

## Herbert Road, Newport

### PILED RETAINING WALL DESIGN CALCULATIONS

#### GEOTECHNICAL DESIGN REPORT

Bored pile wall, designed & constructed in accordance with –

BS.EN.1997.1.2004  
BS.NA.EN.1997.1.2004  
BS.EN.1992.2004  
BS.NA.EN.1992.2004  
BS EN 1536:1999

Job No: GC

**GeMech Ltd**

**Unit 12  
Kenn Court  
South Bristol Business Park  
Roman Farm Way  
Bristol  
BS4 1UL**

**Revision: A**

**Date: 21<sup>st</sup> June 2024**

**Date: 21<sup>st</sup> June 2024**

**Author: T. Widdas, MSc**

**Checked by: B. McCartney**

## RETAINING WALL DESIGN CALCULATIONS

Site:	Herbert Road, Newport	Project Number:	GE12875
Date:	21 <sup>st</sup> June 2024	Revision:	A

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## RETAINING WALL DESIGN CALCULATIONS

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### 1. Design Brief

This report covers the design of a king post retaining wall at Herbert Road, Newport.

#### 1a. Information Received -

PHG Retaining Wall Drawings: 085, Rev A

### 2. Soils Information

The site is underlain by Made Ground and soft clays.

#### 2a. Soils Parameters –

Description	$\Gamma$ (kN/m <sup>3</sup> )	$C_u$	$\phi$	$E_u$
Made Ground	18	-	28	10
Soft Clay	19	-	22	15

#### Values of wall friction - $\delta$

EC7 clause 9.5.1 states –

(5) The amount of shear stress, which can be mobilised at the wall-ground interface should be determined by the wall-ground interface parameter  $\delta$ .

(6) A concrete wall or steel sheet pile wall supporting sand or gravel may be assumed to have a design wall ground interface parameter  $\delta_0 = k \cdot \varphi_{cv,d}$ .  $k$  should not exceed 2/3 for precast concrete or steel sheet piling.

(7) For concrete cast against soil, a value of  $k = 1,0$  may be assumed.

(8) For a steel sheet pile in clay under undrained conditions immediately after driving, no adhesive or frictional resistance should be assumed. Increases in these values may take place over a period of time.

This design will adopt a  $k$  value of 0.67

#### 2a. Ground Water Levels –

Ground water was encountered at the base of the made ground during the site investigation works.

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### 3. Design Principles

The king post wall is to act as an embedded cantilever in all cases, as per requirements noted on the drawing provided, the wall has been designed to resist 5kPa surcharge at the head.

### 4. Partial Factors

#### Factors on Actions –

	$G_k$ (permanent)	$Q_k$ (leading variable)
DA1:1	1.35	1.50
DA1:2	1.00	1.30

#### Factors on Secondary Variable Actions, $\Psi_0^*$ –

	$\Psi_0$
Imposed Loads on Buildings - excluding Storage Areas	0.7
Imposed Loads on Buildings - Storage Areas	1.0
Snow loads – Sites < 1,000m	0.5
Snow loads – Sites > 1,000m	0.7
Wind Loads	0.5
Temperature Effects (excluding fire)	0.6

(\* Persistent & transient load cases only, not appropriate for accidental load cases)

#### Factors on Materials (STR, GEO) –

	DA1:1	DA1:2
$\Phi'$ , or $\phi'_{cv}$	1.00	1.25
$C_u$	1.00	1.40
UCS	1.00	1.40

#### Factors on Resistances (Axially Applied loads, CFA Piles) –

	DA1:1	DA1:2
Base	1.00	2.00
Shaft	1.00	1.40
Total/Combined	1.00	1.70
Shaft (tension)	1.00	1.70

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**5. Overdig Allowances**

EC7 clause 9.3.2.2 states -

(2) In ultimate limit state calculations in which the stability of a retaining wall depends on the ground resistance in front of the structure, the level of the resisting soil should be lowered below the nominally expected level by an amount  $\Delta a$ . The value of  $\Delta a$  should be selected taking into account the degree of site control over the level of the surface. With a normal degree of control, the following should be applied:

— for a cantilever wall,  $\Delta a$  should equal 10 % of the wall height above excavation level, limited to a maximum of 0.5 m;

— for a supported wall,  $\Delta a$  should equal 10 % of the distance between the lowest support and the excavation level, limited to a maximum of 0.5 m.

(3) Smaller values of  $\Delta a$ , including 0, may be used when the surface level is specified to be controlled reliably throughout the appropriate **KS1** design situation **KS1**.

An overdig allowance of 100mm is typically adopted where good control of excavation is enforced on site.

For the purposes of this design an overdig allowance of 100mm will be adopted, and it will be assumed that the surface of the maximum depth excavation is blinded as soon as is reasonably practicable after the required excavation level is achieved.

**6. Surcharges Acting on Piled Wall**

Extracts from CIRIA C580 -

**For flat ground and walls retaining heights greater than 3 m, it is recommended that a minimum surcharge of 10 kPa should be applied to the surface of the retained ground in design. For walls retaining less than 3 m, this surcharge load may be reduced provided the designer is confident that a minimum surcharge of 10 kPa will not apply, during the life of the structure.**

As per retaining wall notes on the provided drawings, a reduced surcharge loading of 5kPa has been adopted.

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### Highway traffic loading

Guidance is provided in BD 37/88 (DMRB 1.3) on how vehicle loading should be calculated. Normal traffic loading (HA) allows for all combinations of vehicles that normally occur on highways. HB loading corresponds to abnormal vehicle unit loading, eg industrial loads. The number of units of HB loading is usually specified by the local authority and depends on the particular usage of the road. Table 5.11 summarises typical loadings.

**Table 5.11** Highway live loading (from BD 37/88)

Type of loading	Equivalent surcharge (kPa)
HB (45 units)	20
HB (37.5 units)	16
HB (30 units)	12
HA	10

### 7. Design Cases

Load Case	Capping Beam Level (m O.D)	SLS Dig Level (m O.D)	SLS Ret. Height (m)	Overdig (m)	ULS Dig Level (m O.D)
1	9.8	7.3	2.5	0.1	7.2

### 8. Structural Capacity

Piles are not designed to resist axially applied loads.

Design Chemical Class = DC - 1

### 9. Estimated Wall Deflections

Design Section	Estimated Deflection (mm)
1	61

The maximum deflection associated with a propped or anchored walls will occur at mid-height between lower props, or between lowest prop & maximum dig level.

Wall deflections can be overestimated by limit equilibrium design packages, owing to an underestimation of beneficial soil arching effects, and difficulties in accurately estimating operation soil stiffness in the horizontal direction – soil stiffness is highly strain dependent.

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### 11. Testing Proposals

#### Concrete Cube Testing

A high fines C28/35 concrete mix, confirming to design chemical class DC - 1 will be provided by a QSRMC accredited supplier.

Concrete cube testing will be carried out at the Client's prior request. The total number of sets of concrete test cubes required is to be confirmed by the Client prior to commencement on site, to allow orders to be placed with a specialist material testing engineer.

Where concrete cube tests are requested sets of 4no. cubes will be made, and tested at 7 days, two at 28 days, and a spare for testing at 56 days if required.

### 12. Design Summary

Piles are to be installed to the design depths presented above and reinforced with the scheduled reinforcement cages.

This design report is to be reviewed by all interested parties, and comments presented to GeMech ahead of the procurement of pile reinforcement cages.

Load Case	Top of wall Level (m O.D)	SLS Dig Level (m O.D)	SLS Ret. Height (m)	Overdig (m)	ULS Dig Level (m O.D)
1	9.8	7.3	2.5	0.1	7.2

Load Case	SLS Retained Height (m)	U/C section	Post Length (m)	Spacing (m)	Borehole Depth (m)
1	2.5	203 x 203 x 60kg/m	7.5	1.8	4.5

## RETAINING WALL DESIGN CALCULATIONS

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### **Appendix A – CADS Output DA1:1**

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CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

### Pile geometry

Pile top Level 9.8 m  
Pile Length 7.5 m  
Pile toe level 2.3 m

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

Initial Ground Water level 4.6

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
9.80	Made Ground	18.00	18.00	10000	0			25	.67	.35	
								25	.67	3.42	
4.60	Soft Clay	18.00	18.00	15000	0			22	.67	.40	
								22	.67	2.88	

### Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1 A	Active surcharge	9.80	5.0	.0		
2 A	Passive side excavation	7.20				

### Code of practice

Code of practice or reference document	Eurocode 7 ULS Design Approach 1 Combination 1
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	1.35
ULS factor on passive soil pressures	1.35
ULS factor on active water pressures	1.35
ULS factor on passive water pressures	1.35
ULS factor on loads applied to the soil	1.11
ULS factor on loads applied to the wall	1.50
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

### 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/m3
Minimum equivalent fluid density	5.0 kN/m3
Depth of passive softened soil	1.0 m
Continuity model for wall analysis	Pins at second and lower props

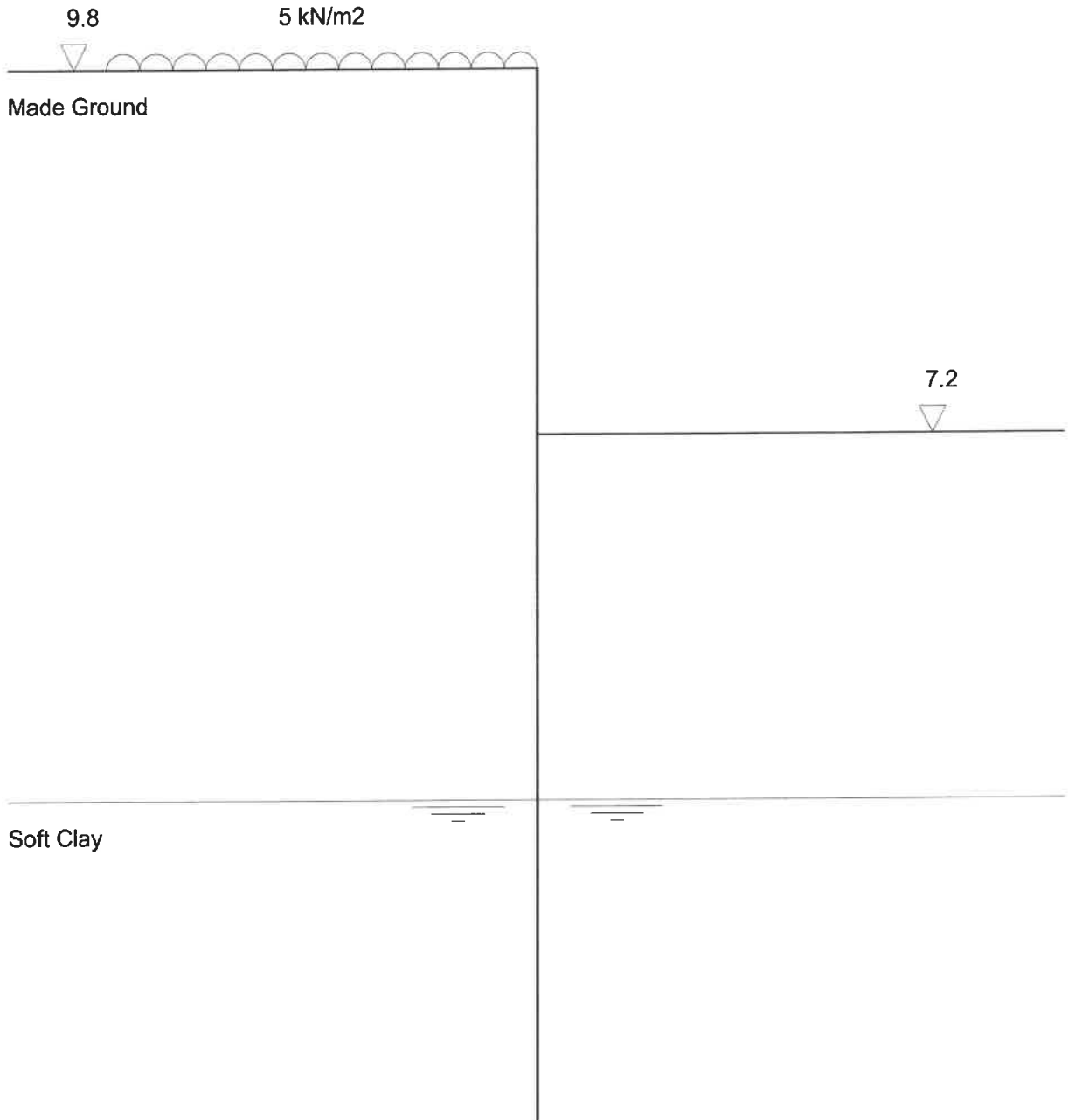
	Page No 2 Analysis DA1:1
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
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Deflection parameters

Wall moment of inertia 3403 cm<sup>4</sup>/m  
Wall Youngs modulus 200000000 kN/m<sup>2</sup>

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Stage ref. 2  
Stage type Passive side excavation



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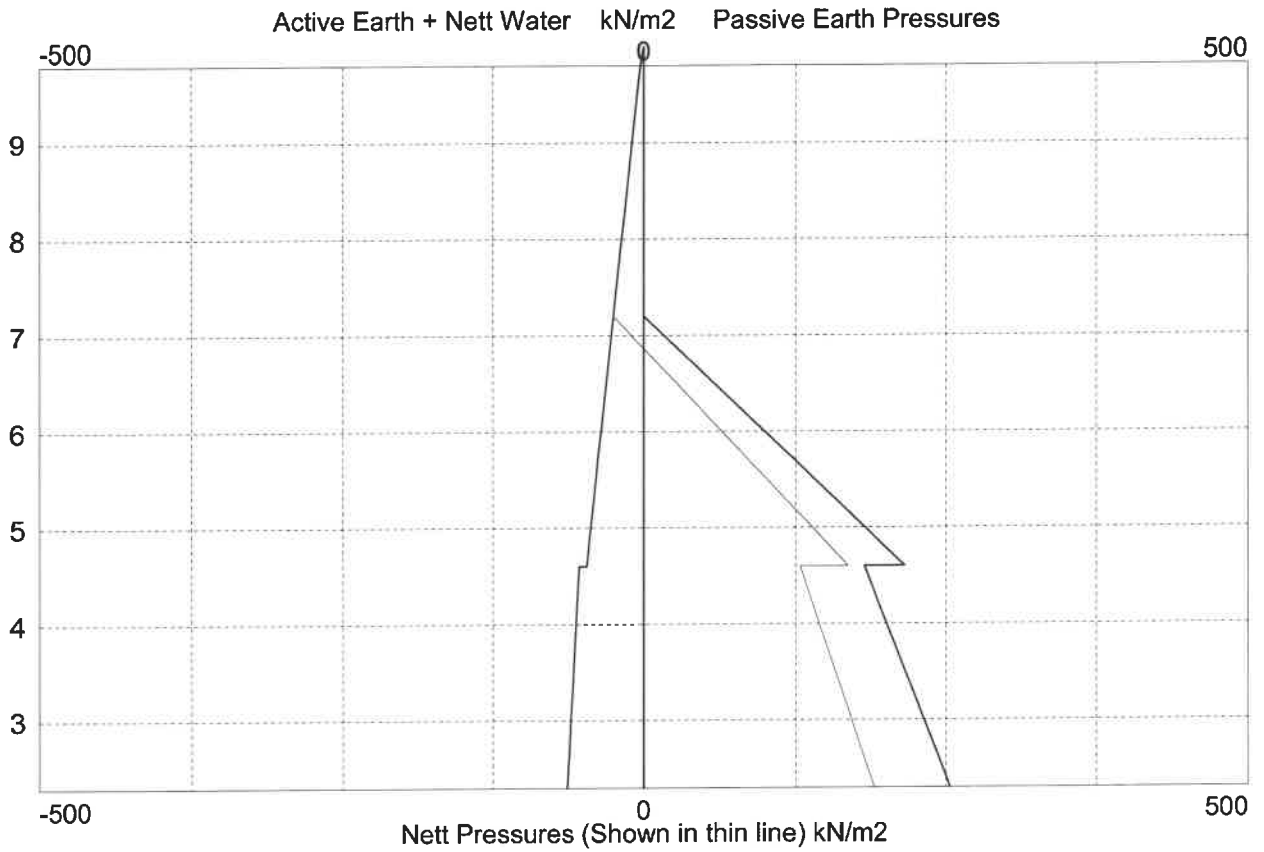
Tabular results from analysis of stage ref 2

- strength.  
f analysis.

Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
9.80	5.6	2.6	.0	.0	.0	.0	2.6	0	-3			.00
9.57	9.7	4.6	.0	.0	.0	.0	4.6	.2	-1.1			.00
9.00	20.0	9.5	.0	.0	.0	.0	9.5	1.8	-5.1			.00
8.00	38.0	18.1	.0	.0	.0	.0	18.1	13.1	-18.9			.00
7.20	52.3	24.9	.0	.0	.0	.0	24.9	34.7	-36.0			.00
7.20	52.4	24.9	.0	.0	.0	.0	24.9	34.7	-36.1			.00
7.00	56.0	26.6	.0	3.6	16.6	.0	10.0	42.3	-39.6			.00
6.00	74.0	35.2	.0	21.6	99.6	.0	-64.4	74.5	-12.4			.16
5.00	92.0	43.8	.0	39.6	182.6	.0	-138.9	42.3	89.3			.56
4.64	98.5	46.9	.0	46.2	212.9	.0	-166.0	0	144.8			.74
4.60	99.2	47.2	.0	46.8	215.8	.0	-168.6	-2.4	134.7			.76
4.60	99.2	53.5	.0	46.8	182.0	.0	-128.6	-2.4	134.7			.76
4.00	104.0	56.1	8.1	51.6	200.7	8.1	-144.6	0	0			1.06
3.00	112.0	60.4	21.6	59.6	231.8	21.6	-171.4	0	0			1.52
2.30	117.6	63.4	31.1	65.2	253.6	31.1	-190.2	0	0			1.78

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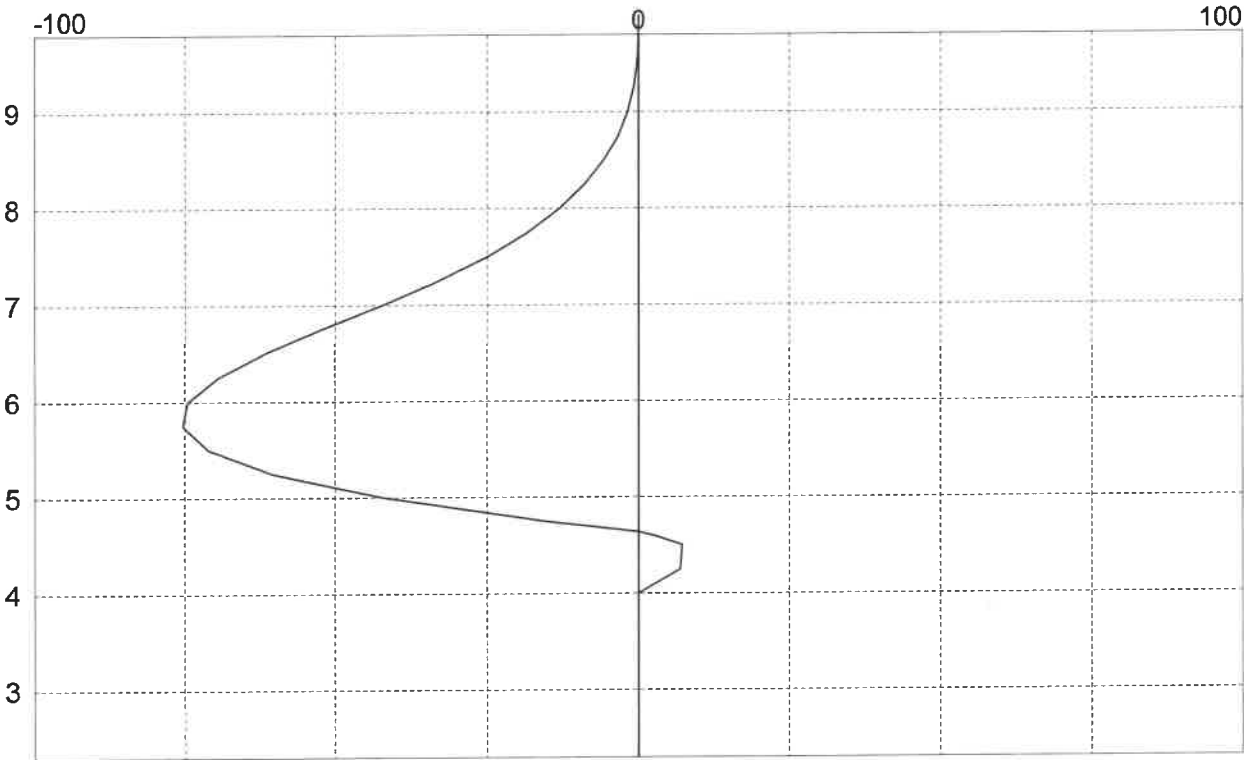
Graphical results from analysis of stage ref 2



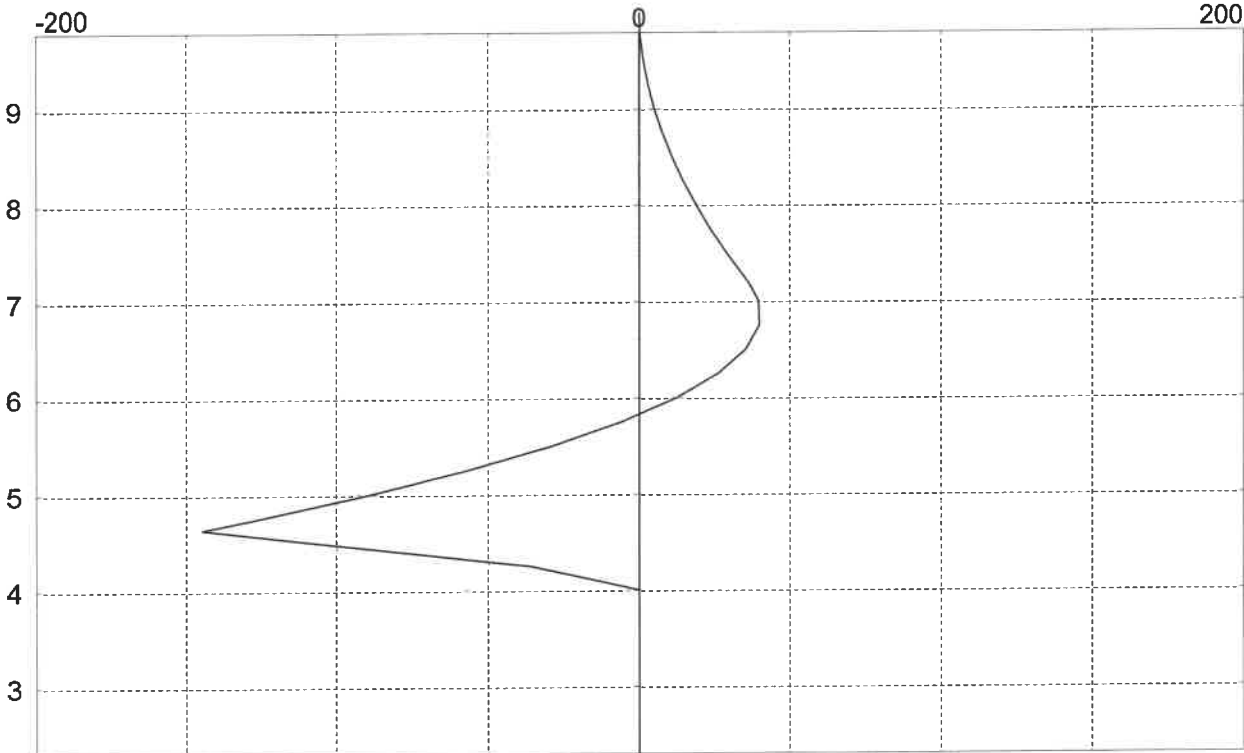
Deflection diagram not shown for analysis with partial factors applied

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Graphical results from analysis of stage ref 2 continued



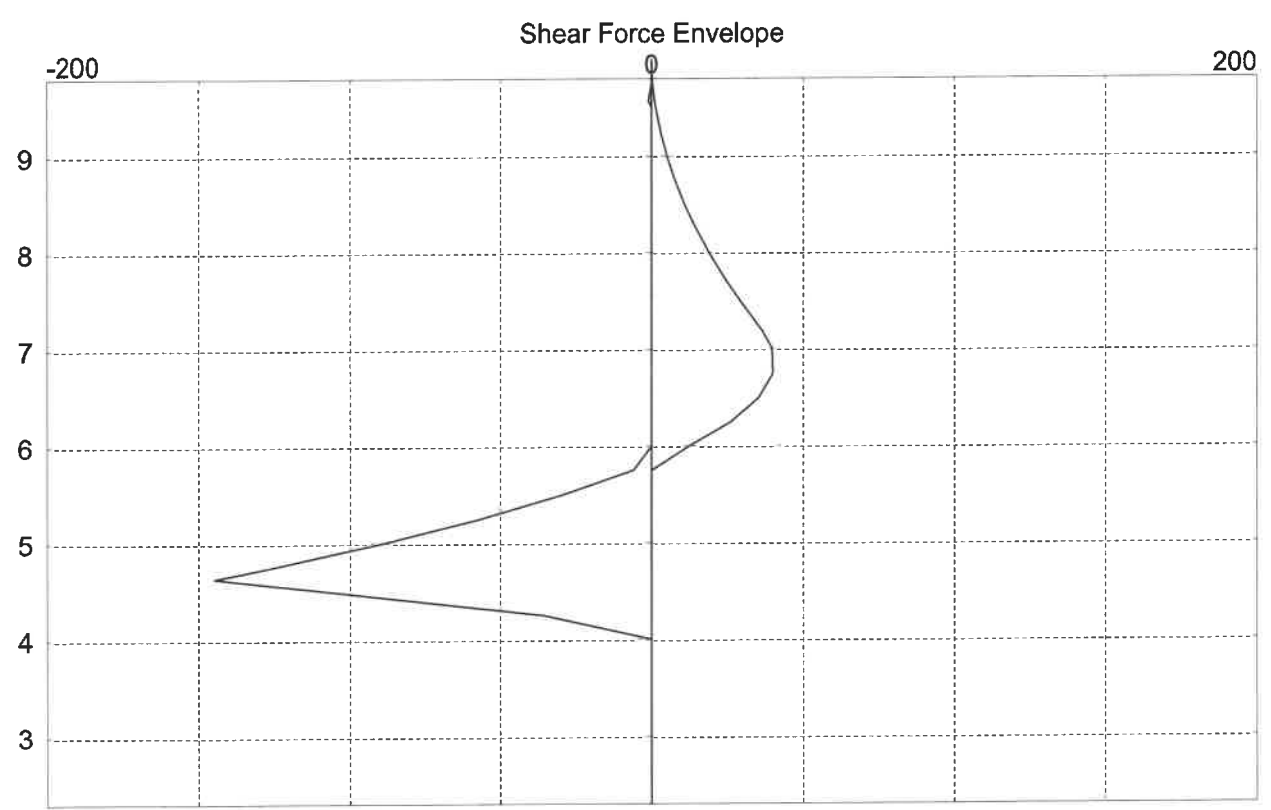
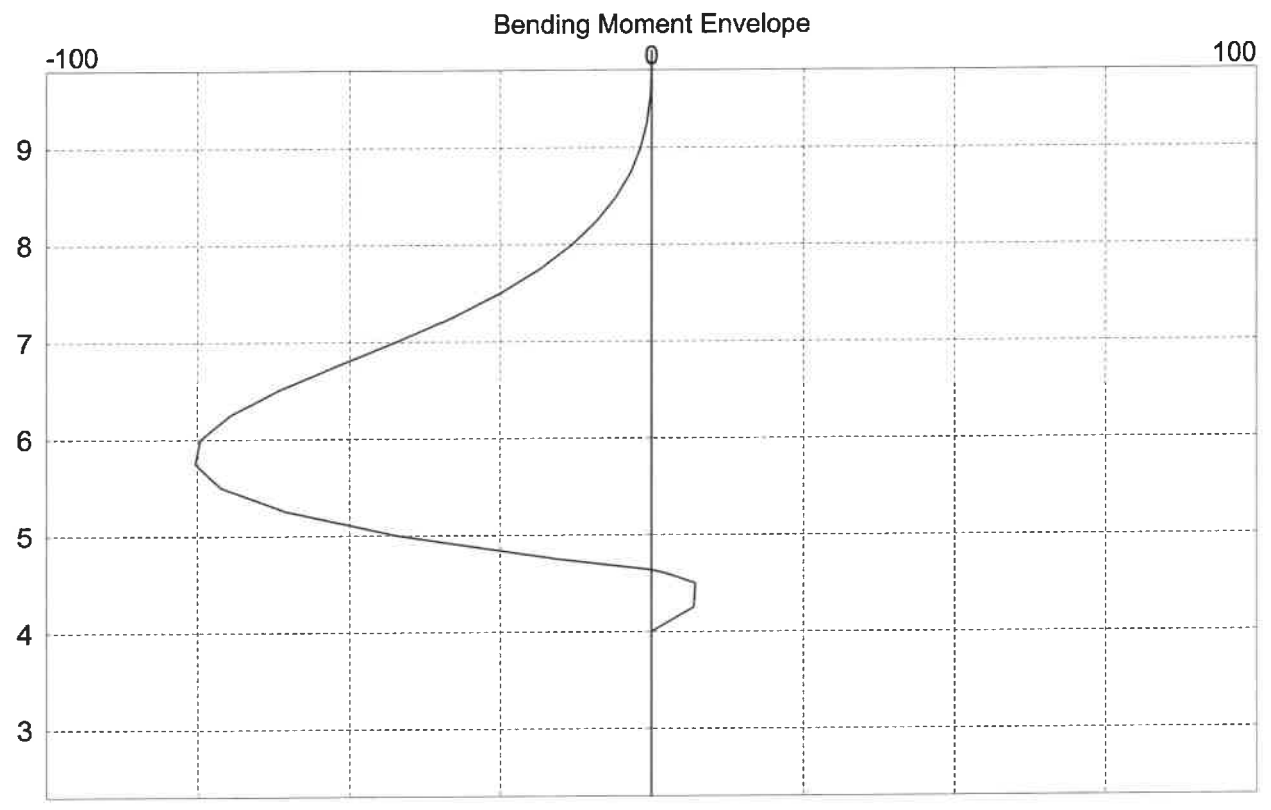
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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Graphical plot of envelope from selected construction stages



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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
9.80	.0	.0	-.3	.0	
9.57	.0	.2	-1.1	1.1	
9.00	.0	1.8	-5.1	.0	
8.00	.0	13.1	-18.9	.0	
7.20	.0	34.7	-36.0	.0	
7.20	.0	34.7	-36.1	.0	
7.00	.0	42.3	-39.6	.0	
6.00	.0	74.5	-12.4	.0	
5.00	.0	42.3	.0	89.3	
4.64	.0	.0	.0	144.8	
4.60	-2.4	.0	.0	134.7	
4.60	-2.4	.0	.0	134.7	
4.00	.0	.0	.0	.0	
3.00	.0	.0	.0	.0	
2.30	.0	.0	.0	.0	

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### Structural design of wall

#### Wall section properties

King pile steel ref UC 203 x 203 x 60	
King pile spacing	1800 mm
King pile pre-bore diameter	600 mm
Lagging material	Timber
Lagging thickness	150 mm

#### Wall material properties

Yield stress of steel	275 N/mm <sup>2</sup>
Bending stress ratio	1.05
Allowable bending stress	261 N/mm <sup>2</sup>
Allowable shear stress	157 N/mm <sup>2</sup>
Timber lagging grade	C24

#### Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Section Class. EC3 Section 5.5	3	1	Class
Bending resistance. EC3 6.2.5 Plastic	136	180	kNm
Shear resistance. EC3 6.2.6	261	352	kN
Bending combined with shear. EC3 6.2.8	136	139	kNm
Timber infill bending. BS5975:2019	10	31	kNm/m
Timber infill shear. BS5975:2019	22	132	kN/m

**RETAINING WALL DESIGN CALCULATIONS**

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**Appendix B – CADS Output DA1:2**

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#### Pile geometry

Pile top Level            9.8 m  
Pile Length                7.5 m  
Pile toe level              2.3 m

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

Initial Ground Water level 4.6

Top Level m	Description	Bulk Dens kN/m <sup>3</sup>	Sat' Dens kN/m <sup>3</sup>	Young Mod kN/m <sup>2</sup>	Young Inc. kN/m <sup>3</sup>	Cu C' kN/m <sup>2</sup>	C Inc. kN/m <sup>3</sup>	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
9.80	Made Ground	18.00	18.00	10000	0			25 25	.67 .67	.35 3.42	
4.60	Soft Clay	18.00	18.00	15000	0			22 22	.67 .67	.40 2.88	

#### Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1 A	Active surcharge	9.80	5.0	.0		
2 A	Passive side excavation	7.20				

#### Code of practice

Code of practice or reference document	Eurocode 7 ULS Design Approach 1 Combination 2
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	1.25
ULS fFactor on drained cohesion values	1.25
ULS factor on undrained cohesion values	1.40
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	1.30
ULS factor on loads applied to the wall	1.30
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

#### 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 <sup>3</sup>
Minimum equivalent fluid density	5.0 kN/m <sup>3</sup>
Depth of passive softened soil	1.0 m
Continuity model for wall analysis	Pins at second and lower props

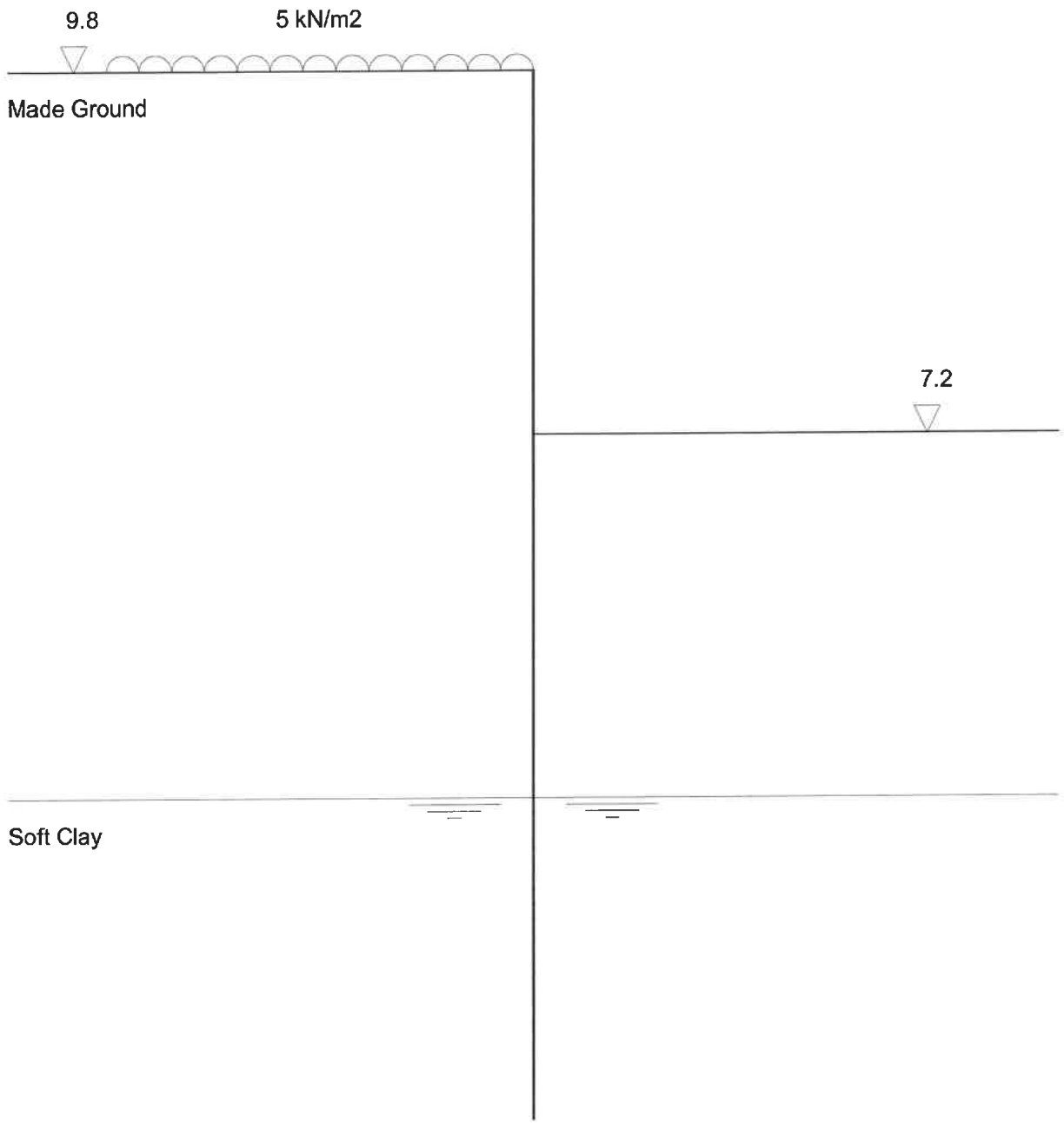
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Deflection parameters

Wall moment of inertia 3403 cm<sup>4</sup>/m  
Wall Youngs modulus 200000000 kN/m<sup>2</sup>

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Stage ref. 2  
Stage type Passive side excavation



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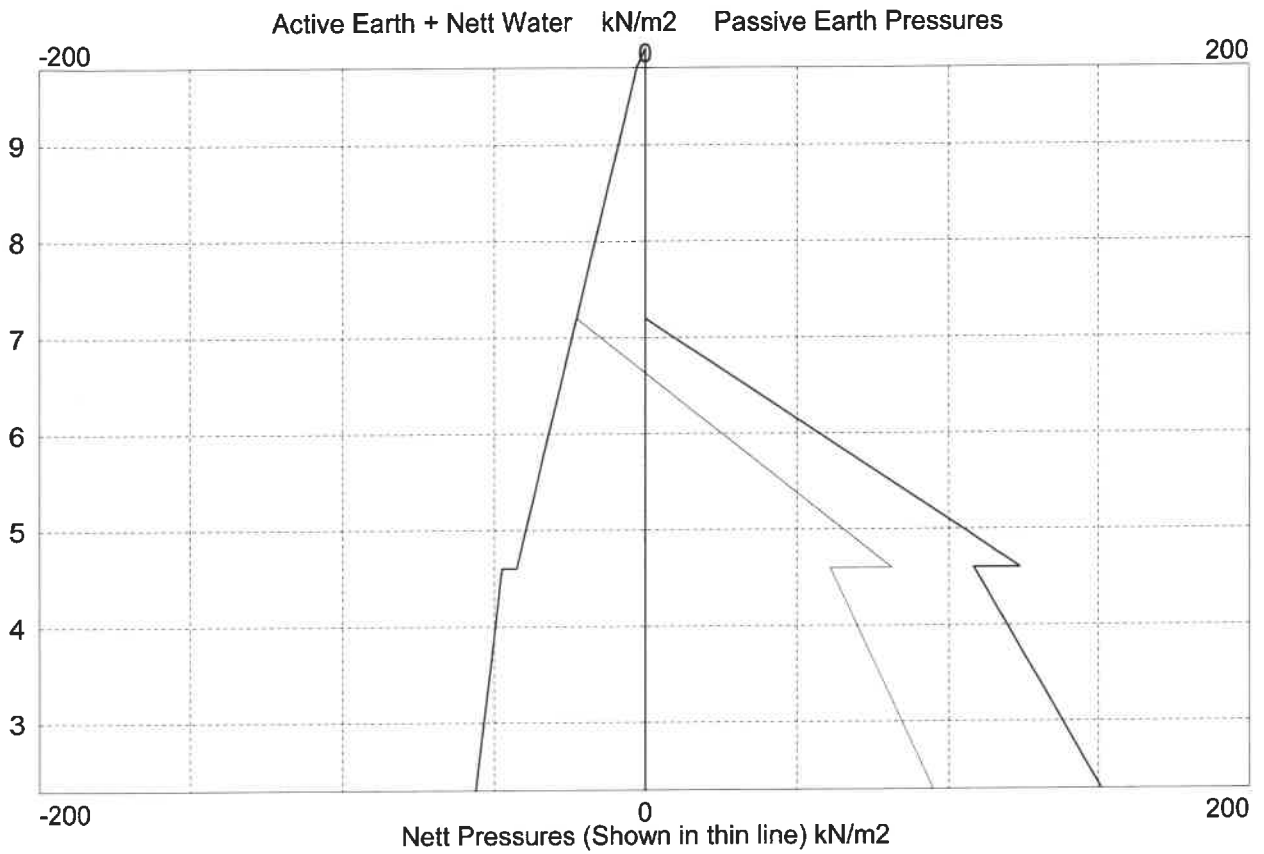
Tabular results from analysis of stage ref 2

strength.  
of analysis.

Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
9.80	6.5	2.8	.0	.0	.0	.0	2.8	0	-3			.00
9.45	12.8	5.5	.0	.0	.0	.0	5.5	.3	-1.7			.00
9.00	20.9	8.9	.0	.0	.0	.0	8.9	1.8	-4.9			.00
8.00	38.9	16.6	.0	.0	.0	.0	16.6	12.5	-17.7			.00
7.20	53.3	22.7	.0	.0	.0	.0	22.7	32.5	-33.3			.00
7.20	53.3	22.7	.0	.0	.0	.0	22.7	32.6	-33.4			.00
7.00	56.9	24.2	.0	3.6	9.5	.0	14.7	39.6	-37.1			.00
6.00	74.9	31.9	.0	21.6	57.2	.0	-25.3	77.5	-31.8			.10
5.00	92.9	39.6	.0	39.6	104.9	.0	-65.3	90.0	13.5			.35
4.60	100.1	42.6	.0	46.8	124.0	.0	-81.3	78.9	42.8			.47
4.60	100.1	47.4	.0	46.8	108.3	.0	-61.0	78.9	42.8			.47
4.00	104.9	49.6	6.0	51.6	119.4	6.0	-69.8	41.7	82.0			.66
3.57	108.3	51.3	10.3	55.0	127.4	10.3	-76.1	0	113.4			.80
3.00	112.9	53.4	16.0	59.6	138.0	16.0	-84.5	-6.9	24.4			.96
2.30	118.5	56.1	23.0	65.2	150.9	23.0	-94.9	0	0			1.13

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CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

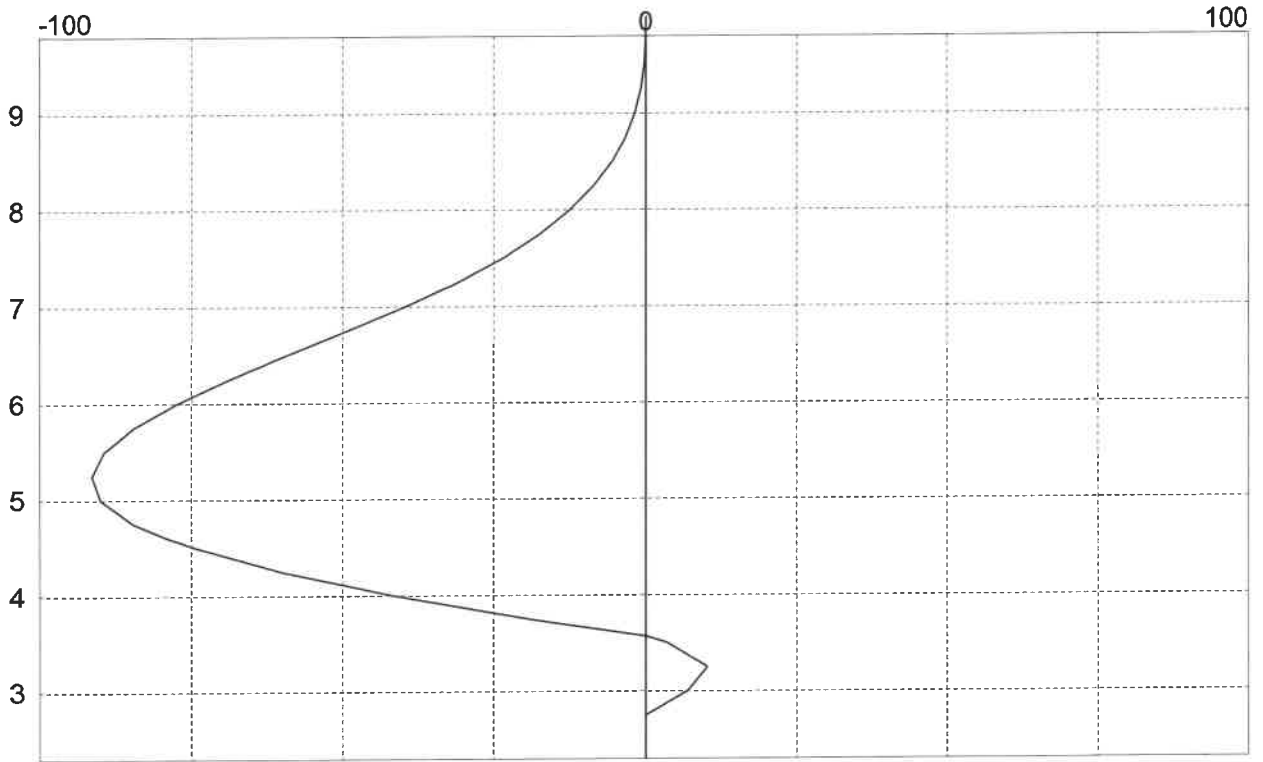
Graphical results from analysis of stage ref 2



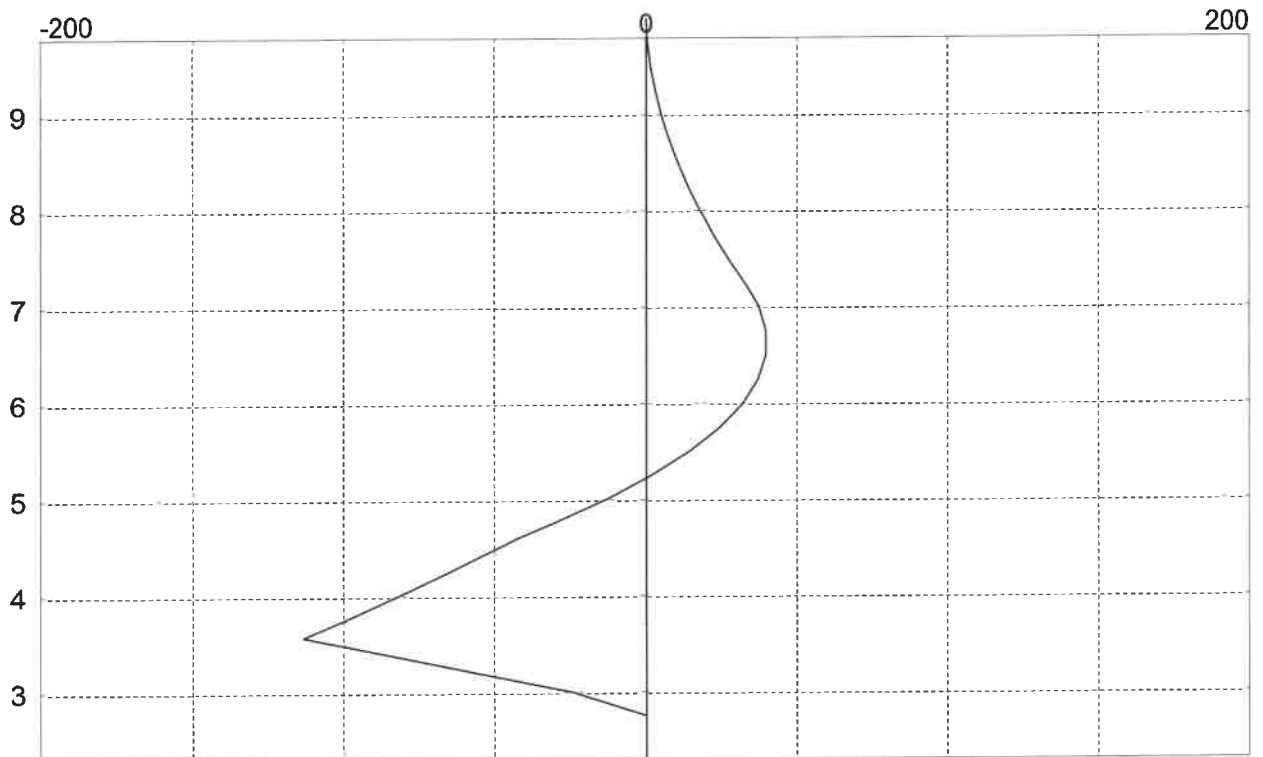
Deflection diagram not shown for analysis with partial factors applied

	Page No 6 Analysis DA1:2
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

Graphical results from analysis of stage ref 2 continued



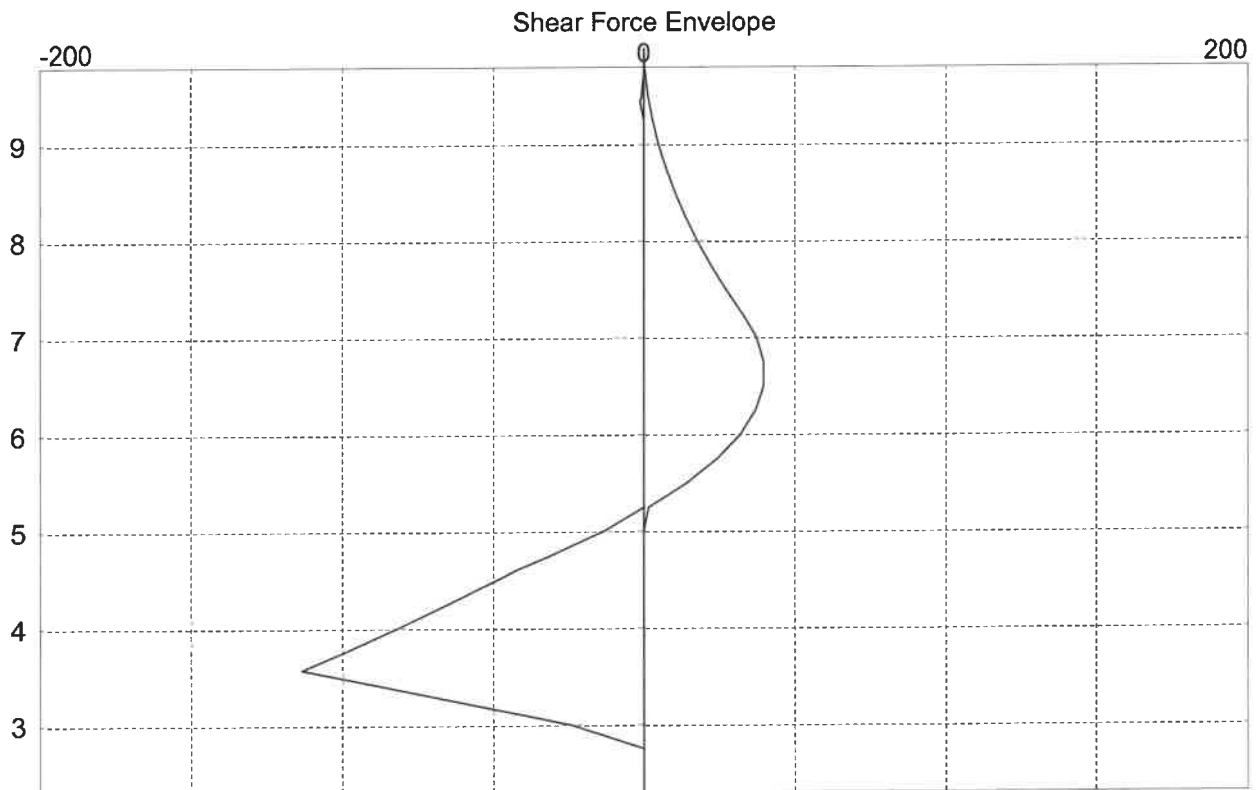
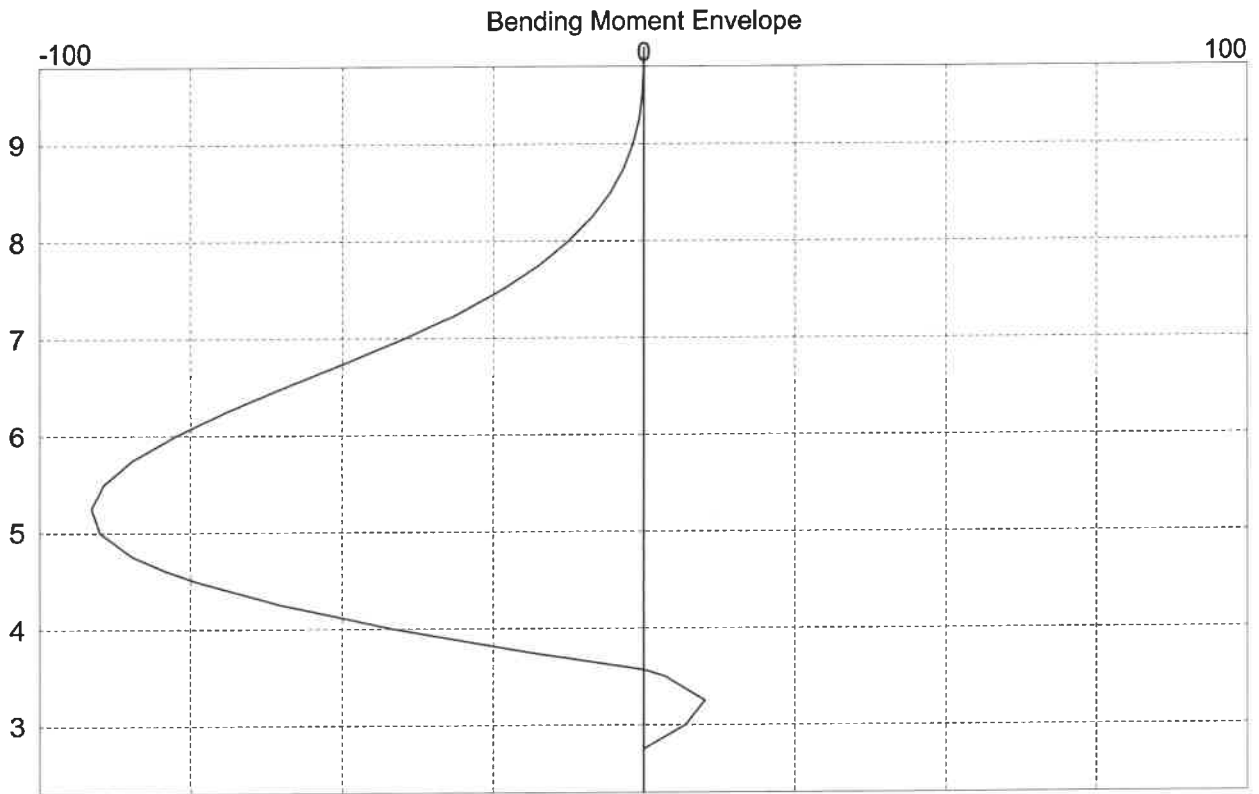
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

	Page No 7 Analysis DA1:2
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
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Graphical plot of envelope from selected construction stages



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CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project File Name	GE12875 ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer Date	TW 25/06/2024

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
9.80	.0	.0	-.3	.0	
9.45	.0	.3	-1.7	1.2	
9.00	.0	1.8	-4.9	.0	
8.00	.0	12.5	-17.7	.0	
7.20	.0	32.5	-33.3	.0	
7.20	.0	32.6	-33.4	.0	
7.00	.0	39.6	-37.1	.0	
6.00	.0	77.5	-31.8	.0	
5.00	.0	90.0	.0	13.5	
4.60	.0	78.9	.0	42.8	
4.60	.0	78.9	.0	42.8	
4.00	.0	41.7	.0	82.0	
3.57	.0	.0	.0	113.4	
3.00	-6.9	.0	.0	24.4	
2.30	.0	.0	.0	.0	

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CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

### Structural design of wall

#### Wall section properties

King pile steel ref UC 203 x 203 x 60	
King pile spacing	1800 mm
King pile pre-bore diameter	600 mm
Lagging material	Timber
Lagging thickness	150 mm

#### Wall material properties

Yield stress of steel	275 N/mm <sup>2</sup>
Bending stress ratio	1.05
Allowable bending stress	261 N/mm <sup>2</sup>
Allowable shear stress	157 N/mm <sup>2</sup>
Timber lagging grade	C24

#### Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Section Class. EC3 Section 5.5	3	1	Class
Bending resistance. EC3 6.2.5 Plastic	165	180	kNm
Shear resistance. EC3 6.2.6	204	352	kN
Bending combined with shear. EC3 6.2.8	165	176	kNm
Timber infill bending. BS5975:2019	9	31	kNm/m
Timber infill shear. BS5975:2019	20	132	kN/m

## RETAINING WALL DESIGN CALCULATIONS

Site:	Herbert Road, Newport	Project Number:	GE12875
Date:	21 <sup>st</sup> June 2024	Revision:	A

### **Appendix C – CADS Output SLS**

	Page No Analysis	1 SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project File Name	GE12875 ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer Date	TW 25/06/2024

#### Pile geometry

Pile top Level            9.8 m  
Pile Length                7.5 m  
Pile toe level              2.3 m

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

Initial Ground Water level    4.6

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
9.80	Made Ground	18.00	18.00	10000	0			25	.67	.35	
								25	.67	3.42	
4.60	Soft Clay	18.00	18.00	15000	0			22	.67	.40	
								22	.67	2.88	

#### Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1 A	Active surcharge	9.80	5.0	.0		
2 A	Passive side excavation	7.30				

#### 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

#### 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/m3
Minimum equivalent fluid density	5.0 kN/m3
Depth of passive softened soil	1.0 m
Continuity model for wall analysis	Pins at second and lower props

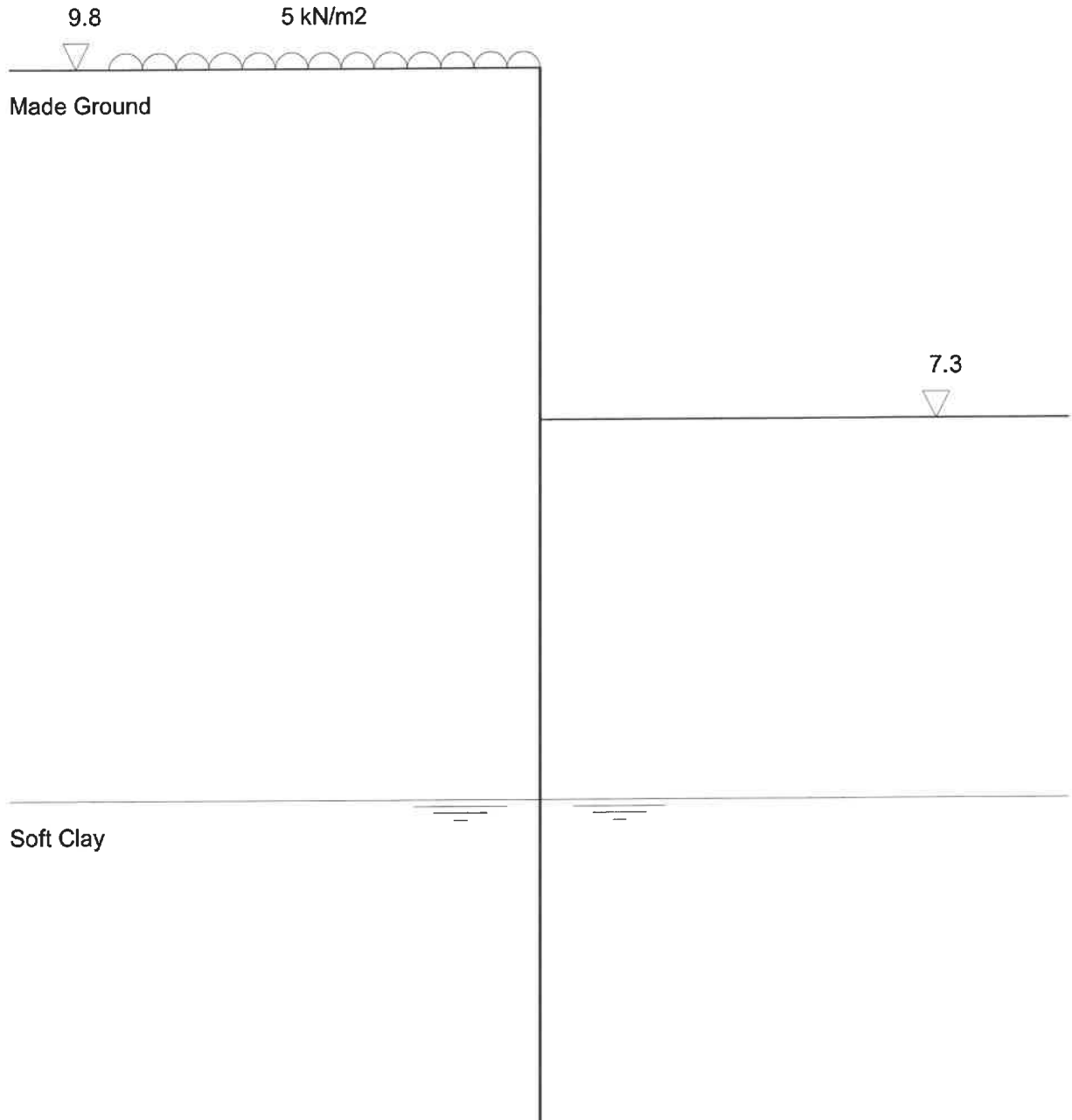
	Page No 2 Analysis SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

Deflection parameters

Wall moment of inertia 3403 cm<sup>4</sup>/m  
Wall Youngs modulus 200000000 kN/m<sup>2</sup>

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CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
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Stage ref. 2  
Stage type Passive side excavation



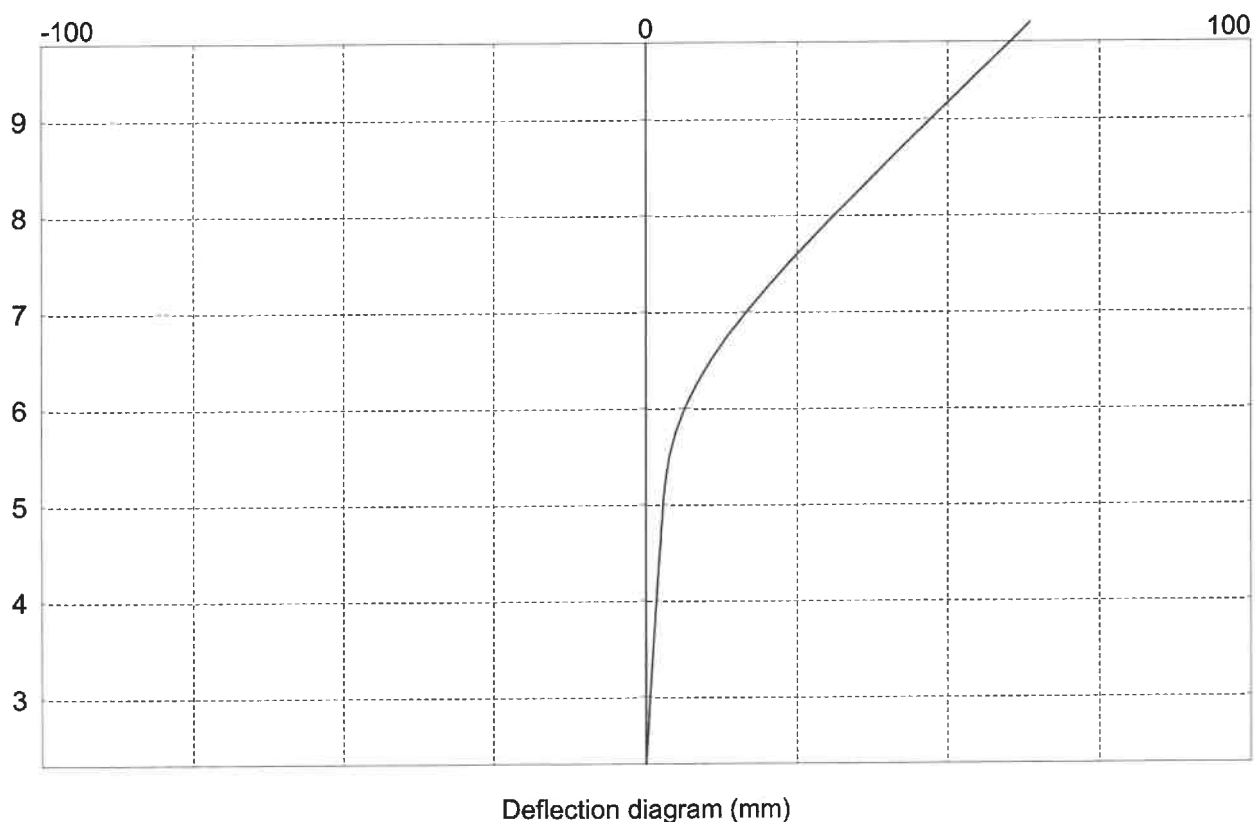
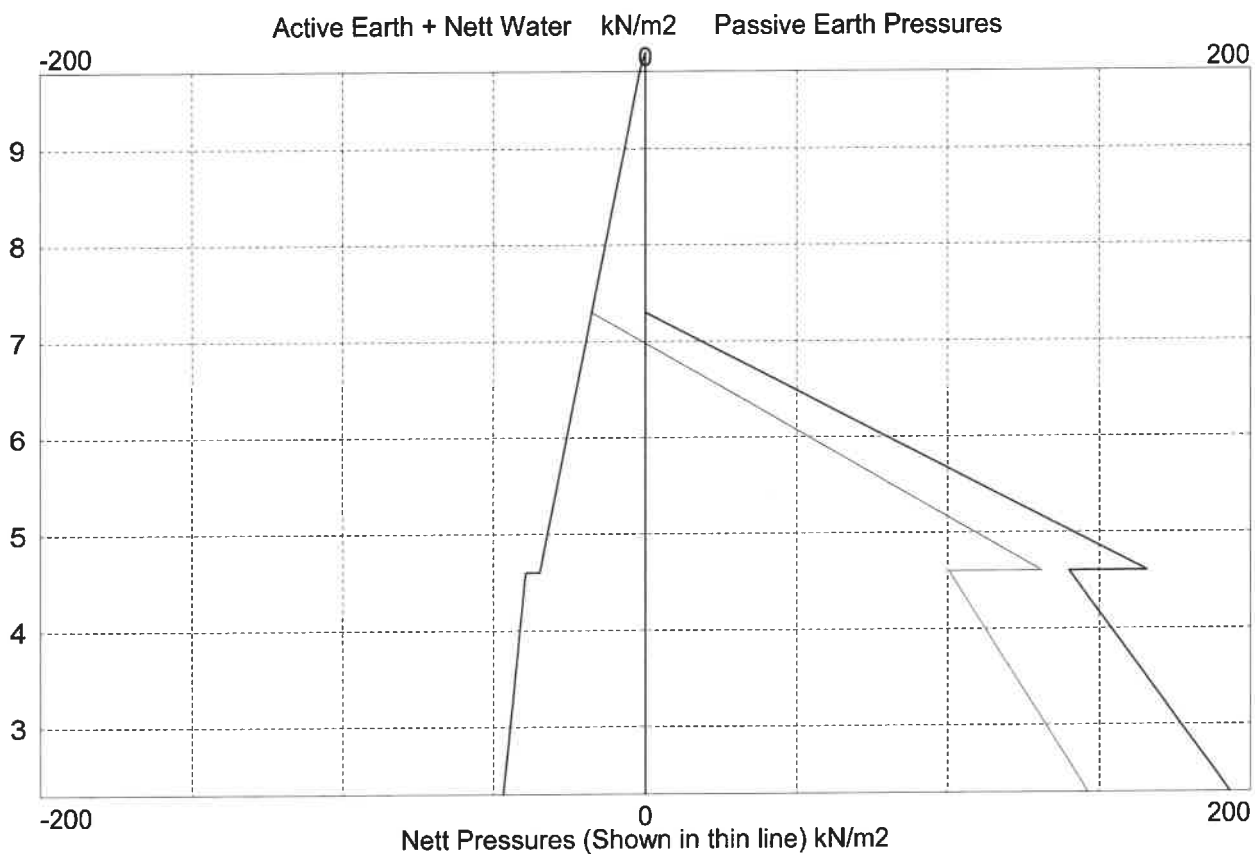
	Page No 4 Analysis SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

Tabular results from analysis of stage ref 2

Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
9.80	5.0	1.8	.0	.0	.0	.0	1.8	0	-2	60.4		.00
9.59	8.9	3.1	.0	.0	.0	.0	3.1	.1	-7	56.9		.00
9.00	19.4	6.8	.0	.0	.0	.0	6.8	1.3	-3.6	47.3		.00
8.00	37.4	13.2	.0	.0	.0	.0	13.2	9.4	-13.6	31.2		.00
7.30	50.0	17.6	.0	.0	.0	.0	17.6	22.4	-24.4	20.7		.00
7.30	50.0	17.6	.0	.0	.0	.0	17.6	22.5	-24.4	20.6		.00
7.00	55.4	19.5	.0	5.4	18.4	.0	1.1	30.4	-27.2	16.6		.01
6.00	73.4	25.9	.0	23.4	79.9	.0	-54.1	48.9	-7	6.4		.21
5.00	91.4	32.2	.0	41.4	141.4	.0	-109.2	13.4	80.9	2.8		.66
4.85	94.1	33.2	.0	44.1	150.7	.0	-117.6	0	98.1	2.7		.74
4.60	98.6	34.8	.0	48.6	166.0	.0	-131.3	-6.0	48.3	2.4		.87
4.60	98.6	39.4	.0	48.6	140.0	.0	-100.6	-6.0	48.3	2.4		.87
4.00	103.4	41.3	6.0	53.4	153.9	6.0	-112.5	0	0	1.8		1.20
3.00	111.4	44.5	16.0	61.4	176.9	16.0	-132.4	0	0	.7		1.67
2.30	117.0	46.8	23.0	67.0	193.1	23.0	-146.3	0	0	0		1.94

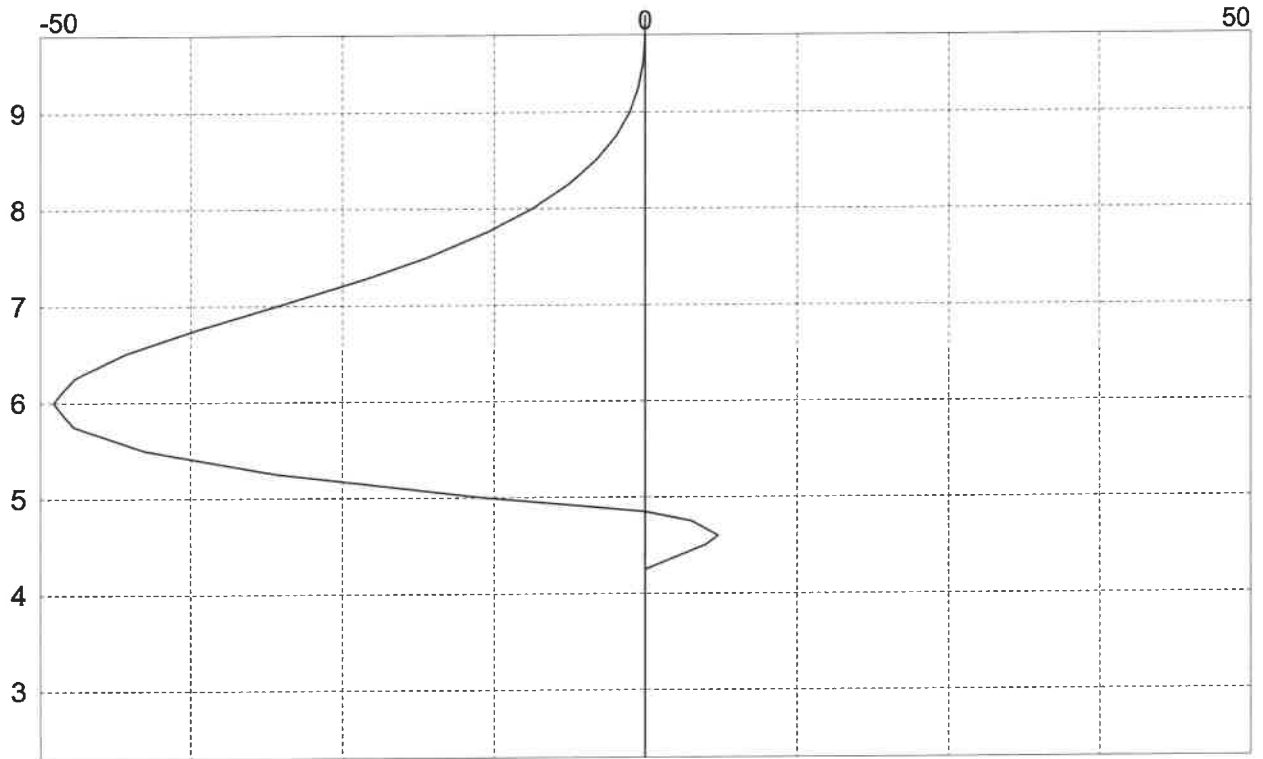
	Page No Analysis	5 SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project File Name	GE12875 ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer Date	TW 25/06/2024

Graphical results from analysis of stage ref 2

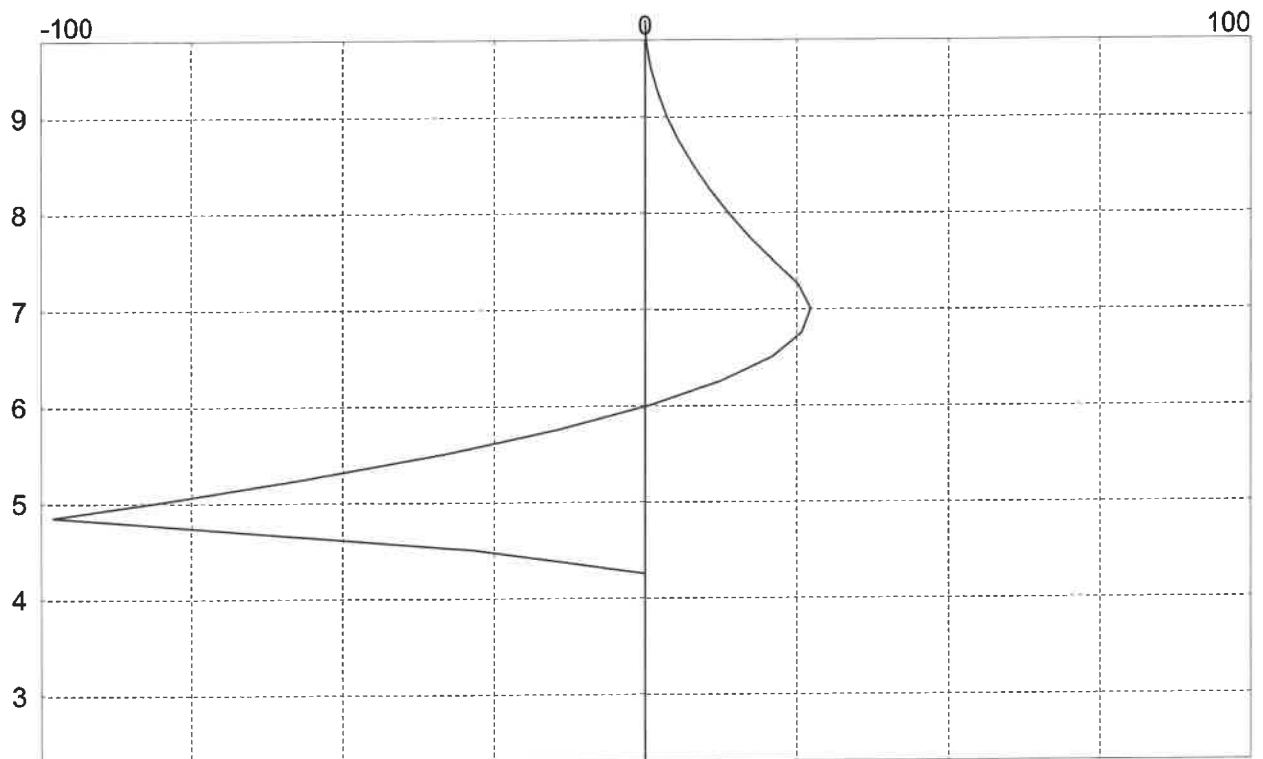


	Page No 6 Analysis SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

Graphical results from analysis of stage ref 2 continued



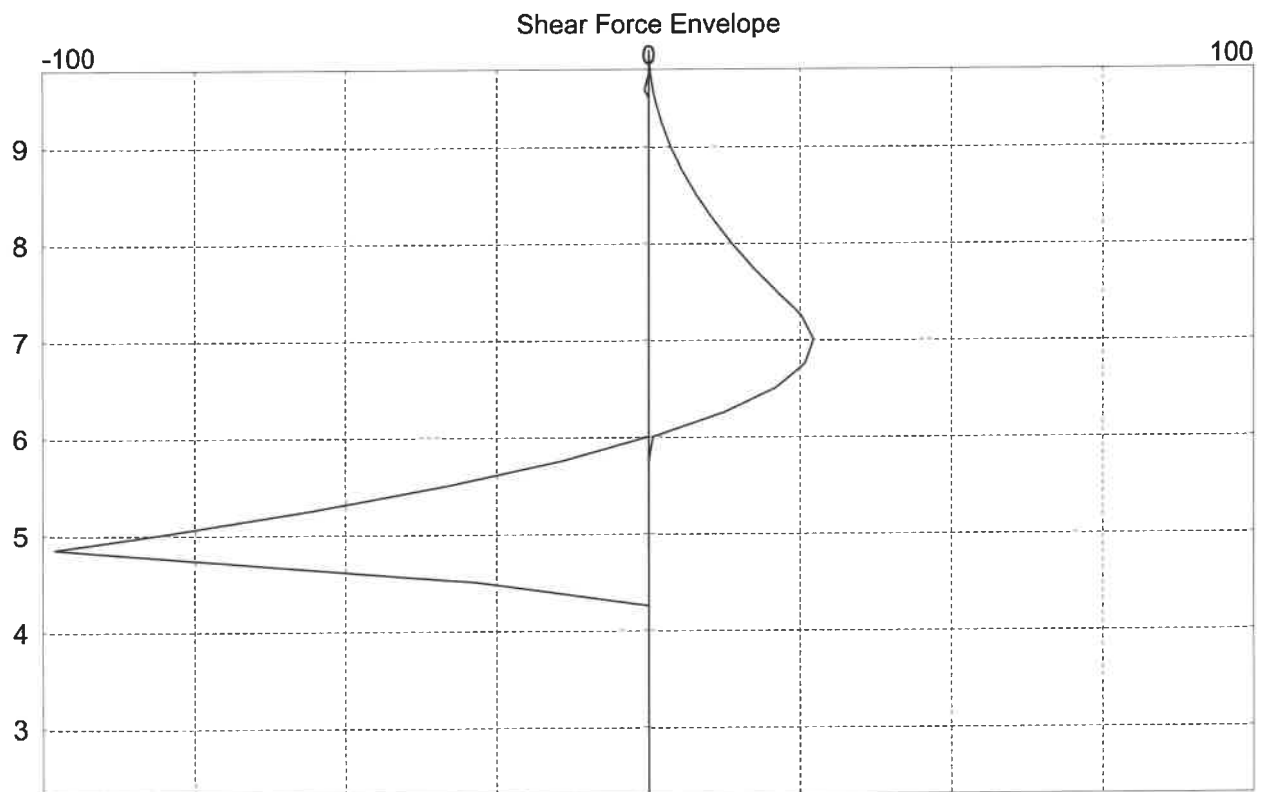
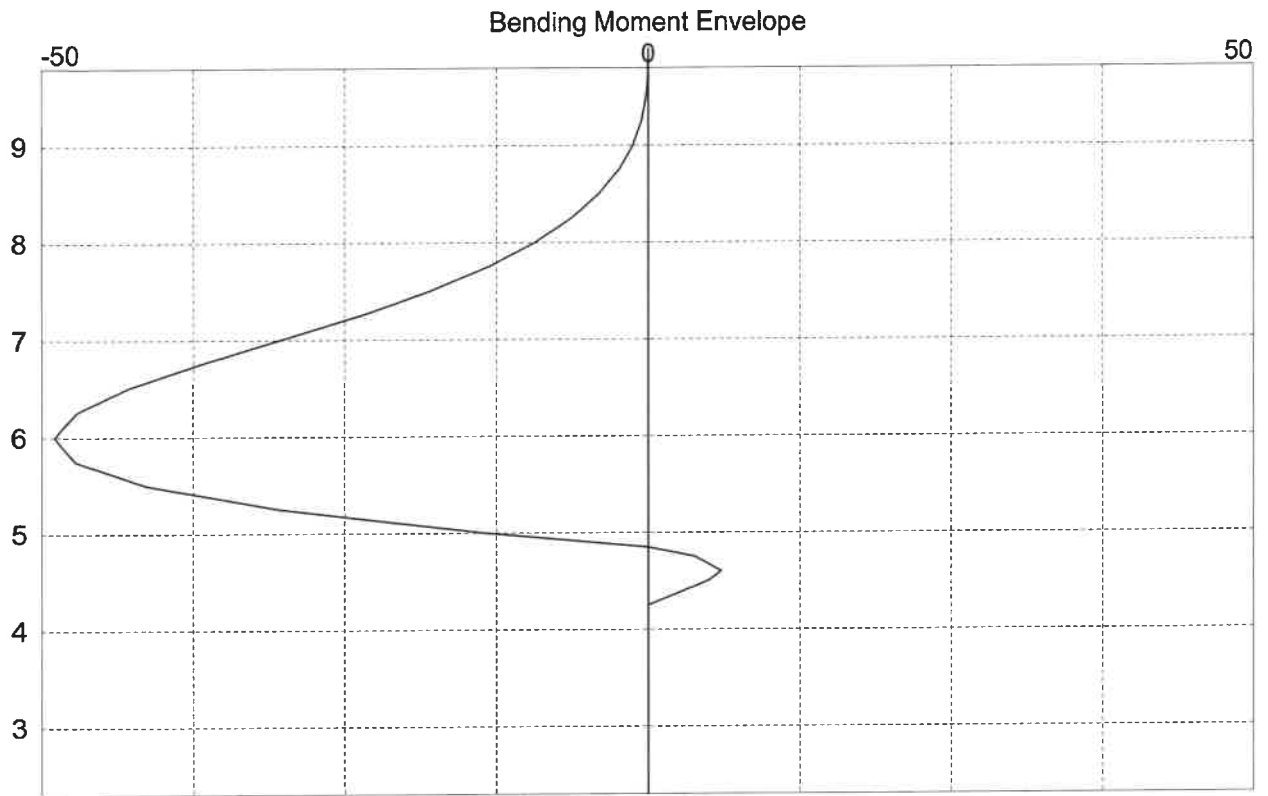
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

	Page No 7 Analysis SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project GE12875 File Name ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer TW Date 25/06/2024

Graphical plot of envelope from selected construction stages



	Page No Analysis	8 SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project File Name	GE12875 ...max case (2.5m).pws"
Herbert Road, Newport King Post Retaining Wall	Engineer Date	TW 25/06/2024

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
9.80	.0	.0	-2	.0	
9.59	.0	.1	-.7	.7	
9.00	.0	1.3	-3.6	.0	
8.00	.0	9.4	-13.6	.0	
7.30	.0	22.4	-24.4	.0	
7.30	.0	22.5	-24.4	.0	
7.00	.0	30.4	-27.2	.0	
6.00	.0	48.9	-.7	.0	
5.00	.0	13.4	.0	80.9	
4.85	.0	.0	.0	98.1	
4.60	-6.0	.0	.0	48.3	
4.60	-6.0	.0	.0	48.3	
4.00	.0	.0	.0	.0	
3.00	.0	.0	.0	.0	
2.30	.0	.0	.0	.0	

	Page No Analysis	9 SLS
CADS Piled Wall Suite Version 6.09 Design of embedded retaining walls and cofferdams	Project File Name	GE12875 ...max case (2.5m).pws"
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### Structural design of wall

#### Wall section properties

King pile steel ref UC 203 x 203 x 60	
King pile spacing	1800 mm
King pile pre-bore diameter	600 mm
Lagging material	Timber
Lagging thickness	150 mm

#### Wall material properties

Yield stress of steel	275 N/mm <sup>2</sup>
Bending stress ratio	1.55
Allowable bending stress	177 N/mm <sup>2</sup>
Allowable shear stress	106 N/mm <sup>2</sup>
Timber lagging grade	C24

#### Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Section Class. EC3 Section 5.5	3	1	Class
Bending resistance. EC3 6.2.5 Plastic	123	180	kNm
Shear resistance. EC3 6.2.6	247	352	kN
Bending combined with shear. EC3 6.2.8	123	151	kNm
Timber infill bending. BS5975:2019	7	31	kNm/m
Timber infill shear. BS5975:2019	16	132	kN/m

**RETAINING WALL DESIGN CALCULATIONS**

Site:	Herbert Road, Newport	Project Number:	GE12875
Date:	21 <sup>st</sup> June 2024	Revision:	A

**Appendix D – Wall Sections**

