

Job No: DFS191007

Design Engineer: AR

Date: 18 July 2020

Job Name: 44 CLEVELAND STREET LONDON
W1T 4JT

Calc Title: Detailed Design for Contiguous Pile Retaining Wall **Rev. 01**

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44 CLEVELAND STREET

LONDON W1T 4JT

Detailed Design for Ø450 Contiguous Pile Retaining Wall **Rev. 01**

Appointed Piling Contractor:

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Springfield Road
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W: www.hillpiling.com

Appointed Piling Contractor's Geotechnical Designers:

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**Foundations, Basements & Temporary Works
Specialist Consulting Geotechnical Engineers**
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Slough SL1 1FQ

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Project Engineers:

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Issued to:

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DESIGN STATUS & ISSUE RECORD

Revision	Status	Description	Design		Check	
			Engineer	Date	Engineer	Date
/	Construction	Detailed design for pile wall	AR	20/06/20	AA	20/06/20
Rev. 01	Construction	Revision based on Project Engineer's new pile loading information and retained heights.	AR	18/07/20	AA	18/07/20

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DETAILED DESIGN FOR Ø450 CONTIGUOUS PILE RETAINING WALL

1.0 INTRODUCTION

HILL Piling Limited has been appointed by Ark Build PLC to carry out the design and installation of the contiguous pile retaining wall for the proposed residential development on the above site in Fitzrovia, West London. The project is centred on the redevelopment of the former Middlesex Hospital Annex in Fitzrovia, London. This involves the refurbishment of some of the buildings on the site, the demolition of the wing buildings at the rear of the site and the construction of new multi-storey mixed-use buildings with single level basement on the site, to provide 50 No. residential units and commercial space on the site.

The approximate National Grid Reference for the 0.305 ha site is TQ 29266 81816. The topography of the site is relatively flat, with an approximately representative topographical level of +27.730m OD.

It is proposed to support the new multi-storey structures on reinforced concrete raft at basement level, while a contiguous bored pile retaining wall is required to enable the deep excavation for the proposed basement. Wall retained height varies between 3.6m – 4.6m.

Detailed designs for the proposed foundations for the site have been carried out and issued by others under separate cover. This particular report presents the detailed design for the proposed contiguous pile retaining wall only. The detailed design report is presented under the following headings:

- **INPUT DATA**
- **OUTLINE OF DESIGN**
- **TYPICAL SECTIONS CONSIDERED IN WALL ANALYSIS & DESIGN**
- **GROUND CONDITIONS**
- **PILE RETAINING WALL DESIGN**

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- Geotechnical Design

- Structural Design

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2.0 INPUT DATA

Design is based on the following site-specific documents received from Ark Build PLC:

- (i) AECOM's Geotechnical Report No. 60516144/MH-ACM-XX-XX-RP-GE-01 of 15 April 2020 – Middlesex Hospital Geotechnical and Geo-Environmental Ground Conditions Report.
- (ii) AECOM's Basement Impact Assessment Report No. 60516144/BIA/004, March 2018.
- (iii) Concept Engineering Consultants' Geotechnical Report No. 18/3104-FR01 of July 2018.
- (iv) AECOM's Document No. 60516144-MHA-ACM-XX-SP-SE-0002 – Groundwork Specification Bedford Passage Development RIBA Stage 4.
- (v) AECOM's Document No. 60516144-MHA-ACM-XX-SP-SE-0007 of 16 April 2020 – Movement & Tolerances Specification Bedford Passage Development Middlesex Annexe LLP Construction Stage 5.
- (vi) AECOM's Document No. 60516144-MHA-ACM-XX-SP-SE-0003 of 10 April 2018 – Concrete Specification Bedford Passage Development.
- (vii) AECOM's Document No. 60516144-MHA-ACM-XX-SP-SE-0009 of April 2020 – Specification for Piling & Embedded Retaining Walls Bedford Passage Development RIBA Stage 4.
- (viii) AECOM's Drawing No. 60516144-MHA-ACM-CS-XX-DR-S-0001 Rev. E – Cleveland Street/Bedford Passage Overall Plan Showing Boundary Wall Rebuild and Proposed Attenuation Tanks.
- (ix) AECOM's Drawing No. 60516144-MHA-ACM-CS-DR-S-0002 Rev. E – Cleveland Street/Bedford Passage Part Ground Floor Plan Showing Front Boundary Wall Rebuild and Proposed Attenuation Tanks (1 of 2).
- (x) AECOM's Drawing No. 60516144-MHA-ACM-CS-XX-DR-S-0003 Rev. E – Cleveland Street/Bedford Passage. Part Ground Floor Plan Showing Front Boundary Wall Rebuild and Proposed Attenuation Tanks (2 of 2).
- (xi) AECOM's (DW) Drawing Rev. A of 09.03.20 – Loading Data for Piling Contractor for the Front Boundary Wall at the Bedford Passage Development.

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- (xii) AECOM's Drawing No. 60516144-MHA-ACM-CS-XX-DE-S-0001 Rev. D – Cleveland Street/Bedford Passage. Sections.
- (xiii) AECOM's Drawing No. 60516144-MHA-ACM-CS-XX-DR-S-50001 Rev. C01 – Cleveland Street/Bedford Passage. RC Details of Capping Beam.

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3.0 OUTLINE OF DESIGN

- The detailed design for the contiguous pile retaining wall has been carried out in accordance with the recommendations of the ICE SPERW (2016), BS 8002 (1994), BS 8004 (1986), BS EN 1997-1:2004 Eurocode 7, BS EN 1992-1-1: 2004 Eurocode 2, PD6687:2006, CIRIA Report No. C760 (2017), London District Surveyors Association's (LDSA) Guidance Note No. 1 for Straight Shafted Bored Piles in London Clay (2018) and the BS 8110 (1997).
- Approx. 32.5 lm total run of contiguous bored pile retaining wall.
- Wall retained height varies between 3.6m – 4.6m.
- Contiguous pile wall shall comprise of 450mm dia. piles @ 600mm c/c.
- **Estimated maximum wall lateral deflection < 10mm.**
- CFA/SFA drilling technique for the contiguous pile wall.
- **The contiguous pile wall design accounts for 1:75 verticality tolerance and 75mm horizontal positional tolerance in accordance with the ICE Specification for Piling & Embedded Retaining Walls (ICE SPERW, 2015). Based on these, there is a potential for piles in the pile wall to encroach into the basement area by up to 140mm and it is imperative that the Architect and Main Contractor make allowance for this.**
- The pile retaining wall is designed to provide lateral retention in the temporary condition only, while the front of the pile wall shall be back-filled in the permanent condition. In the permanent condition, the pile wall is required to provide vertical support to compressive loading of 50 kN, 22 kN/m and 11 kN/m from proposed solid brick piers, boundary wall with railings and RC capping beam respectively. The design calculations presented in this report account for these accordingly.
- In all cases, the contiguous pile wall is designed to act as free-standing cantilever.
- **As already confirmed by the Project Structural Engineer, the design for the pile wall accounts for the fact that no building supported on shallow foundation lies within 4.5m to the rear of the proposed pile wall. Therefore, no structural surcharge has been allowed for in pile wall analysis and design. Only 10 kPa highway/traffic surcharge has been accounted for, as advised by the Project Structural Engineer.**
- Piling platform level has not been confirmed by the Main Contractor at this stage. However, for design purpose, piling platform level for the contiguous pile wall has been taken to be the existing ground level

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on the site; +27.730m OD. Nonetheless, the Main Contractor must confirm actual piling platform level(s) prior to the commencement of piling works, so that the current pile wall design/pile wall schedule can be amended accordingly.

- Estimation of pile wall vertical capacity in compression is based on a global factor of safety of 2.6 and a minimum partial factor of safety of 1.2 on shaft friction only. This is based on the assumption that no pile load tests would be carried out on the site (after LDSA, 2018).
- Estimation of pile wall axial capacities are based on 100% pile group efficiency for closely spaced perimeter pile groups, following the recommendations of Rose & Taylor (2010), Rose (2012), Rose et al. (2013), Broms (2007) & Kezdi (1957).
- While the Project Structural Engineer had specified grade C32/40 concrete for the pile retaining wall, the design presented in this report is based on grade C28/35 DS-4 AC-4 concrete.
- 75mm cover to pile reinforcement.
- All soil layers are conservatively assumed to exhibit drained behaviour and thus modelled with effective stress parameters in both temporary and permanent conditions.

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4.0 TYPICAL SECTIONS CONSIDERED IN WALL ANALYSIS & DESIGN

Typical sections considered in pile wall design are described below. Indicative location of each wall section is highlighted in the marked-up layout drawing attached to the appendices of this report.

CONTIGUOUS PILE WALL SECTION 1 – 1 (ADJACENT TO TANK 2, Ø450, FREE STANDING CANTILEVER): Assumed Piling Platform Level = Existing Ground Level = +27.730. Estimated Lowest Excavation Level Directly in Front of Wall = +23.140. Approx. 4.6m Maximum Retained Height. Wall Section is Designed to Act as Free-Standing Cantilever. 10 kPa Highways/Traffic Surcharge and 7.5 kNm/m Overturning Moment on Pile Wall due to Load Eccentricity and Wind Loading are Accounted for in Design. In Addition to Lateral Retention, the Pile Wall is Designed to Support Service Vertical Compressive Loading of 50 kN, 22 kN/m and 11 kN/m from Proposed Solid Brick Piers, Boundary Wall with Railings and Reinforced Concrete Capping Beam Respectively, as Specified by the Project Structural Engineer.

Proposed Sequence of Construction:

1. Install 450mm dia. piles @ 600mm c/c intervals from piling platform level (+27.730) to specified depths, to form contiguous pile retaining wall.
2. Breakdown piles and construct RC capping beam on piles.
3. Complete Bulk Excavation to Formation Level (+23.140); 4.6m Maximum Dig.
4. Back-fill excavation area once construction works are completed.

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CONTIGUOUS PILE WALL SECTION 2 – 2 (ADJACENT TO TANK 1, Ø450, FREE STANDING CANTILEVER): Assumed

Piling Platform Level = Existing Ground Level = +27.730. Estimated Lowest Excavation Level Directly in Front of Wall = +24.130. Approx. 3.6m Maximum Retained Height. Wall Section is Designed to Act as Free-Standing Cantilever. 10 kPa Highways/Traffic Surcharge and 7.5 kNm/m Overturning Moment on Pile Wall due to Load Eccentricity and Wind Loading are Accounted for in Design. In Addition to Lateral Retention, the Pile Wall is Designed to Support Service Vertical Compressive Loading of 50 kN, 22 kN/m and 11 kN/m from Proposed Solid Brick Piers, Boundary Wall with Railings and Reinforced Concrete Capping Beam Respectively, as Specified by the Project Structural Engineer.

Proposed Sequence of Construction:

1. Install 450mm dia. piles @ 600mm c/c intervals from piling platform level (+27.730) to specified depths, to form contiguous pile retaining wall.
2. Breakdown piles and construct RC capping beam on piles.
3. Complete Bulk Excavation to Formation Level (+24.130); 3.6m Maximum Dig.
4. Back-fill excavation area once construction works are completed.

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5.0 GROUND CONDITIONS

Based on the site-specific ground investigation reports outlined earlier in section 2.0 of this report, site stratigraphy at 44 Cleveland Street London W1T 4JT may be generalised as shown in table 1 below:

LEVEL (m OD)	DESCRIPTION	Measured N_{spt} Values
+27.700 – (+22.700)	Made Ground	1-49
+22.700 – (+18.700)	Loose to Medium Dense to Dense Gravel	10 - R
Below +18.700m OD	Stiff to Very Stiff Clay/Lambeth Group	18 - R

Table 1 – Generalised Site Stratigraphy

Soil parameters used in design are presented in table 2 overleaf. In table 2;

ϕ' values for the cohesionless layers/made ground have been deduced from N_{spt} values (after Peck, Hanson & Thorburn (1974)).

ϕ' values for the cohesive layers are deduced from plasticity indices (after CIRIA Report No. 104, 1984 & CIRIA Report No. C580, 2003).

E' values for cohesionless materials/made ground are estimated with the correlation: $E' = 2000 - 3000 * N_{spt}$ in kPa (after CIRIA Report No. 143, 1995 & CIRIA Report No. C580, 2003).

E' values for cohesive layers are deduced from the expression $E' = 0.8 * E_u$, where $E_u = 800 * C_u$.

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SOIL LAYER	N _{spt}	γ (kN/m³)	φ' (°)	C' (kPa)	C _u (kPa)	E _u	E' (kPa)
Made Ground	1-49	18.0	30.0	0.0	-	-	20000
Loose to Medium Dense to Dense Gravel	10 - R	20.0	37.0	0.0	-	-	75000
Stiff to Very Stiff Clay/Lambeth Group	18 - R	19.0	25.0	5.0	-	-	60000

Table 2 – Input soil parameters

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6.0 PILE RETAINING WALL DESIGN

(i) Geotechnical Design

The geotechnical design for the pile retaining wall involved three stages, which are summarised below;

- (i) Ultimate Limit State (ULS) Analysis – This involves the use of factored soil parameters to estimate the required embedment of the wall, for overall stability to be maintained. This analysis has been carried out with the 'CADS PWS 6.03' geostructural modelling programme. Analysis also provides information on ultimate bending moments, shear forces and if applicable, ultimate loads on the struts.
- (ii) Serviceability Limit State (SLS) Analysis – This involves the use of unfactored soil parameters to estimate the lateral displacement of the wall, as well as service bending moments, shear forces and if applicable, service loads on the struts. The analysis has been carried out with the 'CADS PWS 6.03' geostructural modelling programme.
- (iii) Wall Capacity under Vertical Axial Loading – This is based on the traditional bearing capacity approach for axially loaded piles. Design is based on 100% pile group efficiency for perimeter pile groups in clay, as proposed by Rose & Taylor (2010), Rose (2012) and Rose et al. (2013).

MS Excel spreadsheet showing pile axial capacity calculations for piles is attached to the appendices of this report.

The results of the wall analysis and design are presented in the form of a pile wall schedule, which is attached to the appendices of this report.

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(ii) Structural Design

The 'CADS PWS 6.03' geosstructural modelling programme has also been used to design the reinforcement bars in the piles. Relevant computer output files are attached to the appendices of this report.

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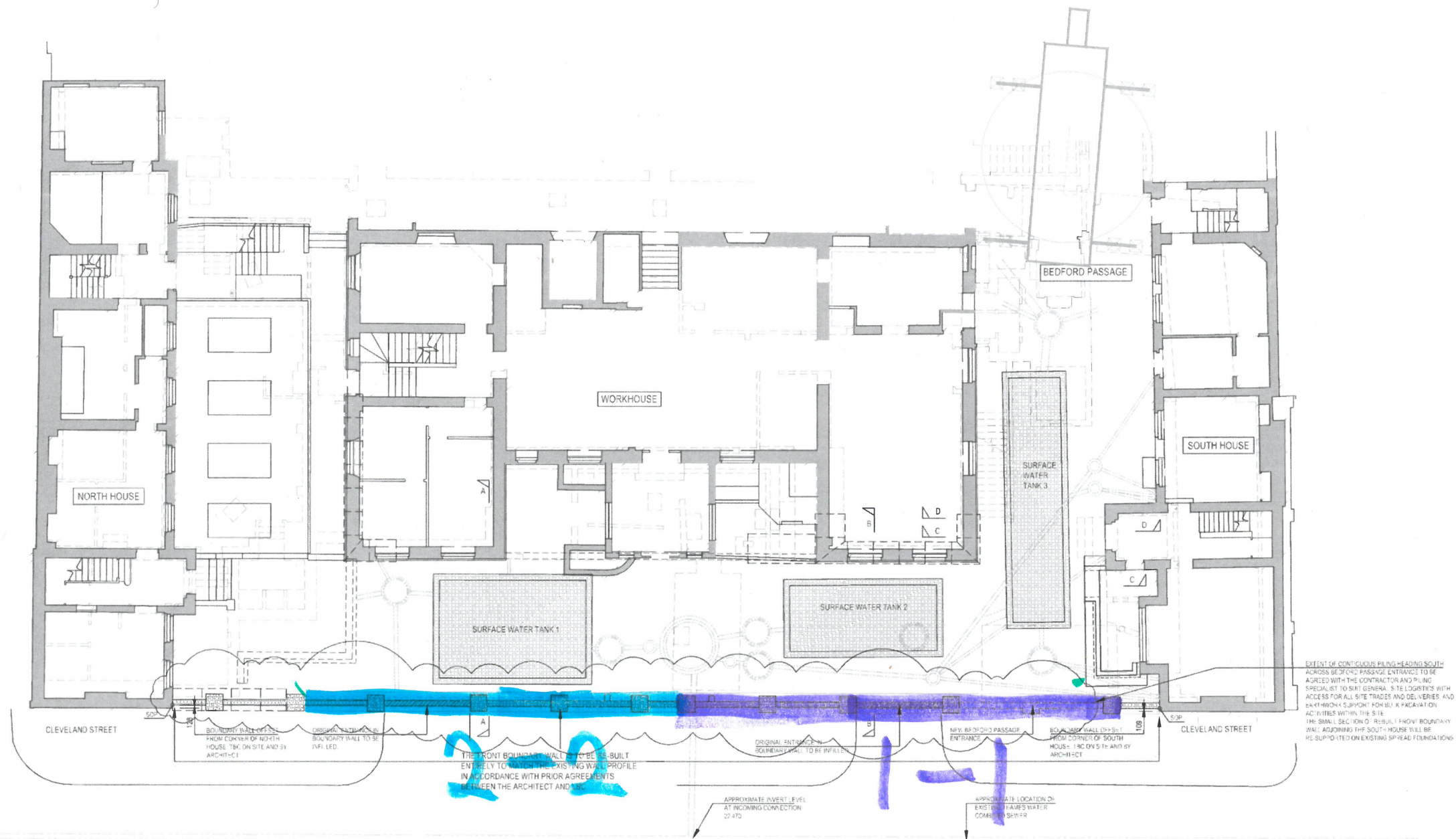
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MARKED-UP LAYOUT ILLUSTRATING THE LOCATIONS OF DESIGN
SECTIONS



EXISTING GROUND FLOOR PLAN

(1:100 @ A1)

BELOW GROUND DRAINAGE SHOWN ON THIS DRAWING IS INDICATIVE.
REFER TO CIVIL ENGINEERS DRAWINGS FOR DRAINAGE DETAILS AND LEVELS.

FOR SECTION DETAILS REFER TO DRAWING MHA-ACM-CS-XX-DE-S-0001

AECOM

PROJECT

BEDFORD PASSAGE DEVELOPMENT

CLIENT

MIDDLESEX ANNEXE LLP

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA
www.aecom.com

GENERAL NOTES

1. FOR GENERAL NOTES REFER TO DRAWING No.
MHA-ACM-CS-XX-GN-S-0001.

ISSUE/REVISION

NO	DATE	DESCRIPTION
E	20.05.2020	PILES MOVED AND CAPPING BEAM SIZE ALTERED.
D	18.05.2020	PILE DIAMETER ALTERED.
C	14.05.2020	SURFACE WATER TANK 1 MOVED. SURFACE WATER TANK 2 SIZE REVISED. THAMES WATER SEWER ADDED. WALL NOTES ADDED.
B	10.10.2019	SURFACE WATER TANK 2 SIZE AND LOCATION REVISED. UPGRADING INDICATED. PILES REMOVED.
A	05.09.2019	INITIAL ISSUE FOR COMMENT
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60516144

SHEET TITLE

CLEVELAND STREET / BEDFORD PASSAGE.
OVERALL PLAN SHOWING BOUNDARY WALL
REBUILD AND PROPOSED ATTENUATION
TANKS.

SHEET NUMBER

MHA-ACM-CS-XX-DR-S-0001

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Pile Wall Schedule



44 CLEVELAND STREET LONDON W1
Contiguous Pile Wall: **OPTION 1** - Free Standing 450mm Dia. Piles @ 600m c/c
Preliminary Wall Schedule
Rev 04

SHEET NO.:
ENQUIRY NO.
CREATED BY:
DATE:

AR
18/07/2020

of
JOB NO.:
CHECKED BY: AA
DATE: 18/07/2020

Pile Wall Section	Wall type	Technique	Temporary Condition	Permament Condition	Wall Length	Proposed PPL	Highest Finished Ground Level	Lowest Excavation Level in Front of Wall	Design Retained level	P/H	Retained height	Pile Dia.	Maximum Pile Spacing c/c	Pile Retaining Toe	No. of Piles	Bored/ Driven Length	Maximum Pile Concreted Length	CADS PWS 6.03 Estimated lateral deflection at COL	Max anticipated lateral deflection at COL	Steel	Steel top	Steel toe	Steel Length	Steel grade
					(m run)	(MOD)	(MOD)	(MOD)	(MOD)		(m)	(mm)	(mm)	(MOD)		(m)	(m)	(mm)	(mm)		(MOD)	(MOD)	(m)	
SECTION 1 - 1	450mm Dia. Contiguous Pile Wall	CFA/SFA	Free Standing Cantilever	N/A; Pile Wall to be Back-Filled	17.5	27.700	27.700	23.140	27.700	0.97	4.6	450	600	18.700	30	9.0	9.0	18	< 10	6 - B20 x 9m & B10 links @ 140mm c/c	27.700	18.700	9.0	B500B
SECTION 2 - 2	450mm Dia. Contiguous Pile Wall	CFA/SFA	Free Standing Cantilever	N/A; Pile Wall to be Back-Filled	15.0	27.700	27.700	24.100	27.700	1.22	3.6	450	600	19.700	25	8.0	8.0	7	< 10	4 - B20 x 8m & B8 links @ 150mm c/c	27.700	19.700	8.0	B500B
					32.5 m run																			
Total																								55

Design Notes:

Support to Vertical Compressive Loading
Based on the Pile Lengths Recommended in the above Table, the Pile Wall can Safely Support Combined Service Vertical Compressive Loading of 50 KN, 22 kN/m & 11 kN/m from Proposed Solid Brick Piers, Boundary Wall with Railings and RC Capping Beam Respectively, as Requested by the Project Structural Engineer.

Groundwater Cut-off
The contiguous pile wall cannot provide groundwater cut-off.

Concrete grade C28/35 DS-4 AC-4 concrete for piles

75mm cover to pile reinforcement

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Site-Specific Exploratory Hole Logs

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 21/01/20 Date Completed 23/01/20	Ground Level (mOD) 26.75	Co-Ordinates E 529306.07 N 181820.44	Final Depth 35.00m
Client University College London Hospitals Charity			Method/ Plant Used Cable Percussion	Sheet 2 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
21/01/20	8.50	12.1			(2.00)	Very stiff, fissured grey micaceous silty CLAY. Fissures are vertical. (THAMES GROUP: LONDON CLAY FORMATION - A3i) 11.50 ... with occasional bioturbation, white flecks and 1No wood fragment	11.00-11.45 11.00	D40	N50/ 75 mm	3, 5 / 50	
21/01/20	8.50	Dry					11.50-11.95 12.00 12.00-12.45 12.00	UT41 D42 D43	100 blows N16	100% Recovery VOC 0.2ppm 10, 5 / 3, 4, 4, 5	
							12.50-12.95	UT44	60 blows	100% Recovery	
			13.75		13.00		13.00 13.00 13.00	D45 D46		VOC 0.1ppm 3, 4 / 5, 7, 7, 9	
21/01/20	8.50	Dry				Stiff, grey slightly sandy silty CLAY with occasional dark grey flecks. Sand is fine. (THAMES GROUP: LONDON CLAY FORMATION - A2) 13.50 ... with occasional pockets of dark and light grey silty fine sand (<10mm)	13.80	D47			
22/01/20	8.50	Dry					14.00-14.45	UT48	60 blows	100% Recovery VOC 0.2ppm	
							14.50 14.50 14.50-14.95	D49 D50	N33	4, 6 / 7, 7, 9, 10 VOC 0.1ppm	
						15.30 ... with frequent bioturbation, white flecks, rare shell fragments and no sand	15.30 15.50-15.95	D51 UT52		75% Recovery	
						16.00 ... becoming slightly sandy and dark brown with frequent pockets of dark and light grey silty fine sand	16.00-16.45 16.00 16.00	D53 D54	N33	VOC 0ppm 4, 6 / 7, 8, 9, 9	
							16.80 17.00-17.45	D55 UT56		100% Recovery VOC 0ppm	
							17.50 17.50 17.50-17.95	D57 D58	N33	4, 6 / 7, 7, 9, 10 VOC 0ppm	
						18.20 ... becoming fissured. Fissures are vertical	18.20 18.50-18.95	D59 UT60		90% Recovery	
							19.00 19.00 19.00-19.45	D61 D62	N32	4, 6 / 6, 7, 9, 10 VOC 0ppm	
			6.95		19.80		19.80	D63		100% Recovery VOC 0ppm	
						Very stiff, dark brownish grey slightly sandy micaceous silty CLAY with occasional pockets of dark grey silty fine sand (<20mm), white flecks and frequent bioturbation. Sand is fine. (THAMES GROUP: LONDON CLAY FORMATION - A2) 21.00 ... with 2No pyrite nodules (<20mm) and 1No claystone fragment (<50mm) 21.20 ... becoming fissured. Fissures are subhorizontal with light greyish white staining	20.00-20.45 20.50 20.50-20.95	UT65 D64 D66	70 blows N33	5, 5 / 6, 8, 9, 10 VOC 0ppm	
							21.20 21.50-21.95	D67 UT68		90% Recovery	
							22.00	D69		VOC 0.1ppm	

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 21/01/20	Ground Level (mOD) 26.75	Co-Ordinates E 529306.07 N 181820.44	Final Depth 35.00m
Date Completed 23/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Cable Percussion	Sheet 3 of 4		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
22/01/20	8.50	Well	-0.55		22.00 ... with occasional pockets of light grey fine sand and frequent pockets of dark grey silty fine sand (<30mm) 22.00 ... with 1 No pyrite nodule (20mm)	22.00-22.45 22.00	D70		N33	5, 7 / 7, 7, 9, 10	
						22.80	D71				
						23.00-23.45	UT72	75 blows	90% Recovery VOC 0.1ppm		
			3.25		23.50	23.00 ... with rare pyrite nodules (<25mm)	23.50		N39	6, 7 / 8, 9, 10, 12	
						Very stiff, dark brownish grey sandy CLAY with frequent pockets of light grey and dark grey fine sand and bioturbation. Sand is fine. (THAMES GROUP: LONDON CLAY FORMATION - A2)	23.50-23.95	D73 D74		VOC 0.2ppm	
					(1.50)		24.20	D76			
							24.50-24.95	UT75	100 blows	75% Recovery	
			1.75		25.00		25.00	D77 D78		VOC 0.3ppm	
						Very stiff, closely fissured grey mottled light blue slightly sandy CLAY with rare pockets of white silt (<10mm). Fissures are 30° subvertical and subhorizontal. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	25.00-25.45 25.00		N50/ 240 mm	7, 12 / 13, 15, 15, 7	
					(2.30)	25.40 ... becoming light grey mottled light blue and light purple	25.80	D79			
						25.80 ... becoming mottled light blue, dark green and red	26.00-26.45	UT80	100 blows	70% Recovery VOC 0.1ppm	
						26.50 ... with pockets of dark brown slightly sandy clay	26.50		N50/ 235 mm	6, 7 / 10, 14, 21, 5	
							26.50	D81			
							26.50-26.95	D82		VOC 0.3ppm	
22/01/20	8.50	Well	-0.55		27.30		27.30	D83			
22/01/20	8.50	Dry				Very stiff, light bluish grey mottled dark brownish green and white very sandy CLAY. Sand is fine. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	27.50-27.95	UT84	100 blows	100% Recovery	
					(1.50)	28.00 ... becoming slightly sandy and light bluish grey mottled brown	28.00	D85 D87		VOC 0.1ppm	
						28.00 ... becoming very sandy	28.00-28.45 28.00		N50/ 157 mm	7, 10 / 14, 20, 16	
			-2.05		28.80		28.80	D86			
						Very stiff, reddish brown mottled red and bluish grey sandy CLAY. Sand is fine. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	29.00-29.45	UT88	100 blows	60% Recovery VOC 0ppm	
					(2.65)		29.50		N50/ 205 mm	6, 9 / 15, 21, 14	
22/01/20	8.50	Dry					29.50	D89		VOC 0.4ppm	
23/01/20	8.50					30.20 ... becoming brown mottled bluish grey and brownish green	29.50-29.95 30.20	D90 D91			
							30.50-30.95	UT92	100 blows	20% Recovery	
						31.00 becoming very sandy	31.00	D93 D94		VOC 0.5ppm	
			-4.70		31.45		31.00-31.45 31.00		N50/ 232 mm	6, 9 / 11, 12, 12, 15	
			-5.05		31.80	Very dense, light brown silty fine SAND. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds- Sand Channel)	31.80	D95			
						Very stiff, grey sandy CLAY with pockets of light grey and light brown fine sand (<20mm) and dark grey silty sandy (<50mm). (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	32.00-32.45	UT96	100 blows	90% Recovery VOC 0.1ppm	
						32.50 ... with frequent pyritised wood	32.50		N50/ 240 mm	4, 9 / 12, 15, 18, 5	
							32.50-32.95	D97		VOC 0.2ppm	

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 21/01/20 Date Completed 23/01/20	Ground Level (mOD) 26.75	Co-Ordinates E 529306.07 N 181820.44	Final Depth 35.00m
Client University College London Hospitals Charity			Method/ Plant Used Cable Percussion	Sheet 4 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20	8.50	Dry	-8.25		(3.20) 35.00	fragments (<100mm) and 1No leaf (<10mm) 33.00 ... becoming very sandy	32.50 33.20 33.50-33.95 34.00 34.00-34.45 34.00 35.00	D98 D99 UT100 D101 D102 D103	100 blows N50/ 205 mm	100% Recovery VOC 0.2ppm 7, 11 / 14, 21, 15 VOC 0.2ppm	
						End of Borehole					

Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 24/01/20
Date Completed 28/01/20

Ground Level (mOD)
26.20

Co-Ordinates
E 529275.54 N 181848.30

Final Depth
35.00m

Client

University College London Hospitals Charity

BOREHOLE SUMMARY

Top (m)	Base (m)	Type	Date Started	Date Ended	Crew	Logged By	Core Barrel (mm)	Core Bit	Plant Used/ Method	SPT Hammer Reference
0.00 1.20	1.20 35.00	IP CP	24/01/2020 24/01/2020	24/01/2020 28/01/2020	SDA SDA	CS CS			Hand Excavated Dando 175	AR1607

WATER STRIKES

WATER ADDED

CHISELLING / SLOW DRILLING

Strike at (m)	Rise to (m)	Time to Rise (min)	Casing Depth (m)	Sealed (m)	From (m)	To (m)	From (m)	To (m)	Duration (hr)	Remarks
					5.00	5.90				

HOLE

CASING

ROTARY RECOVERY

Depth (m)	Diameter (mm)	Depth (m)	Diameter (mm)	From (m)	To (m)	Blows	Recovery (%)
0.00 35.00	200 200	0.00 6.20	200 200				

ROTARY FLUSH DETAIL

From (m)	To (m)	Flush Type	Flush Return (%)	Flush Colour

INSTALLATION DETAILS

Type	Diameter (mm)	Depth of Installation (m)	Top of Response Zone (m)	Bottom of Response Zone (m)	Date of Installation
SPG/GW SPIE	50 19	5.90 19.00	4.50 18.00	5.90 20.00	28/01/2020 28/01/2020

BACKFILL DETAILS

Top (m)	Bottom (m)	Material	Backfill Date
0.00 0.30 4.50 5.90 18.00 20.00	0.30 4.50 5.90 18.00 20.00 35.00	Concrete/ Flush Cover Bentonite Pellets Pea Shingle Bentonite Pellets Pea Shingle Bentonite Pellets	28/01/2020

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20	Ground Level (mOD) 26.20	Co-Ordinates E 529275.54 N 181848.30	Final Depth 35.00m
Date Completed 28/01/20				

Client

University College London Hospitals Charity

PROGRESS

SPT DETAILS

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks	Type	Depth (m)	N Value	Blow Count / 75mm	Casing Depth (m)	Water Depth (m)
24/01/20	0.00		Dry	... Water Added	C	1.50	N2	1, 0 / 0, 0, 1, 1	1.50	Dry
24/01/20	1.20	1.50	Dry		C	2.50	N6	1, 1 / 2, 1, 1, 2	2.50	Dry
24/01/20	5.00	4.50	Wet		S	3.50	N1	0, 0 / 0, 1, 0, 0	3.50	Dry
24/01/20	5.50	5.50	3.00		C	4.50	N36	3, 5 / 6, 9, 10, 11	4.50	Dry
24/01/20	6.50	6.20	Dry		C	5.50	N30	4, 5 / 7, 8, 7, 8	5.50	Dry
24/01/20	15.00	6.20	Dry		S	7.00	N20	3, 4 / 4, 5, 5, 6	6.20	Dry
27/01/20	15.00	6.20	Dry		S	8.00	N22	3, 4 / 5, 5, 6, 6	6.20	Dry
27/01/20	30.00	6.20	Dry		S	9.00	N23	4, 4 / 5, 6, 6, 6	6.20	Dry
28/01/20	30.00	6.20	Dry		S	10.00	N23	3, 5 / 5, 5, 6, 7	6.20	Dry
28/01/20	35.00	6.20	Dry		S	11.00	N24	4, 4 / 5, 6, 6, 7	6.20	Dry
					S	12.50	N26	4, 5 / 6, 6, 7, 7	6.20	Dry
					S	14.00	N27	4, 5 / 6, 6, 7, 8	6.20	Dry
					S	15.50	N31	4, 6 / 6, 7, 9, 9	6.20	Dry
					S	17.00	N32	4, 6 / 7, 7, 9, 9	6.20	Dry
					S	18.50	N34	5, 6 / 8, 8, 8, 10	6.20	Dry
					S	20.00	N34	4, 7 / 7, 8, 9, 10	6.20	Dry
					S	21.50	N39	5, 8 / 9, 8, 10, 12	6.20	Dry
					S	23.00	N40	6, 8 / 8, 10, 10, 12	6.20	Dry
					S	24.50	N44	6, 9 / 9, 11, 12, 12	6.20	Dry
					S	26.00	N50/0.23	6, 10 / 12, 14, 14, 10	6.20	Dry
					S	27.50	N50/0.23	5, 11 / 13, 15, 19, 3	6.20	Dry
					S	29.00	N50/0.153	8, 12 / 18, 20, 12	6.20	Dry
					S	30.50	N50/0.007	11, 14 / 50	6.20	Dry
					S	31.50	N50/0.17	10, 13 / 29, 21	6.20	Dry
					S	33.50	N50/0.157	7, 12 / 15, 16, 19	6.20	Dry
					S	35.00	N50/0.205	11, 14 / 26, 24	6.20	Dry

GENERAL REMARKS

- UXO carried out in the borehole.

KEY

SAMPLES

- ES - Environmental Sample (Tub, Vial, Jar)
- U - 100mm Diameter Undisturbed Sample
- UT - 100mm Diameter Thin Wall Undisturbed Sample
- U38 - 38mm Diameter Undisturbed Sample
- D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample
- C - Core Sample, W-Water Sample, R-Root Sample

INSTALLATION DETAILS

- SPIE - Standpipe Piezometer
- SPGW - Groundwater Monitor Standpipe
- SPG/GW - Gas / Groundwater Monitor Standpipe
- VWP - Vibrating Wire Piezometer
- ICM - Inclinator

HOLE TYPES

- IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
- CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
- DS - Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
- DC - Diamond Coring, CDR-Cable Percussion Rotary follow on

TESTS S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compounds

Note: All depths are in metres, all diameters in millimetres, water strike rise time in minutes. For details of abbreviations see Key

Issue No: 01

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Log Print Date & Time: 02/04/2020 11:04

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20	Ground Level (mOD) 26.20	Co-Ordinates E 529275.54 N 181848.30	Final Depth 35.00m
Date Completed 28/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Cable Percussion	Sheet 1 of 4		

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
24/01/20		Dry				Dark brown clayey very gravelly fine to medium SAND with low brick and concrete cobble content. Gravel comprises angular to subrounded fine to coarse flint, brick, concrete and tile fragments.	0.10 0.30 0.30-0.50 0.50 0.50-0.70	ES1 ES2 B3 ES4 B5		VOC 0.1ppm VOC 0.2ppm VOC 0.2ppm	
24/01/20	1.50	Dry	25.20		1.00	(MADE GROUND) 0.30 ... with 1No metal pipe fragment 0.50 ... with medium brick and concrete cobble content and occasional gravel size coal and slab fragments 0.60 ... becoming very clayey	1.00 1.00 1.20 1.50 1.50 1.50	ES6 B7 D8 B10 ES9		VOC 0.3ppm	
					(1.50)	Very soft, brown sandy very gravelly CLAY. Gravel comprises angular to subrounded fine to coarse flint, brick, concrete and coal fragments. Sand is fine to medium.	2.00	ES11	N2	1, 0 / 0, 0, 1, 1 VOC 0.3ppm	
			23.70		2.50	(MADE GROUND) 1.50 ... with occasional tile fragments, rare bone fragments and chalk and limestone gravel	2.50 2.50-2.80 2.50	ES12 B13		VOC 0.4ppm	
			23.40		2.80		2.80 3.00	D14 ES15	N6	1, 1 / 2, 1, 1, 2 VOC 0.4ppm	
					(0.70)	Firm, dark grey gravelly sandy silty CLAY with medium strong organic odour. Gravel comprises subangular to subrounded fine to coarse flint, chalk, brick, clay tile and bone fragments.	3.50 3.50 3.50	ES16 B17		VOC 0.3ppm	
			22.70		3.50	(MADE GROUND)			N1	0, 0 / 0, 1, 0, 0 VOC 0.2ppm	
					(0.90)	Firm, dark greyish black silty CLAY with strong organic odour.	4.00	ES18			
			21.80		4.40	(MADE GROUND)	4.40 4.40 4.50-5.00 4.50 5.00	ES19 D20 B21		VOC 0.2ppm	
24/01/20	4.50	Wet	21.20		5.00	(MADE GROUND)		D22	N36	3, 5 / 6, 9, 10, 11	
24/01/20	5.50	3.00			(0.90)	Dense, dark grey mottled black slightly gravelly silty clayey fine to medium SAND with pockets of black organic material and medium strong organic odour. Gravel is subangular to subrounded fine to medium flint.	5.30 5.50 5.50-5.90 5.50 5.90	ES23 D24 B25		VOC 0.2ppm	
			20.30		5.90	(MADE GROUND)		ES25A	N30	4, 5 / 7, 8, 7, 8 VOC 0.2ppm	
			20.00		6.20	4.50 ... becoming dark grey	6.20	D26			
24/01/20	6.20	Dry				Medium dense, brown sandy subangular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse.	6.50-6.95	UT27	30 blows	50% Recovery	
					(4.30)	(LYNCH HILL GRAVEL MEMBER)	7.00 7.00 7.00	D28 D29	N20	3, 4 / 4, 5, 5, 6	
						Stiff, brown mottled orange silty CLAY. (THAMES GROUP: WEATHERED LONDON CLAY FORMATION)	7.50-7.95	UT30	50 blows	80% Recovery	
						Stiff, brownish grey silty CLAY with 1No pyrite nodule (<20mm). (THAMES GROUP: LONDON CLAY FORMATION - A3ii)	8.00 8.00-8.45 8.00	D31 D32			
						8.00 ... with occasional pockets of light brown silty fine sand (<100mm)	8.50-8.95	UT33	N22	3, 4 / 5, 5, 6, 6 100% Recovery	
						9.00 ... with rare bioturbation	9.00 9.00-9.45 9.50-9.95	D34 D35	N23	4, 4 / 5, 6, 6, 6	
								UT36	50 blows	100% Recovery	
						10.00 ... with rare pockets of light brown silty fine sand	10.00 10.00-10.45 10.50-10.95	D37 D38	N23	3, 5 / 5, 5, 6, 7	
			15.70		10.50			UT39	50 blows	70% Recovery	
						Stiff, brown greyish silty CLAY. (THAMES GROUP: LONDON CLAY FORMATION - A3i)	11.00		N24	4, 4 / 5, 6, 6, 7	

Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 24/01/20
Date Completed 28/01/20

Ground Level (mOD)
26.20

Co-Ordinates
E 529275.54 N 181848.30

Final Depth
35.00m

Client

University College London Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
2 of 4

PROGRESS

STRATA

SAMPLES & TESTS

Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/Backfill
24/01/20	6.20	Dry				11.00 ... with rare white flecks	11.00 11.00-11.45	D40 D41			
27/01/20	6.20	Dry			(2.00)		11.80 12.00-12.45	D42 UT43	60 blows	90% Recovery	
			13.70		12.50	Stiff, brownish grey sandy CLAY with frequent pockets of grey silt (<8mm), occasional pockets of dark brown and dark grey silty fine sand and bioturbation. Sand is fine to medium. (THAMES GROUP: LONDON CLAY FORMATION - A2)	12.50 12.50 12.50-12.95	D44 D45	N26	4, 5 / 6, 6, 7, 7	
						14.00 ... becoming slightly sandy with occasional pockets of grey silt (<7mm), white flecks and bioturbation	13.20 13.50-13.95	D46 UT47	60 blows	90% Recovery	
						16.00 ... with frequent bioturbation and white flecks	14.00 14.00 14.00-14.45	D48 D49	N27	4, 5 / 6, 6, 7, 8	
						17.00 ... with occasional bioturbation and white flecks	14.80 15.00-15.45	D50 UT51	65 blows	60% Recovery	
						18.00 ... with 1No pyritised wood fragment (<40mm)	15.50 15.50 15.50-15.95	D52 D53	N31	4, 6 / 6, 7, 9, 9	
						19.00 - 20.00 ... becoming very sandy with pockets of white silt and bioturbation	16.20 16.50-16.95	D54 UT55	80 blows	VOC 1.1ppm 90% Recovery	
						21.00 ... with pockets of dark grey and brown fine sand (<50mm)	17.00 17.00-17.45 17.00	D56 D57	N32	VOC 1.2ppm 4, 6 / 7, 7, 9, 9	
							17.80 18.00-18.45	D58 UT59	80 blows	100% Recovery VOC 0.3ppm	
					(12.00)		18.50 18.50 18.50-18.95	D60 D61	N34	5, 6 / 8, 8, 8, 10	
							19.20 19.50-19.95	D62 UT63	80 blows	VOC 0.3ppm 90% Recovery	
							20.00 20.00-20.45 20.00	D64 D65	N34	VOC 0.2ppm 4, 7 / 7, 8, 9, 10	
							20.80 21.00-21.45	D66 UT67	80 blows	90% Recovery VOC 0.3ppm	
							21.50 21.50 21.50-21.95	D68 D70	N39	5, 8 / 9, 8, 10, 12	
										VOC 0ppm	

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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20	Ground Level (mOD) 26.20	Co-Ordinates E 529275.54 N 181848.30	Final Depth 35.00m
Date Completed 28/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Cable Percussion			Sheet 3 of 4

PROGRESS			STRATA				SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result			
27/01/20 28/01/20	6.20 6.20	Dry Dry	1.70		24.50	22.00 ... becoming very sandy with occasional bioturbation and 2No pyrite nodules (<30mm)	22.20	D69	80 blows	100% Recovery		
						22.50-22.95	UT71					
			23.00	D72	N40	6, 8 / 8, 10, 10, 12						
			23.00-23.45	D73								
			23.00									
			0.20		(1.50)	26.00	24.00 ... with 1No pyrite nodule (<25mm)	23.80	D74	90 blows	70% Recovery VOC 0ppm	
							24.00-24.45	UT75				
			24.50	D76	N44	6, 9 / 9, 11, 12, 12						
			24.50	D77								
			24.50-24.95									
			-0.20		(1.00)	27.00	Very stiff, yellowish brown mottled light greyish blue and light orange slightly sandy silty CLAY with pockets of cream brown medium sand. Sand is fine. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	25.20	D78	100 blows	60% Recovery	
								25.50-25.95	UT79			
			-0.80		(1.00)	27.00	Very stiff, red mottled brownish green and grey silty CLAY. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	26.00	D80			N50/ 230 mm
								26.00-26.45	D81			
			26.00	D82	100 blows	50% Recovery VOC 0.2ppm						
			26.80				UT83					
			27.00-27.45									
			-3.80		(3.00)	30.00	Very stiff, greenish brown mottled reddish brown and light blue sandy silty CLAY with rare rootlets. Sand is fine to medium. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	27.50	D84 D85 D86	N50/ 230 mm	5, 11 / 13, 15, 19, 3	
								27.50-27.95				
			-4.30		(1.90)	32.40	31.00 ... with pockets of very soft grey very sandy clay (<200mm). Sand is fine to medium	28.20				D88 D89
								28.50-28.95	UT87			
			-6.20		(1.90)	32.40	32.00 ... with pockets of black wood fragments (<30mm)	29.00	D90	N50/ 170 mm	10, 13 / 29, 21	
								29.00-29.45				100 blows
29.00	D92	VOC 0.1ppm										
-6.20			(1.90)	32.40	32.00 ... with pockets of black wood fragments (<30mm)	29.80	D93 D94	N50/ 170 mm	VOC 0ppm			
						30.00-30.45				UT91		
30.50	D95 B96	VOC 0ppm										
30.50-30.95			100 blows	70% Recovery VOC 0ppm								
30.50												
31.20	D97	70% Recovery										
31.50			100 blows	70% Recovery								
31.50-32.00												
31.50-32.00												
32.40	UT98	100 blows	70% Recovery									

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20 Date Completed 28/01/20	Ground Level (mOD) 26.20	Co-Ordinates E 529275.54 N 181848.30	Final Depth 35.00m
Client University College London Hospitals Charity			Method/ Plant Used Cable Percussion	Sheet 4 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
28/01/20	6.20	Dry	-8.80		(2.60) 34.00 ... becoming light purplish grey mottled red and light blue 34.50 ... becoming mottled light purple and light grey 35.00	34.00 ... becoming light purplish grey mottled red and light blue 34.50 ... becoming mottled light purple and light grey End of Borehole	33.50 33.50-33.95 33.50 34.20 34.50-34.95 35.00 35.00 35.00	D100 D99 D101 UT102 D103 D104	N50/ 157 mm 100 blows N50/ 205 mm	VOC 1.1ppm 7, 12 / 15, 16, 19 VOC 0ppm 60% Recovery VOC 0ppm 11, 14 / 26, 24	

Southern Testing
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

SPT Hammer Ref: AR1607
Test Date: 05/02/2020
Report Date: 05/02/2020
File Name: AR1607.spt
Test Operator: NPB

Instrumented Rod Data

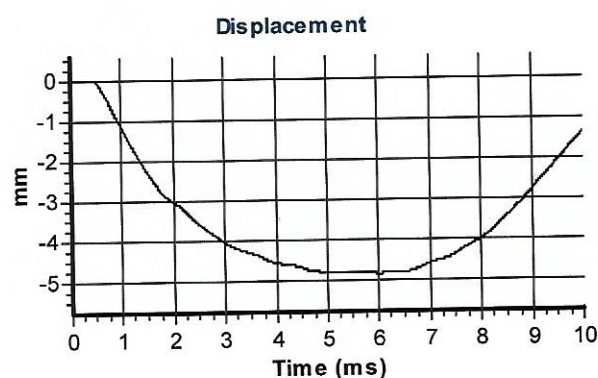
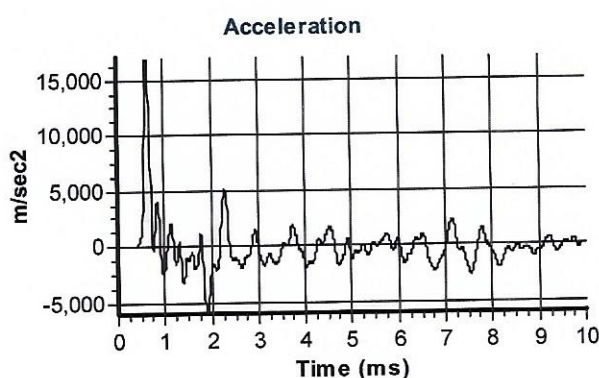
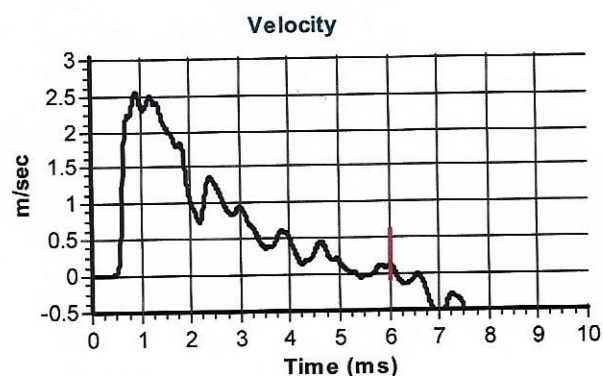
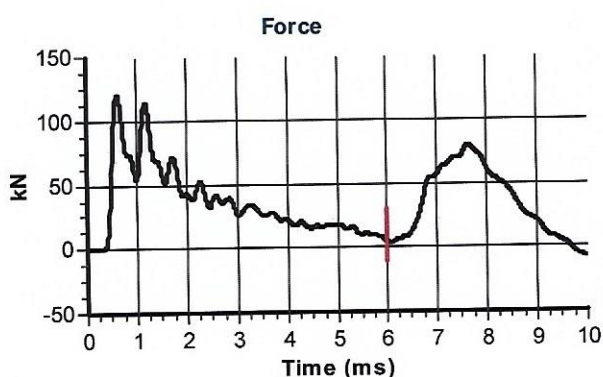
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 6458
Accelerometer No.2: 9607

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 14.5

Comments / Location

CHARLWOODS



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 282

Energy Ratio E_r (%):

60

NPB

Signed: Neil Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months

9. DYNAMIC SAMPLING BOREHOLE LOGS

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 23/01/20	Ground Level (mOD) 26.46	Co-Ordinates E 529289.37 N 181831.00	Final Depth 5.25m
Date Completed 23/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 1 of 3		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20		Dry				Dark brown gravelly fine to coarse SAND with medium brick cobble content. Gravel comprises angular to subrounded fine to coarse flint, brick, concrete clinker and glass fragments. (MADE GROUND)	0.10	ES1		VOC 0ppm	
					(0.50)	0.30 ... becoming light brown with medium to coarse gravel size tile fragments and no glass	0.30 0.30	ES2 B3		VOC 0ppm	
			25.96		0.50		0.50 0.50	ES4 B5		VOC 0ppm	
					(0.70)	Loose, dark brown slightly clayey silty very gravelly fine to coarse SAND with pockets of dark grey slightly gravelly sandy clay (<10mm) and yellowish orange silty clay (<30mm). Gravel comprises subangular to subrounded fine to coarse flint, brick and ceramic fragments. (MADE GROUND)	1.00 1.00	ES6 B7		VOC 0ppm	
23/01/20		Dry	25.26		1.20	1.00 ... becoming dark brown with no pockets of clay	1.20		N5	2, 1 / 1, 1, 1, 2	
			25.11		(0.15)	Loose, brownish red sandy GRAVEL. Gravel comprises angular to rounded fine to coarse flint, brick and concrete fragments. Sand is fine to coarse. (MADE GROUND)					
					1.35	1.33 ... with 1No tile fragment					
			24.96		(0.15)	Dark brown gravelly very clayey fine to medium SAND. Gravel comprises angular to subrounded fine to medium flint, chalk, brick and concrete fragments. (MADE GROUND)	1.50 1.50	ES6 ES8		VOC 0ppm	
			24.81		(0.15)						
			24.66		(0.15)	Light brown and red sandy GRAVEL. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. Sand is fine to medium. (MADE GROUND)					
			24.56		(0.10)	Dark brown gravelly sandy silty CLAY with pockets of black organic material (<10mm). Gravel is subangular to rounded fine to coarse flint. Sand is fine	2.00	ES9		VOC 0ppm	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS	
From	To	Diameter (mm)	Recovery (%)	1. An inspection pit was hand excavated to 1.20m depth prior to boring commencing. 2. UXO carried out every meter to 5.00m depth. 3. Ø116mm casing used from ground level to 5.00m depth. 4. Water encountered at 4.00m depth, rising to 3.80m (15mins). 5. Borehole aborted at 5.25m due to refusal. 6. Borehole backfilled with bentonite pellets upon completion. 7. SPT Hammer: CK WS 01	
1.20	2.00	102	100		
2.00	3.00	102	85		

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	AGS
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 23/01/20 Date Completed 23/01/20	Ground Level (mOD) 26.46	Co-Ordinates E 529289.37 N 181831.00	Final Depth 5.25m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 2 of 3		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20		4.00				to medium. (MADE GROUND) 1.70 ... with 1No bone fragment (<100mm)	2.00		N2	0, 0 / 0, 1, 0, 1	
					(1.00)	White and light grey slightly clayey silty sandy GRAVEL. Gravel comprises subangular to subrounded fine to coarse flint, chalk and coal fragments. Sand is fine to coarse. (MADE GROUND) 1.85 ... with 1No clay pipe fragment					
						Very soft, dark brown gravelly very sandy silty CLAY with pockets of reddish brown coarse sand (<10mm) and occasional bone fragments (<15mm). Gravel comprises subangular to rounded fine to medium flint and brick fragments. Sand is fine to medium. (MADE GROUND) 1.90 ... with 1No clay tile fragment (<60mm)	2.50	ES10		VOC 0.2ppm	
			23.56		2.90	2.20 ... with medium gravel size chalk and concrete fragments, 1No shell fragment and no bones					
					(0.25)	2.30 ... with medium gravel size clinker fragments	3.00	ES11		VOC 0.2ppm	
						2.30 - 2.45 ... becoming very gravelly	3.00		N1	1, 1 / 0, 0, 1, 0	
			23.31		3.15	2.45 ... with 1No clayey pipe fragment					
					(0.10)	2.50 ... with no pockets of red sand					
			23.21		3.25	2.60 ... with occasional oyster shell fragments					
						2.85 ... with 1No brick cobble					
					(0.45)	Very soft, dark brown slightly gravelly slightly sandy silty CLAY with occasional shell fragments. Gravel comprises subangular to subrounded fine to medium flint and brick fragments. Sand is fine to medium. (MADE GROUND)	3.50	ES12		VOC 0ppm	
						Black silty CLAY with organic content and strong organic odour. (MADE GROUND)					
						3.15 ... with 2No metal fragments (<30mm)					
			22.76		3.70	3.20 ... with 1No shell fragment and 1No leather fragment					
					(0.20)	Very soft, dark grey and brown slightly gravelly slightly sandy silty CLAY with organic content. Gravel is subangular to subrounded fine to medium flint. Sand is fine to medium. (MADE GROUND)					
			22.56		3.90	3.30 ... with 1No ceramic tile (<50mm)					
					(0.10)	3.55 ... with 1No granite cobble	4.00	ES13		VOC 0.1ppm	
			22.46		4.00						

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
3.00	4.00	102	100	
4.00	5.00	102	100	

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	AGS
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Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 23/01/20
Date Completed 23/01/20

Ground Level (mOD)
26.46

Co-Ordinates
E 529289.37 N 181831.00

Final Depth
5.25m

Client

University College London Hospitals Charity

**Method/
Plant Used** Dynamic Sampling

Sheet
3 of 3

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20	5.00	Dry			3.65 ...	with rare leather fragments	4.00		N1	1, 0 / 1, 0, 0, 0	
					(0.30)	Black slightly gravelly silty fine to coarse SAND with organic content and medium strong organic odour. Gravel is subangular to rounded fine to medium flint. (MADE GROUND)	4.00			... SPT (4.00-4.45m) with no recovery	
			22.16		4.30	Black slightly gravelly slightly sandy CLAY with organic content. Gravel is subangular to subrounded fine flint. Sand is fine to medium. (MADE GROUND)					
					(0.30)	Very soft, black slightly gravelly slightly sandy clayey SILT with high organic content. (MADE GROUND)	4.50	ES14		VOC 0ppm	
			21.86		4.60	4.10 ... with 1No ceramic and 1No metal fragment					
					(0.20)	4.20 ... with 1No brick cobble					
			21.66		4.80	Soft, black slightly gravelly slightly sandy peaty CLAY. Gravel is subangular to subrounded fine to medium flint. Sand is fine to medium. (MADE GROUND)					
23/01/20	5.00	Dry	21.56		4.90	4.30 ... with 2No bone and 1No metal fragment	5.00	ES15		VOC 0ppm	
					(0.35)	Soft, grey slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to medium flint. Sand is fine to medium. (MADE GROUND)	5.00		N50/96 mm	11, 14 / 29, 21	
			21.21		5.25	4.70 ... becoming stiff	5.25			... Borehole aborted at 5.25m depth (see Remarks)	
						Brownish grey slightly clayey gravelly fine to coarse SAND. Gravel comprises subangular to subrounded fine to medium flint and brick fragments. (MADE GROUND)					
						4.89 - 4.90 ... with firm, grey silty clay					
						Black slightly gravelly slightly peaty fine to medium SAND with medium strong organic odour. Gravel is subangular to subrounded fine to medium flint. (LYNCH HILL GRAVEL MEMBER)					
						4.95 ... becoming very gravelly. Gravel is fine to coarse flint					
						End of Borehole					

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	AGS
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Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 23/01/20
Date Completed 24/01/20

Ground Level (mOD)
26.62

Co-Ordinates
E 529266.32 N 181835.90

Final Depth
6.00m

Client

University College London Hospitals Charity

**Method/
Plant Used** Dynamic Sampling

Sheet
1 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20		Dry				Light grey CONCRETE, clasts are angular to subrounded medium to coarse flint gravel.	0.10 0.10	ES1 B2		VOC 0ppm	
					(0.75)						
			25.87		0.75		0.65 0.65	ES3 B4		VOC 0ppm	
						Brown and yellow CLAY with brick fragments. (MADE GROUND)					
					(0.45)		1.00 1.00	ES5 B6		VOC 0ppm	
23/01/20		Dry	25.42		1.20		1.20		N4	1, 1 / 1, 1, 1, 1	
			25.27		(0.15)	Brown, slightly clayey very gravelly fine to medium SAND. Gravel comprises angular to subrounded fine to coarse flint and brick fragments. (MADE GROUND)					
			25.17		(0.10)	Light grey sandy very clayey GRAVEL. Gravel comprises angular to subrounded fine to coarse brick and concrete fragments. Sand is fine to coarse. (MADE GROUND)	1.50	ES7		VOC 0ppm	
			24.97		(0.20)	Light brown gravelly clayey fine to coarse SAND. Gravel comprises angular to subrounded fine to coarse flint and chalk fragments. Sand is fine to coarse. (MADE GROUND)					
			24.77		(0.20)	1.52 - 1.53 ... with medium gravel size slate fragments 1.60 - 1.65 ... with angular to subangular fine to coarse gravel size brick and concrete fragments					
						Soft, brown slightly gravelly slightly	2.00	ES8		VOC 0ppm	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS	
From	To	Diameter (mm)	Recovery (%)		
1.20	2.00	102	100	1. An inspection pit was hand excavated to 1.20m depth prior to boring commencing. 2. UXO carried out every meter to 5.00m depth. 3. Ø116mm casing used from ground level to 4.00m depth. 4. Water encountered at 5.60m depth, rising to 5.40m (20mins). 5. Borehole collapsing at 5.60m depth. 6. CPT cone was used to probe between 6.10m & 7.50m to indicate the base of the granular material. 7. Borehole backfilled with bentonite pellets upon completion. 8. SPT Hammer: CK WS 01	
2.00	3.00	102	100		

Issue No: 01

Drilled By: KS

Logged By: AO/CS

Checked By: OS

Approved By: OS

Log Print Date & Time:

02/04/2020 11:10

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 23/01/20 Date Completed 24/01/20	Ground Level (mOD) 26.62	Co-Ordinates E 529266.32 N 181835.90	Final Depth 6.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 2 of 4		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20	4.00	Dry	24.42		(0.35) 2.20	sandy silty CLAY with rare wood fragments (<5mm). Gravel comprises subangular to subrounded fine to medium flint and coal fragments. Sand is fine to medium. (MADE GROUND) 1.82 ... with 1No clay tile	2.00		N1	2, 2 / 1, 0, 0, 0	
			24.32		(0.10) 2.30	Light brown grey very sandy clayey GRAVEL. Gravel comprises subangular to subrounded fine to coarse flint, chalk, brick and concrete fragments. Sand is fine to coarse. (MADE GROUND) 2.10 - 2.20 ... becoming very gravelly	2.50	ES9		VOC 0.1ppm	
			23.72		(0.60) 2.90	Soft, dark brown gravelly very sandy CLAY. Gravel comprises subangular to rounded fine to medium flint, brick and coal fragments. Sand is fine to medium. (MADE GROUND) Black, slightly gravelly silty CLAY with organic content and a band of brown silty clay (<5mm), occasional incinerated bone fragments and medium strong organic odour. Gravel comprises angular to subrounded fine to medium flint, brick and concrete fragments. (MADE GROUND) 2.80 ... becoming sandy	3.00 3.00	ES10	N10	VOC 0.2ppm 1, 4 / 3, 3, 2, 2	
			22.90		(0.82) 3.72	Dark grey slightly gravelly silty clayey fine to medium SAND. Gravel comprises subangular to rounded fine to medium flint, brick and ceramic fragments. (MADE GROUND) 2.92 - 2.93 ... with a band of fibrous peat 3.00 - 3.10 ... with subangular medium to coarse gravel size concrete fragments 3.12 - 3.13 ... with a band of fibrous peat 3.20 ... with angular to subrounded medium to coarse flint gravel and no brick and ceramic fragments 3.40 ... becoming very clayey	3.50	ES11		VOC 0.1ppm	
			22.72		(0.18) 3.90	3.60 ... with rare gravel size brick fragments 3.70 ... with 1No oyster shell fragment (<30mm) Reddish orange sandy subangular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. (LYNCH HILL GRAVEL MEMBER)	4.00	ES12		VOC 0ppm	
						Orange slightly gravelly fine to coarse SAND. Gravel is subangular to rounded					

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
3.00 4.00	4.00 5.00	102 87	100 100	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 23/01/20 Date Completed 24/01/20	Ground Level (mOD) 26.62	Co-Ordinates E 529266.32 N 181835.90	Final Depth 6.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 3 of 4		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
23/01/20	4.00	5.60	20.62			fine to coarse flint. (LYNCH HILL GRAVEL MEMBER)	4.00		N42	3, 9 / 9, 11, 10, 12	
						4.20 - 4.30 ... becoming very gravelly					
						4.40 - 4.50 ... becoming yellowish					
						4.50 - 4.58 ... becoming very gravelly					
						4.58 - 4.68 ... becoming very clayey					
						4.84 - 4.86 ... with a band of brown silty clay					
					(2.10)	4.95 ... becoming light yellow	5.00 5.00	B13	N50/ 295 mm	8, 12 / 17, 17, 15, 1	
						5.60 - 5.63 ... becoming orangish yellow					
						5.70 - 5.77 ... becoming orangish yellow					
							6.00		N26	6, 6 / 9, 7, 5, 5	

End of Borehole

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
5.00	6.00	75	100	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	AGS
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 23/01/20 Date Completed 24/01/20	Ground Level (mOD) 26.62	Co-Ordinates E 529266.32 N 181835.90	Final Depth 6.00m
Client University College London Hospitals Charity			Method/ Plant Used Dynamic Sampling	Sheet 4 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
							6.10			6	
							6.20			6	
							6.30			8	
							6.40			7	
							6.50			7	
							6.60			14	
							6.70			13	
							6.80			12	
							6.90			14	
							7.00			13	
							7.10			15	
							7.20			16	
							7.30			17	
							7.40			18	
							7.50			18	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 11:10	
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 27/01/20	Ground Level (mOD) 26.69	Co-Ordinates E 529279.82 N 181825.06	Final Depth 1.20m
Client University College London Hospitals Charity	Date Completed 27/01/20		Method/ Plant Used Hand Excavated	Sheet 1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	
	26.59		(0.10) 0.10	CONCRETE.	0.10	ES1		VOC 0.3ppm
	26.39		(0.20) 0.30	Light brown silty gravelly fine to coarse SAND with low brick cobble content. Gravel is angular to subangular fine to coarse flint. (MADE GROUND)	0.30	ES2 B3		VOC 0.1ppm
	26.19		(0.20) 0.50	Dark brown gravelly silty clayey fine to medium SAND with low brick cobble content. Gravel is angular fine to coarse flint with rare lignite fragments. (MADE GROUND)	0.50	ES4 B5		VOC 0ppm
	25.69		(0.50) 1.00	Dark brown gravelly silty clayey fine to medium SAND with high brick cobble content. Gravel is angular fine to coarse flint. (MADE GROUND)	1.00			
	25.49		(0.20) 1.20	Dark brown gravelly clayey medium to coarse SAND with high brick cobble content. Gravel is angular to subangular fine to coarse flint and concrete fragments. (MADE GROUND)	1.00 1.00	ES6 B7		VOC 0.1ppm ... Location aborted at 1.20 depth (see Remarks)
				End of Trial Pit				

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m depth prior to boring commencing.
2. Pit aborted at 1.20m depth due to presence of concrete obstruction. Location moved to position WS03A.
3. Pit backfilled with soil arising and made good upon completion.

Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 27/01/20
Date Completed 27/01/20

Ground Level (mOD)
26.73

Co-Ordinates
E 529281.49 N 181826.24

Final Depth
8.00m

Client

University College London Hospitals Charity

Method/
Plant Used Dynamic Sampling

Sheet
1 of 5

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
27/01/20		Dry				Dark brown slightly silty gravelly fine to medium SAND with medium brick cobble content. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. (MADE GROUND)	0.10	ES1		VOC 0.3ppm	
							0.30	ES2		VOC 0.1ppm	
							0.30	B3			
						0.50 ... with low brick cobble content and clay tile	0.50	ES4		VOC 0.3ppm	
							0.50	B5			
					(1.20)						
						1.00 ... with rare gravel size tile, slate and shell fragments	1.00	ES6		VOC 0ppm	
							1.00	B7			
27/01/20		Dry	25.53		1.20		1.20		N6	1, 2 / 2, 1, 2, 1	
					(0.25)	Brown slightly gravelly slightly clayey fine to medium SAND. Gravel comprises angular to subrounded fine to coarse flint, brick, coal and ceramic fragments. (MADE GROUND)					
			25.28		1.45	1.25 ... with 2No bone fragments 1.30 ... becoming dark grey and very clayey with gravel size coal fragments					
					(0.15)	Firm, light greyish brown sandy very gravelly CLAY. Gravel comprises subangular to subrounded fine to coarse flint, chalk and brick fragments. Sand is fine to coarse. (MADE GROUND)	1.50	ES8		VOC 0.2ppm	
			25.13		1.60						
					(0.70)	Firm, dark brown sandy very gravelly CLAY. Gravel comprises angular to subrounded fine to coarse flint, brick and coal fragments. Sand is fine to coarse. (MADE GROUND)					
						1.73 ... with 2No snail shells 1.80 ... with 2No angular coarse sandstone gravel fragments	2.00	ES9		VOC 0ppm	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS	
From	To	Diameter (mm)	Recovery (%)		
1.20	2.00	102	100	1. An inspection pit was hand excavated to 1.20m depth prior to boring commencing. 2. Ø116mm casing used from ground level to 5.00m depth. 3. Water encountered at 3.00m depth, sealed at 4.00m. 4. SPT cone was used to probe between 8.00m & 9.50m to indicate the base of the granular material. 5. Borehole backfilled with bentonite pellets upon completion. 6. SPT Hammer: CK WS 01	
2.00	3.00	102	85		

Issue No: 01

Drilled By: KS

Logged By: AO/CS

Checked By: OS

Approved By: OS

Log Print Date & Time:

02/04/2020 12:40

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 27/01/20 Date Completed 27/01/20	Ground Level (mOD) 26.73	Co-Ordinates E 529281.49 N 181826.24	Final Depth 8.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 2 of 5		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
27/01/20		3.00	24.43		2.30		2.00		N1	0, 0 / 1, 0, 0, 0	
			24.23		(0.20) 2.50	Light greyish brown sandy clayey GRAVEL. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. Sand is medium to coarse. (MADE GROUND)	2.50	ES10		VOC 0ppm	
			23.83		(0.40) 2.90	Soft, brown gravelly sandy CLAY. Gravel comprises subangular to rounded fine to coarse flint, brick, coal and limestone fragments. Sand is fine to coarse. (MADE GROUND) 2.75 ... with occasional shell fragments (<40mm) 2.80 ... with rare wood fragments (<20mm)					
			23.73		(0.10) 3.00	Light grey gravelly sandy silty CLAY. Gravel comprises subangular to subrounded fine to coarse flint, brick, ash and limestone fragments. Sand is fine to medium. (MADE GROUND)	3.00 3.00	ES11	N4	VOC 0ppm 0, 1 / 1, 1, 1, 1	
					(0.85)	Soft, brown gravelly sandy CLAY. Gravel comprises angular to subrounded fine to coarse flint, brick and coal fragments. Sand is fine to medium. (MADE GROUND)					
			22.88		3.85	3.80 ... with 1No low brick cobble	3.50	ES12		VOC 0ppm	
						Black CLAY with organic content and medium strong organic odour. (MADE GROUND) 3.95 - 4.10 ... with low brick cobble	4.00		N5	0, 0 / 1, 1, 1, 2	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
3.00 4.00	4.00 5.00	102 102	100 100	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	
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Project

Middlesex Hospital Annex

Job No
19/3355

Date Started 27/01/20
Date Completed 27/01/20

Ground Level (mOD)
26.73

Co-Ordinates
E 529281.49 N 181826.24

Final Depth
8.00m

Client

University College London Hospitals Charity

Method/
Plant Used Dynamic Sampling

Sheet
3 of 5

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
27/01/20	5.00	Wet	22.33		(0.55) 4.40	content 4.10 ... with rare medium flint gravel	4.00 4.10	ES13		... SPT (4.00-4.45m) with no recovery VOC 0.8ppm	
			22.18		(0.15) 4.55	Light grey slightly gravelly slightly clayey fine to coarse SAND. Gravel comprises subangular to subrounded fine to coarse brick, limestone, ash and bone fragments. (MADE GROUND)	4.50			ES14	VOC 0.1ppm
			21.82		(0.36) 4.91	Firm, dark grey gravelly CLAY. Gravel comprises subangular to subrounded fine to coarse brick, limestone, brick and ceramic fragments. (MADE GROUND) 4.70 - 4.75 ... with angular to subangular fine to coarse gravel size brick fragments	5.00 5.00	ES15	N38	VOC 0.1ppm 0, 1 / 4, 8, 12, 14	
			21.33		(0.49) 5.40	4.90 - 4.91 ... with a band of ash and incinerated bone fragments Stiff, dark brown slightly gravelly sandy silty CLAY. Gravel comprises subangular to subrounded fine to medium flint, brick and shell fragments. Sand is fine to coarse. (MADE GROUND)					
			21.03		(0.30) 5.70	Orangish brown very sandy subangular to rounded fine to coarse flint GRAVEL. Sand is fine to coarse. (LYNCH HILL GRAVEL MEMBER)	5.50	ES16	VOC 0.3ppm		
						Yellowish brown slightly gravelly fine to medium SAND. Gravel is subangular to rounded fine to medium flint. (LYNCH HILL GRAVEL MEMBER) 5.80 ... becoming orangish brown 5.90 ... becoming slightly clayey 5.95 - 6.00 ... with a band of brown	6.00		N44	2, 2 / 4, 10, 14, 16	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
5.00	6.00	102	100	
6.00	7.00	87	100	

Issue No: 01

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Log Print Date & Time:

02/04/2020 12:40

Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 27/01/20	Ground Level (mOD) 26.73	Co-Ordinates E 529281.49 N 181826.24	Final Depth 8.00m
Date Completed 27/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling			Sheet 4 of 5

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
27/01/20	5.00		18.94		(2.09)	slightly sandy clay 6.00 ... becoming yellowish brown with no clay 6.10 ... with occasional pockets of brown clay (<20mm) 6.12 - 6.23 ... becoming orange and very gravelly					
						6.90 - 7.00 ... with orange sandy subangular to rounded fine to medium flint gravel	7.00 7.00 7.00	B17 D17	N17	2, 2 / 3, 3, 4, 7	
						7.52 ... with 1No coarse flint gravel					
						7.70 ... becoming very gravelly					
			18.73		(0.21)	Firm, brown silty CLAY. (THAMES GROUP: WEATHERED LONDON CLAY FORMATION)					

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
7.00	8.00	75	100	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 27/01/20 Date Completed 27/01/20	Ground Level (mOD) 26.73	Co-Ordinates E 529281.49 N 181826.24	Final Depth 8.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 5 of 5		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
						7.98 ... becoming brownish grey End of Borehole	8.10			4	
							8.20			5	
							8.30			7	
							8.40			9	
							8.50			11	
							8.60			14	
							8.70			17	
							8.80			16	
							8.90			15	
							9.00			13	
							9.10			15	
							9.20			18	
							9.30			19	
							9.40			21	
							9.50			20	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	

Issue No: 01	Drilled By: KS	Logged By: AO/CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20	Ground Level (mOD) 24.53	Co-Ordinates E 529251.97 N 181815.06	Final Depth 5.00m
Date Completed 24/01/20				
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 1 of 3		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
24/01/20		Dry	24.33		(0.20) 0.20	Light grey sandy GRAVEL. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. Sand is fine to coarse. (MADE GROUND)	0.10	ES1		VOC 0ppm	
						Brown gravelly silty fine to medium SAND. Gravel comprises subangular to subrounded fine to coarse flint, brick, concrete, coal and shell fragments. (MADE GROUND)	0.30 0.30	ES2 B3		VOC 0ppm	
						0.20 - 0.30 ... with low brick and concrete cobble content	0.50 0.50	ES4 B5		VOC 0ppm	
						0.40 - 0.50 ... with medium brick and concrete cobble content					
						0.50 - 1.00 ... with gravel size slate and clay tile fragments and no shells					
24/01/20		Dry				1.00 - 1.20 ... with pockets of brownish grey clay (<30mm), low concrete cobble content and clinker fragments	1.00 1.00	ES6 B7		VOC 0ppm	
						1.20 ... with no clinker fragments	1.20		N0	0, 1 / 0, 0, 0, 0	
					(2.60)	1.50 ... becoming dark brown and very clayey	1.50	ES8		VOC 0ppm	
						1.80 ... with 1No coal fragment (<30mm)					
						2.40 ... with 1No sandstone cobble	2.00 2.00	ES9	N7	VOC 0ppm 1, 2 / 1, 2, 2, 2	
							2.50	ES10		VOC 0ppm	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
1.20 2.00	2.00 3.00	102 102	100 85	
				1. An inspection pit was hand excavated to 1.20m depth prior to boring commencing. 2. Ø116mm casing used from ground level to 3.00m depth. 3. Water encountered at 4.50m depth, rising to 4.20m (20mins). 4. SPT cone was used to probe between 5.00m & 7.50m to indicate the base of the granular material. 5. Borehole backfilled with bentonite pellets upon completion. 6. SPT Hammer: CK WS 01

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	AGS
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20 Date Completed 24/01/20	Ground Level (mOD) 24.53	Co-Ordinates E 529251.97 N 181815.06	Final Depth 5.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 2 of 3		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
24/01/20	3.00	Damp	21.73		2.80	2.70 ... with 1No sandstone cobble					
			21.53		(0.20) 3.00	Orange sandy subangular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. (LYNCH HILL GRAVEL MEMBER)	3.00 3.00	ES11	N50/ 260 mm	VOC 0ppm 10, 15 / 16, 16, 15, 3	
						Orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint. (LYNCH HILL GRAVEL MEMBER)					
24/01/20	3.00	4.50				3.58 - 3.61 ... with a band of brown slightly sandy silty clay	3.70	B12			
						3.70 ... becoming very clayey with pockets of orange medium to coarse sand (<20mm)					
					(2.00)	4.00 ... becoming slightly clayey	4.00		N45	7, 7 / 8, 11, 13, 13	
24/01/20	3.00					4.12 ... becoming orange with no clay	4.20-5.00	B13			
						4.50 - 4.55 ... gravel becoming fine to medium	4.30			... Borehole collapsing at 4.30m depth	
						4.65 - 4.80 ... with a band of orange sandy subangular to subrounded fine to coarse flint gravel. Sand is fine to coarse					
24/01/20	3.00		19.53		5.00	End of Borehole					

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	
3.00 4.00	4.00 5.00	87 75	100 100	

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	AGS
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Project

Middlesex Hospital Annex

Job No 19/3355	Date Started 24/01/20 Date Completed 24/01/20	Ground Level (mOD) 24.53	Co-Ordinates E 529251.97 N 181815.06	Final Depth 5.00m
Client University College London Hospitals Charity	Method/ Plant Used Dynamic Sampling	Sheet 3 of 3		

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
							5.10			5	
							5.20			10	
							5.30			11	
							5.40			10	
							5.50			14	
							5.60			16	
							5.70			17	
							5.80			19	
							5.90			16	
							6.00			15	
							6.10			14	
							6.20			11	
							6.30			12	
							6.40			12	
							6.50			17	
							6.60			16	
							6.70			16	
							6.80			19	
							6.90			18	
							7.00			18	
							7.10			18	
							7.20			21	
							7.30			21	
							7.40			26	
							7.50			27	

DYNAMIC SAMPLING RECOVERY				GENERAL REMARKS
From	To	Diameter (mm)	Recovery (%)	

Issue No: 01	Drilled By: KS	Logged By: CS	Checked By: OS	Approved By: OS	Log Print Date & Time: 02/04/2020 12:40	
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Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 01/05/18
Date Completed 08/05/18

Ground Level (mOD)
27.65

Co-Ordinates
E 529249.1 N 181809.6

Final Depth
35.00m

Client
University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
1 of 4

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
01/05/18		Dry	27.50		0.15	Asphalt (0.03m) over CONCRETE.	0.30	ES01		... VOC 0.0ppm	
					(1.05)	Brown gravelly SAND with low brick and concrete cobble content. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. (MADE GROUND)	0.30 0.30 0.50 0.60 0.60 1.00	B02 B03 B04 B05 B06		... VOC 0.0ppm	
01/05/18		Dry	26.45		1.20	0.90 - 1.00 ... with high concrete cobble content and occasional ceramic fragments	1.00 1.00 1.20	B07	N3	1, 0 / 1, 0, 1, 1	
					(0.80)	Loose, brown slightly clayey gravelly fine to coarse SAND. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. (MADE GROUND)	1.20-1.65	B08			
			25.65		2.00	Loose, brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	2.00	B09	N6	1, 0 / 1, 1, 2, 2	
01/05/18	3.00	3.00				3.00 - 4.00 ... becoming medium dense and slightly clayey 3.00 - 6.50 ... becoming slightly gravelly	2.00-2.45 3.00 3.00-3.45	B10	N15	3, 4 / 4, 3, 4, 4	
					(5.50)		4.00 4.00-4.45	B11	N28	2, 3 / 5, 6, 8, 9	
01/05/18	5.00	4.00				5.00 ... becoming dense	5.00 5.00-5.45	B12	N37	5, 7 / 7, 8, 10, 12	
							6.00	D13			
01/05/18	6.50	4.50					6.50 6.50-6.90	B14	N50/ 250 mm	3, 6 / 9, 17, 17, 7	
			20.15		7.50		7.50	D15			
01/05/18	8.00	5.50	19.65		(0.50) 8.00	Firm, brown mottled orange very sandy CLAY. Sand is fine to coarse. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	8.00 8.00-8.45	B16	N50	2, 5 / 8, 11, 14, 17	
					(0.90)	Very dense, brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	8.90-9.30	B17			
01/05/18	8.90	9.20	18.75		8.90	Stiff, brown mottled orange sandy CLAY. Sand is fine to coarse. (THAMES GROUP: WEATHERED LONDON CLAY FORMATION - A3ii)	9.50-9.95	UT18	70 blows	100% Recovery	
					(2.55)	9.95 ... becoming closely fissured and slightly micaceous with no sand. Fissures are subhorizontal to subvertical, smooth 10.00 - 10.45 ... becoming slightly sandy with rare partings of brown fine sand	9.95 10.00 10.00-10.45 10.70	D19 D20 D21	N30	3, 4 / 6, 7, 8, 9	
01/05/18	8.90	10.50					11.00-11.45	UT22	70 blows	100% Recovery	

Issue No: 01

Checked By: AN

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Log Print Date & Time: 14/06/2018 14:41

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 01/05/18
Date Completed 08/05/18

Ground Level (mOD)
27.65

Co-Ordinates
E 529249.1 N 181809.6

Final Depth
35.00m

Client

University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
2 of 4

PROGRESS			STRATA				SAMPLES & TESTS				Field Records	Instrument/ Backfill			
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result						
01/05/18	11.00	10.90	16.20		11.45	Stiff, brown slightly micaceous CLAY with rare bioturbation. (THAMES GROUP: LONDON CLAY FORMATION - A3i) 12.00 - 12.95 ... becoming slightly sandy	11.45	D23	N30	3, 5 / 6, 6, 8, 10					
							11.50	D24							
03/05/18	11.00	6.40				12.00	D25								
03/05/18	11.50	Dry			(3.05)	13.90 - 14.50 ... with a band of claystone	12.50-12.95	UT26	75 blows	100% Recovery					
									12.95	D27	N35	4, 6 / 7, 8, 9, 11			
									13.00	D28					
									13.00-13.45						
									13.70	D29	N50/ 25 mm	25 / 50			
									14.00						
									14.00-14.50	B30					
			13.15					(12.50)	Very stiff, brown slightly sandy silty CLAY with occasional pockets of dark grey silt and bioturbation. (THAMES GROUP: LONDON CLAY FORMATION - A2) 16.70 - 18.20 ... becoming sandy 16.70 - 19.70 ... with rare white flecks 18.20 - 20.45 ... becoming slightly sandy 19.70 ... becoming micaceous 19.70 - 23.45 ... with occasional white flecks 20.45 - 23.45 ... becoming sandy	15.20	D31	100 blows	100% Recovery		
														15.50-15.95	UT32
														15.95	D33
						16.00				D34	N47	4, 7 / 9, 11, 13, 14			
						16.00-16.45									
						16.70				D35	100 blows	100% Recovery			
						17.00-17.45				UT36					
						17.45				D37			N50/ 290 mm	5, 7 / 10, 12, 14, 14	
						17.50									
						17.50-17.95				D38	100 blows	100% Recovery			
						18.20				D39					
						18.20 - 20.45 ... becoming slightly sandy				18.50-18.95	UT40				
										18.95	D41	N50/ 285 mm	5, 8 / 10, 13, 15, 12		
										19.00					
										19.00-19.45	D42	100 blows	100% Recovery		
										19.70	D43				
						19.70 ... becoming micaceous 19.70 - 23.45 ... with occasional white flecks				20.00-20.45	UT44				
										20.45	D45	N50/ 290 mm	5, 8 / 9, 12, 15, 14		
							20.50								
							20.50-20.95	D46							
							21.20	D47	100 blows	100% Recovery					
03/05/18	11.50	21.50					21.50-21.95	UT48							
03/05/18	11.50	Dry					21.95	D49							

Issue No: 01

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Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 01/05/18
Date Completed 08/05/18

Ground Level (mOD)
27.65

Co-Ordinates
E 529249.1 N 181809.6

Final Depth
35.00m

Client
University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
3 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
							22.00		N50/ 275 mm	5, 7 / 10, 13, 15, 12	
							22.00-22.45	D50			
							22.70	D51			
							23.00-23.45	UT52	100 blows	100% Recovery	
							23.45	D53			
							23.50		N50/ 285 mm	6, 8 / 11, 13, 15, 11	
							23.50-23.95	D54			
							24.20	D55			
							24.50-24.95	UT56	100 blows	100% Recovery	
							24.95	D57			
							25.00		N50/ 290 mm	5, 8 / 10, 12, 15, 13	
							25.00-25.45	D58			
							25.70	D59			
							25.70 ... becoming very sandy				
							26.00-26.45	UT60	100 blows	100% Recovery	
							26.45	D61			
							26.50		N50/ 275 mm	6, 8 / 10, 13, 16, 11	
							26.45 ... becoming sandy with rare bioturbation				
			0.65		27.00		26.50-26.95	D62			
							27.00-27.20	B63			
							27.50-27.95	UT64	100 blows	78% Recovery	
							27.80	D65			
							27.90		N49/ 225 mm	8, 11 / 14, 17, 18	
							27.90-28.30	D66			
							28.70	D67			
							29.00-29.45	UT68	100 blows	56% Recovery	
							29.25	D69			
							29.30		N50/ 120 mm	12, 13 / 30, 20	
							29.30-29.50	D70			
							30.20	D71			
							30.50-30.95	UT72	100 blows	56% Recovery	
							30.75	D73			
							30.80		N50/ 165 mm	7, 15 / 19, 25, 6	
							30.80-31.25	D74			
							31.70	D75			
							32.00-32.45	UT76	100 blows	56% Recovery	
							32.25	D77			
							32.30		N50/ 120 mm	12, 13 / 28, 22	
							32.30-32.75	D78			

Issue No: 01

Checked By: AN

Approved By: OS

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Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 01/05/18
Date Completed 08/05/18

Ground Level (mOD)
27.65

Co-Ordinates
E 529249.1 N 181809.6

Final Depth
35.00m

Client

University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
4 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
04/05/18	11.50	Dry	-5.85		33.50		33.50-33.80	B79		78% Recovery 6, 10 / 27, 23	
					(1.50)	Very stiff, grey mottled blue very sandy CLAY. Sand is fine to medium. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	34.00-34.45	UT80	100 blows		
							34.35	D81			
							34.40		N50/ 105 mm		
							34.40-34.85	D82			
			-7.35		35.00	End of Borehole					

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 16/04/18
Date Completed 19/04/18

Ground Level (mOD)
27.61

Co-Ordinates
E 529264.8 N 181794.1

Final Depth
35.00m

Client

University College Hospitals Charity

BOREHOLE SUMMARY

Top (m)	Base (m)	Type	Date Started	Date Ended	Crew	Logged By	Core Barrel (mm)	Core Bit	Plant Used/ Method	SPT Hammer Reference
0.00 1.20	1.20 35.00	IP CP	16/04/2018 17/04/2018	16/04/2018 19/04/2018	PH PH	TD IK			Hand Excavated Dando 3000	EQU850

WATER STRIKES

WATER ADDED

CHISELLING / SLOW DRILLING

Strike at (m)	Rise to (m)	Time to Rise (min)	Casing Depth (m)	Sealed (m)	From (m)	To (m)	From (m)	To (m)	Duration (hr)	Remarks
29.00	28.50	20	9.50		1.50	9.00	13.20	13.40	00:30	Claystone

HOLE

CASING

ROTARY RECOVERY

Depth (m)	Diameter (mm)	Depth (m)	Diameter (mm)	From (m)	To (m)	Blows	Recovery (%)
0.00 30.00 35.00	200 200 150	0.00 9.50	200 200				

ROTARY FLUSH DETAIL

From (m)	To (m)	Flush Type	Flush Return (%)	Flush Colour

INSTALLATION DETAILS

Type	Diameter (mm)	Depth of Installation (m)	Top of Response Zone (m)	Bottom of Response Zone (m)	Date of Installation
SPG/GW SPIE	50 19	9.10 31.00	4.10 29.00	9.10 32.00	19/04/2018 19/04/2018

BACKFILL DETAILS

Top (m)	Bottom (m)	Material	Backfill Date
0.00 0.30 4.10 9.10 29.00 32.00	0.30 4.10 9.10 29.00 32.00 35.00	Concrete / Flush Cover Bentonite Pellets Pea Shingle Bentonite Pellets Sand filter Bentonite Pellets	19/04/2018

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 16/04/18
Date Completed 19/04/18

Ground Level (mOD)
27.61

Co-Ordinates
E 529264.8 N 181794.1

Final Depth
35.00m

Client

University College Hospitals Charity

PROGRESS

SPT DETAILS

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks
16/04/18	0.00		Dry	
16/04/18	1.20		Dry	
17/04/18	1.20		Dry	
17/04/18	1.50	1.50	1.50	... Water Added
17/04/18	9.20	9.20	Dry	
17/04/18	13.50	9.50	Dry	
18/04/18	13.50	9.50	Dry	
18/04/18	29.00	9.50	Dry	
19/04/18	29.00	9.50	29.00	... Water Strike
19/04/18	29.50	9.50	28.00	
19/04/18	29.90	9.50	29.00	
19/04/18	31.00	9.50	Dry	
19/04/18	35.00	9.50	Dry	

Type	Depth (m)	N Value	Blow Count / 75mm	Casing Depth (m)	Water Depth (m)
S	1.50	N50/0.275	4, 8 / 10, 12, 14, 14	1.50	1.50
C	2.50	N28	3, 4 / 7, 7, 8, 6	2.50	2.50
C	3.50	N19	3, 4 / 7, 4, 4, 4	3.50	3.50
C	4.50	N26	1, 2 / 4, 5, 7, 10	4.50	4.50
C	5.50	N33	2, 3 / 5, 8, 8, 12	5.50	5.50
C	6.70	N32	1, 2 / 5, 8, 9, 10	6.70	6.70
C	7.50	N32	4, 4 / 5, 7, 9, 11	7.50	7.50
S	9.70	N33	4, 5 / 6, 7, 9, 11	9.20	Dry
S	11.50	N32	5, 4 / 6, 7, 9, 10	9.50	Dry
S	13.20	N50/0.02	25 / 50	9.50	Dry
S	14.50	N34	2, 4 / 5, 8, 10, 11	9.50	Dry
S	16.00	N34	3, 4 / 6, 8, 10, 10	9.50	Dry
S	17.50	N34	4, 5 / 7, 9, 4, 14	9.50	Dry
S	19.00	N43	3, 4 / 8, 10, 10, 15	9.50	Dry
S	20.50	N46	4, 5 / 8, 10, 12, 16	9.50	Dry
S	22.00	N40	4, 5 / 7, 8, 11, 14	9.50	Dry
S	24.00	N42	3, 5 / 7, 9, 12, 14	9.50	Dry
S	25.50	N44	3, 5 / 8, 10, 12, 14	9.50	Dry
S	27.50	N50/0.255	9, 10 / 19, 20, 11	9.50	Dry
S	29.90	N50/0.16	4, 9 / 11, 15, 18, 6	9.50	29.00
S	31.50	N50/0.2	6, 10 / 14, 18, 18	9.50	Dry
S	32.50	N51/0.16	7, 10 / 12, 15, 19, 5	9.50	Dry
S	33.50	N50/0.155	8, 14 / 19, 26, 5	9.50	Dry
S	35.00	N51/0.18	5, 10 / 17, 20, 14	9.50	Dry

GENERAL REMARKS

- UXO survey carried out in the borehole.
- Water seepage encountered at 29.00m depth rising to 28.70m (5mins), 28.50m (10mins) and staying.

KEY

SAMPLES

- ES - Environmental Sample (Tub, Vial, Jar)
- U - 100mm Diameter Undisturbed Sample
- UT - 100mm Diameter Thin Wall Undisturbed Sample
- U38 - 38mm Diameter Undisturbed Sample
- D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample
- C - Core Sample, W-Water Sample, R-Root Sample

INSTALLATION DETAILS

- SPIE - Standpipe Piezometer
- SPGW - Groundwater Monitor Standpipe
- SPG/GW - Gas / Groundwater Monitor Standpipe
- VWP - Vibrating Wire Piezometer
- ICM - Inclinator

HOLE TYPES

- IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
- CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
- DS - Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
- DC - Diamond Coring, CPR-Cable Percussion Rotary follow on

TESTS S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compounds

Note: All depths are in metres, all diameters in millimetres, water strike rise time in minutes. For details of abbreviations see Key

Issue No: 01

Checked By: AN

Approved By: OS

Log Print Date & Time: 08/06/2018 09:38

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 16/04/18
Date Completed 19/04/18

Ground Level (mOD)
27.61

Co-Ordinates
E 529264.8 N 181794.1

Final Depth
35.00m

Client
University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
1 of 4

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill								
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result										
16/04/18	1.50	Dry	27.46		0.15	CONCRETE.	0.30	ES01	N50/ 275 mm	... VOC 0.2ppm									
					(1.05)	Greyish brown gravelly fine to coarse SAND. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. (MADE GROUND)	0.30	B02		... VOC 0.0ppm									
							0.70	ES03		... 1No Ø50mm lead pipe encountered at 0.95m depth									
							0.70	B04		... VOC 0.0ppm									
							0.95												
				1.00	ES05														
16/04/18			Dry	26.41		1.20	Dark grey mottled brown slightly gravelly sandy CLAY. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. Sand is fine to medium. (MADE GROUND)	1.00	B06	N28		4, 8 / 10, 12, 14, 14							
17/04/18			Dry			(1.00)		Orangish brown gravelly fine to coarse SAND. Gravel is angular fine to medium flint. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	1.20-1.50			B07							
17/04/18		1.50	1.50	26.11					1.50			1.50							
									2.50			1.50-1.95	D08	3, 4 / 7, 7, 8, 6					
				25.11									2.50	B09					
						(1.40)	Medium dense, brown very sandy angular to well rounded fine to coarse flint GRAVEL. Sand is fine to coarse. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	3.50	N19	3, 4 / 7, 4, 4, 4									
								3.50				B10							
													3.90	B11					
				23.71															
					(0.60)	Medium dense, orangish brown silty very clayey very sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	4.50	N26	1, 2 / 4, 5, 7, 10										
			23.11				4.50			4.50	B12								
							(4.60)			Medium dense to dense, brown very sandy angular to well rounded fine to coarse flint GRAVEL. Sand is fine to coarse. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	5.50	N33	2, 3 / 5, 8, 8, 12						
											5.50			B13					
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	6.70	N32	1, 2 / 5, 8, 9, 10										
							6.70			B14									
											7.50		N32	4, 4 / 5, 7, 9, 11					
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	7.50	N32	4, 4 / 5, 7, 9, 11										
							8.20			B15									
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	8.20	B15	4, 4 / 5, 7, 9, 11										
							9.00			B16									
											9.20-9.65	UT17	50 blows	89% Recovery					
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	9.00	B16	4, 4 / 5, 7, 9, 11										
							9.20-9.65			UT17	50 blows	89% Recovery							
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	9.20-9.65	UT17	50 blows	89% Recovery									
							9.60				D18	N33	4, 5 / 6, 7, 9, 11						
														9.70	D19				
																	9.70-10.15		
					(4.60)	6.70 ... with occasional pockets of soft, brown sandy clay (<50mm) and 1No flint cobble	10.80	D20	80 blows	89% Recovery									
							11.00-11.45				UT21								
17/04/18	9.20	Dry	18.51		9.10	Stiff, extremely closely fissured brownish grey slightly micaceous CLAY with rare bioturbation. (THAMES GROUP: LONDON CLAY FORMATION - A3ii) 9.60 ... with occasional pyrite nodules (<10mm)	9.20-9.65	UT17	50 blows	89% Recovery									
								9.60	D18	N33	4, 5 / 6, 7, 9, 11								
														9.70	D19				
																	9.70-10.15		
							10.80	D20	80 blows	89% Recovery									
												11.00-11.45	UT21						

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 16/04/18
Date Completed 19/04/18

Ground Level (mOD)
27.61

Co-Ordinates
E 529264.8 N 181794.1

Final Depth
35.00m

Client

University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
2 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
17/04/18 18/04/18	9.50 9.50	Dry Dry	14.66		(3.85)	11.40 ... with occasional pockets of light brown fine sand (<35mm), bioturbation and rare shell fragments (<1mm) 11.50 ... with a parting of light brown and dark grey silty fine sand (<15mm) 12.00 ... with frequent bioturbation and rare white flecks	11.40 11.50 11.50-11.95	D22 D23	N32	5, 4 / 6, 7, 9, 10	
					12.95	Stiff to very stiff, extremely closely fissured brownish grey CLAY. (THAMES GROUP: LONDON CLAY FORMATION - A3i) 13.20 - 13.40 ... with a band of very strong, brown claystone with calcite veins (septarian nodules)	12.50-12.95 12.95 13.00-13.20 13.20	UT24 D25 B26	80 blows N50/ 20 mm	100% Recovery 25 / 50	
			11.66		(3.00)	14.45 ... with frequent bioturbation	13.20-13.65 14.00-14.45 14.45 14.50 14.50-14.95 15.10 15.50-15.95	D27 UT28 D29 D30 D31 UT32	80 blows	100% Recovery	
					15.95	Very stiff, brownish grey slightly sandy slightly micaceous CLAY with occasional pockets of light brown fine sand (<30mm), bioturbation and rare pyrite nodules (<16mm). (THAMES GROUP: LONDON CLAY FORMATION - A2) 16.70 ... with occasional pockets of dark grey fine sand (<25mm)	15.95 16.00 16.70 17.00-17.45	D33 D34 UT35	N34	3, 4 / 6, 8, 10, 10	
						17.45 ... with occasional foraminifera and pyrite nodules	17.45 17.50 17.50-17.95 18.10 18.50-18.95 18.95 19.00 19.00-19.45 19.60 20.00-20.45	D36 D37 D38 D39 D40 D41 D42 UT43	N34 80 blows	4, 5 / 7, 9, 4, 14 100% Recovery	
						19.60 ... with frequent pockets of light brown fine sand	20.45 20.50 20.50-20.95 21.20 21.50-21.95	D44 D45 D46 UT47	N46 100 blows	4, 5 / 8, 10, 12, 16 100% Recovery	
					(11.50)	21.20 ... with 1No pyrite nodule (<10mm)	21.95	D48		100% Recovery	

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Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 16/04/18
Date Completed 19/04/18

Ground Level (mOD)
27.61

Co-Ordinates
E 529264.8 N 181794.1

Final Depth
35.00m

Client
University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
3 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
						22.00 ... with frequent pockets of dark grey fine sand	22.00 22.00-22.45 22.70	D49 D50	N40	4, 5 / 7, 8, 11, 14	
							23.50-23.95	UT51	100 blows	100% Recovery	
						23.95 ... becoming silty with rare pockets of sand	23.95 24.00 24.00-24.45	D52 D53	N42	3, 5 / 7, 9, 12, 14	
							24.70	D54			
							25.00-25.45	UT55	100 blows	100% Recovery	
						25.50 ... with occasional pyrite nodules (<15mm)	25.45 25.50 25.50-25.95	D56 D57	N44	3, 5 / 8, 10, 12, 14	
						26.10 ... with occasional pockets of sand	26.10	D58			
							26.50-26.95	UT59	100 blows	100% Recovery	
						26.95 ... with 2No pyrite nodules (<10mm)	26.95 27.00-27.45	D60 UT61	100 blows	100% Recovery	
			0.16		27.45		27.45 27.50	D62	N50/ 255 mm	9, 10 / 19, 20, 11	
						Very stiff, multicoloured sheared CLAY. Shears are of multiple orientation, undulating, smooth, polished. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	27.50-27.95	D63			
					(2.35)	28.50 ... becoming slightly sandy	28.50	D64			
18/04/18	9.50	Dry				29.00 ... becoming silty	29.00	D65			
19/04/18	9.50	29.00					29.50-29.95	UT66	100 blows	67% Recovery	
19/04/18	9.50	28.00					29.80 29.90	D67	N50/ 160 mm	4, 9 / 11, 15, 18, 6	
19/04/18	9.50	29.00	-2.19		29.80	Very dense, bluish grey mottled brown clayey fine SAND. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds - Sand Channel)	29.90-30.35	D68			
					(1.50)		31.00-31.45	UT69	100 blows	67% Recovery	
19/04/18	9.50	Dry					31.30 31.50	D70	N50/ 200 mm	6, 10 / 14, 18, 18	
			-3.69		31.30	Very stiff, brown mottled bluish grey CLAY. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds)	31.50-31.95 31.80 32.10-32.55 32.30 32.50	D71 D72 UT73 D74	100 blows	44% Recovery	
						32.30 ... with a parting of off-white silt			N51/ 160 mm	7, 10 / 12, 15, 19, 5	
							32.50-32.95	D75			

Issue No: 01

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Log Print Date & Time: 07/06/2018 11:37

Project

Middlesex Hospital Annexe

Job No 18/3104	Date Started 16/04/18 Date Completed 19/04/18	Ground Level (mOD) 27.61	Co-Ordinates E 529264.8 N 181794.1	Final Depth 35.00m
Client University College Hospitals Charity			Method/ Plant Used Cable Percussion	Sheet 4 of 4

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
19/04/18	9.50	Dry			(3.40)		33.00	D76		8, 14 / 19, 26, 5	
							33.50		N50/ 155 mm		
							33.50-33.95	D77			
							34.20-34.65	UT78 B79	100 blows	0% Recovery	
						34.20 ... becoming silty	34.20				
							34.70	D80			
			-7.09		34.70						
			-7.39		35.00						
						Very stiff, dark grey locally mottled brown slightly sandy silty CLAY with pockets of light grey fine to medium sand (<20mm) and frequent lignite fragments (<10mm). (LAMBETH GROUP: WOOLWICH FORMATION: Laminated Beds)	35.00		N51/ 180 mm	5, 10 / 17, 20, 14	
						34.99 ... becoming very sandy with occasional pyrite nodules (<25mm)	35.00	D81			
						End of Borehole					

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 20/04/18
Date Completed 30/04/18

Ground Level (mOD)
26.84

Co-Ordinates
E 529289.8 N 181809.3

Final Depth
35.00m

Client

University College Hospitals Charity

BOREHOLE SUMMARY

Top (m)	Base (m)	Type	Date Started	Date Ended	Crew	Logged By	Core Barrel (mm)	Core Bit	Plant Used/ Method	SPT Hammer Reference
0.00 1.20	1.20 35.00	IP CP	20/04/2018 23/04/2018	20/04/2018 27/04/2018	DR DR	IK IK/OJ			Hand Excavated Dando 3000	EQU850

WATER STRIKES

WATER ADDED

CHISELLING / SLOW DRILLING

Strike at (m)	Rise to (m)	Time to Rise (min)	Casing Depth (m)	Sealed (m)	From (m)	To (m)	From (m)	To (m)	Duration (hr)	Remarks
					4.30	8.50	12.40	12.70	01:00	Claystone

HOLE

CASING

ROTARY RECOVERY

Depth (m)	Diameter (mm)	Depth (m)	Diameter (mm)	From (m)	To (m)	Blows	Recovery (%)
0.00 35.00	200 200	0.00 15.90	200 200				

ROTARY FLUSH DETAIL

From (m)	To (m)	Flush Type	Flush Return (%)	Flush Colour

INSTALLATION DETAILS

Type	Diameter (mm)	Depth of Installation (m)	Top of Response Zone (m)	Bottom of Response Zone (m)	Date of Installation
SPG/GW SPIE	50 19	8.70 34.50	4.30 31.00	8.70 35.00	30/04/2018 30/04/2018

BACKFILL DETAILS

Top (m)	Bottom (m)	Material	Backfill Date
0.00 0.30 4.30 8.70 31.00	0.30 4.30 8.70 31.00 35.00	Concrete/ Flush Cover Bentonite Pellets Pea Shingle Bentonite Pellets Pea Shingle	30/04/2018

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 20/04/18
Date Completed 30/04/18

Ground Level (mOD)
26.84

Co-Ordinates
E 529289.8 N 181809.3

Final Depth
35.00m

Client

University College Hospitals Charity

PROGRESS

SPT DETAILS

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks
20/04/18	0.00		Dry	
20/04/18	1.20		Dry	
23/04/18	1.20		Dry	
23/04/18	4.30	3.50	4.30	... Water Added
23/04/18	9.00	9.00	4.20	
24/04/18	9.00	9.00	4.50	
24/04/18	9.30	9.00	8.80	
24/04/18	10.00	9.90	9.50	
24/04/18	11.50	9.90	11.00	
24/04/18	13.00	9.90	12.00	
24/04/18	14.50	9.90	12.50	
24/04/18	15.45	9.90	13.50	
25/04/18	15.45	9.90	5.70	
25/04/18	15.70	15.30	Dry	
25/04/18	21.50	15.90	Dry	
26/04/18	21.50	15.90	19.30	... See Remark 1
26/04/18	21.70	15.90	Dry	
26/04/18	31.75	15.90	Dry	
27/04/18	31.75	15.90	30.80	... See Remark 2
27/04/18	32.00	15.90	Dry	
27/04/18	35.00	15.90	Dry	

Type	Depth (m)	N Value	Blow Count / 75mm	Casing Depth (m)	Water Depth (m)
C	1.50	N2	1, 0 / 1, 0, 1, 0	1.50	Dry
C	2.50	N4	1, 0 / 1, 0, 1, 2	2.50	Dry
C	3.50	N6	1, 1 / 1, 1, 2, 2	3.50	Dry
C	4.50	N24	1, 2 / 4, 5, 6, 9	4.50	4.50
C	5.50	N32	1, 2 / 5, 7, 9, 11	5.50	5.50
C	6.50	N34	2, 3 / 5, 8, 9, 12	6.50	6.50
C	7.50	N36	3, 4 / 6, 9, 10, 11	7.50	7.50
C	8.50	N20	3, 4 / 4, 5, 5, 6	8.50	8.50
S	10.50	N30	4, 5 / 6, 7, 8, 9	9.90	9.50
S	12.00	N37	3, 4 / 6, 8, 9, 14	9.90	11.00
C	13.00	N29	16, 8 / 6, 5, 8, 10	9.90	12.00
S	15.00	N45	6, 7 / 9, 10, 12, 14	9.90	12.50
S	16.50	N47	4, 7 / 10, 11, 12, 14	15.90	Dry
S	18.00	N49	6, 8 / 10, 12, 13, 14	15.90	Dry
S	19.50	N50/0.295	5, 7 / 10, 13, 13, 14	15.90	Dry
S	21.00	N49	5, 7 / 10, 11, 13, 15	15.90	Dry
S	22.45	N50/0.29	4, 7 / 9, 12, 15, 14	15.90	Dry
S	24.00	N49/0.29	6, 9 / 11, 12, 14, 12	15.90	Dry
S	25.45	N46/0.225	7, 10 / 13, 13, 20	15.90	Dry
S	26.95	N50/0.11	13, 12 / 28, 22	15.90	Dry
S	28.45	N50/0.115	11, 14 / 26, 24	15.90	Dry
S	29.90	N50/0.21	7, 15 / 17, 19, 14	15.90	Dry
S	31.40	N50/0.135	6, 17 / 25, 25	15.90	Dry
S	32.95	N50/0.125	10, 15 / 28, 22	15.90	Dry
S	34.50	N50/0.24	5, 9 / 11, 15, 19, 5	15.90	Dry

GENERAL REMARKS

1. UXO survey carried out in the borehole.
2. Water entering the borehole between 25/04/18 and 26/04/18.
3. Water entering the borehole between 26/04/18 and 27/04/18.

KEY

SAMPLES

- ES - Environmental Sample (Tub, Vial, Jar)
- U - 100mm Diameter Undisturbed Sample
- UT - 100mm Diameter Thin Wall Undisturbed Sample
- U38 - 38mm Diameter Undisturbed Sample
- D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample
- C - Core Sample, W-Water Sample, R-Root Sample

INSTALLATION DETAILS

- SPIE - Standpipe Piezometer
- SPGW - Groundwater Monitor Standpipe
- SPG/GW - Gas / Groundwater Monitor Standpipe
- VWP - Vibrating Wire Piezometer
- ICM - Inclinator

HOLE TYPES

- IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
- CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
- DS - Dynamic Sampling, DS/R-Dynamic Sampling /Rotary
- DC - Diamond Coring, CPR-Cable Percussion Rotary follow on

TESTS S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compounds

Note: All depths are in metres, all diameters in millimetres, water strike rise time in minutes. For details of abbreviations see Key

Issue No: 01

Checked By: AN

Approved By: OS

Log Print Date & Time: 08/06/2018 09:38

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 20/04/18
Date Completed 30/04/18

Ground Level (mOD)
26.84

Co-Ordinates
E 529289.8 N 181809.3

Final Depth
35.00m

Client

University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
1 of 4

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
20/04/18		Dry	26.59		0.25	CONCRETE.	0.20	ES01		... VOC 0.0ppm	
			26.34		0.50	Brick wall. (MADE GROUND)	0.20 0.50	B02 ES03 B04		... VOC 0.0ppm	
		Dry Dry			(0.70)	Brown clayey very gravelly fine to coarse SAND. Gravel comprises angular to subrounded fine to coarse flint, brick and concrete fragments. (MADE GROUND)	1.00	ES05		... VOC 0.0ppm	
20/04/18							1.00	B06			
23/04/18			25.64		1.20	Soft to firm, dark brown gravelly sandy CLAY. Gravel comprises angular to subangular fine to coarse flint, brick and chalk fragments. Sand is fine to coarse. (MADE GROUND)	1.20-1.50 1.50 1.50	B07 B08	N2	1, 0 / 1, 0, 1, 0	
				(3.10)	2.50 ... becoming very gravelly with rare wood fragments (<10mm)	2.50	B09	N4	1, 0 / 1, 0, 1, 2		
						2.50					
						3.50					
							3.50 ... becoming brown	3.50	B10	N6	1, 1 / 1, 1, 2, 2
23/04/18			3.50	4.30	22.54		4.30	Medium dense, brown sandy angular to well rounded fine to coarse flint GRAVEL. Sand is fine to coarse. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	4.50 4.50 4.50	ES11 B12	N24
					(2.20)		5.50	B13	N32	1, 2 / 5, 7, 9, 11	
							5.50				
			20.34		6.50		6.50	B14	N34	2, 3 / 5, 8, 9, 12	
				(2.20)	Dense, brown gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. (RIVER TERRACE DEPOSITS - LYNCH HILL GRAVEL)	6.50					
						7.50	B15	N36	3, 4 / 6, 9, 10, 11		
						7.50					
			18.14		8.70		8.50	B16	N20	3, 4 / 4, 5, 5, 6	
						8.50					
23/04/18	9.00	4.20				Very stiff, extremely closely fissured brownish grey CLAY. Fissures are of multiple orientation, undulating, rough. (THAMES GROUP: LONDON CLAY FORMATION - A3ii)	9.30-9.70	B17			
24/04/18	9.00	4.50									
24/04/18	9.00	8.80									
24/04/18	9.90	9.50			(3.25)		10.00-10.45	UT18	60 blows	100% Recovery	
							10.45	D19	N30	4, 5 / 6, 7, 8, 9	
							10.50-10.95				D20

Issue No: 01

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Log Print Date & Time: 07/06/2018 11:38

Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 20/04/18
Date Completed 30/04/18

Ground Level (mOD)
26.84

Co-Ordinates
E 529289.8 N 181809.3

Final Depth
35.00m

Client
University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
2 of 4

PROGRESS			STRATA				SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result			
24/04/18	9.90	11.00					11.20	D21				
							11.50-11.95	UT22	70 blows	100% Recovery		
			14.89		11.95		11.95	D23				
							12.00	D24	N37	3, 4 / 6, 8, 9, 14		
							12.00-12.45	B25				
							12.40-12.70					
24/04/18	9.90	12.00			(3.00)	Stiff, extremely closely fissured brownish grey CLAY. Fissures are of multiple orientation, undulating, rough. (THAMES GROUP: LONDON CLAY FORMATION - A3i) 12.00 ... with medium to coarse gravel size claystone fragments and occasional burrows of dark grey silt 12.40 ... with a band of claystone recovered as: angular to subangular fine to coarse gravel	13.00		N29	16, 8 / 6, 5, 8, 10		
							13.00-13.45	B26				
							14.00	D27				
24/04/18	9.90	12.50					14.50-14.95	UT28	90 blows	100% Recovery		
			11.89		14.95		14.95	D29				
							15.00	D30	N45	6, 7 / 9, 10, 12, 14		
							15.00-15.45					
24/04/18	9.90	13.50			(2.05)	Stiff, brownish grey CLAY with occasional partings and pockets (<30mm) of silty micaceous fine sand and occasional to rare foraminifera. (THAMES GROUP: LONDON CLAY FORMATION - A2)	15.70	D31				
25/04/18	9.90	5.70					16.00-16.45	UT32	100 blows	100% Recovery		
25/04/18	15.30	Dry					16.45	D33				
							16.50	D34	N47	4, 7 / 10, 11, 12, 14		
							16.50-16.95					
			9.84		17.00		17.20	D35				
					(2.45)	Stiff, brownish grey slightly sandy silty CLAY with frequent partings and pockets (<30mm) of silty micaceous fine sand. (THAMES GROUP: LONDON CLAY FORMATION - A2)	17.50-17.95	UT36	100 blows	100% Recovery		
							17.95	D37				
							18.00	D38	N49	6, 8 / 10, 12, 13, 14		
							18.00-18.45					
							18.70	D39				
							19.00-19.45	UT40	100 blows	100% Recovery		
							19.45	D41				
							19.50		N50/ 295 mm	5, 7 / 10, 13, 13, 14		
					(2.25)	Stiff, brownish grey sandy silty CLAY with frequent partings of silty micaceous fine sand and occasional foraminifera. (THAMES GROUP: LONDON CLAY FORMATION - A2)	19.50-19.95	D42				
							20.20	D43				
							20.50-20.95	UT44	100 blows	100% Recovery		
							20.95	D45				
							21.00	D46	N49	5, 7 / 10, 11, 13, 15		
							21.00-21.45					
25/04/18	15.90	Dry					21.70	D47				
26/04/18	15.90	19.30										
26/04/18	15.90	Dry	5.14		21.70							
						Very stiff, brownish grey CLAY with rare partings of silty fine sand.	22.00-22.45	UT48	100 blows	89% Recovery		

Issue No: 01

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Project

Middlesex Hospital Annexe

Job No
18/3104

Date Started 20/04/18
Date Completed 30/04/18

Ground Level (mOD)
26.84

Co-Ordinates
E 529289.8 N 181809.3

Final Depth
35.00m

Client

University College Hospitals Charity

**Method/
Plant Used** Cable Percussion

Sheet
3 of 4

PROGRESS			STRATA			SAMPLES & TESTS				Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result		
26/04/18 27/04/18 27/04/18	15.90 15.90 15.90	Dry 30.80 Dry	3.64		(1.50)	(THAMES GROUP: LONDON CLAY FORMATION - A2) 22.40 - 23.20 ... with a band of slightly silty sand and frequent partings of micaceous fine sand	22.40 22.45 22.45-22.90 23.20	D49 D50 D51	N50/ 290 mm	4, 7 / 9, 12, 15, 14	
					(2.20)	Very stiff, brownish grey slightly sandy silty CLAY with frequent partings and occasional pockets (<50mm) of silty fine sand and rare shell fragments. (THAMES GROUP: LONDON CLAY FORMATION - A2)	23.50-23.95 23.95 24.00 24.00-24.45 24.70 25.00-25.95	UT52 D53 D54 D55 UT56	100 blows N49/ 290 mm 100 blows	100% Recovery 6, 9 / 11, 12, 14, 12 89% Recovery	
			(6.60)	Very stiff, greyish brown mottled bluish grey CLAY. (LAMBETH GROUP: READING FORMATION: Upper Mottled Beds) 25.50 ... becoming brownish grey and pinkish red with occasional polished surfaces 27.70 ... becoming greyish green mottled orangish brown 29.20 ... locally with calcrete nodules 30.70 ... becoming sandy and silty 31.35 ... becoming bluish grey mottled orangish brown and silty with a parting of silty fine sand			25.40 25.45 25.45-25.90 25.50-26.00 26.20 26.50-26.95 26.90 26.95 26.95-27.20 27.70 28.00-28.45 28.40 28.45 28.45-28.90 29.20 29.50-29.95 29.85 29.90 29.90-30.35 30.70 31.00-31.45 31.35 31.40 31.40-31.85 32.00	D57 D58 B59 D60 UT61 D62 D63 D64 UT65 D66 D67 D68 UT69 D70 D71 D72 UT73 D74 D75 D76	N46/ 225 mm N50/ 110 mm <		

Issue No: 01

Checked By: AN

Approved By: OS

Log Print Date & Time: 07/06/2018 11:38

Sheet 4 of 4

Job No: DFS191007

Design Engineer: AR

Date: 18 July 2020

Job Name: 44 CLEVELAND STREET LONDON
W1T 4JT

Calc Title: Detailed Design for Contiguous Pile Retaining Wall **Rev. 01**

Page: 20 of 22

MS Excel Spreadsheet – Pile Wall Vertical Capacity in Compression

CALCULATION SHEET

 Deep Foundations Specialists Tel: 01628 670982 21 Brambling Way Maidenhead Berkshire SL6 8PQ www.deep-foundations.co.uk	Sheet No. of
	Enq. No. Con. No.
44 CLEVELAND STREET LODON W1 450mm Dia. Contiguous Pile Wall Pile Wall Capacity in Compression Rev. 01	Calculated by : AR Date : 18/07/2020 Checked by : AA Date : 18/07/2020

Bored Pile Design: straight - shafted

Version : BSPile 3.03

Design Ground Level (m.O.D.) = **27.700**
Design Ground Water Level (m.O.D.) = **21.500**

SWL = Lesser of USF / 1.20
and
(USF + UEB) / 2.60

where : SWL = Safe working load
USF = Ultimate shaft friction
UEB = Ultimate end bearing

SWL Output enclosed in brackets indicates that overall F.O.S. is used

Pile Toe Level (m.O.D)	Founding Strata Type & Description		Geotechnical Design Parameters							Pile				Pile							
			γ (kN/m³)	SPT "N"	Ks / (α)	Tan(δ)/ (Cu (kPa))	Nq / (Nc)	Qus (kPa)	Qub (kPa)	Dia(mm): 450				Dia(mm): 350							
										Qub (kPa)	USF (kN)	UEB (kN)	SWL (kN)	Qub (kPa)	USF (kN)	UEB (kN)	SWL (kN)	Qub (kPa)	USF (kN)	UEB (kN)	SWL (kN)
27.200	0	Dug-out Basement	18.00							0	0	0	(0)	0	0	0	(0)				
26.700	0		18.00							0	0	0	(0)	0	0	0	(0)				
26.200	0		18.00							0	0	0	(0)	0	0	0	(0)				
25.700	0		18.00							0	0	0	(0)	0	0	0	(0)				
25.200	0		18.00							0	0	0	(0)	0	0	0	(0)				
24.700	0		18.00							0	0	0	(0)	0	0	0	(0)				
24.200	0		18.00							0	0	0	(0)	0	0	0	(0)				
23.700	0		18.00							0	0	0	(0)	0	0	0	(0)				
23.200	0		18.00							0	0	0	(0)	0	0	0	(0)				
22.700	8	L to Dense Gravelly S	20.00		1.00	0.75	98	68	8879	7338	28	1167	23	8026	22	772	18				
22.200	8		20.00		1.00	0.75	98	76	9859	9859	79	1568	66	9859	62	949	51				
21.700	8		20.00		1.00	0.75	98	83	10839	10802	136	1718	113	10821	105	1041	88				
21.200	8		20.00		1.00	0.75	98	89	11525	11511	197	1831	164	11522	153	1109	127				
20.700	8		20.00		1.00	0.75	98	92	12000	11894	261	1892	217	11918	203	1147	169				
20.200	8		20.00		1.00	0.75	98	96	12000	12000	327	1909	273	12000	255	1155	212				
19.700	8		20.00		1.00	0.75	98	100	12000	12000	397	1909	331	12000	309	1155	257				
19.200	8		20.00		1.00	0.75	98	104	12000	7267	469	1156	391	8957	365	862	304				
18.700	8		20.00		1.00	0.75	98	107	12000	1350	544	215	(292)	1350	423	130	(213)				
18.200	2	Stiff to V.Stiff Clay	20.00		(0.50)	(150)	(9.00)	75	1350	1350	597	215	(312)	1350	464	130	(228)				
17.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	650	215	(332)	1350	505	130	(244)				
17.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	703	215	(353)	1350	546	130	(260)				
16.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	756	215	(373)	1350	588	130	(276)				
16.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	809	215	(394)	1350	629	130	(292)				
15.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	862	215	(414)	1350	670	130	(308)				
15.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	915	215	(434)	1350	711	130	(324)				
14.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	968	215	(455)	1350	753	130	(339)				
14.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1021	215	(475)	1350	794	130	(355)				
13.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1074	215	(496)	1350	835	130	(371)				
13.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1127	215	(516)	1350	876	130	(387)				
12.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1180	215	(536)	1350	918	130	(403)				
12.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1233	215	(557)	1350	959	130	(419)				
11.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1286	215	(577)	1350	1000	130	(435)				
11.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1339	215	(597)	1350	1041	130	(450)				
10.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1392	215	(618)	1350	1082	130	(466)				
10.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1445	215	(638)	1350	1124	130	(482)				
9.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1498	215	(659)	1350	1165	130	(498)				
9.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1551	215	(679)	1350	1206	130	(514)				
8.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1604	215	(699)	1350	1247	130	(530)				
8.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1657	215	(720)	1350	1289	130	(546)				
7.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1710	215	(740)	1350	1330	130	(561)				
7.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1763	215	(761)	1350	1371	130	(577)				
6.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1816	215	(781)	1350	1412	130	(593)				
6.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1869	215	(801)	1350	1454	130	(609)				
5.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1922	215	(822)	1350	1495	130	(625)				
5.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	1975	215	(842)	1350	1536	130	(641)				
4.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2028	215	(863)	1350	1577	130	(657)				
4.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2081	215	(883)	1350	1619	130	(672)				
3.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2134	215	(903)	1350	1660	130	(688)				
3.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2187	215	(924)	1350	1701	130	(704)				
2.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2240	215	(944)	1350	1742	130	(720)				
2.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2293	215	(965)	1350	1783	130	(736)				
1.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2346	215	(985)	1350	1825	130	(752)				
1.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2399	215	(1005)	1350	1866	130	(768)				
0.700	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2452	215	(1026)	1350	1907	130	(783)				
0.200	2		20.00		(0.50)	(150)	(9.00)	75	1350	1350	2505	215	(1046)	1350	1948	130	(799)				

Job No: DFS191007

Design Engineer: AR

Date: 18 July 2020

Job Name: 44 CLEVELAND STREET LONDON
W1T 4JT

Calc Title: Detailed Design for Contiguous Pile Retaining Wall Rev. 01

Page: 21 of 22

CADS PWS 2.0 Computer Output Files – ULS Analysis

Section 1 - 1 ULS Analysis	Page No 1 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Pile geometry

Pile top Level 27.7 m
 Pile Length 9.1 m
 Pile toe level 18.6 m
 Active ground slope 0 Degrees (To horizontal)

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

Initial Ground Water level 21.5

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
27.70	Made Ground	18.00	18.00	20000	0	3 3		31 31	.67 .50	.27 5.04	1.34 5.50
22.70	L to Dense Grav	19.00	19.00	90000	0	1 1		37 37	.67 .50	.20 7.92	1.17 6.89
18.70	Stiff to V.Stif	19.00	19.00	100000	0	5 5		28 28	.67 .50	.30 4.15	1.43 4.99
	Granular Fill	19.00	20.00	70000	0			37 37	.67 .50	.20 7.92	
	Construction sequence										

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1 A	Active surcharge	27.70	10.0	.3		
2 A	Moment load					
3 A	Passive side excavation	22.84				
4 A	Passive side fill	23.14				

Code of practice

Code of practice or reference document	
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	1.20
ULS fFactor on drained cohesion values	1.20
ULS factor on undrained cohesion values	1.50
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	1.00

Section 1 - 1 ULS Analysis	Page No 2 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Wall analysis detail options

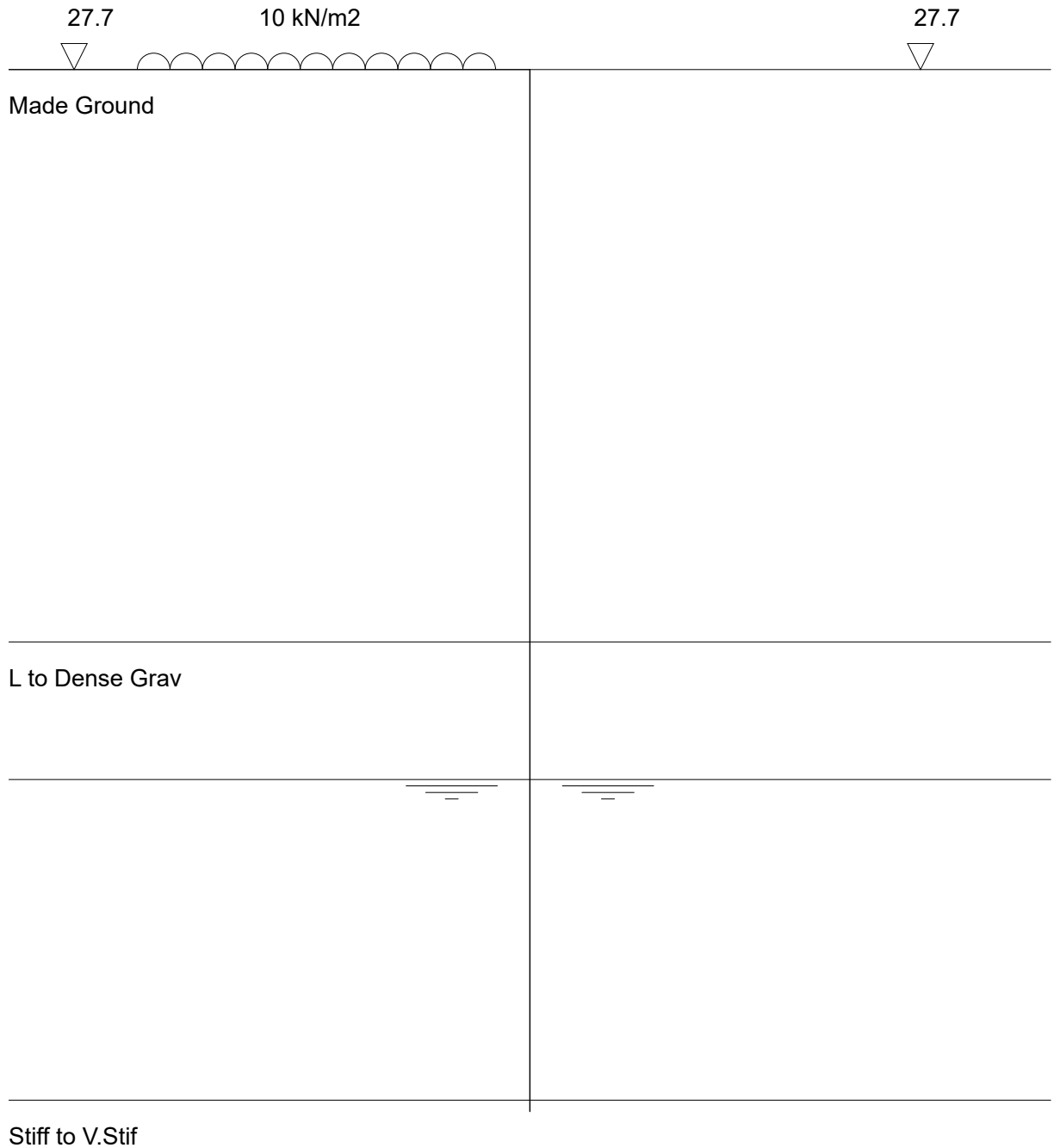
Nominal Phi for load distribution	30.0 Degrees
Depth of water filled tension cracks	.0 m
Density of water	10.0 kN/m3
Minimum equivalent fluid density	5.0 kN/m3
Depth of passive softened soil	.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	335482 cm4/m
Wall Youngs modulus	27000000 kN/m2

Section 1 - 1 ULS Analysis	Page No 3 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Stage ref. 1
Stage type Active surcharge



Section 1 - 1 ULS Analysis	Page No 4 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

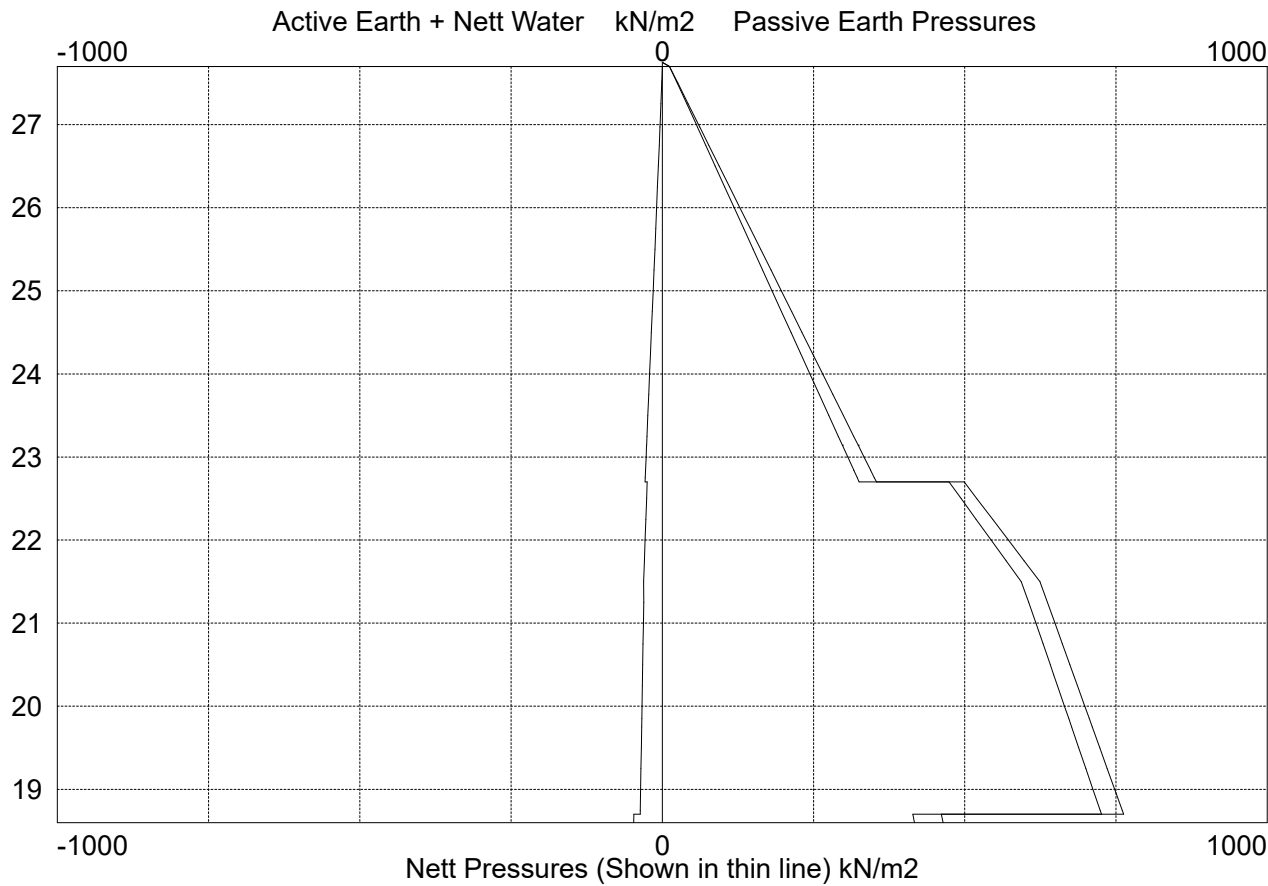
Tabular results from analysis of stage ref 1

strength.
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
	27.70	.0	.0	.0	.0	11.9	.0	-11.9	0	0			>100.00
t	27.70	.0	.0	.0	.0	12.1	.0	-12.1	0	0			>100.00
m	27.53	13.1	.9	.0	3.1	23.8	.0	-22.9	0	0			>100.00
	27.00	22.6	3.6	.0	12.6	59.8	.0	-56.2	0	0			>100.00
	26.97	23.1	3.8	.0	13.1	61.9	.0	-58.1	0	0			>100.00
	26.00	40.6	9.4	.0	30.6	128.2	.0	-118.8	0	0			>100.00
	25.00	58.6	15.2	.0	48.6	196.6	.0	-181.4	0	0			>100.00
	24.00	76.6	21.1	.0	66.6	265.0	.0	-243.9	0	0			>100.00
	23.14	92.0	26.0	.0	82.0	323.7	.0	-297.6	0	0			>100.00
	23.14	92.1	26.1	.0	82.1	323.8	.0	-297.8	0	0			>100.00
	23.00	94.6	26.9	.0	84.6	333.4	.0	-306.5	0	0			>100.00
	22.84	97.4	27.8	.0	87.4	344.2	.0	-316.4	0	0			>100.00
	22.84	97.5	27.8	.0	87.5	344.3	.0	-316.5	0	0			>100.00
	22.70	100.0	28.6	.0	90.0	353.9	.0	-325.3	0	0			>100.00
m	22.70	100.0	25.0	.0	90.0	499.0	.0	-474.0	0	0			>100.00
m	22.00	113.3	28.5	.0	103.3	572.0	.0	-543.5	0	0			>100.00
m	21.50	122.8	31.0	.0	112.8	624.2	.0	-593.2	0	0			>100.00
	21.00	127.3	31.3	5.0	117.3	648.9	5.0	-617.6	0	0			>100.00
	20.38	132.9	32.7	11.2	122.9	679.7	11.2	-647.0	0	0			>100.00
	20.00	136.3	33.6	15.0	126.3	698.3	15.0	-664.7	0	0			>100.00
	19.85	137.6	33.9	16.5	127.6	705.5	16.5	-671.6	0	0			>100.00
	19.00	145.3	35.9	25.0	135.3	747.7	25.0	-711.9	0	0			>100.00
	18.70	148.0	36.6	28.0	138.0	762.6	28.0	-726.0	0	0			>100.00
	18.70	148.0	47.1	28.0	138.0	461.2	28.0	-414.1	0	0			>100.00
	18.60	148.9	47.4	29.0	138.9	464.1	29.0	-416.7	0	0			>100.00

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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

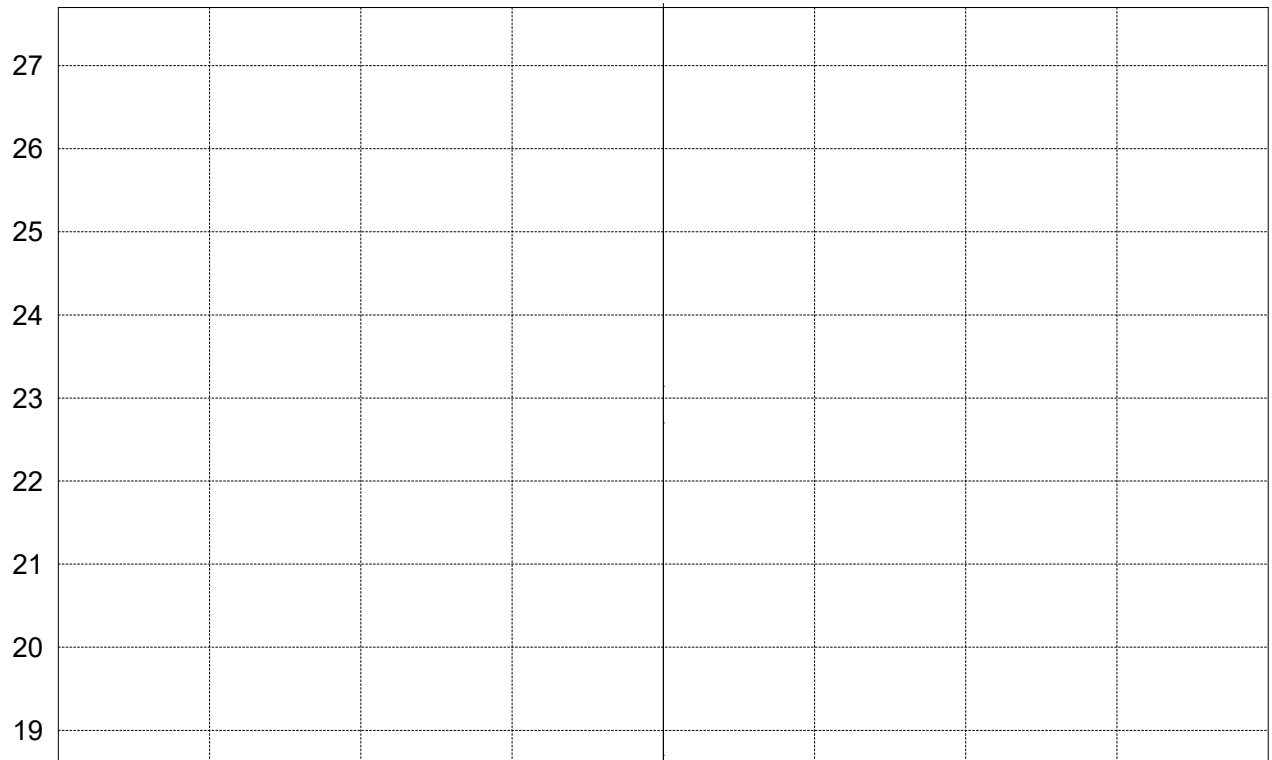
Graphical results from analysis of stage ref 1



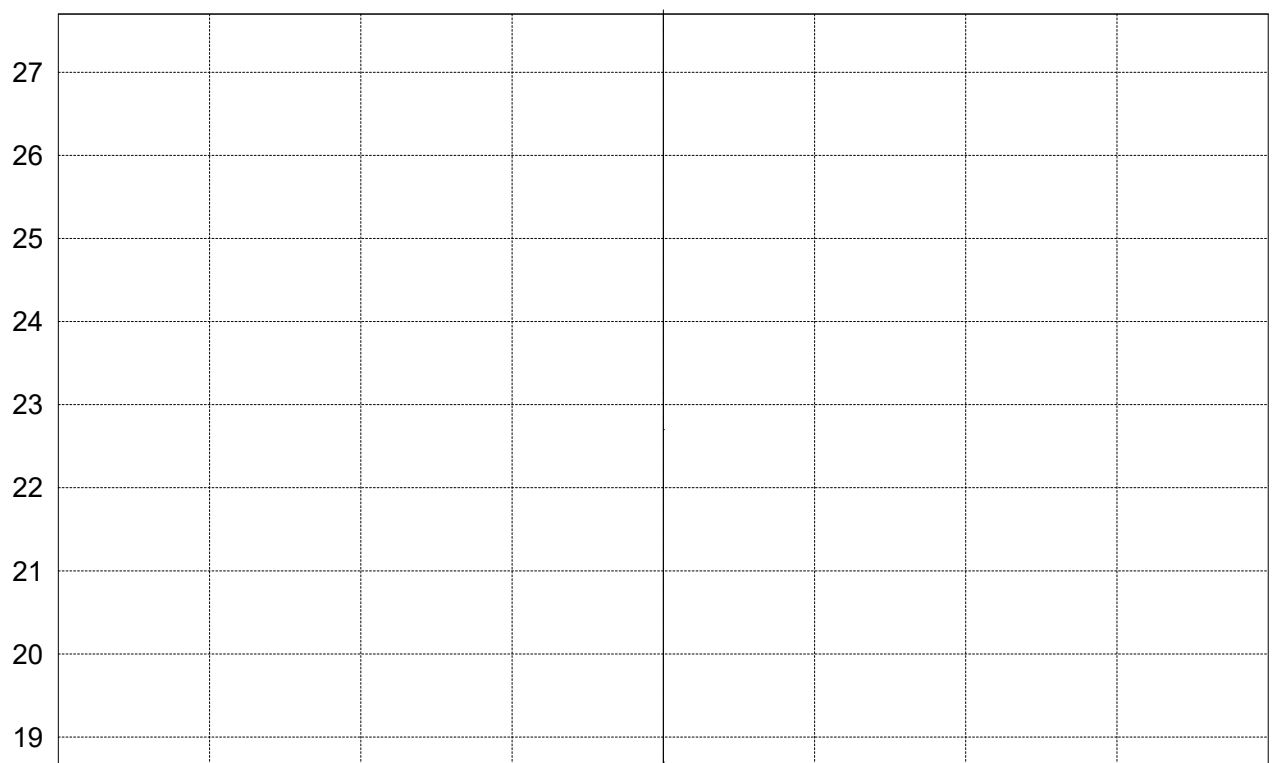
Deflection diagram not shown for analysis with partial factors applied

Section 1 - 1 ULS Analysis	Page No 6 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Graphical results from analysis of stage ref 1 continued



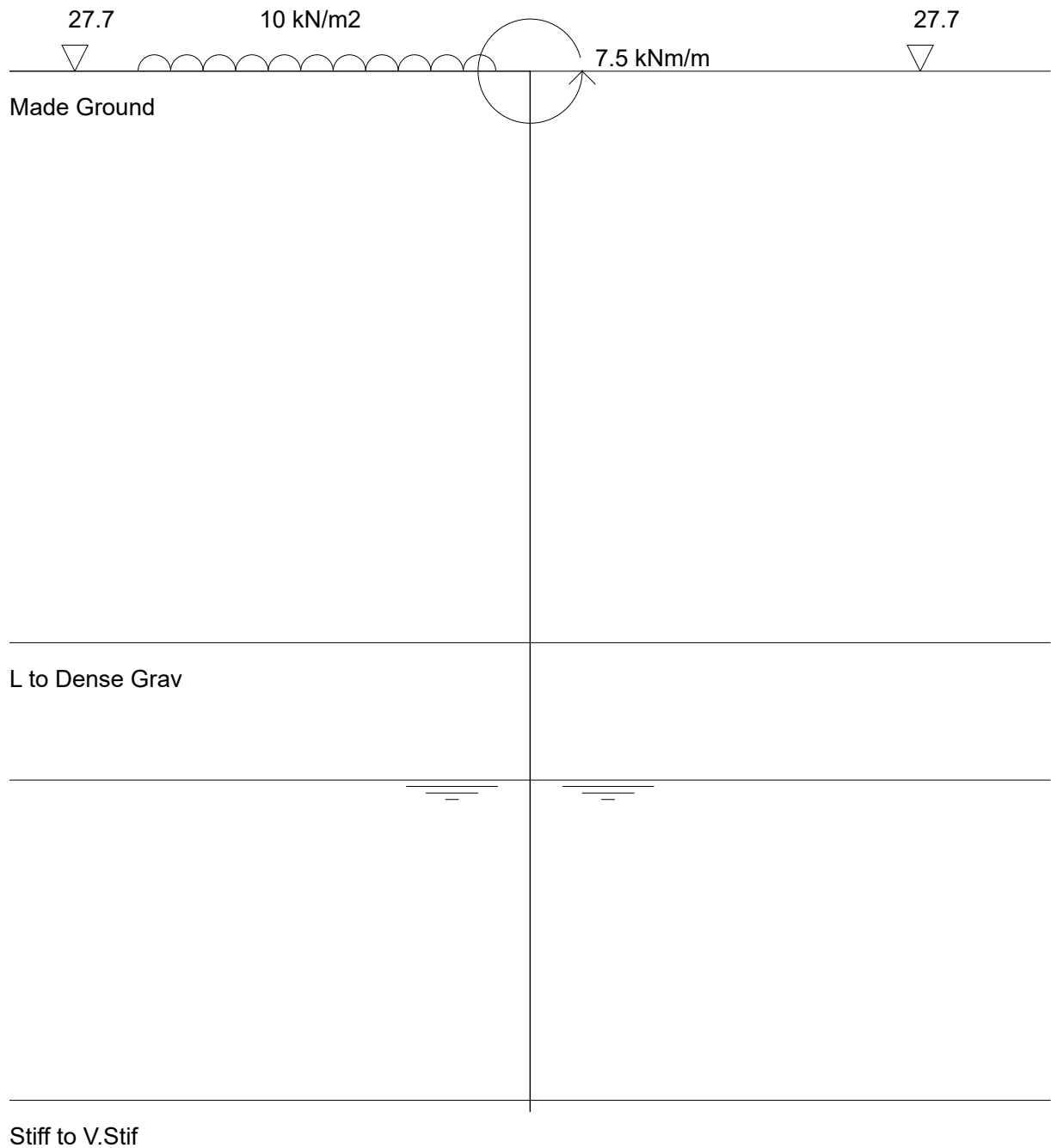
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 1 - 1 ULS Analysis	Page No 7 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Stage ref. 2
Stage type Moment load



Section 1 - 1 ULS Analysis	Page No 8 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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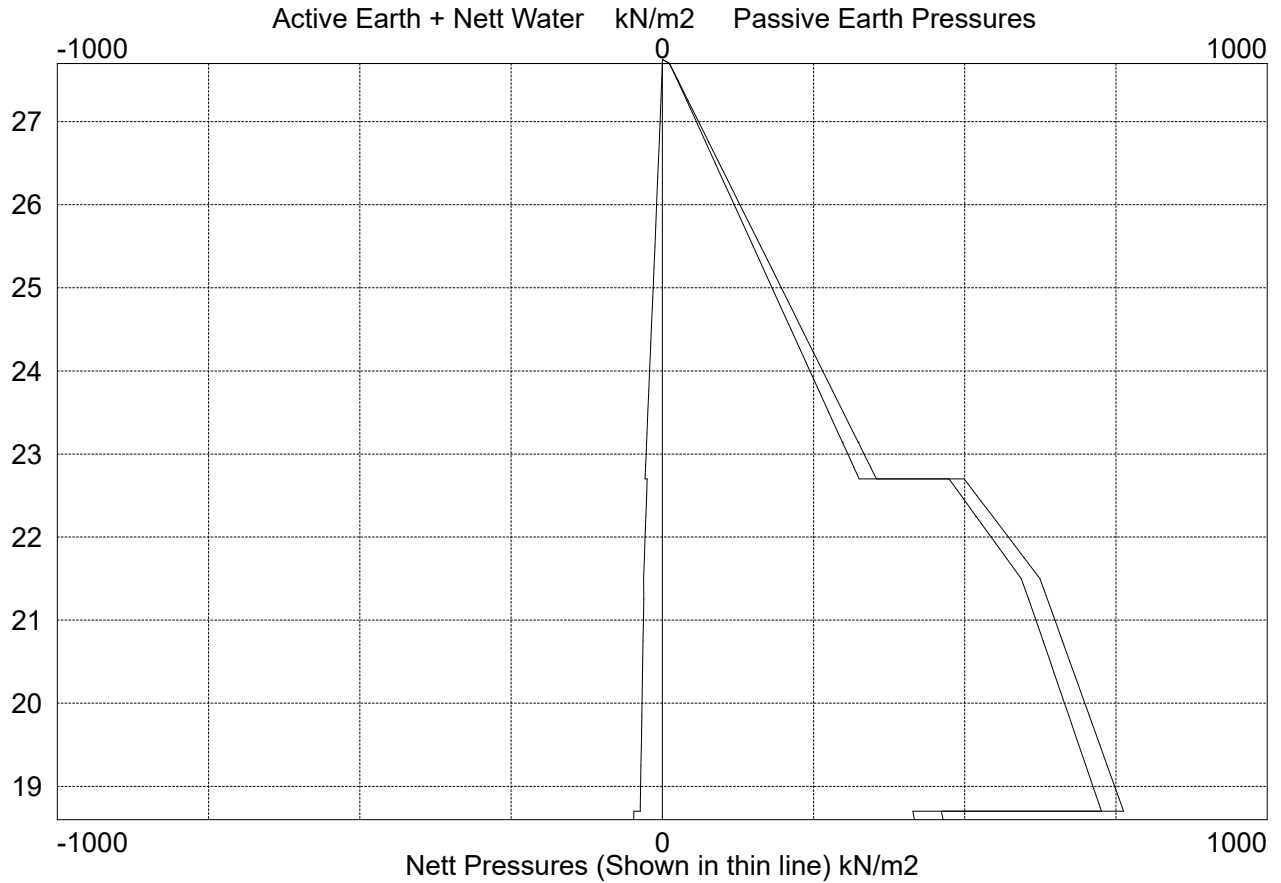
Tabular results from analysis of stage ref 2

strength.
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
	27.70	.0	.0	.0	.0	11.9	.0	-11.9	0	.3			.00
t	27.70	.0	.0	.0	.0	12.1	.0	-12.1	7.5	.3			.00
m	27.53	13.1	.9	.0	3.1	23.8	.0	-22.9	7.2	3.3			.04
	27.00	22.6	3.6	.0	12.6	59.8	.0	-56.2	.7	24.2			.91
	26.97	23.1	3.8	.0	13.1	61.9	.0	-58.1	0	25.9			1.02
	26.00	40.6	9.4	.0	30.6	128.2	.0	-118.8	0	0			6.25
	25.00	58.6	15.2	.0	48.6	196.6	.0	-181.4	0	0			10.63
	24.00	76.6	21.1	.0	66.6	265.0	.0	-243.9	0	0			12.23
	23.14	92.0	26.0	.0	82.0	323.7	.0	-297.6	0	0			12.66
	23.14	92.1	26.1	.0	82.1	323.8	.0	-297.8	0	0			12.66
	23.00	94.6	26.9	.0	84.6	333.4	.0	-306.5	0	0			12.69
	22.84	97.4	27.8	.0	87.4	344.2	.0	-316.4	0	0			12.72
	22.84	97.5	27.8	.0	87.5	344.3	.0	-316.5	0	0			12.72
	22.70	100.0	28.6	.0	90.0	353.9	.0	-325.3	0	0			12.74
m	22.70	100.0	25.0	.0	90.0	499.0	.0	-474.0	0	0			12.74
m	22.00	113.3	28.5	.0	103.3	572.0	.0	-543.5	0	0			13.06
m	21.50	122.8	31.0	.0	112.8	624.2	.0	-593.2	0	0			13.45
	21.00	127.3	31.3	5.0	117.3	648.9	5.0	-617.6	0	0			13.88
	20.38	132.9	32.7	11.2	122.9	679.7	11.2	-647.0	0	0			14.41
	20.00	136.3	33.6	15.0	126.3	698.3	15.0	-664.7	0	0			14.73
	19.85	137.6	33.9	16.5	127.6	705.5	16.5	-671.6	0	0			14.84
	19.00	145.3	35.9	25.0	135.3	747.7	25.0	-711.9	0	0			15.48
	18.70	148.0	36.6	28.0	138.0	762.6	28.0	-726.0	0	0			15.69
	18.70	148.0	47.1	28.0	138.0	461.2	28.0	-414.1	0	0			15.69
	18.60	148.9	47.4	29.0	138.9	464.1	29.0	-416.7	0	0			15.75

Section 1 - 1 ULS Analysis	Page No 9 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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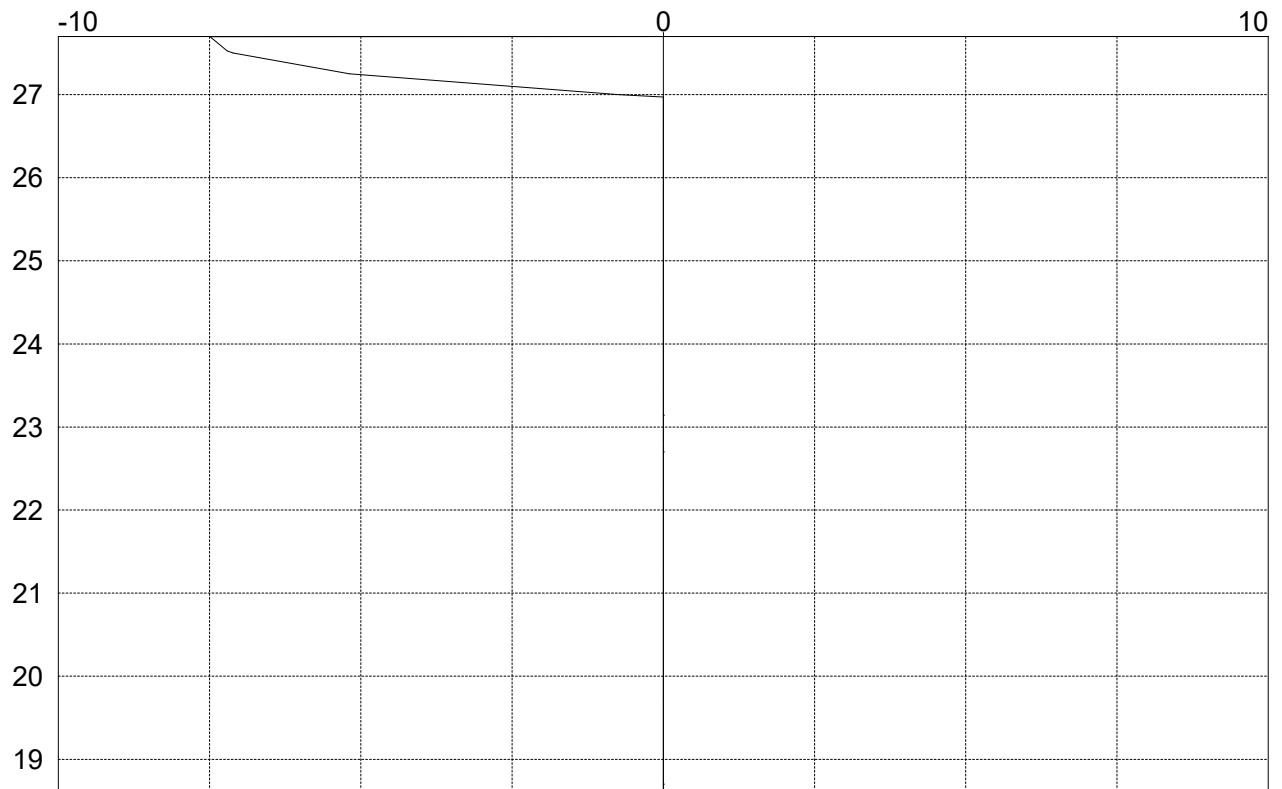
Graphical results from analysis of stage ref 2



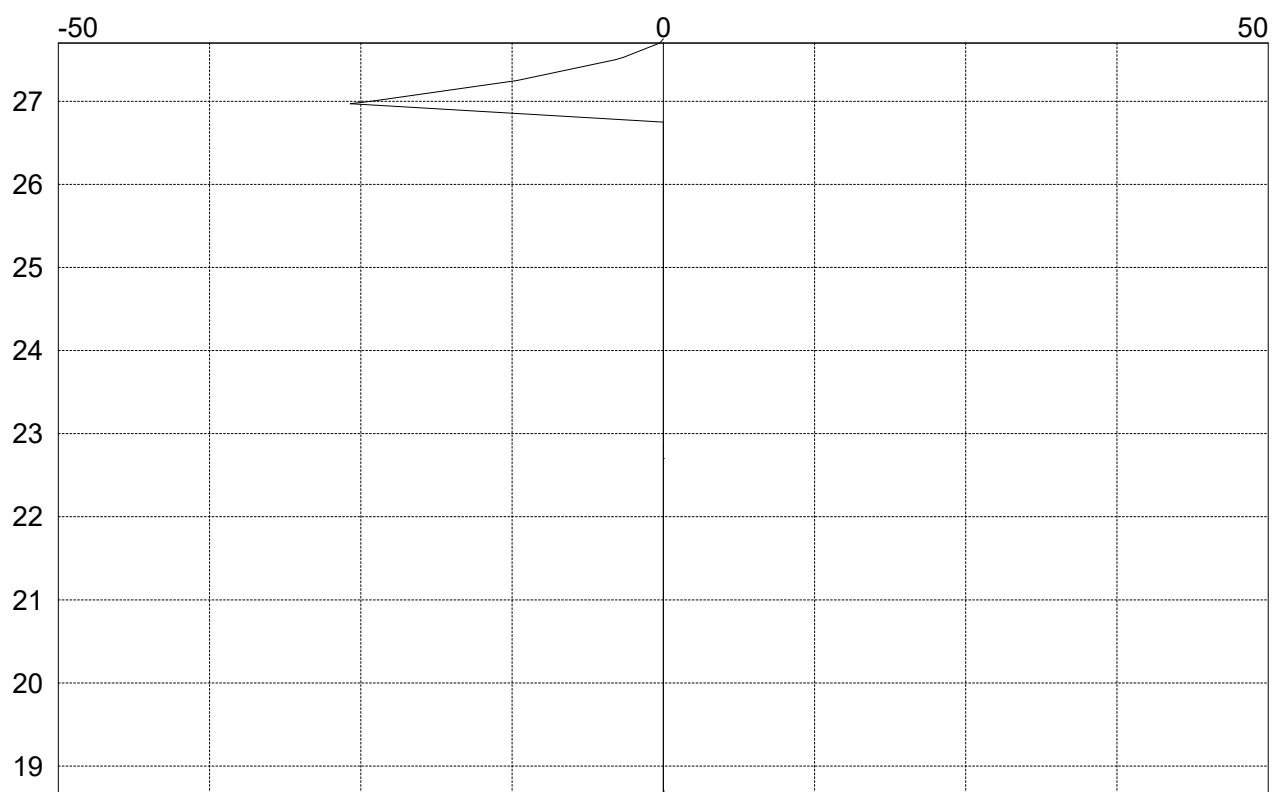
Deflection diagram not shown for analysis with partial factors applied

Section 1 - 1 ULS Analysis	Page No 10 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Graphical results from analysis of stage ref 2 continued



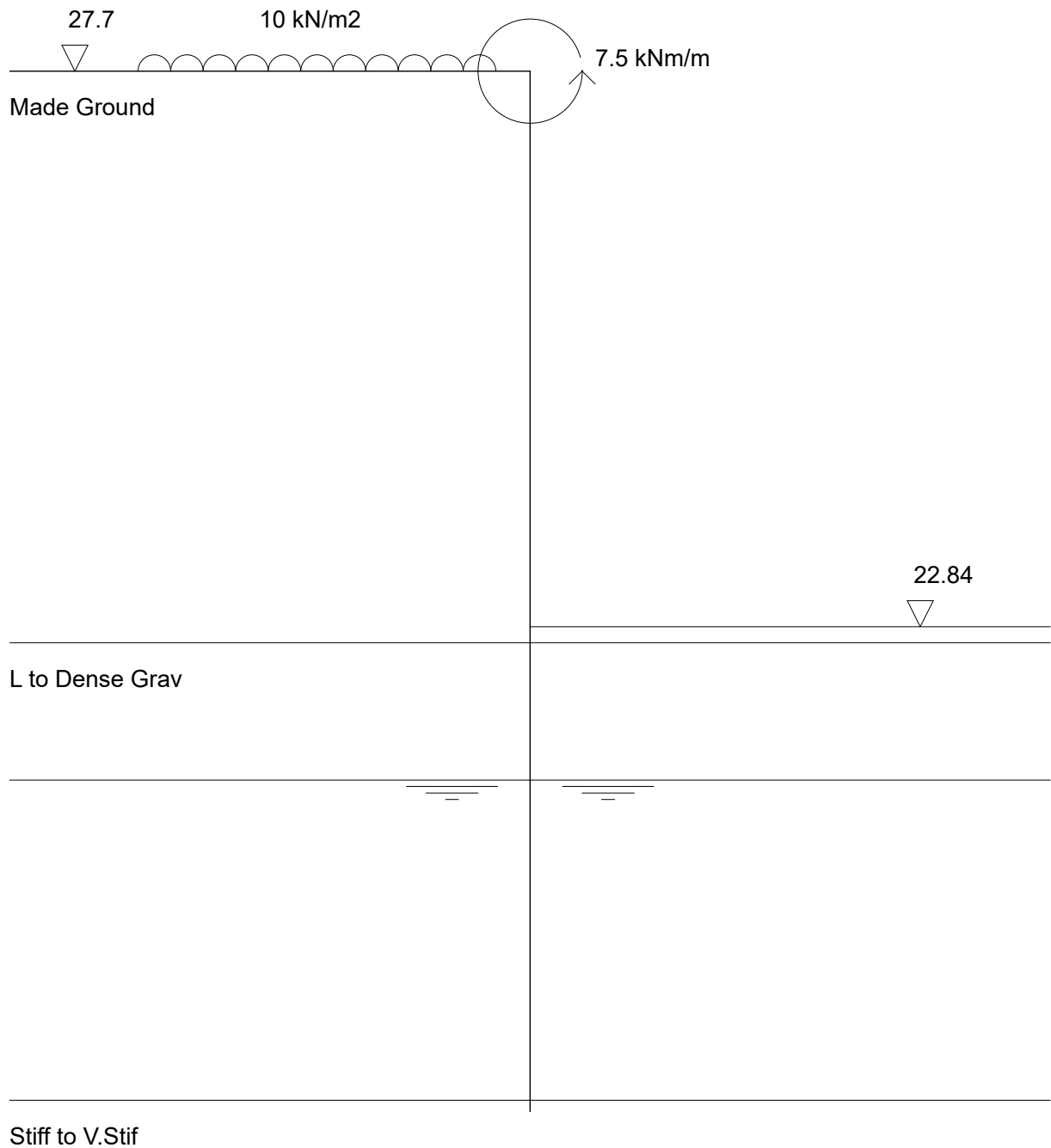
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 1 - 1 ULS Analysis	Page No 11 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Stage ref. 3
Stage type Passive side excavation



Section 1 - 1 ULS Analysis	Page No Analysis	12 ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project File Name	1 - 1 ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer Date	AA 18/07/2020

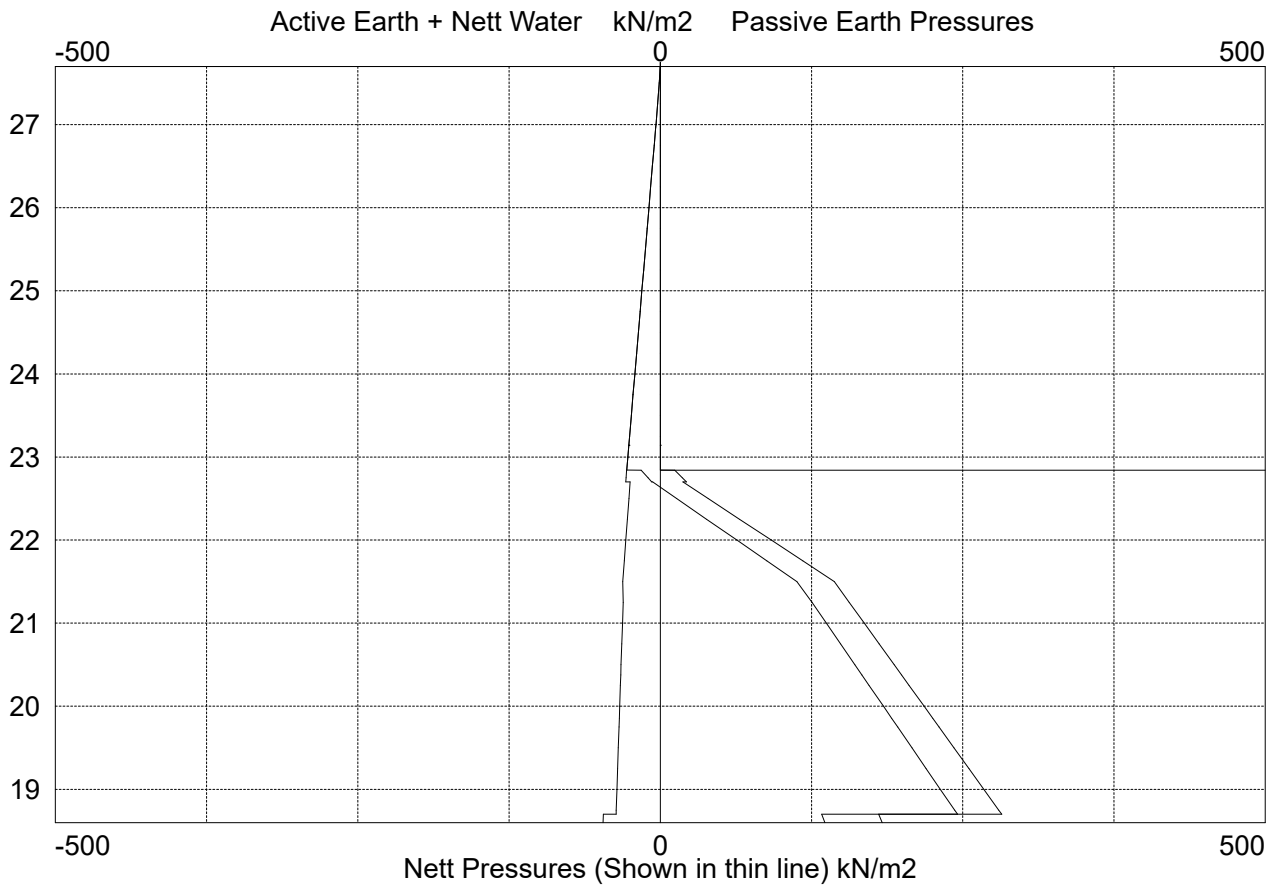
Tabular results from analysis of stage ref 3

strength.
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
	27.70	.0	.0	.0	.0	.0	.0	0	0	0			.00
t	27.70	.0	.0	.0	.0	.0	.0	0	7.5	0			.00
m	27.53	13.1	.9	.0	.0	.0	.0	.9	7.5	-.1			.00
	27.00	22.6	3.6	.0	.0	.0	.0	3.6	7.8	-1.2			.00
	26.97	23.1	3.8	.0	.0	.0	.0	3.8	7.8	-1.4			.00
	26.00	40.6	9.4	.0	.0	.0	.0	9.4	11.8	-7.8			.00
	25.00	58.6	15.2	.0	.0	.0	.0	15.2	25.3	-20.1			.00
	24.00	76.6	21.1	.0	.0	.0	.0	21.1	54.0	-38.3			.00
	23.14	92.0	26.0	.0	.0	.0	.0	26.0	95.2	-58.5			.00
	23.14	92.1	26.1	.0	.0	.0	.0	26.1	95.3	-58.5			.00
	23.00	94.6	26.9	.0	.0	.0	.0	26.9	103.7	-62.2			.00
	22.84	97.4	27.8	.0	.0	.0	.0	27.8	113.9	-66.5			.00
	22.84	97.5	27.8	.0	.0	11.9	.0	15.9	114.0	-66.6			.00
	22.70	100.0	28.6	.0	2.5	21.5	.0	7.1	123.5	-68.2			.00
m	22.70	100.0	25.0	.0	2.5	18.6	.0	6.4	123.6	-68.2			.00
m	22.00	113.3	28.5	.0	15.8	91.7	.0	-63.2	167.1	-48.3			.07
m	21.50	122.8	31.0	.0	25.3	143.8	.0	-112.8	181.3	-4.3			.20
	21.00	127.3	31.3	5.0	29.8	168.5	5.0	-137.2	168.3	58.3			.41
	20.38	132.9	32.7	11.2	35.4	199.4	11.2	-166.6	102.0	153.4			.72
	20.00	136.3	33.6	15.0	38.8	218.0	15.0	-184.3	33.6	219.1			.92
	19.85	137.6	33.9	16.5	40.1	225.2	16.5	-191.2	0	246.5			1.00
	19.00	145.3	35.9	25.0	47.8	267.4	25.0	-231.5	0	0			1.49
	18.70	148.0	36.6	28.0	50.5	282.2	28.0	-245.6	0	0			1.66
	18.70	148.0	47.1	28.0	50.5	180.4	28.0	-133.4	0	0			1.66
	18.60	148.9	47.4	29.0	51.4	183.3	29.0	-135.9	0	0			1.71

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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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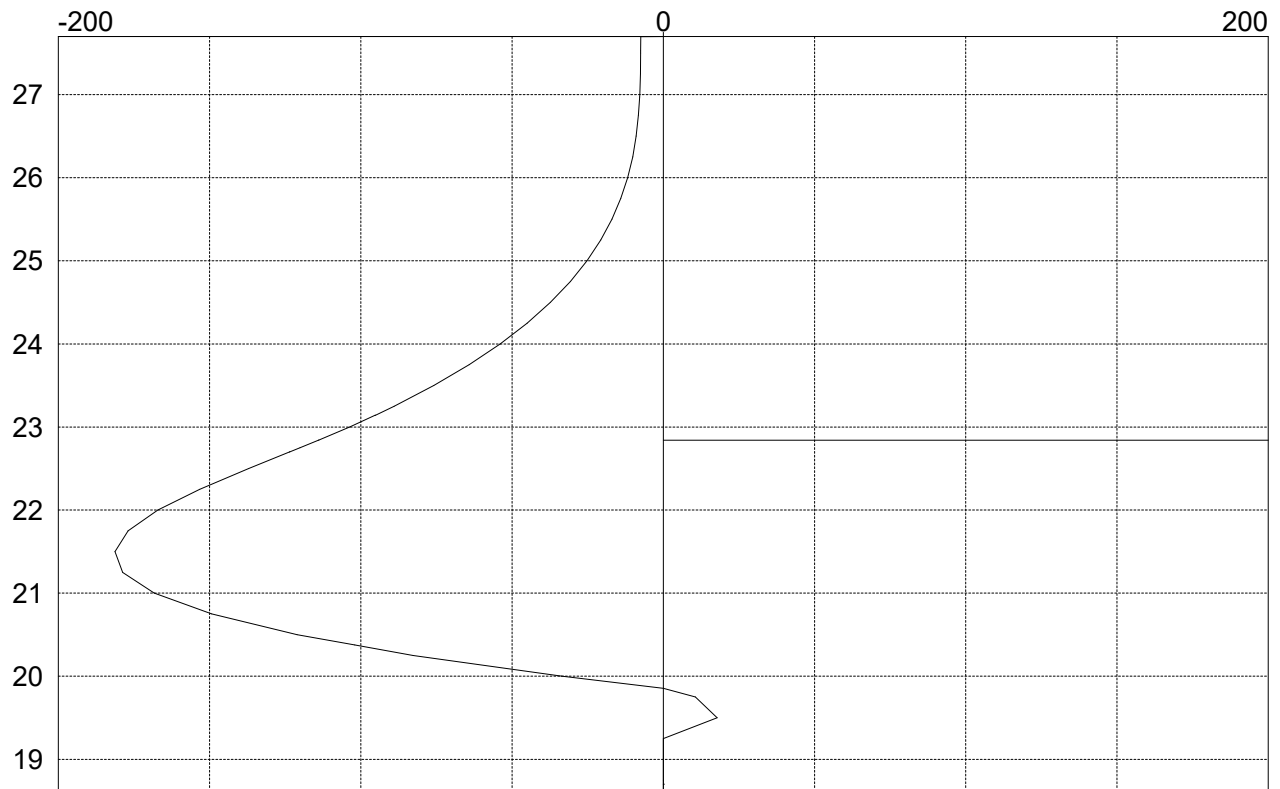
Graphical results from analysis of stage ref 3



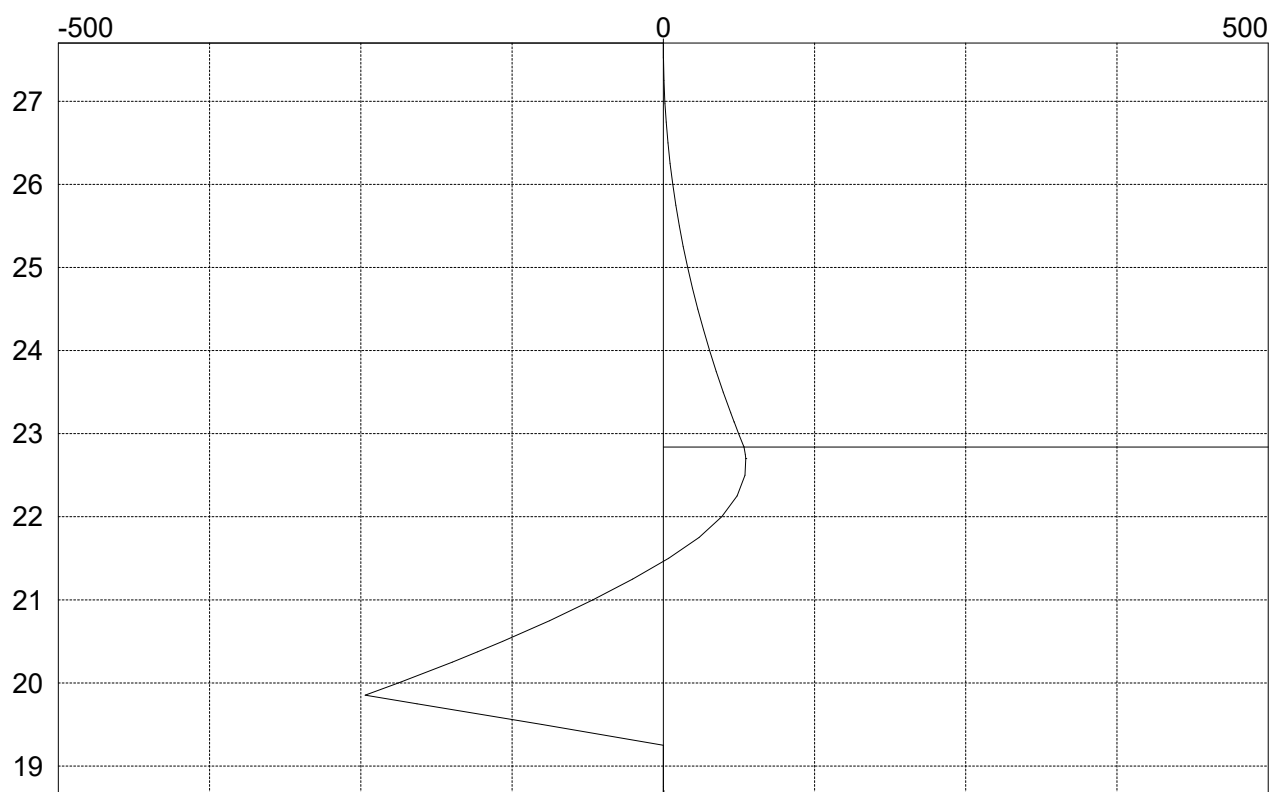
Deflection diagram not shown for analysis with partial factors applied

Section 1 - 1 ULS Analysis	Page No 14 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Graphical results from analysis of stage ref 3 continued



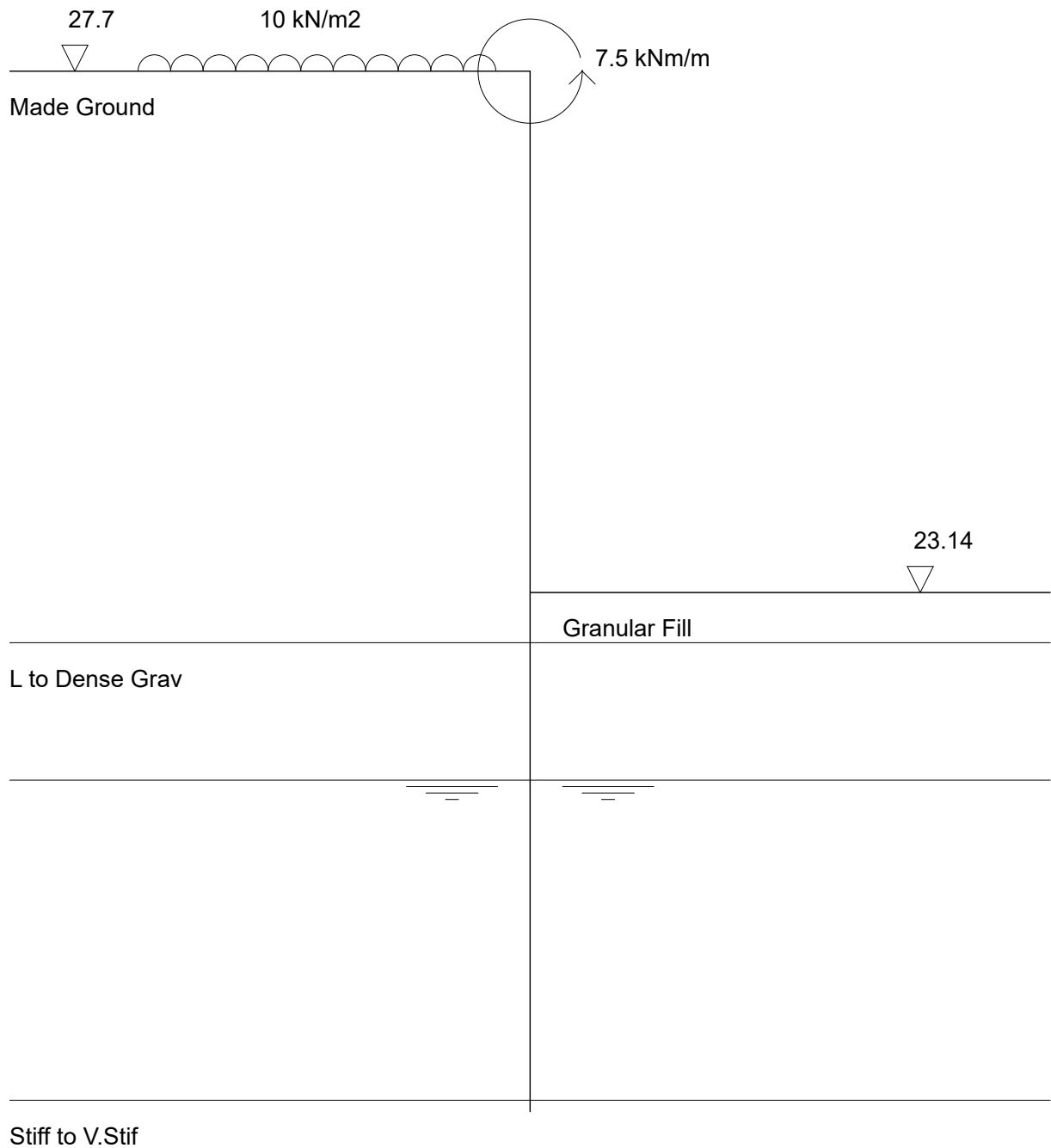
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 1 - 1 ULS Analysis	Page No 15 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Stage ref. 4
Stage type Passive side fill



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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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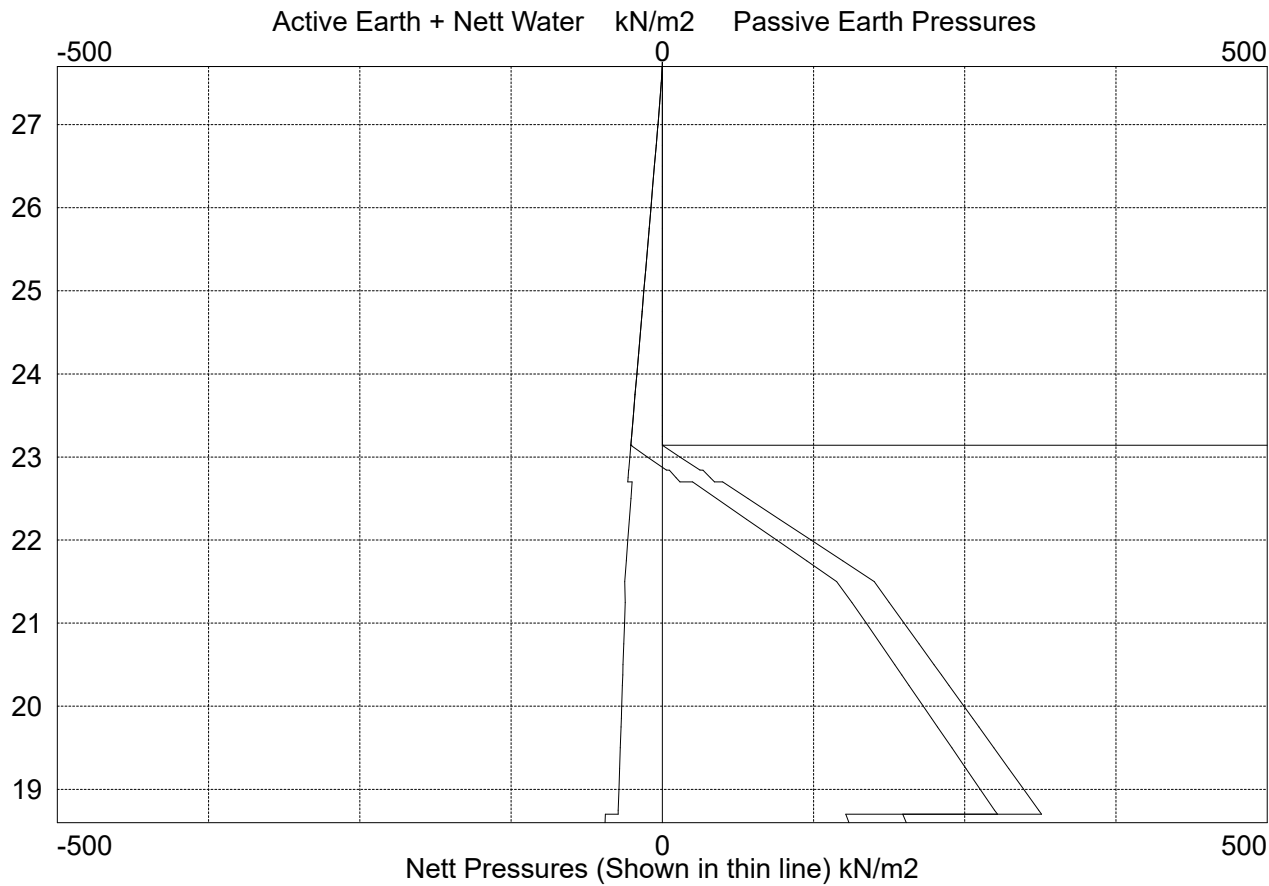
Tabular results from analysis of stage ref 4

strength.
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
	27.70	.0	.0	.0	.0	.0	.0	0	0	0			.00
t	27.70	.0	.0	.0	.0	.0	.0	0	7.5	0			.00
m	27.53	13.1	.9	.0	.0	.0	.0	.9	7.5	-.1			.00
	27.00	22.6	3.6	.0	.0	.0	.0	3.6	7.8	-1.2			.00
	26.97	23.1	3.8	.0	.0	.0	.0	3.8	7.8	-1.4			.00
	26.00	40.6	9.4	.0	.0	.0	.0	9.4	11.8	-7.8			.00
	25.00	58.6	15.2	.0	.0	.0	.0	15.2	25.3	-20.1			.00
	24.00	76.6	21.1	.0	.0	.0	.0	21.1	54.0	-38.3			.00
	23.14	92.0	26.0	.0	.0	.0	.0	26.0	95.2	-58.5			.00
	23.14	92.1	26.1	.0	.0	.0	.0	26.1	95.3	-58.5			.00
	23.00	94.6	26.9	.0	2.7	14.6	.0	12.3	103.7	-61.2			.00
	22.84	97.4	27.8	.0	5.7	31.1	.0	-3.3	113.4	-61.9			.00
	22.84	97.5	27.8	.0	5.7	33.6	.0	-5.8	113.6	-61.9			.00
	22.70	100.0	28.6	.0	8.2	43.2	.0	-14.6	122.2	-60.5			.01
m	22.70	100.0	25.0	.0	8.2	49.9	.0	-24.9	122.2	-60.5			.01
m	22.00	113.3	28.5	.0	21.5	123.0	.0	-94.5	152.7	-18.7			.15
m	21.50	122.8	31.0	.0	31.0	175.1	.0	-144.1	148.2	40.9			.35
	21.00	127.3	31.3	5.0	35.5	199.8	5.0	-168.5	108.6	119.2			.62
	20.38	132.9	32.7	11.2	41.1	230.7	11.2	-197.9	0	233.5			1.00
	20.00	136.3	33.6	15.0	44.5	249.3	15.0	-215.6	-14.0	74.7			1.24
	19.85	137.6	33.9	16.5	45.8	256.5	16.5	-222.5	-3.4	13.0			1.34
	19.00	145.3	35.9	25.0	53.5	298.7	25.0	-262.8	0	0			1.90
	18.70	148.0	36.6	28.0	56.2	313.5	28.0	-276.9	0	0			2.09
	18.70	148.0	47.1	28.0	56.2	198.7	28.0	-151.7	0	0			2.09
	18.60	148.9	47.4	29.0	57.1	201.6	29.0	-154.2	0	0			2.16

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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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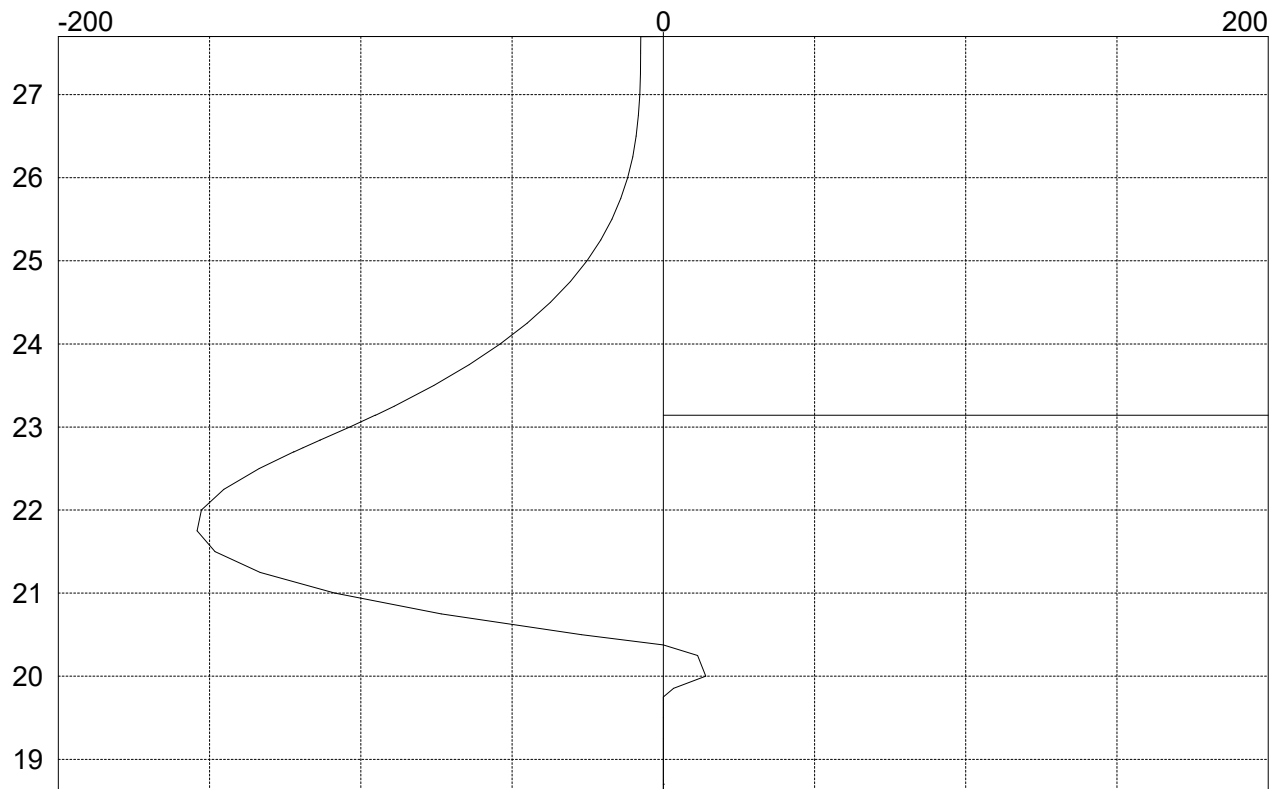
Graphical results from analysis of stage ref 4



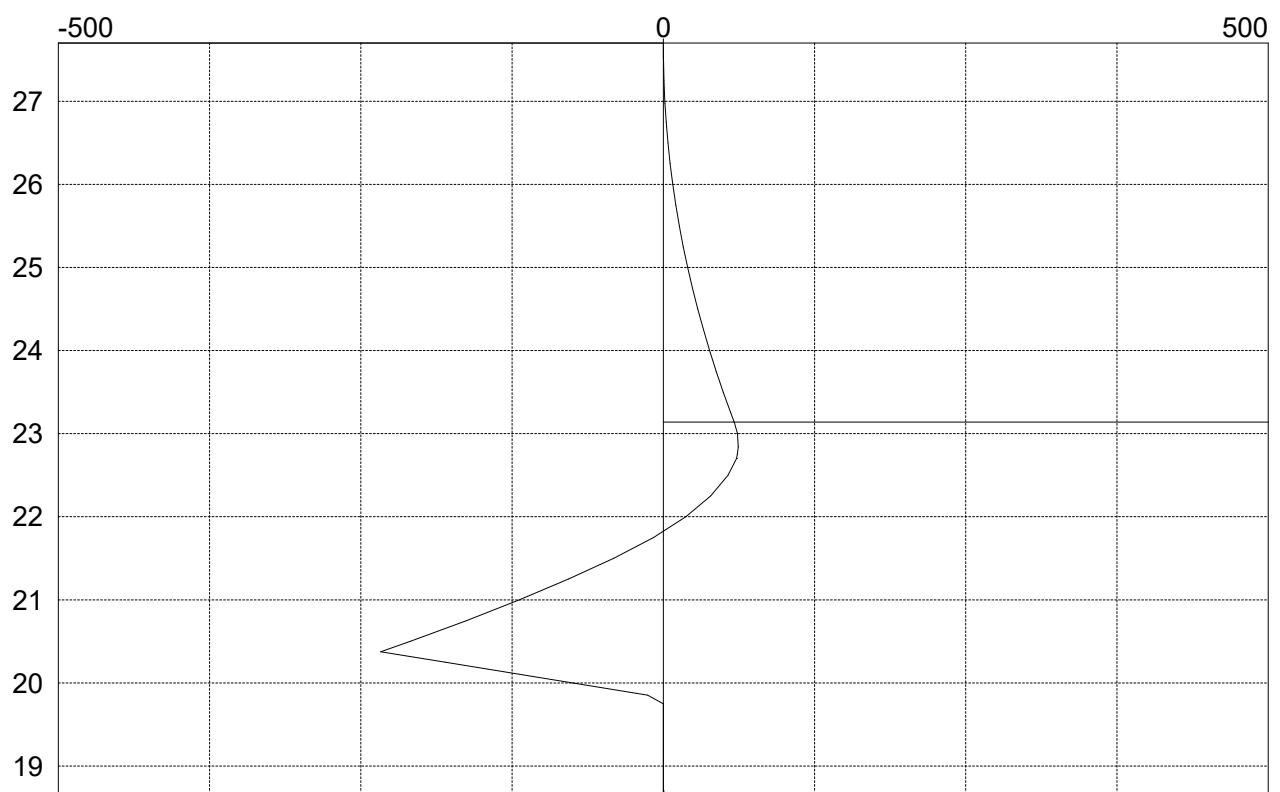
Deflection diagram not shown for analysis with partial factors applied

Section 1 - 1 ULS Analysis	Page No 18 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Graphical results from analysis of stage ref 4 continued



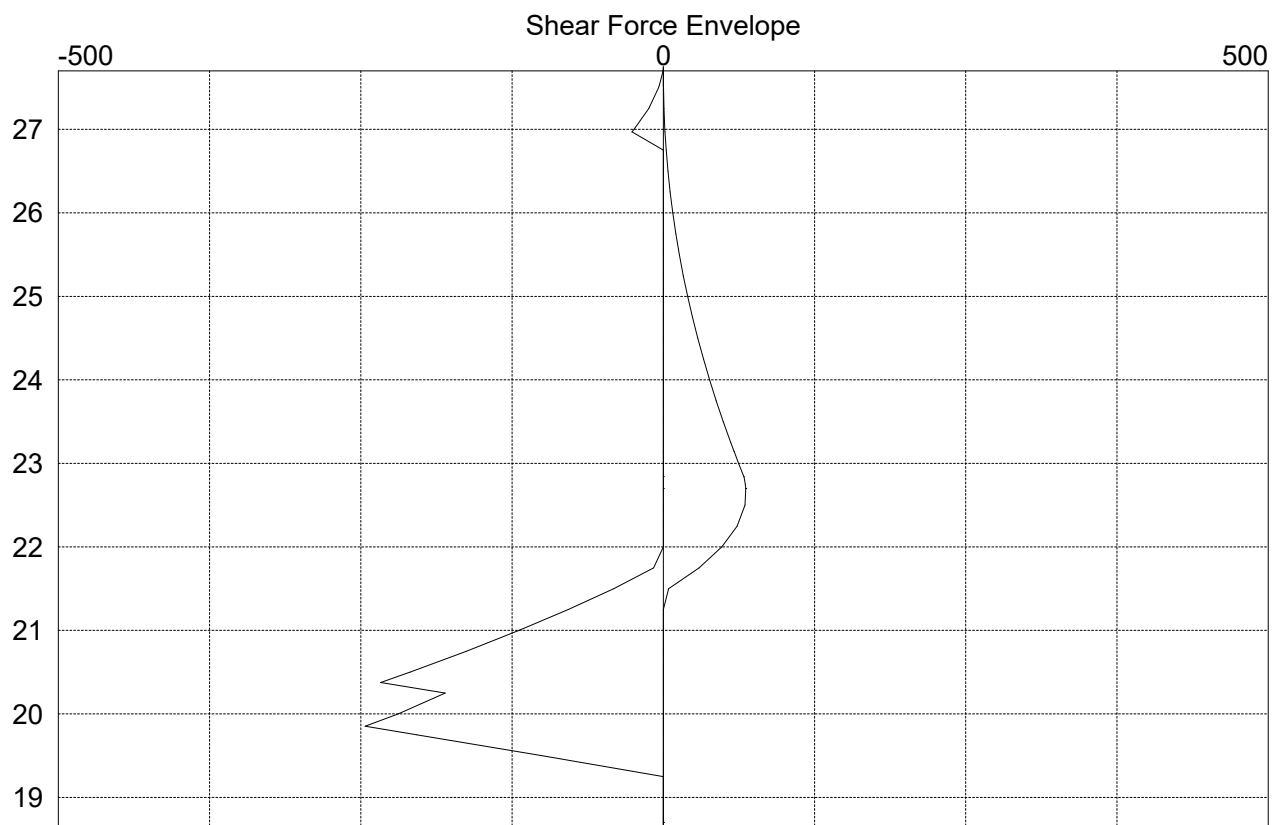
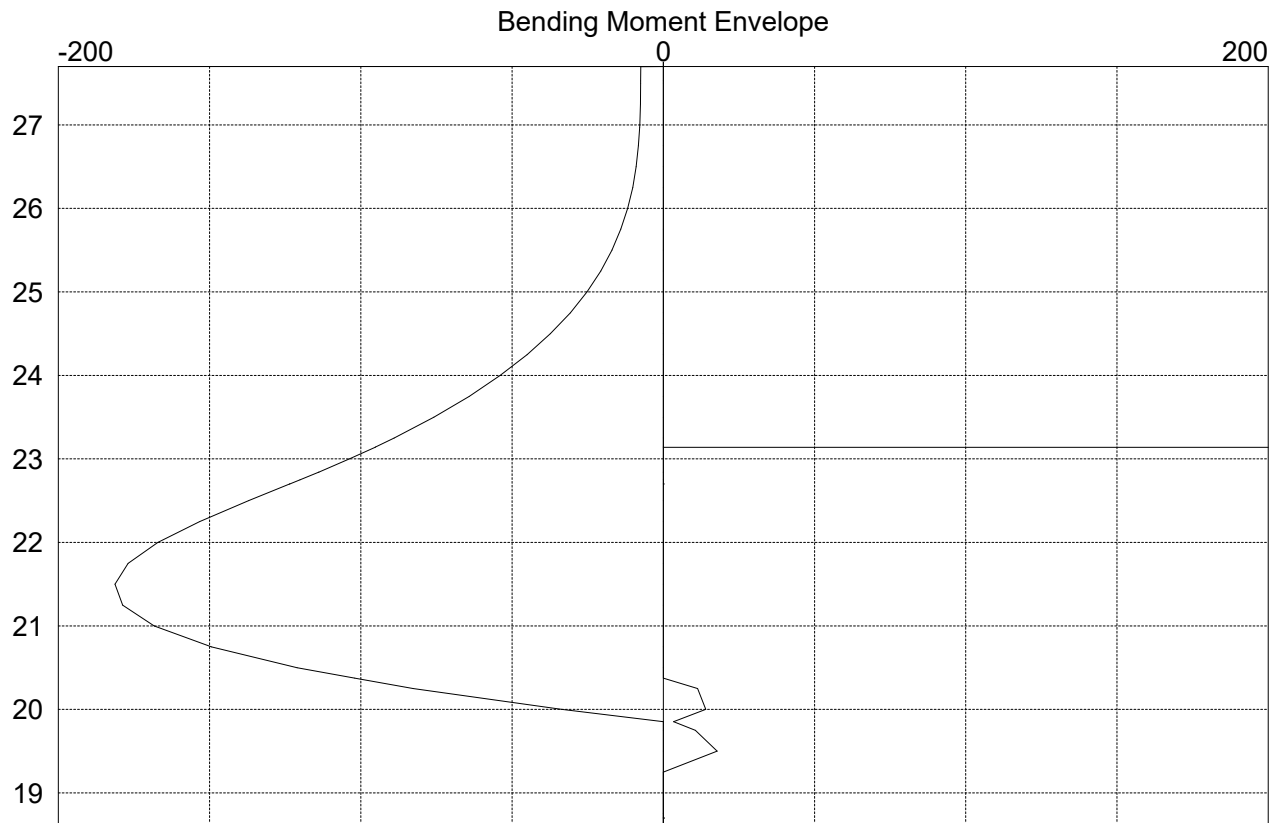
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 1 - 1 ULS Analysis	Page No 19 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Graphical plot of envelope from selected construction stages



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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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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
27.70	.0	.0	.0	.3	
27.70	.0	7.5	.0	.3	
27.53	.0	7.5	-.1	3.3	
27.00	.0	7.8	-1.2	24.2	
26.97	.0	7.8	-1.4	25.9	
26.00	.0	11.8	-7.8	.0	
25.00	.0	25.3	-20.1	.0	
24.00	.0	54.0	-38.3	.0	
23.14	.0	95.2	-58.5	.0	
23.14	.0	95.3	-58.5	.0	
23.00	.0	103.7	-62.2	.0	
22.84	.0	113.9	-66.5	.0	
22.84	.0	114.0	-66.6	.0	
22.70	.0	123.5	-68.2	.0	
22.70	.0	123.6	-68.2	.0	
22.00	.0	167.1	-48.3	.0	
21.50	.0	181.3	-4.3	40.9	
21.00	.0	168.3	.0	119.2	
20.38	.0	102.0	.0	233.5	
20.00	-14.0	33.6	.0	219.1	
19.85	-3.4	.0	.0	246.5	
19.00	.0	.0	.0	.0	
18.70	.0	.0	.0	.0	
18.70	.0	.0	.0	.0	
18.60	.0	.0	.0	.0	

Section 1 - 1 ULS Analysis	Page No 21 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Structural design of wall

Wall section properties

Primary pile diameter	450 mm
Primary pile spacing	600 mm
Infill pile diameter	mm
Main rebar bar diameter	20 mm
Main rebar number of bars	6
Links/Helix bar diameter	10 mm
Links/Helix spacing/pitch	175 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	1.00

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	109	111	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1885	mm ²
Min longitudinal steel. BS8110 min 0.4% by area	636	1885	mm ²
Shear resistance. BS8110	148	170	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	10	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	188	175	mm
Min shear link area. BS8110 Clause 3.4.5	691	898	mm ² /m

Section 2 - 2 ULS Analysis	Page No 1 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

Pile geometry

Pile top Level 27.7 m
 Pile Length 8 m
 Pile toe level 19.7 m
 Active ground slope 0 Degrees (To horizontal)

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

Initial Ground Water level 21.5

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
27.70	Made Ground	18.00	18.00	20000	0	3 3		31 31	.67 .50	.27 5.04	1.34 5.50
22.70	L to Dense Grav	19.00	19.00	90000	0	1 1		37 37	.67 .50	.20 7.92	1.17 6.89
18.70	Stiff to V.Stif	19.00	19.00	100000	0	5 5		28 28	.67 .50	.30 4.15	1.43 4.99
	Granular Fill	19.00	20.00	70000	0			37 37	.67 .50	.20 7.92	
	Construction sequence										

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1 A	Active surcharge	27.70	10.0	.3		
2 A	Moment load					
3 A	Passive side excavation	23.74				
4 A	Passive side fill	24.10				

Code of practice

Code of practice or reference document	
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	1.20
ULS fFactor on drained cohesion values	1.20
ULS factor on undrained cohesion values	1.50
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	1.00

Section 2 - 2 ULS Analysis	Page No 2 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

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	.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	335482 cm4/m
Wall Youngs modulus	27000000 kN/m2

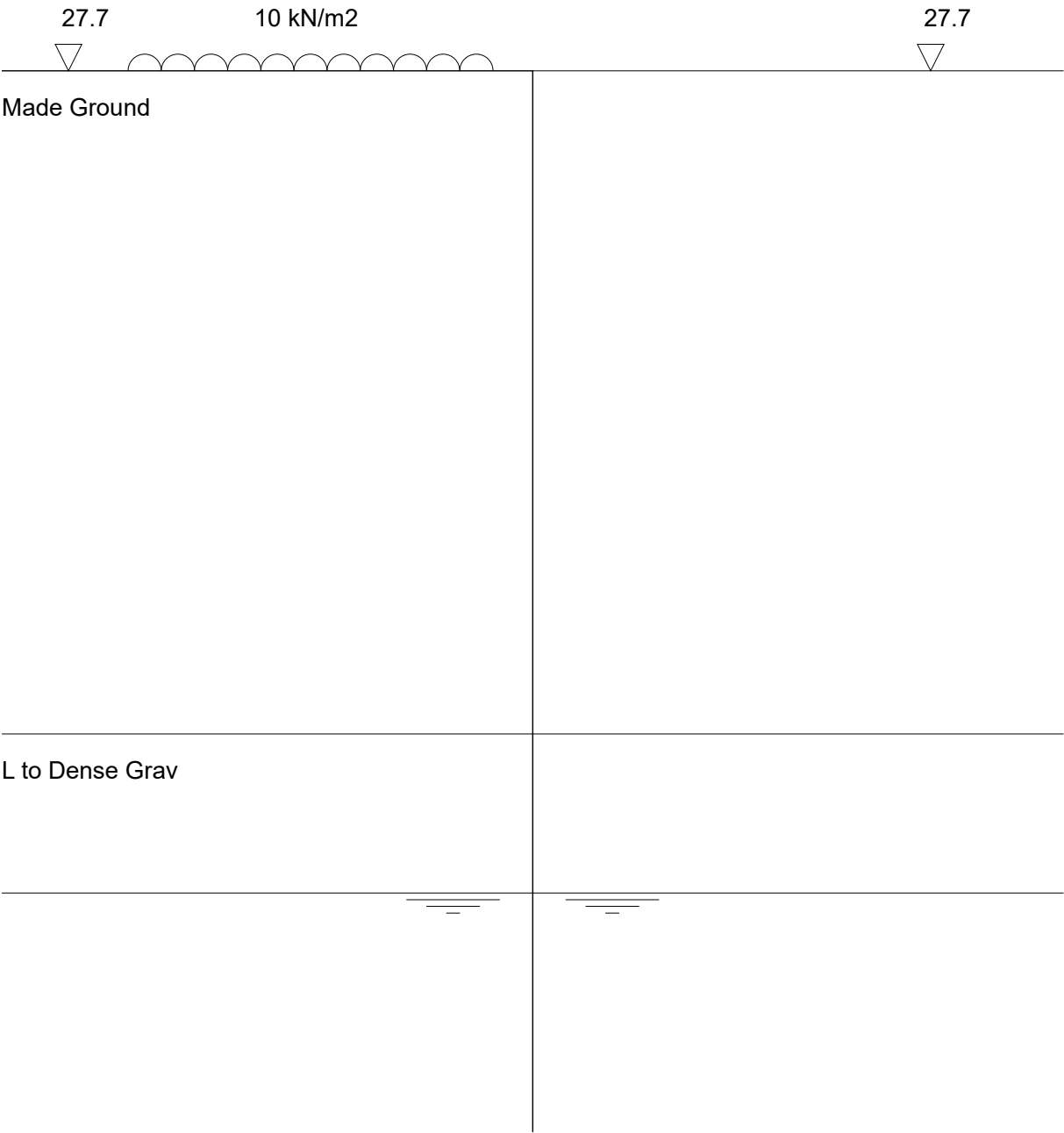
Section 2 - 2 ULS Analysis	Page No 3 Analysis ULS
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Stage ref.

1

Stage type

Active surcharge



Section 2 - 2 ULS Analysis	Page No 4 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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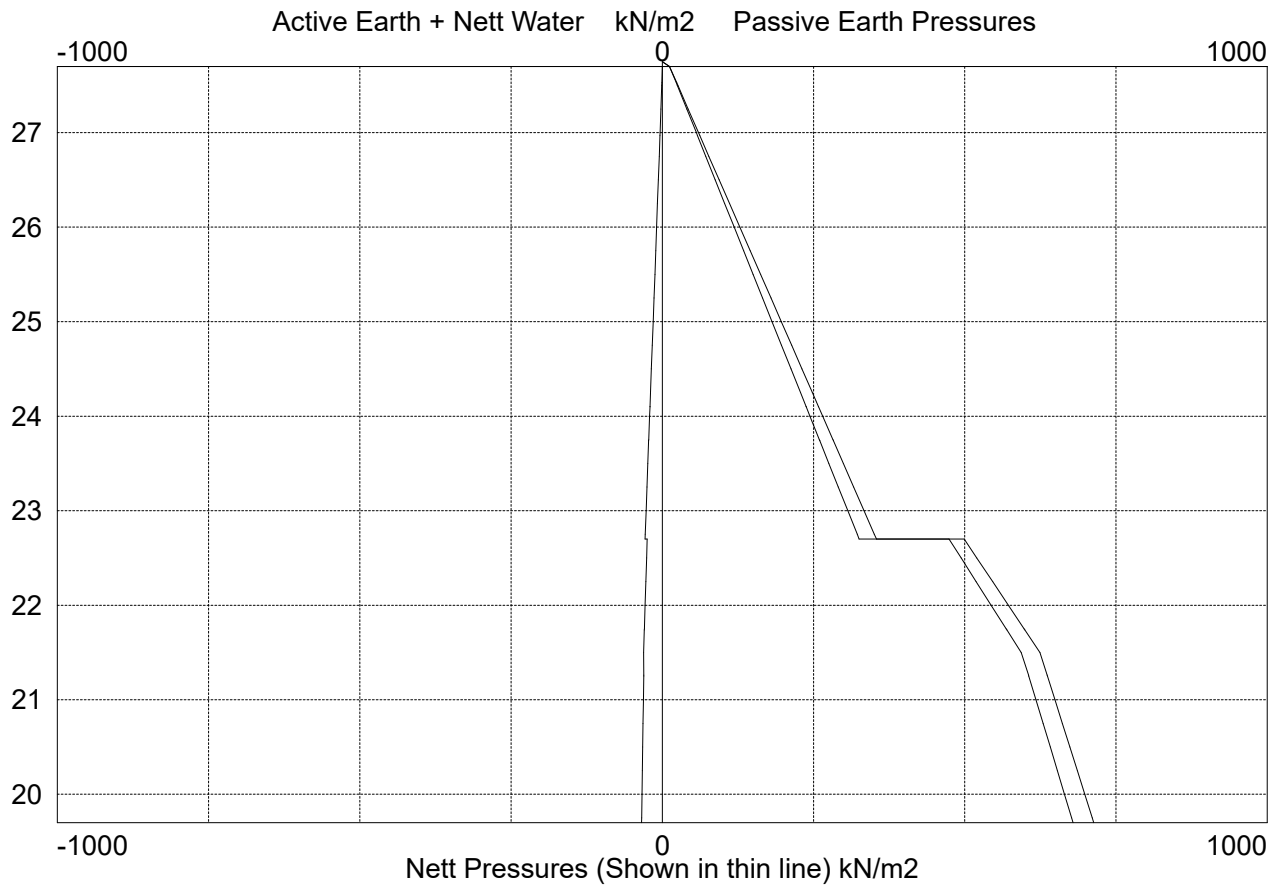
Tabular results from analysis of stage ref 1

strength.
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
	27.70	.0	.0	.0	.0	11.9	.0	-11.9	0	0			>100.00
t	27.70	.0	.0	.0	.0	12.1	.0	-12.1	0	0			>100.00
m	27.53	13.1	.9	.0	3.1	23.8	.0	-22.9	0	0			>100.00
	27.00	22.6	3.6	.0	12.6	59.8	.0	-56.2	0	0			>100.00
	26.97	23.1	3.8	.0	13.1	61.9	.0	-58.1	0	0			>100.00
	26.00	40.6	9.4	.0	30.6	128.2	.0	-118.8	0	0			>100.00
	25.00	58.6	15.2	.0	48.6	196.6	.0	-181.4	0	0			>100.00
	24.10	74.8	20.5	.0	64.8	258.0	.0	-237.6	0	0			>100.00
	24.10	74.8	20.5	.0	64.8	258.2	.0	-237.7	0	0			>100.00
	24.00	76.6	21.1	.0	66.6	265.0	.0	-243.9	0	0			>100.00
	23.74	81.2	22.6	.0	71.2	282.7	.0	-260.1	0	0			>100.00
	23.74	81.3	22.6	.0	71.3	282.8	.0	-260.2	0	0			>100.00
	23.00	94.6	26.9	.0	84.6	333.4	.0	-306.5	0	0			>100.00
	22.70	100.0	28.6	.0	90.0	353.9	.0	-325.3	0	0			>100.00
m	22.70	100.0	25.0	.0	90.0	499.0	.0	-474.0	0	0			>100.00
m	22.00	113.3	28.5	.0	103.3	572.0	.0	-543.5	0	0			>100.00
m	21.74	118.3	29.8	.0	108.3	599.4	.0	-569.6	0	0			>100.00
m	21.50	122.8	31.0	.0	112.8	624.2	.0	-593.2	0	0			>100.00
m	21.26	125.0	30.8	2.4	115.0	636.1	2.4	-605.3	0	0			>100.00
	21.00	127.3	31.3	5.0	117.3	648.9	5.0	-617.6	0	0			>100.00
	20.00	136.3	33.6	15.0	126.3	698.3	15.0	-664.7	0	0			>100.00
	19.70	139.0	34.3	18.0	129.0	713.2	18.0	-678.9	0	0			>100.00

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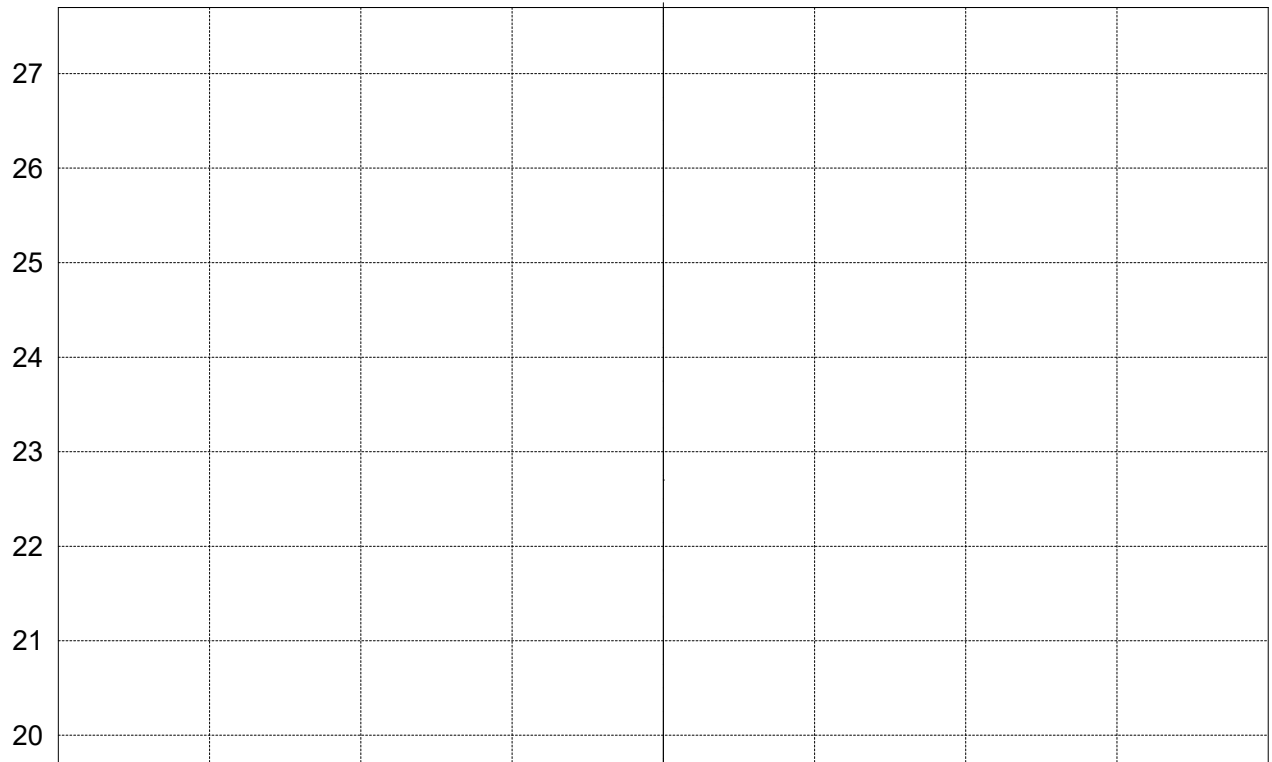
Graphical results from analysis of stage ref 1



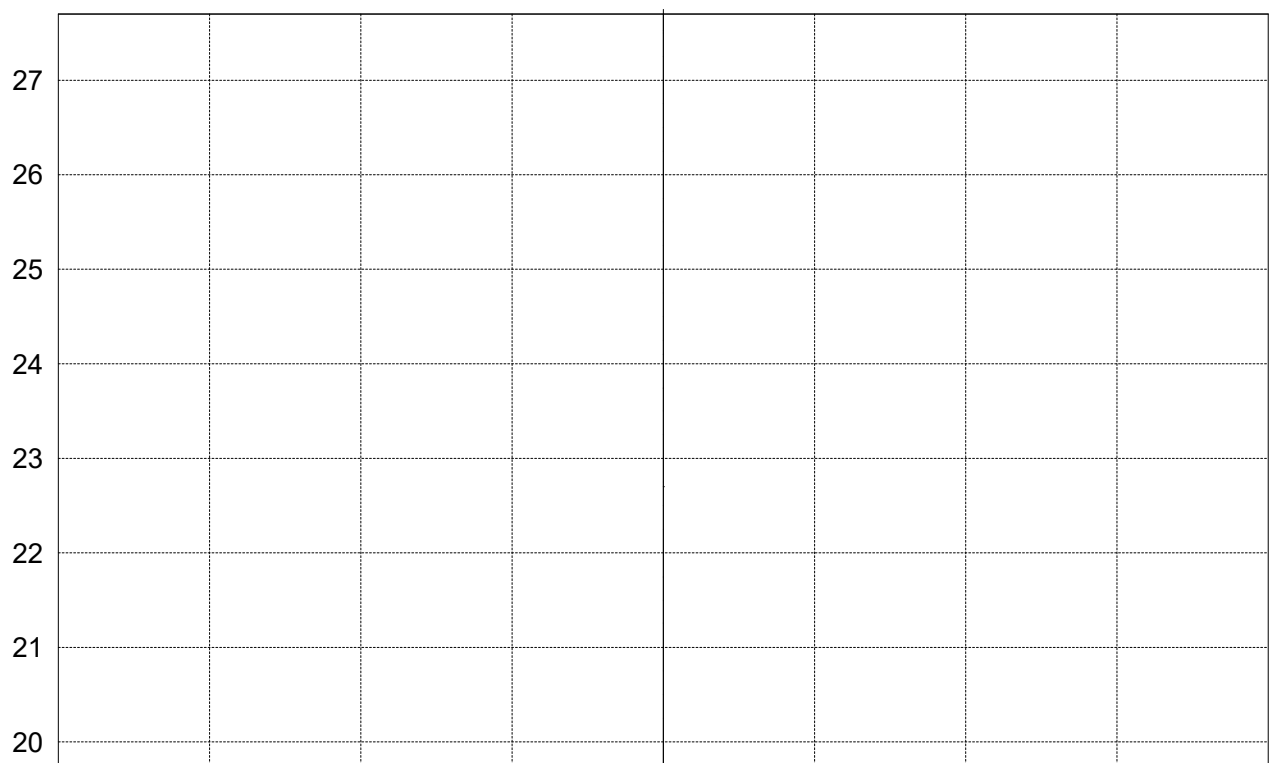
Deflection diagram not shown for analysis with partial factors applied

Section 2 - 2 ULS Analysis	Page No 6 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Graphical results from analysis of stage ref 1 continued



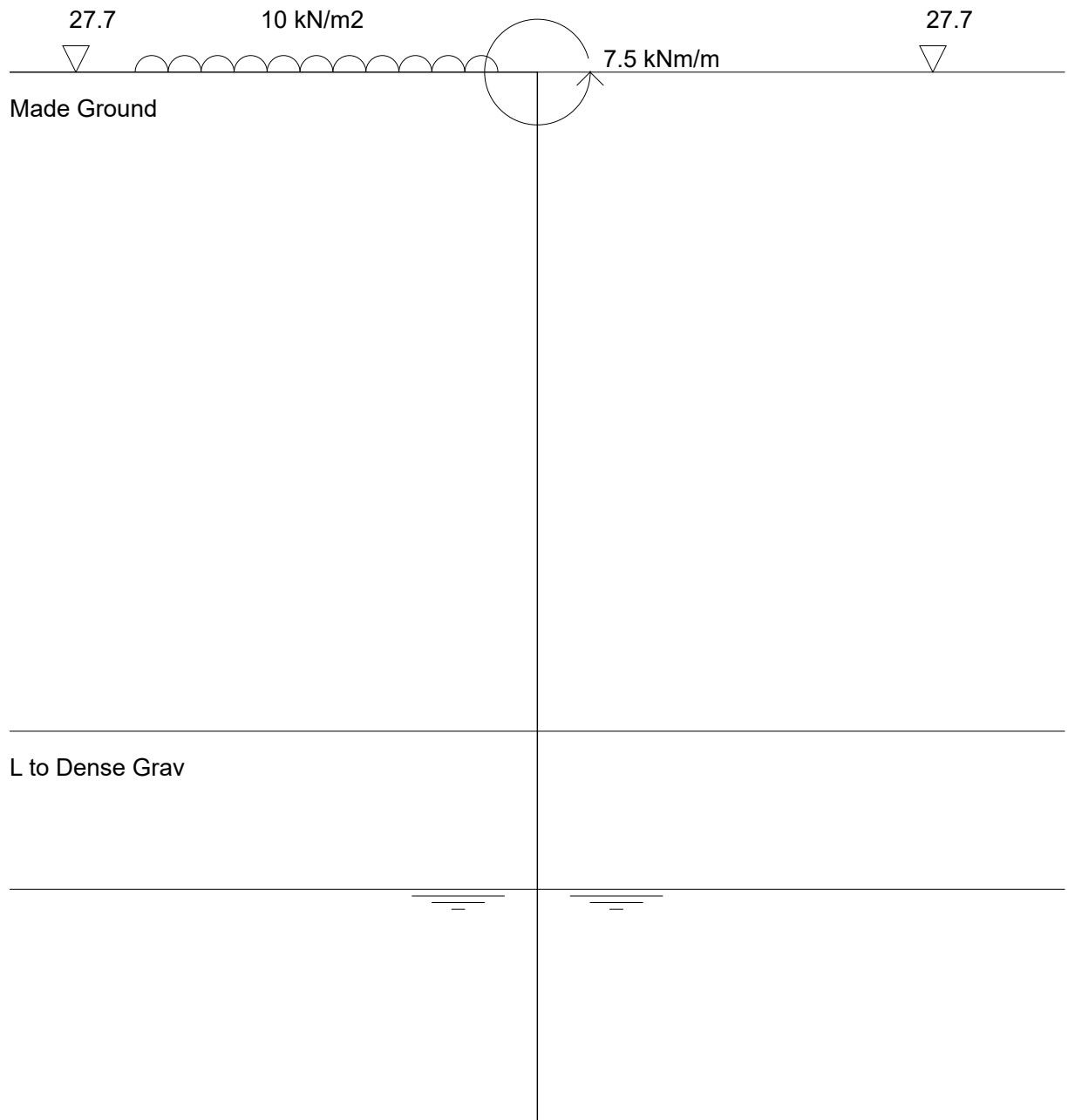
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 2 - 2 ULS Analysis	Page No 7 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Stage ref. 2
Stage type Moment load



Section 2 - 2 ULS Analysis	Page No 8 Analysis ULS
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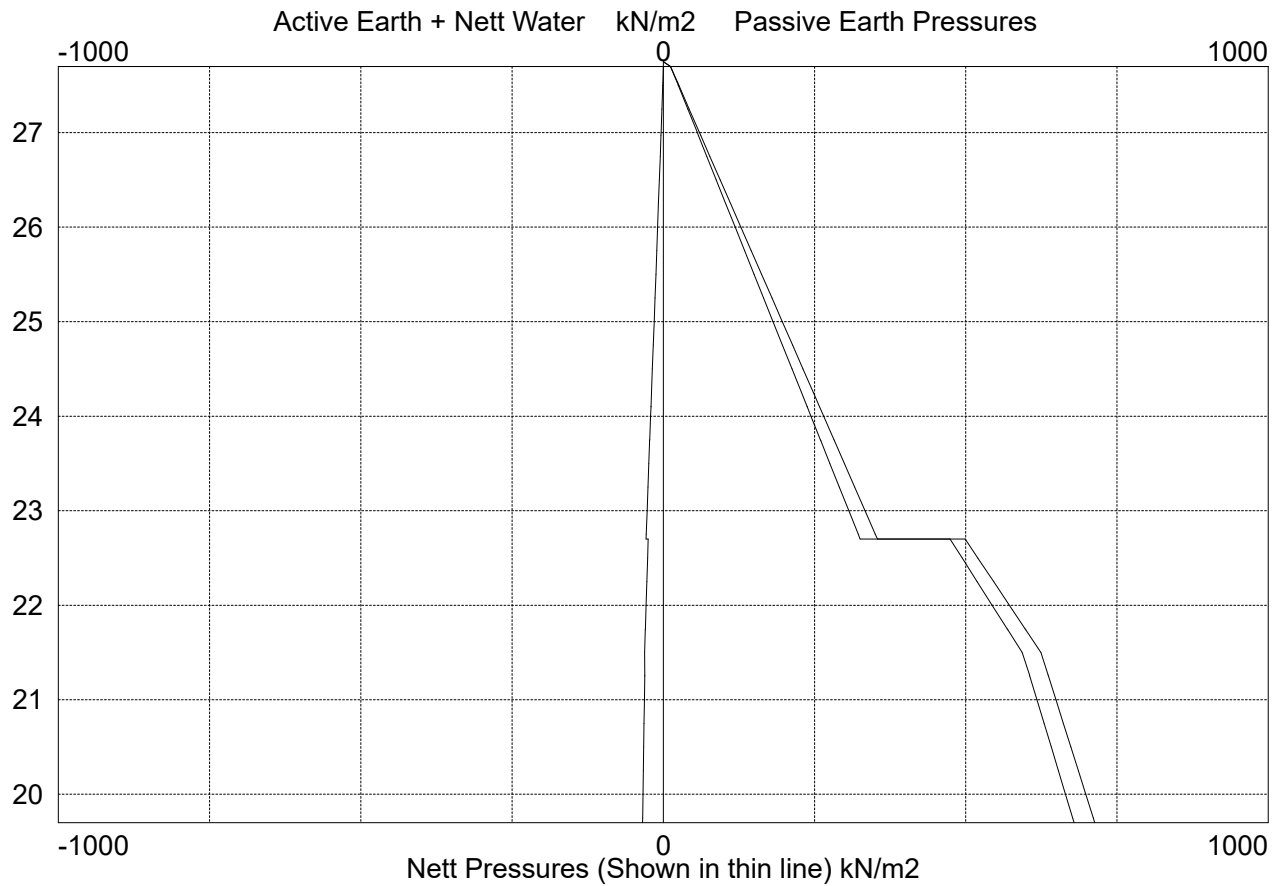
Tabular results from analysis of stage ref 2

strength.
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
	27.70	.0	.0	.0	.0	11.9	.0	-11.9	0	.3			.00
t	27.70	.0	.0	.0	.0	12.1	.0	-12.1	7.5	.3			.00
m	27.53	13.1	.9	.0	3.1	23.8	.0	-22.9	7.2	3.3			.04
	27.00	22.6	3.6	.0	12.6	59.8	.0	-56.2	.7	24.2			.91
	26.97	23.1	3.8	.0	13.1	61.9	.0	-58.1	0	25.9			1.02
	26.00	40.6	9.4	.0	30.6	128.2	.0	-118.8	0	0			6.25
	25.00	58.6	15.2	.0	48.6	196.6	.0	-181.4	0	0			10.63
	24.10	74.8	20.5	.0	64.8	258.0	.0	-237.6	0	0			12.14
	24.10	74.8	20.5	.0	64.8	258.2	.0	-237.7	0	0			12.14
	24.00	76.6	21.1	.0	66.6	265.0	.0	-243.9	0	0			12.23
	23.74	81.2	22.6	.0	71.2	282.7	.0	-260.1	0	0			12.41
	23.74	81.3	22.6	.0	71.3	282.8	.0	-260.2	0	0			12.42
	23.00	94.6	26.9	.0	84.6	333.4	.0	-306.5	0	0			12.69
	22.70	100.0	28.6	.0	90.0	353.9	.0	-325.3	0	0			12.74
m	22.70	100.0	25.0	.0	90.0	499.0	.0	-474.0	0	0			12.74
m	22.00	113.3	28.5	.0	103.3	572.0	.0	-543.5	0	0			13.06
m	21.74	118.3	29.8	.0	108.3	599.4	.0	-569.6	0	0			13.26
m	21.50	122.8	31.0	.0	112.8	624.2	.0	-593.2	0	0			13.45
m	21.26	125.0	30.8	2.4	115.0	636.1	2.4	-605.3	0	0			13.65
	21.00	127.3	31.3	5.0	117.3	648.9	5.0	-617.6	0	0			13.88
	20.00	136.3	33.6	15.0	126.3	698.3	15.0	-664.7	0	0			14.73
	19.70	139.0	34.3	18.0	129.0	713.2	18.0	-678.9	0	0			14.97

Section 2 - 2 ULS Analysis	Page No 9 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
44 Cleveland Street London W1 Contiguous Bored Pile Retaining Wall	Engineer AA Date 18/07/2020

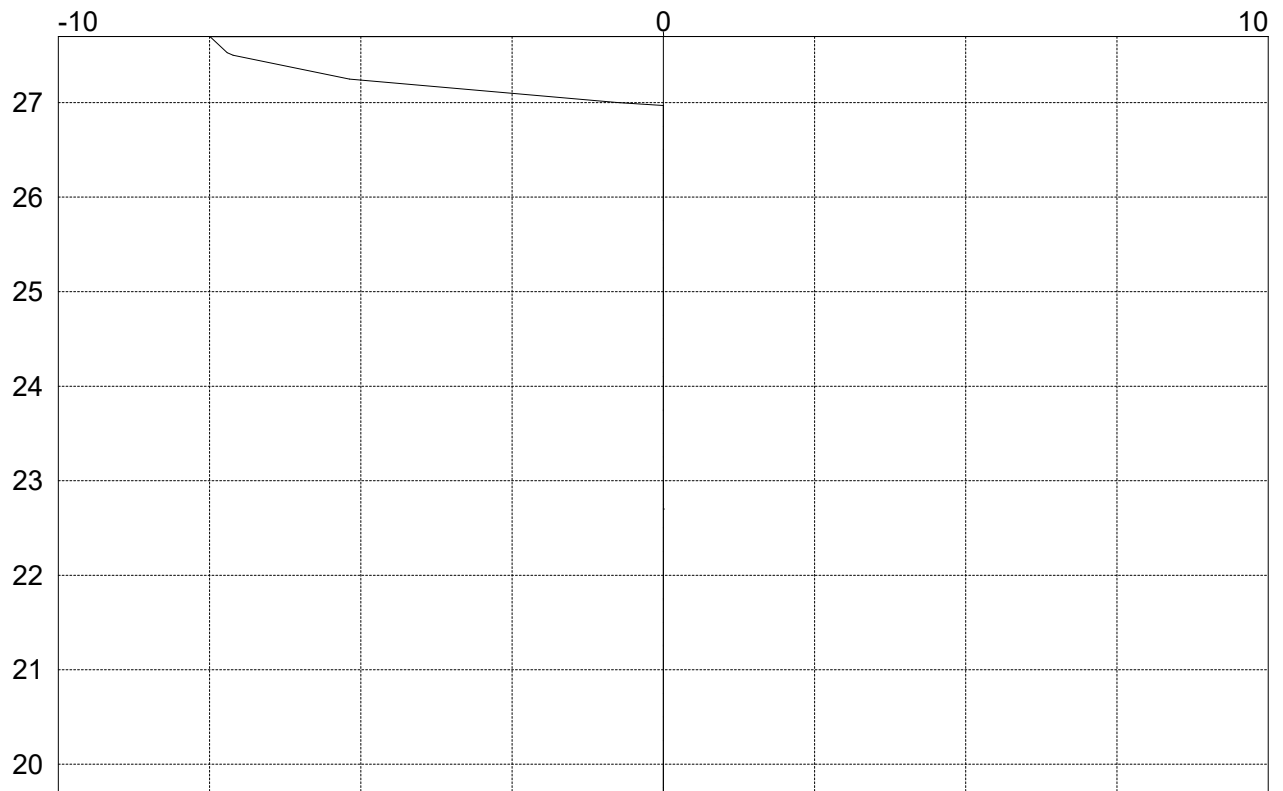
Graphical results from analysis of stage ref 2



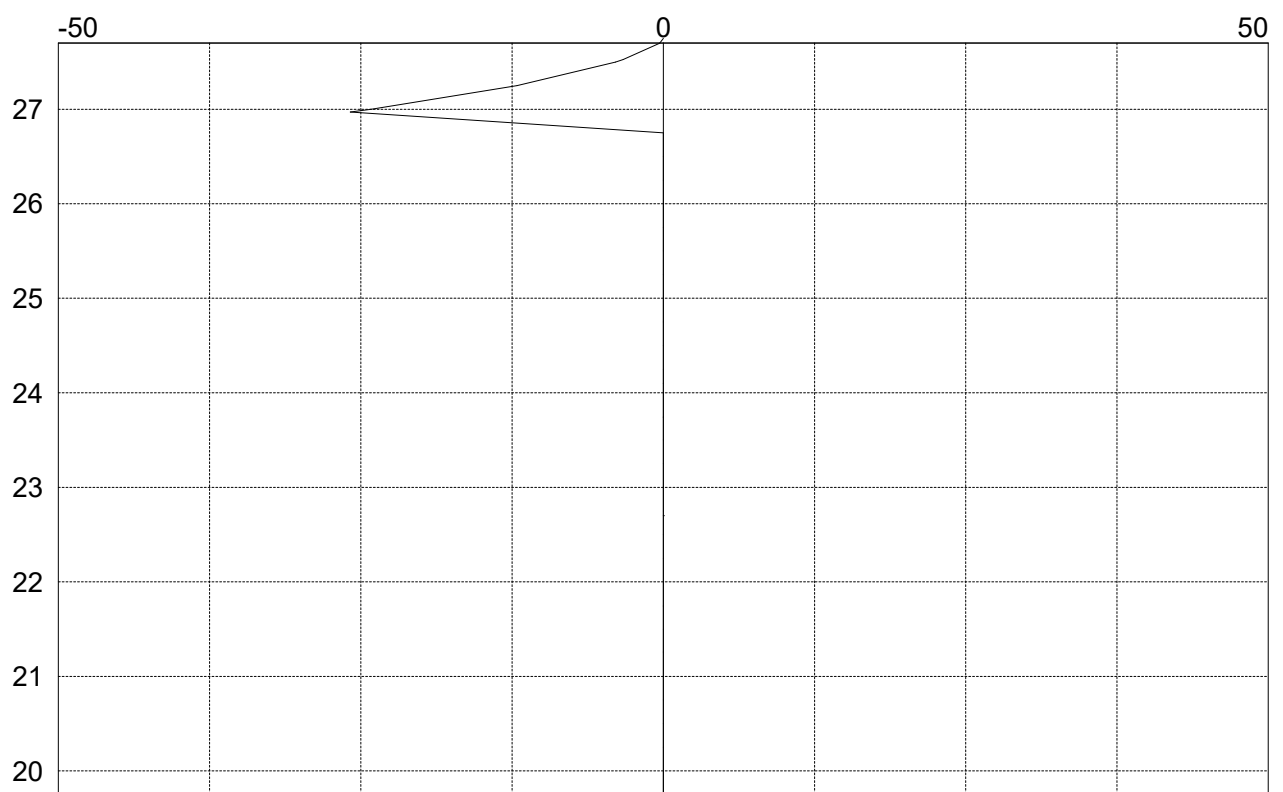
Deflection diagram not shown for analysis with partial factors applied

Section 2 - 2 ULS Analysis	Page No 10 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Graphical results from analysis of stage ref 2 continued



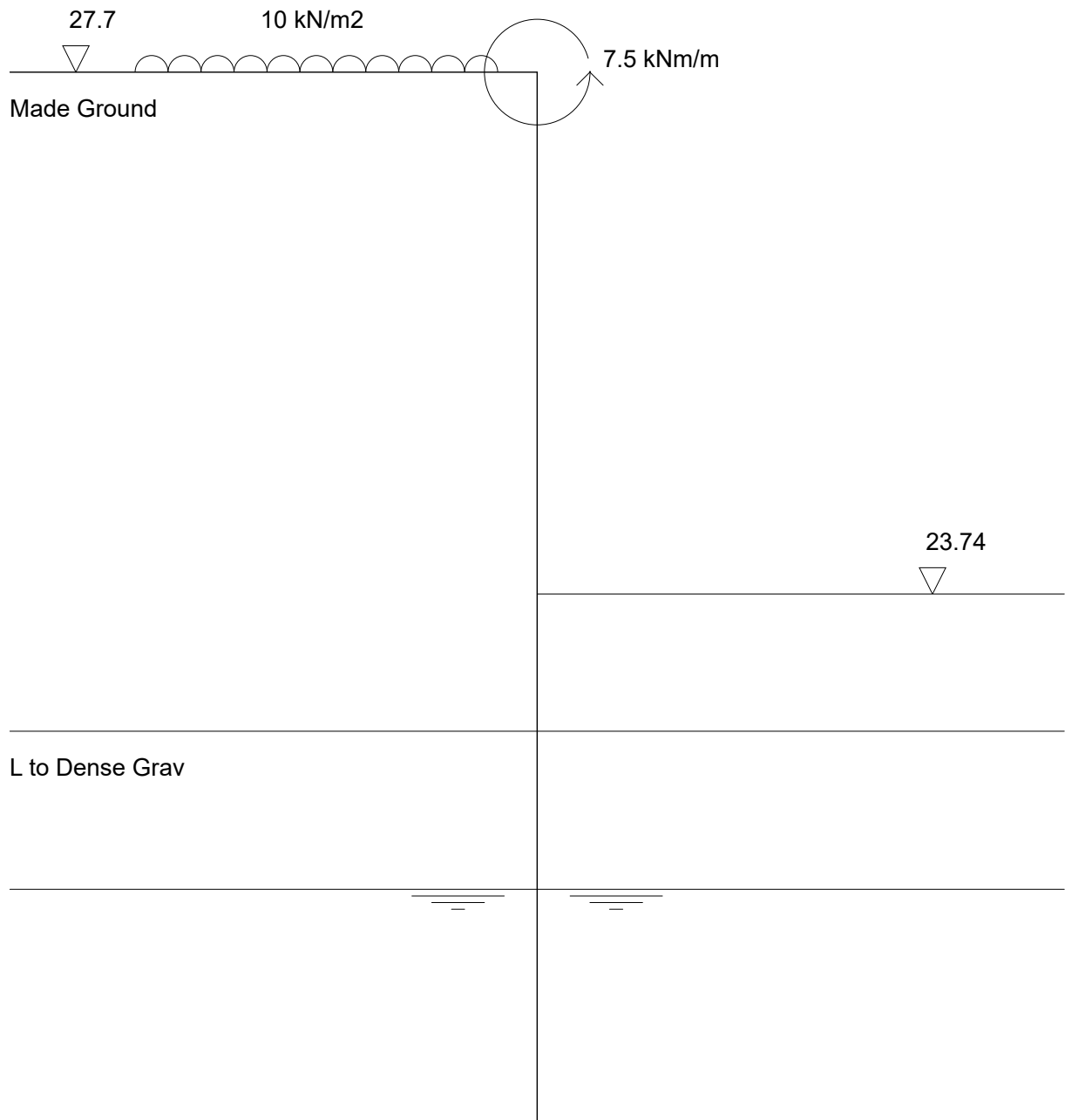
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 2 - 2 ULS Analysis	Page No 11 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Stage ref. 3
Stage type Passive side excavation



Section 2 - 2 ULS Analysis	Page No Analysis	12 ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project File Name	2 - 2 ...2 - temp & perm.pws"
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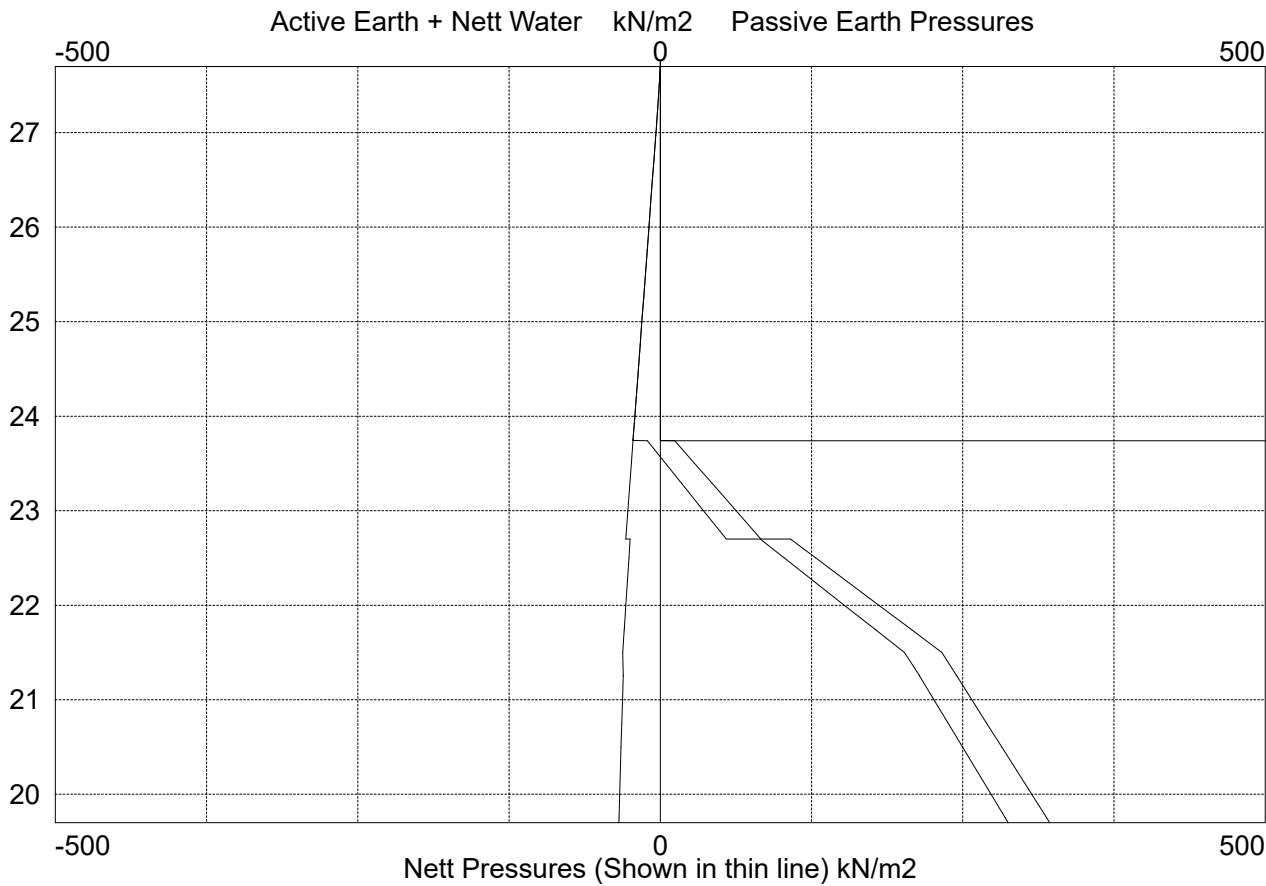
Tabular results from analysis of stage ref 3

strength.
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
	27.70	.0	.0	.0	.0	.0	.0	0	0	0			.00
t	27.70	.0	.0	.0	.0	.0	.0	0	7.5	0			.00
m	27.53	13.1	.9	.0	.0	.0	.0	.9	7.5	-.1			.00
	27.00	22.6	3.6	.0	.0	.0	.0	3.6	7.8	-1.2			.00
	26.97	23.1	3.8	.0	.0	.0	.0	3.8	7.8	-1.4			.00
	26.00	40.6	9.4	.0	.0	.0	.0	9.4	11.8	-7.8			.00
	25.00	58.6	15.2	.0	.0	.0	.0	15.2	25.3	-20.1			.00
	24.10	74.8	20.5	.0	.0	.0	.0	20.5	50.2	-36.1			.00
	24.10	74.8	20.5	.0	.0	.0	.0	20.5	50.3	-36.2			.00
	24.00	76.6	21.1	.0	.0	.0	.0	21.1	54.0	-38.3			.00
	23.74	81.2	22.6	.0	.0	.0	.0	22.6	64.6	-43.9			.00
	23.74	81.3	22.6	.0	.0	11.9	.0	10.6	64.7	-43.9			.00
	23.00	94.6	26.9	.0	13.3	62.6	.0	-35.7	95.8	-34.7			.08
	22.70	100.0	28.6	.0	18.7	83.1	.0	-54.5	104.3	-21.1			.16
m	22.70	100.0	25.0	.0	18.7	107.6	.0	-82.6	104.4	-21.1			.16
m	22.00	113.3	28.5	.0	32.0	180.6	.0	-152.1	93.2	61.0			.48
m	21.74	118.3	29.8	.0	37.0	207.9	.0	-178.1	71.5	104.4			.65
m	21.50	122.8	31.0	.0	41.5	232.8	.0	-201.8	41.7	149.5			.82
m	21.26	125.0	30.8	2.4	43.7	244.6	2.4	-213.9	0	199.4			1.00
	21.00	127.3	31.3	5.0	46.0	257.5	5.0	-226.2	-12.3	94.9			1.21
	20.00	136.3	33.6	15.0	55.0	306.9	15.0	-273.3	0	0			2.04
	19.70	139.0	34.3	18.0	57.7	321.7	18.0	-287.4	0	0			2.29

Section 2 - 2 ULS Analysis	Page No 13 Analysis ULS
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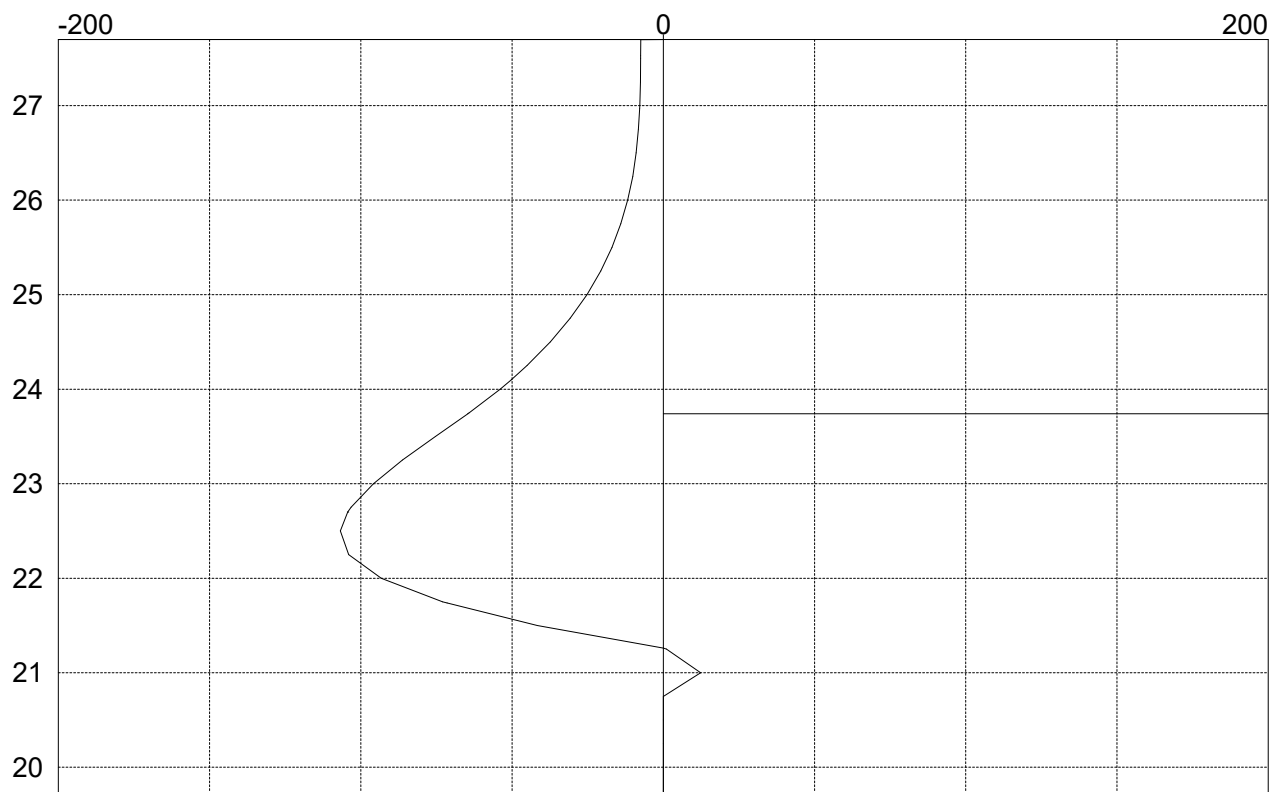
Graphical results from analysis of stage ref 3



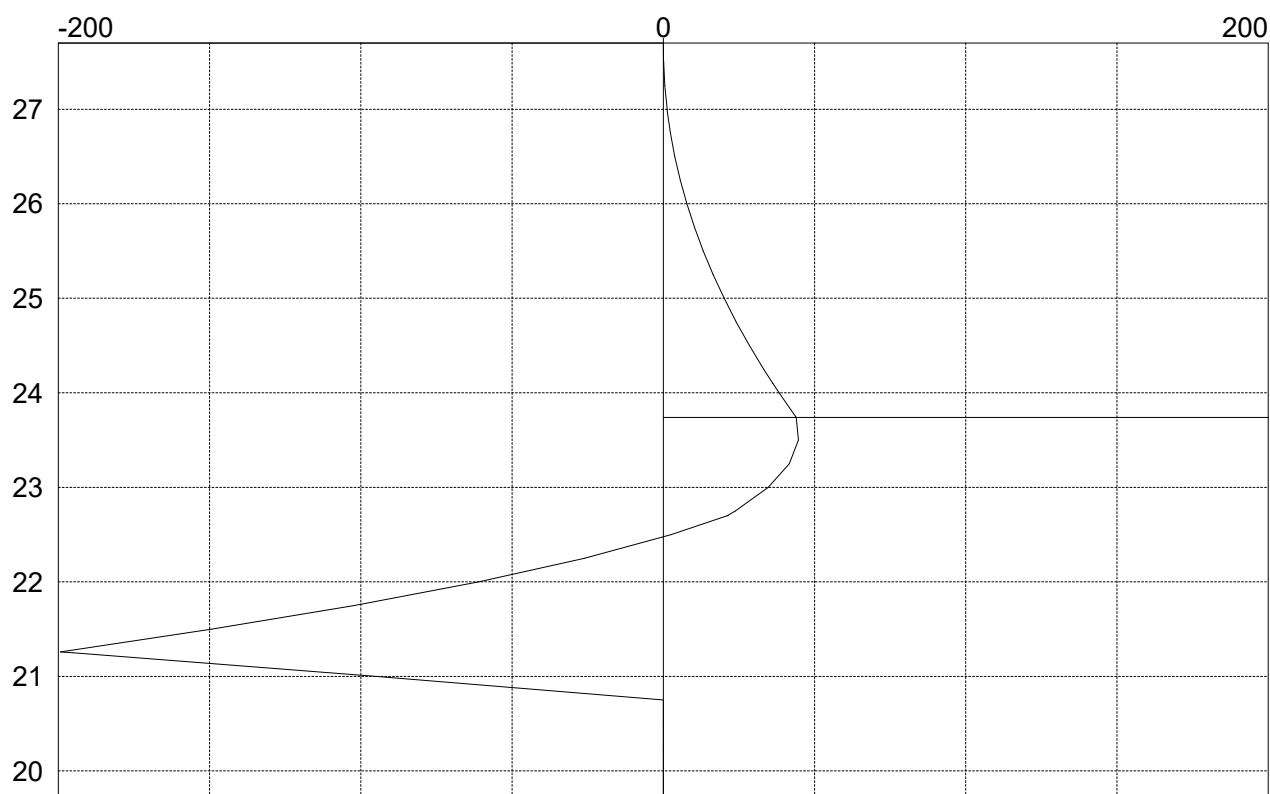
Deflection diagram not shown for analysis with partial factors applied

Section 2 - 2 ULS Analysis	Page No 14 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Graphical results from analysis of stage ref 3 continued



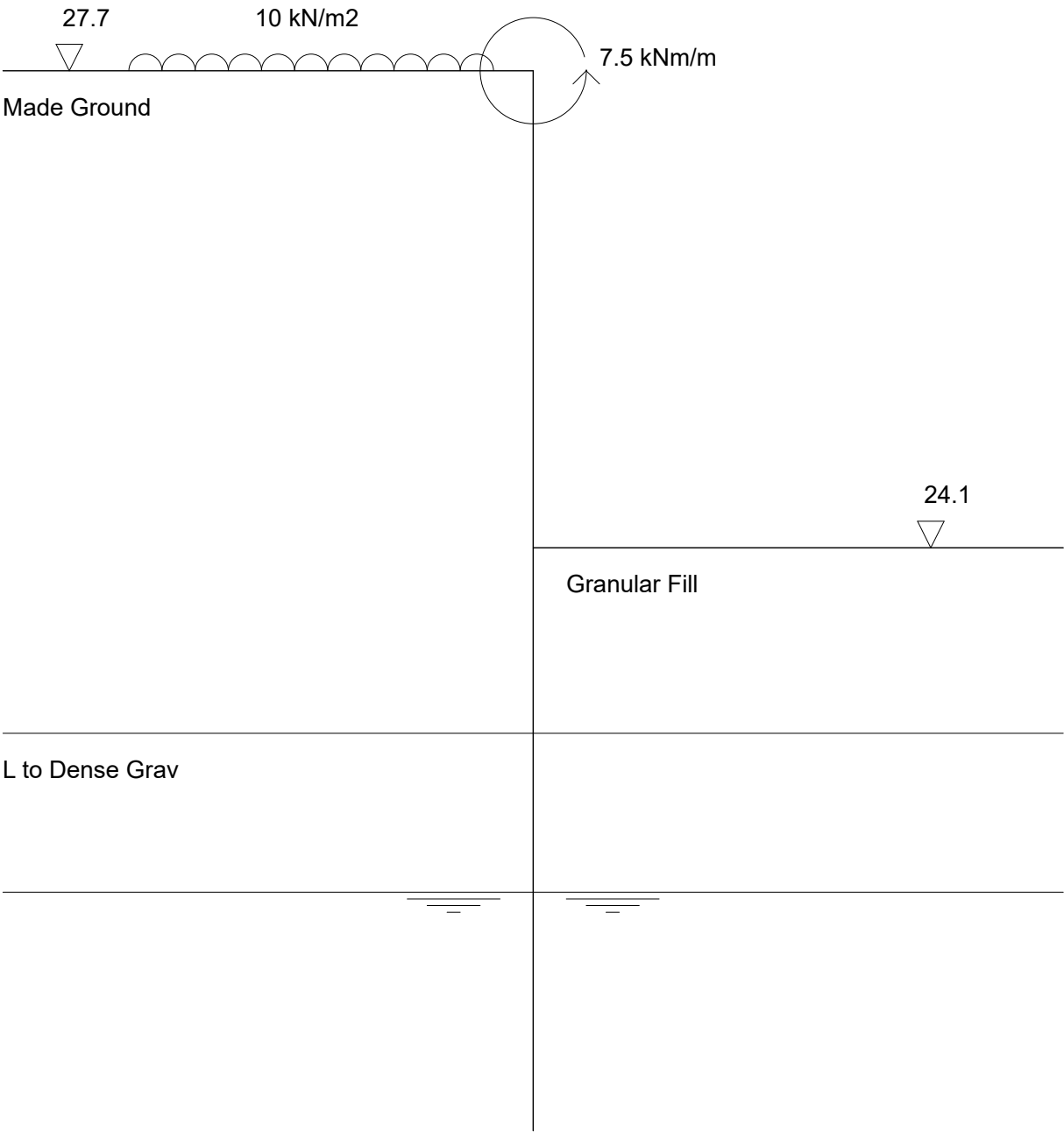
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Section 2 - 2 ULS Analysis	Page No 15 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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Stage ref. 4
Stage type Passive side fill



Section 2 - 2 ULS Analysis	Page No 16 Analysis ULS
CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 2 - 2 File Name ...2 - temp & perm.pws"
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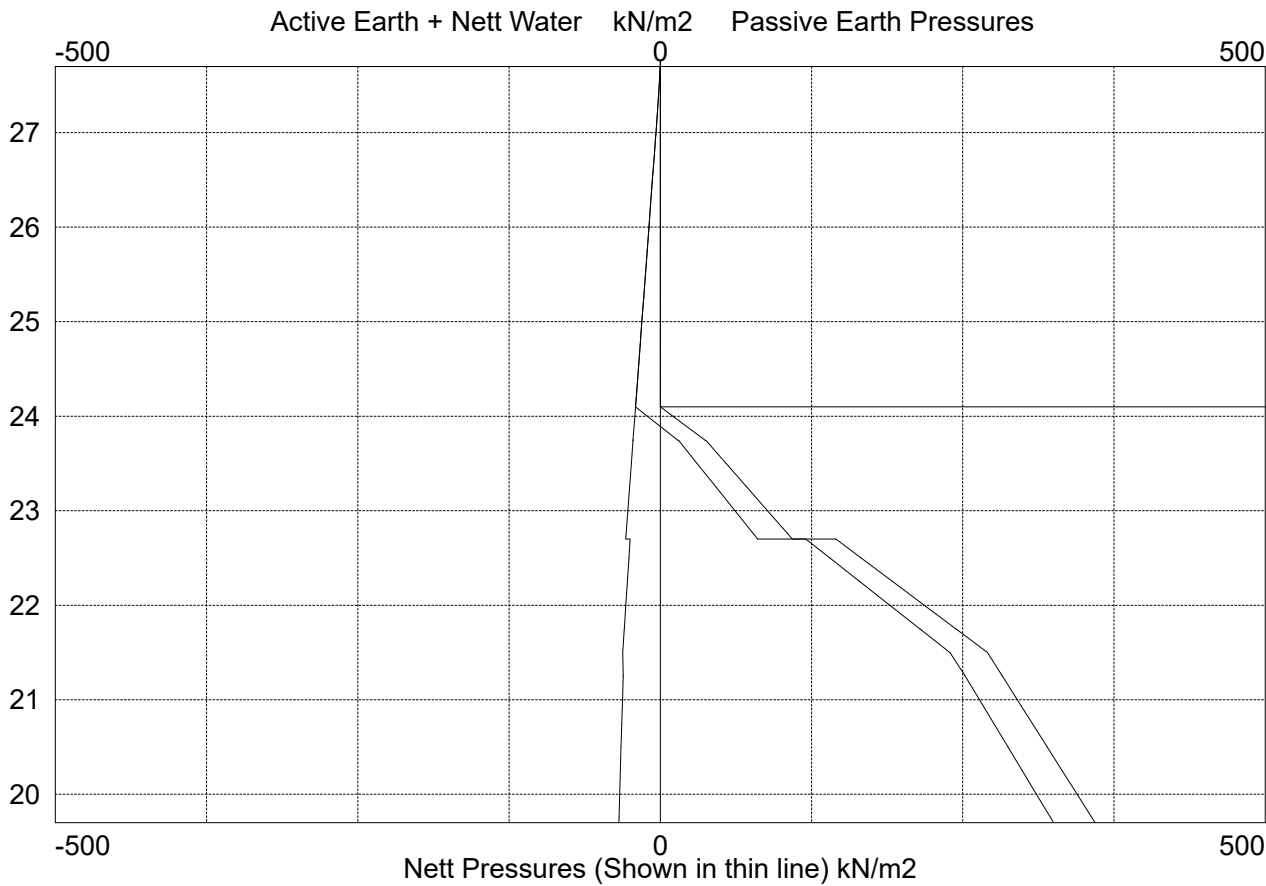
Tabular results from analysis of stage ref 4

strength.
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
	27.70	.0	.0	.0	.0	.0	.0	0	0	0			.00
t	27.70	.0	.0	.0	.0	.0	.0	0	7.5	0			.00
m	27.53	13.1	.9	.0	.0	.0	.0	.9	7.5	-.1			.00
	27.00	22.6	3.6	.0	.0	.0	.0	3.6	7.8	-1.2			.00
	26.97	23.1	3.8	.0	.0	.0	.0	3.8	7.8	-1.4			.00
	26.00	40.6	9.4	.0	.0	.0	.0	9.4	11.8	-7.8			.00
	25.00	58.6	15.2	.0	.0	.0	.0	15.2	25.3	-20.1			.00
	24.10	74.8	20.5	.0	.0	.0	.0	20.5	50.2	-36.1			.00
	24.10	74.8	20.5	.0	.0	.0	.0	20.5	50.3	-36.2			.00
	24.00	76.6	21.1	.0	1.9	10.4	.0	10.6	54.0	-37.7			.00
	23.74	81.2	22.6	.0	6.8	37.4	.0	-14.8	63.8	-37.2			.01
	23.74	81.3	22.6	.0	6.8	37.9	.0	-15.4	63.8	-37.2			.01
	23.00	94.6	26.9	.0	20.2	88.5	.0	-61.7	82.9	-8.7			.20
	22.70	100.0	28.6	.0	25.6	109.1	.0	-80.4	82.5	12.6			.33
m	22.70	100.0	25.0	.0	25.6	145.1	.0	-120.1	82.5	12.6			.33
m	22.00	113.3	28.5	.0	38.9	218.2	.0	-189.7	38.5	121.1			.79
m	21.74	118.3	29.8	.0	43.8	245.5	.0	-215.7	0	174.2			1.00
m	21.50	122.8	31.0	.0	48.4	270.3	.0	-239.3	-10.3	86.4			1.21
	21.26	125.0	30.7	2.4	50.5	282.2	2.4	-251.5	0	0			1.43
	21.00	127.3	31.3	5.0	52.9	295.1	5.0	-263.7	0	0			1.68
	20.00	136.3	33.6	15.0	61.9	344.5	15.0	-310.9	0	0			2.64
	19.70	139.0	34.3	18.0	64.6	359.3	18.0	-325.0	0	0			2.92

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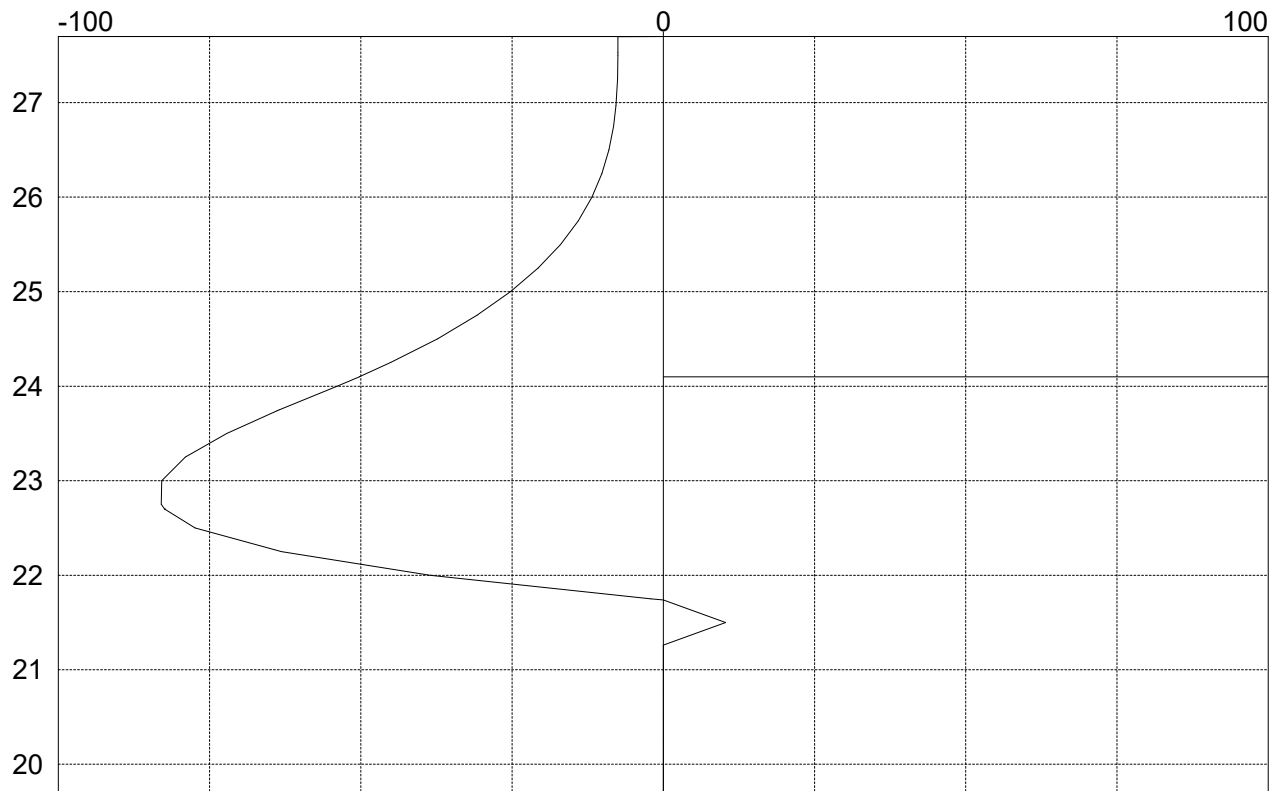
Graphical results from analysis of stage ref 4



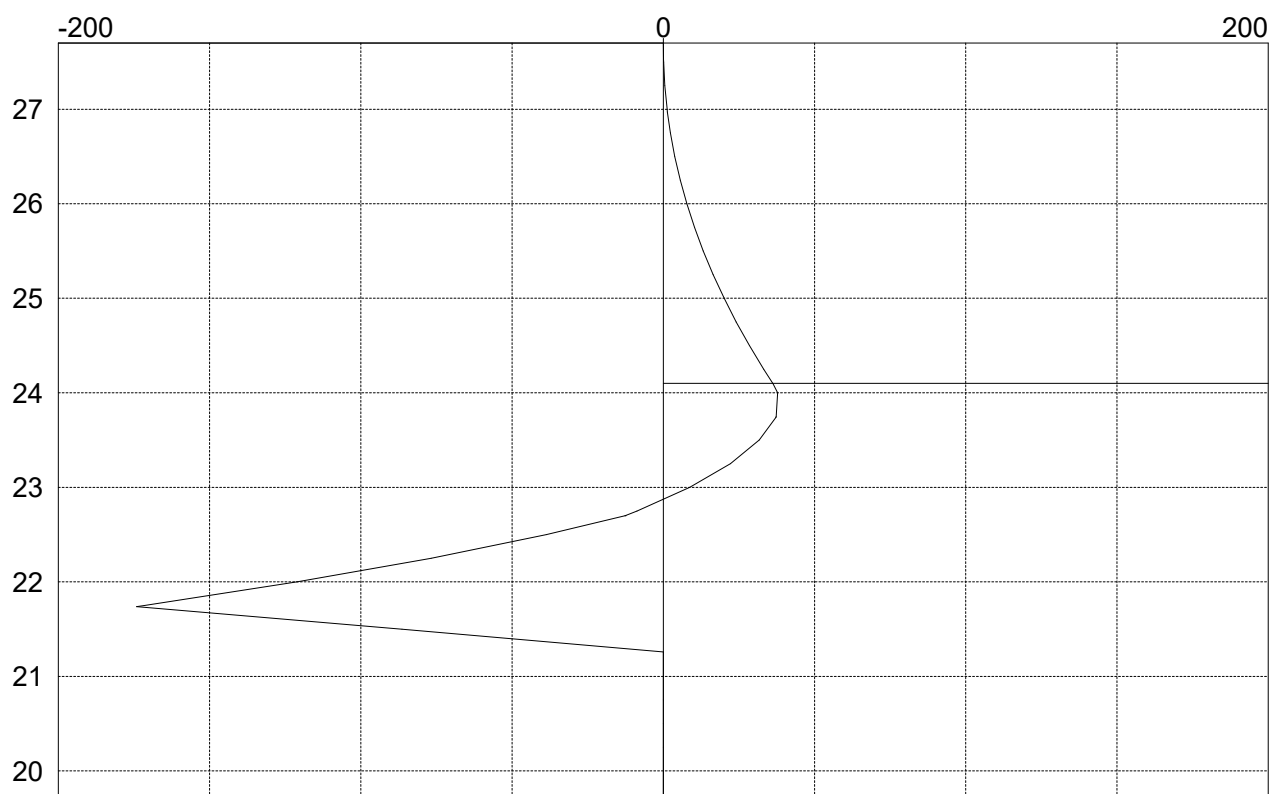
Deflection diagram not shown for analysis with partial factors applied

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Graphical results from analysis of stage ref 4 continued

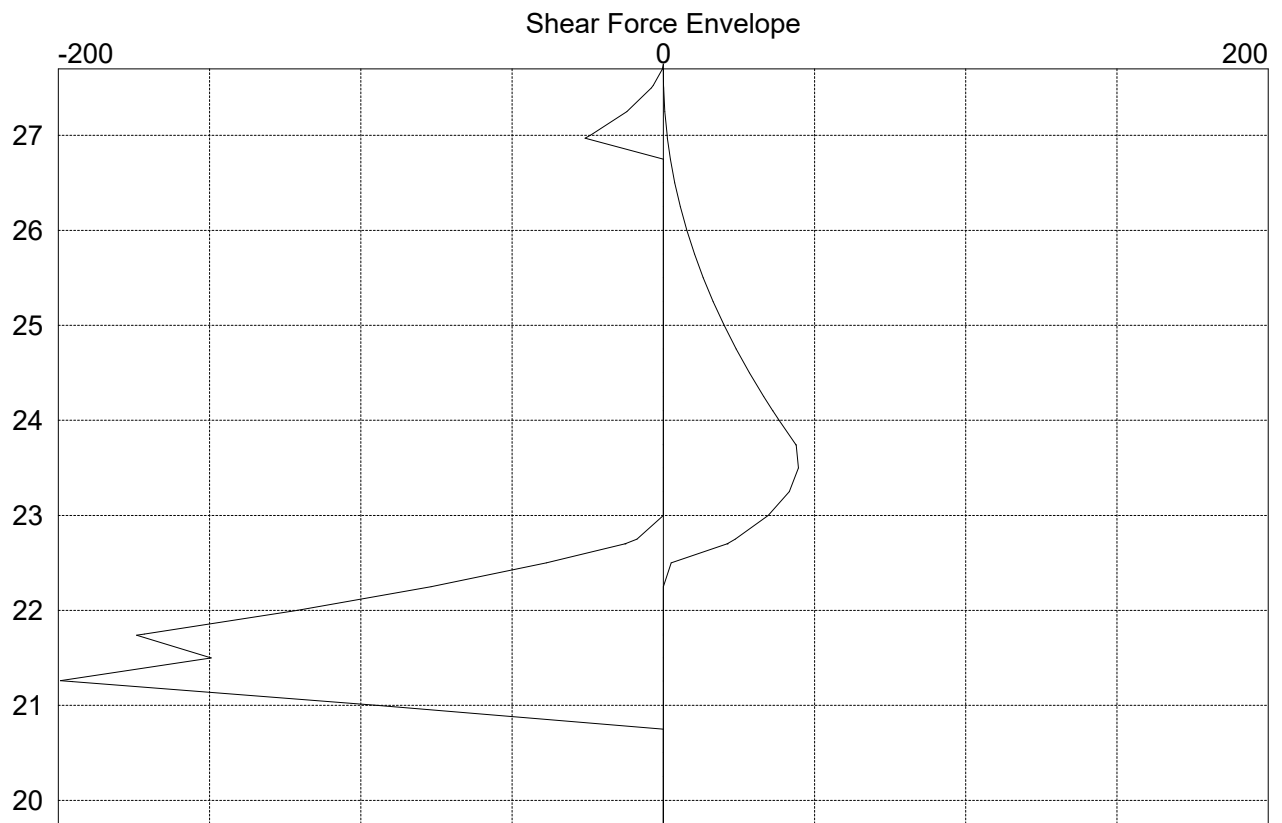
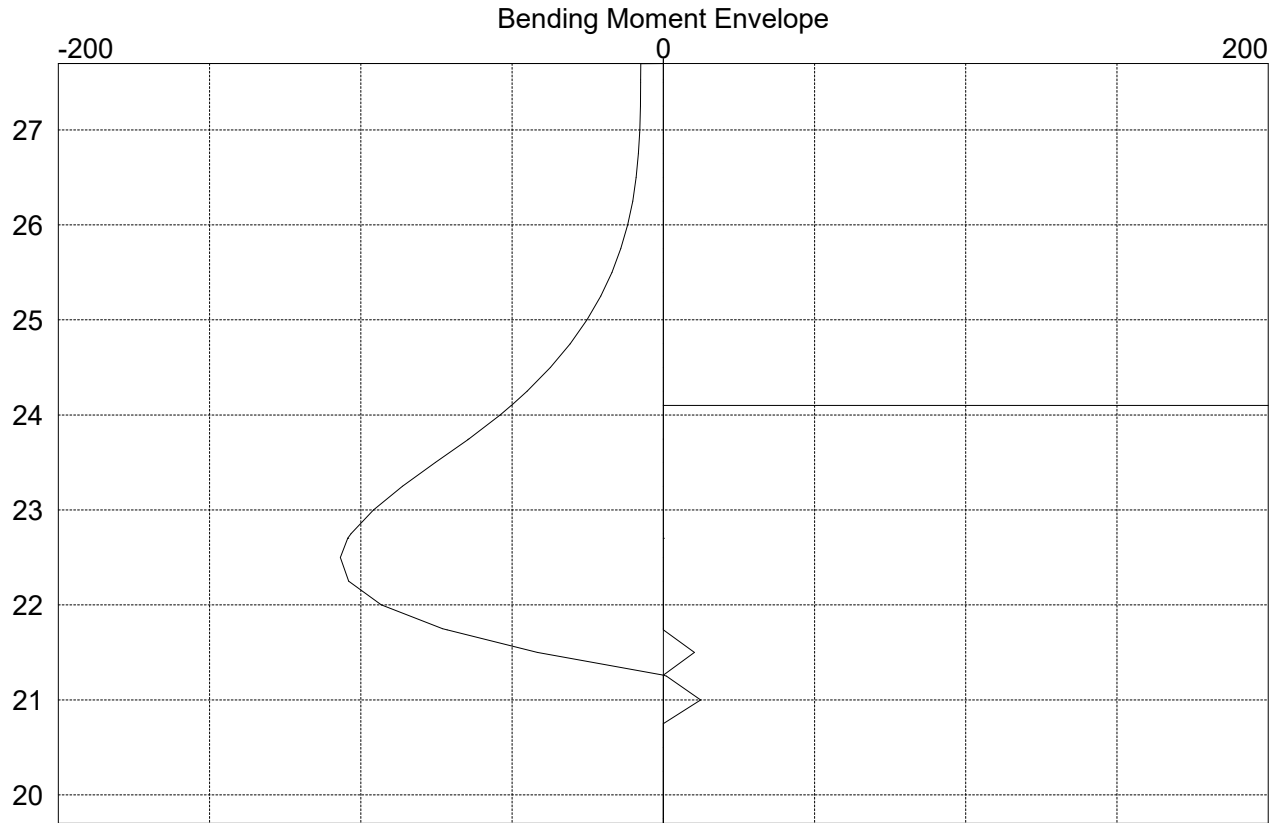


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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
27.70	.0	.0	.0	.3	
27.70	.0	7.5	.0	.3	
27.53	.0	7.5	-.1	3.3	
27.00	.0	7.8	-1.2	24.2	
26.97	.0	7.8	-1.4	25.9	
26.00	.0	11.8	-7.8	.0	
25.00	.0	25.3	-20.1	.0	
24.10	.0	50.2	-36.1	.0	
24.10	.0	50.3	-36.2	.0	
24.00	.0	54.0	-38.3	.0	
23.74	.0	64.6	-43.9	.0	
23.74	.0	64.7	-43.9	.0	
23.00	.0	95.8	-34.7	.0	
22.70	.0	104.3	-21.1	12.6	
22.70	.0	104.4	-21.1	12.6	
22.00	.0	93.2	.0	121.1	
21.74	.0	71.5	.0	174.2	
21.50	-10.3	41.7	.0	149.5	
21.26	.0	.0	.0	199.4	
21.00	-12.3	.0	.0	94.9	
20.00	.0	.0	.0	.0	
19.70	.0	.0	.0	.0	

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Structural design of wall

Wall section properties

Primary pile diameter	450 mm
Primary pile spacing	600 mm
Infill pile diameter	mm
Main rebar bar diameter	20 mm
Main rebar number of bars	4
Links/Helix bar diameter	8 mm
Links/Helix spacing/pitch	175 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	1.00

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	64	86	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1257	mm ²
Min longitudinal steel. BS8110 min 0.4% by area	636	1257	mm ²
Shear resistance. BS8110	120	127	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	8	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	202	175	mm
Min shear link area. BS8110 Clause 3.4.5	508	574	mm ² /m

Job No: DFS191007

Design Engineer: AR

Date: 18 July 2020

Job Name: 44 CLEVELAND STREET LONDON
W1T 4JT

Calc Title: Detailed Design for Contiguous Pile Retaining Wall **Rev. 01**

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CADS PWS 2.0 Computer Output Files – SLS Analysis

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Pile geometry

Pile top Level 27.7 m
 Pile Length 9 m
 Pile toe level 18.7 m
 Active ground slope 0 Degrees (To horizontal)

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

Initial Ground Water level 21.5

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
27.70	Made Ground	18.00	18.00	20000	0	3 3		31 31	.67 .50	.27 5.04	1.34 5.50
22.70	L to Dense Grav	19.00	19.00	90000	0	1 1		37 37	.67 .50	.20 7.92	1.17 6.89
18.70	Stiff to V.Stif	19.00	19.00	100000	0	5 5		28 28	.67 .50	.30 4.15	1.43 4.99

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1 A	Active surcharge	27.70	10.0	.3		
2 A	Moment load					
3 A	Passive side excavation	23.14				

Code of practice

Code of practice or reference document	
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	1.00

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Wall analysis detail options

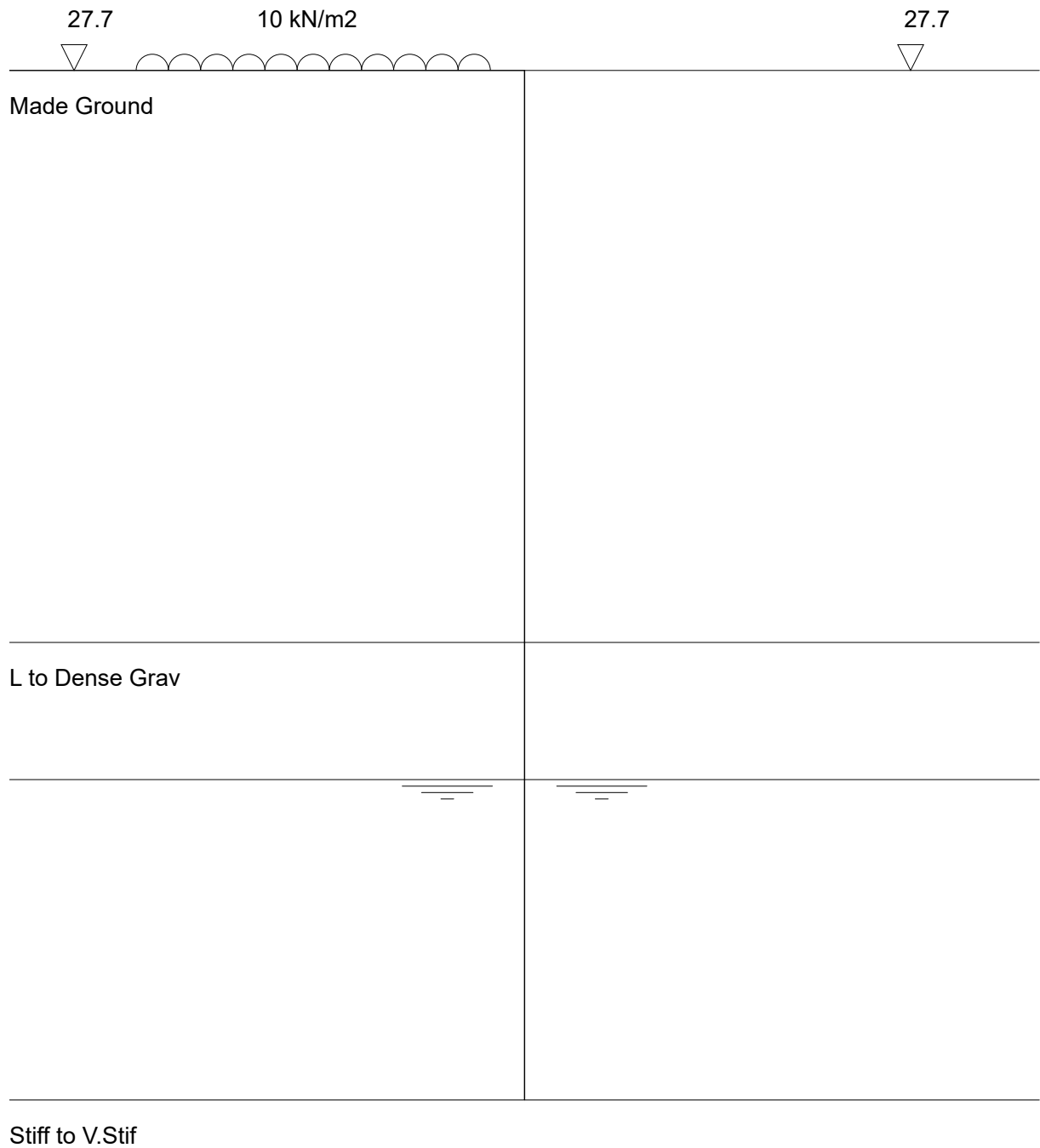
Nominal Phi for load distribution	30.0 Degrees
Depth of water filled tension cracks	.0 m
Density of water	10.0 kN/m3
Minimum equivalent fluid density	5.0 kN/m3
Depth of passive softened soil	.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	335482 cm4/m
Wall Youngs modulus	27000000 kN/m2

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Stage ref. 1
Stage type Active surcharge



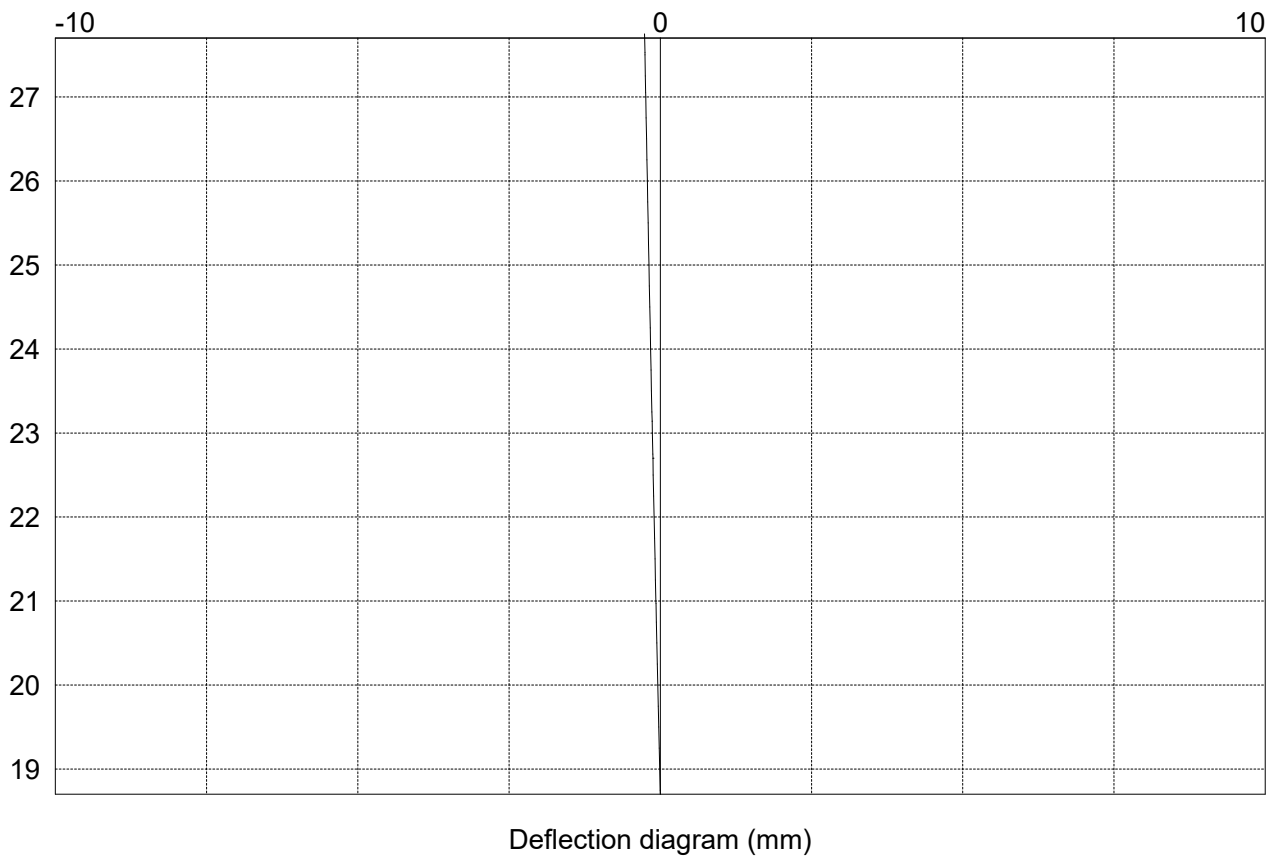
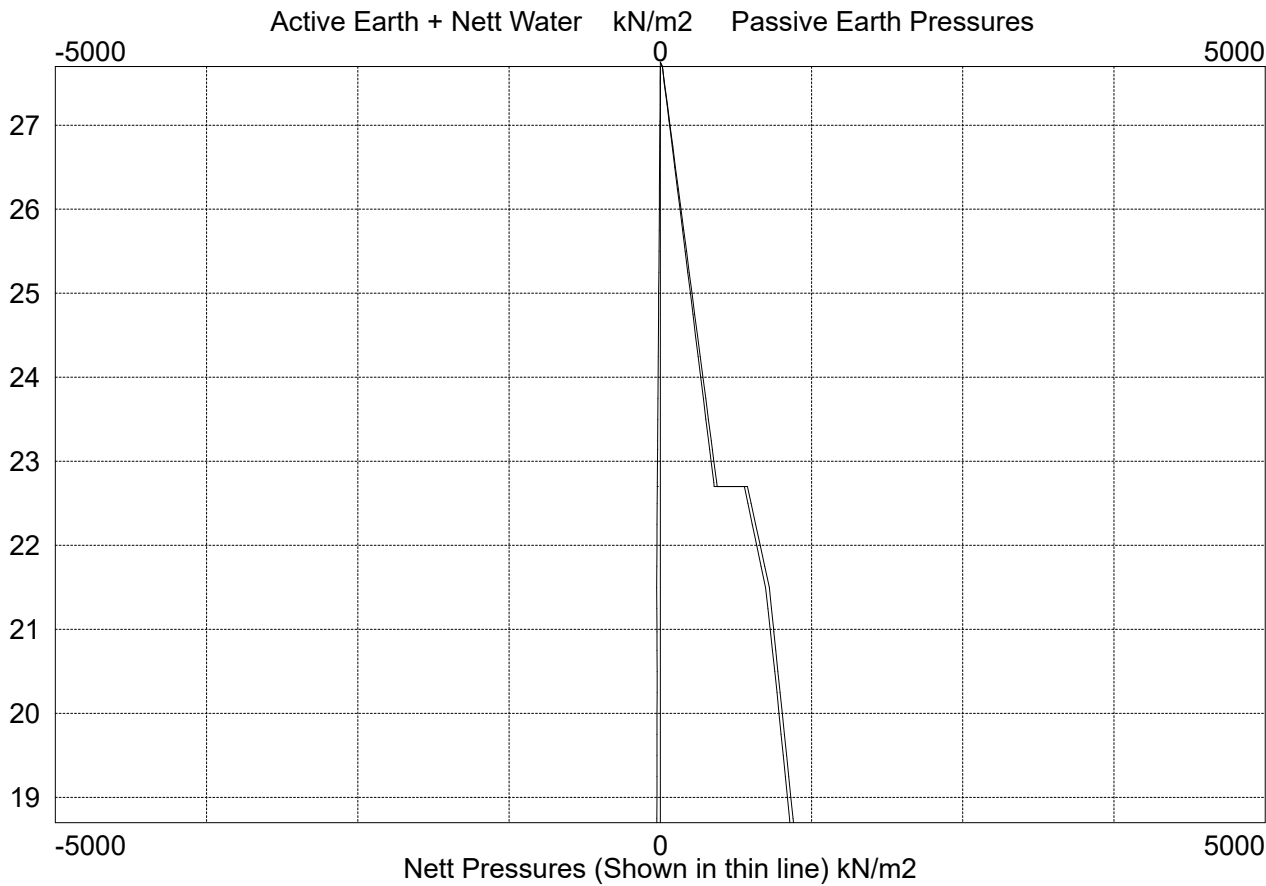
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Tabular results from analysis of stage ref 1

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
27.70	.0	.0	.0	.0	16.5	.0	-16.5	0	0	-.3	>100.00	
t 27.70	.0	.0	.0	.0	16.7	.0	-16.7	0	0	-.3	>100.00	
t 27.53	13.1	.0	1.7	3.1	32.2	.0	-30.5	0	0	-.3	>100.00	
m 27.05	21.7	3.2	.0	11.7	75.3	.0	-72.0	0	0	-.2	>100.00	
m 27.00	22.6	3.5	.0	12.6	80.0	.0	-76.5	0	0	-.2	>100.00	
m 26.00	40.6	8.5	.0	30.6	170.7	.0	-162.2	0	0	-.2	>100.00	
m 25.00	58.6	13.5	.0	48.6	261.5	.0	-248.0	0	0	-.2	>100.00	
m 24.00	76.6	18.5	.0	66.6	352.2	.0	-333.7	0	0	-.2	>100.00	
m 23.14	92.0	22.8	.0	82.0	430.0	.0	-407.2	0	0	-.1	>100.00	
m 23.14	92.1	22.8	.0	82.1	430.2	.0	-407.4	0	0	-.1	>100.00	
m 23.00	94.6	23.5	.0	84.6	442.9	.0	-419.4	0	0	-.1	>100.00	
m 22.70	100.0	25.0	.0	90.0	470.1	.0	-445.1	0	0	-.1	>100.00	
m 22.70	100.0	25.0	.0	90.0	720.0	.0	-695.0	0	0	-.1	>100.00	
m 22.00	113.3	28.5	.0	103.3	825.4	.0	-796.9	0	0	-.1	>100.00	
m 21.50	122.8	31.0	.0	112.8	900.6	.0	-869.6	0	0	-.1	>100.00	
m 21.00	127.3	33.5	.0	117.3	936.3	5.0	-907.8	0	0	-.1	>100.00	
m 20.97	127.6	33.7	.0	117.6	938.4	5.3	-910.1	0	0	-.1	>100.00	
20.00	136.3	26.8	15.0	126.3	1007.6	15.0	-980.8	0	0	0	>100.00	
19.00	145.3	28.6	25.0	135.3	1078.9	25.0	-1050.3	0	0	0	>100.00	
18.70	148.0	29.2	28.0	138.0	1100.3	28.0	-1071.2	0	0	0	>100.00	

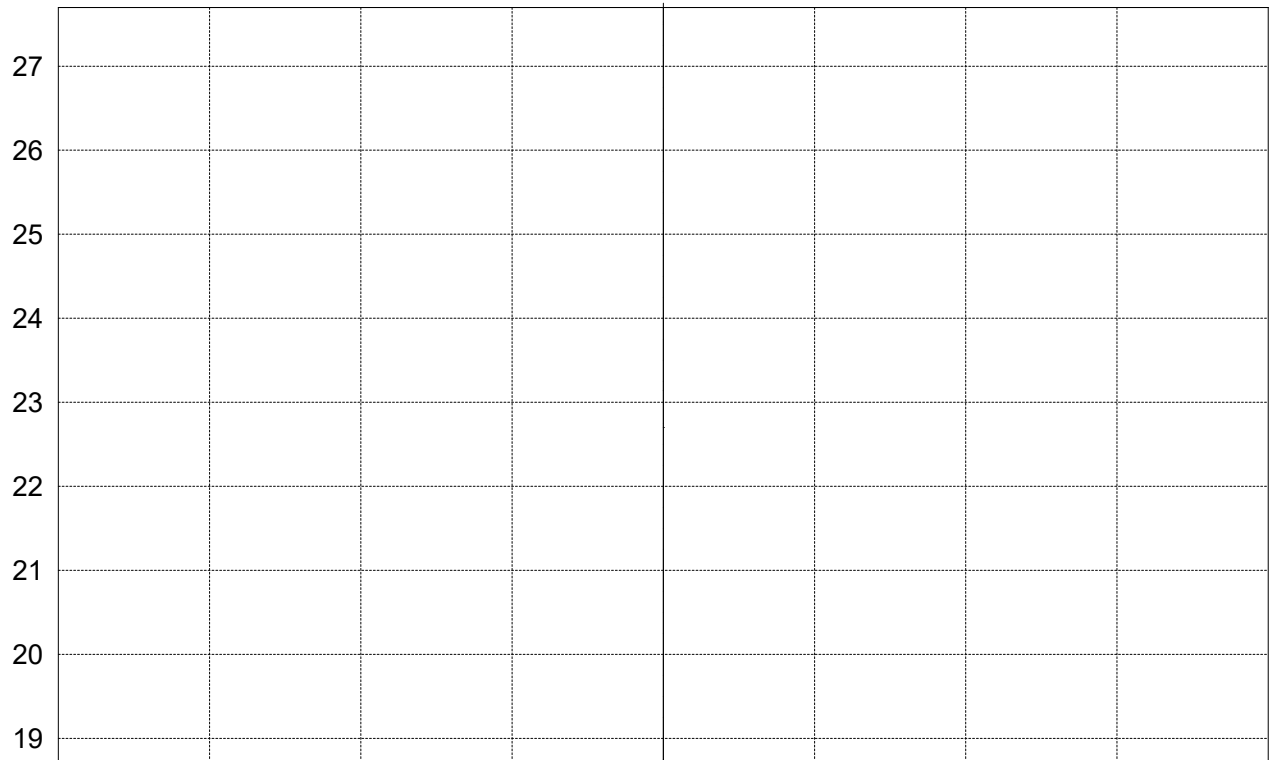
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Graphical results from analysis of stage ref 1

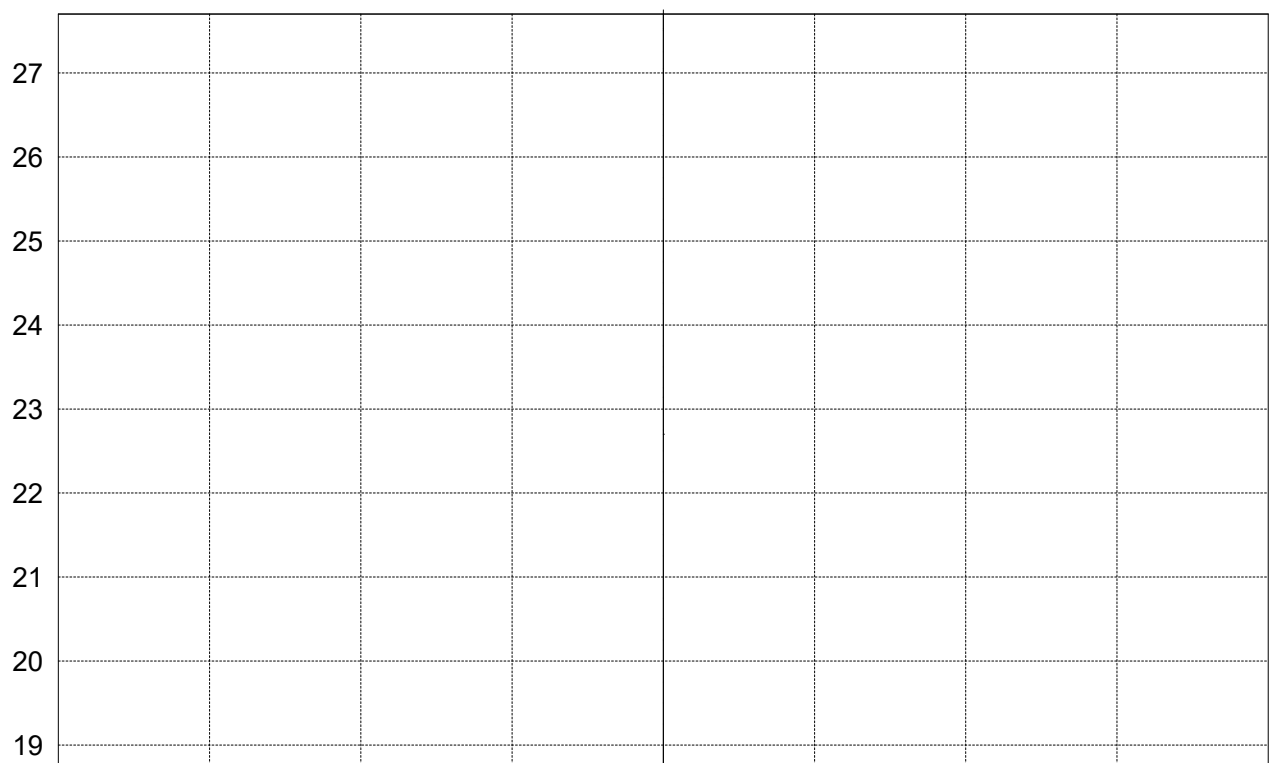


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Graphical results from analysis of stage ref 1 continued



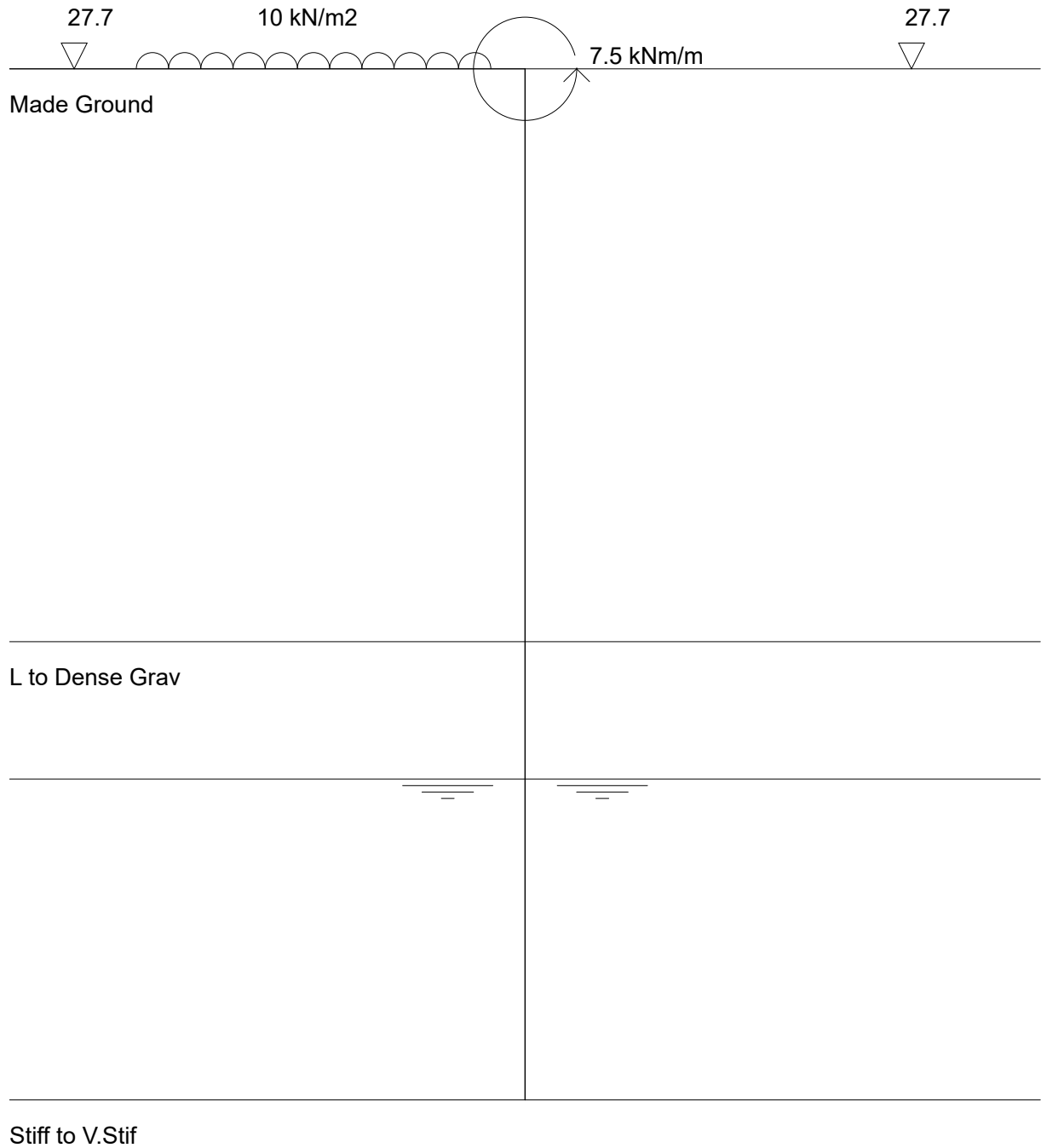
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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CADS Piled Wall Suite Version 6.03 Design of embedded retaining walls and cofferdams	Project 1 - 1 File Name ...1 - temp & perm.pws"
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Stage ref. 2
Stage type Moment load



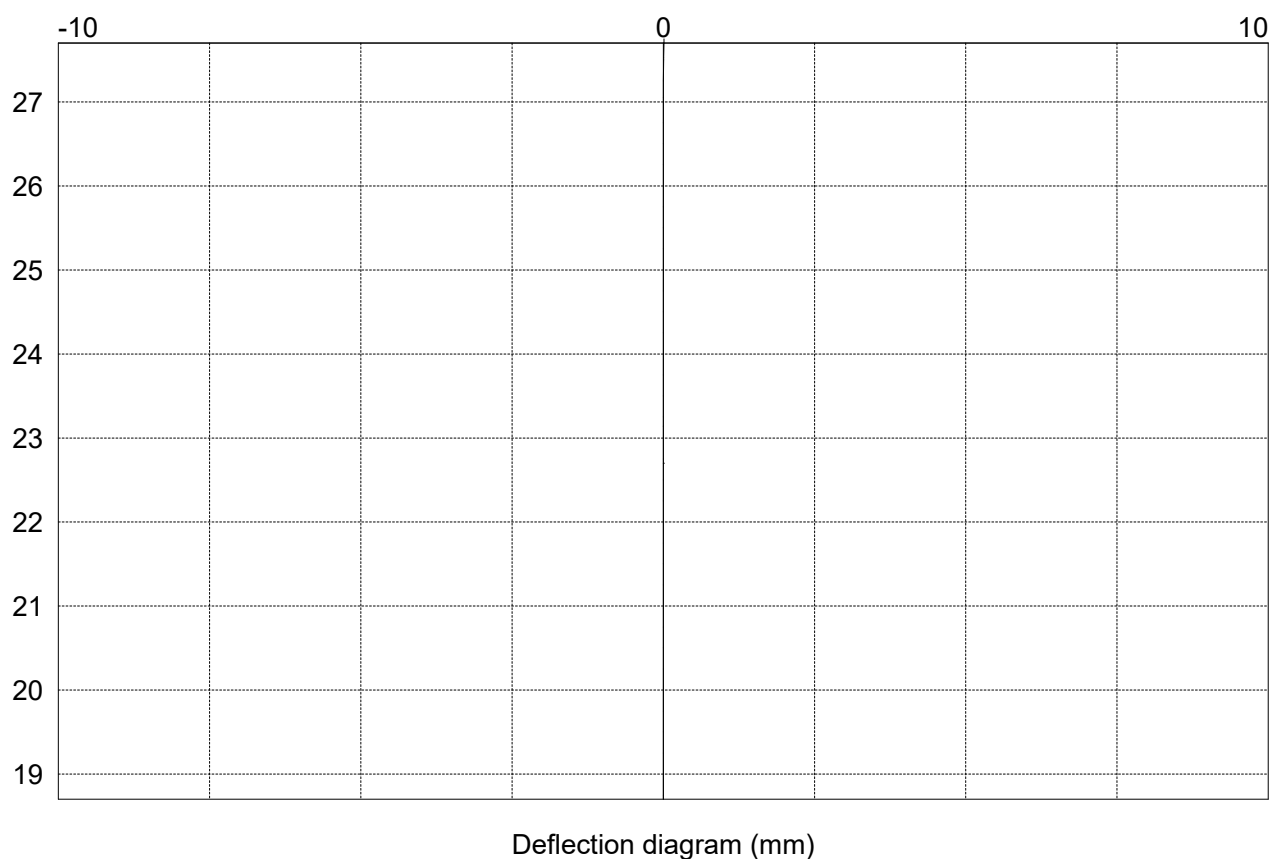
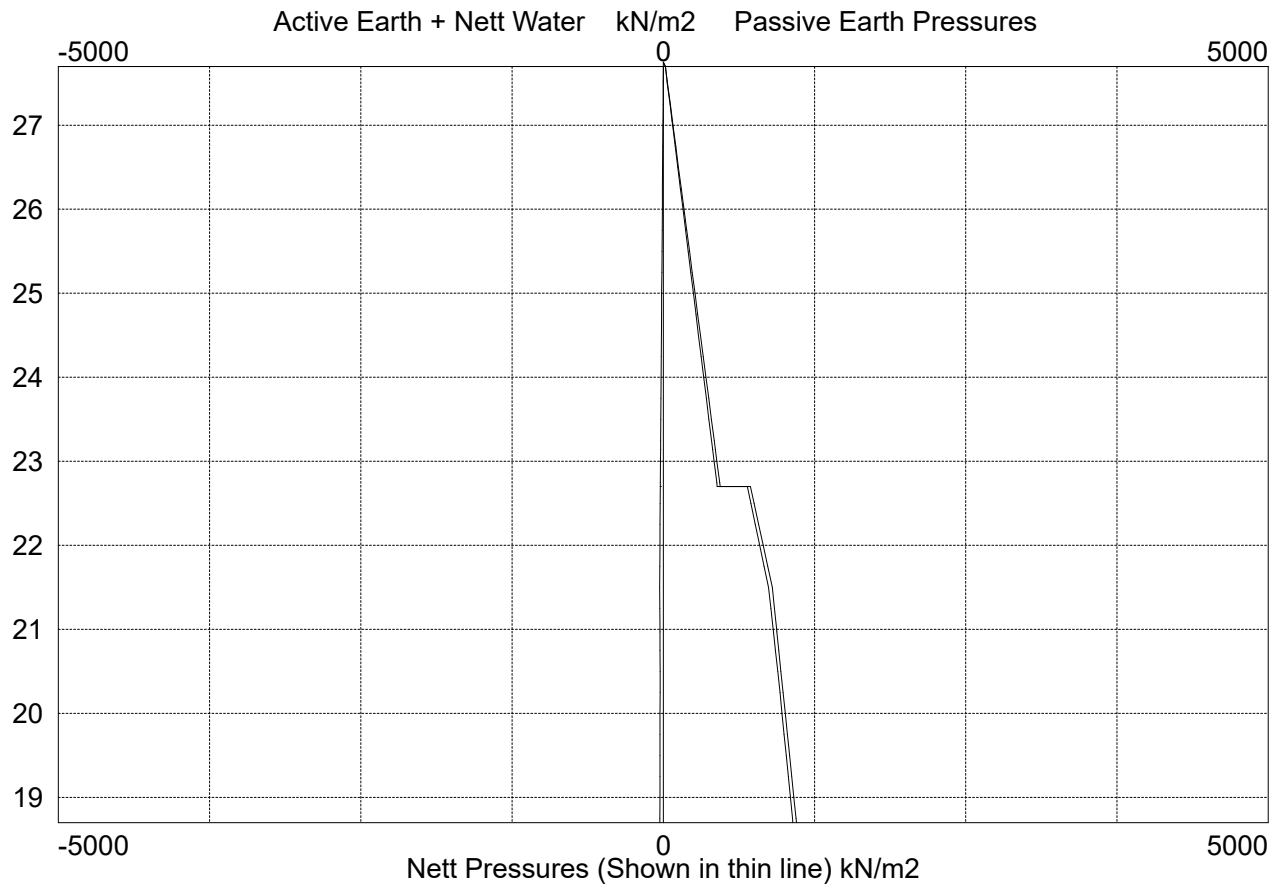
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Tabular results from analysis of stage ref 2

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
27.70	.0	.0	.0	.0	16.5	.0	-16.5	0	.4	0		.00
t 27.70	.0	.0	.0	.0	16.7	.0	-16.7	7.5	.4	0		.00
t 27.53	13.1	.0	1.7	3.1	32.2	.0	-30.5	7.1	4.5	0		.05
m 27.05	21.7	3.2	.0	11.7	75.3	.0	-72.0	0	28.9	0		1.04
m 27.00	22.6	3.5	.0	12.6	80.0	.0	-76.5	-.4	17.3	0		1.21
m 26.00	40.6	8.5	.0	30.6	170.7	.0	-162.2	0	0	0		8.29
m 25.00	58.6	13.5	.0	48.6	261.5	.0	-248.0	0	0	0		14.67
m 24.00	76.6	18.5	.0	66.6	352.2	.0	-333.7	0	0	0		17.44
m 23.14	92.0	22.8	.0	82.0	430.0	.0	-407.2	0	0	0		18.37
m 23.14	92.1	22.8	.0	82.1	430.2	.0	-407.4	0	0	0		18.37
m 23.00	94.6	23.5	.0	84.6	442.9	.0	-419.4	0	0	0		18.46
m 22.70	100.0	25.0	.0	90.0	470.1	.0	-445.1	0	0	0		18.61
m 22.70	100.0	25.0	.0	90.0	720.0	.0	-695.0	0	0	0		18.61
m 22.00	113.3	28.5	.0	103.3	825.4	.0	-796.9	0	0	0		19.23
m 21.50	122.8	31.0	.0	112.8	900.6	.0	-869.6	0	0	0		19.86
m 21.00	127.3	33.5	.0	117.3	936.3	5.0	-907.8	0	0	0		20.55
m 20.97	127.6	33.7	.0	117.6	938.4	5.3	-910.1	0	0	0		20.59
20.00	136.3	26.8	15.0	126.3	1007.6	15.0	-980.8	0	0	0		22.02
19.00	145.3	28.6	25.0	135.3	1078.9	25.0	-1050.3	0	0	0		23.50
18.70	148.0	29.2	28.0	138.0	1100.3	28.0	-1071.2	0	0	0		23.93

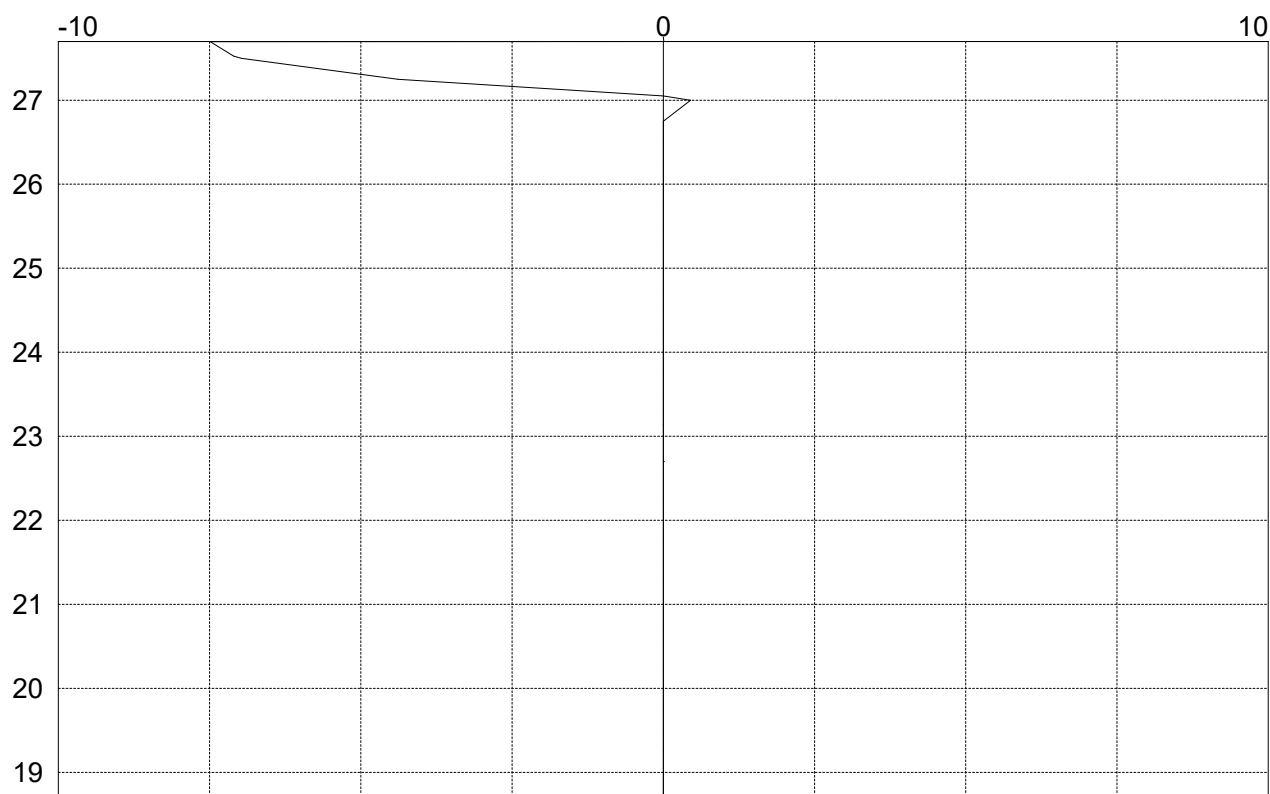
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Graphical results from analysis of stage ref 2

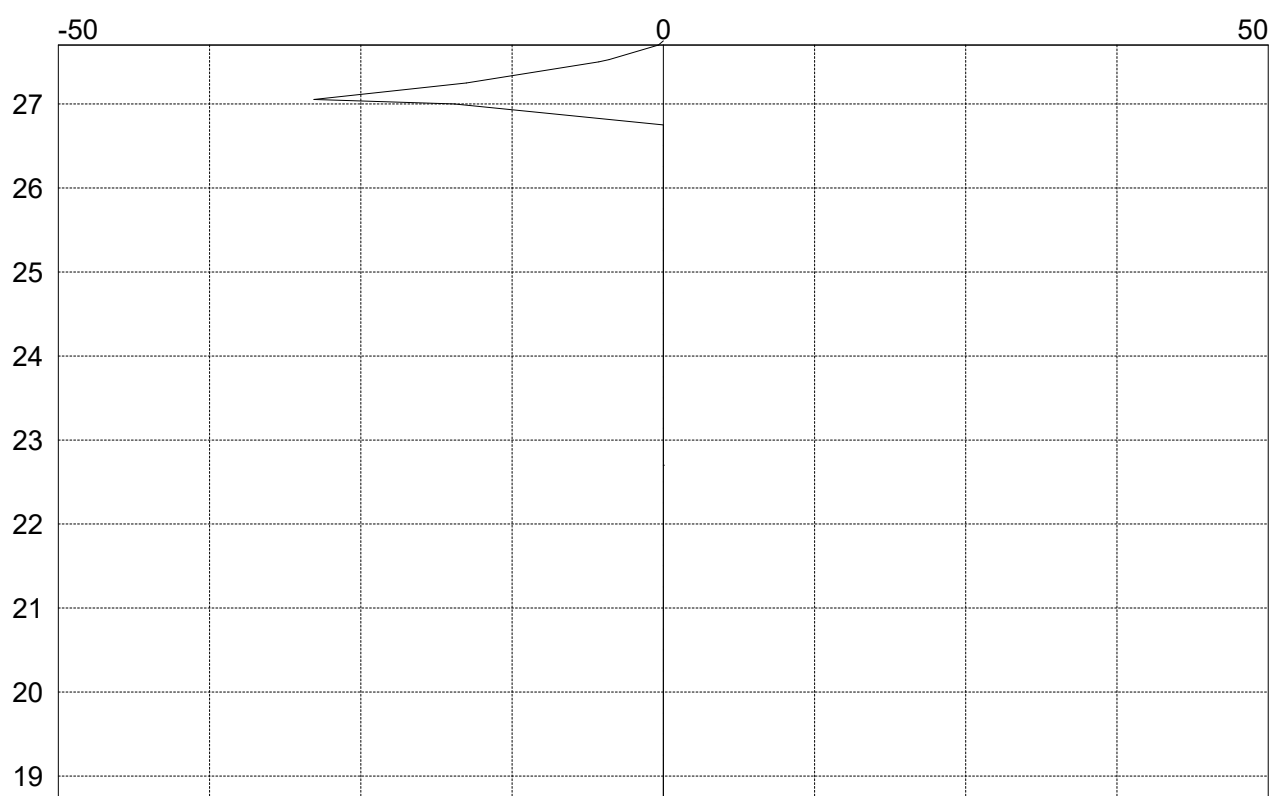


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Graphical results from analysis of stage ref 2 continued



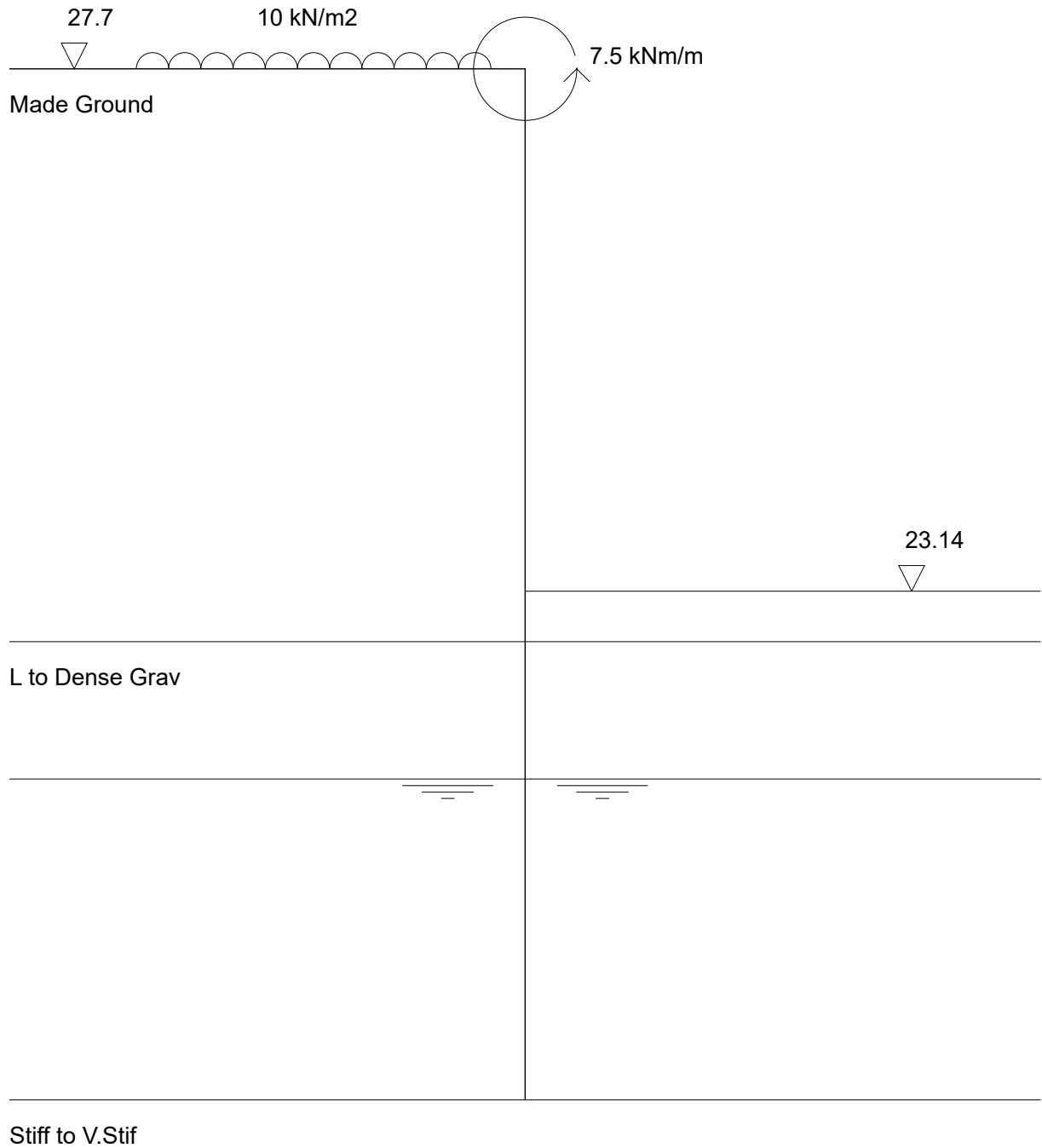
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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Stage ref. 3
Stage type Passive side excavation



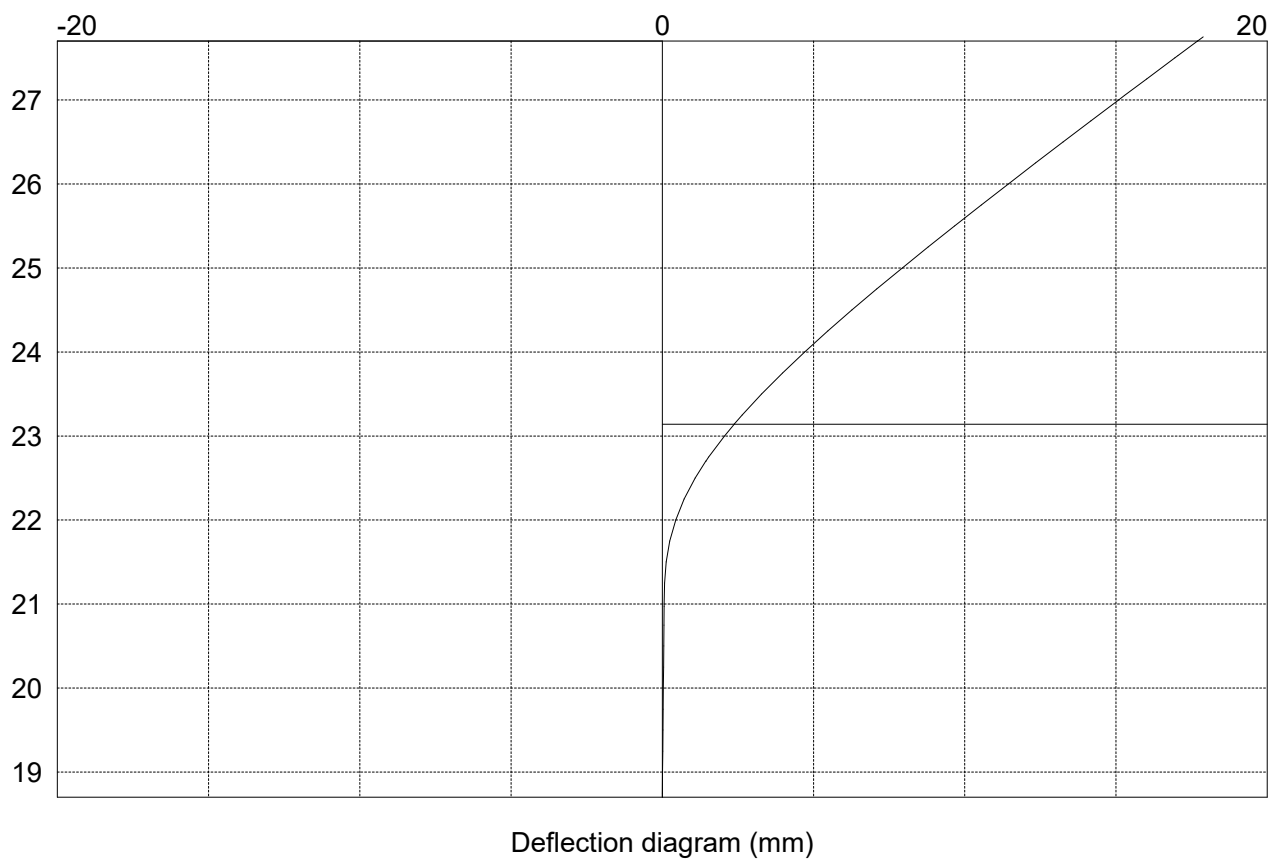
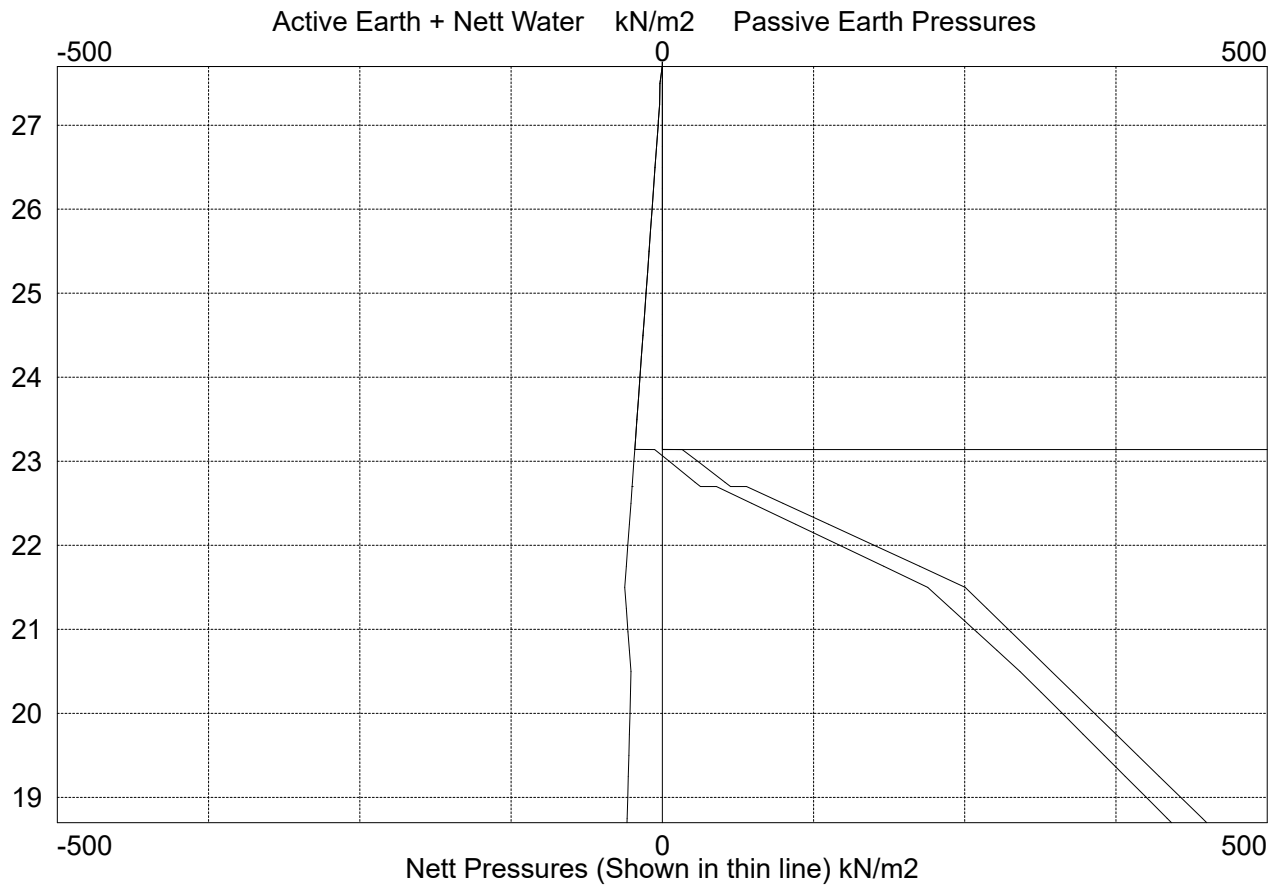
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Tabular results from analysis of stage ref 3

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
27.70	.0	.0	.0	.0	.0	.0	0	0	0	17.7		.00
t 27.70	.0	.0	.0	.0	.0	.0	0	7.5	0	17.7		.00
t 27.53	13.1	.0	1.7	.0	.0	.0	1.7	7.5	-.1	17.0		.00
m 27.05	21.7	3.2	.0	.0	.0	.0	3.2	7.8	-1.3	15.3		.00
m 27.00	22.6	3.5	.0	.0	.0	.0	3.5	7.9	-1.4	15.1		.00
m 26.00	40.6	8.5	.0	.0	.0	.0	8.5	11.9	-7.4	11.4		.00
m 25.00	58.6	13.5	.0	.0	.0	.0	13.5	24.5	-18.4	7.9		.00
m 24.00	76.6	18.5	.0	.0	.0	.0	18.5	50.5	-34.4	4.7		.00
m 23.14	92.0	22.8	.0	.0	.0	.0	22.8	87.4	-52.2	2.4		.00
m 23.14	92.1	22.8	.0	.0	16.5	.0	6.3	87.5	-52.2	2.4		.00
m 23.00	94.6	23.5	.0	2.5	29.2	.0	-5.7	94.8	-52.2	2.1		.00
m 22.70	100.0	25.0	.0	7.9	56.4	.0	-31.4	109.8	-46.7	1.4		.03
m 22.70	100.0	25.0	.0	7.9	69.6	.0	-44.6	109.9	-46.7	1.4		.03
m 22.00	113.3	28.5	.0	21.2	175.0	.0	-146.5	123.3	20.2	.4		.24
m 21.50	122.8	31.0	.0	30.7	250.3	.0	-219.3	91.8	111.7	.1		.56
m 21.00	127.3	33.5	.0	35.2	286.0	5.0	-257.5	6.9	230.9	.1		.97
m 20.97	127.6	33.7	.0	35.5	288.1	5.3	-259.7	0	238.6	.1		1.00
20.00	136.3	26.8	15.0	44.2	357.3	15.0	-330.5	0	0	0		1.95
19.00	145.3	28.6	25.0	53.2	428.6	25.0	-400.0	0	0	0		2.99
18.70	148.0	29.2	28.0	55.9	450.0	28.0	-420.8	0	0	0		3.31

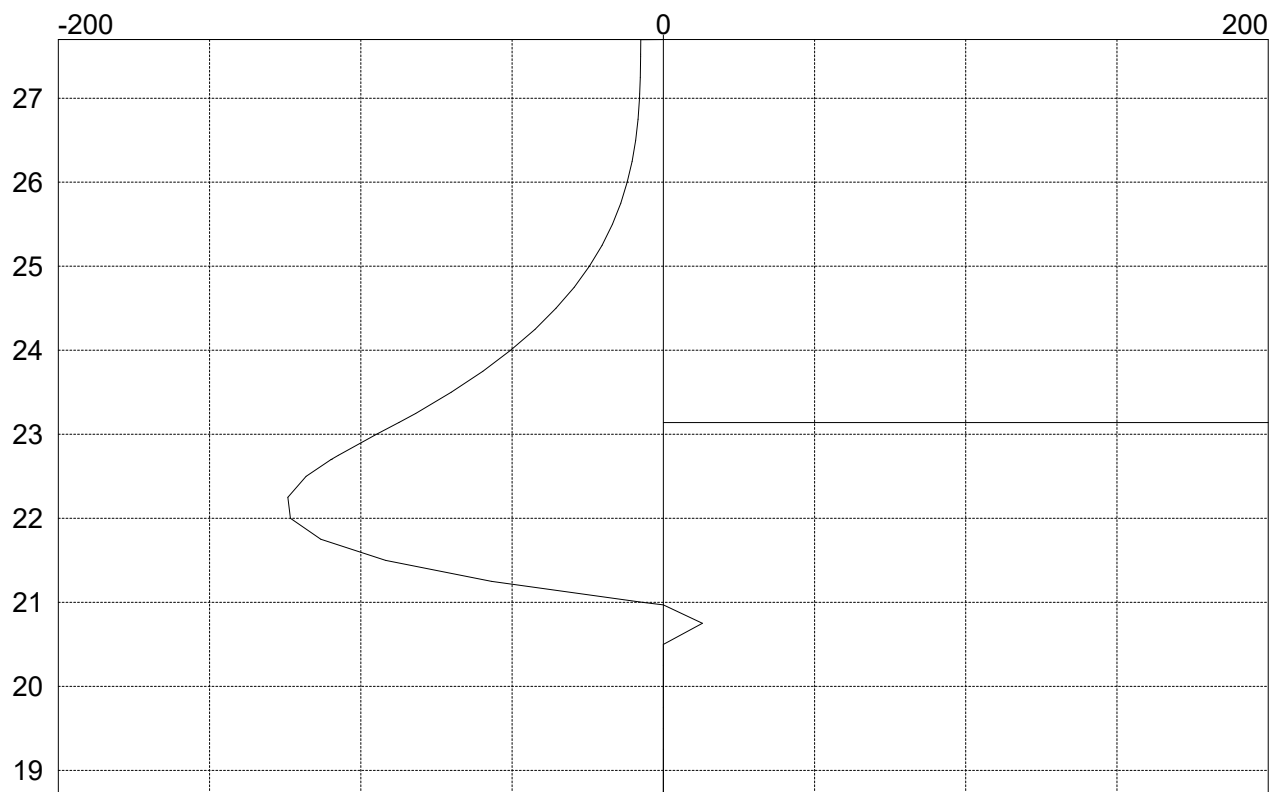
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Graphical results from analysis of stage ref 3

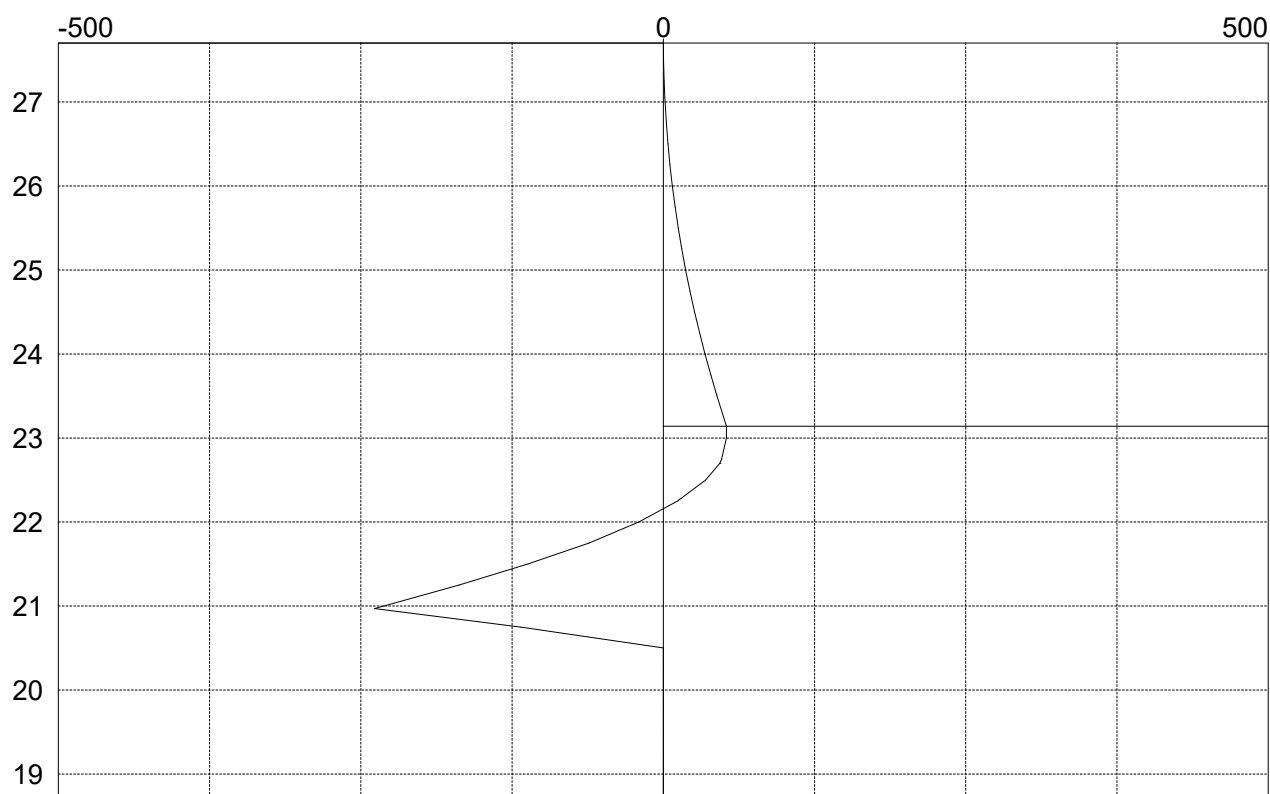


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Graphical results from analysis of stage ref 3 continued



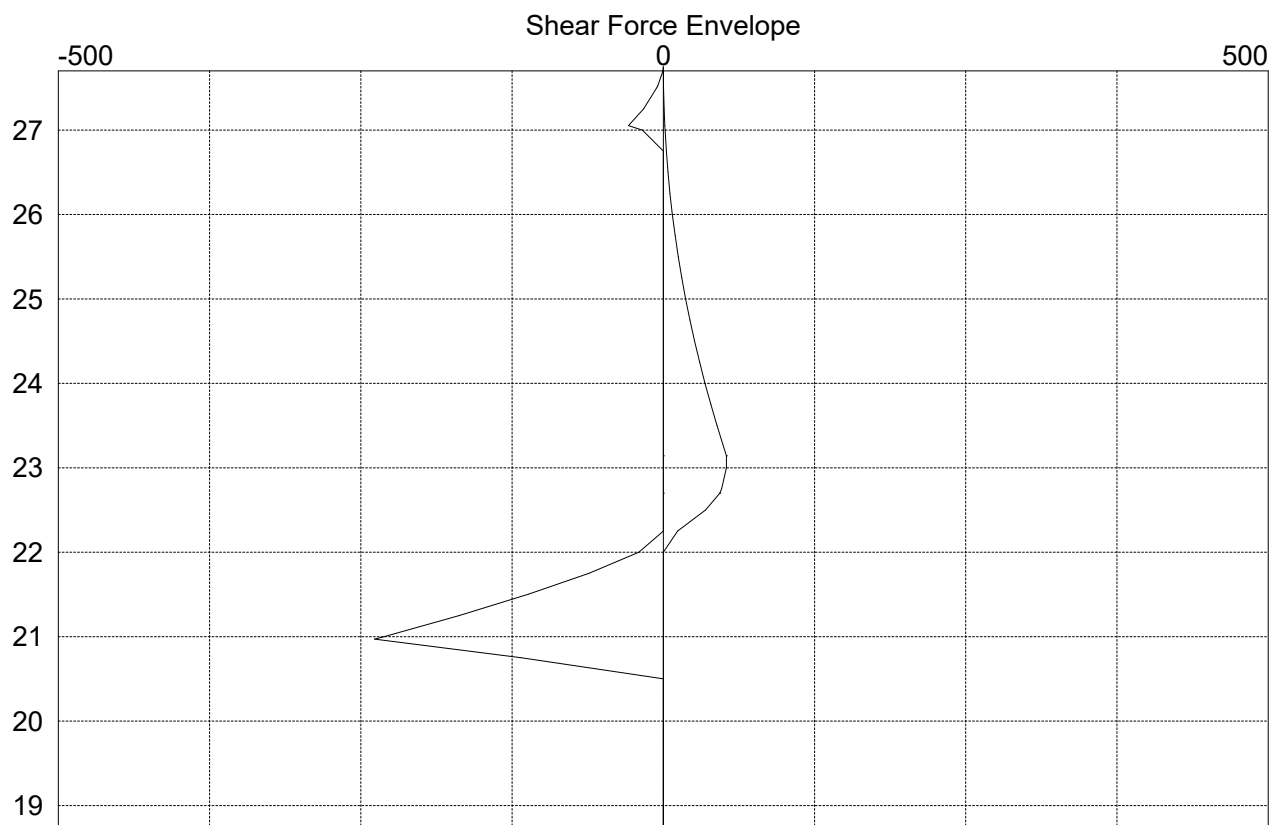
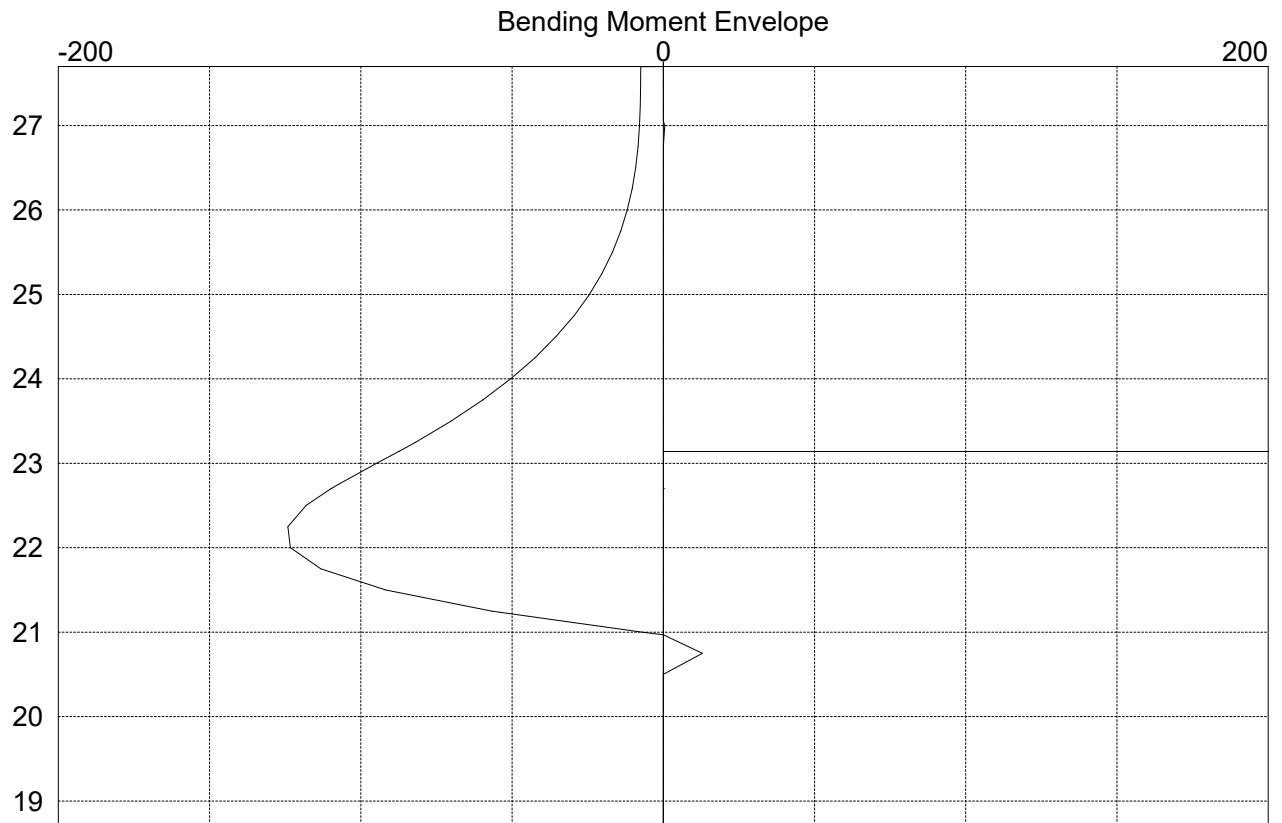
Bending Moment Diagram (kNm/m)



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
27.70	.0	.0	.0	.4	
27.70	.0	7.5	.0	.4	
27.53	.0	7.5	-.1	4.5	
27.05	.0	7.8	-1.3	28.9	
27.00	-.4	7.9	-1.4	17.3	
26.00	.0	11.9	-7.4	.0	
25.00	.0	24.5	-18.4	.0	
24.00	.0	50.5	-34.4	.0	
23.14	.0	87.4	-52.2	.0	
23.14	.0	87.5	-52.2	.0	
23.00	.0	94.8	-52.2	.0	
22.70	.0	109.8	-46.7	.0	
22.70	.0	109.9	-46.7	.0	
22.00	.0	123.3	.0	20.2	
21.50	.0	91.8	.0	111.7	
21.00	.0	6.9	.0	230.9	
20.97	.0	.0	.0	238.6	
20.00	.0	.0	.0	.0	
19.00	.0	.0	.0	.0	
18.70	.0	.0	.0	.0	

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Structural design of wall

Wall section properties

Primary pile diameter	450 mm
Primary pile spacing	600 mm
Infill pile diameter	mm
Main rebar bar diameter	20 mm
Main rebar number of bars	6
Links/Helix bar diameter	10 mm
Links/Helix spacing/pitch	140 mm

Wall material properties

Concrete cube strength	35 N/mm ²
Concrete cover	50 mm
Main rebar steel grade	500 N/mm ²
Link rebar steel grade	500 N/mm ²
Ultimate load factor	1.35

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	101	118	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1885	mm ²
Min longitudinal steel. BS8110 min 0.4% by area	636	1885	mm ²
Shear resistance. BS8110	193	197	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	10	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	192	140	mm
Min shear link area. BS8110 Clause 3.4.5	1092	1122	mm ² /m

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Pile geometry

Pile top Level 27.7 m
 Pile Length 8 m
 Pile toe level 19.7 m
 Active ground slope 0 Degrees (To horizontal)

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

Initial Ground Water level 21.5

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
27.70	Made Ground	18.00	18.00	20000	0	3 3		31 31	.67 .50	.27 5.04	1.34 5.50
22.70	L to Dense Grav	19.00	19.00	90000	0	1 1		37 37	.67 .50	.20 7.92	1.17 6.89
18.70	Stiff to V.Stif	19.00	19.00	100000	0	5 5		28 28	.67 .50	.30 4.15	1.43 4.99

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN/(m)	Offset m	Width m	Length m
1 A	Active surcharge	27.70	10.0	.3		
2 A	Moment load					
3 A	Passive side excavation	24.13				

Code of practice

Code of practice or reference document	
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	1.00

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Wall analysis detail options

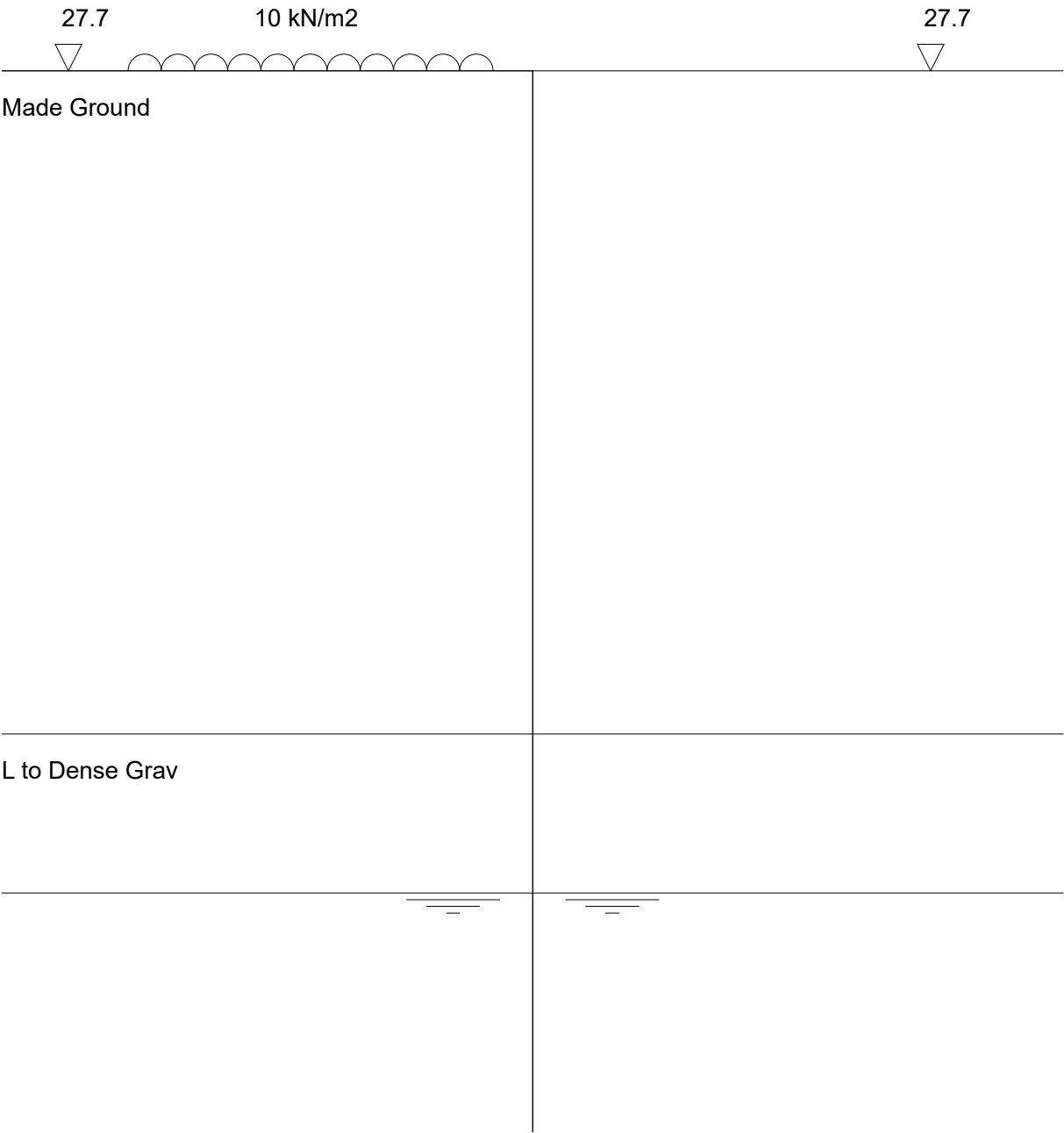
Nominal Phi for load distribution	30.0 Degrees
Depth of water filled tension cracks	.0 m
Density of water	10.0 kN/m3
Minimum equivalent fluid density	5.0 kN/m3
Depth of passive softened soil	.0 m
Continuity model for wall analysis	Pins at second and lower props

Deflection parameters

Wall moment of inertia	335482 cm4/m
Wall Youngs modulus	27000000 kN/m2

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Stage ref. 1
Stage type Active surcharge



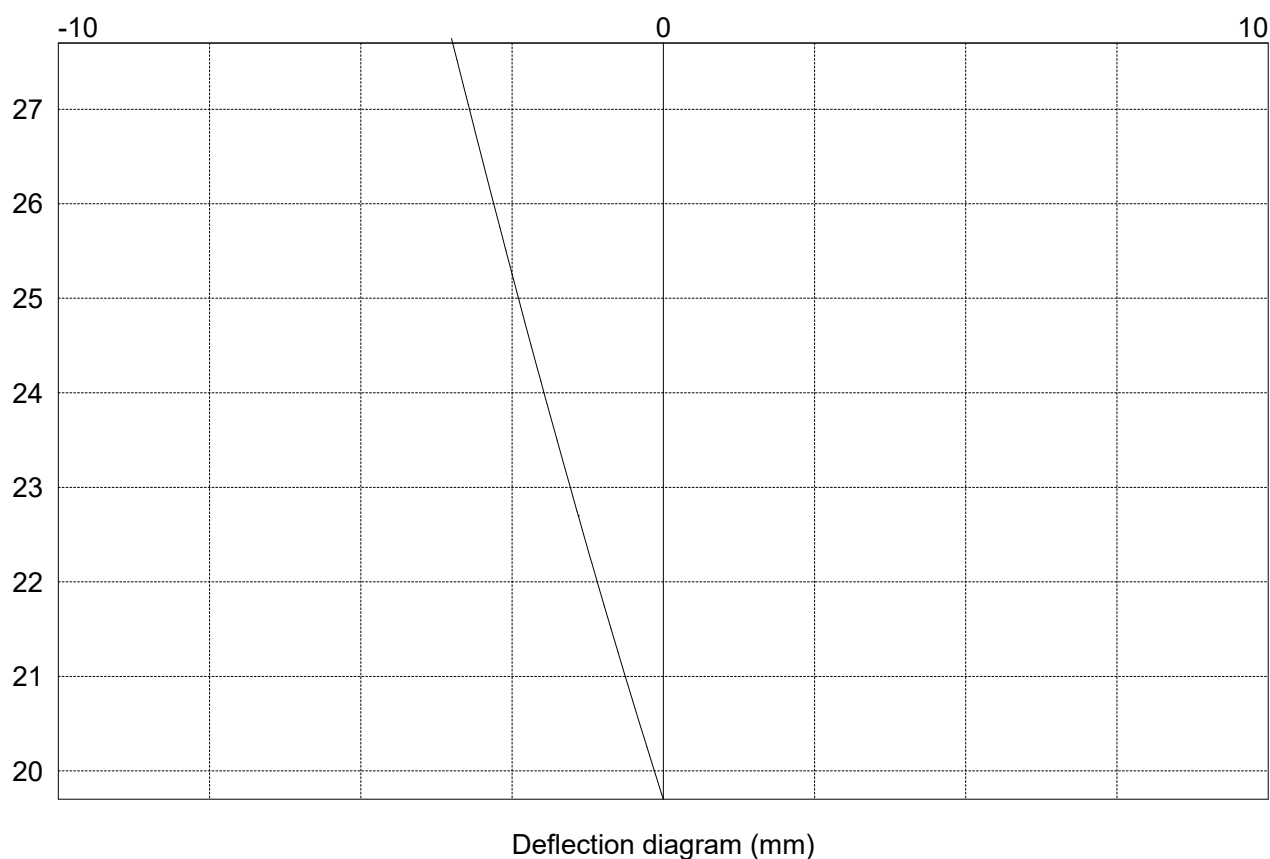
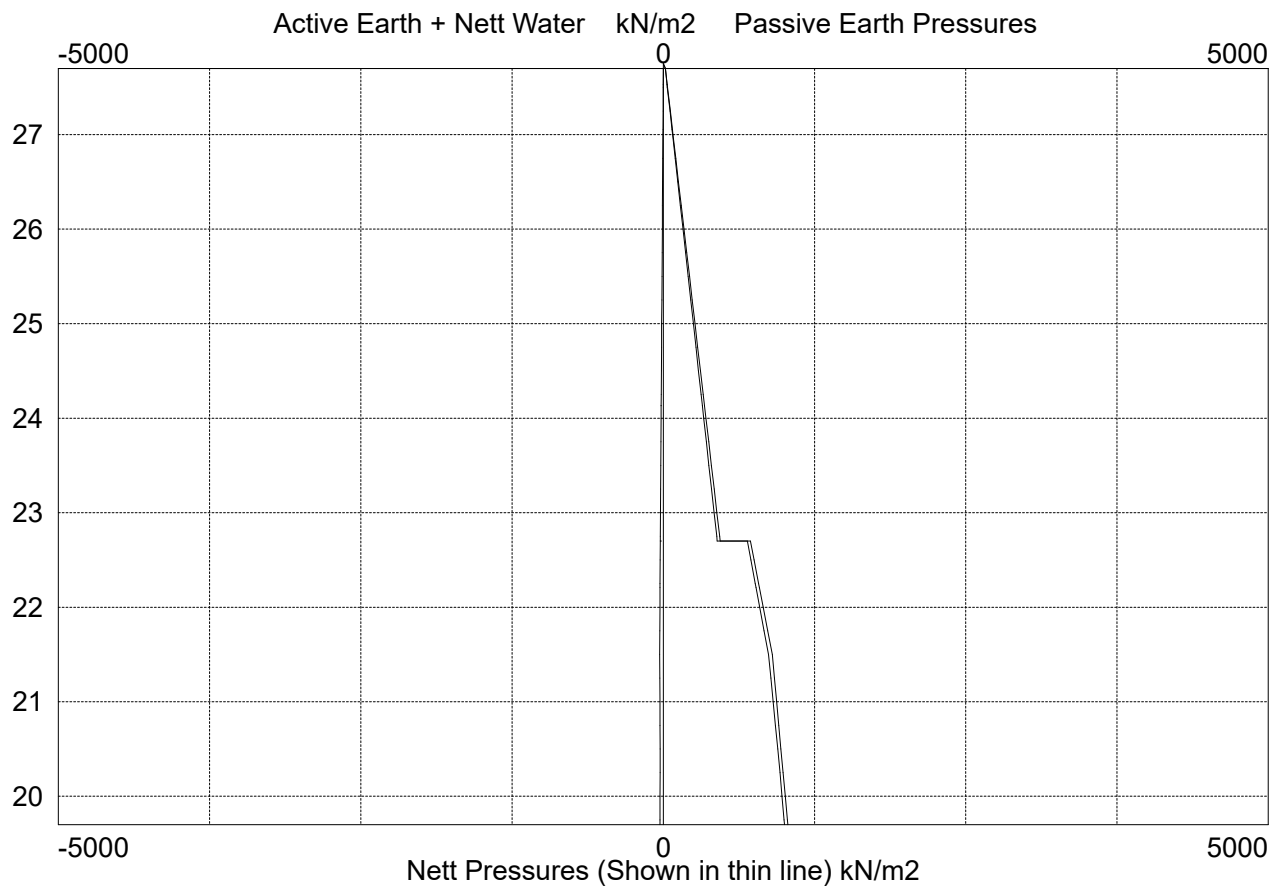
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Tabular results from analysis of stage ref 1

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
27.70	.0	.0	.0	.0	16.5	.0	-16.5	0	0	-3.5		>100.00
t 27.70	.0	.0	.0	.0	16.7	.0	-16.7	0	0	-3.5		>100.00
t 27.53	13.1	.0	1.7	3.1	32.2	.0	-30.5	0	0	-3.4		>100.00
m 27.05	21.7	3.2	.0	11.7	75.3	.0	-72.0	0	0	-3.2		>100.00
m 27.00	22.6	3.5	.0	12.6	80.0	.0	-76.5	0	0	-3.2		>100.00
m 26.00	40.6	8.5	.0	30.6	170.7	.0	-162.2	0	0	-2.8		>100.00
m 25.00	58.6	13.5	.0	48.6	261.5	.0	-248.0	0	0	-2.4		>100.00
m 24.13	74.2	17.8	.0	64.2	340.2	.0	-322.4	0	0	-2.0		>100.00
m 24.13	74.3	17.9	.0	64.3	340.4	.0	-322.5	0	0	-2.0		>100.00
m 24.00	76.6	18.5	.0	66.6	352.2	.0	-333.7	0	0	-2.0		>100.00
m 23.00	94.6	23.5	.0	84.6	442.9	.0	-419.4	0	0	-1.5		>100.00
m 22.70	100.0	25.0	.0	90.0	470.1	.0	-445.1	0	0	-1.4		>100.00
m 22.70	100.0	25.0	.0	90.0	720.0	.0	-695.0	0	0	-1.4		>100.00
m 22.21	109.3	27.5	.0	99.3	794.1	.0	-766.6	0	0	-1.2		>100.00
m 22.00	113.3	28.5	.0	103.3	825.4	.0	-796.9	0	0	-1.1		>100.00
m 21.50	122.8	31.0	.0	112.8	900.6	.0	-869.6	0	0	-.9		>100.00
m 21.00	127.3	33.5	.0	117.3	936.3	5.0	-907.8	0	0	-.6		>100.00
20.00	136.3	26.8	15.0	126.3	1007.6	15.0	-980.8	0	0	-.1		>100.00
19.70	139.0	27.3	18.0	129.0	1029.0	18.0	-1001.7	0	0	0		>100.00

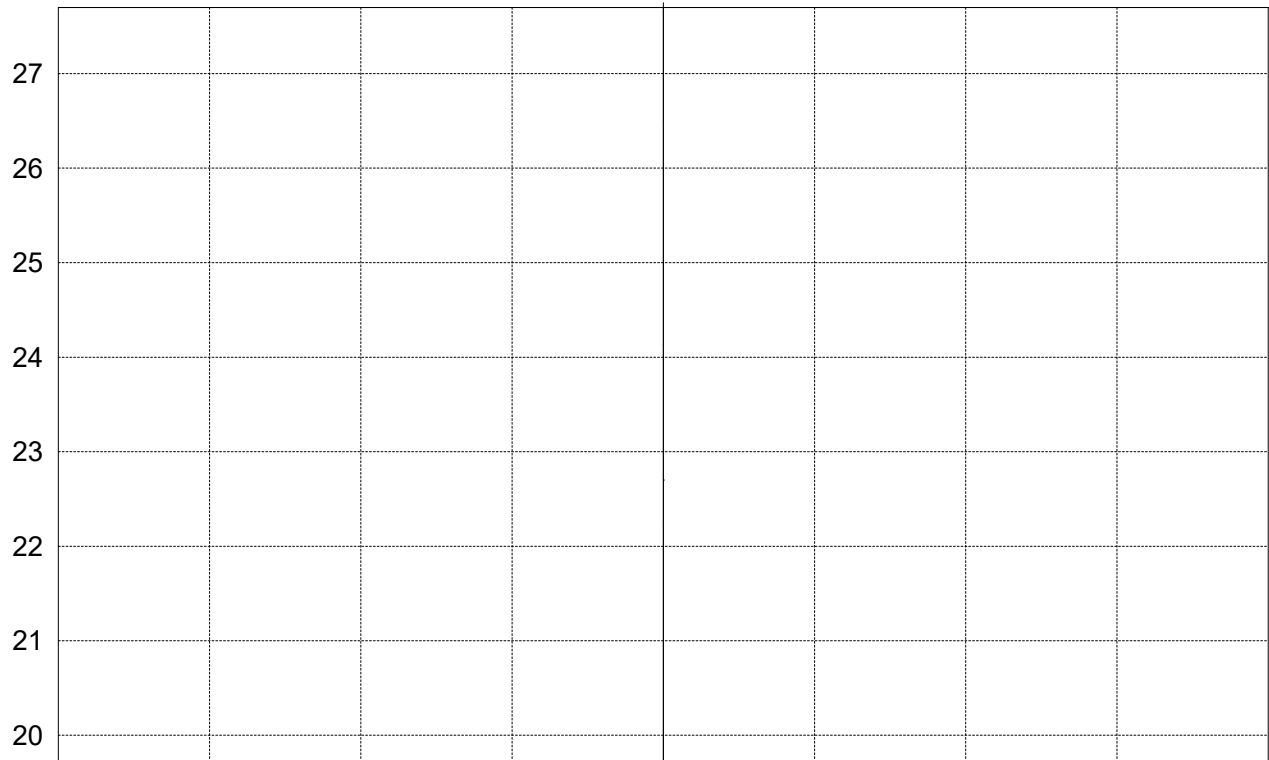
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Graphical results from analysis of stage ref 1

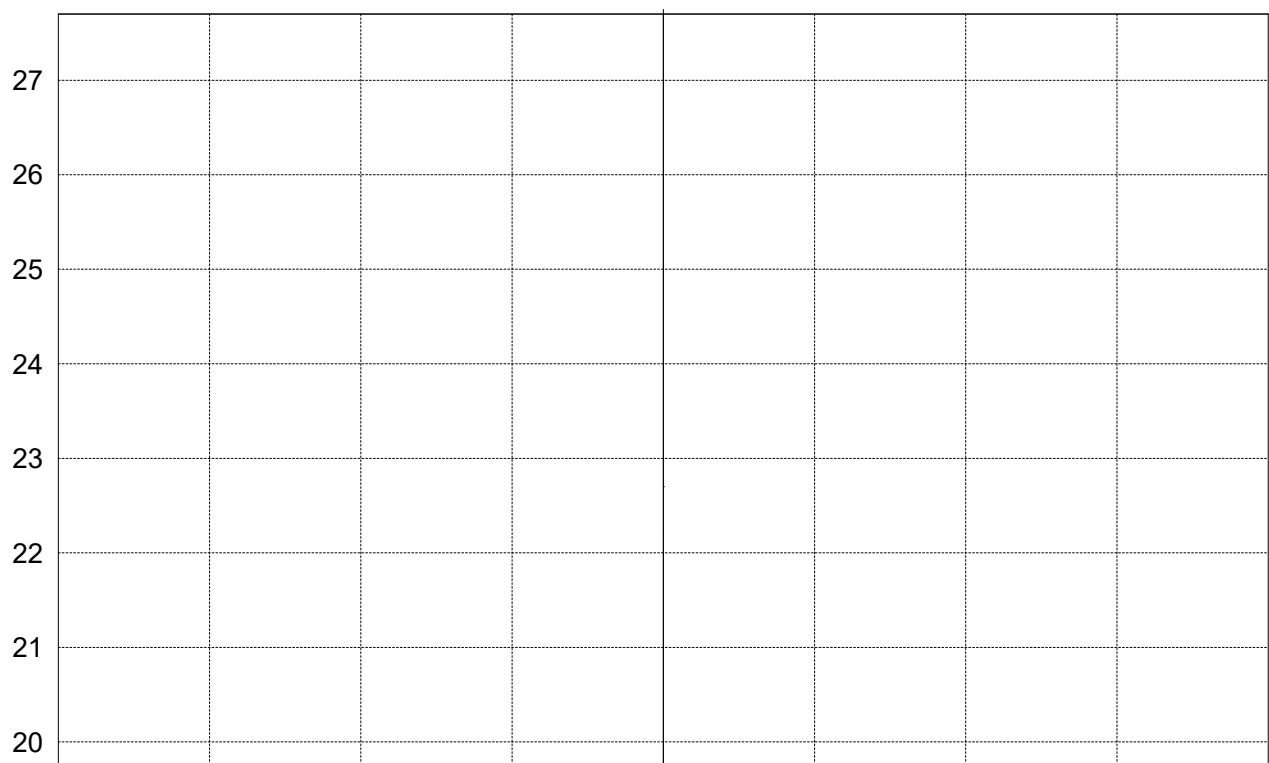


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Graphical results from analysis of stage ref 1 continued



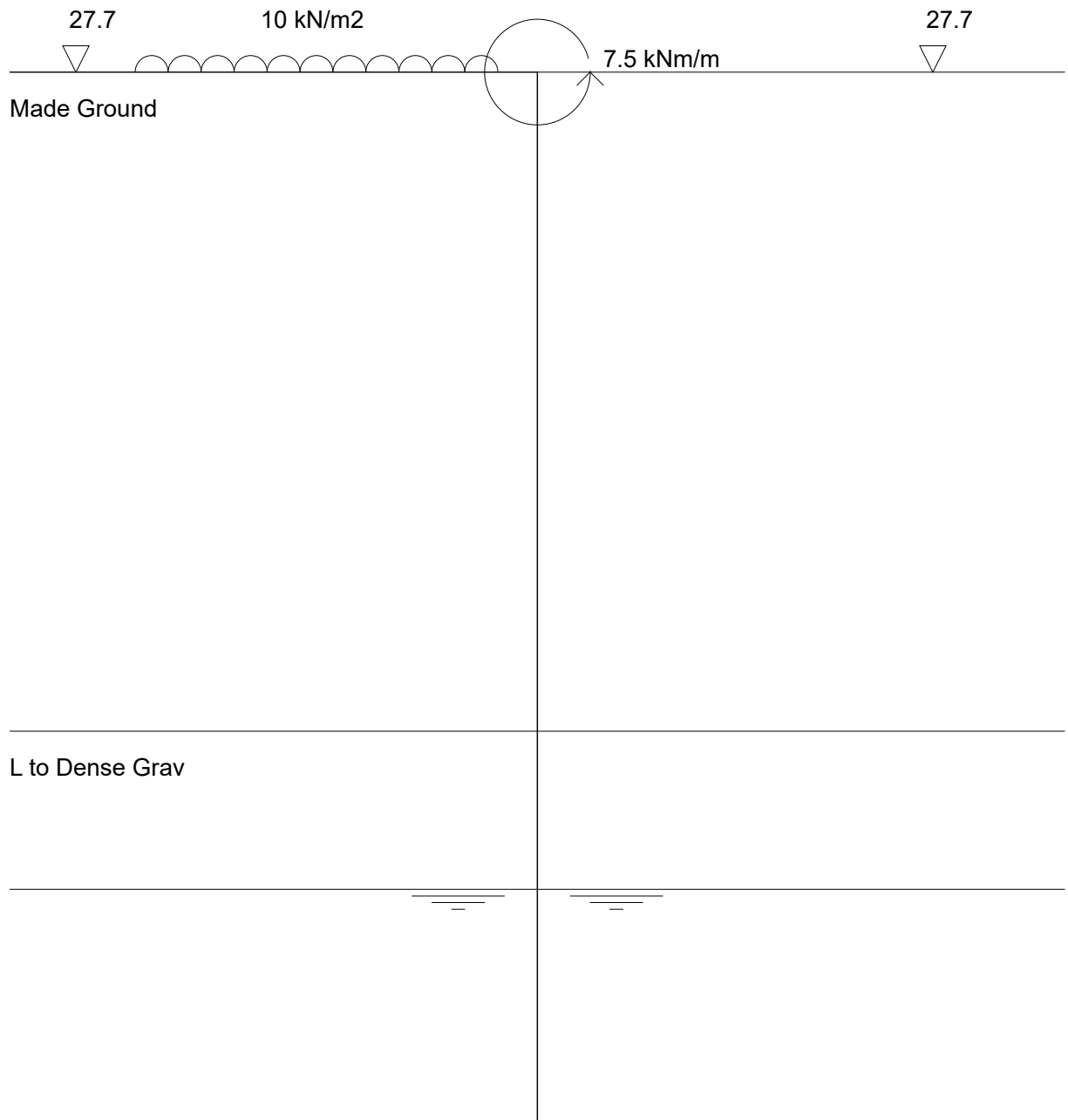
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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Stage ref. 2
Stage type Moment load



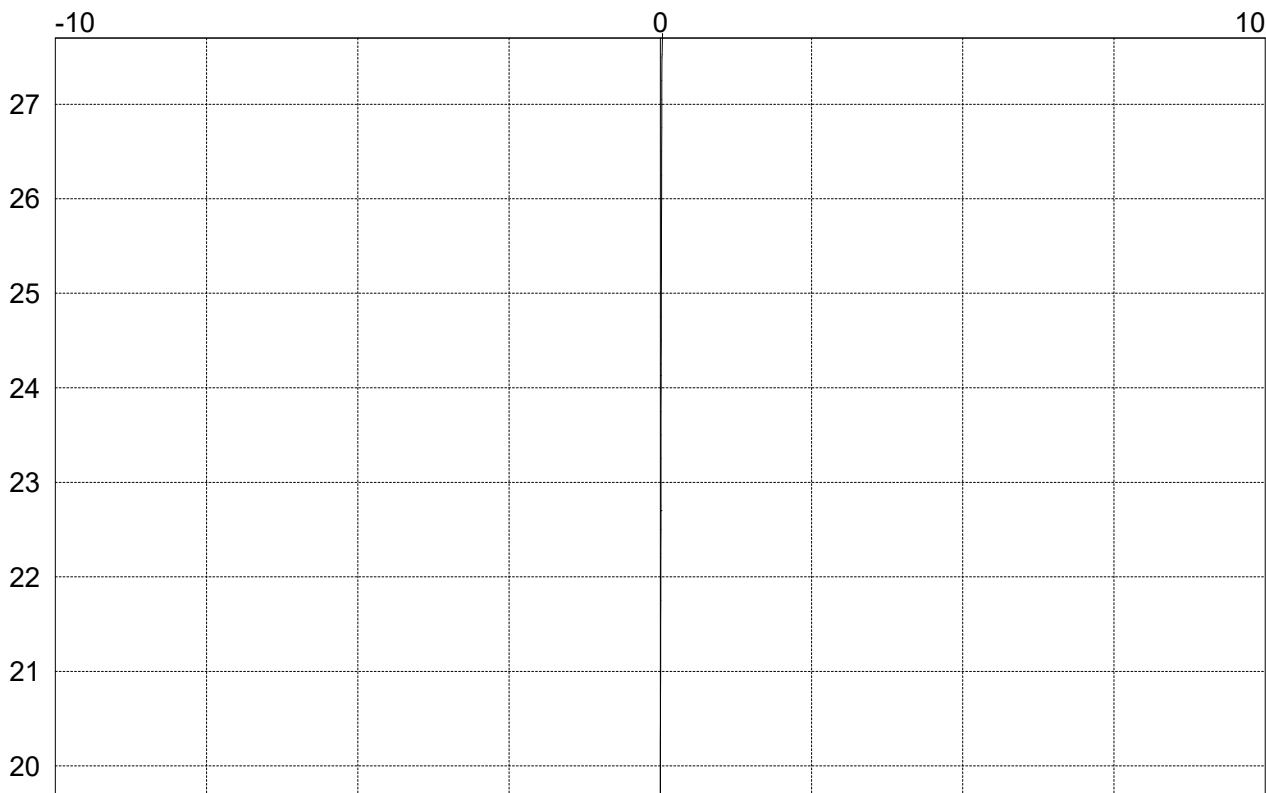
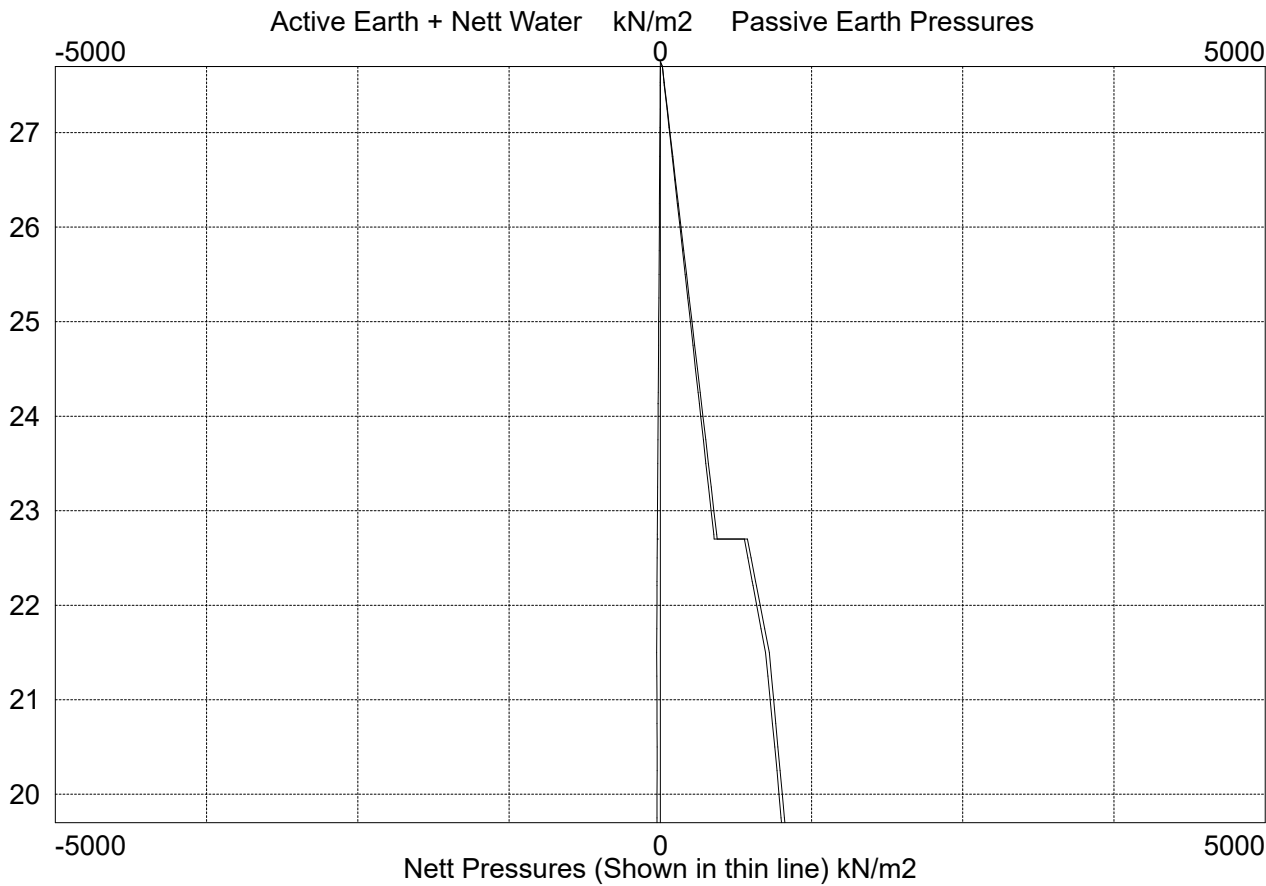
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Tabular results from analysis of stage ref 2

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
27.70	.0	.0	.0	.0	16.5	.0	-16.5	0	.4	0		.00
t 27.70	.0	.0	.0	.0	16.7	.0	-16.7	7.5	.4	0		.00
t 27.53	13.1	.0	1.7	3.1	32.2	.0	-30.5	7.1	4.5	0		.05
m 27.05	21.7	3.2	.0	11.7	75.3	.0	-72.0	0	28.9	0		1.04
m 27.00	22.6	3.5	.0	12.6	80.0	.0	-76.5	-.4	17.3	0		1.21
m 26.00	40.6	8.5	.0	30.6	170.7	.0	-162.2	0	0	0		8.29
m 25.00	58.6	13.5	.0	48.6	261.5	.0	-248.0	0	0	0		14.67
m 24.13	74.2	17.8	.0	64.2	340.2	.0	-322.4	0	0	0		17.21
m 24.13	74.3	17.9	.0	64.3	340.4	.0	-322.5	0	0	0		17.21
m 24.00	76.6	18.5	.0	66.6	352.2	.0	-333.7	0	0	0		17.44
m 23.00	94.6	23.5	.0	84.6	442.9	.0	-419.4	0	0	0		18.46
m 22.70	100.0	25.0	.0	90.0	470.1	.0	-445.1	0	0	0		18.61
m 22.70	100.0	25.0	.0	90.0	720.0	.0	-695.0	0	0	0		18.61
m 22.21	109.3	27.5	.0	99.3	794.1	.0	-766.6	0	0	0		19.00
m 22.00	113.3	28.5	.0	103.3	825.4	.0	-796.9	0	0	0		19.23
m 21.50	122.8	31.0	.0	112.8	900.6	.0	-869.6	0	0	0		19.86
m 21.00	127.3	33.5	.0	117.3	936.3	5.0	-907.8	0	0	0		20.55
20.00	136.3	26.8	15.0	126.3	1007.6	15.0	-980.8	0	0	0		22.02
19.70	139.0	27.3	18.0	129.0	1029.0	18.0	-1001.7	0	0	0		22.47

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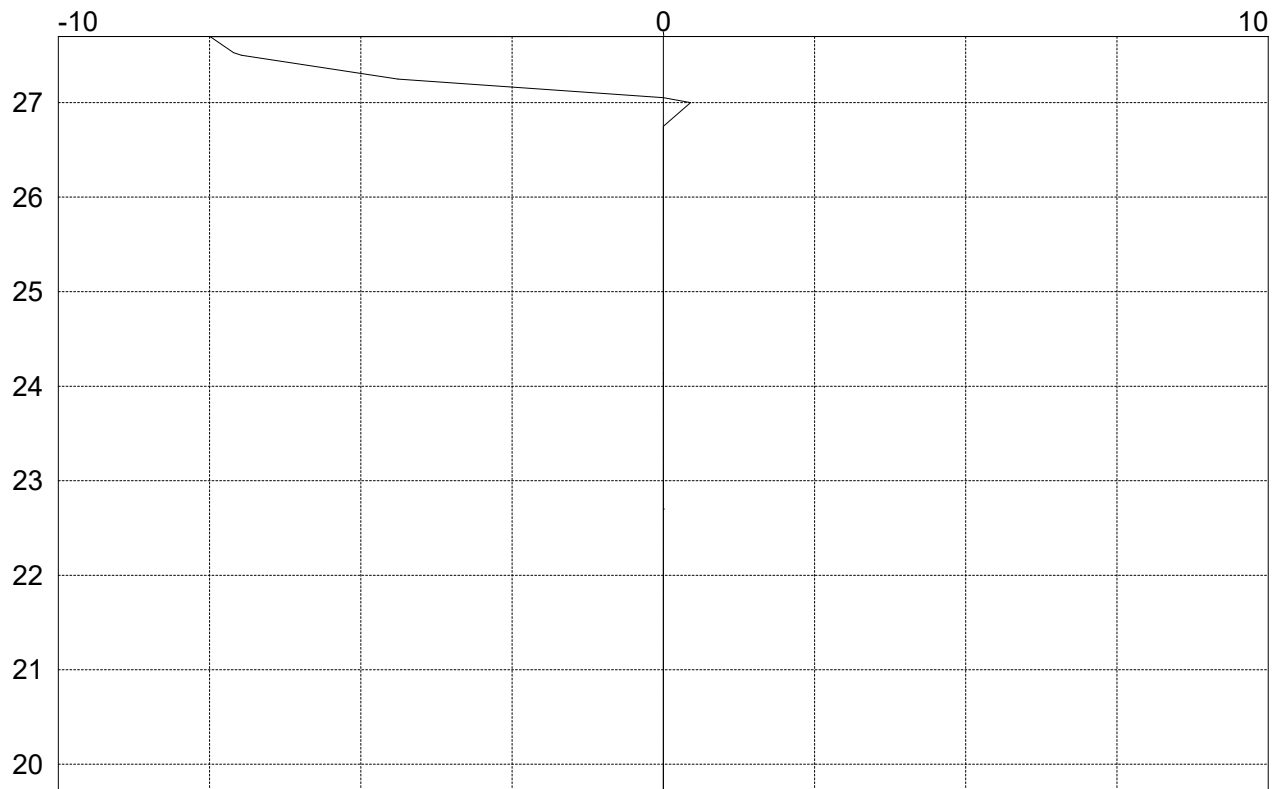
Graphical results from analysis of stage ref 2



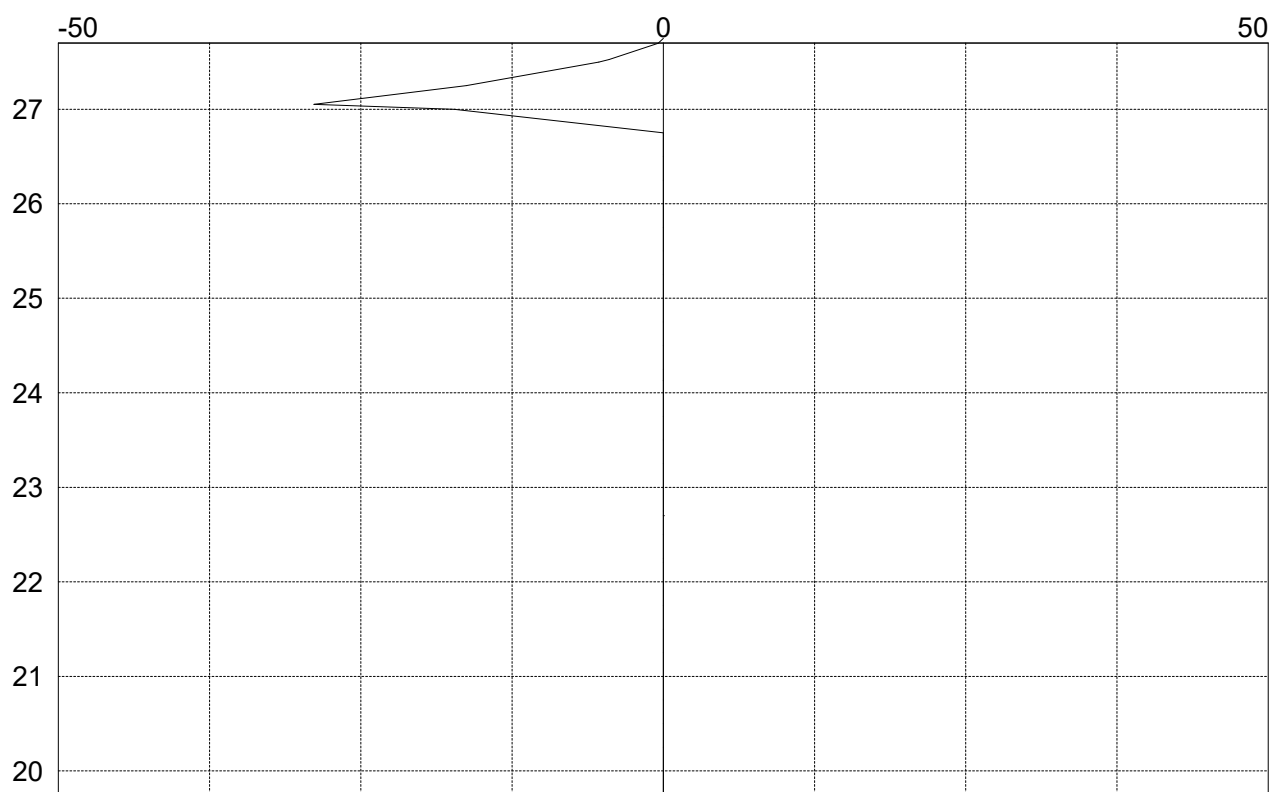
Deflection diagram (mm)

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Graphical results from analysis of stage ref 2 continued



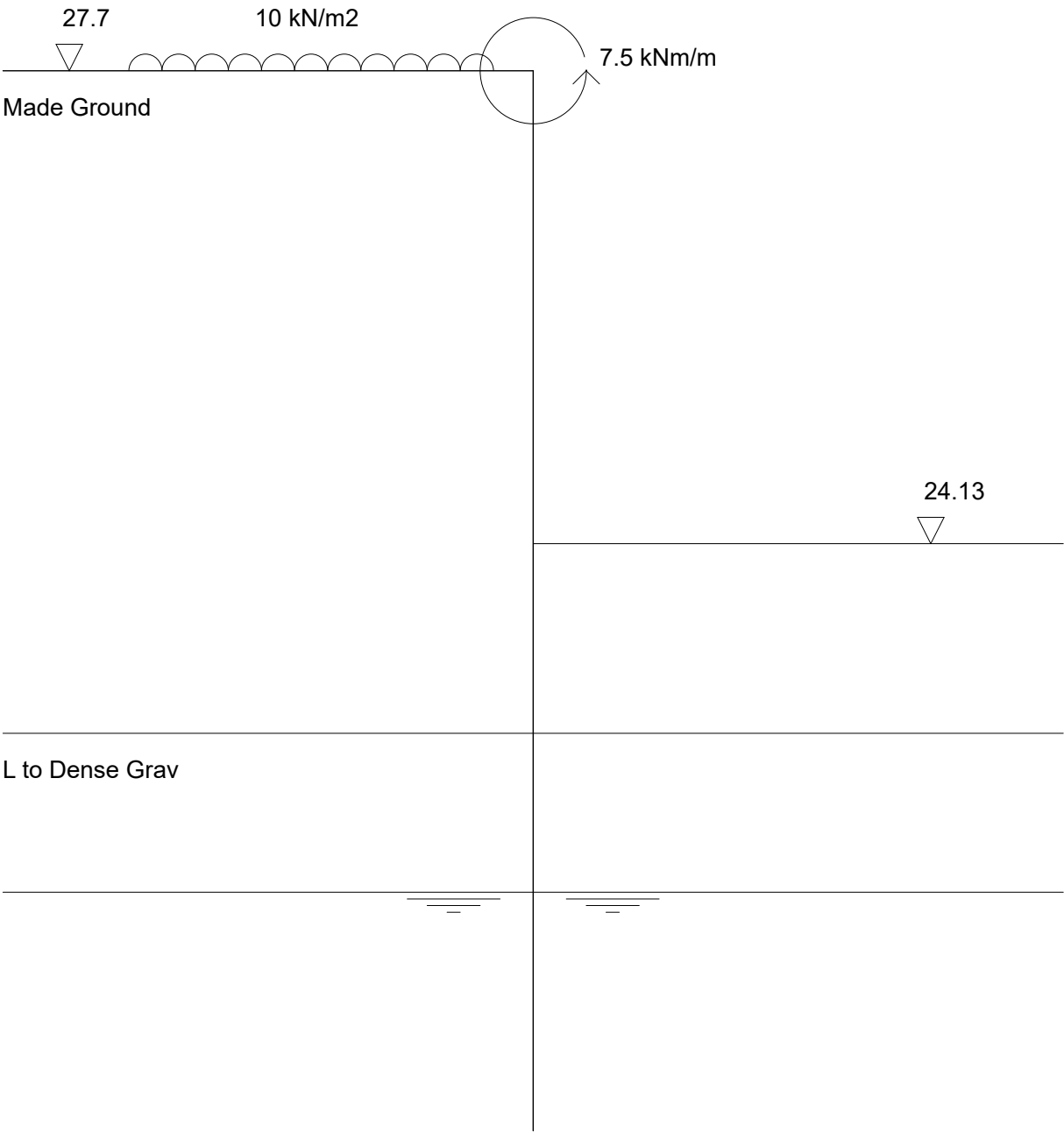
Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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Stage ref. 3
Stage type Passive side excavation



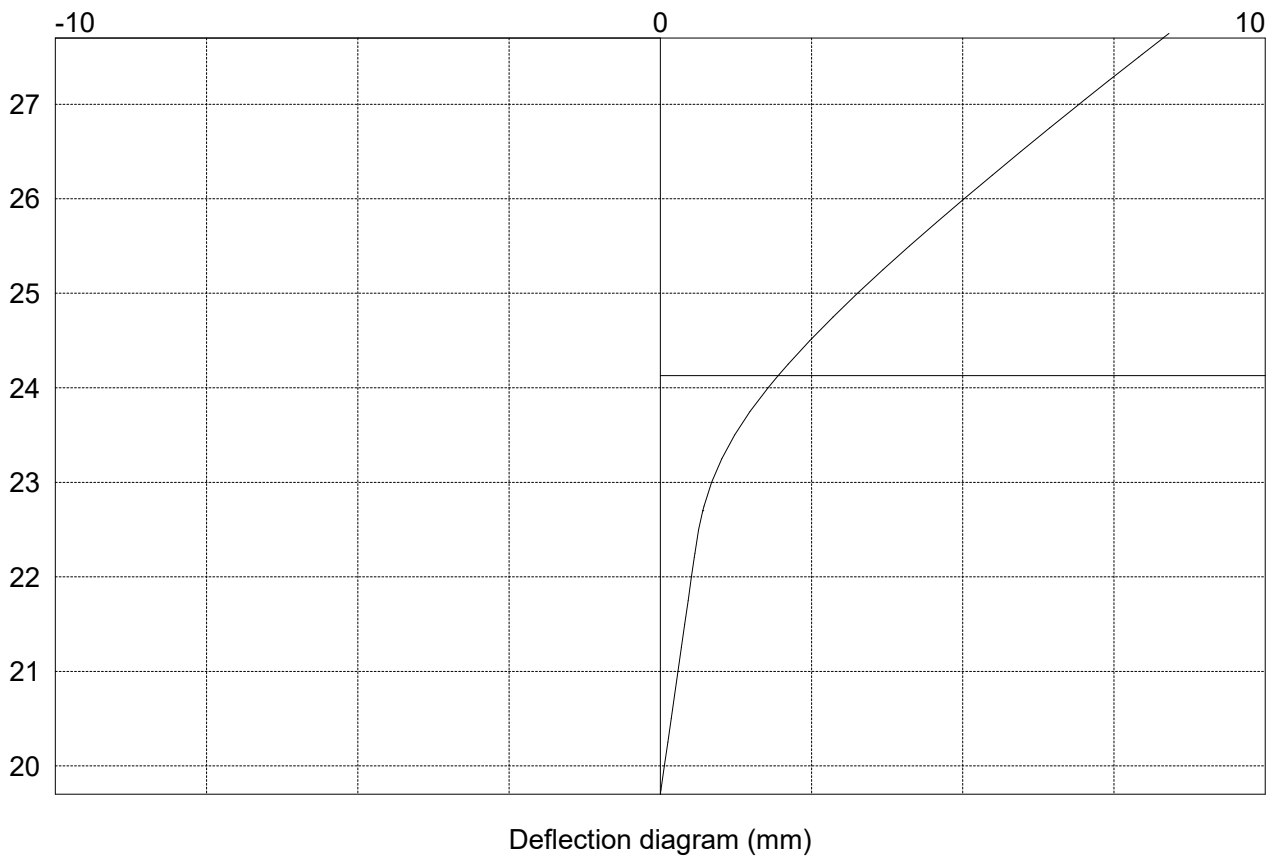
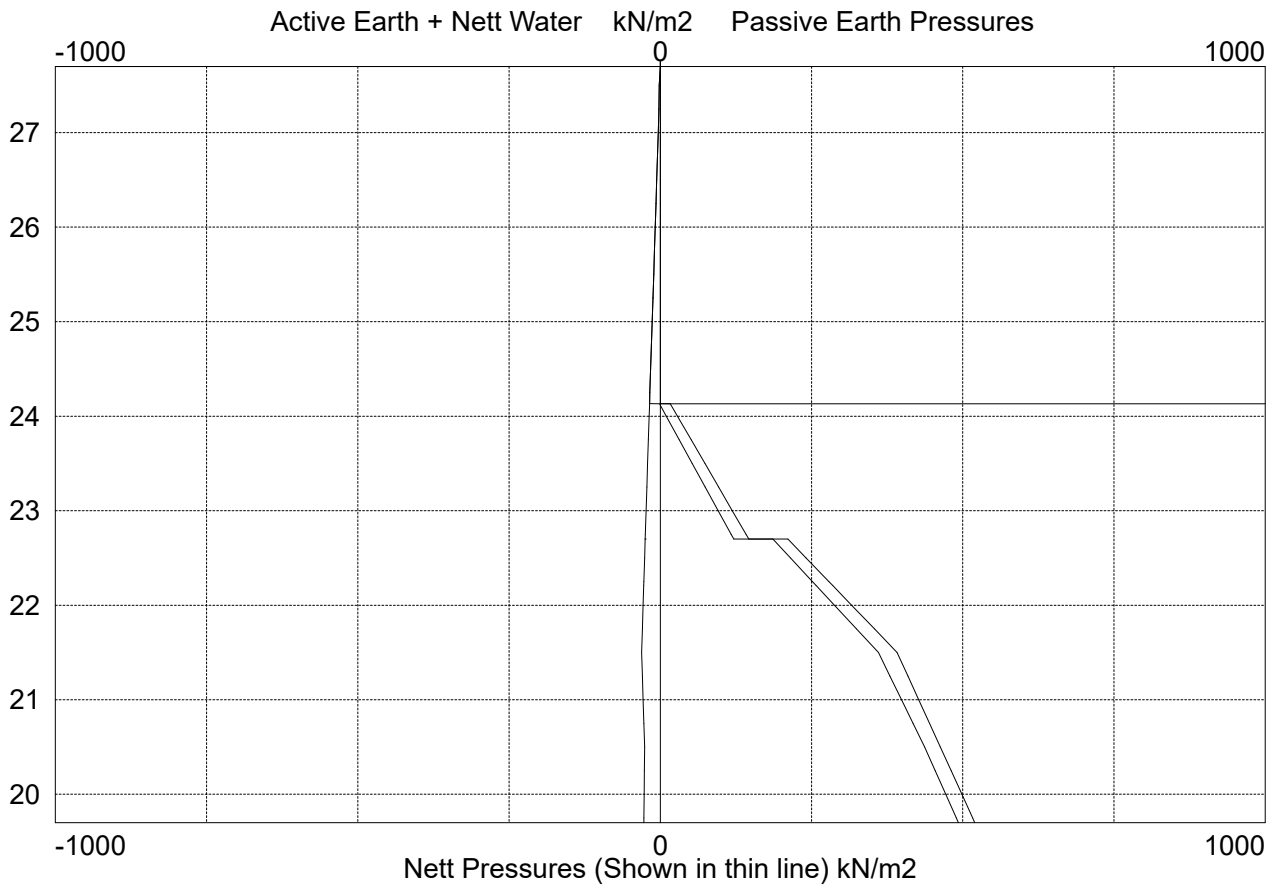
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Tabular results from analysis of stage ref 3

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
27.70	.0	.0	.0	.0	.0	.0	0	0	0	8.3		.00
t 27.70	.0	.0	.0	.0	.0	.0	0	7.5	0	8.3		.00
t 27.53	13.1	.0	1.7	.0	.0	.0	1.7	7.5	-1	8.0		.00
m 27.05	21.7	3.2	.0	.0	.0	.0	3.2	7.8	-1.3	7.0		.00
m 27.00	22.6	3.5	.0	.0	.0	.0	3.5	7.9	-1.4	6.9		.00
m 26.00	40.6	8.5	.0	.0	.0	.0	8.5	11.9	-7.4	5.0		.00
m 25.00	58.6	13.5	.0	.0	.0	.0	13.5	24.5	-18.4	3.3		.00
m 24.13	74.2	17.8	.0	.0	.0	.0	17.8	46.1	-32.1	1.9		.00
m 24.13	74.3	17.9	.0	.0	16.5	.0	1.4	46.2	-32.1	1.9		.00
m 24.00	76.6	18.5	.0	2.3	28.3	.0	-9.8	50.3	-31.5	1.8		.00
m 23.00	94.6	23.5	.0	20.3	119.0	.0	-95.5	62.7	21.1	.8		.34
m 22.70	100.0	25.0	.0	25.7	146.2	.0	-121.2	51.6	53.6	.7		.54
m 22.70	100.0	25.0	.0	25.7	210.8	.0	-185.8	51.6	53.6	.7		.54
m 22.21	109.3	27.5	.0	35.1	284.9	.0	-257.4	0	162.7	.6		1.00
m 22.00	113.3	28.5	.0	39.0	316.2	.0	-287.7	-7.8	74.7	.5		1.24
m 21.50	122.8	31.0	.0	48.5	391.5	.0	-360.5	0	0	.4		1.91
m 21.00	127.3	33.5	.0	53.0	427.1	5.0	-398.6	0	0	.3		2.64
20.00	136.3	26.8	15.0	62.0	498.5	15.0	-471.7	0	0	.1		4.15
19.70	139.0	27.3	18.0	64.7	519.8	18.0	-492.5	0	0	0		4.59

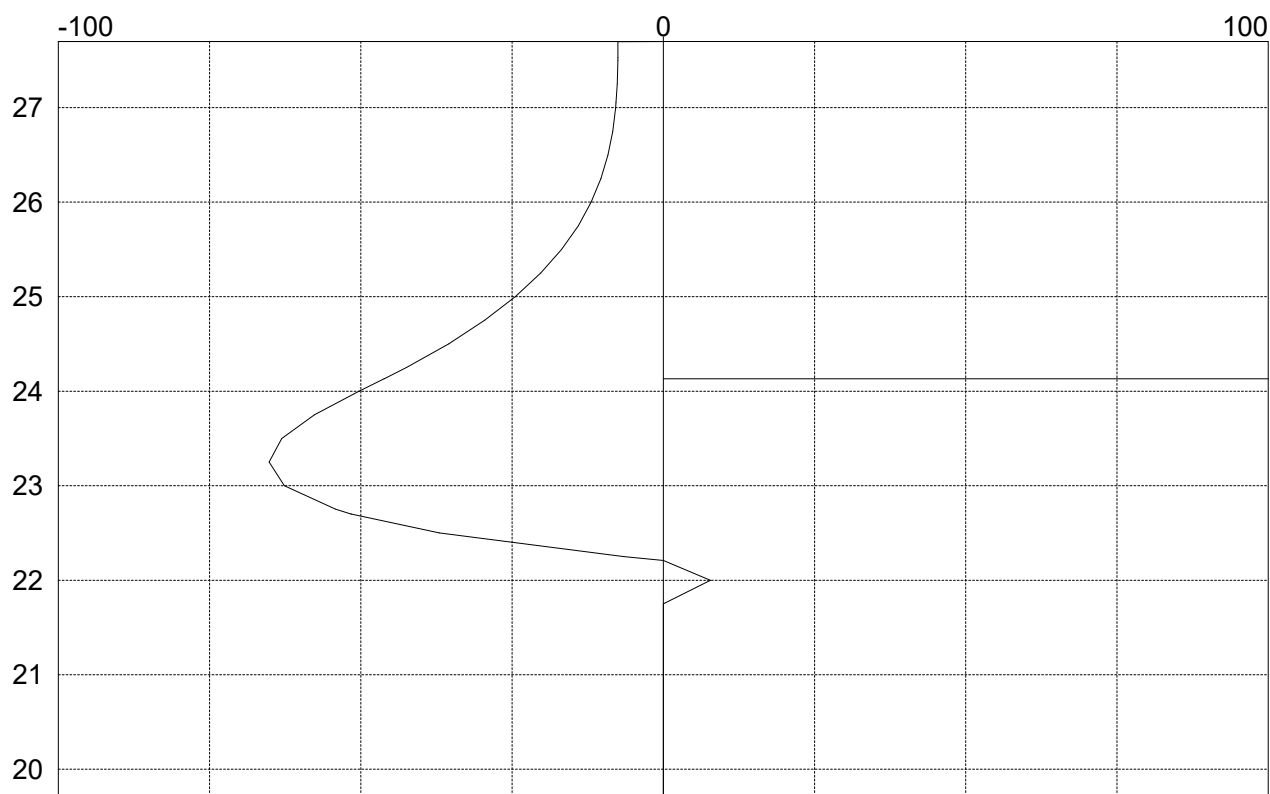
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Graphical results from analysis of stage ref 3

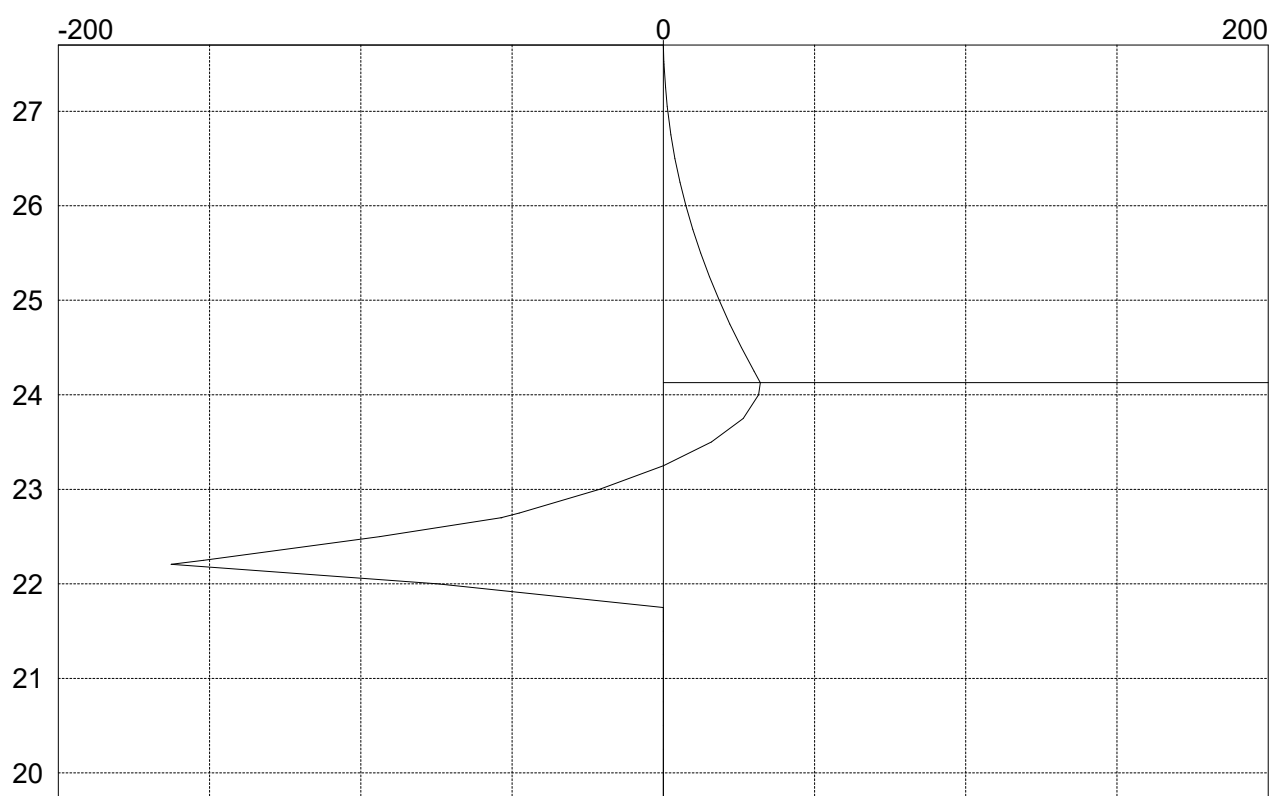


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Graphical results from analysis of stage ref 3 continued

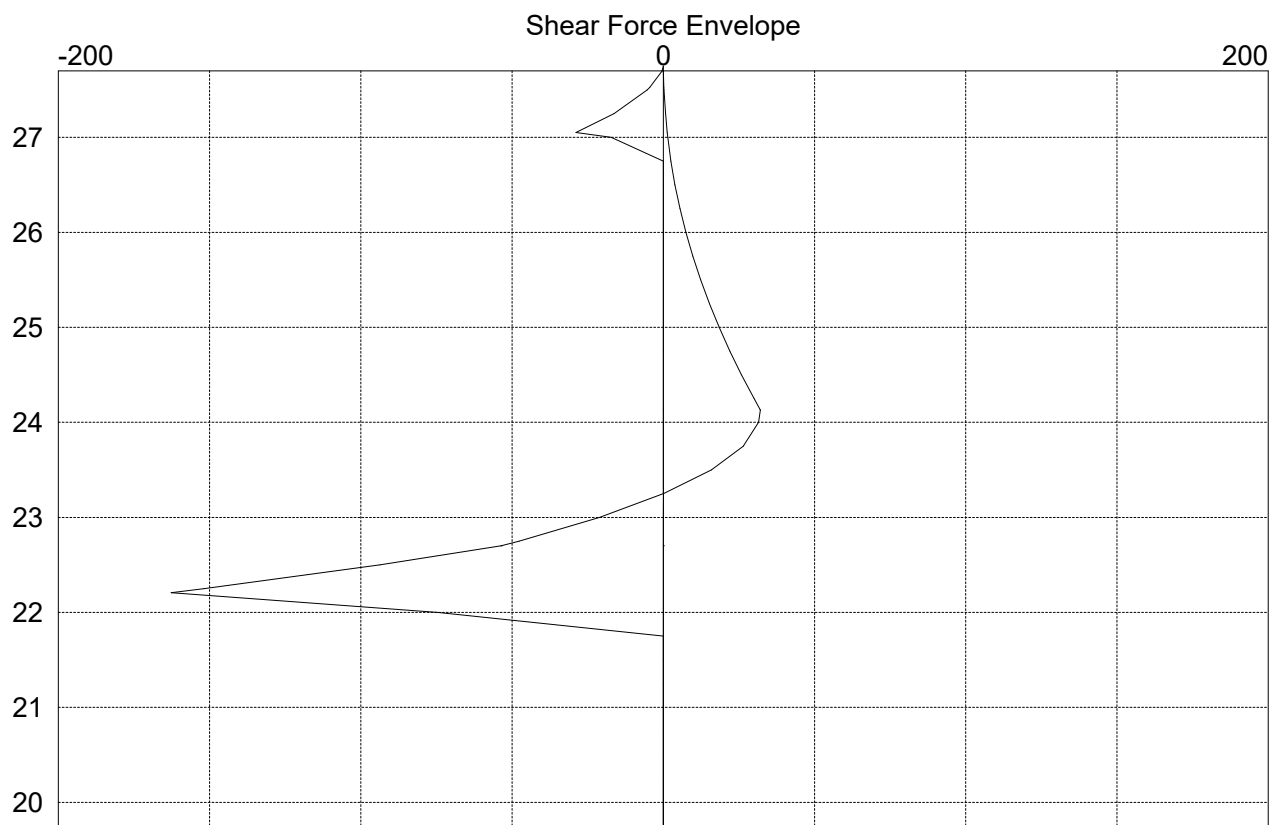
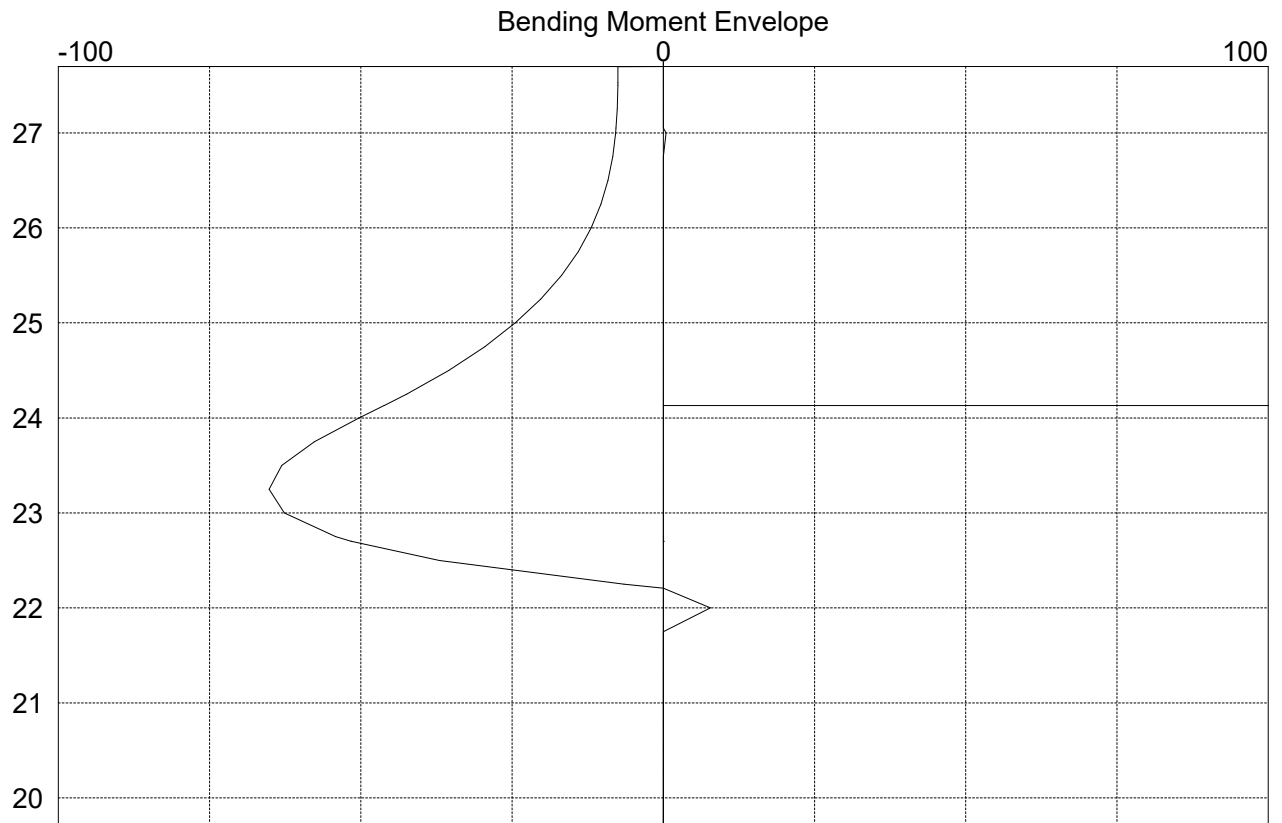


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

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
27.70	.0	.0	.0	.4	
27.70	.0	7.5	.0	.4	
27.53	.0	7.5	-.1	4.5	
27.05	.0	7.8	-1.3	28.9	
27.00	-.4	7.9	-1.4	17.3	
26.00	.0	11.9	-7.4	.0	
25.00	.0	24.5	-18.4	.0	
24.13	.0	46.1	-32.1	.0	
24.13	.0	46.2	-32.1	.0	
24.00	.0	50.3	-31.5	.0	
23.00	.0	62.7	.0	21.1	
22.70	.0	51.6	.0	53.6	
22.70	.0	51.6	.0	53.6	
22.21	.0	.0	.0	162.7	
22.00	-7.8	.0	.0	74.7	
21.50	.0	.0	.0	.0	
21.00	.0	.0	.0	.0	
20.00	.0	.0	.0	.0	
19.70	.0	.0	.0	.0	

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Structural design of wall

Wall section properties

Primary pile diameter	450 mm
Primary pile spacing	600 mm
Infill pile diameter	mm
Main rebar bar diameter	20 mm
Main rebar number of bars	4
Links/Helix bar diameter	8 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	1.35

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	53	86	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1257	mm ²
Min longitudinal steel. BS8110 min 0.4% by area	636	1257	mm ²
Shear resistance. BS8110	132	138	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	8	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	202	150	mm
Min shear link area. BS8110 Clause 3.4.5	612	670	mm ² /m