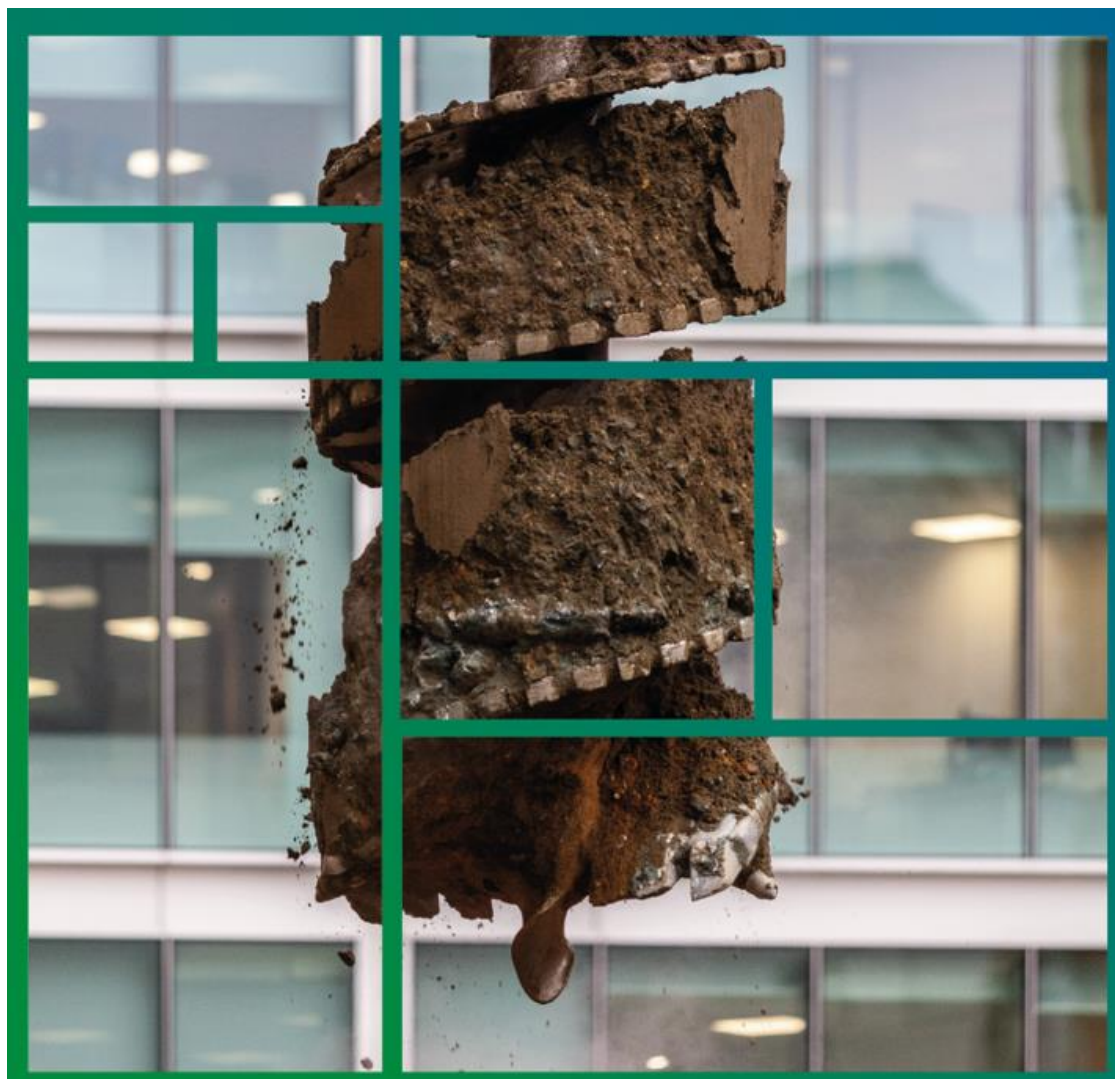


Project Olympus

LCY11 Tower Crane Pile Design Report



Report reference: LCY11-KTB-B1-ZZ-DN-C-00003 C02

PROJECT DETAILS

Client: McLaren

DOCUMENT

Title: Project Olympus

Reference: LCY11-KTB-B1-ZZ-DN-C-00003

DOCUMENT ISSUE

Rev	Dated	Details	Prepared by	Checked by	Approved by
P01	20/12/2024	Preliminary Issue	CM	FM	SS
P02	13/03/2025	Updated pile schedules	CM	MS	KL
C01	04/04/2025	Updated for Construction Issue Information	CM	GW	KL
C02	11/06/2025	Updated for comments	CM	SS	SS

This design is in accordance with the principles set out in current Standards, Codes of Practice and Industry Specifications. Reference to a Standard, Code of Practice or Specification does not imply total compliance within the whole document. Standards, Codes of Practice and Specifications are complied with where, in the experience of Keltbray, they are appropriate. In the event of a conflict between Specifications, Standards and Codes of Practice, Keltbray will generally design in accordance with the ICE Specification for Piling and Embedded Retaining Walls (SPERW) 2016.

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1 Executive Summary

- The calculations presented herein cover the design for the TC1 and TC2 tower crane base piles at Project Olympus.
- The piles are to be constructed using the continuous flight auger (CFA) method of piling. The bases for TC1 and TC2 comprises 24no piles each. 8no within each based are also permanent works piles. The permanent works bearing pile design shall be updated to account for the worst-case loading for these piles.
- Design of the bearing piles is based on a minimum characteristic concrete cylinder strength of 32N/mm^2 (i.e. C32/40).
- Piles shall be installed from a piling platform at a level of 2.9mOD.
- Piles have been designed in accordance with BS EN 1997-1:2004 (Eurocode 7) and the accompanying UK National Annex taking account of permanent, leading variable, accompanying variable and transverse actions.
- 2no. Preliminary tests are planned across the site with 1no within LCY11 and 1no within LCY13. Back analysis of PTP1 is covered in report LCY10-KTB-XX-ZZ-DN-C-00002.
- Working pile tests are to be undertaken in accordance with the ICE Specification for Piling and Embedded Retaining Walls (SPERW), 3rd Edition. As these do not include tension tests, no reduction in the partial factors in tension are taken.
- Reinforcement design carried out in accordance with BS EN 1992-1-1:2004 (Eurocode 2). Central bars shall be used to reinforce the piles to the required tension toe levels.
- All piles have been designed as fully restrained at the head and no additional moments resulting from eccentric loading have been considered in the design of the piles.
- A detailed CDM risk assessment has been undertaken for the proposed works and is contained in Appendix A.
- The design for the tower crane piles is summarised in Table 1 below.

Load Case	Pile diameter (mm)	Number of Piles	Main Reinforcement	Helical	Tensile Reinforcement ¹	Cage length below COL (m) ¹	Minimum Anchorage (mm)
TC1	600	24	7B20	B12@200	D47/D40	8.0	690
TC2	600	24	7B20	B12@200	D47/D40	8.0	690

Table 1 Pile design summary

Notes:

1. D47 central bars shall be used for piles ULS C1 tension loads in excess of 1MN. D40 central bars shall be used for ULS C1 tension loads below 1MN. Central bars shall extend to the tension toe of the pile.
2. Dywidag bars shall have anchor plates to achieve required anchorage. Base designer to confirm the location of the plates.

2 Project summary

2.1 General

The proposed scheme for new data centres comprises 3no data centre buildings up to eight storeys in height, a substation and a secant wall. This report covers the design of the tower crane piles to service LCY11. The designs for the LCY11 bearing piles is covered in report ref. LCY11-KTB-B1-ZZ-DN-C-00002.

The site is located in Silvertown, it is bound to the north and to the south by commercial properties, to the east by the DLR and Silvertown Way, and to the west by the River Thames.

It is proposed that 2no 600mm diameter preliminary test piles are installed to different toe levels to verify the geotechnical designs of the bearing piles. 7no working pile tests are also to be carried out across LCY11. The design and analysis of test piles shall be covered in separate reports. **100% of the piles shall be integrity tested.**

3 Piling Specification – Key Requirements

3.1 Project piling specification

- Specification for the bearing piles can be found in the document titled, Project Olympus – Performance Specification for Piling and Embedded Retaining Walls, report reference LCY10-CDL-XX-XX-SP-GE-50001 revP02.
- B1.2(j) – The design life of all bearing piles should be a minimum of 50 years.
- B1.2(j) - All piles shall have a minimum factor of safety of 1.2 on shaft friction when ignoring pile base resistance.
- B1.2(j) – The design shall consider the effects from negative skin friction arising from upfilling of the site.
- An overall factor of safety of 3.0 is required on the tower crane piles in accordance with Note 4 on LCY11-STP-B1-ZZ-TW-S-18001 and 18002.

3.2 Comments on the project piling specification

- F_{rep} hasn't been provided by the Engineer. Therefore, F_{rep} has been determined by Keltbray.
- Using an overall factor of safety of 3.0 causes CP35, 38, 47 and 50 to exceed the capacity of a 600mm diameter CFA pile. This is as agreed with the tower crane base designer. See the tower crane base drawings LCY11-STP-B1-ZZ-TW-S-18001 and 18002 for details.

3.3 Information to be provided / clarified by the Clients Engineer

- Acceptance of the basis for this design by all parties and any qualifications presented herein.
- Full construction issue information with pile loads and geometry are to be provided ahead of the construction of the piles.

4 Ground Conditions

4.1 Ground Investigation

For a full breakdown of the information used in the assessment of the ground conditions, please refer to the bearing pile design report LCY11-KTB-B1-ZZ-DN-C-00002.

Due to the size of the site, an individual stratigraphic model has been determined for each building. For the design of TC1, the soil levels for LCY11 are to be used and are summarised in Table 2 below.

Stratum	Design Strata Top (mOD)
Made Ground	2.9 (PPL)
Alluvium/Peat	0.0
River Terrace Deposits	-4.0
London Clay	-11.5
Harwich Formation ¹	-17.5
Lambeth Sand/Gravel	-18.5
Lambeth Clay	-24.0
Thanet Sands	-28.0

Table 2 Soil Levels for LCY11

- 1. Harwich Formation and the Lambeth Sands have been grouped in capacity calculations due to identical parameters being used for design.*

4.2 Geotechnical Design Parameters

For a full breakdown of the assessment of the parameters used in the design of the piles, please refer to the bearing pile design report ref. LCY11-KTB-B1-ZZ-DN-C-00002. The soil parameters adopted for the pile design are summarised in Table 3 below with a soil strength plot in Appendix B.

A preliminary test pile has been carried out to further verify the geotechnical ground model. For a full breakdown of the assessment, please refer to LCY10-KTB-XX-ZZ-DN-C-00002.

Stratum	γ (kN/m ³)	$\alpha /$ K_s	ϕ' (°)	C_u (kPa)	$Q_{us, max}$ (kPA)	$Q_{ub, max}$ (kPA)	E_u (MPa)	E' (MPa)
Made Ground	16	N/A	30	N/A	N/A	N/A	N/A	10
Alluvium	16	N/A	N/A	15	N/A	N/A	$800C_u$	$0.8E_u$
River Terrace Deposits	20	0.8	34	N/A	200	10000	N/A	100
London Clay	20	0.5	N/A	$140+13.3z$	140	4000	$800C_u$	$0.8E_u$
Harwich Formation	20	0.9	38	N/A	200	$4000^{(1)}$	N/A	100
Lambeth Sand/Gravel	20	0.9	38	N/A	200	$4000^{(1)}$	N/A	100
Lambeth Clay	20	0.5	N/A	300	140	4000	$800C_u$	$0.8E_u$
Thanet Sands	20	0.9	38	N/A	200	15000	N/A	100

Table 3 Summary of design soil parameters LCY11

1. Base limit through the Harwich and Lambeth Sands/Gravels is set to the same as the clays due to variability of the strata.

4.3 Groundwater

A groundwater level of 1mOD has been considered in the design of the piles.

5 Design Methodology

5.1 Pile Bearing Capacity

5.1.1 Design Philosophy

The geotechnical axial bearing capacity of the bearing piles is calculated in accordance with DA-1, outlined in Eurocode 7 (BS EN 1997-1:2004). As part of DA-1, two combinations are considered. For the design of axially loaded piles the following combinations are considered:

Combination 1: A1 + M1 + R1

Combination 2: A2 + M1 + R4

Where A, M and R are the action, material and resistance partial factors respectively. Analyses are carried out for Combinations 1 and 2 based on the partial factors outlined in Table 4 below. These partial factors are in line with the UK National Annex. Reduced R4 factors are taken in compression as a result of explicit SLS verification. As no tension testing is planned to be carried out, the increased R4 of 2.0 is used in tension.

	DA-1 (UK National Annex)	Combination 1 (STR)	Combination 2 (GEO)
Actions (A)	Permanent Action (γ_F)	1.35	1.0
	Variable Action (γ_F)	1.50	1.30
	Accompanying Variable ($\psi_{0,1}$) – Wind	0.5	0.5
	Accompanying Variable ($\psi_{0,1}$) – Imposed	0.7	0.7
Materials (M)	ϕ' (γ_M)	1.0	1.0
	c' (γ_M)	1.0	1.0
	c_u (γ_M)	1.0	1.0
Resistance (R)	Shaft resistance in compression	1.0	1.4
	Shaft resistance in tension	1.0	2.0
	Base resistance	1.0	1.7
	Model factor	1.2	1.2

Table 4 Partial factors summary

The design is based on Eurocode 7 adopting a design approach based on empirical calculations taking into account partial safety factors on shaft friction, end bearing and an additional model factor.

The fundamental principles of an EC7 design approach is that applied loads (actions) are factored up and design reactions (resistances) are factored down. In summary, design is to ensure that for Combinations 1 & 2 to Design Approach 1:

Design actions < Design resistance

A preliminary test pile has been carried out ahead within the footprint of LCY11, with back analysis provided in LCY10-KTB-XX-ZZ-DN-C-00002. A total of 7no working test piles are proposed to be carried out across LCY11. Design of the working test piles shall be covered in a separate report. Therefore, reduced R4 partial factors and a reduced model factor have been used in design. As no tension testing is proposed, the higher R4 factor has been used in tension.

5.1.2 Axial Loading

Axial loads for the tower crane piles are provided on drawing refs. LCY11-STP-B1-ZZ-TW-S-18001 **revC02** and 18002 **revC01**. The provided loads have been factored in accordance with Eurocode 7 and the partial factors in Table 4 above. A breakdown of the load interpretation has been provided below. For a full design schedule, see Appendix F.

DA1 C1 Maximum

$$(1.35 \times \text{Self Weight}) + (1.35 \times \text{SDL}) + (1.35 \times \text{NSF}) + (1.5 \times \text{Variable Compression})$$

DA1 C2 Maximum:

$$(1.0 \times \text{Self Weight}) + (1.0 \times \text{SDL}) + (1.0 \times \text{NSF}) + (1.3 \times \text{Variable Compression})$$

DA1 C1 Minimum:

$$(1.0 \times \text{Self Weight, min}) + (1.5 \times \text{Variable Tension})$$

DA1 C2 Minimum:

$$(1.0 \times \text{Self Weight, min}) + (1.3 \times \text{Variable Tension})$$

5.1.3 Negative Skin Friction

Due to the significant thickness of soft organic material and the need to raise the site level, an assessment has been carried out to determine the magnitude of negative skin friction (NSF). The neutral point is the point at which the soil and the pile are settling by the same amount. In the calculations for the magnitude of NSF, the neutral point is assumed to be at the base of the alluvial soils.

The calculations for the estimation of the negative skin friction follow the β -method for shaft capacity (Meyerhof, 1976). Where $q_s = \beta \sigma'_v$ Where $\beta = 0.3$ and σ'_v is the average vertical effective stress over the length of shaft above the neutral point.

Values of NSF are provided in the design schedule (Appendix F). The negative skin friction is then checked in combination with the permanent compression loads and factored in accordance with Eurocode 7. The impact of NSF is ignored in tension as it would provide a favourable action on the piles.

5.1.4 Calculation of Ultimate Bearing Capacity

Given the spacing of the piles, the bearing capacity has been calculated as single piles. No bearing capacity is taken through the Made Ground or the Alluvium.

Shaft Resistance - Cohesive

$$\text{Characteristic Shaft Resistance of Stratum} \quad q_{s;i;k} = \alpha \times C_{u \text{ av.}}$$

$$\text{Characteristic Shaft Resistance of Pile} \quad R_{s;k} = A_{s;i} q_{s;i;k}$$

Where:

$$A_s = \text{Shaft perimeter x length of shaft in strata}$$

$$C_{u \text{ av.}} = \text{Av. Undrained shear strength over length of shaft}$$

$$\alpha = 0.50 \text{ (London clay)}$$

Note that ultimate shaft friction has been limited to a maximum value of 140kPa in the London Clay with the average value over the pile shaft length not exceeding 110kPa.

Base Resistance - Cohesive

$$\text{Characteristic Base Resistance of Stratum} \quad q_{b;k} = C_{u \text{ base}} \times N_c$$

$$\text{Characteristic Base Resistance of Pile} \quad R_{b;k} = A_b q_{b;k}$$

Where:

$$A_b = \text{Base area}$$

$$N_c = 9.0 \text{ (Individual pile)}$$

$$C_{u \text{ base}} = \text{Undrained shear strength at the base}$$

Shaft Resistance – Cohesionless

$$\text{Characteristic Shaft Resistance of Stratum} \quad q_{s;i;k} = K_s \tan \delta \times \bar{\sigma}'_v$$

$$\text{Where shaft friction factor} \quad K_s = \text{values as per Table 4}$$

$$\text{Characteristic Shaft Resistance of Pile} \quad R_{s;k} = A_{s;i} q_{s;i;k}$$

Where:

$$A_s = \pi \times \text{dia} \times \text{length of shaft}$$

$$\bar{\sigma}'_v = \text{Average effective vertical stress}$$

Base Resistance – Cohesionless

Characteristic Base Resistance of Stratum $q_{b;i;k} = \bar{\sigma}'_v \times N_q$

Characteristic Base Resistance of Pile $R_{b;k} = A_{b;i} q_{b;i;k}$

Where;

$A_b = \pi \times \text{dia}^2 \times 0.25$

$\sigma'_v =$ Effective vertical stress at base

$N_q =$ Bearing capacity factor (after Berezantsev)

6 Design Summary

6.1 Geotechnical Design

6.1.1 Single Pile Analysis

WALLAP has been used to assess the bending moments and shear forces generated by the lateral loads applied. The results of the analyses are contained in Appendix D and summarised in Table 5. Cohesive soils have been modelled as undrained in WALLAP. As single-pile analysis prevents the use of undrained soils, the undrained parameters have been used in the drained state in accordance with the WALLAP user manual.

Load Case	Pile Diameter (mm)	Pile COL (mOD)	Applied Lateral Load (kN)	ULS Bending moment (kNm)	ULS Shear force (kN)
TC1	600	1.44	88.0	102	128
TC2	600	0.99	88.3	104	128

Table 5 Summary of single pile analysis

6.2 Structural Design

6.2.1 General

Reinforcement design has been carried out on the basis of the reinforced concrete design code BS EN 1992-1-1:2004 (Eurocode 2).

- All reinforcement calculations have been undertaken in accordance with BS EN 1992-1-1:2004.
- Where necessary reinforcement cages may be stiffened and lengthened in order to facilitate installation.

6.2.2 Structural Design Parameters

Pile diameter	=	600mm (CFA)
Min Concrete strength, f_{cu}	=	40 N/mm ² (i.e. C32/40)
Steel f_y	=	500 N/mm ² [high yield] (BS EN 1992-1-1:2004)
Minimum Concrete Cover	=	75mm

6.2.3 Main Reinforcement

The pile reinforcement has been designed to accommodate the peak bending moments (summarised in Table 5) applied in conjunction with the applied axial load. The moment capacity for each reinforcement cage has been calculated using WALLAP. The calculations are contained in Appendix E.

6.2.4 Tensile Reinforcement

Pile subjected to net tension shall have reinforcement designed to the required tension toe level. See Appendix F for further details.

6.2.5 Shear Reinforcement

Shear calculations are based on the method described in Orr et al. Shear truss analogy for concrete members of solid and hollow circular cross section. Shear calculations contained in Appendix E have been carried out based on the ULS shear forces in Table 5.

6.2.6 Anchorage Requirements

The minimum required anchorage has been calculated in accordance with BS EN 1992-1. Reinforcement shall be provided to piling platform level. Debonding foam shall be provided down to pile cut off level.

Anchor plates are to be provided for the Dywidag bars. Plate details are presented in Figure 1.

Nominal Diameter	Steel Grade	Recessed Plate	Domed Nut		Flat Plate	Lock Nut		Hexagonal Nut		Coupler	
		Stock Size*	AF	Length	Stock Size*	AF	Length	AF	Length	Dia.	Length
mm	N/mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
15	900/1100	n/a	n/a	n/a	120 x 120 x 12	30	30	30	50	30	105
20	900/1100	n/a	n/a	n/a	120 x 120 x 20	36	30	36	70	40	130
26.5	950/1050	130 x 130 x 35	46	55	130 x 130 x 35	46	25	46	80	50	170
32	950/1050	160 x 160 x 40	55	70	160 x 160 x 40	55	35	55	90	60	200
36	950/1050	180 x 180 x 45	60	90	180 x 180 x 45	60	35	60	110	68	210
40	950/1050	220 x 220 x 50	70	115	220 x 220 x 50	50	25	70	120	70	245
47	950/1050	260 x 260 x 50	80	135	260 x 260 x 50	60	30	80	140	83	270
57	835/1035	n/a	n/a	n/a	285 x 285 x 65	90	35	90	120	95	240
65	835/1035	n/a	n/a	n/a	325 x 325 x 70	90	40	100	130	105	260
75	835/1035	n/a	n/a	n/a	370 x 370 x 80	105	50	105	145	114	290

Figure 1 Dywidag Anchor Plate Details

6.2.7 Structural Design Summary

A summary of the required reinforcement cages is provided in Table 6 below.

Load Case	Pile diameter (mm)	Number of Piles	Main Reinforcement	Helical	Tensile Reinforcement ¹	Cage length below COL (m) ¹	Minimum Anchorage (mm) ²
TC1	600	24	7B20	B12@200	D47/D40	8.0	690
TC2	600	24	7B20	B12@200	D47/D40	8.0	690

Table 6 Structural design summary

Notes:

1. D47 central bars shall be used for piles ULS C1 tension loads in excess of 1MN. D40 central bars shall be used for ULS C1 tension loads below 1MN. Central bars shall extend to the tension toe of the pile.
2. Anchorage specified for main cage only. Dywidag central bars require a plate to achieve the required anchorage. Base designer to confirm the location of the plates.

6.3 Serviceability Assessment

Calculations have been carried out to model the expected individual settlement of the most heavily loaded piles. Pile settlement analyses have been carried out using the method derived by Fleming, W.G.K (1992). As a Safe Working Load (SWL) has not been specified by the Engineer, this has been calculated by Keltbray.

Pile Ref	Pile Diameter (mm)	COL (mOD)	Pile Toe Level (mOD)	SWL (kN)	Predicted Settlement at SWL (mm)	Differential Settlement (mm)
CP10	600	1.44	-29.6	1539	3.3	4.8
CP08	600	1.44	-29.6	3389	8.1	
CP40	600	0.99	-29.6	1553	3.2	5.1 ¹
CP35	600	0.99	-29.6	3403	8.3	

Table 7 Predicted Settlements

Notes:

1. CP40 and CP35 are spaced at 2.7m, therefore the differential settlement is within the 5.4mm limit (1 in 500).

7 References

7.1 Document References

1. LCY10-CDL-XX-XX-RP-GE-10002 – Geotechnical and Geoenvironmental Summary Report revP01 (Cundall, 2024)
2. LCY-CDL-XX-XX-RP-GE-20004 – Phase II Geotechnical and Geoenvironmental Assessment revP01 (Cundall, 2024)
3. 13464-HYD-XX-DS-GE-1000 – Report on Desk Study and Ground Investigation (Hydrock, 2020)
4. DUN-H30219 – Factual Report on Site Investigation for Land at Project Olympus (Dunelm, 2024)
5. LCY10-CDL-XX-XX-SP-GE-50001 revP02 – Specification for Piling and Embedded Retaining Walls (Cundall, 2024)
6. BRE Special Digest 1: 2005 3rd Edition
7. BS 8002:2015. Code of practice for retaining structures, BSI Standards Publication
8. BS EN 1536: 2010. Execution of special geotechnical work – Bored Piles
9. BS EN 1992-1-1:2004. Eurocode 2: Design of concrete structures
10. BS EN 1997-1:2004. Eurocode 7 Geotechnical Design
11. BS EN ISO 14688-1: 2002 + A1:2013. Geotechnical investigation and testing – Identification and classification of soil. Part 1: Identification and description
12. BS EN ISO 14688-2: 2004 + A1:2013. Geotechnical investigation and testing – Identification and classification of soil. Part 2: Principles for a classification
13. BS4449: 2005. Steel for reinforced concrete
14. CIRIA C761 (2018). Tower crane foundation and tie design
15. ICE Specification for Piling and Embedded Retaining Wall (SPERW) 3rd edition 2016
16. NA to BS EN 1991:2004. UK National annex to Eurocode 7: Geotechnical Design
17. NA to BS EN 1992-1-1:2004. UK National annex to Eurocode 2 Design of concrete structures. 1.1 General rules and rules for building
18. The Concrete Centre, How to Design Concrete Structures using Eurocode 2 (Bond, A.J., Brooker, O., Harris, A.J., Harrison, T., Moss, R.M., Narayanan, R.S., and Webster, R., 2006)
19. Orr et al (2010) Shear design EC2 truss model
20. BS 8004:2015. Code of practice for foundations, BSI Standards Publication

7.2 Drawing References

Drawing Title	Drawing No	Revision
Building 1 Tower Crane TC-1 Foundation Sheet 1	LCY11-STP-B1-ZZ-TW-S-18001	C02
Building 1 Tower Crane TC-2 Foundation Sheet 1	LCY11-STP-B1-ZZ-TW-S-18002	C01

Table 8 List of drawings used in design

Appendix A Design Risk Assessment

Project:		Project Olympus	
Contract no:		BE0046	
Prepared by:		CM	
Checked by:		SS	
Date:		16/12/2024	
Revision:		C01	

Severity category		
Score	Health & Safety	Technical
1	Inconvenience / Minor delay to work	Design approval required
2	Minor injury	Onerous performance specification
3	Reportable / Lost time injury	Complex design solution / Variable soil
4	Major injury or illness. Long term effects	Limited SI data / Highly variable soil
5	Fatalities	Catastrophic element failure / Novel design

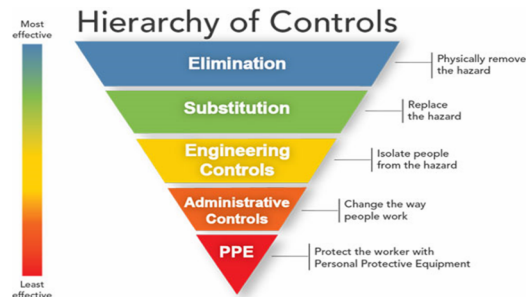
Likelihood category		
Score	Description	Likelihood
1	Improbable	About 1:1000
2	Remote	About 1:100
3	Occasional	About 1:10
4	Probable	Likely
5	Frequent	Expected

Risk matrix	
Severity score	Likelihood score
	1 2 3 4 5
1	Low Low Low Med Med
2	Low Low Med Med High
3	Low Med Med High High
4	Med Med High High High
5	Med High High High High

Residual Risk level action	
Risk level	Action required
Low	Check that no further risks can be eliminated by design modifications. Proceed with design.
Med	Consider alternative design or construction method. If alternatives are not available, specify precautions to be adopted. List residual hazards in risk register.
High	Seek alternative solutions. If alternatives are not available, specify precautions to be adopted. Inform Ops Manager and list residual hazards in risk register.

Ref	Hazard	Cause	Type	Activity	Pre Control Measure			Control Measure	Responsibility	Post Control Measure			Residual risk
					Severity	Likelihood	Risk			Severity	Likelihood	Risk	
Construction Risks													
1	Obstructions	Unidentified obstructions disrupting piling operation	Technical	Piling	3	3	Med	Rig operator/banksman to closely monitor drilling. Any obstructions to stop drilling and notify site management.	Main Contractor	3	1	Low	
2	Striking UXO	Unidentified UXO	Health & Safety	Piling	5	2	High	UXO risk assessment to be undertaken for the site. All site staff to obey the UXO risk management strategy. All pile locations to be UXO probed ahead of installation.	Main Contractor	5	1	Med	
3	Personal injury or death	Slaking live services	Health & Safety	Piling	5	3	High	Review of existing service plans. Additional surveys to be carried out to locate any services. Any known services are to be clearly demarcated on piling platform level and exclusion zones set up.	Main Contractor / Keltbray	5	1	Med	
4	Personal injury or death	Reinforcement falling during lifting activities due to failure at lifting points	Health & Safety	Piling	5	3	High	Checks to be carried out on the lifting points to ensure sufficient capacity. Lift plans to be covered in the RAMS.	Keltbray	5	1	Med	
5	Personal injury	Pile reinforcement protruding above piling platform level	Health & Safety	Piling	3	3	Med	Mushroom caps to be placed on all rebar. Pile reinforcement to be left below piling platform level. Pile covers to be placed over pile locations.	Keltbray	3	1	Low	
6	Piles installed out of position	Revised pile load schedules provided and not updated on site.	Technical	Piling	3	2	Med	Check construction schedule against latest version of the Engineer's load schedule each day. Check pile setting out before commencing pile installation.	Keltbray	3	1	Low	
7	Tensile failure of pile	Insufficient tensile reinforcement for the long term conditions	Technical	Piling	3	2	Med	Piles designed for the tension conditions in accordance with Eurocode 7. Piles designed for the worst-case tensile requirements of ULS DA1 Combination 1, Combination 2.	Keltbray	3	1	Low	
8	Personal injury	Manual handling during site fixing of cages	Health & Safety	Piling	4	2	Med	Site fixed cage methodologies to be considered and covered in RAMS. Cage size and weight limits to be set to prevent injury during site fixing.	Keltbray	4	1	Med	
9	Geotechnical failure of the pile	Unexpected ground conditions	Technical	Piling	3	2	Med	Site team to be aware of the expected ground conditions used in the design. On-going review of the ground conditions seen during drilling. Designers to be notified if ground conditions differ from anticipated.	Keltbray	3	1	Low	
10	Geotechnical failure of the pile	Pile refusal on concrete band	Technical	Piling	3	2	Med	Trial bores to be carried out ahead of installation. PTPs to be carried out to verify the ground conditions above and below the concrete band.	Keltbray	3	1	Low	
CFA Risks													
11	Excessive pile settlements	Overlighting of pile bore	Technical	Piling	3	2	Med	Control of the auger revolutions per metre. Target of 10 revolutions per metre. Use of "Auto-drill" function on the rig where available.	Keltbray	3	1	Low	
12	Personal injury or death	CFA auger changes	Technical	Piling	5	3	High	Reduced the number of pile diameters as far as reasonable possible. Sequence the works in such a way that reduces the number of auger changes.	Keltbray	5	1	Med	
13	Structural failure of pile	Rebar installation refusal	Technical	Piling	4	2	Med	Cages to be detailed to allow for them to be pushed into the pile. Where necessary, cage vibrators are to be used.	Keltbray	4	1	Med	

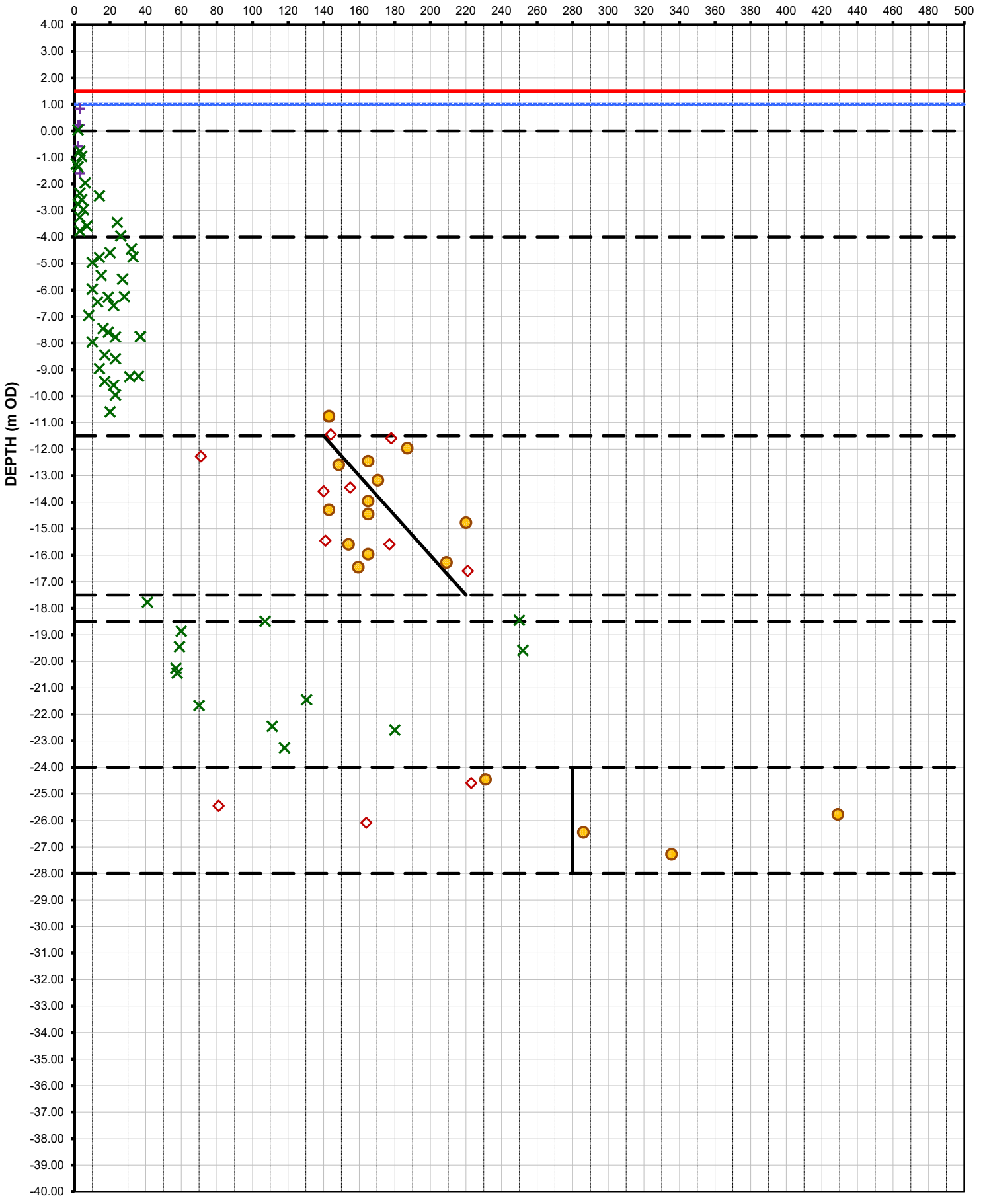
14	Tensile failure of pile	Unable to install sufficient tensile reinforcement	Technical	Piling	3	3	Med	Concrete mix designs to account for the requirement of long central bars and allow for pushing to depth. Reinforcement to be stiff enough to allow for plunging to depth.	Keltbray	3	1	Low
15	Tensile failure of pile	Failure of tensile reinforcement coupled joints	Technical	Piling	3	3	Med	Coupled joints within tensile reinforcement to be located away from areas of peak tension loading.	Keltbray	3	1	Low
16	Structural failure of pile	Insufficient reinforcement anchorage due to cages being installed low.	Technical	Piling	4	3	High	Cages to be detailed to allow for reinforcement installation tolerances as per ICE SPERW. Cages to be tied off at the required level to prevent striking under self-weight.	Keltbray	4	1	Med
17	Structural failure of pile	DYWIDAG anchorage requirements not achieved	Technical	Piling	3	3	Med	In order to shorten the required anchorage length, DYWIDAG anchor plates are to be provided. These are to be placed at a location as agreed by the Engineer.	Keltbray	3	1	Low
17	Excessive Pile Settlements	Consolidation of compressible soils	Technical	Piling	3	3	Med	Assessment of the negative skin friction has been undertaken in design. This has been applied as an additional load on the piles.	Keltbray	3	1	Low
Concrete Risks												
18	Structural failure of concrete	Incorrect concrete mix design leading to low strength concrete.	Technical	Piling	3	3	Med	The mix design to be reviewed and approved by the Engineer before commencement of piling works. Concrete trials ahead of pile installation.	Keltbray	3	1	Low
19	Low concrete durability	Incorrect concrete specification	Technical	Piling	3	3	Med	Ensure soil and groundwater testing has been carried out in accordance with BRE SD1. Appropriate concrete chemical class chosen based upon results.	Keltbray	3	1	Low
20	Structural failure of pile	Insufficient concrete strength	Technical	Piling	5	3	High	Concrete trials to be undertaken ahead piling works. Concrete cubes to be taken at 7, 28 and 56 days. Cubes to be taken by trained operatives and in accordance with relevant standards.	Keltbray	5	1	Med
21	Structural failure of pile	Necking of pile shaft	Technical	Piling	4	3	High	Ensure the rig instrumentation is correctly calibrated. Carry out slump tests to ensure workability of the concrete.	Keltbray	4	1	Med
22	Structural failure of pile	Inclusions within the pile	Technical	Piling	4	3	High	Piles to be integrity tested in accordance with the piling specification.	Keltbray	4	1	Med
23	Poor concrete quality	Water ingress into the bore	Technical	Piling	4	3	High	Where possible, use of CFA to prevent the need for an open bore. Site team to be aware of the correct procedures. Seal casing where possible. Support fluid to be used if required.	Keltbray	4	1	Med
Environmental Risks												
24	Illness	Asbestos present in site-won or imported fill material	Health & Safety	Piling	4	3	High	Asbestos risk assessments to be completed ahead of mobilisation to site. Asbestos screening to take place on all fill material to be used on the site. Procedures to be followed should asbestos be located on site.	Keltbray	4	1	Med
25	Contamination of groundwater	Fuel / oil leaks from plant	Environmental	Piling	3	3	Med	Spill kits to be available on site. "Plant Nappys" to be used under plant to prevent contamination of the working platform.	Keltbray	3	1	Low
26	Contamination of groundwater	Contaminants present in fill material	Environmental	Piling	3	3	Med	Any site-won fill material to be tested to ensure it is free from contamination. Imported fill material to be tested ahead of use.	Keltbray	3	1	Low



Appendix B Soil Strength Profiles

B.1: LCY11 Only

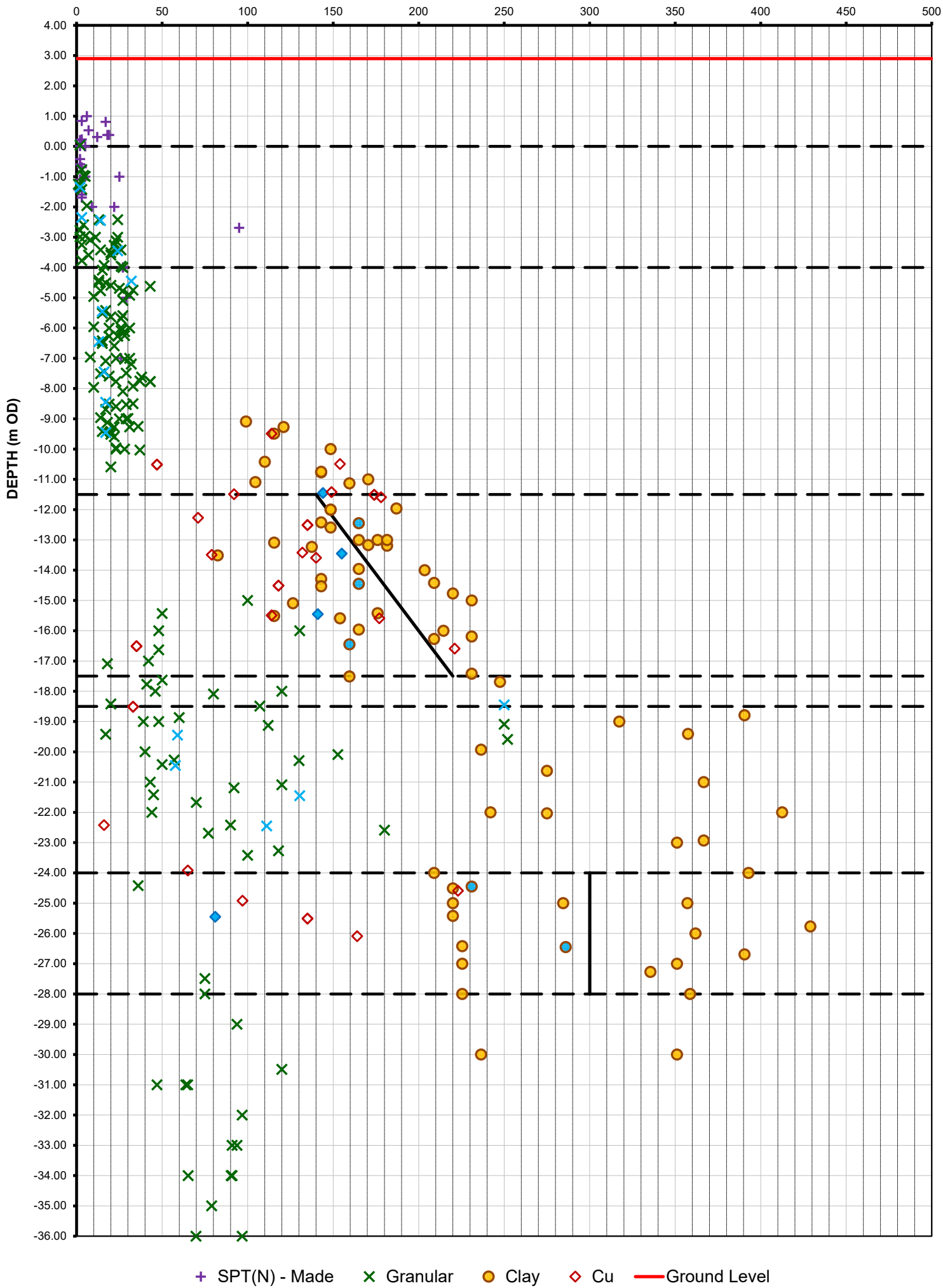
SPT (N) / Cu



+ SPT(N) - Made x Granular o Clay d Cu — Ground Level

B.2: All Site Testing

SPT (N) / Cu



Appendix C Bearing Capacity Calculations

Project			
Project Olympus			
Calculations for		Job No	
Bearing capacity - TC1	Cal'd by	CM	Date 11/12/2024
	Ch'd by	SS	Date 11/12/2024

Pile Details

Analysis: Single pile
 Piling method: CFA
 Compression testing? Yes
 Tension testing? No
 Prelim test? Yes

Design factors: EC7
 PPL = 2.900 mOD
 COL = 1.440 mOD
 Calculation increment = 0.100 m

Pile Properties

$f_{ck} = 32$ N/mm² i.e. C32/40
 $\alpha_{cc} = 0.85$
 $K_f = 1.1$
 $\gamma_c = 1.5$

Pile diameters (mm)

600

Concrete capacity (kN)

4661

Partial factors for pile resistance

EC7 - Combination 1		EC7 - Combination 2	
+ Shaft	1	+ Shaft	1.4
Base	1	Base	1.7
- Shaft	1	- Shaft	2.0

LDSA (2009)	
FoS in compression =	N/A
FoS in tension =	N/A
FoS on shaft resistance =	N/A

Model factor 1.2 BS EN 1997
 Minimum FoS on shaft resistance = 1.2 (Nominal factor - not used in LDSA analysis)

Analysis options

Overburden stress $\alpha_v' = 0$ Minimum embedment in founding stratum = 2 x D

Groundwater conditions

Porewater pressure profile: Hydrostatic
 Water level = 1.0 mOD

Granular soils

delta/phi: $\delta/\phi = 1.00$
 N_q : Calculated based on phi
 Limiting N_q : $N_{q,max} = 200$

Chalk

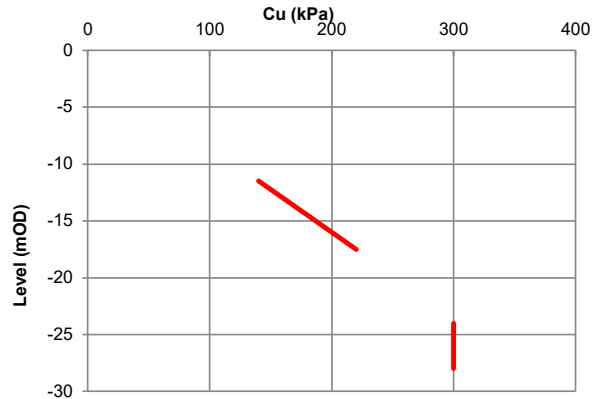
PR11 Base resistance factor: $q_b/N =$

Cohesive soils

Bearing capacity factor: $N_c = 9.0$

Undrained strength

Level (mOD)	Cu (kPa)	
-11.5	140	
-17.5	220	z= 13.333
-24	300	z= 12.5
-28	300	z= 0



Soil Information

Number of strata 6

Soil No	Stratum	Type	γ (kN/m ³)	ϕ'	α or K_s	Top	Bottom	$q_{us,max}$ (kPa)	$q_{ub,max}$ (kPa)	Cased?
1	Alluvium	made ground	16	#N/A	#N/A	4.0	-4.0	#N/A	#N/A	No
2	RTD	sand	20	34.0	0.80	-4.0	-11.5	200	10000	No
3	LC	clay	20	#N/A	0.50	-11.5	-17.5	140	4000	No
4	LG Gravel	sand	20	38.0	0.90	-17.5	-24.0	200	4000	No
5	LG Clay	clay	20	#N/A	0.50	-24.0	-28.0	140	4000	No
6	Thanet	sand	20	38.0	0.90	-28.0	-35.0	200	15000	No

Project
Project Olympus

Calculations for
Bearing capacity - TC1



Job No:		CM	Date	11/12/24	Sheet Nr of
Calculated by	SS	Date	11/12/24		
Checked by		Date	11/12/24		

RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
Bottom -35 mOD

Level	Bore	Soil	γ	ϕ'	Nq	Cu	$\alpha/K_{\phi}/\beta$	N-value	α_v	u	α'_v	q _s	q _b	Rs,k Shaft Capacity (kN)	Rb,k Base Capacity (kN)	Rcd DA1 - Comb 2 (kN)	Tension - Comb 2 (kN)
m	m		kN/m ³			kPa			kPa	kPa	kPa	kPa	kPa	600	600	600mm	600mm
1.44	1.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
1.34	1.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	1.6	0.0	1.6	0.0	0.0	0.0	0.0	0	0
1.24	1.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	3.2	0.0	3.2	0.0	0.0	0.0	0.0	0	0
1.14	1.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	4.8	0.0	4.8	0.0	0.0	0.0	0.0	0	0
1.04	1.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	6.4	0.0	6.4	0.0	0.0	0.0	0.0	0	0
0.94	1.96	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	8.0	0.6	7.4	0.0	0.0	0.0	0.0	0	0
0.84	2.06	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	9.6	1.6	8.0	0.0	0.0	0.0	0.0	0	0
0.74	2.16	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	11.2	2.6	8.6	0.0	0.0	0.0	0.0	0	0
0.64	2.26	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	12.8	3.5	9.3	0.0	0.0	0.0	0.0	0	0
0.54	2.36	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	14.4	4.5	9.9	0.0	0.0	0.0	0.0	0	0
0.44	2.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	16.0	5.5	10.5	0.0	0.0	0.0	0.0	0	0
0.34	2.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	17.6	6.5	11.1	0.0	0.0	0.0	0.0	0	0
0.24	2.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	19.2	7.5	11.7	0.0	0.0	0.0	0.0	0	0
0.14	2.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	20.8	8.4	12.4	0.0	0.0	0.0	0.0	0	0
0.04	2.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	22.4	9.4	13.0	0.0	0.0	0.0	0.0	0	0
-0.06	2.96	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	24.0	10.4	13.6	0.0	0.0	0.0	0.0	0	0
-0.16	3.06	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	25.6	11.4	14.2	0.0	0.0	0.0	0.0	0	0
-0.26	3.16	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	27.2	12.4	14.8	0.0	0.0	0.0	0.0	0	0
-0.36	3.26	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	28.8	13.3	15.5	0.0	0.0	0.0	0.0	0	0
-0.46	3.36	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	30.4	14.3	16.1	0.0	0.0	0.0	0.0	0	0
-0.56	3.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	32.0	15.3	16.7	0.0	0.0	0.0	0.0	0	0
-0.66	3.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	33.6	16.3	17.3	0.0	0.0	0.0	0.0	0	0
-0.76	3.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	35.2	17.3	17.9	0.0	0.0	0.0	0.0	0	0
-0.86	3.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	36.8	18.2	18.6	0.0	0.0	0.0	0.0	0	0
-0.96	3.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	38.4	19.2	19.2	0.0	0.0	0.0	0.0	0	0
-1.06	3.96	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	40.0	20.2	19.8	0.0	0.0	0.0	0.0	0	0
-1.16	4.06	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	41.6	21.2	20.4	0.0	0.0	0.0	0.0	0	0
-1.26	4.16	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	43.2	22.2	21.0	0.0	0.0	0.0	0.0	0	0
-1.36	4.26	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	44.8	23.2	21.6	0.0	0.0	0.0	0.0	0	0
-1.46	4.36	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	46.4	24.1	22.3	0.0	0.0	0.0	0.0	0	0
-1.56	4.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	48.0	25.1	22.9	0.0	0.0	0.0	0.0	0	0
-1.66	4.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	49.6	26.1	23.5	0.0	0.0	0.0	0.0	0	0
-1.76	4.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	51.2	27.1	24.1	0.0	0.0	0.0	0.0	0	0
-1.86	4.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	52.8	28.1	24.7	0.0	0.0	0.0	0.0	0	0
-1.96	4.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	54.4	29.0	25.4	0.0	0.0	0.0	0.0	0	0
-2.06	4.96	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	56.0	30.0	26.0	0.0	0.0	0.0	0.0	0	0
-2.16	5.06	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	57.6	31.0	26.6	0.0	0.0	0.0	0.0	0	0
-2.26	5.16	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	59.2	32.0	27.2	0.0	0.0	0.0	0.0	0	0
-2.36	5.26	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	60.8	33.0	27.8	0.0	0.0	0.0	0.0	0	0
-2.46	5.36	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	62.4	33.9	28.5	0.0	0.0	0.0	0.0	0	0
-2.56	5.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	64.0	34.9	29.1	0.0	0.0	0.0	0.0	0	0
-2.66	5.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	65.6	35.9	29.7	0.0	0.0	0.0	0.0	0	0
-2.76	5.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	67.2	36.9	30.3	0.0	0.0	0.0	0.0	0	0
-2.86	5.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	68.8	37.9	30.9	0.0	0.0	0.0	0.0	0	0
-2.96	5.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	70.4	38.8	31.6	0.0	0.0	0.0	0.0	0	0
-3.06	5.96	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	72.0	39.8	32.2	0.0	0.0	0.0	0.0	0	0
-3.16	6.06	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	73.6	40.8	32.8	0.0	0.0	0.0	0.0	0	0
-3.26	6.16	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	75.2	41.8	33.4	0.0	0.0	0.0	0.0	0	0
-3.36	6.26	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	76.8	42.8	34.0	0.0	0.0	0.0	0.0	0	0
-3.46	6.36	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	78.4	43.8	34.6	0.0	0.0	0.0	0.0	0	0
-3.56	6.46	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	80.0	44.7	35.3	0.0	0.0	0.0	0.0	0	0
-3.66	6.56	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	81.6	45.7	35.9	0.0	0.0	0.0	0.0	0	0
-3.76	6.66	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	83.2	46.7	36.5	0.0	0.0	0.0	0.0	0	0
-3.86	6.76	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	84.8	47.7	37.1	0.0	0.0	0.0	0.0	0	0
-3.96	6.86	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	86.4	48.7	37.7	0.0	0.0	0.0	0.0	0	0

Project
Project Olympus



Calculations for
Bearing capacity - TC1

Job No:		CM	Date	11/12/24	Sheet Nr of
Calculated by	SS	Date	11/12/24		
Checked by		Date			

RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	φ	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-4.06	6.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	88.4	49.6	38.8	20.6	2538.3	3.9	0.0	2538.3	2	2			
-4.16	7.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	90.4	50.6	39.8	21.2	2605.0	7.9	0.0	2605.0	5	3			
-4.26	7.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	92.4	51.6	40.8	21.7	2671.8	12.0	0.0	2671.8	7	5			
-4.36	7.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	94.4	52.6	41.8	22.3	2738.5	16.2	0.0	2738.5	10	7			
-4.46	7.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	96.4	53.6	42.8	22.8	2805.2	20.5	0.0	2805.2	12	9			
-4.56	7.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	98.4	54.5	43.9	23.4	2871.9	24.9	0.0	2871.9	15	10			
-4.66	7.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	100.4	55.5	44.9	23.9	2938.7	29.4	0.0	2938.7	18	12			
-4.76	7.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	102.4	56.5	45.9	24.5	3005.4	34.0	0.0	3005.4	20	14			
-4.86	7.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	104.4	57.5	46.9	25.0	3072.1	38.7	0.0	3072.1	23	16			
-4.96	7.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	106.4	58.5	47.9	25.6	3138.9	43.6	0.0	3138.9	26	18			
-5.06	7.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	108.4	59.4	49.0	26.1	3205.6	48.5	0.0	3205.6	29	20			
-5.16	8.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	110.4	60.4	50.0	26.7	3272.3	53.5	0.0	3272.3	32	22			
-5.26	8.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	112.4	61.4	51.0	27.2	3339.1	58.7	944.1	3339.1	49	24			
-5.36	8.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	114.4	62.4	52.0	27.8	3405.8	63.9	963.0	3405.8	53	27			
-5.46	8.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	116.4	63.4	53.0	28.3	3472.5	69.2	981.8	3472.5	58	29			
-5.56	8.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	118.4	64.4	54.0	28.9	3539.2	74.7	1000.7	3539.2	62	31			
-5.66	8.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	120.4	65.3	55.1	29.4	3606.0	80.2	1019.6	3606.0	67	33			
-5.76	8.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	122.4	66.3	56.1	30.0	3672.7	85.9	1038.4	3672.7	72	36			
-5.86	8.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	124.4	67.3	57.1	30.5	3739.4	91.6	1057.3	3739.4	76	38			
-5.96	8.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	126.4	68.3	58.1	31.1	3806.2	97.5	1076.2	3806.2	81	41			
-6.06	8.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	128.4	69.3	59.1	31.6	3872.9	103.5	1095.0	3872.9	86	43			
-6.16	9.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	130.4	70.2	60.2	32.2	3939.6	109.5	1113.9	3939.6	91	46			
-6.26	9.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	132.4	71.2	61.2	32.7	4006.3	115.7	1132.8	4006.3	96	48			
-6.36	9.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	134.4	72.2	62.2	33.3	4073.1	122.0	1151.6	4073.1	102	51			
-6.46	9.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	136.4	73.2	63.2	33.8	4139.8	128.4	1170.5	4139.8	107	53			
-6.56	9.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	138.4	74.2	64.2	34.4	4206.5	134.8	1189.4	4206.5	112	56			
-6.66	9.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	140.4	75.1	65.3	34.9	4273.3	141.4	1208.2	4273.3	118	59			
-6.76	9.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	142.4	76.1	66.3	35.5	4340.0	148.1	1227.1	4340.0	123	62			
-6.86	9.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	144.4	77.1	67.3	36.0	4406.7	154.9	1246.0	4406.7	129	65			
-6.96	9.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	146.4	78.1	68.3	36.6	4473.5	161.8	1264.8	4473.5	135	67			
-7.06	9.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	148.4	79.1	69.3	37.1	4540.2	168.8	1283.7	4540.2	141	70			
-7.16	10.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	150.4	80.0	70.4	37.7	4606.9	175.9	1302.6	4606.9	147	73			
-7.26	10.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	152.4	81.0	71.4	38.2	4673.6	183.1	1321.4	4673.6	153	76			
-7.36	10.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	154.4	82.0	72.4	38.8	4740.4	190.4	1340.3	4740.4	159	79			
-7.46	10.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	156.4	83.0	73.4	39.3	4807.1	197.8	1359.2	4807.1	165	82			
-7.56	10.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	158.4	84.0	74.4	39.9	4873.8	205.4	1378.0	4873.8	171	86			
-7.66	10.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	160.4	85.0	75.4	40.4	4940.6	213.0	1396.9	4940.6	177	89			
-7.76	10.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	162.4	85.9	76.5	41.0	5007.3	220.7	1415.8	5007.3	184	92			
-7.86	10.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	164.4	86.9	77.5	41.5	5074.0	228.5	1434.6	5074.0	190	95			
-7.96	10.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	166.4	87.9	78.5	42.1	5140.7	236.5	1453.5	5140.7	197	99			
-8.06	10.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	168.4	88.9	79.5	42.6	5207.5	244.5	1472.4	5207.5	204	102			
-8.16	11.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	170.4	89.9	80.5	43.2	5274.2	252.7	1491.2	5274.2	211	105			
-8.26	11.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	172.4	90.8	81.6	43.7	5340.9	260.9	1510.1	5340.9	217	109			
-8.36	11.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	174.4	91.8	82.6	44.3	5407.7	269.2	1529.0	5407.7	224	112			
-8.46	11.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	176.4	92.8	83.6	44.8	5474.4	277.7	1547.8	5474.4	231	116			
-8.56	11.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	178.4	93.8	84.6	45.4	5541.1	286.2	1566.7	5541.1	239	119			
-8.66	11.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	180.4	94.8	85.6	45.9	5607.9	294.9	1585.6	5607.9	246	123			
-8.76	11.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	182.4	95.7	86.7	46.5	5674.6	303.7	1604.5	5674.6	253	127			
-8.86	11.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	184.4	96.7	87.7	47.0	5741.3	312.5	1623.3	5741.3	260	130			
-8.96	11.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	186.4	97.7	88.7	47.6	5808.0	321.5	1642.2	5808.0	268	134			
-9.06	11.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	188.4	98.7	89.7	48.1	5874.8	330.6	1661.1	5874.8	275	138			
-9.16	12.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	190.4	99.7	90.7	48.7	5941.5	339.8	1679.9	5941.5	283	142			
-9.26	12.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	192.4	100.7	91.7	49.2	6008.2	349.0	1698.8	6008.2	291	145			
-9.36	12.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	194.4	101.6	92.8	49.8	6075.0	358.4	1717.7	6075.0	299	149			
-9.46	12.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	196.4	102.6	93.8	50.3	6141.7	367.9	1736.5	6141.7	307	153			

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Calculations for
Bearing capacity - TC1

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RESULTS SUMMARY														Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
Level m	Bore m	Soil	γ kN/m ³	ϕ'	Nq	Cu kPa	$\alpha/K_{\alpha}/\beta$	N-value	α_v kPa	u kPa	α'_v kPa	q _s kPa	q _b kPa	600	600	600mm	600mm				
-9.56	12.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	198.4	103.6	94.8	50.9	6208.4	377.5	1755.4	315	157				
-9.66	12.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	200.4	104.6	95.8	51.4	6275.2	387.2	1774.3	323	161				
-9.76	12.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	202.4	105.6	96.8	52.0	6341.9	397.0	1793.1	331	165				
-9.86	12.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	204.4	106.5	97.9	52.5	6408.6	406.9	1812.0	339	170				
-9.96	12.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	206.4	107.5	98.9	53.1	6475.3	416.9	1830.9	347	174				
-10.06	12.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	208.4	108.5	99.9	53.6	6542.1	427.0	1849.7	356	178				
-10.16	13.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	210.4	109.5	100.9	54.2	6608.8	437.2	1868.6	364	182				
-10.26	13.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	212.4	110.5	101.9	54.7	6675.5	447.5	1887.5	373	186				
-10.36	13.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	214.4	111.4	103.0	55.3	6742.3	458.0	1906.3	382	191				
-10.46	13.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	216.4	112.4	104.0	55.8	6809.0	468.5	1925.2	390	195				
-10.56	13.46	2	20.0	34.0	65.5	#N/A	0.80	#N/A	218.4	113.4	105.0	56.4	6875.7	479.1	1944.1	399	200				
-10.66	13.56	2	20.0	34.0	65.5	#N/A	0.80	#N/A	220.4	114.4	106.0	56.9	6942.4	489.8	1962.9	408	204				
-10.76	13.66	2	20.0	34.0	65.5	#N/A	0.80	#N/A	222.4	115.4	107.0	57.5	7009.2	500.7	1981.8	417	209				
-10.86	13.76	2	20.0	34.0	65.5	#N/A	0.80	#N/A	224.4	116.3	108.1	58.0	7075.9	511.6	2000.7	426	213				
-10.96	13.86	2	20.0	34.0	65.5	#N/A	0.80	#N/A	226.4	117.3	109.1	58.6	7142.6	522.7	2019.5	436	218				
-11.06	13.96	2	20.0	34.0	65.5	#N/A	0.80	#N/A	228.4	118.3	110.1	59.1	7209.4	533.8	2038.4	445	222				
-11.16	14.06	2	20.0	34.0	65.5	#N/A	0.80	#N/A	230.4	119.3	111.1	59.7	7276.1	545.1	2057.3	454	227				
-11.26	14.16	2	20.0	34.0	65.5	#N/A	0.80	#N/A	232.4	120.3	112.1	60.2	7342.8	556.4	2076.1	464	232				
-11.36	14.26	2	20.0	34.0	65.5	#N/A	0.80	#N/A	234.4	121.3	113.1	60.8	7409.6	567.9	2095.0	473	237				
-11.46	14.36	2	20.0	34.0	65.5	#N/A	0.80	#N/A	236.4	122.2	114.2	61.3	7476.3	579.4	2113.9	483	241				
-11.56	14.46	3	20.0	#N/A	#N/A	140.8	0.50	#N/A	238.4	123.2	115.2	70.2	1267.2	592.7	0.0	483	247				
-11.66	14.56	3	20.0	#N/A	#N/A	142.1	0.50	#N/A	240.4	124.2	116.2	70.7	1279.2	606.0	0.0	483	252				
-11.76	14.66	3	20.0	#N/A	#N/A	143.5	0.50	#N/A	242.4	125.2	117.2	71.4	1291.2	619.4	0.0	483	258				
-11.86	14.76	3	20.0	#N/A	#N/A	144.8	0.50	#N/A	244.4	126.2	118.2	72.1	1303.2	633.0	0.0	483	264				
-11.96	14.86	3	20.0	#N/A	#N/A	146.1	0.50	#N/A	246.4	127.1	119.3	72.7	1315.2	646.7	0.0	483	269				
-12.06	14.96	3	20.0	#N/A	#N/A	147.5	0.50	#N/A	248.4	128.1	120.3	73.4	1327.2	660.6	0.0	483	275				
-12.16	15.06	3	20.0	#N/A	#N/A	148.8	0.50	#N/A	250.4	129.1	121.3	74.1	1339.2	674.5	0.0	483	281				
-12.26	15.16	3	20.0	#N/A	#N/A	150.1	0.50	#N/A	252.4	130.1	122.3	74.7	1351.2	688.6	0.0	483	287				
-12.36	15.26	3	20.0	#N/A	#N/A	151.5	0.50	#N/A	254.4	131.1	123.3	75.4	1363.2	702.8	0.0	483	293				
-12.46	15.36	3	20.0	#N/A	#N/A	152.8	0.50	#N/A	256.4	132.0	124.4	76.1	1375.2	717.2	0.0	483	299				
-12.56	15.46	3	20.0	#N/A	#N/A	154.1	0.50	#N/A	258.4	133.0	125.4	76.7	1387.2	731.6	0.0	483	305				
-12.66	15.56	3	20.0	#N/A	#N/A	155.5	0.50	#N/A	260.4	134.0	126.4	77.4	1399.2	746.2	0.0	483	311				
-12.76	15.66	3	20.0	#N/A	#N/A	156.8	0.50	#N/A	262.4	135.0	127.4	78.1	1411.2	760.9	0.0	634	317				
-12.86	15.76	3	20.0	#N/A	#N/A	158.1	0.50	#N/A	264.4	136.0	128.4	78.7	1423.2	775.8	402.4	646	323				
-12.96	15.86	3	20.0	#N/A	#N/A	159.5	0.50	#N/A	266.4	136.9	129.5	79.4	1435.2	790.8	405.8	659	329				
-13.06	15.96	3	20.0	#N/A	#N/A	160.8	0.50	#N/A	268.4	137.9	130.5	80.1	1447.2	805.8	409.2	672	336				
-13.16	16.06	3	20.0	#N/A	#N/A	162.1	0.50	#N/A	270.4	138.9	131.5	80.7	1459.2	821.1	412.6	684	342				
-13.26	16.16	3	20.0	#N/A	#N/A	163.5	0.50	#N/A	272.4	139.9	132.5	81.4	1471.2	836.4	416.0	697	349				
-13.36	16.26	3	20.0	#N/A	#N/A	164.8	0.50	#N/A	274.4	140.9	133.5	82.1	1483.2	851.9	419.4	710	355				
-13.46	16.36	3	20.0	#N/A	#N/A	166.1	0.50	#N/A	276.4	141.9	134.5	82.7	1495.2	867.5	422.8	723	361				
-13.56	16.46	3	20.0	#N/A	#N/A	167.5	0.50	#N/A	278.4	142.8	135.6	83.4	1507.2	883.2	426.2	735	368				
-13.66	16.56	3	20.0	#N/A	#N/A	168.8	0.50	#N/A	280.4	143.8	136.6	84.1	1519.2	899.0	429.5	746	375				
-13.76	16.66	3	20.0	#N/A	#N/A	170.1	0.50	#N/A	282.4	144.8	137.6	84.7	1531.2	915.0	432.9	757	381				
-13.86	16.76	3	20.0	#N/A	#N/A	171.5	0.50	#N/A	284.4	145.8	138.6	85.4	1543.2	931.1	436.3	768	388				
-13.96	16.86	3	20.0	#N/A	#N/A	172.8	0.50	#N/A	286.4	146.8	139.6	86.1	1555.2	947.3	439.7	779	395				
-14.06	16.96	3	20.0	#N/A	#N/A	174.1	0.50	#N/A	288.4	147.7	140.7	86.7	1567.2	963.7	443.1	791	402				
-14.16	17.06	3	20.0	#N/A	#N/A	175.5	0.50	#N/A	290.4	148.7	141.7	87.4	1579.2	980.2	446.5	802	408				
-14.26	17.16	3	20.0	#N/A	#N/A	176.8	0.50	#N/A	292.4	149.7	142.7	88.1	1591.2	996.8	449.9	814	415				
-14.36	17.26	3	20.0	#N/A	#N/A	178.1	0.50	#N/A	294.4	150.7	143.7	88.7	1603.2	1013.5	453.3	825	422				
-14.46	17.36	3	20.0	#N/A	#N/A	179.5	0.50	#N/A	296.4	151.7	144.7	89.4	1615.2	1030.3	456.7	837	429				
-14.56	17.46	3	20.0	#N/A	#N/A	180.8	0.50	#N/A	298.4	152.6	145.8	90.1	1627.2	1047.3	460.1	849	436				
-14.66	17.56	3	20.0	#N/A	#N/A	182.1	0.50	#N/A	300.4	153.6	146.8	90.7	1639.2	1064.4	463.5	861	444				
-14.76	17.66	3	20.0	#N/A	#N/A	183.5	0.50	#N/A	302.4	154.6	147.8	91.4	1651.2	1081.6	466.9	873	451				
-14.86	17.76	3	20.0	#N/A	#N/A	184.8	0.50	#N/A	304.4	155.6	148.8	92.1	1663.2	1099.0	470.3	885	458				

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Calculations for
Bearing capacity - TC1

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RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	ϕ'	Nq	Cu kPa	$\alpha/K_{\alpha}/\beta$	N-value	α_v kPa	u kPa	α'_v kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-14.96	17.86	3	20.0	#N/A	#N/A	186.1	0.50	#N/A	306.4	156.6	149.8	92.7	1675.2	1116.5	473.7	600mm	600mm				
-15.06	17.96	3	20.0	#N/A	#N/A	187.5	0.50	#N/A	308.4	157.5	150.9	93.4	1687.2	1134.1	477.0	600mm	600mm				
-15.16	18.06	3	20.0	#N/A	#N/A	188.8	0.50	#N/A	310.4	158.5	151.9	94.1	1699.2	1151.8	480.4	600mm	600mm				
-15.26	18.16	3	20.0	#N/A	#N/A	190.1	0.50	#N/A	312.4	159.5	152.9	94.7	1711.2	1169.7	483.8	600mm	600mm				
-15.36	18.26	3	20.0	#N/A	#N/A	191.5	0.50	#N/A	314.4	160.5	153.9	95.4	1723.2	1187.6	487.2	600mm	600mm				
-15.46	18.36	3	20.0	#N/A	#N/A	192.8	0.50	#N/A	316.4	161.5	154.9	96.1	1735.2	1205.8	490.6	600mm	600mm				
-15.56	18.46	3	20.0	#N/A	#N/A	194.1	0.50	#N/A	318.4	162.5	155.9	96.7	1747.2	1224.0	494.0	600mm	600mm				
-15.66	18.56	3	20.0	#N/A	#N/A	195.5	0.50	#N/A	320.4	163.4	157.0	97.4	1759.2	1242.3	497.4	600mm	600mm				
-15.76	18.66	3	20.0	#N/A	#N/A	196.8	0.50	#N/A	322.4	164.4	158.0	98.1	1771.2	1260.8	500.8	600mm	600mm				
-15.86	18.76	3	20.0	#N/A	#N/A	198.1	0.50	#N/A	324.4	165.4	159.0	98.7	1783.2	1279.4	504.2	600mm	600mm				
-15.96	18.86	3	20.0	#N/A	#N/A	199.5	0.50	#N/A	326.4	166.4	160.0	99.4	1795.2	1298.2	507.6	600mm	600mm				
-16.06	18.96	3	20.0	#N/A	#N/A	200.8	0.50	#N/A	328.4	167.4	161.0	100.1	1807.2	1317.0	511.0	600mm	600mm				
-16.16	19.06	3	20.0	#N/A	#N/A	202.1	0.50	#N/A	330.4	168.3	162.1	100.7	1819.2	1336.0	514.4	600mm	600mm				
-16.26	19.16	3	20.0	#N/A	#N/A	203.5	0.50	#N/A	332.4	169.3	163.1	101.4	1831.2	1355.1	517.8	600mm	600mm				
-16.36	19.26	3	20.0	#N/A	#N/A	204.8	0.50	#N/A	334.4	170.3	164.1	102.1	1843.2	1374.4	521.2	600mm	600mm				
-16.46	19.36	3	20.0	#N/A	#N/A	206.1	0.50	#N/A	336.4	171.3	165.1	102.7	1855.2	1393.7	524.5	600mm	600mm				
-16.56	19.46	3	20.0	#N/A	#N/A	207.5	0.50	#N/A	338.4	172.3	166.1	103.4	1867.2	1413.2	527.9	600mm	600mm				
-16.66	19.56	3	20.0	#N/A	#N/A	208.8	0.50	#N/A	340.4	173.2	167.2	104.1	1879.2	1432.9	531.3	600mm	600mm				
-16.76	19.66	3	20.0	#N/A	#N/A	210.1	0.50	#N/A	342.4	174.2	168.2	104.7	1891.2	1452.6	534.7	600mm	600mm				
-16.86	19.76	3	20.0	#N/A	#N/A	211.5	0.50	#N/A	344.4	175.2	169.2	105.4	1903.2	1472.5	538.1	600mm	600mm				
-16.96	19.86	3	20.0	#N/A	#N/A	212.8	0.50	#N/A	346.4	176.2	170.2	106.1	1915.2	1492.5	541.5	600mm	600mm				
-17.06	19.96	3	20.0	#N/A	#N/A	214.1	0.50	#N/A	348.4	177.2	171.2	106.7	1927.2	1512.6	544.9	600mm	600mm				
-17.16	20.06	3	20.0	#N/A	#N/A	215.5	0.50	#N/A	350.4	178.1	172.3	107.4	1939.2	1532.8	548.3	600mm	600mm				
-17.26	20.16	3	20.0	#N/A	#N/A	216.8	0.50	#N/A	352.4	179.1	173.3	108.1	1951.2	1553.2	551.7	600mm	600mm				
-17.36	20.26	3	20.0	#N/A	#N/A	218.1	0.50	#N/A	354.4	180.1	174.3	108.7	1963.2	1573.7	555.1	600mm	600mm				
-17.46	20.36	3	20.0	#N/A	#N/A	219.5	0.50	#N/A	356.4	181.1	175.3	109.4	1975.2	1594.3	558.5	600mm	600mm				
-17.56	20.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	358.4	182.1	176.3	123.6	4000.0	1617.6	0.0	600mm	600mm				
-17.66	20.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	360.4	183.1	177.3	124.3	4000.0	1641.0	0.0	600mm	600mm				
-17.76	20.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	362.4	184.0	178.4	125.1	4000.0	1664.6	0.0	600mm	600mm				
-17.86	20.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	364.4	185.0	179.4	125.8	4000.0	1688.3	0.0	600mm	600mm				
-17.96	20.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	366.4	186.0	180.4	126.5	4000.0	1712.2	0.0	600mm	600mm				
-18.06	20.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	368.4	187.0	181.4	127.2	4000.0	1736.2	0.0	600mm	600mm				
-18.16	21.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	370.4	188.0	182.4	127.9	4000.0	1760.3	0.0	600mm	600mm				
-18.26	21.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	372.4	188.9	183.5	128.6	4000.0	1784.5	0.0	600mm	600mm				
-18.36	21.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	374.4	189.9	184.5	129.4	4000.0	1808.9	0.0	600mm	600mm				
-18.46	21.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	376.4	190.9	185.5	130.1	4000.0	1833.4	0.0	600mm	600mm				
-18.56	21.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	378.4	191.9	186.5	130.8	4000.0	1858.1	0.0	600mm	600mm				
-18.66	21.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	380.4	192.9	187.5	131.5	4000.0	1882.9	0.0	600mm	600mm				
-18.76	21.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	382.4	193.8	188.6	132.2	4000.0	1907.8	1131.0	600mm	600mm				
-18.86	21.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	384.4	194.8	189.6	132.9	4000.0	1932.8	1131.0	600mm	600mm				
-18.96	21.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	386.4	195.8	190.6	133.7	4000.0	1958.0	1131.0	600mm	600mm				
-19.06	21.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	388.4	196.8	191.6	134.4	4000.0	1983.4	1131.0	600mm	600mm				
-19.16	22.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	390.4	197.8	192.6	135.1	4000.0	2008.8	1131.0	600mm	600mm				
-19.26	22.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	392.4	198.8	193.6	135.8	4000.0	2034.4	1131.0	600mm	600mm				
-19.36	22.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	394.4	199.7	194.7	136.5	4000.0	2060.2	1131.0	600mm	600mm				
-19.46	22.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	396.4	200.7	195.7	137.2	4000.0	2086.0	1131.0	600mm	600mm				
-19.56	22.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	398.4	201.7	196.7	138.0	4000.0	2112.0	1131.0	600mm	600mm				
-19.66	22.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	400.4	202.7	197.7	138.7	4000.0	2138.2	1131.0	600mm	600mm				
-19.76	22.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	402.4	203.7	198.7	139.4	4000.0	2164.5	1131.0	600mm	600mm				
-19.86	22.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	404.4	204.6	199.8	140.1	4000.0	2190.9	1131.0	600mm	600mm				
-19.96	22.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	406.4	205.6	200.8	140.8	4000.0	2217.4	1131.0	600mm	600mm				
-20.06	22.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	408.4	206.6	201.8	141.5	4000.0	2244.1	1131.0	600mm	600mm				
-20.16	23.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	410.4	207.6	202.8	142.3	4000.0	2270.9	1131.0	600mm	600mm				
-20.26	23.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	412.4	208.6	203.8	143.0	4000.0	2297.8	1131.0	600mm	600mm				

Project
Project Olympus



Calculations for
Bearing capacity - TC1

Job No:			
Calculated by	CM	Date	11/12/24
Checked by	SS	Date	11/12/24
			Sheet Nr of

RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	φ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)	Rb,k Base Capacity (kN)	Rcd DA1 - Comb 2 (kN)	Tension - Comb 2 (kN)
														600	600	600mm	600mm
-20.36	23.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	414.4	209.5	204.9	143.7	4000.0	2324.9	1131.0	1937	969
-20.46	23.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	416.4	210.5	205.9	144.4	4000.0	2352.2	1131.0	1954	980
-20.56	23.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	418.4	211.5	206.9	145.1	4000.0	2379.5	1131.0	1971	991
-20.66	23.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	420.4	212.5	207.9	145.8	4000.0	2407.0	1131.0	1987	1003
-20.76	23.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	422.4	213.5	208.9	146.6	4000.0	2434.6	1131.0	2004	1014
-20.86	23.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	424.4	214.4	210.0	147.3	4000.0	2462.4	1131.0	2020	1026
-20.96	23.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	426.4	215.4	211.0	148.0	4000.0	2490.3	1131.0	2037	1038
-21.06	23.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	428.4	216.4	212.0	148.7	4000.0	2518.3	1131.0	2053	1049
-21.16	24.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	430.4	217.4	213.0	149.4	4000.0	2546.5	1131.0	2070	1061
-21.26	24.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	432.4	218.4	214.0	150.1	4000.0	2574.8	1131.0	2087	1073
-21.36	24.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	434.4	219.4	215.0	150.9	4000.0	2603.2	1131.0	2104	1085
-21.46	24.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	436.4	220.3	216.1	151.6	4000.0	2631.8	1131.0	2121	1097
-21.56	24.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	438.4	221.3	217.1	152.3	4000.0	2660.5	1131.0	2138	1109
-21.66	24.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	440.4	222.3	218.1	153.0	4000.0	2689.3	1131.0	2155	1121
-21.76	24.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	442.4	223.3	219.1	153.7	4000.0	2718.3	1131.0	2172	1133
-21.86	24.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	444.4	224.3	220.1	154.4	4000.0	2747.4	1131.0	2190	1145
-21.96	24.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	446.4	225.2	221.2	155.2	4000.0	2776.7	1131.0	2207	1157
-22.06	24.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	448.4	226.2	222.2	155.9	4000.0	2806.0	1131.0	2225	1169
-22.16	25.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	450.4	227.2	223.2	156.6	4000.0	2835.6	1131.0	2242	1181
-22.26	25.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	452.4	228.2	224.2	157.3	4000.0	2865.2	1131.0	2260	1194
-22.36	25.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	454.4	229.2	225.2	158.0	4000.0	2895.0	1131.0	2278	1206
-22.46	25.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	456.4	230.1	226.3	158.7	4000.0	2924.9	1131.0	2295	1219
-22.56	25.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	458.4	231.1	227.3	159.5	4000.0	2955.0	1131.0	2313	1231
-22.66	25.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	460.4	232.1	228.3	160.2	4000.0	2985.2	1131.0	2331	1244
-22.76	25.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	462.4	233.1	229.3	160.9	4000.0	3015.5	1131.0	2349	1256
-22.86	25.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	464.4	234.1	230.3	161.6	4000.0	3045.9	1131.0	2367	1269
-22.96	25.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	466.4	235.0	231.4	162.3	4000.0	3076.5	1131.0	2386	1282
-23.06	25.96	4	20.0	38.0	130.3	#N/A	0.90	#N/A	468.4	236.0	232.4	163.0	4000.0	3107.3	1131.0	2404	1295
-23.16	26.06	4	20.0	38.0	130.3	#N/A	0.90	#N/A	470.4	237.0	233.4	163.8	4000.0	3138.1	1131.0	2422	1308
-23.26	26.16	4	20.0	38.0	130.3	#N/A	0.90	#N/A	472.4	238.0	234.4	164.5	4000.0	3169.1	1131.0	2441	1320
-23.36	26.26	4	20.0	38.0	130.3	#N/A	0.90	#N/A	474.4	239.0	235.4	165.2	4000.0	3200.3	1131.0	2459	1333
-23.46	26.36	4	20.0	38.0	130.3	#N/A	0.90	#N/A	476.4	240.0	236.4	165.9	4000.0	3231.6	1131.0	2478	1346
-23.56	26.46	4	20.0	38.0	130.3	#N/A	0.90	#N/A	478.4	240.9	237.5	166.6	4000.0	3263.0	1131.0	2497	1360
-23.66	26.56	4	20.0	38.0	130.3	#N/A	0.90	#N/A	480.4	241.9	238.5	167.3	4000.0	3294.5	1131.0	2515	1373
-23.76	26.66	4	20.0	38.0	130.3	#N/A	0.90	#N/A	482.4	242.9	239.5	168.1	4000.0	3326.2	1131.0	2534	1386
-23.86	26.76	4	20.0	38.0	130.3	#N/A	0.90	#N/A	484.4	243.9	240.5	168.8	4000.0	3358.0	1131.0	2553	1399
-23.96	26.86	4	20.0	38.0	130.3	#N/A	0.90	#N/A	486.4	244.9	241.5	169.5	4000.0	3389.9	1131.0	2572	1412
-24.06	26.96	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	488.4	245.8	242.6	140.0	2700.0	3416.3	0.0	2572	1423
-24.16	27.06	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	490.4	246.8	243.6	140.0	2700.0	3442.7	0.0	2572	1434
-24.26	27.16	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	492.4	247.8	244.6	140.0	2700.0	3469.1	0.0	2572	1445
-24.36	27.26	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	494.4	248.8	245.6	140.0	2700.0	3495.5	0.0	2572	1456
-24.46	27.36	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	496.4	249.8	246.6	140.0	2700.0	3521.9	0.0	2572	1467
-24.56	27.46	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	498.4	250.7	247.7	140.0	2700.0	3548.3	0.0	2572	1478
-24.66	27.56	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	500.4	251.7	248.7	140.0	2700.0	3574.7	0.0	2572	1489
-24.76	27.66	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	502.4	252.7	249.7	140.0	2700.0	3601.1	0.0	2572	1500
-24.86	27.76	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	504.4	253.7	250.7	140.0	2700.0	3627.4	0.0	2572	1511
-24.96	27.86	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	506.4	254.7	251.7	140.0	2700.0	3653.8	0.0	2572	1522
-25.06	27.96	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	508.4	255.6	252.8	140.0	2700.0	3680.2	0.0	2572	1533
-25.16	28.06	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	510.4	256.6	253.8	140.0	2700.0	3706.6	0.0	2572	1544
-25.26	28.16	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	512.4	257.6	254.8	140.0	2700.0	3733.0	763.4	2596	1555
-25.36	28.26	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	514.4	258.6	255.8	140.0	2700.0	3759.4	763.4	2612	1566
-25.46	28.36	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	516.4	259.6	256.8	140.0	2700.0	3785.8	763.4	2628	1577
-25.56	28.46	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	518.4	260.6	257.8	140.0	2700.0	3812.2	763.4	2643	1588
-25.66	28.56	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	520.4	261.5	258.9	140.0	2700.0	3838.6	763.4	2659	1599

Project
 Project Olympus
 Calculations for
 Bearing capacity - TC1



Job No:		CM	Date	11/12/24	Sheet Nr of
Calculated by	SS	Date	11/12/24		
Checked by		Date			

RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
 Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	ϕ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-25.76	28.66	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	522.4	262.5	259.9	140.0	2700.0	3864.9	763.4	600mm	2675	600mm	1610		
-25.86	28.76	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	524.4	263.5	260.9	140.0	2700.0	3891.3	763.4	600mm	2690	600mm	1621		
-25.96	28.86	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	526.4	264.5	261.9	140.0	2700.0	3917.7	763.4	600mm	2706	600mm	1632		
-26.06	28.96	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	528.4	265.5	262.9	140.0	2700.0	3944.1	763.4	600mm	2722	600mm	1643		
-26.16	29.06	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	530.4	266.4	264.0	140.0	2700.0	3970.5	763.4	600mm	2738	600mm	1654		
-26.26	29.16	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	532.4	267.4	265.0	140.0	2700.0	3996.9	763.4	600mm	2753	600mm	1665		
-26.36	29.26	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	534.4	268.4	266.0	140.0	2700.0	4023.3	763.4	600mm	2769	600mm	1676		
-26.46	29.36	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	536.4	269.4	267.0	140.0	2700.0	4049.7	763.4	600mm	2785	600mm	1687		
-26.56	29.46	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	538.4	270.4	268.0	140.0	2700.0	4076.1	763.4	600mm	2800	600mm	1698		
-26.66	29.56	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	540.4	271.3	269.1	140.0	2700.0	4102.4	763.4	600mm	2816	600mm	1709		
-26.76	29.66	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	542.4	272.3	270.1	140.0	2700.0	4128.8	763.4	600mm	2832	600mm	1720		
-26.86	29.76	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	544.4	273.3	271.1	140.0	2700.0	4155.2	763.4	600mm	2848	600mm	1731		
-26.96	29.86	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	546.4	274.3	272.1	140.0	2700.0	4181.6	763.4	600mm	2863	600mm	1742		
-27.06	29.96	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	548.4	275.3	273.1	140.0	2700.0	4208.0	763.4	600mm	2879	600mm	1753		
-27.16	30.06	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	550.4	276.2	274.2	140.0	2700.0	4234.4	763.4	600mm	2895	600mm	1764		
-27.26	30.16	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	552.4	277.2	275.2	140.0	2700.0	4260.8	763.4	600mm	2910	600mm	1775		
-27.36	30.26	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	554.4	278.2	276.2	140.0	2700.0	4287.2	763.4	600mm	2926	600mm	1786		
-27.46	30.36	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	556.4	279.2	277.2	140.0	2700.0	4313.6	763.4	600mm	2942	600mm	1797		
-27.56	30.46	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	558.4	280.2	278.2	140.0	2700.0	4340.0	763.4	600mm	2958	600mm	1808		
-27.66	30.56	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	560.4	281.2	279.2	140.0	2700.0	4366.3	763.4	600mm	2973	600mm	1819		
-27.76	30.66	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	562.4	282.1	280.3	140.0	2700.0	4392.7	763.4	600mm	2989	600mm	1830		
-27.86	30.76	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	564.4	283.1	281.3	140.0	2700.0	4419.1	763.4	600mm	3005	600mm	1841		
-27.96	30.86	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	566.4	284.1	282.3	140.0	2700.0	4445.5	763.4	600mm	3020	600mm	1852		
-28.06	30.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	568.4	285.1	283.3	198.9	15000.0	4483.0	0.0	600mm	3020	600mm	1868		
-28.16	31.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	570.4	286.1	284.3	199.6	15000.0	4520.6	0.0	600mm	3020	600mm	1884		
-28.26	31.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	572.4	287.0	285.4	200.0	15000.0	4558.3	0.0	600mm	3020	600mm	1899		
-28.36	31.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	574.4	288.0	286.4	200.0	15000.0	4596.0	0.0	600mm	3020	600mm	1915		
-28.46	31.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	576.4	289.0	287.4	200.0	15000.0	4633.7	0.0	600mm	3020	600mm	1931		
-28.56	31.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	578.4	290.0	288.4	200.0	15000.0	4671.4	0.0	600mm	3020	600mm	1946		
-28.66	31.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	580.4	291.0	289.4	200.0	15000.0	4709.1	0.0	600mm	3020	600mm	1962		
-28.76	31.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	582.4	291.9	290.5	200.0	15000.0	4746.8	0.0	600mm	3020	600mm	1978		
-28.86	31.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	584.4	292.9	291.5	200.0	15000.0	4784.5	0.0	600mm	3020	600mm	1994		
-28.96	31.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	586.4	293.9	292.5	200.0	15000.0	4822.2	0.0	600mm	3020	600mm	2009		
-29.06	31.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	588.4	294.9	293.5	200.0	15000.0	4859.9	0.0	600mm	3020	600mm	2025		
-29.16	32.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	590.4	295.9	294.5	200.0	15000.0	4897.6	0.0	600mm	3020	600mm	2041		
-29.26	32.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	592.4	296.9	295.5	200.0	15000.0	4935.3	4241.2	600mm	4113	600mm	2056		
-29.36	32.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	594.4	297.8	296.6	200.0	15000.0	4973.0	4241.2	600mm	4144	600mm	2072		
-29.46	32.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	596.4	298.8	297.6	200.0	15000.0	5010.7	4241.2	600mm	4176	600mm	2088		
-29.56	32.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	598.4	299.8	298.6	200.0	15000.0	5048.4	4241.2	600mm	4207	600mm	2104		
-29.66	32.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	600.4	300.8	299.6	200.0	15000.0	5086.1	4241.2	600mm	4238	600mm	2119		
-29.76	32.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	602.4	301.8	300.6	200.0	15000.0	5123.8	4241.2	600mm	4270	600mm	2135		
-29.86	32.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	604.4	302.7	301.7	200.0	15000.0	5161.5	4241.2	600mm	4301	600mm	2151		
-29.96	32.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	606.4	303.7	302.7	200.0	15000.0	5199.2	4241.2	600mm	4333	600mm	2166		
-30.06	32.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	608.4	304.7	303.7	200.0	15000.0	5236.9	4241.2	600mm	4364	600mm	2182		
-30.16	33.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	610.4	305.7	304.7	200.0	15000.0	5274.6	4241.2	600mm	4395	600mm	2198		
-30.26	33.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	612.4	306.7	305.7	200.0	15000.0	5312.3	4241.2	600mm	4427	600mm	2213		
-30.36	33.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	614.4	307.6	306.8	200.0	15000.0	5350.0	4241.2	600mm	4458	600mm	2229		
-30.46	33.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	616.4	308.6	307.8	200.0	15000.0	5387.7	4241.2	600mm	4490	600mm	2245		
-30.56	33.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	618.4	309.6	308.8	200.0	15000.0	5425.4	4241.2	600mm	4521	600mm	2261		
-30.66	33.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	620.4	310.6	309.8	200.0	15000.0	5463.1	4241.2	600mm	4553	600mm	2276		
-30.76	33.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	622.4	311.6	310.8	200.0	15000.0	5500.8	4241.2	600mm	4584	600mm	2292		
-30.86	33.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	624.4	312.5	311.9	200.0	15000.0	5538.5	4241.2	600mm	4615	600mm	2308		
-30.96	33.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	626.4	313.5	312.9	200.0	15000.0	5576.2	4241.2	600mm	4647	600mm	2323		
-31.06	33.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	628.4	314.5	313.9	200.0	15000.0	5613.9	4241.2	600mm	4678	600mm	2339		

Project
Project Olympus

Calculations for
Bearing capacity - TC1



Job No:		CM	Date	11/12/24	Sheet Nr of
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Checked by		Date	11/12/24		

RESULTS SUMMARY

Top 1.44 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	φ	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α' _v kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rod DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-31.16	34.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	630.4	315.5	314.9	200.0	15000.0	5651.6	4241.2	4710	2355				
-31.26	34.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	632.4	316.5	315.9	200.0	15000.0	5689.3	4241.2	4741	2371				
-31.36	34.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	634.4	317.5	316.9	200.0	15000.0	5727.0	4241.2	4772	2386				
-31.46	34.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	636.4	318.4	318.0	200.0	15000.0	5764.7	4241.2	4804	2402				
-31.56	34.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	638.4	319.4	319.0	200.0	15000.0	5802.4	4241.2	4835	2418				
-31.66	34.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	640.4	320.4	320.0	200.0	15000.0	5840.1	4241.2	4867	2433				
-31.76	34.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	642.4	321.4	321.0	200.0	15000.0	5877.8	4241.2	4898	2449				
-31.86	34.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	644.4	322.4	322.0	200.0	15000.0	5915.5	4241.2	4930	2465				
-31.96	34.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	646.4	323.3	323.1	200.0	15000.0	5953.2	4241.2	4961	2480				
-32.06	34.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	648.4	324.3	324.1	200.0	15000.0	5990.9	4241.2	4992	2496				
-32.16	35.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	650.4	325.3	325.1	200.0	15000.0	6028.6	4241.2	5024	2512				
-32.26	35.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	652.4	326.3	326.1	200.0	15000.0	6066.3	4241.2	5055	2528				
-32.36	35.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	654.4	327.3	327.1	200.0	15000.0	6104.0	4241.2	5087	2543				
-32.46	35.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	656.4	328.2	328.2	200.0	15000.0	6141.7	4241.2	5118	2559				
-32.56	35.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	658.4	329.2	329.2	200.0	15000.0	6179.4	4241.2	5149	2575				
-32.66	35.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	660.4	330.2	330.2	200.0	15000.0	6217.1	4241.2	5181	2590				
-32.76	35.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	662.4	331.2	331.2	200.0	15000.0	6254.8	4241.2	5212	2606				
-32.86	35.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	664.4	332.2	332.2	200.0	15000.0	6292.5	4241.2	5244	2622				
-32.96	35.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	666.4	333.1	333.3	200.0	15000.0	6330.2	4241.2	5275	2638				
-33.06	35.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	668.4	334.1	334.3	200.0	15000.0	6367.9	4241.2	5307	2653				
-33.16	36.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	670.4	335.1	335.3	200.0	15000.0	6405.6	4241.2	5338	2669				
-33.26	36.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	672.4	336.1	336.3	200.0	15000.0	6443.3	4241.2	5369	2685				
-33.36	36.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	674.4	337.1	337.3	200.0	15000.0	6481.0	4241.2	5401	2700				
-33.46	36.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	676.4	338.1	338.3	200.0	15000.0	6518.7	4241.2	5432	2716				
-33.56	36.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	678.4	339.0	339.4	200.0	15000.0	6556.4	4241.2	5464	2732				
-33.66	36.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	680.4	340.0	340.4	200.0	15000.0	6594.1	4241.2	5495	2748				
-33.76	36.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	682.4	341.0	341.4	200.0	15000.0	6631.8	4241.2	5526	2763				
-33.86	36.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	684.4	342.0	342.4	200.0	15000.0	6669.5	4241.2	5558	2779				
-33.96	36.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	686.4	343.0	343.4	200.0	15000.0	6707.2	4241.2	5589	2795				
-34.06	36.96	6	20.0	38.0	130.3	#N/A	0.90	#N/A	688.4	343.9	344.5	200.0	15000.0	6744.9	4241.2	5621	2810				
-34.16	37.06	6	20.0	38.0	130.3	#N/A	0.90	#N/A	690.4	344.9	345.5	200.0	15000.0	6782.6	4241.2	5652	2826				
-34.26	37.16	6	20.0	38.0	130.3	#N/A	0.90	#N/A	692.4	345.9	346.5	200.0	15000.0	6820.3	4241.2	5684	2842				
-34.36	37.26	6	20.0	38.0	130.3	#N/A	0.90	#N/A	694.4	346.9	347.5	200.0	15000.0	6858.0	4241.2	5715	2857				
-34.46	37.36	6	20.0	38.0	130.3	#N/A	0.90	#N/A	696.4	347.9	348.5	200.0	15000.0	6895.7	4241.2	5746	2873				
-34.56	37.46	6	20.0	38.0	130.3	#N/A	0.90	#N/A	698.4	348.8	349.6	200.0	15000.0	6933.4	4241.2	5778	2889				
-34.66	37.56	6	20.0	38.0	130.3	#N/A	0.90	#N/A	700.4	349.8	350.6	200.0	15000.0	6971.1	4241.2	5809	2905				
-34.76	37.66	6	20.0	38.0	130.3	#N/A	0.90	#N/A	702.4	350.8	351.6	200.0	15000.0	7008.8	4241.2	5841	2920				
-34.86	37.76	6	20.0	38.0	130.3	#N/A	0.90	#N/A	704.4	351.8	352.6	200.0	15000.0	7046.5	4241.2	5872	2936				
-34.96	37.86	6	20.0	38.0	130.3	#N/A	0.90	#N/A	706.4	352.8	353.6	200.0	15000.0	7084.2	4241.2	5903	2952				

Project			
Project Olympus			
Calculations for		Job No	
Bearing capacity - TC2	Cal'd by	CM	Date 11/12/2024
	Ch'd by	SS	Date 11/12/2024

Pile Details

Analysis: Single pile
 Piling method: CFA
 Compression testing? Yes
 Tension testing? No
 Prelim test? Yes

Design factors: EC7
 PPL = 2.900 mOD
 COL = 0.990 mOD
 Calculation increment = 0.100 m

Pile Properties

$f_{ck} = 32$ N/mm² i.e. C32/40
 $\alpha_{cc} = 0.85$
 $K_f = 1.1$
 $\gamma_c = 1.5$

Pile diameters (mm)

600

Concrete capacity (kN)

4661

Partial factors for pile resistance

EC7 - Combination 1		EC7 - Combination 2	
+ Shaft	1	+ Shaft	1.4
Base	1	Base	1.7
- Shaft	1	- Shaft	2.0

LDSA (2009)	
FoS in compression =	N/A
FoS in tension =	N/A
FoS on shaft resistance =	N/A

Model factor 1.2 BS EN 1997
 Minimum FoS on shaft resistance = 1.2 (Nominal factor - not used in LDSA analysis)

Analysis options

Overburden stress $\alpha_v' = 0$ Minimum embedment in founding stratum = 2 x D

Groundwater conditions

Porewater pressure profile: Hydrostatic
 Water level = 1.0 mOD

Granular soils

delta/phi: $\delta/\phi = 1.00$
 N_q : Calculated based on phi
 Limiting N_q : $N_{q,max} = 200$

Chalk

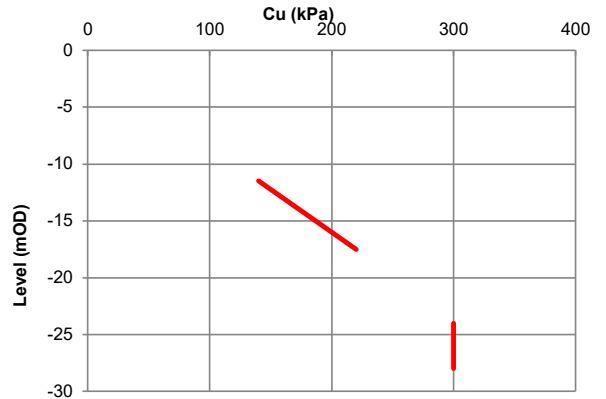
PR11 Base resistance factor: $q_b/N =$

Cohesive soils

Bearing capacity factor: $N_c = 9.0$

Undrained strength

Level (mOD)	Cu (kPa)	
-11.5	140	
-17.5	220	z= 13.333
-24	300	z= 12.5
-28	300	z= 0



Soil Information

Number of strata 6

Soil No	Stratum	Type	γ (kN/m ³)	ϕ'	α or K_s	Top	Bottom	$q_{us,max}$ (kPa)	$q_{ub,max}$ (kPa)	Cased?
1	Alluvium	made ground	16	#N/A	#N/A	4.0	-4.0	#N/A	#N/A	No
2	RTD	sand	20	34.0	0.80	-4.0	-11.5	200	10000	No
3	LC	clay	20	#N/A	0.50	-11.5	-17.5	140	4000	No
4	LG Gravel	sand	20	38.0	0.90	-17.5	-24.0	200	4000	No
5	LG Clay	clay	20	#N/A	0.50	-24.0	-28.0	140	4000	No
6	Thanet	sand	20	38.0	0.90	-28.0	-35.0	200	15000	No

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Calculations for
Bearing capacity - TC2

Job No:			
Calculated by	CM	Date	11/12/24
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RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	ϕ'	Nq	Cu kPa	$\alpha/K_{\alpha}/\beta$	N-value	α_v kPa	u kPa	α'_v kPa	q_s kPa	q_b kPa	Rs,k Shaft Capacity (kN) 600	Rb,k Base Capacity (kN) 600	Rcd DA1 - Comb 2 (kN) 600mm	Tension - Comb 2 (kN) 600mm
0.99	1.91	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0	0
0.89	2.01	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	1.6	1.1	0.5	0.0	0.0	0.0	0.0	0	0
0.79	2.11	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	3.2	2.1	1.1	0.0	0.0	0.0	0.0	0	0
0.69	2.21	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	4.8	3.0	1.8	0.0	0.0	0.0	0.0	0	0
0.59	2.31	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	6.4	4.0	2.4	0.0	0.0	0.0	0.0	0	0
0.49	2.41	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	8.0	5.0	3.0	0.0	0.0	0.0	0.0	0	0
0.39	2.51	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	9.6	6.0	3.6	0.0	0.0	0.0	0.0	0	0
0.29	2.61	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	11.2	7.0	4.2	0.0	0.0	0.0	0.0	0	0
0.19	2.71	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	12.8	7.9	4.9	0.0	0.0	0.0	0.0	0	0
0.09	2.81	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	14.4	8.9	5.5	0.0	0.0	0.0	0.0	0	0
-0.01	2.91	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	16.0	9.9	6.1	0.0	0.0	0.0	0.0	0	0
-0.11	3.01	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	17.6	10.9	6.7	0.0	0.0	0.0	0.0	0	0
-0.21	3.11	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	19.2	11.9	7.3	0.0	0.0	0.0	0.0	0	0
-0.31	3.21	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	20.8	12.9	7.9	0.0	0.0	0.0	0.0	0	0
-0.41	3.31	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	22.4	13.8	8.6	0.0	0.0	0.0	0.0	0	0
-0.51	3.41	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	24.0	14.8	9.2	0.0	0.0	0.0	0.0	0	0
-0.61	3.51	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	25.6	15.8	9.8	0.0	0.0	0.0	0.0	0	0
-0.71	3.61	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	27.2	16.8	10.4	0.0	0.0	0.0	0.0	0	0
-0.81	3.71	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	28.8	17.8	11.0	0.0	0.0	0.0	0.0	0	0
-0.91	3.81	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	30.4	18.7	11.7	0.0	0.0	0.0	0.0	0	0
-1.01	3.91	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	32.0	19.7	12.3	0.0	0.0	0.0	0.0	0	0
-1.11	4.01	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	33.6	20.7	12.9	0.0	0.0	0.0	0.0	0	0
-1.21	4.11	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	35.2	21.7	13.5	0.0	0.0	0.0	0.0	0	0
-1.31	4.21	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	36.8	22.7	14.1	0.0	0.0	0.0	0.0	0	0
-1.41	4.31	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	38.4	23.6	14.8	0.0	0.0	0.0	0.0	0	0
-1.51	4.41	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	40.0	24.6	15.4	0.0	0.0	0.0	0.0	0	0
-1.61	4.51	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	41.6	25.6	16.0	0.0	0.0	0.0	0.0	0	0
-1.71	4.61	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	43.2	26.6	16.6	0.0	0.0	0.0	0.0	0	0
-1.81	4.71	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	44.8	27.6	17.2	0.0	0.0	0.0	0.0	0	0
-1.91	4.81	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	46.4	28.5	17.9	0.0	0.0	0.0	0.0	0	0
-2.01	4.91	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	48.0	29.5	18.5	0.0	0.0	0.0	0.0	0	0
-2.11	5.01	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	49.6	30.5	19.1	0.0	0.0	0.0	0.0	0	0
-2.21	5.11	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	51.2	31.5	19.7	0.0	0.0	0.0	0.0	0	0
-2.31	5.21	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	52.8	32.5	20.3	0.0	0.0	0.0	0.0	0	0
-2.41	5.31	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	54.4	33.5	20.9	0.0	0.0	0.0	0.0	0	0
-2.51	5.41	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	56.0	34.4	21.6	0.0	0.0	0.0	0.0	0	0
-2.61	5.51	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	57.6	35.4	22.2	0.0	0.0	0.0	0.0	0	0
-2.71	5.61	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	59.2	36.4	22.8	0.0	0.0	0.0	0.0	0	0
-2.81	5.71	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	60.8	37.4	23.4	0.0	0.0	0.0	0.0	0	0
-2.91	5.81	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	62.4	38.4	24.0	0.0	0.0	0.0	0.0	0	0
-3.01	5.91	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	64.0	39.3	24.7	0.0	0.0	0.0	0.0	0	0
-3.11	6.01	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	65.6	40.3	25.3	0.0	0.0	0.0	0.0	0	0
-3.21	6.11	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	67.2	41.3	25.9	0.0	0.0	0.0	0.0	0	0
-3.31	6.21	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	68.8	42.3	26.5	0.0	0.0	0.0	0.0	0	0
-3.41	6.31	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	70.4	43.3	27.1	0.0	0.0	0.0	0.0	0	0
-3.51	6.41	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	72.0	44.2	27.8	0.0	0.0	0.0	0.0	0	0
-3.61	6.51	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	73.6	45.2	28.4	0.0	0.0	0.0	0.0	0	0
-3.71	6.61	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	75.2	46.2	29.0	0.0	0.0	0.0	0.0	0	0
-3.81	6.71	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	76.8	47.2	29.6	0.0	0.0	0.0	0.0	0	0
-3.91	6.81	1	16.0	#N/A	#N/A	#N/A	#N/A	#N/A	78.4	48.2	30.2	0.0	0.0	0.0	0.0	0	0
-4.01	6.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	80.4	49.1	31.3	16.6	2046.5	3.1	0.0	2	1
-4.11	7.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	82.4	50.1	32.3	17.1	2113.3	6.4	0.0	4	3
-4.21	7.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	84.4	51.1	33.3	17.7	2180.0	9.7	0.0	6	4
-4.31	7.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	86.4	52.1	34.3	18.2	2246.7	13.1	0.0	8	5
-4.41	7.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	88.4	53.1	35.3	18.8	2313.5	16.7	0.0	10	7

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Calculations for
Bearing capacity - TC2

Job No:			
Calculated by	CM	Date	11/12/24
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RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	φ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α' _v kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-4.51	7.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	90.4	54.1	36.3	19.3	2380.2	20.3	0.0	0.0	12	8			
-4.61	7.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	92.4	55.0	37.4	19.9	2446.9	24.1	0.0	0.0	14	10			
-4.71	7.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	94.4	56.0	38.4	20.4	2513.6	27.9	0.0	0.0	17	12			
-4.81	7.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	96.4	57.0	39.4	21.0	2580.4	31.9	0.0	0.0	19	13			
-4.91	7.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	98.4	58.0	40.4	21.5	2647.1	35.9	0.0	0.0	21	15			
-5.01	7.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	100.4	59.0	41.4	22.1	2713.8	40.1	0.0	0.0	24	17			
-5.11	8.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	102.4	59.9	42.5	22.6	2780.6	44.4	0.0	0.0	26	18			
-5.21	8.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	104.4	60.9	43.5	23.2	2847.3	48.7	805.1	805.1	41	20			
-5.31	8.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	106.4	61.9	44.5	23.7	2914.0	53.2	823.9	823.9	44	22			
-5.41	8.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	108.4	62.9	45.5	24.3	2980.8	57.8	842.8	842.8	48	24			
-5.51	8.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	110.4	63.9	46.5	24.8	3047.5	62.5	861.7	861.7	52	26			
-5.61	8.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	112.4	64.8	47.6	25.4	3114.2	67.3	880.5	880.5	56	28			
-5.71	8.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	114.4	65.8	48.6	25.9	3180.9	72.1	899.4	899.4	60	30			
-5.81	8.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	116.4	66.8	49.6	26.5	3247.7	77.1	918.3	918.3	64	32			
-5.91	8.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	118.4	67.8	50.6	27.0	3314.4	82.2	937.1	937.1	69	34			
-6.01	8.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	120.4	68.8	51.6	27.6	3381.1	87.4	956.0	956.0	73	36			
-6.11	9.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	122.4	69.7	52.7	28.1	3447.9	92.7	974.9	974.9	77	39			
-6.21	9.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	124.4	70.7	53.7	28.7	3514.6	98.1	993.7	993.7	82	41			
-6.31	9.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	126.4	71.7	54.7	29.2	3581.3	103.7	1012.6	1012.6	86	43			
-6.41	9.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	128.4	72.7	55.7	29.8	3648.0	109.3	1031.5	1031.5	91	46			
-6.51	9.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	130.4	73.7	56.7	30.3	3714.8	115.0	1050.3	1050.3	96	48			
-6.61	9.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	132.4	74.7	57.7	30.9	3781.5	120.8	1069.2	1069.2	101	50			
-6.71	9.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	134.4	75.6	58.8	31.4	3848.2	126.7	1088.1	1088.1	106	53			
-6.81	9.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	136.4	76.6	59.8	32.0	3915.0	132.8	1106.9	1106.9	111	55			
-6.91	9.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	138.4	77.6	60.8	32.5	3981.7	138.9	1125.8	1125.8	116	58			
-7.01	9.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	140.4	78.6	61.8	33.1	4048.4	145.1	1144.7	1144.7	121	60			
-7.11	10.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	142.4	79.6	62.8	33.6	4115.2	151.5	1163.5	1163.5	126	63			
-7.21	10.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	144.4	80.5	63.9	34.2	4181.9	157.9	1182.4	1182.4	132	66			
-7.31	10.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	146.4	81.5	64.9	34.7	4248.6	164.5	1201.3	1201.3	137	69			
-7.41	10.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	148.4	82.5	65.9	35.3	4315.3	171.1	1220.1	1220.1	143	71			
-7.51	10.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	150.4	83.5	66.9	35.8	4382.1	177.9	1239.0	1239.0	148	74			
-7.61	10.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	152.4	84.5	67.9	36.4	4448.8	184.7	1257.9	1257.9	154	77			
-7.71	10.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	154.4	85.4	69.0	36.9	4515.5	191.7	1276.7	1276.7	160	80			
-7.81	10.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	156.4	86.4	70.0	37.5	4582.3	198.8	1295.6	1295.6	166	83			
-7.91	10.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	158.4	87.4	71.0	38.0	4649.0	205.9	1314.5	1314.5	172	86			
-8.01	10.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	160.4	88.4	72.0	38.6	4715.7	213.2	1333.3	1333.3	178	89			
-8.11	11.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	162.4	89.4	73.0	39.1	4782.4	220.6	1352.2	1352.2	184	92			
-8.21	11.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	164.4	90.4	74.0	39.7	4849.2	228.0	1371.1	1371.1	190	95			
-8.31	11.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	166.4	91.3	75.1	40.2	4915.9	235.6	1389.9	1389.9	196	98			
-8.41	11.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	168.4	92.3	76.1	40.8	4982.6	243.3	1408.8	1408.8	203	101			
-8.51	11.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	170.4	93.3	77.1	41.3	5049.4	251.1	1427.7	1427.7	209	105			
-8.61	11.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	172.4	94.3	78.1	41.9	5116.1	259.0	1446.5	1446.5	216	108			
-8.71	11.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	174.4	95.3	79.1	42.4	5182.8	267.0	1465.4	1465.4	223	111			
-8.81	11.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	176.4	96.2	80.2	43.0	5249.6	275.1	1484.3	1484.3	229	115			
-8.91	11.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	178.4	97.2	81.2	43.5	5316.3	283.3	1503.1	1503.1	236	118			
-9.01	11.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	180.4	98.2	82.2	44.1	5383.0	291.6	1522.0	1522.0	243	122			
-9.11	12.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	182.4	99.2	83.2	44.6	5449.7	300.0	1540.9	1540.9	250	125			
-9.21	12.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	184.4	100.2	84.2	45.2	5516.5	308.6	1559.7	1559.7	257	129			
-9.31	12.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	186.4	101.1	85.3	45.7	5583.2	317.2	1578.6	1578.6	264	132			
-9.41	12.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	188.4	102.1	86.3	46.3	5649.9	325.9	1597.5	1597.5	272	136			
-9.51	12.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	190.4	103.1	87.3	46.8	5716.7	334.7	1616.3	1616.3	279	139			
-9.61	12.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	192.4	104.1	88.3	47.4	5783.4	343.7	1635.2	1635.2	286	143			
-9.71	12.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	194.4	105.1	89.3	47.9	5850.1	352.7	1654.1	1654.1	294	147			
-9.81	12.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	196.4	106.0	90.4	48.5	5916.8	361.8	1672.9	1672.9	302	151			
-9.91	12.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	198.4	107.0	91.4	49.0	5983.6	371.1	1691.8	1691.8	309	155			

Project
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Calculations for
Bearing capacity - TC2

Job No:				Sheet Nr	
Calculated by	CM	Date	11/12/24		
Checked by	SS	Date	11/12/24	of	

RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	φ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α' _v kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-10.01	12.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	200.4	108.0	92.4	49.6	6050.3	380.4	1710.7	317	159				
-10.11	13.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	202.4	109.0	93.4	50.1	6117.0	389.9	1729.6	325	162				
-10.21	13.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	204.4	110.0	94.4	50.7	6183.8	399.4	1748.4	333	166				
-10.31	13.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	206.4	111.0	95.4	51.2	6250.5	409.1	1767.3	341	170				
-10.41	13.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	208.4	111.9	96.5	51.8	6317.2	418.8	1786.2	349	175				
-10.51	13.41	2	20.0	34.0	65.5	#N/A	0.80	#N/A	210.4	112.9	97.5	52.3	6384.0	428.7	1805.0	357	179				
-10.61	13.51	2	20.0	34.0	65.5	#N/A	0.80	#N/A	212.4	113.9	98.5	52.9	6450.7	438.7	1823.9	366	183				
-10.71	13.61	2	20.0	34.0	65.5	#N/A	0.80	#N/A	214.4	114.9	99.5	53.4	6517.4	448.7	1842.8	374	187				
-10.81	13.71	2	20.0	34.0	65.5	#N/A	0.80	#N/A	216.4	115.9	100.5	54.0	6584.1	458.9	1861.6	382	191				
-10.91	13.81	2	20.0	34.0	65.5	#N/A	0.80	#N/A	218.4	116.8	101.6	54.5	6650.9	469.2	1880.5	391	195				
-11.01	13.91	2	20.0	34.0	65.5	#N/A	0.80	#N/A	220.4	117.8	102.6	55.1	6717.6	479.6	1899.4	400	200				
-11.11	14.01	2	20.0	34.0	65.5	#N/A	0.80	#N/A	222.4	118.8	103.6	55.6	6784.3	490.1	1918.2	408	204				
-11.21	14.11	2	20.0	34.0	65.5	#N/A	0.80	#N/A	224.4	119.8	104.6	56.2	6851.1	500.6	1937.1	417	209				
-11.31	14.21	2	20.0	34.0	65.5	#N/A	0.80	#N/A	226.4	120.8	105.6	56.7	6917.8	511.3	1956.0	426	213				
-11.41	14.31	2	20.0	34.0	65.5	#N/A	0.80	#N/A	228.4	121.7	106.7	57.3	6984.5	522.1	1974.8	435	218				
-11.51	14.41	3	20.0	#N/A	#N/A	140.1	0.50	#N/A	230.4	122.7	107.7	70.0	1261.2	535.3	0.0	435	223				
-11.61	14.51	3	20.0	#N/A	#N/A	141.5	0.50	#N/A	232.4	123.7	108.7	70.4	1273.2	548.6	0.0	435	229				
-11.71	14.61	3	20.0	#N/A	#N/A	142.8	0.50	#N/A	234.4	124.7	109.7	71.1	1285.2	562.0	0.0	435	234				
-11.81	14.71	3	20.0	#N/A	#N/A	144.1	0.50	#N/A	236.4	125.7	110.7	71.7	1297.2	575.5	0.0	435	240				
-11.91	14.81	3	20.0	#N/A	#N/A	145.5	0.50	#N/A	238.4	126.6	111.8	72.4	1309.2	589.2	0.0	435	245				
-12.01	14.91	3	20.0	#N/A	#N/A	146.8	0.50	#N/A	240.4	127.6	112.8	73.1	1321.2	602.9	0.0	435	251				
-12.11	15.01	3	20.0	#N/A	#N/A	148.1	0.50	#N/A	242.4	128.6	113.8	73.7	1333.2	616.8	0.0	435	257				
-12.21	15.11	3	20.0	#N/A	#N/A	149.5	0.50	#N/A	244.4	129.6	114.8	74.4	1345.2	630.9	0.0	435	263				
-12.31	15.21	3	20.0	#N/A	#N/A	150.8	0.50	#N/A	246.4	130.6	115.8	75.1	1357.2	645.0	0.0	435	269				
-12.41	15.31	3	20.0	#N/A	#N/A	152.1	0.50	#N/A	248.4	131.6	116.8	75.7	1369.2	659.3	0.0	435	275				
-12.51	15.41	3	20.0	#N/A	#N/A	153.5	0.50	#N/A	250.4	132.5	117.9	76.4	1381.2	673.7	0.0	435	281				
-12.61	15.51	3	20.0	#N/A	#N/A	154.8	0.50	#N/A	252.4	133.5	118.9	77.1	1393.2	688.2	0.0	435	287				
-12.71	15.61	3	20.0	#N/A	#N/A	156.1	0.50	#N/A	254.4	134.5	119.9	77.7	1405.2	702.9	397.3	586	293				
-12.81	15.71	3	20.0	#N/A	#N/A	157.5	0.50	#N/A	256.4	135.5	120.9	78.4	1417.2	717.7	400.7	598	299				
-12.91	15.81	3	20.0	#N/A	#N/A	158.8	0.50	#N/A	258.4	136.5	121.9	79.1	1429.2	732.6	404.1	610	305				
-13.01	15.91	3	20.0	#N/A	#N/A	160.1	0.50	#N/A	260.4	137.4	123.0	79.7	1441.2	747.6	407.5	623	311				
-13.11	16.01	3	20.0	#N/A	#N/A	161.5	0.50	#N/A	262.4	138.4	124.0	80.4	1453.2	762.7	410.9	636	318				
-13.21	16.11	3	20.0	#N/A	#N/A	162.8	0.50	#N/A	264.4	139.4	125.0	81.1	1465.2	778.0	414.3	648	324				
-13.31	16.21	3	20.0	#N/A	#N/A	164.1	0.50	#N/A	266.4	140.4	126.0	81.7	1477.2	793.4	417.7	661	331				
-13.41	16.31	3	20.0	#N/A	#N/A	165.5	0.50	#N/A	268.4	141.4	127.0	82.4	1489.2	809.0	421.1	674	337				
-13.51	16.41	3	20.0	#N/A	#N/A	166.8	0.50	#N/A	270.4	142.3	128.1	83.1	1501.2	824.6	424.5	687	344				
-13.61	16.51	3	20.0	#N/A	#N/A	168.1	0.50	#N/A	272.4	143.3	129.1	83.7	1513.2	840.4	427.8	700	350				
-13.71	16.61	3	20.0	#N/A	#N/A	169.5	0.50	#N/A	274.4	144.3	130.1	84.4	1525.2	856.3	431.2	714	357				
-13.81	16.71	3	20.0	#N/A	#N/A	170.8	0.50	#N/A	276.4	145.3	131.1	85.1	1537.2	872.3	434.6	727	363				
-13.91	16.81	3	20.0	#N/A	#N/A	172.1	0.50	#N/A	278.4	146.3	132.1	85.7	1549.2	888.5	438.0	740	370				
-14.01	16.91	3	20.0	#N/A	#N/A	173.5	0.50	#N/A	280.4	147.2	133.2	86.4	1561.2	904.8	441.4	754	377				
-14.11	17.01	3	20.0	#N/A	#N/A	174.8	0.50	#N/A	282.4	148.2	134.2	87.1	1573.2	921.2	444.8	766	384				
-14.21	17.11	3	20.0	#N/A	#N/A	176.1	0.50	#N/A	284.4	149.2	135.2	87.7	1585.2	937.7	448.2	778	391				
-14.31	17.21	3	20.0	#N/A	#N/A	177.5	0.50	#N/A	286.4	150.2	136.2	88.4	1597.2	954.4	451.6	789	398				
-14.41	17.31	3	20.0	#N/A	#N/A	178.8	0.50	#N/A	288.4	151.2	137.2	89.1	1609.2	971.2	455.0	801	405				
-14.51	17.41	3	20.0	#N/A	#N/A	180.1	0.50	#N/A	290.4	152.2	138.2	89.7	1621.2	988.1	458.4	813	412				
-14.61	17.51	3	20.0	#N/A	#N/A	181.5	0.50	#N/A	292.4	153.1	139.3	90.4	1633.2	1005.1	461.8	825	419				
-14.71	17.61	3	20.0	#N/A	#N/A	182.8	0.50	#N/A	294.4	154.1	140.3	91.1	1645.2	1022.3	465.2	837	426				
-14.81	17.71	3	20.0	#N/A	#N/A	184.1	0.50	#N/A	296.4	155.1	141.3	91.7	1657.2	1039.6	468.6	848	433				
-14.91	17.81	3	20.0	#N/A	#N/A	185.5	0.50	#N/A	298.4	156.1	142.3	92.4	1669.2	1057.0	472.0	861	440				
-15.01	17.91	3	20.0	#N/A	#N/A	186.8	0.50	#N/A	300.4	157.1	143.3	93.1	1681.2	1074.6	475.3	873	448				
-15.11	18.01	3	20.0	#N/A	#N/A	188.1	0.50	#N/A	302.4	158.0	144.4	93.7	1693.2	1092.2	478.7	885	455				
-15.21	18.11	3	20.0	#N/A	#N/A	189.5	0.50	#N/A	304.4	159.0	145.4	94.4	1705.2	1110.0	482.1	897	463				
-15.31	18.21	3	20.0	#N/A	#N/A	190.8	0.50	#N/A	306.4	160.0	146.4	95.1	1717.2	1127.9	485.5	909	470				

Project
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Calculations for
Bearing capacity - TC2

Job No:		Date 11/12/24		Sheet Nr of
Calculated by CM	SS	Date	11/12/24	

RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	φ'	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-15.41	18.31	3	20.0	#N/A	#N/A	192.1	0.50	#N/A	308.4	161.0	147.4	95.7	1729.2	1146.0	488.9	922	477				
-15.51	18.41	3	20.0	#N/A	#N/A	193.5	0.50	#N/A	310.4	162.0	148.4	96.4	1741.2	1164.2	492.3	934	485				
-15.61	18.51	3	20.0	#N/A	#N/A	194.8	0.50	#N/A	312.4	162.9	149.5	97.1	1753.2	1182.5	495.7	947	493				
-15.71	18.61	3	20.0	#N/A	#N/A	196.1	0.50	#N/A	314.4	163.9	150.5	97.7	1765.2	1200.9	499.1	959	500				
-15.81	18.71	3	20.0	#N/A	#N/A	197.5	0.50	#N/A	316.4	164.9	151.5	98.4	1777.2	1219.4	502.5	972	508				
-15.91	18.81	3	20.0	#N/A	#N/A	198.8	0.50	#N/A	318.4	165.9	152.5	99.1	1789.2	1238.1	505.9	985	516				
-16.01	18.91	3	20.0	#N/A	#N/A	200.1	0.50	#N/A	320.4	166.9	153.5	99.7	1801.2	1256.9	509.3	998	524				
-16.11	19.01	3	20.0	#N/A	#N/A	201.5	0.50	#N/A	322.4	167.8	154.6	100.4	1813.2	1275.8	512.7	1011	532				
-16.21	19.11	3	20.0	#N/A	#N/A	202.8	0.50	#N/A	324.4	168.8	155.6	101.1	1825.2	1294.9	516.1	1024	540				
-16.31	19.21	3	20.0	#N/A	#N/A	204.1	0.50	#N/A	326.4	169.8	156.6	101.7	1837.2	1314.1	519.5	1037	548				
-16.41	19.31	3	20.0	#N/A	#N/A	205.5	0.50	#N/A	328.4	170.8	157.6	102.4	1849.2	1333.4	522.8	1050	556				
-16.51	19.41	3	20.0	#N/A	#N/A	206.8	0.50	#N/A	330.4	171.8	158.6	103.1	1861.2	1352.8	526.2	1063	564				
-16.61	19.51	3	20.0	#N/A	#N/A	208.1	0.50	#N/A	332.4	172.8	159.6	103.7	1873.2	1372.3	529.6	1076	572				
-16.71	19.61	3	20.0	#N/A	#N/A	209.5	0.50	#N/A	334.4	173.7	160.7	104.4	1885.2	1392.0	533.0	1090	580				
-16.81	19.71	3	20.0	#N/A	#N/A	210.8	0.50	#N/A	336.4	174.7	161.7	105.1	1897.2	1411.8	536.4	1103	588				
-16.91	19.81	3	20.0	#N/A	#N/A	212.1	0.50	#N/A	338.4	175.7	162.7	105.7	1909.2	1431.7	539.8	1117	597				
-17.01	19.91	3	20.0	#N/A	#N/A	213.5	0.50	#N/A	340.4	176.7	163.7	106.4	1921.2	1451.8	543.2	1130	605				
-17.11	20.01	3	20.0	#N/A	#N/A	214.8	0.50	#N/A	342.4	177.7	164.7	107.1	1933.2	1472.0	546.6	1144	613				
-17.21	20.11	3	20.0	#N/A	#N/A	216.1	0.50	#N/A	344.4	178.6	165.8	107.7	1945.2	1492.3	550.0	1158	622				
-17.31	20.21	3	20.0	#N/A	#N/A	217.5	0.50	#N/A	346.4	179.6	166.8	108.4	1957.2	1512.7	553.4	1172	630				
-17.41	20.31	3	20.0	#N/A	#N/A	218.8	0.50	#N/A	348.4	180.6	167.8	109.1	1969.2	1533.3	556.8	1186	639				
-17.51	20.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	350.4	181.6	168.8	118.3	4000.0	1555.6	0.0	1186	648				
-17.61	20.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	352.4	182.6	169.8	119.1	4000.0	1578.0	0.0	1186	658				
-17.71	20.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	354.4	183.5	170.9	119.8	4000.0	1600.6	0.0	1186	667				
-17.81	20.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	356.4	184.5	171.9	120.5	4000.0	1623.3	0.0	1186	676				
-17.91	20.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	358.4	185.5	172.9	121.2	4000.0	1646.2	0.0	1186	686				
-18.01	20.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	360.4	186.5	173.9	121.9	4000.0	1669.2	0.0	1186	695				
-18.11	21.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	362.4	187.5	174.9	122.6	4000.0	1692.3	0.0	1186	705				
-18.21	21.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	364.4	188.5	175.9	123.4	4000.0	1715.5	0.0	1186	715				
-18.31	21.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	366.4	189.4	177.0	124.1	4000.0	1738.9	0.0	1186	725				
-18.41	21.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	368.4	190.4	178.0	124.8	4000.0	1762.4	0.0	1186	734				
-18.51	21.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	370.4	191.4	179.0	125.5	4000.0	1786.1	0.0	1186	744				
-18.61	21.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	372.4	192.4	180.0	126.2	4000.0	1809.9	0.0	1186	754				
-18.71	21.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	374.4	193.4	181.0	126.9	4000.0	1833.8	1131.0	1528	764				
-18.81	21.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	376.4	194.3	182.1	127.7	4000.0	1857.9	1131.0	1548	774				
-18.91	21.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	378.4	195.3	183.1	128.4	4000.0	1882.1	1131.0	1568	784				
-19.01	21.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	380.4	196.3	184.1	129.1	4000.0	1906.4	1131.0	1589	794				
-19.11	22.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	382.4	197.3	185.1	129.8	4000.0	1930.9	1131.0	1609	805				
-19.21	22.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	384.4	198.3	186.1	130.5	4000.0	1955.5	1131.0	1630	815				
-19.31	22.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	386.4	199.2	187.2	131.2	4000.0	1980.2	1131.0	1650	825				
-19.41	22.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	388.4	200.2	188.2	132.0	4000.0	2005.1	1131.0	1671	835				
-19.51	22.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	390.4	201.2	189.2	132.7	4000.0	2030.1	1131.0	1692	846				
-19.61	22.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	392.4	202.2	190.2	133.4	4000.0	2055.3	1131.0	1713	856				
-19.71	22.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	394.4	203.2	191.2	134.1	4000.0	2080.5	1131.0	1734	867				
-19.81	22.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	396.4	204.1	192.3	134.8	4000.0	2105.9	1131.0	1755	877				
-19.91	22.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	398.4	205.1	193.3	135.5	4000.0	2131.5	1131.0	1776	888				
-20.01	22.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	400.4	206.1	194.3	136.3	4000.0	2157.2	1131.0	1798	899				
-20.11	23.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	402.4	207.1	195.3	137.0	4000.0	2183.0	1131.0	1819	910				
-20.21	23.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	404.4	208.1	196.3	137.7	4000.0	2209.0	1131.0	1841	920				
-20.31	23.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	406.4	209.1	197.3	138.4	4000.0	2235.0	1131.0	1863	931				
-20.41	23.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	408.4	210.0	198.4	139.1	4000.0	2261.3	1131.0	1884	942				
-20.51	23.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	410.4	211.0	199.4	139.8	4000.0	2287.6	1131.0	1906	953				
-20.61	23.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	412.4	212.0	200.4	140.6	4000.0	2314.1	1131.0	1928	964				
-20.71	23.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	414.4	213.0	201.4	141.3	4000.0	2340.8	1131.0	1948	975				

Project
Project Olympus



Calculations for
Bearing capacity - TC2

Job No:			
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RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	φ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)	Rb,k Base Capacity (kN)	Rcd DA1 - Comb 2 (kN)	Tension - Comb 2 (kN)
														600	600	600mm	600mm
-20.81	23.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	416.4	214.0	202.4	142.0	4000.0	2367.5	1131.0	1964	986
-20.91	23.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	418.4	214.9	203.5	142.7	4000.0	2394.4	1131.0	1980	998
-21.01	23.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	420.4	215.9	204.5	143.4	4000.0	2421.5	1131.0	1996	1009
-21.11	24.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	422.4	216.9	205.5	144.1	4000.0	2448.6	1131.0	2012	1020
-21.21	24.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	424.4	217.9	206.5	144.9	4000.0	2475.9	1131.0	2028	1032
-21.31	24.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	426.4	218.9	207.5	145.6	4000.0	2503.4	1131.0	2044	1043
-21.41	24.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	428.4	219.8	208.6	146.3	4000.0	2530.9	1131.0	2061	1055
-21.51	24.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	430.4	220.8	209.6	147.0	4000.0	2558.7	1131.0	2077	1066
-21.61	24.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	432.4	221.8	210.6	147.7	4000.0	2586.5	1131.0	2094	1078
-21.71	24.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	434.4	222.8	211.6	148.4	4000.0	2614.5	1131.0	2111	1089
-21.81	24.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	436.4	223.8	212.6	149.2	4000.0	2642.6	1131.0	2127	1101
-21.91	24.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	438.4	224.7	213.7	149.9	4000.0	2670.8	1131.0	2144	1113
-22.01	24.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	440.4	225.7	214.7	150.6	4000.0	2699.2	1131.0	2161	1125
-22.11	25.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	442.4	226.7	215.7	151.3	4000.0	2727.7	1131.0	2178	1137
-22.21	25.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	444.4	227.7	216.7	152.0	4000.0	2756.4	1131.0	2195	1149
-22.31	25.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	446.4	228.7	217.7	152.7	4000.0	2785.2	1131.0	2212	1160
-22.41	25.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	448.4	229.7	218.7	153.5	4000.0	2814.1	1131.0	2229	1173
-22.51	25.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	450.4	230.6	219.8	154.2	4000.0	2843.2	1131.0	2247	1185
-22.61	25.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	452.4	231.6	220.8	154.9	4000.0	2872.4	1131.0	2264	1197
-22.71	25.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	454.4	232.6	221.8	155.6	4000.0	2901.7	1131.0	2282	1209
-22.81	25.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	456.4	233.6	222.8	156.3	4000.0	2931.2	1131.0	2299	1221
-22.91	25.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	458.4	234.6	223.8	157.0	4000.0	2960.8	1131.0	2317	1234
-23.01	25.91	4	20.0	38.0	130.3	#N/A	0.90	#N/A	460.4	235.5	224.9	157.8	4000.0	2990.5	1131.0	2334	1246
-23.11	26.01	4	20.0	38.0	130.3	#N/A	0.90	#N/A	462.4	236.5	225.9	158.5	4000.0	3020.4	1131.0	2352	1258
-23.21	26.11	4	20.0	38.0	130.3	#N/A	0.90	#N/A	464.4	237.5	226.9	159.2	4000.0	3050.4	1131.0	2370	1271
-23.31	26.21	4	20.0	38.0	130.3	#N/A	0.90	#N/A	466.4	238.5	227.9	159.9	4000.0	3080.5	1131.0	2388	1284
-23.41	26.31	4	20.0	38.0	130.3	#N/A	0.90	#N/A	468.4	239.5	228.9	160.6	4000.0	3110.8	1131.0	2406	1296
-23.51	26.41	4	20.0	38.0	130.3	#N/A	0.90	#N/A	470.4	240.4	230.0	161.3	4000.0	3141.2	1131.0	2424	1309
-23.61	26.51	4	20.0	38.0	130.3	#N/A	0.90	#N/A	472.4	241.4	231.0	162.1	4000.0	3171.8	1131.0	2442	1322
-23.71	26.61	4	20.0	38.0	130.3	#N/A	0.90	#N/A	474.4	242.4	232.0	162.8	4000.0	3202.4	1131.0	2461	1334
-23.81	26.71	4	20.0	38.0	130.3	#N/A	0.90	#N/A	476.4	243.4	233.0	163.5	4000.0	3233.3	1131.0	2479	1347
-23.91	26.81	4	20.0	38.0	130.3	#N/A	0.90	#N/A	478.4	244.4	234.0	164.2	4000.0	3264.2	1131.0	2497	1360
-24.01	26.91	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	480.4	245.3	235.1	140.0	2700.0	3290.6	0.0	2497	1371
-24.11	27.01	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	482.4	246.3	236.1	140.0	2700.0	3317.0	0.0	2497	1382
-24.21	27.11	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	484.4	247.3	237.1	140.0	2700.0	3343.4	0.0	2497	1393
-24.31	27.21	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	486.4	248.3	238.1	140.0	2700.0	3369.8	0.0	2497	1404
-24.41	27.31	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	488.4	249.3	239.1	140.0	2700.0	3396.2	0.0	2497	1415
-24.51	27.41	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	490.4	250.3	240.1	140.0	2700.0	3422.6	0.0	2497	1426
-24.61	27.51	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	492.4	251.2	241.2	140.0	2700.0	3448.9	0.0	2497	1437
-24.71	27.61	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	494.4	252.2	242.2	140.0	2700.0	3475.3	0.0	2497	1448
-24.81	27.71	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	496.4	253.2	243.2	140.0	2700.0	3501.7	0.0	2497	1459
-24.91	27.81	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	498.4	254.2	244.2	140.0	2700.0	3528.1	0.0	2497	1470
-25.01	27.91	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	500.4	255.2	245.2	140.0	2700.0	3554.5	0.0	2497	1481
-25.11	28.01	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	502.4	256.1	246.3	140.0	2700.0	3580.9	0.0	2497	1492
-25.21	28.11	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	504.4	257.1	247.3	140.0	2700.0	3607.3	763.4	2521	1503
-25.31	28.21	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	506.4	258.1	248.3	140.0	2700.0	3633.7	763.4	2537	1514
-25.41	28.31	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	508.4	259.1	249.3	140.0	2700.0	3660.1	763.4	2553	1525
-25.51	28.41	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	510.4	260.1	250.3	140.0	2700.0	3686.4	763.4	2569	1536
-25.61	28.51	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	512.4	261.0	251.4	140.0	2700.0	3712.8	763.4	2584	1547
-25.71	28.61	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	514.4	262.0	252.4	140.0	2700.0	3739.2	763.4	2600	1558
-25.81	28.71	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	516.4	263.0	253.4	140.0	2700.0	3765.6	763.4	2616	1569
-25.91	28.81	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	518.4	264.0	254.4	140.0	2700.0	3792.0	763.4	2631	1580
-26.01	28.91	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	520.4	265.0	255.4	140.0	2700.0	3818.4	763.4	2647	1591
-26.11	29.01	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	522.4	265.9	256.5	140.0	2700.0	3844.8	763.4	2663	1602

Project
 Project Olympus
 Calculations for
 Bearing capacity - TC2



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 Checked by SS Date 11/12/24 of

RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
 Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m³	φ°	Nq	Cu kPa	α/K _v /β	N-value	α _v kPa	u kPa	α _v ' kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-26.21	29.11	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	524.4	266.9	257.5	140.0	2700.0	3871.2	763.4	2678	1613				
-26.31	29.21	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	526.4	267.9	258.5	140.0	2700.0	3897.6	763.4	2694	1624				
-26.41	29.31	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	528.4	268.9	259.5	140.0	2700.0	3923.9	763.4	2710	1635				
-26.51	29.41	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	530.4	269.9	260.5	140.0	2700.0	3950.3	763.4	2726	1646				
-26.61	29.51	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	532.4	270.9	261.5	140.0	2700.0	3976.7	763.4	2741	1657				
-26.71	29.61	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	534.4	271.8	262.6	140.0	2700.0	4003.1	763.4	2757	1668				
-26.81	29.71	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	536.4	272.8	263.6	140.0	2700.0	4029.5	763.4	2773	1679				
-26.91	29.81	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	538.4	273.8	264.6	140.0	2700.0	4055.9	763.4	2788	1690				
-27.01	29.91	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	540.4	274.8	265.6	140.0	2700.0	4082.3	763.4	2804	1701				
-27.11	30.01	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	542.4	275.8	266.6	140.0	2700.0	4108.7	763.4	2820	1712				
-27.21	30.11	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	544.4	276.7	267.7	140.0	2700.0	4135.1	763.4	2836	1723				
-27.31	30.21	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	546.4	277.7	268.7	140.0	2700.0	4161.5	763.4	2851	1734				
-27.41	30.31	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	548.4	278.7	269.7	140.0	2700.0	4187.8	763.4	2867	1745				
-27.51	30.41	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	550.4	279.7	270.7	140.0	2700.0	4214.2	763.4	2883	1756				
-27.61	30.51	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	552.4	280.7	271.7	140.0	2700.0	4240.6	763.4	2898	1767				
-27.71	30.61	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	554.4	281.6	272.8	140.0	2700.0	4267.0	763.4	2914	1778				
-27.81	30.71	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	556.4	282.6	273.8	140.0	2700.0	4293.4	763.4	2930	1789				
-27.91	30.81	5	20.0	#N/A	#N/A	300.0	0.50	#N/A	558.4	283.6	274.8	140.0	2700.0	4319.8	763.4	2946	1800				
-28.01	30.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	560.4	284.6	275.8	193.6	15000.0	4356.3	0.0	2962	1815				
-28.11	31.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	562.4	285.6	276.8	194.3	15000.0	4392.9	0.0	2978	1830				
-28.21	31.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	564.4	286.6	277.8	195.0	15000.0	4429.7	0.0	2994	1846				
-28.31	31.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	566.4	287.5	278.9	195.7	15000.0	4466.6	0.0	3010	1861				
-28.41	31.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	568.4	288.5	279.9	196.4	15000.0	4503.6	0.0	3026	1876				
-28.51	31.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	570.4	289.5	280.9	197.2	15000.0	4540.8	0.0	3042	1892				
-28.61	31.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	572.4	290.5	281.9	197.9	15000.0	4578.1	0.0	3058	1908				
-28.71	31.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	574.4	291.5	282.9	198.6	15000.0	4615.5	0.0	3074	1923				
-28.81	31.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	576.4	292.4	284.0	199.3	15000.0	4653.1	0.0	3090	1939				
-28.91	31.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	578.4	293.4	285.0	200.0	15000.0	4690.8	0.0	3106	1954				
-29.01	31.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	580.4	294.4	286.0	200.0	15000.0	4728.5	0.0	3122	1970				
-29.11	32.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	582.4	295.4	287.0	200.0	15000.0	4766.2	0.0	3138	1986				
-29.21	32.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	584.4	296.4	288.0	200.0	15000.0	4803.9	4241.2	4003	2002				
-29.31	32.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	586.4	297.3	289.1	200.0	15000.0	4841.6	4241.2	4035	2017				
-29.41	32.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	588.4	298.3	290.1	200.0	15000.0	4879.2	4241.2	4066	2033				
-29.51	32.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	590.4	299.3	291.1	200.0	15000.0	4916.9	4241.2	4097	2049				
-29.61	32.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	592.4	300.3	292.1	200.0	15000.0	4954.6	4241.2	4129	2064				
-29.71	32.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	594.4	301.3	293.1	200.0	15000.0	4992.3	4241.2	4160	2080				
-29.81	32.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	596.4	302.2	294.2	200.0	15000.0	5030.0	4241.2	4192	2096				
-29.91	32.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	598.4	303.2	295.2	200.0	15000.0	5067.7	4241.2	4223	2112				
-30.01	32.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	600.4	304.2	296.2	200.0	15000.0	5105.4	4241.2	4255	2127				
-30.11	33.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	602.4	305.2	297.2	200.0	15000.0	5143.1	4241.2	4286	2143				
-30.21	33.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	604.4	306.2	298.2	200.0	15000.0	5180.8	4241.2	4317	2159				
-30.31	33.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	606.4	307.2	299.2	200.0	15000.0	5218.5	4241.2	4349	2174				
-30.41	33.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	608.4	308.1	300.3	200.0	15000.0	5256.2	4241.2	4380	2190				
-30.51	33.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	610.4	309.1	301.3	200.0	15000.0	5293.9	4241.2	4412	2206				
-30.61	33.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	612.4	310.1	302.3	200.0	15000.0	5331.6	4241.2	4443	2222				
-30.71	33.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	614.4	311.1	303.3	200.0	15000.0	5369.3	4241.2	4474	2237				
-30.81	33.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	616.4	312.1	304.3	200.0	15000.0	5407.0	4241.2	4506	2253				
-30.91	33.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	618.4	313.0	305.4	200.0	15000.0	5444.7	4241.2	4537	2269				
-31.01	33.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	620.4	314.0	306.4	200.0	15000.0	5482.4	4241.2	4569	2284				
-31.11	34.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	622.4	315.0	307.4	200.0	15000.0	5520.1	4241.2	4600	2300				
-31.21	34.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	624.4	316.0	308.4	200.0	15000.0	5557.8	4241.2	4632	2316				
-31.31	34.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	626.4	317.0	309.4	200.0	15000.0	5595.5	4241.2	4663	2331				
-31.41	34.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	628.4	317.9	310.5	200.0	15000.0	5633.2	4241.2	4694	2347				
-31.51	34.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	630.4	318.9	311.5	200.0	15000.0	5670.9	4241.2	4726	2363				

Project
Project Olympus



Calculations for
Bearing capacity - TC2

Job No:			
Calculated by	CM	Date	11/12/24
Checked by	SS	Date	11/12/24
			Sheet Nr of

RESULTS SUMMARY

Top 0.99 mOD Step 0.1 m
Bottom -35 mOD

Level m	Bore m	Soil	γ kN/m ³	φ°	Nq	Cu kPa	α/K _v /β	N-value	σ _v kPa	u kPa	σ' _v kPa	q _s kPa	q _b kPa	Rs,k Shaft Capacity (kN)		Rb,k Base Capacity (kN)		Rcd DA1 - Comb 2 (kN)		Tension - Comb 2 (kN)	
														600	600	600mm	600mm	600mm	600mm		
-31.61	34.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	632.4	319.9	312.5	200.0	15000.0	5708.6	4241.2	4757	2379				
-31.71	34.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	634.4	320.9	313.5	200.0	15000.0	5746.3	4241.2	4789	2394				
-31.81	34.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	636.4	321.9	314.5	200.0	15000.0	5784.0	4241.2	4820	2410				
-31.91	34.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	638.4	322.8	315.6	200.0	15000.0	5821.7	4241.2	4851	2426				
-32.01	34.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	640.4	323.8	316.6	200.0	15000.0	5859.4	4241.2	4883	2441				
-32.11	35.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	642.4	324.8	317.6	200.0	15000.0	5897.1	4241.2	4914	2457				
-32.21	35.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	644.4	325.8	318.6	200.0	15000.0	5934.8	4241.2	4946	2473				
-32.31	35.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	646.4	326.8	319.6	200.0	15000.0	5972.5	4241.2	4977	2489				
-32.41	35.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	648.4	327.8	320.6	200.0	15000.0	6010.2	4241.2	5009	2504				
-32.51	35.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	650.4	328.7	321.7	200.0	15000.0	6047.9	4241.2	5040	2520				
-32.61	35.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	652.4	329.7	322.7	200.0	15000.0	6085.6	4241.2	5071	2536				
-32.71	35.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	654.4	330.7	323.7	200.0	15000.0	6123.3	4241.2	5103	2551				
-32.81	35.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	656.4	331.7	324.7	200.0	15000.0	6161.0	4241.2	5134	2567				
-32.91	35.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	658.4	332.7	325.7	200.0	15000.0	6198.7	4241.2	5166	2583				
-33.01	35.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	660.4	333.6	326.8	200.0	15000.0	6236.4	4241.2	5197	2599				
-33.11	36.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	662.4	334.6	327.8	200.0	15000.0	6274.1	4241.2	5228	2614				
-33.21	36.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	664.4	335.6	328.8	200.0	15000.0	6311.8	4241.2	5260	2630				
-33.31	36.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	666.4	336.6	329.8	200.0	15000.0	6349.5	4241.2	5291	2646				
-33.41	36.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	668.4	337.6	330.8	200.0	15000.0	6387.2	4241.2	5323	2661				
-33.51	36.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	670.4	338.5	331.9	200.0	15000.0	6424.9	4241.2	5354	2677				
-33.61	36.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	672.4	339.5	332.9	200.0	15000.0	6462.6	4241.2	5386	2693				
-33.71	36.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	674.4	340.5	333.9	200.0	15000.0	6500.3	4241.2	5417	2708				
-33.81	36.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	676.4	341.5	334.9	200.0	15000.0	6538.0	4241.2	5448	2724				
-33.91	36.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	678.4	342.5	335.9	200.0	15000.0	6575.7	4241.2	5480	2740				
-34.01	36.91	6	20.0	38.0	130.3	#N/A	0.90	#N/A	680.4	343.4	337.0	200.0	15000.0	6613.4	4241.2	5511	2756				
-34.11	37.01	6	20.0	38.0	130.3	#N/A	0.90	#N/A	682.4	344.4	338.0	200.0	15000.0	6651.1	4241.2	5543	2771				
-34.21	37.11	6	20.0	38.0	130.3	#N/A	0.90	#N/A	684.4	345.4	339.0	200.0	15000.0	6688.8	4241.2	5574	2787				
-34.31	37.21	6	20.0	38.0	130.3	#N/A	0.90	#N/A	686.4	346.4	340.0	200.0	15000.0	6726.5	4241.2	5605	2803				
-34.41	37.31	6	20.0	38.0	130.3	#N/A	0.90	#N/A	688.4	347.4	341.0	200.0	15000.0	6764.2	4241.2	5637	2818				
-34.51	37.41	6	20.0	38.0	130.3	#N/A	0.90	#N/A	690.4	348.4	342.0	200.0	15000.0	6801.9	4241.2	5668	2834				
-34.61	37.51	6	20.0	38.0	130.3	#N/A	0.90	#N/A	692.4	349.3	343.1	200.0	15000.0	6839.6	4241.2	5700	2850				
-34.71	37.61	6	20.0	38.0	130.3	#N/A	0.90	#N/A	694.4	350.3	344.1	200.0	15000.0	6877.3	4241.2	5731	2866				
-34.81	37.71	6	20.0	38.0	130.3	#N/A	0.90	#N/A	696.4	351.3	345.1	200.0	15000.0	6915.0	4241.2	5763	2881				
-34.91	37.81	6	20.0	38.0	130.3	#N/A	0.90	#N/A	698.4	352.3	346.1	200.0	15000.0	6952.7	4241.2	5794	2897				

Appendix D Single Pile Analyses

HORIZONTAL and MOMENT LOADS/RESTRAINTS

Load no.	Elevation	Horizontal load kN	Moment load kN.m	Moment restraint kN.m/rad	Partial factor (Category)	Load Orientation (degrees)
1	1.44	27.70	0	62000	1.00 (P/U)	0
2	1.44	69.00	0	62000	1.10 (Var)	0

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply load no.1 at elevation 1.44
2	Apply load no.2 at elevation 1.44

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: ULS DA1 Combination 1
Water pressures : Moderately Conservative
Partial factor on C' = 1.000
Partial factor on Phi' = 1.000
Partial factor on Cu = 1.000
Partial factor on Soil Modulus = 1.000
Partial factor on Permanent Unfavourable loads = 1.000
Partial factor on Permanent Favourable loads = 1.000
Partial factor on Variable Unfavourable loads = 1.100
Design factor on calculated Bending Moments = 1.350

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

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients

OUTPUT OPTIONS

Stage no.	Stage description	Displacement	Active, Graph.	Passive output	pressures
1	Apply load no.1 at elev. 1.44	Yes	Yes	Yes	Yes
2	Apply load no.2 at elev. 1.44	Yes	Yes	Yes	Yes
*	Summary output	Yes	-	-	Yes

KELTBRAY PILING
 Program: WALLAP Version 6.07 Revision A55.B74.R58
 Licensed from GEOSOLVE
 Data filename/Run ID: TC1_ULS1
 Soil properties file: Soil_Model.dat
 Project Olympus
 TC1

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

Units: kN,m

Stage No. 1 Apply load no.1 at elevation 1.44

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 1

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

<u>Node no.</u>	<u>Y coord</u>	<u>Nett pressure</u> kN/m2	<u>Pile disp.</u> m	<u>Pile rotation</u> rad.	<u>Shear force</u> kN	<u>Bending moment</u> kN.m	<u>Prop forces</u> kN	<u>Applied moments</u> kN.m
1	1.44	0.00	0.001	3.31E-04	27.7	-20.5	27.7	-20.5
2	1.00	-16.10	0.001	3.61E-04	25.6	-8.4		
3	0.00	-14.93	0.001	3.52E-04	16.3	12.0		
		-21.13	0.001	3.52E-04	16.3	12.0		
4	-1.60	-12.44	0.000	2.21E-04	0.2	22.8		
5	-2.80	-3.36	0.000	1.07E-04	-5.5	17.6		
6	-4.00	0.28	-0.000	3.03E-05	-6.6	9.5		
		1.68	-0.000	3.03E-05	-6.6	9.5		
7	-5.20	5.05	-0.000	-3.05E-06	-4.2	2.3		
8	-6.40	2.81	-0.000	-7.86E-06	-1.4	-0.6		
9	-8.00	0.37	-0.000	-3.16E-06	0.1	-0.7		
10	-9.60	-0.21	0.000	-7.28E-08	0.2	-0.2		
11	-10.55	-0.16	0.000	3.27E-07	0.1	-0.0		
12	-11.50	-0.07	0.000	2.82E-07	0.0	0.0		
		-0.11	0.000	2.82E-07	0.0	0.0		
13	-12.95	-0.00	0.000	7.58E-08	-0.0	0.0		
14	-14.40	0.01	-0.000	-8.54E-09	-0.0	0.0		
15	-15.95	0.00	-0.000	-9.29E-09	-0.0	-0.0		
16	-17.50	-0.00	0.000	-9.61E-10	0.0	-0.0		
17	-18.35	-0.00	0.000	3.26E-10	0.0	-0.0		
18	-19.20	-0.00	0.000	5.90E-10	0.0	0.0		
19	-20.80	-0.00	0.000	3.00E-10	-0.0	0.0		
20	-22.40	0.00	-0.000	2.87E-11	-0.0	0.0		
21	-23.70	0.00	-0.000	-2.47E-11	-0.0	0.0		
22	-25.00	0.00	-0.000	-1.77E-11	-0.0	-0.0		
23	-26.50	-0.00	0.000	-3.03E-12	0.0	-0.0		
24	-28.00	-0.00	0.000	1.04E-12	0.0	-0.0		
25	-29.30	-0.00	0.000	1.21E-12	0.0	-0.0		

LEFT side

<u>Node no.</u>	<u>Y coord</u>	<u>Effective stresses</u>					<u>Total earth pressure</u> kN/m2	<u>Coeff. of subgrade reaction</u> kN/m3
		<u>Water press.</u> kN/m2	<u>Vertic -al</u> kN/m2	<u>Active limit</u> kN/m2	<u>Passive limit</u> kN/m2	<u>Earth pressure</u> kN/m2		
1	1.44	0.00	0.00	0.00	0.00	0.00	0.00	11433
2	1.00	0.00	7.04	0.00	68.70	0.00	0.00a	11433
3	0.00	10.00	13.04	0.00	127.25	0.00	10.00a	11433
		10.00	13.04	0.00	146.68	0.00	10.00a	23396
4	-1.60	26.00	22.64	0.00	175.48	0.57	26.57	23396
5	-2.80	38.00	29.84	0.00	197.09	7.27	45.27	23396
6	-4.00	50.00	37.04	0.00	218.69	11.25	61.25	22591
		50.00	37.04	0.00	689.38	17.18	67.18	136993

(continued)

Stage No.1 Apply load no.1 at elevation 1.44

LEFT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
7	-5.20	62.00	49.04	0.00	912.72	24.15	86.15	136993
8	-6.40	74.00	61.04	0.00	1136.07	28.32	102.32	136993
9	-8.00	90.00	77.04	0.00	1433.85	34.16	124.16	136993
10	-9.60	106.00	93.04	0.00	1731.64	40.93	146.93	142500
11	-10.55	115.50	102.54	0.00	1908.46	45.14	160.64	142500
12	-11.50	125.00	112.04	0.00	2085.27	49.37	174.37	142500
		125.00	112.04	0.00	1339.98	111.98	236.98	217823
13	-12.95	139.50	126.54	0.00	1521.76	126.54	266.04	247828
14	-14.40	154.00	141.04	0.00	1703.54	141.05	295.05	286730
15	-15.95	169.50	156.54	0.00	1897.86	156.54	326.04	319832
16	-17.50	185.00	172.04	0.00	2092.17	172.04	357.04	330172
		185.00	172.04	0.00	4359.20	66.06	251.06	136551
17	-18.35	193.50	180.54	0.00	4574.58	69.33	262.83	136551
18	-19.20	202.00	189.04	0.00	4789.95	72.59	274.59	136551
19	-20.80	218.00	205.04	0.00	5195.36	78.74	296.74	136551
20	-22.40	234.00	221.04	0.00	5600.78	84.88	318.88	137540
21	-23.70	247.00	234.04	0.00	5930.17	89.87	336.87	137540
22	-25.00	260.00	247.04	0.00	6259.57	94.86	354.86	137540
		260.00	247.04	0.00	2280.45	247.04	507.04	264077
23	-26.50	275.00	262.04	0.00	2418.92	262.04	537.04	261566
24	-28.00	290.00	277.04	0.00	2557.39	277.04	567.04	261566
		290.00	277.04	0.00	7019.72	106.38	396.38	136232
25	-29.30	303.00	290.04	0.00	7349.12	111.38	414.38	136232

RIGHT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	1.44	0.00	0.00	0.00	0.00	0.00	0.00	11433
2	1.00	0.00	7.04	0.00	68.70	16.10	16.10	11433
3	0.00	10.00	13.04	0.00	127.25	14.93	24.93	11433
		10.00	13.04	0.00	146.68	21.13	31.13	23396
4	-1.60	26.00	22.64	0.00	175.48	13.01	39.01	23396
5	-2.80	38.00	29.84	0.00	197.09	10.63	48.63	23396
6	-4.00	50.00	37.04	0.00	218.69	10.97	60.97	22591
		50.00	37.04	0.00	689.38	15.49	65.49	136993
7	-5.20	62.00	49.04	0.00	912.72	19.10	81.10	136993
8	-6.40	74.00	61.04	0.00	1136.07	25.51	99.51	136993
9	-8.00	90.00	77.04	0.00	1433.85	33.79	123.79	136993
10	-9.60	106.00	93.04	0.00	1731.64	41.14	147.14	142500
11	-10.55	115.50	102.54	0.00	1908.46	45.30	160.80	142500
12	-11.50	125.00	112.04	0.00	2085.27	49.45	174.45	142500
		125.00	112.04	0.00	1339.98	112.10	237.10	217823
13	-12.95	139.50	126.54	0.00	1521.76	126.54	266.04	247828
14	-14.40	154.00	141.04	0.00	1703.54	141.03	295.03	286730
15	-15.95	169.50	156.54	0.00	1897.86	156.54	326.04	319832
16	-17.50	185.00	172.04	0.00	2092.17	172.04	357.04	330172
		185.00	172.04	0.00	4359.20	66.06	251.06	136551
17	-18.35	193.50	180.54	0.00	4574.58	69.33	262.83	136551
18	-19.20	202.00	189.04	0.00	4789.95	72.59	274.59	136551
19	-20.80	218.00	205.04	0.00	5195.36	78.74	296.74	136551
20	-22.40	234.00	221.04	0.00	5600.78	84.88	318.88	137540
21	-23.70	247.00	234.04	0.00	5930.17	89.87	336.87	137540

Run ID. TC1_ULS1
 Project Olympus
 TC1

Sheet No.
 Date: 7-03-2025
 Checked :

(continued)

Stage No.1 Apply load no.1 at elevation 1.44

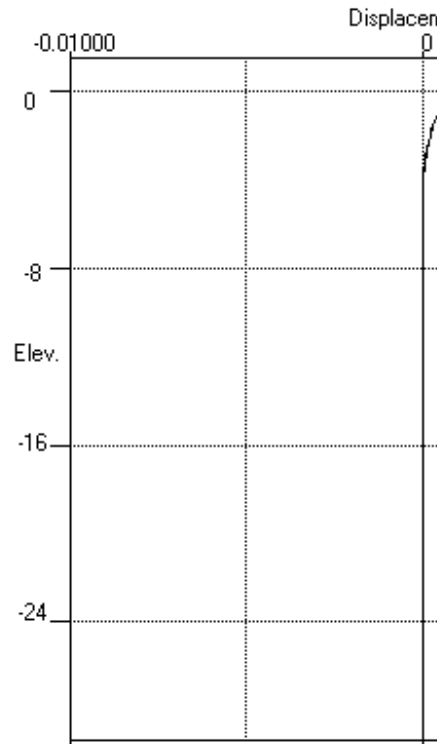
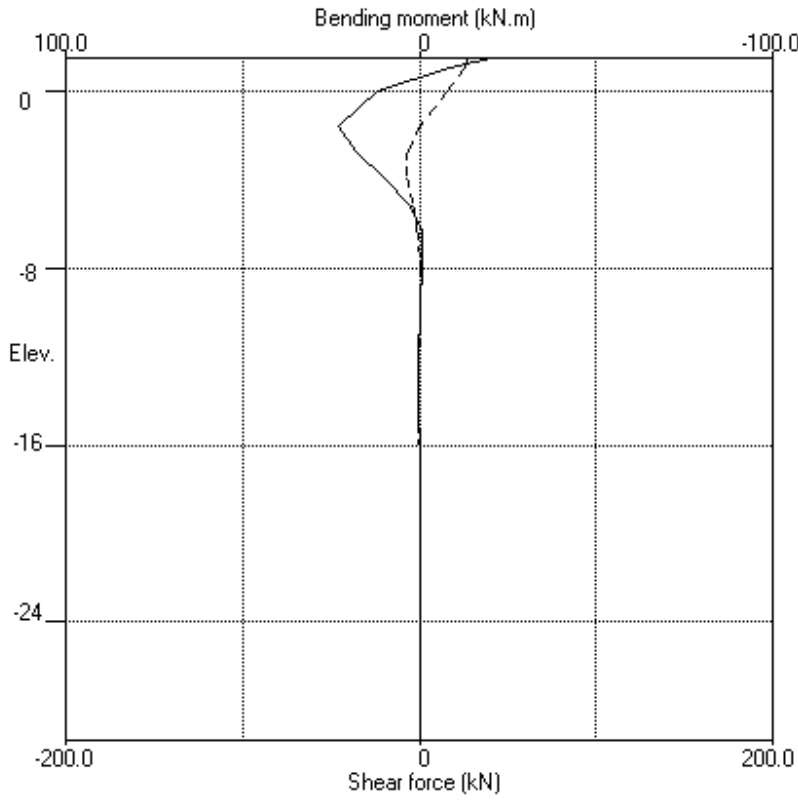
<u>Node no.</u>	<u>Y coord</u>	<u>RIGHT side</u>					<u>Total earth pressure</u>	<u>Coeff. of subgrade reaction</u>
		<u>Water press.</u>	<u>Vertic -al</u>	<u>Effective stresses</u>		<u>Earth pressure</u>		
		<u>kN/m²</u>	<u>kN/m²</u>	<u>Active limit</u>	<u>Passive limit</u>	<u>kN/m²</u>	<u>kN/m³</u>	
22	-25.00	260.00	247.04	0.00	6259.57	94.86	354.86	137540
		260.00	247.04	0.00	2280.45	247.04	507.04	264077
23	-26.50	275.00	262.04	0.00	2418.92	262.04	537.04	261566
24	-28.00	290.00	277.04	0.00	2557.39	277.04	567.04	261566
		290.00	277.04	0.00	7019.72	106.38	396.38	136232
25	-29.30	303.00	290.04	0.00	7349.12	111.38	414.38	136232

Note: 10.00 a Soil pressure at active limit
 123.45 p Soil pressure at passive limit

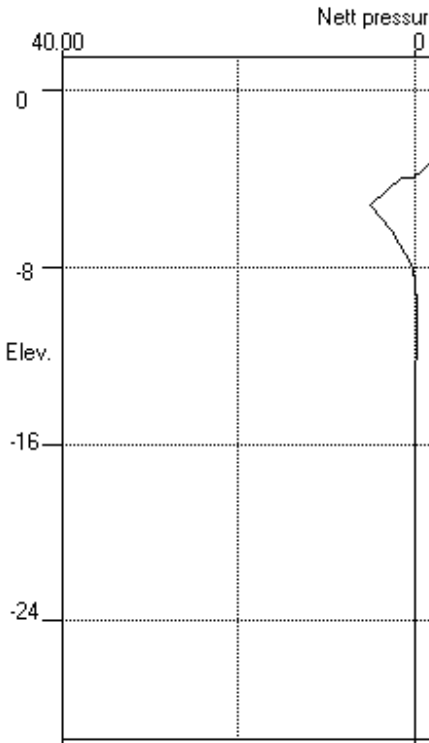
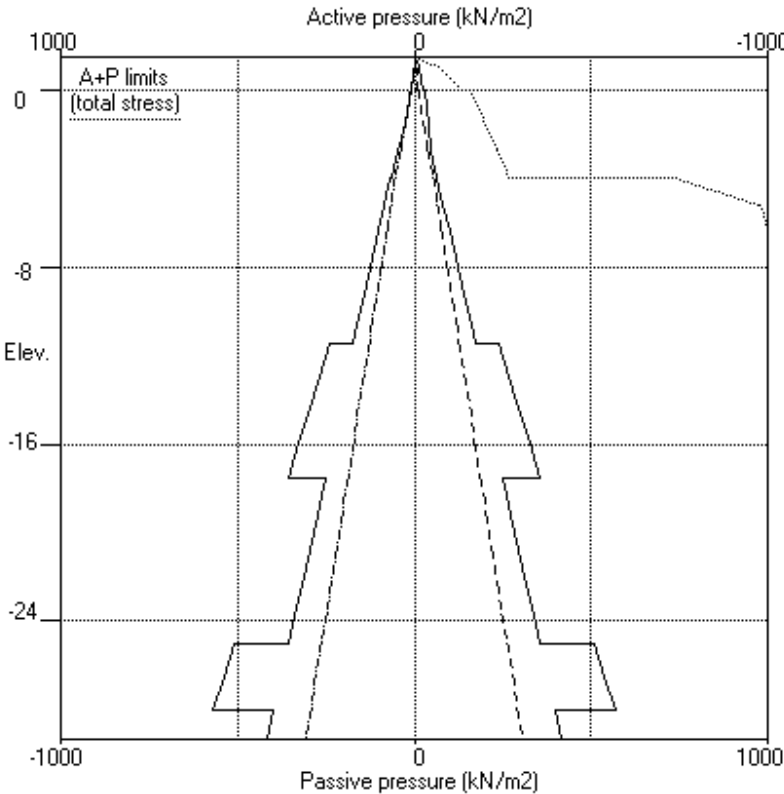
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Soil properties file: Soil_Model.dat
Project Olympus
TC1

Sheet No.
Job No. BE0046
Made by : CM
Date: 7-03-2025
Checked :

Stage No.1 Apply load no.1 at elev. 1.44



Stage No.1 Apply load no.1 at elev. 1.44



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 Soil properties file: Soil_Model.dat
 Project Olympus
 TC1

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

Units: kN,m

Stage No. 2 Apply load no.2 at elevation 1.44

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 1

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

<u>Node no.</u>	<u>Y coord</u>	<u>Nett pressure</u> kN/m2	<u>Pile disp.</u> m	<u>Pile rotation</u> rad.	<u>Shear force</u> kN	<u>Bending moment</u> kN.m	<u>Prop forces</u> kN	<u>Applied moments</u> kN.m
1	1.44	0.00	0.005	1.33E-03	103.6	-82.7	103.6	-82.7
2	1.00	-58.36	0.005	1.45E-03	95.9	-37.2		
3	0.00	-44.61	0.003	1.45E-03	65.0	40.9		
		-82.05	0.003	1.45E-03	65.0	40.9		
4	-1.60	-38.92	0.001	9.85E-04	6.9	82.7		
5	-2.80	-20.00	0.000	5.44E-04	-14.3	73.3		
6	-4.00	-2.10	0.000	2.00E-04	-22.2	48.5		
		-12.80	0.000	2.00E-04	-22.2	48.5		
7	-5.20	18.35	-0.000	1.75E-05	-20.2	16.3		
8	-6.40	14.02	-0.000	-2.85E-05	-8.6	-0.0		
9	-8.00	3.19	-0.000	-1.73E-05	-0.3	-3.0		
10	-9.60	-0.56	0.000	-2.23E-06	0.9	-1.0		
11	-10.55	-0.68	0.000	7.23E-07	0.6	-0.3		
12	-11.50	-0.39	0.000	1.17E-06	0.3	0.1		
		-0.61	0.000	1.17E-06	0.3	0.1		
13	-12.95	-0.10	0.000	4.86E-07	-0.0	0.1		
14	-14.40	0.05	-0.000	1.46E-08	-0.0	0.0		
15	-15.95	0.02	-0.000	-4.43E-08	-0.0	-0.0		
16	-17.50	-0.00	0.000	-9.34E-09	0.0	-0.0		
17	-18.35	-0.00	0.000	-1.06E-09	0.0	-0.0		
18	-19.20	-0.00	0.000	1.82E-09	0.0	-0.0		
19	-20.80	-0.00	0.000	1.68E-09	0.0	0.0		
20	-22.40	0.00	-0.000	3.42E-10	-0.0	0.0		
21	-23.70	0.00	-0.000	-5.79E-11	-0.0	0.0		
22	-25.00	0.00	-0.000	-8.74E-11	-0.0	-0.0		
23	-26.50	0.00	-0.000	-2.35E-11	0.0	-0.0		
24	-28.00	-0.00	0.000	2.15E-12	0.0	-0.0		
25	-29.30	-0.00	0.000	4.31E-12	0.0	-0.0		

LEFT side

<u>Node no.</u>	<u>Y coord</u>	<u>Effective stresses</u>					<u>Total earth pressure</u> kN/m2	<u>Coeff. of subgrade reaction</u> kN/m3
		<u>Water press.</u> kN/m2	<u>Vertic -al</u> kN/m2	<u>Active limit</u> kN/m2	<u>Passive limit</u> kN/m2	<u>Earth pressure</u> kN/m2		
1	1.44	0.00	0.00	0.00	0.00	0.00	11219	
2	1.00	0.00	7.04	0.00	68.70	0.00a	11219	
3	0.00	10.00	13.04	0.00	127.25	10.00a	11219	
		10.00	13.04	0.00	146.68	0.00	23027	
4	-1.60	26.00	22.64	0.00	175.48	26.00a	23027	
5	-2.80	38.00	29.84	0.00	197.09	38.00a	23027	
6	-4.00	50.00	37.04	0.00	218.69	60.06	23027	
		50.00	37.04	0.00	689.38	9.94	140240	

(continued)

Stage No.2 Apply load no.2 at elevation 1.44

LEFT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
7	-5.20	62.00	49.04	0.00	912.72	30.80	92.80	136294
8	-6.40	74.00	61.04	0.00	1136.07	33.93	107.93	136294
9	-8.00	90.00	77.04	0.00	1433.85	35.57	125.57	136294
10	-9.60	106.00	93.04	0.00	1731.64	40.75	146.75	137116
11	-10.55	115.50	102.54	0.00	1908.46	44.88	160.38	137116
12	-11.50	125.00	112.04	0.00	2085.27	49.21	174.21	137116
		125.00	112.04	0.00	1339.98	111.74	236.74	210997
13	-12.95	139.50	126.54	0.00	1521.76	126.49	265.99	240062
14	-14.40	154.00	141.04	0.00	1703.54	141.06	295.06	282269
15	-15.95	169.50	156.54	0.00	1897.86	156.55	326.05	314856
16	-17.50	185.00	172.04	0.00	2092.17	172.04	357.04	328521
		185.00	172.04	0.00	4359.20	66.06	251.06	135691
17	-18.35	193.50	180.54	0.00	4574.58	69.33	262.83	135691
18	-19.20	202.00	189.04	0.00	4789.95	72.59	274.59	135691
19	-20.80	218.00	205.04	0.00	5195.36	78.74	296.74	135691
20	-22.40	234.00	221.04	0.00	5600.78	84.88	318.88	141390
21	-23.70	247.00	234.04	0.00	5930.17	89.87	336.87	141390
22	-25.00	260.00	247.04	0.00	6259.57	94.86	354.86	141390
		260.00	247.04	0.00	2280.45	247.04	507.04	271470
23	-26.50	275.00	262.04	0.00	2418.92	262.04	537.04	271470
24	-28.00	290.00	277.04	0.00	2557.39	277.04	567.04	273018
		290.00	277.04	0.00	7019.72	106.38	396.38	142197
25	-29.30	303.00	290.04	0.00	7349.12	111.38	414.38	142197

RIGHT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	1.44	0.00	0.00	0.00	0.00	0.00	0.00	11219
2	1.00	0.00	7.04	0.00	68.70	58.36	58.36	11219
3	0.00	10.00	13.04	0.00	127.25	44.61	54.61	11219
		10.00	13.04	0.00	146.68	82.05	92.05	23027
4	-1.60	26.00	22.64	0.00	175.48	38.92	64.92	23027
5	-2.80	38.00	29.84	0.00	197.09	20.00	58.00	23027
6	-4.00	50.00	37.04	0.00	218.69	12.16	62.16	23027
		50.00	37.04	0.00	689.38	22.73	72.73	140240
7	-5.20	62.00	49.04	0.00	912.72	12.45	74.45	136294
8	-6.40	74.00	61.04	0.00	1136.07	19.91	93.91	136294
9	-8.00	90.00	77.04	0.00	1433.85	32.38	122.38	136294
10	-9.60	106.00	93.04	0.00	1731.64	41.31	147.31	137116
11	-10.55	115.50	102.54	0.00	1908.46	45.56	161.06	137116
12	-11.50	125.00	112.04	0.00	2085.27	49.61	174.61	137116
		125.00	112.04	0.00	1339.98	112.34	237.34	210997
13	-12.95	139.50	126.54	0.00	1521.76	126.59	266.09	240062
14	-14.40	154.00	141.04	0.00	1703.54	141.02	295.02	282269
15	-15.95	169.50	156.54	0.00	1897.86	156.53	326.03	314856
16	-17.50	185.00	172.04	0.00	2092.17	172.04	357.04	328521
		185.00	172.04	0.00	4359.20	66.06	251.06	135691
17	-18.35	193.50	180.54	0.00	4574.58	69.33	262.83	135691
18	-19.20	202.00	189.04	0.00	4789.95	72.59	274.59	135691
19	-20.80	218.00	205.04	0.00	5195.36	78.74	296.74	135691
20	-22.40	234.00	221.04	0.00	5600.78	84.88	318.88	141390
21	-23.70	247.00	234.04	0.00	5930.17	89.87	336.87	141390

Run ID. TC1_ULS1
 Project Olympus
 TC1

Sheet No.
 Date: 7-03-2025
 Checked :

(continued)

Stage No.2 Apply load no.2 at elevation 1.44

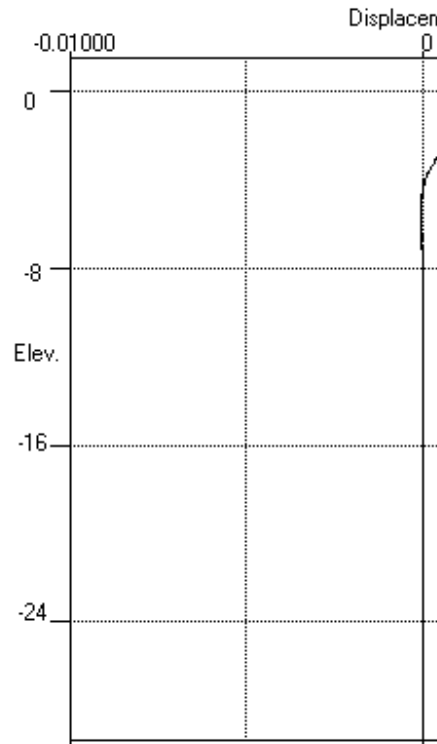
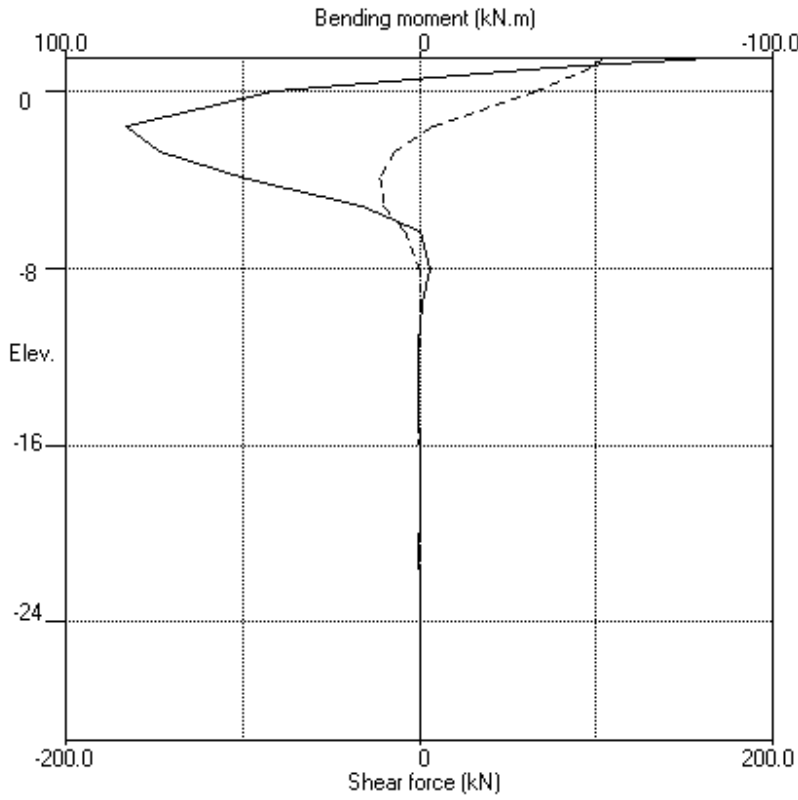
<u>Node no.</u>	<u>Y coord</u>	<u>RIGHT side</u>					<u>Total earth pressure</u>	<u>Coeff. of subgrade reaction</u>
		<u>Water press.</u>	<u>Vertic -al</u>	<u>Effective stresses</u>		<u>Earth pressure</u>		
		<u>kN/m2</u>	<u>kN/m2</u>	<u>Active limit</u>	<u>Passive limit</u>	<u>kN/m2</u>	<u>kN/m3</u>	
22	-25.00	260.00	247.04	0.00	6259.57	94.86	354.86	141390
		260.00	247.04	0.00	2280.45	247.04	507.04	271470
23	-26.50	275.00	262.04	0.00	2418.92	262.04	537.04	271470
24	-28.00	290.00	277.04	0.00	2557.39	277.04	567.04	273018
		290.00	277.04	0.00	7019.72	106.38	396.38	142197
25	-29.30	303.00	290.04	0.00	7349.12	111.38	414.38	142197

Note: 38.00 a Soil pressure at active limit
 123.45 p Soil pressure at passive limit

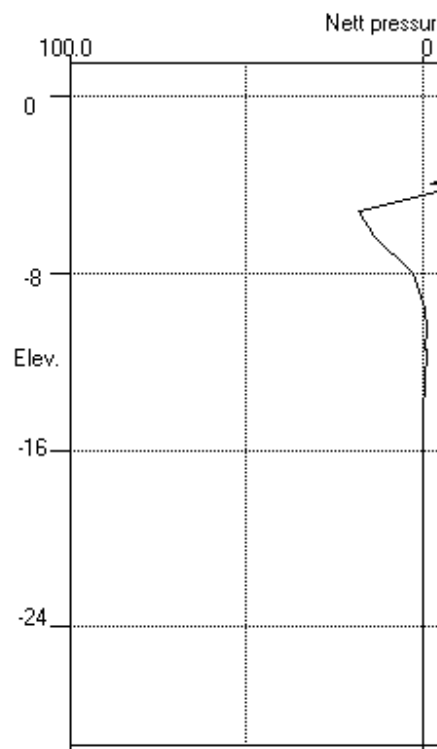
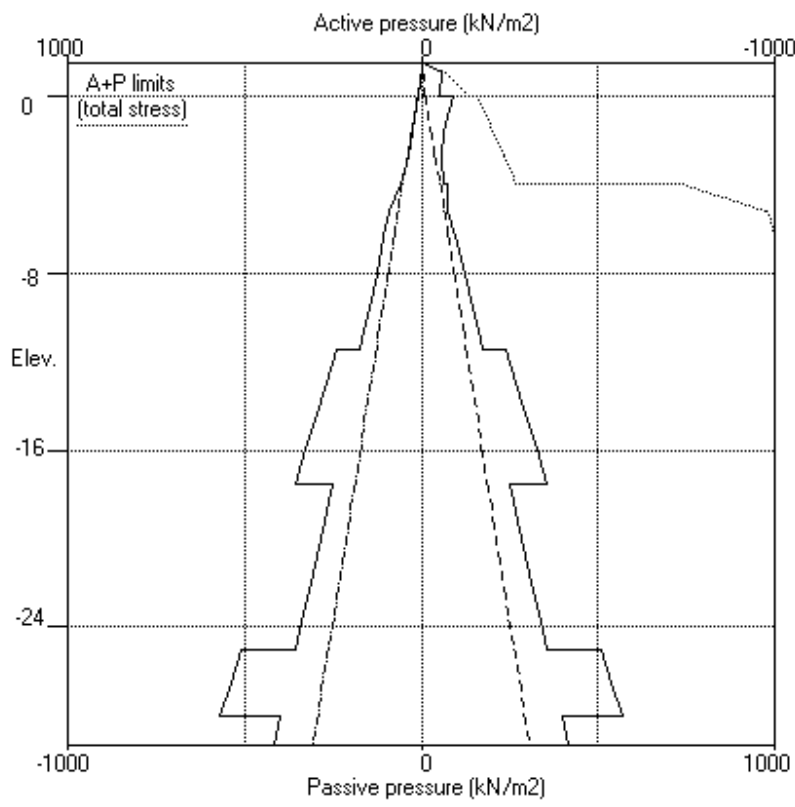
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Soil properties file: Soil_Model.dat
Project Olympus
TC1

Sheet No.
Job No. BE0046
Made by : CM
Date: 7-03-2025
Checked :

Stage No.2 Apply load no.2 at elev. 1.44



Stage No.2 Apply load no.2 at elev. 1.44



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 TC1

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: ULS DA1 Combination 1
 Water pressures : Moderately Conservative
 Partial factor on C' = 1.000
 Partial factor on Phi' = 1.000
 Partial factor on Cu = 1.000
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.100

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 1

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

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment				Shear force			
		max.	min.	Calculated		Factored		Calculated		Factored	
		m	m	max.	min.	max.	min.	max.	min.	max.	min.
				kN.m		kN.m		kN		kN	
1	1.44	0.005	0.000	0	-83	0	-112	104	0	140	0
2	1.00	0.005	0.000	0	-37	0	-50	96	0	129	0
3	0.00	0.003	0.000	41	0	55	0	65	0	88	0
4	-1.60	0.001	0.000	83	0	112	0	7	0	9	0
5	-2.80	0.000	0.000	73	0	99	0	0	-14	0	-19
6	-4.00	0.000	-0.000	49	0	66	0	0	-22	0	-30
7	-5.20	0.000	-0.000	16	0	22	0	0	-20	0	-27
8	-6.40	0.000	-0.000	0	-1	0	-1	0	-9	0	-12
9	-8.00	0.000	-0.000	0	-3	0	-4	0	-0	0	-0
10	-9.60	0.000	0.000	0	-1	0	-1	1	0	1	0
11	-10.55	0.000	0.000	0	-0	0	-0	1	0	1	0
12	-11.50	0.000	0.000	0	0	0	0	0	0	0	0
13	-12.95	0.000	0.000	0	0	0	0	0	-0	0	-0
14	-14.40	0.000	-0.000	0	0	0	0	0	-0	0	-0
15	-15.95	0.000	-0.000	0	-0	0	-0	0	-0	0	-0
16	-17.50	0.000	0.000	0	-0	0	-0	0	0	0	0
17	-18.35	0.000	0.000	0	-0	0	-0	0	0	0	0
18	-19.20	0.000	0.000	0	-0	0	-0	0	0	0	0
19	-20.80	0.000	0.000	0	0	0	0	0	-0	0	-0
20	-22.40	0.000	-0.000	0	0	0	0	0	-0	0	-0
21	-23.70	0.000	-0.000	0	0	0	0	0	-0	0	-0
22	-25.00	0.000	-0.000	0	-0	0	-0	0	-0	0	-0
23	-26.50	0.000	-0.000	0	-0	0	-0	0	0	0	0
24	-28.00	0.000	0.000	0	-0	0	-0	0	0	0	0
25	-29.30	0.000	0.000	0	-0	0	-0	0	0	0	0

Run ID. TC1_ULS1
 Project Olympus
 TC1

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Summary of results (continued)

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

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
	max. kN.m	elev.	min. kN.m	elev.	max. kN.m	min. kN.m	max. kN	elev.	min. kN	elev.	max. kN	min. kN
1	23	-1.60	-21	1.44	31	-28	28	1.44	-7	-4.00	37	-9
2	83	-1.60	-83	1.44	112	-112	104	1.44	-22	-4.00	140	-30

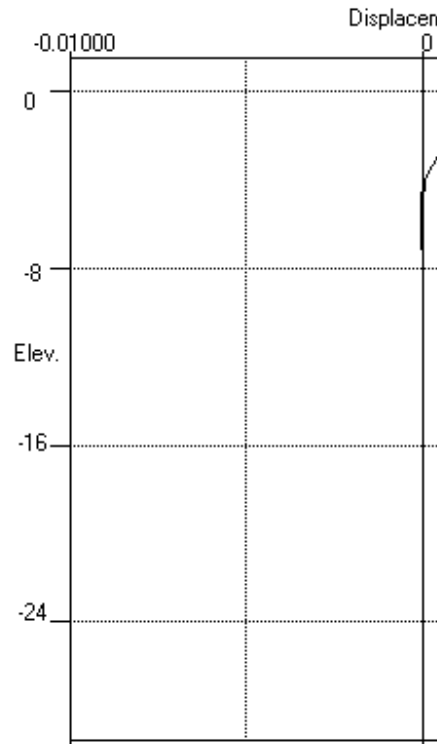
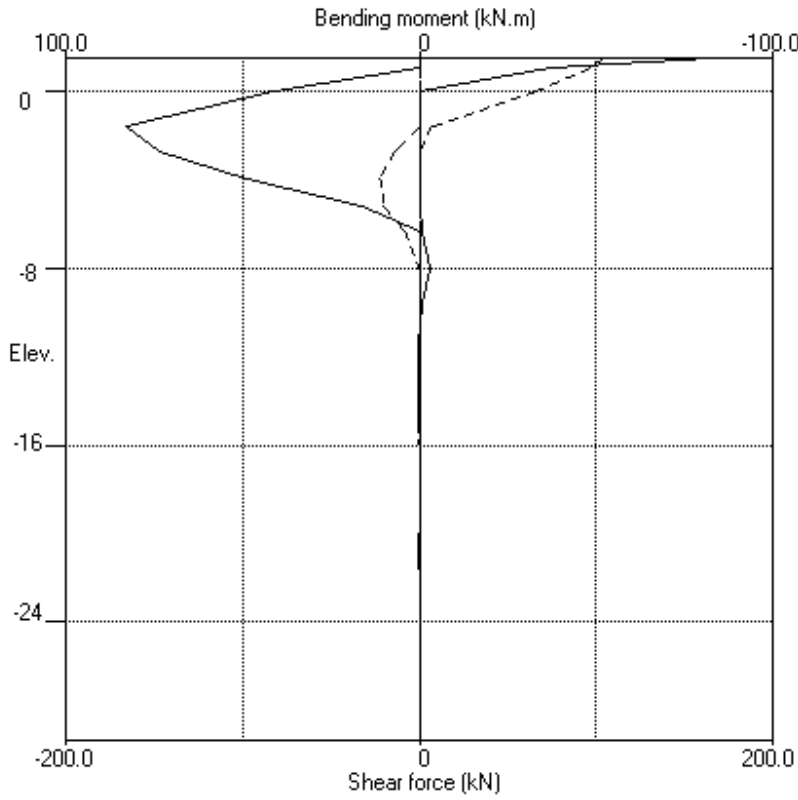
Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum m	elev.	minimum m	elev.	
1	0.001	1.44	-0.000	-5.20	Apply load no.1 at elev. 1.44
2	0.005	1.44	-0.000	-5.20	Apply load no.2 at elev. 1.44

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Bending moment, shear force, displacement envelopes



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 Soil properties file: Soil_Model.dat
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 TC1

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	1.44	1 Made Ground	1 Made Ground
2	0.00	6 Alluvium	6 Alluvium
3	-4.00	2 RTG	2 RTG
4	-11.50	3 London Clay	3 London Clay
5	-17.50	4 Lamb G	4 Lamb G
6	-25.00	5 Lam C	5 Lam C
7	-28.00	4 Lamb G	4 Lamb G

SOIL PROPERTIES (Unfactored SLS soil strengths)

Soil Properties File = Soil_Model.dat

No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh, kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	Made Ground	16.00	8000	0.500	OC (0.200)	0.000 (0.000)	3.253 (0.000)	
2	RTG	20.00	100000	0.441	OC (0.200)	0.000 (0.000)	6.204 (0.000)	
3	London Clay (-11.50)	20.00	112000 (10640)	1.000	OC (0.490)	0.000 (0.000)	1.000 (2.390)	140.0d (13.30)
4	Lamb G	20.00	100000	0.384	OC (0.200)	0.000 (0.000)	8.446 (0.000)	
5	Lam C	20.00	192000	1.000	OC (0.200)	0.000 (0.000)	3.077 (4.665)	0.0d
6	Alluvium	16.00	12000	0.300	NC (0.490)	0.000 (0.000)	1.000 (2.390)	15.00d

Additional soil parameters associated with Ka and Kp

No.	Description	parameters for Ka			parameters for Kp		
		Soil friction angle	Wall adhesion coeff.	Back-fill angle	Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	Made Ground	0.00	0.000	0.00	25.00	0.500	0.00
2	RTG	0.00	0.000	0.00	34.00	0.670	0.00
3	London Clay	0.00	0.000	0.00	0.00	0.500	0.00
4	Lamb G	0.00	0.000	0.00	38.00	0.670	0.00
5	Lam C	0.00	0.000	0.00	24.00	0.500	0.00
6	Alluvium	0.00	0.000	0.00	0.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3
 Left side Right side
 Initial water table elevation 1.00 1.00
 Automatic water pressure balancing at toe of pile : No

PILE PROPERTIES

Type of structure = Single Pile
 Pile diameter = 0.60 m
 Elevation of toe of pile = -29.30
 Maximum finite element length = 1.60 m
 Pile diameter = 0.60 m
 Youngs modulus of pile E = 3.3400E+07 kN/m2
 Moment of inertia of pile I = 6.3617E-03 m4
 E.I = 212481 kN.m2
 Yield Moment of pile = Not defined

HORIZONTAL and MOMENT LOADS/RESTRAINTS

Load no.	Elevation	Horizontal load kN	Moment load kN.m	Moment restraint kN.m/rad	Partial factor (Category)	Load Orientation (degrees)
1	1.44	27.70	0	62000	1.00 (P/U)	0
2	1.44	69.00	0	62000	1.30 (Var)	0

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply load no.1 at elevation 1.44
2	Apply load no.2 at elevation 1.44

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: ULS DA1 Combination 2
 Water pressures : Worst Credible
 Partial factor on C' = 1.250
 Partial factor on Phi' = 1.250
 Partial factor on Cu = 1.400
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.300

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

Bending moment and displacement calculation:
 Method - Subgrade reaction model using Influence Coefficients

OUTPUT OPTIONS

Stage no.	Stage description	Displacement	Active, Graph.	Passive output	pressures
1	Apply load no.1 at elev. 1.44	Yes	Yes	Yes	Yes
2	Apply load no.2 at elev. 1.44	Yes	Yes	Yes	Yes
*	Summary output	Yes	-	Yes	Yes

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 Project Olympus
 TC1

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 Made by : CM
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 Checked :

Units: kN,m

Stage No. 1 Apply load no.1 at elevation 1.44

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	File disp. m	File rotation rad.	Shear force kN	Bending moment kN.m	Prop forces kN	Applied moments kN.m
1	1.44	0.00	0.001	3.31E-04	27.7	-20.5	27.7	-20.5
2	1.00	-16.10	0.001	3.61E-04	25.6	-8.4		
3	0.00	-14.93	0.001	3.52E-04	16.3	12.0		
		-21.13	0.001	3.52E-04	16.3	12.0		
4	-1.60	-12.44	0.000	2.21E-04	0.2	22.8		
5	-2.80	-3.36	0.000	1.07E-04	-5.5	17.6		
6	-4.00	0.28	-0.000	3.03E-05	-6.6	9.5		
		1.68	-0.000	3.03E-05	-6.6	9.5		
7	-5.20	5.05	-0.000	-3.05E-06	-4.2	2.3		
8	-6.40	2.81	-0.000	-7.86E-06	-1.4	-0.6		
9	-8.00	0.37	-0.000	-3.16E-06	0.1	-0.7		
10	-9.60	-0.21	0.000	-7.28E-08	0.2	-0.2		
11	-10.55	-0.16	0.000	3.27E-07	0.1	-0.0		
12	-11.50	-0.07	0.000	2.82E-07	0.0	0.0		
		-0.11	0.000	2.82E-07	0.0	0.0		
13	-12.95	-0.00	0.000	7.58E-08	-0.0	0.0		
14	-14.40	0.01	-0.000	-8.54E-09	-0.0	0.0		
15	-15.95	0.00	-0.000	-9.29E-09	-0.0	-0.0		
16	-17.50	-0.00	0.000	-9.61E-10	0.0	-0.0		
17	-18.35	-0.00	0.000	3.26E-10	0.0	-0.0		
18	-19.20	-0.00	0.000	5.90E-10	0.0	0.0		
19	-20.80	-0.00	0.000	3.00E-10	-0.0	0.0		
20	-22.40	0.00	-0.000	2.87E-11	-0.0	0.0		
21	-23.70	0.00	-0.000	-2.47E-11	-0.0	0.0		
22	-25.00	0.00	-0.000	-1.77E-11	-0.0	-0.0		
23	-26.50	-0.00	0.000	-3.03E-12	0.0	-0.0		
24	-28.00	-0.00	0.000	1.04E-12	0.0	-0.0		
25	-29.30	-0.00	0.000	1.21E-12	0.0	-0.0		

LEFT side

Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	1.44	0.00	0.00	0.00	0.00	0.00	11433	
2	1.00	0.00	7.04	0.00	53.80	0.00	11433	
3	0.00	10.00	13.04	0.00	99.65	0.00	11433	
		10.00	13.04	0.00	125.17	0.00	23396	
4	-1.60	26.00	22.64	0.00	153.97	0.57	23396	
5	-2.80	38.00	29.84	0.00	175.58	7.27	23396	
6	-4.00	50.00	37.04	0.00	197.18	11.25	22591	
		50.00	37.04	0.00	469.51	17.18	136993	
7	-5.20	62.00	49.04	0.00	621.61	24.15	136993	

(continued)

Stage No.1 Apply load no.1 at elevation 1.44

LEFT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses		Earth pressure	Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit			
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
8	-6.40	74.00	61.04	0.00	773.72	28.32	102.32	136993
9	-8.00	90.00	77.04	0.00	976.53	34.16	124.16	136993
10	-9.60	106.00	93.04	0.00	1179.34	40.93	146.93	142500
11	-10.55	115.50	102.54	0.00	1299.76	45.14	160.64	142500
12	-11.50	125.00	112.04	0.00	1420.18	49.37	174.37	142500
		125.00	112.04	0.00	1139.22	111.98	236.98	217823
13	-12.95	139.50	126.54	0.00	1293.35	126.54	266.04	247828
14	-14.40	154.00	141.04	0.00	1447.48	141.05	295.05	286730
15	-15.95	169.50	156.54	0.00	1612.23	156.54	326.04	319832
16	-17.50	185.00	172.04	0.00	1776.99	172.04	357.04	330172
		185.00	172.04	0.00	2779.00	66.06	251.06	136551
17	-18.35	193.50	180.54	0.00	2916.31	69.33	262.83	136551
18	-19.20	202.00	189.04	0.00	3053.61	72.59	274.59	136551
19	-20.80	218.00	205.04	0.00	3312.06	78.74	296.74	136551
20	-22.40	234.00	221.04	0.00	3570.51	84.88	318.88	137540
21	-23.70	247.00	234.04	0.00	3780.51	89.87	336.87	137540
22	-25.00	260.00	247.04	0.00	3990.50	94.86	354.86	137540
		260.00	247.04	0.00	1806.99	247.04	507.04	264077
23	-26.50	275.00	262.04	0.00	1916.70	262.04	537.04	261566
24	-28.00	290.00	277.04	0.00	2026.42	277.04	567.04	261566
		290.00	277.04	0.00	4475.10	106.38	396.38	136232
25	-29.30	303.00	290.04	0.00	4685.09	111.38	414.38	136232

RIGHT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses		Earth pressure	Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit			
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	1.44	0.00	0.00	0.00	0.00	0.00	0.00	11433
2	1.00	0.00	7.04	0.00	53.80	16.10	16.10	11433
3	0.00	10.00	13.04	0.00	99.65	14.93	24.93	11433
		10.00	13.04	0.00	125.17	21.13	31.13	23396
4	-1.60	26.00	22.64	0.00	153.97	13.01	39.01	23396
5	-2.80	38.00	29.84	0.00	175.58	10.63	48.63	23396
6	-4.00	50.00	37.04	0.00	197.18	10.97	60.97	22591
		50.00	37.04	0.00	469.51	15.49	65.49	136993
7	-5.20	62.00	49.04	0.00	621.61	19.10	81.10	136993
8	-6.40	74.00	61.04	0.00	773.72	25.51	99.51	136993
9	-8.00	90.00	77.04	0.00	976.53	33.79	123.79	136993
10	-9.60	106.00	93.04	0.00	1179.34	41.14	147.14	142500
11	-10.55	115.50	102.54	0.00	1299.76	45.30	160.80	142500
12	-11.50	125.00	112.04	0.00	1420.18	49.45	174.45	142500
		125.00	112.04	0.00	1139.22	112.10	237.10	217823
13	-12.95	139.50	126.54	0.00	1293.35	126.54	266.04	247828
14	-14.40	154.00	141.04	0.00	1447.48	141.03	295.03	286730
15	-15.95	169.50	156.54	0.00	1612.23	156.54	326.04	319832
16	-17.50	185.00	172.04	0.00	1776.99	172.04	357.04	330172
		185.00	172.04	0.00	2779.00	66.06	251.06	136551
17	-18.35	193.50	180.54	0.00	2916.31	69.33	262.83	136551
18	-19.20	202.00	189.04	0.00	3053.61	72.59	274.59	136551
19	-20.80	218.00	205.04	0.00	3312.06	78.74	296.74	136551
20	-22.40	234.00	221.04	0.00	3570.51	84.88	318.88	137540
21	-23.70	247.00	234.04	0.00	3780.51	89.87	336.87	137540
22	-25.00	260.00	247.04	0.00	3990.50	94.86	354.86	137540
		260.00	247.04	0.00	1806.99	247.04	507.04	264077

Run ID. TC1_ULS2
 Project Olympus
 TC1

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Stage No.1 Apply load no.1 at elevation 1.44

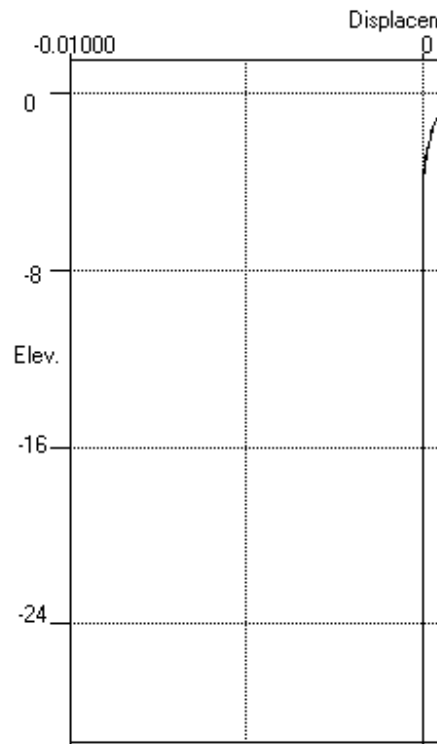
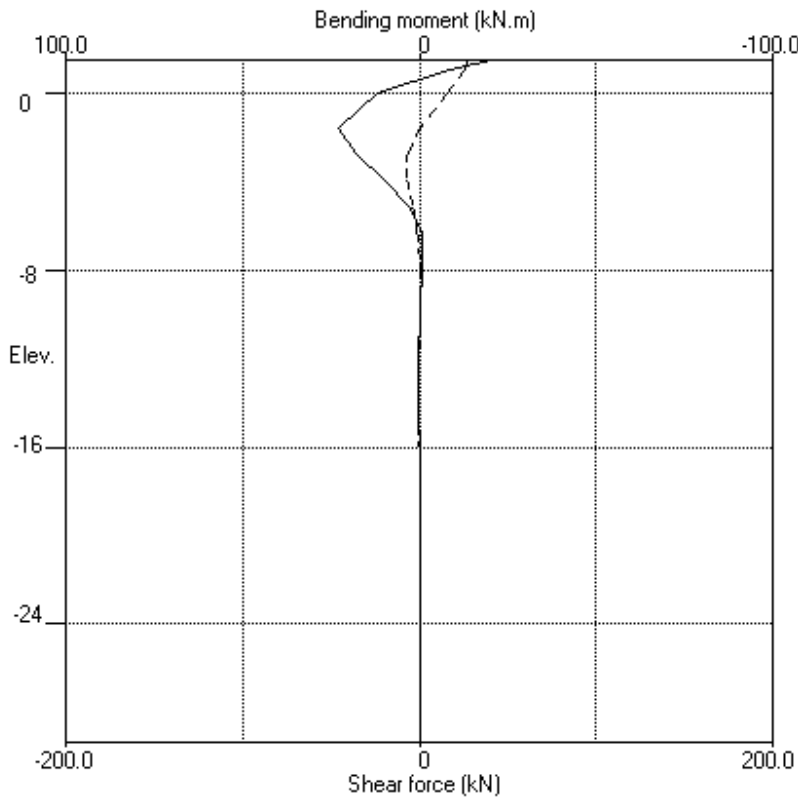
RIGHT side								
Node no.	Y coord	Water press. kN/m ²	Vertic -al kN/m ²	Effective stresses			Total earth pressure kN/m ²	Coeff. of subgrade reaction kN/m ³
				Active limit kN/m ²	Passive limit kN/m ²	Earth pressure kN/m ²		
23	-26.50	275.00	262.04	0.00	1916.70	262.04	537.04	261566
24	-28.00	290.00	277.04	0.00	2026.42	277.04	567.04	261566
		290.00	277.04	0.00	4475.10	106.38	396.38	136232
25	-29.30	303.00	290.04	0.00	4685.09	111.38	414.38	136232

Note: 10.00 a Soil pressure at active limit
 123.45 p Soil pressure at passive limit

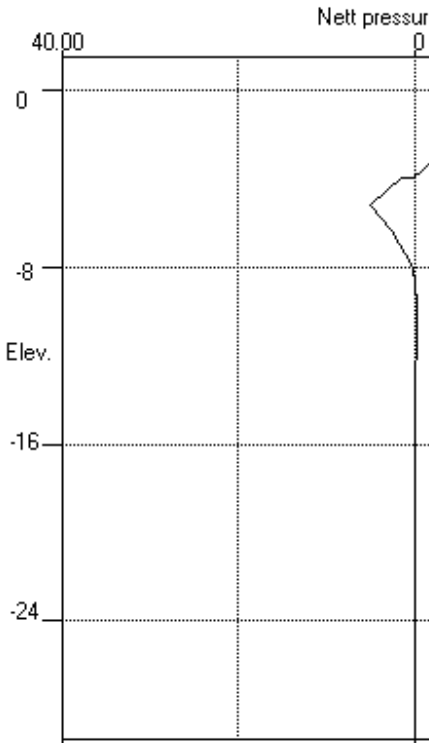
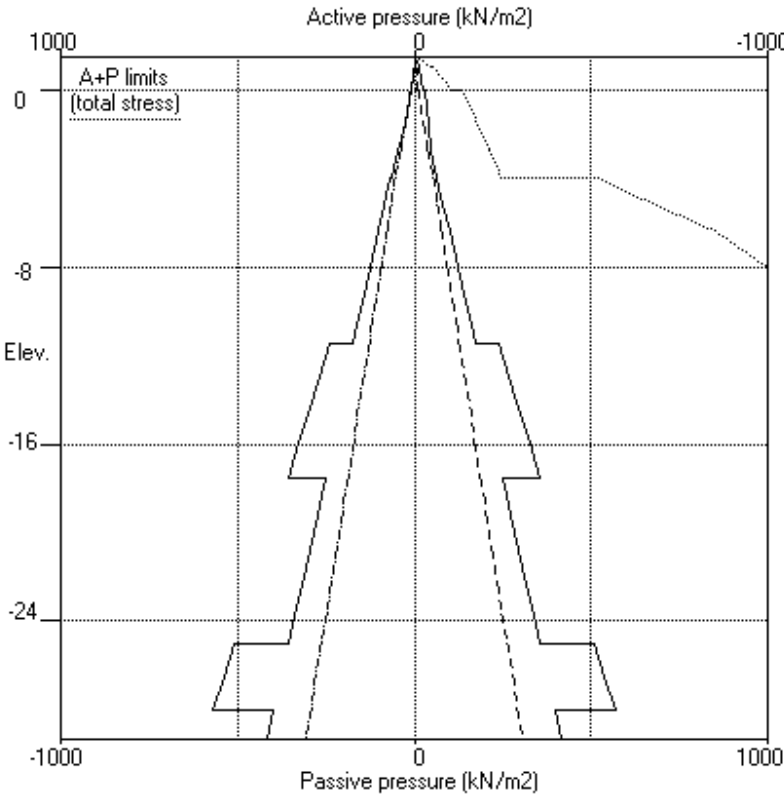
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Project Olympus
TC1

Sheet No.
Job No. BE0046
Made by : CM
Date: 7-03-2025
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Stage No.1 Apply load no.1 at elev. 1.44



Stage No.1 Apply load no.1 at elev. 1.44



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 Project Olympus
 TC1

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

Units: kN,m

Stage No. 2 Apply load no.2 at elevation 1.44

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	File disp. m	File rotation rad.	Shear force kN	Bending moment kN.m	Prop forces kN	Applied moments kN.m
1	1.44	0.00	0.007	1.60E-03	117.4	-99.4	117.4	-99.4
2	1.00	-53.80	0.006	1.75E-03	110.3	-48.5		
3	0.00	-52.95	0.004	1.75E-03	78.3	49.1		
		-99.17	0.004	1.75E-03	78.3	49.1		
4	-1.60	-46.37	0.002	1.19E-03	8.4	99.0		
5	-2.80	-22.83	0.001	6.68E-04	-16.5	88.1		
6	-4.00	-3.02	0.000	2.51E-04	-25.8	59.5		
		-18.37	0.000	2.51E-04	-25.8	59.5		
7	-5.20	21.57	-0.000	2.56E-05	-24.6	20.6		
8	-6.40	17.15	-0.000	-3.35E-05	-10.7	0.4		
9	-8.00	4.08	-0.000	-2.14E-05	-0.5	-3.6		
10	-9.60	-0.62	0.000	-2.98E-06	1.1	-1.3		
11	-10.55	-0.82	0.000	7.63E-07	0.7	-0.4		
12	-11.50	-0.49	0.000	1.40E-06	0.4	0.1		
		-0.75	0.000	1.40E-06	0.4	0.1		
13	-12.95	-0.13	0.000	6.09E-07	-0.0	0.1		
14	-14.40	0.06	-0.000	2.56E-08	-0.1	0.0		
15	-15.95	0.03	-0.000	-5.40E-08	-0.0	-0.0		
16	-17.50	-0.00	0.000	-1.21E-08	0.0	-0.0		
17	-18.35	-0.00	0.000	-1.69E-09	0.0	-0.0		
18	-19.20	-0.00	0.000	2.07E-09	0.0	-0.0		
19	-20.80	-0.00	0.000	2.08E-09	0.0	0.0		
20	-22.40	0.00	-0.000	4.48E-10	-0.0	0.0		
21	-23.70	0.00	-0.000	-6.16E-11	-0.0	0.0		
22	-25.00	0.00	-0.000	-1.06E-10	-0.0	-0.0		
23	-26.50	0.00	-0.000	-3.01E-11	0.0	-0.0		
24	-28.00	-0.00	0.000	2.23E-12	0.0	-0.0		
25	-29.30	-0.00	0.000	5.05E-12	0.0	-0.0		

LEFT side

Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	1.44	0.00	0.00	0.00	0.00	0.00	11212	
2	1.00	0.00	7.04	0.00	53.80	0.00	0.00a 11212	
3	0.00	10.00	13.04	0.00	99.65	0.00	10.00a 11212	
		10.00	13.04	0.00	125.17	0.00	10.00a 23014	
4	-1.60	26.00	22.64	0.00	153.97	0.00	26.00a 23014	
5	-2.80	38.00	29.84	0.00	175.58	0.00	38.00a 23014	
6	-4.00	50.00	37.04	0.00	197.18	9.60	59.60 23014	
		50.00	37.04	0.00	469.51	7.15	57.15 140145	
7	-5.20	62.00	49.04	0.00	621.61	32.41	94.41 136027	

(continued)

Stage No.2 Apply load no.2 at elevation 1.44

LEFT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses		Earth pressure	Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit			
		kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ³
8	-6.40	74.00	61.04	0.00	773.72	35.49	109.49	136027
9	-8.00	90.00	77.04	0.00	976.53	36.01	126.01	136027
10	-9.60	106.00	93.04	0.00	1179.34	40.72	146.72	136955
11	-10.55	115.50	102.54	0.00	1299.76	44.81	160.31	136955
12	-11.50	125.00	112.04	0.00	1420.18	49.17	174.17	136955
		125.00	112.04	0.00	1139.22	111.67	236.67	210798
13	-12.95	139.50	126.54	0.00	1293.35	126.48	265.98	239836
14	-14.40	154.00	141.04	0.00	1447.48	141.07	295.07	280591
15	-15.95	169.50	156.54	0.00	1612.23	156.55	326.05	312984
16	-17.50	185.00	172.04	0.00	1776.99	172.04	357.04	345377
		185.00	172.04	0.00	2779.00	66.06	251.06	144164
17	-18.35	193.50	180.54	0.00	2916.31	69.33	262.83	135549
18	-19.20	202.00	189.04	0.00	3053.61	72.59	274.59	135549
19	-20.80	218.00	205.04	0.00	3312.06	78.74	296.74	135549
20	-22.40	234.00	221.04	0.00	3570.51	84.88	318.88	141983
21	-23.70	247.00	234.04	0.00	3780.51	89.87	336.87	141983
22	-25.00	260.00	247.04	0.00	3990.50	94.86	354.86	141983
		260.00	247.04	0.00	1806.99	247.04	507.04	272608
23	-26.50	275.00	262.04	0.00	1916.70	262.04	537.04	272608
24	-28.00	290.00	277.04	0.00	2026.42	277.04	567.04	273757
		290.00	277.04	0.00	4475.10	106.38	396.38	142582
25	-29.30	303.00	290.04	0.00	4685.09	111.38	414.38	142582

RIGHT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses		Earth pressure	Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit			
		kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ³
1	1.44	0.00	0.00	0.00	0.00	0.00	0.00	11212
2	1.00	0.00	7.04	0.00	53.80	53.80	53.80p	11212
3	0.00	10.00	13.04	0.00	99.65	52.95	62.95	11212
		10.00	13.04	0.00	125.17	99.17	109.17	23014
4	-1.60	26.00	22.64	0.00	153.97	46.37	72.37	23014
5	-2.80	38.00	29.84	0.00	175.58	22.83	60.83	23014
6	-4.00	50.00	37.04	0.00	197.18	12.62	62.62	23014
		50.00	37.04	0.00	469.51	25.52	75.52	140145
7	-5.20	62.00	49.04	0.00	621.61	10.84	72.84	136027
8	-6.40	74.00	61.04	0.00	773.72	18.34	92.34	136027
9	-8.00	90.00	77.04	0.00	976.53	31.94	121.94	136027
10	-9.60	106.00	93.04	0.00	1179.34	41.34	147.34	136955
11	-10.55	115.50	102.54	0.00	1299.76	45.63	161.13	136955
12	-11.50	125.00	112.04	0.00	1420.18	49.65	174.65	136955
		125.00	112.04	0.00	1139.22	112.41	237.41	210798
13	-12.95	139.50	126.54	0.00	1293.35	126.60	266.10	239836
14	-14.40	154.00	141.04	0.00	1447.48	141.01	295.01	280591
15	-15.95	169.50	156.54	0.00	1612.23	156.53	326.03	312984
16	-17.50	185.00	172.04	0.00	1776.99	172.04	357.04	345377
		185.00	172.04	0.00	2779.00	66.06	251.06	144164
17	-18.35	193.50	180.54	0.00	2916.31	69.33	262.83	135549
18	-19.20	202.00	189.04	0.00	3053.61	72.59	274.59	135549
19	-20.80	218.00	205.04	0.00	3312.06	78.74	296.74	135549
20	-22.40	234.00	221.04	0.00	3570.51	84.88	318.88	141983
21	-23.70	247.00	234.04	0.00	3780.51	89.87	336.87	141983
22	-25.00	260.00	247.04	0.00	3990.50	94.86	354.86	141983
		260.00	247.04	0.00	1806.99	247.04	507.04	272608

Run ID. TC1_ULS2
 Project Olympus
 TC1

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(continued)

Stage No.2 Apply load no.2 at elevation 1.44

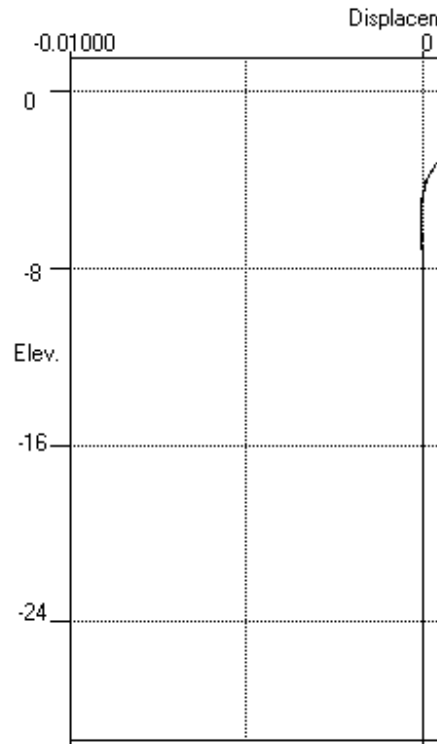
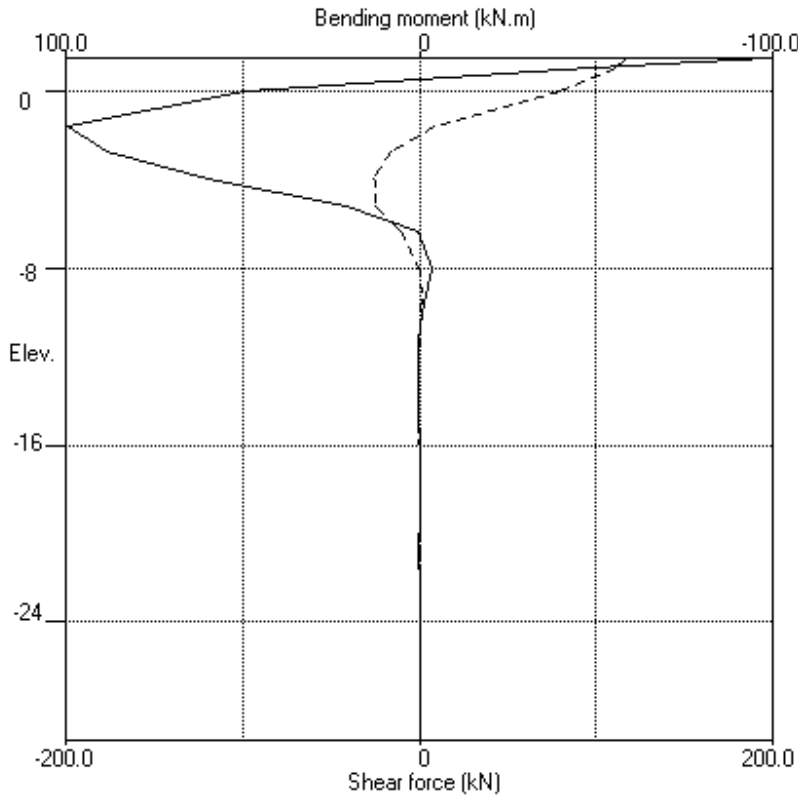
RIGHT side								
Node no.	Y coord	Water press. kN/m ²	Vertic -al kN/m ²	Effective stresses			Total earth pressure kN/m ²	Coeff. of subgrade reaction kN/m ³
				Active limit kN/m ²	Passive limit kN/m ²	Earth pressure kN/m ²		
23	-26.50	275.00	262.04	0.00	1916.70	262.04	537.04	272608
24	-28.00	290.00	277.04	0.00	2026.42	277.04	567.04	273757
		290.00	277.04	0.00	4475.10	106.38	396.38	142582
25	-29.30	303.00	290.04	0.00	4685.09	111.38	414.38	142582

Note: 38.00 a Soil pressure at active limit
 53.80 p Soil pressure at passive limit

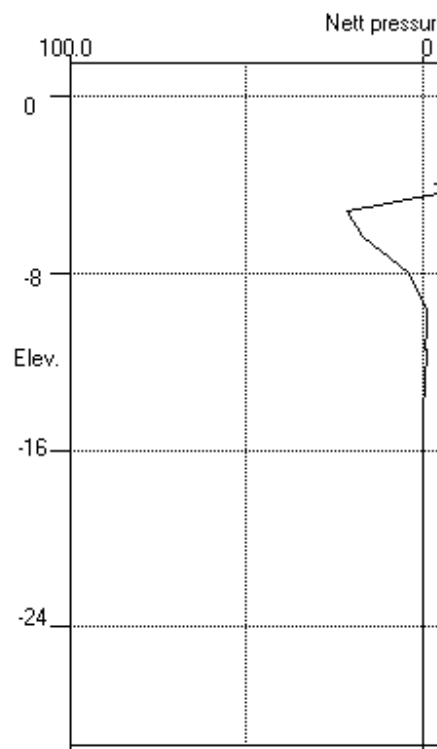
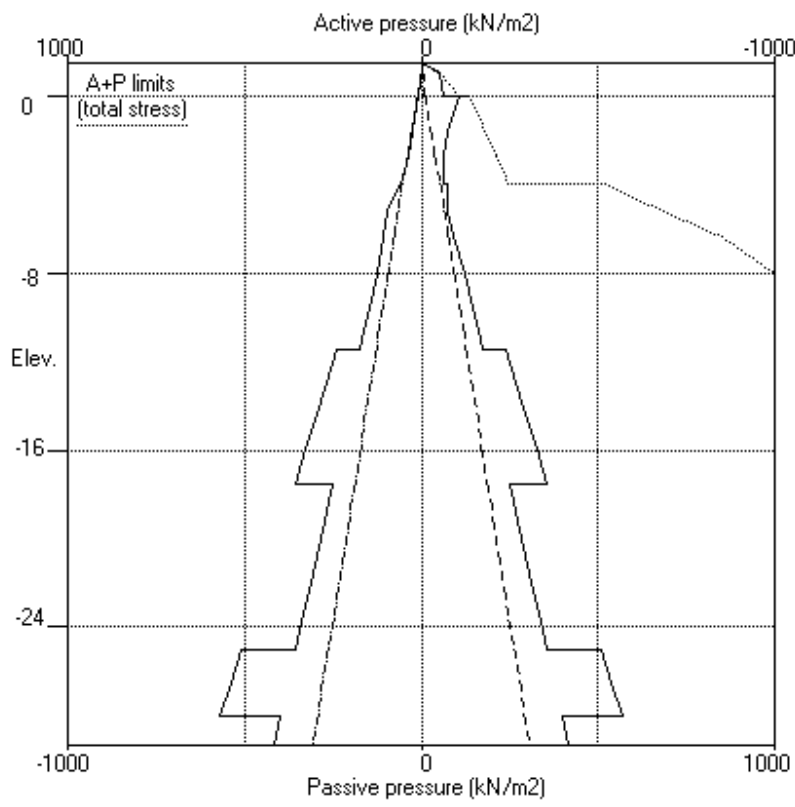
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Stage No.2 Apply load no.2 at elev. 1.44



Stage No.2 Apply load no.2 at elev. 1.44



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Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 7-03-2025
 Checked :

 Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: ULS DA1 Combination 2
 Water pressures : Worst Credible
 Partial factor on C' = 1.250
 Partial factor on Phi' = 1.250
 Partial factor on Cu = 1.400
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.300

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Bending moment, shear force and displacement envelopes

<u>Node</u> <u>no.</u>	<u>Y</u> <u>coord</u>	<u>Displacement</u>		<u>Bending moment</u>		<u>Shear force</u>	
		<u>maximum</u> m	<u>minimum</u> m	<u>maximum</u> kN.m	<u>minimum</u> kN.m	<u>maximum</u> kN	<u>minimum</u> kN
1	1.44	0.007	0.000	0.0	-99.4	117.4	0.0
2	1.00	0.006	0.000	0.0	-48.5	110.3	0.0
3	0.00	0.004	0.000	49.1	0.0	78.3	0.0
4	-1.60	0.002	0.000	99.0	0.0	8.4	0.0
5	-2.80	0.001	0.000	88.1	0.0	0.0	-16.5
6	-4.00	0.000	-0.000	59.5	0.0	0.0	-25.8
7	-5.20	0.000	-0.000	20.6	0.0	0.0	-24.6
8	-6.40	0.000	-0.000	0.4	-0.6	0.0	-10.7
9	-8.00	0.000	-0.000	0.0	-3.6	0.1	-0.5
10	-9.60	0.000	0.000	0.0	-1.3	1.1	0.0
11	-10.55	0.000	0.000	0.0	-0.4	0.7	0.0
12	-11.50	0.000	0.000	0.1	0.0	0.4	0.0
13	-12.95	0.000	0.000	0.1	0.0	0.0	-0.0
14	-14.40	0.000	-0.000	0.0	0.0	0.0	-0.1
15	-15.95	0.000	-0.000	0.0	-0.0	0.0	-0.0
16	-17.50	0.000	0.000	0.0	-0.0	0.0	0.0
17	-18.35	0.000	0.000	0.0	-0.0	0.0	0.0
18	-19.20	0.000	0.000	0.0	-0.0	0.0	0.0
19	-20.80	0.000	0.000	0.0	0.0	0.0	-0.0
20	-22.40	0.000	-0.000	0.0	0.0	0.0	-0.0
21	-23.70	0.000	-0.000	0.0	0.0	0.0	-0.0
22	-25.00	0.000	-0.000	0.0	-0.0	0.0	-0.0
23	-26.50	0.000	-0.000	0.0	-0.0	0.0	0.0
24	-28.00	0.000	0.000	0.0	-0.0	0.0	0.0
25	-29.30	0.000	0.000	0.0	-0.0	0.0	0.0

Run ID. TC1_ULS2
Project Olympus
TC1

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Date: 7-03-2025
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Summary of results (continued)

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment				Shear force			
no.	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>
	kN.m		kN.m		kN		kN	
1	22.8	-1.60	-20.5	1.44	27.7	1.44	-6.6	-4.00
2	99.0	-1.60	-99.4	1.44	117.4	1.44	-25.8	-4.00

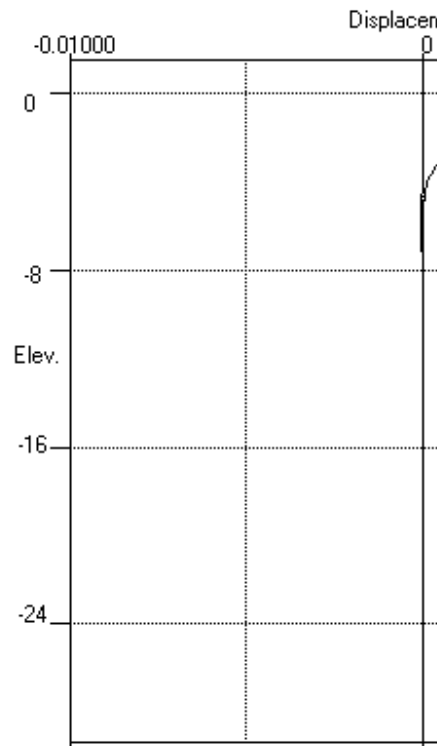
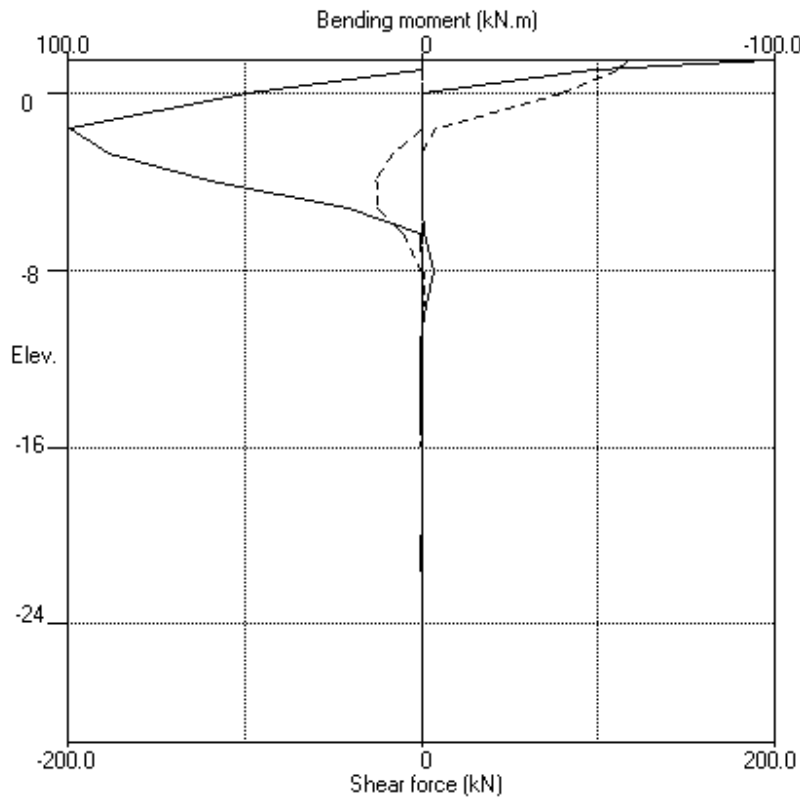
Maximum and minimum displacement at each stage

Stage	Displacement				<u>Stage description</u>
no.	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>	
	m		m		
1	0.001	1.44	-0.000	-5.20	Apply load no.1 at elev. 1.44
2	0.007	1.44	-0.000	-5.20	Apply load no.2 at elev. 1.44

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TC1

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Bending moment, shear force, displacement envelopes



HORIZONTAL and MOMENT LOADS/RESTRAINTS

Load no.	Elevation	Horizontal load kN	Moment load kN.m	Moment restraint kN.m/rad	Partial factor (Category)	Load Orientation (degrees)
1	0.99	25.00	0	59000	1.00 (P/U)	0
2	0.99	63.30	0	59000	1.10 (Var)	0

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply load no.1 at elevation 0.99
2	Apply load no.2 at elevation 0.99

LIMIT STATE PARAMETERS

Limit State: ULS DA1 Combination 1
 Water pressures : Moderately Conservative
 Partial factor on C' = 1.000
 Partial factor on Phi' = 1.000
 Partial factor on Cu = 1.000
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.100

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: ULS DA1 Combination 1
 Water pressures : Moderately Conservative
 Partial factor on C' = 1.000
 Partial factor on Phi' = 1.000
 Partial factor on Cu = 1.000
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.100
 Design factor on calculated Bending Moments = 1.350

Parameters for undrained strata:
 Minimum equivalent fluid density - not relevant to a Single Pile
 Maximum depth of water filled tension crack - not relevant to a Single Pile

Bending moment and displacement calculation:
 Method - Subgrade reaction model using Influence Coefficients

OUTPUT OPTIONS

Stage no.	Stage description	Displacement	Active, Graph.	Passive output	Shear force pressures
1	Apply load no.1 at elev. 0.99	Yes	Yes	Yes	Yes
2	Apply load no.2 at elev. 0.99	Yes	Yes	Yes	Yes
*	Summary output	Yes	-	-	Yes

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 Soil properties file: Soil_Model.dat
 Project Olympus
 TC2

Sheet No.
 Job No. BE0046
 Made by : CM
 Date: 2-04-2025
 Checked :

 Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: ULS DA1 Combination 1
 Water pressures : Moderately Conservative
 Partial factor on C' = 1.000
 Partial factor on Phi' = 1.000
 Partial factor on Cu = 1.000
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.100

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Single pile diameter = 0.60m
 Passive mobilisation factor = 3.000
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00m from pile
 Right side 20.00m from pile

Limit State: ULS DA1 Combination 1

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

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment				Shear force			
		max.	min.	Calculated		Factored		Calculated		Factored	
				max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m		kN.m		kN		kN	
1	0.99	0.005	0.000	0	-77	0	-104	95	0	128	0
2	0.00	0.004	0.000	17	0	22	0	81	0	109	0
3	-1.60	0.002	0.000	76	0	103	0	16	0	22	0
4	-2.80	0.001	0.000	76	0	103	0	0	-8	0	-11
5	-4.00	0.000	0.000	58	0	78	0	0	-18	0	-25
6	-5.20	0.000	-0.000	24	0	33	0	0	-24	0	-32
7	-6.40	0.000	-0.000	3	0	4	0	0	-12	0	-16
8	-8.00	0.000	-0.000	0	-3	0	-4	0	-1	0	-2
9	-9.60	0.000	0.000	0	-1	0	-2	1	0	1	0
10	-10.55	0.000	0.000	0	-1	0	-1	1	0	1	0
11	-11.50	0.000	0.000	0	0	0	0	0	0	1	0
12	-12.95	0.000	0.000	0	0	0	0	0	-0	0	-0
13	-14.40	0.000	-0.000	0	0	0	0	0	-0	0	-0
14	-15.95	0.000	-0.000	0	-0	0	-0	0	-0	0	-0
15	-17.50	0.000	-0.000	0	-0	0	-0	0	0	0	0
16	-18.35	0.000	0.000	0	-0	0	-0	0	0	0	0
17	-19.20	0.000	0.000	0	-0	0	-0	0	0	0	0
18	-20.80	0.000	0.000	0	0	0	0	0	0	0	0
19	-22.40	0.000	-0.000	0	0	0	0	0	-0	0	-0
20	-23.70	0.000	-0.000	0	0	0	0	0	-0	0	-0
21	-25.00	0.000	-0.000	0	-0	0	-0	0	-0	0	-0
22	-26.50	0.000	-0.000	0	-0	0	-0	0	0	0	0
23	-28.00	0.000	0.000	0	-0	0	-0	0	0	0	0
24	-29.30	0.000	0.000	0	-0	0	-0	0	0	0	0

Run ID. TC2_ULS1
 Project Olympus
 TC2

Sheet No.
 Date: 2-04-2025
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Summary of results (continued)

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

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
	max. kN.m	elev.	min. kN.m	elev.	max. kN.m	min. kN.m	max. kN	elev.	min. kN	elev.	max. kN	min. kN
1	21	-1.60	-19	0.99	28	-26	25	0.99	-6	-4.00	34	-8
2	76	-2.80	-77	0.99	103	-104	95	0.99	-24	-5.20	128	-32

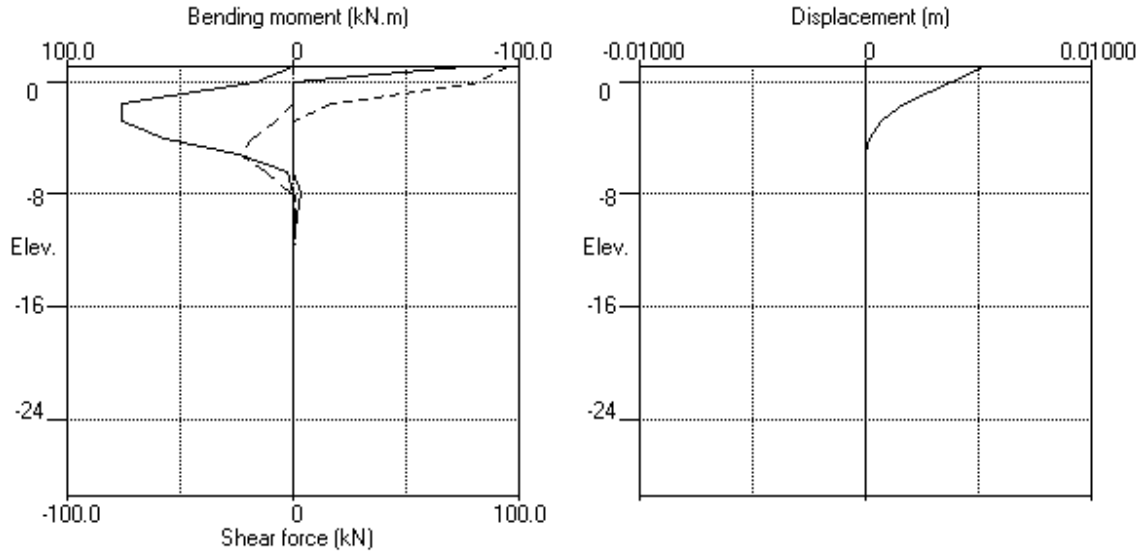
Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum m	elev.	minimum m	elev.	
1	0.001	0.99	-0.000	-5.20	Apply load no.1 at elev. 0.99
2	0.005	0.99	-0.000	-6.40	Apply load no.2 at elev. 0.99

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Job No. BE0046
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Date: 2-04-2025
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Bending moment, shear force, displacement envelopes



HORIZONTAL and MOMENT LOADS/RESTRAINTS

Load no.	Elevation	Horizontal load kN	Moment load kN.m	Moment restraint kN.m/rad	Partial factor (Category)	Load Orientation (degrees)
1	0.99	28.30	0	56000	1.00 (P/U)	0
2	0.99	63.30	0	56000	1.30 (Var)	0

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply load no.1 at elevation 0.99
2	Apply load no.2 at elevation 0.99

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: ULS DA1 Combination 2
Water pressures : Worst Credible
Partial factor on C' = 1.250
Partial factor on Phi' = 1.250
Partial factor on Cu = 1.400
Partial factor on Soil Modulus = 1.000
Partial factor on Permanent Unfavourable loads = 1.000
Partial factor on Permanent Favourable loads = 1.000
Partial factor on Variable Unfavourable loads = 1.300

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

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients

OUTPUT OPTIONS

Stage no.	Stage description	Displacement	Active, pressures	Graph. output
1	Apply load no.1 at elev. 0.99	Yes	Yes	Yes
2	Apply load no.2 at elev. 0.99	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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 Project Olympus
 TC2

Sheet No.
 Job No. BE0046
 Made by : CM
 Date:13-03-2025
 Checked :

Units: kN,m

Stage No. 1 Apply load no.1 at elevation 0.99

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	File disp. m	File rotation rad.	Shear force kN	Bending moment kN.m	Prop forces kN	Applied moments kN.m
1	0.99	0.00	0.001	3.83E-04	28.3	-21.5	28.3	-21.5
2	0.00	-14.81	0.001	4.18E-04	23.9	6.3		
		-26.03	0.001	4.18E-04	23.9	6.3		
3	-1.60	-14.98	0.000	3.05E-04	4.2	23.8		
4	-2.80	-7.25	0.000	1.73E-04	-3.8	23.0		
5	-4.00	-0.78	0.000	6.48E-05	-6.7	15.4		
		-4.75	0.000	6.48E-05	-6.7	15.4		
6	-5.20	5.60	-0.000	6.49E-06	-6.4	5.3		
7	-6.40	4.43	-0.000	-8.69E-06	-2.8	0.1		
8	-8.00	1.04	-0.000	-5.50E-06	-0.1	-0.9		
9	-9.60	-0.16	0.000	-7.54E-07	0.3	-0.3		
10	-10.55	-0.21	0.000	2.04E-07	0.2	-0.1		
11	-11.50	-0.13	0.000	3.65E-07	0.1	0.0		
		-0.19	0.000	3.65E-07	0.1	0.0		
12	-12.95	-0.03	0.000	1.56E-07	-0.0	0.0		
13	-14.40	0.02	-0.000	6.14E-09	-0.0	0.0		
14	-15.95	0.01	-0.000	-1.39E-08	-0.0	-0.0		
15	-17.50	-0.00	0.000	-3.03E-09	0.0	-0.0		
16	-18.35	-0.00	0.000	-3.89E-10	0.0	-0.0		
17	-19.20	-0.00	0.000	5.52E-10	0.0	-0.0		
18	-20.80	-0.00	0.000	5.32E-10	0.0	0.0		
19	-22.40	0.00	-0.000	1.11E-10	-0.0	0.0		
20	-23.70	0.00	-0.000	-1.68E-11	-0.0	0.0		
21	-25.00	0.00	-0.000	-2.75E-11	-0.0	-0.0		
22	-26.50	0.00	-0.000	-7.69E-12	0.0	-0.0		
23	-28.00	-0.00	0.000	5.89E-13	0.0	-0.0		
24	-29.30	-0.00	0.000	1.30E-12	0.0	-0.0		

LEFT side

Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.99	0.00	0.00	0.00	0.00	0.00	11402	
2	0.00	9.90	5.94	0.00	45.39	0.00	9.90a 11402	
		9.90	5.94	0.00	103.86	0.00	9.90a 23341	
3	-1.60	25.90	15.54	0.00	132.67	0.00	25.90a 23341	
4	-2.80	37.90	22.74	0.00	154.27	3.20	41.10 23341	
5	-4.00	49.90	29.94	0.00	175.88	8.59	58.49 23341	
		49.90	29.94	0.00	379.51	10.83	60.73 142520	
6	-5.20	61.90	41.94	0.00	531.62	21.30	83.20 136858	
7	-6.40	73.90	53.94	0.00	683.73	26.00	99.90 136858	
8	-8.00	89.90	69.94	0.00	886.54	31.37	121.27 136858	

(continued)

Stage No.1 Apply load no.1 at elevation 0.99

LEFT side								
Node no.	Y coord	Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ³
9	-9.60	105.90	85.94	0.00	1089.35	37.82	143.72	137466
10	-10.55	115.40	95.44	0.00	1209.77	41.98	157.38	137466
11	-11.50	124.90	104.94	0.00	1330.18	46.22	171.12	137466
		124.90	104.94	0.00	1117.92	104.84	229.74	211431
12	-12.95	139.40	119.44	0.00	1272.04	119.42	258.82	240556
13	-14.40	153.90	133.94	0.00	1426.17	133.95	287.85	285445
14	-15.95	169.40	149.44	0.00	1590.93	149.44	318.84	318398
15	-17.50	184.90	164.94	0.00	1755.68	164.94	349.84	328789
		184.90	164.94	0.00	2664.32	63.34	248.24	135832
16	-18.35	193.40	173.44	0.00	2801.62	66.60	260.00	135832
17	-19.20	201.90	181.94	0.00	2938.92	69.86	271.76	135832
18	-20.80	217.90	197.94	0.00	3197.37	76.01	293.91	135832
19	-22.40	233.90	213.94	0.00	3455.83	82.15	316.05	139517
20	-23.70	246.90	226.94	0.00	3665.82	87.14	334.04	139517
21	-25.00	259.90	239.94	0.00	3875.81	92.14	352.04	139517
		259.90	239.94	0.00	1755.05	239.94	499.84	267873
22	-26.50	274.90	254.94	0.00	1864.77	254.94	529.84	267873
23	-28.00	289.90	269.94	0.00	1974.49	269.94	559.84	271268
		289.90	269.94	0.00	4360.41	103.66	393.56	141286
24	-29.30	302.90	282.94	0.00	4570.40	108.65	411.55	141286

RIGHT side								
Node no.	Y coord	Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ³
1	0.99	0.00	0.00	0.00	0.00	0.00	0.00	11402
2	0.00	9.90	5.94	0.00	45.39	14.81	24.71	11402
		9.90	5.94	0.00	103.86	26.03	35.93	23341
3	-1.60	25.90	15.54	0.00	132.67	14.98	40.88	23341
4	-2.80	37.90	22.74	0.00	154.27	10.44	48.34	23341
5	-4.00	49.90	29.94	0.00	175.88	9.37	59.27	23341
		49.90	29.94	0.00	379.51	15.58	65.48	142520
6	-5.20	61.90	41.94	0.00	531.62	15.70	77.60	136858
7	-6.40	73.90	53.94	0.00	683.73	21.57	95.47	136858
8	-8.00	89.90	69.94	0.00	886.54	30.32	120.22	136858
9	-9.60	105.90	85.94	0.00	1089.35	37.98	143.88	137466
10	-10.55	115.40	95.44	0.00	1209.77	42.19	157.59	137466
11	-11.50	124.90	104.94	0.00	1330.18	46.34	171.24	137466
		124.90	104.94	0.00	1117.92	105.04	229.94	211431
12	-12.95	139.40	119.44	0.00	1272.04	119.46	258.86	240556
13	-14.40	153.90	133.94	0.00	1426.17	133.93	287.83	285445
14	-15.95	169.40	149.44	0.00	1590.93	149.44	318.84	318398
15	-17.50	184.90	164.94	0.00	1755.68	164.94	349.84	328789
		184.90	164.94	0.00	2664.32	63.34	248.24	135832
16	-18.35	193.40	173.44	0.00	2801.62	66.60	260.00	135832
17	-19.20	201.90	181.94	0.00	2938.92	69.87	271.77	135832
18	-20.80	217.90	197.94	0.00	3197.37	76.01	293.91	135832
19	-22.40	233.90	213.94	0.00	3455.83	82.15	316.05	139517
20	-23.70	246.90	226.94	0.00	3665.82	87.14	334.04	139517
21	-25.00	259.90	239.94	0.00	3875.81	92.14	352.04	139517
		259.90	239.94	0.00	1755.05	239.94	499.84	267873
22	-26.50	274.90	254.94	0.00	1864.77	254.94	529.84	267873
23	-28.00	289.90	269.94	0.00	1974.49	269.94	559.84	271268
		289.90	269.94	0.00	4360.41	103.66	393.56	141286

Run ID. TC2_ULS2
Project Olympus
TC2

Sheet No.
Date:13-03-2025
Checked :

(continued)

Stage No.1 Apply load no.1 at elevation 0.99

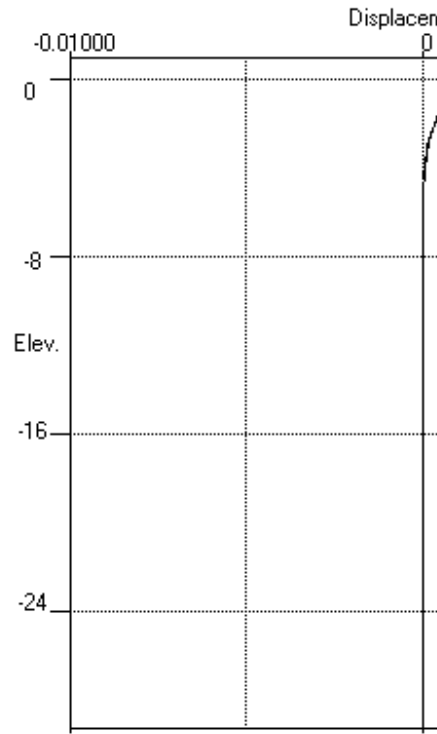
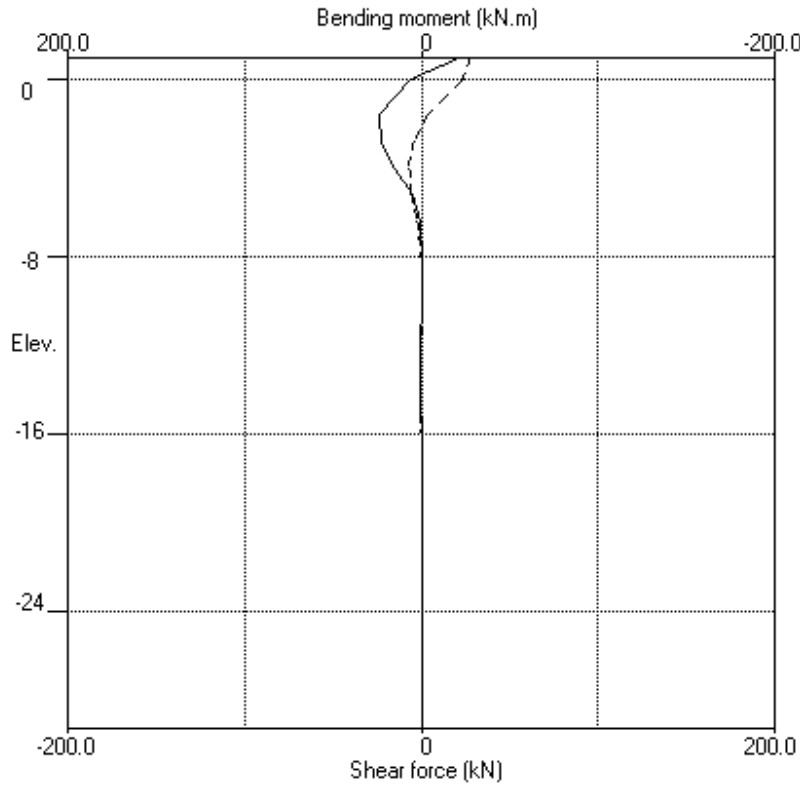
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		<u>Water</u> <u>press.</u>	<u>Vertic</u> <u>-al</u>	<u>Active</u> <u>limit</u>	<u>Passive</u> <u>limit</u>	<u>Earth</u> <u>pressure</u>		
		<u>kN/m²</u>	<u>kN/m²</u>	<u>kN/m²</u>	<u>kN/m²</u>	<u>kN/m²</u>	<u>kN/m³</u>	
24	-29.30	302.90	282.94	0.00	4570.40	108.65	411.55	141286

Note: 25.90 a Soil pressure at active limit
 123.45 p Soil pressure at passive limit

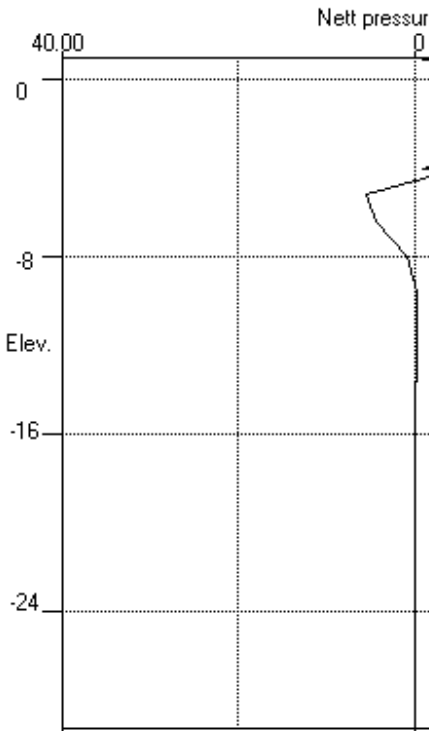
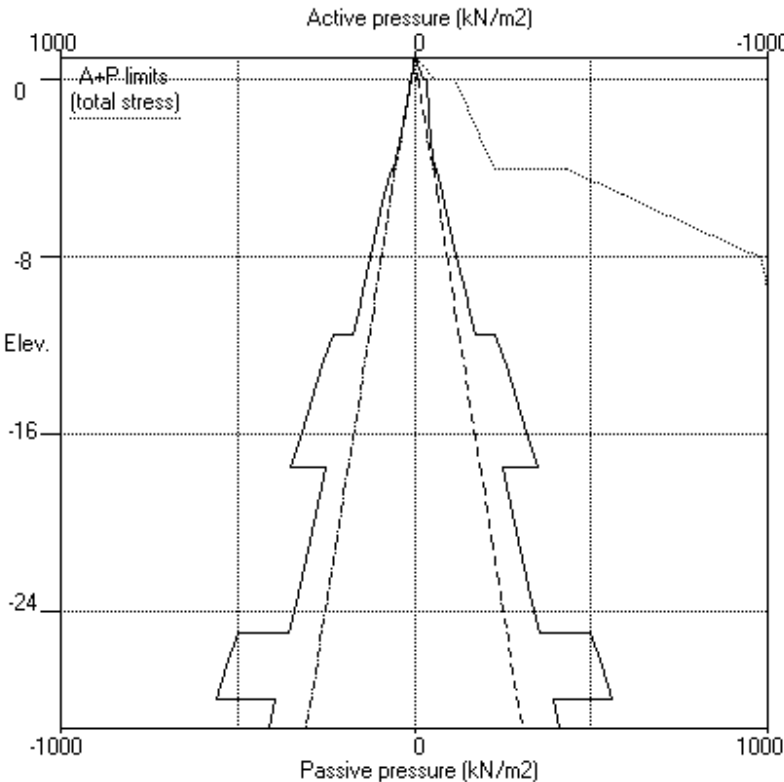
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Program: WALLAP Version 6.07 Revision A55.B74.R58
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Soil properties file: Soil_Model.dat
Project Olympus
TC2

Sheet No.
Job No. BE0046
Made by : CM
Date: 13-03-2025
Checked :

Stage No.1 Apply load no.1 at elev. 0.99



Stage No.1 Apply load no.1 at elev. 0.99



KELTBRAY PILING
 Program: WALLAP Version 6.07 Revision A55.B74.R58
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 Data filename/Run ID: TC2_ULS2
 Soil properties file: Soil_Model.dat
 Project Olympus
 TC2

Sheet No.
 Job No. BE0046
 Made by : CM
 Date:13-03-2025
 Checked :

Units: kN,m

Stage No. 2 Apply load no.2 at elevation 0.99

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	File disp. m	File rotation rad.	Shear force kN	Bending moment kN.m	Prop forces kN	Applied moments kN.m
1	0.99	0.00	0.007	1.71E-03	110.6	-95.8	110.6	-95.8
2	0.00	-45.39	0.005	1.91E-03	97.1	10.4		
		-103.86	0.005	1.91E-03	97.1	10.4		
3	-1.60	-58.62	0.002	1.47E-03	19.1	105.2		
4	-2.80	-28.00	0.001	8.87E-04	-12.1	103.0		
5	-4.00	-7.87	0.000	3.79E-04	-25.0	76.9		
		-37.19	0.000	3.79E-04	-25.0	76.9		
6	-5.20	20.26	-0.000	7.08E-05	-31.1	32.4		
7	-6.40	22.27	-0.000	-3.14E-05	-15.8	3.8		
8	-8.00	6.84	-0.000	-2.95E-05	-1.8	-4.3		
9	-9.60	-0.24	0.000	-6.04E-06	1.4	-1.9		
10	-10.55	-0.93	0.000	-7.93E-08	1.0	-0.7		
11	-11.50	-0.67	0.000	1.52E-06	0.6	0.0		
		-1.03	0.000	1.52E-06	0.6	0.0		
12	-12.95	-0.25	0.000	8.96E-07	0.0	0.2		
13	-14.40	0.06	-0.000	9.60E-08	-0.1	0.1		
14	-15.95	0.04	-0.000	-6.71E-08	-0.0	-0.0		
15	-17.50	0.00	-0.000	-2.10E-08	0.0	-0.0		
		0.00	-0.000	-2.10E-08	0.0	-0.0		
16	-18.35	-0.00	0.000	-5.41E-09	0.0	-0.0		
17	-19.20	-0.00	0.000	1.33E-09	0.0	-0.0		
18	-20.80	-0.00	0.000	2.89E-09	0.0	0.0		
19	-22.40	-0.00	0.000	8.11E-10	-0.0	0.0		
20	-23.70	0.00	-0.000	-1.92E-12	-0.0	0.0		
21	-25.00	0.00	-0.000	-1.36E-10	-0.0	-0.0		
22	-26.50	0.00	-0.000	-4.92E-11	0.0	-0.0		
23	-28.00	-0.00	0.000	-7.06E-13	0.0	-0.0		
24	-29.30	-0.00	0.000	4.54E-12	0.0	-0.0		

LEFT side

Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	0.99	0.00	0.00	0.00	0.00	0.00	11261	
2	0.00	9.90	5.94	0.00	45.39	0.00	9.90a 11261	
		9.90	5.94	0.00	103.86	0.00	9.90a 23099	
3	-1.60	25.90	15.54	0.00	132.67	0.00	25.90a 23099	
4	-2.80	37.90	22.74	0.00	154.27	0.00	37.90a 23099	
5	-4.00	49.90	29.94	0.00	175.88	5.05	54.95 23099	
		49.90	29.94	0.00	379.51	0.00	49.90a 140766	
6	-5.20	61.90	41.94	0.00	531.62	28.62	90.52 135030	
7	-6.40	73.90	53.94	0.00	683.73	34.92	108.82 135030	

(continued)

Stage No.2 Apply load no.2 at elevation 0.99

LEFT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
8	-8.00	89.90	69.94	0.00	886.54	34.26	124.16	135030
9	-9.60	105.90	85.94	0.00	1089.35	37.78	143.68	138759
10	-10.55	115.40	95.44	0.00	1209.77	41.62	157.02	138759
11	-11.50	124.90	104.94	0.00	1330.18	45.94	170.84	138759
		124.90	104.94	0.00	1117.92	104.43	229.33	213047
12	-12.95	139.40	119.44	0.00	1272.04	119.32	258.72	242394
13	-14.40	153.90	133.94	0.00	1426.17	133.97	287.87	269779
14	-15.95	169.40	149.44	0.00	1590.93	149.46	318.86	300923
15	-17.50	184.90	164.94	0.00	1755.68	164.94	349.84	332068
		184.90	164.94	0.00	2664.32	63.34	248.24	137528
16	-18.35	193.40	173.44	0.00	2801.62	66.60	260.00	136135
17	-19.20	201.90	181.94	0.00	2938.92	69.86	271.76	136135
18	-20.80	217.90	197.94	0.00	3197.37	76.01	293.91	136135
19	-22.40	233.90	213.94	0.00	3455.83	82.15	316.05	136135
20	-23.70	246.90	226.94	0.00	3665.82	87.15	334.05	142252
21	-25.00	259.90	239.94	0.00	3875.81	92.14	352.04	142252
		259.90	239.94	0.00	1755.05	239.94	499.84	273124
22	-26.50	274.90	254.94	0.00	1864.77	254.94	529.84	273124
23	-28.00	289.90	269.94	0.00	1974.49	269.94	559.84	278864
		289.90	269.94	0.00	4360.41	103.66	393.56	145242
24	-29.30	302.90	282.94	0.00	4570.40	108.65	411.55	145242

RIGHT side								
Node no.	Y coord	Water press.	Vertic -al	Effective stresses			Total earth pressure	Coeff. of subgrade reaction
				Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.99	0.00	0.00	0.00	0.00	0.00	0.00	11261
2	0.00	9.90	5.94	0.00	45.39	45.39	55.29p	11261
		9.90	5.94	0.00	103.86	103.86	113.76p	23099
3	-1.60	25.90	15.54	0.00	132.67	58.62	84.52	23099
4	-2.80	37.90	22.74	0.00	154.27	28.00	65.90	23099
5	-4.00	49.90	29.94	0.00	175.88	12.92	62.82	23099
		49.90	29.94	0.00	379.51	37.19	87.09	140766
6	-5.20	61.90	41.94	0.00	531.62	8.37	70.27	135030
7	-6.40	73.90	53.94	0.00	683.73	12.65	86.55	135030
8	-8.00	89.90	69.94	0.00	886.54	27.43	117.33	135030
9	-9.60	105.90	85.94	0.00	1089.35	38.02	143.92	138759
10	-10.55	115.40	95.44	0.00	1209.77	42.55	157.95	138759
11	-11.50	124.90	104.94	0.00	1330.18	46.61	171.51	138759
		124.90	104.94	0.00	1117.92	105.45	230.35	213047
12	-12.95	139.40	119.44	0.00	1272.04	119.56	258.96	242394
13	-14.40	153.90	133.94	0.00	1426.17	133.91	287.81	269779
14	-15.95	169.40	149.44	0.00	1590.93	149.42	318.82	300923
15	-17.50	184.90	164.94	0.00	1755.68	164.94	349.84	332068
		184.90	164.94	0.00	2664.32	63.34	248.24	137528
16	-18.35	193.40	173.44	0.00	2801.62	66.60	260.00	136135
17	-19.20	201.90	181.94	0.00	2938.92	69.87	271.77	136135
18	-20.80	217.90	197.94	0.00	3197.37	76.01	293.91	136135
19	-22.40	233.90	213.94	0.00	3455.83	82.15	316.05	136135
20	-23.70	246.90	226.94	0.00	3665.82	87.14	334.04	142252
21	-25.00	259.90	239.94	0.00	3875.81	92.14	352.04	142252
		259.90	239.94	0.00	1755.05	239.94	499.84	273124
22	-26.50	274.90	254.94	0.00	1864.77	254.94	529.84	273124

Run ID. TC2_ULS2
 Project Olympus
 TC2

Sheet No.
 Date:13-03-2025
 Checked :

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Stage No.2 Apply load no.2 at elevation 0.99

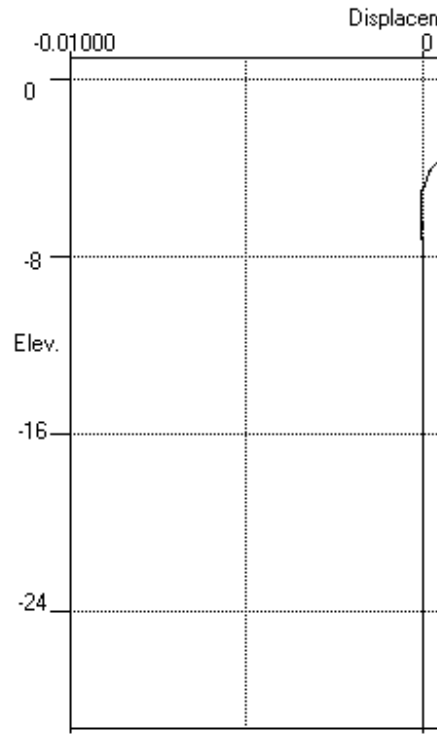
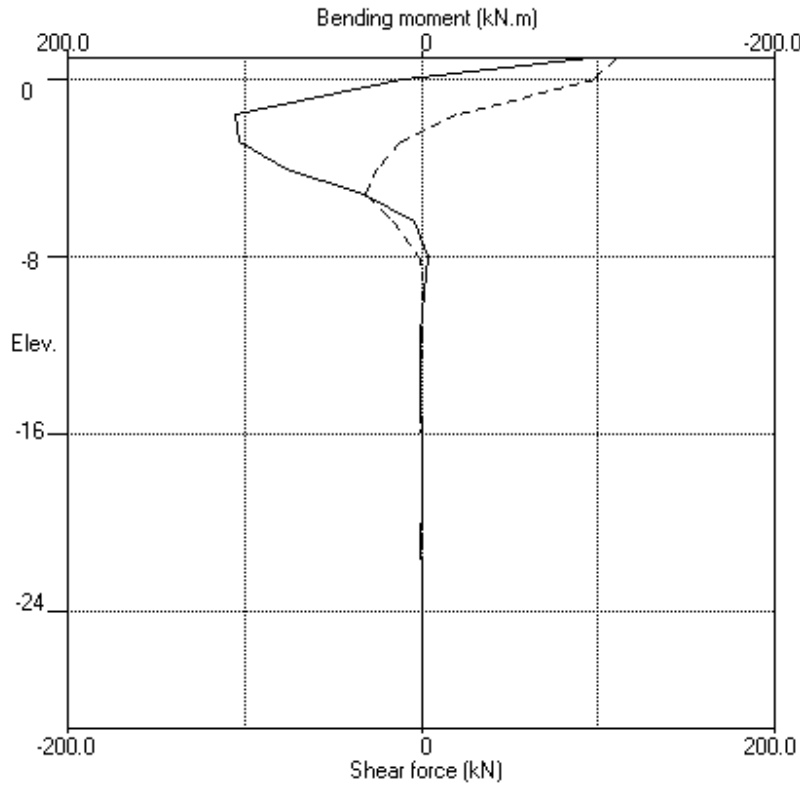
RIGHT side								
Node no.	Y coord	Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ³
23	-28.00	289.90	269.94	0.00	1974.49	269.94	559.84	278864
		289.90	269.94	0.00	4360.41	103.66	393.56	145242
24	-29.30	302.90	282.94	0.00	4570.40	108.65	411.55	145242

Note: 49.90 a Soil pressure at active limit
 113.76 p Soil pressure at passive limit

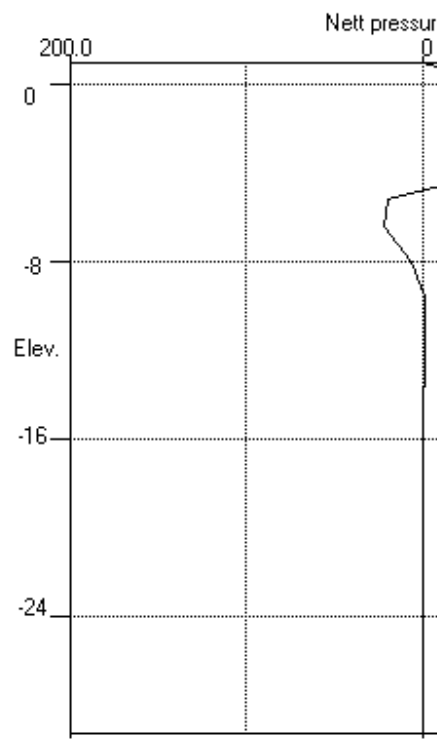
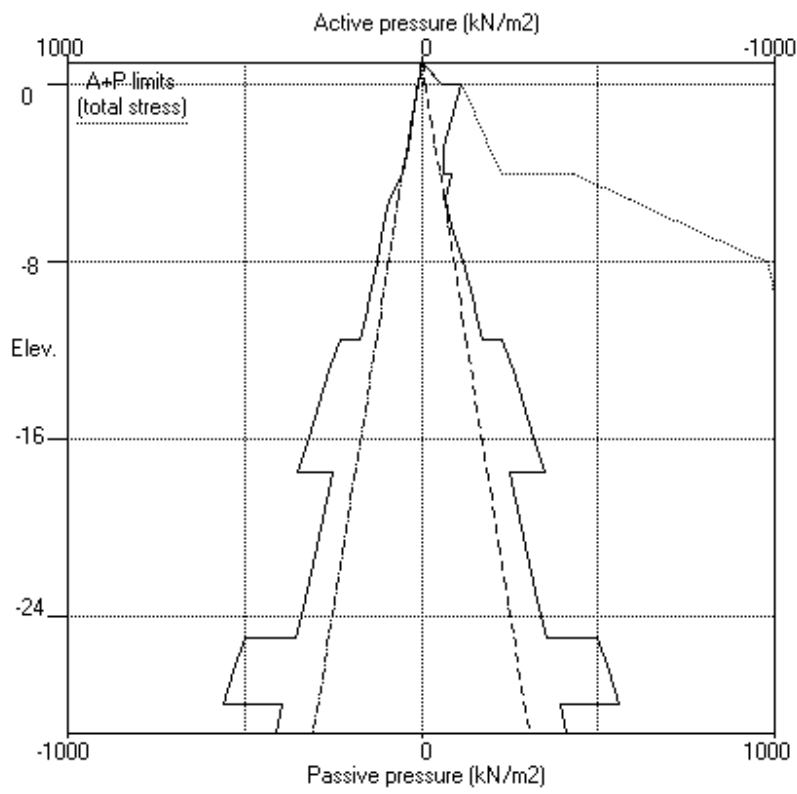
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Program: WALLAP Version 6.07 Revision A55.B74.R58
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Data filename/Run ID: TC2_ULS2
Soil properties file: Soil_Model.dat
Project Olympus
TC2

Sheet No.
Job No. BE0046
Made by : CM
Date: 13-03-2025
Checked :

Stage No.2 Apply load no.2 at elev. 0.99



Stage No.2 Apply load no.2 at elev. 0.99



KELTBRAY PILING
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 Data filename/Run ID: TC2_ULS2
 Soil properties file: Soil_Model.dat
 Project Olympus
 TC2

Sheet No.
 Job No. BE0046
 Made by : CM
 Date:13-03-2025
 Checked :

 Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: ULS DA1 Combination 2
 Water pressures : Worst Credible
 Partial factor on C' = 1.250
 Partial factor on Phi' = 1.250
 Partial factor on Cu = 1.400
 Partial factor on Soil Modulus = 1.000
 Partial factor on Permanent Unfavourable loads = 1.000
 Partial factor on Permanent Favourable loads = 1.000
 Partial factor on Variable Unfavourable loads = 1.300

BENDING MOMENT and DISPLACEMENT ANALYSIS of Single Pile

Analysis options

Pile diameter = 0.60m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached

Rigid boundaries: Left side 20.00 from pile
 Right side 20.00 from pile

Limit State: ULS DA1 Combination 2

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment		Shear force	
		maximum m	minimum m	maximum kN.m	minimum kN.m	maximum kN	minimum kN
1	0.99	0.007	0.000	0.0	-95.8	110.6	0.0
2	0.00	0.005	0.000	10.4	0.0	97.1	0.0
3	-1.60	0.002	0.000	105.2	0.0	19.1	0.0
4	-2.80	0.001	0.000	103.0	0.0	0.0	-12.1
5	-4.00	0.000	0.000	76.9	0.0	0.0	-25.0
6	-5.20	0.000	-0.000	32.4	0.0	0.0	-31.1
7	-6.40	0.000	-0.000	3.8	0.0	0.0	-15.8
8	-8.00	0.000	-0.000	0.0	-4.3	0.0	-1.8
9	-9.60	0.000	0.000	0.0	-1.9	1.4	0.0
10	-10.55	0.000	0.000	0.0	-0.7	1.0	0.0
11	-11.50	0.000	0.000	0.0	0.0	0.6	0.0
12	-12.95	0.000	0.000	0.2	0.0	0.0	-0.0
13	-14.40	0.000	-0.000	0.1	0.0	0.0	-0.1
14	-15.95	0.000	-0.000	0.0	-0.0	0.0	-0.0
15	-17.50	0.000	-0.000	0.0	-0.0	0.0	0.0
16	-18.35	0.000	0.000	0.0	-0.0	0.0	0.0
17	-19.20	0.000	0.000	0.0	-0.0	0.0	0.0
18	-20.80	0.000	0.000	0.0	0.0	0.0	0.0
19	-22.40	0.000	-0.000	0.0	0.0	0.0	-0.0
20	-23.70	0.000	-0.000	0.0	0.0	0.0	-0.0
21	-25.00	0.000	-0.000	0.0	-0.0	0.0	-0.0
22	-26.50	0.000	-0.000	0.0	-0.0	0.0	0.0
23	-28.00	0.000	0.000	0.0	-0.0	0.0	0.0
24	-29.30	0.000	0.000	0.0	-0.0	0.0	0.0

Run ID. TC2_ULS2
Project Olympus
TC2

Sheet No.
Date:13-03-2025
Checked :

Summary of results (continued)

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment				Shear force			
no.	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>
	kN.m		kN.m		kN		kN	
1	23.8	-1.60	-21.5	0.99	28.3	0.99	-6.7	-4.00
2	105.2	-1.60	-95.8	0.99	110.6	0.99	-31.1	-5.20

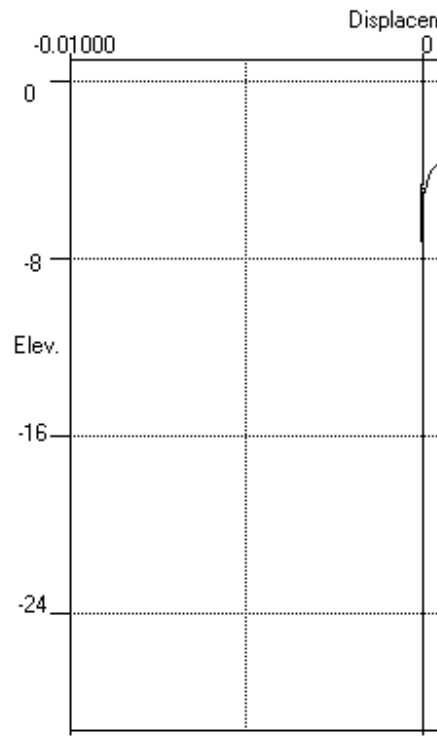
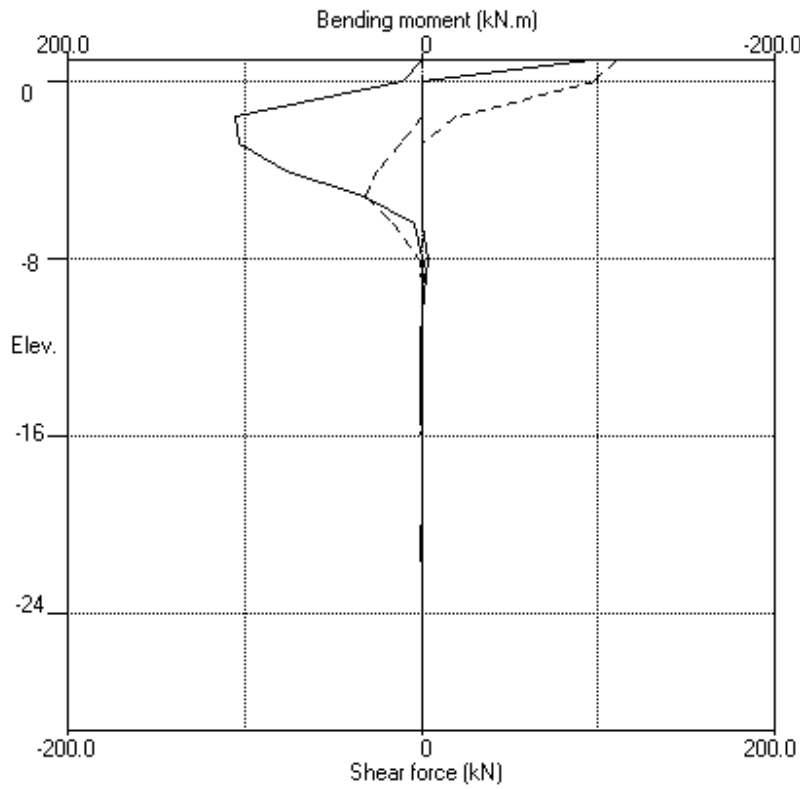
Maximum and minimum displacement at each stage

Stage	Displacement				<u>Stage description</u>
no.	<u>maximum</u>	<u>elev.</u>	<u>minimum</u>	<u>elev.</u>	
	m		m		
1	0.001	0.99	-0.000	-5.20	Apply load no.1 at elev. 0.99
2	0.007	0.99	-0.000	-6.40	Apply load no.2 at elev. 0.99

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Program: WALLAP Version 6.07 Revision A55.B74.R58
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Data filename/Run ID: TC2_ULS2
Soil properties file: Soil_Model.dat
Project Olympus
TC2


Sheet No.
Job No. BE0046
Made by : CM
Date: 13-03-2025
Checked :

Bending moment, shear force, displacement envelopes



Appendix E Structural Calculations to EC2

E.1: Shear Capacity

PROJECT: Project Olympus							
TITLE or DESCRIPTION: Shear Design TC1/tc2		Orig.	Date	Verif.	Date	Ref. No/rev.	SHEET
		CM	13/03/2025	ms	13/03/2025	P02	1 of 1
						Date	02/12/2021
						Version	v3
REFERENCE	Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ) using helical reinforcement						
EC2	Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ) using helical reinforcement						
4.4.1.3(4)	<p><u>Pile section</u></p> <p>pile dia d_{nom} = 600 mm design pile diameter = 570 mm A_c = 255176 mm² cover c_{nom} = 60 mm main bar dia = 20 mm no. main bars = 7 no. helical dia. = 12 mm d = 408 mm</p> <p>k_2 = 75 mm [NA.1 4.4.1.3 (4)]</p> <p>f_{ck} = 32 MPa f_{yk} = 500 MPa Ult V_{Ed} = 128 kN factored actions N_{Ed} = -1410 kN</p> <p>$\gamma_c = 1.5$ (This is adjusted by $K_f=1.1$ [2.4.2.5 (2)] to give 1.65) γ_c = 1.65 γ_s = 1.15 SF factor = 1</p> <p>α_{cc} = 0.85 [NA.1 3.1.6 (1)]</p>						
6.2.2	<p>Check requirement for shear reinforcement</p> <p>$V_{Rd,c} = [C_{Rd,c}k(100\rho_1f_{ck})^{1/3} + k_1\sigma_{cp}]b_wd$ with minimum = $(V_{min} + k_1\sigma_{cp})b_wd$ $V_{min} = 0.035k^{3/2}f_{ck}^{1/2}$ 0.4389</p> <p>$CRd,c = 0.18 / \gamma_c = 0.10909091$ $k = 1 + (200/d)^{1/2} = 1.70 <= 2.0$ $\rho_1 = A_{s1}/b_wd = 0.00472959 <= 0.02$ $\sigma_{cp} = N_{Ed}/A_c = -5.52560098 < 0.2f_{cd}$ $k_1 = 0.15$ [NA.1 6.2.2(1)]</p> <p>$V_{Rd,c} = -91$ kN Is $V_{Rd,c} > V_{Ed}$ => NO Action: Design of shear reinforcement required</p>						
6.2.3	<p>Design Shear Reinforcement</p> <p>Check concrete strut capacity at $\cot \theta = 2.5$:- $V_{Rd,max} = \alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9) $V_{Rd,max} = 772$ kN</p> <p>$\cot \theta = 1$ $\tan \theta = 1$ $\alpha_{cw} = 1$ [NA.1 6.2.3(3)] $z = 0.77d = 314.058064$ mm $v_1 = 0.6 (1 - (f_{ck}/250)) = 0.5232$ [6.6N]</p> <p>Is $V_{Rd,c} > V_{Ed}$ => YES Action: Calculate link spacing</p>						
6.2.3 (3) exp 6.9	<p>Calculation for strut inclination:- $\theta = 0.5 \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$ $\theta = NA$ rad $\cot \theta = 1 > 1.0$</p> <p>Calculate shear reinforcement spacing per Orr et al (2010);</p> <p>$V_{Rd,s} = \lambda_1 \cdot \lambda_2 \cdot (A_{sw}/s) \cdot z \cdot f_{ywd} \cdot \cot \theta$ $s = \lambda_1 \cdot \lambda_2 \cdot A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$ = 200 mm</p> <p>$A_{sw} = 226.194671$ mm² $f_{ywd} = 435$ MPa $\lambda_1 = 0.85$ $\lambda_2 = ((p / (2 \cdot \pi \cdot f_{sv}))^2 + 1)^{-0.5} = 0.98$</p>						
9.5.3 (3)	<p>Check maximum shear link spacing EC2</p> <p>is $s_{1,max} > 20D_{longitudinalbars}$ NO is $s_{1,max} > D_{pile}$ NO is $s_{1,max} > 400$mm NO</p> <p>Provide 12 mm helical at nominal pitch 200 mm</p>						
Orr et al (2010) Shear design EC2 truss model							

E.2: Flexural Reinforcement

Job number BE0046
Job title Project Olympus
Subtitle Tower Crane Piles
By CM
Checked by GW

1 Units

The following units are used throughout this calculation.

<i>Force</i>	kN	<i>Area</i>	mm ²
<i>Length</i>	m	<i>Second moment of area</i>	mm ⁴
<i>Section dimensions</i>	mm	<i>Section modulus</i>	mm ³
<i>Stress</i>	N/mm ²	<i>Area per unit length</i>	mm ² /m
<i>Strain</i>	‰	<i>Angle</i>	°
<i>Moment</i>	kNm	<i>Axial stiffness</i>	kN
<i>Curvature</i>	‰/m	<i>Bending stiffness</i>	kNm ²
<i>Density</i>	t/m ³		

2 Design code

The following design code is used: Eurocode 2 (part 1), National Annex: UK

3 Materials

The following materials are used in these calculations.

3.1 Concrete

- C32/40

<i>Strength, f_{ck}:</i>	32 N/mm ²
<i>Elastic modulus, E:</i>	33346 N/mm ²
<i>Density, ρ:</i>	2.4 t/m ³

3.2 Reinforcement

- 500B

<i>Strength, f_{yk}:</i>	500 N/mm ²
<i>Elastic modulus, E:</i>	200e3 N/mm ²

- Density, ρ :* 7.85 t/m³

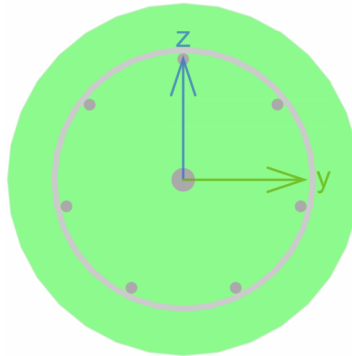
Strength, f_{yk} : 950 N/mm²

Elastic modulus, E : 380e3 N/mm²

Density, ρ : 7.85 t/m³

4 Sections

4.1 Section 1 (TC1)



<i>Definition</i>		<i>Reinforcement</i>		
<i>Material</i>	Concrete	<i>Type</i>	<i>Description</i>	<i>Position(s)</i>
<i>Grade</i>	5	LINK	B10	
<i>Profile</i>	STD C 600	PERIMETER	7B20	
<i>Cover</i>	75mm	POINT	D40	0,0

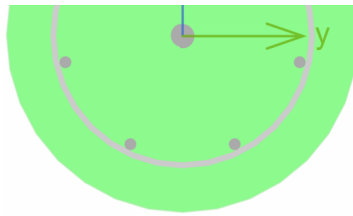
4.1.1 Analysis

4.1.1.1 ULS Results Summary

<i>Case</i>	<i>F_x (kN)</i>	<i>M_{yy} (kNm)</i>	<i>M_{zz} (kNm)</i>	<i>Utilisation</i>	<i>Status</i>
1	1410	102	0	91%	✓
2	1410	0	102	91%	✓
3	-3615	102	0	66%	✓
4	-3615	0	102	66%	✓

4.2 Section 2 (TC2)






<i>Definition</i>		<i>Reinforcement</i>		
<i>Material</i>	Concrete	<i>Type</i>	<i>Description</i>	<i>Position(s)</i>
<i>Grade</i>	5	<i>LINK</i>	B10	
<i>Profile</i>	STD C 600	<i>PERIMETER</i>	7B20	
<i>Cover</i>	75mm	<i>POINT</i>	D40	0,0


4.2.1 Analysis

4.2.1.1 ULS Results Summary

<i>Case</i>	F_x (kN)	M_{yy} (kNm)	M_{zz} (kNm)	<i>Utilisation</i>	<i>Status</i>
1	1398	104	0	91%	✓
2	1398	0	104	91%	✓
3	-4819	104	0	85%	✓
4	-4819	0	104	85%	✓

E.3: Anchorage

PROJECT		 St. Andrew's House, Esher, Surrey, KT10 9TA				
TITLE	Calculation of reinforcement anchorage length (20mm bars)	Orig	Check	Job No.		Sheet
		CM	SS	Date:	20/12/24	1 of 1
Calculation						Reference
MATERIAL PROPERTIES						
Design concrete cylinder strength:	$f_{ck} = 32$	N/mm ²				EC2 Table 3.1
Design concrete cube strength:	$f_{cu} = 40$	N/mm ²		i.e. C32/40		
Characteristic yield strength for steel:	$f_{yk} = 500$	N/mm ²				
Design yield strength for steel:	$f_{yd} = 435$	N/mm ²		(= $f_{yk} / 1.15$)		
Bar diameter:	$\phi = 20$	mm				
DESIGN TENSILE STRENGTH						
Mean axial tensile strength of concrete:	$f_{ctm} = 0.3 \cdot f_{ck}^{2/3}$					EC2 Table 3.1
	$f_{ctm} = 3.02$	N/mm ²				
Characteristic axial tensile strength:	$f_{ctk,0.05} = 0.7 \times f_{ctm}$					EC2 Table 3.1
	$f_{ctk,0.05} = 2.12$	N/mm ²				
Design tensile strength:	$f_{ctd} = \alpha_{ct} \cdot f_{ctk,0.05} / \gamma_c$					
Loading type:				Persistent & Transient		
Partial factor for concrete:	$\gamma_c = 1.5$					EC2 2.4.2.4
Coefficient of long term effects:	$\alpha_{ct} = 1.0$					EC2 3.1.6
	$f_{ctd} = 1.41$	N/mm ²				
ULTIMATE BOND STRESS						
Design value for ultimate bond stress:	$f_{bd} = 2.25 \cdot \eta_1 \cdot \eta_2 \cdot f_{ctd}$					EC2 8.4.2
Coefficient for bond condition:	$\eta_1 = 1.0$			[1.0 for 'good'; 0.7 otherwise]		
Coefficient for bar diameter:	$\eta_2 = 1.0$			$\left\{ \begin{array}{l} 1.0 \text{ for } \phi \leq 32\text{mm}; \\ (132-\phi)/100 \text{ otherwise} \end{array} \right.$		
	$f_{bd} = 3.18$	N/mm ²				
BASIC ANCHORAGE LENGTH						
Basic anchorage length:	$I_{b,rqd} = \left(\frac{\phi}{4} \right) \left(\frac{\sigma_{sd}}{f_{bd}} \right)$					EC2 8.4.3 Equation (8.3)
Design stress on anchorage bar:	$\sigma_{sd} = 435$	N/mm ²				EC2 8.4.3
Basic required anchorage length:	$I_{b,rqd} = 685$	mm				
DESIGN ANCHORAGE LENGTH						
Design anchorage length:	$I_{bd} = \alpha_1 \alpha_2 \alpha_3 \alpha_4 \alpha_5 I_{b,rqd}$					EC2 8.4.4
				Tension	Compression	
Shape of bars:	$\alpha_1 = 1$			1	1	EC2 Table 8.2
Concrete cover:	$\alpha_2 = 0.70$			1.00		EC2 Figure 8.3
Non-welded transverse bars:	$\alpha_3 = 1$			1	1	
Welded transverse bars:	$\alpha_4 = 1$			1	1	
Confinement by transverse pressure:	$\alpha_5 = 1$			1	1	
Design anchorage length:	$I_o = 480\text{mm}$			685mm		
CHECK MINIMUM REQUIRED ANCHORAGE LENGTH						
Minimum for anchorage in tension:	$I_{b,min} \geq \max\{0.3I_{b,rqd}; 10\phi; 100\text{mm}\}$					EC2 8.4.4
	$I_{b,min} = 206$	mm				
Minimum for anchorage in compression:	$I_{b,min} \geq \max\{0.6I_{b,rqd}; 10\phi; 100\text{mm}\}$					
	$I_{b,min} = 411$	mm				
SUMMARY						
Basic anchorage length:	$I_{b,rqd} = 690$	mm				
Design anchorage length in tension:	$I_{bd} = 480$	mm				
Design anchorage length in compression:	$I_{bd} = 690$	mm				
Provided anchorage length:	= 690	mm				

PROJECT		 St. Andrew's House, Esher, Surrey, KT10 9TA				
TITLE	Calculation of reinforcement anchorage length (40mm bars)	Orig	Check	Job No.		Sheet
		CM	SS	Date:	20/12/24	1 of 1
Calculation						Reference
MATERIAL PROPERTIES						
Design concrete cylinder strength:	$f_{ck} = 32$	N/mm ²				EC2 Table 3.1
Design concrete cube strength:	$f_{cu} = 40$	N/mm ²		i.e. C32/40		
Characteristic yield strength for steel:	$f_{yk} = 500$	N/mm ²				
Design yield strength for steel:	$f_{yd} = 435$	N/mm ²		(= $f_{yk} / 1.15$)		
Bar diameter:	$\phi = 40$	mm				
DESIGN TENSILE STRENGTH						
Mean axial tensile strength of concrete:	$f_{ctm} = 0.3 \cdot f_{ck}^{2/3}$					EC2 Table 3.1
	$f_{ctm} = 3.02$	N/mm ²				
Characteristic axial tensile strength:	$f_{ctk,0.05} = 0.7 \times f_{ctm}$					EC2 Table 3.1
	$f_{ctk,0.05} = 2.12$	N/mm ²				
Design tensile strength:	$f_{ctd} = \alpha_{ct} \cdot f_{ctk,0.05} / \gamma_c$					
Loading type:	= Persistent & Transient					
Partial factor for concrete:	$\gamma_c = 1.5$					EC2 2.4.2.4
Coefficient of long term effects:	$\alpha_{ct} = 1.0$					EC2 3.1.6
	$f_{ctd} = 1.41$	N/mm ²				
ULTIMATE BOND STRESS						
Design value for ultimate bond stress:	$f_{bd} = 2.25 \cdot \eta_1 \cdot \eta_2 \cdot f_{ctd}$					EC2 8.4.2
Coefficient for bond condition:	$\eta_1 = 1.0$	[1.0 for 'good'; 0.7 otherwise]				
Coefficient for bar diameter:	$\eta_2 = 0.9$	$\left\{ \begin{array}{l} 1.0 \text{ for } \phi \leq 32\text{mm}; \\ (132-\phi)/100 \text{ otherwise} \end{array} \right.$				
	$f_{bd} = 2.92$	N/mm ²				
BASIC ANCHORAGE LENGTH						
Basic anchorage length:	$l_{b,rqd} = \left(\frac{\phi}{4} \right) \left(\frac{\sigma_{sd}}{f_{bd}} \right)$					EC2 8.4.3 Equation (8.3)
Design stress on anchorage bar:	$\sigma_{sd} = 435$	N/mm ²				EC2 8.4.3
Basic required anchorage length:	$l_{b,rqd} = 1489$	mm				
DESIGN ANCHORAGE LENGTH						
Design anchorage length:	$l_{bd} = \alpha_1 \alpha_2 \alpha_3 \alpha_4 \alpha_5 l_{b,rqd}$					EC2 8.4.4
			Tension	Compression		
Shape of bars:	$\alpha_1 = 1$		1	1		EC2 Table 8.2
Concrete cover:	$\alpha_2 = 0.87$		0.87	1.00		EC2 Figure 8.3
Non-welded transverse bars:	$\alpha_3 = 1$		1	1		
Welded transverse bars:	$\alpha_4 = 1$		1	1		
Confinement by transverse pressure:	$\alpha_5 = 1$		1	1		
Design anchorage length:	$l_o = 1294\text{mm}$		1294mm	1489mm		
CHECK MINIMUM REQUIRED ANCHORAGE LENGTH						
Minimum for anchorage in tension:	$l_{b,min} \geq \max\{0.3l_{b,rqd}; 10\phi; 100\text{mm}\}$					EC2 8.4.4
	$l_{b,min} = 447$	mm				
Minimum for anchorage in compression:	$l_{b,min} \geq \max\{0.6l_{b,rqd}; 10\phi; 100\text{mm}\}$					
	$l_{b,min} = 894$	mm				
SUMMARY						
Basic anchorage length:	$l_{b,rqd} = 1490$	mm				
Design anchorage length in tension:	$l_{bd} = 1300$	mm				
Design anchorage length in compression:	$l_{bd} = 1490$	mm				
Provided anchorage length:	= 1490	mm				

Appendix F Design Schedule

Appendix G Settlement Analysis

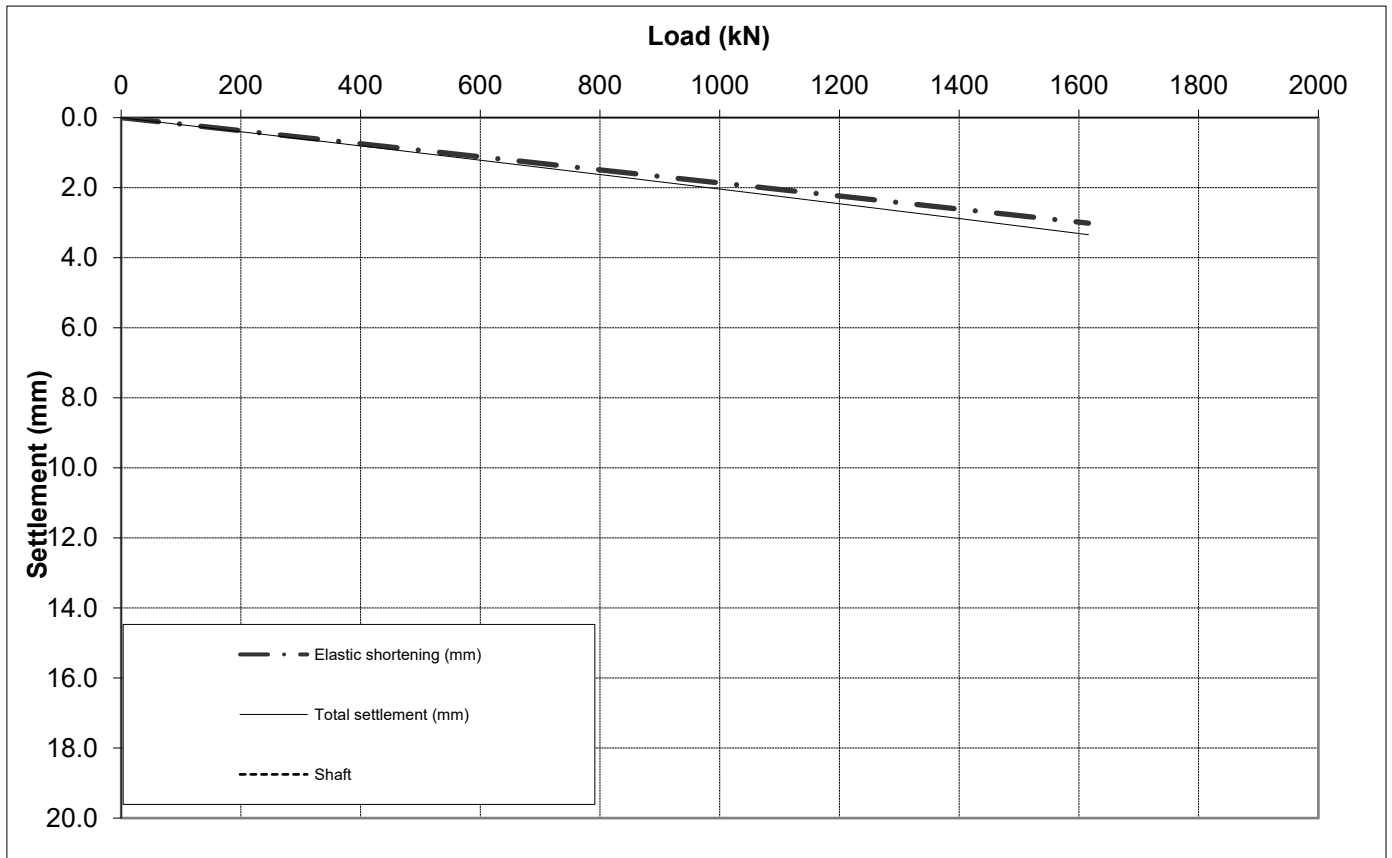


Input data

Pile shaft diameter	600 mm	Concrete modulus	3.34E+07 kN/m ²
Pile base diameter	600 mm	Soil elastic modulus at base	100000 kN/m ²
Shaft free length	5.4 m	Shaft flexibility factor Ms	0.0012
Shaft friction length	27.1 m	Friction centroid Ke	0.45
Ultimate shaft friction	5048.4 kN	Load Increment	76.95 kN
Ultimate end bearing	4241.2 kN	Working load (optional)	1539 kN

Output

Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)	Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)
0	0.0	0.0	0.0	846	55.0	1.6	1.7
77	5.0	0.1	0.2	923	60.0	1.7	1.9
154	10.0	0.3	0.3	1000	65.0	1.9	2.0
231	15.0	0.4	0.5	1077	70.0	2.0	2.2
308	20.0	0.6	0.6	1154	75.0	2.2	2.4
385	25.0	0.7	0.8	1231	80.0	2.3	2.5
462	30.0	0.9	0.9	1308	85.0	2.4	2.7
539	35.0	1.0	1.1	1385	90.0	2.6	2.8
616	40.0	1.1	1.2	1462	95.0	2.7	3.0
693	45.0	1.3	1.4	1539	100.0	2.9	3.2
770	50.0	1.4	1.6	1616	105.0	3.0	3.3



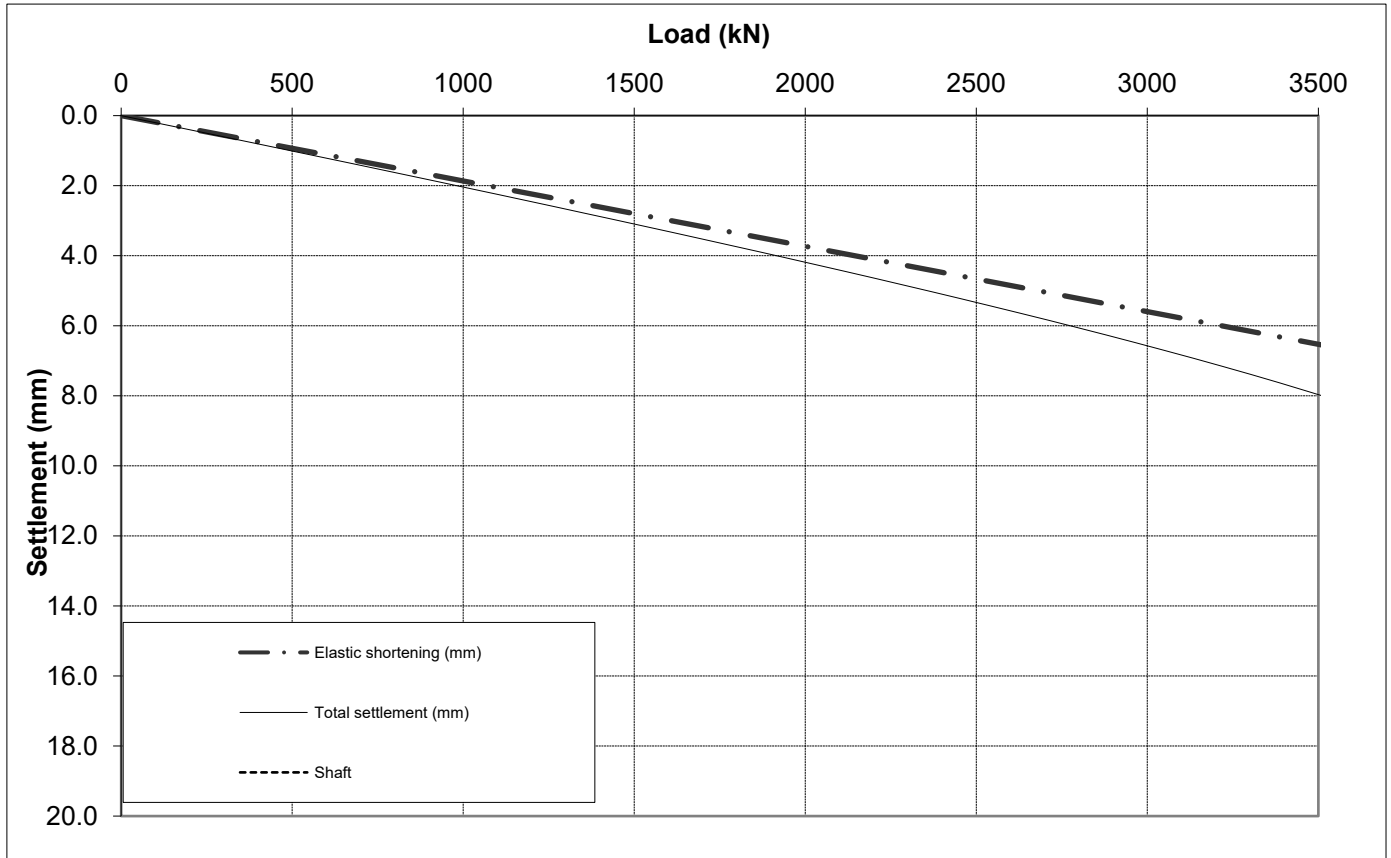


Input data

Pile shaft diameter	600 mm	Concrete modulus	3.34E+07 kN/m ²
Pile base diameter	600 mm	Soil elastic modulus at base	100000 kN/m ²
Shaft free length	5.4 m	Shaft flexibility factor Ms	0.0012
Shaft friction length	27.1 m	Friction centroid Ke	0.45
Ultimate shaft friction	5048.4 kN	Load Increment	169.45 kN
Ultimate end bearing	4241.2 kN	Working load (optional)	3389 kN

Output

Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)	Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)
0	0.0	0.0	0.0	1864	55.0	3.5	3.9
169	5.0	0.3	0.3	2033	60.0	3.8	4.3
339	10.0	0.6	0.7	2203	65.0	4.1	4.6
508	15.0	0.9	1.0	2372	70.0	4.4	5.0
678	20.0	1.3	1.4	2542	75.0	4.7	5.4
847	25.0	1.6	1.7	2711	80.0	5.1	5.8
1017	30.0	1.9	2.1	2881	85.0	5.4	6.3
1186	35.0	2.2	2.4	3050	90.0	5.7	6.7
1356	40.0	2.5	2.8	3220	95.0	6.0	7.2
1525	45.0	2.8	3.1	3389	100.0	6.3	7.6
1695	50.0	3.2	3.5	3558	105.0	6.6	8.1



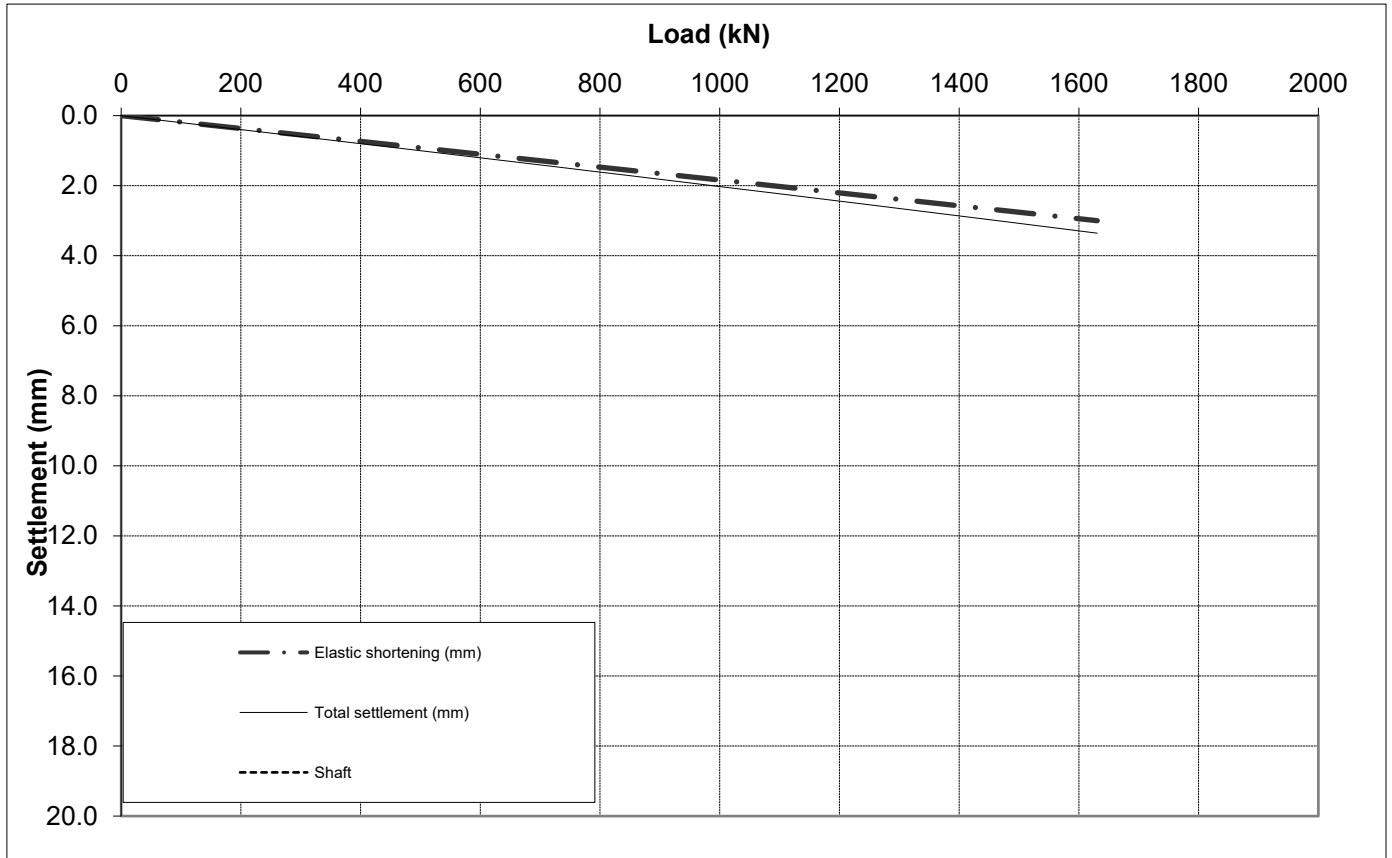


Input data

Pile shaft diameter	600 mm	Concrete modulus	3.34E+07 kN/m ²
Pile base diameter	600 mm	Soil elastic modulus at base	100000 kN/m ²
Shaft free length	5.0 m	Shaft flexibility factor Ms	0.0012
Shaft friction length	27.5 m	Friction centroid Ke	0.45
Ultimate shaft friction	4803 kN	Load Increment	77.65 kN
Ultimate end bearing	4241.2 kN	Working load (optional)	1553 kN

Output

Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)	Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)
0	0.0	0.0	0.0	854	55.0	1.6	1.7
78	5.0	0.1	0.2	932	60.0	1.7	1.9
155	10.0	0.3	0.3	1009	65.0	1.9	2.0
233	15.0	0.4	0.5	1087	70.0	2.0	2.2
311	20.0	0.6	0.6	1165	75.0	2.1	2.4
388	25.0	0.7	0.8	1242	80.0	2.3	2.5
466	30.0	0.9	0.9	1320	85.0	2.4	2.7
544	35.0	1.0	1.1	1398	90.0	2.6	2.9
621	40.0	1.1	1.2	1475	95.0	2.7	3.0
699	45.0	1.3	1.4	1553	100.0	2.9	3.2
777	50.0	1.4	1.6	1631	105.0	3.0	3.4





Input data

Pile shaft diameter	600 mm	Concrete modulus	3.34E+07 kN/m ²
Pile base diameter	600 mm	Soil elastic modulus at base	100000 kN/m ²
Shaft free length	5.0 m	Shaft flexibility factor Ms	0.0012
Shaft friction length	27.5 m	Friction centroid Ke	0.45
Ultimate shaft friction	4803 kN	Load Increment	170.15 kN
Ultimate end bearing	4241.2 kN	Working load (optional)	3403 kN

Output

Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)	Load (kN)	% Working Load	Elastic shortening (mm)	Total settlement (mm)
0	0.0	0.0	0.0	1872	55.0	3.4	3.9
170	5.0	0.3	0.3	2042	60.0	3.8	4.3
340	10.0	0.6	0.7	2212	65.0	4.1	4.7
510	15.0	0.9	1.0	2382	70.0	4.4	5.1
681	20.0	1.3	1.4	2552	75.0	4.7	5.5
851	25.0	1.6	1.7	2722	80.0	5.0	5.9
1021	30.0	1.9	2.1	2893	85.0	5.3	6.3
1191	35.0	2.2	2.4	3063	90.0	5.6	6.8
1361	40.0	2.5	2.8	3233	95.0	5.9	7.3
1531	45.0	2.8	3.1	3403	100.0	6.3	7.8
1702	50.0	3.1	3.5	3573	105.0	6.6	8.3

