



CONTRACT DESIGN

Project: Blue Hills Farm, Off Whitehall Rd West, Birkenshaw

Location: Off Whitehall Rd West, Birkenshaw, BD11 2DU

Client: Vistry Partnerships

Ref. No.: T30295

Date: 07 December 2023

HEAD OFFICE

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BSI-CDP-00

DOCUMENT CONTROL SHEET

Project Ref	Revision	Design prepared by	Design Approved by
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Project Blue Hills Farm, Off Whitehall Rd West, Birkenshaw		Job Ref. T30295	
Document Title Contract Design Package		Sheet no./rev. 0	
Calc. by BSI	Date 07 December 2023	Chk'd by BSI	App'd by BSI

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600mm Diameter CFA Retaining Wall Pile Design Calculations

1. Design Brief

M&D Foundations have been instructed to design and install bearing piles, contiguous wall piles for the above project. It is proposed that the foundation system will utilise 600 mm diameter Continuous Flight Auger (CFA) Piles.

The piles have been designed in accordance with British Standards BS 8004:2015+A1:2020 + NA.

2. Data Provided

Specification:- None provided
BS EN 1992-1-1:2004 Eurocode 2: Design of Concrete Structures
BS 8004:2015 + A1:2020 Code of practice of Foundations
PD 6687-2:2008
BS EN 1536:2010
Ciria C760
AIP Revision P1, Status S2, Draft Copy, dated 17/11/2023

Drawings: - 09.21011-ACE-00-ZZ-DR-C-3201 P9
09.21011-ACE-ZZ-XX-DR-S-7021 P2
09.21011-ACE-ZZ-XX-DR-S-7022 P2

Ground Investigation Report: - Ground Investigation Report – 2230244 March 2021
Liquid and Plastic Limit Testing – Land at Blue Hills Farm, Birkenshaw,
BD11 2DU. Ref: 2281661/1) dated 05/10/2023

3. Geotechnical Soil Profile Adopted

Design Parameters adopted.

Level (m AOD)	Description	Bulk Density	Saturated Density	E (kN/m ²)	Phi degrees	Wall friction	Ka Kp
169.75	Fill	18	20	16000	25	0.5	0.36 3.22
164.62	Clay	20	20	15000	27	0.5	0.33 3.6
162.12	Mudstone	23	23	18667	28	0.5	0.32 3.81

The Ground water has been taken as being below the toe of the pile.



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4. Contiguous Pile Design Calculations

The geotechnical design of the retaining wall has been carried out in accordance with BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 1: General Rules and with respect to the UK National Annex to this document. The structural design has been carried out in accordance with BS EN 1992-1-1:2004 and the UK National Annex. The recommendations of CIRIA C760 are also taken into account.

The CADS software package has been used to calculate the required minimum toe level and loads for design of the Contiguous piled wall. Calculations for Design Approach 1 have been completed as allowed in the UK National Annex. Combination 1 and 2 ultimate limit state (ULS) analyses have been carried out in accordance with BS 80021:2015 to assess the stability and loads on the wall. The relevant EC7 Combinations and Factors are included in Appendix B.

A serviceability limit state (SLS) analysis has also been carried out to assess likely wall deflections. This analysis has also been carried out using CADS software.

The calculation is presented for 600mm diameter CFA piles for a maximum safe working load surcharge of 10kN/m² and as per the additional loads specified in the AIP document calculated using the CADS Pile Wall software and is found onto suitable founding stratum.

The calculation is presented for a 600 mm diameter @ 750 mm c/c CFA contiguous pile wall calculated using CADS Pile Wall Suite software.

5. Structural Design

A Pile diameter of 600 mm pile with the reinforcement shown in the table below is sufficient to cater for the shear loads provided.

Pile Summary table:

Retaining Wall	Retained Height (m)	Pile Diameter/ Spacing (mm)	Pile Length (m)	Reinforcement Cage Detail
No.1	4.2	600 @ 750c/c	11.5	8B32 with B10 Helical at 150mm c/c
No.2	3.65	600 @ 750c/c	10	8B25 with B10 Helical at 150mm c/c

Please note that we have not assessed the required projection/anchorage length of reinforcement into the pile caps, any such connection detail should be provided by others. They should also check that sufficient length is available in the difference between PPL and COL. The maximum working stress for both the 8B25 and 8B32 cage is 434.8N/mm². for further information, please refer to the calculations to facilitate the assessment of anchorage length.



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Concrete to be 35 N/mm² strength to Class DC-2 of BRE Special Digest 1. This satisfies the direct stress and durability requirements and we would require confirmation of the acceptability of the above concrete class. Please note that we have not assessed the required projection/anchorage length of reinforcement into the capping beam, any such connection detail should be provided by others. They should also check that sufficient length is available in the difference between PPL and COL. At present,

It is recommended to use a reinforced capping beam, as it provides a mechanism for the distribution of bending moments, shear forces and vertical load (if applicable) onto several wall piles.

6. Construction Sequence

The construction sequence below should be adhered too:

1. Install piles from PPL level
2. Minimal dig of 0.50m and capping beam installation
3. Dig to formation level of 3.65m, 4.2m BGL

7. Action required by client for realisation of design

- Acceptance of this design and any qualification therein at least one week prior to site commencement.
- Any instruction issued to commence works on site verbally or otherwise prior to the receipt of any formal acceptance of this design and qualification therein will be deemed to be confirmation of "acceptance of this design and any qualifications therein, in its entirety."
- The Mudstone level is assumed to be at 162.12m BGL, the pile length is to be confirmed on site.
- Piling platform level assumed within the pile schedule has been confirmed by Client
- A surcharge of 10kPa has been assumed in design, the client should confirm this is sufficient.
- The maximum retained height including overall dig is 3.00m, 3.65m and 4.2m BGL. The client should ensure the assumed formation level is not exceeded; any variations should be notified to the designer immediately.
- Blinding (or other technique) should be placed upon excavation of the wall to ensure passive softening of the wall does not occur.
- The maximum retained height assumed should not be exceeded, any variations should be notified to the designer immediately.
- Appropriate drainage measures are assumed to be installed in the wall, so that the water level does not exceed the formation level during its lifetime.
- The wall should be monitored to ensure that the actual deflections do not exceed 50% of the theoretical values quoted within this design. If the deflections differ, the designer should be notified immediately.
- Fines migration of soil through the wall is the responsibility of the client.

BS 8004 : 2015 Geotechnical Design Factors

Design Approach for UK Design

<p>2.4.7.3.4.2 Design Approach 1</p> <p>Combination 1: A1 "+" M1 "+" R1</p> <p>Combination 2: A2 "+" M2 "+" R1</p>	<p>Where:</p> <p>A = Action Factors</p> <p>M = Material Factors</p> <p>R = Resistance Factors</p>
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Action Factors

Table A 2 – Table A.3 of Eurocode 7: Partial factors on actions or the effects of actions

Action	Symbol	Set	
		A1	A2
Permanent unfavourable	γ_G	1.35	1
Permanent favourable	γ_G	1	1
Variable unfavourable	γ_Q	1.5	1.3
Variable favourable	γ_Q	0	0

Material Factors

Table A.NA.4 Partial factors for soil parameters (γ_M) for the STR and GEO limit state

Soil parameter	Symbol	Set	
		M1	M2
Angle of shearing resistance ^{A)}	γ_ϕ	1.0	1.25
Effective cohesion	γ_c	1.0	1.25
Undrained shear strength	γ_{cu}	1.0	1.4
Unconfined strength	γ_{qu}	1.0	1.4

^{A)} Applied to $\tan \phi'$ and $\tan \phi'_{cv}$, although it might be more appropriate to determine the design value of ϕ'_{cv} directly.

NOTE The value of the partial factor should be taken as the reciprocal of the specified value if such a reciprocal value produces a more onerous effect than the specified value (but see also the Note to 2.4.2(9)P in BS EN 1997-1:2004).

Resistance Factors

Resistance factors 'R' are taken to be 1.0 in retaining wall design

600mm diameter Piles at 750mm c/c	Page No 1 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ...5m Wall_cBSI_00.pws"
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 3.65m	Engineer AM Date 27/11/2023

Pile geometry

Pile top Level 169.75 m
Pile Length 10 m
Pile toe level 159.75 m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level 0

Top Level m	Description	Bulk Dens kN/m ³	Sat' Dens kN/m ³	Young Mod kN/m ²	Young Inc. kN/m ³	Cu C' kN/m ²	C Inc. kN/m ³	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
169.75	Fill	18.00	20.00	16000	0			25	.50	.36	
								25	.50	3.22	
164.62	CLAY	20.00	20.00	15000	0			27	.50	.33	
								27	.50	3.60	
162.12	Mudstone	23.00	23.00	18667	0			28	.50	.32	
								28	.50	3.81	

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1	Active surcharge	169.75	10.0	.0		
2 A	Passive side excavation	166.10				
3 A	Moment load					

Code of practice

Code of practice or reference document	Custom parameters (user selection)
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

600mm diameter Piles at 750mm c/c	Page No 2 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ...5m Wall_cBSI_00.pws"
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 3.65m	Engineer AM Date 27/11/2023

Wall analysis detail options

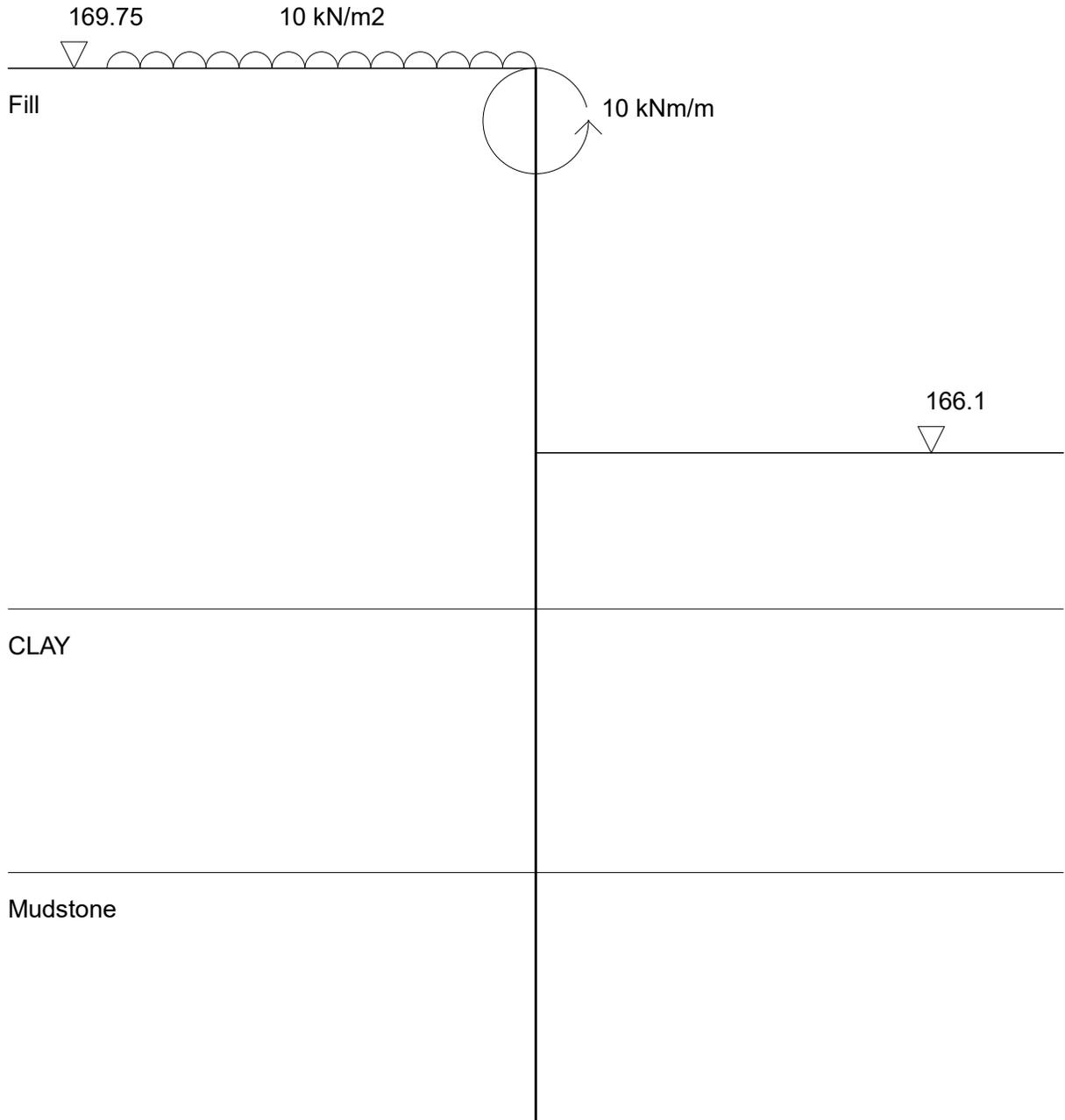
Nominal Phi for load distribution	30.0 Degrees
Depth of water filled tension cracks	.0 m
Density of water	10.0 kN/m ³
Minimum equivalent fluid density	5.0 kN/m ³
Depth of passive softened soil	1.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	848230 cm ⁴ /m
Wall Youngs modulus	27000000 kN/m ²

600mm diameter Piles at 750mm c/c	Page No 3 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ...5m Wall_cBSI_00.pws"
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 3.65m	Engineer AM Date 27/11/2023

Stage ref. 3
Stage type Moment load

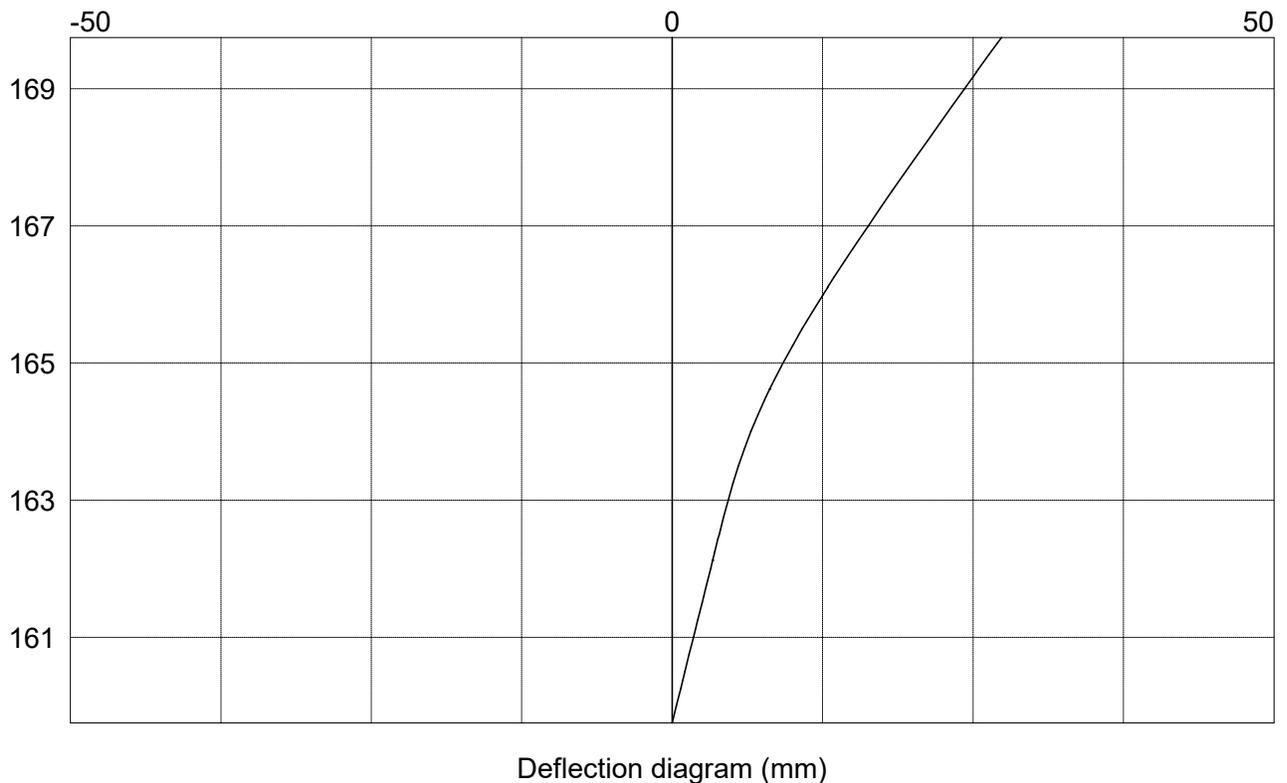
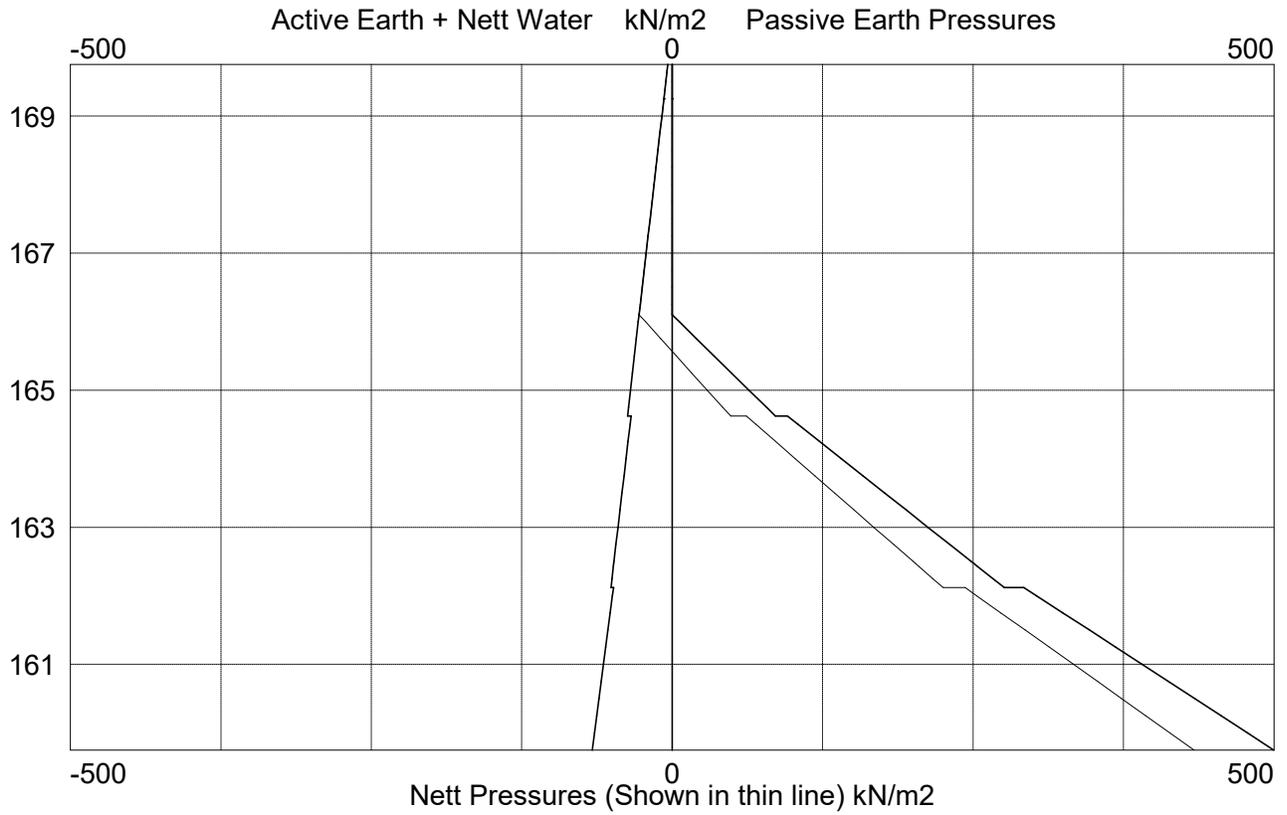


600mm diameter Piles at 750mm c/c	Page No 4 Analysis
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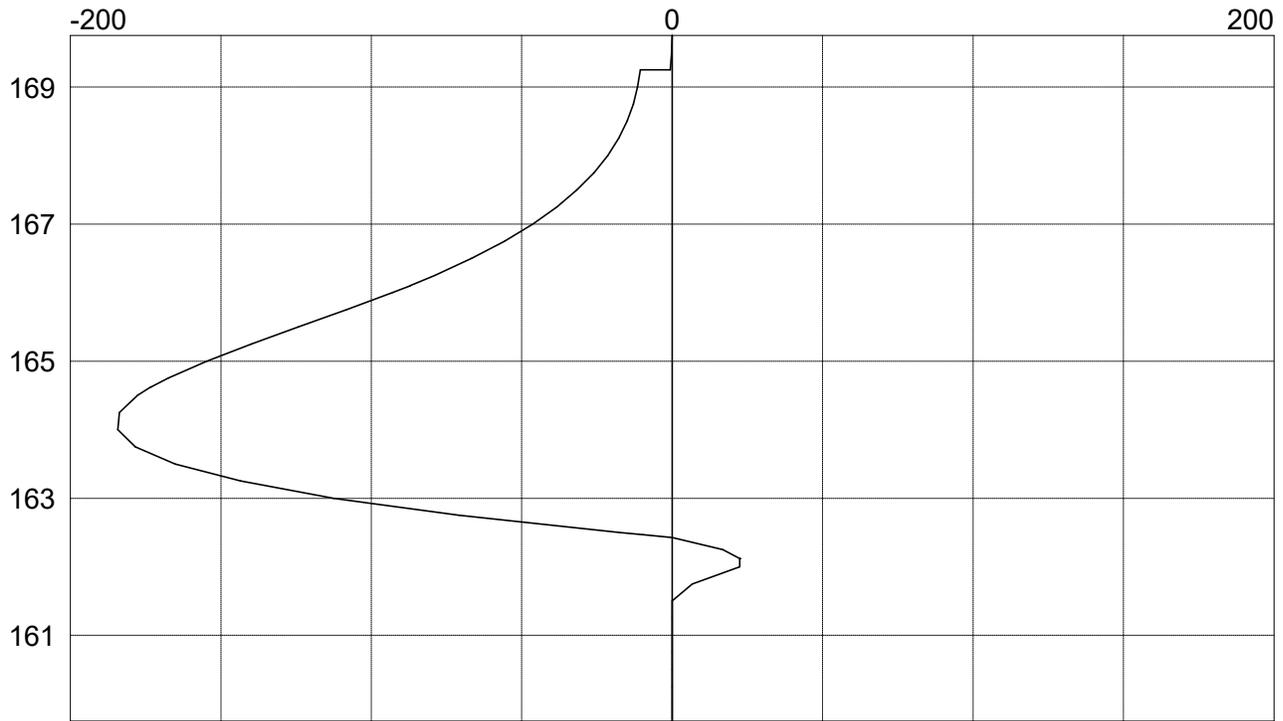
Tabular results from analysis of stage ref 3

Calc Level m	Active Vert kN/m ²	Active Earth kN/m ²	Active Water kN/m ²	Pas' Vert kN/m ²	Pas' Earth kN/m ²	Pas' Water kN/m ²	Total Nett kN/m ²	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
169.75	10.0	3.6	.0	.0	.0	.0	3.6	0	0	27.4		.00
169.25	19.0	6.9	.0	.0	.0	.0	6.9	.6	-2.6	25.3		.00
169.25	19.0	6.9	.0	.0	.0	.0	6.9	10.6	-2.6	25.3		.00
169.00	23.5	8.5	.0	.0	.0	.0	8.5	11.5	-4.6	24.3		.00
168.00	41.5	15.0	.0	.0	.0	.0	15.0	21.4	-16.3	20.2		.00
167.00	59.5	21.6	.0	.0	.0	.0	21.6	46.3	-34.7	16.3		.00
166.10	75.7	27.4	.0	.0	.0	.0	27.4	86.9	-56.7	12.9		.00
166.10	75.7	27.5	.0	.0	.0	.0	27.5	87.1	-56.7	12.9		.00
166.00	77.5	28.1	.0	1.8	5.8	.0	22.3	92.9	-59.2	12.5		.00
165.00	95.5	34.6	.0	19.8	63.8	.0	-29.2	154.6	-55.8	9.2		.05
164.62	102.3	37.1	.0	26.6	85.8	.0	-48.7	173.3	-41.0	8.1		.10
164.62	102.3	34.2	.0	26.6	95.9	.0	-61.8	173.3	-41.0	8.1		.10
164.00	114.7	38.3	.0	39.0	140.6	.0	-102.3	184.2	9.9	6.5		.22
163.00	134.7	45.0	.0	59.0	212.6	.0	-167.6	112.3	144.8	4.6		.51
162.47	145.4	48.5	.0	69.7	251.0	.0	-202.4	9.7	243.4	3.9		.70
162.43	146.2	48.8	.0	70.5	253.8	.0	-205.0	0	251.5	3.8		.72
162.12	152.3	50.9	.0	76.6	276.0	.0	-225.1	-22.5	146.4	3.4		.83
162.12	152.3	48.8	.0	76.6	292.2	.0	-243.4	-22.5	146.4	3.4		.83
162.00	155.1	49.7	.0	79.4	302.7	.0	-253.0	-22.5	105.3	3.2		.88
161.00	178.1	57.0	.0	102.4	390.4	.0	-333.3	0	0	1.8		1.28
160.00	201.1	64.4	.0	125.4	478.1	.0	-413.7	0	0	.4		1.71
159.75	206.9	66.2	.0	131.2	500.0	.0	-433.7	0	0	0		1.82

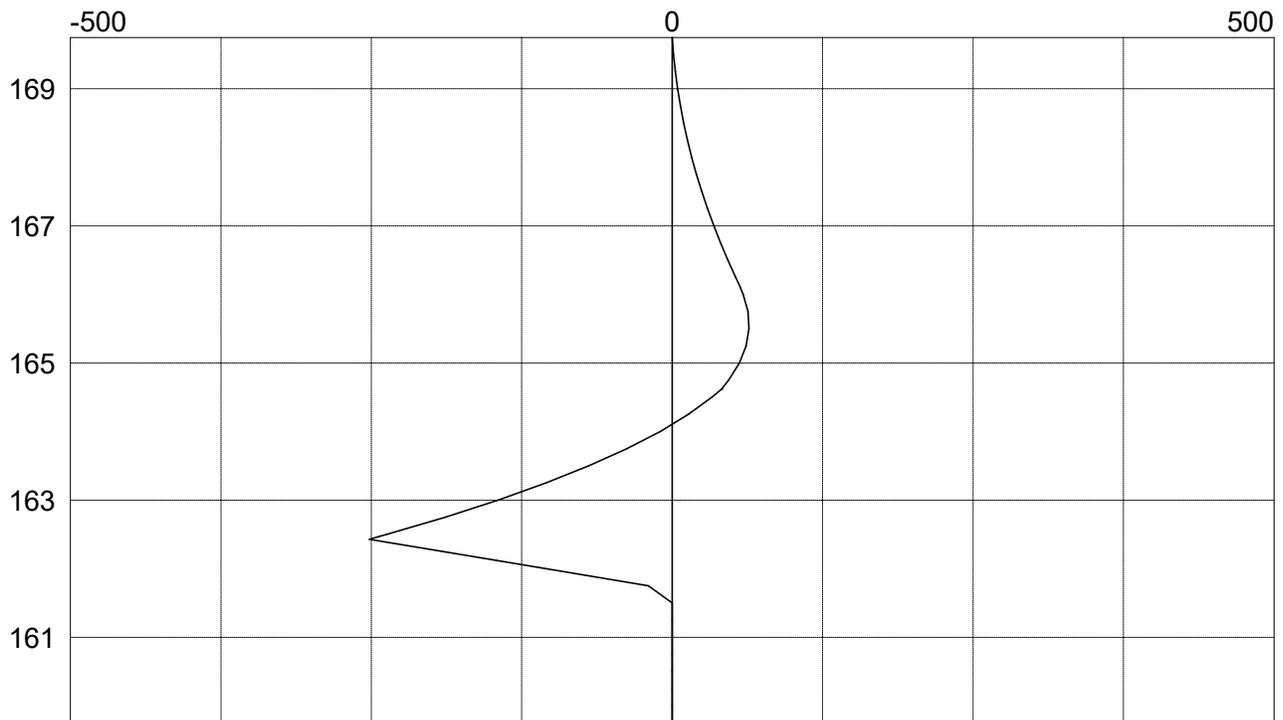
Graphical results from analysis of stage ref 3



Graphical results from analysis of stage ref 3 continued



Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

600mm diameter Piles at 750mm c/c

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Analysis

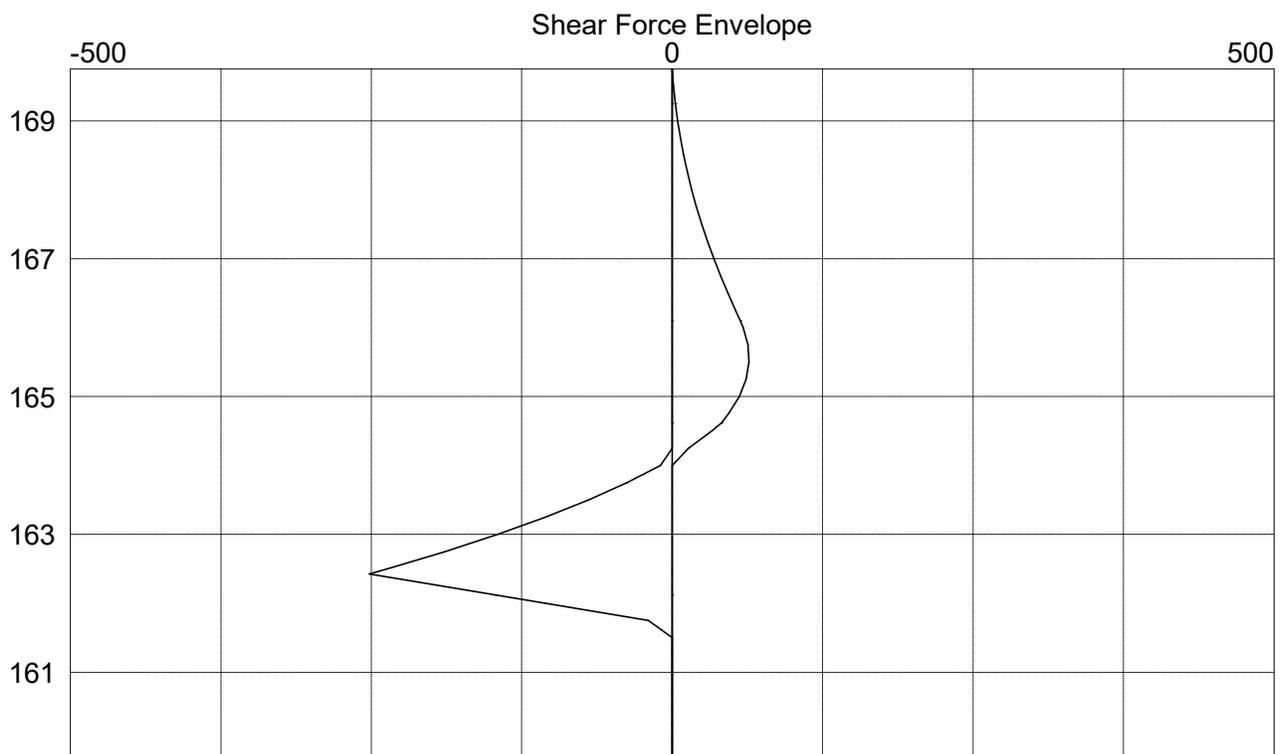
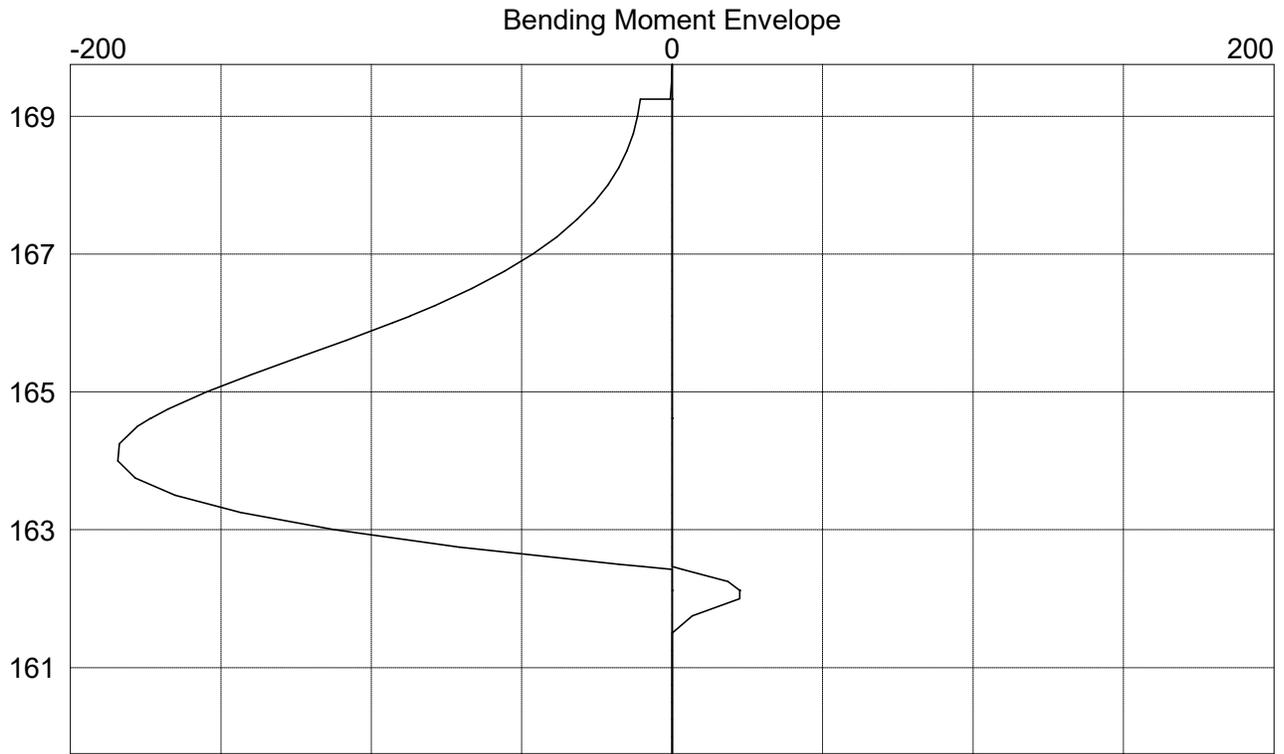
CADS Piled Wall Suite Version 6.07
Design of embedded retaining walls and cofferdams

Project T30295
File Name ...5m Wall_cBSI_00.pws"

Blue Hills Farm, Off Whitehall Rd West, Birkenshaw
Retained Height = 3.65m

Engineer AM
Date 27/11/2023

Graphical plot of envelope from selected construction stages



600mm diameter Piles at 750mm c/c	Page No 8 Analysis
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Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 3.65m	Engineer AM Date 27/11/2023

Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
169.75	.0	.0	.0	.0	
169.25	.0	.6	-2.6	.0	
169.25	.0	10.6	-2.6	.0	
169.00	.0	11.5	-4.6	.0	
168.00	.0	21.4	-16.3	.0	
167.00	.0	46.3	-34.7	.0	
166.10	.0	86.9	-56.7	.0	
166.10	.0	87.1	-56.7	.0	
166.00	.0	92.9	-59.2	.0	
165.00	.0	154.6	-55.8	.0	
164.62	.0	173.3	-41.0	.0	
164.62	.0	173.3	-41.0	.0	
164.00	.0	184.2	.0	9.9	
163.00	.0	112.3	.0	144.8	
162.47	.0	9.7	.0	243.4	
162.43	-3.4	.0	.0	251.5	
162.12	-22.5	.0	.0	146.4	
162.12	-22.5	.0	.0	146.4	
162.00	-22.5	.0	.0	105.3	
161.00	.0	.0	.0	.0	
160.00	.0	.0	.0	.0	
159.75	.0	.0	.0	.0	

600mm diameter Piles at 750mm c/c	Page No 9 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ...5m Wall_cBSI_00.pws"
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 3.65m	Engineer AM Date 27/11/2023

Structural design of wall

Wall section properties

Primary pile diameter	600 mm
Primary pile spacing	750 mm
Infill pile diameter	mm
Main rebar bar diameter	25 mm
Main rebar number of bars	8
Links/Helix bar diameter	10 mm
Links/Helix spacing/pitch	150 mm

Wall material properties

Concrete cube strength	35 N/mm ²
Concrete cover	75 mm
Main rebar steel grade	500 N/mm ²
Link rebar steel grade	500 N/mm ²
Ultimate load factor	1.40

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance, EC2 plane strain model	193	309	kNm
Max main steel, EC2 9.5.2(3), 4%	11310	3927	mm ²
Min main steel, EC2 9.8.5(3)	1414	3927	mm ²
Shear resistance, EC2 variable angle truss model	264	408	kN
Max main steel spc, BS EN 1536+A1:2015	400	130	mm
Min main steel spc, BS EN 1536+A1:2015	100	130	mm
Min link diameter, EC2 9.5.3(1), 0.25x long. bar dia.	8	10	mm
Max link spc, EC2 9.5.3(2) + 9.2.2(6), 400mm/20xbar/0.35d	300	150	mm
Min link spc, BS EN 1536:2010+A1:2015	100	150	mm

600mm diameter Piles at 750mm c/c	Page No 1 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ... wall_am_cbsi_01.pws
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 4.2m	Engineer AM Date 27/11/2023

Pile geometry

Pile top Level 169.75 m
Pile Length 11.5 m
Pile toe level 158.25 m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level 0

Top Level m	Description	Bulk Dens kN/m ³	Sat' Dens kN/m ³	Young Mod kN/m ²	Young Inc. kN/m ³	Cu C' kN/m ²	C Inc. kN/m ³	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
169.75	Fill	18.00	20.00	16000	0			25	.50	.36	3.22
								25	.50		
164.62	CLAY	20.00	20.00	15000	0			27	.50	.33	3.60
								27	.50		
162.12	Mudstone	23.00	23.00	18667	0			28	.50	.32	3.81
								28	.50		

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1	Active surcharge	169.75	10.0	.0		
2 A	Passive side excavation	165.55				
3 A	Moment load					

Code of practice

Code of practice or reference document	Custom parameters (user selection)
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

600mm diameter Piles at 750mm c/c	Page No 2 Analysis
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Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 4.2m	Engineer AM Date 27/11/2023

Wall analysis detail options

Nominal Phi for load distribution	30.0 Degrees
Depth of water filled tension cracks	.0 m
Density of water	10.0 kN/m ³
Minimum equivalent fluid density	5.0 kN/m ³
Depth of passive softened soil	1.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	848230 cm ⁴ /m
Wall Youngs modulus	27000000 kN/m ²

600mm diameter Piles at 750mm c/c

Page No 3
Analysis

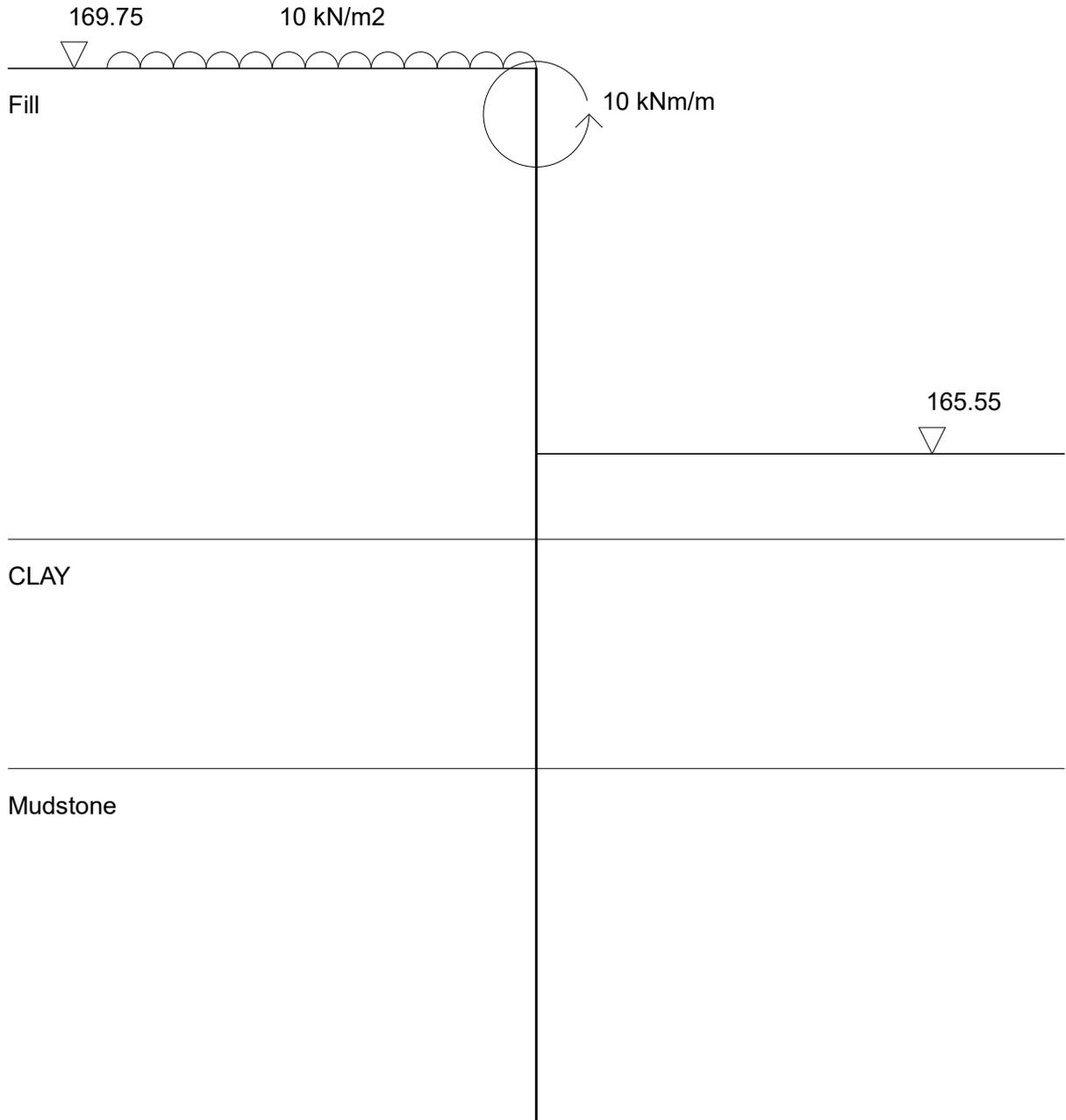
CADS Piled Wall Suite Version 6.07
Design of embedded retaining walls and cofferdams

Project T30295
File Name ... wall_am_cbsi_01.pws

Blue Hills Farm, Off Whitehall Rd West, Birkenshaw
Retained Height = 4.2m

Engineer AM
Date 27/11/2023

Stage ref. 3
Stage type Moment load

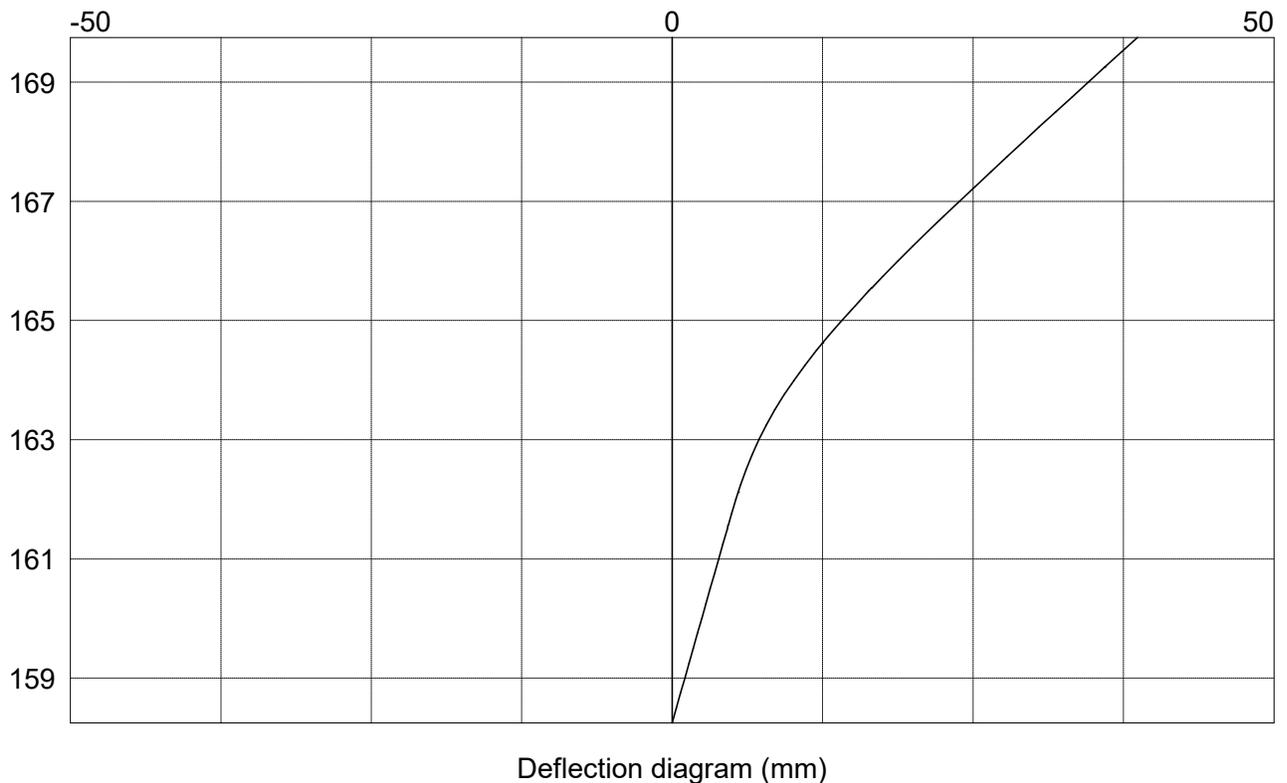
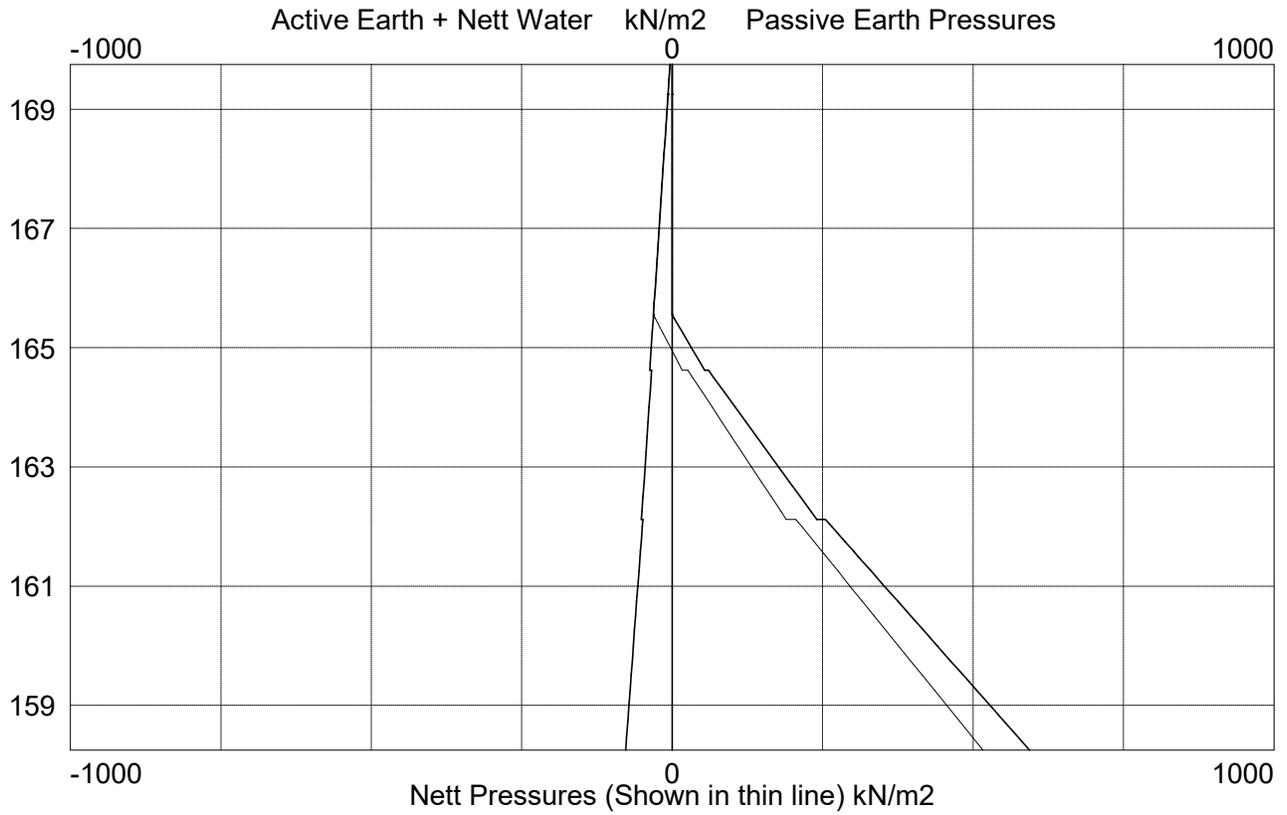


600mm diameter Piles at 750mm c/c	Page No 4 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ... wall_am_cbsi_01.pws
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 4.2m	Engineer AM Date 27/11/2023

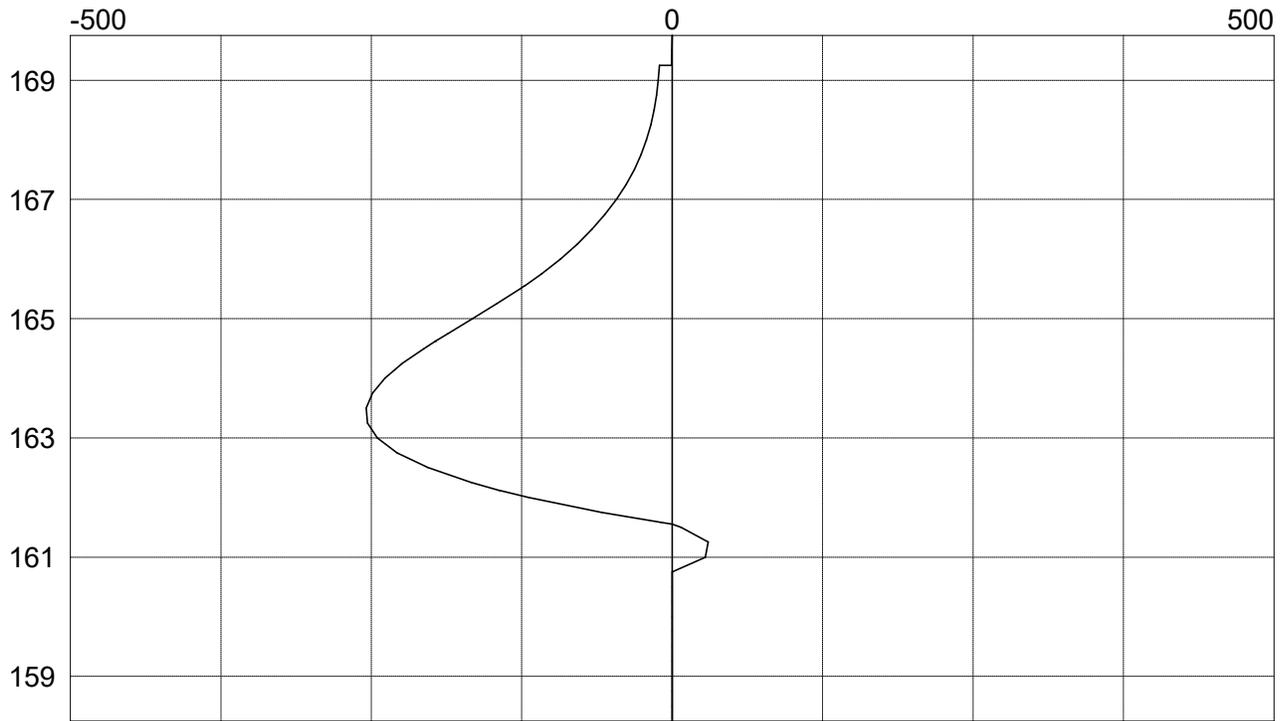
Tabular results from analysis of stage ref 3

Calc Level m	Active Vert kN/m ²	Active Earth kN/m ²	Active Water kN/m ²	Pas' Vert kN/m ²	Pas' Earth kN/m ²	Pas' Water kN/m ²	Total Nett kN/m ²	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
169.75	10.0	3.6	.0	.0	.0	.0	3.6	0	0	38.7		.00
169.25	19.0	6.9	.0	.0	.0	.0	6.9	.6	-2.6	35.9		.00
169.25	19.0	6.9	.0	.0	.0	.0	6.9	10.6	-2.6	35.9		.00
169.00	23.5	8.5	.0	.0	.0	.0	8.5	11.5	-4.6	34.6		.00
168.00	41.5	15.0	.0	.0	.0	.0	15.0	21.4	-16.3	29.2		.00
167.00	59.5	21.6	.0	.0	.0	.0	21.6	46.3	-34.7	23.9		.00
166.00	77.5	28.1	.0	.0	.0	.0	28.1	92.9	-59.5	18.8		.00
165.55	85.6	31.0	.0	.0	.0	.0	31.0	122.4	-72.7	16.6		.00
165.55	85.6	31.0	.0	.0	.0	.0	31.0	122.6	-72.8	16.6		.00
165.00	95.5	34.6	.0	9.9	31.9	.0	2.7	165.9	-82.1	14.1		.01
164.62	102.3	37.1	.0	16.7	53.9	.0	-16.8	196.8	-79.4	12.5		.02
164.62	102.3	34.2	.0	16.7	60.3	.0	-26.1	196.9	-79.4	12.5		.02
164.00	114.7	38.3	.0	29.1	104.9	.0	-66.6	238.4	-50.7	10.1		.09
163.00	134.7	45.0	.0	49.1	176.9	.0	-132.0	244.9	48.6	7.2		.28
162.12	152.3	50.9	.0	66.7	240.3	.0	-189.4	143.6	190.0	5.5		.53
162.12	152.3	48.8	.0	66.7	254.4	.0	-205.6	143.4	190.0	5.5		.53
162.00	155.1	49.7	.0	69.5	265.0	.0	-215.3	119.3	215.3	5.3		.57
161.58	164.7	52.7	.0	79.1	301.6	.0	-248.9	9.6	312.3	4.7		.71
161.55	165.4	53.0	.0	79.8	304.4	.0	-251.4	0	320.3	4.6		.72
161.00	178.1	57.0	.0	92.5	352.6	.0	-295.6	-27.5	100.1	3.9		.91
160.00	201.1	64.4	.0	115.5	440.3	.0	-375.9	0	0	2.5		1.29
159.00	224.1	71.8	.0	138.5	528.0	.0	-456.2	0	0	1.1		1.69
158.25	241.4	77.3	.0	155.8	593.8	.0	-516.5	0	0	0		1.99

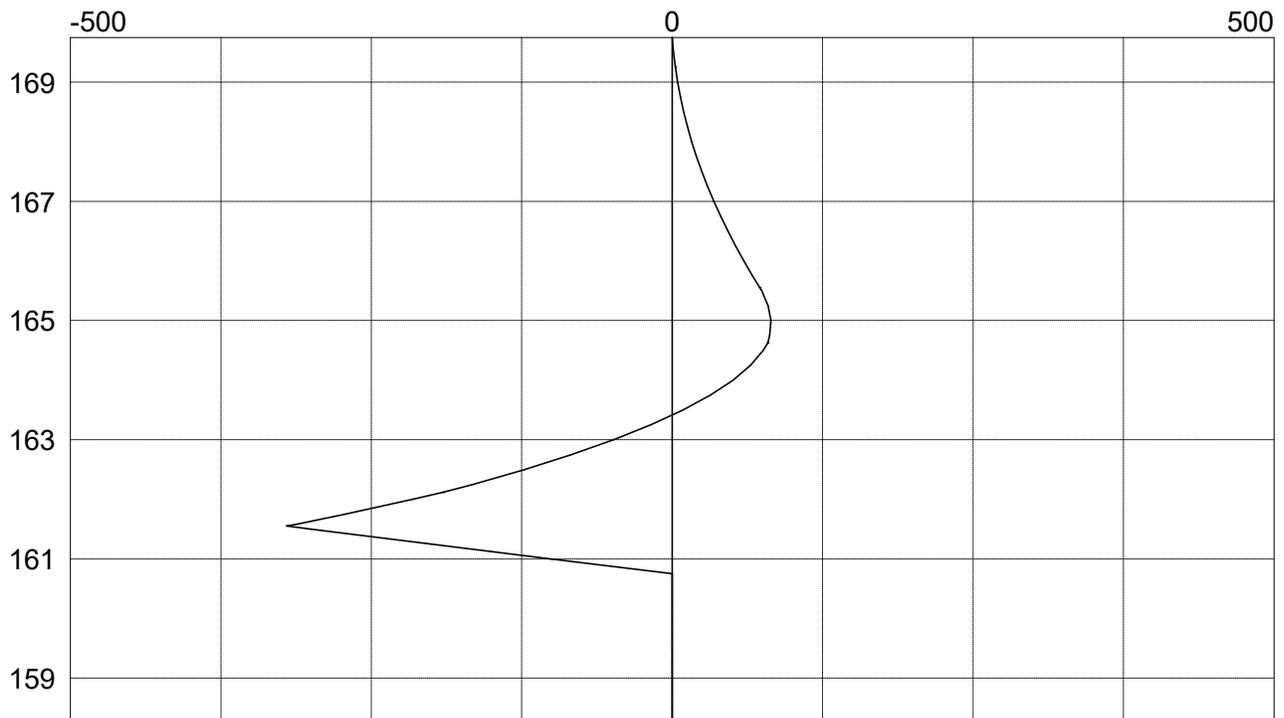
Graphical results from analysis of stage ref 3



Graphical results from analysis of stage ref 3 continued



Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

600mm diameter Piles at 750mm c/c

Page No 7
Analysis

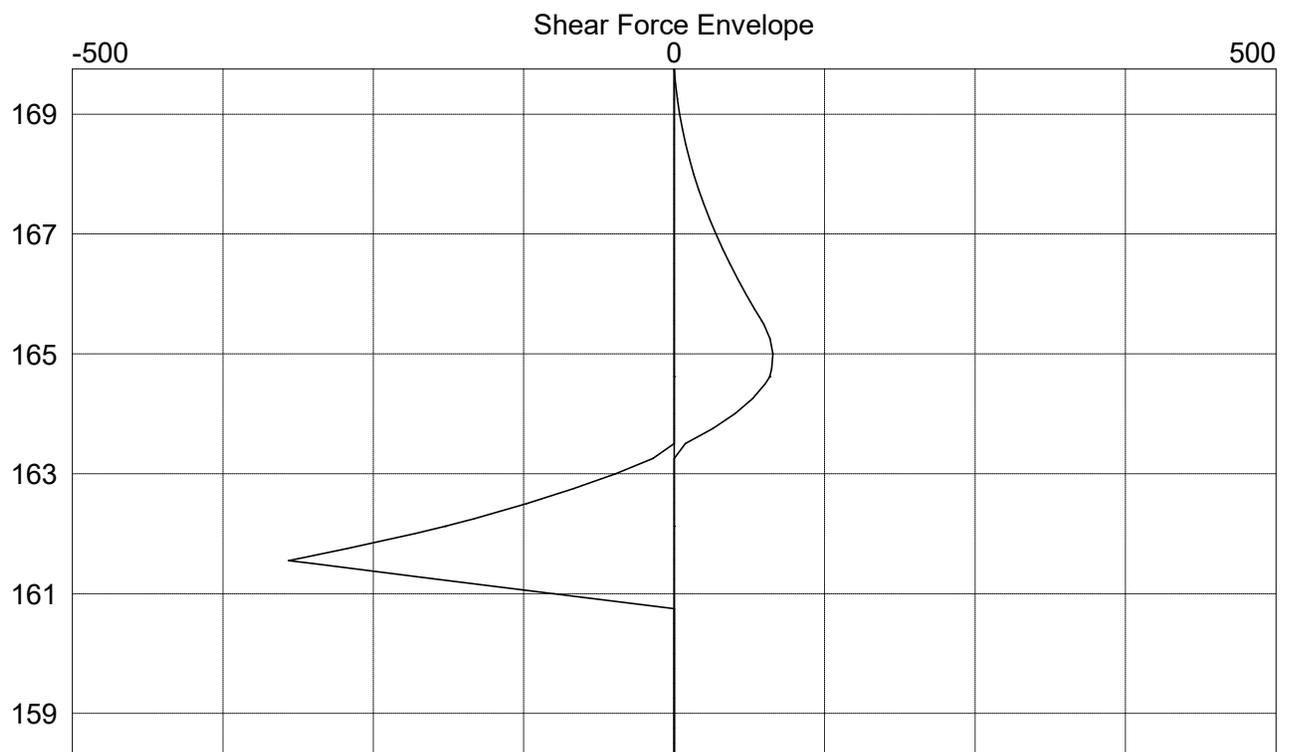
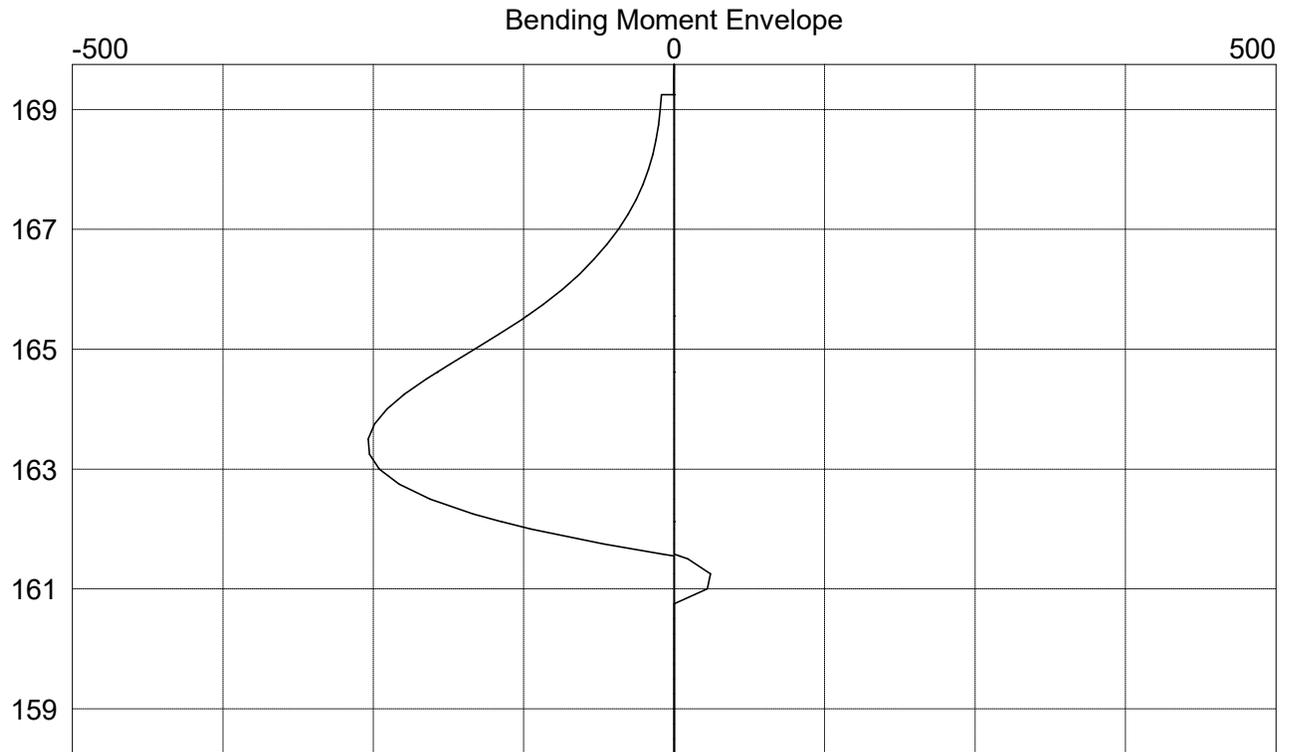
CADS Piled Wall Suite Version 6.07
Design of embedded retaining walls and cofferdams

Project T30295
File Name ... wall_am_cbsi_01.pws

Blue Hills Farm, Off Whitehall Rd West, Birkenshaw
Retained Height = 4.2m

Engineer AM
Date 27/11/2023

Graphical plot of envelope from selected construction stages



600mm diameter Piles at 750mm c/c	Page No 8 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ... wall_am_cbsi_01.pws
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 4.2m	Engineer AM Date 27/11/2023

Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
169.75	.0	.0	.0	.0	
169.25	.0	.6	-2.6	.0	
169.25	.0	10.6	-2.6	.0	
169.00	.0	11.5	-4.6	.0	
168.00	.0	21.4	-16.3	.0	
167.00	.0	46.3	-34.7	.0	
166.00	.0	92.9	-59.5	.0	
165.55	.0	122.4	-72.7	.0	
165.55	.0	122.6	-72.8	.0	
165.00	.0	165.9	-82.1	.0	
164.62	.0	196.8	-79.4	.0	
164.62	.0	196.9	-79.4	.0	
164.00	.0	238.4	-50.7	.0	
163.00	.0	244.9	.0	48.6	
162.12	.0	143.6	.0	190.0	
162.12	.0	143.4	.0	190.0	
162.00	.0	119.3	.0	215.3	
161.58	.0	9.6	.0	312.3	
161.55	-4.5	.0	.0	320.3	
161.00	-27.5	.0	.0	100.1	
160.00	.0	.0	.0	.0	
159.00	.0	.0	.0	.0	
158.25	.0	.0	.0	.0	

600mm diameter Piles at 750mm c/c	Page No 9 Analysis
CADS Piled Wall Suite Version 6.07 Design of embedded retaining walls and cofferdams	Project T30295 File Name ... wall_am_cbsi_01.pws
Blue Hills Farm, Off Whitehall Rd West, Birkenshaw Retained Height = 4.2m	Engineer AM Date 27/11/2023

Structural design of wall

Wall section properties

Primary pile diameter	600 mm
Primary pile spacing	750 mm
Infill pile diameter	mm
Main rebar bar diameter	32 mm
Main rebar number of bars	8
Links/Helix bar diameter	10 mm
Links/Helix spacing/pitch	150 mm

Wall material properties

Concrete cube strength	35 N/mm ²
Concrete cover	75 mm
Main rebar steel grade	500 N/mm ²
Link rebar steel grade	500 N/mm ²
Ultimate load factor	1.40

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance, EC2 plane strain model	267	440	kNm
Max main steel, EC2 9.5.2(3), 4%	11310	6434	mm ²
Min main steel, EC2 9.8.5(3)	1414	6434	mm ²
Shear resistance, EC2 variable angle truss model	336	484	kN
Max main steel spc, BS EN 1536+A1:2015	400	120	mm
Min main steel spc, BS EN 1536+A1:2015	100	120	mm
Min link diameter, EC2 9.5.3(1), 0.25x long. bar dia.	8	10	mm
Max link spc, EC2 9.5.3(2) + 9.2.2(6), 400mm/20xbar/0.25d	250	150	mm
Min link spc, BS EN 1536:2010+A1:2015	100	150	mm



Title & Specification

Job number T30019
 Job title
 Subtitle
 Calc. heading
 File X:\Job Files\M and DT30000 - T30999\T30295
 - Blue Hills Farm, Off Whitehall Rd West, Birkenshaw, BD11 2DU\08 - M&D Design Calculations\8.2 Contract Design\600 dia with 8 B25 cage.ads
 Notes (none)
 Code of Practice BS EN 1992-1-1:2004 (United Kingdom)
 Bending Axes Biaxial
 Number of sections 1
 Number of ULS cases 1
 Number of SLS cases 0

Section : Definition

1 : 600mm dia piles

Name 600mm dia piles
 Type Concrete
 Material C30/37
 Origin Centre
Dimensions
 Diameter 600.0mm
 Section Area 282700.mm²
 Reinforcement Area 3927.mm²
 Reinforcement 1.389%

Section : Nodes

1 : 600mm dia piles

Node	Y [mm]	Z [mm]
1	0.0	301.3
2	67.04	293.7
3	130.7	271.4
4	187.8	235.5
5	235.5	187.8
6	271.4	130.7
7	293.7	67.04
8	301.3	-13.17E-6
9	293.7	-67.04
10	271.4	-130.7
11	235.5	-187.8
12	187.8	-235.5
13	130.7	-271.4
14	67.04	-293.7
15	-26.34E-6	-301.3
16	-67.04	-293.7
17	-130.7	-271.4
18	-187.8	-235.5
19	-235.5	-187.8
20	-271.4	-130.7
21	-293.7	67.04
22	-301.3	3.593E-6
23	-293.7	67.04
24	-271.4	130.7
25	-235.5	187.8
26	-187.8	235.5
27	-130.7	271.4
28	-67.04	293.7

Section : Cover & Links

1 : 600mm dia piles

Cover 75.00mm
 Link Size 10.00mm
 Link Material 500B

Section : Bars

1 : 600mm dia piles

Bar	Y	Z	Diameter	Area	Effective Area	Type	Material	Prestress Force	Prestress Strain	Appl. loads include/exclude prestress
	[mm]	[mm]	[mm]	[mm ²]	[mm ²]			[kN]		
1	202.5	0.0	25.00	490.9	490.9	Steel	500B			
2	143.2	143.2	25.00	490.9	490.9	Steel	500B			
3	11.54E-6	202.5	25.00	490.9	490.9	Steel	500B			
4	-143.2	143.2	25.00	490.9	490.9	Steel	500B			
5	-202.5	23.09E-6	25.00	490.9	490.9	Steel	500B			
6	-143.2	-143.2	25.00	490.9	490.9	Steel	500B			
7	-9.436E-6	-202.5	25.00	490.9	490.9	Steel	500B			
8	143.2	-143.2	25.00	490.9	490.9	Steel	500B			

Section : Elastic Properties

1 : 600mm dia piles

Effective properties of the section, ignoring reinforcement.

Geometric Centroid y 0.0mm
 z 0.0mm
 Area 282700.mm²
 Second Moments of Area I_{yy} 6.362E+9mm⁴
 I_{zz} 6.362E+9mm⁴
 I_{yz} 0.0mm⁴
 Principal Second Moments of Area I_{uu} 6.362E+9mm⁴
 I_{zz} 6.362E+9mm⁴
 Angle 0.0°
 Shear Area Factor k_y 0.8571
 k_z 0.8571
 Torsion Constant 12.72E+9mm⁴
 Section Modulus Z_y 21.21E+6mm³
 Z_z 21.21E+6mm³

Bar	Y	Z	Diameter	Area	Effective Area	Type	Material	Prestress Force	Prestress Strain	Appl. loads include/exclude prestress
	[mm]	[mm]	[mm]	[mm ²]	[mm ²]			[kN]		
Plastic Modulus			Z_{py}		$36.00E+6mm^3$					
			Z_{pz}		$36.00E+6mm^3$					
Radius of Gyration			R_y		150.0mm					
			R_z		150.0mm					

Properties of gross section, including reinforcement.

Geometric Centroid	y	0.0mm
	z	769.1E-9mm
EA		9.941E+6kN
EI	EI_{yy}	222400.kNm ²
	EI_{zz}	222400.kNm ²
	EI_{yz}	0.0kNm ²
Principal EI	EI_{uu}	222400.kNm ²
	EI_{zz}	222400.kNm ²
	Angle	0.0°

Material : Concrete

1 : C30/37

Name	C30/37 (Standard)
Cylinder Strength	f_{ck} 30.00N/mm ²
Tensile Strength	f_{ctm} 2.896N/mm ²
Weight	Normal Weight
Density	ρ 2.400t/m ³
Elastic Modulus	E 32840.N/mm ²
Poisson's Ratio	ν 0.2000
Coeff. Thermal Expansion	α 10.00E-6/°C
Partial Safety Factor	γ_c 1.500
Safety Factor Maximum Strain	0.003500
Plateau Strain	0.002000
ULS Compression Curve	Parabola rectangle
ULS Tension Curve	No-tension
SLS Compression Curve	FIB Model Code
SLS Tension Curve	Interpolated
Design strength factor	α_{cc} 0.8500
Aggregate Size	20.00mm

Material : Rebar

1 : 500B

Type	Steel rebar
Strength	f_{yk} 500.0N/mm ²
Elastic Modulus	E 200000.N/mm ²
Hardening Modulus	E_h 0.0N/mm ²
Density	ρ 7.850t/m ³
Poisson's Ratio	ν 0.3000
Coeff. Thermal Expansion	α 12.00E-6/°C
Ductility	Normal
Partial Safety Factor	γ_s 1.150
	γ_{se} 1.000
Maximum Strain	ϵ_{uk} 0.05000
Maximum Strain	ϵ_{ud} 0.05000
Stress/Strain Curve	Elastic-plastic

Loading

Reference Point

All loading acts through the Reference Point.
All strain planes are defined relative to the Reference Point.

Definition	Geometric Centroid
Reference Point Coordinates	y 0.0mm
	z 0.0mm

Load Case Titles

Load Case	Title
1	L1

Applied loads

Load Case	N	M_{yy}	M_{zz}	Note
	[kN]	[kNm]	[kNm]	
1	0.0	185.0	0.0	

Section 1 Details

1.39% reinforcement in section 1 (600mm dia piles). Check this against code requirements.

ULS Cases Analysed

Load Case	N [kN]	M _{yy} [kNm]	M _{zz} [kNm]	Note
1	0.0	277.5	0.0	

Name	Section	Loading	Prestress Factor
ULS Case 1	1 : 600mm dia piles	1.5L1	1.000

Strength Analysis - Loads

Case	N	M _{yy}	M _{zz}	M	θ
	[kN]	[kNm]	[kNm]	[kNm]	[°]
1	0.0	277.5	0.0	277.5	0.0

Strength Analysis - Summary

Governing conditions are defined as:
 A - reinforcing steel tension strain limit
 B - concrete compression strain limit
 C - concrete pure compression strain limit
 Eurocode 2 Section 6.1
 Effective centroid is reported relative to the reference point.

Case	Eff. Centroid (y)	Eff. Centroid (z)	N [kN]	M [kNm]	M _u [kNm]	M/M _u	Governing Condition	Neutral Axis Angle [°]	Neutral Axis Depth [mm]
1	0.0	769.1E-9	0.0	277.5	326.7	0.8494	B: Node 1	0.0	175.2

Strength Analysis - Details

Case	Moment Angle [°]	Description	N [kN]	M [kNm]	Warning
1	19.20	Max. compressive strain		6311.17	17.91E-6
1	178.9	Max. tensile strain		-1707.24	0.01E-6
1	0.0	Axial strength at M	4743.0	277.3	
1		Initial yield	0.04303	240.6	
1		Balanced yield	1941.0	458.3	
1		Bending strength at N=0	0.0	326.7	

Strain Planes at ULS Strength

Related to Reference Point

Case	Strain Plane	ε _{ax} [-]	κ _{yy} [1/m]	κ _{zz} [1/m]
1	Reinforcement	-0.002517	0.01997	-75.82E-12
1	User Creep/Shrinkage	0.0	0.0	0.0
1	Total (Concrete)	-0.002517	0.01997	-75.82E-12

Section Material Stresses/Strains at ULS Strength

Case Point	Coordinates [mm]		Strain [-]	Stress [N/mm²]	Notes
	y	z			
1	1	0.0	301.3	0.003500	17.00
1	2	67.04	293.7	0.003349	17.00
1	3	130.7	271.4	0.002904	17.00
1	4	187.8	235.5	0.002187	17.00
1	5	235.5	187.8	0.001235	14.51
1	6	271.4	130.7	93.76E-6	1.557
1	7	293.7	67.04	-0.001178	0.0
1	8	301.3	-13.17E-6	-0.002517	0.0
1	9	293.7	-67.04	-0.003856	0.0
1	10	271.4	-130.7	-0.005127	0.0
1	11	235.5	-187.8	-0.006268	0.0
1	12	187.8	-235.5	-0.007938	0.0
1	13	130.7	-271.4	-0.007938	0.0
1	14	67.04	-293.7	-0.008383	0.0
1	15	-26.34E-6	-301.3	-0.008534	0.0
1	16	-67.04	-293.7	-0.008383	0.0
1	17	-130.7	-271.4	-0.007938	0.0
1	18	-187.8	-235.5	-0.007221	0.0
1	19	-235.5	-187.8	-0.006268	0.0
1	20	-271.4	-130.7	-0.005127	0.0
1	21	-293.7	-67.04	-0.003856	0.0
1	22	-301.3	3.593E-6	-0.002517	0.0
1	23	-293.7	67.04	-0.001178	0.0
1	24	-271.4	130.7	93.76E-6	1.557
1	25	-235.5	187.8	0.001235	14.51
1	26	-187.8	235.5	0.002187	17.00
1	27	-130.7	271.4	0.002904	17.00
1	28	-67.04	293.7	0.003349	17.00

Reinforcement Stresses/Strains at ULS Strength

Case Bar	Coordinates [mm]		Strain [-]	Stress [N/mm²]	Notes
	y	z			
1	1	202.5	0.0	-0.002517	-434.8 500B
1	2	143.2	143.2	342.9E-6	68.59 500B
1	3	11.54E-6	202.5	0.001527	305.5 500B
1	4	-143.2	143.2	342.9E-6	68.59 500B
1	5	-202.5	23.09E-6	-0.002517	-434.8 500B
1	6	-143.2	-143.2	-0.005377	-434.8 500B
1	7	-9.436E-6	-202.5	-0.006561	-434.8 500B
1	8	143.2	-143.2	-0.005377	-434.8 500B



Title & Specification

Job number T30295
 Job title Bluehills
 Subtitle 600dia contig piles
 Calc. heading Max Stress calculation
 File X:\Job Files\M and DT30000 - T30999\T30295
 - Blue Hills Farm, Off
 Whitehall Rd West,
 Birkenshaw, BD11 2DU\08
 - M&D Design
 Calculations\8.2
 Contract Design\600 dia
 with 8 B32 cage.ads
 Notes (none)
 Code of Practice BS EN 1992-1-1:2004
 [United Kingdom]
 Bending Axes Biaxial
 Number of sections 1
 Number of ULS cases 1
 Number of SLS cases 0

Section : Definition

1 : 600mm dia piles

Name 600mm dia piles
 Type Concrete
 Material C30/37
 Origin Centre
Dimensions
 Diameter 600.0mm
 Section Area 282700.mm²
 Reinforcement Area 6434.mm²
 Reinforcement 2.276%

Section : Nodes

1 : 600mm dia piles

Node	Y [mm]	Z [mm]
1	0.0	301.3
2	67.04	293.7
3	130.7	271.4
4	187.8	235.5
5	235.5	187.8
6	271.4	130.7
7	293.7	67.04
8	301.3	-13.17E-6
9	293.7	-67.04
10	271.4	-130.7
11	235.5	-187.8
12	187.8	-235.5
13	130.7	-271.4
14	67.04	-293.7
15	-26.94E-6	-301.3
16	-67.04	-293.7
17	-130.7	-271.4
18	-187.8	-235.5
19	-235.5	-187.8
20	-271.4	-130.7
21	-293.7	-67.04
22	-301.3	3.593E-6
23	-293.7	67.04
24	-271.4	130.7
25	-235.5	187.8
26	-187.8	235.5
27	-130.7	271.4
28	-67.04	293.7

Section : Cover & Links

1 : 600mm dia piles

Cover 75.00mm
 Link Size 10.00mm
 Link Material 500B

Section : Bars

1 : 600mm dia piles

Bar	Y	Z	Diameter	Area	Effective Area	Type	Material	Prestress Force	Prestress Strain	Appl. loads include/exclude prestress
	[mm]	[mm]	[mm]	[mm ²]	[mm ²]			[kN]		
1	199.0	0.0	32.00	804.2	804.2	Steel	500B			
2	140.7	140.7	32.00	804.2	804.2	Steel	500B			
3	12.97E-6	199.0	32.00	804.2	804.2	Steel	500B			
4	-140.7	140.7	32.00	804.2	804.2	Steel	500B			
5	-199.0	25.94E-6	32.00	804.2	804.2	Steel	500B			
6	-140.7	-140.7	32.00	804.2	804.2	Steel	500B			
7	-10.60E-6	-199.0	32.00	804.2	804.2	Steel	500B			
8	140.7	-140.7	32.00	804.2	804.2	Steel	500B			

Section : Elastic Properties

1 : 600mm dia piles

Effective properties of the section, ignoring reinforcement.

Geometric Centroid	y	0.0mm
	z	0.0mm
Area		282700.mm ²
Second Moments of Area	I _{yy}	6.362E+9mm ⁴
	I _{zz}	6.362E+9mm ⁴
	I _{yz}	0.0mm ⁴
Principal Second Moments of Area	I _{uu}	6.362E+9mm ⁴
	I _{zz}	6.362E+9mm ⁴
	Angle	0.0°
Shear Area Factor	k _y	0.8571
	k _z	0.8571
Torsion Constant		12.72E+9mm ⁴
Section Modulus	Z _y	21.21E+6mm ³
	Z _z	21.21E+6mm ³
Plastic Modulus	Z _{py}	36.00E+6mm ³
	Z _{pz}	36.00E+6mm ³
Radius of Gyration	R _y	150.0mm
	R _z	150.0mm

Properties of gross section, including reinforcement.

Bar	Y	Z	Diameter	Area	Effective Area	Type	Material	Prestress Force	Prestress Strain	Appl. loads include/exclude prestress
	[mm]	[mm]	[mm]	[mm ²]	[mm ²]			[kN]		
Geometric Centroid			y		-369.0E-9mm					
			z		1.107E-6mm					
EA					10.36E+6kN					
EI			EI _{yy}		230200.kNm ²					
			EI _{zz}		230200.kNm ²					
			EI _{yz}		-238.9E-6kNm ²					
Principal EI			EI _{uu}		230200.kNm ²					
			EI _{zz}		230200.kNm ²					
			Angle		-45.00°					

Material : Concrete

1 : C30/37

Name		C30/37 (Standard)
Cylinder Strength	f _{ck}	30.00N/mm ²
Tensile Strength	f _{ctm}	2.896N/mm ²
Weight		Normal Weight
Density	ρ	2.400t/m ³
Elastic Modulus	E	32840.N/mm ²
Poisson's Ratio	ν	0.2000
Coeff. Thermal Expansion	α	10.00E-6/°C
Partial Safety Factor	γ _c	1.500
Safety Factor		
Maximum Strain		0.003500
Plateau Strain		0.002000
ULS Compression Curve		Parabola rectangle
ULS Tension Curve		No-tension
SLS Compression Curve		FIB Model Code
SLS Tension Curve		Interpolated
Design strength factor	α _{cc}	0.8500
Aggregate Size		20.00mm

Material : Rebar

1 : 500B

Type		Steel rebar
Strength	f _{yk}	500.0N/mm ²
Elastic Modulus	E	200000.N/mm ²
Hardening Modulus	E _h	0.0N/mm ²
Density	ρ	7.850t/m ³
Poisson's Ratio	ν	0.3000
Coeff. Thermal Expansion	α	12.00E-6/°C
Ductility		Normal <i>Modified</i>
Partial Safety Factor	γ _s	1.150
	γ _{se}	1.000
Maximum Strain	ε _{yk}	0.05000 <i>Modified</i>
Maximum Strain	ε _{ud}	0.05000 <i>Modified</i>
Stress/Strain Curve		Elastic-plastic

Loading

Reference Point

All loading acts through the Reference Point.
All strain planes are defined relative to the Reference Point.

Definition		Geometric Centroid
Reference Point Coordinates	y	0.0mm
	z	0.0mm

Load Case Titles

Load Case	Title
1 L1	

Applied loads

Load Case	N	M _{yy}	M _{zz}	Note
	[kN]	[kNm]	[kNm]	
1	0.0	255.0	0.0	

Section 1 Details

2.28% reinforcement in section 1 (600mm dia piles). Check this against code requirements.

ULS Cases Analysed

Name	Section	Loading	Prestress Factor
ULS Case 1	1 : 600mm dia piles	1.5L1	1.000

Strength Analysis - Loads

Case	N	M _{yy}	M _{zz}	M	θ
	[kN]	[kNm]	[kNm]	[kNm]	[°]
1	0.0	382.5	0.0	382.5	0.0

Strength Analysis - Summary

Governing conditions are defined as:
A - reinforcing steel tension strain limit
B - concrete compression strain limit
C - concrete pure compression strain limit

Case N M_{yy} M_{zz} M 0
 [kN] [kNm] [kNm] [kNm] [°]

WU

Eurocode 2 Section 6.1

Effective centroid is reported relative to the reference point.

Case	Eff. Centroid (y)	Eff. Centroid (z)	N [kN]	M [kNm]	M _u [kNm]	M/M _u	Governing Condition	Neutral Axis Angle [°]	Neutral Axis Depth [mm]
1	-369.0E-9	1.107E-6	0.0	382.5	468.9	0.8157	B: Node 1	0.0	205.2

Strength Analysis - Details

Case Moment Angle [°]	Description	N [kN]	M [kNm]	Warning
10.07	Max. compressive strain	7271.	31.79E-6	
178.8	Max. tensile strain	-2797.	40.34E-6	
1	0.0 Axial strength at M	4929.	382.3	
	Initial yield	0.1457	363.2	
	Balanced yield	1925.	561.6	
	Bending strength at N=0	0.0	468.9	

Strain Planes at ULS Strength

Related to Reference Point

Case	Strain Plane	ϵ_{ax} [-]	K_{yy} [1/m]	K_{zz} [1/m]
1	Reinforcement	-0.001639	0.01706	508.2E-12
	User Creep/Shrinkage	0.0	0.0	0.0
	Total (Concrete)	-0.001639	0.01706	508.2E-12

Section Material Stresses/Strains at ULS Strength

Case Point	Coordinates y [mm]	Coordinates z [mm]	Strain [-]	Stress [N/mm ²]	Notes
1	1	0.0	301.3	0.003500	17.00
1	2	67.04	293.7	0.003371	17.00
1	3	130.7	271.4	0.002991	17.00
1	4	187.8	235.5	0.002379	17.00
1	5	235.5	187.8	0.001565	16.20
1	6	271.4	130.7	591.0E-6	8.562
1	7	293.7	67.04	-495.1E-6	0.0
1	8	301.3	-13.17E-6	-0.001639	0.0
1	9	293.7	-67.04	-0.002782	0.0
1	10	271.4	-130.7	-0.003868	0.0
1	11	235.5	-187.8	-0.004842	0.0
1	12	187.8	-235.5	-0.005656	0.0
1	13	130.7	-271.4	-0.006268	0.0
1	14	67.04	-293.7	-0.006648	0.0
1	15	-26.34E-6	-301.3	-0.006777	0.0
1	16	-67.04	-293.7	-0.006648	0.0
1	17	-130.7	-271.4	-0.006268	0.0
1	18	-187.8	-235.5	-0.005656	0.0
1	19	-235.5	-187.8	-0.004842	0.0
1	20	-271.4	-130.7	-0.003868	0.0
1	21	-293.7	-67.04	-0.002782	0.0
1	22	-301.3	3.593E-6	-0.001639	0.0
1	23	-293.7	67.04	-495.1E-6	0.0
1	24	-271.4	130.7	591.0E-6	8.562
1	25	-235.5	187.8	0.001565	16.20
1	26	-187.8	235.5	0.002379	17.00
1	27	-130.7	271.4	0.002991	17.00
1	28	-67.04	293.7	0.003371	17.00

Reinforcement Stresses/Strains at ULS Strength

Case Bar	Coordinates y [mm]	Coordinates z [mm]	Strain [-]	Stress [N/mm ²]	Notes
1	1	199.0	0.0	-0.001639	-327.7 500B
1	2	140.7	140.7	761.5E-6	152.3 500B
1	3	12.97E-6	199.0	0.001756	351.1 500B
1	4	-140.7	140.7	761.5E-6	152.3 500B
1	5	-199.0	25.94E-6	-0.001639	-327.7 500B
1	6	-140.7	-140.7	-0.004039	-434.8 500B
1	7	-10.60E-6	-199.0	-0.005033	-434.8 500B
1	8	140.7	-140.7	-0.004039	-434.8 500B



Omitted Pile ██████████

Contract No: T30295		Contract Title: Blue Hills Farm, Off Whitehall Rd West, Birkenshaw				Page No.: SCHED/01	
Rev	Comment	Date	Drawings			Rev	Piling Requirements
0	First Issue	22/09/2023	Piled Retaining Wall - T30295 - 01			-	Concrete Grade C28/35
1	Updated with additional Piles	04/10/2023	09.21011-ACE-ZZ-XX-DR-S-7021			P2	Concrete Class DC-2
2	Revised drawing Issued by Client showing an additional Pile.	27/11/2023	09.21011-ACE-ZZ-XX-DR-S-7022			P2	Integrity Test TBC
							Prelim Test Pile NIL
							Working Test Pile TBC
							Site crew to check 'working drawing on site' is the same as the drawings referenced above.

CFA Pile No.	Pile DIA (mm)	P.P.L (m OD)	COL (m OD)	Pile Length (m)	De-Bond Length (m) DIM 'A'	Depth of Cage from PPL (m)	Main Reinforcement	Secondary Reinforcement	Cage Type	Theoretical Concrete Volume (m³)	Design Pile Length (m)	Installed Pile Length (m)	Date of Installation	Comments
RW 1 - P1	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P2	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P3	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P4	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P5	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P6	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P7	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P8	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P9	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P10	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P11	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P12	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P13	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P14	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P15	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P16	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P17	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P18	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			



Omitted Pile ██████████

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Rev	Comment	Date	Drawings			Rev	Piling Requirements
0	First Issue	22/09/2023	Piled Retaining Wall - T30295 - 01			-	Concrete Grade C28/35
1	Updated with additional Piles	04/10/2023	09.21011-ACE-ZZ-XX-DR-S-7021			P2	Concrete Class DC-2
2	Revised drawing Issued by Client showing an additional Pile.	27/11/2023	09.21011-ACE-ZZ-XX-DR-S-7022			P2	Integrity Test TBC
							Prelim Test Pile NIL
							Working Test Pile TBC
							Site crew to check 'working drawing on site' is the same as the drawings referenced above.

CFA Pile No.	Pile DIA (mm)	P.P.L (m OD)	COL (m OD)	Pile Length (m)	De-Bond Length (m) DIM 'A'	Depth of Cage from PPL (m)	Main Reinforcement	Secondary Reinforcement	Cage Type	Theoretical Concrete Volume (m³)	Design Pile Length (m)	Installed Pile Length (m)	Date of Installation	Comments
RW 1 - P19	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P20	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P21	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P22	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P23	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P24	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P25	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P26	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 1 - P27	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P28	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P29	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P30	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P31	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P32	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P33	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P34	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P35	600 @750c/c	169.750	TBC	11.50	TBC	11.50	8 B 32 x 11.50	B 10 @ 150 mm c/c	A	3.739	11.50			
RW 2 - P36	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			



Omitted Pile ██████████

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2	Revised drawing Issued by Client showing an additional Pile.	27/11/2023	09.21011-ACE-ZZ-XX-DR-S-7022			P2	Integrity Test TBC
							Prelim Test Pile NIL
							Working Test Pile TBC
							Site crew to check 'working drawing on site' is the same as the drawings referenced above.

CFA Pile No.	Pile DIA (mm)	P.P.L (m OD)	COL (m OD)	Pile Length (m)	De-Bond Length (m) DIM 'A'	Depth of Cage from PPL (m)	Main Reinforcement	Secondary Reinforcement	Cage Type	Theoretical Concrete Volume (m³)	Design Pile Length (m)	Installed Pile Length (m)	Date of Installation	Comments
RW 2 - P37	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P38	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P39	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P40	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P41	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P42	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P43	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P44	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P45	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P46	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P47	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P48	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P49	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P50	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P51	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P52	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P53	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P54	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			



Omitted Pile ██████████

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1	Updated with additional Piles	04/10/2023	09.21011-ACE-ZZ-XX-DR-S-7021			P2	Concrete Class DC-2
2	Revised drawing Issued by Client showing an additional Pile.	27/11/2023	09.21011-ACE-ZZ-XX-DR-S-7022			P2	Integrity Test TBC
							Prelim Test Pile NIL
							Working Test Pile TBC
							Site crew to check 'working drawing on site' is the same as the drawings referenced above.

CFA Pile No.	Pile DIA (mm)	P.P.L (m OD)	COL (m OD)	Pile Length (m)	De-Bond Length (m) DIM 'A'	Depth of Cage from PPL (m)	Main Reinforcement	Secondary Reinforcement	Cage Type	Theoretical Concrete Volume (m³)	Design Pile Length (m)	Installed Pile Length (m)	Date of Installation	Comments
RW 2 - P55	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P56	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P57	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P58	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P59	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P60	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P61	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P62	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P63	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P64	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P65	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P66	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P67	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P68	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P69	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P70	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 2 - P71	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P72	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			



Omitted Pile ██████████

Contract No: T30295		Contract Title: Blue Hills Farm, Off Whitehall Rd West, Birkenshaw				Page No.: SCHED/01	
Rev	Comment	Date	Drawings		Rev	Piling Requirements	
0	First Issue	22/09/2023	Piled Retaining Wall - T30295 - 01		-	Concrete Grade C28/35	
1	Updated with additional Piles	04/10/2023	09.21011-ACE-ZZ-XX-DR-S-7021		P2	Concrete Class DC-2	
2	Revised drawing Issued by Client showing an additional Pile.	27/11/2023	09.21011-ACE-ZZ-XX-DR-S-7022		P2	Integrity Test TBC	
						Prelim Test Pile NIL	
						Working Test Pile TBC	
						Site crew to check 'working drawing on site' is the same as the drawings referenced above.	

CFA Pile No.	Pile DIA (mm)	P.P.L (m OD)	COL (m OD)	Pile Length (m)	De-Bond Length (m) DIM 'A'	Depth of Cage from PPL (m)	Main Reinforcement	Secondary Reinforcement	Cage Type	Theoretical Concrete Volume (m³)	Design Pile Length (m)	Installed Pile Length (m)	Date of Installation	Comments
RW 3 - P73	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P74	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P75	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P76	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P77	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P78	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P79	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			
RW 3 - P80	600 @750c/c	169.750	TBC	10.00	TBC	10.00	8 B 25 x 10.00	B 10 @ 150 mm c/c	B	3.252	10.00			