CampbellReith
consulting engineers

Ashton Court
254 – 256 Camden Road
London
NW1 9HE

Ground Movement Assessment

DRAFT

For

Origin Housing

Project Number:

12047

September 2017

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Contents

1.0 INTRODUCTION

1.1. Appointment and Scope

1.1.1. Campbell Reith Hill LLP (CampbellReith) has been appointed by Origin Housing (the client), to undertake a ground movement assessment to determine the impact of the construction of a basement at Ashton Court on Camden Mews in north London. This assessment comprises part of a basement impact assessment required by the London Borough of Camden Council for the proposed redevelopment of Ashton Court, 254 – 256 Camden Road, NW1 9HE (the site). The proposal comprises the demolition of two existing buildings and the construction of a new building with three above ground floors and a single storey basement on Camden Mews; and a two storey building on Camden Park Road.

1.1.2. Since the issue of the previous report, the basement proposals have recently been revised to include a nominal increase in area and depth. This report reflects these changes with respect to the ground movements and corresponding damage assessments for the neighbouring buildings.

1.1.3. The report only considers the magnitude and impact of vertical and horizontal ground movements on the neighbouring properties on Camden Mews, in particular 103 Camden Mews which is adjacent to the west. The report is based on a site specific investigation undertaken by Ground Engineering Limited in January 2015 and further trial pitting undertaken in August 2017. The ground conditions at the site and the assumptions made as to the existing and proposed structures are outlined. The approach taken to determining ground movements is described together with a discussion on the implications for the neighbouring properties. It is intended that this report is submitted to London Borough of Camden as part of the BIA.

1.1.4. Appendix A contains figures showing the site location together with the properties along Camden Mews within the zone of influence of the proposed development and the proposed development. A basement construction sequence report prepared by CampbellReith is included in Appendix B. The results of the analyses undertaken using the Oasys programmes Pdisp Version 19.3 and Xdisp Version 19.4 to determine the horizontal and vertical ground movements associated with the construction of the retaining wall and subsequent excavation are presented in Appendix C. Geosolve WALLAP Version 6.06 was used to assess the wall embedment depth and this is also included.

2.0 GROUND CONDITIONS

2.1. Site Investigation

2.1.1. A site specific ground investigation was procured by the Robert Lombardelli Partnership and is reported separately. The BIA report prepared by CampbellReith (FDemb-12047-110917-BIA-F2) contains an assessment of the data obtained. The investigation comprised a single windowless sampler hole in the garden in the rear of the site undertaken to 10m bgl. The sequence of strata encountered was Made Ground (1.50m thick) underlain by London Clay to the base of the hole. Three foundation inspection pits have been undertaken on the boundary with the neighbouring property on the west and these indicated the Made Ground extends to at least 1.70m bgl in places. The base of the London Clay is believed to be at c.45m bgl overlying the Lambeth Group (which changes between clays and sands) and the Thanet Sand, which are anticipated to be present up to 70m bgl. The Lambeth Group and Thanet Sand are underlain by Chalk up to at least 120m bgl.

2.1.2. Groundwater was not encountered during the site works. A single monitoring visit was undertaken on 3rd February 2015 and the recorded water level was c.5.25m bgl (c.40.15m AOD).

3.0 EXISTING AND PROPOSED STRUCTURES

3.1. Existing Building

3.1.1. The existing building dates from the early 1980s and is anticipated to be of traditional cavity wall construction (from drawings on a previous planning application for rebuilding the common room). This section on Camden Mews, which is to be demolished and rebuilt with a basement, currently has two above ground floors with partial undercroft parking at ground level. The ground level in the vicinity of the site along Camden Mews (road) is approximately 45.60m AOD and it gently slopes down to 45.40m AOD in the garden in the rear of the building.

3.2. Proposed Building

3.2.1. It is proposed to demolish the existing building and construct a new building with three above ground floors and a single storey basement comprising flats. The basement is indicated to extend to approximately 2.50m beyond the existing building area beneath the garden on the proposed plans. The basement is to extend to c.42.35m AOD (maximum excavation of 3.25m) and is to be formed within a contiguous piled wall.

4.0 ANALYSIS ASSUMPTIONS AND INPUT PARAMETERS

4.1. Ground Conditions

4.1.1. The sequence of strata is outlined above and the soils have been assumed to be incompressible below 0m AOD.

4.2. Foundation Assumptions

4.2.1. The revised proposed basement is irrelugarly shaped. The proposed flats in the eastern half extend 8.50m from front to back whilst the ones in the western half extend to 11m (2.50m beneath the garden) to accommodate a basement level terrace. The basement is to be formed within a contiguous piled wall and due to the proposed rig size, the wall will be offset by c.1.20 from the party wall with 103 Camden Mews.

4.2.2. In considering ground movements associated with the proposed redevelopment, Oasys Pdisp (Version 19.3) has been used to model the vertical movements (heave) due to demolition and excavation. Oasys Xdisp (Version 19.4) is used to calculate the anticipated horizontal and vertical movements due to installation of the piled wall and excavation of the basement together with the resulting damage to the neighbouring properties. The Oasys Xdisp programme does not allow re-entrant corners therefore the basement has been modelled as a rectangle (26.5 x 11) in both programmes. This is larger than the area the basement will occupy in reality.

4.2.3. It has been assumed that demolition will result in an unloading on the founding stratum of approximately 30kN/m^2. The maximum excavation depth is anticipated to be c.3.25m, and this will result in a further unloading of 65kN/m^2 due to the weight of soil being removed.

4.2.4. For this assessment, the proposed structure is assumed to be supported by a 450mm diameter contiguous piled wall.

4.2.5. The foundations to the neighbouring properties have been assumed to be strip footings at a depth of 0.50m bgl (45.10m AOD). At 103 Camden Mews, these are assumed to be perpendicular to the road at intervals of 4.50m. The foundation inspection trial pits were inconclusive but suggested they might be piled. Consequently this is a conservative assumption.

4.3. Basement Construction Sequence

4.3.1. Whilst the final construction sequence is the responsibility of the Contractor, an assumed basement construction sequence is detailed in SKsk-12047-120917-CS-F2 in Appendix B. A summary is provided below.

4.3.2. The ground movement assessment assumes that piles are installed around the perimeter of the basement following demolition, followed by partial excavation to 500mm. High level propping across the width of the basement would be installed at capping beam level followed by excavation down to 50mm below the underside of the basement slab level. Propping ensures that ground movements are minimised.

4.3.3. The basement slab would then be cast on the blinding. It is assumed the basement slab would be 300mm thick reinforced concrete with 450mm deep local thickenings under all concrete walls and around the perimeter.

4.3.4. The basement walls would then be constructed followed by temporary prop removal and casting of the ground floor slab. All the props would be removed. The basement tanking system would then be installed followed by the internal basement walls and then construction of the upper floors.

4.4. Pdisp Analysis

4.4.1. The purpose of the Pdisp analysis is to estimate the vertical ground movements as a result of demolition and excavation. Reference to CIRIA C760 [1] reveals that ground movements typically reduce to zero at a distance not exceeding four times the excavation depth. Pdisp relies on structural loads and soil properties being defined by reference to x, y coordinates, hence the modelling of the proposed building footprint as a rectangle and the strip footings of the neighbouring properties as grid lines. In this case however, the basement is to be formed by a piled wall around the perimeter, therefore ground movements due to heave are likely to be restricted within the basement footprint. Nonetheless, GL1 to GL6 represent the assumed locations of the strip footings of the properties within four times the depth of the excavation (c.12m). The coordinates used in these assessments are indicated on Figure 3 in Appendix A. The assumptions are based on observations of the form and type of nearby buildings made during a site reconnaissance visit. Vertical ground movements have been estimated at the assumed foundation locations and the programme assumes a fully flexible foundation which is likely to overestimate ground movements.

4.4.1. Modulus values have been derived empirically, with the undrained modulus (Eu) being equal 400 x undrained shear strength (Cu) in the London Clay [2]. The drained modulus (E') has been taken as 0.75 x Eu. In the Made Ground, Eu has conservatively been assumed to be 5000kN/m^2 which is based on our experience in similar soils and has been taken to be equal to E'. The following parameters were adopted for analysis:

TABLE 4.1: Soil Input Parameters

Stratum	Bulk Unit Weight (kN/m^3)	Undrained Shear Strength (kN/m^2)	Young's Modulus (kN/m^2)	Poisson's ratio
Made Ground	18	N/A	Eu= E'= 5000	ν = 0.5 ν' = 0.2
London Clay	20	Cu = 70+6z[1]	Eu= 28000 + 2400z E' = 21000 + 1800z	ν = 0.5 ν'= 0.2

[1]Where z = depth below the top of the London Clay which was encountered at 43.90m AOD

4.4.2. Laboratory triaxial tests were undertaken as part of the ground investigation, however, these were performed on samples from a windowless sampler hole which are likely to have experienced sample disturbance, resulting in lower apparent strengths. CampbellReith's experience in working with the London Clay allowed a reasonable estimation of the undrained shear strength (Cu) to be made using both the site investigation information and data from other sites in north London. The vertical undrained modulus in the London Clay Eu=400Cu and drained modulus, E'=0.75Eu.

4.5. Xdisp Analysis

4.5.1. Xdisp has been used to estimate the effects of the vertical and horizontal settlement due installation of the contiguous piled wall and the subsequent excavation. As with the Pdisp analysis, GL1 to GL6 represent the assumed locations of the strip footings of the properties within four times the depth of the excavation (c.13m). The sequence of works described above allows the wall support to be assessed as high support stiffness. The programme uses the curves presented in Figures 2.8a, 2.8b, 2.11a and 2.11b of CIRIA C580 (Figures 6.8a and 6.8b and 6.15a and 6.15b of CIRIA C760) respectively to allow the profile of ground movements behind the wall to be estimated. The programme calculates the likely maximum vertical and horizontal strain at the assumed location of the neighbouring property foundations which then enables an estimation of the building damage category of the neighbouring properties.

4.6. WALLAP Analysis

4.6.1. Although detailed design of the basement has not yet been undertaken and is not required at this stage, an initial analysis has been undertaken to ensure the depth of the wall used in the building damage assessment satisfies the CIRIA C580/C760 stability requirements.

4.6.2. The construction sequence was modelled as described above with an allowance made for accidental overdig and cracking in the wall over time. Eurocode Ultimate Limit State (ULS) Design Action 1 (DA1), whereby partial factors greater than unity are applied to the actions only and Design Action 2 (DA2 – usually the governing case) where partial factors greater than unity are applied to the variable unfavourable loads, soil properties and resulting bending moments were both modelled. A serviceability limit state (SLS) analysis was also undertaken to determine the wall deflections although this was not used in the damage assessment.

4.6.3. The basement wall design parameters used are as indicated in the BIA.

TABLE 4.2: Basement Wall Design Parameters

Stratum	Bulk Unit Weight (kN/m^3)	Effective Cohesion, c', kPa	Angle of Shearing resistance, f '	Undrained Shear Strength (kN/m^2)	Young's Modulus (kN/m^2)
Made Ground	18	0	28°	N/A	E'_h= 5000
London Clay	20	1.5	20°	Cu = 70+6z[1]	E'_h= 60270 + 5166z[1]

[1] z is the depth below 43.90m AOD

5.0 ASSESSMENT OF GROUND MOVEMENTS AND BUILDING DAMAGE

5.1. Ground Movements, Assessment of Strain and Building Damage

5.1.1. Ground movements have been estimated along the length of the neighbouring property footings at a level of 45.10m AOD (0.50m below the street level in front of 103 Camden Mews as given in the topographic survey provided by the client). According to CIRIA C760, ground movements associated with the construction of the basement and retaining walls are could theoretically extend to 101 and 103 Camden Mews, 88 – 90 Camden Mews and 59 Camden Park Road.

5.1.2. An analysis of the vertical ground movements (heave) associated with the demolition of the existing building and subsequent basement excavation has been undertaken using the Oasys programme Pdisp Version 19.3. Immediate heave due to the demolition of the existing building and excavation of the basement is in the order of 10mm at the western boundary of the piled wall which is 1.20m away from the party wall with 103 Camden Mews. In reality, the heave movements will be offset by the settlements from the construction and are likely to be confined within the basement footprint. On this basis, these have not been included in the building damage assessment.

5.1.3. Oasys Xdisp Version 19.4 was used to calculate the ground movements as a result of the installation of the contiguous piles and the excavation of the basement. A total wall depth of 5.10m (embedment depth of 1.85m) was assumed. A WALLAP analysis was undertaken to demonstrate the pile length to be sufficient to satisfy the CIRIA C760 stability requirements.

5.1.4. The length of the neighbouring property (103 Camden Mews) has been assumed to be 9m with an approximate height (H) of 6m. The maximum combined movements due to the excavation and installation occur at GL4 (strip foundations for 103 Camden Mews perpendicular to the excavation). These are indicated on the Xdisp output included in Appendix C. In summary, the vertical movement is 4mm at near side (party wall foundations with 103 Camden Mews) reducing to 0 at the far side of the property (party wall between 103 and 101 Camden Mews). The horizontal movements at the near side of GL4 is 6mm with 1mm indicated along the far side.

5.1.5. An additional analysis was undertaken to determine wall deflections using WALLAP (SLS case). The analysis indicates a maximum wall deflection of 2mm and given the piled wall is offset by 1.20m way from the party wall, ground surface movements are likely to be less than predicted by the Xdisp analysis above. The more conservative Xdisp analysis was used in the damage assessment of the neighbouring properties and on this basis, it is considered that an increase to the pile length to accommodate structural loads following detailed design will not alter the maximum damage category indicated below.

5.1.6. Building damage is caused by differential movement between the two ends of a foundation/structure which generates strains. Xdisp divides each foundation/sub-structure (displacement line in this case) into hogging and sagging segments and calculates the building damage. Segment 1 (sagging) within GL4 (halfway along the length of the foundation) is the critical section and the analyses indicates the horizontal strain, ε_h (dh/L) = 0.075% with the deflection ratio Δ/L = 0.01%. This represents a maximum damage category of 'very slight'

(Burland Category 1). Negligible (Burland Category 0) is indicated for Segment 2. These results are illustrated on the Xdisp graphical output included in Appendix C.

5.1.7. Negligible damage (Burland Category 0) is indicated for the remaining grid lines (GL1 to GL3, GL5 and GL6) representing foundations beneath 103 Camden Mews (parallel to the piled wall) and the remaining properties. The results of all the analyses above are included in Appendix C.

6.0 MOVEMENT MONITORING

6.1. On the basis of the assumed construction methods and sequence, the ground movement analysis suggests damage to the neighbouring properties is likely to remain within Category 1 ('very slight') damage. To ensure the movements remain within acceptable limits, movement monitoring is recommended. These should be broadly in accordance with the 'observational method' outlined in CIRIA Report 185 [3] and agreed prior to construction. Guidance on setting trigger levels is also given in CIRIA C760. Suggested trigger levels based on the 'traffic light system' are summarised below:

TABLE 6.1: Suggested trigger values

Trigger levels (mm)		Action
Green	4	Continue regular monitoring – movements well within acceptable limits.
Amber	5	Movements approaching Category 1 limit – review data for trends and implement contingency measures as prepared.
Red	7	Movements exceeding Category 1 limit – construction pause. Review data trends, sequence and implement contingency measures as prepared.

7.0 CONCLUSIONS

7.1. An assessment of the strain as a result of the installation of the bored piled wall and basement excavation indicates that the maximum damage to 103 Camden Mews falls within Category 1, 'very slight'.

7.2. The movements and hence the damage on the remaining properties within the zone of influence are negligible.

7.3. Further analysis of wall deflections indicates damage to the neighbouring properties is likely to remain within Category 1 even if the pile lengths are longer than assumed above.

7.4. Movement monitoring is recommended to ensure the movements remain within acceptable limits. The monitoring strategy should be agreed between the relevant parties following detailed design.

TECHNICAL REFERENCES

Reference	Reference Title	Type
1	CIRIA C760 Embedded retaining walls - guidance for economic design.	CIRIA Publication
2	C J Padfield and M J Sharrock, Settlement of Structures on Clay Soils	CIRIA Publication
3	CIRIA Report 185 The Observational method in Ground Engineering	CIRIA Publication

LIMITATIONS

1. Where any data or information supplied by the client or other external source, including that from previous studies, has been used, it has been assumed that the information is correct. No responsibility can be accepted by CampbellReith for inaccuracies within this data or information.
2. This report is limited to those aspects described in the introduction and no liability is accepted for any other aspects.
3. The generalised soil conditions described in the text are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and have been developed on interpretations of the exploration locations and samples collected.
4. Water level and gas readings have been taken at times and under conditions stated on the exploration logs. It must be noted that fluctuations in the level of groundwater or gas may occur due to a variety of factors which may differ from those prevailing at the time the measurements were taken.
5. The findings and opinions expressed are relevant to those dates of the reported site work and should not be relied upon to represent conditions at substantially later dates.
6. This report is produced solely for the benefit of the client, and no liability is accepted for any reliance placed upon it by any other party unless specifically agreed in writing.

APPENDIX A: FIGURES

Figure 1: Site Location

Figure 2a and 2b: Proposed Development

Ashton Court

Client: Origin Housing

Figure 1:
Site Location and Neighbouring Properties Within Zone of Influence of Proposed Basement

Scale: 1:2500@A4

Job Number: 12047
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Drg No - Status/Revision: GIS005 - A
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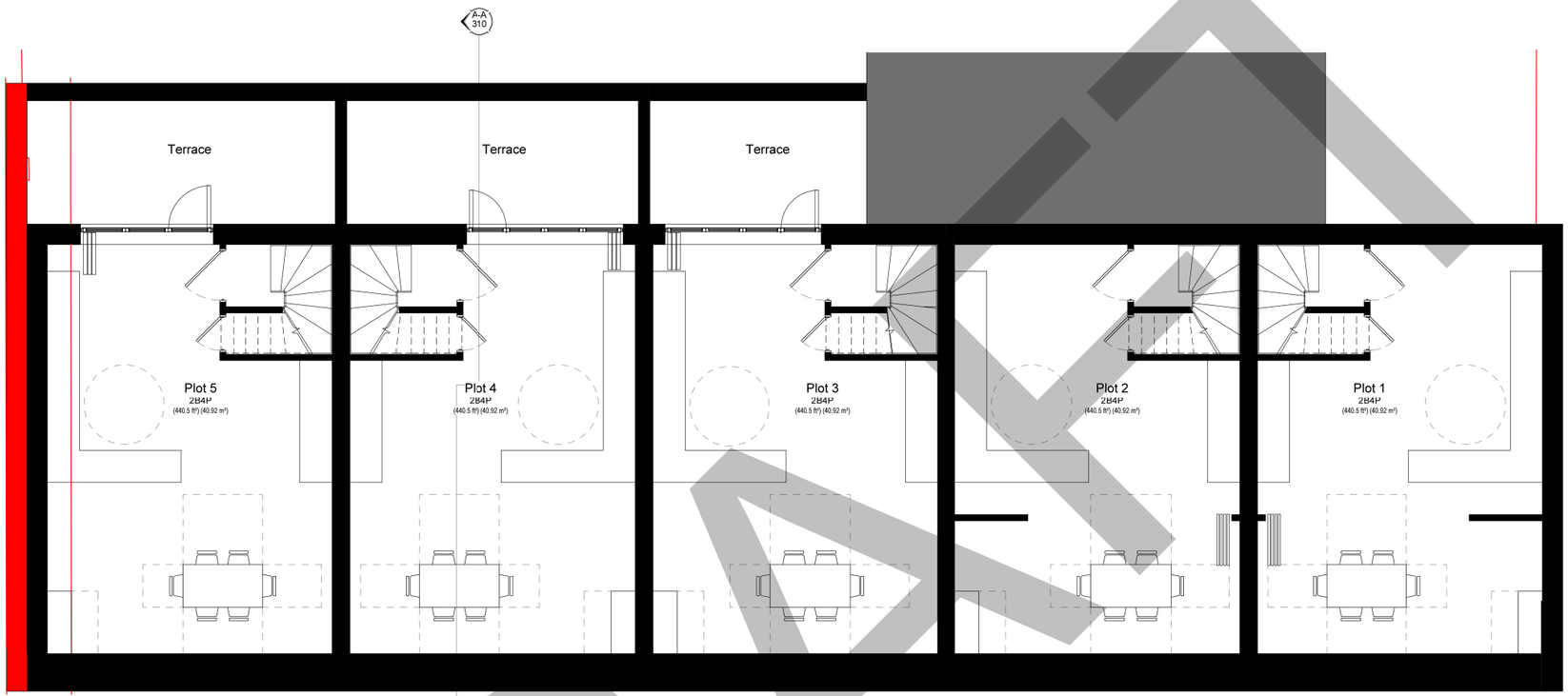
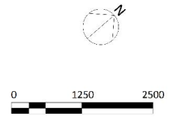


Basement GA



Ashton Court

Client: Origin Housing

Figure 2a:
Proposed Basement Plan

Based on calfordseaden Project no. K160423 Drawing no. A(2)200 Rev 4 (Oct 2016)
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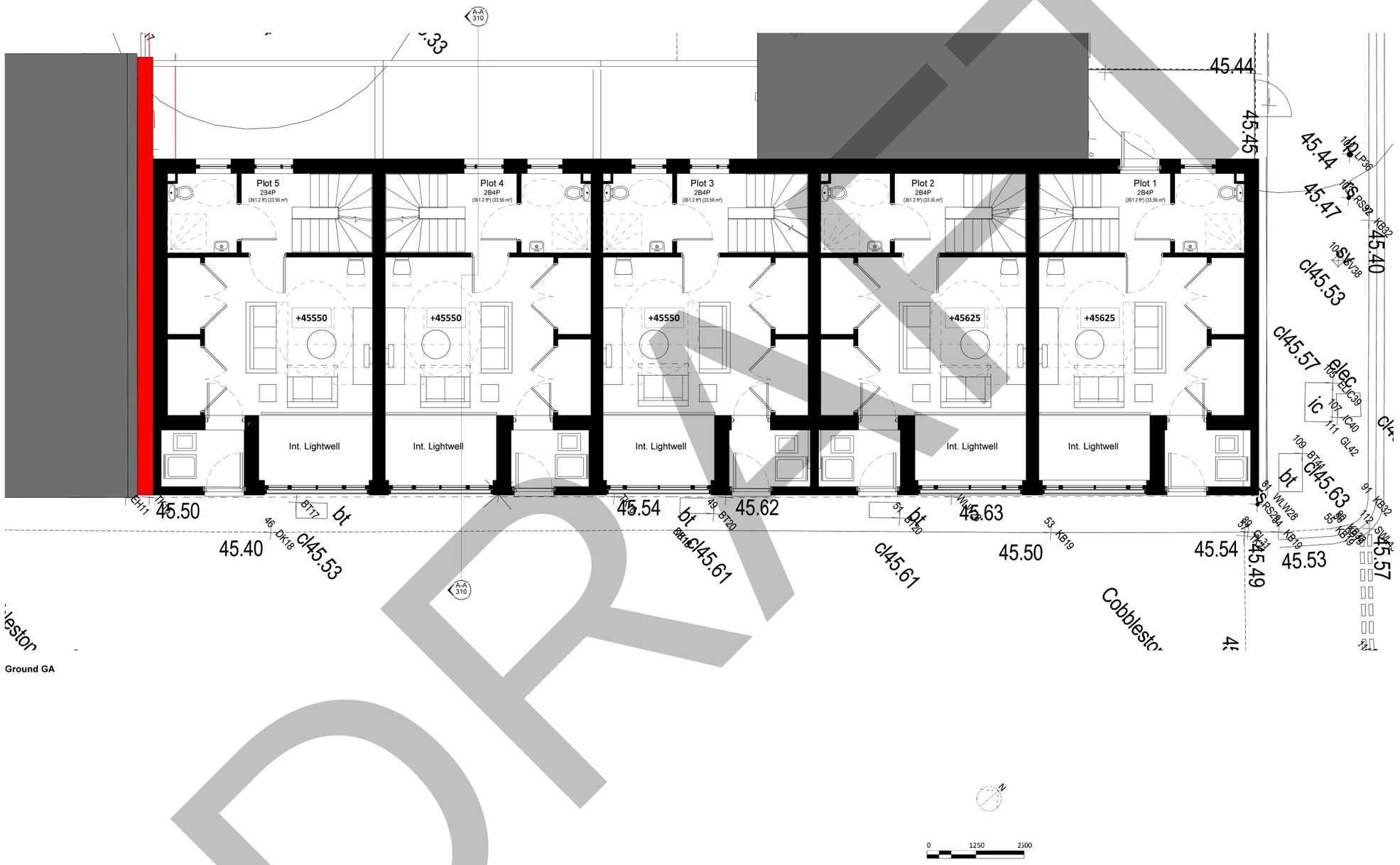

Ground GA

Ashton Court

Client: Origin Housing

Figure 2b:
Proposed Ground Level Plan

Based on calfordseaden Project no. K160423 Drawing no. A(2)200 Rev 4 (Oct 2016)
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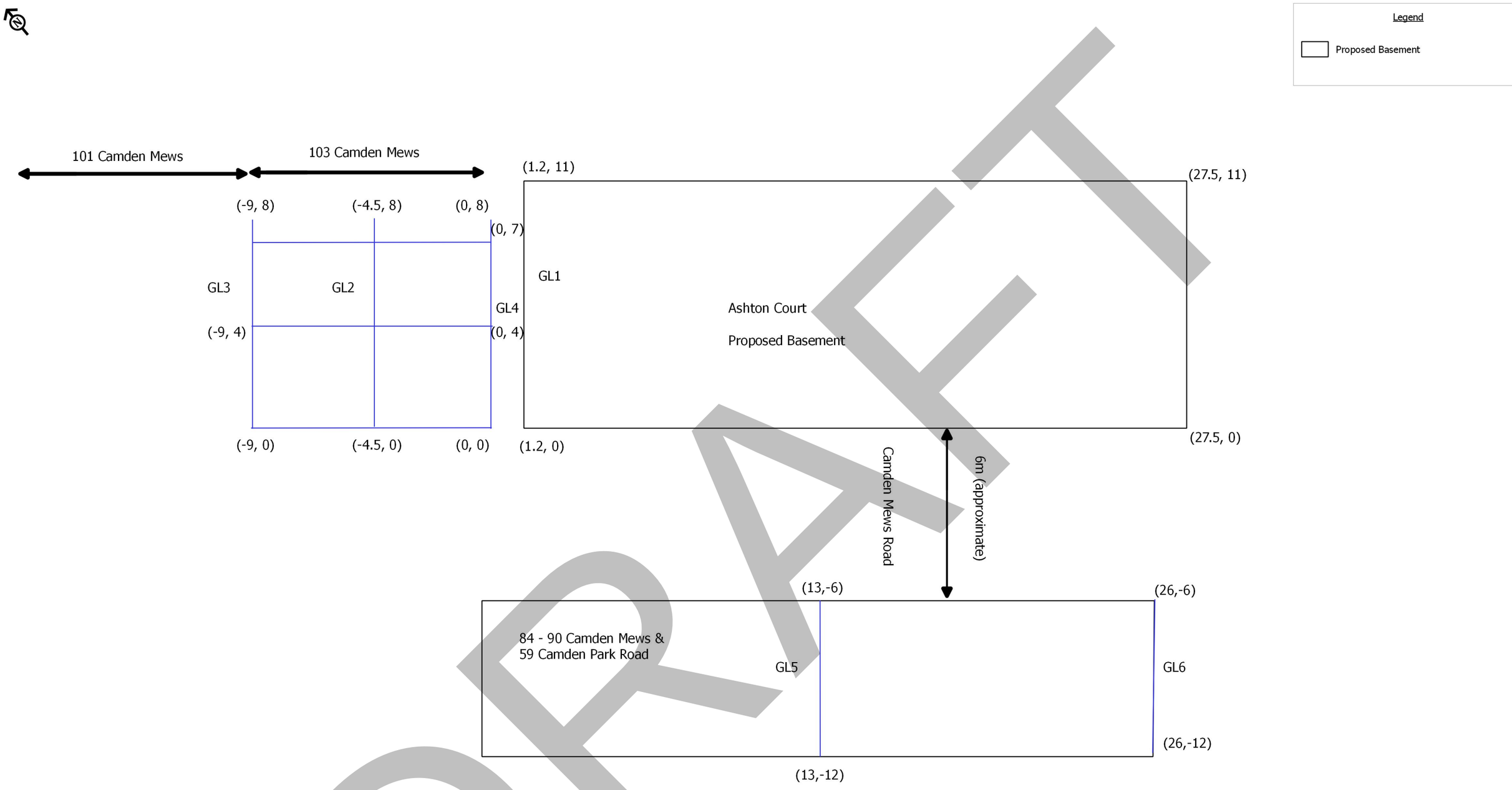

NTS

Ashton Court

Client: Origin Housing

Figure 3:
Coordinates (X,Y) adopted in Pdisp and Xdisp analysis

Scale:	NTS
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APPENDIX B: BASEMENT CONSTRUCTION SEQUENCE

APPENDIX C: GROUND MOVEMENT ANALYSES

Contents

Oasys Pdisp

Notes

Eu=400Cu
Cu=70+6z

Analysis Options

Analysis: Boussinesq
Global Poisson's ratio: 0.20
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 0.00 [m OD]
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No
Displacements at load centroids: Yes

Soil ProfilesSoil Profile

Layer	Level at top	Number of intermediate displacement levels	Youngs Modulus Top	Youngs Modulus Btm	Poissons ratio	Non-linear curve
	[mOD]		[kN/m²]	[kN/m²]		
1	45.600	2	5000.0	5000.0	0.50000	None
2	43.900	43	28000.	131200.	0.50000	None

Soil Zones

Zone	Name	X coordinates min [m]	X coordinates max [m]	Y coordinates min [m]	Y coordinates max [m]	Profile
1	SZ1	-60.00000	60.00000	-60.00000	60.00000	Soil Profile

Non-linear Curve Coordinates - Non-linear Curve 1

Point	Strain [%]	Factor

Load Data

Load ref.	Name	Shape	Orientation of Plane	Centre of load (Global) X [m]	Y [m]	Z (level) [m]	Load position Angle of local x from [Degrees]	Width x or Radius [m]	Length y [m]	Polygon Coordinates [m]	Rectangle tolerance [%]	Number of rectangles	Load value Normal (local z) [kN/m²]	Tangential (local x) [kN/m²]	Tangential (local y) [kN/m²]
1	Basement	Rectangular	Horizontal	13.25000	5.50000	42.35000	0.0	26.500	11.000	N/A	N/A	1	-95.000	0.0	0.0

Displacement Data

Ref.	Type	Name	Direction of Extrusion	First point X [m]	First point Y [m]	First point Z(level) [m]	Second point X [m]	Second point Y [m]	Second point Z(level) [m]	No. of intrvls across extrusion/line	Extrusion Depth [m]	No. of intrvls along extrusion	Calculate	Show Detailed results
1	Grid	BL	Global X	1.20000	0.00000	42.35000	N/A	11.00000	42.35000	10	26.50000	26	Yes	No
2	Line	GL1	N/A	0.00000	0.00000	45.10000	0.00000	8.00000	45.10000	8	N/A	N/A	Yes	No
3	Line	GL2	N/A	-4.50000	0.00000	45.10000	-4.50000	8.00000	45.10000	8	N/A	N/A	Yes	No
4	Line	GL3	N/A	-9.00000	0.00000	45.10000	-9.00000	8.00000	45.10000	8	N/A	N/A	Yes	No
5	Line	GL4	N/A	0.00000	4.00000	45.10000	-9.00000	4.00000	45.10000	9	N/A	N/A	Yes	No
6	Line	GL5	N/A	13.00000	-6.00000	45.10000	13.00000	-12.00000	45.10000	6	N/A	N/A	Yes	No
7	Line	GL6	N/A	26.00000	-6.00000	45.10000	26.00000	-12.00000	45.10000	6	N/A	N/A	Yes	No

RESULTS FOR GRIDS

Analysis: Boussinesq
Global Poisson's ratio: 0.20
Horizontal rigid boundary level: 0.00 [m OD]

The maximum displacement difference between the Boussinesq method (-21.613mm) and the Mindlin method (-16.760mm) occurs at point X = 13.25000m, Y = 5.50000m, level = 42.350mOD, and is 4.8523mm.

Name	Location X [m]	Location Y [m]	Z[Level] [mOD]	Displacement Z [mm]	Stresses Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
Basement	13.25000	5.50000	42.35000	-21.613	41.962	-94.985	-216.93	-0.0010451
BL	1.20000	0.00000	42.35000	-9.6214	41.962	-47.197	-101.19	-620.72E-6
	2.21923	0.00000	42.35000	-10.636	41.962	-47.447	-106.19	-555.45E-6
	3.23846	0.00000	42.35000	-11.350	41.962	-47.482	-108.07	-528.07E-6
	4.25769	0.00000	42.35000	-11.883	41.962	-47.492	-109.04	-513.71E-6
	5.27692	0.00000	42.35000	-12.292	41.962	-47.495	-109.60	-505.14E-6
	6.29615	0.00000	42.35000	-12.611	41.962	-47.497	-109.97	-499.60E-6
	7.31538	0.00000	42.35000	-12.860	41.962	-47.498	-110.22	-495.86E-6
	8.33462	0.00000	42.35000	-13.053	41.962	-47.498	-110.39	-493.26E-6
	9.35385	0.00000	42.35000	-13.200	41.962	-47.498	-110.50	-491.45E-6
	10.37308	0.00000	42.35000	-13.307	41.962	-47.499	-110.59	-490.20E-6
	11.39231	0.00000	42.35000	-13.380	41.962	-47.499	-110.64	-489.40E-6
	12.41154	0.00000	42.35000	-13.420	41.962	-47.499	-110.67	-488.97E-6
	13.43077	0.00000	42.35000	-13.430	41.962	-47.499	-110.67	-488.87E-6
	14.45000	0.00000	42.35000	-13.409	41.962	-47.499	-110.66	-489.08E-6
	15.46923	0.00000	42.35000	-13.358	41.962	-47.499	-110.62	-489.64E-6
	16.48846	0.00000	42.35000	-13.273	41.962	-47.499	-110.56	-490.59E-6
	17.50769	0.00000	42.35000	-13.153	41.962	-47.498	-110.47	-492.02E-6
	18.52692	0.00000	42.35000	-12.990	41.962	-47.498	-110.33	-494.08E-6
	19.54615	0.00000	42.35000	-12.778	41.962	-47.498	-110.14	-497.03E-6
	20.56538	0.00000	42.35000	-12.506	41.962	-47.496	-109.86	-501.32E-6
	21.58462	0.00000	42.35000	-12.158	41.962	-47.494	-109.43	-507.74E-6
	22.60385	0.00000	42.35000	-11.710	41.962	-47.490	-108.75	-517.92E-6
	23.62308	0.00000	42.35000	-11.122	41.962	-47.475	-107.56	-535.63E-6
	24.64231	0.00000	42.35000	-10.321	41.962	-47.412	-105.02	-571.75E-6
	25.66154	0.00000	42.35000	-9.1400	41.962	-46.709	-96.829	-665.14E-6
	26.68077	0.00000	42.35000	-6.5565	41.962	-11.371	-39.808	87.475E-6
	27.70000	0.00000	42.35000	-4.7732	41.962	-0.30205	-10.042	140.35E-6
	1.20000	1.10000	42.35000	-13.200	41.962	-93.711	-186.13	-0.0014595
	2.21923	1.10000	42.35000	-14.526	41.962	-94.153	-193.94	-0.0013598
	3.23846	1.10000	42.35000	-15.402	41.962	-94.207	-196.56	-0.0013221
	4.25769	1.10000	42.35000	-16.031	41.962	-94.221	-197.81	-0.0013036
	5.27692	1.10000	42.35000	-16.502	41.962	-94.226	-198.51	-0.0012930
	6.29615	1.10000	42.35000	-16.863	41.962	-94.228	-198.94	-0.0012864
	7.31538	1.10000	42.35000	-17.141	41.962	-94.229	-199.23	-0.0012821
	8.33462	1.10000	42.35000	-17.355	41.962	-94.229	-199.43	-0.0012791
	9.35385	1.10000	42.35000	-17.516	41.962	-94.229	-199.56	-0.0012770
	10.37308	1.10000	42.35000	-17.634	41.962	-94.230	-199.65	-0.0012756
	11.39231	1.10000	42.35000	-17.712	41.962	-94.230	-199.71	-0.0012748
	12.41154	1.10000	42.35000	-17.756	41.962	-94.230	-199.74	-0.0012743
	13.43077	1.10000	42.35000	-17.766	41.962	-94.230	-199.75	-0.0012742
	14.45000	1.10000	42.35000	-17.744	41.962	-94.230	-199.73	-0.0012744
	15.46923	1.10000	42.35000	-17.688	41.962	-94.230	-199.69	-0.0012750
	16.48846	1.10000	42.35000	-17.597	41.962	-94.230	-199.62	-0.0012761
	17.50769	1.10000	42.35000	-17.464	41.962	-94.229	-199.52	-0.0012777
	18.52692	1.10000	42.35000	-17.286	41.962	-94.229	-199.36	-0.0012800
	19.54615	1.10000	42.35000	-17.051	41.962	-94.228	-199.14	-0.0012834
	20.56538	1.10000	42.35000	-16.746	41.962	-94.227	-198.81	-0.0012885
	21.58462	1.10000	42.35000	-16.350	41.962	-94.224	-198.30	-0.0012962
	22.60385	1.10000	42.35000	-15.829	41.962	-94.218	-197.45	-0.0013089
	23.62308	1.10000	42.35000	-15.126	41.962	-94.197	-195.87	-0.0013322
	24.64231	1.10000	42.35000	-14.125	41.962	-94.095	-192.22	-0.0013836
	25.66154	1.10000	42.35000	-12.529	41.962	-92.786	-178.64	-0.0015319
	26.68077	1.10000	42.35000	-8.2709	41.962	-22.425	-69.498	34.169E-6
	27.70000	1.10000	42.35000	-5.5770	41.962	-0.51954	-14.200	194.20E-6

Name	Location			Displacement		Stresses			
	X [m]	Y [m]	Z[Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
	1.20000	2.20000	42.35000	-14.554	41.962	-94.313	-195.54	-0.0013426
	2.21923	2.20000	42.35000	-16.083	41.962	-94.801	-204.56	-0.0012266
	3.23846	2.20000	42.35000	-17.084	41.962	-94.865	-207.65	-0.0011820
	4.25769	2.20000	42.35000	-17.793	41.962	-94.881	-209.11	-0.0011603
	5.27692	2.20000	42.35000	-18.317	41.962	-94.886	-209.92	-0.0011481
	6.29615	2.20000	42.35000	-18.714	41.962	-94.889	-210.42	-0.0011406
	7.31538	2.20000	42.35000	-19.017	41.962	-94.890	-210.74	-0.0011357
	8.33462	2.20000	42.35000	-19.248	41.962	-94.890	-210.96	-0.0011324
	9.35385	2.20000	42.35000	-19.422	41.962	-94.891	-211.11	-0.0011301
	10.37308	2.20000	42.35000	-19.547	41.962	-94.891	-211.21	-0.0011286
	11.39231	2.20000	42.35000	-19.631	41.962	-94.891	-211.27	-0.0011276
	12.41154	2.20000	42.35000	-19.678	41.962	-94.891	-211.31	-0.0011271
	13.43077	2.20000	42.35000	-19.689	41.962	-94.891	-211.31	-0.0011270
	14.45000	2.20000	42.35000	-19.666	41.962	-94.891	-211.30	-0.0011272
	15.46923	2.20000	42.35000	-19.606	41.962	-94.891	-211.25	-0.0011279
	16.48846	2.20000	42.35000	-19.508	41.962	-94.891	-211.18	-0.0011290
	17.50769	2.20000	42.35000	-19.366	41.962	-94.891	-211.06	-0.0011308
	18.52692	2.20000	42.35000	-19.173	41.962	-94.890	-210.89	-0.0011334
	19.54615	2.20000	42.35000	-18.919	41.962	-94.890	-210.64	-0.0011372
	20.56538	2.20000	42.35000	-18.585	41.962	-94.888	-210.27	-0.0011429
	21.58462	2.20000	42.35000	-18.148	41.962	-94.885	-209.68	-0.0011517
	22.60385	2.20000	42.35000	-17.566	41.962	-94.877	-208.70	-0.0011665
	23.62308	2.20000	42.35000	-16.770	41.962	-94.852	-206.84	-0.0011939
	24.64231	2.20000	42.35000	-15.621	41.962	-94.734	-202.53	-0.0012546
	25.66154	2.20000	42.35000	-13.785	41.962	-93.343	-187.26	-0.0014251
	26.68077	2.20000	42.35000	-9.1879	41.962	-22.694	-74.594	100.05E-6
	27.70000	2.20000	42.35000	-6.1832	41.962	-0.57885	-16.372	224.83E-6
	1.20000	3.30000	42.35000	-15.303	41.962	-94.371	-198.22	-0.0013041
	2.21923	3.30000	42.35000	-16.947	41.962	-94.868	-207.68	-0.0011817
	3.23846	3.30000	42.35000	-18.030	41.962	-94.936	-211.03	-0.0011333
	4.25769	3.30000	42.35000	-18.796	41.962	-94.953	-212.63	-0.0011096
	5.27692	3.30000	42.35000	-19.359	41.962	-94.959	-213.52	-0.0010963
	6.29615	3.30000	42.35000	-19.783	41.962	-94.962	-214.06	-0.0010881
	7.31538	3.30000	42.35000	-20.106	41.962	-94.963	-214.41	-0.0010828
	8.33462	3.30000	42.35000	-20.350	41.962	-94.964	-214.64	-0.0010792
	9.35385	3.30000	42.35000	-20.533	41.962	-94.964	-214.80	-0.0010768
	10.37308	3.30000	42.35000	-20.665	41.962	-94.965	-214.90	-0.0010752
	11.39231	3.30000	42.35000	-20.753	41.962	-94.965	-214.97	-0.0010742
	12.41154	3.30000	42.35000	-20.802	41.962	-94.965	-215.01	-0.0010736
	13.43077	3.30000	42.35000	-20.814	41.962	-94.965	-215.02	-0.0010735
	14.45000	3.30000	42.35000	-20.789	41.962	-94.965	-215.00	-0.0010737
	15.46923	3.30000	42.35000	-20.727	41.962	-94.965	-214.95	-0.0010745
	16.48846	3.30000	42.35000	-20.624	41.962	-94.964	-214.87	-0.0010757
	17.50769	3.30000	42.35000	-20.475	41.962	-94.964	-214.75	-0.0010775
	18.52692	3.30000	42.35000	-20.271	41.962	-94.964	-214.57	-0.0010803
	19.54615	3.30000	42.35000	-20.001	41.962	-94.963	-214.30	-0.0010844
	20.56538	3.30000	42.35000	-19.646	41.962	-94.961	-213.89	-0.0010906
	21.58462	3.30000	42.35000	-19.178	41.962	-94.958	-213.25	-0.0011002
	22.60385	3.30000	42.35000	-18.552	41.962	-94.949	-212.17	-0.0011164
	23.62308	3.30000	42.35000	-17.690	41.962	-94.922	-210.14	-0.0011464
	24.64231	3.30000	42.35000	-16.448	41.962	-94.799	-205.53	-0.0012116
	25.66154	3.30000	42.35000	-14.485	41.962	-93.397	-189.72	-0.0013898
	26.68077	3.30000	42.35000	-9.7368	41.962	-22.727	-76.317	125.00E-6
	27.70000	3.30000	42.35000	-6.5867	41.962	-0.59382	-17.411	240.10E-6
	1.20000	4.40000	42.35000	-15.696	41.962	-94.384	-199.24	-0.0012891
	2.21923	4.40000	42.35000	-17.399	41.962	-94.883	-208.88	-0.0011640
	3.23846	4.40000	42.35000	-18.527	41.962	-94.952	-212.34	-0.0011140
	4.25769	4.40000	42.35000	-19.327	41.962	-94.970	-214.01	-0.0010892
	5.27692	4.40000	42.35000	-19.914	41.962	-94.976	-214.94	-0.0010751
	6.29615	4.40000	42.35000	-20.355	41.962	-94.979	-215.51	-0.0010665
	7.31538	4.40000	42.35000	-20.689	41.962	-94.980	-215.88	-0.0010610
	8.33462	4.40000	42.35000	-20.942	41.962	-94.981	-216.12	-0.0010573
	9.35385	4.40000	42.35000	-21.131	41.962	-94.981	-216.28	-0.0010548
	10.37308	4.40000	42.35000	-21.267	41.962	-94.982	-216.39	-0.0010531
	11.39231	4.40000	42.35000	-21.357	41.962	-94.982	-216.46	-0.0010520
	12.41154	4.40000	42.35000	-21.408	41.962	-94.982	-216.50	-0.0010515
	13.43077	4.40000	42.35000	-21.420	41.962	-94.982	-216.51	-0.0010513
	14.45000	4.40000	42.35000	-21.394	41.962	-94.982	-216.49	-0.0010516
	15.46923	4.40000	42.35000	-21.330	41.962	-94.982	-216.44	-0.0010523
	16.48846	4.40000	42.35000	-21.224	41.962	-94.982	-216.36	-0.0010536
	17.50769	4.40000	42.35000	-21.070	41.962	-94.981	-216.23	-0.0010555
	18.52692	4.40000	42.35000	-20.860	41.962	-94.981	-216.04	-0.0010584
	19.54615	4.40000	42.35000	-20.581	41.962	-94.980	-215.76	-0.0010627
	20.56538	4.40000	42.35000	-20.212	41.962	-94.978	-215.34	-0.0010692
	21.58462	4.40000	42.35000	-19.725	41.962	-94.974	-214.67	-0.0010793
	22.60385	4.40000	42.35000	-19.072	41.962	-94.965	-213.53	-0.0010963
	23.62308	4.40000	42.35000	-18.173	41.962	-94.938	-211.42	-0.0011275
	24.64231	4.40000	42.35000	-16.881	41.962	-94.813	-206.67	-0.0011947
	25.66154	4.40000	42.35000	-14.854	41.962	-93.408	-190.67	-0.0013758
	26.68077	4.40000	42.35000	-10.036	41.962	-22.735	-77.026	135.53E-6
	27.70000	4.40000	42.35000	-6.8164	41.962	-0.59841	-17.894	247.32E-6
	1.20000	5.50000	42.35000	-15.820	41.962	-94.386	-199.52	-0.0012849
	2.21923	5.50000	42.35000	-17.541	41.962	-94.886	-209.20	-0.0011591
	3.23846	5.50000	42.35000	-18.683	41.962	-94.955	-212.70	-0.0011086
	4.25769	5.50000	42.35000	-19.494	41.962	-94.973	-214.39	-0.0010834
	5.27692	5.50000	42.35000	-20.089	41.962	-94.980	-215.34	-0.0010692
	6.29615	5.50000	42.35000	-20.535	41.962	-94.983	-215.91	-0.0010605
	7.31538	5.50000	42.35000	-20.874	41.962	-94.984	-216.29	-0.0010549
	8.33462	5.50000	42.35000	-21.129	41.962	-94.985	-216.53	-0.0010511
	9.35385	5.50000	42.35000	-21.320	41.962	-94.985	-216.70	-0.0010485
	10.37308	5.50000	42.35000	-21.458	41.962	-94.985	-216.81	-0.0010468
	11.39231	5.50000	42.35000	-21.549	41.962	-94.985	-216.88	-0.0010458
	12.41154	5.50000	42.35000	-21.600	41.962	-94.985	-216.92	-0.0010452
	13.43077	5.50000	42.35000	-21.612	41.962	-94.985	-216.93	-0.0010451
	14.45000	5.50000	42.35000	-21.586	41.962	-94.985	-216.91	-0.0010453
	15.46923	5.50000	42.35000	-21.522	41.962	-94.985	-216.86	-0.0010461
	16.48846	5.50000	42.35000	-21.414	41.962	-94.985	-216.78	-0.0010474
	17.50769	5.50000	42.35000	-21.259	41.962	-94.985	-216.65	-0.0010493
	18.52692	5.50000	42.35000	-21.047	41.962	-94.984	-216.46	-0.0010523
	19.54615	5.50000	42.35000	-20.764	41.962	-94.983	-216.17	-0.0010566
	20.56538	5.50000	42.35000	-20.391	41.962	-94.982	-215.74	-0.0010631
	21.58462	5.50000	42.35000	-19.898	41.962	-94.978	-215.06	-0.0010735
	22.60385	5.50000	42.35000	-19.235	41.962	-94.969	-213.91	-0.0010907
	23.62308	5.50000	42.35000	-18.325	41.962	-94.941	-211.77	-0.0011223
	24.64231	5.50000	42.35000	-17.016	41.962	-94.816	-206.98	-0.0011901
	25.66154	5.50000	42.35000	-14.971	41.962	-93.410	-190.93	-0.0013719
	26.68077	5.50000	42.35000	-10.131	41.962	-22.736	-77.226	138.53E-6
	27.70000	5.50000	42.35000	-6.8909	41.962	-0.59952	-18.037	249.47E-6
	1.20000	6.60000	42.35000	-15.696	41.962	-94.384	-199.24	-0.0012891
	2.21923	6.60000	42.35000	-17.399	41.962	-94.883	-208.88	-0.0011640
	3.23846	6.60000	42.35000	-18.527	41.962	-94.952	-212.34	-0.0011140
	4.25769	6.60000	42.35000	-19.327	41.962	-94.970	-214.01	-0.0010892
	5.27692	6.60000	42.35000	-19.914	41.962	-94.976	-214.94	-0.0010751
	6.29615	6.60000	42.35000	-20.355	41.962	-94.979	-215.51	-0.0010665
	7.31538	6.60000	42.35000	-20.689	41.962	-94.980	-215.88	-0.0010610
	8.33462	6.60000	42.35000	-20.942	41.962	-94.981	-216.12	-0.0010573
	9.35385	6.60000	42.35000	-21.131	41.962	-94.981	-216.28	-0.0010548
	10.37308	6.60000	42.35000	-21.267	41.962	-94.982	-216.39	-0.0010531
	11.39231	6.60000	42.35000	-21.357	41.962	-94.982	-216.46	-0.0010520
	12.41154	6.60000	42.35000	-21.408	41.962	-94.982	-216.50	-0.0010515
	13.43077	6.60000	42.35000	-21.420	41.962	-94.982	-216.51	-0.0010513
	14.45000	6.60000	42.35000	-21.394	41.962	-94.982	-216.49	-0.0010516
	15.46923	6.60000	42.35000	-21.330	41.962	-94.982	-216.44	-0.0010523
	16.48846	6.60000	42.35000	-21.224	41.962	-94.982	-216.36	-0.0010536
	17.50769	6.60000	42.35000	-21.070	41.962	-94.981	-216.23	-0.0010555
	18.52692	6.60000	42.35000	-20.860	41.962	-94.981	-216.04	-0.0010584
	19.54615	6.60000	42.35000	-20.581	41.962	-94.980	-215.76	-0.0010627
	20.56538	6.60000	42.35000	-20.212	41.962	-94.978	-215.34	-0.0010692
	21.58462	6.60000	42.35000	-19.725	41.962	-94.974	-214.67	-0.0010793
	22.60385	6.60000	42.35000	-19.072	41.962	-94.965	-213.53	-0.0010963
	23.62308	6.60000	42.35000	-18.173	41.962	-94.938	-211.42	-0.0011275
	24.64231	6.60000	42.35000	-16.881	41.962	-94.813	-206.67	-0.0011947
	25.66154	6.60000	42.35000	-14.854	41.962	-93.408	-190.67	-0.0013758
	26.68077	6.60000	42.35000	-10.036	41.962	-22.735	-77.026	135.53E-6

Ashton Court

Demolition & Basement excavation

Immediate heave

Name	Location			Displacement		Stresses			
	X [m]	Y [m]	Z[Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]	
	27.70000	6.60000	42.35000	-6.8164	41.962	-0.59841	-17.894	247.32E-6	
	1.20000	7.70000	42.35000	-15.303	41.962	-94.371	-198.22	-0.0013041	
	2.21923	7.70000	42.35000	-16.947	41.962	-94.868	-207.68	-0.0011817	
	3.23846	7.70000	42.35000	-18.030	41.962	-94.936	-211.03	-0.0011333	
	4.25769	7.70000	42.35000	-18.796	41.962	-94.953	-212.63	-0.0011096	
	5.27692	7.70000	42.35000	-19.359	41.962	-94.959	-213.52	-0.0010963	
	6.29615	7.70000	42.35000	-19.783	41.962	-94.962	-214.06	-0.0010881	
	7.31538	7.70000	42.35000	-20.106	41.962	-94.963	-214.41	-0.0010828	
	8.33462	7.70000	42.35000	-20.350	41.962	-94.964	-214.64	-0.0010792	
	9.35385	7.70000	42.35000	-20.533	41.962	-94.964	-214.80	-0.0010768	
	10.37308	7.70000	42.35000	-20.665	41.962	-94.965	-214.90	-0.0010752	
	11.39231	7.70000	42.35000	-20.753	41.962	-94.965	-214.97	-0.0010742	
	12.41154	7.70000	42.35000	-20.802	41.962	-94.965	-215.01	-0.0010736	
	13.43077	7.70000	42.35000	-20.814	41.962	-94.965	-215.02	-0.0010735	
	14.45000	7.70000	42.35000	-20.789	41.962	-94.965	-215.00	-0.0010737	
	15.46923	7.70000	42.35000	-20.727	41.962	-94.965	-214.95	-0.0010745	
	16.48846	7.70000	42.35000	-20.624	41.962	-94.964	-214.87	-0.0010757	
	17.50769	7.70000	42.35000	-20.475	41.962	-94.964	-214.75	-0.0010775	
	18.52692	7.70000	42.35000	-20.271	41.962	-94.964	-214.57	-0.0010803	
	19.54615	7.70000	42.35000	-20.001	41.962	-94.963	-214.30	-0.0010844	
	20.56538	7.70000	42.35000	-19.646	41.962	-94.961	-213.89	-0.0010906	
	21.58462	7.70000	42.35000	-19.178	41.962	-94.958	-213.25	-0.0011002	
	22.60385	7.70000	42.35000	-18.552	41.962	-94.949	-212.17	-0.0011164	
	23.62308	7.70000	42.35000	-17.690	41.962	-94.922	-210.14	-0.0011464	
	24.64231	7.70000	42.35000	-16.448	41.962	-94.799	-205.53	-0.0012116	
	25.66154	7.70000	42.35000	-14.485	41.962	-93.397	-189.72	-0.0013898	
	26.68077	7.70000	42.35000	-9.7368	41.962	-22.727	-76.317	125.00E-6	
	27.70000	7.70000	42.35000	-6.5867	41.962	-0.59382	-17.411	240.10E-6	
	1.20000	8.80000	42.35000	-14.554	41.962	-94.313	-195.54	-0.0013426	
	2.21923	8.80000	42.35000	-16.083	41.962	-94.801	-204.56	-0.0012266	
	3.23846	8.80000	42.35000	-17.084	41.962	-94.865	-207.65	-0.0011820	
	4.25769	8.80000	42.35000	-17.793	41.962	-94.881	-209.11	-0.0011603	
	5.27692	8.80000	42.35000	-18.317	41.962	-94.886	-209.92	-0.0011481	
	6.29615	8.80000	42.35000	-18.714	41.962	-94.889	-210.42	-0.0011406	
	7.31538	8.80000	42.35000	-19.017	41.962	-94.890	-210.74	-0.0011357	
	8.33462	8.80000	42.35000	-19.248	41.962	-94.890	-210.96	-0.0011324	
	9.35385	8.80000	42.35000	-19.422	41.962	-94.891	-211.11	-0.0011301	
	10.37308	8.80000	42.35000	-19.547	41.962	-94.891	-211.21	-0.0011286	
	11.39231	8.80000	42.35000	-19.631	41.962	-94.891	-211.27	-0.0011276	
	12.41154	8.80000	42.35000	-19.678	41.962	-94.891	-211.31	-0.0011271	
	13.43077	8.80000	42.35000	-19.689	41.962	-94.891	-211.31	-0.0011270	
	14.45000	8.80000	42.35000	-19.666	41.962	-94.891	-211.30	-0.0011272	
	15.46923	8.80000	42.35000	-19.606	41.962	-94.891	-211.25	-0.0011279	
	16.48846	8.80000	42.35000	-19.508	41.962	-94.891	-211.18	-0.0011290	
	17.50769	8.80000	42.35000	-19.366	41.962	-94.891	-211.06	-0.0011308	
	18.52692	8.80000	42.35000	-19.173	41.962	-94.890	-210.89	-0.0011334	
	19.54615	8.80000	42.35000	-18.919	41.962	-94.890	-210.64	-0.0011372	
	20.56538	8.80000	42.35000	-18.585	41.962	-94.888	-210.27	-0.0011429	
	21.58462	8.80000	42.35000	-18.148	41.962	-94.885	-209.68	-0.0011517	
	22.60385	8.80000	42.35000	-17.566	41.962	-94.877	-208.70	-0.0011665	
	23.62308	8.80000	42.35000	-16.770	41.962	-94.852	-206.84	-0.0011939	
	24.64231	8.80000	42.35000	-15.621	41.962	-94.734	-202.53	-0.0012546	
	25.66154	8.80000	42.35000	-13.785	41.962	-93.343	-187.76	-0.0014251	
	26.68077	8.80000	42.35000	-9.1879	41.962	-22.694	-74.594	100.05E-6	
	27.70000	8.80000	42.35000	-6.1832	41.962	-0.57885	-16.372	224.83E-6	
	1.20000	9.90000	42.35000	-13.200	41.962	-93.711	-186.13	-0.0014595	
	2.21923	9.90000	42.35000	-14.526	41.962	-94.153	-193.94	-0.0013598	
	3.23846	9.90000	42.35000	-15.402	41.962	-94.207	-196.56	-0.0013221	
	4.25769	9.90000	42.35000	-16.031	41.962	-94.221	-197.81	-0.0013036	
	5.27692	9.90000	42.35000	-16.502	41.962	-94.226	-198.51	-0.0012930	
	6.29615	9.90000	42.35000	-16.863	41.962	-94.228	-198.94	-0.0012864	
	7.31538	9.90000	42.35000	-17.141	41.962	-94.229	-199.23	-0.0012821	
	8.33462	9.90000	42.35000	-17.355	41.962	-94.229	-199.43	-0.0012791	
	9.35385	9.90000	42.35000	-17.516	41.962	-94.229	-199.56	-0.0012770	
	10.37308	9.90000	42.35000	-17.634	41.962	-94.230	-199.65	-0.0012756	
	11.39231	9.90000	42.35000	-17.712	41.962	-94.230	-199.71	-0.0012748	
	12.41154	9.90000	42.35000	-17.756	41.962	-94.230	-199.74	-0.0012743	
	13.43077	9.90000	42.35000	-17.766	41.962	-94.230	-199.75	-0.0012742	
	14.45000	9.90000	42.35000	-17.744	41.962	-94.230	-199.73	-0.0012744	
	15.46923	9.90000	42.35000	-17.688	41.962	-94.230	-199.69	-0.0012750	
	16.48846	9.90000	42.35000	-17.597	41.962	-94.230	-199.62	-0.0012761	
	17.50769	9.90000	42.35000	-17.464	41.962	-94.229	-199.52	-0.0012777	
	18.52692	9.90000	42.35000	-17.286	41.962	-94.229	-199.36	-0.0012800	
	19.54615	9.90000	42.35000	-17.051	41.962	-94.228	-199.14	-0.0012834	
	20.56538	9.90000	42.35000	-16.746	41.962	-94.227	-198.81	-0.0012885	
	21.58462	9.90000	42.35000	-16.350	41.962	-94.224	-198.30	-0.0012962	
	22.60385	9.90000	42.35000	-15.829	41.962	-94.218	-197.45	-0.0013089	
	23.62308	9.90000	42.35000	-15.126	41.962	-94.197	-195.87	-0.0013322	
	24.64231	9.90000	42.35000	-14.125	41.962	-94.095	-192.22	-0.0013836	
	25.66154	9.90000	42.35000	-12.529	41.962	-92.786	-178.64	-0.0015319	
	26.68077	9.90000	42.35000	-8.2709	41.962	-22.425	-69.498	34.169E-6	
	27.70000	9.90000	42.35000	-5.5770	41.962	-0.51954	-14.200	194.20E-6	
	1.20000	11.00000	42.35000	-9.6214	41.962	-47.197	-101.19	-620.72E-6	
	2.21923	11.00000	42.35000	-10.636	41.962	-47.447	-106.19	-555.45E-6	
	3.23846	11.00000	42.35000	-11.350	41.962	-47.482	-108.07	-528.07E-6	
	4.25769	11.00000	42.35000	-11.883	41.962	-47.492	-109.04	-513.71E-6	
	5.27692	11.00000	42.35000	-12.292	41.962	-47.495	-109.60	-505.14E-6	
	6.29615	11.00000	42.35000	-12.611	41.962	-47.497	-109.97	-499.60E-6	
	7.31538	11.00000	42.35000	-12.860	41.962	-47.498	-110.22	-495.86E-6	
	8.33462	11.00000	42.35000	-13.053	41.962	-47.498	-110.39	-493.26E-6	
	9.35385	11.00000	42.35000	-13.200	41.962	-47.498	-110.50	-491.45E-6	
	10.37308	11.00000	42.35000	-13.307	41.962	-47.499	-110.59	-490.20E-6	
	11.39231	11.00000	42.35000	-13.380	41.962	-47.499	-110.64	-489.40E-6	
	12.41154	11.00000	42.35000	-13.420	41.962	-47.499	-110.67	-488.97E-6	
	13.43077	11.00000	42.35000	-13.430	41.962	-47.499	-110.67	-488.87E-6	
	14.45000	11.00000	42.35000	-13.409	41.962	-47.499	-110.66	-489.08E-6	
	15.46923	11.00000	42.35000	-13.358	41.962	-47.499	-110.62	-489.64E-6	
	16.48846	11.00000	42.35000	-13.273	41.962	-47.499	-110.56	-490.59E-6	
	17.50769	11.00000	42.35000	-13.153	41.962	-47.498	-110.47	-492.02E-6	
	18.52692	11.00000	42.35000	-12.990	41.962	-47.498	-110.33	-494.08E-6	
	19.54615	11.00000	42.35000	-12.778	41.962	-47.498	-110.14	-497.03E-6	
	20.56538	11.00000	42.35000	-12.506	41.962	-47.496	-109.86	-501.32E-6	
	21.58462	11.00000	42.35000	-12.158	41.962	-47.494	-109.43	-507.74E-6	
	22.60385	11.00000	42.35000	-11.710	41.962	-47.490	-108.75	-517.92E-6	
	23.62308	11.00000	42.35000	-11.122	41.962	-47.475	-107.56	-535.63E-6	
	24.64231	11.00000	42.35000	-10.321	41.962	-47.412	-105.02	-571.75E-6	
	25.66154	11.00000	42.35000	-9.1400	41.962	-46.709	-96.829	-665.14E-6	
	26.68077	11.00000	42.35000	-6.5565	41.962	-11.371	-39.808	87.475E-6	
	27.70000	11.00000	42.35000	-4.7732	41.962	-0.30205	-10.042	140.35E-6	
GL1	0.00000	0.00000	45.10000	-7.2270	44.800	0.0	0.0	0.0	
	0.00000	1.00000	45.10000	-9.3201	44.800	0.0	0.0	0.0	
	0.00000	2.00000	45.10000	-10.282	44.800	0.0	0.0	0.0	
	0.00000	3.00000	45.10000	-10.874	44.800	0.0	0.0	0.0	
	0.00000	4.00000	45.10000	-11.226	44.800	0.0	0.0	0.0	
	0.00000	5.00000	45.10000	-11.392	44.800	0.0	0.0	0.0	
	0.00000	6.00000	45.10000	-11.392	44.800	0.0	0.0	0.0	
	0.00000	7.00000	45.10000	-11.226	44.800	0.0	0.0	0.0	
	0.00000	8.00000	45.10000	-10.874	44.800	0.0	0.0	0.0	
GL2	-4.50000	0.00000	45.10000	-2.3678	44.800	0.0	0.0	0.0	
	-4.50000	1.00000	45.10000	-2.5651	44.800	0.0	0.0	0.0	
	-4.50000	2.00000	45.10000	-2.7363	44.800	0.0	0.0	0.0	
	-4.50000	3.00000	45.10000	-2.8718	44.800	0.0	0.0	0.0	
	-4.50000	4.00000	45.10000	-2.9651	44.800	0.0	0.0	0.0	
	-4.50000	5.00000	45.10000	-3.0125	44.800	0.0	0.0	0.0	
	-4.50000	6.00000	45.10000	-3.0125	44.800	0.0	0.0	0.0	
	-4.50000	7.00000	45.10000	-2.9651	44.800	0.0	0.0	0.0	
	-4.50000	8.00000	45.10000	-2.8718	44.800	0.0	0.0	0.0	
GL3	-9.00000	0.00000	45.10000	-1.0628	44.800	0.0	0.0	0.0	
	-9.00000	1.00000	45.10000	-1.1211	44.800	0.0	0.0	0.0	
	-9.00000	2.00000	45.10000	-1.1706	44.800	0.0	0.0	0.0	
	-9.00000	3.00000	45.10000	-1.2097	44.800	0.0	0.0	0.0	
	-9.00000	4.00000	45.10000	-1.2366	44.800	0.0	0.0	0.0	
	-9.00000	5.00000	45.10000	-1.2503	44.800	0.0	0.0	0.0	
	-9.00000	6.00000	45.10000	-1.2503	44.800	0.0	0.0	0.0	

Name	Location		Displacement		Stresses			
	X [m]	Y [m]	Z[Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
	-9.00000	7.00000	45.10000	-1.2366	44.800	0.0	0.0	0.0
	-9.00000	8.00000	45.10000	-1.2097	44.800	0.0	0.0	0.0
GL4	0.00000	4.00000	45.10000	-11.226	44.800	0.0	0.0	0.0
	-1.00000	4.00000	45.10000	-7.2059	44.800	0.0	0.0	0.0
	-2.00000	4.00000	45.10000	-5.3657	44.800	0.0	0.0	0.0
	-3.00000	4.00000	45.10000	-4.1612	44.800	0.0	0.0	0.0
	-4.00000	4.00000	45.10000	-3.3056	44.800	0.0	0.0	0.0
	-5.00000	4.00000	45.10000	-2.6687	44.800	0.0	0.0	0.0
	-6.00000	4.00000	45.10000	-2.1794	44.800	0.0	0.0	0.0
	-7.00000	4.00000	45.10000	-1.7947	44.800	0.0	0.0	0.0
	-8.00000	4.00000	45.10000	-1.4867	44.800	0.0	0.0	0.0
	-9.00000	4.00000	45.10000	-1.2366	44.800	0.0	0.0	0.0
GL5	13.00000	-6.00000	45.10000	-3.3601	44.800	0.0	0.0	0.0
	13.00000	-7.00000	45.10000	-2.8334	44.800	0.0	0.0	0.0
	13.00000	-8.00000	45.10000	-2.3993	44.800	0.0	0.0	0.0
	13.00000	-9.00000	45.10000	-2.0376	44.800	0.0	0.0	0.0
	13.00000	-10.00000	45.10000	-1.7339	44.800	0.0	0.0	0.0
	13.00000	-11.00000	45.10000	-1.4771	44.800	0.0	0.0	0.0
	13.00000	-12.00000	45.10000	-1.2587	44.800	0.0	0.0	0.0
GL6	26.00000	-6.00000	45.10000	-2.0940	44.800	0.0	0.0	0.0
	26.00000	-7.00000	45.10000	-1.7835	44.800	0.0	0.0	0.0
	26.00000	-8.00000	45.10000	-1.5245	44.800	0.0	0.0	0.0
	26.00000	-9.00000	45.10000	-1.3059	44.800	0.0	0.0	0.0
	26.00000	-10.00000	45.10000	-1.1198	44.800	0.0	0.0	0.0
	26.00000	-11.00000	45.10000	-0.96014	44.800	0.0	0.0	0.0
	26.00000	-12.00000	45.10000	-0.82251	44.800	0.0	0.0	0.0

Oasys

CAMPBELLREITH - LONDON

Job No.	Sheet No.	Rev.
12047		

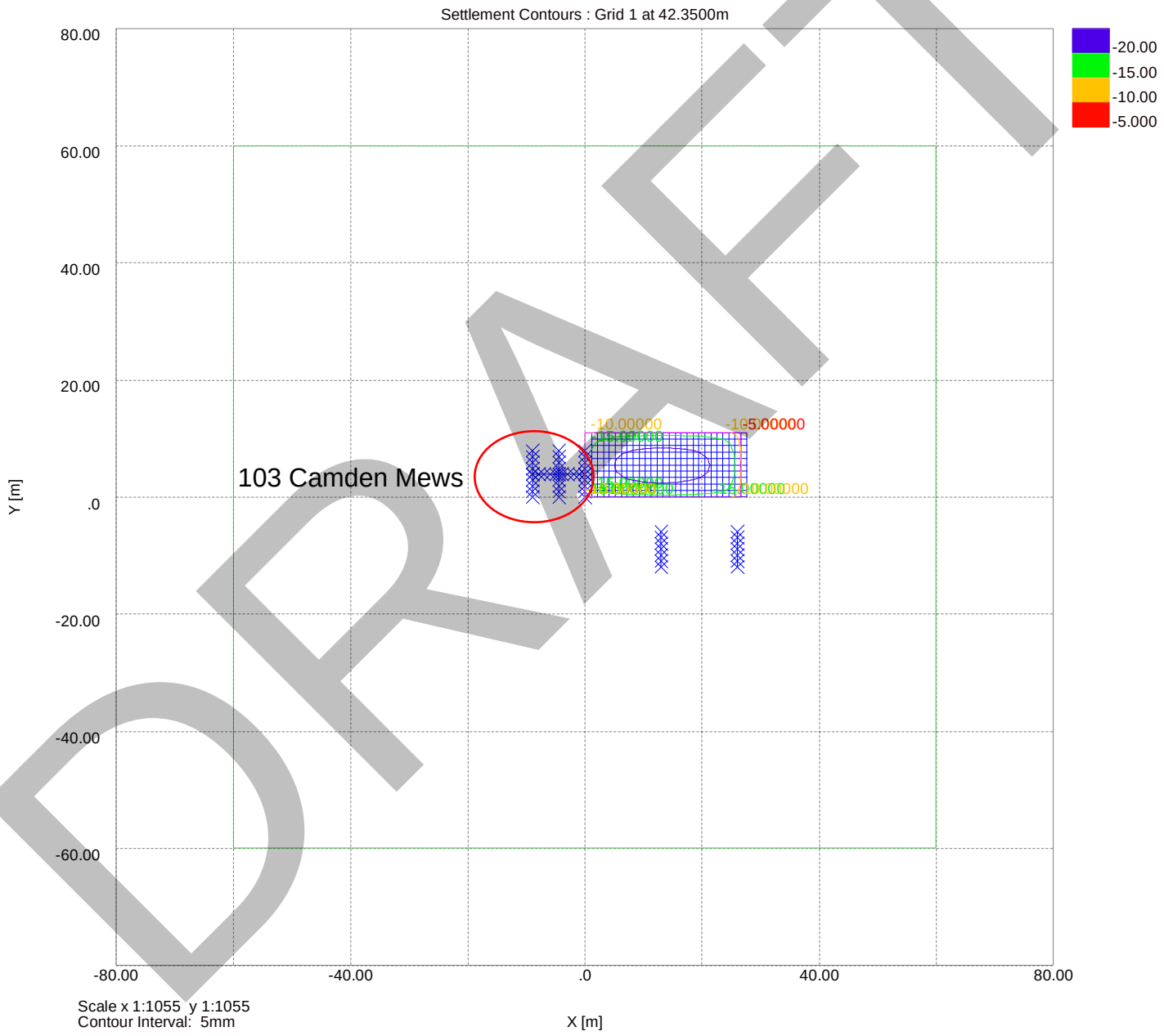
Drg. Ref.

Made by	Date	Checked
FD	11/09/17	EMB

Ashton Court

Demolition & Basement excavation

Immediate heave



Geosolve
WALLAP

Campbell Reith | Sheet No.
Program: WALLAP Version 6.06 Revision A51.B69.R54 | Job No. 12047
Licensed from GEOSOLVE | Made by : FD
Data filename/Run ID: 12047ULSDA1 C1 |
Ashton Court | Date:13-09-2017
Wall depth determination - ULS DA1 C1 | Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Right side
1	45.60	1 Made Ground	1 Made Ground
2	43.90	2 London Clay	2 London Clay

SOIL PROPERTIES (Unfactored SLS soil strengths)

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	Made Ground	18.00	5000	0.530	NC (0.490)	0.298 (1.319)	4.393 (6.381)	0.0d
2	London Clay (43.90)	20.00	60270 (5166)	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	70.00u (6.000)
3	London Cl.. (43.90)	20.00	46407 (3977)	1.000	OC (0.200)	0.422 (1.589)	2.699 (4.668)	1.500d

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	Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2	London Clay	0.00	0.500	0.00	0.00	0.500	0.00
3	London Clay drained	20.00	1.000	0.00	20.00	1.000	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	40.15	40.15

Automatic water pressure balancing at toe of wall : Yes

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = 40.50
Maximum finite element length = 0.30 m
Youngs modulus of wall E = 1.9600E+07 kN/m2
Moment of inertia of wall I = 3.3500E-03 m4/m run
E.I = 65660 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/ anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /strut kN	Tension allowed
1	45.10	5.00	0.020000	2.000E+08	5.50	0.00	0	No
2	45.50	1.00	0.300000	2.000E+07	5.50	0.00	0	No
3	42.35	1.00	0.300000	2.000E+07	5.50	0.00	0	No

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Excavate to elevation 45.10 on RIGHT side
2	Install strut or anchor no.1 at elevation 45.10
3	Excavate to elevation 41.85 on RIGHT side
4	Fill to elevation 42.35 on RIGHT side with soil type 2
5	Install strut or anchor no.3 at elevation 42.35
6	Install strut or anchor no.2 at elevation 45.50
7	Remove strut or anchor no.1 at elevation 45.10
8	Change EI of wall to 46900 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
9	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)
Water pressures : Worst Credible
Partial factor on C' = 1.000
Partial factor on Phi' = 1.000
Partial factor on Cu = 1.000
Partial factor on Soil Modulus = 1.000
Partial factor on Permanent Unfavourable loads = 1.350
Partial factor on Permanent Favourable loads = 1.000
Partial factor on Variable Unfavourable loads = 1.500

Stability analysis:
Method of analysis - Strength Factor method
Overall factor on soil strength for calculating wall depth = 1.00

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

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 9.00 m

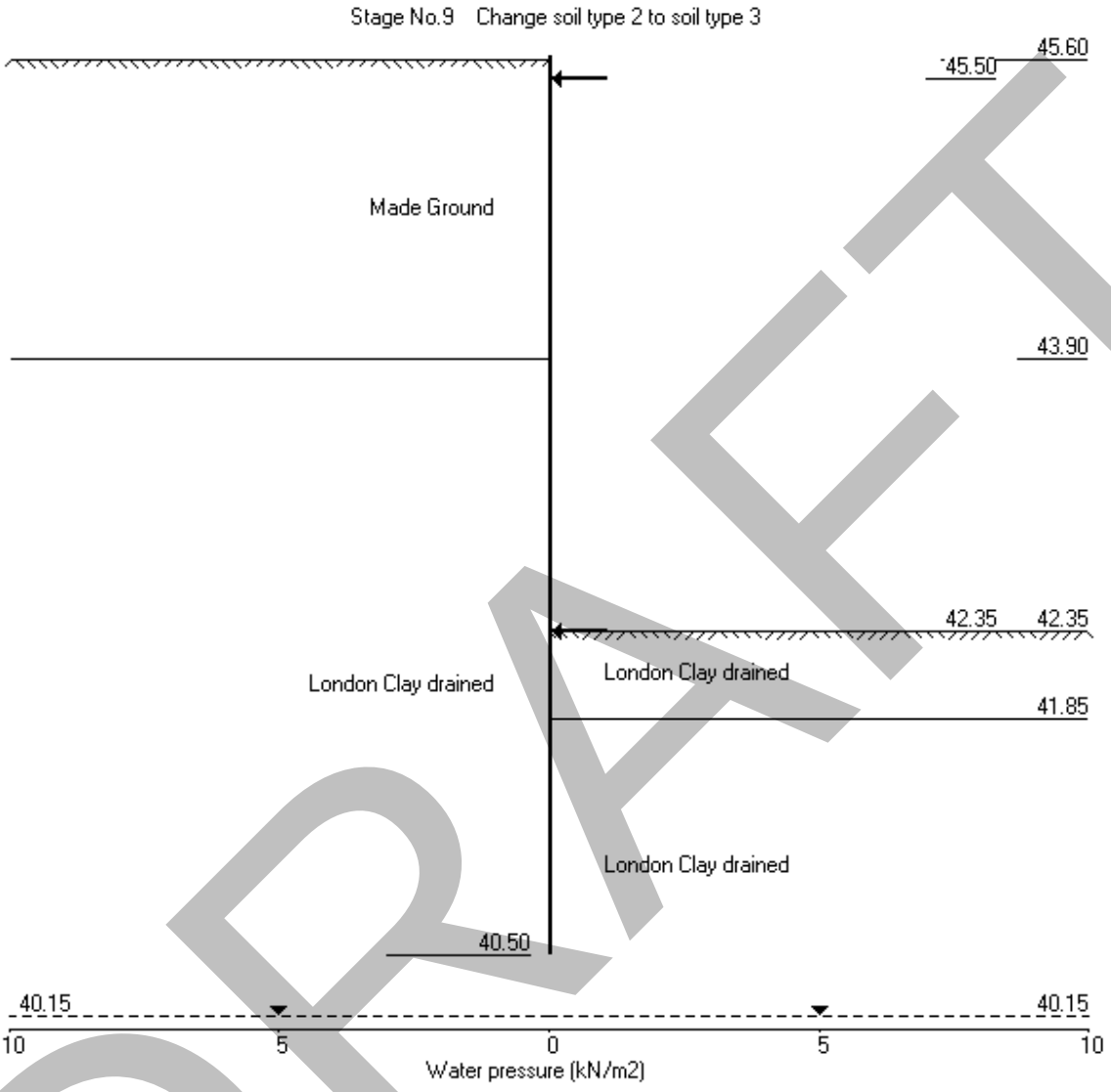
Width of excavation on Left side of wall = 30.00 m
Width of excavation on Right side of wall = 30.00 m

Distance to rigid boundary on Left side = 50.00 m
Distance to rigid boundary on Right side = 50.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Excav. to elev. 45.10 on RIGHT side	No	No	No
2	Install strut no.1 at elev. 45.10	Yes	Yes	Yes
3	Excav. to elev. 41.85 on RIGHT side	Yes	Yes	Yes
4	Fill to elev. 42.35 on RIGHT side	Yes	Yes	Yes
5	Install strut no.3 at elev. 42.35	No	No	No
6	Install strut no.2 at elev. 45.50	No	No	No
7	Remove strut no.1 at elev. 45.10	Yes	Yes	Yes
8	Change EI of wall to 46900kN.m2/m run	Yes	Yes	Yes
9	Change soil type 2 to soil type 3	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

Units: kN,m



Units: kN,m

Stage No. 1 Excavate to elevation 45.10 on RIGHT side

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50: Factor of Safety	Moment equilib. at elev.	Toe FoS = 1.000: Toe elev.	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	19.594	41.09	44.76	0.34	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

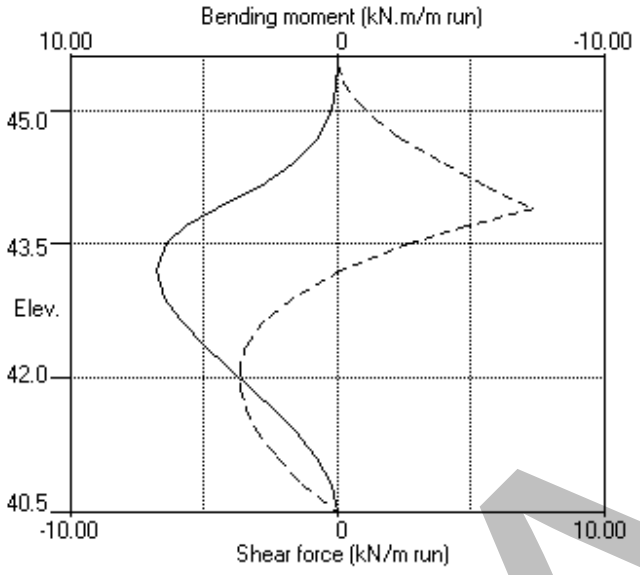
Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	2.79E-04	0.0	-0.0		65660
2	45.50	0.54	0.001	2.79E-04	0.0	0.0		65660
3	45.30	1.61	0.001	2.79E-04	0.2	0.0		65660
4	45.10	3.27	0.001	2.78E-04	0.7	0.1		65660
5	44.90	3.76	0.001	2.78E-04	1.4	0.3		65660
6	44.70	5.15	0.001	2.76E-04	2.3	0.7		65660
7	44.40	6.28	0.001	2.71E-04	4.0	1.7		65660
8	44.15	6.54	0.001	2.62E-04	5.6	2.9		65660
9	43.90	6.80	0.000	2.48E-04	7.3	4.5		65660
		-13.62	0.000	2.48E-04	7.3	4.5		
10	43.70	-11.63	0.000	2.33E-04	4.8	5.7		65660
11	43.50	-9.74	0.000	2.14E-04	2.6	6.4		65660
12	43.20	-7.13	0.000	1.84E-04	0.1	6.8		65660
13	42.90	-4.86	0.000	1.54E-04	-1.7	6.5		65660
14	42.63	-3.07	0.000	1.28E-04	-2.8	5.8		65660
15	42.35	-1.56	0.000	1.06E-04	-3.4	4.9		65660
16	42.10	-0.40	0.000	8.89E-05	-3.7	4.0		65660
17	41.85	0.59	0.000	7.53E-05	-3.6	3.1		65660
18	41.63	1.37	0.000	6.60E-05	-3.4	2.3		65660
19	41.40	2.07	0.000	5.93E-05	-3.0	1.6		65660
20	41.10	2.94	0.000	5.40E-05	-2.3	0.8		65660
21	40.80	3.79	0.000	5.18E-05	-1.3	0.2		65660
22	40.50	4.65	0.000	5.13E-05	-0.0	-0.0		---

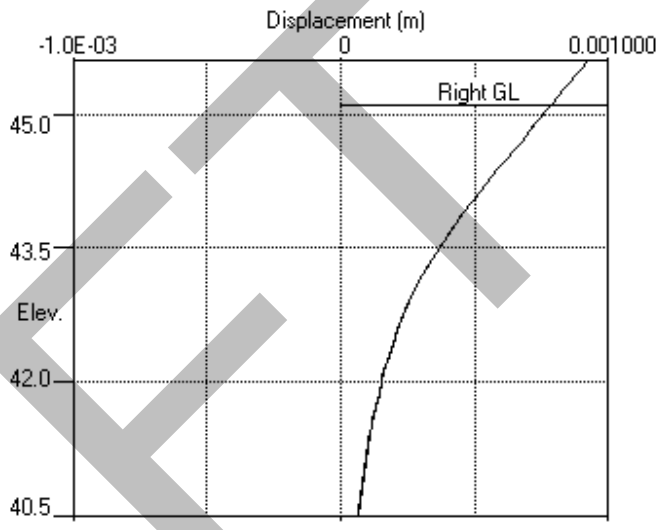
(continued)

Stage No.1 Excavate to elevation 45.10 on RIGHT side

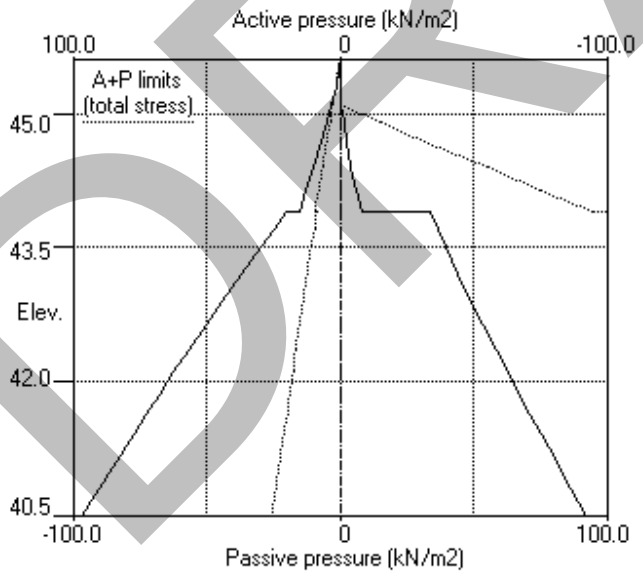
Units: kN,m

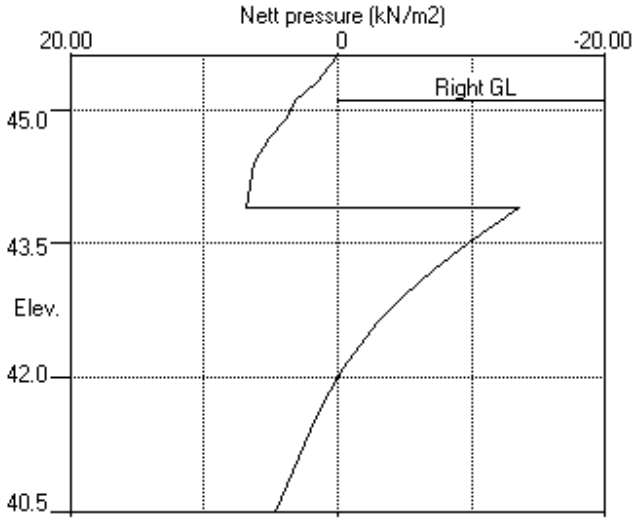
Stage No.1 Excav. to elev. 45.10 on RIGHT side





Stage No.1 Excav. to elev. 45.10 on RIGHT side





Units: kN,m

Stage No. 3 Excavate to elevation 41.85 on RIGHT side

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50: Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000	Wall Penetr -ation	Direction of failure
3	45.60	41.85	45.10	4.648	n/a	41.73	0.12	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.34E-04	0.0	-0.0		65660
2	45.50	3.24	0.001	-7.34E-04	0.2	0.0		65660
3	45.30	2.06	0.001	-7.35E-04	0.7	0.1		65660
4	45.10	3.08	0.001	-7.35E-04	1.2	0.3	23.6	65660
		3.08	0.001	-7.35E-04	-22.4	0.3		
5	44.90	4.87	0.001	-7.29E-04	-21.6	-4.1		65660
6	44.70	6.65	0.001	-7.11E-04	-20.4	-8.3		65660
7	44.40	9.34	0.001	-6.60E-04	-18.0	-14.1		65660
8	44.15	11.60	0.002	-5.98E-04	-15.4	-18.2		65660
9	43.90	13.88	0.002	-5.22E-04	-12.2	-21.7		65660
		8.50	0.002	-5.22E-04	-12.2	-21.7		
10	43.70	9.50	0.002	-4.52E-04	-10.4	-24.0		65660
11	43.50	10.50	0.002	-3.77E-04	-8.4	-25.9		65660
12	43.20	12.19	0.002	-2.55E-04	-5.0	-27.6		65660
13	42.90	17.06	0.002	-1.27E-04	-0.6	-28.4		65660
14	42.63	21.95	0.002	-9.11E-06	4.8	-27.9		65660
15	42.35	27.27	0.002	1.03E-04	11.5	-25.7		65660
16	42.10	32.47	0.002	1.93E-04	19.0	-21.9		65660
17	41.85	38.00	0.002	2.66E-04	27.8	-16.1		65660
		-27.64	0.002	2.66E-04	27.8	-16.1		
18	41.63	-25.89	0.002	3.11E-04	21.8	-10.6		65660
19	41.40	-23.64	0.002	3.40E-04	16.2	-6.3		65660
20	41.10	-20.10	0.002	3.61E-04	9.6	-2.5		65660
21	40.80	-16.14	0.002	3.68E-04	4.2	-0.5		65660
22	40.50	-11.90	0.002	3.69E-04	0.0	-0.0		---

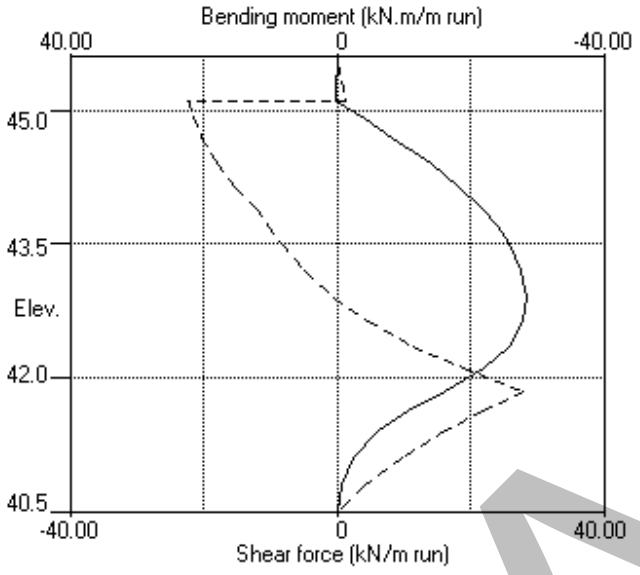
At elev. 45.10 Strut force = 117.8 kN/strut = 23.6 kN/m run

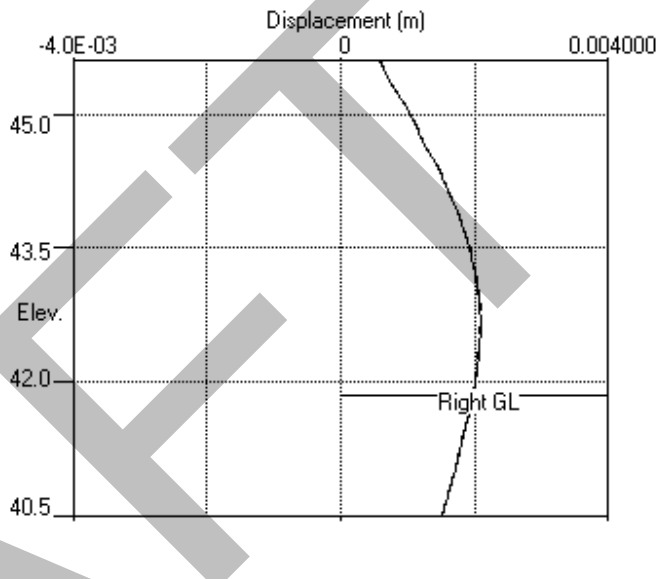
(continued)

Stage No.3 Excavate to elevation 41.85 on RIGHT side

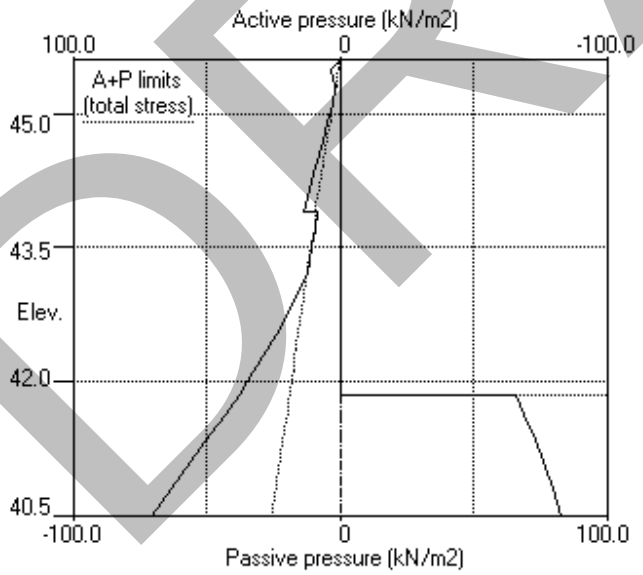
Units: kN,m

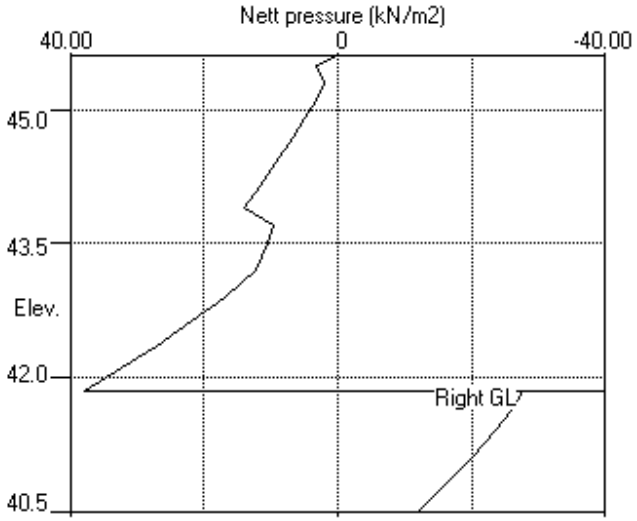
Stage No.3 Excav. to elev. 41.85 on RIGHT side





Stage No.3 Excav. to elev. 41.85 on RIGHT side





Units: kN,m

Stage No. 4 Fill to elevation 42.35 on RIGHT side with soil type 2

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
4	45.60	42.35	45.10	5.707	n/a	42.26	0.09	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.14E-04	0.0	-0.0		65660
2	45.50	3.16	0.001	-7.14E-04	0.2	0.0		65660
3	45.30	2.01	0.001	-7.14E-04	0.7	0.1		65660
4	45.10	3.05	0.001	-7.14E-04	1.2	0.3	24.2	65660
		3.05	0.001	-7.14E-04	-23.1	0.3		
5	44.90	4.86	0.001	-7.09E-04	-22.3	-4.2		65660
6	44.70	6.66	0.001	-6.89E-04	-21.1	-8.6		65660
7	44.40	9.36	0.001	-6.36E-04	-18.7	-14.6		65660
8	44.15	11.63	0.002	-5.72E-04	-16.1	-18.9		65660
9	43.90	13.92	0.002	-4.93E-04	-12.9	-22.6		65660
		9.03	0.002	-4.93E-04	-12.9	-22.6		
10	43.70	10.18	0.002	-4.21E-04	-11.0	-25.0		65660
11	43.50	11.35	0.002	-3.42E-04	-8.8	-27.0		65660
12	43.20	13.33	0.002	-2.15E-04	-5.1	-28.7		65660
13	42.90	18.55	0.002	-8.19E-05	-0.3	-29.6		65660
14	42.63	23.80	0.002	4.06E-05	5.5	-28.9		65660
15	42.35	29.53	0.002	1.56E-04	12.8	-26.5		65660
16	42.10	33.00	0.002	2.49E-04	20.6	-22.3		65660
17	41.85	34.58	0.002	3.22E-04	29.1	-16.2		65660
		-31.05	0.002	3.22E-04	29.1	-16.2		
18	41.63	-28.51	0.002	3.68E-04	22.4	-10.4		65660
19	41.40	-25.45	0.002	3.96E-04	16.3	-6.1		65660
20	41.10	-20.80	0.002	4.15E-04	9.4	-2.3		65660
21	40.80	-15.71	0.001	4.22E-04	3.9	-0.5		65660
22	40.50	-10.29	0.001	4.23E-04	0.0	-0.0		---

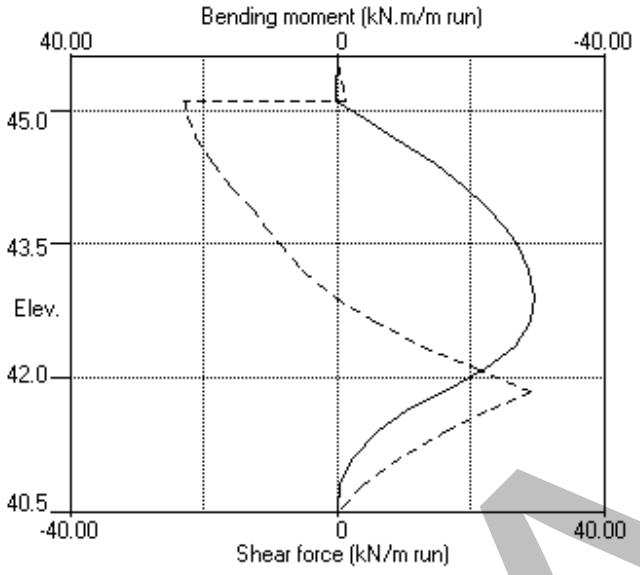
At elev. 45.10 Strut force = 121.2 kN/strut = 24.2 kN/m run

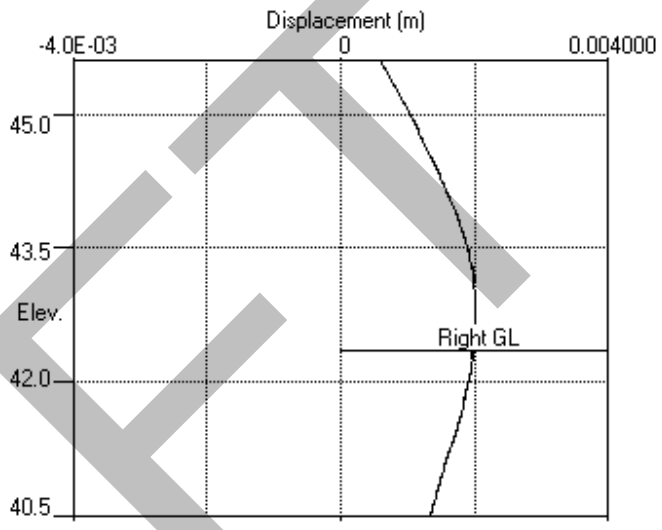
(continued)

Stage No.4 Fill to elevation 42.35 on RIGHT side with soil type 2

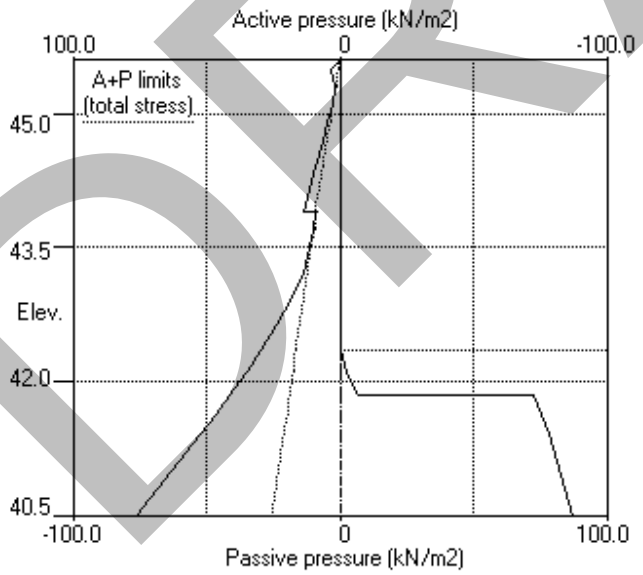
Units: kN,m

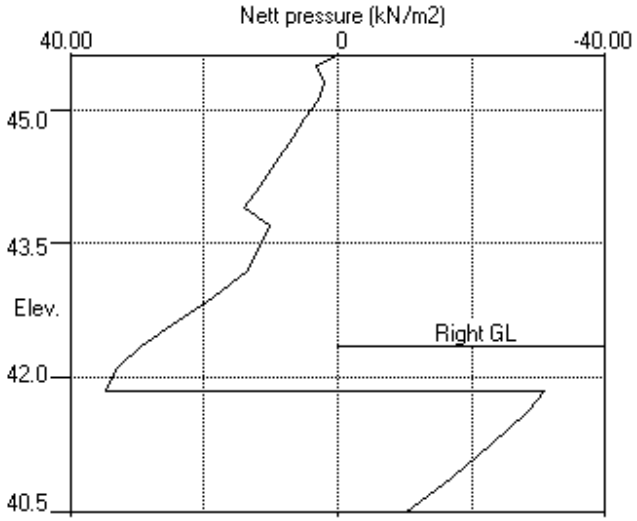
Stage No.4 Fill to elev. 42.35 on RIGHT side





Stage No.4 Fill to elev. 42.35 on RIGHT side





Units: kN,m

Stage No. 7 Remove strut or anchor no.1 at elevation 45.10

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
7	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.10E-04	0.0	-0.0		65660
2	45.50	3.13	0.001	-8.10E-04	0.2	0.0	20.0	65660
		3.13	0.001	-8.10E-04	-19.9	0.0		
3	45.30	1.95	0.001	-8.04E-04	-19.4	-3.9		65660
4	45.10	2.97	0.001	-7.86E-04	-18.9	-7.7		65660
5	44.90	4.76	0.001	-7.57E-04	-18.1	-11.4		65660
6	44.70	6.54	0.001	-7.17E-04	-17.0	-14.9		65660
7	44.40	9.24	0.002	-6.38E-04	-14.6	-19.7		65660
8	44.15	11.51	0.002	-5.57E-04	-12.0	-23.0		65660
9	43.90	13.81	0.002	-4.64E-04	-8.8	-25.6		65660
		8.50	0.002	-4.64E-04	-8.8	-25.6		
10	43.70	9.50	0.002	-3.84E-04	-7.0	-27.2		65660
11	43.50	10.50	0.002	-2.99E-04	-5.0	-28.5		65660
12	43.20	12.46	0.002	-1.67E-04	-1.6	-29.1		65660
13	42.90	17.96	0.002	-3.51E-05	3.0	-29.0		65660
14	42.63	23.47	0.002	8.29E-05	8.7	-27.4		65660
15	42.35	29.43	0.002	1.90E-04	15.9	-24.1	4.9	65660
		28.09	0.002	1.90E-04	11.1	-24.1		
16	42.10	33.21	0.002	2.75E-04	18.7	-20.4		65660
17	41.85	35.20	0.002	3.42E-04	27.3	-14.7		65660
		-30.43	0.002	3.42E-04	27.3	-14.7		
18	41.63	-27.59	0.002	3.83E-04	20.7	-9.4		65660
19	41.40	-24.29	0.002	4.09E-04	14.9	-5.4		65660
20	41.10	-19.36	0.002	4.26E-04	8.4	-2.0		65660
21	40.80	-14.02	0.001	4.31E-04	3.4	-0.4		65660
22	40.50	-8.36	0.001	4.32E-04	0.0	-0.0		---

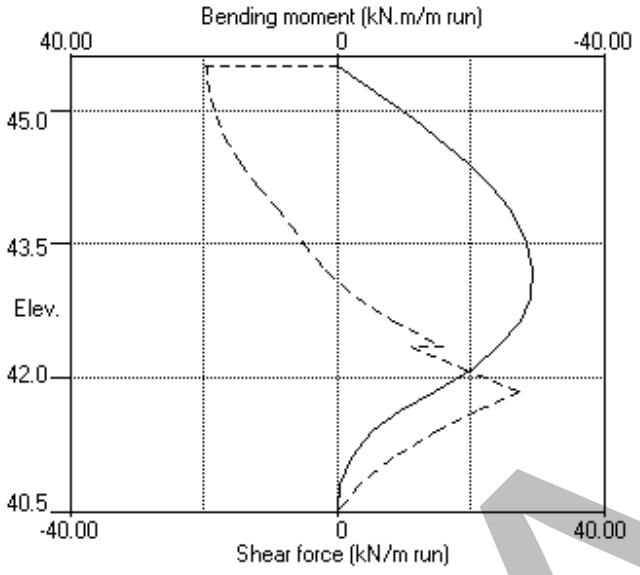
At elev. 45.50 Strut force = 20.0 kN/strut = 20.0 kN/m run
At elev. 42.35 Strut force = 4.9 kN/strut = 4.9 kN/m run

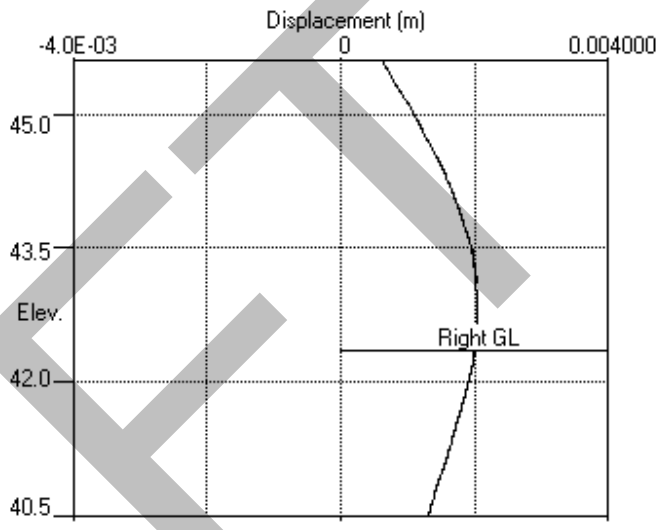
(continued)

Stage No.7 Remove strut or anchor no.1 at elevation 45.10

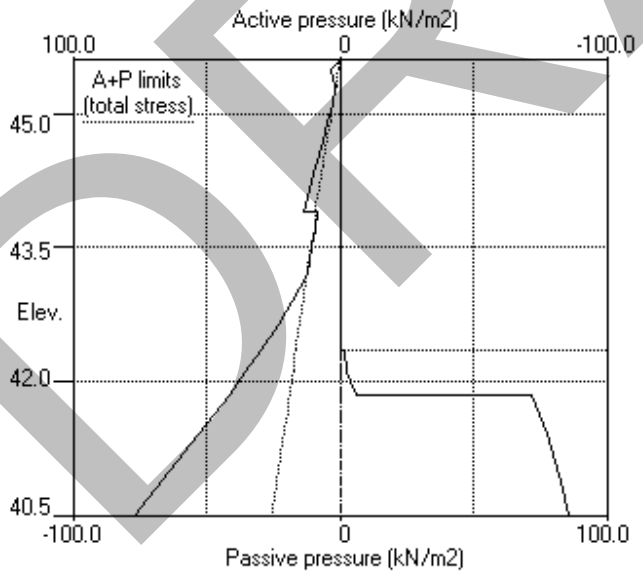
Units: kN,m

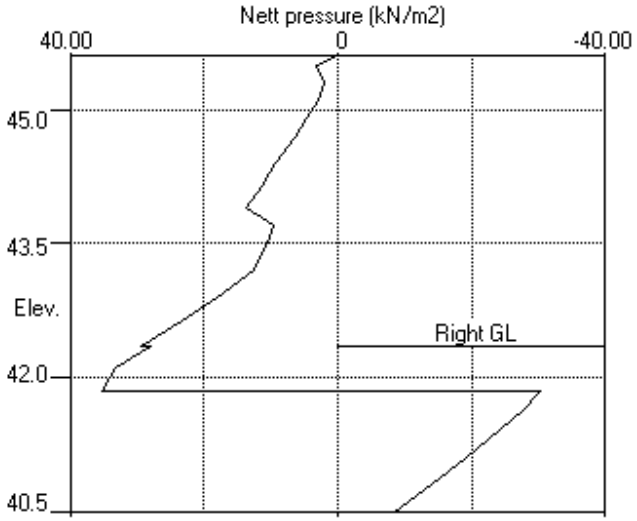
Stage No.7 Remove strut no.1 at elev. 45.10





Stage No.7 Remove strut no.1 at elev. 45.10





Units: kN,m

Stage No. 8 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
8	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.78E-04	0.0	-0.0		46900
2	45.50	3.19	0.001	-8.78E-04	0.2	0.0	17.4	46900
		3.19	0.001	-8.78E-04	-17.2	0.0		
3	45.30	1.93	0.001	-8.71E-04	-16.7	-3.5		46900
4	45.10	2.93	0.001	-8.49E-04	-16.2	-6.9		46900
5	44.90	4.70	0.001	-8.14E-04	-15.5	-10.2		46900
6	44.70	6.46	0.001	-7.66E-04	-14.3	-13.3		46900
7	44.40	9.14	0.002	-6.71E-04	-12.0	-17.4		46900
8	44.15	11.40	0.002	-5.75E-04	-9.4	-20.2		46900
9	43.90	13.69	0.002	-4.66E-04	-6.3	-22.4		46900
		8.50	0.002	-4.66E-04	-6.3	-22.4		
10	43.70	9.50	0.002	-3.72E-04	-4.5	-23.6		46900
11	43.50	10.50	0.002	-2.75E-04	-2.5	-24.4		46900
12	43.20	12.00	0.002	-1.26E-04	0.9	-24.5		46900
13	42.90	17.12	0.002	1.85E-05	5.3	-23.8		46900
14	42.63	22.95	0.002	1.42E-04	10.8	-21.7		46900
15	42.35	29.27	0.002	2.49E-04	17.9	-18.0	12.7	46900
		25.46	0.002	2.49E-04	5.2	-18.0		
16	42.10	33.76	0.002	3.30E-04	12.6	-15.5		46900
17	41.85	36.84	0.002	3.94E-04	21.4	-11.0		46900
		-28.80	0.002	3.94E-04	21.4	-11.0		
18	41.63	-25.00	0.002	4.32E-04	15.4	-6.6		46900
19	41.40	-20.78	0.002	4.53E-04	10.2	-3.5		46900
20	41.10	-14.71	0.002	4.66E-04	4.9	-1.1		46900
21	40.80	-8.26	0.001	4.69E-04	1.5	-0.1		46900
22	40.50	-1.50	0.001	4.69E-04	0.0	-0.0		---

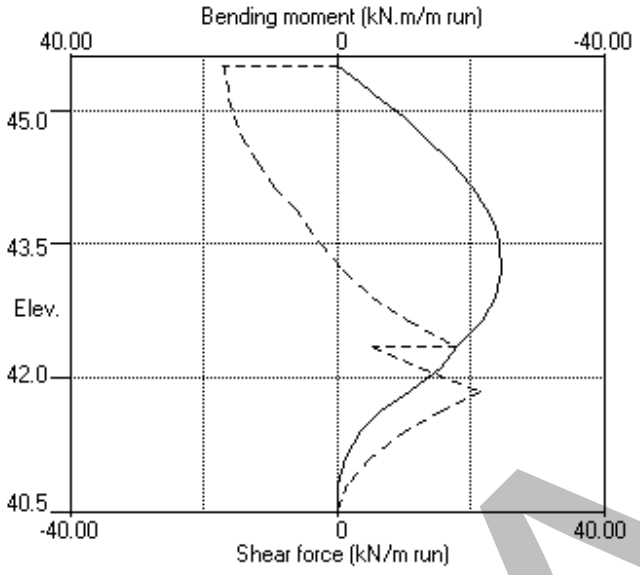
At elev. 45.50 Strut force = 17.4 kN/strut = 17.4 kN/m run
At elev. 42.35 Strut force = 12.7 kN/strut = 12.7 kN/m run

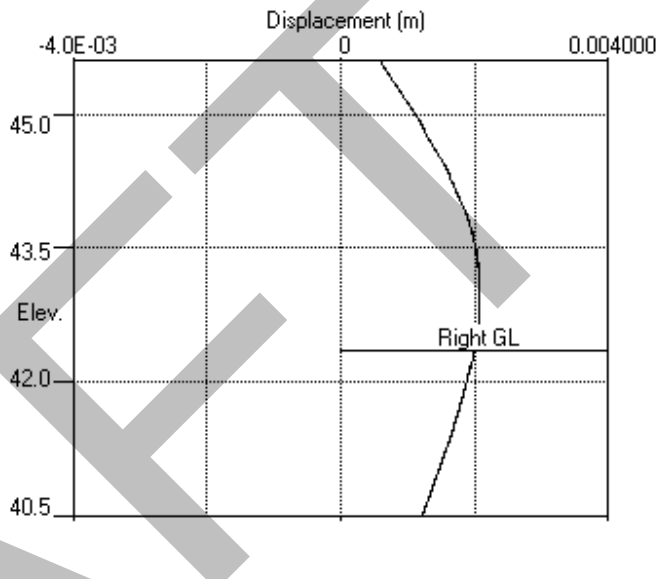
(continued)

Stage No.8 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

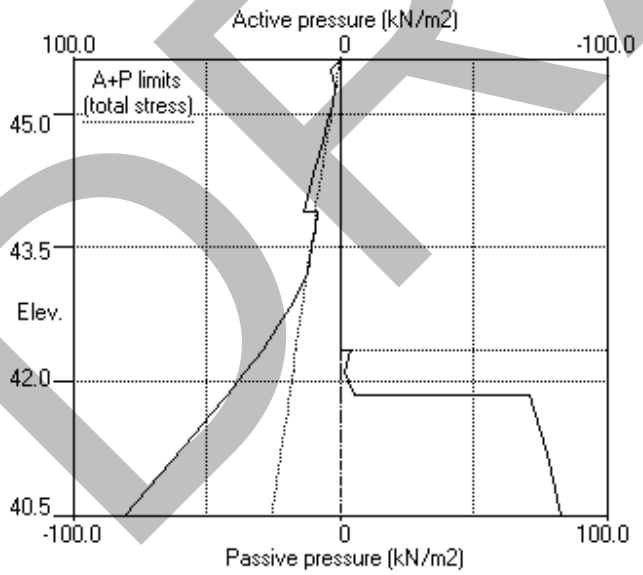
Units: kN,m

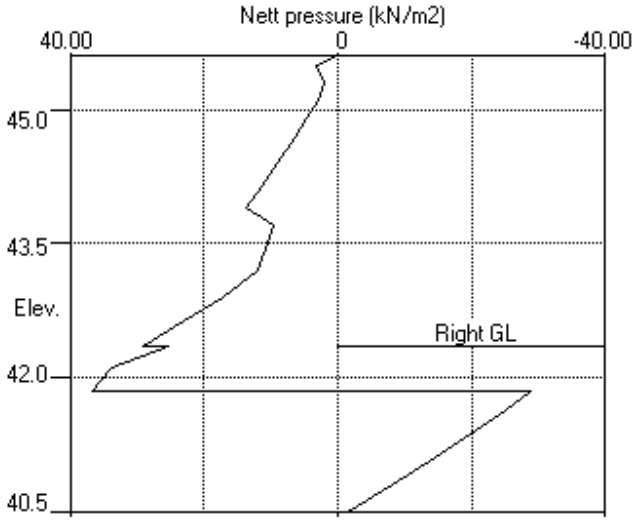
Stage No.8 Change EI of wall to 46900kN.m2/m run





Stage No.8 Change EI of wall to 46900kN.m2/m run





Units: kN,m

Stage No. 9 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
9	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.61E-04	0.0	-0.0		46900
2	45.50	3.19	0.001	-8.61E-04	0.2	0.0	16.9	46900
		3.19	0.001	-8.61E-04	-16.8	0.0		
3	45.30	1.94	0.001	-8.54E-04	-16.2	-3.4		46900
4	45.10	2.94	0.001	-8.33E-04	-15.8	-6.7		46900
5	44.90	4.71	0.001	-7.99E-04	-15.0	-9.9		46900
6	44.70	6.49	0.001	-7.52E-04	-13.9	-12.9		46900
7	44.40	9.17	0.002	-6.60E-04	-11.5	-16.9		46900
8	44.15	11.43	0.002	-5.67E-04	-9.0	-19.6		46900
9	43.90	13.73	0.002	-4.61E-04	-5.8	-21.6		46900
		10.52	0.002	-4.61E-04	-5.8	-21.6		
10	43.70	12.21	0.002	-3.71E-04	-3.5	-22.7		46900
11	43.50	13.90	0.002	-2.78E-04	-0.9	-23.3		46900
12	43.20	16.43	0.002	-1.39E-04	3.6	-22.7		46900
13	42.90	18.96	0.002	-8.52E-06	8.9	-21.0		46900
14	42.63	23.00	0.002	9.64E-05	14.7	-17.9		46900
15	42.35	29.00	0.002	1.77E-04	21.9	-13.1	26.5	46900
		24.91	0.002	1.77E-04	-4.7	-13.1		
16	42.10	32.30	0.002	2.38E-04	2.5	-13.1		46900
17	41.85	34.27	0.002	2.97E-04	10.8	-11.2		46900
		6.95	0.002	2.97E-04	10.8	-11.2		
18	41.63	0.51	0.002	3.39E-04	11.6	-8.4		46900
19	41.40	-5.79	0.002	3.69E-04	11.1	-5.5		46900
20	41.10	-14.00	0.002	3.92E-04	8.1	-2.4		46900
21	40.80	-15.17	0.002	4.00E-04	3.7	-0.5		46900
22	40.50	-9.54	0.001	4.02E-04	0.0	-0.0		---

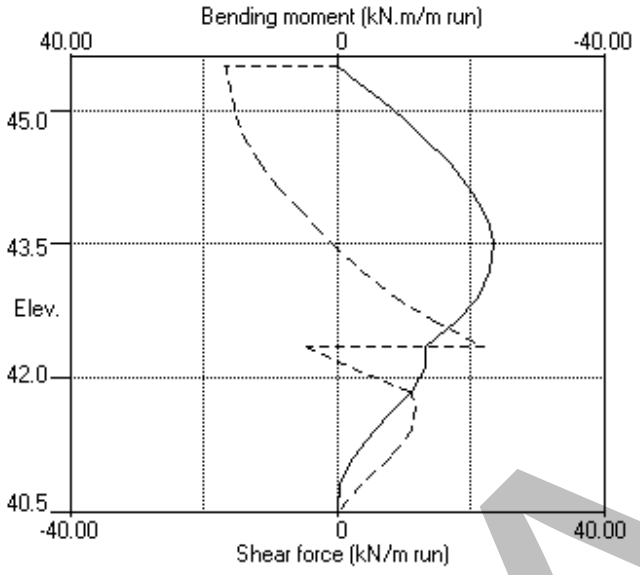
At elev. 45.50 Strut force = 16.9 kN/strut = 16.9 kN/m run
At elev. 42.35 Strut force = 26.5 kN/strut = 26.5 kN/m run

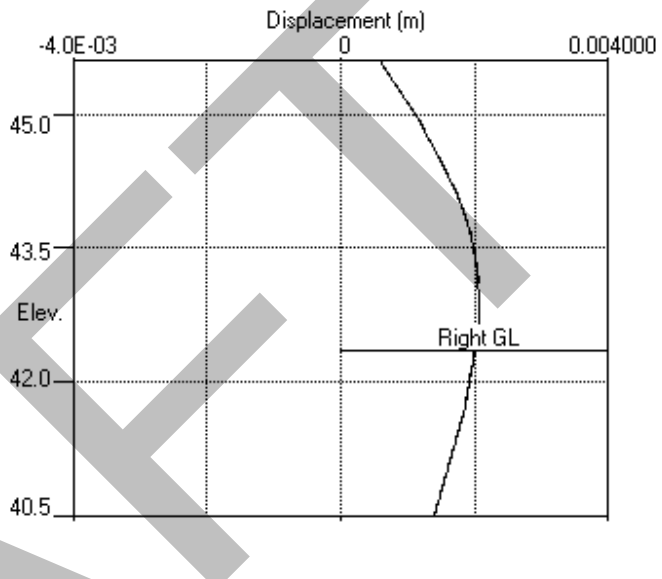
(continued)

Stage No.9 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

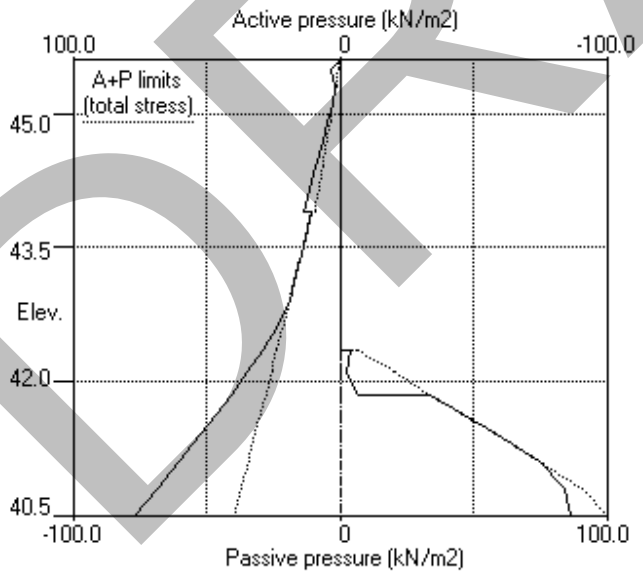
Units: kN,m

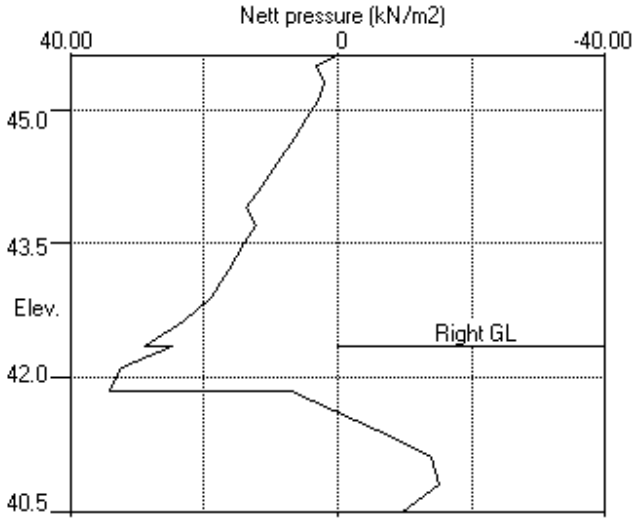
Stage No.9 Change soil type 2 to soil type 3





Stage No.9 Change soil type 2 to soil type 3





Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)
Water pressures : Worst Credible
Partial factor on C' = 1.000
Partial factor on Phi' = 1.000
Partial factor on Cu = 1.000
Partial factor on Soil Modulus = 1.000
Partial factor on Permanent Unfavourable loads = 1.350
Partial factor on Permanent Favourable loads = 1.000
Partial factor on Variable Unfavourable loads = 1.500

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	19.594	41.09	44.76	0.34	L to R
2	45.60	45.10		No analysis at this stage				
3	45.60	41.85	45.10	4.648	n/a	41.73	0.12	L to R
4	45.60	42.35	45.10	5.707	n/a	42.26	0.09	L to R
5	45.60	42.35		No analysis at this stage				

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

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall

Limit State: DA1 Comb. 1 (Alternative) (User Defined Limit State No.1)

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum m	Displacement minimum m	Bending moment maximum kN.m/m	Bending moment minimum kN.m/m	Shear force maximum kN/m	Shear force minimum kN/m
1	45.60	0.001	0.000	0.0	-0.0	0.0	0.0
2	45.50	0.001	0.000	0.0	0.0	0.2	-19.9
3	45.30	0.001	0.000	0.1	-3.9	0.7	-19.4
4	45.10	0.001	0.000	0.3	-7.7	1.2	-23.1
5	44.90	0.001	0.000	0.3	-11.4	1.4	-22.3
6	44.70	0.001	0.000	0.7	-14.9	2.3	-21.1
7	44.40	0.002	0.000	1.7	-19.7	4.0	-18.7
8	44.15	0.002	0.000	2.9	-23.0	5.6	-16.1
9	43.90	0.002	0.000	4.5	-25.6	7.3	-12.9
10	43.70	0.002	0.000	5.7	-27.2	4.8	-11.0
11	43.50	0.002	0.000	6.4	-28.5	2.6	-8.8
12	43.20	0.002	0.000	6.8	-29.1	3.6	-5.1
13	42.90	0.002	0.000	6.5	-29.6	8.9	-1.7
14	42.63	0.002	0.000	5.8	-28.9	14.7	-2.8
15	42.35	0.002	0.000	4.9	-26.5	21.9	-4.7
16	42.10	0.002	0.000	4.0	-22.3	20.6	-3.7
17	41.85	0.002	0.000	3.1	-16.2	29.1	-3.6
18	41.63	0.002	0.000	2.3	-10.6	22.4	-3.4
19	41.40	0.002	0.000	1.6	-6.3	16.3	-3.0
20	41.10	0.002	0.000	0.8	-2.5	9.6	-2.3
21	40.80	0.002	0.000	0.2	-0.5	4.2	-1.3
22	40.50	0.002	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 kN.m/m	Bending moment elev.	Bending moment minimum kN.m/m	Bending moment elev.	Shear force maximum kN/m	Shear force elev.	Shear force minimum kN/m	Shear force elev.
1	6.8	43.20	-0.0	45.60	7.3	43.90	-3.7	42.10
2	No calculation at this stage							
3	0.3	45.10	-28.4	42.90	27.8	41.85	-22.4	45.10
4	0.3	45.10	-29.6	42.90	29.1	41.85	-23.1	45.10
5	No calculation at this stage							
6	No calculation at this stage							
7	0.0	45.50	-29.1	43.20	27.3	41.85	-19.9	45.50
8	0.0	45.50	-24.5	43.20	21.4	41.85	-17.2	45.50
9	0.0	45.50	-23.3	43.50	21.9	42.35	-16.8	45.50

Summary of results (continued)

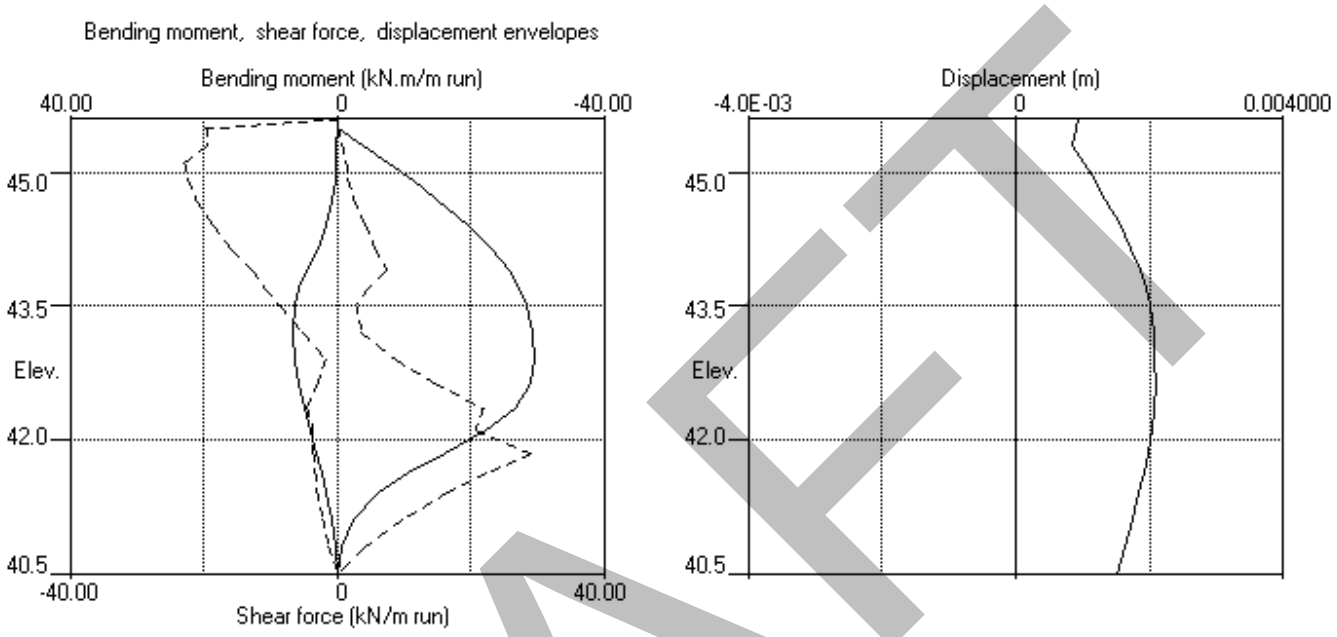
Maximum and minimum displacement at each stage

Stage no.	Displacement maximum m	elev.	minimum m	elev.	Stage description
1	0.001	45.60	0.000	45.60	Excav. to elev. 45.10 on RIGHT side
2	No calculation at this stage				Install strut no.1 at elev. 45.10
3	0.002	42.63	0.000	45.60	Excav. to elev. 41.85 on RIGHT side
4	0.002	42.63	0.000	45.60	Fill to elev. 42.35 on RIGHT side
5	No calculation at this stage				Install strut no.3 at elev. 42.35
6	No calculation at this stage				Install strut no.2 at elev. 45.50
7	0.002	42.90	0.000	45.60	Remove strut no.1 at elev. 45.10
8	0.002	42.90	0.000	45.60	Change EI of wall to 46900kN.m2/m run
9	0.002	42.90	0.000	45.60	Change soil type 2 to soil type 3

Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev. 45.10 kN/m run	Strut no. 1 at elev. 45.10 kN/strut	Strut no. 2 at elev. 45.50 kN/m run	Strut no. 2 at elev. 45.50 kN/strut	Strut no. 3 at elev. 42.35 kN/m run	Strut no. 3 at elev. 42.35 kN/strut
3	23.56	117.79	---	---	---	---
4	24.25	121.23	---	---	---	---
7	---	---	20.03	20.03	4.87	4.87
8	---	---	17.37	17.37	12.73	12.73
9	---	---	16.92	16.92	26.52	26.52

Units: kN,m



Campbell Reith | Sheet No.
Program: WALLAP Version 6.06 Revision A51.B69.R54 | Job No. 12047
Licensed from GEOSOLVE | Made by : FD
Data filename/Run ID: 12047ULSDA1C2 |
Ashton Court | Date:13-09-2017
Wall depth determination - ULS DA1 C2 | Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Soil types Right side
1	45.60	1 Made Ground	1 Made Ground
2	43.90	2 London Clay	2 London Clay

SOIL PROPERTIES (Unfactored SLS soil strengths)

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	Made Ground	18.00	5000	0.530	NC (0.490)	0.298 (1.319)	4.393 (6.381)	0.0d
2	London Clay (43.90)	20.00	60270 (5166)	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	70.00u (6.000)
3	London Cl.. (43.90)	20.00	46407 (3977)	1.000	OC (0.200)	0.422 (1.589)	2.699 (4.668)	1.500d

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	Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2	London Clay	0.00	0.500	0.00	0.00	0.500	0.00
3	London Clay drained	20.00	1.000	0.00	20.00	1.000	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	40.15	40.15

Automatic water pressure balancing at toe of wall : Yes

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = 40.50
Maximum finite element length = 0.30 m
Youngs modulus of wall E = 1.9600E+07 kN/m2
Moment of inertia of wall I = 3.3500E-03 m4/m run
E.I = 65660 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /strut kN	Tension allowed
1	45.10	5.00	0.020000	2.000E+08	5.50	0.00	0	No
2	45.50	1.00	0.300000	2.000E+07	5.50	0.00	0	No
3	42.35	1.00	0.300000	2.000E+07	5.50	0.00	0	No

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Excavate to elevation 45.10 on RIGHT side
2	Install strut or anchor no.1 at elevation 45.10
3	Excavate to elevation 41.85 on RIGHT side
4	Fill to elevation 42.35 on RIGHT side with soil type 2
5	Install strut or anchor no.3 at elevation 42.35
6	Install strut or anchor no.2 at elevation 45.50
7	Remove strut or anchor no.1 at elevation 45.10
8	Change EI of wall to 46900 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
9	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset

FACTORS OF SAFETY and ANALYSIS OPTIONS

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

Stability analysis:
Method of analysis - Strength Factor method
Overall factor on soil strength for calculating wall depth = 1.00

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

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 9.00 m

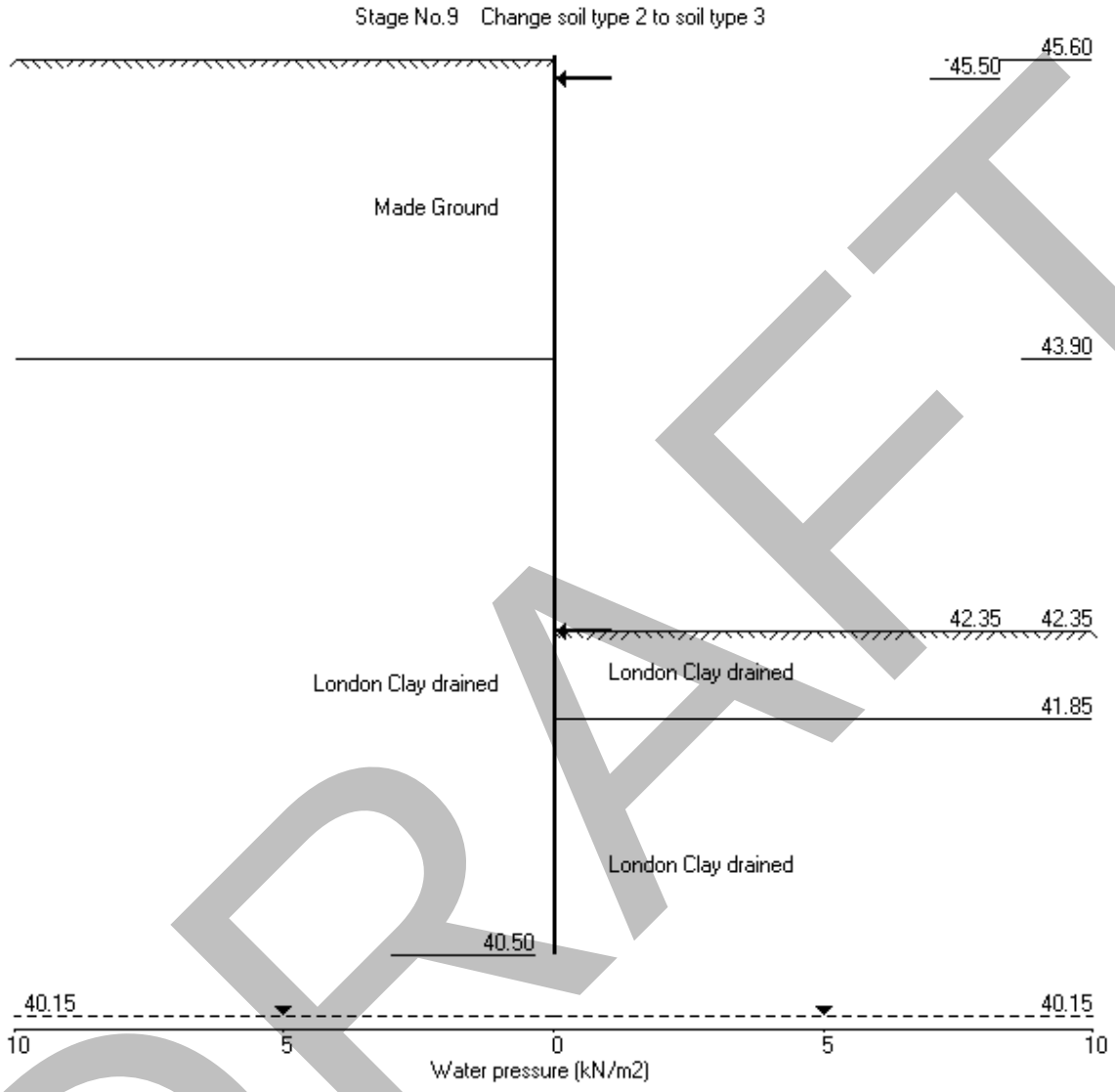
Width of excavation on Left side of wall = 30.00 m
Width of excavation on Right side of wall = 30.00 m

Distance to rigid boundary on Left side = 50.00 m
Distance to rigid boundary on Right side = 50.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Excav. to elev. 45.10 on RIGHT side	No	No	No
2	Install strut no.1 at elev. 45.10	Yes	Yes	Yes
3	Excav. to elev. 41.85 on RIGHT side	Yes	Yes	Yes
4	Fill to elev. 42.35 on RIGHT side	Yes	Yes	Yes
5	Install strut no.3 at elev. 42.35	No	No	No
6	Install strut no.2 at elev. 45.50	No	No	No
7	Remove strut no.1 at elev. 45.10	Yes	Yes	Yes
8	Change EI of wall to 46900kN.m2/m run	Yes	Yes	Yes
9	Change soil type 2 to soil type 3	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

Units: kN,m



Units: kN,m

Stage No. 1 Excavate to elevation 45.10 on RIGHT side

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	14.203	41.09	44.61	0.49	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

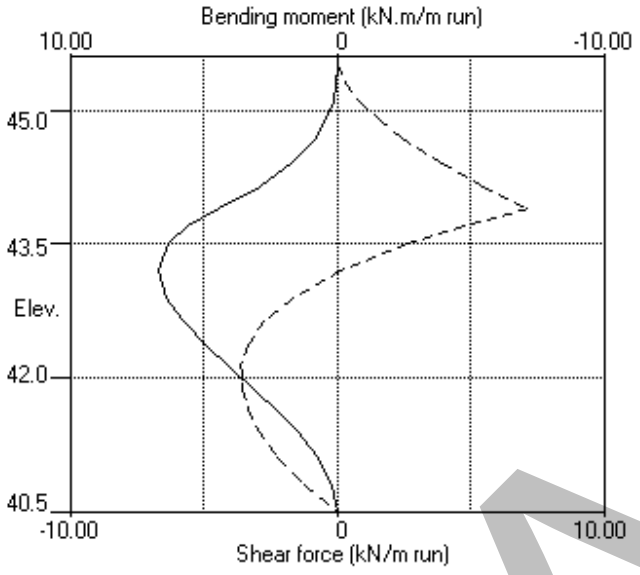
Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	2.76E-04	0.0	-0.0		65660
2	45.50	0.67	0.001	2.76E-04	0.0	0.0		65660
3	45.30	2.00	0.001	2.75E-04	0.3	0.0		65660
4	45.10	3.33	0.001	2.75E-04	0.8	0.1		65660
5	44.90	3.79	0.001	2.74E-04	1.5	0.4		65660
6	44.70	4.65	0.001	2.73E-04	2.4	0.8		65660
7	44.40	5.67	0.001	2.67E-04	3.9	1.7		65660
8	44.15	6.51	0.001	2.58E-04	5.5	2.9		65660
9	43.90	6.82	0.000	2.44E-04	7.1	4.5		65660
		-13.35	0.000	2.44E-04	7.1	4.5		
10	43.70	-11.40	0.000	2.29E-04	4.7	5.6		65660
11	43.50	-9.54	0.000	2.11E-04	2.6	6.3		65660
12	43.20	-6.98	0.000	1.81E-04	0.1	6.7		65660
13	42.90	-4.75	0.000	1.51E-04	-1.7	6.4		65660
14	42.63	-3.00	0.000	1.26E-04	-2.7	5.7		65660
15	42.35	-1.52	0.000	1.04E-04	-3.4	4.9		65660
16	42.10	-0.38	0.000	8.74E-05	-3.6	4.0		65660
17	41.85	0.59	0.000	7.40E-05	-3.6	3.1		65660
18	41.63	1.35	0.000	6.49E-05	-3.4	2.3		65660
19	41.40	2.04	0.000	5.83E-05	-3.0	1.5		65660
20	41.10	2.90	0.000	5.31E-05	-2.2	0.7		65660
21	40.80	3.72	0.000	5.09E-05	-1.2	0.2		65660
22	40.50	4.57	0.000	5.05E-05	-0.0	-0.0		---

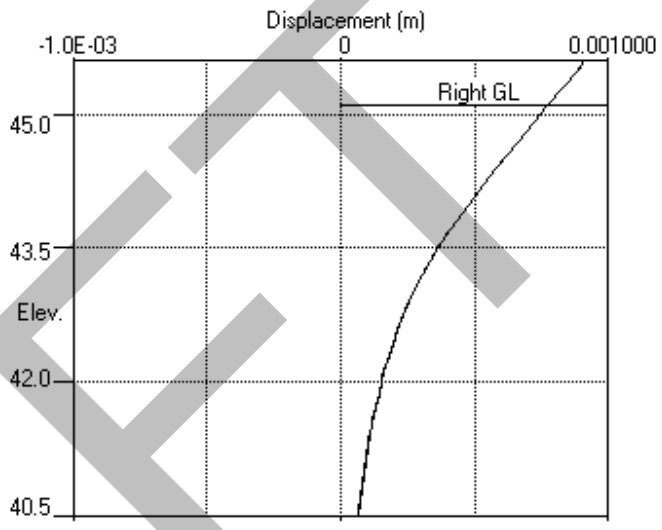
(continued)

Stage No.1 Excavate to elevation 45.10 on RIGHT side

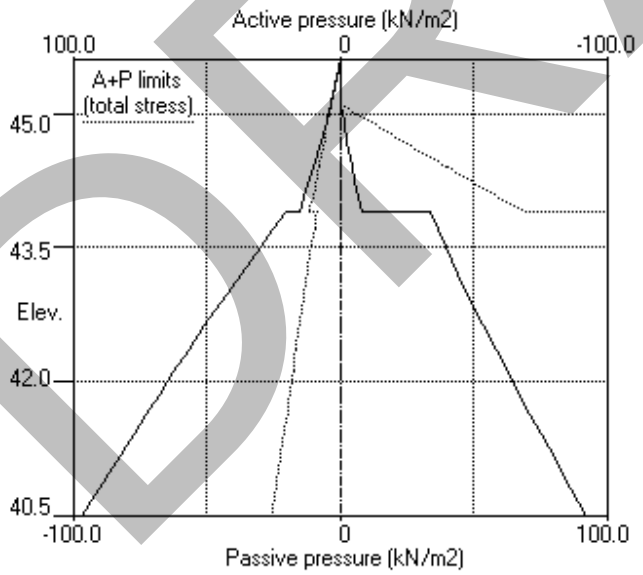
Units: kN,m

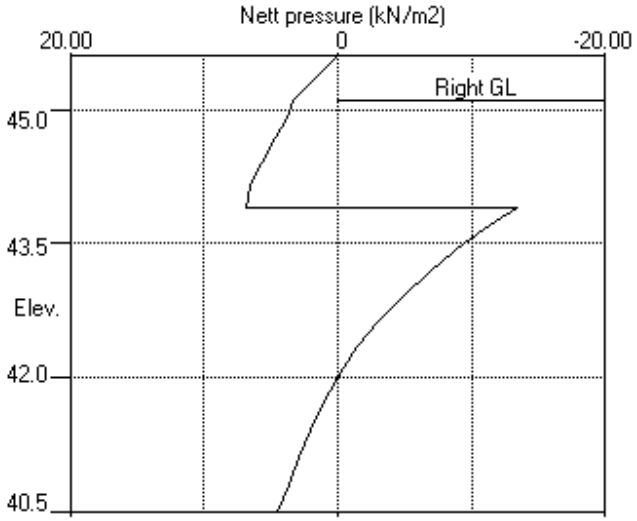
Stage No.1 Excav. to elev. 45.10 on RIGHT side





Stage No.1 Excav. to elev. 45.10 on RIGHT side





Units: kN,m

Stage No. 3 Excavate to elevation 41.85 on RIGHT side

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50: Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000: Toe elev.	Wall Penetr-ation	Direction of failure
3	45.60	41.85	45.10	3.324	n/a	41.68	0.17	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.37E-04	0.0	-0.0		65660
2	45.50	3.36	0.001	-7.37E-04	0.2	0.0		65660
3	45.30	2.44	0.001	-7.38E-04	0.7	0.1		65660
4	45.10	3.33	0.001	-7.38E-04	1.3	0.3	23.7	65660
		3.33	0.001	-7.38E-04	-22.4	0.3		
5	44.90	4.88	0.001	-7.33E-04	-21.6	-4.1		65660
6	44.70	6.67	0.001	-7.14E-04	-20.4	-8.3		65660
7	44.40	9.36	0.001	-6.63E-04	-18.0	-14.1		65660
8	44.15	11.61	0.002	-6.01E-04	-15.4	-18.3		65660
9	43.90	13.89	0.002	-5.25E-04	-12.2	-21.7		65660
		8.50	0.002	-5.25E-04	-12.2	-21.7		
10	43.70	9.50	0.002	-4.55E-04	-10.4	-24.0		65660
11	43.50	10.50	0.002	-3.79E-04	-8.4	-25.9		65660
12	43.20	12.26	0.002	-2.57E-04	-5.0	-27.6		65660
13	42.90	17.12	0.002	-1.29E-04	-0.6	-28.5		65660
14	42.63	21.99	0.002	-1.09E-05	4.8	-28.0		65660
15	42.35	27.30	0.002	1.01E-04	11.5	-25.8		65660
16	42.10	32.49	0.002	1.92E-04	19.0	-22.0		65660
17	41.85	38.01	0.002	2.64E-04	27.8	-16.2		65660
		-27.61	0.002	2.64E-04	27.8	-16.2		
18	41.63	-25.88	0.002	3.10E-04	21.8	-10.6		65660
19	41.40	-23.65	0.002	3.39E-04	16.2	-6.3		65660
20	41.10	-20.13	0.002	3.60E-04	9.7	-2.5		65660
21	40.80	-16.19	0.002	3.67E-04	4.2	-0.5		65660
22	40.50	-11.97	0.002	3.68E-04	0.0	-0.0		---

At elev. 45.10 Strut force = 118.7 kN/strut = 23.7 kN/m run

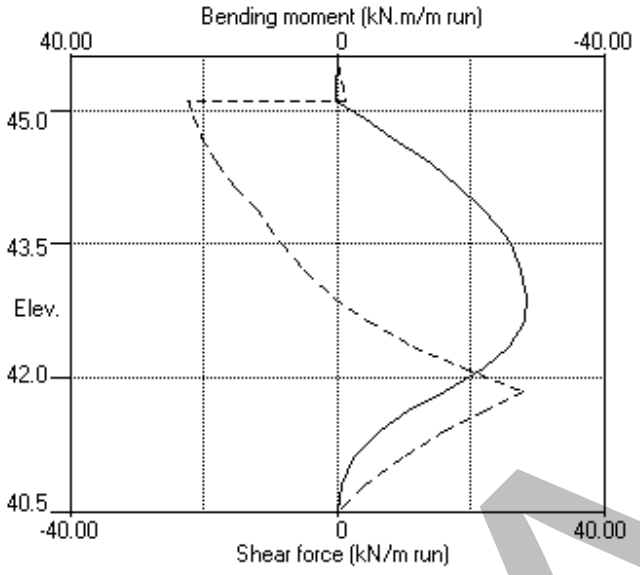
(continued)

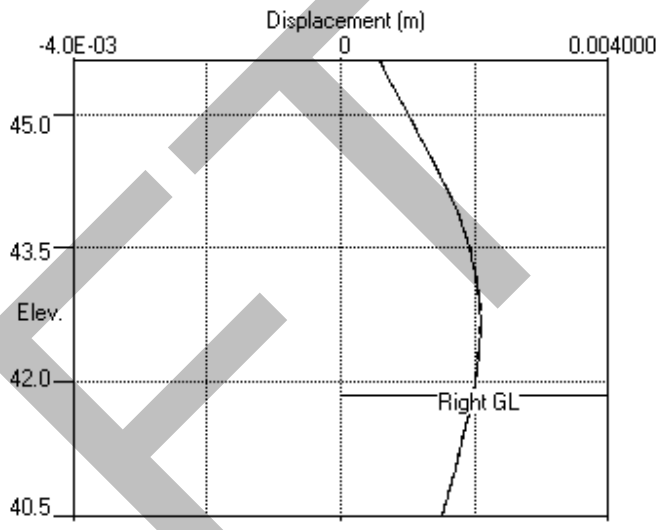
Stage No.3 Excavate to elevation 41.85 on RIGHT side

Campbell Reith | Sheet No.
Program: WALLAP Version 6.06 Revision A51.B69.R54 | Job No. 12047
Licensed from GEOSOLVE | Made by : FD
Data filename/Run ID: 12047ULSDA1C2 |
Ashton Court | Date:13-09-2017
Wall depth determination - ULS DA1 C2 | Checked :

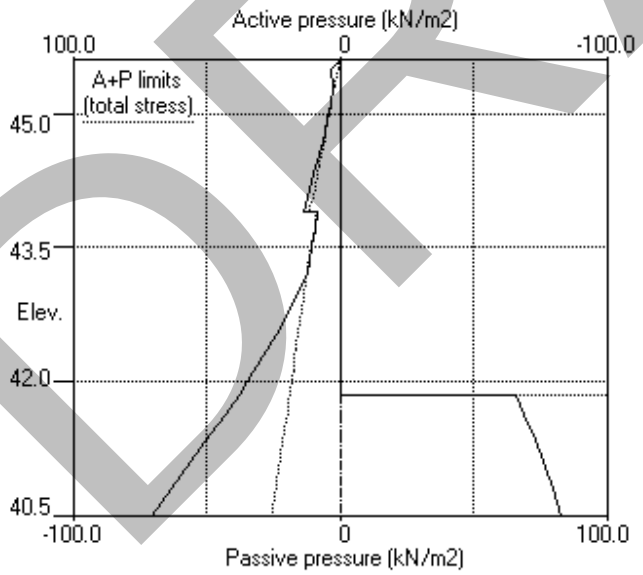
Units: kN,m

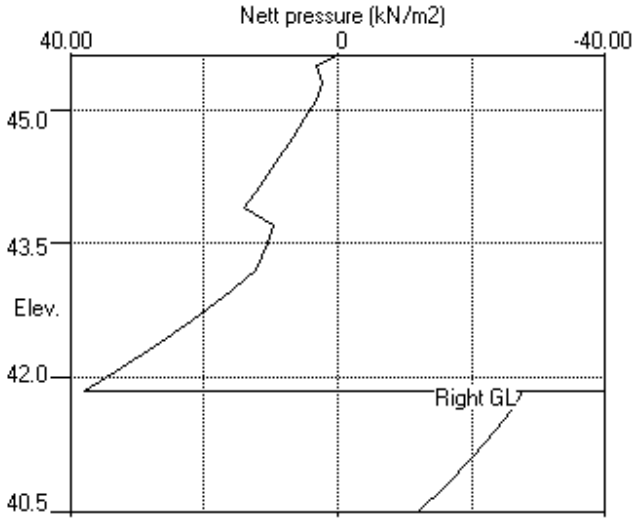
Stage No.3 Excav. to elev. 41.85 on RIGHT side





Stage No.3 Excav. to elev. 41.85 on RIGHT side





Units: kN,m

Stage No. 4 Fill to elevation 42.35 on RIGHT side with soil type 2

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50: Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000	Wall Penetr -ation	Direction of failure
4	45.60	42.35	45.10	4.078	n/a	42.22	0.13	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.17E-04	0.0	-0.0		65660
2	45.50	3.28	0.001	-7.17E-04	0.2	0.0		65660
3	45.30	2.39	0.001	-7.17E-04	0.7	0.1		65660
4	45.10	3.33	0.001	-7.18E-04	1.3	0.3	24.4	65660
		3.33	0.001	-7.18E-04	-23.1	0.3		
5	44.90	4.88	0.001	-7.12E-04	-22.3	-4.2		65660
6	44.70	6.68	0.001	-6.92E-04	-21.2	-8.6		65660
7	44.40	9.38	0.001	-6.39E-04	-18.8	-14.6		65660
8	44.15	11.64	0.002	-5.75E-04	-16.1	-19.0		65660
9	43.90	13.93	0.002	-4.96E-04	-12.9	-22.6		65660
		9.03	0.002	-4.96E-04	-12.9	-22.6		
10	43.70	10.18	0.002	-4.24E-04	-11.0	-25.0		65660
11	43.50	11.35	0.002	-3.45E-04	-8.9	-27.0		65660
12	43.20	13.41	0.002	-2.17E-04	-5.1	-28.8		65660
13	42.90	18.61	0.002	-8.40E-05	-0.3	-29.7		65660
14	42.63	23.85	0.002	3.88E-05	5.5	-29.0		65660
15	42.35	29.56	0.002	1.55E-04	12.8	-26.5		65660
16	42.10	33.02	0.002	2.48E-04	20.7	-22.4		65660
17	41.85	34.59	0.002	3.21E-04	29.1	-16.2		65660
		-31.03	0.002	3.21E-04	29.1	-16.2		
18	41.63	-28.50	0.002	3.67E-04	22.4	-10.4		65660
19	41.40	-25.45	0.002	3.95E-04	16.3	-6.1		65660
20	41.10	-20.83	0.002	4.14E-04	9.4	-2.4		65660
21	40.80	-15.75	0.001	4.21E-04	3.9	-0.5		65660
22	40.50	-10.36	0.001	4.22E-04	0.0	-0.0		---

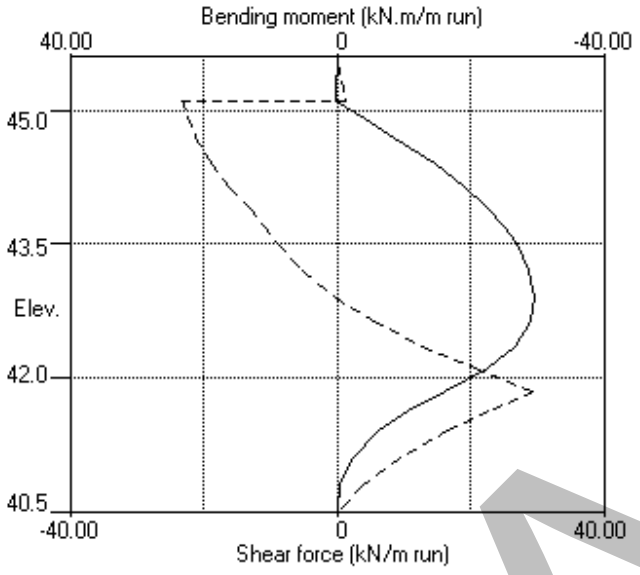
At elev. 45.10 Strut force = 122.2 kN/strut = 24.4 kN/m run

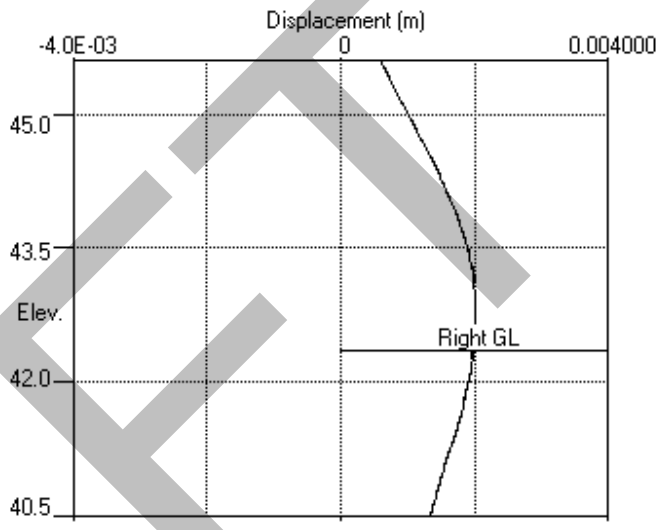
(continued)

Stage No.4 Fill to elevation 42.35 on RIGHT side with soil type 2

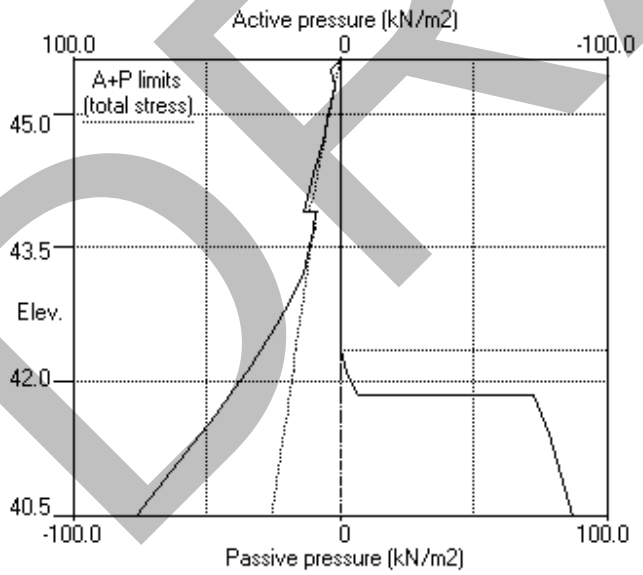
Units: kN,m

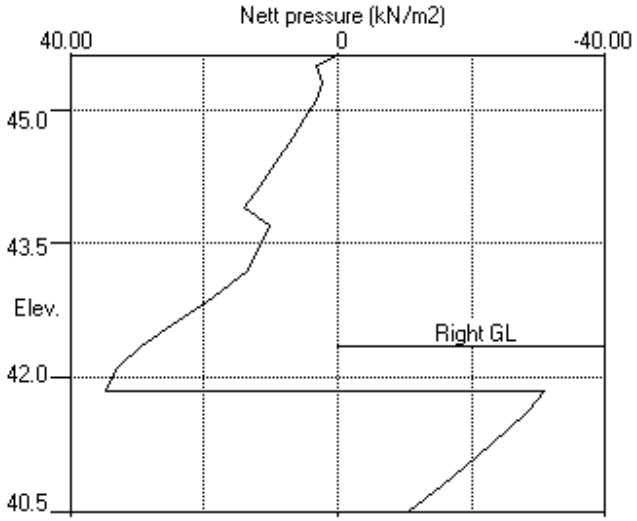
Stage No.4 Fill to elev. 42.35 on RIGHT side





Stage No.4 Fill to elev. 42.35 on RIGHT side





Units: kN,m

Stage No. 7 Remove strut or anchor no.1 at elevation 45.10

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
7	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.14E-04	0.0	-0.0		65660
2	45.50	3.25	0.001	-8.14E-04	0.2	0.0	20.2	65660
		3.25	0.001	-8.14E-04	-20.0	0.0		
3	45.30	2.32	0.001	-8.08E-04	-19.5	-3.9		65660
4	45.10	3.33	0.001	-7.90E-04	-18.9	-7.8		65660
5	44.90	4.77	0.001	-7.61E-04	-18.1	-11.5		65660
6	44.70	6.56	0.001	-7.20E-04	-17.0	-15.0		65660
7	44.40	9.25	0.002	-6.41E-04	-14.6	-19.7		65660
8	44.15	11.52	0.002	-5.60E-04	-12.0	-23.1		65660
9	43.90	13.82	0.002	-4.67E-04	-8.8	-25.7		65660
		8.50	0.002	-4.67E-04	-8.8	-25.7		
10	43.70	9.50	0.002	-3.86E-04	-7.0	-27.3		65660
11	43.50	10.50	0.002	-3.01E-04	-5.0	-28.5		65660
12	43.20	12.53	0.002	-1.69E-04	-1.6	-29.2		65660
13	42.90	18.02	0.002	-3.68E-05	3.0	-29.0		65660
14	42.63	23.51	0.002	8.14E-05	8.7	-27.5		65660
15	42.35	29.46	0.002	1.89E-04	16.0	-24.1	4.9	65660
		28.11	0.002	1.89E-04	11.1	-24.1		
16	42.10	33.23	0.002	2.74E-04	18.7	-20.5		65660
17	41.85	35.22	0.002	3.41E-04	27.3	-14.8		65660
		-30.40	0.002	3.41E-04	27.3	-14.8		
18	41.63	-27.58	0.002	3.82E-04	20.8	-9.4		65660
19	41.40	-24.28	0.002	4.08E-04	14.9	-5.4		65660
20	41.10	-19.38	0.002	4.25E-04	8.4	-2.0		65660
21	40.80	-14.05	0.001	4.30E-04	3.4	-0.4		65660
22	40.50	-8.41	0.001	4.31E-04	0.0	-0.0		---

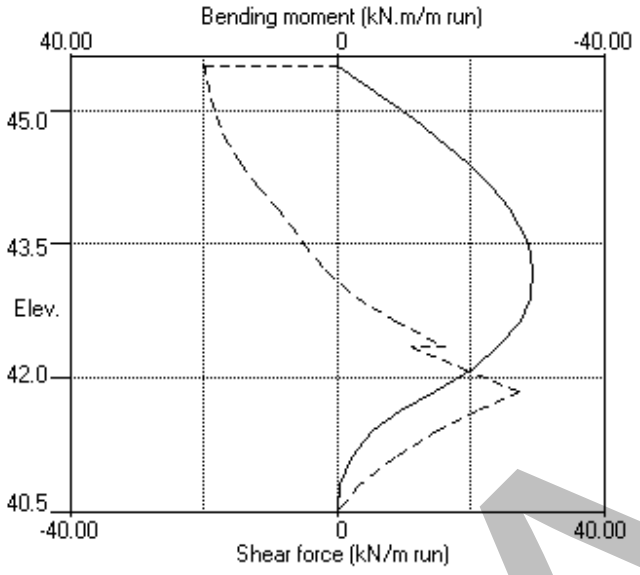
At elev. 45.50 Strut force = 20.2 kN/strut = 20.2 kN/m run
At elev. 42.35 Strut force = 4.9 kN/strut = 4.9 kN/m run

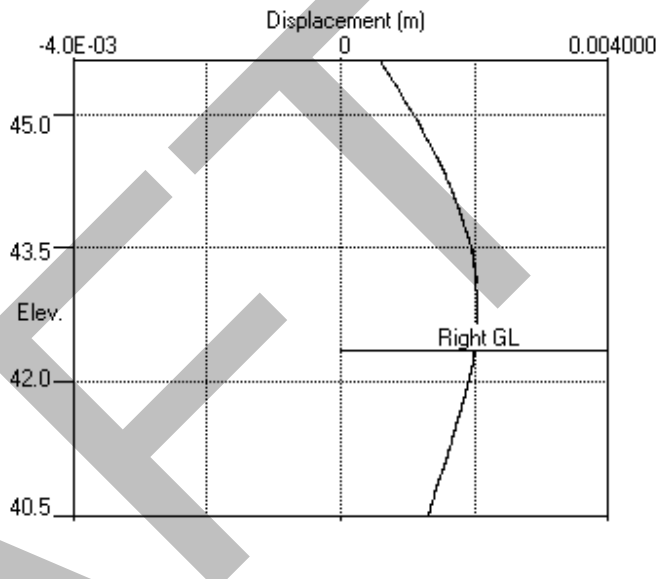
(continued)

Stage No.7 Remove strut or anchor no.1 at elevation 45.10

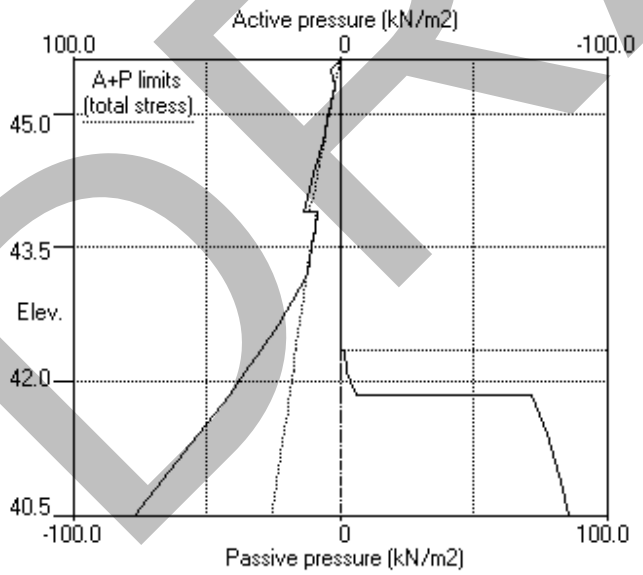
Units: kN,m

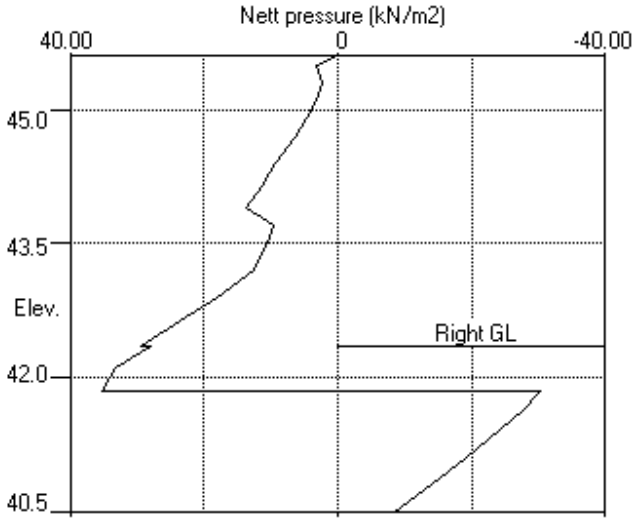
Stage No.7 Remove strut no.1 at elev. 45.10





Stage No.7 Remove strut no.1 at elev. 45.10





Units: kN,m

Stage No. 8 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
8	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.82E-04	0.0	-0.0		46900
2	45.50	3.31	0.001	-8.82E-04	0.2	0.0	17.5	46900
		3.31	0.001	-8.82E-04	-17.4	0.0		
3	45.30	2.31	0.001	-8.75E-04	-16.8	-3.5		46900
4	45.10	3.33	0.001	-8.53E-04	-16.3	-6.9		46900
5	44.90	4.71	0.001	-8.18E-04	-15.5	-10.2		46900
6	44.70	6.48	0.001	-7.69E-04	-14.3	-13.3		46900
7	44.40	9.15	0.002	-6.75E-04	-12.0	-17.5		46900
8	44.15	11.41	0.002	-5.78E-04	-9.4	-20.3		46900
9	43.90	13.70	0.002	-4.68E-04	-6.3	-22.4		46900
		8.50	0.002	-4.68E-04	-6.3	-22.4		
10	43.70	9.50	0.002	-3.74E-04	-4.5	-23.6		46900
11	43.50	10.50	0.002	-2.77E-04	-2.5	-24.4		46900
12	43.20	12.00	0.002	-1.28E-04	0.9	-24.5		46900
13	42.90	17.17	0.002	1.69E-05	5.3	-23.8		46900
14	42.63	22.99	0.002	1.41E-04	10.8	-21.8		46900
15	42.35	29.30	0.002	2.48E-04	18.0	-18.0	12.8	46900
		25.47	0.002	2.48E-04	5.2	-18.0		
16	42.10	33.78	0.002	3.29E-04	12.6	-15.6		46900
17	41.85	36.86	0.002	3.93E-04	21.4	-11.0		46900
		-28.77	0.002	3.93E-04	21.4	-11.0		
18	41.63	-24.98	0.002	4.31E-04	15.4	-6.6		46900
19	41.40	-20.78	0.002	4.52E-04	10.3	-3.6		46900
20	41.10	-14.72	0.002	4.65E-04	4.9	-1.1		46900
21	40.80	-8.29	0.001	4.68E-04	1.5	-0.1		46900
22	40.50	-1.54	0.001	4.68E-04	0.0	-0.0		---

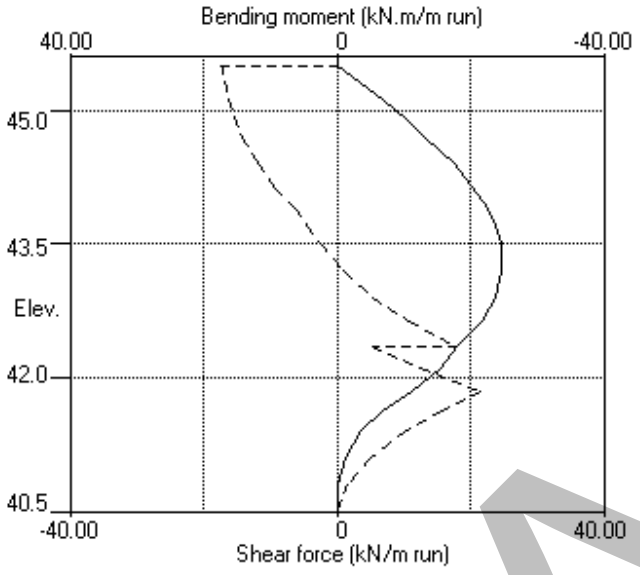
At elev. 45.50 Strut force = 17.5 kN/strut = 17.5 kN/m run
At elev. 42.35 Strut force = 12.8 kN/strut = 12.8 kN/m run

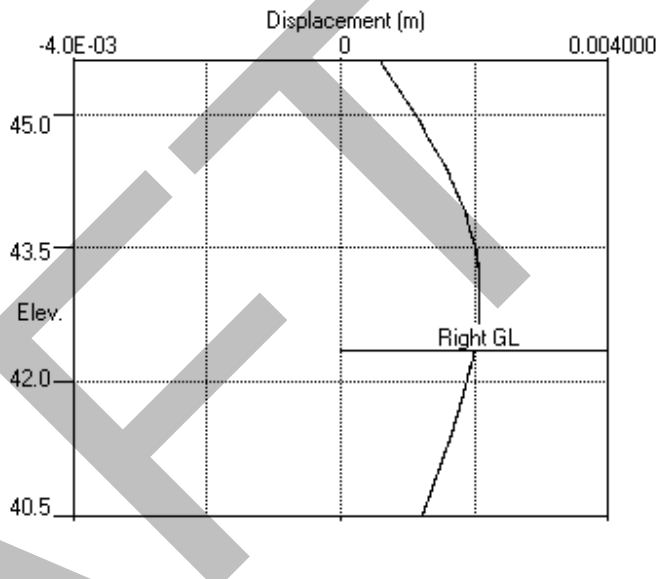
(continued)

Stage No.8 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

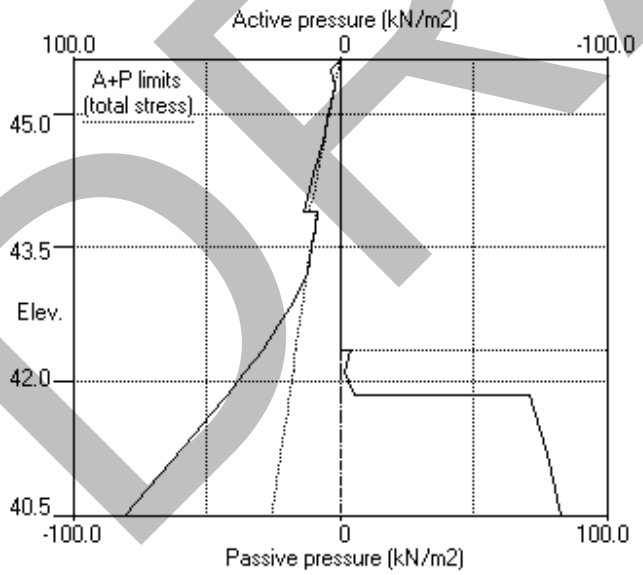
Units: kN,m

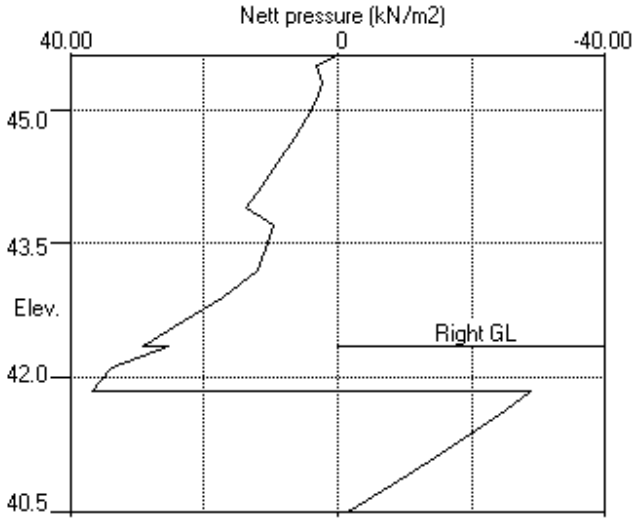
Stage No.8 Change EI of wall to 46900kN.m2/m run





Stage No.8 Change EI of wall to 46900kN.m2/m run





Units: kN,m

Stage No. 9 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
9	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: ULS DA1 Combination 2

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-8.36E-04	0.0	-0.0		46900
2	45.50	3.31	0.001	-8.36E-04	0.2	0.0	16.3	46900
		3.31	0.001	-8.36E-04	-16.2	0.0		
3	45.30	2.32	0.001	-8.29E-04	-15.6	-3.3		46900
4	45.10	3.36	0.001	-8.09E-04	-15.0	-6.5		46900
5	44.90	4.76	0.001	-7.77E-04	-14.2	-9.5		46900
6	44.70	6.54	0.001	-7.32E-04	-13.1	-12.4		46900
7	44.40	9.23	0.002	-6.44E-04	-10.7	-16.1		46900
8	44.15	11.50	0.002	-5.55E-04	-8.1	-18.6		46900
9	43.90	13.80	0.002	-4.56E-04	-5.0	-20.4		46900
		13.07	0.002	-4.56E-04	-5.0	-20.4		
10	43.70	15.05	0.002	-3.71E-04	-2.2	-21.3		46900
11	43.50	17.03	0.002	-2.85E-04	1.0	-21.5		46900
12	43.20	20.01	0.002	-1.59E-04	6.6	-20.2		46900
13	42.90	22.98	0.002	-4.81E-05	13.0	-17.5		46900
14	42.63	25.70	0.002	3.22E-05	19.7	-13.1		46900
15	42.35	28.75	0.002	8.08E-05	27.2	-6.8	37.8	46900
		24.38	0.002	8.08E-05	-10.5	-6.8		
16	42.10	30.33	0.002	1.12E-04	-3.7	-8.3		46900
17	41.85	30.48	0.002	1.49E-04	3.9	-8.0		46900
		12.17	0.002	1.49E-04	3.9	-8.0		
18	41.63	7.05	0.002	1.80E-04	6.1	-6.6		46900
19	41.40	2.00	0.002	2.04E-04	7.1	-4.8		46900
20	41.10	-4.63	0.002	2.25E-04	6.7	-2.5		46900
21	40.80	-11.17	0.002	2.34E-04	4.3	-0.7		46900
22	40.50	-17.64	0.002	2.36E-04	0.0	-0.0		---

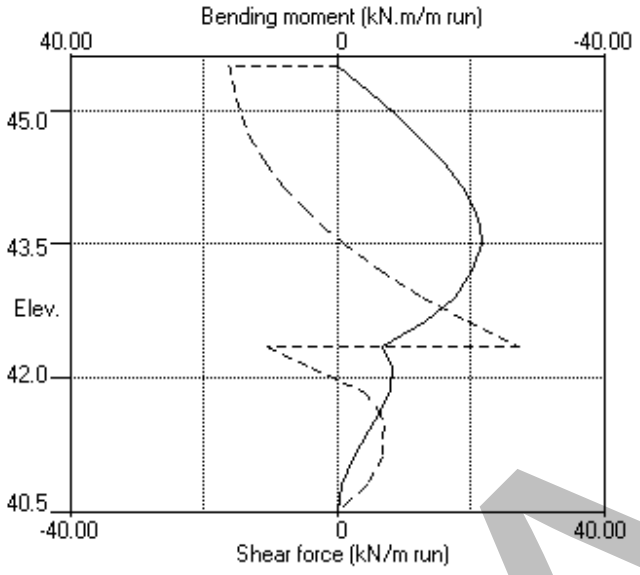
At elev. 45.50 Strut force = 16.3 kN/strut = 16.3 kN/m run
At elev. 42.35 Strut force = 37.8 kN/strut = 37.8 kN/m run

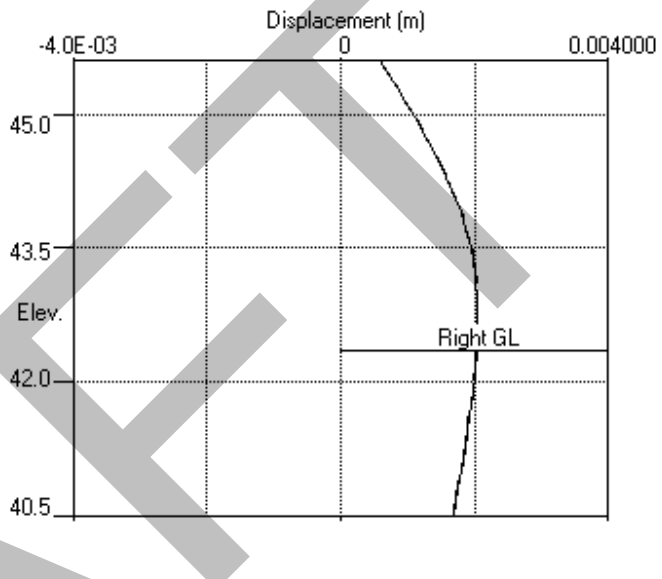
(continued)

Stage No.9 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

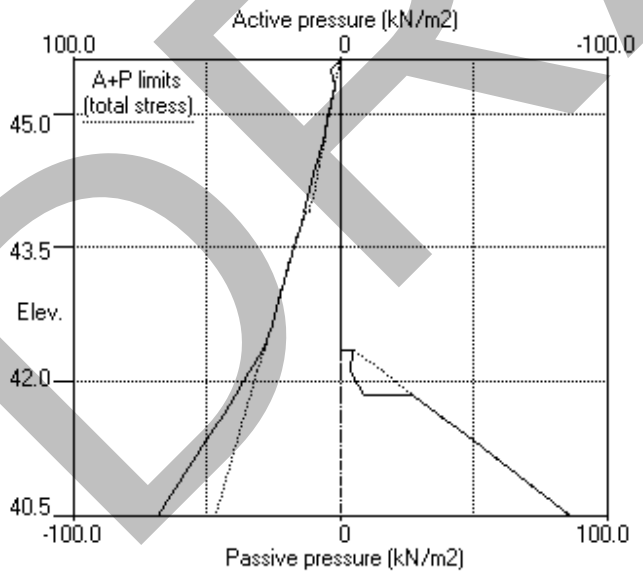
Units: kN,m

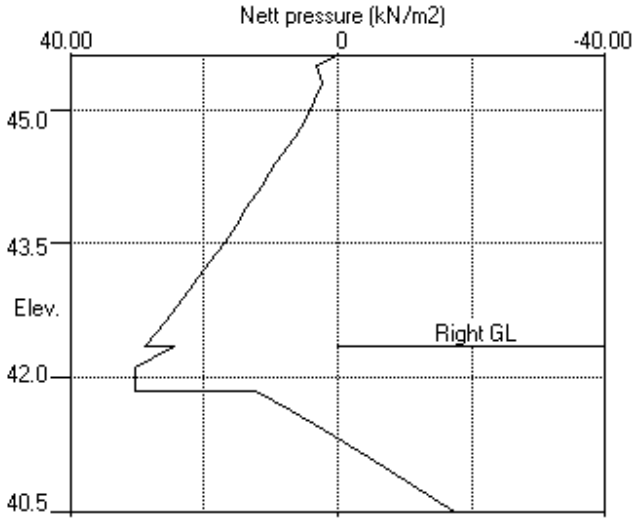
Stage No.9 Change soil type 2 to soil type 3





Stage No.9 Change soil type 2 to soil type 3





Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

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

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	Overall FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	14.203	41.09	44.61	0.49	L to R
2	45.60	45.10		No analysis at this stage				
3	45.60	41.85	45.10	3.324	n/a	41.68	0.17	L to R
4	45.60	42.35	45.10	4.078	n/a	42.22	0.13	L to R
5	45.60	42.35		No analysis at this stage				

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

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall

Limit State: ULS DA1 Combination 2

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum m	Displacement minimum m	Bending moment maximum kN.m/m	Bending moment minimum kN.m/m	Shear force maximum kN/m	Shear force minimum kN/m
1	45.60	0.001	0.000	0.0	-0.0	0.0	0.0
2	45.50	0.001	0.000	0.0	0.0	0.2	-20.0
3	45.30	0.001	0.000	0.1	-3.9	0.7	-19.5
4	45.10	0.001	0.000	0.3	-7.8	1.3	-23.1
5	44.90	0.001	0.000	0.4	-11.5	1.5	-22.3
6	44.70	0.001	0.000	0.8	-15.0	2.4	-21.2
7	44.40	0.002	0.000	1.7	-19.7	3.9	-18.8
8	44.15	0.002	0.000	2.9	-23.1	5.5	-16.1
9	43.90	0.002	0.000	4.5	-25.7	7.1	-12.9
10	43.70	0.002	0.000	5.6	-27.3	4.7	-11.0
11	43.50	0.002	0.000	6.3	-28.5	2.6	-8.9
12	43.20	0.002	0.000	6.7	-29.2	6.6	-5.1
13	42.90	0.002	0.000	6.4	-29.7	13.0	-1.7
14	42.63	0.002	0.000	5.7	-29.0	19.7	-2.7
15	42.35	0.002	0.000	4.9	-26.5	27.2	-10.5
16	42.10	0.002	0.000	4.0	-22.4	20.7	-3.7
17	41.85	0.002	0.000	3.1	-16.2	29.1	-3.6
18	41.63	0.002	0.000	2.3	-10.6	22.4	-3.4
19	41.40	0.002	0.000	1.5	-6.3	16.3	-3.0
20	41.10	0.002	0.000	0.7	-2.5	9.7	-2.2
21	40.80	0.002	0.000	0.2	-0.7	4.3	-1.2
22	40.50	0.002	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 kN.m/m	Bending moment elev.	Bending moment minimum kN.m/m	Bending moment elev.	Shear force maximum kN/m	Shear force elev.	Shear force minimum kN/m	Shear force elev.
1	6.7	43.20	-0.0	45.60	7.1	43.90	-3.6	42.10
2	No calculation at this stage							
3	0.3	45.10	-28.5	42.90	27.8	41.85	-22.4	45.10
4	0.3	45.10	-29.7	42.90	29.1	41.85	-23.1	45.10
5	No calculation at this stage							
6	No calculation at this stage							
7	0.0	45.50	-29.2	43.20	27.3	41.85	-20.0	45.50
8	0.0	45.50	-24.5	43.20	21.4	41.85	-17.4	45.50
9	0.0	45.50	-21.5	43.50	27.2	42.35	-16.2	45.50

Summary of results (continued)

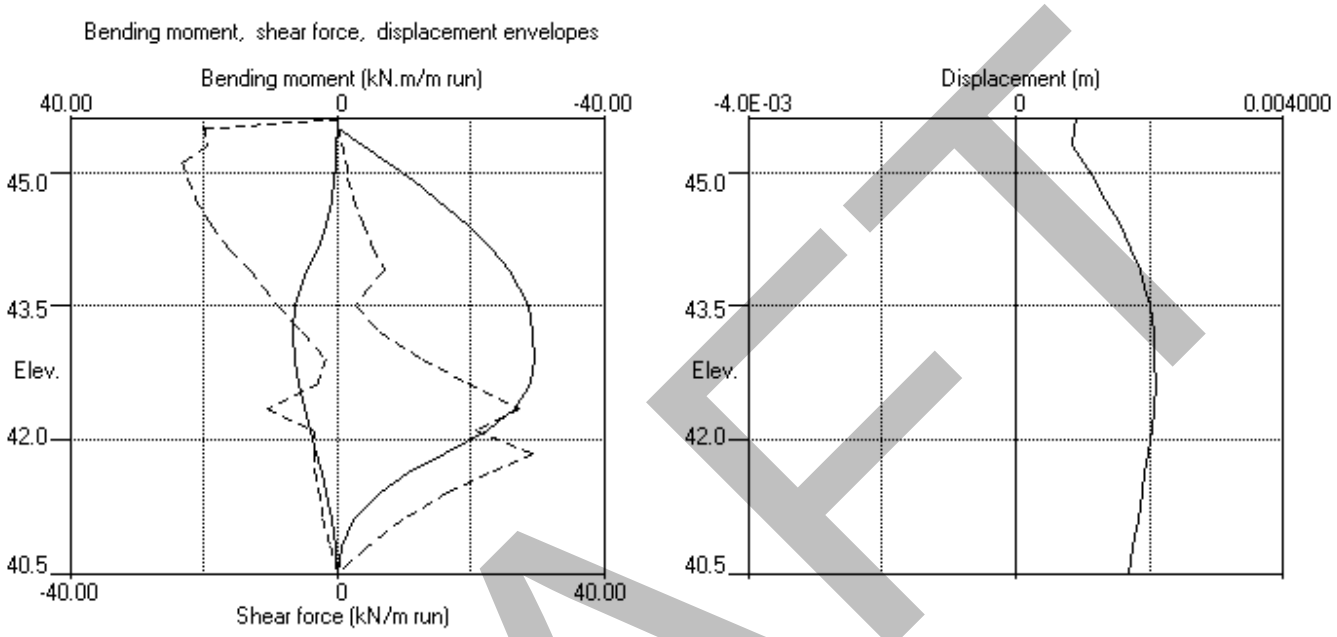
Maximum and minimum displacement at each stage

Stage no.	Displacement maximum m	elev.	minimum m	elev.	Stage description
1	0.001	45.60	0.000	45.60	Excav. to elev. 45.10 on RIGHT side
2	No calculation at this stage				Install strut no.1 at elev. 45.10
3	0.002	42.63	0.000	45.60	Excav. to elev. 41.85 on RIGHT side
4	0.002	42.63	0.000	45.60	Fill to elev. 42.35 on RIGHT side
5	No calculation at this stage				Install strut no.3 at elev. 42.35
6	No calculation at this stage				Install strut no.2 at elev. 45.50
7	0.002	42.90	0.000	45.60	Remove strut no.1 at elev. 45.10
8	0.002	42.90	0.000	45.60	Change EI of wall to 46900kN.m2/m run
9	0.002	42.63	0.000	45.60	Change soil type 2 to soil type 3

Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev. 45.10 kN/m run	kN/strut	Strut no. 2 at elev. 45.50 kN/m run	kN/strut	Strut no. 3 at elev. 42.35 kN/m run	kN/strut
3	23.75	118.75	---	---	---	---
4	24.44	122.22	---	---	---	---
7	---	---	20.20	20.20	4.92	4.92
8	---	---	17.55	17.55	12.77	12.77
9	---	---	16.34	16.34	37.76	37.76

Units: kN,m



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                          Licensed from GEOSOLVE                | Made by :    FD
Data filename/Run ID: 12047_dat_SLS                             |
Ashton Court                                                    | Date:13-09-2017
Wall Deflection- SLS                                            | Checked :
-------------------------------------------------------------------------------
                                                          Units: kN,m
```

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Soil types Right side
1	45.60	1 Made Ground	1 Made Ground
2	43.90	2 London Clay	2 London Clay

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	Made Ground	18.00	5000	0.530	NC	0.298	4.393	0.0d
					(0.490)	(1.319)	(6.381)	
2	London Clay	20.00	60270	1.000	OC	1.000	1.000	70.00u
	(43.90)		(5166)		(0.490)	(2.389)	(2.390)	(6.000)
3	London Cl..	20.00	46407	1.000	OC	0.422	2.699	1.500d
	(43.90)		(3977)		(0.200)	(1.589)	(4.668)	

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	Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2	London Clay	0.00	0.500	0.00	0.00	0.500	0.00
3	London Clay drained	20.00	1.000	0.00	20.00	1.000	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	40.15	40.15

Automatic water pressure balancing at toe of wall : Yes

WALL PROPERTIES

```
                    Type of structure = Fully Embedded Wall
                 Elevation of toe of wall = 40.50
           Maximum finite element length =  0.30 m
              Youngs modulus of wall E = 1.9600E+07 kN/m2
          Moment of inertia of wall I = 3.3500E-03 m4/m run
                                 E.I = 65660 kN.m2/m run
                   Yield Moment of wall = Not defined
```

STRUTS and ANCHORS

Strut/anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /strut kN	Tension allowed
1	45.10	5.00	0.020000	2.000E+08	5.50	0.00	0	No
2	45.50	1.00	0.300000	2.000E+07	5.50	0.00	0	No
3	42.35	1.00	0.300000	2.000E+07	5.50	0.00	0	No

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Excavate to elevation 45.10 on RIGHT side
2	Install strut or anchor no.1 at elevation 45.10
3	Excavate to elevation 42.35 on RIGHT side
4	Install strut or anchor no.3 at elevation 42.35
5	Install strut or anchor no.2 at elevation 45.50
6	Remove strut or anchor no.1 at elevation 45.10
7	Change EI of wall to 46900 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
8	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: Serviceability Limit State
All loads and soil strengths are unfactored

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.00

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

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 9.00 m

Width of excavation on Left side of wall = 30.00 m
Width of excavation on Right side of wall = 30.00 m

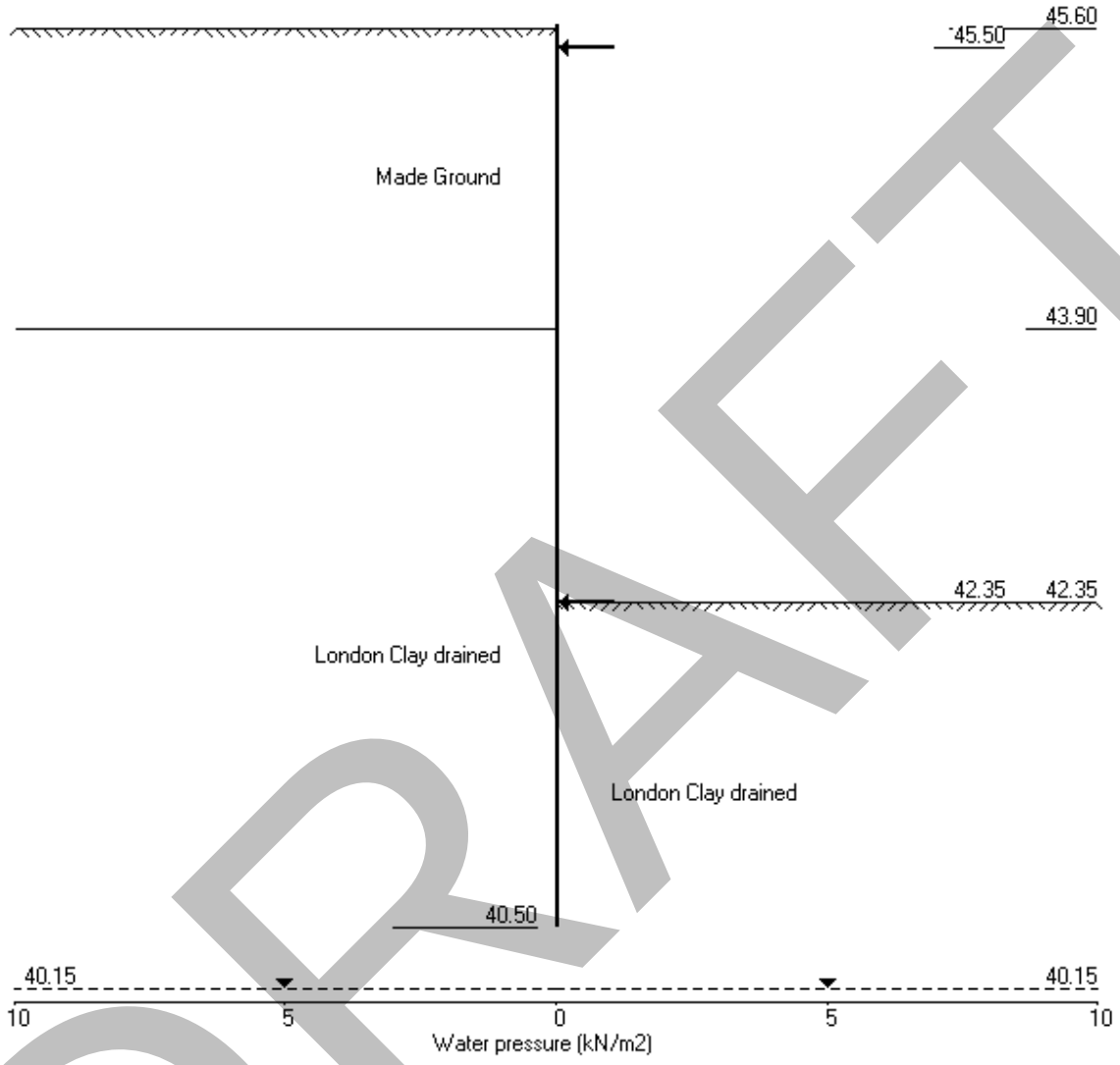
Distance to rigid boundary on Left side = 50.00 m
Distance to rigid boundary on Right side = 50.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement Bending mom. Shear force	Active, Passive pressures	Graph. output
1	Excav. to elev. 45.10 on RIGHT side	No	No	No
2	Install strut no.1 at elev. 45.10	Yes	Yes	Yes
3	Excav. to elev. 42.35 on RIGHT side	Yes	Yes	Yes
4	Install strut no.3 at elev. 42.35	No	No	No
5	Install strut no.2 at elev. 45.50	No	No	No
6	Remove strut no.1 at elev. 45.10	Yes	Yes	Yes
7	Change EI of wall to 46900kN.m2/m run	Yes	Yes	Yes
8	Change soil type 2 to soil type 3	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.8 Change soil type 2 to soil type 3



Campbell Reith | Sheet No.
Program: WALLAP Version 6.06 Revision A51.B69.R54 | Job No. 12047
Licensed from GEOSOLVE | Made by : FD
Data filename/Run ID: 12047_dat_SLS |
Ashton Court | Date:13-09-2017
Wall Deflection- SLS | Checked :

Units: kN,m

Stage No. 1 Excavate to elevation 45.10 on RIGHT side

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	19.594	41.09	44.76	0.34	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	2.79E-04	0.0	0.0		65660
2	45.50	0.54	0.001	2.79E-04	0.0	0.0		65660
3	45.30	1.61	0.001	2.79E-04	0.2	0.0		65660
4	45.10	3.27	0.001	2.79E-04	0.7	0.1		65660
5	44.90	3.76	0.001	2.78E-04	1.4	0.3		65660
6	44.70	5.15	0.001	2.76E-04	2.3	0.7		65660
7	44.40	6.28	0.001	2.71E-04	4.0	1.7		65660
8	44.15	6.54	0.001	2.62E-04	5.6	2.9		65660
9	43.90	6.80	0.000	2.48E-04	7.3	4.5		65660
		-13.62	0.000	2.48E-04	7.3	4.5		
10	43.70	-11.63	0.000	2.33E-04	4.8	5.7		65660
11	43.50	-9.74	0.000	2.14E-04	2.6	6.4		65660
12	43.20	-7.13	0.000	1.84E-04	0.1	6.8		65660
13	42.90	-4.86	0.000	1.54E-04	-1.7	6.5		65660
14	42.63	-3.07	0.000	1.28E-04	-2.8	5.8		65660
15	42.35	-1.56	0.000	1.06E-04	-3.4	4.9		65660
16	42.17	-0.73	0.000	9.37E-05	-3.6	4.3		65660
17	42.00	0.01	0.000	8.30E-05	-3.7	3.7		65660
18	41.70	1.12	0.000	6.87E-05	-3.5	2.6		65660
19	41.40	2.07	0.000	5.93E-05	-3.0	1.6		65660
20	41.10	2.94	0.000	5.39E-05	-2.3	0.8		65660
21	40.80	3.79	0.000	5.17E-05	-1.3	0.2		65660
22	40.50	4.65	0.000	5.12E-05	-0.0	0.0		---

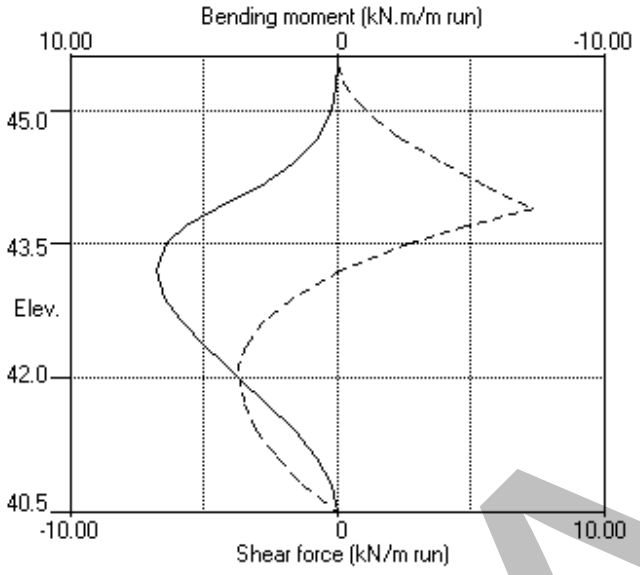
(continued)

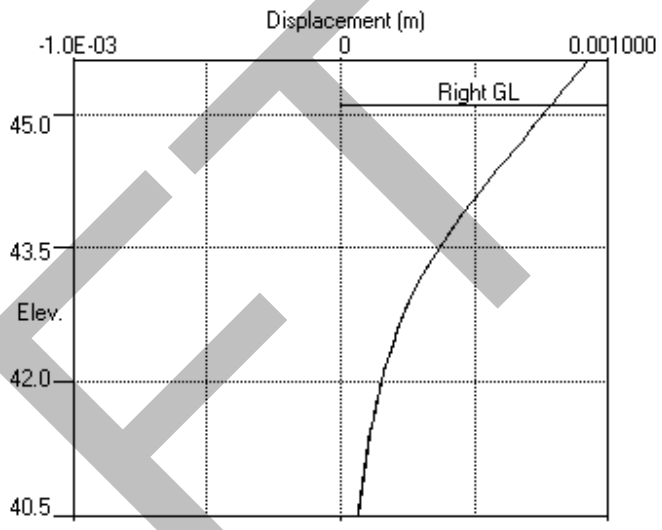
Stage No.1 Excavate to elevation 45.10 on RIGHT side

Campbell Reith | Sheet No.
Program: WALLAP Version 6.06 Revision A51.B69.R54 | Job No. 12047
Licensed from GEOSOLVE | Made by : FD
Data filename/Run ID: 12047_dat_SLS |
Ashton Court | Date:13-09-2017
Wall Deflection- SLS | Checked :

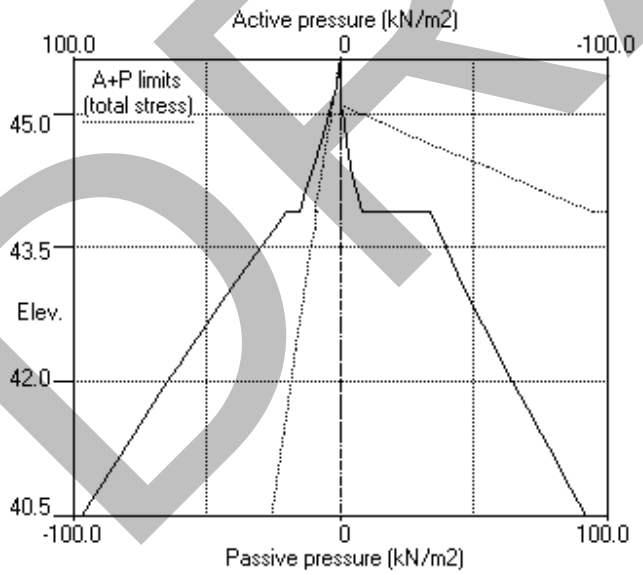
Units: kN,m

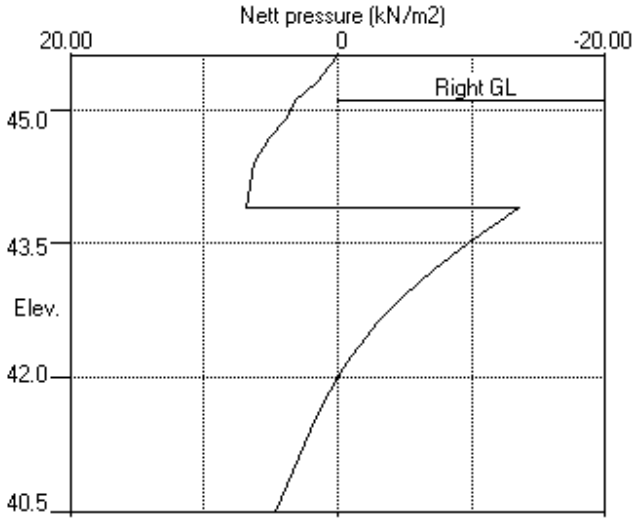
Stage No.1 Excav. to elev. 45.10 on RIGHT side





Stage No.1 Excav. to elev. 45.10 on RIGHT side





Units: kN,m

Stage No. 3 Excavate to elevation 42.35 on RIGHT side

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
3	45.60	42.35	45.10	5.707	n/a	42.26	0.09	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-5.66E-04	0.0	0.0		65660
2	45.50	2.76	0.001	-5.66E-04	0.1	0.0		65660
3	45.30	1.92	0.001	-5.66E-04	0.6	0.1		65660
4	45.10	3.11	0.001	-5.67E-04	1.1	0.3	20.7	65660
		3.11	0.001	-5.67E-04	-19.6	0.3		
5	44.90	4.93	0.001	-5.62E-04	-18.8	-3.6		65660
6	44.70	6.75	0.001	-5.45E-04	-17.6	-7.2		65660
7	44.40	9.50	0.001	-5.01E-04	-15.1	-12.1		65660
8	44.15	11.80	0.001	-4.49E-04	-12.5	-15.6		65660
9	43.90	14.12	0.002	-3.84E-04	-9.2	-18.3		65660
		8.50	0.002	-3.84E-04	-9.2	-18.3		
10	43.70	9.50	0.002	-3.26E-04	-7.4	-20.0		65660
11	43.50	11.49	0.002	-2.63E-04	-5.3	-21.2		65660
12	43.20	16.48	0.002	-1.64E-04	-1.1	-22.2		65660
13	42.90	21.81	0.002	-6.42E-05	4.6	-21.7		65660
14	42.63	27.00	0.002	2.22E-05	11.3	-19.6		65660
15	42.35	32.48	0.002	9.54E-05	19.5	-15.4		65660
		-13.76	0.002	9.54E-05	19.5	-15.4		
16	42.17	-13.65	0.002	1.32E-04	17.1	-12.2		65660
17	42.00	-13.31	0.002	1.60E-04	14.7	-9.4		65660
18	41.70	-12.30	0.002	1.95E-04	10.9	-5.6		65660
19	41.40	-10.90	0.002	2.14E-04	7.4	-2.9		65660
20	41.10	-9.22	0.002	2.23E-04	4.4	-1.1		65660
21	40.80	-7.35	0.001	2.26E-04	1.9	-0.2		65660
22	40.50	-5.33	0.001	2.27E-04	-0.0	-0.0		---

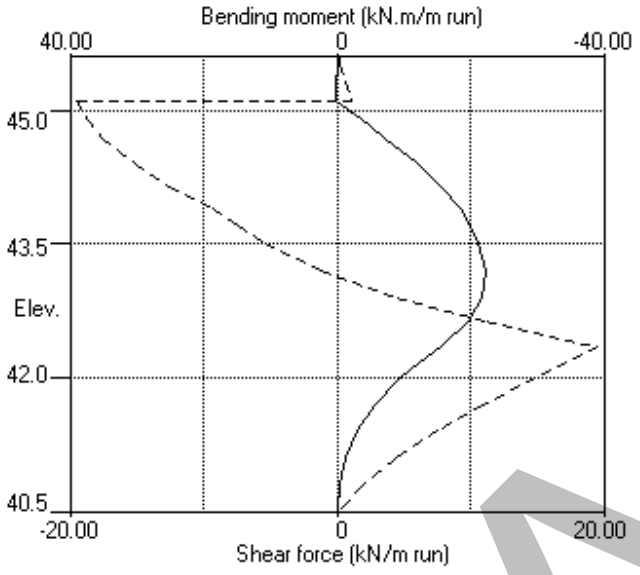
At elev. 45.10 Strut force = 103.3 kN/strut = 20.7 kN/m run

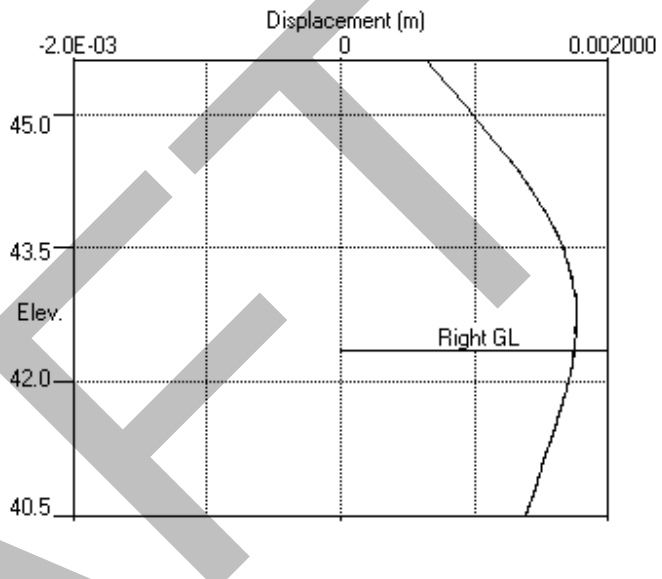
(continued)

Stage No.3 Excavate to elevation 42.35 on RIGHT side

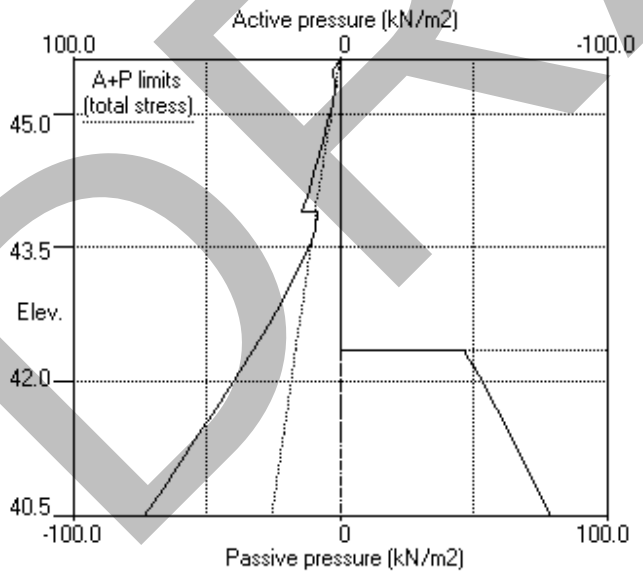
Units: kN,m

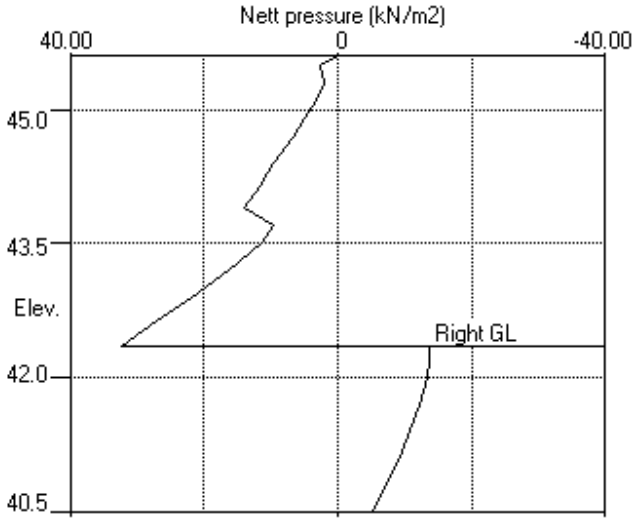
Stage No.3 Excav. to elev. 42.35 on RIGHT side





Stage No.3 Excav. to elev. 42.35 on RIGHT side





Units: kN,m

Stage No. 6 Remove strut or anchor no.1 at elevation 45.10

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
6	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 9.00m

Subgrade reaction model - Boussinesq Influence coefficients

Soil deformations are elastic until the active or passive limit is reached

Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall

Limit State: Serviceability Limit State

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

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-6.49E-04	0.0	0.0		65660
2	45.50	2.73	0.001	-6.49E-04	0.1	0.0	17.1	65660
		2.73	0.001	-6.49E-04	-17.0	0.0		
3	45.30	1.87	0.001	-6.44E-04	-16.5	-3.3		65660
4	45.10	3.03	0.001	-6.29E-04	-16.0	-6.6		65660
5	44.90	4.84	0.001	-6.04E-04	-15.2	-9.7		65660
6	44.70	6.65	0.001	-5.70E-04	-14.1	-12.6		65660
7	44.40	9.39	0.001	-5.03E-04	-11.7	-16.5		65660
8	44.15	11.70	0.001	-4.35E-04	-9.0	-19.1		65660
9	43.90	14.02	0.002	-3.59E-04	-5.8	-21.0		65660
		8.50	0.002	-3.59E-04	-5.8	-21.0		
10	43.70	9.50	0.002	-2.94E-04	-4.0	-22.0		65660
11	43.50	10.52	0.002	-2.26E-04	-2.0	-22.5		65660
12	43.20	15.73	0.002	-1.23E-04	1.9	-22.5		65660
13	42.90	21.30	0.002	-2.38E-05	7.5	-21.2		65660
14	42.63	26.72	0.002	5.87E-05	14.1	-18.3		65660
15	42.35	32.39	0.002	1.24E-04	22.2	-13.3	4.3	65660
		-15.04	0.002	1.24E-04	17.9	-13.3		
16	42.17	-13.59	0.002	1.56E-04	15.4	-10.4		65660
17	42.00	-12.98	0.002	1.81E-04	13.1	-7.9		65660
18	41.70	-11.59	0.002	2.09E-04	9.4	-4.6		65660
19	41.40	-9.90	0.002	2.25E-04	6.2	-2.3		65660
20	41.10	-7.98	0.002	2.32E-04	3.5	-0.9		65660
21	40.80	-5.89	0.001	2.34E-04	1.4	-0.2		65660
22	40.50	-3.66	0.001	2.35E-04	-0.0	-0.0		---

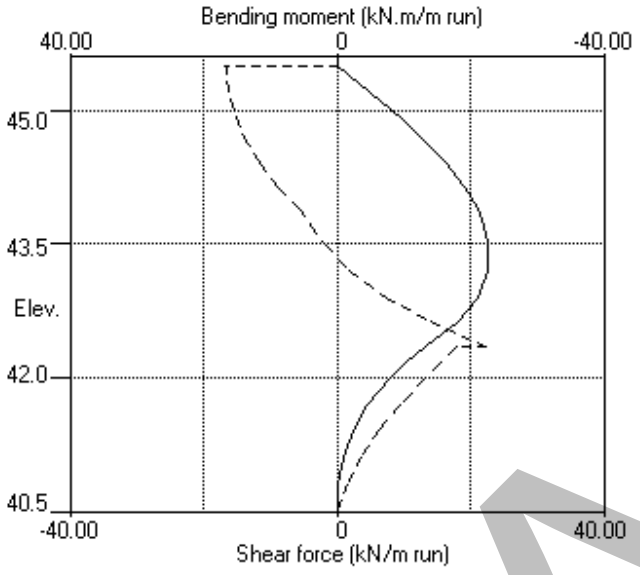
At elev. 45.50 Strut force = 17.1 kN/strut = 17.1 kN/m run
At elev. 42.35 Strut force = 4.3 kN/strut = 4.3 kN/m run

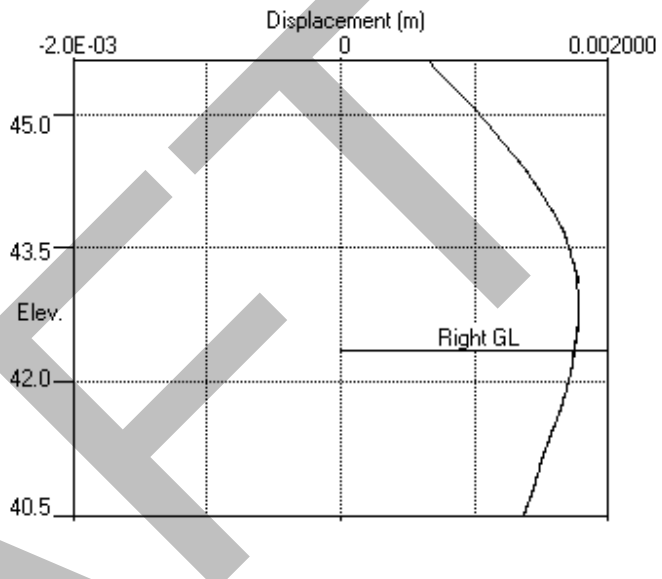
(continued)

Stage No.6 Remove strut or anchor no.1 at elevation 45.10

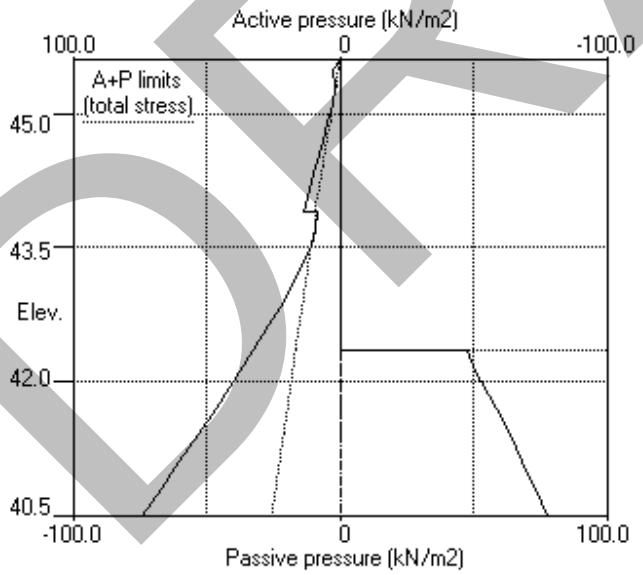
Units: kN,m

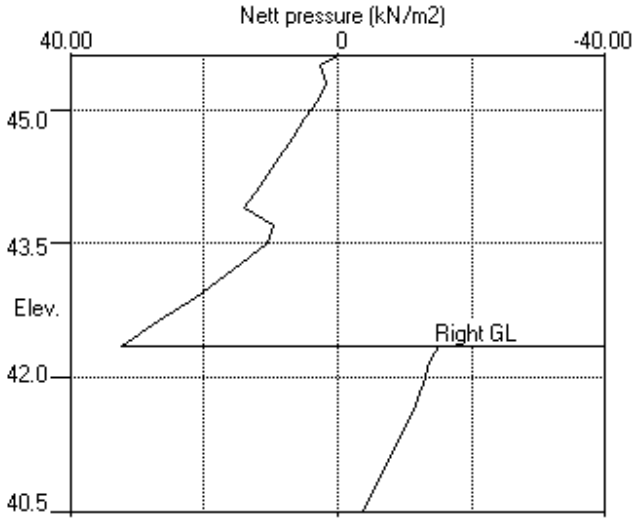
Stage No.6 Remove strut no.1 at elev. 45.10





Stage No.6 Remove strut no.1 at elev. 45.10





Units: kN,m

Stage No. 7 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

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

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000	Wall Penetr -ation	Direction of failure
7	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.14E-04	0.0	0.0		46900
2	45.50	2.77	0.001	-7.14E-04	0.1	0.0	15.2	46900
		2.77	0.001	-7.14E-04	-15.1	0.0		
3	45.30	1.85	0.001	-7.08E-04	-14.6	-3.0		46900
4	45.10	2.99	0.001	-6.89E-04	-14.1	-6.0		46900
5	44.90	4.78	0.001	-6.58E-04	-13.4	-8.8		46900
6	44.70	6.58	0.001	-6.16E-04	-12.2	-11.5		46900
7	44.40	9.30	0.001	-5.34E-04	-9.9	-14.9		46900
8	44.15	11.59	0.002	-4.52E-04	-7.2	-17.2		46900
9	43.90	13.91	0.002	-3.59E-04	-4.1	-18.7		46900
		8.50	0.002	-3.59E-04	-4.1	-18.7		
10	43.70	9.50	0.002	-2.81E-04	-2.3	-19.4		46900
11	43.50	10.50	0.002	-2.01E-04	-0.3	-19.6		46900
12	43.20	14.67	0.002	-8.26E-05	3.5	-19.3		46900
13	42.90	20.53	0.002	2.90E-05	8.8	-17.6		46900
14	42.63	26.26	0.002	1.16E-04	15.2	-14.4		46900
15	42.35	32.29	0.002	1.79E-04	23.3	-9.2	9.4	46900
		-17.30	0.002	1.79E-04	13.9	-9.2		
16	42.17	-13.29	0.002	2.05E-04	11.2	-6.9		46900
17	42.00	-12.08	0.002	2.24E-04	9.0	-5.0		46900
18	41.70	-9.82	0.002	2.43E-04	5.7	-2.6		46900
19	41.40	-7.38	0.002	2.52E-04	3.1	-1.1		46900
20	41.10	-4.83	0.001	2.55E-04	1.3	-0.3		46900
21	40.80	-2.16	0.001	2.55E-04	0.2	-0.0		46900
22	40.50	0.64	0.001	2.55E-04	0.0	-0.0		---

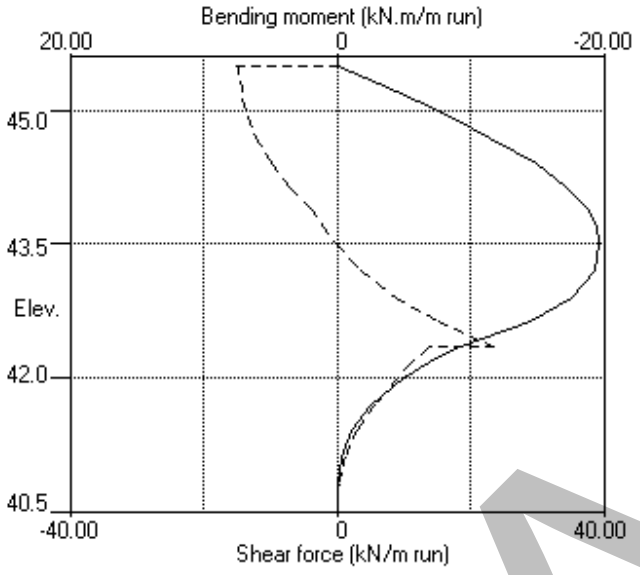
At elev. 45.50 Strut force = 15.2 kN/strut = 15.2 kN/m run
At elev. 42.35 Strut force = 9.4 kN/strut = 9.4 kN/m run

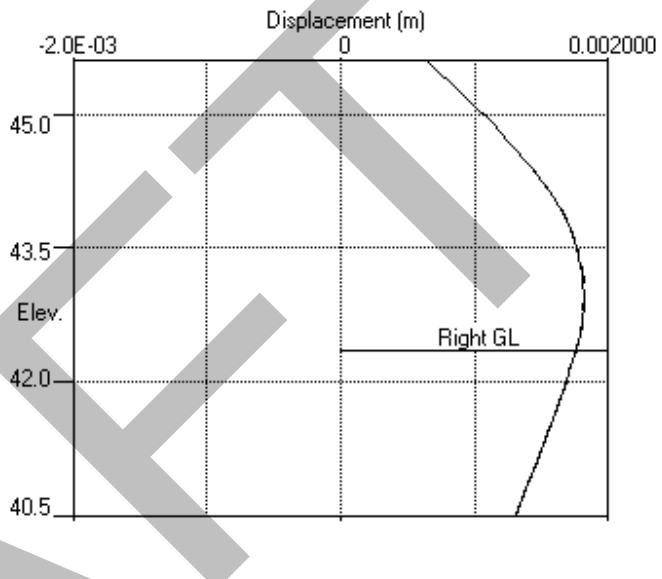
(continued)

Stage No.7 Change EI of wall to 46900 kN.m2/m run
Yield moment not defined
Allow wall to relax with new modulus value

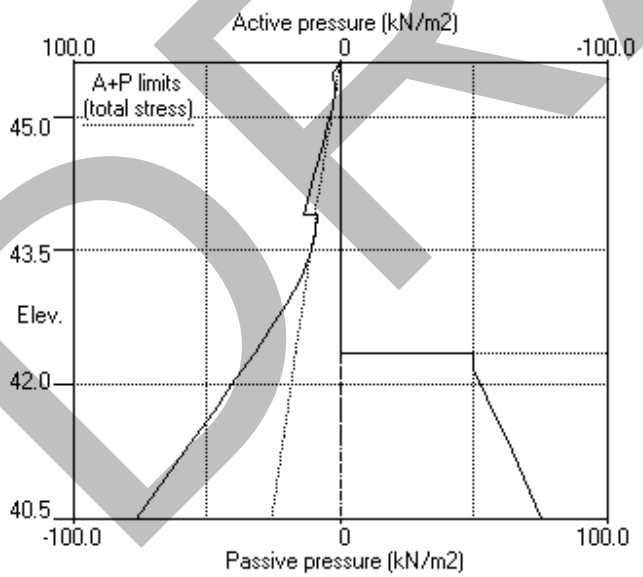
Units: kN,m

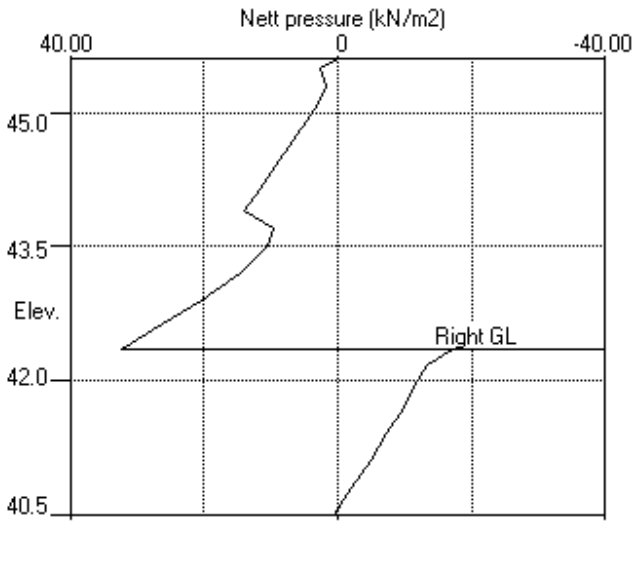
Stage No.7 Change EI of wall to 46900kN.m2/m run





Stage No.7 Change EI of wall to 46900kN.m2/m run





Units: kN,m

Stage No. 8 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

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

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation	Direction of failure
8	45.60	42.35		More than one strut. No FoS calc.				

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall
Analysis options
Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall
Limit State: Serviceability Limit State
Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m	EI of wall kN.m2/m
1	45.60	0.00	0.001	-7.08E-04	0.0	0.0		46900
2	45.50	2.77	0.001	-7.08E-04	0.1	0.0	15.0	46900
		2.77	0.001	-7.08E-04	-14.9	0.0		
3	45.30	1.85	0.001	-7.02E-04	-14.4	-3.0		46900
4	45.10	3.00	0.001	-6.83E-04	-13.9	-5.9		46900
5	44.90	4.79	0.001	-6.53E-04	-13.1	-8.7		46900
6	44.70	6.59	0.001	-6.12E-04	-12.0	-11.3		46900
7	44.40	9.31	0.001	-5.31E-04	-9.6	-14.7		46900
8	44.15	11.60	0.002	-4.50E-04	-7.0	-16.9		46900
9	43.90	13.93	0.002	-3.59E-04	-3.8	-18.3		46900
		10.52	0.002	-3.59E-04	-3.8	-18.3		
10	43.70	12.21	0.002	-2.83E-04	-1.5	-18.9		46900
11	43.50	13.90	0.002	-2.05E-04	1.1	-19.0		46900
12	43.20	16.43	0.002	-9.26E-05	5.6	-18.1		46900
13	42.90	20.52	0.002	9.17E-06	11.2	-15.7		46900
14	42.63	26.13	0.002	8.38E-05	17.6	-11.9		46900
15	42.35	31.94	0.002	1.29E-04	25.6	-6.1	29.6	46900
		24.94	0.002	1.29E-04	-4.1	-6.1		
16	42.17	19.30	0.002	1.48E-04	-0.2	-6.3		46900
17	42.00	13.79	0.002	1.68E-04	2.7	-5.9		46900
18	41.70	4.38	0.002	1.96E-04	5.4	-4.4		46900
19	41.40	-4.94	0.002	2.15E-04	5.3	-2.5		46900
20	41.10	-7.96	0.002	2.24E-04	3.4	-1.0		46900
21	40.80	-5.72	0.001	2.27E-04	1.4	-0.2		46900
22	40.50	-3.33	0.001	2.28E-04	0.0	-0.0		---

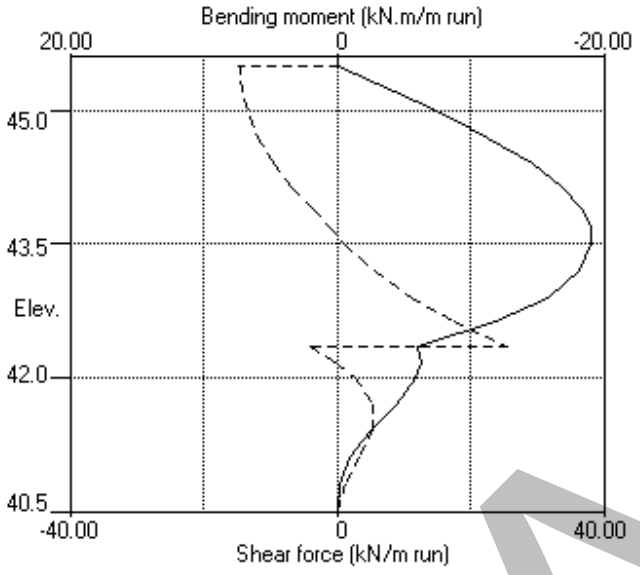
At elev. 45.50 Strut force = 15.0 kN/strut = 15.0 kN/m run
At elev. 42.35 Strut force = 29.6 kN/strut = 29.6 kN/m run

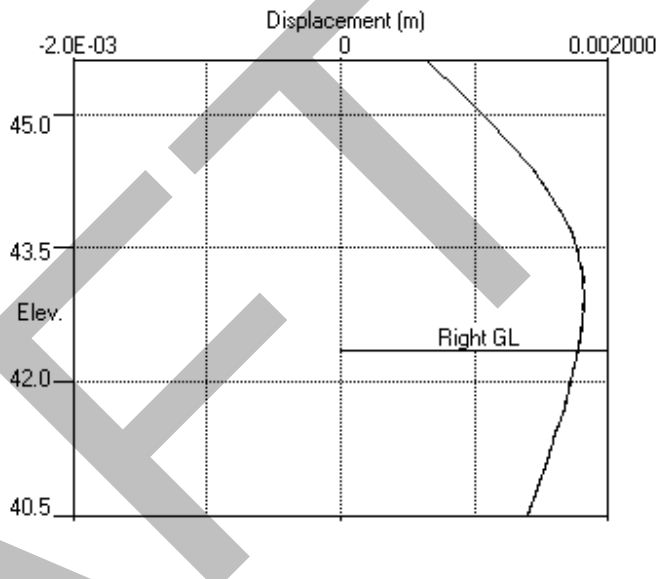
(continued)

Stage No.8 Change properties of soil type 2 to soil type 3
Ko pressures will not be reset

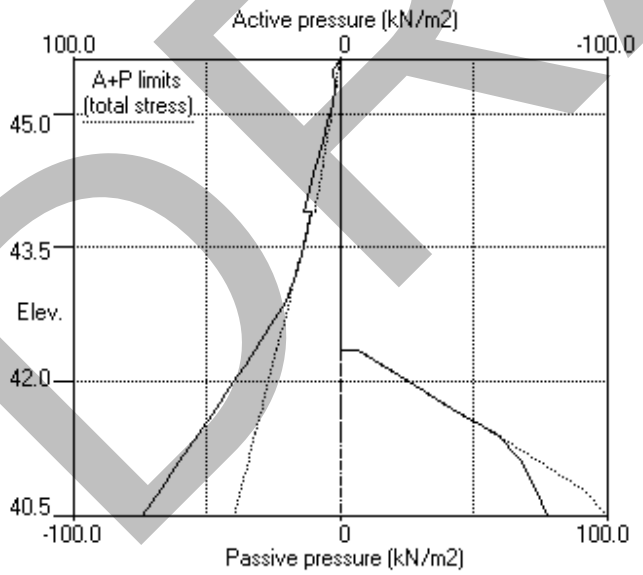
Units: kN,m

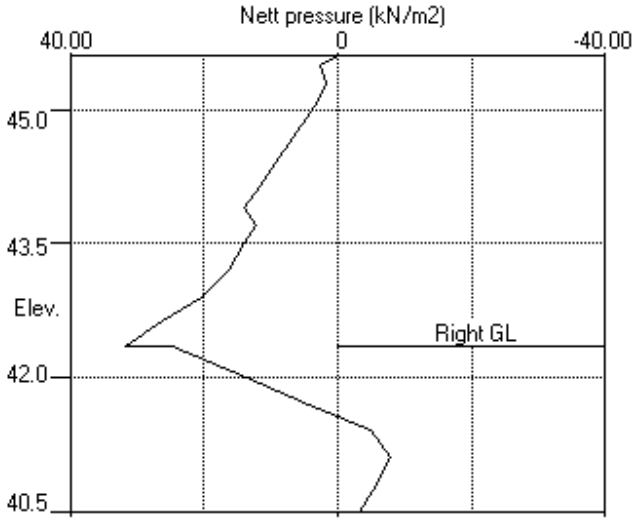
Stage No.8 Change soil type 2 to soil type 3





Stage No.8 Change soil type 2 to soil type 3





Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: Serviceability Limit State

All loads and soil strengths are unfactored

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = 40.50 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000	Wall Penetr -ation	Direction of failure
1	45.60	45.10	Cant.	19.594	41.09	44.76	0.34	L to R
2	45.60	45.10		No analysis at this stage				
3	45.60	42.35	45.10	5.707	n/a	42.26	0.09	L to R
4	45.60	42.35		No analysis at this stage				

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

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 9.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 50.00 from wall
Right side 50.00 from wall

Limit State: Serviceability Limit State

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

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement max. m	Displacement min. m	Bending moment Calculated max. kN.m/m	Bending moment Calculated min. kN.m/m	Bending moment Factored max. kN.m/m	Bending moment Factored min. kN.m/m	Shear force Calculated max. kN/m	Shear force Calculated min. kN/m	Shear force Factored max. kN/m	Shear force Factored min. kN/m
1	45.60	0.001	0.000	0	0	0	0	0	0	0	0
2	45.50	0.001	0.000	0	0	0	0	0	-17	0	-23
3	45.30	0.001	0.000	0	-3	0	-4	1	-17	1	-22
4	45.10	0.001	0.000	0	-7	0	-9	1	-20	1	-26
5	44.90	0.001	0.000	0	-10	0	-13	1	-19	2	-25
6	44.70	0.001	0.000	1	-13	1	-17	2	-18	3	-24
7	44.40	0.001	0.000	2	-17	2	-22	4	-15	5	-20
8	44.15	0.002	0.000	3	-19	4	-26	6	-12	8	-17
9	43.90	0.002	0.000	4	-21	6	-28	7	-9	10	-12
10	43.70	0.002	0.000	6	-22	8	-30	5	-7	6	-10
11	43.50	0.002	0.000	6	-22	9	-30	3	-5	4	-7
12	43.20	0.002	0.000	7	-23	9	-30	6	-1	8	-2
13	42.90	0.002	0.000	6	-22	9	-29	11	-2	15	-2
14	42.63	0.002	0.000	6	-20	8	-26	18	-3	24	-4
15	42.35	0.002	0.000	5	-15	7	-21	26	-4	35	-5
16	42.17	0.002	0.000	4	-12	6	-16	17	-4	23	-5
17	42.00	0.002	0.000	4	-9	5	-13	15	-4	20	-5
18	41.70	0.002	0.000	3	-6	3	-8	11	-4	15	-5
19	41.40	0.002	0.000	2	-3	2	-4	7	-3	10	-4
20	41.10	0.002	0.000	1	-1	1	-2	4	-2	6	-3
21	40.80	0.001	0.000	0	-0	0	-0	2	-1	3	-2
22	40.50	0.001	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 Calculated max. kN.m/m	Bending moment Calculated max. elev.	Bending moment Calculated min. kN.m/m	Bending moment Calculated min. elev.	Bending moment Factored max. kN.m/m	Bending moment Factored min. kN.m/m	Shear force Calculated max. kN/m	Shear force Calculated max. elev.	Shear force Calculated min. kN/m	Shear force Calculated min. elev.	Shear force Factored max. kN/m	Shear force Factored min. kN/m
1	7	43.20	0	45.60	9	0	7	43.90	-4	42.00	10	-5
2	No calculation at this stage											
3	0	45.10	-22	43.20	0	-30	19	42.35	-20	45.10	26	-26
4	No calculation at this stage											
5	No calculation at this stage											
6	0	45.50	-23	43.20	0	-30	22	42.35	-17	45.50	30	-23
7	0	45.50	-20	43.50	0	-27	23	42.35	-15	45.50	31	-20
8	0	45.50	-19	43.50	0	-26	26	42.35	-15	45.50	35	-20

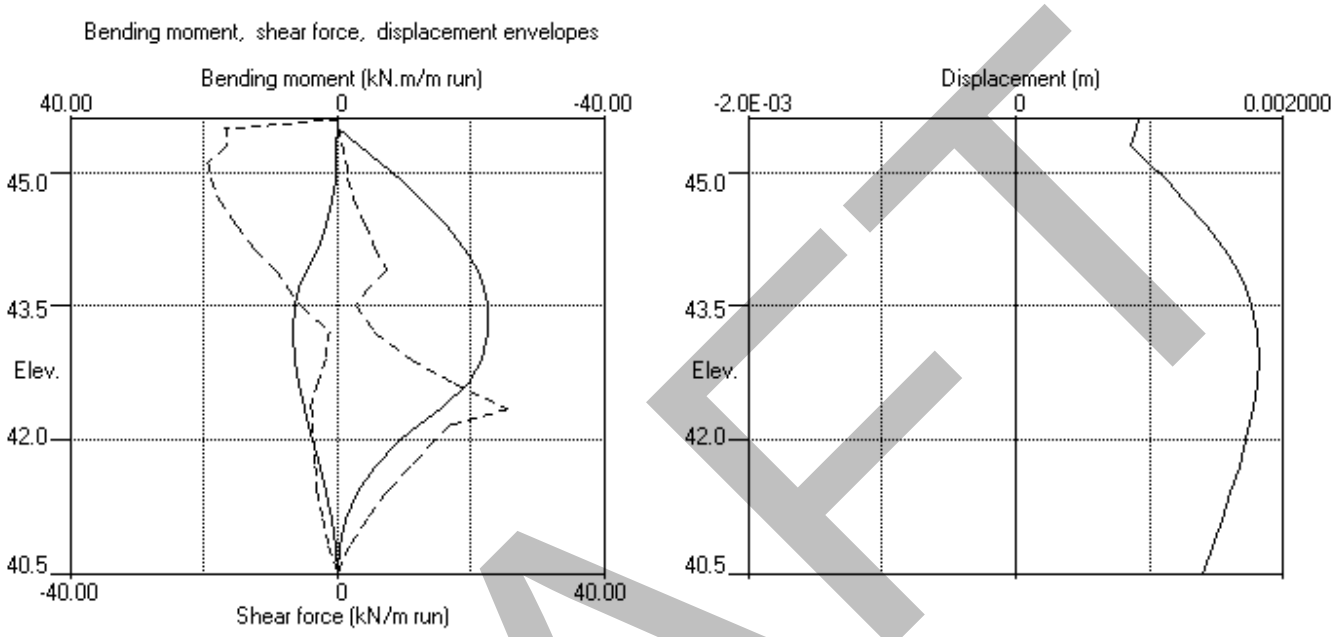
Summary of results (continued)

Maximum and minimum displacement at each stage

Stage no.	Displacement maximum m	elev.	minimum m	elev.	Stage description
1	0.001	45.60	0.000	45.60	Excav. to elev. 45.10 on RIGHT side
2	No calculation at this stage				Install strut no.1 at elev. 45.10
3	0.002	42.63	0.000	45.60	Excav. to elev. 42.35 on RIGHT side
4	No calculation at this stage				Install strut no.3 at elev. 42.35
5	No calculation at this stage				Install strut no.2 at elev. 45.50
6	0.002	42.90	0.000	45.60	Remove strut no.1 at elev. 45.10
7	0.002	42.90	0.000	45.60	Change EI of wall to 46900kN.m2/m run
8	0.002	42.90	0.000	45.60	Change soil type 2 to soil type 3

Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev. 45.10 --Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	Strut no. 2 at elev. 45.50 --Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	Strut no. 3 at elev. 42.35 --Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
3	21	103	139	---	---	---	---	---	---
6	---	---	---	17	17	23	4	4	6
7	---	---	---	15	15	21	9	9	13
8	---	---	---	15	15	20	30	30	40


Bending moment, shear force, displacement envelopes
Bending moment (kN.m/m run)
40.00
0
-40.00
45.0
43.5
Elev.
42.0
40.5
-40.00
0
40.00
Shear force (kN/m run)
Displacement (m)
-2.0E-03
0
0.002000
45.0
43.5
Elev.
42.0
40.5

Oasys Xdisp

Notes

Propped contiguous piled wall. Larger area modelled to avoid re-entrant corners

Problem Type

Problem Type : Tunnelling and Embedded Wall Excavations

Displacement Data

Type	Name	Direction of extrusion	Point/Line/Line for extrusion						No. of intervals across extrusion/line	Extrusion depth	No. of intervals along extrusion	Calculate Surface type for tunnels	Surface type for tunnels
			First point			Second point							
			X [m]	Y [m]	Z(level) [m]	X [m]	Y [m]	Z(level) [m]		[m]			
Line	103 GL1	-	0.00000	0.00000	45.10000	0.00000	8.00000	45.10000	10	-	-	Yes	Surface
Line	103 GL2	-	-4.50000	0.00000	45.10000	-4.50000	8.00000	45.10000	10	-	-	Yes	Surface
Line	103 GL3	-	-9.00000	0.00000	45.10000	-9.00000	8.00000	45.10000	10	-	-	Yes	Surface
Line	103 GL4	-	0.00000	4.00000	45.10000	-9.00000	4.00000	45.10000	10	-	-	Yes	Surface
Line	Mews GL5	-	26.00000	-6.00000	45.10000	26.00000	-12.00000	45.10000	10	-	-	Yes	Surface
Line	Mews GL6	-	13.00000	-6.00000	45.10000	13.00000	-12.00000	45.10000	10	-	-	Yes	Surface

Vertical Ground Movement Curves

Curve Name: **Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.040][2.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -2.0E-2x + 4.0E-2
Coeff. of Determination: 1.0

Curve Name: **Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b)**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.039][0.100,0.000,0.049][0.200,0.000,0.056][0.300,0.000,0.062]
[0.400,0.000,0.067][0.500,0.000,0.070][0.600,0.000,0.072][0.700,0.000,0.073]
[0.800,0.000,0.073][0.900,0.000,0.072][1.000,0.000,0.070][1.100,0.000,0.068]
[1.200,0.000,0.065][1.300,0.000,0.061][1.400,0.000,0.058][1.500,0.000,0.054]
[1.600,0.000,0.050][1.700,0.000,0.046][1.800,0.000,0.042][1.900,0.000,0.038]
[2.000,0.000,0.034][2.100,0.000,0.030][2.200,0.000,0.027][2.300,0.000,0.023]
[2.400,0.000,0.020][2.500,0.000,0.017][2.600,0.000,0.014][2.700,0.000,0.012]
[2.800,0.000,0.010][2.900,0.000,0.008][3.000,0.000,0.007][3.100,0.000,0.005]
[3.200,0.000,0.004][3.300,0.000,0.004][3.400,0.000,0.003][3.500,0.000,0.002]
[3.600,0.000,0.002][3.700,0.000,0.002][3.800,0.000,0.001][3.900,0.000,0.001]
[4.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 4
y Order: 0
Polynomial: z = $-2.6455E-3x^4 + 2.8495E-2x^3 - 1.0051E-1x^2 + 1.0569E-1x + 3.8990E-2$
Coeff. of Determination: 9.9991E-1

Horizontal Ground Movement Curves

Curve Name: **Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.041][0.050,0.000,0.039][0.100,0.000,0.036][0.150,0.000,0.034]
[0.200,0.000,0.032][0.250,0.000,0.030][0.300,0.000,0.029][0.350,0.000,0.027]
[0.400,0.000,0.025][0.450,0.000,0.023][0.500,0.000,0.022][0.550,0.000,0.020]
[0.600,0.000,0.019][0.650,0.000,0.018][0.700,0.000,0.016][0.750,0.000,0.015]
[0.800,0.000,0.014][0.850,0.000,0.013][0.900,0.000,0.012][0.950,0.000,0.010]
[1.000,0.000,0.009][1.050,0.000,0.008][1.100,0.000,0.007][1.150,0.000,0.006]
[1.200,0.000,0.005][1.250,0.000,0.004][1.300,0.000,0.004][1.350,0.000,0.003]
[1.400,0.000,0.002][1.450,0.000,0.001][1.500,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 3
y Order: 0
Polynomial: z = $-4.2486E-3x^3 + 1.9096E-2x^2 - 4.6221E-2x + 4.0729E-2$
Coeff. of Determination: 1.0000

Curve Name: **Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(a))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.150][4.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -3.75E-2x + 1.50E-1
Coeff. of Determination: 1.00

Polygonal Excavations

Excavation Name:	Excavation
Surface level [m]:	45.600
Contribution:	Positive
Enabled:	Yes
Surface movement curves which are selected are applied between surface and [m]:	45.100

Corner	x [m]	y [m]	Base Level [m]	Stiffened	Previous Side d [m]	Previous Side p1 [%]	Previous Side p2* [%]	Next Side d [m]	Next Side p1 [%]	Next Side p2* [%]
1	1.2000	0.0	42.350	Yes	0.0	67.000	25.000	0.0	67.000	25.000
2	1.2000	11.000	42.350	Yes	0.0	67.000	25.000	0.0	67.000	25.000
3	27.500	11.000	42.350	Yes	0.0	67.000	25.000	0.0	67.000	25.000
4	27.500	0.0	42.350	Yes	0.0	67.000	25.000	0.0	67.000	25.000

Side	Corner 1 x [m]	Corner 1 y [m]	Corner 2 x [m]	Corner 2 y [m]	Ground Movement Curve: Vertical	Ground Movement Curve: Horizontal
1	1.2000	0.0	1.2000	11.000	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b)	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(a))
2	1.2000	11.000	27.500	11.000	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b)	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(a))

Side	Corner 1 x [m]	Corner 1 y [m]	Corner 2 x [m]	Corner 2 y [m]	Ground Movement Curve Vertical	Ground Movement Curve Horizontal
3	27.500	11.000	27.500	0.0	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b))	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(a))
4	27.500	0.0	1.2000	0.0	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b))	Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(a))

Excavation Name:	**Installation**
Surface level [m]:	45.600
Contribution:	Positive
Enabled:	Yes
Surface movement curves which are selected are applied between surface and [m]:	45.100

Corner	x [m]	y [m]	Base Level [m]	Stiffened	Previous Side d [m]	Previous Side p1 [%]	Previous Side p2* [%]	Next Side d [m]	Next Side p1 [%]	Next Side p2* [%]
1	1.2000	0.0	40.500	Yes	0.0	67.000	25.000	0.0	67.000	25.000
2	1.2000	11.000	40.500	Yes	0.0	67.000	25.000	0.0	67.000	25.000
3	27.500	11.000	40.500	Yes	0.0	67.000	25.000	0.0	67.000	25.000
4	27.500	0.0	40.500	Yes	0.0	67.000	25.000	0.0	67.000	25.000

Side	Corner 1 x [m]	Corner 1 y [m]	Corner 2 x [m]	Corner 2 y [m]	Ground Movement Curve Vertical	Ground Movement Curve Horizontal
1	1.2000	0.0	1.2000	11.000	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b))	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a))
2	1.2000	11.000	27.500	11.000	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b))	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a))
3	27.500	11.000	27.500	0.0	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b))	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a))
4	27.500	0.0	1.2000	0.0	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b))	Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a))

Damage Category Strains

Name	0 (Negligible) to 1 (Very Slight)	1 (Very Slight) to 2 (Slight)	2 (Slight) to 3 (Moderate)	3 (Moderate) to 4 (Severe)
Burland Strain Limits	0.0	500.00E-6	750.00E-6	0.0015000

Specific Structures - Geometry

Structure Name	Sub-Structure Name	Displacement Line	Start Distance Along Line [m]	End Distance Along Line [m]	Vertical Offsets from Line for Vertical Movement Calculations [m]	Vertical Displacement Limit Sensitivity [mm]	Damage Category Strains	Poisson's Ratio	E/G
103	GL1	103 GL1	0.00000	8.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
103	GL2	103 GL2	0.00000	8.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
103	GL3	103 GL3	0.00000	8.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
103	GL4	103 GL4	0.00000	9.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
Mews	GL5	Mews GL5	0.00000	6.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
Mews	GL6	Mews GL6	0.00000	6.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000

Specific Structures - Bending Parameters

Structure Name	Sub-Structure Name	Height [m]	Default Properties	Hogging 2nd Moment of Area (per unit width) [m³]	Hogging Distance of Bending Strain from N.A. [m]	Hogging Distance of N.A. from Edge of Beam in Tension [m]	Sagging 2nd Moment of Area (per unit width) [m³]	Sagging Distance of Bending Strain from N.A. [m]	Sagging Distance of N.A. from Edge of Beam in Tension [m]
103	GL1	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000
103	GL2	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000
103	GL3	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000
103	GL4	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000
Mews	GL5	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000
Mews	GL6	6.0000	Yes	72.000	6.0000	6.0000	18.000	3.0000	3.0000

Building Segment Combinations

Structure Name	Sub-Structure Name	Vertical Offset from Line for Vertical Movement Calculations [m]	Segment Start [m]	Length [m]	Curvature	Combined Segment

No structures have segments combined.

Utility Strain Calculation Options

Neglect beneficial contribution of axial strains : No

Warnings

1 Multiple excavations have been specified. The displacements resulting from these excavations are calculated by summing the displacements resulting from each individual excavation. No account has been taken of the interactions between excavations (e.g. overlapping zones of influence or 'shielding' of one excavation by another).

Errors

None

Displacement and Strain Results

Type/No. Name	Dist. [m]	Coordinates x [m]	y [m]	z [m]	Displacements x [mm]	y [mm]	z [mm]	Horizontal displacement along Line [mm]	Horizontal displacement perpendicular to Line [mm]	Angle of Line to x Axis [°]
103 GL1	Line 1	0.00000	0.00000	45.10000	4.0191	0.0	2.6366	0.0	-4.0191	90.000
	0.80000	0.00000	0.80000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	1.6000	0.00000	1.60000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	2.4000	0.00000	2.40000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	3.2000	0.00000	3.20000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000

Type/No.		Coordinates			Displacements					Angle of Line
Name	Dist.	x	y	z	x	y	z	Horizontal displacement	Horizontal displacement	to x Axis
	4.0000	0.00000	4.00000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	4.8000	0.00000	4.80000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	5.6000	0.00000	5.60000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	6.4000	0.00000	6.40000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	7.2000	0.00000	7.20000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
	8.0000	0.00000	8.00000	45.10000	5.9986	0.0	3.9352	0.0	-5.9986	90.000
103 GL2	Line 2	-4.50000	0.00000	45.10000	2.0730	0.0	1.5588	0.0	-2.0730	90.000
	0.80000	-4.50000	0.80000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	1.6000	-4.50000	1.60000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	2.4000	-4.50000	2.40000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	3.2000	-4.50000	3.20000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	4.0000	-4.50000	4.00000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	4.8000	-4.50000	4.80000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	5.6000	-4.50000	5.60000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	6.4000	-4.50000	6.40000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	7.2000	-4.50000	7.20000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
	8.0000	-4.50000	8.00000	45.10000	3.0941	0.0	2.3266	0.0	-3.0941	90.000
103 GL3	Line 3	-9.00000	0.00000	45.10000	0.70350	0.0	0.10740	0.0	-0.70350	90.000
	0.80000	-9.00000	0.80000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	1.6000	-9.00000	1.60000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	2.4000	-9.00000	2.40000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	3.2000	-9.00000	3.20000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	4.0000	-9.00000	4.00000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	4.8000	-9.00000	4.80000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	5.6000	-9.00000	5.60000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	6.4000	-9.00000	6.40000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	7.2000	-9.00000	7.20000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
	8.0000	-9.00000	8.00000	45.10000	1.0500	0.0	0.16030	0.0	-1.0500	90.000
103 GL4	Line 4	0.00000	4.00000	45.10000	5.9986	0.0	3.9352	-5.9986	0.0	180.00
	0.90000	-0.90000	4.00000	45.10000	5.3440	0.0	3.9778	-5.3440	0.0	180.00
	1.8000	-1.80000	4.00000	45.10000	4.7334	0.0	3.7607	-4.7334	0.0	180.00
	2.7000	-2.70000	4.00000	45.10000	4.1597	0.0	3.3675	-4.1597	0.0	180.00
	3.6000	-3.60000	4.00000	45.10000	3.6156	0.0	2.8697	-3.6156	0.0	180.00
	4.5000	-4.50000	4.00000	45.10000	3.0941	0.0	2.3266	-3.0941	0.0	180.00
	5.4000	-5.40000	4.00000	45.10000	2.5880	0.0	1.7855	-2.5880	0.0	180.00
	6.3000	-6.30000	4.00000	45.10000	2.0901	0.0	1.2815	-2.0901	0.0	180.00
	7.2000	-7.20000	4.00000	45.10000	1.7250	0.0	0.83742	-1.7250	0.0	180.00
	8.1000	-8.10000	4.00000	45.10000	1.3875	0.0	0.46413	-1.3875	0.0	180.00
	9.0000	-9.00000	4.00000	45.10000	1.0500	0.0	0.16030	-1.0500	0.0	180.00
Mews GL5	Line 5	26.00000	-6.00000	45.10000	0.0	2.9240	2.1441	-2.9240	0.0	270.00
	0.60000	26.00000	-6.60000	45.10000	0.0	2.5880	1.7855	-2.5880	0.0	270.00
	1.2000	26.00000	-7.20000	45.10000	0.0	2.2556	1.4437	-2.2556	0.0	270.00
	1.8000	26.00000	-7.80000	45.10000	0.0	1.9500	1.1260	-1.9500	0.0	270.00
	2.4000	26.00000	-8.40000	45.10000	0.0	1.7250	0.83742	-1.7250	0.0	270.00
	3.0000	26.00000	-9.00000	45.10000	0.0	1.5000	0.58053	-1.5000	0.0	270.00
	3.6000	26.00000	-9.60000	45.10000	0.0	1.2750	0.35555	-1.2750	0.0	270.00
	4.2000	26.00000	-10.20000	45.10000	0.0	1.0500	0.16030	-1.0500	0.0	270.00
	4.8000	26.00000	-10.80000	45.10000	0.0	0.82500	0.11019	-0.82500	0.0	270.00
	5.4000	26.00000	-11.40000	45.10000	0.0	0.60000	0.078226	-0.60000	0.0	270.00
	6.0000	26.00000	-12.00000	45.10000	0.0	0.37500	0.055034	-0.37500	0.0	270.00
Mews GL6	Line 6	13.00000	-6.00000	45.10000	0.0	2.9240	2.1441	-2.9240	0.0	270.00
	0.60000	13.00000	-6.60000	45.10000	0.0	2.5880	1.7855	-2.5880	0.0	270.00
	1.2000	13.00000	-7.20000	45.10000	0.0	2.2556	1.4437	-2.2556	0.0	270.00
	1.8000	13.00000	-7.80000	45.10000	0.0	1.9500	1.1260	-1.9500	0.0	270.00
	2.4000	13.00000	-8.40000	45.10000	0.0	1.7250	0.83742	-1.7250	0.0	270.00
	3.0000	13.00000	-9.00000	45.10000	0.0	1.5000	0.58053	-1.5000	0.0	270.00
	3.6000	13.00000	-9.60000	45.10000	0.0	1.2750	0.35555	-1.2750	0.0	270.00
	4.2000	13.00000	-10.20000	45.10000	0.0	1.0500	0.16030	-1.0500	0.0	270.00
	4.8000	13.00000	-10.80000	45.10000	0.0	0.82500	0.11019	-0.82500	0.0	270.00
	5.4000	13.00000	-11.40000	45.10000	0.0	0.60000	0.078226	-0.60000	0.0	270.00
	6.0000	13.00000	-12.00000	45.10000	0.0	0.37500	0.055034	-0.37500	0.0	270.00

Specific Building Damage Results - Horizontal Displacements

Structure: 103 | Sub-structure: GL1

Dist.	Coordinates					Displacements	
	x	y	z	x	y	Horizontal displacement along the Line	Horizontal displacement perpendicular to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	0.00000	0.00000	45.10000	4.0191	0.0	0.0	-4.0191
0.80000	0.00000	0.80000	45.10000	5.9986	0.0	0.0	-5.9986
1.6000	0.00000	1.60000	45.10000	5.9986	0.0	0.0	-5.9986
2.4000	0.00000	2.40000	45.10000	5.9986	0.0	0.0	-5.9986
3.2000	0.00000	3.20000	45.10000	5.9986	0.0	0.0	-5.9986
4.0000	0.00000	4.00000	45.10000	5.9986	0.0	0.0	-5.9986
4.8000	0.00000	4.80000	45.10000	5.9986	0.0	0.0	-5.9986
5.6000	0.00000	5.60000	45.10000	5.9986	0.0	0.0	-5.9986
6.4000	0.00000	6.40000	45.10000	5.9986	0.0	0.0	-5.9986
7.2000	0.00000	7.20000	45.10000	5.9986	0.0	0.0	-5.9986
8.0000	0.00000	8.00000	45.10000	5.9986	0.0	0.0	-5.9986

Structure: 103 | Sub-structure: GL2

Dist.	Coordinates					Displacements	
	x	y	z	x	y	Horizontal displacement along the Line	Horizontal displacement perpendicular to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	-4.50000	0.00000	45.10000	2.0730	0.0	0.0	-2.0730
0.80000	-4.50000	0.80000	45.10000	3.0941	0.0	0.0	-3.0941
1.6000	-4.50000	1.60000	45.10000	3.0941	0.0	0.0	-3.0941
2.4000	-4.50000	2.40000	45.10000	3.0941	0.0	0.0	-3.0941
3.2000	-4.50000	3.20000	45.10000	3.0941	0.0	0.0	-3.0941
4.0000	-4.50000	4.00000	45.10000	3.0941	0.0	0.0	-3.0941
4.8000	-4.50000	4.80000	45.10000	3.0941	0.0	0.0	-3.0941
5.6000	-4.50000	5.60000	45.10000	3.0941	0.0	0.0	-3.0941
6.4000	-4.50000	6.40000	45.10000	3.0941	0.0	0.0	-3.0941
7.2000	-4.50000	7.20000	45.10000	3.0941	0.0	0.0	-3.0941
8.0000	-4.50000	8.00000	45.10000	3.0941	0.0	0.0	-3.0941

Structure: 103 | Sub-structure: GL3

Dist.	Coordinates					Displacements	
	x	y	z	x	y	Horizontal displacement along the Line	Horizontal displacement perpendicular to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	-9.00000	0.00000	45.10000	0.70350	0.0	0.0	-0.70350
0.80000	-9.00000	0.80000	45.10000	1.0500	0.0	0.0	-1.0500
1.6000	-9.00000	1.60000	45.10000	1.0500	0.0	0.0	-1.0500
2.4000	-9.00000	2.40000	45.10000	1.0500	0.0	0.0	-1.0500
3.2000	-9.00000	3.20000	45.10000	1.0500	0.0	0.0	-1.0500
4.0000	-9.00000	4.00000	45.10000	1.0500	0.0	0.0	-1.0500
4.8000	-9.00000	4.80000	45.10000	1.0500	0.0	0.0	-1.0500
5.6000	-9.00000	5.60000	45.10000	1.0500	0.0	0.0	-1.0500
6.4000	-9.00000	6.40000	45.10000	1.0500	0.0	0.0	-1.0500
7.2000	-9.00000	7.20000	45.10000	1.0500	0.0	0.0	-1.0500
8.0000	-9.00000	8.00000	45.10000	1.0500	0.0	0.0	-1.0500

Structure: 103 | Sub-structure: GL4

Dist.	Coordinates			Displacements

x [m]	y [m]	z [m]	x [mm]	y [mm]	Horizontal displacement along the Line [mm]	Horizontal displacement perpendicular to Line [mm]
0.0	0.00000	4.00000	45.10000	5.9986	0.0	-5.9986	0.0
0.90000	-0.90000	4.00000	45.10000	5.3440	0.0	-5.3440	0.0
1.8000	-1.80000	4.00000	45.10000	4.7334	0.0	-4.7334	0.0
2.7000	-2.70000	4.00000	45.10000	4.1597	0.0	-4.1597	0.0
3.6000	-3.60000	4.00000	45.10000	3.6156	0.0	-3.6156	0.0
4.5000	-4.50000	4.00000	45.10000	3.0941	0.0	-3.0941	0.0
5.4000	-5.40000	4.00000	45.10000	2.5880	0.0	-2.5880	0.0
6.3000	-6.30000	4.00000	45.10000	2.0901	0.0	-2.0901	0.0
7.2000	-7.20000	4.00000	45.10000	1.7250	0.0	-1.7250	0.0
8.1000	-8.10000	4.00000	45.10000	1.3875	0.0	-1.3875	0.0
9.0000	-9.00000	4.00000	45.10000	1.0500	0.0	-1.0500	0.0

Structure: Mews | Sub-structure: GL5

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements x [mm]	y [mm]	Horizontal displacement along the Line [mm]	Horizontal displacement perpendicular to Line [mm]
0.0	26.00000	-6.00000	45.10000	0.0	2.9240	-2.9240	0.0
0.60000	26.00000	-6.60000	45.10000	0.0	2.5880	-2.5880	0.0
1.2000	26.00000	-7.20000	45.10000	0.0	2.2556	-2.2556	0.0
1.8000	26.00000	-7.80000	45.10000	0.0	1.9500	-1.9500	0.0
2.4000	26.00000	-8.40000	45.10000	0.0	1.7250	-1.7250	0.0
3.0000	26.00000	-9.00000	45.10000	0.0	1.5000	-1.5000	0.0
3.6000	26.00000	-9.60000	45.10000	0.0	1.2750	-1.2750	0.0
4.2000	26.00000	-10.20000	45.10000	0.0	1.0500	-1.0500	0.0
4.8000	26.00000	-10.80000	45.10000	0.0	0.82500	-0.82500	0.0
5.4000	26.00000	-11.40000	45.10000	0.0	0.60000	-0.60000	0.0
6.0000	26.00000	-12.00000	45.10000	0.0	0.37500	-0.37500	0.0

Structure: Mews | Sub-structure: GL6

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements x [mm]	y [mm]	Horizontal displacement along the Line [mm]	Horizontal displacement perpendicular to Line [mm]
0.0	13.00000	-6.00000	45.10000	0.0	2.9240	-2.9240	0.0
0.60000	13.00000	-6.60000	45.10000	0.0	2.5880	-2.5880	0.0
1.2000	13.00000	-7.20000	45.10000	0.0	2.2556	-2.2556	0.0
1.8000	13.00000	-7.80000	45.10000	0.0	1.9500	-1.9500	0.0
2.4000	13.00000	-8.40000	45.10000	0.0	1.7250	-1.7250	0.0
3.0000	13.00000	-9.00000	45.10000	0.0	1.5000	-1.5000	0.0
3.6000	13.00000	-9.60000	45.10000	0.0	1.2750	-1.2750	0.0
4.2000	13.00000	-10.20000	45.10000	0.0	1.0500	-1.0500	0.0
4.8000	13.00000	-10.80000	45.10000	0.0	0.82500	-0.82500	0.0
5.4000	13.00000	-11.40000	45.10000	0.0	0.60000	-0.60000	0.0
6.0000	13.00000	-12.00000	45.10000	0.0	0.37500	-0.37500	0.0

Specific Building Damage Results - Vertical Displacements

Structure: 103 | Sub-structure: GL1

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements z [mm]
Vertical Offset 1				
0.0	0.00000	0.00000	45.10000	2.6366
0.80000	0.00000	0.80000	45.10000	3.9352
1.6000	0.00000	1.60000	45.10000	3.9352
2.4000	0.00000	2.40000	45.10000	3.9352
3.2000	0.00000	3.20000	45.10000	3.9352
4.0000	0.00000	4.00000	45.10000	3.9352
4.8000	0.00000	4.80000	45.10000	3.9352
5.6000	0.00000	5.60000	45.10000	3.9352
6.4000	0.00000	6.40000	45.10000	3.9352
7.2000	0.00000	7.20000	45.10000	3.9352
8.0000	0.00000	8.00000	45.10000	3.9352

Structure: 103 | Sub-structure: GL2

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements z [mm]
Vertical Offset 1				
0.0	-4.50000	0.00000	45.10000	1.5588
0.80000	-4.50000	0.80000	45.10000	2.3266
1.6000	-4.50000	1.60000	45.10000	2.3266
2.4000	-4.50000	2.40000	45.10000	2.3266
3.2000	-4.50000	3.20000	45.10000	2.3266
4.0000	-4.50000	4.00000	45.10000	2.3266
4.8000	-4.50000	4.80000	45.10000	2.3266
5.6000	-4.50000	5.60000	45.10000	2.3266
6.4000	-4.50000	6.40000	45.10000	2.3266
7.2000	-4.50000	7.20000	45.10000	2.3266
8.0000	-4.50000	8.00000	45.10000	2.3266

Structure: 103 | Sub-structure: GL3

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements z [mm]
Vertical Offset 1				
0.0	-9.00000	0.00000	45.10000	0.10740
0.80000	-9.00000	0.80000	45.10000	0.16030
1.6000	-9.00000	1.60000	45.10000	0.16030
2.4000	-9.00000	2.40000	45.10000	0.16030
3.2000	-9.00000	3.20000	45.10000	0.16030
4.0000	-9.00000	4.00000	45.10000	0.16030
4.8000	-9.00000	4.80000	45.10000	0.16030
5.6000	-9.00000	5.60000	45.10000	0.16030
6.4000	-9.00000	6.40000	45.10000	0.16030
7.2000	-9.00000	7.20000	45.10000	0.16030
8.0000	-9.00000	8.00000	45.10000	0.16030

Structure: 103 | Sub-structure: GL4

Dist.	Coordinates x [m]	y [m]	z [m]	Displacements z [mm]
Vertical Offset 1				
0.0	0.00000	4.00000	45.10000	3.9352
0.90000	-0.90000	4.00000	45.10000	3.9778
1.8000	-1.80000	4.00000	45.10000	3.7607

Dist.	Coordinates x	y	z	Displacements z
[m]	[m]	[m]	[m]	[mm]
2.7000	-2.70000	4.00000	45.10000	3.3675
3.6000	-3.60000	4.00000	45.10000	2.8697
4.5000	-4.50000	4.00000	45.10000	2.3266
5.4000	-5.40000	4.00000	45.10000	1.7855
6.3000	-6.30000	4.00000	45.10000	1.2815
7.2000	-7.20000	4.00000	45.10000	0.83742
8.1000	-8.10000	4.00000	45.10000	0.46413
9.0000	-9.00000	4.00000	45.10000	0.16030

Structure: Mews | Sub-structure: GL5

Dist.	Coordinates x	y	z	Displacements z
[m]	[m]	[m]	[m]	[mm]
Vertical Offset 1				
0.0	26.00000	-6.00000	45.10000	2.1441
0.60000	26.00000	-6.60000	45.10000	1.7855
1.2000	26.00000	-7.20000	45.10000	1.4437
1.8000	26.00000	-7.80000	45.10000	1.1260
2.4000	26.00000	-8.40000	45.10000	0.83742
3.0000	26.00000	-9.00000	45.10000	0.58053
3.6000	26.00000	-9.60000	45.10000	0.35555
4.2000	26.00000	-10.20000	45.10000	0.16030
4.8000	26.00000	-10.80000	45.10000	0.11019
5.4000	26.00000	-11.40000	45.10000	0.078226
6.0000	26.00000	-12.00000	45.10000	0.055034

Structure: Mews | Sub-structure: GL6

Dist.	Coordinates x	y	z	Displacements z
[m]	[m]	[m]	[m]	[mm]
Vertical Offset 1				
0.0	13.00000	-6.00000	45.10000	2.1441
0.60000	13.00000	-6.60000	45.10000	1.7855
1.2000	13.00000	-7.20000	45.10000	1.4437
1.8000	13.00000	-7.80000	45.10000	1.1260
2.4000	13.00000	-8.40000	45.10000	0.83742
3.0000	13.00000	-9.00000	45.10000	0.58053
3.6000	13.00000	-9.60000	45.10000	0.35555
4.2000	13.00000	-10.20000	45.10000	0.16030
4.8000	13.00000	-10.80000	45.10000	0.11019
5.4000	13.00000	-11.40000	45.10000	0.078226
6.0000	13.00000	-12.00000	45.10000	0.055034

Specific Building Damage Results - All Segments

Structure: 103 | Sub-structure: GL1

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	2.4000	Sagging	0.036073	0.0	0.034651	0.0	-0.0016233	394.27	0 (Negligible)
	2	2.4000	5.6000	None	0.0	0.0	0.0	0.0	0.0	-	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Structure: 103 | Sub-structure: GL2

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	2.4000	Sagging	0.021327	0.0	0.020487	0.0	-959.74E-6	666.85	0 (Negligible)
	2	2.4000	5.6000	None	0.0	0.0	0.0	0.0	0.0	-	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Structure: 103 | Sub-structure: GL3

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	2.4000	Sagging	0.0014694	0.0	0.0014115	0.0	-66.125E-6	9678.6	0 (Negligible)
	2	2.4000	0.0	None	0.0	0.0	0.0	0.0	0.0	-	0 (Negligible)
	3	2.4000	1.6000	Sagging	0.0	0.0	0.0	0.0	0.0	47.706E+18	0 (Negligible)
	4	4.0000	0.0	None	0.0	0.0	0.0	0.0	0.0	-	0 (Negligible)
	5	4.0000	1.6000	None	0.0	0.0	0.0	0.0	0.0	95.411E+18	0 (Negligible)
	6	5.6000	2.4000	None	0.0	0.0	0.0	0.0	0.0	-	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Structure: 103 | Sub-structure: GL4

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	4.5278	Sagging	0.010367	0.064494	0.074996	-726.79E-6	603.03E-6	2890.7	1 (Very Slight)
	2	4.5278	4.4722	Hogging	0.0041999	0.045357	0.047682	-562.02E-6	600.87E-6	11617.	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Structure: Mews | Sub-structure: GL5

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	4.8000	Hogging	0.0060833	0.043730	0.047326	-559.76E-6	597.21E-6	4318.8	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Vertical Offset from Line for Vertical Movement	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
Calculations											
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	4.8000	Hogging	0.0060833	0.043730	0.047326	-559.76E-6	597.21E-6	4318.8	0 (Negligible)

Structure: Mews | Sub-structure: GL6

Vertical Offset from Line for Vertical Movement Calculations	Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0.0	1	0.0	4.8000	Hogging	0.0060833	0.043730	0.047326	-559.76E-6	597.21E-6	4318.8	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Specific Building Damage Results - Critical Values for All Segments within Each Sub-Structure

Structure: 103 | Sub-structure: GL1

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.036073	0.0	-0.0016233	3.9352	0.034651	0.0	-0.0016233	-	394.27	0 (Negligible)

Structure: 103 | Sub-structure: GL2

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.021327	0.0	-959.74E-6	2.3266	0.020487	0.0	-959.74E-6	-	666.85	0 (Negligible)

Structure: 103 | Sub-structure: GL3

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.0014694	0.0	-66.125E-6	0.16030	0.0014115	0.0	-66.125E-6	-	9678.6	0 (Negligible)

Structure: 103 | Sub-structure: GL4

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.010367	0.064494	603.03E-6	3.9763	0.074996	-726.79E-6	603.03E-6	11617.	2890.7	1 (Very Slight)

Structure: Mews | Sub-structure: GL5

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.0060833	0.043730	597.21E-6	2.1441	0.047326	-559.76E-6	597.21E-6	4318.8	-	0 (Negligible)

Structure: Mews | Sub-structure: GL6

Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Max Slope	Max Settlement	Max Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
[m]	[%]	[%]		[mm]	[%]			[m]	[m]	
0.0	0.0060833	0.043730	597.21E-6	2.1441	0.047326	-559.76E-6	597.21E-6	4318.8	-	0 (Negligible)

Specific Building Damage Results - Critical Segments within Each Structure

Structure Name	Parameter	Critical Sub-Structure	Critical Segment	Start	End	Curvature	Max Slope	Max Settlement	Max Tensile Strain	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
				[m]	[m]			[mm]	[%]	[m]	[m]	
103	Max Slope	GL1	1	0.0	2.4000	Sagging	**0.0016233**	3.9352	0.034651	-	394.27	0 (Negligible)
	Max Settlement	GL4	1	0.0	4.5278	Sagging	603.03E-6	**3.9763**	0.074996	-	2890.7	1 (Very Slight)
	Max Tensile Strain	GL4	1	0.0	4.5278	Sagging	603.03E-6	3.9763	**0.074996**	-	2890.7	1 (Very Slight)
	Min Radius of Curvature (Hogging)	GL4	2	4.5278	9.0000	Hogging	600.87E-6	2.3099	0.047682	**11617.**	-	0 (Negligible)
	Min Radius of Curvature (Sagging)	GL1	1	0.0	2.4000	Sagging	0.0016233	3.9352	0.034651	-	**394.27**	0 (Negligible)
Mews	Max Slope	GL5	1	0.0	4.8000	Hogging	**597.21E-6**	2.1441	0.047326	4318.8	-	0 (Negligible)
	Max Settlement	GL5	1	0.0	4.8000	Hogging	597.21E-6	**2.1441**	0.047326	4318.8	-	0 (Negligible)
	Max Tensile Strain	GL5	1	0.0	4.8000	Hogging	597.21E-6	2.1441	**0.047326**	4318.8	-	0 (Negligible)
	Min Radius of Curvature (Hogging)	GL5	1	0.0	4.8000	Hogging	597.21E-6	2.1441	0.047326	**4318.8**	-	0 (Negligible)
	Min Radius of Curvature (Sagging)		-	-	-	-	-	-	-	-	-	-

Specific Building Damage Results - All Combined Segments

Structure: 103 | Sub-structure: GL1

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

Vertical Offset from Line for Vertical	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category

No structures have segments combined.

Structure: 103 | Sub-structure: GL2

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

No structures have segments combined.

Structure: 103 | Sub-structure: GL3

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

No structures have segments combined.

Structure: 103 | Sub-structure: GL4

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

No structures have segments combined.

Structure: Mews | Sub-structure: GL5

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

No structures have segments combined.

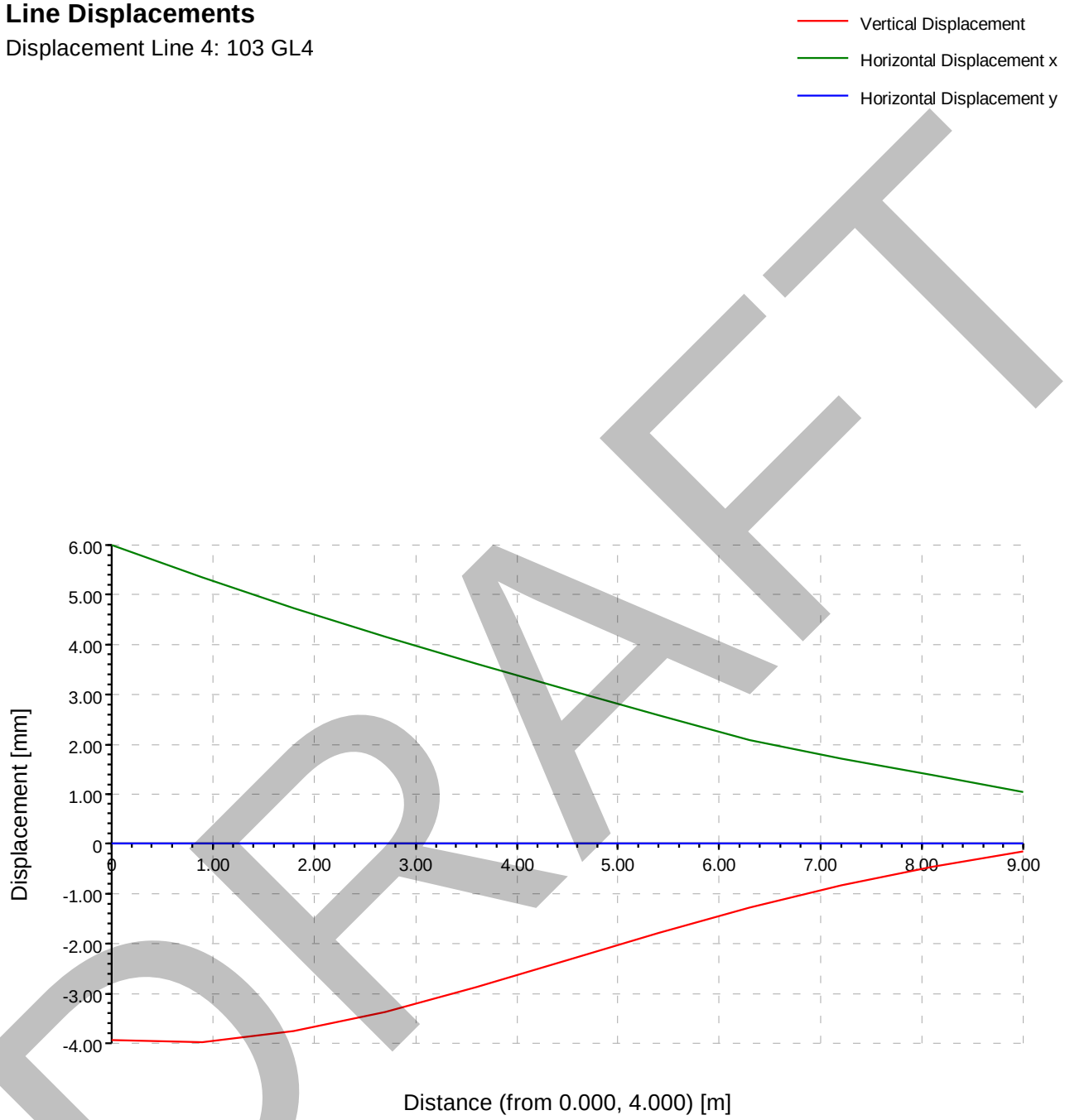
Structure: Mews | Sub-structure: GL6

Vertical Offset from Line for Vertical Movement Calculations	Combined Segment	Start	Length	Curvature	Deflection Ratio	Average Horizontal Strain	Max Tensile Strain	Damage Category
[m]		[m]	[m]		[%]	[%]	[%]	

No structures have segments combined.

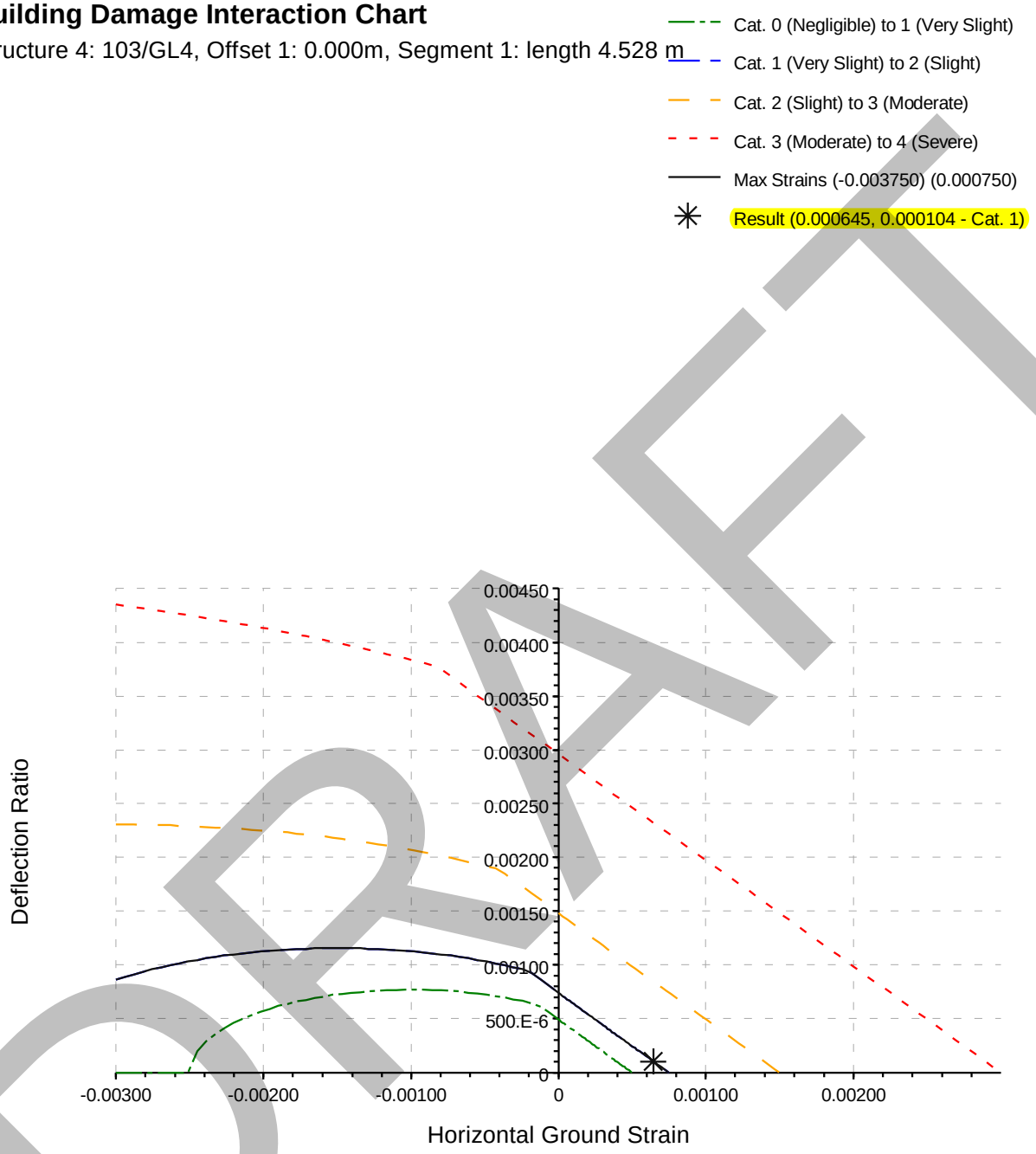
Line Displacements

Displacement Line 4: 103 GL4



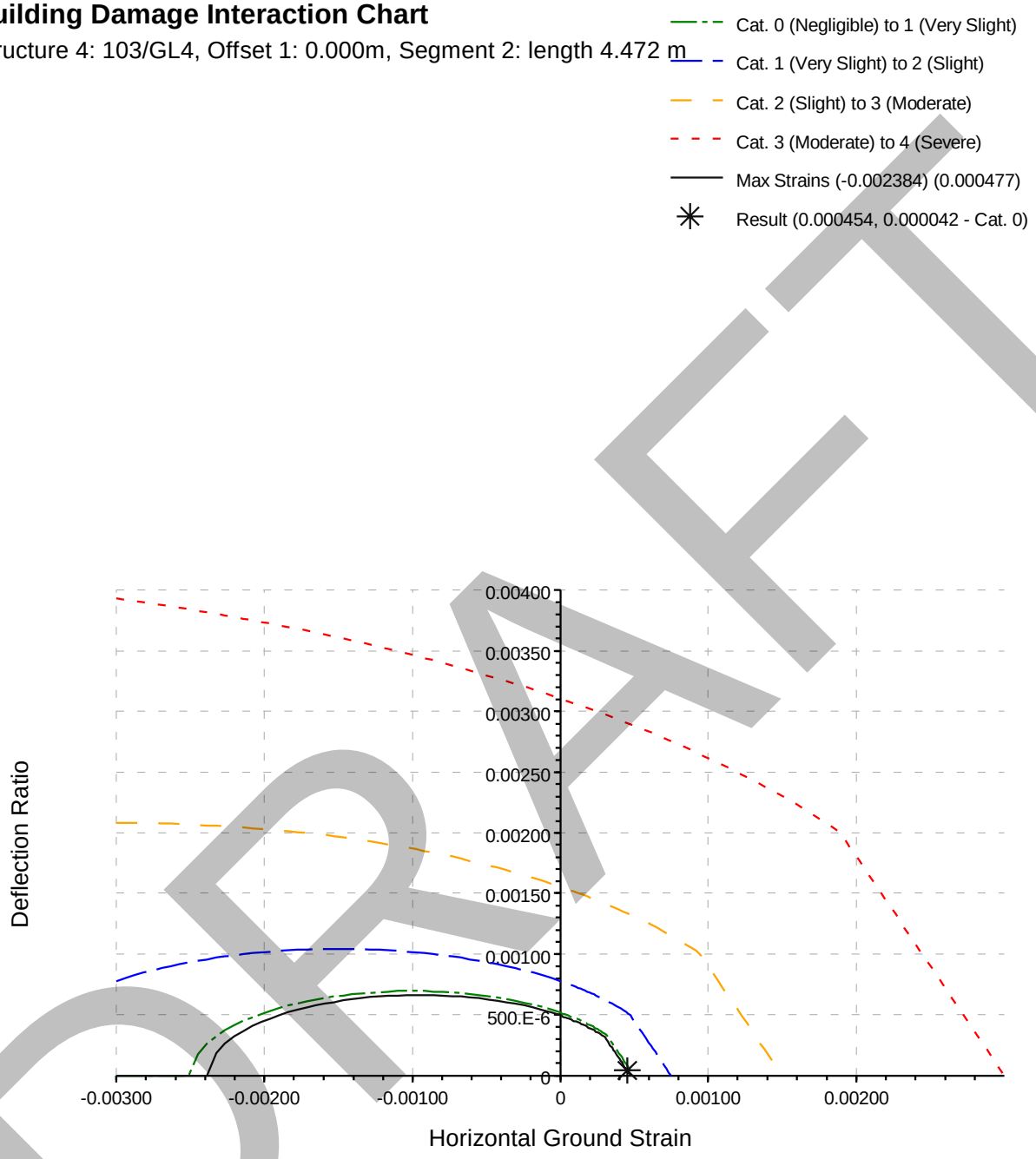
Building Damage Interaction Chart

Structure 4: 103/GL4, Offset 1: 0.000m, Segment 1: length 4.528 m



Building Damage Interaction Chart

Structure 4: 103/GL4, Offset 1: 0.000m, Segment 2: length 4.472 m



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