

100 Halsey Street

Geotechnical Retaining Wall Design

1101937.1000-RPT-GEO-102

Prepared for: NZCRE 100 Halsey Limited

Prepared by: Tonkin & Taylor Ltd

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1 Introduction

1.1 General

Tonkin & Taylor Ltd (T+T) was engaged by NZ CRE 100 Halsey Limited to conduct geotechnical investigations and analyses for the proposed development at 100 Halsey Street in Wynyard Quarter, Auckland Central.

The current stage of design was undertaken to support the Fast Track Approvals Act (2024) Substantive Application and support preliminary structural design.

This report has been prepared to summarise the temporary retention geotechnical design required to support the proposed development and provides inputs used in the Groundwater and Settlement Effects Report[1].

Our work has been undertaken in accordance with our Variation Order dated 20th of August 2026.

1.2 Site description and proposed development

The site is located in the Wynyard Quarter precinct, Auckland and is bounded by Pakenham Street West to the north; Halsey Street to the east; Gaunt Street to the south and; Amey Daldy Park and 55 Gaunt to the west, Figure *1*.1. Additional details on the site location and history are presented in the Geotechnical Assessment Report (GAR)[2].



Figure 1.*1: Site location.*

[1] T+T (October 2026). *100 Halsey Street – Groundwater and Settlement Effects Report.* T+T ref 1101931.1000-RPT-GEO-103.



Figure 1.2: Proposed development (source: Peddlethorpe 2/10/2026).

Five commercial buildings (Buildings B1 to B5) are indicated in the development plans prepared by Peddlethorp[2]. No basement levels are proposed for Building B1. Buildings B2 and B3 are proposed to have a single basement floor level. Buildings B4 and B5 are proposed to have a two-level continuous basement. To support temporary retention analysis and design, concept level foundation design information has been provided by the project structural engineer[3] to assist in derivation of bulk excavation levels. This indicates between 900 mm and 1300 mm thick foundation beams or a raft slab with 200 mm allowance for under slab layers may be assumed. A summary of proposed floor and assumed bulk excavation levels is provided in Table 1.1. No allowance has been made for localised over excavation for lift pits, services and piles and ground beams at this design stage but should be considered during detailed design. The plaza area between the buildings is expected to be around the building threshold levels of RL+3.35 m.

Table 1.1: Summary of proposed floor and excavation levels

Building	Approximate plan area (m^2)	Lowest finished floor level (mRL)	Assumed bulk excavation level (mRL)
B1	1,200	+3.35	+2.1
B2	3,200	-0.56	-2.1
B3A / B3B	3,900	-0.85	-2.1
B4 / B5	1,700	-4.45	-5.7

Notes: 1. NZVD2016 datum.

2. Excludes local detailed excavation which may be required for piles, pile caps, lift pits, and subfloor building infrastructure.

[2] Peddlethorp (2/10/2026). 100 Halsey Street, Substantive.

[3] Email: R. van Ballegooy (Holmes) to M. Kent (T+T), 8/9/2026, 3:31pm. *RE: 100 Halsey*.

1.3 Retention scheme

A summary of the proposed retention scheme for each building is presented in Table 1.2. In the permanent design case, the basement walls are intended to be supported by the internal building structure at each relevant floor level. Design actions for the permanent and seismic load cases will be assessed during detailed design.

Table 1.2: Summary of temporary retention schemes

Building	Retention Scheme	Assumed ground level for preliminary design (mRL)(1)	Maximum retained height (m)
B2	Secant piles with temporary corner props	2.9	5
B3	Secant piles with temporary props	3.2	5.3
B4 & B5	Option 1: Secant piles with temporary ground anchors	2.9	8.6
B4 & B5	Option 2: Top-down construction - Secant piles + GF slab + B1 slab construction	3.35(3)	8.9

Notes: 1) Based on the maximum spot height at the building boundary[4].
2) Based on preliminary inputs from the project structural engineer[5].
3) Assuming existing ground level is prepared to proposed ground floor slab elevation prior to construction[2].

2 Design requirements

2.1 Groundwater cutoff

The minimum groundwater cutoff is at the interface with ECBF rock for groundwater drawdown purposes. Refer to the Groundwater and Settlement Effects Report[1] for more information.

2.2 Stability

Minimum Factors of Safety (FoS) against overturning of the walls have been adopted as follows using the strength factor method:

- Temporary stability; FoS ≥ 1.2.

2.3 Displacement

The temporary retention was designed to the following target maximum wall deflections:

- Wall deflection ≤ 35 mm for the site road boundaries.
- Wall deflection ≤ 10 mm for the wall adjacent to the existing Travelodge building at a depth equal to the distance between the wall alignment and the building (10 m).

[4] Peddlethorp (18/09/2026). *Proposed Detailed Ground Plane – 100 Halsey ST.* Ref: 2153-1-105.
[5] Email from Holmes (Rick Van Balleggy) to Tonkin + Taylor (Matthew Kent) (8/9/2026). *RE: 100 Halsey.*

3 Design assumptions

3.1 Methodology

The temporary retention design was assessed using a 2D retaining wall design program, WALLAP[6], to determine the embedment lengths, prop requirements, bending moments, shear force and construction staging.

3.2 Ground model and typical sections

The site geotechnical investigation data and interpretation are set out in the GAR[1]. The site is inferred to be underlain by (in order of sequence) surficial fill, hydraulic fill, marine sediments, Pleistocene sediments, and East Coast Bays Formation. Investigations have identified a paleo-channel in the ECBF rock in the western edge of the site.

The recent and historic geotechnical information was used to develop three key general ground models. These three sections are representative of the worst-case ground conditions for preliminary retention design purposes. The sections relate to the buildings as follows:

- Section 1: B3.
- Section 2: B2.
- Section 3: B4 & B5.

The locations of the representative sections are shown in Figure 3.1 and the ground models are presented in Table 3.1.

[6] Geosolve (2013). Computer program. *WALLAP Anchored and Cantilevered Retaining Wall Analysis Program*. Version 6.05.

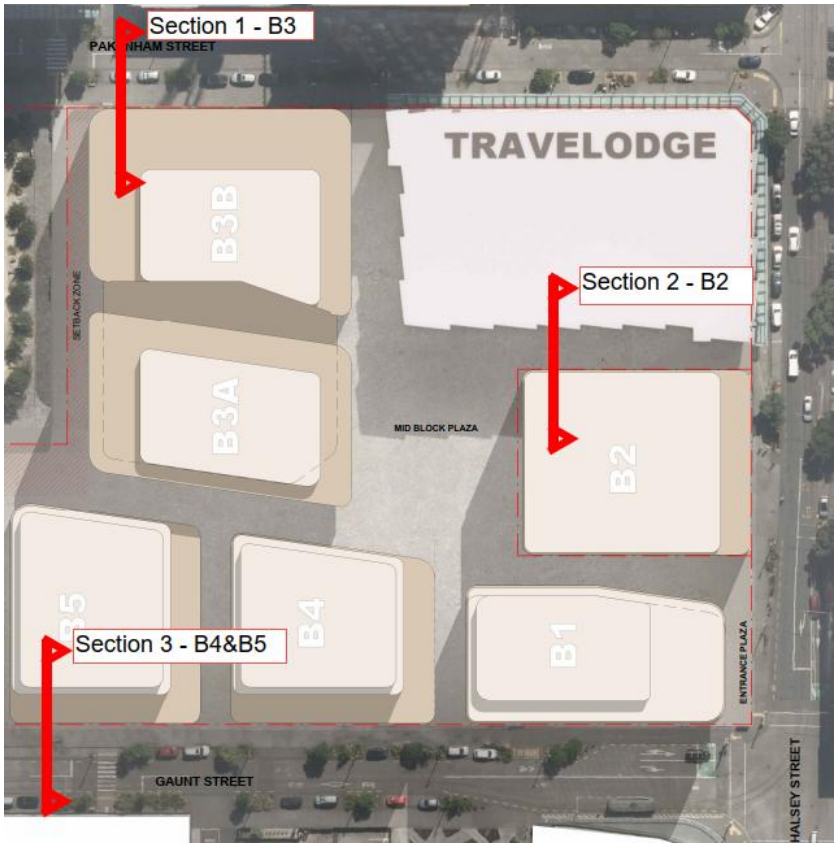


Figure 3.1: Location of representative sections used for temporary retention analysis.

Table 3.1: Summary of adopted ground models for preliminary retention design

Geological unit	Strata elevation m RL (thickness)		
	Section 1	Section 2 (1)	Section 3
Surficial Fill	3.2 (1.8 m)	2.9 (0.8 m)	2.9 (1.5 m)
Hydraulic Fill / Marine Sediments	1.4 (7.2 m)	2.1 (6 m)	1.4 (10 m)
Pleistocene sediments	-5.8 (2 m)	-	-8.6 (4.5 m)
CW – HW ECBF	-7.8 (2.2 m)	-3.9 (2.1 m)	-13.1 (1.9 m)
ECBF rock	-10	-6	-15

Notes: 1): For the top-down option the strata elevation for the surficial fill layer is 3.35 m RL and 1.1 m thick.

3.3 Design soil parameters

In accordance with the T+T GAR[1],the design soil parameters presented in Table 3.2 have been adopted for design of the retaining walls. These parameters have been assessed based on the results of the field investigations from recent and historic investigations on the site and our experience in the area with similar materials.

Table 3.2: Geotechnical Design Parameters – Strength and Stiffness

Geological Unit	Bulk density (kN/m³)	Effective cohesion. c' (kPa)	Friction Angle ϕ' (°)	Young's elastic modulus (MPa)	Poisson's ratio, v
Surficial fill	18	3	28	15	0.3
Hydraulic fill	15	1	25	7[1]	0.35
Marine sediments (sand)	18	0	26	10[1]	0.35
Marine sediments (silt)	17	1	25	10[1]	0.35
Pleistocene sediments	18	5	30	20	0.35
CW-HW ECBF	18	10	32	30	0.3
MW-UW ECBF	20	50	36	200	0.3

Notes: 1. Typical values. The normally consolidated hydraulic fill and marine sediments stiffness increases with depth. For modelling purposes, these materials may be combined with an elastic modulus profile of 0.7z+6 (MPa), where z is depth below ground level.

3.4 Groundwater Profile

In line with the T+T GAR[1], the following groundwater levels have been adopted for design:

- For temporary and long-term conditions, a groundwater level of 0.8 m RL has been assumed based on the average recorded readings during groundwater monitoring at the site.

An elevated groundwater case should be considered during detailed design.

3.5 Surcharges

The following surcharges have been applied at the top of walls as follows:

- The site road boundaries to the north, east and south are considered the critical surcharge cases and have been adopted for all design cases:
  - Pedestrian loading of 5 kPa, immediately behind the wall and extending to 3 m away from the wall,
  - Normal traffic loading of 10 kPa, offset 3 m from the wall and applied for 10 m.
- Travelodge building: The superstructure is supported on piles, a 5kPa surcharge applied 10 m behind the back of the wall, extending up to 30 m, has been adopted to represent the ground bearing floor slab.

Assumptions:

- While Section 2 (B2) is not adjacent to a roadway, it has been used to assess the effects on the eastern boundary of Building 2 (adjacent to Halsey ST). As such, normal traffic loading has been included.

3.6 Seismic loading

Seismic loading has been omitted from this preliminary assessment, which is being undertaken to assess effects on surrounding structures for resource consent purposes and focuses on the temporary loading case. Seismic loading will be assessed during detailed design.

3.7 Structural properties

The structural properties and assumptions presented below should be reviewed and confirmed by the project structural engineer.

3.7.1 Secant piles

The following structural properties have been assumed in the retention analyses:

- Wall properties for perimeter secant retaining walls (with composite stiffness), modelled in WALLAP as fully embedded walls.
  - Hard piles Modulus of Elasticity (*E*): 30 GPa.
  - Soft piles Modulus of Elasticity (*E*): 15 GPa.
  - A cracking factor for temporary, permanent and seismic load conditions has been applied. A summary of the derived composite pile stiffnesses adopted in the analysis is presented in Table 3.3. Composite stiffness values are included for the permanent and seismic loadings cases, which will be assessed during detailed design.
- Hard secant piles will extend a nominal length into the underlying ECBF for toe fixity

Additional embedment may be required to accommodate structural loading, which shall be assessed by the structural engineer.

Table 3.3: Summary of wall stiffness

Wall	Pile type	Pile Spacing	Composite Stiffness, *EI/m run* [kNm²/m]		
			Temporary 75%	Permanent 50%	Seismic 25%
Section 1 (B3)	750 dia. reinforced concrete (RC) piles	600 mm c/c (150 mm overlap)	432000	288000	144000
Section 2 (B2) and Section 3 (B4&B5)	900 dia. reinforced concrete (RC) piles	750 mm c/c (150 mm overlap)	719000	479000	239000

3.8 Props and anchors

Temporary props/anchors are required to support the proposed basements at the site. A summary of the propping details and properties is presented in Table 3.4.

The piles have been assumed to act as a continuous wall. Capping beam stiffness and corner effects have been excluded from the analysis for B3 and B4 & B5, however, has been considered for B2. A capping beam is recommended for all basement walls. Construction of the capping beam prior to excavation will be required to mitigate over-rotation of singular piles founded in loose/soft soil.

An equivalent axial stiffness/m (EA/L/m run) is presented for all props in Table 3.4. For B2, a composite capping beam and corner CHS prop stiffness has been calculated to better represent the actual conditions in WALLAP, given the significant span between corner props (~31 m). The analysis software WALLAP assumes a waler (capping beam) provides infinite stiffness in comparison to the prop.
Given that there is approximately 31 m unsupported span between the corner props, this assumption is not considered appropriate.

As such, an equivalent stiffness (composite stiffness of capping beam and corner prop) has been calculated to reflect actual expected deflection of the wall at the mid-span between corner props. Maximum deflection is expected to occur at the mid-span. The capping beam has been analysed as a continuous beam (structurally connected to the piles), and the props spaced 31 m c/c.

Where temporary steel props are adopted, the following properties are assumed:

Modulus of Elasticity (*E*): 200 GPa

For the top-down option for B4 & B5, the ground floor (GF) and basement level 1 (BL-1) floor slabs will be used to prop the walls in the temporary case. A free length equivalent to half the basement width has been assumed. While a void will be required in the centre of the GF and BL-1 floor slabs to facilitate construction access, the impact on stiffness is considered negligible and has therefore been omitted from the analysis (i.e. continuous floor slab assumed). A modulus of elasticity of 25 GPa has been assumed for the GF and BL-1 floor slabs.

Table 3.4: Summary of prop details

Retention Scheme		Elevation (mRL)	Approximate length (m)	Section Area (m^2/prop)	Axial stiffness EA/L/m run (kN/m/m run)(1)
B3: 310 UC97 @ 5 m c/c spacing, incl. 25°		2.9	10.4	0.0124	47,700
B2: Equivalent composite capping beam (1.5 m wide and 1.2 m depth) and prop (750 CHS 16 corner props, incl. 45°, ~31 m between corner props) at mid-span (~31 m span length)			N/A	N/A	2887
Option 1	B4 & B5: Anchor (upper) – 15.2 mm VSL 8 strands @ 3 c/c spacing, incl. 45°, 600 kN preload	1	22.6(3)	0.00146	4307
	B4 & B5: Anchor (lower) – 15.2 mm VSL 16 strands @ 1.5 c/c spacing, incl. 45°, 1000 kN preload	-2	18.4(3)	0.002293	16,616

Note: (1) The adopted prop axial stiffness in the geotechnical design is the minimum required to control wall deformation. Alternative type/layout of props may be considered by the structural designer provided the individual axial prop stiffness ≥ required stiffness per metre run x prop spacing.
(2) Prop connections to be detailed by the structural designer. Internal raked props will require internal structure such as partially constructed basement foundations and floor slab that can support the prop loads without significant deformation.
(3) Free length of anchor.

3.9 Top-Down Option - B4&B5

A top-down construction option, utilising the ground and basement floor slabs as temporary/permanent props, has also been assessed for B4 & B5 as an alternative to temporary anchors. To minimise calculated secant wall deflections near the base of the excavation ground improvement is required to increase the stiffness at the base of the wall. Secant Continuous Flight Auger (CFA) unreinforced low strength concrete columns are a viable option. Refer to Figure 3.2 for the schematic. The CFAs would be installed following construction of the perimeter secant piles, prior to bulk excavation, with the column section extending from the bulk excavation level to a minimum 1 m into ECBF rock. This method has been successfully installed at a nearby site with excavation works currently pending.

A composite relative soil stiffness (CFA piles and in-situ soil) has been calculated and assumed in the retention analysis on the passive side of the retention pile. A summary of the proposed CFA composite ground improvement parameters, and floor slab properties adopted in design are presented in Table 3.5 and Table 3.6. Additional analysis will be required during detailed design to support this approach.

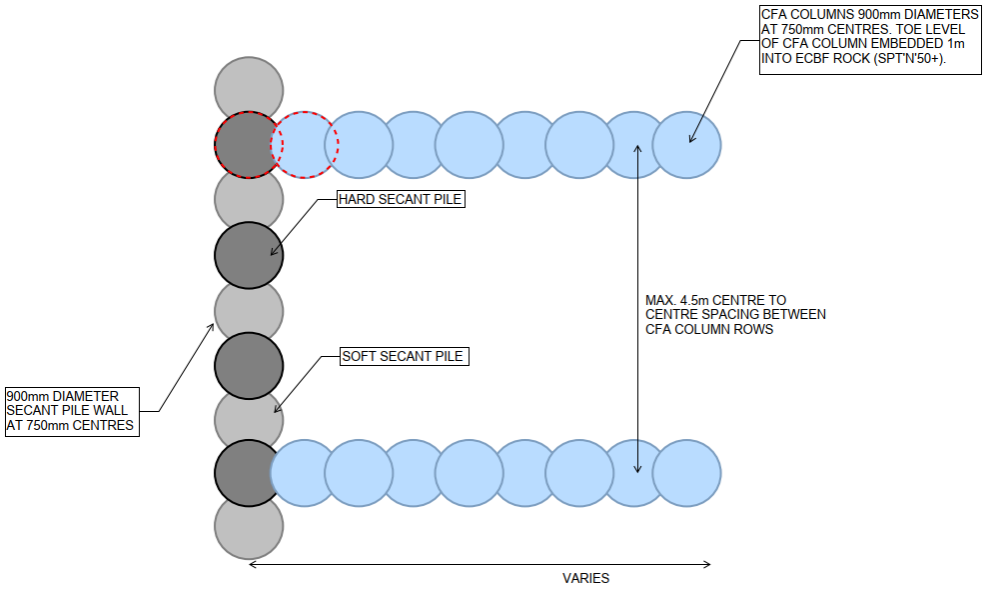


Figure 3.2: Schematic of proposed ground improvement.

Table 3.5: Summary of composite ground improvement geotechnical parameters

Description			
Composite ground improvement (CFA and in-situ soil)	Bulk density	(kN/m^3)	18
	Effective cohesion. c'	(kPa)	30
	Friction Angle ϕ'	(°)	25
	Young's elastic modulus	(GPa)	2
	Poisson's ratio	v	0.2

Table 3.6: Summary of floor prop details

Retention Scheme		Elevation (mRL)	Approximate length (m)	Section Area (m^2/prop)	Axial stiffness EA/L/m run (kN/m/m run)
B4 & B5: Option 2	GF slab	3.35	20	0.2	2 x 10^6
	BL-1 slab	-0.25	20	0.2	2 x 10^6

4 Construction sequence

The following summarises the assumed construction sequence.

Section 1 (B3) – Refer Figure 4.1 for indicative staging schematic:

1 Install secant piles and capping beam.
2 Bulk excavation to 1 m below ground level (RL 2.2 m).
3 Form battered excavation (2H:1V) to max excavation depth (RL -2.1 m).
4 Install raked prop at capping beam mid-point (RL 2.9 m) landing on rigid basement level support. This will require partial construction of the basement ground beams and floor slab within the central portion of the basement excavation.
5 Excavate to full depth (RL -2.1 m) (end of temporary load case assessed).
6 Install floor slabs in bottom-up sequence (not modelled or shown in schematic).

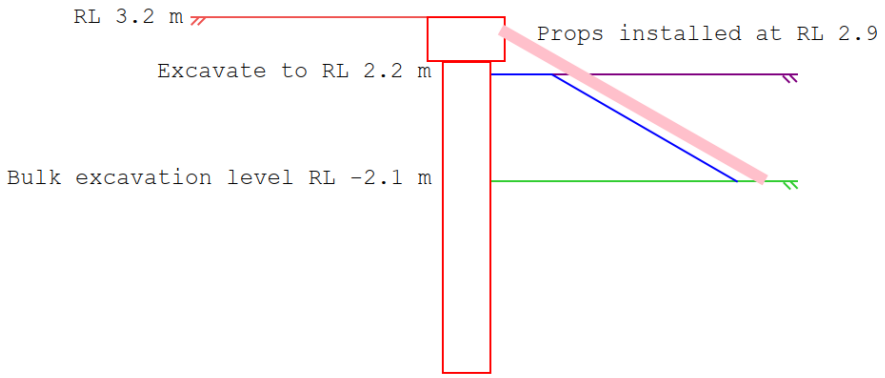


Figure 4.1: B3 staging schematic.

Section 2 (B2) – Refer to Figure 4.2 for indicative staging schematic:

1 Install secant piles and capping beam.
2 Bulk excavation to just below capping beam (RL 1.7 m) and install corner props.
3 Excavate full depth (RL -2.1 m) (end of temporary load case assessed).
4 Install floor slabs in bottom-up sequence (not modelled or shown in schematic).

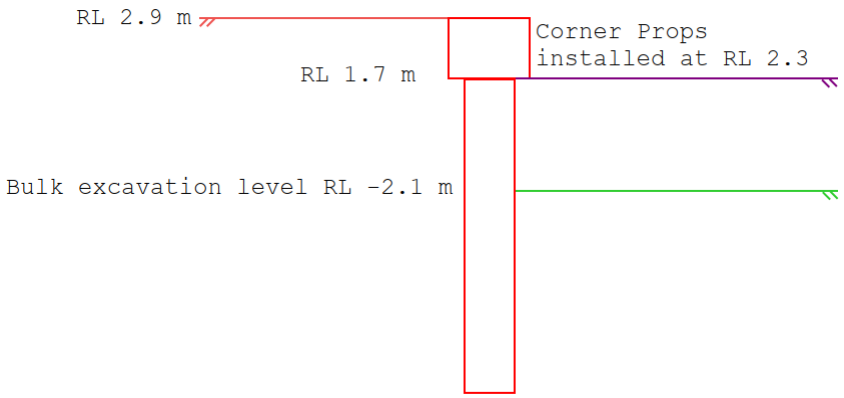


Figure 4.2: B2 staging schematic.

Section 3 (B4 & B5) Option 1 – anchors, refer to Figure 4.3 for indicative staging schematic:

1. Install secant piles and capping beam.
2. Bulk excavation to below anchor installation level (RL 0.8 m).
3. Install upper anchors at RL 1 m.
4. Bulk excavation to RL -2.2 m.
5. Install lower anchors at RL -2 m.

5 Bulk excavation to RL -5.7 m (end of temporary load case assessed).

6. Install floor slabs in bottom-up sequence (not modelled or shown in schematic).

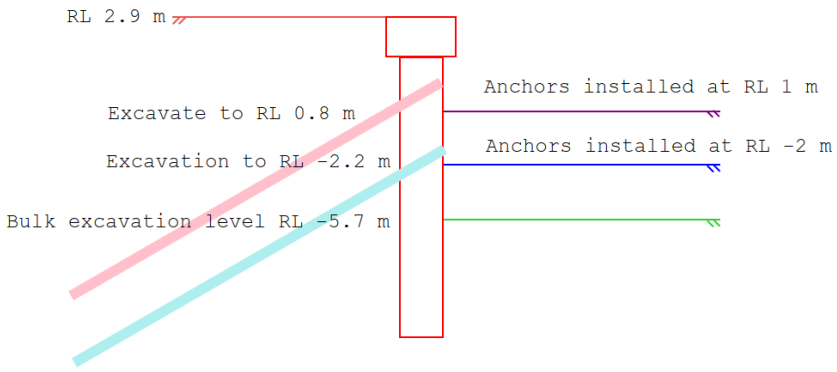


Figure 4.3: B4 & B5 option 1 staging schematic.

Section 3 (B4 & B5) Option 2 – top-down construction, refer to Figure 4.4 Figure 4.3:for indicative staging schematic:

1 Install secant piles and capping beam.

2 Install ground floor slab at RL 3.35 m.

3 Bulk excavation to 200 mm below B1 level to RL -1.1 m.

4 Install basement level 1 floor at RL -0.85 m.

5 Bulk excavation to -5.7 m (end of temporary load case assessed).

6 Install basement level 2 floor (not modelled or shown in schematic).

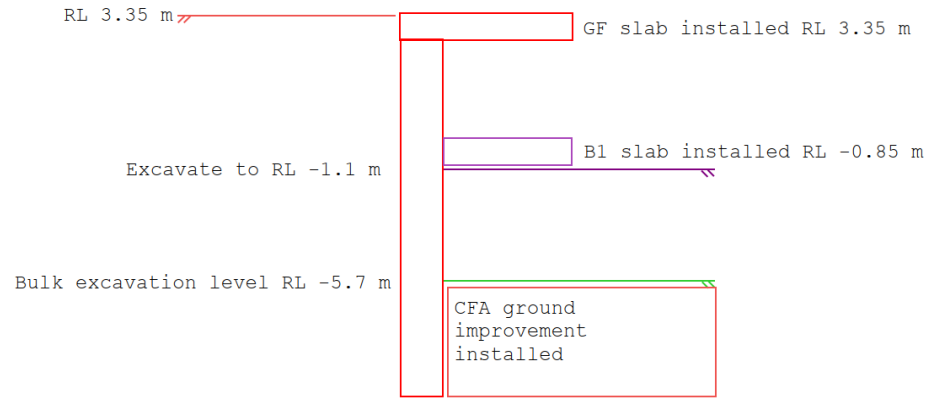


Figure 4.4: B4 & B5 option 2 staging schematic.

5 Analysis results

A summary of the retaining wall analyses is presented in Table 5.1 below. Pile design forces are presented unfactored as per metre length of wall, and prop forces are unfactored and presented as horizontal component and axial force per metre length of wall (i.e. axial force is corrected for the adopted prop inclination).

Table 5.1: Summary of WALLAP analysis results

Section Analysed			B3 – Section 1	B2 – Section 2	B4 & B5 – Section 3	B4 & B5 – Section 3
Adopted ground level		mRL	3.2 m RL	2.9 m RL	2.9 m RL	3.35 m RL
Base of temporary excavation		mRL	-2.1	-2.1	-5.7	-5.7
Wall Type		-	Secant piles with temporary inclined props	Secant piles with temporary corner props and allowance for capping beam stiffness	Option 1: Secant piles with temporary ground anchors	Option 2: Top-down construction -Secant pile + GF slab + B1 slab construction
Pile size			750 @ 600 c/c	900 @ 750 c/c	900 @ 750 c/c	
Wall stiffness ($EI_{c=0.75}$) – temp.		kNm^4/m	432000	719000	719000	
Retention pile embedment (min)		**m**	**3**	**3**	**4**	**4**
Props	Floor prop [GF]	mRL	-	-	-	3.35
	Floor prop [B1]	mRL	-	-	-	-0.85
	Temporary prop [a]	mRL	2.9	2.3	1	-
		spacing	5	30.8	3	-
		inclination	25°	45°	45°	-
		-	**310UC97**	**750 CHS 16**	**15.2 mm VSL 8 strands**	**-**
		m^2	0.0124	0.0369	0.00146	-
		Axial stiffness EA/L/m run (kN/m/m run)	47700	2887 (2)	4307	-
	Axial pre-stress[a]	kN/prop	-	-	600	-
	Temporary prop [b]	mRL	-	-	-2	-
		spacing	-	-	1.5	-
		inclination	-	-	45°	-
		-	**-**	**-**	**15.2 mm VSL 16 strands**	**-**
		m^2	-	-	0.002293	-
		Axial stiffness EA/L/m run (kN/m/m run)	-	-	16616	-
	Axial pre-stress[b]	kN/prop	-		1000	-

Section Analysed				B3 – Section 1	B2 – Section 2	B4 & B5 – Section 3 (anchored)	B4 & B5 – Section 3 (top-down)
Design actions – **temp.**	Deflection (ground level)		mm	20	25	25	10
	Deflection (maximum)		mm	25	25	25	10
	Bending moment (max)		kNm/m	345	250	680	300
	Shear force (maximum)		kN/m	120	125	385	215
	Max. temporary force applied to support	[a] **horizontal**	kN/m	125	10	175	105
		[a] **axial**	kN/m	140	15	250	-
		[b] **horizontal**	kN/m	-	-	540	175
		[b] **axial**	kN/m	-	-	765	-

Note. 1 Design actions are unfactored (working load).
2 Composite corner props and mid-span capping beam stiffness.

6 Further work and construction considerations

Additional analysis is required to assess the long-term and seismic loading cases. Additional analyses will be required to support the top-down option for B4&B5.

Monitoring during construction will be required to verify design assumptions and ensure there are no adverse off-site stability or settlement effects as construction progresses. Monitoring is expected to comprise a combination of survey settlement monitoring points, and top of wall deflection survey. Pre- and post- conditions surveys should be carried out for public services present in proximity to the proposed retention and excavation works. Refer to GAR[2] for additional details and recommended monitoring plan.

7 Applicability

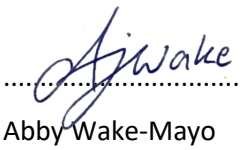
This report has been prepared for the exclusive use of our client NZ CRE 100 Halsey Limited , with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application under the Fast-Track Approvals Act 2024 and that the Expert Panel as the consenting authority will use this report for the purpose of assessing that application.

Recommendations and opinions in this report are based on data from discrete investigation locations. The nature and continuity of subsoil away from these locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:



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Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:



.....

Andrew Hope
Project Director

Technical review by Matthew Kent, Senior Geotechnical Engineer

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Appendix A WALLAP outputs

TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
Licensed from GEOSOLVE | Made by : AWM
Data filename/Run ID: B3_Section_1 |
B3_Section1 | Date:12-10-2026
Please modify / add | Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Soil types Right side
1	3.20	1 Surficial fill	1 Surficial fill
2	1.40	2 Hydraulic/marine Sed	2 Hydraulic/marine Sed
3	-5.80	3 Pleist. Sed	3 Pleist. Sed
4	-7.80	4 CW-HW ECBF	4 CW-HW ECBF
5	-10.00	5 MW-UW ECBF	5 MW-UW ECBF

SOIL PROPERTIES

No.	Soil type -- 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	Surficial fill	18.00	15000	0.530	OC (0.300)	0.309 (0.000)	3.868 (0.000)	
2	Hydraulic.. (3.20)	15.00	6000 (700.0)	0.577	OC (0.350)	0.351 (1.391)	3.253 (4.831)	1.000d
3	Pleist. Sed	18.00	20000	0.500	OC (0.350)	0.283 (1.241)	4.369 (5.836)	5.000d
4	CW-HW ECBF	18.00	30000	0.470	OC (0.300)	0.259 (1.185)	4.964 (6.343)	10.00d
5	MW-UW ECBF	20.00	200000	0.410	OC (0.300)	0.217 (1.078)	6.535 (7.619)	50.00d

Additional soil parameters associated with Ka and Kp

No.	Soil type Description	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	Surficial fill	28.00	0.670	0.00	28.00	0.500	0.00
2	Hydraulic/marine Sed	25.00	0.670	0.00	25.00	0.500	0.00
3	Pleist. Sed	30.00	0.670	0.00	30.00	0.500	0.00
4	CW-HW ECBF	32.00	0.670	0.00	32.00	0.500	0.00
5	MW-UW ECBF	36.00	0.670	0.00	36.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	0.80	0.80

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Left side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Right side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2
1	1	0.80	0.80	0.0	1	-2.10	-2.10	0.0

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -13.00
Maximum finite element length = 1.00 m
Youngs modulus of wall E = 1000.0 kN/m2
Moment of inertia of wall I = 0.012943 m4/m run
E.I = 12.943 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Elev.	Prop spacing m	Cross-section area sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /prop kN	Strut or Anchor	Allow tension ?	L/R
1	2.90	5.00	0.012400	2.000E+08	11.80	-25.00	0	Strut	No	R

SURCHARGE LOADS

Surcharge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge(kN/m2) Near edge	Far edge	Surcharge Cat.	Soil type	Part fact.	Short Q reduc. fact.
1	3.20	0.00(L)	50.00	3.00	5.00	=	--	--	--	--
2	3.20	3.00(L)	50.00	10.00	10.00	=	--	--	--	--

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 3.20
	No analysis at this stage
2	Apply surcharge no.2 at elevation 3.20
3	Change EI of wall to 432341 kN.m2/m run
	Reset wall displacements to zero at this stage
4	Apply water pressure profile no.1
5	Excavate to elevation 2.20 on RIGHT side
	Toe of berm at elevation -2.10
	Width of top of berm = 1.00
	Width of toe of berm = 9.60
6	Install strut or anchor no.1 at elevation 2.90
7	Excavate to elevation -2.10 on RIGHT side

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.20

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 - 2-D finite element model
Open Tension Crack analysis? - No
Active limit arching modelled? - No
Non-linear Modulus Parameter (L) = 16.20 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 50.00 m

Width of excavation/fill on Left side of wall = 30.00 m
Width of excavation/fill on Right side of wall = 75.00 m

Distance to rigid boundary on Left side = 30.00 m
Distance to rigid boundary on Right side = 50.00 m
Elevation of rigid lower boundary = -22.00

Lower rigid boundary at elevation -22.00 - Rough
Rigid boundary on Left side - Rough
Rigid boundary on Right side - Rough
Soil-wall interface - Smooth

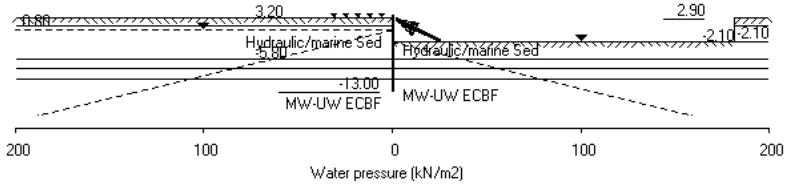
OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement / Bending mom. / Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 3.20	No	No	No
2	Apply surcharge no.2 at elev. 3.20	No	No	No
3	Change EI of wall to 432341kN.m2/m run	Yes	Yes	Yes
4	Apply water pressure profile no.1	No	No	No
5	Excav. to elev. 2.20 on RIGHT side	Yes	Yes	Yes
6	Install prop no.1 at elev. 2.90	Yes	Yes	Yes
7	Excav. to elev. -2.10 on RIGHT side	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No.7 Excav. to elev. -2.10 on RIGHT side



Units: kN,m

Stage No. 5 Excavate to elevation 2.20 on RIGHT side
Toe of berm at elevation -2.10
Width of top of berm = 1.00
Width of toe of berm = 9.60

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

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -13.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
5	3.20	2.20	Cant.	1.913	-11.42	-2.85	5.05	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 30.00m from wall Rough
Right side 50.00m from wall Rough
Lower boundary at elevation -22.00m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	3.20	1.55	0.014	8.74E-04	0.0	0.0		432341
2	2.90	3.21	0.014	8.74E-04	0.7	0.2		432341
3	2.20	7.13	0.013	8.73E-04	4.3	2.0		432341
4	1.40	-17.05	0.013	8.64E-04	0.4	7.2		432341
		-5.23	0.013	8.64E-04	0.4	7.2		
5	0.80	-7.01	0.012	8.55E-04	-3.3	6.5		432341
6	-0.10	-3.12	0.011	8.46E-04	-7.9	1.3		432341
7	-1.00	0.80	0.010	8.52E-04	-8.9	-6.5		432341
8	-1.55	2.95	0.010	8.63E-04	-7.9	-11.1		432341
9	-2.10	5.23	0.010	8.80E-04	-5.6	-14.9		432341
10	-3.05	5.33	0.009	9.15E-04	-0.6	-17.8		432341
11	-4.00	5.64	0.008	9.53E-04	4.6	-16.0		432341
12	-4.90	6.27	0.007	9.79E-04	10.0	-9.6		432341
13	-5.80	7.88	0.006	9.87E-04	16.3	1.9		432341
		-4.01	0.006	9.87E-04	16.3	1.9		
14	-6.80	1.40	0.005	9.66E-04	15.0	16.2		432341
15	-7.80	5.84	0.004	9.11E-04	18.6	31.9		432341
		-4.18	0.004	9.11E-04	18.6	31.9		
16	-8.40	2.24	0.004	8.59E-04	18.1	42.3		432341
17	-9.00	8.20	0.003	7.93E-04	21.2	53.6		432341
18	-10.00	10.29	0.002	6.39E-04	30.4	78.9		432341
		-75.61	0.002	6.39E-04	30.4	78.9		
19	-11.00	-30.08	0.002	4.66E-04	-22.4	71.5		432341
20	-12.00	3.46	0.001	3.44E-04	-35.7	34.0		432341
21	-13.00	61.80	0.001	3.04E-04	-3.1	-0.0		0
22	-13.10	0.00	0.001	0	0.0	0.0		0
23	-13.30	0.06	0.001	0	0.0	0.0		0

(continued)

Stage No.5 Excavate to elevation 2.20 on RIGHT side
Toe of berm at elevation -2.10
Width of top of berm = 1.00
Width of toe of berm = 9.60

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
24	-15.48	-0.00	0.001	0	0.1	0.0		0
25	-17.65	-0.00	0.001	0	0.1	0.0		0
26	-19.83	-0.00	0.000	0	0.1	0.0		0
27	-22.00	-0.06	0.000	0	0.0	0.0		---

LEFT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.20	0.00	5.00	1.55	19.34	1.55	1.55a	15065
2	2.90	0.00	10.40	3.21	40.24	3.21	3.21a	15065
3	2.20	0.00	23.07	7.13	89.23	7.13	7.13a	15065
4	1.40	0.00	37.70	11.65	145.85	11.65	11.65a	15065
		0.00	37.70	11.85	127.47	13.08	13.08	7292
5	0.80	0.00	46.97	15.11	157.61	17.40	17.40	7713
6	-0.10	9.00	51.90	16.84	173.65	19.91	28.91	8346
7	-1.00	18.00	56.78	18.56	189.54	22.44	40.44	8979
8	-1.55	23.50	59.73	19.59	199.12	23.85	47.35	9366
9	-2.10	29.00	62.64	20.61	208.59	25.32	54.32	9752
10	-3.05	38.50	67.59	22.35	224.69	28.14	66.64	10420
11	-4.00	48.00	72.45	24.06	240.50	31.04	79.04	11088
12	-4.90	57.00	76.99	25.65	255.26	33.94	90.94	11721
13	-5.80	66.00	81.47	27.23	269.84	37.31	103.31	12354
		66.00	81.47	16.88	385.16	25.67	91.67	20087
14	-6.80	76.00	89.40	19.13	419.81	32.33	108.33	20087
15	-7.80	86.00	97.29	21.36	454.28	38.47	124.47	20087
		86.00	97.29	13.40	546.34	29.79	115.79	30131
16	-8.40	92.00	102.01	14.62	569.76	35.24	127.24	30131
17	-9.00	98.00	106.72	15.84	593.12	40.42	138.42	30131
18	-10.00	108.00	114.55	17.87	631.99	45.12	153.12	30131
		108.00	114.55	0.00	1129.54	0.00	108.00a	200871
19	-11.00	118.00	124.36	0.00	1193.68	22.40	140.40	200871
20	-12.00	128.00	134.16	0.00	1257.75	42.95	170.95	200871
21	-13.00	138.00	143.96	0.00	1321.79	76.74	214.74	200871
22	-13.10	139.00	144.94	0.00	1328.19	44.36	183.36	200871
23	-13.30	141.00	146.90	0.00	1341.00	46.44	187.44	200871
24	-15.48	162.75	168.21	0.00	1480.25	55.39	218.14	200871
25	-17.65	184.50	189.53	0.00	1619.57	64.28	248.78	200871
26	-19.83	206.25	210.87	0.00	1759.05	73.38	279.63	200871
27	-22.00	228.00	232.24	0.00	1898.72	84.43	312.43	200871

RIGHT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	0.00	0.00	0.00	15289
4	1.40	0.00	14.40	4.45	34.45b	28.70	28.70	15289
		0.00	14.40	3.67	19.71b	18.32	18.32	7400

(continued)

Stage No.5 Excavate to elevation 2.20 on RIGHT side
Toe of berm at elevation -2.10
Width of top of berm = 1.00
Width of toe of berm = 9.60

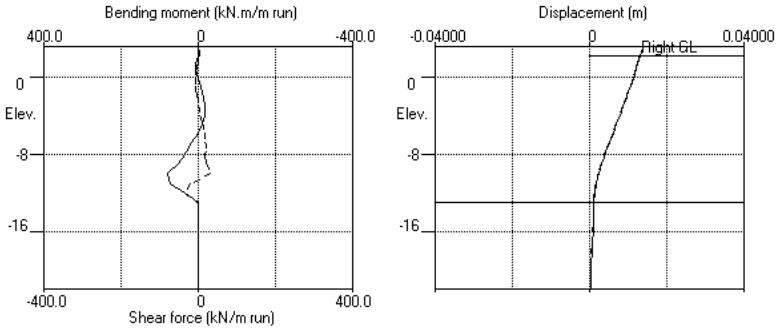
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic-al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
5	0.80	0.00	23.40	6.83	26.88b	24.41	24.41	7828
6	-0.10	0.00	36.90	11.57	38.38b	32.03	32.03	8470
7	-1.00	0.00	50.40	16.31	54.23b	39.64	39.64	9112
8	-1.55	0.00	58.65	19.21	65.96b	44.40	44.40	9505
9	-2.10	0.00	66.90	22.11	61.69b	49.09	49.09	9897
10	-3.05	9.50	71.65	23.78	62.53b	51.81	61.31	10575
11	-4.00	19.00	76.40	25.45	77.74b	54.40	73.40	11253
12	-4.90	28.00	80.91	27.03	92.69b	56.68	84.68	11895
13	-5.80	37.00	85.41	28.61	102.81b	58.42	95.42	12537
		37.00	85.41	18.00	297.98b	58.68	95.68	20385
14	-6.80	47.00	93.41	20.26	273.32b	59.93	106.93	20385
15	-7.80	57.00	101.42	22.53	240.58b	61.64	118.64	20385
		57.00	101.42	14.47	464.82b	62.96	119.96	30578
16	-8.40	63.00	106.22	15.71	411.46b	62.00	125.00	30578
17	-9.00	69.00	111.02	16.96	360.43b	61.22	130.22	30578
18	-10.00	79.00	119.03	19.04	388.99b	63.83	142.83	30578
		79.00	119.03	0.00	1158.86	104.61	183.61	203852
19	-11.00	89.00	129.04	0.00	1142.51	81.48	170.48	203852
20	-12.00	99.00	139.05	0.00	1039.60b	68.49	167.49	203852
21	-13.00	109.00	149.06	0.00	1011.39b	43.94	152.94	203852
22	-13.10	110.00	150.06	0.00	1026.22b	73.36	183.36	203852
23	-13.30	112.00	152.06	0.00	1053.52b	75.38	187.38	203852
24	-15.48	133.75	173.84	0.00	1180.10b	84.39	218.14	203852
25	-17.65	155.50	195.63	0.00	1322.61b	93.29	248.79	203852
26	-19.83	177.25	217.43	0.00	1465.13b	102.38	279.63	203852
27	-22.00	199.00	239.23	0.00	1595.36b	113.49	312.49	203852

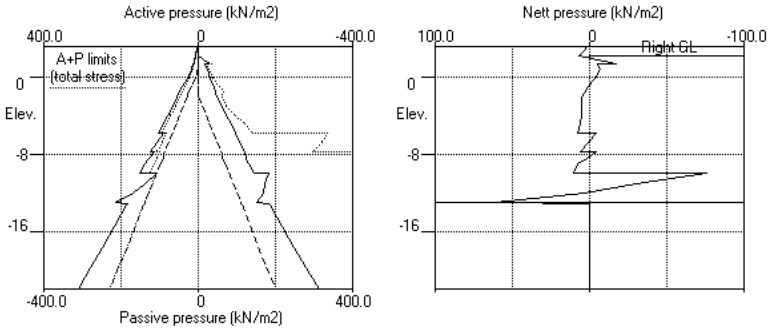
Legend: 108.00 a Soil pressure at active limit
123.45 p Soil pressure at passive limit
1595.36 b Passive limit reduced because of berm

Units: kN,m

Stage No.5 Excav. to elev. 2.20 on RIGHT side



Stage No.5 Excav. to elev. 2.20 on RIGHT side



Units: kN,m

Stage No. 7 Excavate to elevation -2.10 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -13.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
7	3.20	-2.10	2.90	3.429	n/a	-7.80	5.70	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 50.00m

Rigid boundaries:		
Left side	30.00m from wall	Rough
Right side	50.00m from wall	Rough
Lower boundary	at elevation -22.00m	Rough
	Soil-wall interface	Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	3.20	19.34	0.017	-2.13E-03	0.0	0.0		432341
2	2.90	20.04	0.017	-2.13E-03	5.9	1.0	-122.0	432341
		20.04	0.017	-2.13E-03	-116.1	1.0		
3	2.20	12.97	0.019	-2.07E-03	-104.5	-74.8		432341
4	1.40	11.65	0.020	-1.86E-03	-94.7	-151.7		432341
		11.85	0.020	-1.86E-03	-94.7	-151.7		
5	0.80	15.11	0.021	-1.61E-03	-86.6	-206.0		432341
6	-0.10	25.84	0.023	-1.11E-03	-68.1	-276.2		432341
7	-1.00	36.56	0.023	-4.89E-04	-40.1	-325.4		432341
8	-1.55	43.09	0.024	-6.49E-05	-18.2	-341.6		432341
9	-2.10	49.61	0.023	3.71E-04	7.3	-344.7		432341
		44.78	0.023	3.71E-04	7.3	-344.7		
10	-3.05	31.07	0.023	1.10E-03	43.4	-318.7		432341
11	-4.00	17.32	0.021	1.74E-03	66.3	-263.5		432341
12	-4.90	13.54	0.020	2.21E-03	80.2	-196.8		432341
13	-5.80	14.33	0.017	2.54E-03	92.8	-119.1		432341
		-8.49	0.017	2.54E-03	92.8	-119.1		
14	-6.80	-2.56	0.015	2.72E-03	87.2	-30.6		432341
15	-7.80	2.71	0.012	2.69E-03	87.3	55.4		432341
		-24.96	0.012	2.69E-03	87.3	55.4		
16	-8.40	-15.88	0.011	2.58E-03	75.1	103.3		432341
17	-9.00	-3.55	0.009	2.40E-03	69.2	145.5		432341
18	-10.00	2.54	0.007	1.99E-03	68.7	212.9		432341
		-167.61	0.007	1.99E-03	68.7	212.9		
19	-11.00	-84.86	0.005	1.52E-03	-57.5	197.8		432341
20	-12.00	2.03	0.004	1.17E-03	-98.9	97.9		432341
21	-13.00	177.98	0.003	1.06E-03	-8.9	-0.0		0
22	-13.10	0.00	0.003	0	0.0	0.0		0
23	-13.30	0.07	0.003	0	0.0	0.0		0
24	-15.48	0.00	0.002	0	0.1	0.0		0

(continued)

Stage No.7 Excavate to elevation -2.10 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
25	-17.65	0.00	0.002	0	0.1	0.0		0
26	-19.83	0.00	0.001	0	0.1	0.0		0
27	-22.00	-0.08	0.000	0	0.0	0.0		---

At elev. 2.90 Prop force = 122.0 kN/m run (horiz.)
= 134.6 kN/m run (inclined)

LEFT side

Node no.	Y coord	Water press.	Effective stresses Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.20	0.00	5.00	1.55	19.34	19.34	19.34p	15065
2	2.90	0.00	10.40	3.21	40.24	20.04	20.04	15065
3	2.20	0.00	23.07	7.13	89.23	12.97	12.97	15065
4	1.40	0.00	37.70	11.65	145.85	11.65	11.65a	15065
		0.00	37.70	11.85	127.47	11.85	11.85a	7292
5	0.80	0.00	46.97	15.11	157.61	15.11	15.11a	7713
6	-0.10	9.00	51.90	16.84	173.65	16.84	25.84a	8346
7	-1.00	18.00	56.78	18.56	189.54	18.56	36.56a	8979
8	-1.55	23.50	59.73	19.59	199.12	19.59	43.09a	9366
9	-2.10	29.00	62.64	20.61	208.59	20.61	49.61a	9752
10	-3.05	38.50	67.59	22.35	224.69	22.35	60.85a	10420
11	-4.00	48.00	72.45	24.06	240.50	24.06	72.06a	11088
12	-4.90	57.00	76.99	25.65	255.26	25.65	82.65a	11721
13	-5.80	66.00	81.47	27.23	269.84	27.23	93.23a	12354
		66.00	81.47	16.88	385.16	16.88	82.88a	20087
14	-6.80	76.00	89.40	19.13	419.81	19.13	95.13a	20087
15	-7.80	86.00	97.29	21.36	454.28	21.36	107.36a	20087
		86.00	97.29	13.40	546.34	13.40	99.40a	30131
16	-8.40	92.00	102.01	14.62	569.76	14.62	106.62a	30131
17	-9.00	98.00	106.72	15.84	593.12	20.07	118.07	30131
18	-10.00	108.00	114.55	17.87	631.99	26.80	134.80	30131
		108.00	114.55	0.00	1129.54	0.00	108.00a	200871
19	-11.00	118.00	124.36	0.00	1193.68	0.00	118.00a	200871
20	-12.00	128.00	134.16	0.00	1257.75	27.66	155.66	200871
21	-13.00	138.00	143.96	0.00	1321.79	148.98	286.98	200871
22	-13.10	139.00	144.94	0.00	1328.19	26.10	165.10	200871
23	-13.30	141.00	146.90	0.00	1341.00	31.61	172.61	200871
24	-15.48	162.75	168.21	0.00	1480.25	40.82	203.57	200871
25	-17.65	184.50	189.53	0.00	1619.57	49.73	234.23	200871
26	-19.83	206.25	210.87	0.00	1759.05	59.02	265.27	200871
27	-22.00	228.00	232.24	0.00	1898.72	72.68	300.68	200871

RIGHT side

Node no.	Y coord	Water press.	Effective stresses Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0

(continued)

Stage No.7 Excavate to elevation -2.10 on RIGHT side

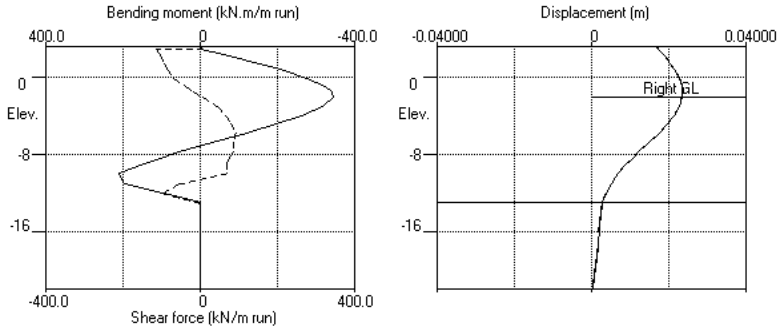
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic-al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
9	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	4.83	4.83p	9866
10	-3.05	9.50	4.75	0.28	20.28	20.28	29.78p	10542
11	-4.00	19.00	9.50	1.95	35.73	35.73	54.73p	11218
12	-4.90	28.00	14.00	3.53	50.38	41.12	69.12	11858
13	-5.80	37.00	18.50	5.11	65.02	41.90	78.90	12498
		37.00	18.50	0.00	110.03	54.37	91.37	20322
14	-6.80	47.00	26.51	1.31	145.01	50.68	97.68	20322
15	-7.80	57.00	34.52	3.57	179.99	47.65	104.65	20322
		57.00	34.52	0.00	234.75	67.35	124.35	30483
16	-8.40	63.00	39.32	0.00	258.61	59.50	122.50	30483
17	-9.00	69.00	44.13	0.00	282.46	52.62	121.62	30483
18	-10.00	79.00	52.14	1.68	322.24	53.26	132.26	30483
		79.00	52.14	0.00	721.71	196.61	275.61	203221
19	-11.00	89.00	62.16	0.00	787.18	113.86	202.86	203221
20	-12.00	99.00	72.18	0.00	852.68	54.63	153.63	203221
21	-13.00	109.00	82.21	0.00	918.20	0.00	109.00a	203221
22	-13.10	110.00	83.21	0.00	924.76	55.10	165.10	203221
23	-13.30	112.00	85.22	0.00	937.87	60.54	172.54	203221
24	-15.48	133.75	107.05	0.00	1080.53	69.82	203.57	203221
25	-17.65	155.50	128.91	0.00	1223.38	78.73	234.23	203221
26	-19.83	177.25	150.80	0.00	1366.44	88.02	265.27	203221
27	-22.00	199.00	172.72	0.00	1509.73	101.76	300.76	203221

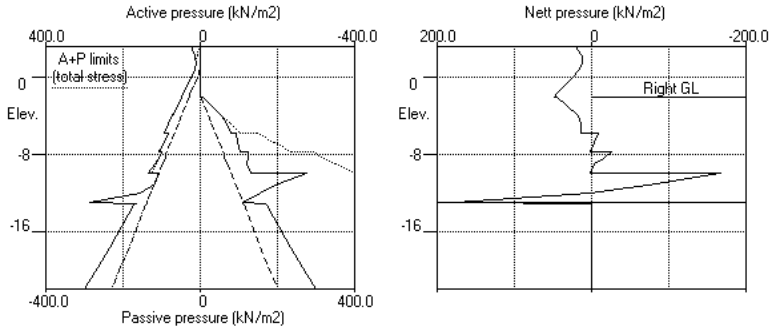
Legend: 109.00 a Soil pressure at active limit
54.73 p Soil pressure at passive limit

Units: kN,m

Stage No.7 Excav. to elev. -2.10 on RIGHT side



Stage No.7 Excav. to elev. -2.10 on RIGHT side



Units: kN,m

Summary of results

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

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -13.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
1	3.20	3.20	Cant.	Conditions not suitable for FoS calc.				
2	3.20	3.20	Cant.	Conditions not suitable for FoS calc.				
3	3.20	3.20		No analysis at this stage				
4	3.20	3.20	Cant.	Conditions not suitable for FoS calc.				
5	3.20	2.20	Cant.	1.913	-11.42	-2.85	5.05	L to R
6	3.20	2.20		No analysis at this stage				
7	3.20	-2.10	2.90	3.429	n/a	-7.80	5.70	L to R

TONKIN + TAYLOR LTD | Sheet No.
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B3_Section1 | Date:12-10-2026
Please modify / add | Checked :

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 50.00m

Rigid boundaries:	Left side 30.00m from wall	Rough
	Right side 50.00m from wall	Rough
	Lower boundary at elevation -22.00m	Rough
	Soil-wall interface	Smooth

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum	Displacement minimum	Bending moment maximum	Bending moment minimum	Shear force maximum	Shear force minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	3.20	0.017	0.000	0.0	-0.0	0.0	0.0
2	2.90	0.017	0.000	1.0	0.0	5.9	-116.1
3	2.20	0.019	0.000	2.0	-74.8	4.3	-104.5
4	1.40	0.020	0.000	7.2	-151.7	0.4	-94.7
5	0.80	0.021	0.000	6.5	-206.0	0.0	-86.6
6	-0.10	0.023	0.000	1.3	-276.2	0.0	-68.1
7	-1.00	0.023	0.000	0.0	-325.4	0.0	-40.1
8	-1.55	0.024	0.000	0.0	-341.6	0.0	-18.2
9	-2.10	0.023	0.000	0.0	-344.7	7.3	-6.0
10	-3.05	0.023	0.000	0.0	-318.7	43.4	-0.8
11	-4.00	0.021	0.000	0.0	-263.5	66.3	-0.0
12	-4.90	0.020	0.000	0.0	-196.8	80.2	-0.0
13	-5.80	0.017	0.000	1.9	-119.1	92.8	0.0
14	-6.80	0.015	0.000	16.2	-30.6	87.2	0.0
15	-7.80	0.012	0.000	55.4	-2.0	87.3	0.0
16	-8.40	0.011	0.000	103.3	0.0	75.1	0.0
17	-9.00	0.009	0.000	145.5	-0.0	69.2	0.0
18	-10.00	0.007	0.000	212.9	0.0	68.7	0.0
19	-11.00	0.005	0.000	197.8	-0.0	0.0	-57.5
20	-12.00	0.004	0.000	97.9	0.0	0.0	-98.9
21	-13.00	0.003	0.000	0.0	-0.0	0.0	-8.9
22	-13.10	0.003	0.000	0.0	0.0	0.0	0.0
23	-13.30	0.003	0.000	0.0	0.0	0.0	0.0
24	-15.48	0.002	0.000	0.0	0.0	0.1	0.0
25	-17.65	0.002	0.000	0.0	0.0	0.1	0.0
26	-19.83	0.001	0.000	0.0	0.0	0.1	0.0
27	-22.00	0.000	0.000	0.0	0.0	0.0	0.0

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment maximum	elev.	minimum	elev.	Shear force maximum	elev.	minimum	elev.
	kN.m/m		kN.m/m		kN/m		kN/m	
1	0.1	2.90	-0.0	0.80	0.2	-10.00	-0.3	1.40
2	0.1	2.90	-0.0	0.80	1.1	-10.00	-0.4	1.40
3	No calculation at this stage							
4	34.6	-11.00	-39.9	-3.05	24.3	-10.00	-17.3	-12.00
5	78.9	-10.00	-17.8	-3.05	30.4	-10.00	-35.7	-12.00
6	No calculation at this stage							
7	212.9	-10.00	-344.7	-2.10	92.8	-5.80	-116.1	2.90

Summary of results (continued)

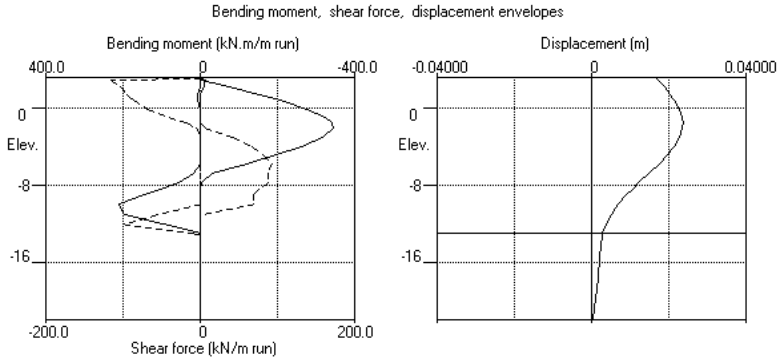
Maximum and minimum displacement at each stage

Stage no.	maximum m	elev.	minimum m	elev.	Stage description
1	0.004	3.20	0.000	3.20	Apply surcharge no.1 at elev. 3.20
2	0.004	3.20	0.000	3.20	Apply surcharge no.2 at elev. 3.20
3	Wall displacements reset to zero				Change EI of wall to 432341kN.m2/m run
4	0.004	-1.55	0.000	3.20	Apply water pressure profile no.1
5	0.014	3.20	0.000	3.20	Excav. to elev. 2.20 on RIGHT side
6	No calculation at this stage				Install prop no.1 at elev. 2.90
7	0.024	-1.55	0.000	3.20	Excav. to elev. -2.10 on RIGHT side

Prop forces at each stage (horizontal components)

Stage no.	--- Strut no. 1 --- at elev. 2.90 kN/m run	kN/prop
7	121.97	609.86

Units: kN,m



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Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
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Data filename/Run ID: B2_Section_2_cornerProp_900 |
B2_Section2 | Date: 7-10-2026
| Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Right side
1	2.90	1 Surficial fill	1 Surficial fill
2	2.10	2 Hydraulic/marine Sed	2 Hydraulic/marine Sed
3	-3.90	4 CW-HW ECBF	4 CW-HW ECBF
4	-6.00	5 MW-UW ECBF	5 MW-UW ECBF

SOIL PROPERTIES

-- Soil type -- No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	Surficial fill	18.00	15000	0.530	OC (0.300)	0.309 (0.000)	3.868 (0.000)	
2	Hydraulic.. (2.90)	15.00	6000 (700.0)	0.577	OC (0.350)	0.351 (1.391)	3.253 (4.831)	1.000d
3	Pleist. Sed	18.00	20000	0.500	OC (0.350)	0.283 (1.241)	4.369 (5.836)	5.000d
4	CW-HW ECBF	18.00	30000	0.470	OC (0.300)	0.259 (1.185)	4.964 (6.343)	10.00d
5	MW-UW ECBF	20.00	200000	0.410	OC (0.300)	0.217 (1.078)	6.535 (7.619)	50.00d

Additional soil parameters associated with Ka and Kp

No.	Soil type	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	Surficial fill	28.00	0.670	0.00	28.00	0.500	0.00
2	Hydraulic/marine Sed	25.00	0.670	0.00	25.00	0.500	0.00
3	Pleist. Sed	30.00	0.670	0.00	30.00	0.500	0.00
4	CW-HW ECBF	32.00	0.670	0.00	32.00	0.500	0.00
5	MW-UW ECBF	36.00	0.670	0.00	36.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	0.80	0.80

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Left side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Right side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2
1	1	0.80	0.80	0.0	1	-2.10	-2.10	0.0

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -9.00
Maximum finite element length = 0.60 m
Youngs modulus of wall E = 1000.0 kN/m2
Moment of inertia of wall I = 0.012943 m4/m run
E.I = 12.943 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Elev.	Prop spacing m	Cross-section area sq.m	Youngs modulus kN/m2	Free length m	Inclin-ation (degs)	Pre-stress /prop kN	Strut or Anchor	Allow tension ?	L/R
1	Not defined									
2	2.30	30.80	0.036900	2.000E+08	41.50	45.00	0	Strut	No	R
3	2.30	1.00	1.000000	2887	1.00	0.00	0	Strut	No	R

SURCHARGE LOADS

Surcharge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge(kN/m2) Near edge	Far edge	Surcharge Soil Cat.	type	Part fact.	Short Q reduc. fact.
1	2.90	0.00(L)	50.00	3.00	5.00	=	--	--	--	--
2	2.90	3.00(L)	50.00	10.00	10.00	=	--	--	--	--
3	2.90	10.00(L)	50.00	30.00	5.00	=	--	--	--	--

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.3 at elevation 2.90
2	Apply surcharge no.1 at elevation 2.90 No analysis at this stage
3	Apply surcharge no.2 at elevation 2.90
4	Change EI of wall to 719834 kN.m2/m run Reset wall displacements to zero at this stage
5	Excavate to elevation 1.70 on RIGHT side
6	Install strut or anchor no.2 at elevation 2.30
7	Apply water pressure profile no.1
8	Excavate to elevation -2.10 on RIGHT side

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.20

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 - 2-D finite element model
Open Tension Crack analysis? - No
Active limit arching modelled? - No
Non-linear Modulus Parameter (L) = 11.90 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 45.00 m

Width of excavation/fill on Left side of wall = 30.00 m
Width of excavation/fill on Right side of wall = 37.00 m

Distance to rigid boundary on Left side = 30.00 m
Distance to rigid boundary on Right side = 37.00 m
Elevation of rigid lower boundary = -18.00

Lower rigid boundary at elevation -18.00 - Rough
Rigid boundary on Left side - Rough
Rigid boundary on Right side - Rough
Soil-wall interface - Smooth

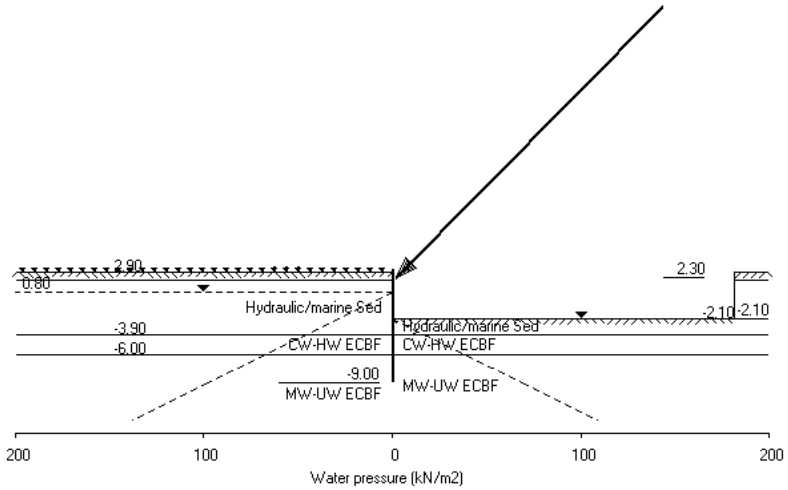
OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement / Bending mom. / Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.3 at elev. 2.90	Yes	Yes	No
2	Apply surcharge no.1 at elev. 2.90	No	No	No
3	Apply surcharge no.2 at elev. 2.90	No	No	No
4	Change EI of wall to 719834kN.m2/m run	Yes	Yes	Yes
5	Excav. to elev. 1.70 on RIGHT side	Yes	Yes	Yes
6	Install prop no.2 at elev. 2.30	Yes	Yes	Yes
7	Apply water pressure profile no.1	Yes	Yes	Yes
8	Excav. to elev. -2.10 on RIGHT side	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No.8 Excav. to elev. -2.10 on RIGHT side



Units: kN,m

Stage No. 5 Excavate to elevation 1.70 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -9.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
5	2.90	1.70	Cant.	3.759	-7.79	-0.04	1.74	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 45.00m

Rigid boundaries:	Left side 30.00m from wall	Rough
	Right side 37.00m from wall	Rough
	Lower boundary at elevation -18.00m	Rough
	Soil-wall interface	Smooth

*** Wall displacements reset to zero at stage 4

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	2.90	1.55	0.007	7.75E-04	0.0	0.0		719834
2	2.30	4.89	0.006	7.75E-04	1.9	0.8		719834
3	2.10	6.01	0.006	7.75E-04	3.0	1.3		719834
		6.18	0.006	7.75E-04	3.0	1.3		
4	1.70	8.08	0.006	7.74E-04	5.9	3.1		719834
		3.25	0.006	7.74E-04	5.9	3.1		
5	1.25	-0.47	0.006	7.71E-04	6.5	6.1		719834
6	0.80	0.11	0.005	7.66E-04	6.4	9.0		719834
7	0.40	0.44	0.005	7.60E-04	6.5	11.6		719834
8	0.00	0.83	0.005	7.53E-04	6.8	14.2		719834
9	-0.60	1.43	0.004	7.40E-04	7.5	18.4		719834
10	-1.20	2.04	0.004	7.22E-04	8.5	23.2		719834
11	-1.65	2.55	0.004	7.06E-04	9.5	27.2		719834
12	-2.10	3.04	0.003	6.88E-04	10.8	31.8		719834
13	-2.55	3.56	0.003	6.67E-04	12.3	36.9		719834
14	-3.00	3.96	0.003	6.42E-04	14.0	42.8		719834
15	-3.45	4.72	0.002	6.13E-04	15.9	49.5		719834
16	-3.90	5.83	0.002	5.79E-04	18.3	57.1		719834
		-13.55	0.002	5.79E-04	18.3	57.1		
17	-4.35	-8.19	0.002	5.42E-04	13.4	64.0		719834
18	-4.80	-4.24	0.002	5.00E-04	10.6	69.2		719834
19	-5.40	-0.99	0.001	4.40E-04	9.0	74.8		719834
20	-6.00	0.95	0.001	3.75E-04	9.0	80.0		719834
		-59.03	0.001	3.75E-04	9.0	80.0		
21	-6.60	-32.81	0.001	3.11E-04	-18.5	74.8		719834
22	-7.20	-11.98	0.001	2.56E-04	-32.0	57.8		719834
23	-7.80	0.64	0.001	2.16E-04	-35.4	36.4		719834
24	-8.40	16.07	0.000	1.95E-04	-30.4	15.3		719834
25	-9.00	72.99	0.000	1.88E-04	-3.6	-0.0		0
26	-9.10	0.00	0.000	0	0.0	0.0		0

(continued)

Stage No.5 Excavate to elevation 1.70 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
27	-9.30	0.02	0.000	0	0.0	0.0		0
28	-10.65	0.00	0.000	0	0.0	0.0		0
29	-12.00	0.03	0.000	0	0.0	0.0		0
30	-14.40	-0.01	0.000	0	0.1	0.0		0
31	-16.20	0.00	0.000	0	0.1	0.0		0
32	-18.00	-0.07	0.000	0	0.0	0.0		---

LEFT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	5.00	1.55	19.34	1.55	1.55a	15073
2	2.30	0.00	15.82	4.89	61.18	4.89	4.89a	15073
3	2.10	0.00	19.44	6.01	75.19	6.01	6.01a	15073
		0.00	19.44	5.44	68.06	6.18	6.18	6592
4	1.70	0.00	25.51	7.57	87.82	8.08	8.08	6873
5	1.25	0.00	32.41	9.99	110.24	11.91	11.91	7190
6	0.80	0.00	39.35	12.43	132.82	16.08	16.08	7507
7	0.40	4.00	41.54	13.20	139.97	17.39	21.39	7788
8	0.00	8.00	43.75	13.98	147.15	18.74	26.74	8069
9	-0.60	14.00	47.07	15.14	157.92	20.80	34.80	8491
10	-1.20	20.00	50.36	16.30	168.64	22.86	42.86	8913
11	-1.65	24.50	52.81	17.16	176.62	24.44	48.94	9230
12	-2.10	29.00	55.25	18.02	184.54	26.01	55.01	9546
13	-2.55	33.50	57.66	18.86	192.40	27.59	61.09	9863
14	-3.00	38.00	60.06	19.71	200.20	29.12	67.12	10180
15	-3.45	42.50	62.44	20.54	207.94	30.82	73.32	10496
16	-3.90	47.00	64.81	21.37	215.63	32.64	79.64	10813
		47.00	64.81	4.97	385.10	17.69	64.69	30147
17	-4.35	51.50	68.50	5.93	403.46	21.90	73.40	30147
18	-4.80	56.00	72.19	6.88	421.74	25.62	81.62	30147
19	-5.40	62.00	77.08	8.15	446.02	29.53	91.53	30147
20	-6.00	68.00	81.95	9.41	470.19	32.71	100.71	30147
		68.00	81.95	0.00	916.50	0.00	68.00a	200978
21	-6.60	74.00	88.00	0.00	956.04	13.75	87.75	200978
22	-7.20	80.00	94.03	0.00	995.45	26.68	106.68	200978
23	-7.80	86.00	100.04	0.00	1034.76	35.46	121.46	200978
24	-8.40	92.00	106.04	0.00	1073.98	45.66	137.66	200978
25	-9.00	98.00	112.03	0.00	1113.11	75.60	173.60	200978
26	-9.10	99.00	113.03	0.00	1119.62	41.66	140.66	200978
27	-9.30	101.00	115.02	0.00	1132.64	41.34	142.34	200978
28	-10.65	114.50	128.44	0.00	1220.35	46.81	161.31	200978
29	-12.00	128.00	141.82	0.00	1307.78	52.33	180.33	200978
30	-14.40	152.00	165.53	0.00	1462.75	62.16	214.16	200978
31	-16.20	170.00	183.28	0.00	1578.71	69.53	239.53	200978
32	-18.00	188.00	201.00	0.00	1694.56	75.77	263.77	200978

(continued)

Stage No.5 Excavate to elevation 1.70 on RIGHT side

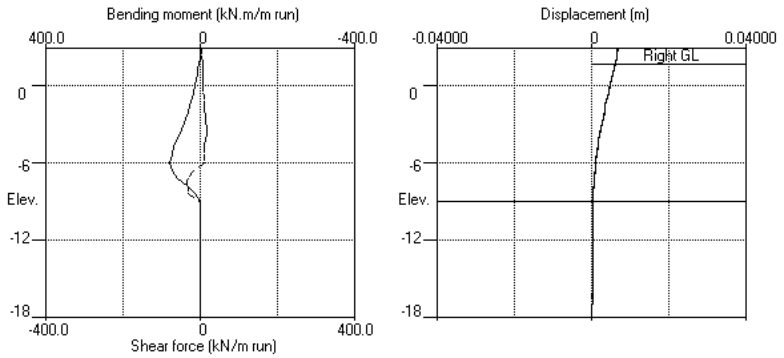
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	4.83	4.83p	6899
5	1.25	0.00	6.75	0.98	26.79	12.38	12.38	7217
6	0.80	0.00	13.50	3.35	48.74	15.97	15.97	7535
7	0.40	4.00	15.50	4.05	55.25	16.95	20.95	7817
8	0.00	8.00	17.50	4.76	61.76	17.91	25.91	8100
9	-0.60	14.00	20.50	5.81	71.52	19.37	33.37	8523
10	-1.20	20.00	23.50	6.87	81.28	20.82	40.82	8947
11	-1.65	24.50	25.76	7.66	88.61	21.89	46.39	9265
12	-2.10	29.00	28.01	8.45	95.94	22.97	51.97	9583
13	-2.55	33.50	30.26	9.24	103.27	24.03	57.53	9900
14	-3.00	38.00	32.52	10.03	110.60	25.15	63.15	10218
15	-3.45	42.50	34.77	10.82	117.94	26.11	68.61	10536
16	-3.90	47.00	37.03	11.62	125.28	26.81	73.81	10854
		47.00	37.03	0.00	247.23	31.24	78.24	30261
17	-4.35	51.50	40.64	0.00	265.13	30.10	81.60	30261
18	-4.80	56.00	44.25	0.00	283.05	29.85	85.85	30261
19	-5.40	62.00	49.06	0.88	306.94	30.51	92.51	30261
20	-6.00	68.00	53.87	2.13	330.84	31.76	99.76	30261
		68.00	53.87	0.00	733.03	59.03	127.03	201738
21	-6.60	74.00	59.89	0.00	772.36	46.56	120.56	201738
22	-7.20	80.00	65.91	0.00	811.71	38.66	118.66	201738
23	-7.80	86.00	71.94	0.00	851.07	34.83	120.83	201738
24	-8.40	92.00	77.96	0.00	890.45	29.59	121.59	201738
25	-9.00	98.00	83.99	0.00	929.85	2.61	100.61	201738
26	-9.10	99.00	85.00	0.00	936.42	41.66	140.66	201738
27	-9.30	101.00	87.01	0.00	949.56	41.32	142.32	201738
28	-10.65	114.50	100.58	0.00	1038.29	46.80	161.30	201738
29	-12.00	128.00	114.18	0.00	1127.13	52.29	180.29	201738
30	-14.40	152.00	138.38	0.00	1285.30	62.17	214.17	201738
31	-16.20	170.00	156.56	0.00	1404.12	69.53	239.53	201738
32	-18.00	188.00	174.77	0.00	1523.10	75.83	263.83	201738

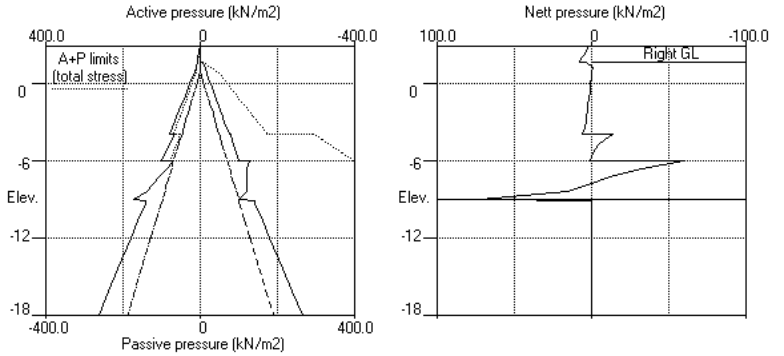
Legend: 68.00 a Soil pressure at active limit
4.83 p Soil pressure at passive limit

Units: kN,m

Stage No.5 Excav. to elev. 1.70 on RIGHT side



Stage No.5 Excav. to elev. 1.70 on RIGHT side



Units: kN,m

Stage No. 8 Excavate to elevation -2.10 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -9.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
8	2.90	-2.10	2.30	3.469	n/a	-5.44	3.34	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 45.00m

Rigid boundaries:		
Left side	30.00m from wall	Rough
Right side	37.00m from wall	Rough
Lower boundary	at elevation -18.00m	Rough
Soil-wall interface		Smooth

*** Wall displacements reset to zero at stage 4

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	2.90	1.55	0.025	1.93E-03	0.0	0.0		719834
2	2.30	4.89	0.024	1.93E-03	1.9	0.8	-51.3	719834
		4.89	0.024	1.93E-03	-49.4	0.8		
3	2.10	6.01	0.024	1.93E-03	-48.3	-9.0		719834
		5.44	0.024	1.93E-03	-48.3	-9.0		
4	1.70	7.57	0.023	1.94E-03	-45.7	-27.7		719834
5	1.25	9.99	0.022	1.96E-03	-41.8	-47.2		719834
6	0.80	12.43	0.021	2.00E-03	-36.7	-64.9		719834
7	0.40	17.20	0.021	2.04E-03	-30.8	-78.4		719834
8	0.00	21.98	0.020	2.09E-03	-22.9	-89.2		719834
9	-0.60	29.14	0.018	2.16E-03	-7.6	-98.6		719834
10	-1.20	36.30	0.017	2.25E-03	12.0	-97.4		719834
11	-1.65	41.66	0.016	2.30E-03	29.6	-88.1		719834
12	-2.10	47.02	0.015	2.35E-03	49.5	-70.4		719834
		42.18	0.015	2.35E-03	49.5	-70.4		
13	-2.55	35.71	0.014	2.39E-03	67.0	-44.1		719834
14	-3.00	29.24	0.013	2.41E-03	81.7	-10.3		719834
15	-3.45	22.75	0.012	2.40E-03	93.4	29.4		719834
16	-3.90	21.76	0.011	2.37E-03	103.4	73.8		719834
		-32.36	0.011	2.37E-03	103.4	73.8		
17	-4.35	-24.14	0.010	2.31E-03	90.7	117.0		719834
18	-4.80	-16.61	0.009	2.22E-03	81.5	155.4		719834
19	-5.40	-10.56	0.007	2.07E-03	73.3	201.3		719834
20	-6.00	-8.23	0.006	1.89E-03	67.7	243.4		719834
		-197.36	0.006	1.89E-03	67.7	243.4		
21	-6.60	-130.96	0.005	1.68E-03	-30.8	248.5		719834
22	-7.20	-74.65	0.004	1.49E-03	-92.5	206.4		719834
23	-7.80	-34.10	0.003	1.35E-03	-125.1	137.5		719834
24	-8.40	72.82	0.002	1.27E-03	-113.5	56.3		719834
25	-9.00	260.82	0.002	1.25E-03	-13.4	-0.0		0

(continued)

Stage No.8 Excavate to elevation -2.10 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
26	-9.10	2.39	0.002	0	-0.2	0.0		0
27	-9.30	0.03	0.002	0	0.0	0.0		0
28	-10.65	0.01	0.002	0	0.0	0.0		0
29	-12.00	0.05	0.002	0	0.1	0.0		0
30	-14.40	-0.02	0.001	0	0.1	0.0		0
31	-16.20	0.01	0.001	0	0.1	0.0		0
32	-18.00	-0.12	0.000	0	0.0	0.0		---

At elev. 2.30 Prop force = 51.3 kN/m run (horiz.)
= 72.6 kN/m run (inclined)

LEFT side

Node no.	Y coord	Water press.	Effective stresses Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	5.00	1.55	19.34	1.55	1.55a	15073
2	2.30	0.00	15.82	4.89	61.18	4.89	4.89a	15073
3	2.10	0.00	19.44	6.01	75.19	6.01	6.01a	15073
		0.00	19.44	5.44	68.06	5.44	5.44a	6592
4	1.70	0.00	25.51	7.57	87.82	7.57	7.57a	6873
5	1.25	0.00	32.41	9.99	110.24	9.99	9.99a	7190
6	0.80	0.00	39.35	12.43	132.82	12.43	12.43a	7507
7	0.40	4.00	41.54	13.20	139.97	13.20	17.20a	7788
8	0.00	8.00	43.75	13.98	147.15	13.98	21.98a	8069
9	-0.60	14.00	47.07	15.14	157.92	15.14	29.14a	8491
10	-1.20	20.00	50.36	16.30	168.64	16.30	36.30a	8913
11	-1.65	24.50	52.81	17.16	176.62	17.16	41.66a	9230
12	-2.10	29.00	55.25	18.02	184.54	18.02	47.02a	9546
13	-2.55	33.50	57.66	18.86	192.40	18.86	52.36a	9863
14	-3.00	38.00	60.06	19.71	200.20	19.71	57.71a	10180
15	-3.45	42.50	62.44	20.54	207.94	20.54	63.04a	10496
16	-3.90	47.00	64.81	21.37	215.63	21.37	68.37a	10813
		47.00	64.81	4.97	385.10	4.97	51.97a	30147
17	-4.35	51.50	68.50	5.93	403.46	5.93	57.43a	30147
18	-4.80	56.00	72.19	6.88	421.74	6.88	62.88a	30147
19	-5.40	62.00	77.08	8.15	446.02	8.15	70.15a	30147
20	-6.00	68.00	81.95	9.41	470.19	9.41	77.41a	30147
		68.00	81.95	0.00	916.50	0.00	68.00a	200978
21	-6.60	74.00	88.00	0.00	956.04	0.00	74.00a	200978
22	-7.20	80.00	94.03	0.00	995.45	0.00	80.00a	200978
23	-7.80	86.00	100.04	0.00	1034.76	0.00	86.00a	200978
24	-8.40	92.00	106.04	0.00	1073.98	54.72	146.72	200978
25	-9.00	98.00	112.03	0.00	1113.11	231.82	329.82	200978
26	-9.10	99.00	113.03	0.00	1119.62	29.09	128.09	200978
27	-9.30	101.00	115.02	0.00	1132.64	21.82	122.82	200978
28	-10.65	114.50	128.44	0.00	1220.35	26.87	141.37	200978
29	-12.00	128.00	141.82	0.00	1307.78	32.15	160.15	200978
30	-14.40	152.00	165.53	0.00	1462.75	42.05	194.05	200978
31	-16.20	170.00	183.28	0.00	1578.71	49.44	219.44	200978
32	-18.00	188.00	201.00	0.00	1694.56	52.21	240.21	200978

(continued)

Stage No.8 Excavate to elevation -2.10 on RIGHT side

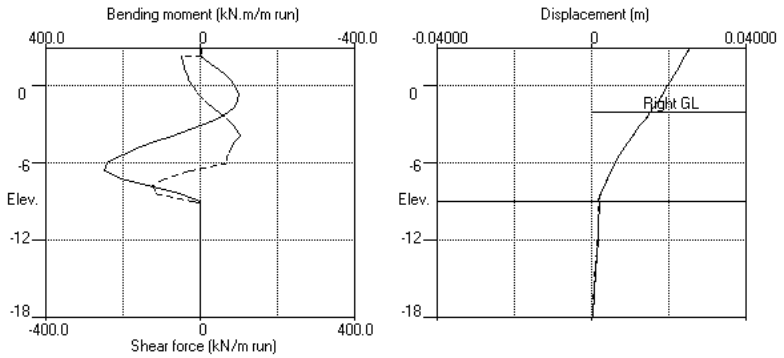
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	4.83	4.83p	9566
13	-2.55	4.50	2.25	0.00	12.15	12.15	16.65p	9883
14	-3.00	9.00	4.50	0.19	19.47	19.47	28.47p	10200
15	-3.45	13.50	6.75	0.98	26.79	26.79	40.29p	10517
16	-3.90	18.00	9.00	1.77	34.12	28.61	46.61	10834
		18.00	9.00	0.00	108.12	66.33	84.33	30207
17	-4.35	22.50	12.61	0.00	126.01	59.07	81.57	30207
18	-4.80	27.00	16.21	0.00	143.90	52.49	79.49	30207
19	-5.40	33.00	21.02	0.00	167.78	47.71	80.71	30207
20	-6.00	39.00	25.84	0.00	191.68	46.65	85.65	30207
		39.00	25.84	0.00	549.81	226.36	265.36	201381
21	-6.60	45.00	31.86	0.00	589.15	159.96	204.96	201381
22	-7.20	51.00	37.88	0.00	628.53	103.65	154.65	201381
23	-7.80	57.00	43.92	0.00	667.96	63.10	120.10	201381
24	-8.40	63.00	49.96	0.00	707.43	10.90	73.90	201381
25	-9.00	69.00	56.00	0.00	746.96	0.00	69.00a	201381
26	-9.10	70.00	57.01	0.00	753.55	55.70	125.70	201381
27	-9.30	72.00	59.03	0.00	766.74	50.79	122.79	201381
28	-10.65	85.50	72.68	0.00	855.94	55.86	141.36	201381
29	-12.00	99.00	86.38	0.00	945.46	61.10	160.10	201381
30	-14.40	123.00	110.86	0.00	1105.48	71.07	194.07	201381
31	-16.20	141.00	129.34	0.00	1226.25	78.43	219.43	201381
32	-18.00	159.00	147.93	0.00	1347.68	81.33	240.33	201381

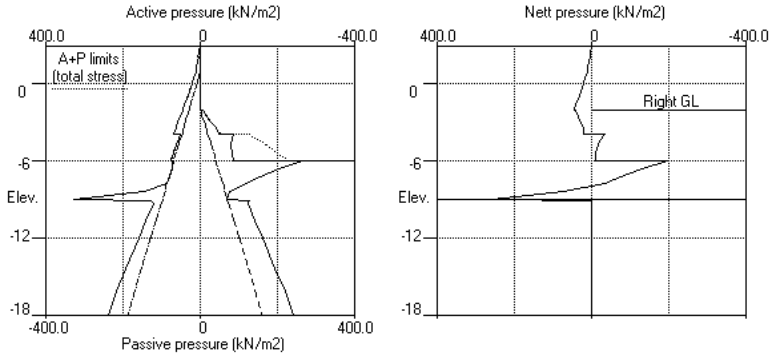
Legend: 69.00 a Soil pressure at active limit
40.29 p Soil pressure at passive limit

Units: kN,m

Stage No.8 Excav. to elev. -2.10 on RIGHT side



Stage No.8 Excav. to elev. -2.10 on RIGHT side



Units: kN,m

Summary of results

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

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -9.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
1	2.90	2.90	Cant.	Conditions not suitable for FoS calc.				
2	2.90	2.90		No analysis at this stage				
3	2.90	2.90	Cant.	Conditions not suitable for FoS calc.				
4	2.90	2.90		No analysis at this stage				
5	2.90	1.70	Cant.	3.759	-7.79	-0.04	1.74	L to R
6	2.90	1.70		No analysis at this stage				
7	2.90	1.70	2.30	13.486	n/a	1.28	0.42	L to R
8	2.90	-2.10	2.30	3.469	n/a	-5.44	3.34	L to R

TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
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Data filename/Run ID: B2_Section_2_cornerProp_900 |
B2_Section2 | Date: 7-10-2026
| Checked :

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
2-D finite element model. Active limit arching not modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Length of wall perpendicular to section = 45.00m

Rigid boundaries:	Left side 30.00m from wall	Rough
	Right side 37.00m from wall	Rough
	Lower boundary at elevation -18.00m	Rough
	Soil-wall interface	Smooth

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum	Displacement minimum	Bending moment maximum	Bending moment minimum	Shear force maximum	Shear force minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	2.90	0.025	0.000	0.0	-0.0	0.0	0.0
2	2.30	0.024	0.000	0.8	0.0	1.9	-49.4
3	2.10	0.024	0.000	1.3	-9.0	3.0	-48.3
4	1.70	0.023	0.000	3.1	-27.7	5.9	-45.7
5	1.25	0.022	0.000	6.1	-47.2	6.5	-41.8
6	0.80	0.021	0.000	9.0	-64.9	6.4	-36.7
7	0.40	0.021	0.000	11.6	-78.4	6.5	-30.8
8	0.00	0.020	0.000	14.2	-89.2	6.8	-22.9
9	-0.60	0.018	0.000	18.4	-98.6	7.5	-7.6
10	-1.20	0.017	0.000	23.2	-97.4	12.0	-0.0
11	-1.65	0.016	0.000	27.2	-88.1	29.6	-0.0
12	-2.10	0.015	0.000	31.8	-70.4	49.5	-0.0
13	-2.55	0.014	0.000	36.9	-44.1	67.0	-0.0
14	-3.00	0.013	0.000	42.8	-10.3	81.7	-0.0
15	-3.45	0.012	0.000	49.5	-0.0	93.4	-0.0
16	-3.90	0.011	0.000	73.8	0.0	103.4	0.0
17	-4.35	0.010	0.000	117.0	0.0	90.7	-0.0
18	-4.80	0.009	0.000	155.4	0.0	81.5	-0.0
19	-5.40	0.007	0.000	201.3	-0.0	73.3	-0.0
20	-6.00	0.006	0.000	243.4	0.0	67.7	0.0
21	-6.60	0.005	0.000	248.5	-0.0	0.0	-30.8
22	-7.20	0.004	0.000	206.4	0.0	0.0	-92.5
23	-7.80	0.003	0.000	137.5	0.0	0.0	-125.1
24	-8.40	0.002	0.000	56.3	0.0	0.0	-113.5
25	-9.00	0.002	0.000	0.0	-0.0	0.0	-13.4
26	-9.10	0.002	0.000	0.0	0.0	0.0	-0.2
27	-9.30	0.002	0.000	0.0	0.0	0.0	-0.0
28	-10.65	0.002	0.000	0.0	0.0	0.0	-0.0
29	-12.00	0.002	0.000	0.0	0.0	0.1	-0.0
30	-14.40	0.001	0.000	0.0	0.0	0.1	-0.0
31	-16.20	0.001	0.000	0.0	0.0	0.1	-0.0
32	-18.00	0.000	0.000	0.0	0.0	0.0	0.0

Summary of results (continued)

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment maximum	Bending moment elev.	Bending moment minimum	Bending moment elev.	Shear force maximum	Shear force elev.	Shear force minimum	Shear force elev.
no.	kN.m/m		kN.m/m		kN/m		kN/m	
1	0.0	-6.00	-0.0	-3.45	0.1	-6.00	-0.0	-14.40
2	No calculation at this stage							
3	0.3	2.30	-0.0	-3.45	0.7	-6.00	-0.8	2.10
4	No calculation at this stage							
5	80.0	-6.00	-0.0	-9.00	18.3	-3.90	-35.4	-7.80
6	No calculation at this stage							
7	96.4	-6.60	-6.6	-1.20	31.3	-6.00	-47.9	-7.80
8	248.5	-6.60	-98.6	-0.60	103.4	-3.90	-125.1	-7.80

Maximum and minimum displacement at each stage

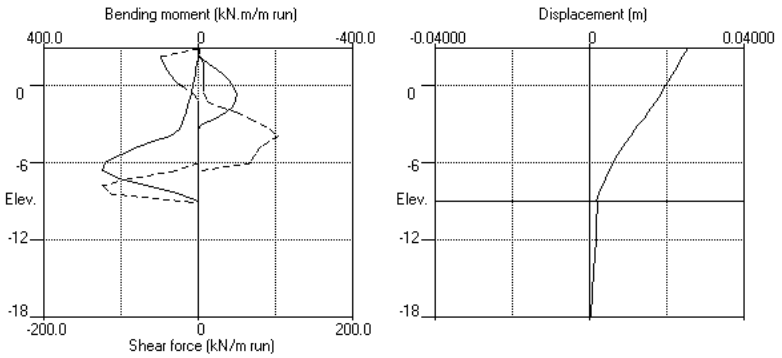
Stage	Displacement maximum	Displacement elev.	Displacement minimum	Displacement elev.	Stage description
no.	m		m		
1	0.000	-3.00	0.000	2.90	Apply surcharge no.3 at elev. 2.90
2	No calculation at this stage				Apply surcharge no.1 at elev. 2.90
3	0.013	2.90	0.000	2.90	Apply surcharge no.2 at elev. 2.90
4	Wall displacements reset to zero				Change EI of wall to 719834kN.m2/m run
5	0.007	2.90	0.000	2.90	Excav. to elev. 1.70 on RIGHT side
6	No calculation at this stage				Install prop no.2 at elev. 2.30
7	0.009	2.90	0.000	2.90	Apply water pressure profile no.1
8	0.025	2.90	0.000	2.90	Excav. to elev. -2.10 on RIGHT side

Prop forces at each stage (horizontal components)

Stage	--- Strut no. 2 --- at elev. 2.30	
no.	kN/m run	kN/prop
7	6.53	200.98
8	51.33	1580.83

Units: kN,m

Bending moment, shear force, displacement envelopes



TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
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Data filename/Run ID: B4&5_Section_3_anchors |
B4&5_Section3 | Date:13-10-2026
Anchored | Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Soil types Right side
1	2.90	1 Surficial fill	1 Surficial fill
2	1.40	2 Hydraulic/marine Sed	2 Hydraulic/marine Sed
3	-8.60	3 Pleist. Sed	3 Pleist. Sed
4	-13.10	4 CW-HW ECBF	4 CW-HW ECBF
5	-15.00	5 MW-UW ECBF	5 MW-UW ECBF

SOIL PROPERTIES

-- Soil type -- No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	Surficial fill	18.00	15000	0.530	OC (0.300)	0.309 (0.000)	3.868 (0.000)	
2	Hydraulic.. (2.90)	15.00	6000 (700.0)	0.577	OC (0.350)	0.351 (1.391)	3.253 (4.831)	1.000d
3	Pleist. Sed	18.00	20000	0.500	OC (0.300)	0.283 (1.241)	4.369 (5.836)	5.000d
4	CW-HW ECBF	18.00	30000	0.470	OC (0.300)	0.259 (1.185)	4.964 (6.343)	10.00d
5	MW-UW ECBF	20.00	200000	0.410	OC (0.300)	0.217 (1.078)	6.535 (7.619)	50.00d

Additional soil parameters associated with Ka and Kp

------- Soil type ------- No.	Description	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	Surficial fill	28.00	0.670	0.00	28.00	0.500	0.00
2	Hydraulic/marine Sed	25.00	0.670	0.00	25.00	0.500	0.00
3	Pleist. Sed	30.00	0.670	0.00	30.00	0.500	0.00
4	CW-HW ECBF	32.00	0.670	0.00	32.00	0.500	0.00
5	MW-UW ECBF	36.00	0.670	0.00	36.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	0.80	0.80

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Left side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Right side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2
1	1	0.80	0.80	0.0	1	-5.70	-5.70	0.0
2	1	0.80	0.80	0.0	1	-2.10	-2.10	0.0

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -19.00
Maximum finite element length = 1.20 m
Youngs modulus of wall E = 300000 kN/m2
Moment of inertia of wall I = 0.011390 m4/m run
E.I = 3417.0 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Elev.	Prop spacing m	Cross-section area sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /prop kN	Strut or Anchor	Allow tension ?	L/R
1	Not defined									
2	1.00	3.00	0.001146	2.000E+08	22.60	45.00	600.0	Anchor	n/a	R
3	-2.00	1.50	0.002293	2.000E+08	18.40	45.00	1000	Anchor	n/a	R

SURCHARGE LOADS

Surcharge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge(kN/m2) Near edge	Far edge	Surcharge Cat.	Soil type	Part fact.	Short Q reduc. fact.
1	2.90	0.00(L)	50.00	3.00	5.00	=	--	--	--	--
2	2.90	3.00(L)	50.00	10.00	10.00	=	--	--	--	--

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 2.90
	No analysis at this stage
2	Apply surcharge no.2 at elevation 2.90
3	Change EI of wall to 719834 kN.m2/m run
	Reset wall displacements to zero at this stage
4	Excavate to elevation 0.80 on RIGHT side
5	Install strut or anchor no.2 at elevation 1.00
6	Apply water pressure profile no.2
7	Excavate to elevation -2.20 on RIGHT side
8	Install strut or anchor no.3 at elevation -2.00
9	Apply water pressure profile no.1
10	Excavate to elevation -5.70 on RIGHT side

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.20

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 - 2-D finite element model
Open Tension Crack analysis? - No
Active limit arching modelled? - Yes
Non-linear Modulus Parameter (L) = 20.15 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 50.00 m

Width of excavation/fill on Left side of wall = 40.00 m
Width of excavation/fill on Right side of wall = 40.00 m

Distance to rigid boundary on Left side = 40.00 m
Distance to rigid boundary on Right side = 40.00 m
Elevation of rigid lower boundary = -25.25

Lower rigid boundary at elevation -25.25 - Rough
Rigid boundary on Left side - Rough
Rigid boundary on Right side - Rough
Soil-wall interface - Smooth

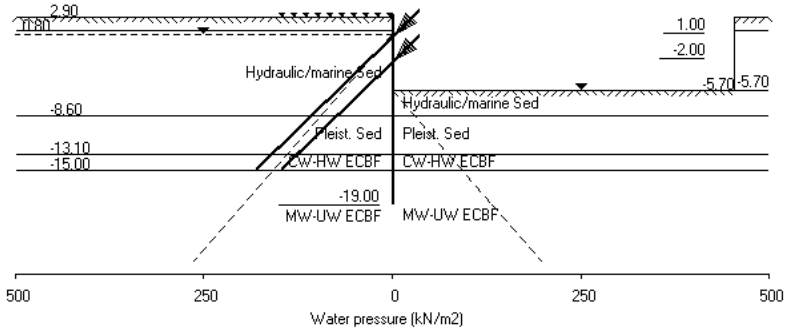
OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 2.90	No	No	No
2	Apply surcharge no.2 at elev. 2.90	No	No	No
3	Change EI of wall to 719834kN.m2/m run	Yes	Yes	Yes
4	Excav. to elev. 0.80 on RIGHT side	Yes	Yes	Yes
5	Install prop no.2 at elev. 1.00	Yes	Yes	Yes
6	Apply water pressure profile no.2	Yes	Yes	Yes
7	Excav. to elev. -2.20 on RIGHT side	Yes	Yes	Yes
8	Install prop no.3 at elev. -2.00	Yes	Yes	Yes
9	Apply water pressure profile no.1	Yes	Yes	Yes
10	Excav. to elev. -5.70 on RIGHT side	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No.10 Excav. to elev. -5.70 on RIGHT side



Units: kN,m

Stage No. 4 Excavate to elevation 0.80 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
4	2.90	0.80	Cant.	3.019	-16.99	-5.07	5.87	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	2.90	1.55	0.025	1.81E-03	0.0	0.0		719834
2	2.15	5.73	0.024	1.81E-03	2.7	1.3		719834
3	1.40	9.95	0.023	1.81E-03	8.6	5.6		719834
		9.92	0.023	1.81E-03	8.6	5.6		
4	1.00	12.08	0.022	1.81E-03	13.0	9.9		719834
5	0.80	13.16	0.022	1.80E-03	15.5	12.8		719834
		8.33	0.022	1.80E-03	15.5	12.8		
6	0.10	-1.71	0.020	1.78E-03	17.8	25.7		719834
7	-0.60	-5.73	0.019	1.75E-03	15.2	37.8		719834
8	-1.30	-5.87	0.018	1.71E-03	11.2	47.1		719834
9	-2.00	-5.21	0.017	1.66E-03	7.3	53.5		719834
10	-2.10	-5.07	0.016	1.65E-03	6.8	54.2		719834
11	-2.20	-4.94	0.016	1.65E-03	6.3	54.9		719834
12	-2.90	-3.90	0.015	1.59E-03	3.2	58.0		719834
13	-3.60	-2.82	0.014	1.54E-03	0.8	59.3		719834
14	-4.65	-1.29	0.013	1.45E-03	-1.3	58.7		719834
15	-5.70	0.21	0.011	1.36E-03	-1.9	56.6		719834
16	-6.45	1.45	0.010	1.31E-03	-1.3	55.2		719834
17	-7.20	2.71	0.009	1.25E-03	0.3	54.7		719834
18	-7.90	4.22	0.008	1.20E-03	2.7	55.6		719834
19	-8.60	5.38	0.007	1.14E-03	6.1	58.5		719834
		-6.75	0.007	1.14E-03	6.1	58.5		
20	-9.70	-2.49	0.006	1.05E-03	1.0	61.1		719834
21	-10.80	2.00	0.005	9.60E-04	0.7	60.7		719834
22	-11.95	5.59	0.004	8.62E-04	5.1	62.8		719834
23	-13.10	7.37	0.003	7.54E-04	12.6	72.4		719834
		2.17	0.003	7.54E-04	12.6	72.4		

(continued)

Stage No.4 Excavate to elevation 0.80 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
24	-14.05	7.18	0.002	6.50E-04	17.0	85.3		719834
25	-15.00	4.90	0.002	5.24E-04	22.7	104.6		719834
		-66.49	0.002	5.24E-04	22.7	104.6		
26	-15.90	-28.07	0.001	3.98E-04	-19.8	98.1		719834
27	-16.80	-3.62	0.001	2.94E-04	-34.1	68.9		719834
28	-17.90	8.67	0.001	2.19E-04	-31.3	29.2		719834
29	-19.00	42.45	0.001	1.96E-04	-3.2	-0.0		0
30	-19.15	0.01	0.001	0	0.0	0.0		0
31	-19.45	0.14	0.001	0	0.0	0.0		0
32	-22.35	0.00	0.000	0	0.2	0.0		0
33	-25.25	-0.16	0.000	0	0.0	0.0		---

LEFT side

Node no.	Y coord	Water press.	Effective stresses Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	5.00	1.55	19.34	1.55	1.55a	15305
2	2.15	0.00	18.53	5.73	71.68	5.73	5.73a	15305
3	1.40	0.00	32.20	9.95	124.54	9.95	9.95a	15305
		0.00	32.20	9.92	109.56	9.92	9.92a	7194
4	1.00	0.00	38.34	12.08	129.56	12.08	12.08a	7479
5	0.80	0.00	41.43	13.16	139.59	13.16	13.16a	7622
6	0.10	7.00	45.26	14.51	152.05	14.51	21.51a	8122
7	-0.60	14.00	49.09	15.85	164.51	15.85	29.85a	8622
8	-1.30	21.00	52.88	17.19	176.85	17.19	38.19a	9122
9	-2.00	28.00	56.63	18.50	189.02	19.31	47.31	9622
10	-2.10	29.00	57.16	18.69	190.75	19.63	48.63	9693
11	-2.20	30.00	57.69	18.87	192.47	19.97	49.97	9765
12	-2.90	37.00	61.36	20.16	204.41	22.47	59.47	10265
13	-3.60	44.00	64.98	21.43	216.19	24.96	68.96	10765
14	-4.65	54.50	70.32	23.31	233.58	28.68	83.18	11515
15	-5.70	65.00	75.59	25.16	250.69	32.39	97.39	12265
16	-6.45	72.50	79.30	26.47	262.79	35.11	107.61	12800
17	-7.20	80.00	82.99	27.76	274.79	37.86	117.86	13336
18	-7.90	87.00	86.42	28.96	285.92	40.58	127.58	13836
19	-8.60	94.00	89.82	30.16	297.00	43.04	137.04	14336
		94.00	89.82	19.24	421.65	32.30	126.30	20407
20	-9.70	105.00	98.45	21.69	459.34	38.70	143.70	20407
21	-10.80	116.00	107.05	24.13	496.94	45.29	161.29	20407
22	-11.95	127.50	116.03	26.67	536.17	51.63	179.13	20407
23	-13.10	139.00	125.00	29.21	575.37	57.05	196.05	20407
		139.00	125.00	20.59	683.90	50.97	189.97	30611
24	-14.05	148.50	132.41	22.51	720.66	56.98	205.48	30611
25	-15.00	158.00	139.82	24.43	757.42	59.24	217.24	30611
		158.00	139.82	0.00	1294.69	15.80	173.80	204073
26	-15.90	167.00	148.63	0.00	1352.32	38.51	205.51	204073
27	-16.80	176.00	157.45	0.00	1409.96	54.39	230.39	204073
28	-17.90	187.00	168.24	0.00	1480.43	65.02	252.02	204073
29	-19.00	198.00	179.03	0.00	1550.95	86.41	284.41	204073
30	-19.15	199.50	180.50	0.00	1560.57	65.79	265.29	204073
31	-19.45	202.50	183.44	0.00	1579.81	67.08	269.58	204073
32	-22.35	231.50	211.93	0.00	1766.00	78.93	310.43	204073
33	-25.25	260.50	240.48	0.00	1952.54	90.81	351.31	204073

(continued)

Stage No.4 Excavate to elevation 0.80 on RIGHT side

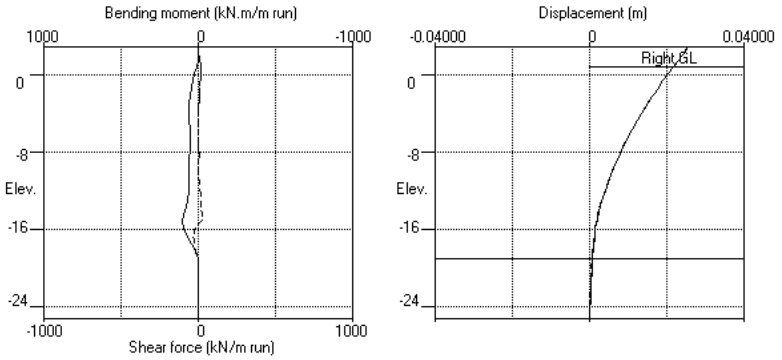
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	4.83	4.83p	7614
6	0.10	7.00	3.50	0.00	16.22	16.22	23.22p	8114
7	-0.60	14.00	7.00	1.07	27.60	21.58	35.58	8613
8	-1.30	21.00	10.50	2.30	38.99	23.06	44.06	9113
9	-2.00	28.00	14.01	3.53	50.39	24.52	52.52	9612
10	-2.10	29.00	14.51	3.70	52.02	24.71	53.71	9684
11	-2.20	30.00	15.01	3.88	53.64	24.91	54.91	9755
12	-2.90	37.00	18.51	5.11	65.05	26.36	63.36	10255
13	-3.60	44.00	22.02	6.34	76.46	27.78	71.78	10754
14	-4.65	54.50	27.29	8.19	93.59	29.97	84.47	11503
15	-5.70	65.00	32.56	10.05	110.75	32.18	97.18	12252
16	-6.45	72.50	36.34	11.37	123.03	33.66	106.16	12788
17	-7.20	80.00	40.12	12.70	135.32	35.14	115.14	13323
18	-7.90	87.00	43.65	13.94	146.81	36.37	123.37	13822
19	-8.60	94.00	47.19	15.18	158.32	37.66	131.66	14322
		94.00	47.19	7.16	235.35	39.04	133.04	20387
20	-9.70	105.00	56.06	9.68	274.11	41.19	146.19	20387
21	-10.80	116.00	64.94	12.19	312.92	43.29	159.29	20387
22	-11.95	127.50	74.24	14.83	353.56	46.05	173.55	20387
23	-13.10	139.00	83.56	17.47	394.28	49.68	188.68	20387
		139.00	83.56	9.83	478.18	48.80	187.80	30580
24	-14.05	148.50	91.27	11.83	516.46	49.80	198.30	30580
25	-15.00	158.00	98.99	13.84	554.78	54.34	212.34	30580
		158.00	98.99	0.00	1027.88	82.30	240.30	203867
26	-15.90	167.00	108.12	0.00	1087.52	66.58	233.58	203867
27	-16.80	176.00	117.25	0.00	1147.22	58.01	234.01	203867
28	-17.90	187.00	128.43	0.00	1220.28	56.35	243.35	203867
29	-19.00	198.00	139.62	0.00	1293.42	43.96	241.96	203867
30	-19.15	199.50	141.15	0.00	1303.40	65.78	265.28	203867
31	-19.45	202.50	144.20	0.00	1323.37	66.94	269.44	203867
32	-22.35	231.50	173.79	0.00	1516.71	78.93	310.43	203867
33	-25.25	260.50	203.45	0.00	1710.55	90.97	351.47	203867

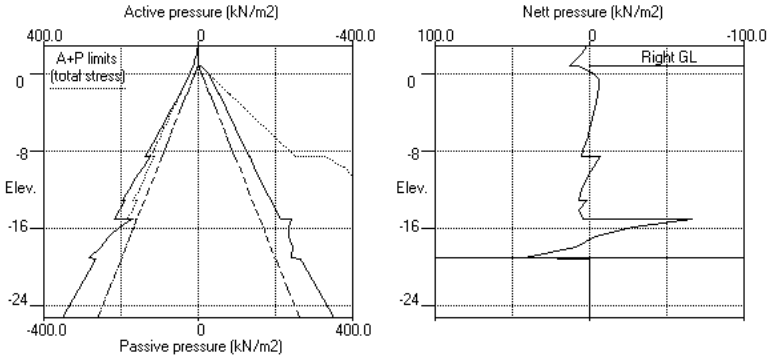
Legend: 38.19 a Soil pressure at active limit
23.22 p Soil pressure at passive limit

Units: kN,m

Stage No.4 Excav. to elev. 0.80 on RIGHT side



Stage No.4 Excav. to elev. 0.80 on RIGHT side



Units: kN,m

Stage No. 7 Excavate to elevation -2.20 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
7	2.90	-2.20	1.00	4.648	n/a	-9.09	6.89	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	2.90	11.76	0.019	-8.59E-04	0.0	-0.0		719834
2	2.15	26.38	0.020	-8.61E-04	14.3	4.1		719834
3	1.40	24.52	0.020	-8.75E-04	33.4	23.0		719834
		16.77	0.020	-8.75E-04	33.4	23.0		
4	1.00	17.30	0.021	-8.92E-04	40.2	37.8	-171.6	719834
		17.30	0.021	-8.92E-04	-131.4	37.8		
5	0.80	17.26	0.021	-8.99E-04	-127.9	11.9		719834
6	0.10	23.77	0.022	-8.69E-04	-113.6	-72.8		719834
7	-0.60	29.52	0.022	-7.63E-04	-94.9	-145.3		719834
8	-1.30	35.13	0.023	-5.94E-04	-72.3	-203.6		719834
9	-2.00	42.32	0.023	-3.76E-04	-45.2	-244.7		719834
10	-2.10	42.46	0.023	-3.42E-04	-41.0	-249.0		719834
11	-2.20	41.74	0.023	-3.07E-04	-36.8	-252.9		719834
		36.91	0.023	-3.07E-04	-36.8	-252.9		
12	-2.90	26.30	0.023	-5.31E-05	-14.6	-270.1		719834
13	-3.60	14.85	0.023	2.11E-04	-0.2	-273.9		719834
14	-4.65	9.52	0.023	6.05E-04	12.6	-265.9		719834
15	-5.70	8.67	0.022	9.79E-04	22.1	-247.5		719834
16	-6.45	13.49	0.021	1.22E-03	30.4	-228.5		719834
17	-7.20	12.40	0.020	1.45E-03	40.1	-201.9		719834
18	-7.90	11.72	0.019	1.63E-03	48.6	-170.8		719834
19	-8.60	13.07	0.018	1.78E-03	57.3	-133.9		719834
		-7.88	0.018	1.78E-03	57.3	-133.9		
20	-9.70	-5.09	0.016	1.94E-03	50.1	-75.7		719834
21	-10.80	0.40	0.014	2.01E-03	47.5	-23.7		719834
22	-11.95	9.25	0.011	2.01E-03	53.1	31.2		719834

(continued)

Stage No.7 Excavate to elevation -2.20 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
23	-13.10	15.54	0.009	1.90E-03	67.4	98.4		719834
		-3.26	0.009	1.90E-03	67.4	98.4		
24	-14.05	10.03	0.007	1.73E-03	70.6	160.8		719834
25	-15.00	11.20	0.006	1.47E-03	80.7	232.4		719834
		-143.44	0.006	1.47E-03	80.7	232.4		
26	-15.90	-89.75	0.004	1.17E-03	-24.3	246.9		719834
27	-16.80	-29.71	0.004	9.05E-04	-78.0	188.6		719834
28	-17.90	15.78	0.003	6.96E-04	-85.7	84.8		719834
29	-19.00	123.23	0.002	6.32E-04	-9.2	-0.0		0
30	-19.15	0.01	0.002	0	0.0	0.0		0
31	-19.45	0.20	0.002	0	0.0	0.0		0
32	-22.35	0.01	0.001	0	0.3	0.0		0
33	-25.25	-0.25	0.000	0	0.0	0.0		---

At elev. 1.00 Prop force = 171.6 kN/m run (horiz.)
= 242.7 kN/m run (inclined)

Node no.	Y coord	LEFT side Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	5.00	1.55	19.34	11.76	11.76	15305
2	2.15	0.00	18.53	5.73	71.68	26.38	26.38	15305
3	1.40	0.00	32.20	9.95	124.54	24.52	24.52	15305
		0.00	32.20	9.92	109.56	16.77	16.77	7194
4	1.00	0.00	38.34	12.08	129.56	17.30	17.30	7479
5	0.80	0.00	41.43	13.16	139.59	17.26	17.26	7622
6	0.10	7.00	45.26	14.51	152.05	16.77	23.77	8122
7	-0.60	14.00	49.09	15.85	164.51	15.52	29.52A	8622
8	-1.30	21.00	52.88	17.19	176.85	14.13	35.13A	9122
9	-2.00	28.00	56.63	18.50	189.02	14.32	42.32A	9622
10	-2.10	29.00	57.16	18.69	190.75	13.46	42.46A	9693
11	-2.20	30.00	57.69	18.87	192.47	12.74	42.74A	9765
12	-2.90	37.00	61.36	20.16	204.41	13.52	50.52A	10265
13	-3.60	44.00	64.98	21.43	216.19	13.45	57.45A	10765
14	-4.65	54.50	70.32	23.31	233.58	14.73	69.23A	11515
15	-5.70	65.00	75.59	25.16	250.69	18.55	83.55A	12265
16	-6.45	72.50	79.30	26.47	262.79	26.47	98.97a	12800
17	-7.20	80.00	82.99	27.76	274.79	27.76	107.76a	13336
18	-7.90	87.00	86.42	28.96	285.92	28.96	115.96a	13836
19	-8.60	94.00	89.82	30.16	297.00	30.16	124.16a	14336
		94.00	89.82	19.24	421.65	19.24	113.24a	20407
20	-9.70	105.00	98.45	21.69	459.34	21.69	126.69a	20407
21	-10.80	116.00	107.05	24.13	496.94	26.69	142.69	20407
22	-11.95	127.50	116.03	26.67	536.17	35.63	163.13	20407
23	-13.10	139.00	125.00	29.21	575.37	43.31	182.31	20407
		139.00	125.00	20.59	683.90	30.36	169.36	30611
24	-14.05	148.50	132.41	22.51	720.66	40.53	189.03	30611
25	-15.00	158.00	139.82	24.43	757.42	44.67	202.67	30611
		158.00	139.82	0.00	1294.69	0.00	158.00a	204073
26	-15.90	167.00	148.63	0.00	1352.32	0.00	167.00a	204073
27	-16.80	176.00	157.45	0.00	1409.96	23.73	199.73	204073
28	-17.90	187.00	168.24	0.00	1480.43	51.00	238.00	204073
29	-19.00	198.00	179.03	0.00	1550.95	109.29	307.29	204073
30	-19.15	199.50	180.50	0.00	1560.57	48.24	247.74	204073
31	-19.45	202.50	183.44	0.00	1579.81	49.56	252.06	204073
32	-22.35	231.50	211.93	0.00	1766.00	61.43	292.93	204073

(continued)

Stage No.7 Excavate to elevation -2.20 on RIGHT side

LEFT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
33	-25.25	260.50	240.48	0.00	1952.54	73.31	333.81	204073

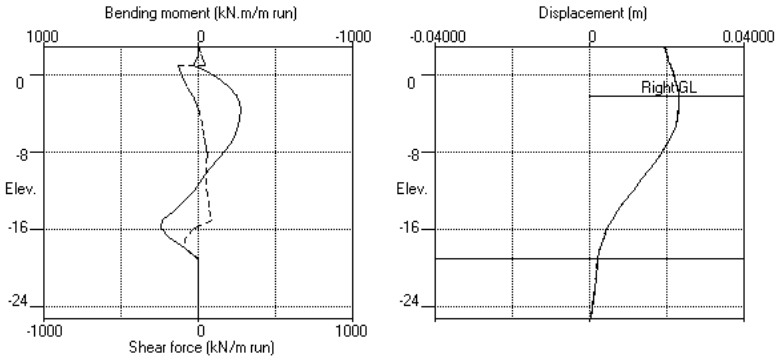
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-2.20	1.00	0.00	0.00	0.00	0.00	1.00	0.0
		1.00	0.00	0.00	4.83	4.83	5.83p	9740
12	-2.90	8.00	3.50	0.00	16.22	16.22	24.22p	10239
13	-3.60	15.00	7.00	1.07	27.61	27.61	42.61p	10737
14	-4.65	25.50	12.26	2.91	44.70	34.21	59.71	11485
15	-5.70	36.00	17.52	4.76	61.83	38.88	74.88	12233
16	-6.45	43.50	21.29	6.09	74.08	41.97	85.47	12768
17	-7.20	51.00	25.07	7.41	86.36	44.36	95.36	13302
18	-7.90	58.00	28.60	8.65	97.85	46.24	104.24	13801
19	-8.60	65.00	32.13	9.90	109.36	46.09	111.09	14299
		65.00	32.13	2.90	169.59	56.12	121.12	20355
20	-9.70	76.00	41.01	5.41	208.39	55.78	131.78	20355
21	-10.80	87.00	49.92	7.94	247.30	55.29	142.29	20355
22	-11.95	98.50	59.26	10.58	288.10	55.39	153.89	20355
23	-13.10	110.00	68.63	13.24	329.05	56.77	166.77	20355
		110.00	68.63	5.96	404.08	62.63	172.63	30533
24	-14.05	119.50	76.40	7.97	442.64	59.50	179.00	30533
25	-15.00	129.00	84.19	10.00	481.31	62.47	191.47	30533
		129.00	84.19	0.00	931.15	172.44	301.44	203552
26	-15.90	138.00	93.39	0.00	991.31	118.75	256.75	203552
27	-16.80	147.00	102.62	0.00	1051.60	82.44	229.44	203552
28	-17.90	158.00	113.93	0.00	1125.50	64.22	222.22	203552
29	-19.00	169.00	125.27	0.00	1199.61	15.06	184.06	203552
30	-19.15	170.50	126.82	0.00	1209.74	77.23	247.73	203552
31	-19.45	173.50	129.92	0.00	1230.00	78.36	251.86	203552
32	-22.35	202.50	160.00	0.00	1426.62	90.42	292.92	203552
33	-25.25	231.50	190.29	0.00	1624.57	102.56	334.06	203552

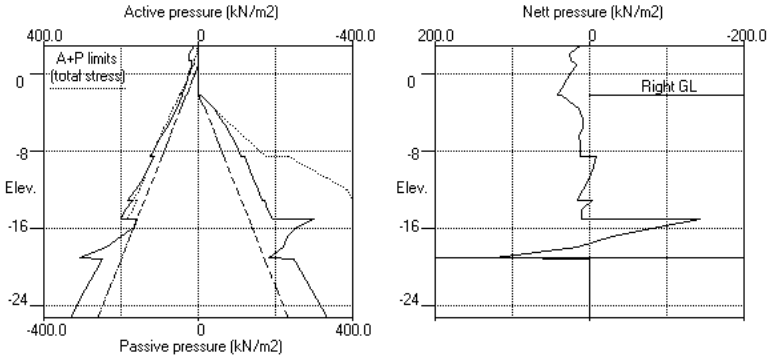
Legend: 167.00 a Soil pressure at active limit
42.61 p Soil pressure at passive limit
83.55 A Arching - soil pressure below active limit

Units: kN,m

Stage No.7 Excav. to elev. -2.20 on RIGHT side



Stage No.7 Excav. to elev. -2.20 on RIGHT side



Units: kN,m

Stage No. 10 Excavate to elevation -5.70 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
10	2.90	-5.70		More than one prop. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	2.90	19.34	-0.021	-3.59E-03	0.0	-0.0		719834
2	2.15	71.68	-0.018	-3.59E-03	34.1	6.3		719834
3	1.40	72.47	-0.015	-3.62E-03	88.2	52.7		719834
		39.30	-0.015	-3.62E-03	88.2	52.7		
4	1.00	40.70	-0.014	-3.66E-03	104.2	91.2	-112.9	719834
		40.70	-0.014	-3.66E-03	-8.7	91.2		
5	0.80	41.48	-0.013	-3.69E-03	-0.5	90.3		719834
6	0.10	48.51	-0.011	-3.78E-03	31.0	100.8		719834
7	-0.60	55.15	-0.008	-3.90E-03	67.3	135.6		719834
8	-1.30	61.24	-0.005	-4.06E-03	108.0	197.1		719834
9	-2.00	68.13	-0.002	-4.29E-03	153.3	288.6	-535.7	719834
		68.13	-0.002	-4.29E-03	-382.4	288.6		
10	-2.10	68.11	-0.002	-4.33E-03	-375.6	250.7		719834
11	-2.20	67.45	-0.001	-4.36E-03	-368.9	213.5		719834
12	-2.90	72.75	0.002	-4.45E-03	-319.8	-28.1		719834
13	-3.60	75.08	0.005	-4.33E-03	-268.1	-233.4		719834
14	-4.65	80.52	0.009	-3.81E-03	-186.4	-470.4		719834
15	-5.70	88.33	0.013	-3.02E-03	-97.7	-617.7		719834
		83.50	0.013	-3.02E-03	-97.7	-617.7		
16	-6.45	73.84	0.015	-2.35E-03	-38.7	-667.9		719834
17	-7.20	58.77	0.016	-1.65E-03	11.0	-676.3		719834
18	-7.90	45.81	0.017	-1.00E-03	47.6	-654.2		719834
19	-8.60	44.92	0.018	-3.94E-04	79.4	-609.6		719834
		16.26	0.018	-3.94E-04	79.4	-609.6		
20	-9.70	11.88	0.018	4.62E-04	94.8	-512.5		719834
21	-10.80	10.87	0.017	1.16E-03	107.4	-401.0		719834

(continued)

Stage No.10 Excavate to elevation -5.70 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
22	-11.95	17.75	0.015	1.69E-03	123.8	-270.4		719834
23	-13.10	27.05	0.013	2.00E-03	149.6	-116.3		719834
		-7.81	0.013	2.00E-03	149.6	-116.3		
24	-14.05	10.36	0.011	2.06E-03	150.8	22.3		719834
25	-15.00	24.71	0.009	1.94E-03	167.4	170.2		719834
		-198.01	0.009	1.94E-03	167.4	170.2		
26	-15.90	-120.90	0.007	1.68E-03	23.9	240.7		719834
27	-16.80	-62.41	0.006	1.40E-03	-58.6	213.2		719834
28	-17.90	-7.25	0.005	1.15E-03	-96.9	111.0		719834
29	-19.00	161.37	0.004	1.06E-03	-12.1	-0.0		0
30	-19.15	0.01	0.004	0	0.0	0.0		0
31	-19.45	0.24	0.003	0	0.0	0.0		0
32	-22.35	0.02	0.002	0	0.4	0.0		0
33	-25.25	-0.31	0.000	0	-0.0	0.0		---

At elev. 1.00 Prop force = 112.9 kN/m run (horiz.)
= 159.7 kN/m run (inclined)

At elev. -2.00 Prop force = 535.7 kN/m run (horiz.)
= 757.7 kN/m run (inclined)

LEFT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	5.00	1.55	19.34	19.34	19.34p	15305
2	2.15	0.00	18.53	5.73	71.68	71.68	71.68p	15305
3	1.40	0.00	32.20	9.95	124.54	72.47	72.47	15305
		0.00	32.20	9.92	109.56	39.30	39.30	7194
4	1.00	0.00	38.34	12.08	129.56	40.70	40.70	7479
5	0.80	0.00	41.43	13.16	139.59	41.48	41.48	7622
6	0.10	7.00	45.26	14.51	152.05	41.51	48.51	8122
7	-0.60	14.00	49.09	15.85	164.51	41.15	55.15	8622
8	-1.30	21.00	52.88	17.19	176.85	40.24	61.24	9122
9	-2.00	28.00	56.63	18.50	189.02	40.13	68.13	9622
10	-2.10	29.00	57.16	18.69	190.75	39.11	68.11	9693
11	-2.20	30.00	57.69	18.87	192.47	37.45	67.45	9765
12	-2.90	37.00	61.36	20.16	204.41	35.75	72.75	10265
13	-3.60	44.00	64.98	21.43	216.19	31.08	75.08	10765
14	-4.65	54.50	70.32	23.31	233.58	26.02	80.52	11515
15	-5.70	65.00	75.59	25.16	250.69	23.33	88.33A	12265
16	-6.45	72.50	79.30	26.47	262.79	25.87	98.37A	12800
17	-7.20	80.00	82.99	27.76	274.79	23.00	103.00A	13336
18	-7.90	87.00	86.42	28.96	285.92	20.47	107.47A	13836
19	-8.60	94.00	89.82	30.16	297.00	21.58	115.58A	14336
		94.00	89.82	19.24	421.65	7.03	101.03A	20407
20	-9.70	105.00	98.45	21.69	459.34	6.73	111.73A	20407
21	-10.80	116.00	107.05	24.13	496.94	8.79	124.79A	20407
22	-11.95	127.50	116.03	26.67	536.17	16.87	144.37A	20407
23	-13.10	139.00	125.00	29.21	575.37	26.29	165.29A	20407
		139.00	125.00	20.59	683.90	4.83	143.83A	30611
24	-14.05	148.50	132.41	22.51	720.66	17.70	166.20A	30611
25	-15.00	158.00	139.82	24.43	757.42	29.27	187.27	30611
		158.00	139.82	0.00	1294.69	0.00	158.00a	204073
26	-15.90	167.00	148.63	0.00	1352.32	0.00	167.00a	204073
27	-16.80	176.00	157.45	0.00	1409.96	0.00	176.00a	204073
28	-17.90	187.00	168.24	0.00	1480.43	17.01	204.01	204073
29	-19.00	198.00	179.03	0.00	1550.95	106.01	304.01	204073

(continued)

Stage No.10 Excavate to elevation -5.70 on RIGHT side

LEFT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
30	-19.15	199.50	180.50	0.00	1560.57	25.93	225.43	204073
31	-19.45	202.50	183.44	0.00	1579.81	27.28	229.78	204073
32	-22.35	231.50	211.93	0.00	1766.00	39.10	270.60	204073
33	-25.25	260.50	240.48	0.00	1952.54	50.85	311.35	204073

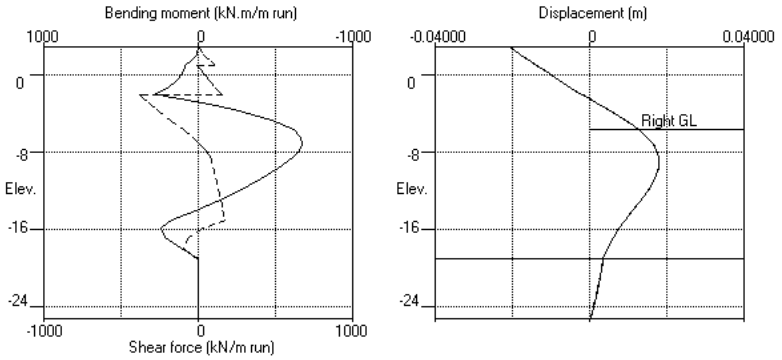
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-5.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	4.83	4.83p	12209
16	-6.45	7.50	3.75	0.00	17.03	17.03	24.53p	12742
17	-7.20	15.00	7.50	1.24	29.24	29.24	44.24p	13276
18	-7.90	22.00	11.01	2.48	40.64	39.66	61.66	13773
19	-8.60	29.00	14.52	3.71	52.07	41.66	70.66	14271
		29.00	14.52	0.00	92.63	55.77	84.77	20315
20	-9.70	40.00	23.36	0.41	131.23	59.86	99.86	20315
21	-10.80	51.00	32.22	2.92	169.94	62.92	113.92	20315
22	-11.95	62.50	41.51	5.56	210.55	64.12	126.62	20315
23	-13.10	74.00	50.84	8.20	251.34	64.24	138.24	20315
		74.00	50.84	1.34	315.80	77.64	151.64	30472
24	-14.05	83.50	58.59	3.35	354.25	72.34	155.84	30472
25	-15.00	93.00	66.37	5.37	392.86	69.56	162.56	30472
		93.00	66.37	0.00	814.69	263.01	356.01	203148
26	-15.90	102.00	75.57	0.00	874.83	185.90	287.90	203148
27	-16.80	111.00	84.81	0.00	935.19	127.41	238.41	203148
28	-17.90	122.00	96.14	0.00	1009.28	89.26	211.26	203148
29	-19.00	133.00	107.54	0.00	1083.73	9.65	142.65	203148
30	-19.15	134.50	109.09	0.00	1093.91	90.92	225.42	203148
31	-19.45	137.50	112.21	0.00	1114.29	92.04	229.54	203148
32	-22.35	166.50	142.57	0.00	1312.69	104.07	270.57	203148
33	-25.25	195.50	173.31	0.00	1513.57	116.16	311.66	203148

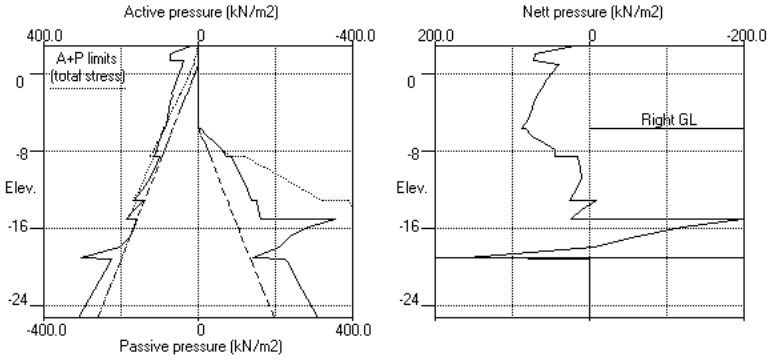
Legend: 176.00 a Soil pressure at active limit
44.24 p Soil pressure at passive limit
166.20 A Arching - soil pressure below active limit

Units: kN,m

Stage No.10 Excav. to elev. -5.70 on RIGHT side



Stage No.10 Excav. to elev. -5.70 on RIGHT side



Units: kN,m

Summary of results

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

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
1	2.90	2.90	Cant.	Conditions not suitable for FoS calc.				
2	2.90	2.90	Cant.	Conditions not suitable for FoS calc.				
3	2.90	2.90		No analysis at this stage				
4	2.90	0.80	Cant.	3.019	-16.99	-5.07	5.87	L to R
5	2.90	0.80	1.00	Conditions not suitable for FoS calc.				
6	2.90	0.80	1.00	Conditions not suitable for FoS calc.				
7	2.90	-2.20	1.00	4.648	n/a	-9.09	6.89	L to R
8	2.90	-2.20		More than one prop. No FoS calc.				

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

Minimum required Anchor Free Lengths
This additional information would be given here if the
Wedge Analysis option had been selected.

TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
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Data filename/Run ID: B4&5_Section_3_anchors |
B4&5_Section3 | Date:13-10-2026
Anchored | Checked :

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum	Displacement minimum	Bending moment maximum	Bending moment minimum	Shear force maximum	Shear force minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	2.90	0.025	-0.023	0.0	-0.0	0.0	0.0
2	2.15	0.024	-0.021	6.3	0.0	34.1	0.0
3	1.40	0.023	-0.019	52.7	0.0	88.2	-0.8
4	1.00	0.022	-0.018	91.2	-0.0	104.2	-131.4
5	0.80	0.022	-0.018	90.3	-0.1	15.5	-127.9
6	0.10	0.022	-0.016	101.9	-72.8	33.7	-113.6
7	-0.60	0.022	-0.014	138.6	-145.3	70.4	-94.9
8	-1.30	0.023	-0.012	202.4	-203.6	112.4	-72.3
9	-2.00	0.023	-0.010	297.0	-244.7	159.7	-382.4
10	-2.10	0.023	-0.010	264.8	-249.0	6.8	-375.6
11	-2.20	0.023	-0.009	234.7	-252.9	6.3	-368.9
12	-2.90	0.023	-0.007	58.0	-270.1	3.2	-319.8
13	-3.60	0.023	-0.005	59.3	-273.9	0.8	-268.1
14	-4.65	0.023	-0.001	58.7	-470.4	12.6	-186.4
15	-5.70	0.022	0.000	56.6	-617.7	22.1	-97.7
16	-6.45	0.021	0.000	55.2	-667.9	30.4	-43.1
17	-7.20	0.020	0.000	54.7	-676.3	40.1	-5.9
18	-7.90	0.019	0.000	55.6	-654.2	48.6	0.0
19	-8.60	0.018	0.000	58.5	-609.6	79.4	0.0
20	-9.70	0.018	0.000	61.1	-512.5	94.8	-0.0
21	-10.80	0.017	0.000	60.7	-401.0	107.4	-0.1
22	-11.95	0.015	0.000	62.8	-270.4	123.8	0.0
23	-13.10	0.013	0.000	98.4	-121.4	149.6	0.0
24	-14.05	0.011	0.000	160.8	-19.4	150.8	0.0
25	-15.00	0.009	0.000	232.4	0.0	167.4	0.0
26	-15.90	0.007	0.000	246.9	0.0	26.5	-24.3
27	-16.80	0.006	0.000	213.2	0.0	0.0	-78.0
28	-17.90	0.005	0.000	111.0	0.0	0.0	-96.9
29	-19.00	0.004	0.000	0.0	-0.0	0.0	-12.1
30	-19.15	0.004	0.000	0.0	0.0	0.0	0.0
31	-19.45	0.003	0.000	0.0	0.0	0.0	0.0
32	-22.35	0.002	0.000	0.0	0.0	0.4	0.0
33	-25.25	0.000	0.000	0.0	0.0	0.0	-0.0

Summary of results (continued)

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment				Shear force			
no.	maximum	elev.	minimum	elev.	maximum	elev.	minimum	elev.
	kN.m/m		kN.m/m		kN/m		kN/m	
1	0.4	2.15	-0.1	0.10	0.3	-15.00	-0.7	1.40
2	0.5	2.15	-0.2	0.10	1.2	-15.00	-0.8	1.40
3	No calculation at this stage							
4	104.6	-15.00	-0.0	-19.00	22.7	-15.00	-34.1	-16.80
5	73.8	-15.90	-112.8	-4.65	58.3	1.00	-83.1	1.00
6	139.0	-15.90	-165.8	-4.65	57.6	-15.00	-96.1	1.00
7	246.9	-15.90	-273.9	-3.60	80.7	-15.00	-131.4	1.00
8	295.6	-2.00	-447.6	-7.20	159.7	-2.00	-311.7	-2.00
9	297.0	-2.00	-530.2	-7.20	158.4	-2.00	-337.1	-2.00
10	288.6	-2.00	-676.3	-7.20	167.4	-15.00	-382.4	-2.00

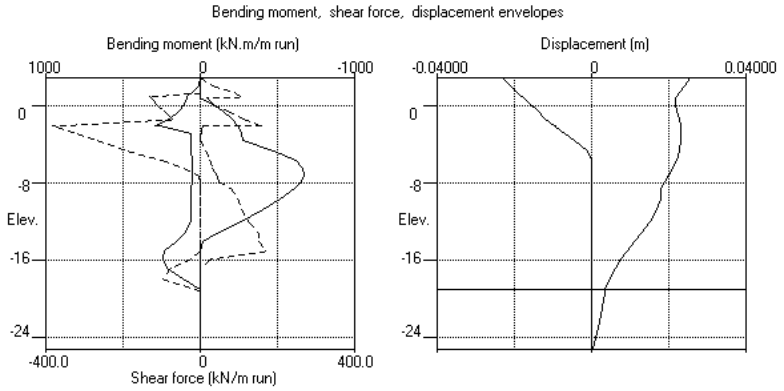
Maximum and minimum displacement at each stage

Stage	Displacement				
no.	maximum	elev.	minimum	elev.	Stage description
	m		m		
1	0.002	2.90	0.000	2.90	Apply surcharge no.1 at elev. 2.90
2	0.002	2.90	0.000	2.90	Apply surcharge no.2 at elev. 2.90
3	Wall displacements reset to zero				Change EI of wall to 719834kN.m2/m run
4	0.025	2.90	0.000	2.90	Excav. to elev. 0.80 on RIGHT side
5	0.006	-5.70	0.000	2.90	Install prop no.2 at elev. 1.00
6	0.011	-4.65	0.000	2.90	Apply water pressure profile no.2
7	0.023	-2.90	0.000	2.90	Excav. to elev. -2.20 on RIGHT side
8	0.007	-10.80	-0.023	2.90	Install prop no.3 at elev. -2.00
9	0.012	-9.70	-0.022	2.90	Apply water pressure profile no.1
10	0.018	-8.60	-0.021	2.90	Excav. to elev. -5.70 on RIGHT side

Prop forces at each stage (horizontal components)

Stage	-- Anchor no. 2 ---		-- Anchor no. 3 ---	
no.	at elev. 1.00		at elev.-2.00	
	kN/m run	kN/prop	kN/m run	kN/prop
5	141.42	424.26	---	---
6	150.26	450.78	---	---
7	171.60	514.80	---	---
8	105.43	316.28	471.40	707.11
9	108.24	324.73	495.57	743.35
10	112.90	338.71	535.75	803.62

Units: kN,m



TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
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Data filename/Run ID: B4&5_Section_3_TopDown |
B4&5_Section3 | Date:13-10-2026
Top Down | Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Left side	Right side
1	3.35	1 Surficial fill	1 Surficial fill
2	1.40	2 Hydraulic/marine Sed	2 Hydraulic/marine Sed
3	-5.70	2 Hydraulic/marine Sed	6 Comp. soil/buttress
4	-8.60	3 Pleist. Sed	6 Comp. soil/buttress
5	-13.10	4 CW-HW ECBF	6 Comp. soil/buttress
6	-15.00	5 MW-UW ECBF	5 MW-UW ECBF

SOIL PROPERTIES

No.	Soil type 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	Surficial fill	18.00	15000	0.530	OC (0.300)	0.309 (0.000)	3.868 (0.000)	
2	Hydraulic.. (3.35)	15.00	6000 (700.0)	0.577	OC (0.350)	0.351 (1.391)	3.253 (4.831)	1.000d
3	Pleist. Sed	18.00	20000	0.500	OC (0.350)	0.283 (1.241)	4.369 (5.836)	5.000d
4	CW-HW ECBF	18.00	30000	0.470	OC (0.300)	0.259 (1.185)	4.964 (6.343)	10.00d
5	MW-UW ECBF	20.00	200000	0.410	OC (0.300)	0.217 (1.078)	6.535 (7.619)	50.00d
6	Comp. soil-/buttress	18.50	2000000	0.410	OC (0.200)	0.351 (1.391)	3.253 (4.831)	30.00d

Additional soil parameters associated with Ka and Kp

No.	Soil type Description	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	Surficial fill	28.00	0.670	0.00	28.00	0.500	0.00
2	Hydraulic/marine Sed	25.00	0.670	0.00	25.00	0.500	0.00
3	Pleist. Sed	30.00	0.670	0.00	30.00	0.500	0.00
4	CW-HW ECBF	32.00	0.670	0.00	32.00	0.500	0.00
5	MW-UW ECBF	36.00	0.670	0.00	36.00	0.500	0.00
6	Comp. soil/buttress	25.00	0.670	0.00	25.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	0.80	0.80

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Left side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Right side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2
1	1	0.80	0.80	0.0	1	-5.70	-5.70	0.0
2	1	0.80	0.80	0.0	1	-2.05	-2.05	0.0

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -19.00
Maximum finite element length = 1.20 m
Youngs modulus of wall E = 300000 kN/m2
Moment of inertia of wall I = 0.011390 m4/m run
E.I = 3417.0 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Elev.	Prop spacing m	Cross-section area sq.m	Youngs modulus kN/m2	Free length m	Inclin-ation (degs)	Pre-stress /prop kN	Strut or Anchor	Allow tension ?	L/R
1	3.30	1.00	0.200000	3.000E+07	20.00	0.00	0	Strut	No	R
2	-0.95	1.00	0.200000	3.000E+07	20.00	0.00	0	Strut	No	R

SURCHARGE LOADS

Surcharge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge(kN/m2) Near edge	Far edge	Surcharge Soil Cat.	Soil type	Part fact.	Short Q reduc. fact.
1	3.35	0.00(L)	50.00	3.00	5.00	=	--	--	--	--
2	3.35	3.00(L)	50.00	10.00	10.00	=	--	--	--	--

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 3.35
	No analysis at this stage
2	Apply surcharge no.2 at elevation 3.35
3	Change EI of wall to 720000 kN.m2/m run
	Reset wall displacements to zero at this stage
4	Excavate to elevation 2.35 on RIGHT side
5	Install strut or anchor no.1 at elevation 3.30
6	Apply water pressure profile no.2
7	Excavate to elevation -1.95 on RIGHT side
8	Install strut or anchor no.2 at elevation -0.95
9	Apply water pressure profile no.1
10	Excavate to elevation -5.70 on RIGHT side

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.20

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 - 2-D finite element model
Open Tension Crack analysis? - No
Active limit arching modelled? - Yes
Non-linear Modulus Parameter (L) = 22.35 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 50.00 m

Width of excavation/fill on Left side of wall = 40.00 m
Width of excavation/fill on Right side of wall = 40.00 m

Distance to rigid boundary on Left side = 40.00 m
Distance to rigid boundary on Right side = 40.00 m
Elevation of rigid lower boundary = -25.25

Lower rigid boundary at elevation -25.25 - Rough
Rigid boundary on Left side - Rough
Rigid boundary on Right side - Rough
Soil-wall interface - Smooth

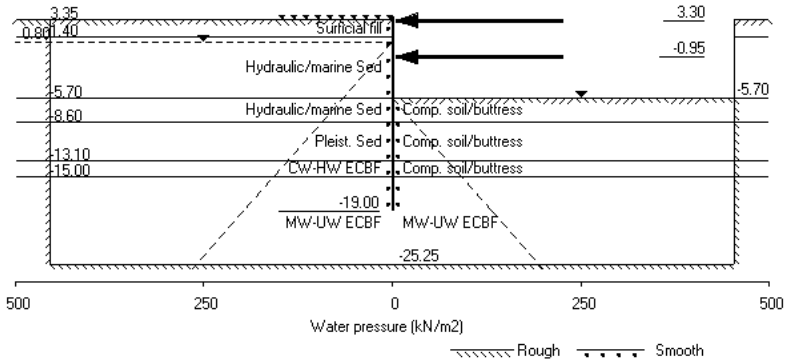
OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 3.35	No	No	No
2	Apply surcharge no.2 at elev. 3.35	No	No	No
3	Change EI of wall to 720000kN.m2/m run	Yes	Yes	Yes
4	Excav. to elev. 2.35 on RIGHT side	Yes	Yes	Yes
5	Install prop no.1 at elev. 3.30	Yes	Yes	Yes
6	Apply water pressure profile no.2	Yes	Yes	Yes
7	Excav. to elev. -1.95 on RIGHT side	Yes	Yes	Yes
8	Install prop no.2 at elev. -0.95	Yes	Yes	Yes
9	Apply water pressure profile no.1	Yes	Yes	Yes
10	Excav. to elev. -5.70 on RIGHT side	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No.10 Excav. to elev. -5.70 on RIGHT side



Units: kN,m

Stage No. 4 Excavate to elevation 2.35 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
4	3.35	2.35	Cant.	7.841	-16.35	1.07	1.28	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	3.35	1.55	0.007	8.36E-04	0.0	-0.0		720000
2	3.30	1.82	0.007	8.36E-04	0.1	0.0		720000
3	2.35	7.13	0.006	8.34E-04	4.3	2.3		720000
4	1.40	-10.23	0.005	8.27E-04	2.9	9.2		720000
		2.29	0.005	8.27E-04	2.9	9.2		
5	0.80	2.59	0.005	8.18E-04	4.3	11.3		720000
6	-0.07	3.15	0.004	8.01E-04	6.8	16.1		720000
7	-0.95	4.10	0.003	7.77E-04	10.0	23.3		720000
8	-1.95	5.11	0.003	7.36E-04	14.6	35.4		720000
9	-2.05	5.89	0.003	7.31E-04	15.2	36.9		720000
10	-2.83	6.88	0.002	6.84E-04	20.1	50.4		720000
11	-3.60	8.80	0.002	6.19E-04	26.2	68.1		720000
12	-4.65	12.87	0.001	4.96E-04	37.6	100.4		720000
13	-5.70	15.25	0.001	3.17E-04	52.3	147.0		720000
		-255.95	0.001	3.17E-04	52.3	147.0		
14	-6.45	-32.45	0.000	1.81E-04	-55.8	114.2		720000
15	-7.20	28.45	0.000	8.94E-05	-57.3	63.2		720000
16	-7.90	30.60	0.000	4.42E-05	-36.7	30.0		720000
17	-8.60	22.32	0.000	2.39E-05	-18.1	11.8		720000
		15.74	0.000	2.39E-05	-18.1	11.8		
18	-9.70	7.42	0.000	1.38E-05	-5.4	1.4		720000
19	-10.80	2.03	0.000	1.27E-05	-0.2	0.1		720000
20	-11.95	1.51	0.000	1.16E-05	1.8	1.3		720000
21	-13.10	3.34	0.000	6.96E-06	4.6	4.5		720000
		-0.88	0.000	6.96E-06	4.6	4.5		
22	-14.05	-5.56	0.000	-1.64E-06	1.6	8.5		720000

(continued)

Stage No.4 Excavate to elevation 2.35 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
23	-15.00	-14.80	0.000	-1.23E-05	-8.1	7.5		720000
		0.90	0.000	-1.23E-05	-8.1	7.5		
24	-15.90	5.13	0.000	-1.73E-05	-5.4	0.6		720000
25	-16.80	3.45	0.000	-1.62E-05	-1.5	-2.2		720000
26	-17.90	1.22	0.000	-1.31E-05	1.0	-1.8		720000
27	-19.00	-2.72	0.000	-1.17E-05	0.2	-0.0		0
28	-19.15	0.01	0.000	0	0.0	0.0		0
29	-19.45	0.10	0.000	0	0.0	0.0		0
30	-22.35	-0.00	0.000	0	0.2	0.0		0
31	-25.25	-0.11	0.000	0	0.0	0.0		---

LEFT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	5.00	1.55	19.34	1.55	1.55a	15337
2	3.30	0.00	5.90	1.82	22.82	1.82	1.82a	15337
3	2.35	0.00	23.07	7.13	89.23	7.13	7.13a	15337
4	1.40	0.00	40.47	12.50	156.53	12.50	12.50a	15337
		0.00	40.47	12.82	136.46	18.66	18.66	7531
5	0.80	0.00	49.74	16.08	166.62	24.05	24.05	7960
6	-0.07	8.75	54.53	17.76	182.21	26.93	35.68	8586
7	-0.95	17.50	59.27	19.43	197.63	30.04	47.54	9213
8	-1.95	27.50	64.59	21.30	214.93	33.55	61.05	9928
9	-2.05	28.50	65.12	21.48	216.64	34.26	62.76	10000
10	-2.83	36.25	69.15	22.90	229.77	37.10	73.35	10555
11	-3.60	44.00	73.13	24.30	242.71	40.46	84.46	11109
12	-4.65	54.50	78.44	26.16	259.97	45.70	100.20	11861
13	-5.70	65.00	83.67	28.00	276.99	51.52	116.52	12612
14	-6.45	72.50	87.37	29.30	289.03	53.04	125.54	13149
15	-7.20	80.00	91.05	30.59	300.98	54.48	134.48	13686
16	-7.90	87.00	94.46	31.79	312.08	56.03	143.03	14187
17	-8.60	94.00	97.86	32.98	323.13	57.31	151.31	14688
		94.00	97.86	21.52	456.75	50.73	144.73	20450
18	-9.70	105.00	106.47	23.96	494.40	54.40	159.40	20450
19	-10.80	116.00	115.07	26.40	531.96	58.46	174.46	20450
20	-11.95	127.50	124.04	28.94	571.18	62.93	190.43	20450
21	-13.10	139.00	133.01	31.48	610.36	67.21	206.21	20450
		139.00	133.01	22.66	723.65	62.99	201.99	30674
22	-14.05	148.50	140.42	24.59	760.41	66.22	214.72	30674
23	-15.00	158.00	147.82	26.51	797.18	69.09	227.09	30674
		158.00	147.82	0.00	1347.03	59.67	217.67	204496
24	-15.90	167.00	156.64	0.00	1404.66	64.11	231.11	204496
25	-16.80	176.00	165.46	0.00	1462.31	67.10	243.10	204496
26	-17.90	187.00	176.25	0.00	1532.80	70.53	257.53	204496
27	-19.00	198.00	187.04	0.00	1603.34	73.06	271.06	204496
28	-19.15	199.50	188.52	0.00	1612.96	75.05	274.55	204496
29	-19.45	202.50	191.46	0.00	1632.21	76.35	278.85	204496
30	-22.35	231.50	219.96	0.00	1818.45	88.10	319.60	204496
31	-25.25	260.50	248.51	0.00	2005.04	99.83	360.33	204496

(continued)

Stage No.4 Excavate to elevation 2.35 on RIGHT side

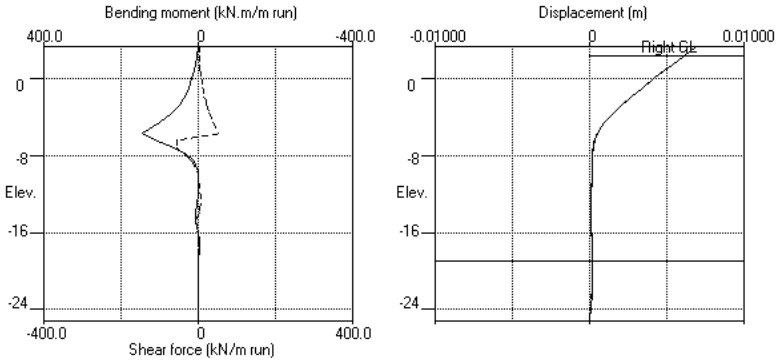
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	0.00	0.00	0.00	15330
4	1.40	0.00	17.10	5.28	66.15	22.73	22.73	15330
		0.00	17.10	4.62	60.45	16.38	16.38	7527
5	0.80	0.00	26.10	7.78	89.73	21.46	21.46	7956
6	-0.07	8.75	30.48	9.31	103.96	23.79	32.54	8582
7	-0.95	17.50	34.85	10.85	118.20	25.94	43.44	9208
8	-1.95	27.50	39.86	12.61	134.48	28.44	55.94	9923
9	-2.05	28.50	40.36	12.79	136.11	28.38	56.88	9995
10	-2.83	36.25	44.24	14.15	148.74	30.22	66.47	10549
11	-3.60	44.00	48.12	15.51	161.37	31.65	75.65	11104
12	-4.65	54.50	53.39	17.36	178.50	32.83	87.33	11855
13	-5.70	65.00	58.66	19.21	195.64	36.27	101.27	12606
		65.00	58.66	0.00	335.74	307.47	372.47	2043971
14	-6.45	72.50	65.05	0.00	356.53	85.49	157.99	2043971
15	-7.20	80.00	71.45	0.00	377.33	26.02	106.02	2043971
16	-7.90	87.00	77.42	0.00	396.76	25.43	112.43	2043971
17	-8.60	94.00	83.39	0.00	416.19	34.99	128.99	2043971
18	-9.70	105.00	92.79	0.00	446.75	46.98	151.98	2043971
19	-10.80	116.00	102.19	0.00	477.33	56.43	172.43	2043971
20	-11.95	127.50	112.03	0.00	509.33	61.42	188.92	2043971
21	-13.10	139.00	121.87	1.08	541.36	63.87	202.87	2043971
22	-14.05	148.50	130.01	3.93	567.83	71.78	220.28	2043971
23	-15.00	158.00	138.16	6.80	594.32	83.89	241.89	2043971
		158.00	138.16	0.00	1283.84	58.76	216.76	204397
24	-15.90	167.00	147.23	0.00	1343.13	58.98	225.98	204397
25	-16.80	176.00	156.30	0.00	1402.44	63.66	239.66	204397
26	-17.90	187.00	167.40	0.00	1474.97	69.31	256.31	204397
27	-19.00	198.00	178.51	0.00	1547.55	75.78	273.78	204397
28	-19.15	199.50	180.02	0.00	1557.45	75.05	274.55	204397
29	-19.45	202.50	183.05	0.00	1577.26	76.24	278.74	204397
30	-22.35	231.50	212.37	0.00	1768.83	88.11	319.61	204397
31	-25.25	260.50	241.71	0.00	1960.63	99.94	360.44	204397

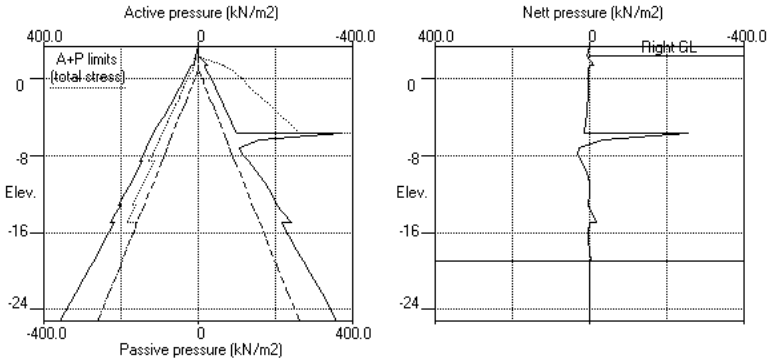
Legend: 12.50 a Soil pressure at active limit
123.45 p Soil pressure at passive limit

Units: kN,m

Stage No.4 Excav. to elev. 2.35 on RIGHT side



Stage No.4 Excav. to elev. 2.35 on RIGHT side



Units: kN,m

Stage No. 7 Excavate to elevation -1.95 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
7	3.35	-1.95	3.30	5.290	n/a	-6.76	4.81	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	3.35	19.34	0.007	-7.79E-04	0.0	-0.0		720000
2	3.30	12.79	0.007	-7.79E-04	0.8	0.0	-102.6	720000
		12.79	0.007	-7.79E-04	-101.8	0.0		
3	2.35	11.48	0.008	-7.20E-04	-90.2	-89.5		720000
4	1.40	10.35	0.009	-5.51E-04	-79.9	-167.1		720000
		17.61	0.009	-5.51E-04	-79.9	-167.1		
5	0.80	20.42	0.009	-3.93E-04	-68.4	-211.5		720000
6	-0.07	30.46	0.009	-1.06E-04	-46.2	-262.1		720000
7	-0.95	40.57	0.009	2.28E-04	-15.1	-289.4		720000
8	-1.95	53.15	0.009	6.25E-04	31.8	-282.1		720000
		49.29	0.009	6.25E-04	31.8	-282.1		
9	-2.05	44.51	0.009	6.64E-04	36.4	-278.7		720000
10	-2.83	40.28	0.008	9.41E-04	69.3	-237.0		720000
11	-3.60	41.68	0.007	1.16E-03	101.1	-171.2		720000
12	-4.65	47.43	0.006	1.31E-03	147.8	-42.1		720000
13	-5.70	53.31	0.004	1.24E-03	200.7	139.2		720000
		-133.89	0.004	1.24E-03	200.7	139.2		
14	-6.45	-150.93	0.004	1.05E-03	93.9	233.1		720000
15	-7.20	-168.78	0.003	7.95E-04	-26.0	261.1		720000
16	-7.90	-21.29	0.002	5.70E-04	-92.5	201.5		720000
17	-8.60	40.59	0.002	4.08E-04	-85.7	131.5		720000
		34.01	0.002	4.08E-04	-85.7	131.5		
18	-9.70	34.50	0.002	2.64E-04	-48.1	57.8		720000
19	-10.80	20.74	0.001	2.00E-04	-17.7	25.9		720000
20	-11.95	17.29	0.001	1.63E-04	4.2	19.4		720000
21	-13.10	16.77	0.001	1.19E-04	23.8	35.8		720000
		12.63	0.001	1.19E-04	23.8	35.8		

(continued)

Stage No.7 Excavate to elevation -1.95 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
22	-14.05	-34.49	0.001	5.40E-05	13.4	64.1		720000
23	-15.00	-138.75	0.001	-2.87E-05	-68.9	61.3		720000
		28.90	0.001	-2.87E-05	-68.9	61.3		
24	-15.90	36.32	0.001	-7.38E-05	-39.5	10.9		720000
25	-16.80	22.78	0.001	-7.43E-05	-13.0	-10.0		720000
26	-17.90	9.10	0.001	-5.87E-05	4.6	-10.5		720000
27	-19.00	-15.33	0.001	-5.07E-05	1.2	0.0		0
28	-19.15	0.01	0.001	0	0.0	0.0		0
29	-19.45	0.22	0.001	0	0.0	0.0		0
30	-22.35	0.01	0.001	0	0.4	0.0		0
31	-25.25	-0.26	0.000	0	0.0	0.0		---

At elev. 3.30 Prop force = 102.6 kN/m run

Node no.	Y coord	LEFT side Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	5.00	1.55	19.34	19.34	19.34p	15337
2	3.30	0.00	5.90	1.82	22.82	12.79	12.79	15337
3	2.35	0.00	23.07	7.13	89.23	11.48	11.48	15337
4	1.40	0.00	40.47	12.50	156.53	10.35	10.35A	15337
		0.00	40.47	12.82	136.46	17.61	17.61	7531
5	0.80	0.00	49.74	16.08	166.62	20.42	20.42	7960
6	-0.07	8.75	54.53	17.76	182.21	21.71	30.46	8586
7	-0.95	17.50	59.27	19.43	197.63	23.07	40.57	9213
8	-1.95	27.50	64.59	21.30	214.93	25.65	53.15	9928
9	-2.05	28.50	65.12	21.48	216.64	25.72	54.22	10000
10	-2.83	36.25	69.15	22.90	229.77	28.46	64.71	10555
11	-3.60	44.00	73.13	24.30	242.71	32.22	76.22	11109
12	-4.65	54.50	78.44	26.16	259.97	38.89	93.39	11861
13	-5.70	65.00	83.67	28.00	276.99	46.89	111.89	12612
14	-6.45	72.50	87.37	29.30	289.03	50.64	123.14	13149
15	-7.20	80.00	91.05	30.59	300.98	53.63	133.63	13686
16	-7.90	87.00	94.46	31.79	312.08	55.97	142.97	14187
17	-8.60	94.00	97.86	32.98	323.13	57.30	151.30	14688
		94.00	97.86	21.52	456.75	50.72	144.72	20450
18	-9.70	105.00	106.47	23.96	494.40	54.37	159.37	20450
19	-10.80	116.00	115.07	26.40	531.96	58.38	174.38	20450
20	-11.95	127.50	124.04	28.94	571.18	63.00	190.50	20450
21	-13.10	139.00	133.01	31.48	610.36	67.38	206.38	20450
		139.00	133.01	22.66	723.65	63.24	202.24	30674
22	-14.05	148.50	140.42	24.59	760.41	66.79	215.29	30674
23	-15.00	158.00	147.82	26.51	797.18	68.99	226.99	30674
		158.00	147.82	0.00	1347.03	58.96	216.96	204496
24	-15.90	167.00	156.64	0.00	1404.66	58.07	225.07	204496
25	-16.80	176.00	165.46	0.00	1462.31	54.11	230.11	204496
26	-17.90	187.00	176.25	0.00	1532.80	51.10	238.10	204496
27	-19.00	198.00	187.04	0.00	1603.34	43.00	241.00	204496
28	-19.15	199.50	188.52	0.00	1612.96	51.24	250.74	204496
29	-19.45	202.50	191.46	0.00	1632.21	52.49	254.99	204496
30	-22.35	231.50	219.96	0.00	1818.45	63.61	295.11	204496
31	-25.25	260.50	248.51	0.00	2005.04	74.47	334.97	204496

(continued)

Stage No.7 Excavate to elevation -1.95 on RIGHT side

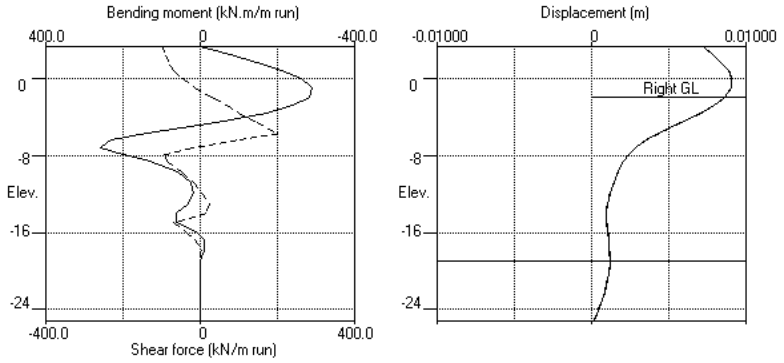
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	4.83	3.86	3.86	9900
9	-2.05	0.00	1.50	0.00	9.71	9.71	9.71p	9972
10	-2.83	7.75	5.38	0.50	22.32	16.67	24.42	10525
11	-3.60	15.50	9.25	1.86	34.93	19.04	34.54	11078
12	-4.65	26.00	14.51	3.71	52.03	19.96	45.96	11827
13	-5.70	36.50	19.78	5.56	69.17	22.08	58.58	12577
		36.50	19.78	0.00	209.27	209.27	245.77p	2039178
14	-6.45	44.00	26.18	0.00	230.08	230.08	274.08p	2039178
15	-7.20	51.50	32.58	0.00	250.91	250.91	302.41p	2039178
16	-7.90	58.50	38.57	0.00	270.38	105.76	164.26	2039178
17	-8.60	65.50	44.56	0.00	289.88	45.21	110.71	2039178
18	-9.70	76.50	54.00	0.00	320.59	48.37	124.87	2039178
19	-10.80	87.50	63.47	0.00	351.39	66.14	153.64	2039178
20	-11.95	99.00	73.40	0.00	383.69	74.21	173.21	2039178
21	-13.10	110.50	83.37	0.00	416.11	79.10	189.60	2039178
22	-14.05	120.00	91.63	0.00	442.98	129.79	249.79	2039178
23	-15.00	129.50	99.91	0.00	469.93	236.24	365.74	2039178
		129.50	99.91	0.00	1033.92	58.57	188.07	203918
24	-15.90	138.50	109.14	0.00	1094.20	50.25	188.75	203918
25	-16.80	147.50	118.39	0.00	1154.64	59.83	207.33	203918
26	-17.90	158.50	129.72	0.00	1228.73	70.51	229.01	203918
27	-19.00	169.50	141.09	0.00	1303.04	86.84	256.34	203918
28	-19.15	171.00	142.65	0.00	1313.19	79.72	250.72	203918
29	-19.45	174.00	145.76	0.00	1333.51	80.77	254.77	203918
30	-22.35	203.00	175.93	0.00	1530.73	92.09	295.09	203918
31	-25.25	232.00	206.33	0.00	1729.36	103.23	335.23	203918

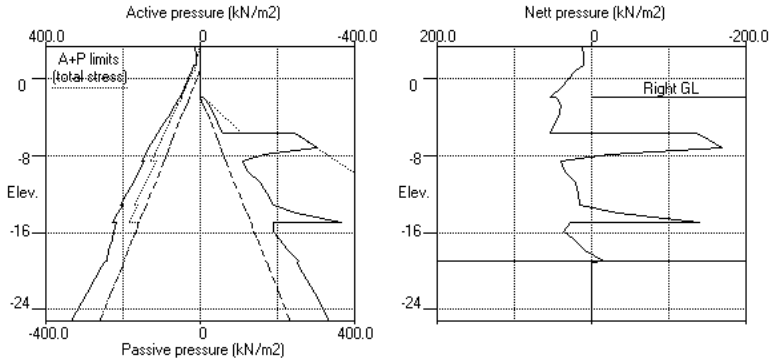
Legend: 12.34 a Soil pressure at active limit
302.41 p Soil pressure at passive limit
10.35 A Arching - soil pressure below active limit

Units: kN,m

Stage No.7 Excav. to elev. -1.95 on RIGHT side



Stage No.7 Excav. to elev. -1.95 on RIGHT side



Units: kN,m

Stage No. 10 Excavate to elevation -5.70 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
10	3.35	-5.70		More than one prop. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

*** Wall displacements reset to zero at stage 3

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
1	3.35	18.24	0.007	-7.75E-04	0.0	-0.0		720000
2	3.30	13.75	0.007	-7.75E-04	0.8	0.0	-63.4	720000
		13.75	0.007	-7.75E-04	-62.6	0.0		
3	2.35	13.45	0.008	-7.41E-04	-49.7	-51.9		720000
4	1.40	13.20	0.008	-6.47E-04	-37.0	-90.1		720000
		19.01	0.008	-6.47E-04	-37.0	-90.1		
5	0.80	22.20	0.009	-5.64E-04	-24.7	-108.5		720000
6	-0.07	32.35	0.009	-4.25E-04	-0.8	-120.1		720000
7	-0.95	42.14	0.010	-2.88E-04	31.8	-107.0	-173.0	720000
		42.14	0.010	-2.88E-04	-141.2	-107.0		
8	-1.95	53.93	0.010	-5.78E-05	-93.2	-225.0		720000
9	-2.05	53.89	0.010	-2.60E-05	-87.8	-234.1		720000
10	-2.83	63.24	0.010	2.52E-04	-42.4	-284.5		720000
11	-3.60	72.94	0.009	5.65E-04	10.3	-297.3		720000
12	-4.65	88.38	0.009	9.59E-04	95.0	-244.1		720000
13	-5.70	105.84	0.007	1.20E-03	197.0	-93.3		720000
		-39.10	0.007	1.20E-03	197.0	-93.3		
14	-6.45	-56.13	0.007	1.24E-03	161.3	25.1		720000
15	-7.20	-73.11	0.006	1.16E-03	112.8	130.0		720000
16	-7.90	-88.94	0.005	1.01E-03	56.1	183.5		720000
17	-8.60	-93.21	0.004	8.23E-04	-7.7	200.9		720000
		-100.83	0.004	8.23E-04	-7.7	200.9		
18	-9.70	5.96	0.003	5.69E-04	-59.8	131.6		720000
19	-10.80	31.51	0.003	4.15E-04	-39.2	69.4		720000
20	-11.95	34.44	0.002	3.24E-04	-1.3	45.3		720000
21	-13.10	31.23	0.002	2.34E-04	36.5	66.6		720000
		26.76	0.002	2.34E-04	36.5	66.6		

(continued)

Stage No.10 Excavate to elevation -5.70 on RIGHT side

Node no.	Y coord	Nett pressure	Wall disp.	Wall rotation	Shear force	Bending moment	Prop forces	EI of wall
		kN/m2	m	rad.	kN/m	kN.m/m	kN/m	kN.m2/m
22	-14.05	-57.93	0.002	1.15E-04	21.7	113.4		720000
23	-15.00	-245.25	0.002	-3.00E-05	-122.4	107.8		720000
		53.86	0.002	-3.00E-05	-122.4	107.8		
24	-15.90	63.75	0.002	-1.09E-04	-69.4	19.5		720000
25	-16.80	39.79	0.002	-1.10E-04	-22.8	-17.2		720000
26	-17.90	16.03	0.002	-8.38E-05	7.9	-18.3		720000
27	-19.00	-26.69	0.002	-6.98E-05	2.0	-0.0		0
28	-19.15	0.01	0.002	0	0.0	0.0		0
29	-19.45	0.25	0.002	0	0.0	0.0		0
30	-22.35	0.02	0.002	0	0.4	0.0		0
31	-25.25	-0.33	0.000	0	0.0	0.0		---

At elev. 3.30 Prop force = 63.4 kN/m run
At elev. -0.95 Prop force = 173.0 kN/m run

LEFT side

Node no.	Y coord	Effective stresses Water press.	Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	5.00	1.55	19.34	18.24	18.24	15337
2	3.30	0.00	5.90	1.82	22.82	13.75	13.75	15337
3	2.35	0.00	23.07	7.13	89.23	13.45	13.45	15337
4	1.40	0.00	40.47	12.50	156.53	13.20	13.20	15337
		0.00	40.47	12.82	136.46	19.01	19.01	7531
5	0.80	0.00	49.74	16.08	166.62	22.20	22.20	7960
6	-0.07	8.75	54.53	17.76	182.21	23.60	32.35	8586
7	-0.95	17.50	59.27	19.43	197.63	24.64	42.14	9213
8	-1.95	27.50	64.59	21.30	214.93	26.43	53.93	9928
9	-2.05	28.50	65.12	21.48	216.64	25.39	53.89	10000
10	-2.83	36.25	69.15	22.90	229.77	26.99	63.24	10555
11	-3.60	44.00	73.13	24.30	242.71	28.94	72.94	11109
12	-4.65	54.50	78.44	26.16	259.97	33.88	88.38	11861
13	-5.70	65.00	83.67	28.00	276.99	40.84	105.84	12612
14	-6.45	72.50	87.37	29.30	289.03	44.54	117.04	13149
15	-7.20	80.00	91.05	30.59	300.98	48.31	128.31	13686
16	-7.90	87.00	94.46	31.79	312.08	51.85	138.85	14187
17	-8.60	94.00	97.86	32.98	323.13	54.67	148.67	14688
		94.00	97.86	21.52	456.75	47.06	141.06	20450
18	-9.70	105.00	106.47	23.96	494.40	52.38	157.38	20450
19	-10.80	116.00	115.07	26.40	531.96	57.14	173.14	20450
20	-11.95	127.50	124.04	28.94	571.18	62.08	189.58	20450
21	-13.10	139.00	133.01	31.48	610.36	66.70	205.70	20450
		139.00	133.01	22.66	723.65	62.22	201.22	30674
22	-14.05	148.50	140.42	24.59	760.41	66.24	214.74	30674
23	-15.00	158.00	147.82	26.51	797.18	68.17	226.17	30674
		158.00	147.82	0.00	1347.03	53.51	211.51	204496
24	-15.90	167.00	156.64	0.00	1404.66	48.43	215.43	204496
25	-16.80	176.00	165.46	0.00	1462.31	38.53	214.53	204496
26	-17.90	187.00	176.25	0.00	1532.80	30.03	217.03	204496
27	-19.00	198.00	187.04	0.00	1603.34	12.55	210.55	204496
28	-19.15	199.50	188.52	0.00	1612.96	26.48	225.98	204496
29	-19.45	202.50	191.46	0.00	1632.21	27.76	230.26	204496
30	-22.35	231.50	219.96	0.00	1818.45	38.49	269.99	204496
31	-25.25	260.50	248.51	0.00	2005.04	48.71	309.21	204496

(continued)

Stage No.10 Excavate to elevation -5.70 on RIGHT side

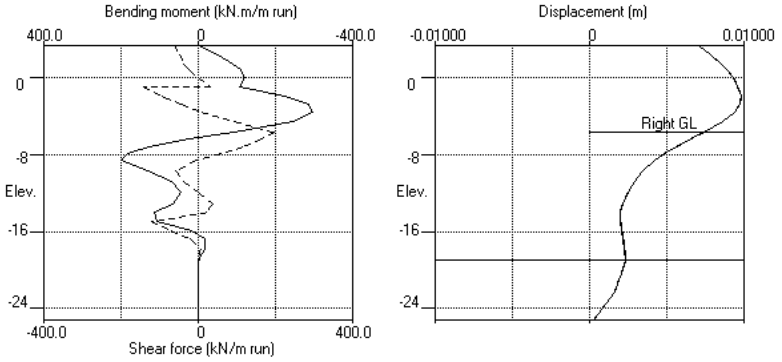
RIGHT side

Node no.	Y coord	Water press.	Effective stresses: Vertic -al	Active limit	Passive limit	Earth press.	Total earth press.	Adjusted soil modulus
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-2.83	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-5.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	144.93	144.93	144.93p	2034537
14	-6.45	7.50	6.38	0.00	165.67	165.67	173.17p	2034537
15	-7.20	15.00	12.75	0.00	186.42	186.42	201.42p	2034537
16	-7.90	22.00	18.71	0.00	205.79	205.79	227.79p	2034537
17	-8.60	29.00	24.67	0.00	225.19	212.89	241.89	2034537
18	-9.70	40.00	34.06	0.00	255.72	111.42	151.42	2034537
19	-10.80	51.00	43.47	0.00	286.34	90.63	141.63	2034537
20	-11.95	62.50	53.35	0.00	318.46	92.63	155.13	2034537
21	-13.10	74.00	63.27	0.00	350.72	100.47	174.47	2034537
22	-14.05	83.50	71.49	0.00	377.49	189.17	272.67	2034537
23	-15.00	93.00	79.76	0.00	404.37	378.42	471.42	2034537
		93.00	79.76	0.00	902.20	64.65	157.65	203454
24	-15.90	102.00	88.97	0.00	962.42	49.68	151.68	203454
25	-16.80	111.00	98.22	0.00	1022.88	63.74	174.74	203454
26	-17.90	122.00	109.58	0.00	1097.10	79.00	201.00	203454
27	-19.00	133.00	121.00	0.00	1171.70	104.24	237.24	203454
28	-19.15	134.50	122.56	0.00	1181.91	91.46	225.96	203454
29	-19.45	137.50	125.68	0.00	1202.33	92.51	230.01	203454
30	-22.35	166.50	156.12	0.00	1401.27	103.46	269.96	203454
31	-25.25	195.50	186.97	0.00	1602.84	114.04	309.54	203454

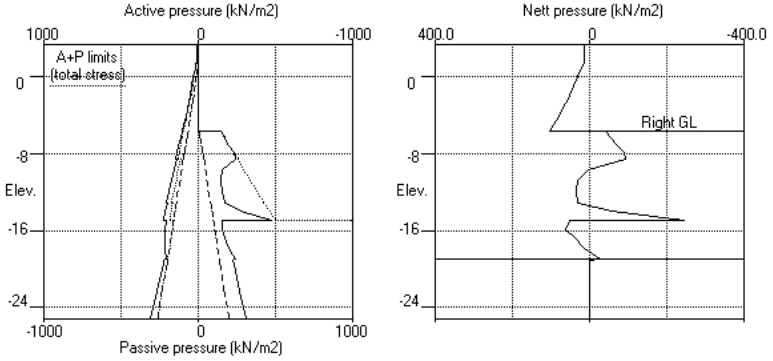
Legend: 12.34 a Soil pressure at active limit
227.79 p Soil pressure at passive limit

Units: kN,m

Stage No.10 Excav. to elev. -5.70 on RIGHT side



Stage No.10 Excav. to elev. -5.70 on RIGHT side



Units: kN,m

Summary of results

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

Stage No.	Ground level Act.	Pass.	Prop Elev.	FoS for toe elev. = -19.00 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.200 Toe elev.	Wall Penetr -ation	Direction of failure
1	3.35	3.35	Cant.	Conditions not suitable for FoS calc.				
2	3.35	3.35	Cant.	Conditions not suitable for FoS calc.				
3	3.35	3.35		No analysis at this stage				
4	3.35	2.35	Cant.	7.841	-16.35	1.07	1.28	L to R
5	3.35	2.35		No analysis at this stage				
6	3.35	2.35	3.30	36.600	n/a	2.23	0.12	L to R
7	3.35	-1.95	3.30	5.290	n/a	-6.76	4.81	L to R
8	3.35	-1.95		No analysis at this stage				

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

TONKIN + TAYLOR LTD | Sheet No.
Program: WALLAP Version 6.09 Revision A61.B78.R61 | Job No. 1101937
Licensed from GEOSOLVE | Made by : AWM
Data filename/Run ID: B4&5_Section_3_TopDown |
B4&5_Section3 | Date:13-10-2026
Top Down | Checked :

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
2-D finite element model. Active limit arching modelled.
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No
All soil moduli were factored to take account of
3-D effects due to the finite length of wall:
Modulus factors - Left side = 1.02
Right side = 1.02

Length of wall perpendicular to section = 50.00m
Rigid boundaries: Left side 40.00m from wall Rough
Right side 40.00m from wall Rough
Lower boundary at elevation -25.25m Rough
Soil-wall interface Smooth

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum	Displacement minimum	Bending moment maximum	Bending moment minimum	Shear force maximum	Shear force minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	3.35	0.007	0.000	0.0	-0.0	0.0	0.0
2	3.30	0.007	0.000	0.0	0.0	0.8	-101.8
3	2.35	0.008	0.000	2.3	-89.5	4.3	-90.2
4	1.40	0.009	0.000	9.2	-167.1	2.9	-79.9
5	0.80	0.009	0.000	11.3	-211.5	4.3	-68.4
6	-0.07	0.009	0.000	16.1	-262.1	6.8	-46.2
7	-0.95	0.010	0.000	23.3	-289.4	31.8	-141.2
8	-1.95	0.010	0.000	35.4	-282.1	31.8	-93.2
9	-2.05	0.010	0.000	36.9	-278.7	36.4	-87.8
10	-2.83	0.010	0.000	50.4	-284.5	69.3	-42.4
11	-3.60	0.009	0.000	68.1	-297.3	101.1	-0.1
12	-4.65	0.009	0.000	100.4	-244.1	147.8	0.0
13	-5.70	0.007	0.000	176.8	-93.3	214.7	0.0
14	-6.45	0.007	0.000	233.1	-0.4	161.3	-59.3
15	-7.20	0.006	0.000	261.1	0.0	112.8	-72.4
16	-7.90	0.005	0.000	202.4	-0.0	56.1	-92.5
17	-8.60	0.004	0.000	200.9	0.0	1.5	-85.7
18	-9.70	0.003	0.000	131.6	0.0	0.0	-59.8
19	-10.80	0.003	0.000	69.4	0.0	0.0	-39.2
20	-11.95	0.002	0.000	45.3	-0.0	6.3	-1.3
21	-13.10	0.002	0.000	66.6	-0.0	36.5	0.0
22	-14.05	0.002	0.000	113.4	0.0	21.7	-0.1
23	-15.00	0.002	0.000	107.8	-0.2	3.8	-122.4
24	-15.90	0.002	0.000	19.5	-1.4	0.1	-69.4
25	-16.80	0.002	0.000	0.0	-17.2	0.0	-22.8
26	-17.90	0.002	0.000	0.0	-18.3	7.9	-0.0
27	-19.00	0.002	0.000	0.0	-0.0	2.0	-0.0
28	-19.15	0.002	0.000	0.0	0.0	0.0	0.0
29	-19.45	0.002	0.000	0.0	0.0	0.0	0.0
30	-22.35	0.002	0.000	0.0	0.0	0.4	0.0
31	-25.25	0.000	0.000	0.0	0.0	0.0	0.0

Summary of results (continued)

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment				Shear force			
no.	maximum	elev.	minimum	elev.	maximum	elev.	minimum	elev.
	kN.m/m		kN.m/m		kN/m		kN/m	
1	0.9	-5.70	-0.2	0.80	3.8	-15.00	-0.6	1.40
2	2.1	-5.70	-0.5	-4.65	5.3	-5.70	-1.3	-6.45
3	No calculation at this stage							
4	147.0	-5.70	-2.2	-16.80	52.3	-5.70	-57.3	-7.20
5	No calculation at this stage							
6	176.8	-5.70	-24.8	-0.95	95.5	-5.70	-72.4	-7.20
7	261.1	-7.20	-289.4	-0.95	200.7	-5.70	-101.8	3.30
8	No calculation at this stage							
9	260.2	-7.20	-276.5	-1.95	214.7	-5.70	-97.2	3.30
10	200.9	-8.60	-297.3	-3.60	197.0	-5.70	-141.2	-0.95

Maximum and minimum displacement at each stage

Stage	Displacement				
no.	maximum	elev.	minimum	elev.	Stage description
	m		m		
1	0.001	3.35	-0.000	-19.45	Apply surcharge no.1 at elev. 3.35
2	0.002	-0.07	-0.000	-22.35	Apply surcharge no.2 at elev. 3.35
3	Wall displacements reset to zero				Change EI of wall to 720000kN.m2/m run
4	0.007	3.35	0.000	3.35	Excav. to elev. 2.35 on RIGHT side
5	No calculation at this stage				Install prop no.1 at elev. 3.30
6	0.007	3.35	0.000	3.35	Apply water pressure profile no.2
7	0.009	-0.07	0.000	3.35	Excav. to elev. -1.95 on RIGHT side
8	No calculation at this stage				Install prop no.2 at elev. -0.95
9	0.009	-0.07	0.000	3.35	Apply water pressure profile no.1
10	0.010	-2.05	0.000	3.35	Excav. to elev. -5.70 on RIGHT side

Prop forces at each stage (horizontal components)

Stage	--- Strut no. 1 ---		--- Strut no. 2 ---	
no.	at elev. 3.30		at elev.-0.95	
	kN/m run	kN/prop	kN/m run	kN/prop
6	13.15	13.15	---	---
7	102.56	102.56	---	---
9	98.04	98.04	21.54	21.54
10	63.42	63.42	173.03	173.03

Units: kN,m

