

APPENDIX E

CGL Interpretative Letter Report

22 June 2022

Aldo d'Aponte
62 St. Martin's Lane
London
WC2N 4JS

Our ref: CG28408B

Please reply to: Anna Prescott

Dear Aldo

Barrie House, 29 St Edmunds Terrace, London

The following letter report reviews the historical ground investigation undertaken at Barrie House by Soil Consultants in 2012¹ alongside the supplementary ground investigation completed by CGL in 2022², providing updated recommendations where applicable. This letter report presents the following:

- A review of the anticipated ground conditions based on published and unpublished sources;
- An interpretation of the ground conditions encountered on site;
- Permeability calculations following the completion of rising head tests;
- A review of the ground gas risk; and
- Basement foundation recommendations following a review of the hydrological conditions.

Site Context

The site, Barrie House, is located at 29 St Edmund's Terrace, London, NW8 7QH. The site is located within the London Borough of Camden. The approximate National Grid Reference for the site is 527495E, 183575N. A site location plan is included as Figure 1.

The site is bound to the south by St Edmund's Terrace and to the west by Broxwood Way. Two rows of terraced houses & apartment blocks are present to the north of the site, referred to as Nos. 32 to 72 Kingsland and Nos. 1 to 16 Kingsland. To the east of the site, buildings named Regent Heights and Nos. 30 to 36 St Edmund's Terrace are positioned. Adjacent to the north-east of the site lies Barrow Hill water treatment plant.

The site comprises a roughly square plot approximately 0.18 hectares in area and is currently occupied by Barrie House, an eight-storey detached residential block, understood to have been constructed in the 1950's. The existing structure is located approximately central within the site and includes a basement beneath the centre of the building.

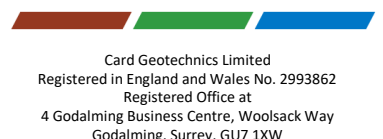
The proposed development is understood to comprise excavation of a single storey basement under the entire footprint of the existing building and an increase in the number of storeys of the existing building on site.

¹ Soil Consultants. (November 2012). *Ground Investigation Report. Barrie House, 29 St Edmund's Terrace, London NW8 7QH.* 9241/OT/JRCB.

² CGL. (June 2022). *Factual Report. Barrie House, 29 St Edmunds Terrace, London.* CG/28408B.



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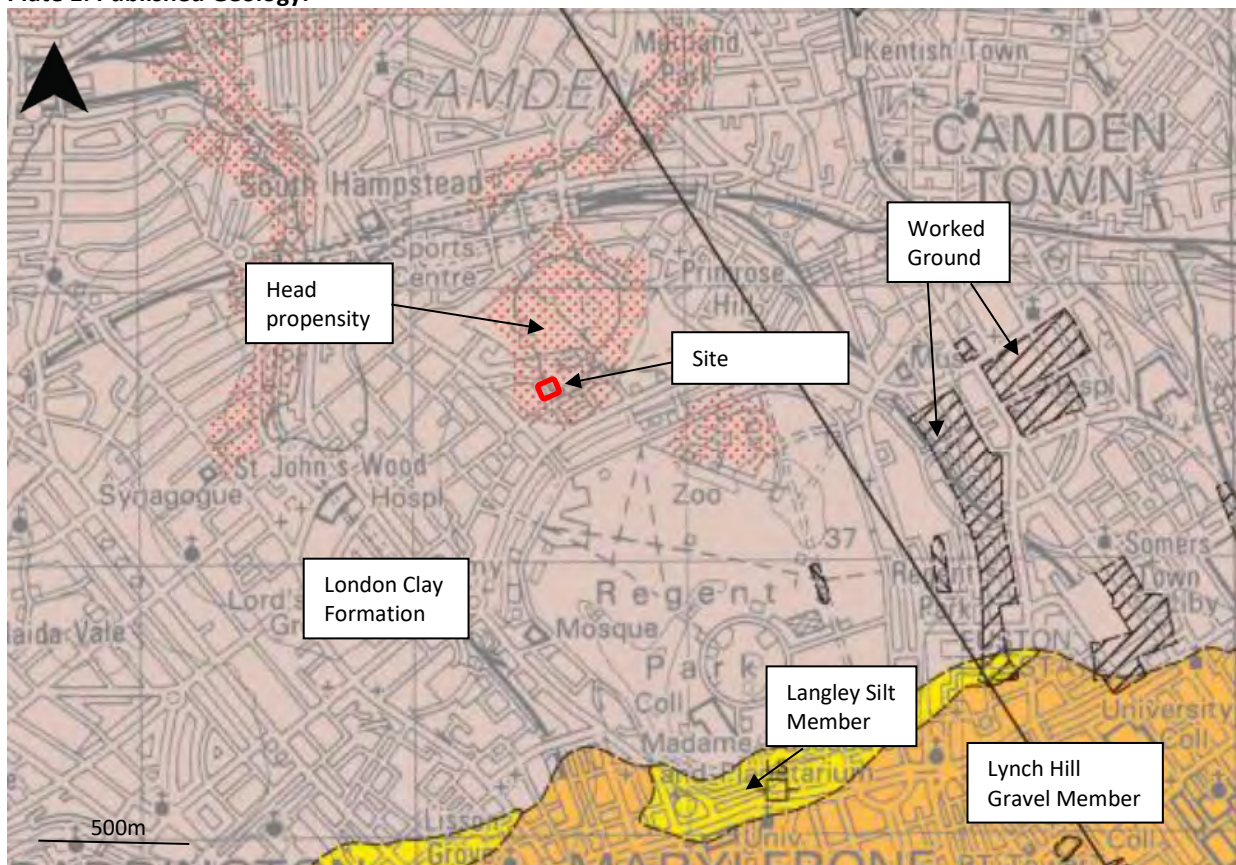
Anticipated Ground Conditions

The published geology of the site is illustrated in Plate 1, below. With reference to the British Geological Survey (BGS) mapping³, the site is anticipated to be underlain by solid geology of the London Clay Formation, typically comprising firm to stiff blueish grey or greyish brown silty clay. This is anticipated to be some 50m thick on site.

No superficial deposits are mapped on site, however, as illustrated in Plate 1, below, the site lies within an area for 'Head propensity' indicating Quaternary Head deposits are likely to be present based on digital slope analysis.

Superficial deposits comprising the Langley Silt Member and Lynch Hill Gravel Member are recorded some 1.5km south of the site. The Langley Silt Member typically comprises yellowish brown silts and clays, and the Lynch Hill Gravel Member usually consists of sands and gravels, locally with lenses of silt, clay or peat. Worked Ground is recorded approximately 1.2km east of the site.

Plate 1. Published Geology.



³ British Geological Survey (BGS). *Geology of Britain Viewer*. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>. [Accessed March 2022].

Previous investigation (2012)

In September 2012, Soil Consultants¹ undertook a ground investigation on site comprising one cable percussive borehole to 7.5mbgl, three windowless sample boreholes to a maximum depth of 5mbgl, and three foundation inspection trial pits. The windowless sample and cable percussive borehole records and subsequent monitoring data are summarised in Table 1, below.

Table 1. Summary of Soil Consultants 2012 Ground Investigation.

Reference	Base of Borehole (mbgl)	Depth to Top of Stratum (mbgl)		Groundwater Level (mbgl)	
		Made Ground / Topsoil	London Clay Formation	Strike During Drilling	Water Level During Monitoring
BH1	7.5	0.00 [46.00]	0.50 [45.50]	Not observed	Not installed
WS1	5.0	0.00 [45.60]	1.75 [43.85]	1.40	0.95
WS2	5.0	0.00 [44.60]	2.10 [42.50]	Not observed	3.5m
WS3	5.0	0.00 [45.30]	1.62 [43.68]	Not observed	Not installed

Some 0.5m to 2.0m of Made Ground or Topsoil was encountered on site, overlying London Clay Formation. The location of these exploratory holes are illustrated on Figure 2.

Within the London Clay Formation, a total of three SPT 'N' values were recorded between 6 and 16. Assuming an SPT hammer energy ratio of 60 and an f_1 value of 4.5, these correspond to undrained shear strengths of between 27kPa and 72kPa. One undrained triaxial test was undertaken on the clay from 1.1mbgl, recording an undrained shear strength of 51kPa. A total of 43 Hand Shear Vane (HSV) tests were undertaken within the London Clay, recording undrained shear strengths of between 47kPa and 120kPa. These correspond to relative consistencies of 'soft' to 'stiff'⁴.

CGL 2022 Investigation

An intrusive ground investigation was carried out at the site by CGL on 5th May 2022² and comprised the excavation of four windowless sample boreholes (WS201 to WS204) to a maximum depth of 6.0mbgl, with the installation of ground gas and groundwater monitoring standpipes. The location of the exploratory holes are illustrated in Figure 2.

The ground conditions encountered during the intrusive investigation generally agreed with the published geology, typically comprising Made Ground overlying Weathered London Clay Formation. A propensity for Head was anticipated based on BGS mapping, and deposits considered consistent with Head were identified in WS204. The ground conditions are summarised in Table 2, below.

⁴ British Standards Institution. (2020). *Code of practice for site investigations*. BS 5930:2015 +A1:2020.

Table 2. Summary of CGL 2022 Ground Conditions.

Stratum	Top of Stratum (mbgl) [Level (mOD)]	Thickness (m)
<p>Brown, occasionally mottled yellow, occasionally red or light brown mottled black, silty gravelly sand, sandy cobbles, sandy cobbly gravel, or gravelly clay. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of flint, concrete, bound surfacing and brick. Cobbles are angular to subangular of broken brick, concrete, bound surfacing and mortar. Occasional to frequent rootlets noted.</p> <p>Variable hardstanding encountered – 50mm thick paving blocks and 100mm concrete layer encountered in WS201; bound surfacing and reinforced concrete to 0.25mbgl encountered in WS203; and bound surfacing to 0.18mbgl encountered in WS204.</p> <p>Turf was encountered at ground level in WS202.</p> <p>[MADE GROUND]</p>	<p>0.00 [46.42 to 46.12]</p>	<p>0.25 to 1.60</p>
<p>Soft light brown slightly sandy cobbly CLAY. Cobbles are angular to subrounded, <150mm diameter, of flint. Sand is fine to medium. Occasional <5mm lignite inclusions.</p> <p>[HEAD]</p> <p><i>Only encountered in WS204</i></p>	<p>0.45 [45.52]</p>	<p>0.45</p>
<p>Soft to firm, becoming firm to stiff with depth, light brown, occasionally mottled yellow, red brown or grey, often sandy CLAY. Sand is fine to coarse. Clay is extremely closely fissured, becoming closely fissured with depth. Occasional inclusions of yellow or orange sand <40mm diameter and 1-10mm thick sand lenses noted throughout. Occasional to frequent, typically <2mm diameter, selenite crystals noted throughout.</p> <p>Occasional <5mm diameter lignite inclusions, relict rootlets and bioturbation noted in WS204.</p> <p>[WEATHERED LONDON CLAY FORMATION]</p>	<p>0.25 to 1.6 [45.87 to 43.76]</p>	<p>>5.75 (base not proven)</p>

Plots of SPT ‘N₆₀’ values versus level and undrained shear strength (C_u) vs level are included as Figure 3 and Figure 4, respectively. Further details of the ground conditions are provided below.

Made Ground

Made Ground was encountered in all window sampler borehole locations to a maximum depth of 1.60mbgl. The stratum was highly variable, typically comprising hardstanding over a silty gravelly sand. The gravel was typically of flint, concrete, brick and bound surfacing. Rootlets were occasionally recorded.

In WS201, 50mm thick paving blocks were encountered at ground level, with an additional 100mm thick concrete layer at 0.2mbgl, and sandy cobbles encountered between 1.3mbgl and 1.6mbgl. No hardstanding was encountered in WS202, where turf was noted at ground level and a soft light brown mottled black gravelly clay was encountered between 0.6mbgl and 1.4mbgl. In WS203, 50mm of bound surfacing was noted overlying reinforced concrete to 0.25mbgl; and in WS204, 180mm of b was encountered from ground level overlying a brown sandy cobbly gravel.

One SPT ‘N’ value was recorded within this stratum at 8, within the cohesive deposits in WS202. Based on an energy ratio of 65%, this corresponds to an SPT ‘N₆₀’ value of 9, correlating to an undrained shear strength (C_u) value of 40.5kPa (where f₁ = 4.5)⁵ or a relative consistency of ‘firm’⁴.

⁵ Stroud, M. A. (1975). The standard penetration test in insensitive clays and soft rocks, *Proceedings of the European Symposium on Penetration Tests*, 2, 367-375.

Head

Head was only encountered in window sampler borehole WS204 between 0.45mbgl and 0.9mbgl. The stratum comprised soft light brown slightly sandy cobbly clay. The cobbles were of flint and occasional lignite inclusions were noted.

Weathered London Clay Formation

Weathered London Clay Formation were encountered in all exploratory hole locations, proven to a maximum depth of 6mbgl. The stratum typically comprised soft to firm, becoming firm to stiff with depth, light brown, occasionally mottled yellow, red brown or grey, often sandy clay. The clay was typically extremely closely fissured, becoming very closely and closely fissured with depth. Yellow and orange sand inclusions up to 40mm diameter were frequently noted, alongside sand partings up to 10mm diameter. Selenite crystals, typically up to 2mm diameter, were frequently recorded.

Ten SPT 'N' values were recorded within this stratum between 8 and 18. Based on an energy ratio of 65%, these correspond to SPT 'N₆₀' values of between 9 and 20, correlating to undrained shear strength (C_u) of between 36kPa and 90kPa (where $f_1 = 4.5$)⁵ and a relative consistency of 'soft' to 'stiff'⁴.

A total of 14 Hand Shear Vane (HSV) tests were undertaken within this stratum, recording values of undrained shear strength (C_u) of between 41kPa and 103kPa. These correspond to relative consistencies of 'firm' to 'stiff'.

Ground Model Summary

The ground model encountered on site comprised Made Ground containing variable hard standing surfaces overlying Weathered London Clay Formation. The Made Ground was noted to be thicker in the west of the site (1.6m and 1.4m in WS201 and WS202, respectively), becoming thinner in the east (0.25m and 0.45m in WS203 and WS204, respectively). This is consistent with the Soil Consultants 2012 investigation¹, which recorded 0.5m of Made Ground in BH1 towards the east of the site, and 2.1m of Made Ground in WS2 in the south-west. Head comprising slightly sandy cobbly clay was only encountered in WS204 in the far east of the site.

The underlying Weathered London Clay Formation comprised often sandy clay, typically soft to firm, becoming firm to stiff with depth.

Permeability Testing

Rising head permeability tests were undertaken in three of the window sampler boreholes. Over a significant period of time (between 2 and 4.5 hours) none of the tests completed (i.e. the water did not recover to 75% its original volume) however, permeability results have been summarised in Table 4, below, and are consistent with values for a predominantly silty sandy clay.

Table 3. Summary of Permeability Results.

Location	Length of Test (hours)	Measured Rise in Water Level (m)	Head Recovery (%)	Permeability (m/sec)
WS201	4.5	0.12	10	3.4 x 10 ⁻⁷
WS202	2.0	0.18	6	1.1 x 10 ⁻⁶
WS203	4.0	0.15	23	3.8 x 10 ⁻⁷

Water Summary

The water monitoring results indicate that localised pockets of perched water are present within the Made Ground and Weathered London Clay Formation, between 0.20mbgl and 3.73mbgl (45.92mOD and 41.43mOD). The water strike recorded in borehole WS202 at 2.8mbgl occurred in a sand lens, suggesting pockets of water

are present within granular horizons. The poor recovery of water level during the rising head tests indicates a low permeability within the stratum.

Basement Foundations

A high groundwater table is not anticipated within the vicinity of the proposed basement and as such, contiguous piles would be sufficient for the basement construction. In view of the groundwater seepage encountered, consideration should be given to a narrower gap between piles (~100mm), whilst remaining compatible with installation requirements.

Ground Gases

The ground gas monitoring results indicate that steady flow was not recorded above the detection limit of the equipment of 0.1 l/hr in any exploratory hole; the maximum carbon dioxide concentration detected was 8.2% (in WS201); and methane was not detected above the instrument detection limit of 0.1% in any location. Oxygen concentrations were depleted to a minimum of 12.0% (in WS202) and the maximum Volatile Organic Compound (VOC) concentrations recorded was 1.1 parts per million (ppm) (in WS202).

Gas Screening Values (GSVs) have been calculated in accordance with CIRIA 665⁶ and BS 8485:2015+A1:2019⁷. Assuming a worst case scenario, an average maximum steady flow rate of 0.1 l/hr was used, alongside a maximum carbon dioxide concentration of 8.2% and a maximum methane concentration of 0.1%. The maximum worst credible GSVs for carbon dioxide and methane are 0.008 l/hr and 0.0001 l/hr, respectively.

Methane concentrations were not recorded above 1%, however carbon dioxide concentrations elevated above 5% was consistently recorded in WS201. Given the distance of this borehole location from the proposed building development (some 15m) and the absence of steady flow detected across the site, the site is considered to conform to Characteristic Situation (CS) 1.

The risk to future site occupiers from ground gases is considered low as the site is considered to conform to CS1 and no ground gas protection measures are proposed. It is recommended that the absence of gas protection measures is approved by the project warrantors and Building Control prior to commencing construction as additional monitoring visits may be requested.

Yours sincerely



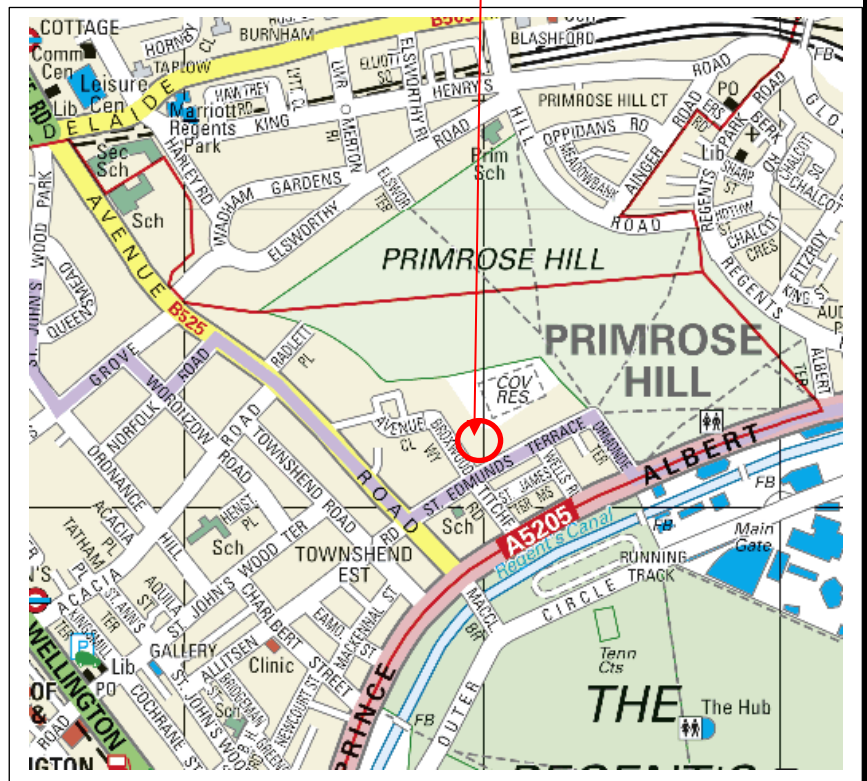
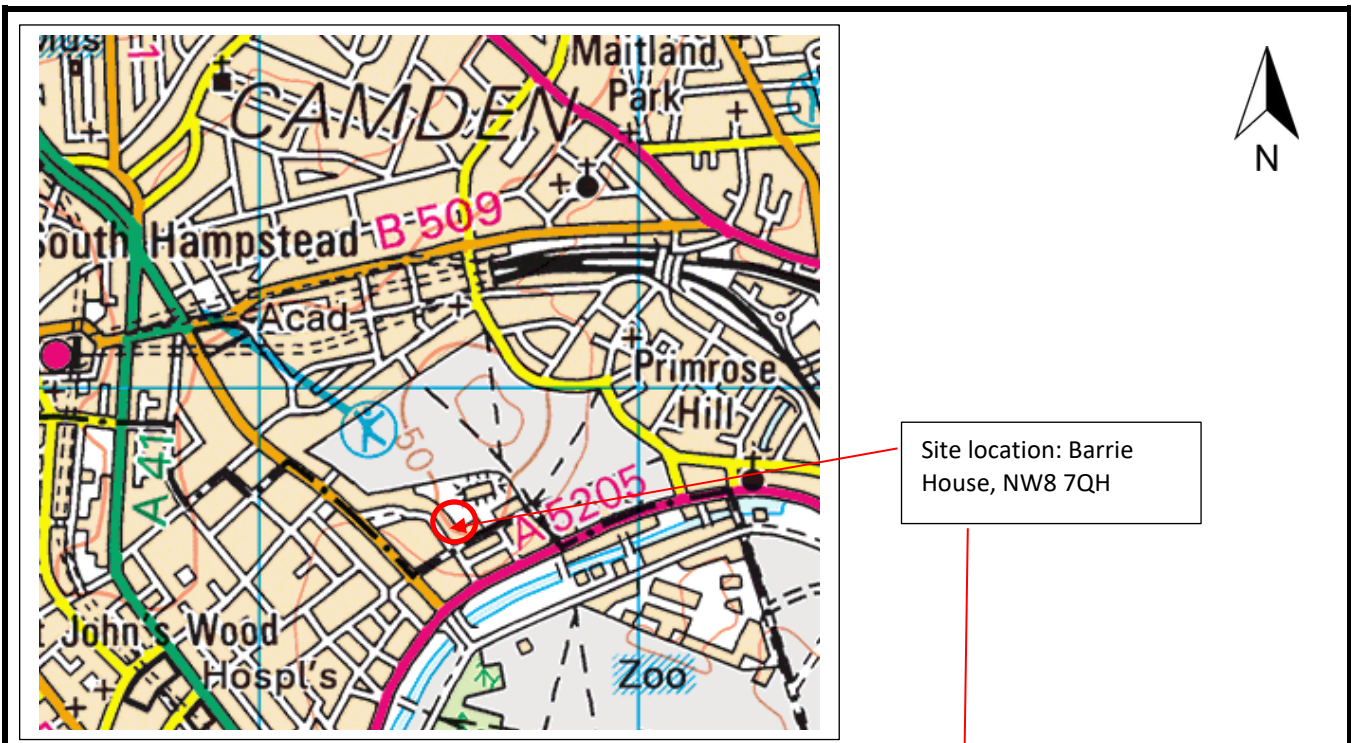
Anna Prescott, Senior Engineer
Card Geotechnics Limited

FIGURES


- Figure 1** **Site Location Plan**
- Figure 2** **Site Layout and Exploratory Hole Location Plan**
- Figure 3** **SPT 'N₆₀' Value vs Level**
- Figure 4** **Undrained Shear Strength vs Level**

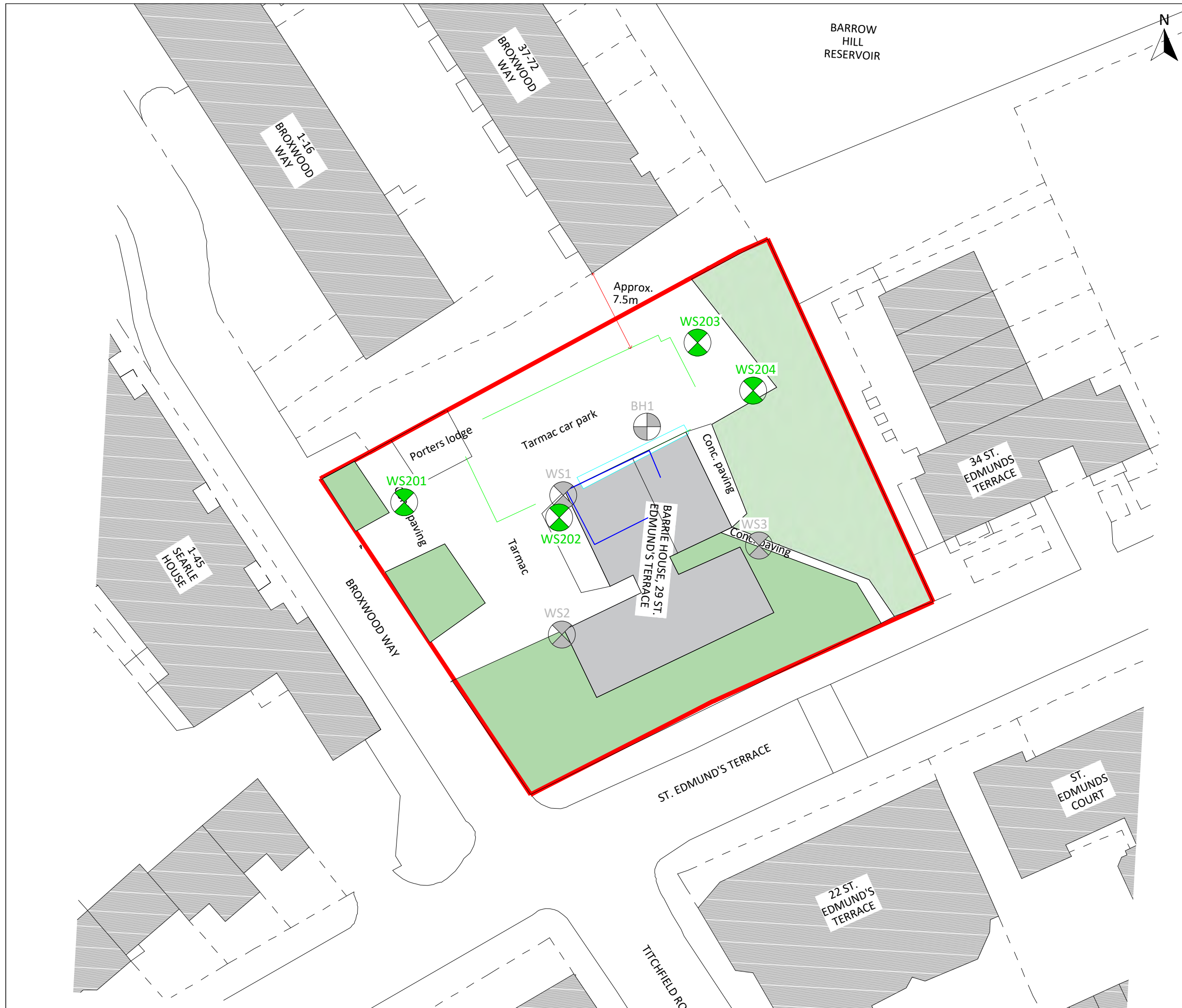
⁶ CIRIA. (2007). *Assessing risks posed by hazardous ground gases to buildings*, CIRIA Report C665, London.

⁷ British Standards Institute. (2019). *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*. BS 8485:2015+A1:2019.







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<p>Client</p> <p>Broxwood View Limited</p>	<p>Project</p> <p>Barrie House, 29 St Edmunds Terrace, London</p>	<p>Job No</p> <p>CG/28408B</p>
	<p>Title</p> <p>Site Location Plan</p>	<p>Figure 1</p>



KEY

-  Site Boundary
-  CGL Window Sampler Boreholes
-  Soil Consultants Window Samples (2012)
-  Soil Consultants Boreholes (2012)

Notes

1. Site Layout Plan taken from CGL Drawing "CG/28408 Site Layout_1".

Rev	Date	Comments
0	26/05/2022	



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Project **Barrie House, 29 St Edmunds Terrace, London**

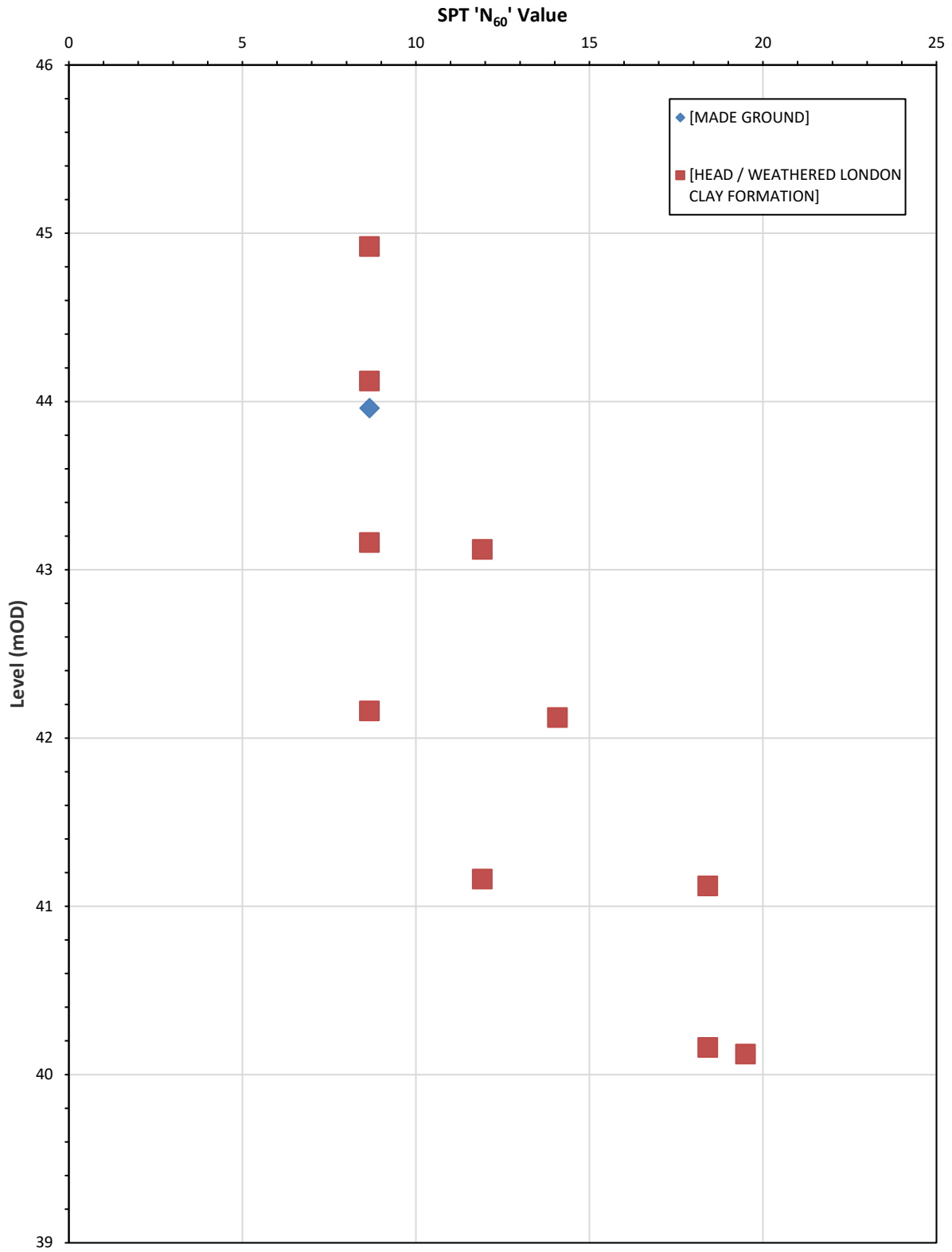
Client **Broxwood View Limited**

Drawing title **Figure 2 - Site Layout and Exploratory Hole Location Plan**

Scale(s) **NTS** Job No. **CG/28408B**

Drawn	OCR	26/05/2022	Dwg No.	CG/28408B-001	Rev.	0
Checked	ARA	21/06/2022				
Approved	NIL	22/06/2022				

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Client

Broxwood View Limited

Project

Barrie House, 29 St Edmunds Terrace, London

Job No

CG/28408B



Title

SPT 'N₆₀' Value vs Level

Figure 3

APPENDIX F

Modelling Output Results

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	46.00	1 Made Ground	1 Made Ground
2	44.50	2 Head /LC Undrained	2 Head /LC Undrained
3	43.50	4 LC Undrained	4 LC Undrained

SOIL PROPERTIES

-- Soil type --	Bulk density	Young's Modulus	At rest coeff.	Consol state.	Active limit	Passive limit	Cohesion
No. Description (Datum elev.)	kN/m3	Eh, kN/m2 (dEh/dy)	Ko (dKo/dy)	(Nu) (NC/OC)	(Kac) (Ka)	(Kpc) (Kp)	(dc/dy) (kN/m2)
1 Made Ground	18.00	15000	0.531	OC (0.200)	0.298 (0.000)	4.393 (0.000)	
2 Head /LC Undrained	20.00	24000	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u
3 Head /LC Drained	20.00	18000	1.000	OC (0.200)	0.376 (1.401)	3.077 (4.665)	5.000d
4 LC Undrai.. (43.50)	20.00	24000 (6000)	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u (10.00)
5 LC Drained (43.50)	20.00	18000 (4500)	1.000	OC (0.200)	0.346 (1.340)	3.442 (5.007)	5.000d

Additional soil parameters associated with Ka and Kp

Soil type	--- parameters for Ka ---			--- parameters for Kp ---		
	Soil friction	Wall adhesion	Back-fill	Soil friction	Wall adhesion	Back-fill
No. Description	angle	coeff.	angle	angle	coeff.	angle
1 Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2 Head /LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
3 Head /LC Drained	24.00	0.500	0.00	24.00	0.500	0.00
4 LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
5 LC Drained	26.00	0.500	0.00	26.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

Initial water table elevation Left side Right side
 30.00 30.00

Automatic water pressure balancing at toe of wall : No

WALL PROPERTIES

Type of structure = Fully Embedded Wall
 Elevation of toe of wall = 36.60
 Maximum finite element length = 0.50 m
 Youngs modulus of wall E = 2.8000E+07 kN/m2
 Moment of inertia of wall I = 3.1950E-03 m4/m run
 E.I = 89460 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	43.65	1.00	1.000000	80000	1.00	0.00	0	Yes
2	40.30	1.00	0.950000	1.500E+07	1.00	0.00	0	Yes
3	44.50	1.00	0.300000	1.500E+07	1.00	0.00	0	Yes
4	42.10	1.00	1.000000	80000	1.00	0.00	0	Yes

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- Near edge	Surcharge ----- Far edge	Equiv. soil type	Partial factor/ Category
1	45.00	0.50(L)	20.00	1.00	10.00	=	N/A	1.00 -

Note: L = Left side, R = Right side

Limit State Categories P/U = Permanent Unfavourable
P/F = Permanent Favourable
Var = Variable (unfavourable)

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Change EI of wall to 1.0000E-03 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
2	Apply surcharge no.1 at elevation 45.00 No analysis at this stage
3	Change EI of wall to 67096 kN.m2/m run Yield moment not defined Reset wall displacements to zero at this stage
4	Excavate to elevation 43.00 on RIGHT side
5	Install strut or anchor no.1 at elevation 43.65
6	Excavate to elevation 39.77 on RIGHT side
7	Install strut or anchor no.2 at elevation 40.30
8	Install strut or anchor no.3 at elevation 44.50
9	Remove strut or anchor no.1 at elevation 43.65
10	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset
11	Change properties of soil type 4 to soil type 5 Ko pressures will not be reset
12	Change EI of wall to 47926 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value

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) = 9.300 m

Boundary conditions:

Length of wall (normal to plane of analysis) = 26.50 m

Width of excavation on Left side of wall = 20.00 m

Width of excavation on Right side of wall = 11.50 m

Distance to rigid boundary on Left side = 30.00 m

Distance to rigid boundary on Right side = 30.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Displacement	Active, Passive pressures	Graph. output
1	Change EI of wall to 1.0000E-03kN.m2/m	Yes	Yes	Yes
2	Apply surcharge no.1 at elev. 45.00	No	No	No
3	Change EI of wall to 67096kN.m2/m run	No	No	No
4	Excav. to elev. 43.00 on RIGHT side	Yes	Yes	Yes
5	Install strut no.1 at elev. 43.65	Yes	Yes	Yes
6	Excav. to elev. 39.77 on RIGHT side	Yes	Yes	Yes
7	Install strut no.2 at elev. 40.30	Yes	Yes	Yes
8	Install strut no.3 at elev. 44.50	Yes	Yes	Yes
9	Remove strut no.1 at elev. 43.65	Yes	Yes	Yes
10	Change soil type 2 to soil type 3	Yes	Yes	Yes
11	Change soil type 4 to soil type 5	Yes	Yes	Yes
12	Change EI of wall to 47926kN.m2/m run	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

Program WALLAP - Copyright (C) 2017 by DL Borin, distributed by GEOSOLVE
150 St. Alphonsus Road, London SW4 7BW, UK www.geosolve.co.uk

Units: kN,m

Stage No. 12 Change EI of wall to 47926 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

			FoS for toe	Toe elev. for			
			elev. = 36.60	FoS = 1.000			
			-----	-----			
Stage	--- G.L. ---	Strut	Factor	Moment	Toe	Wall	Direction
No.	Act. Pass.	Elev.	of	of equilib.	elev.	Penetr	of
			Safety	at elev.		-ation	failure
12	46.00 39.77		More than one strut.	No FoS calc.			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 26.50m
 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 30.00 from wall
 Right side 30.00 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.

*** Wall displacements reset to zero at stage 3

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	46.00	0.00	0.005	-1.83E-04	0.0	0.0		47926
2	45.50	23.44	0.005	-1.84E-04	5.9	0.1		47926
3	45.00	17.11	0.006	-2.16E-04	16.0	6.1		47926
4	44.50	11.06	0.006	-3.33E-04	23.0	16.3	57.9	47926
		13.03	0.006	-3.33E-04	-34.8	16.3		
5	44.08	9.59	0.006	-4.18E-04	-30.0	2.5		47926
6	43.65	11.64	0.006	-3.90E-04	-25.5	-9.5		47926
7	43.50	12.36	0.006	-3.56E-04	-23.7	-13.2		47926
8	43.00	14.77	0.006	-1.79E-04	-16.9	-21.9		47926
9	42.50	17.80	0.006	7.85E-05	-8.8	-28.9		47926
10	42.00	21.14	0.006	3.84E-04	0.9	-31.4		47926
11	41.50	24.49	0.006	6.88E-04	12.3	-28.6		47926
12	41.00	27.85	0.005	9.19E-04	25.4	-17.6		47926
13	40.65	31.54	0.005	1.00E-03	35.8	-7.0		47926
14	40.30	40.63	0.005	9.92E-04	48.4	7.5	75.4	47926
		40.63	0.005	9.92E-04	-27.0	7.5		
15	40.04	47.80	0.005	9.60E-04	-15.3	2.0		47926
16	39.77	55.10	0.004	9.50E-04	-1.6	-0.1		47926
		30.48	0.004	9.50E-04	-1.6	-0.1		
17	39.39	15.02	0.004	9.41E-04	7.1	1.2		47926
18	39.00	-0.38	0.004	9.15E-04	9.9	4.6		47926
19	38.50	-20.62	0.003	8.45E-04	4.7	8.4		47926
20	38.00	-12.28	0.003	7.58E-04	-3.5	8.3		47926
21	37.50	-1.53	0.002	6.89E-04	-7.0	5.0		47926
22	37.05	8.31	0.002	6.59E-04	-5.5	1.7		47926
23	36.60	15.91	0.002	6.51E-04	0.0	0.0		---
At elev. 44.50	Strut force =		57.9 kN/strut =			57.9 kN/m run		
At elev. 40.30	Strut force =		75.4 kN/strut =			75.4 kN/m run		

Run ID. WALLAP_Model_Neighbouring_Properties
Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment

| Sheet No.
| Date:17-03-2023
| Checked :

(continued)

Stage No.12 Change EI of wall to 47926 kN.m²/m run
Yield moment not defined
Allow wall to relax with new modulus value

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.		Strut Elev.	FoS for toe elev. = 36.60		Toe elev. for FoS = 1.000		Direction of failure
	Act.	Pass.		Factor of Safety	Moment at elev.	Toe elev.	Wall Penetration	
1	46.00	46.00	Cant.	Conditions not suitable for FoS calc.				
2	46.00	46.00		No analysis at this stage				
3	46.00	46.00		No analysis at this stage				
4	46.00	43.00	Cant.	3.879	37.32	41.75	1.25	L to R
5	46.00	43.00		No analysis at this stage				
6	46.00	39.77	43.65	3.156	n/a	39.50	0.27	L to R
7	46.00	39.77		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 = 26.50m
 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 30.00 from wall
 Right side 30.00 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		Bending moment				Shear force			
		Calculated		Factored		Calculated		Factored			
		max.	min.	max.	min.	max.	min.	max.	min.		
		m	m	kN.m/m		kN.m/m		kN/m		kN/m	
1	46.00	0.009	0.000	0	0	0	0	0	0	0	0
2	45.50	0.008	0.000	0	0	0	0	6	0	8	0
3	45.00	0.007	0.000	6	0	8	0	16	0	22	0
4	44.50	0.006	0.000	17	0	22	0	23	-39	31	-52
5	44.08	0.006	0.000	22	0	29	0	23	-34	31	-46
6	43.65	0.006	0.000	32	-12	44	-16	28	-48	38	-65
7	43.50	0.006	0.000	25	-16	34	-22	16	-46	22	-63
8	43.00	0.006	0.000	25	-27	34	-36	24	-40	33	-53
9	42.50	0.006	0.000	33	-35	45	-48	9	-31	12	-42
10	42.00	0.006	0.000	34	-40	46	-54	1	-22	1	-30
11	41.50	0.006	0.000	31	-39	42	-53	12	-11	17	-15
12	41.00	0.005	0.000	25	-36	34	-49	25	-12	34	-16
13	40.65	0.005	0.000	21	-34	28	-46	36	-12	48	-16
14	40.30	0.005	0.000	17	-28	23	-38	48	-27	65	-36
15	40.04	0.005	0.000	14	-20	18	-28	36	-15	48	-21
16	39.77	0.004	0.000	11	-9	15	-12	49	-10	66	-13
17	39.39	0.004	0.000	14	-0	19	-1	30	-8	40	-11
18	39.00	0.004	0.000	19	0	26	0	14	-6	19	-8
19	38.50	0.003	0.000	19	0	26	0	6	-5	8	-7
20	38.00	0.003	0.000	14	0	19	0	0	-12	0	-16
21	37.50	0.002	0.000	8	0	10	0	0	-12	0	-17
22	37.05	0.002	0.000	2	0	3	0	0	-8	0	-11
23	36.60	0.002	0.000	0	-0	0	-0	0	-0	0	-0

Summary of results (continued)

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

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	
1	0	46.00	0	46.00	0	0	0	46.00	0	46.00	0	0
2	No calculation at this stage											
3	No calculation at this stage											
4	34	42.00	-0	36.60	46	-0	24	43.00	-12	40.65	33	-16
5	No calculation at this stage											
6	32	43.65	-36	41.00	44	-49	49	39.77	-48	43.65	66	-65
7	No calculation at this stage											
8	No calculation at this stage											
9	19	39.00	-40	42.00	26	-54	42	40.30	-39	44.50	57	-52
10	19	39.00	-40	42.00	26	-54	42	40.30	-39	44.50	57	-52
11	16	44.50	-34	42.00	22	-46	48	40.30	-37	44.50	65	-50
12	16	44.50	-31	42.00	22	-42	48	40.30	-35	44.50	65	-47

Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	46.00	0.000	46.00	Change EI of wall to 1.0000E-03kN.m2/m run
2	No calculation at this stage				Apply surcharge no.1 at elev. 45.00
3	Wall displacements reset to zero				Change EI of wall to 67096kN.m2/m run
4	0.009	46.00	0.000	46.00	Excav. to elev. 43.00 on RIGHT side
5	No calculation at this stage				Install strut no.1 at elev. 43.65
6	0.006	46.00	0.000	46.00	Excav. to elev. 39.77 on RIGHT side
7	No calculation at this stage				Install strut no.2 at elev. 40.30
8	No calculation at this stage				Install strut no.3 at elev. 44.50
9	0.006	42.50	0.000	46.00	Remove strut no.1 at elev. 43.65
10	0.006	42.50	0.000	46.00	Change soil type 2 to soil type 3
11	0.006	42.50	0.000	46.00	Change soil type 4 to soil type 5
12	0.006	42.50	0.000	46.00	Change EI of wall to 47926kN.m2/m run

Summary of results (continued)

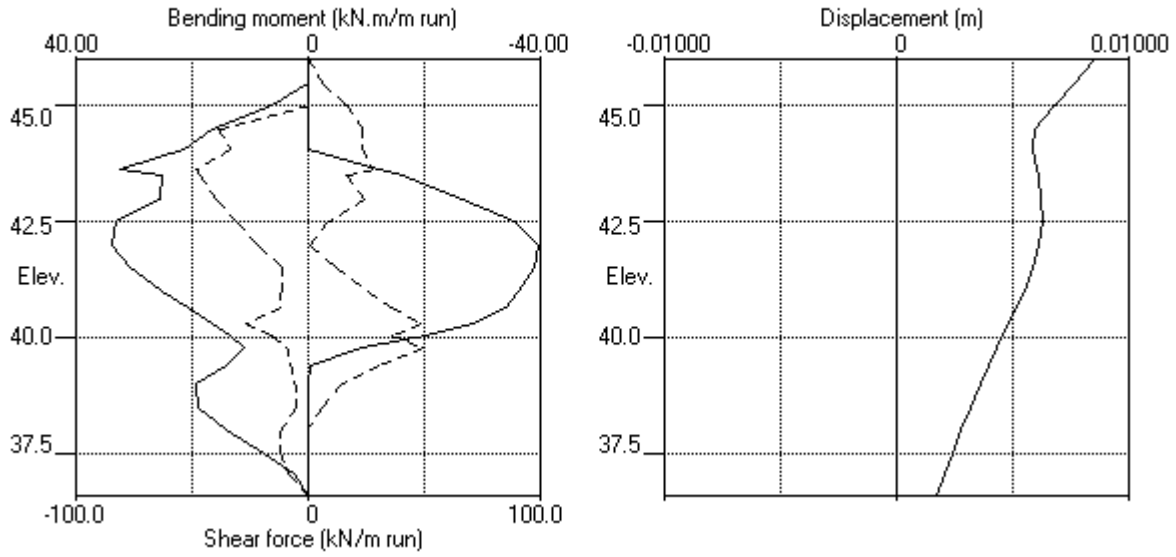
Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Strut forces at each stage (horizontal components)

Stage no.	----- Strut no. 1 ----- at elev. 43.65			----- Strut no. 2 ----- at elev. 40.30			----- Strut no. 3 ----- at elev. 44.50		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
6	76	76	103	---	---	---	---	---	---
9	---	---	---	29	29	39	62	62	84
10	---	---	---	29	29	39	62	62	84
11	---	---	---	71	71	97	59	59	80
12	---	---	---	75	75	102	58	58	78

Units: kN,m

Bending moment, shear force, displacement envelopes



Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	45.00	1 Made Ground	1 Made Ground
2	44.50	2 Head /LC Undrained	2 Head /LC Undrained
3	43.50	4 LC Undrained	4 LC Undrained

SOIL PROPERTIES

-- Soil type --	Bulk density	Young's Modulus	At rest coeff.	Consol state.	Active limit	Passive limit	Cohesion
No. Description (Datum elev.)	kN/m3	Eh, kN/m2 (dEh/dy)	Ko (dKo/dy)	(Nu) (NC/OC)	(Kac) (Ka)	(Kpc) (Kp)	(dc/dy) (kN/m2)
1 Made Ground	18.00	15000	0.531	OC (0.200)	0.298 (0.000)	4.393 (0.000)	
2 Head /LC Undrained	20.00	24000	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u
3 Head /LC Drained	20.00	18000	1.000	OC (0.200)	0.376 (1.401)	3.077 (4.665)	5.000d
4 LC Undrai.. (43.50)	20.00	24000 (6000)	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u (10.00)
5 LC Drained (43.50)	20.00	18000 (4500)	1.000	OC (0.200)	0.346 (1.340)	3.442 (5.007)	5.000d

Additional soil parameters associated with Ka and Kp

Soil type	--- parameters for Ka ---			--- parameters for Kp ---		
	Soil friction	Wall adhesion	Back-fill	Soil friction	Wall adhesion	Back-fill
No. Description	angle	coeff.	angle	angle	coeff.	angle
1 Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2 Head /LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
3 Head /LC Drained	24.00	0.500	0.00	24.00	0.500	0.00
4 LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
5 LC Drained	26.00	0.500	0.00	26.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

Initial water table elevation Left side Right side
 30.00 30.00

Automatic water pressure balancing at toe of wall : No

WALL PROPERTIES

Type of structure = Fully Embedded Wall
 Elevation of toe of wall = 28.60
 Maximum finite element length = 1.00 m
 Youngs modulus of wall E = 3.0000E+07 kN/m2
 Moment of inertia of wall I = 9.0880E-03 m4/m run
 E.I = 272640 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	43.65	1.00	1.000000	80000	1.00	0.00	0	Yes
2	40.30	1.00	0.950000	1.500E+07	1.00	0.00	0	Yes
3	44.50	1.00	0.300000	1.500E+07	1.00	0.00	0	Yes
4	42.10	1.00	1.000000	80000	1.00	0.00	0	Yes

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- Near edge	Surcharge ----- Far edge	Equiv. soil type	Partial factor/ Category
1	45.00	1.25(L)	20.00	20.00	5.00	=	N/A	1.00 -
2	43.70	0.25(L)	2.00	2.00	220.00	=	N/A	1.00 -
3	43.70	0.25(L)	2.00	2.00	50.00	=	N/A	1.00 -

Note: L = Left side, R = Right side

Limit State Categories P/U = Permanent Unfavourable
P/F = Permanent Favourable
Var = Variable (unfavourable)

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Change EI of wall to 1.0000E-03 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
2	Apply surcharge no.1 at elevation 45.00 No analysis at this stage
3	Apply surcharge no.2 at elevation 43.70 No analysis at this stage
4	Change EI of wall to 190852 kN.m2/m run Yield moment not defined Reset wall displacements to zero at this stage
5	Excavate to elevation 43.00 on RIGHT side
6	Install strut or anchor no.1 at elevation 43.65
7	Excavate to elevation 41.60 on RIGHT side
8	Install strut or anchor no.4 at elevation 42.10
9	Excavate to elevation 39.77 on RIGHT side
10	Install strut or anchor no.2 at elevation 40.30
11	Remove strut or anchor no.4 at elevation 42.10
12	Install strut or anchor no.3 at elevation 44.50
13	Remove strut or anchor no.1 at elevation 43.65
14	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset
15	Change properties of soil type 4 to soil type 5 Ko pressures will not be reset
16	Change EI of wall to 136323 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
17	Apply surcharge no.3 at elevation 43.70

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) = 15.00 m

Boundary conditions:

Length of wall (normal to plane of analysis) = 26.50 m

Width of excavation on Left side of wall = 20.00 m
Width of excavation on Right side of wall = 11.50 m

Distance to rigid boundary on Left side = 30.00 m
Distance to rigid boundary on Right side = 30.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Displacement Bending mom. Shear force	Active, Passive pressures	Graph. output
1	Change EI of wall to 1.0000E-03kN.m2/m	No	No	No
2	Apply surcharge no.1 at elev. 45.00	No	No	No
3	Apply surcharge no.2 at elev. 43.70	No	No	No
4	Change EI of wall to 190852kN.m2/m run	Yes	Yes	Yes
5	Excav. to elev. 43.00 on RIGHT side	Yes	Yes	Yes
6	Install strut no.1 at elev. 43.65	Yes	Yes	Yes
7	Excav. to elev. 41.60 on RIGHT side	Yes	Yes	Yes
8	Install strut no.4 at elev. 42.10	Yes	Yes	Yes
9	Excav. to elev. 39.77 on RIGHT side	Yes	Yes	Yes
10	Install strut no.2 at elev. 40.30	Yes	Yes	Yes
11	Remove strut no.4 at elev. 42.10	No	No	No
12	Install strut no.3 at elev. 44.50	Yes	Yes	Yes
13	Remove strut no.1 at elev. 43.65	Yes	Yes	Yes
14	Change soil type 2 to soil type 3	Yes	Yes	Yes
15	Change soil type 4 to soil type 5	Yes	Yes	Yes
16	Change EI of wall to 136323kN.m2/m run	Yes	Yes	Yes
17	Apply surcharge no.3 at elev. 43.70	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No. 17 Apply surcharge no.3 at elevation 43.70

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. = 28.60	Moment of equil. at elev.	Toe elev. for FoS = 1.000	Wall Penetration	Direction of failure
17	45.00 39.77			More than one strut.	No FoS calc.		

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 26.50m

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 30.00 from wall

Right side 30.00 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.

*** Wall displacements reset to zero at stage 4

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	45.00	0.00	0.010	-1.97E-04	0.0	0.0		136323
2	44.50	7.28	0.011	-1.97E-04	1.8	0.1	73.6	136323
		12.24	0.011	-1.97E-04	-71.7	0.1		
3	43.70	5.80	0.011	-4.24E-05	-64.5	-53.6		136323
4	43.65	6.05	0.011	-2.24E-05	-64.2	-56.9		136323
5	43.50	16.20	0.011	4.46E-05	-62.6	-66.5		136323
		14.65	0.011	4.46E-05	-62.6	-66.5		
6	43.00	67.97	0.011	3.29E-04	-41.9	-90.5		136323
7	42.10	70.16	0.010	9.50E-04	20.3	-100.4		136323
8	41.60	61.25	0.009	1.27E-03	53.1	-82.2		136323
9	40.95	56.64	0.009	1.55E-03	91.4	-35.6		136323
10	40.30	59.94	0.008	1.54E-03	129.3	35.1	165.5	136323
		59.94	0.008	1.54E-03	-36.2	35.1		
11	39.77	66.42	0.007	1.42E-03	-2.7	25.1		136323
		41.99	0.007	1.42E-03	-2.7	25.1		
12	38.89	-3.19	0.006	1.23E-03	14.4	32.1		136323
13	38.00	-16.46	0.005	1.00E-03	5.7	40.8		136323
14	37.00	-6.49	0.004	7.28E-04	-5.7	38.0		136323
15	36.00	-0.18	0.003	5.01E-04	-9.1	28.4		136323
16	35.00	2.57	0.003	3.46E-04	-7.9	18.2		136323
17	34.00	2.93	0.002	2.53E-04	-5.1	10.5		136323
18	33.00	2.13	0.002	2.03E-04	-2.6	5.8		136323
19	32.00	1.07	0.002	1.76E-04	-1.0	3.2		136323
20	31.00	0.25	0.002	1.60E-04	-0.3	1.8		136323
21	30.00	-0.11	0.002	1.51E-04	-0.3	0.9		136323
22	29.30	0.05	0.002	1.48E-04	-0.3	0.4		136323
23	28.60	0.79	0.001	1.47E-04	-0.0	0.0		---
At elev. 44.50		Strut force =	73.6 kN/strut =		73.6 kN/m run			
At elev. 40.30		Strut force =	165.5 kN/strut =		165.5 kN/m run			

Run ID. WALLAP_Model_SLS_PADAC_AGcheck
Barrie House, 29 St Edmunds Terrace, London
Pad A / C Foundations Assessment

| Sheet No.
| Date:17-03-2023
| Checked :

Stage No.17 Apply surcharge no.3 at elevation 43.70

(continued)

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.		Strut Elev.	FoS for toe elev. = 28.60		Toe elev. for FoS = 1.000		Direction of failure
	Act.	Pass.		Factor of Safety	Moment at elev.	Toe elev.	Wall Penetration	
1	45.00	45.00	Cant.	Conditions not suitable for FoS calc.				
2	45.00	45.00		No analysis at this stage				
3	45.00	45.00		No analysis at this stage				
4	45.00	45.00		No analysis at this stage				
5	45.00	43.00	Cant.	4.350	30.84	42.45	0.55	L to R
6	45.00	43.00		No analysis at this stage				
7	45.00	41.60	43.65	8.719	n/a	41.41	0.19	L to R
8	45.00	41.60		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 = 26.50m

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 30.00 from wall

Right side 30.00 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		Bending moment				Shear force			
		max.	min.	Calculated		Factored		Calculated		Factored	
				max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m		kN/m	
1	45.00	0.011	0.000	0	0	0	0	0	0	0	0
2	44.50	0.011	0.000	0	0	0	0	2	-74	3	-99
3	43.70	0.011	0.000	7	-54	9	-73	11	-66	14	-89
4	43.65	0.011	0.000	7	-58	10	-78	11	-95	15	-128
5	43.50	0.011	0.000	3	-67	4	-91	6	-94	8	-126
6	43.00	0.011	0.000	12	-93	17	-125	28	-75	37	-102
7	42.10	0.010	0.000	36	-108	49	-146	27	-68	37	-92
8	41.60	0.009	0.000	49	-95	66	-128	63	-34	85	-45
9	40.95	0.009	0.000	62	-67	83	-91	91	0	123	0
10	40.30	0.008	0.000	68	-52	92	-70	129	-36	175	-49
11	39.77	0.007	0.000	68	-22	92	-29	74	-3	100	-4
12	38.89	0.006	0.000	60	0	81	0	41	-11	56	-15
13	38.00	0.005	0.000	58	0	79	0	15	-15	20	-20
14	37.00	0.004	0.000	51	0	69	0	0	-14	0	-19
15	36.00	0.003	0.000	41	0	55	0	0	-13	0	-17
16	35.00	0.003	0.000	28	0	38	0	0	-12	0	-16
17	34.00	0.002	0.000	17	0	22	0	0	-9	0	-12
18	33.00	0.002	0.000	9	0	13	0	0	-6	0	-8
19	32.00	0.002	0.000	5	0	7	0	0	-3	0	-4
20	31.00	0.002	0.000	3	0	4	0	0	-1	0	-2
21	30.00	0.002	0.000	1	0	1	0	0	-1	0	-1
22	29.30	0.002	0.000	0	0	1	0	0	-1	0	-1
23	28.60	0.001	0.000	0	-0	0	-0	0	-0	0	-0

Summary of results (continued)

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

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.
	kN.m/m	kN.m/m	kN.m/m	kN.m/m	kN/m	kN/m	kN/m	kN/m	kN/m	kN/m	kN/m	kN/m
1	0	45.00	0	45.00	0	0	0	45.00	0	45.00	0	0
2	No calculation at this stage											
3	No calculation at this stage											
4	No calculation at this stage											
5	68	39.77	-0	28.60	92	-0	28	43.00	-15	38.00	37	-20
6	No calculation at this stage											
7	60	38.89	-44	42.10	81	-60	63	41.60	-66	43.65	85	-90
8	No calculation at this stage											
9	51	37.00	-67	40.95	69	-91	74	39.77	-68	42.10	100	-92
10	No calculation at this stage											
11	55	38.00	-88	42.10	74	-119	92	40.30	-95	43.65	124	-128
12	No calculation at this stage											
13	58	38.00	-108	42.10	79	-146	114	40.30	-73	44.50	154	-99
14	58	38.00	-108	42.10	79	-146	114	40.30	-74	44.50	154	-99
15	47	37.00	-100	42.10	63	-136	119	40.30	-71	44.50	161	-96
16	41	38.00	-95	42.10	56	-128	119	40.30	-67	44.50	161	-91
17	41	38.00	-100	42.10	55	-136	129	40.30	-72	44.50	175	-97

Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum elev.	minimum elev.	maximum elev.	minimum elev.	
	m	m	m	m	
1	0.000	45.00	0.000	45.00	Change EI of wall to 1.0000E-03kN.m2/m run
2	No calculation at this stage				Apply surcharge no.1 at elev. 45.00
3	No calculation at this stage				Apply surcharge no.2 at elev. 43.70
4	Wall displacements reset to zero				Change EI of wall to 190852kN.m2/m run
5	0.011	45.00	0.000	45.00	Excav. to elev. 43.00 on RIGHT side
6	No calculation at this stage				Install strut no.1 at elev. 43.65
7	0.011	45.00	0.000	45.00	Excav. to elev. 41.60 on RIGHT side
8	No calculation at this stage				Install strut no.4 at elev. 42.10
9	0.010	45.00	0.000	45.00	Excav. to elev. 39.77 on RIGHT side
10	No calculation at this stage				Install strut no.2 at elev. 40.30
11	0.011	45.00	0.000	45.00	Remove strut no.4 at elev. 42.10
12	No calculation at this stage				Install strut no.3 at elev. 44.50
13	0.011	45.00	0.000	45.00	Remove strut no.1 at elev. 43.65
14	0.011	45.00	0.000	45.00	Change soil type 2 to soil type 3
15	0.011	45.00	0.000	45.00	Change soil type 4 to soil type 5
16	0.011	43.70	0.000	45.00	Change EI of wall to 136323kN.m2/m run
17	0.011	43.65	0.000	45.00	Apply surcharge no.3 at elev. 43.70

Summary of results (continued)

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

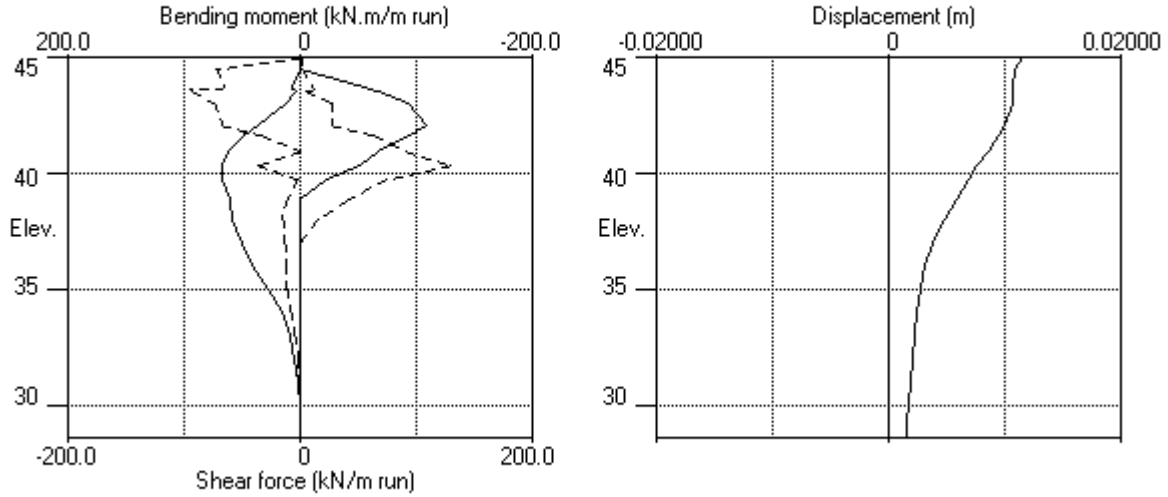
Strut forces at each stage (horizontal components)

Stage no.	----- Strut no. 1 ----- at elev. 43.65			----- Strut no. 2 ----- at elev. 40.30			----- Strut no. 3 ----- at elev. 44.50		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
7	71	71	96	---	---	---	---	---	---
9	72	72	98	---	---	---	---	---	---
11	104	104	141	65	65	88	---	---	---
13	---	---	---	96	96	130	75	75	101
14	---	---	---	97	97	130	75	75	102
15	---	---	---	142	142	192	73	73	98
16	---	---	---	150	150	202	69	69	93
17	---	---	---	166	166	223	74	74	99

Stage no.	----- Strut no. 4 ----- at elev. 42.10		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
9	91	91	123

Units: kN,m

Bending moment, shear force, displacement envelopes



Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	45.00	1 Made Ground	1 Made Ground
2	44.50	2 Head /LC Undrained	2 Head /LC Undrained
3	43.50	4 LC Undrained	4 LC Undrained

SOIL PROPERTIES

-- Soil type --	Bulk density	Young's Modulus	At rest coeff.	Consol state.	Active limit	Passive limit	Cohesion
No. Description (Datum elev.)	kN/m3	Eh, kN/m2 (dEh/dy)	Ko (dKo/dy)	(Nu) (NC/OC)	(Kac) (Ka)	(Kpc) (Kp)	(dc/dy) (kN/m2)
1 Made Ground	18.00	15000	0.531	OC (0.200)	0.298 (0.000)	4.393 (0.000)	
2 Head /LC Undrained	20.00	24000	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u
3 Head /LC Drained	20.00	18000	1.000	OC (0.200)	0.376 (1.401)	3.077 (4.665)	5.000d
4 LC Undrai.. (43.50)	20.00	24000 (6000)	1.000	OC (0.490)	1.000 (2.389)	1.000 (2.390)	40.00u (10.00)
5 LC Drained (43.50)	20.00	18000 (4500)	1.000	OC (0.200)	0.346 (1.340)	3.442 (5.007)	5.000d

Additional soil parameters associated with Ka and Kp

Soil type	--- parameters for Ka ---			--- parameters for Kp ---		
	Soil friction	Wall adhesion	Back-fill	Soil friction	Wall adhesion	Back-fill
No. Description	angle	coeff.	angle	angle	coeff.	angle
1 Made Ground	28.00	1.000	0.00	28.00	1.000	0.00
2 Head /LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
3 Head /LC Drained	24.00	0.500	0.00	24.00	0.500	0.00
4 LC Undrained	0.00	0.500	0.00	0.00	0.500	0.00
5 LC Drained	26.00	0.500	0.00	26.00	0.500	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

Initial water table elevation Left side Right side
 30.00 30.00

Automatic water pressure balancing at toe of wall : No

WALL PROPERTIES

Type of structure = Fully Embedded Wall
 Elevation of toe of wall = 28.60
 Maximum finite element length = 1.00 m
 Youngs modulus of wall E = 3.0000E+07 kN/m2
 Moment of inertia of wall I = 9.0880E-03 m4/m run
 E.I = 272640 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	43.65	1.00	1.000000	80000	1.00	0.00	0	Yes
2	40.30	1.00	0.950000	1.500E+07	1.00	0.00	0	Yes
3	44.50	1.00	0.300000	1.500E+07	1.00	0.00	0	Yes
4	42.10	1.00	1.000000	80000	1.00	0.00	0	Yes

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- Near edge	Surcharge ----- Far edge	Equiv. soil type	Partial factor/ Category
1	45.00	1.25(L)	20.00	20.00	5.00	=	N/A 1.00 -	
2	43.70	0.25(L)	2.50	2.50	220.00	=	N/A 1.00 -	
3	43.70	0.25(L)	2.50	2.50	50.00	=	N/A 1.00 -	

Note: L = Left side, R = Right side

Limit State Categories P/U = Permanent Unfavourable
P/F = Permanent Favourable
Var = Variable (unfavourable)

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Change EI of wall to 1.0000E-03 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
2	Apply surcharge no.1 at elevation 45.00 No analysis at this stage
3	Apply surcharge no.2 at elevation 43.70 No analysis at this stage
4	Change EI of wall to 190852 kN.m2/m run Yield moment not defined Reset wall displacements to zero at this stage
5	Excavate to elevation 43.00 on RIGHT side
6	Install strut or anchor no.1 at elevation 43.65
7	Excavate to elevation 41.60 on RIGHT side
8	Install strut or anchor no.4 at elevation 42.10
9	Excavate to elevation 39.77 on RIGHT side
10	Install strut or anchor no.2 at elevation 40.30
11	Remove strut or anchor no.4 at elevation 42.10
12	Install strut or anchor no.3 at elevation 44.50
13	Remove strut or anchor no.1 at elevation 43.65
14	Change properties of soil type 2 to soil type 3 Ko pressures will not be reset
15	Change properties of soil type 4 to soil type 5 Ko pressures will not be reset
16	Change EI of wall to 136323 kN.m2/m run Yield moment not defined Allow wall to relax with new modulus value
17	Apply surcharge no.3 at elevation 43.70

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) = 15.00 m

Boundary conditions:

Length of wall (normal to plane of analysis) = 26.50 m

Width of excavation on Left side of wall = 20.00 m
Width of excavation on Right side of wall = 11.50 m

Distance to rigid boundary on Left side = 30.00 m
Distance to rigid boundary on Right side = 30.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Displacement Bending mom. Shear force	Active, Passive pressures	Graph. output
1	Change EI of wall to 1.0000E-03kN.m2/m	No	No	No
2	Apply surcharge no.1 at elev. 45.00	Yes	Yes	Yes
3	Apply surcharge no.2 at elev. 43.70	Yes	Yes	Yes
4	Change EI of wall to 190852kN.m2/m run	Yes	Yes	Yes
5	Excav. to elev. 43.00 on RIGHT side	Yes	Yes	Yes
6	Install strut no.1 at elev. 43.65	Yes	Yes	Yes
7	Excav. to elev. 41.60 on RIGHT side	Yes	Yes	Yes
8	Install strut no.4 at elev. 42.10	Yes	Yes	Yes
9	Excav. to elev. 39.77 on RIGHT side	Yes	Yes	Yes
10	Install strut no.2 at elev. 40.30	Yes	Yes	Yes
11	Remove strut no.4 at elev. 42.10	No	No	No
12	Install strut no.3 at elev. 44.50	Yes	Yes	Yes
13	Remove strut no.1 at elev. 43.65	Yes	Yes	Yes
14	Change soil type 2 to soil type 3	Yes	Yes	Yes
15	Change soil type 4 to soil type 5	Yes	Yes	Yes
16	Change EI of wall to 136323kN.m2/m run	Yes	Yes	Yes
17	Apply surcharge no.3 at elev. 43.70	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

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Units: kN,m

Stage No. 17 Apply surcharge no.3 at elevation 43.70

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. =	Moment of equil. at elev.	Toe elev. for FoS =	Wall Penetration	Direction of failure
17	45.00 39.77		28.60	1.000	1.000	No FoS calc.	

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 26.50m

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 30.00 from wall

Right side 30.00 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.

*** Wall displacements reset to zero at stage 4

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	45.00	0.00	0.012	-1.79E-04	0.0	-0.0		136323
2	44.50	7.48	0.012	-1.80E-04	1.9	0.1	78.4	136323
		12.65	0.012	-1.80E-04	-76.6	0.1		
3	43.70	5.78	0.012	-1.40E-05	-69.2	-57.4		136323
4	43.65	6.03	0.012	7.34E-06	-68.9	-60.9		136323
5	43.50	16.32	0.012	7.91E-05	-67.2	-71.3		136323
		14.76	0.012	7.91E-05	-67.2	-71.3		
6	43.00	66.24	0.012	3.84E-04	-47.0	-97.4		136323
7	42.10	79.65	0.011	1.06E-03	18.7	-110.8		136323
8	41.60	72.18	0.010	1.42E-03	56.6	-92.1		136323
9	40.95	66.78	0.009	1.73E-03	101.8	-41.1		136323
10	40.30	68.31	0.008	1.73E-03	145.7	38.4	188.3	136323
		68.31	0.008	1.73E-03	-42.6	38.4		
11	39.77	73.36	0.007	1.59E-03	-5.0	26.1		136323
		49.09	0.007	1.59E-03	-5.0	26.1		
12	38.89	1.86	0.006	1.40E-03	17.5	33.5		136323
13	38.00	-20.34	0.005	1.15E-03	9.3	45.6		136323
14	37.00	-8.76	0.004	8.40E-04	-5.2	44.2		136323
15	36.00	-1.00	0.003	5.73E-04	-10.1	33.7		136323
16	35.00	2.66	0.003	3.88E-04	-9.3	21.9		136323
17	34.00	3.39	0.002	2.76E-04	-6.2	12.7		136323
18	33.00	2.57	0.002	2.16E-04	-3.3	6.8		136323
19	32.00	1.35	0.002	1.84E-04	-1.3	3.7		136323
20	31.00	0.37	0.002	1.67E-04	-0.4	2.0		136323
21	30.00	-0.09	0.002	1.57E-04	-0.3	0.9		136323
22	29.30	0.05	0.002	1.54E-04	-0.3	0.4		136323
23	28.60	0.81	0.001	1.53E-04	-0.0	-0.0		---
At elev. 44.50		Strut force =	78.4 kN/strut =		78.4 kN/m run			
At elev. 40.30		Strut force =	188.3 kN/strut =		188.3 kN/m run			

Run ID. WALLAP_Model_SLS_PADB_AGcheck
Barrie House, 29 St Edmunds Terrace, London
Pad B Foundations Assessment

| Sheet No.
| Date:17-03-2023
| Checked :

Stage No.17 Apply surcharge no.3 at elevation 43.70

(continued)

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.		Strut Elev.	FoS for toe elev. = 28.60		Toe elev. for FoS = 1.000		Direction of failure
	Act.	Pass.		Factor of Safety	Moment at elev.	Toe elev.	Wall Penetration	
1	45.00	45.00	Cant.	Conditions not suitable for FoS calc.				
2	45.00	45.00		No analysis at this stage				
3	45.00	45.00		No analysis at this stage				
4	45.00	45.00		No analysis at this stage				
5	45.00	43.00	Cant.	3.752	30.89	42.12	0.88	L to R
6	45.00	43.00		No analysis at this stage				
7	45.00	41.60	43.65	8.086	n/a	41.30	0.30	L to R
8	45.00	41.60		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 = 26.50m

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 30.00 from wall

Right side 30.00 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		---- Bending moment ----				----- Shear force -----			
		max.	min.	Calculated		Factored		Calculated		Factored	
				max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m		kN/m	
1	45.00	0.013	0.000	0	-0	0	-0	0	0	0	0
2	44.50	0.012	0.000	0	0	0	0	2	-79	3	-107
3	43.70	0.012	0.000	7	-59	10	-80	11	-72	15	-97
4	43.65	0.012	0.000	8	-62	10	-84	11	-103	15	-139
5	43.50	0.012	0.000	3	-73	4	-99	6	-102	8	-137
6	43.00	0.012	0.000	13	-101	17	-136	27	-84	37	-113
7	42.10	0.011	0.000	35	-121	47	-164	25	-76	34	-103
8	41.60	0.010	0.000	47	-108	63	-146	67	-37	90	-51
9	40.95	0.009	0.000	60	-78	81	-106	102	0	137	0
10	40.30	0.008	0.000	67	-60	91	-81	146	-43	197	-57
11	39.77	0.008	0.000	69	-24	93	-33	86	-5	116	-7
12	38.89	0.006	0.000	65	0	88	0	48	-9	65	-12
13	38.00	0.005	0.000	68	0	92	0	18	-14	24	-18
14	37.00	0.004	0.000	60	0	81	0	0	-14	0	-19
15	36.00	0.003	0.000	48	0	65	0	0	-15	0	-20
16	35.00	0.003	0.000	33	0	44	0	0	-14	0	-19
17	34.00	0.002	0.000	19	0	26	0	0	-11	0	-14
18	33.00	0.002	0.000	11	0	15	0	0	-7	0	-9
19	32.00	0.002	0.000	6	0	8	0	0	-3	0	-5
20	31.00	0.002	0.000	3	0	4	0	0	-2	0	-2
21	30.00	0.002	0.000	1	0	2	0	0	-1	0	-1
22	29.30	0.002	0.000	0	0	1	0	0	-1	0	-1
23	28.60	0.001	0.000	0	-0	0	-0	0	-0	0	-0

Summary of results (continued)

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

Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment						Shear force					
	Calculated		Factored		Calculated		Factored		Calculated		Factored	
	max. elev.	min. elev.	max.	min.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.	max. elev.	min. elev.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	
1	0	45.00	0	45.00	0	0	0	45.00	0	45.00	0	0
2	No calculation at this stage											
3	No calculation at this stage											
4	No calculation at this stage											
5	69	39.77	-0	45.00	93	-0	27	43.00	-14	37.00	37	-19
6	No calculation at this stage											
7	65	38.89	-51	42.10	88	-69	67	41.60	-72	43.65	90	-97
8	No calculation at this stage											
9	60	37.00	-78	40.95	81	-106	86	39.77	-76	42.10	116	-103
10	No calculation at this stage											
11	64	38.00	-99	41.60	87	-134	103	40.30	-103	43.65	139	-139
12	No calculation at this stage											
13	68	38.00	-121	42.10	92	-164	127	40.30	-79	44.50	171	-107
14	68	38.00	-121	42.10	92	-164	127	40.30	-79	44.50	172	-107
15	54	37.00	-111	42.10	73	-150	133	40.30	-76	44.50	180	-102
16	46	38.00	-105	42.10	62	-141	134	40.30	-72	44.50	180	-97
17	46	38.00	-111	42.10	62	-150	146	40.30	-77	44.50	197	-103

Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	45.00	0.000	45.00	Change EI of wall to 1.0000E-03kN.m2/m run
2	No calculation at this stage				Apply surcharge no.1 at elev. 45.00
3	No calculation at this stage				Apply surcharge no.2 at elev. 43.70
4	Wall displacements reset to zero				Change EI of wall to 190852kN.m2/m run
5	0.013	45.00	0.000	45.00	Excav. to elev. 43.00 on RIGHT side
6	No calculation at this stage				Install strut no.1 at elev. 43.65
7	0.013	45.00	0.000	45.00	Excav. to elev. 41.60 on RIGHT side
8	No calculation at this stage				Install strut no.4 at elev. 42.10
9	0.012	45.00	0.000	45.00	Excav. to elev. 39.77 on RIGHT side
10	No calculation at this stage				Install strut no.2 at elev. 40.30
11	0.012	45.00	0.000	45.00	Remove strut no.4 at elev. 42.10
12	No calculation at this stage				Install strut no.3 at elev. 44.50
13	0.012	45.00	0.000	45.00	Remove strut no.1 at elev. 43.65
14	0.012	45.00	0.000	45.00	Change soil type 2 to soil type 3
15	0.012	45.00	0.000	45.00	Change soil type 4 to soil type 5
16	0.012	43.70	0.000	45.00	Change EI of wall to 136323kN.m2/m run
17	0.012	43.65	0.000	45.00	Apply surcharge no.3 at elev. 43.70

Summary of results (continued)

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

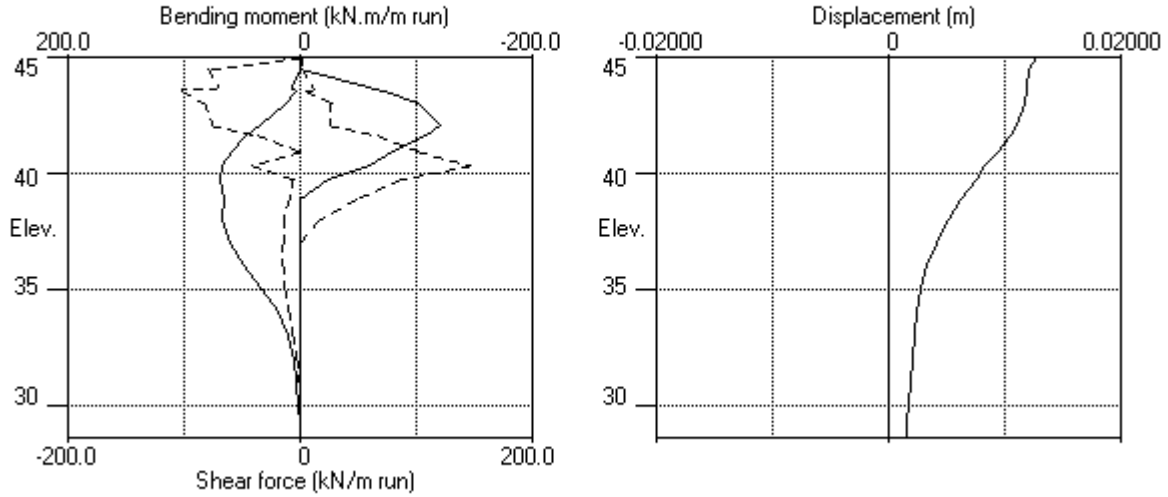
Strut forces at each stage (horizontal components)

Stage no.	----- Strut no. 1 ----- at elev. 43.65			----- Strut no. 2 ----- at elev. 40.30			----- Strut no. 3 ----- at elev. 44.50		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
7	76	76	103	---	---	---	---	---	---
9	78	78	106	---	---	---	---	---	---
11	113	113	152	69	69	93	---	---	---
13	---	---	---	103	103	139	81	81	109
14	---	---	---	103	103	139	81	81	110
15	---	---	---	160	160	216	78	78	105
16	---	---	---	169	169	228	74	74	100
17	---	---	---	188	188	254	78	78	106

Stage no.	----- Strut no. 4 ----- at elev. 42.10		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
9	97	97	131

Units: kN,m

Bending moment, shear force, displacement envelopes





CARD GEOTECHNICS LIMITED

Job No. Sheet No. Rev.

CG/28408B

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Short Term Excavation, 4 Storey Structure

Drg. Ref.

Made by
ALP

Date

Checked

Analysis Options

Analysis: Boussinesq
Global Poisson's ratio: 0.50
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 15.00 [m OD]
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No
Displacements at load centroids: Yes

Soil Profiles Soil Profile 1

Layer	Level at top	Number of intermediate displacement levels	Youngs Modulus	Poissons ratio	Non-linear curve
	[mOD]		Top [kN/m ²]	Btm [kN/m ²]	
1	46.100	5	15000.	15000.	0.20000 None
2	44.500	5	24000.	24000.	0.49500 None
3	43.500	5	24000.	195000.	0.49500 None

Soil Zones

Zone	Name	X coordinates min max	Y coordinates min max	Profile
1	1	-10.00000 40.00000	-15.00000 55.00000	Soil Profile 1

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 Y Z	Angle of local x from Radius	Width x or Radius	Length y	Polygon Coordinates	Rectangle tolerance	Number of rectangles	Normal (local z)	Tangential (local x)	Load value (local y)
1	Extension Excavation	Polygonal	Horizontal	N/A N/A 39.77000	N/A	N/A	N/A	(0,18.4) (25.9,18.4) (25.9,16.2) (26.4,16.2) (26.4,9.44) (25.9,9.44) (25.9,6.82) (17.6,6.83) (17.6,8.25) (14.2,8.25) (14.2,8.5) (9.97,8.5) (9.97,8.25) (6.42,8.25) (6.42,6.83) (6.45,5.13) (8.28,5.13) (8.28,4.89) (16.2,4.88) (16.2,-3.81) (13.5,-3.81) (13.5,-0.607) (13.6,-0.607) (13.6,1.29) (7.09,1.29) (7.09,0.22) (6.44,0.22) (6.44,5.13)	10.000	6	-123.40	N/A	N/A
2	Barrie House Excavation	Polygonal	Horizontal	N/A N/A 42.70000	N/A	N/A	N/A	(-1.06,19.1) (-1.06,13.4) (-8.06,13.4) (-8.06,19.1)	10.000	5	-46.080	N/A	N/A
3	Porters Lodge Demolition	Polygonal	Horizontal	N/A N/A 45.00000	N/A	N/A	N/A		10.000	1	-30.000	N/A	N/A

Polygonal Loads' Rectangles

No.	Centre of load X Y	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
Load 1 : Extension Excavation (Edge 2 optimal)				
1	3.20850 12.59050	0.0	6.4170	11.519
2	8.19550 13.30050	0.0	3.5570	10.099
3	12.07450 13.42350	0.0	4.2010	9.8530
4	15.88900 13.30050	0.0	3.4280	10.099
5	21.73300 12.58825	0.0	8.2600	11.524
6	26.13350 12.84050	0.0	0.56700	6.8010
Load 2 : Barrie House Excavation (Edge 2 optimal)				
1	7.35875 5.00900	-90.000	0.23800	1.8455
2	11.31698 3.08900	-90.000	3.5920	9.7620
3	6.76100 0.75650	-90.000	1.0730	0.65000
4	14.87619 0.34300	-90.000	1.9000	2.6404
5	14.84096 -2.20650	-90.000	3.1990	2.7079
Load 3 : Porters Lodge Demolition (Edge 2 optimal)				
1	-4.56400 16.25700	-90.000	5.7500	7.0000

Displacement Data

Ref.	Type	Name	Direction of Extrusion	Line/Line for extrusion First point X Y Z (level)	Second point X Y Z (level)	No. of intrvl across extrusion/line	Extrusion Depth [m]	No. of intrvl along extrusion	Calculate	Show Detailed results
1	Line	72 Kingsland	N/A	21.37000 18.35000 45.10000	21.37000 48.35000 45.10000	300	N/A	N/A	Yes	Yes
2	Line	16 Kingsland	N/A	0.00000 18.35000 45.10000	0.00000 48.35000 45.10000	300	N/A	N/A	Yes	Yes
3	Line	Pad A	N/A	8.19500 8.25100 43.70000	8.19500 -6.74900 43.70000	150	N/A	N/A	Yes	Yes
4	Line	Pad B	N/A	12.07500 8.49700 43.70000	12.07500 -6.50300 43.70000	150	N/A	N/A	Yes	Yes
5	Line	Pad C	N/A	15.88900 8.25100 43.70000	15.88900 -11.74900 43.70000	200	N/A	N/A	Yes	Yes
6	Grid	Grid 2	Global X	-30.00000 -30.00000 46.10000	N/A 70.00000 46.10000	90	90.00000	100	No	N/A

Warnings

(1)One or more displacement grids or lines have numbers of intervals of at least 100. Large numbers of intervals will slow the analysis.

RESULTS FOR GRIDS

Analysis: Boussinesq
Global Poisson's ratio: 0.50
Horizontal rigid boundary level: 15.00 [m OD]

The maximum displacement difference between the Boussinesq method (-5.6167mm) and the Mindlin method (-4.3754mm) occurs at point X = 21.37000m, Y = 18.35000m, level = 45.100mOD, and is 1.2413mm.

Name	Location X Y	Displacement Z [Level] [mOD]	Stresses Calc Level [mOD]	Vert Stress [kN/m ²]	Sum Princ [kN/m ²]	Vert Strain [-]
Extension Excavation	13.16898 12.89018	39.77000	-11.158	37.548	-120.30	-269.30
Barrie House Excavation	12.18661 11.87954	42.70000	-4.2113	39.990	-27.923	-46.981
Porters Lodge Demolition	-4.56400 16.25700	45.00000	-4.2259	44.875	-29.999	-86.489
72 Kingsland	21.37000 18.35000	45.10000	-5.6167	44.950	0.0	-0.0016809
	21.37000 18.45000	45.10000	-5.1736	44.950	0.0	-0.0016793
	21.37000 18.55000	45.10000	-4.7427	44.950	0.0	-0.0016776
	21.37000 18.65000	45.10000	-4.3351	44.950	0.0	-0.0016758
	21.37000 18.75000	45.10000	-3.9589	44.950	0.0	-0.0016739
	21.37000 18.85000	45.10000	-3.6194	44.950	0.0	-0.0016720
	21.37000 18.95000	45.10000	-3.3185	44.950	0.0	-0.0016700
	21.37000 19.05000	45.10000	-3.0557	44.950	0.0	-0.0016679
	21.37000 19.15000	45.10000	-2.8285	44.950	0.0	-0.0016658
	21.37000 19.25000	45.10000	-2.6333	44.950	0.0	-0.0016636
	21.37000 19.35000	45.10000	-2.4660	44.950	0.0	-0.0016613



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Short Term Excavation, 4 Storey Structure

Table with 3 columns: Job No., Sheet No., Rev. and 3 rows containing project details like CG/28408B, Drg. Ref., Made by ALP, Date, and Checked.

Main data table with columns: Name, Location (X, Y, Z), Displacement (Z), Calc Level, Stresses (Vert Stress, Sum Princ, Vert Strain). Contains multiple rows of data for 'Pad A'.



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Short Term Excavation, 4 Storey Structure

Table with Job No., Sheet No., Rev., Drg. Ref., Made by, Date, Checked

Main data table with columns: Name, Location (X, Y, Z), Displacement (Z), Calc Level, Stresses (Vert Stress, Sum Princ, Vert Strain)



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Short Term Excavation, 4 Storey Structure

Table with Job No. (CG/28408B), Sheet No., Rev., Drg. Ref., Made by (ALP), Date, and Checked.

Main data table with columns: Name, Location (X, Y, Z), Displacement (Z), Calc Level, Stresses (Vert Stress, Sum Princ), and Vert Strain.



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Long Term Excavation, 4 Storey Structure

Job No.	Sheet No.	Rev.
CG/28408B		
Drg. Ref.		
Made by ALP	Date	Checked

Analysis Options

Analysis: Boussinesq
Global Poisson's ratio: 0.20
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 15.00 [m OD]
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No
Displacements at load centroids: Yes

Soil Profiles

Layer	Level at top [mOD]	Number of intermediate displacement levels	Youngs Modulus [kN/m ²]	Poissons ratio	Non-linear curve
			Top [kN/m ²]	Btm [kN/m ²]	
1	46.100	5	15000.	15000.	0.20000 None
2	44.500	5	18000.	18000.	0.20000 None
3	43.500	5	18000.	146250.	0.20000 None

Soil Zones

Zone	Name	X coordinates min max [m]	Y coordinates min max [m]	Profile
1	1	-10.00000 40.00000	-15.00000 55.00000	Soil Profile 1

Non-linear Curve Coordinates - Non-linear Curve 1

Point Strain Factor [%]

Load Data

Load ref.	Name	Shape	Orientation of Plane	Centre of load (Global)			Angle of local x from	Width x or Radius	Length y	Polygon Coordinates	Rectangle tolerance	Number of rectangles	Load value		
				X [m]	Y [m]	Z (level) [m]							Normal (local z) [kN/m ²]	Tangential (local x) [kN/m ²]	Tangential (local y) [kN/m ²]
1	Extension Excavation	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(0,18.4) (25.9,18.4) (25.9,16.2) (26.4,16.2) (26.4,9.44) (25.9,9.44) (25.9,6.82) (17.6,6.83) (17.6,8.25) (14.2,8.25) (14.2,8.5) (9.97,8.5) (9.97,8.25) (6.42,8.25) (6.42,6.83) (0,6.83)	10.000	6	-123.40	N/A	N/A
2	Barrie House Excavation	Polygonal	Horizontal	N/A	N/A	42.70000	N/A	N/A	N/A	(6.45,5.13) (8.28,5.13) (8.28,4.89) (16.2,4.88) (16.2,-3.81) (13.5,-3.81) (13.5,-0.607) (13.6,-0.607) (13.6,1.29) (7.09,1.29) (7.09,0.22) (6.44,0.22) (6.44,5.13)	10.000	5	-46.080	N/A	N/A
3	Porters Lodge Demolition	Polygonal	Horizontal	N/A	N/A	45.00000	N/A	N/A	N/A	(-1.06,19.1) (-1.06,13.4) (-8.06,13.4) (-8.06,19.1)	10.000	1	-30.000	N/A	N/A
4	1	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(0.2,18.1) (3.64,18.1) (3.64,14.7) (0.2,14.7)	10.000	1	86.412	N/A	N/A
5	2	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(10.9,18.1) (10.9,14.7) (3.64,14.7) (3.64,18.1)	10.000	1	71.457	N/A	N/A
6	3	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(0.2,14.7) (3.64,14.7) (3.64,7.03) (0.2,7.03)	10.000	1	55.763	N/A	N/A
7	4	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(3.64,7.03) (3.64,14.7) (10.9,14.7) (10.9,18.1) (13.7,18.1) (13.7,14.7) (17.8,14.7) (17.8,10.9) (18.6,10.9) (18.6,7.03) (18.7,0.3) (18.8,4.5) (14.4,8.45) (14.4,8.7) (9.77,8.7) (9.77,8.45) (6.22,8.45) (6.22,7.03)	10.000	7	76.974	N/A	N/A
8	5	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(13.7,14.7) (13.7,18.1) (25.6,18.1) (25.6,15.9) (26.1,15.9) (26.1,14.7) (17.8,14.7) (26.1,14.7) (26.1,10.9) (17.8,10.9)	10.000	2	70.610	N/A	N/A
9	6	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(26.1,10.9) (26.1,14.7) (26.1,9.74) (25.6,9.74) (25.6,7.02) (18.6,7.03)	10.000	1	32.130	N/A	N/A
10	7	Polygonal	Horizontal	N/A	N/A	39.77000	N/A	N/A	N/A	(26.1,9.74) (25.6,9.74) (25.6,7.02) (18.6,7.03)	10.000	2	61.784	N/A	N/A
11	Wall Top Half	Polygonal	Horizontal	N/A	N/A	39.82000	N/A	N/A	N/A	(0,18.4) (25.9,18.4) (25.9,16.2) (26.4,16.2) (26.4,9.44) (25.9,9.44) (25.9,6.82) (17.6,6.83) (17.6,8.25) (14.2,8.25) (14.2,8.5) (9.97,8.5) (9.97,8.25) (6.42,8.25) (6.42,6.83) (0,6.83)	10.000	7	136.63	N/A	N/A
12	Wall Bottom Half	Polygonal	Horizontal	N/A	N/A	39.82000	N/A	N/A	N/A	(0,18.4) (0.2,18.1) (0.2,7.03) (6.22,7.03) (6.22,8.45) (9.77,8.45) (9.77,8.7) (14.4,8.7) (14.4,8.45) (18,8.45) (18,7.03) (25.6,7.02) (25.6,9.74) (26.1,9.74) (26.4,9.44) (25.9,9.44) (25.9,6.82) (17.6,6.83) (17.6,8.25) (14.2,8.25) (14.2,8.5) (9.97,8.5) (9.97,8.25) (6.42,8.25) (6.42,6.83) (0,6.83)	10.000	14	136.63	N/A	N/A
13	Slab	Polygonal	Horizontal	N/A	N/A	39.82000	N/A	N/A	N/A	(0.2,18.1) (25.6,18.1) (25.6,15.9) (26.1,15.9) (26.1,9.74) (25.6,9.74) (25.6,7.02) (18,7.03) (18,8.45) (14.4,8.45) (14.4,8.7) (9.77,8.7) (9.77,8.45) (6.22,8.45) (6.22,7.03)	10.000	6	29.500	N/A	N/A
14	Underpin	Polygonal	Horizontal	N/A	N/A	39.22000	N/A	N/A	N/A	(25.9,8.2) (25.9,6) (17.6,6) (17.6,8.2)	10.000	1	45.000	N/A	N/A
15	8	Polygonal	Horizontal	N/A	N/A	42.70000	N/A	N/A	N/A	(6.45,5.13) (8.28,5.13) (8.28,4.89) (16.2,4.88) (16.2,-3.81) (13.5,-3.81) (13.5,-0.607) (13.6,-0.607) (13.6,1.29) (7.09,1.29) (7.09,0.22) (6.44,0.22) (6.44,5.13)	10.000	5	7.5000	N/A	N/A

Polygonal Loads' Rectangles

No.	Centre of load X [m]	Y [m]	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
Load 1 : Extension Excavation (Edge 2 optimal)					
1	3.20850	12.59050	0.0	6.4170	11.519
2	8.19550	13.30050	0.0	3.5570	10.099
3	12.07450	13.42350	0.0	4.2010	9.8530
4	15.88900	13.30050	0.0	3.4280	10.099
5	21.73300	12.58825	0.0	8.2600	11.524
6	26.15350	12.84050	0.0	0.56700	6.8010
Load 2 : Barrie House Excavation (Edge 2 optimal)					
1	7.35875	5.00900	-90.000	0.23800	1.8455
2	11.31698	3.08900	-90.000	3.5920	9.7620
3	6.76100	0.75650	-90.000	1.0730	0.65000



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No.	Centre of load X Y	Angle of local x From global X	Width x	Depth y
4	14.87619 0.34300	-90.000	1.9000	2.6404
5	14.84096 -2.20650	-90.000	3.1990	2.7079
Load 3 : Porters Lodge Demolition (Edge 2 optimal)				
1	-4.56400 16.25700	-90.000	5.7500	7.0000
Load 4 : 1 (Edge 2 optimal)				
1	1.92150 16.44450	0.0	3.4430	3.4110
Load 5 : 2 (Edge 2 optimal)				
1	7.25700 16.42200	-90.000	3.4560	7.2280
Load 6 : 3 (Edge 2 optimal)				
1	1.92150 10.88500	0.0	3.4430	7.7080
Load 7 : 4 (Edge 2 optimal)				
1	4.93200 7.74100	90.000	1.4200	2.5780
2	6.70850 8.57400	90.000	0.24600	6.1310
3	18.26169 7.74000	90.000	1.4220	0.61737
4	16.47315 8.57400	90.000	0.24600	4.1953
5	11.10722 9.78350	90.000	2.1730	14.928
6	10.69876 12.78200	90.000	3.8240	14.112
7	12.27050 16.43750	90.000	3.4250	2.7990
Load 8 : 5 (Edge 2 optimal)				
1	19.90250 15.33550	90.000	1.2110	12.469
2	19.61900 17.04550	90.000	2.2090	11.902
Load 9 : 6 (Edge 2 optimal)				
1	21.94450 12.80000	0.0	8.3850	3.8600
Load 10 : 7 (Edge 2 optimal)				
1	22.06760 8.94800	-0.032792	6.9890	3.8440
2	25.85000 10.30500	-0.032792	0.57335	1.1300
Load 11 : Wall Top Half (Edge 10 optimal)				
1	12.88500 18.25000	0.0	25.370	0.20000
2	25.72000 17.14550	0.0	0.30000	2.4190
3	26.00350 16.09100	0.0	0.26700	0.30000
4	26.28700 12.91550	0.0	0.30000	6.6510
5	0.03333 18.33333	0.0	0.066667	0.033333
6	0.10000 18.30000	0.0	0.066667	0.10000
7	0.16667 18.26667	0.0	0.066667	0.16667
Load 12 : Wall Bottom Half (Edge 19 optimal)				
1	3.20850 6.93108	89.956	0.19525	6.4170
2	6.31900 7.64100	89.956	1.2201	0.19600
3	8.09750 8.35100	89.956	0.19713	3.7530
4	21.73204 6.92663	89.956	0.19895	8.2581
5	25.71154 8.23200	89.956	2.4162	0.30108
6	25.96156 9.51520	89.956	0.14967	0.80111
7	25.88667 9.66492	89.956	0.14967	0.65133
8	17.77771 7.64000	89.956	1.2217	0.34943
9	16.06396 8.35094	89.956	0.19753	3.7779
10	12.07500 8.59692	89.956	0.19664	4.6020
11	0.10000 12.59058	89.956	11.119	0.20000
12	0.08333 18.18340	89.956	0.066616	0.16667
13	0.05000 18.25004	89.956	0.066616	0.10000
14	0.01667 18.31668	89.956	0.066616	0.033333
Load 13 : Slab (Edge 2 optimal)				
1	3.21050 12.59050	0.0	6.0210	11.119
2	7.99750 13.30050	0.0	3.5530	9.6990
3	12.07500 13.42350	0.0	4.6020	9.4530
4	16.16450 13.30050	0.0	3.5770	9.6990
5	21.75700 12.58825	0.0	7.6080	11.123
6	25.85350 12.84075	0.0	0.56700	6.2005
Load 14 : Underpin (Edge 2 optimal)				
1	21.73200 7.10150	-90.000	2.1950	8.2580
Load 15 : 8 (Edge 2 optimal)				
1	7.35875 5.00900	-90.000	0.23800	1.8455
2	11.21698 3.08900	-90.000	3.5920	9.7650
3	6.76100 0.75650	-90.000	1.0730	0.65000
4	14.87619 0.34300	-90.000	1.9000	2.6404
5	14.84096 -2.20650	-90.000	3.1990	2.7079

Displacement Data

Ref.	Type	Name	Direction of Extrusion	First point X [m]	Y [m]	Z [Level] [m]	Line/Line for extrusion	Second point X [m]	Y [m]	Z [Level] [m]	No. of intrvl's across extrusion/line	Extrusion Depth [m]	No. of intrvl's along extrusion	Calculate	Show Detailed results
1	Line	72 Kingsland	N/A	21.37000	18.35000	45.10000	21.37000	48.35000	45.10000	300	N/A	N/A	Yes	Yes	
2	Line	16 Kingsland	N/A	0.00000	18.35000	45.10000	0.00000	48.35000	45.10000	300	N/A	N/A	Yes	Yes	
3	Line	Pad A	N/A	8.19500	8.25100	43.70000	8.19500	-6.74900	43.70000	150	N/A	N/A	Yes	Yes	
4	Line	Pad B	N/A	12.07500	8.49700	43.70000	12.07500	-6.50300	43.70000	150	N/A	N/A	Yes	Yes	
5	Line	Pad C	N/A	15.88900	8.25100	43.70000	15.88900	-11.74900	43.70000	200	N/A	N/A	Yes	Yes	
6	Grid	Grid 2	Global X	-30.00000	-30.00000	46.10000	N/A	70.00000	46.10000	90	90.00000	100	No	N/A	
7	Grid	Grid 2	Global X	-30.00000	-30.00000	39.77000	N/A	70.00000	39.77000	90	90.00000	100	No	N/A	

Warnings

(1) One or more displacement grids or lines have numbers of intervals of at least 100. Large numbers of intervals will slow the analysis.

RESULTS FOR GRIDS

Analysis: Boussinesq
Global Poisson's ratio: 0.20
Horizontal rigid boundary level: 15.00 [m OD]

The maximum displacement difference between the Boussinesq method (-6.9296mm) and the Mindlin method (-4.8962mm) occurs at point X = 8.19500m, Y = 3.95100m, level = 43.700mOD, and is 2.0333mm.

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Displacement Z [mm]	Calc Level [mOD]	Vert Stress [kN/m ²]	Sum Princ [kN/m ²]	Vert Strain [-]
Extension Excavation	13.16898	12.89018	39.77000	-3.7755	37.548	-17.892	-35.819	-324.94E-6
Barrie House Excavation	12.18861	1.87954	42.70000	-5.4392	39.990	-23.381	-31.606	-673.45E-6
Porters Lodge Demolition	-4.56400	16.25700	45.00000	-6.7235	44.875	-29.999	-69.423	-0.0014742
1	1.92150	16.44450	39.77000	-2.5649	37.548	-12.158	-23.077	-226.55E-6
2	7.25700	16.42200	39.77000	-3.5104	37.548	-18.945	-32.130	-370.40E-6
3	1.92150	10.88500	39.77000	-4.8181	37.548	-30.738	-44.129	-637.29E-6
4	10.84029	11.85863	39.77000	-3.6497	37.548	-17.374	-33.982	-319.17E-6
5	19.72099	16.42040	39.77000	-4.2658	37.548	-23.847	-43.227	-453.59E-6
6	21.94450	12.80000	39.77000	-7.6012	37.548	-51.753	-74.270	-0.0010731
7	22.15690	8.98008	39.77000	-3.7709	37.548	-21.063	-32.499	-426.44E-6
Wall Top Half	17.54978	16.77821	39.82000	-3.9112	37.590	-20.267	-37.228	-385.00E-6
Wall Bottom Half	11.17879	8.93432	39.82000	-2.9956	37.590	-12.446	-26.209	-221.17E-6
Slab	13.10849	12.91205	39.82000	-3.7891	37.590	-17.874	-35.930	-325.39E-6
Underpin	21.73200	7.10150	39.22000	-0.28954	37.086	8.2884	-1.8428	223.25E-6
8	12.18861	1.87954	42.70000	-5.4392	39.990	-23.381	-31.606	-673.45E-6
72 Kingsland	21.37000	18.35000	45.10000	-2.4835	44.950	0.0	-0.0013493	0.0
	21.37000	18.45000	45.10000	-2.3408	44.950	0.0	-0.0013479	0.0
	21.37000	18.55000	45.10000	-2.2073	44.950	0.0	-0.0013466	0.0
	21.37000	18.65000	45.10000	-2.0848	44.950	0.0	-0.0013451	0.0
	21.37000	18.75000	45.10000	-1.9744	44.950	0.0	-0.0013436	0.0
	21.37000	18.85000	45.10000	-1.8761	44.950	0.0	-0.0013421	0.0
	21.37000	18.95000	45.10000	-1.7893	44.950	0.0	-0.0013405	0.0



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
 Basement Impact Assessment
 Long Term Excavation, 4 Storey Structure

Job No. CG/28408B	Sheet No.	Rev.
Drg. Ref.		
Made by ALP	Date	Checked

Name	Location	Displacement	Stresses			Vert Strain	
X [m]	Y [m]	Z [Level] [mm]	Calc Level [mOD]	Vert Stress [kN/m ²]	Sum Princ [kN/m ²]	[-]	
21.37000	33.15000	45.10000	-0.091011	44.950	0.0	-792.25E-6	0.0
21.37000	33.25000	45.10000	-0.089331	44.950	0.0	-787.99E-6	0.0
21.37000	33.35000	45.10000	-0.087680	44.950	0.0	-783.75E-6	0.0
21.37000	33.45000	45.10000	-0.086058	44.950	0.0	-779.52E-6	0.0
21.37000	33.55000	45.10000	-0.084465	44.950	0.0	-775.30E-6	0.0
21.37000	33.65000	45.10000	-0.082899	44.950	0.0	-771.10E-6	0.0
21.37000	33.75000	45.10000	-0.081361	44.950	0.0	-766.91E-6	0.0
21.37000	33.85000	45.10000	-0.079850	44.950	0.0	-762.74E-6	0.0
21.37000	33.95000	45.10000	-0.078365	44.950	0.0	-758.58E-6	0.0
21.37000	34.05000	45.10000	-0.076906	44.950	0.0	-754.44E-6	0.0
21.37000	34.15000	45.10000	-0.075492	44.950	0.0	-750.31E-6	0.0
21.37000	34.25000	45.10000	-0.074064	44.950	0.0	-746.19E-6	0.0
21.37000	34.35000	45.10000	-0.072680	44.950	0.0	-742.09E-6	0.0
21.37000	34.45000	45.10000	-0.071320	44.950	0.0	-738.00E-6	0.0
21.37000	34.55000	45.10000	-0.069983	44.950	0.0	-733.93E-6	0.0
21.37000	34.65000	45.10000	-0.068698	44.950	0.0	-729.88E-6	0.0
21.37000	34.75000	45.10000	-0.067379	44.950	0.0	-725.84E-6	0.0
21.37000	34.85000	45.10000	-0.066111	44.950	0.0	-721.82E-6	0.0
21.37000	34.95000	45.10000	-0.064864	44.950	0.0	-717.81E-6	0.0
21.37000	35.05000	45.10000	-0.063639	44.950	0.0	-713.82E-6	0.0
21.37000	35.15000	45.10000	-0.062435	44.950	0.0	-709.84E-6	0.0
21.37000	35.25000	45.10000	-0.061252	44.950	0.0	-705.88E-6	0.0
21.37000	35.35000	45.10000	-0.060089	44.950	0.0	-701.94E-6	0.0
21.37000	35.45000	45.10000	-0.058946	44.950	0.0	-698.01E-6	0.0
21.37000	35.55000	45.10000	-0.057823	44.950	0.0	-694.10E-6	0.0
21.37000	35.65000	45.10000	-0.056719	44.950	0.0	-690.20E-6	0.0
21.37000	35.75000	45.10000	-0.055634	44.950	0.0	-686.33E-6	0.0
21.37000	35.85000	45.10000	-0.054567	44.950	0.0	-682.47E-6	0.0
21.37000	35.95000	45.10000	-0.053519	44.950	0.0	-678.62E-6	0.0
21.37000	36.05000	45.10000	-0.052489	44.950	0.0	-674.78E-6	0.0
21.37000	36.15000	45.10000	-0.051476	44.950	0.0	-670.96E-6	0.0
21.37000	36.25000	45.10000	-0.050480	44.950	0.0	-667.19E-6	0.0
21.37000	36.35000	45.10000	-0.049501	44.950	0.0	-663.41E-6	0.0
21.37000	36.45000	45.10000	-0.048540	44.950	0.0	-659.65E-6	0.0
21.37000	36.55000	45.10000	-0.047594	44.950	0.0	-655.91E-6	0.0
21.37000	36.65000	45.10000	-0.046664	44.950	0.0	-652.18E-6	0.0
21.37000	36.75000	45.10000	-0.045751	44.950	0.0	-648.47E-6	0.0
21.37000	36.85000	45.10000	-0.044852	44.950	0.0	-644.78E-6	0.0
21.37000	36.95000	45.10000	-0.043969	44.950	0.0	-641.11E-6	0.0
21.37000	37.05000	45.10000	-0.043101	44.950	0.0	-637.45E-6	0.0
21.37000	37.15000	45.10000	-0.042248	44.950	0.0	-633.81E-6	0.0
21.37000	37.25000	45.10000	-0.041409	44.950	0.0	-630.19E-6	0.0
21.37000	37.35000	45.10000	-0.040584	44.950	0.0	-626.58E-6	0.0
21.37000	37.45000	45.10000	-0.039774	44.950	0.0	-622.99E-6	0.0
21.37000	37.55000	45.10000	-0.038976	44.950	0.0	-619.42E-6	0.0
21.37000	37.65000	45.10000	-0.038193	44.950	0.0	-615.87E-6	0.0
21.37000	37.75000	45.10000	-0.037422	44.950	0.0	-612.34E-6	0.0
21.37000	37.85000	45.10000	-0.036665	44.950	0.0	-608.82E-6	0.0
21.37000	37.95000	45.10000	-0.035920	44.950	0.0	-605.32E-6	0.0
21.37000	38.05000	45.10000	-0.035188	44.950	0.0	-601.84E-6	0.0
21.37000	38.15000	45.10000	-0.034468	44.950	0.0	-598.37E-6	0.0
21.37000	38.25000	45.10000	-0.033761	44.950	0.0	-594.92E-6	0.0
21.37000	38.35000	45.10000	-0.033065	44.950	0.0	-591.49E-6	0.0
21.37000	38.45000	45.10000	-0.032381	44.950	0.0	-588.08E-6	0.0
21.37000	38.55000	45.10000	-0.031708	44.950	0.0	-584.67E-6	0.0
21.37000	38.65000	45.10000	-0.031047	44.950	0.0	-581.28E-6	0.0
21.37000	38.75000	45.10000	-0.030397	44.950	0.0	-577.95E-6	0.0
21.37000	38.85000	45.10000	-0.029758	44.950	0.0	-574.61E-6	0.0
21.37000	38.95000	45.10000	-0.029129	44.950	0.0	-571.29E-6	0.0
21.37000	39.05000	45.10000	-0.028511	44.950	0.0	-567.98E-6	0.0
21.37000	39.15000	45.10000	-0.027904	44.950	0.0	-564.69E-6	0.0
21.37000	39.25000	45.10000	-0.027306	44.950	0.0	-561.42E-6	0.0
21.37000	39.35000	45.10000	-0.026719	44.950	0.0	-558.16E-6	0.0
21.37000	39.45000	45.10000	-0.026141	44.950	0.0	-554.93E-6	0.0
21.37000	39.55000	45.10000	-0.025573	44.950	0.0	-551.71E-6	0.0
21.37000	39.65000	45.10000	-0.025015	44.950	0.0	-548.50E-6	0.0
21.37000	39.75000	45.10000	-0.024466	44.950	0.0	-545.32E-6	0.0
21.37000	39.85000	45.10000	-0.023926	44.950	0.0	-542.15E-6	0.0
21.37000	39.95000	45.10000	-0.023395	44.950	0.0	-539.00E-6	0.0
21.37000	40.05000	45.10000	-0.022873	44.950	0.0	-535.87E-6	0.0
21.37000	40.15000	45.10000	-0.022360	44.950	0.0	-532.76E-6	0.0
21.37000	40.25000	45.10000	-0.021856	44.950	0.0	-529.66E-6	0.0
21.37000	40.35000	45.10000	-0.021359	44.950	0.0	-526.58E-6	0.0
21.37000	40.45000	45.10000	-0.020871	44.950	0.0	-523.51E-6	0.0
21.37000	40.55000	45.10000	-0.020392	44.950	0.0	-520.45E-6	0.0
21.37000	40.65000	45.10000	-0.019920	44.950	0.0	-517.41E-6	0.0
21.37000	40.75000	45.10000	-0.019456	44.950	0.0	-514.38E-6	0.0
21.37000	40.85000	45.10000	-0.019000	44.950	0.0	-511.36E-6	0.0
21.37000	40.95000	45.10000	-0.018552	44.950	0.0	-508.35E-6	0.0
21.37000	41.05000	45.10000	-0.018111	44.950	0.0	-505.35E-6	0.0
21.37000	41.15000	45.10000	-0.017677	44.950	0.0	-502.35E-6	0.0
21.37000	41.25000	45.10000	-0.017251	44.950	0.0	-499.36E-6	0.0
21.37000	41.35000	45.10000	-0.016832	44.950	0.0	-496.37E-6	0.0
21.37000	41.45000	45.10000	-0.016419	44.950	0.0	-493.38E-6	0.0
21.37000	41.55000	45.10000	-0.016014	44.950	0.0	-490.40E-6	0.0
21.37000	41.65000	45.10000	-0.015616	44.950	0.0	-488.08E-6	0.0
21.37000	41.75000	45.10000	-0.015224	44.950	0.0	-485.23E-6	0.0
21.37000	41.85000	45.10000	-0.014838	44.950	0.0	-482.41E-6	0.0
21.37000	41.95000	45.10000	-0.014460	44.950	0.0	-479.59E-6	0.0
21.37000	42.05000	45.10000	-0.014087	44.950	0.0	-476.79E-6	0.0
21.37000	42.15000	45.10000	-0.013721	44.950	0.0	-474.02E-6	0.0
21.37000	42.25000	45.10000	-0.013361	44.950	0.0	-471.26E-6	0.0
21.37000	42.35000	45.10000	-0.013006	44.950	0.0	-468.51E-6	0.0
21.37000	42.45000	45.10000	-0.012658	44.950	0.0	-465.78E-6	0.0
21.37000	42.55000	45.10000	-0.012316	44.950	0.0	-463.06E-6	0.0
21.37000	42.65000	45.10000	-0.011979	44.950	0.0	-460.37E-6	0.0
21.37000	42.75000	45.10000	-0.011648	44.950	0.0	-457.69E-6	0.0
21.37000	42.85000	45.10000	-0.011323	44.950	0.0	-455.03E-6	0.0
21.37000	42.95000	45.10000	-0.011003	44.950	0.0	-452.38E-6	0.0
21.37000	43.05000	45.10000	-0.010688	44.950	0.0	-449.74E-6	0.0
21.37000	43.15000	45.10000	-0.010379	44.950	0.0	-447.13E-6	0.0
21.37000	43.25000	45.10000	-0.010075	44.950	0.0	-444.53E-6	0.0
21.37000	43.35000	45.10000	-0.009775	44.950	0.0	-441.94E-6	0.0
21.37000	43.45000	45.10000	-0.009481	44.950	0.0	-439.37E-6	0.0
21.37000	43.55000	45.10000	-0.009192	44.950	0.0	-436.81E-6	0.0
21.37000	43.65000	45.10000	-0.008908	44.950	0.0	-434.28E-6	0.0
21.37000	43.75000	45.10000	-0.008629	44.950	0.0	-431.75E-6	0.0
21.37000	43.85000	45.10000	-0.008354	44.950	0.0	-429.24E-6	0.0
21.37000	43.95000	45.10000	-0.008084	44.950	0.0	-426.75E-6	0.0
21.37000	44.05000	45.10000	-0.007818	44.950	0.0	-424.27E-6	0.0
21.37000	44.15000	45.10000	-0.007557	44.950	0.0	-421.81E-6	0.0
21.37000	44.25000	45.10000	-0.007301	44.950	0.0	-419.36E-6	0.0
21.37000	44.35000	45.10000	-0.007048	44.950	0.0	-416.93E-6	0.0
21.37000	44.45000	45.10000	-0.006796	44.950	0.0	-414.51E-6	0.0
21.37000	44.55000	45.10000	-0.006548	44.950	0.0	-412.10E-6	0.0
21.37000	44.65000	45.10000	-0.006303	44.950	0.0	-409.72E-6	0.0
21.37000	44.75000	45.10000	-0.006061	44.950	0.0	-407.34E-6	0.0
21.37000	44.85000	45.10000	-0.005849	44.950	0.0	-404.98E-6	0.0
21.37000	44.95000	45.10000	-0.005620	44.950	0.0	-402.64E-6	0.0
21.37000	45.05000	45.10000	-0.005393	44.950	0.0	-400.32E-6	0.0
21.37000	45.15000	45.10000	-0.005178	44.950	0.0	-397.99E-6	0.0
21.37000	45.25000						



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Long Term Excavation, 4 Storey Structure

Table with 3 columns: Job No., Sheet No., Rev.
CG/28408B
Drg. Ref.
Made by ALP, Date, Checked

Main data table with columns: Name, Location (X, Y, Z), Displacement (Z), Calc Level, Stresses (Vert Stress, Sum Princ, Vert Strain). Contains 95 rows of data.



CARD GEOTECHNICS LIMITED

**Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Long Term Excavation, 4 Storey Structure**

Job No.	Sheet No.	Rev.
CG/28408B		
Drg. Ref.		
Made by	Date	Checked
ALP		

Name	Location		Displacement Z [mm]	Calc Level [mOD]	Stresses		Vert Strain [-]
	X [m]	Y [m]			Z[Level] [mOD]	Sum Princ [kN/m²]	
15.88900	-0.74900	43.70000	-5.4015	43.650	-112.90E-6	-0.033736	0.0
15.88900	-0.84900	43.70000	-5.3821	43.650	-111.51E-6	-0.033489	0.0
15.88900	-0.94900	43.70000	-5.3622	43.650	-110.14E-6	-0.033244	0.0
15.88900	-1.04900	43.70000	-5.3419	43.650	-108.78E-6	-0.033000	0.0
15.88900	-1.14900	43.70000	-5.3210	43.650	-107.43E-6	-0.032758	0.0
15.88900	-1.24900	43.70000	-5.2997	43.650	-106.11E-6	-0.032517	0.0
15.88900	-1.34900	43.70000	-5.2778	43.650	-104.79E-6	-0.032278	0.0
15.88900	-1.44900	43.70000	-5.2553	43.650	-103.50E-6	-0.032040	0.0
15.88900	-1.54900	43.70000	-5.2321	43.650	-102.22E-6	-0.031805	0.0
15.88900	-1.64900	43.70000	-5.2083	43.650	-100.95E-6	-0.031570	0.0
15.88900	-1.74900	43.70000	-5.1837	43.650	-99.69E-6	-0.031338	0.0
15.88900	-1.84900	43.70000	-5.1582	43.650	-98.46E-6	-0.031106	0.0
15.88900	-1.94900	43.70000	-5.1318	43.650	-97.23E-6	-0.030877	0.0
15.88900	-2.04900	43.70000	-5.1043	43.650	-96.03E-6	-0.030649	0.0
15.88900	-2.14900	43.70000	-5.0754	43.650	-94.84E-6	-0.030423	0.0
15.88900	-2.24900	43.70000	-5.0450	43.650	-93.66E-6	-0.030198	0.0
15.88900	-2.34900	43.70000	-5.0125	43.650	-92.49E-6	-0.029974	0.0
15.88900	-2.44900	43.70000	-4.9774	43.650	-91.34E-6	-0.029753	0.0
15.88900	-2.54900	43.70000	-4.9390	43.650	-90.21E-6	-0.029533	0.0
15.88900	-2.64900	43.70000	-4.8961	43.650	-89.08E-6	-0.029314	0.0
15.88900	-2.74900	43.70000	-4.8472	43.650	-87.98E-6	-0.029097	0.0
15.88900	-2.84900	43.70000	-4.7902	43.650	-86.86E-6	-0.028882	0.0
15.88900	-2.94900	43.70000	-4.7220	43.650	-85.80E-6	-0.028668	0.0
15.88900	-3.04900	43.70000	-4.6386	43.650	-84.73E-6	-0.028455	0.0
15.88900	-3.14900	43.70000	-4.5345	43.650	-83.68E-6	-0.028245	0.0
15.88900	-3.24900	43.70000	-4.4033	43.650	-82.64E-6	-0.028035	0.0
15.88900	-3.34900	43.70000	-4.2373	43.650	-81.61E-6	-0.027827	0.0
15.88900	-3.44900	43.70000	-4.0294	43.650	-80.59E-6	-0.027621	0.0
15.88900	-3.54900	43.70000	-3.7755	43.650	-79.59E-6	-0.027416	0.0
15.88900	-3.64900	43.70000	-3.4778	43.650	-78.60E-6	-0.027213	0.0
15.88900	-3.74900	43.70000	-3.1473	43.650	-77.62E-6	-0.027011	0.0
15.88900	-3.84900	43.70000	-2.8035	43.650	-76.65E-6	-0.026811	0.0
15.88900	-3.94900	43.70000	-2.4699	43.650	-75.70E-6	-0.026612	0.0
15.88900	-4.04900	43.70000	-2.1670	43.650	-74.75E-6	-0.026415	0.0
15.88900	-4.14900	43.70000	-1.9071	43.650	-73.82E-6	-0.026219	0.0
15.88900	-4.24900	43.70000	-1.6935	43.650	-72.90E-6	-0.026025	0.0
15.88900	-4.34900	43.70000	-1.5227	43.650	-72.00E-6	-0.025832	0.0
15.88900	-4.44900	43.70000	-1.3879	43.650	-71.10E-6	-0.025641	0.0
15.88900	-4.54900	43.70000	-1.2814	43.650	-70.22E-6	-0.025451	0.0
15.88900	-4.64900	43.70000	-1.1966	43.650	-69.34E-6	-0.025262	0.0
15.88900	-4.74900	43.70000	-1.1278	43.650	-68.48E-6	-0.025075	0.0
15.88900	-4.84900	43.70000	-1.0707	43.650	-67.63E-6	-0.024890	0.0
15.88900	-4.94900	43.70000	-1.0224	43.650	-66.79E-6	-0.024705	0.0
15.88900	-5.04900	43.70000	-0.98044	43.650	-65.96E-6	-0.024522	0.0
15.88900	-5.14900	43.70000	-0.94326	43.650	-65.14E-6	-0.024341	0.0
15.88900	-5.24900	43.70000	-0.90970	43.650	-64.33E-6	-0.024161	0.0
15.88900	-5.34900	43.70000	-0.87893	43.650	-63.54E-6	-0.023982	0.0
15.88900	-5.44900	43.70000	-0.85038	43.650	-62.75E-6	-0.023805	0.0
15.88900	-5.54900	43.70000	-0.82362	43.650	-61.97E-6	-0.023629	0.0
15.88900	-5.64900	43.70000	-0.79834	43.650	-61.20E-6	-0.023455	0.0
15.88900	-5.74900	43.70000	-0.77433	43.650	-60.44E-6	-0.023282	0.0
15.88900	-5.84900	43.70000	-0.75142	43.650	-59.70E-6	-0.023110	0.0
15.88900	-5.94900	43.70000	-0.72948	43.650	-58.96E-6	-0.022939	0.0
15.88900	-6.04900	43.70000	-0.70844	43.650	-58.23E-6	-0.022770	0.0
15.88900	-6.14900	43.70000	-0.68821	43.650	-57.51E-6	-0.022603	0.0
15.88900	-6.24900	43.70000	-0.66874	43.650	-56.80E-6	-0.022436	0.0
15.88900	-6.34900	43.70000	-0.64998	43.650	-56.10E-6	-0.022271	0.0
15.88900	-6.44900	43.70000	-0.63190	43.650	-55.40E-6	-0.022107	0.0
15.88900	-6.54900	43.70000	-0.61446	43.650	-54.72E-6	-0.021944	0.0
15.88900	-6.64900	43.70000	-0.59763	43.650	-54.05E-6	-0.021783	0.0
15.88900	-6.74900	43.70000	-0.58139	43.650	-53.38E-6	-0.021623	0.0
15.88900	-6.84900	43.70000	-0.56570	43.650	-52.72E-6	-0.021464	0.0
15.88900	-6.94900	43.70000	-0.55056	43.650	-52.08E-6	-0.021307	0.0
15.88900	-7.04900	43.70000	-0.53593	43.650	-51.44E-6	-0.021151	0.0
15.88900	-7.14900	43.70000	-0.52180	43.650	-50.80E-6	-0.020996	0.0
15.88900	-7.24900	43.70000	-0.50815	43.650	-50.18E-6	-0.020842	0.0
15.88900	-7.34900	43.70000	-0.49495	43.650	-49.56E-6	-0.020690	0.0
15.88900	-7.44900	43.70000	-0.48220	43.650	-48.96E-6	-0.020538	0.0
15.88900	-7.54900	43.70000	-0.46987	43.650	-48.36E-6	-0.020388	0.0
15.88900	-7.64900	43.70000	-0.45794	43.650	-47.77E-6	-0.020239	0.0
15.88900	-7.74900	43.70000	-0.44641	43.650	-47.18E-6	-0.020092	0.0
15.88900	-7.84900	43.70000	-0.43526	43.650	-46.61E-6	-0.019945	0.0
15.88900	-7.94900	43.70000	-0.42446	43.650	-46.04E-6	-0.019800	0.0
15.88900	-8.04900	43.70000	-0.41401	43.650	-45.47E-6	-0.019656	0.0
15.88900	-8.14900	43.70000	-0.40389	43.650	-44.92E-6	-0.019513	0.0
15.88900	-8.24900	43.70000	-0.39409	43.650	-44.37E-6	-0.019371	0.0
15.88900	-8.34900	43.70000	-0.38459	43.650	-43.83E-6	-0.019230	0.0
15.88900	-8.44900	43.70000	-0.37539	43.650	-43.30E-6	-0.019091	0.0
15.88900	-8.54900	43.70000	-0.36647	43.650	-42.77E-6	-0.018952	0.0
15.88900	-8.64900	43.70000	-0.35782	43.650	-42.25E-6	-0.018815	0.0
15.88900	-8.74900	43.70000	-0.34944	43.650	-41.74E-6	-0.018679	0.0
15.88900	-8.84900	43.70000	-0.34130	43.650	-41.24E-6	-0.018544	0.0
15.88900	-8.94900	43.70000	-0.33340	43.650	-40.74E-6	-0.018410	0.0
15.88900	-9.04900	43.70000	-0.32573	43.650	-40.24E-6	-0.018277	0.0
15.88900	-9.14900	43.70000	-0.31829	43.650	-39.76E-6	-0.018145	0.0
15.88900	-9.24900	43.70000	-0.31106	43.650	-39.28E-6	-0.018014	0.0
15.88900	-9.34900	43.70000	-0.30403	43.650	-38.80E-6	-0.017884	0.0
15.88900	-9.44900	43.70000	-0.29720	43.650	-38.34E-6	-0.017756	0.0
15.88900	-9.54900	43.70000	-0.29056	43.650	-37.89E-6	-0.017629	0.0
15.88900	-9.64900	43.70000	-0.28411	43.650	-37.42E-6	-0.017502	0.0
15.88900	-9.74900	43.70000	-0.27783	43.650	-36.97E-6	-0.017376	0.0
15.88900	-9.84900	43.70000	-0.27172	43.650	-36.53E-6	-0.017252	0.0
15.88900	-9.94900	43.70000	-0.26577	43.650	-36.09E-6	-0.017128	0.0
15.88900	-10.04900	43.70000	-0.25998	43.650	-35.66E-6	-0.017006	0.0
15.88900	-10.14900	43.70000	-0.25435	43.650	-35.23E-6	-0.016884	0.0
15.88900	-10.24900	43.70000	-0.24886	43.650	-34.81E-6	-0.016764	0.0
15.88900	-10.34900	43.70000	-0.24351	43.650	-34.39E-6	-0.016644	0.0
15.88900	-10.44900	43.70000	-0.23831	43.650	-33.98E-6	-0.016526	0.0
15.88900	-10.54900	43.70000	-0.23323	43.650	-33.58E-6	-0.016408	0.0
15.88900	-10.64900	43.70000	-0.22828	43.650	-33.18E-6	-0.016291	0.0
15.88900	-10.74900	43.70000	-0.22346	43.650	-32.79E-6	-0.016176	0.0
15.88900	-10.84900	43.70000	-0.21875	43.650	-32.40E-6	-0.016061	0.0
15.88900	-10.94900	43.70000	-0.21416	43.650	-32.01E-6	-0.015947	0.0
15.88900	-11.04900	43.70000	-0.20969	43.650	-31.63E-6	-0.015834	0.0
15.88900	-11.14900	43.70000	-0.20532	43.650	-31.26E-6	-0.015722	0.0
15.88900	-11.24900	43.70000	-0.20106	43.650	-30.89E-6	-0.015611	0.0
15.88900	-11.34900	43.70000	-0.19690	43.650	-30.52E-6	-0.015501	0.0
15.88900	-11.44900	43.70000	-0.19283	43.650	-30.16E-6	-0.015392	0.0
15.88900	-11.54900	43.70000	-0.18887	43.650	-29.81E-6	-0.015284	0.0
15.88900	-11.64900	43.70000	-0.18499	43.650	-29.46E-6	-0.015176	0.0
15.88900	-11.74900	43.70000	-0.18121	43.650	-29.11E-6	-0.015069	0.0



CARD GEOTECHNICS LIMITED

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Long Term Excavation, 4 Storey Structure

Job No.	Sheet No.	Rev.
CG/28408B		
Drg. Ref.		
Made by ALP	Date	Checked

Analysis Options

Analysis: Boussinesq
 Global Poisson's ratio: 0.20
 Maximum allowable ratio between values of E: 1.5
 Horizontal rigid boundary level: 15.00 [m OD]
 Stiffness for horizontal displacement calculations: Weighted average
 Using legacy heave correction factor: No
 Displacements at load centroids: Yes

Soil Profiles Soil Profile 1

Layer	Level at top	Number of intermediate displacement levels	Youngs Modulus	Poissons ratio	Non-linear curve
	[mOD]		Top [kN/m ²]	Btm [kN/m ²]	
1	46.100	5	15000.	15000.	0.20000
2	44.500	5	18000.	18000.	0.20000
3	43.500	5	18000.	146250.	0.20000

Soil Zones

Zone	Name	X coordinates min max [m]	Y coordinates min max [m]	Profile
1		-10.00000 40.00000	-15.00000 55.00000	Soil Profile 1

Non-linear Curve Coordinates - Non-linear Curve 1

Point	Strain [%]	Factor
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Load Data

Load ref.	Name	Shape	Orientation of Plane	Centre of load (Global) X Y Z [level]	Load position Angle local x from [Degrees]	Width x or Radius [m]	Length y [m]	Polygon Coordinates	Rectangle tolerance	Number of rectangles	Normal (local z) [kN/m ²]	Tangential (local x) [kN/m ²]	Tangential (local y) [kN/m ²]
1	Porters Lodge Demolition	Polygonal	Horizontal	N/A N/A 45.00000	N/A	N/A	N/A	(-1.06,19.1) (-1.06,13.4) (-8.06,13.4) (-8.06,19.1)	10.000	1	-30.000	N/A	N/A

Polygonal Loads' Rectangles

No.	Centre of load X Y [m]	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
1	-4.56400 16.25700	-90.000	5.7500	7.0000

Displacement Data

Ref.	Type	Name	Direction of Extrusion	Line/Line for extrusion First point X Y Z [level] [m]	Second point X Y Z [level] [m]	No. of intrvl across extrusion/line	Extrusion Depth [m]	No. of intrvl along extrusion	Calculate	Show Detailed results
1	Line	Porters Lodge	N/A	-4.56400 19.13200 45.00000	34.13200 45.00000	150	N/A	N/A	Yes	No
2	Grid	Grid 2	Global X	-30.00000 -30.00000 46.10000	N/A 70.00000 46.10000	90	90.00000	100	No	N/A

Warnings

(1) One or more displacement grids or lines have numbers of intervals of at least 100. Large numbers of intervals will slow the analysis.

RESULTS FOR GRIDS

Analysis: Boussinesq
 Global Poisson's ratio: 0.20
 Horizontal rigid boundary level: 15.00 [m OD]

The maximum displacement difference between the Boussinesq method (-1.8983mm) and the Mindlin method (-1.8343mm) occurs at point X = -4.56400m, Y = 20.13200m, Level = 43.833mOD, and is 0.063983mm.

Name	X [m]	Location Y [m]	Z [level] [mOD]	Displacement [mm]	Calc Level [mOD]	Vert Stress [kN/m ²]	Stresses Sum Princ [kN/m ²]	Vert Strain [-]
Porters Lodge Demolition	-4.56400	16.25700	45.00000	-6.3238	44.875	-29.999	-69.423	-0.0014742
Porters Lodge	-4.56400	19.13200	45.00000	-3.7694	44.875	-15.000	-35.042	-732.74E-6
	-4.56400	19.23200	45.00000	-3.3189	44.875	-3.8932	-19.594	-50.597E-6
	-4.56400	19.33200	45.00000	-3.0322	44.875	-1.0421	-11.876	74.982E-6
	-4.56400	19.43200	45.00000	-2.8156	44.875	-0.37940	-8.1377	78.151E-6
	-4.56400	19.53200	45.00000	-2.6321	44.875	-0.17339	-6.0468	66.752E-6
	-4.56400	19.63200	45.00000	-2.4728	44.875	-0.092209	-4.7349	55.755E-6
	-4.56400	19.73200	45.00000	-2.3318	44.875	-0.054439	-3.8427	46.880E-6
	-4.56400	19.83200	45.00000	-2.2049	44.875	-0.034659	-3.2000	39.893E-6
	-4.56400	19.93200	45.00000	-2.0895	44.875	-0.023351	-2.7169	34.357E-6
	-4.56400	20.03200	45.00000	-1.9835	44.875	-0.016439	-2.3417	29.908E-6
	-4.56400	20.13200	45.00000	-1.8856	44.875	-0.011984	-2.0429	26.280E-6
	-4.56400	20.23200	45.00000	-1.7945	44.875	-0.0089871	-1.7999	23.280E-6
	-4.56400	20.33200	45.00000	-1.7096	44.875	-0.0068999	-1.5990	20.768E-6
	-4.56400	20.43200	45.00000	-1.6300	44.875	-0.0054028	-1.4304	18.640E-6
	-4.56400	20.53200	45.00000	-1.5553	44.875	-0.0043021	-1.2874	16.821E-6
	-4.56400	20.63200	45.00000	-1.4851	44.875	-0.0034754	-1.1648	15.252E-6
	-4.56400	20.73200	45.00000	-1.4190	44.875	-0.0028430	-1.0587	13.889E-6
	-4.56400	20.83200	45.00000	-1.3566	44.875	-0.0023514	-0.96627	12.695E-6
	-4.56400	20.93200	45.00000	-1.2978	44.875	-0.0019637	-0.88514	11.645E-6
	-4.56400	21.03200	45.00000	-1.2423	44.875	-0.0016542	-0.81353	10.715E-6
	-4.56400	21.13200	45.00000	-1.1898	44.875	-0.0014043	-0.74996	9.8872E-6
	-4.56400	21.23200	45.00000	-1.1403	44.875	-0.0012005	-0.69327	9.1476E-6
	-4.56400	21.33200	45.00000	-1.0934	44.875	-0.0010328	-0.64249	8.4840E-6
	-4.56400	21.43200	45.00000	-1.0491	44.875	-893.61E-6	-0.59683	7.8862E-6
	-4.56400	21.53200	45.00000	-1.0072	44.875	-777.28E-6	-0.55561	7.3459E-6
	-4.56400	21.63200	45.00000	-0.96750	44.875	-679.37E-6	-0.51828	6.8560E-6
	-4.56400	21.73200	45.00000	-0.92994	44.875	-596.44E-6	-0.48437	6.4106E-6
	-4.56400	21.83200	45.00000	-0.89435	44.875	-525.80E-6	-0.45348	6.0043E-6
	-4.56400	21.93200	45.00000	-0.86062	44.875	-465.31E-6	-0.42526	5.6329E-6
	-4.56400	22.03200	45.00000	-0.82863	44.875	-413.25E-6	-0.39942	5.2926E-6
	-4.56400	22.13200	45.00000	-0.79827	44.875	-368.24E-6	-0.37571	4.9800E-6
	-4.56400	22.23200	45.00000	-0.76946	44.875	-329.16E-6	-0.35390	4.6923E-6
	-4.56400	22.33200	45.00000	-0.74208	44.875	-295.09E-6	-0.33380	4.4270E-6
	-4.56400	22.43200	45.00000	-0.71605	44.875	-265.28E-6	-0.31523	4.1819E-6
	-4.56400	22.53200	45.00000	-0.69129	44.875	-239.11E-6	-0.29806	3.9550E-6
	-4.56400	22.63200	45.00000	-0.66772	44.875	-216.05E-6	-0.28215	3.7446E-6
	-4.56400	22.73200	45.00000	-0.64527	44.875	-195.67E-6	-0.26737	3.5493E-6
	-4.56400	22.83200	45.00000	-0.62387	44.875	-177.61E-6	-0.25364	3.3676E-6
	-4.56400	22.93200	45.00000	-0.60346	44.875	-161.56E-6	-0.24085	3.1984E-6
	-4.56400	23.03200	45.00000	-0.58398	44.875	-147.25E-6	-0.22893	3.0406E-6
	-4.56400	23.13200	45.00000	-0.56537	44.875	-134.47E-6	-0.21780	2.8932E-6
	-4.56400	23.23200	45.00000	-0.54759	44.875	-123.02E-6	-0.20739	2.7554E-6
	-4.56400	23.33200	45.00000	-0.53058	44.875	-112.75E-6	-0.19765	2.6264E-6
	-4.56400	23.43200	45.00000	-0.51430	44.875	-103.51E-6	-0.18853	2.5054E-6
	-4.56400	23.53200	45.00000	-0.49871	44.875	-95.174E-6	-0.17996	2.3919E-6
	-4.56400	23.63200	45.00000	-0.48377	44.875	-87.648E-6	-0.17192	2.2853E-6
	-4.56400	23.73200	45.00000	-0.46944	44.875	-80.837E-6	-0.16436	2.1850E-6
	-4.56400	23.83200	45.00000	-0.45570	44.875	-74.662E-6	-0.15724	2.0906E-6
	-4.56400	23.93200	45.00000	-0.44251	44.875	-69.054E-6	-0.15054	2.0016E-6



**CARD GEOTECHNICS
LIMITED**

Barrie House, 29 St Edmunds Terrace, London
Basement Impact Assessment
Long Term Excavation, 4 Storey Structure

Job No.	Sheet No.	Rev.
CG/28408B		
Drg. Ref.		
Made by ALP	Date	Checked

Name	Location			Displacement Z [mm]	Calc Level [mOD]	Stresses		
	X [m]	Y [m]	Z [Level] [mOD]			Vert Stress [kN/m ²]	Sum Princ [kN/m ²]	Vert Strain [-]
-4.56400	24.03200	45.00000	-0.42983	44.875	-63.952E-6	-0.14422	1.9178E-6	
-4.56400	24.13200	45.00000	-0.41766	44.875	-59.303E-6	-0.13825	1.8386E-6	
-4.56400	24.23200	45.00000	-0.40594	44.875	-55.059E-6	-0.13261	1.7637E-6	
-4.56400	24.33200	45.00000	-0.39468	44.875	-51.180E-6	-0.12728	1.6930E-6	
-4.56400	24.43200	45.00000	-0.38383	44.875	-47.629E-6	-0.12224	1.6260E-6	
-4.56400	24.53200	45.00000	-0.37339	44.875	-44.374E-6	-0.11746	1.5626E-6	
-4.56400	24.63200	45.00000	-0.36332	44.875	-41.386E-6	-0.11293	1.5024E-6	
-4.56400	24.73200	45.00000	-0.35362	44.875	-38.640E-6	-0.10864	1.4454E-6	
-4.56400	24.83200	45.00000	-0.34426	44.875	-36.112E-6	-0.10456	1.3912E-6	
-4.56400	24.93200	45.00000	-0.33523	44.875	-33.783E-6	-0.10069	1.3398E-6	
-4.56400	25.03200	45.00000	-0.32653	44.875	-31.638E-6	-0.09700	1.2909E-6	
-4.56400	25.13200	45.00000	-0.31810	44.875	-29.649E-6	-0.09350	1.2444E-6	
-4.56400	25.23200	45.00000	-0.30997	44.875	-27.814E-6	-0.09017	1.2001E-6	
-4.56400	25.33200	45.00000	-0.30212	44.875	-26.115E-6	-0.08699	1.1579E-6	
-4.56400	25.43200	45.00000	-0.29452	44.875	-24.540E-6	-0.08395	1.1177E-6	
-4.56400	25.53200	45.00000	-0.28717	44.875	-23.080E-6	-0.08109	1.0794E-6	
-4.56400	25.63200	45.00000	-0.28007	44.875	-21.724E-6	-0.07838	1.0428E-6	
-4.56400	25.73200	45.00000	-0.27319	44.875	-20.463E-6	-0.07571	1.0078E-6	
-4.56400	25.83200	45.00000	-0.26652	44.875	-19.290E-6	-0.07320	0.0	
-4.56400	25.93200	45.00000	-0.26007	44.875	-18.198E-6	-0.07080	0.0	
-4.56400	26.03200	45.00000	-0.25382	44.875	-17.180E-6	-0.06850	0.0	
-4.56400	26.13200	45.00000	-0.24776	44.875	-16.231E-6	-0.06631	0.0	
-4.56400	26.23200	45.00000	-0.24189	44.875	-15.344E-6	-0.06421	0.0	
-4.56400	26.33200	45.00000	-0.23620	44.875	-14.516E-6	-0.06220	0.0	
-4.56400	26.43200	45.00000	-0.23067	44.875	-13.741E-6	-0.06027	0.0	
-4.56400	26.53200	45.00000	-0.22531	44.875	-13.016E-6	-0.05843	0.0	
-4.56400	26.63200	45.00000	-0.22011	44.875	-12.336E-6	-0.05665	0.0	
-4.56400	26.73200	45.00000	-0.21506	44.875	-11.700E-6	-0.05495	0.0	
-4.56400	26.83200	45.00000	-0.21016	44.875	-11.102E-6	-0.05331	0.0	
-4.56400	26.93200	45.00000	-0.20539	44.875	-10.542E-6	-0.05174	0.0	
-4.56400	27.03200	45.00000	-0.20077	44.875	-10.015E-6	-0.05022	0.0	
-4.56400	27.13200	45.00000	-0.19627	44.875	-9.519E-6	-0.04879	0.0	
-4.56400	27.23200	45.00000	-0.19190	44.875	-9.0540E-6	-0.04740	0.0	
-4.56400	27.33200	45.00000	-0.18765	44.875	-8.6156E-6	-0.04602	0.0	
-4.56400	27.43200	45.00000	-0.18351	44.875	-8.2027E-6	-0.04477	0.0	
-4.56400	27.53200	45.00000	-0.17949	44.875	-7.8133E-6	-0.04363	0.0	
-4.56400	27.63200	45.00000	-0.17558	44.875	-7.4464E-6	-0.04258	0.0	
-4.56400	27.73200	45.00000	-0.17177	44.875	-7.1001E-6	-0.04166	0.0	
-4.56400	27.83200	45.00000	-0.16807	44.875	-6.7731E-6	-0.04077	0.0	
-4.56400	27.93200	45.00000	-0.16446	44.875	-6.4641E-6	-0.03990	0.0	
-4.56400	28.03200	45.00000	-0.16095	44.875	-6.1721E-6	-0.03916	0.0	
-4.56400	28.13200	45.00000	-0.15753	44.875	-5.8959E-6	-0.03850	0.0	
-4.56400	28.23200	45.00000	-0.15420	44.875	-5.6345E-6	-0.03800	0.0	
-4.56400	28.33200	45.00000	-0.15095	44.875	-5.3871E-6	-0.03760	0.0	
-4.56400	28.43200	45.00000	-0.14779	44.875	-5.1527E-6	-0.03729	0.0	
-4.56400	28.53200	45.00000	-0.14471	44.875	-4.9305E-6	-0.03703	0.0	
-4.56400	28.63200	45.00000	-0.14170	44.875	-4.7198E-6	-0.03249	0.0	
-4.56400	28.73200	45.00000	-0.13877	44.875	-4.5199E-6	-0.03169	0.0	
-4.56400	28.83200	45.00000	-0.13591	44.875	-4.3302E-6	-0.03098	0.0	
-4.56400	28.93200	45.00000	-0.13313	44.875	-4.1505E-6	-0.03033	0.0	
-4.56400	29.03200	45.00000	-0.13041	44.875	-3.9788E-6	-0.02972	0.0	
-4.56400	29.13200	45.00000	-0.12776	44.875	-3.8161E-6	-0.02915	0.0	
-4.56400	29.23200	45.00000	-0.12517	44.875	-3.6614E-6	-0.02860	0.0	
-4.56400	29.33200	45.00000	-0.12264	44.875	-3.5142E-6	-0.02736	0.0	
-4.56400	29.43200	45.00000	-0.12018	44.875	-3.3741E-6	-0.02628	0.0	
-4.56400	29.53200	45.00000	-0.11777	44.875	-3.2407E-6	-0.02510	0.0	
-4.56400	29.63200	45.00000	-0.11542	44.875	-3.1136E-6	-0.02501	0.0	
-4.56400	29.73200	45.00000	-0.11313	44.875	-2.9925E-6	-0.02491	0.0	
-4.56400	29.83200	45.00000	-0.11089	44.875	-2.8771E-6	-0.02431	0.0	
-4.56400	29.93200	45.00000	-0.10870	44.875	-2.7670E-6	-0.02380	0.0	
-4.56400	30.03200	45.00000	-0.10656	44.875	-2.6619E-6	-0.02320	0.0	
-4.56400	30.13200	45.00000	-0.10448	44.875	-2.5617E-6	-0.02275	0.0	
-4.56400	30.23200	45.00000	-0.10244	44.875	-2.4660E-6	-0.02225	0.0	
-4.56400	30.33200	45.00000	-0.10044	44.875	-2.3745E-6	-0.02176	0.0	
-4.56400	30.43200	45.00000	-0.09849	44.875	-2.2871E-6	-0.02129	0.0	
-4.56400	30.53200	45.00000	-0.09658	44.875	-2.2036E-6	-0.02083	0.0	
-4.56400	30.63200	45.00000	-0.09472	44.875	-2.1238E-6	-0.02038	0.0	
-4.56400	30.73200	45.00000	-0.09290	44.875	-2.0474E-6	-0.01995	0.0	
-4.56400	30.83200	45.00000	-0.09112	44.875	-1.9743E-6	-0.01955	0.0	
-4.56400	30.93200	45.00000	-0.08938	44.875	-1.9043E-6	-0.01916	0.0	
-4.56400	31.03200	45.00000	-0.08769	44.875	-1.8374E-6	-0.01878	0.0	
-4.56400	31.13200	45.00000	-0.08603	44.875	-1.7732E-6	-0.01842	0.0	
-4.56400	31.23200	45.00000	-0.08438	44.875	-1.7117E-6	-0.01796	0.0	
-4.56400	31.33200	45.00000	-0.08278	44.875	-1.6528E-6	-0.01761	0.0	
-4.56400	31.43200	45.00000	-0.08122	44.875	-1.5963E-6	-0.01724	0.0	
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-4.56400	31.63200	45.00000	-0.07820	44.875	-1.4902E-6	-0.01656	0.0	
-4.56400	31.73200	45.00000	-0.07674	44.875	-1.4403E-6	-0.01623	0.0	
-4.56400	31.83200	45.00000	-0.07531	44.875	-1.3925E-6	-0.01591	0.0	
-4.56400	31.93200	45.00000	-0.07391	44.875	-1.3465E-6	-0.01560	0.0	
-4.56400	32.03200	45.00000	-0.07254	44.875	-1.3024E-6	-0.01530	0.0	
-4.56400	32.13200	45.00000	-0.07119	44.875	-1.2600E-6	-0.01500	0.0	
-4.56400	32.23200	45.00000	-0.06988	44.875	-1.2192E-6	-0.01471	0.0	
-4.56400	32.33200	45.00000	-0.06859	44.875	-1.1801E-6	-0.01443	0.0	
-4.56400	32.43200	45.00000	-0.06734	44.875	-1.1428E-6	-0.01416	0.0	
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-4.56400	32.73200	45.00000	-0.06370	44.875	-1.0379E-6	-0.01338	0.0	
-4.56400	32.83200	45.00000	-0.06254	44.875	-1.0056E-6	-0.01314	0.0	
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-4.56400	33.03200	45.00000	-0.06028	44.875	0.0	-0.01265	0.0	
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-4.56400	33.83200	45.00000	-0.05213	44.875	0.0	-0.01097	0.0	
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