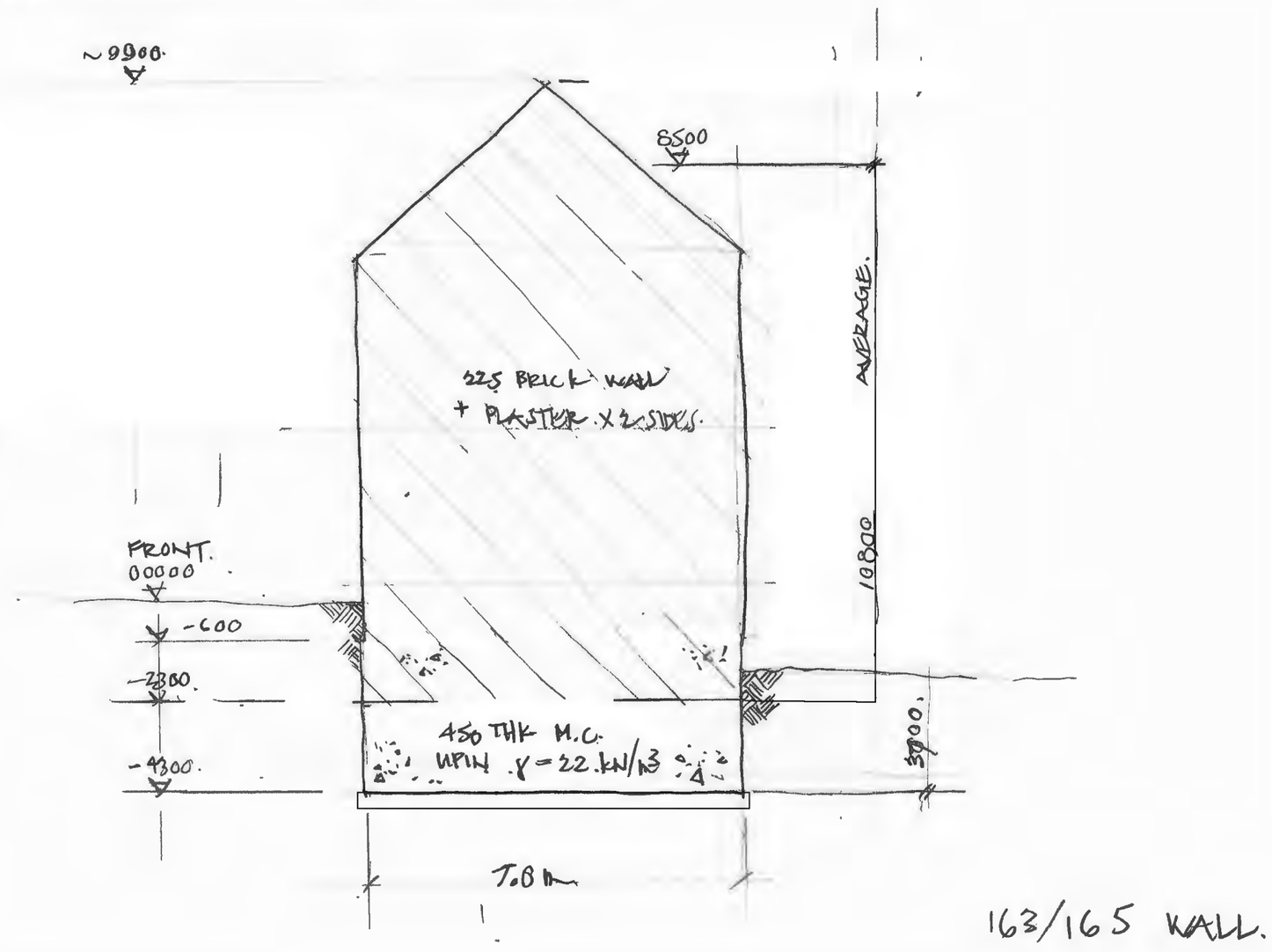
Job:	

LOADS AT FOUNDATION LEVEL (PROPOSED)

	height	thickness	density	UDL				
	m	m	kN/m3	kN/m				
	10.80	0.27	22.00	62.96				
	2.00	0.45	22.00	19.80				
				82.76	kN/m total at base of underpinning			



9508
+2300
10706

4300
-2300
2000

163/165 WALL.

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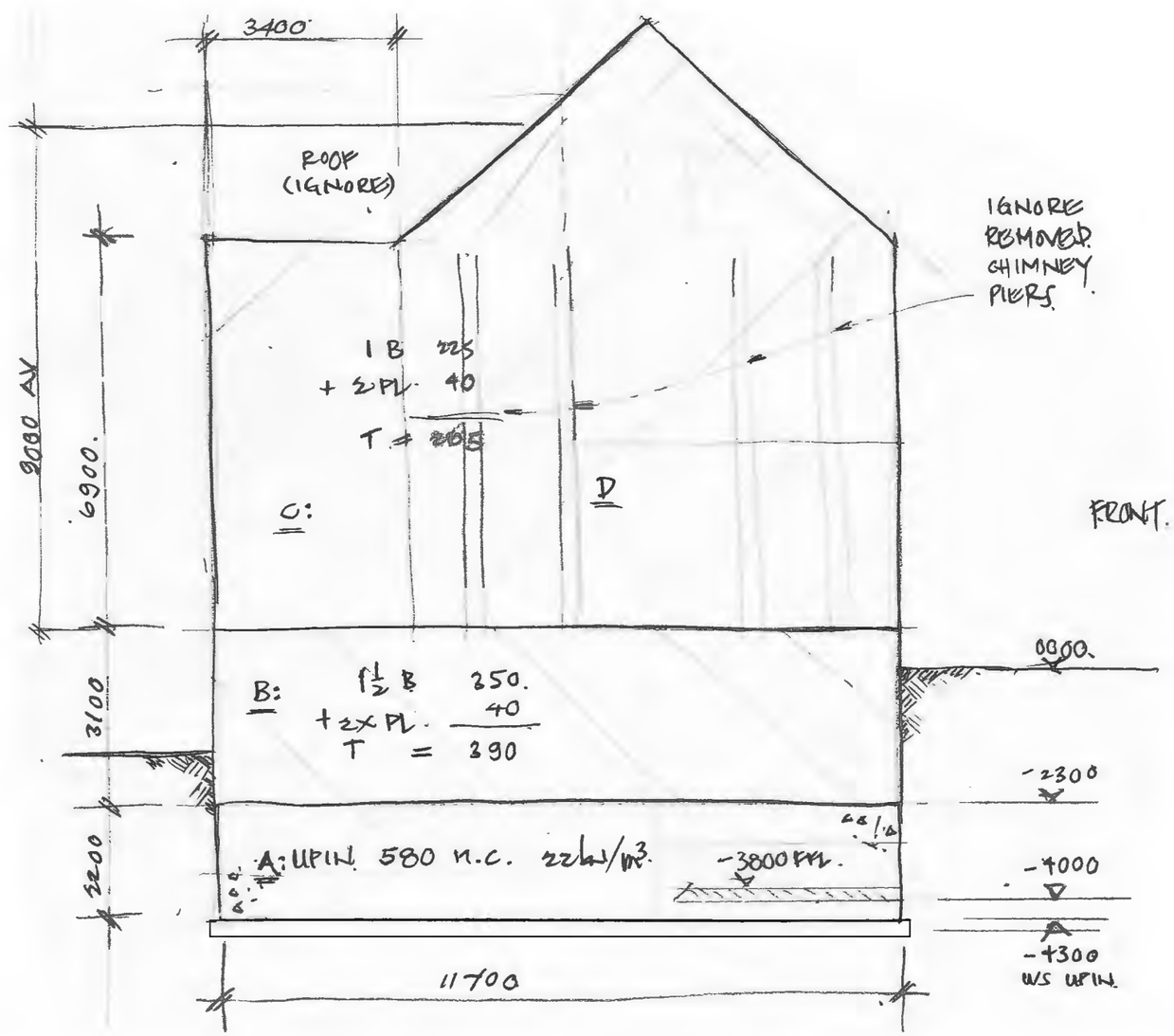
165/163 Loaded Wall Elevation

163 161 wall udl (base of underpinning)				103.58	kN/m (unf)						
item	item description		thickness	height	density	kN/m	length	weight of item			
			mm	mm	kN/m3		mm	kN (unf)			
A	underpin		580.00	2,200.00	22.00	28.07	11,700.00	328.44			
B	1.5 brick + plaster either side		390.00	3,100.00	22.00	26.60	11,700.00	311.20			
C	1 brick + plaster either side		265.00	6,900.00	22.00	40.23	3,400.00	136.77			
D	1 brick + plaster either side		265.00	9,000.00	22.00	52.47	8,300.00	435.50			
TOTAL FOR WALL							11,700.00	1,211.91		103.58	kN/m (unf)



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161 to 163 Loaded Wall Elevation

Wall Type UDL (u/s founds) kN/m

A **53.88** **2 storey 9" wall no windows, floors**

	Floors	fl-fl	height	density	thickness		dead unfactored	live	d+l	oncoming	Window reduction	
	number	m		kN/m3	mm		kN/m2	kN/m2		m	%	
Roof							1.20	0.75	1.95	2.00		3.90
Loft							1.00	1.50	2.50	2.00		5.00
First Floor							1.00	1.50	2.50	2.00		5.00
Ground Floor							1.00	1.50	2.50	2.00		5.00
Walls	2.00	3.00	6.00	22.00	265.00		5.83	0.00	5.83	6.00	0%	34.98

B **Orange** **43.39** **two storey 9" wall, windows, floors**

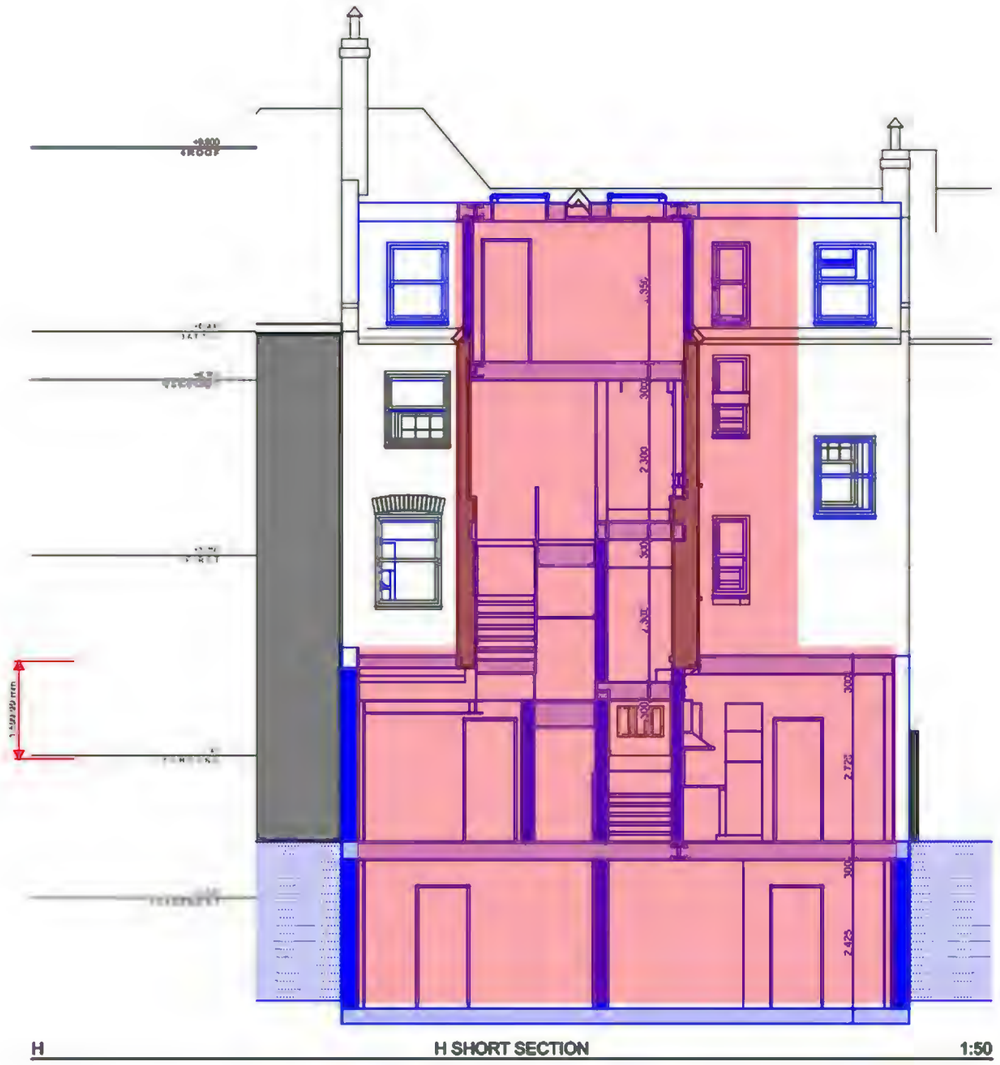
	Floors	fl-fl	height	density	thickness		dead unfactored	live	d+l	oncoming	Window reduction	
	number	m		kN/m3	mm		kN/m2	kN/m2		m	%	
Roof							1.20	0.75	1.95	2.00		3.90
Loft							1.00	1.50	2.50	2.00		5.00
First Floor							1.00	1.50	2.50	2.00		5.00
Ground Floor							1.00	1.50	2.50	2.00		5.00
Walls	2.00	3.00	6.00	22.00	265.00	70%	4.08	0.00	4.08	6.00	30%	24.49

C **Green** PW 62.96 **party wall, no basement**

	Floors	fl-fl	height	density	thickness		dead unfactored	live	d+l	oncoming	Window reduction	
	number	m		kN/m3	mm		kN/m2	kN/m2		m	%	
Roof							1.20	0.75	1.95	0.00		0.00
Loft							1.00	1.50	2.50	0.00		0.00
First Floor							1.00	1.50	2.50	0.00		0.00
Ground Floor							1.00	1.50	2.50	0.00		0.00
Walls			10.80	22.00	265.00		5.83	0.00	5.83	10.80	0%	62.96

D **Purple** PW 56.54 **internal 4" with floors and roof**

	Floors	fl-fl	height	density	thickness		dead unfactored	live	d+l	oncoming	Window reduction	
	number	m		kN/m3	mm		kN/m2	kN/m2		m	%	
Roof							1.20	0.75	1.95	4.00		7.80
Loft							1.00	1.50	2.50	4.00		10.00
First Floor							1.00	1.50	2.50	4.00		10.00
Ground Floor							1.00	1.50	2.50	4.00		10.00
Walls	2.00	3.00	6.00	22.00	142.00	100%	18.74	0.00	18.74	1.00	0%	18.74



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S1-Shear and Vertical Load Carrying Wall

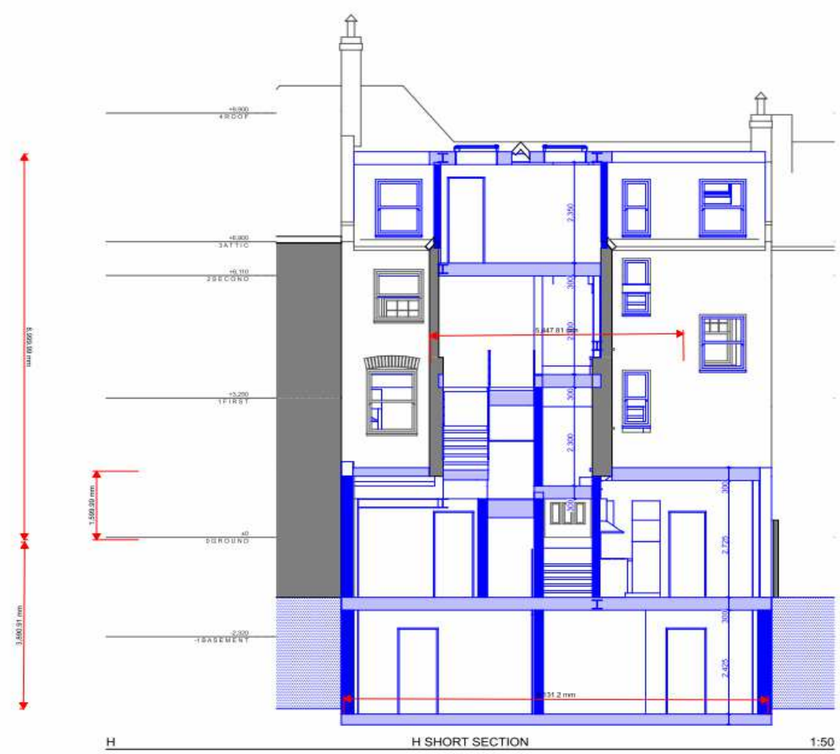
Wall S1

Calculate Weight of Wall

	height(m)	width(m)	area (m2)	weight kN/m2	kN	
upper part	9.00	5.40	48.60	5.20	252.72	
lower part	5.60	9.10	50.96	5.20	264.99	
			99.56		**517.71**	kN, unf

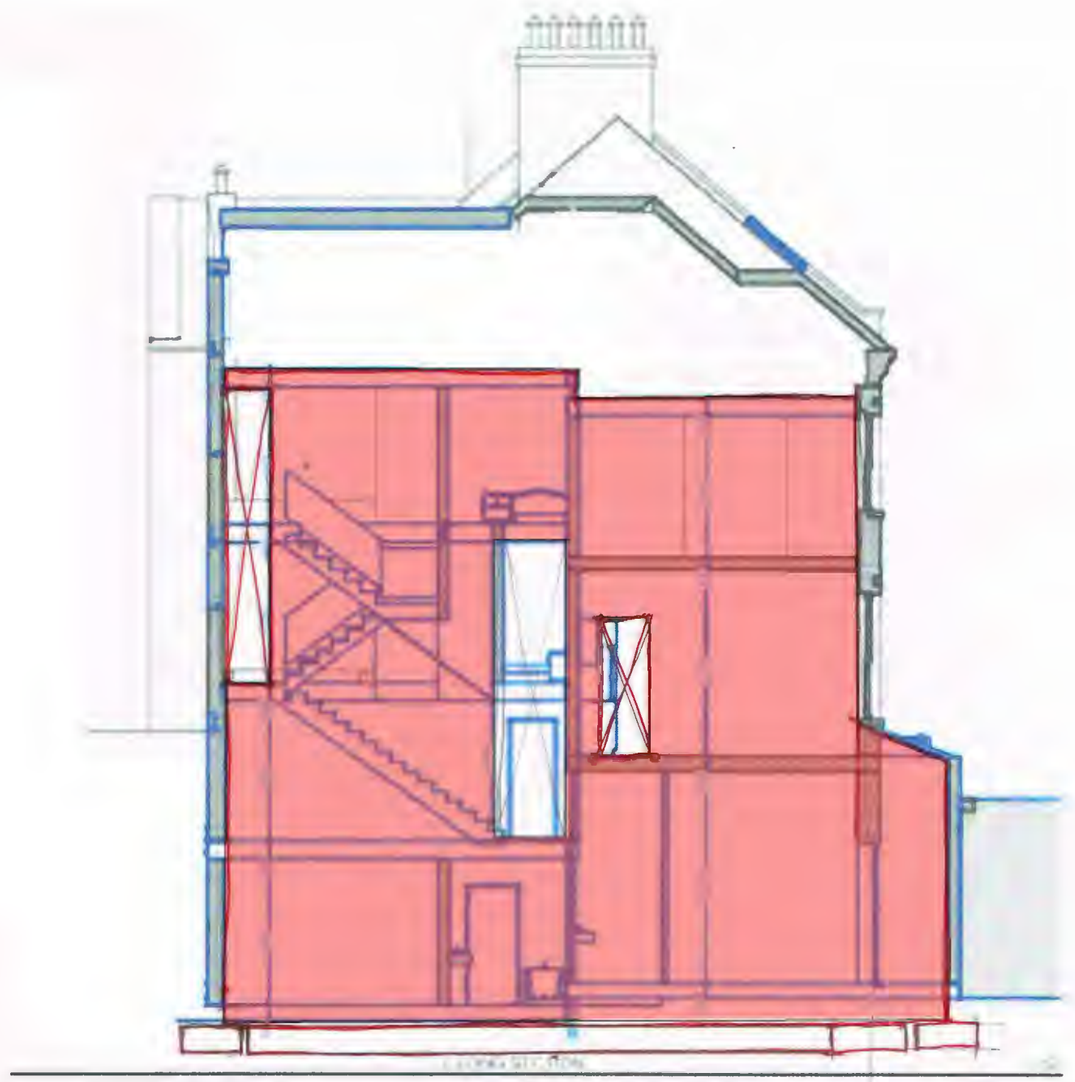
Calculate Weight of Oncoming Floors and Roof

Floor Loads:	m2	d+l kN/m2	width m	o/c m	kN d+l unf
Roof	76.40	1.53	5.40	2.50	20.60
Attic	76.40	8.40	5.40	2.50	113.40
Second	37.40	8.40	5.40	2.50	113.40
First	79.00	8.40	9.10	2.50	191.10
Ground	89.50	8.40	9.10	2.50	191.10
Basement	89.50	8.18	0.00	0.00	0.00
TOTAL					**629.60** **kN, unf**



Foundation Load under S1

	517.71
Wall	629.60
Floors	
TOTAL	**1,147.31** **kN, unf**
GBP	212.46



Mass concrete strip foundations approx 500mm deep and 600 to 1000mm wide

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EW1-Shear and Vertical Load Carrying Wall

Wall EW1

Calculate Height of Wall **10.16 m**

Basement Slab Level	-4.00	
Top of Wall	6.16	
Top of Wall Average	6.16	m aod
	6.40	m aod
	5.91	m aod

Length of Wall **11.00 m**

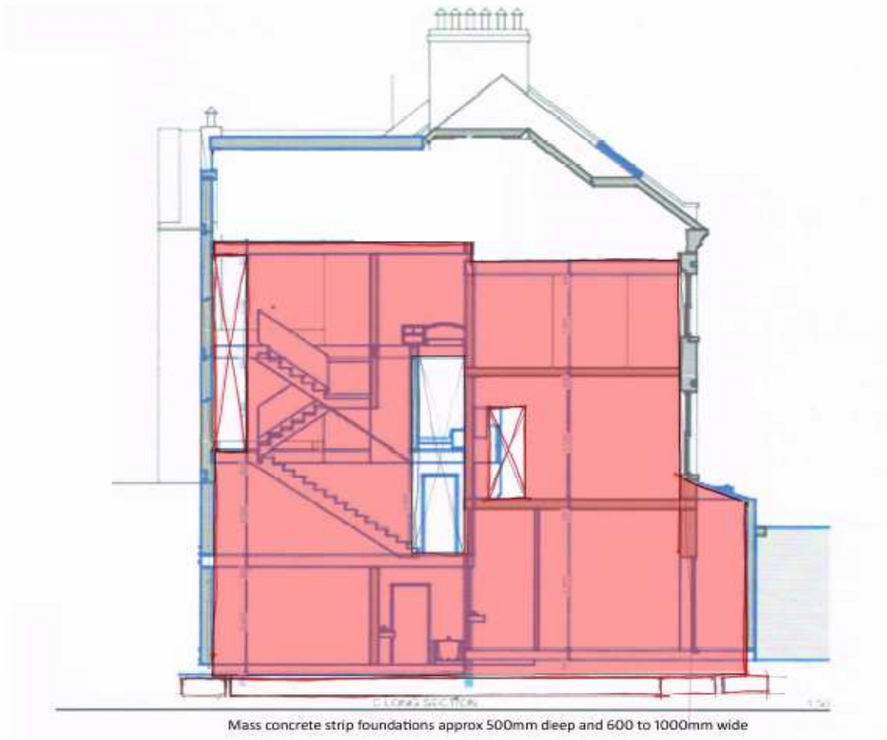
Area of Wall 111.71 m2

Wall Construction (tentative) and LOADING:

	kN/m2	
plaster and skim both sides	0.36	
220 thick concrete blocks	4.84	
	5.20	**5.20** kN/m2

Calculate Weight of EW1 **580.87 kN, unf**

height	10.16
length	11.00
loading	5.20



Mass concrete strip foundations approx 500mm deep and 600 to 1000mm wide

Foundation Pressures

		m2	d+l kN/m2	**kN** d+l unf
Floor Loads:				
	Roof	76.40	1.53	116.57
	Attic	76.40	8.40	641.76
	Second	37.40	8.40	314.16
	First	79.00	8.40	663.60
	Ground	89.50	8.40	751.80
	Basement	89.50	8.18	731.97
Wall EW1				580.87
TOTAL				**3,800.73**

3,800.73 kN, unf

The load will be distributed as follows:

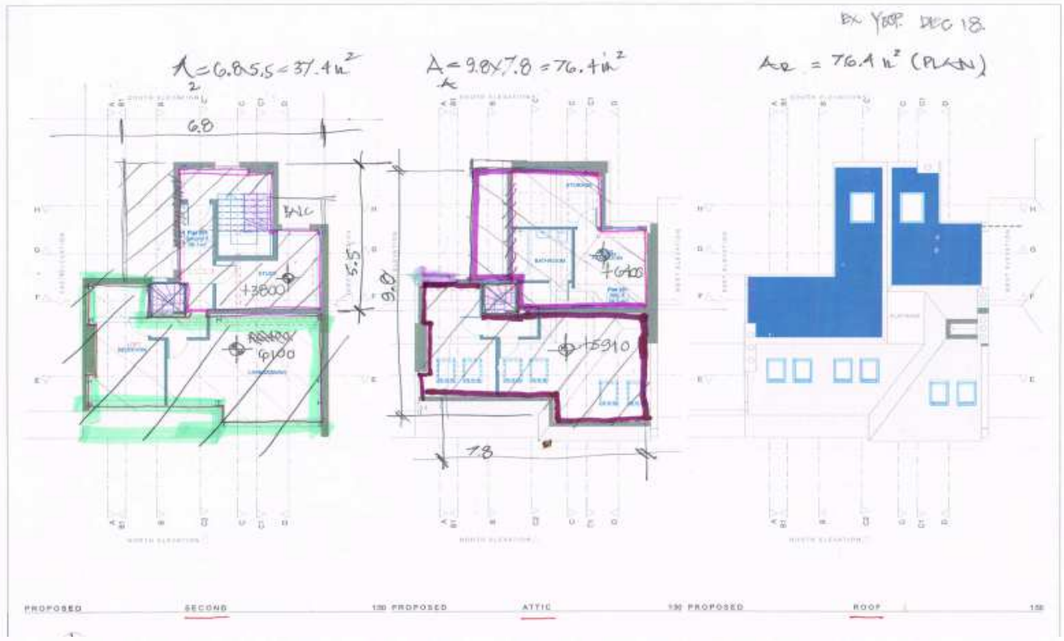
165/163 Wall		**Mass concrete strip foundation**		**161/163 Wall**		
25%		50%		25%		
kN						
950.18	+	1,900.36	+	950.18	=	3,800.73 kN, unf

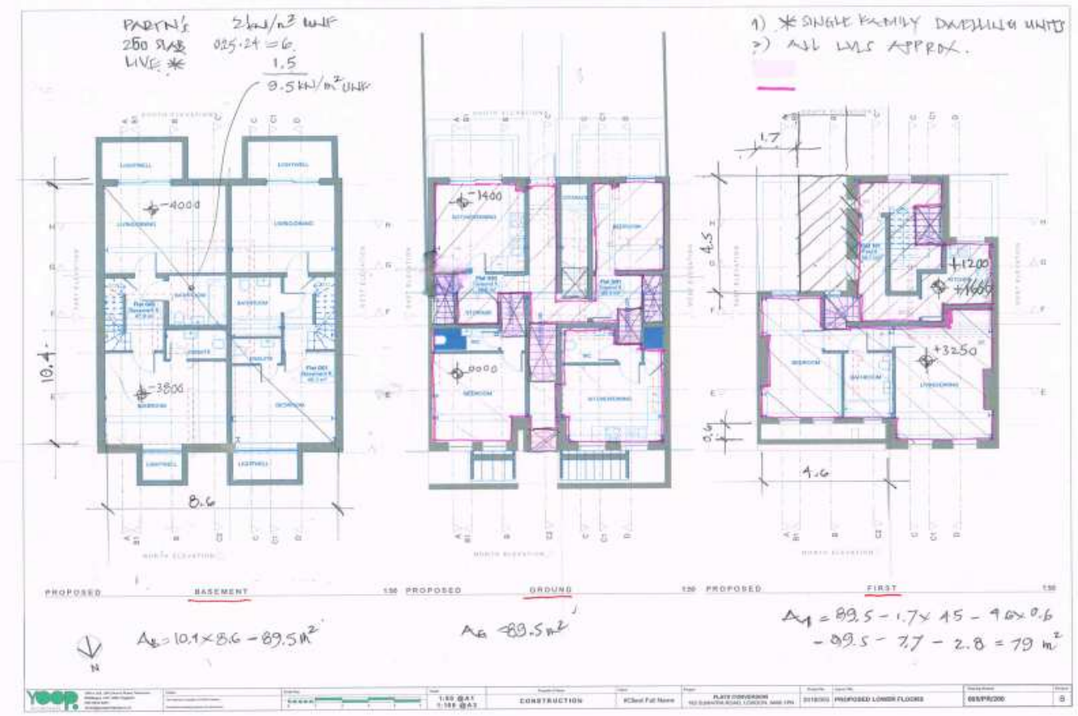
GBP for BASEMENT Ground Bearing Strip **115.17 kN/m2**

Load	1,900.36	kN (d+l, unf)
Length	11.00	m
	1.50	

GBP for underpinning to side walls **196.55 kN/m2, unf**

Existing Load	1,211.91	
Additional Load	950.18	
TOTAL	2,162.09	kN,unf
Area	11.00	
Length	11.00	
Width (concentric)	1.00	





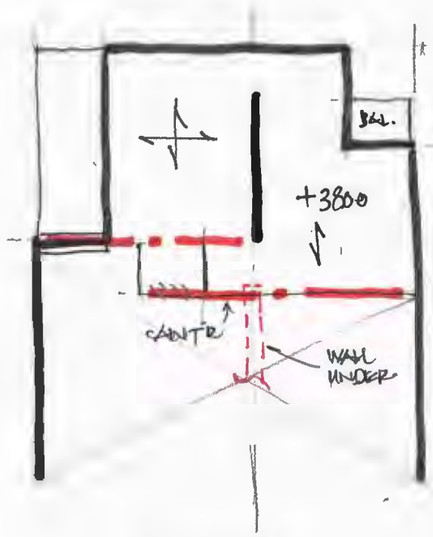
LOADING

Floor Loads	**kN/m2**
floor finishes and insul	0.55
50 screed	1.60
Comfloor	2.75
Partitions	2.00
DEAD	6.90
LIVE	1.50
d+l	**8.40**

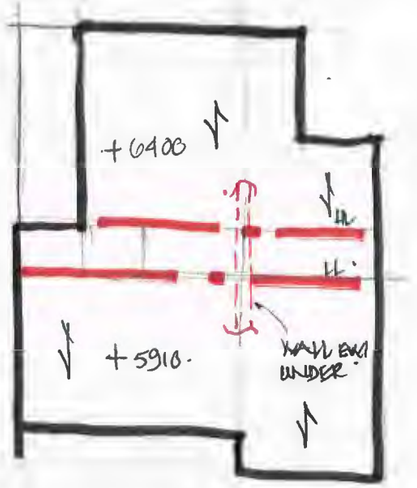
Roof Loads (pitched	**kN/m2**				
	on slope	on PLAN			
slates	0.35	0.46	SLOPE	41.00	degrees
battens and	0.05	0.07	**cos(slope)**	**0.75**	
raftes	0.11	0.15			
		0.68			
ceiling plaster, joists, ir		0.25			
DEAD		0.93			
LIVE		0.60			
d+l		**1.53**			

Basement

Screed 75	1.80
slab 200	4.80
Insulation and dpm	0.08
DEAD	6.68
LIVE	1.50
d+l	8.18



SECOND



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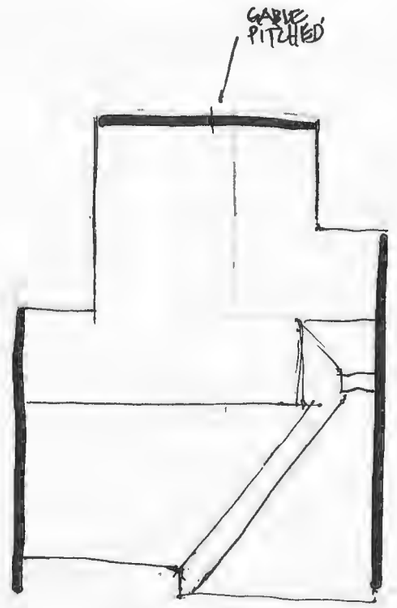
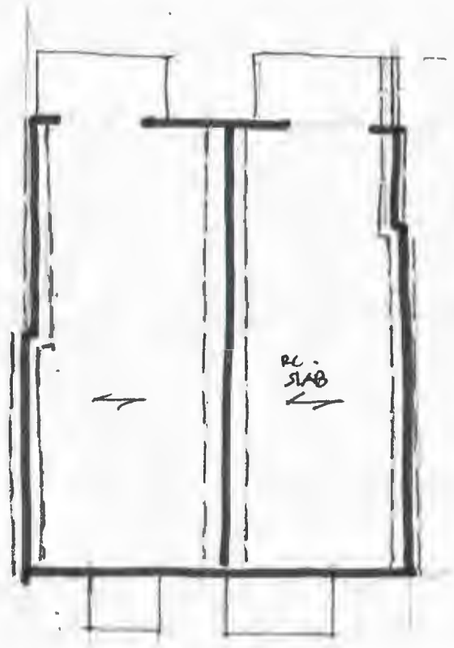
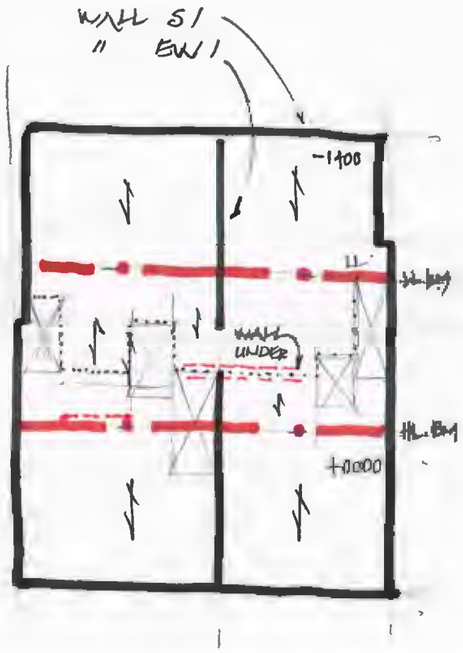


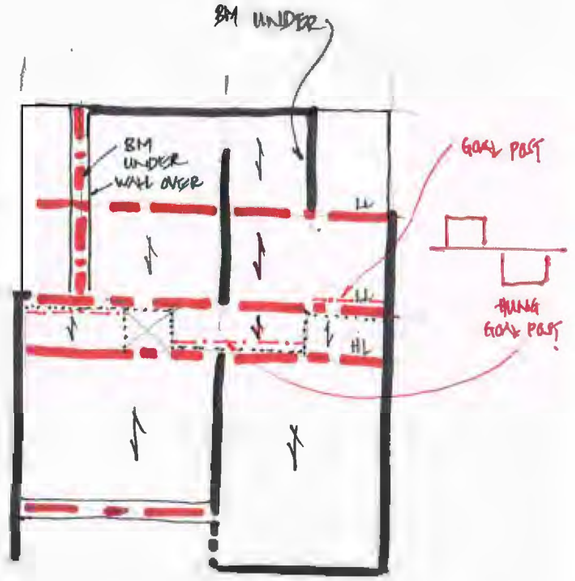
ROOF



BASEMENT



GROUND



FIRST

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PROPOSED SUPERSTRUCTURE

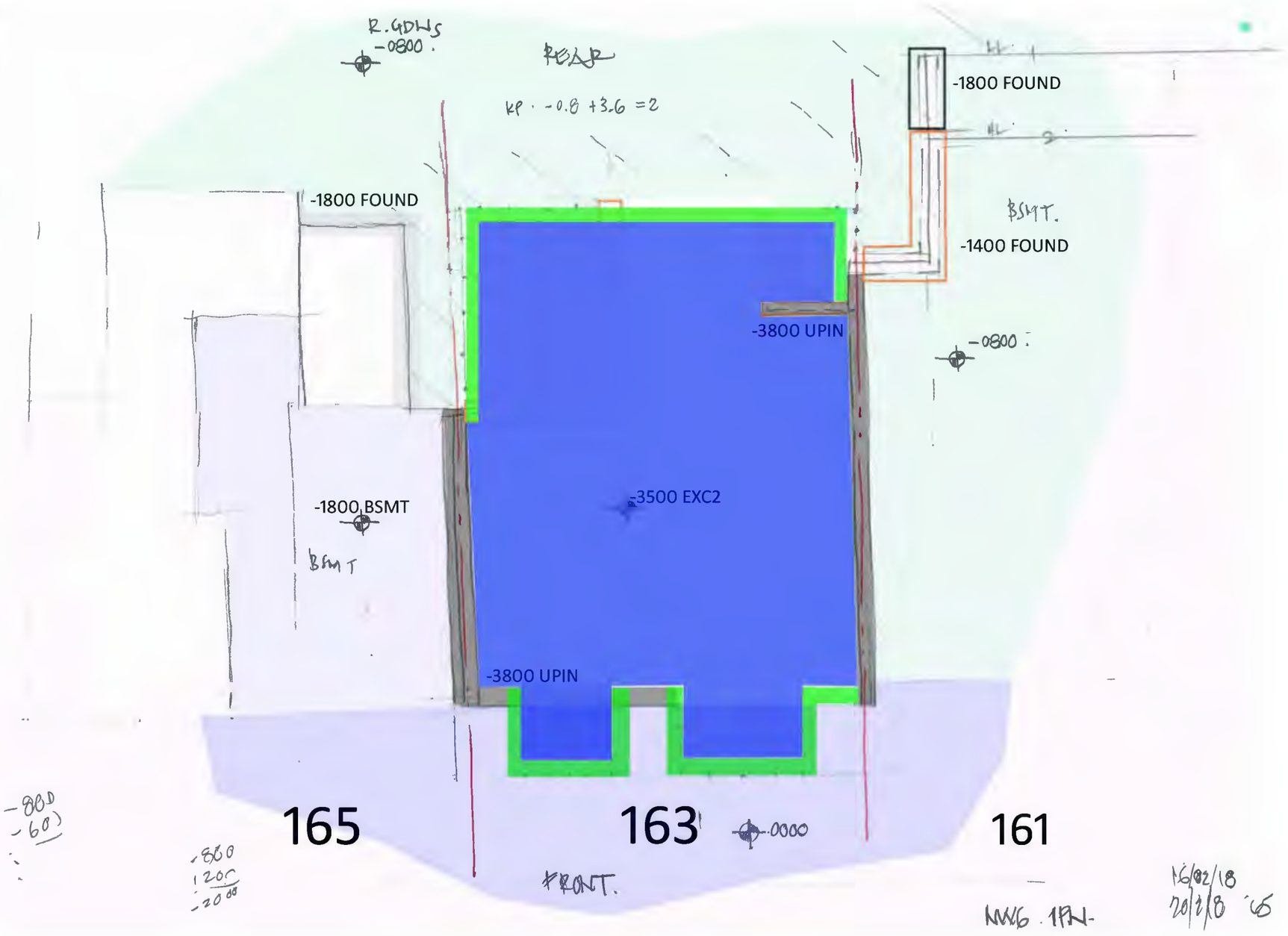
TEMPORARY WORKS FOR EARTH RETENTION

PRELIMINARY = ISSUED FOR INFORMATION ONLY AND NOT FOR DESIGN OR CONSTRUCTION

TEMPORARY WORKS FOR THE CONSTRUCTION OF THE NEW GREEN RETAINING WALLS TO BE EITHER:

A) BANKING
B) KINGPOST RW

UNDERSIDE OF NEW GREEN RETAINING WALLS TO BE -3800.



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PLAN OF EXC2 TEMPORARY EARTH RETAINING WORKS

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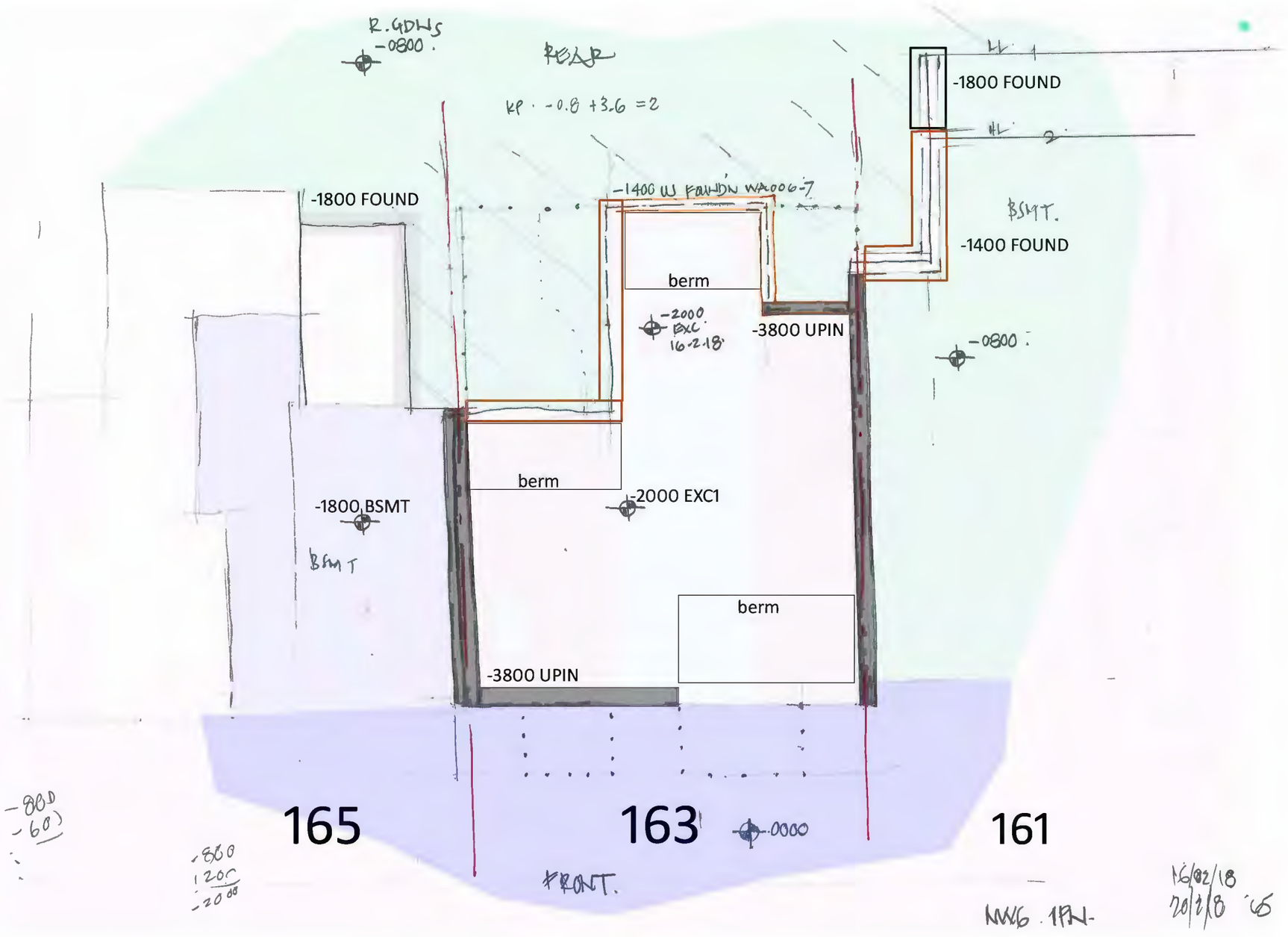

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PLAN OF EXISTING TEMPORARY EARTH RETAINING WORKS

PROGRAM OF BASEMENT EXCAVATION WORKS

Program of Works
Basement Construction

Operation	**Week:**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Commencement																		
Site preparation																		
Mobilisation																		
King Post Walls/Banking																		
Excavation																		

DVT QUERY & ANSWER

Item	Originator	Document	Query	Response
1	DVT 4/7/19		Drawings of the proposed development showing details of structures in elevation, basement and foundations	This information has been provided.
2	DVT 4/7/19		Architectural description of the proposed building	The building is to be converted into a number of flats.
3	DVT 4/7/19		Loads acting at formation level in kN/m2	This information has been provided in the current package.
4	DVT 4/7/19		Loads acting at ground level in kN/m2 in the surroundings of the excavation	This information has been provided in the current package.
5	DVT 4/7/19	email	Second moment of inertia of the retaining structures/underpinning	Second moment of area is 0.13 m^4 per m length. This is measured about the centroidal axis of the stem (horizontal axis in plane of wall/underpin)
6	DVT 4/7/19	email	Modulus of elasticity of the underpinning	Modulus of elasticity of underpinning concrete is between 19 and 31 kN/mm2.
7	DVT 4/7/19	email	Drawing of temporary works showing construction sequence and proposed propping strategy, including props number and application depths	This information has been provided in the current package.
8	DVT 4/7/19	email	Details of temporary props including cross section and modulus of elasticity	This information has been provided in the current package.
9	DVT 4/7/19	email	Plans of the neighbouring structures (if available) for the definition of the critical distances and the development of ground movement assessment and estimation of Burland's damage category	This information has been provided in the current package.
10	DVT 4/7/19	Audit Template	Plan showing boundary of development including any land required temporarily during construction.	Refer to Architectural Drawings
11	DVT 4/7/19	Audit Template	Plans, maps and or photographs to show location of basement relative to surrounding structures.	Refer to Architectural Drawings
12	DVT 4/7/19	Audit Template	Plans, maps and or photographs to show topography of surrounding area with any nearby watercourses/waterbodies including consideration of the relevant maps in the Strategic FRA by URS (2014)	I believe these are provided within the body of the BIA report.
13	DVT 4/7/19	Audit Template	Plans and sections to show foundation details of adjacent structures.	This information has been provided in the current package.
14	DVT 4/7/19	Audit Template	Plans and sections to show layout and dimensions of proposed basement.	Refer to Architectural Drawings
15	DVT 4/7/19	Audit Template	Programme for enabling works, construction and restoration.	This information has been provided in the current package.

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