GROUND MOVEMENT ASSESSMENT REPORT

31 Heath Drive London NW3 7SB

Client:	Mr Ravi Gupta
Engineer:	Crownwell Basements
J15308A	
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1.0 INTRODUCTION

Geotechnical and Environmental Associates (GEA) has been commissioned by Crownwell Basements, on behalf of Mr Ravi Gupta, to complete a ground movement assessment for the proposed extension to the existing single level basement beneath No 31 Heath Drive, London NW3 7SB.

A Ground Investigation Report has previously been carried out by Sub Surface South East Ltd (report ref AJP/SE1281, dated 16th April 2015) and the findings of the report have been used in the derivation of parameters for use in this assessment.

The purpose of this assessment has been to assess any effects of the proposed basement construction upon nearby sensitive structures.

1.1 **Proposed Development**

It is understood that it is proposed to extend the existing single level basement laterally towards the west and south beneath the existing building to a depth of 3.5 m from existing internal ground level.

This report is specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

1.2 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located in the London Borough of Camden, approximately 800 m west of Hampstead London Underground station and 780 m northwest of Finchley Road & Frognal London Underground station. It fronts onto Heath Drive to the northwest and is bounded by Nos 30 and 32 Heath Drive, three-storey houses located to the northeast and southwest respectively and by the rear gardens of houses fronting onto Bracknell Gardens and Oakhill Avenue to the south. The site may additionally be located by National Grid Reference 525594, 185736, and is shown on the map overleaf.

A site walkover was carried out by an engineer from GEA on 13th November 2015. The site is rectangular in shape and measures approximately 50 m northwest-southeast by 13 m northeast-southwest. It is occupied by the existing three-storey house which occupies roughly half of the area of site. The site slopes downward to the northwest and is known to have a partial single level basement beneath part of the front of the house, which extends to a depth of roughly 2.5 m below existing internal floor level. The house is connected to its neighbour



at No 32 Heath Drive. There is an access route from the front garden to the rear garden along the northeastern boundary of the house, adjacent No 30 Heath Drive. The sloping nature of the site necessitates a retaining wall adjacent to No 32 Heath Drive and a series of permanent struts between the retaining wall and No 31 Heath Drive. Signs of movement in the retaining wall in the form of cracks were noted during the walkover.



Left: Access via side of house, Middle: Cracking to adjacent retaining wall, Right: Struts between house and retaining wall



3.0 SUMMARY OF GROUND CONDITIONS

The ground investigation carried out by Sub Surface South East Ltd generally encountered a moderate thickness of made ground overlying the Claygate Member of the London Clay.

The made ground comprised dark and light orange-brown mottled gravelly sandy silty clay and gravelly sand with clinker and fragments of brick, coal and concrete and extended to a depth of 1.9 m below existing basement level. Asbestos fragments were noted within Borehole No M1 from a depth of 0.40 m.

The Claygate Member was found to comprise firm becoming stiff brown and occasional grey mottled silty clay to the full depth of the borehole, of 5.45 m. This stratum was noted as becoming stiff at around 5.0 m depth. No geotechnical testing was carried out as part of the ground investigation.

Groundwater was not encountered during the drilling of the boreholes.

A previous investigation has been carried out by GEA approximately 170 m to the east, along Oakhill Avenue. A single cable percussion borehole was advanced to a depth of 15 m at this location and the strength profile of the soils at depth at this location has been used in the assessment at No 31 Heath Drive.

Furthermore, reference to a record of a borehole located 830 m to the south of the site held within the British Geological Survey (BGS) archive indicates the London Clay and clay of the Lambeth Group extends to a depth of around 100 m, although the depth to the base of the London Clay itself is unclear.

4.0 CONSTRUCTION SEQUENCE



The proposed basement layout is shown in the diagram below.



Plan: Existing and proposed basement area



Section: Existing flank wall

For the purposes of the ground movement assessment, the ground level will be taken at existing internal ground level. The proposed basement will be formed by means of traditional underpinning to a depth of 3.50 m below ground level, which, it is assumed, includes the basement floor slab, with all new loadings assumed to be applied at the same depth.

The following sequence of operations has been assumed to enable analysis of the ground movements around the proposed basement both during and after construction.

In general, the sequence of works for basement construction will comprise the following stages.

- 1. Construct underpinned retaining walls. These are commonly formed in a 'hit and miss' sequence using a trench box excavation, commonly sheet lined, shored and strutted; all temporary shoring and propping to be inspected by a suitably qualified person; and
- 2. excavate new basement and temporarily retain and strengthen, with sufficient propping and walling beams, the new retaining walls. Construct new ground beams.

The underpins will be adequately laterally propped and sufficiently dowelled together, concrete cast and adequately cured prior to excavation of the basement and removal of the formwork and supports.

The detail of the support provided to adjacent walls is beyond the scope of this report at this stage and the structural engineer will be best placed to agree a methodology with the underpinning contractor once appointed.

When the final excavation depths have been reached the permanent works will be formed, which are likely to comprise reinforced concrete walls with a drained cavity lining the inside of the underpinned walls. Reinforced concrete will be used for floor slabs and it is anticipated



that heave protection will be installed beneath the basement slab. Following this, the floor slab will be constructed at basement depth and the temporary props will be removed.

5.0 GROUND MOVEMENTS

An assessment of ground movements within and surrounding the excavation has been undertaken using the X-Disp and P-Disp computer programs licensed from the OASYS suite of geotechnical modelling software from Arup. These programs are commonly used within the ground engineering industry and are considered to be appropriate tools for this analysis.

The X-Disp program has been used to predict ground movements likely to arise from the construction of the proposed basement. This includes the settlement of the ground (vertical movement) and the lateral movement of soil behind the proposed retaining walls (horizontal movement).

The analysis of potential ground movements within the excavation, as a result of unloading of the underlying soils, has been carried out using the Oasys P-Disp Version 19.3 – Build 12 software package and is based on the assumption that the soils behave elastically, which provides a reasonable approximation to soil behaviour at small strains.

For the purpose of these analyses, the corners have been defined by x and y coordinates, with the x-direction parallel with the orientation northwest-southeast, whilst the y-direction is parallel with the orientation of northeast-southwest. Vertical movement is in the z-direction. Wall lengths of less than 10 m have been modelled as 1 m long structural elements, while greater than 10 m wall lengths have been modelled as 2 m elements to reflect the greater stiffness of the longer walls. The full outputs of all the analyses can be provided on request and samples of the output movement contour plots are included within the appendix.

5.1 **Ground Movements – Surrounding the Basement**

5.1.1 Model Used

For the X-Disp analysis, the soil movement relationships used for the embedded retaining walls are the default values within CIRIA report C580¹, which were derived from a number of historic case studies.

The analysis has adopted the values for 'installation of a planar diaphragm wall' to represent the installation of the underpinned and reinforced concrete retaining walls. The ground movement curves for 'excavations in front of a high stiffness wall in stiff clay' have been adopted as being considered most appropriate for the proposed excavation and its support at this site.

5.1.2 Results

The predicted movements are based on the worst case of the individually analysed segments of 'hogging' and 'sagging' and these are summarised in the tables below. It should be noted that the combined effect of segments acting together typically improve the resultant movements and the values below are therefore deemed to be conservative.

1



Gaba, A, Simpson, B, Powrie, W and Beadman, D (2003) *Embedded retaining walls – guidance for economic design*. CIRIA Report C580.





The heights and basement depths of each of the nearby sensitive structures are summarised in the table below.

Sensitive Structure	Elevation	Depth below ground level of basement / foundations (m)	Height of building above level of basement / foundations
	А	2.6	10.6
No 31 Heath Drive	В	2.6	10.6
	С	1.6	7.6
	D	1.6	7.6
	E	1.6	7.6
No 31/No 32 Front Elevation	F	2.6	10.6
	G	2.6	10.6
	н	1.6	7.6
No 32 Heath Drive	T	1.6	7.6
	J	1.6	7.6
	К	2.6	10.6
	L	2.6	10.6
No 30 Heath Drive	М	2.6	10.6
	Ν	2.6	10.6



Sensitive Structure	Elevation	Depth below ground level of basement / foundations (m)	Height of building above level of basement / foundations
	0	2.6	10.6

The results are presented below to the degree of accuracy required to allow predicted variations in ground movements around the structure(s) to be illustrated, but may not reflect the anticipated accuracy of the predictions.

Wall Installation Phase:

Sensitive Structure	Elevation	Vertical Movement (Settlement) (mm)	Horizontal Movement (mm)
No 31 Heath Drive	А	2	2
	В	2	2
	С	2	2
	D	2	2
	E	2	2
No 31/No 32 Front Elevation	F	2	2
	G	1	1
	н	1	1
No 32 Heath Drive	T	1	1
	J	1	1
	К	1	1
	L	1	1
No 20 Heath Drive	М	1	1
NO SU REALLI DIIVE	Ν	1	1
	0	1	1

Wall Installation and Excavation Phases Combined:

Sensitive Structure	Elevation	Vertical Movement (Settlement) (mm)	Horizontal Movement (mm)
	А	4	7
	В	4	7
No 31 Heath Drive	С	4	8
	D	4	8
	E	4	8
No 31/No 32 Front Elevation	F	4	8
	G	3	5
	н	2	3
No 32 Heath Drive	L	2	3
	J	1	2
	К	2	2
No 20 Llooth Drive	L	3	5
No 30 Heath Drive	М	3	5



Sensitive Structure	Elevation	Vertical Movement (Settlement) (mm)	Horizontal Movement (mm)
	Ν	2	3
	0	2	3

The analysis has indicated that the maximum vertical settlements and horizontal movements that will result from the new retaining wall construction are less than 5 mm. Furthermore, the analysis has indicated that the maximum vertical settlements and horizontal movements that will result from the combined effect of the retaining wall installation and excavation are less than 10 mm.

5.2 **Movements within the Excavation (Heave)**

5.2.1 Model Used

At this site unloading of the London Clay will take place as a result of the proposed building demolition and subsequent excavation and the reduction in vertical stress in the short term will cause heave to take place. Undrained soil parameters have been used to estimate the potential short term movements, which include the "immediate" or elastic movements as a result of the basement excavation. Drained parameters have been used to provide an estimate of the total long-term movement.

The elastic analysis requires values of soil stiffness at various levels to calculate displacements. Values of stiffness for the soils at this site are readily available from published data and we have used a well-established method to provide our estimates. This relates values of E_u and E', the drained and undrained stiffness respectively, to values of undrained cohesion, as described by Padfield and Sharrock² and Butler³ and more recently by O'Brien and Sharp⁴. Relationships of $E_u = 500 C_u$ and E' = 300 C_u for the cohesive soils have been used to obtain values of Young's modulus. More recent published data⁵ indicates stiffness values of 750 x Cu for the London Clay and a ratio of E' to Eu of 0.75, and it is considered that the use of the more conservative values provides a sensible approach for this stage in the design. The profile of the underlying Claygate Member has been interpolated from a nearby site investigation carried out by GEA at Oakhill Avenue, roughly 170 m to the east .

At this stage it is assumed that there will be no new net loading applied at basement level.

The proposed excavation will result in a net unloading of around 70 kN/m².

A rigid boundary for the analysis has been set within the London Clay and underlying clay of the Lambeth Group at a depth of 100 m below existing internal ground level, where local BGS records indicate that the base of these formations are likely to be present.

5.2.2 Results

The P-Disp analysis indicates that, by the time the basement construction is complete, around 5 mm to 10 mm of heave is likely to have taken place at the centre of the proposed excavation, reducing to less than 5 mm at the edges.



² Padfield CJ and Sharrock MJ (1983) Settlement of structures on clay soils. CIRIA Special Publication 27

Butler FG (1974) *Heavily overconsolidated clays: a state of the art review.* Proc Conf Settlement of Structures, Cambridge, 531-578, Pentech Press, Lond

⁴ O'Brien AS and Sharp P (2001) Settlement and heave of overconsolidated clays - a simplified non-linear method. Part Two, Ground Engineering, Nov 2001, 48-53

⁵ Burland JB, Standing, JR, and Jardine, FM (2001) *Building response to tunnelling, case studies from construction of the Jubilee Line Extension* CIRIA Special Publication 200

Following completion of the basement construction, roughly an additional 10 mm of heave is likely to occur at the centre of the proposed excavation in the long term.

The results of the P-Disp analysis can be used to indicate the likely impact of the proposed basement construction beyond the site boundaries; about 5 m away from the excavation a total movement up to around 5 mm is predicted, reducing to relatively negligible movements about 10 m away. Movements outside the excavation will be constrained to a certain extent by the presence of the new retaining walls and the estimated movements obtained from the analysis are not likely to occur in practice.

A void or layer of compressible material may need to be incorporated into the design to accommodate these potential long term movements. If a compressible material is used beneath the slab, it will need to be designed to be able to resist the potential uplift forces generated by the ground movements. In this respect potential heave pressures are typically taken to equate to around 30 % of the total unloading pressure.

6.0 DAMAGE ASSESSMENT

In addition to the above assessment of the likely movements that will result from the proposed development, the neighbouring buildings are considered to be sensitive structures, requiring Building Damage Assessments, on the basis of the classification given in Table 2.5 of $C580^{1}$.

All structures are shown on the plan in Section 5.1.2.

6.1 **Damage to Neighbouring Structures**

The movements resulting from the wall installation phase and the combined retaining wall installation and basement excavation phases, have been calculated using the X-Disp modelling software to carry out an assessment of the likely damage to adjacent properties and the results are summarised for the combined wall installation and basement excavation in the table below.

The potential heave movements predicted by P-Disp have not been included in this assessment.

Sensitive Structure	Elevation	Category of Damage*
	А	Category 0 - Negligible
	В	Category 0 - Negligible
No 31 Heath Drive	С	Category 1 – Very Slight
	D	Category 1 – Very Slight
	E	Category 0 - Negligible
No 31/No 32 Front Elevation	F	Category 1 – Very Slight
	G	Category 0 - Negligible
	н	Category 0 - Negligible
No 32 Heath Drive	I	Category 0 - Negligible
	J	Category 0 - Negligible
	К	Category 0 - Negligible
No 20 Hosth Drive	L	Category 1 – Very Slight
No 30 Heath Drive	М	Category 0 - Negligible



Sensitive Structure	Elevation	Category of Damage*
	Ν	Category 0 - Negligible
	0	Category 0 - Negligible

*From Table 2.5 of C580¹: Classification of visible damage to walls.

The analysis has predicted that the proposed installation of the retaining walls and excavation of the proposed basement may generally result in a building damage for sensitive structures ranging between Category 0 (negligible) and Category 1 (Very Slight), which fall within acceptable limits according to the Camden Planning Guidance.

In addition to the above, there is a wealth of experience with respect to the construction of underpinned retaining walls, that suggests that ground movements should remain typically within the range of 2 mm to 5 mm following completion of the works and provided that they are installed by a reputable and experienced contractor in accordance with the guidelines published by the Association of Specialist Underpinning Contractors⁶, which indicates that the predicted movements represent a conservative assessment of the likely movements.

6.2 **Monitoring of Ground Movements**

The predictions of ground movement based on the ground movement analysis should be checked by monitoring of the adjacent properties and structures. The structures to be monitored during the construction stages should include the neighbouring structures. Condition surveys of the above existing structures should be carried out before and after the proposed works.

The precise monitoring strategy will be developed at a later stage and it will be subject to discussions and agreements with the owners of the adjacent properties and structures. Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works.

7.0 CONCLUSIONS

The analysis has concluded that the predicted damage to the neighbouring properties from the construction of the retaining walls and basement excavations would generally fall between Category 'Negligible' and 'Very Slight', which would fall within the acceptable limits. It is recommended that movement monitoring is carried out on all structures prior to and during the proposed basement construction.

The separate phases of work, including excavation of the proposed basement, will in practice be separated by a number of weeks during which time construction of permanent supports, basement slab and retaining wall curing will take place. This will provide an opportunity for the ground movements during and immediately after retaining wall construction to be measured and the data acquired can be fed back into the design and compared with the predicted values. Such a comparison will allow the ground model to be reviewed and the predicted wall movements to be reassessed prior to the main excavation taking place so that propping arrangements can be adjusted if required.



⁶ Haslam S, O'Connor L (2013) Guidelines on safe and efficient basement construction directly below or near to existing structures ASUC

APPENDICES

X-DISP ANALYSIS:

Wall Installation E1

Contour Plots of Vertical Movements and Horizontal Movements

Wall Installation and Basement Excavation combined

Contour Plots of Combined Vertical Movements and Horizontal Movements

Tabular Output of Results

Wall Installation E2

Contour Plots of Vertical Movements and Horizontal Movements

Wall Installation and Basement Excavation combined

Contour Plots of Combined Vertical Movements and Horizontal Movements

Tabular Output of Results

P-DISP ANALYSIS

Short Term Movement Contour Plots

Total Movement Contour Plots











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U	nas ys		(Gl	EOTE	CHNICAL & EN	VASSOC)J15308A			
1 He √all I	ath Drive, Lond	on NW3	7SB	mbined F	1	Drg. Ref.			I
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Specific	Building Damage Results	Horizontal I	Displacem	nents					
Specific	Building Damage Results	Horizontal L	Displacem	ients					
Specific Structu: Dist.	Building Damage Results re: A Sub-structure: Coordinates x y z	Horizontal [x	Displacem ם. צ	isplacements Horizontal displacement along the	Horizontal displacement perpendicular				
Specific Structu: Dist.	Building Damage Results re: A Sub-structure: Coordinates x y z	Horizontal I x	Displacem D. y	isplacements Horizontal displacement along the Line [mm] 	Horizontal displacement perpendicular to Line [mm]				
Specific Structu: Dist.	Building Damage Results re: A Sub-structure: Coordinates x y [m] [m] 19.08000 18.10000 20.94899 18.10000	[mm] 00 2.6019 03 3.4695	Displacem D Y [mm] 0.041679 0.097104	isplacements Horisontal displacement along the Line [mm] 2.6019 3.4695	Horizontal dieplacement perpendicular to Line [mm] 0.041679 0.037104				
Specific Structur Dist. [m] 0.0 : 1.8689 : 3.7378 :	Building Damage Results Coordinates x y z [m]	[mm] 00 2.6019 00 3.4695 00 4.2061	Displacem D y [mm] 0.041679 0.097104 0.097104	isplacements Horizontal displacement along the <u>Line</u> [mm] 3.46019 3.46019 4.2061	Horizontal displacement perpendicular to Line [mm] 0.041679 0.097104 0.46570				
Specific Structu: Dist. [m] 0.01 1.8689 3.7378 5.6067 5.74756	Building Damage Results re: A Sub-structure: Coordinates X Y [m] [m] 19.08000 18.10000 -2.600 22.81778 18.10000 - 2.600 24.85756 18.10000 - 2.600 26.55556 18.10000 - 2.600 26.55556 18.10000 - 2.600	[mm] 00 2.6019 00 3.4695 00 4.2061 00 0.0	Displacem p y 0.041679 0.097104 0.46570 0.46570 0.46570	isplacements Horisontal displacement along the Line [mm] 2.6019 3.4695 4.2061 0.0	Horizontal displacement perpendicular to Line [mm] 0.041679 0.04570 0.46570 6.9504				
Structu: Dist. [m] 0.03 3.7378 5.6067 7.4756 9.3444	Building Damage Results re: A Sub-structure: Coordinates x y z [m] [m] [m] [m] 19.08000 18.1000 - 2.600 0.94889 18.10000 - 2.600 22.81778 18.10000 - 2.600 24.66667 18.10000 - 2.600 26.55556 18.10000 - 2.600	[mm] 00 2.6019 00 3.4695 00 4.2061 00 0.0 00 0.0	Displacem D y [mm] 0.041679 0.097104 0.46570 0.46570 6.9504 6.9504	isplacements Horisontal displacement Line [mm] 3.4695 4.2061 4.2061 0.0 0.0 0.0	Horizontal displacement perpendicular to Line [mm] 0.041679 0.097104 0.46570 6.9504 6.9504 6.9504				
[m] 0.0 : 1.8689 : 3.7378 : 5.6067 : 7.4756 : 9.3444 : 11.213 :	Building Damage Results re: A Sub-structure: Coordinates x y z [m] [m] [m] [m] 19.08000 18.10000 - 2.602 02.81778 18.10000 - 2.602 24.6867 18.10000 - 2.602 24.6867 18.10000 - 2.602 34.6867 18.10000 - 2.602 34.24244 18.10000 - 2.602 34.2424 18.10000 - 2.602 34.1000 - 2.602 34.100	Imm1 00 2.6019 00 3.4695 00 4.2061 00 0.0 00 0.0 00 0.0 00 0.0 00 0.0	Displacem y (mm] 0.041679 0.097104 0.46570 6.9504 6.9504 6.9504 6.9504	eents Horisontal digplacements Line [m] 3.4619 3.4019 3.4019 0.00 0.00 0.00 0.00 0.00	Horizontal displacement to Line [mm] 0.14679 0.46770 0.46570 6.9504 6.9504 6.9504 6.9504				

Structure: B | Sub-structure:

Dist.	Co x	pordinate: y	5 Z	x	У	Displacements Horizontal displacement along the Line	Horizontal displacement perpendicular to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	35.90000	18.10000	-2.60000	-2.1608	3.0251	3.0569	2.1155
0.84009	35.88750	18.94000	-2.60000	-6.9734	0.0	0.10376	6.9727
1.6802	35.87500	19.78000	-2.60000	-6.9823	0.0	0.10389	6.9815
2.5203	35.86250	20.62000	-2.60000	-6.9911	0.0	0.10402	6.9904
3.3604	35.85000	21.46000	-2.60000	-7.0000	0.0	0.10416	6.9992
Structu	re: C Si	ub-struct:	ure:				

Dist.	Coordinates x y z x y					Displacements Horizontal	Horizontal
						displacement along the Line	displacement perpendicular to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	35.85000	21.46000	-1.60000	-7.0000	0.0	-7.0000	0.0
0.83500 1.6700	36.68500 37.52000	21.46000 21.46000	-1.60000 -1.60000	-6.4085 -5.8171	0.0	-6.4085 -5.8171	0.0

Structure: D | Sub-structure:

Dist.	Co	oordinates	3			Displacements	3
	x	У	z	x	У	Horizontal displacement along the Line	Horizontal displacement perpendicular
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	37.52000	21.46000	-1.60000	-5.8171	0.0	0.0	5.8171
0.91833	37.52000	22.37833	-1.60000	-5.8171	0.0	0.0	5.8171
1.8367	37.52000	23.29667	-1.60000	-5.8171	0.0	0.0	5.8171
2.7550	37.52000	24.21500	-1.60000	-5.8171	0.0	0.0	5.8171
3.6733	37.52000	25.13333	-1.60000	-5.8171	0.0	0.0	5.8171
4.5917	37.52000	26.05167	-1.60000	-5.8171	0.0	0.0	5.8171
5.5100	37.52000	26.97000	-1.60000	-3.8974	0.0	0.0	3.8974

Structure: E | Sub-structure:

Dist.	C	ordinates	3	Displacements									
	x y [m] [m]		z	х у		Horizontal displacement along the Line	Horizontal displacement perpendicular to Line						
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]						
0.0	37.52000	26.97000	-1.60000	-3.8974	0.0	3.8974	0.0						
0.81333	36.70667	26.97000	-1.60000	-4.2834	0.0	4.2834	0.0						
1.6267	35.89333	26.97000	-1.60000	-4.6694	0.0	4.6694	0.0						
2.4400	35.08000	26.97000	-1.60000	0.0	-7.0000	0.0	7.0000						

Structure: F | Sub-structure:

Dist.	C	ordinates	3	Displacements									
	x	х у		х у		Horizontal displacement along the	Horizontal displacement perpendicular						
						Line	to Line						
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]						
0.0	35.08000	26.97000	-2.60000	0.0	-7.0000	-7.0000	0.0						
1.6675	35.08000	28.63750	-2.60000	0.0	-5.8189	-5.8189	0.0						
3.3350	35.08000	30.30500	-2.60000	0.0	-4.6377	-4.6377	0.0						
5.0025	35.08000	31.97250	-2.60000	0.0	-3.4566	-3.4566	0.0						
6.6700	35.08000	33.64000	-2.60000	0.0	-2.7487	-2.7487	0.0						

Structure: G | Sub-structure:

Dist.	C	ordinates	3	Displacements									
	x	У	z	x	У	Horizontal displacement along the	Horizontal displacement perpendicular						
						Line	to Line						
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]						
0.0	35.08000	30.58000	-2.60000	0.0	-4.4429	-0.0097007	4.4429						
1.9629	33.11714	30.58429	-2.60000	0.0	-4.4399	-0.0096940	4.4399						
3.9257	31.15429	30.58857	-2.60000	0.0	-4.4368	-0.0096874	4.4368						
5.8886	29.19143	30.59286	-2.60000	0.0	-4.4338	-0.0096808	4.4338						
7.8514	27.22857	30.59714	-2.60000	0.0	-4.4308	-0.0096742	4.4308						
9.8143	25.26571	30.60143	-2.60000	0.0	-4.4277	-0.0096675	4.4277						
11.777	23.30286	30.60571	-2.60000	0.11826	-2.9220	-0.12464	2.9218						
13.740	21.34000	30.61000	-2.60000	1.1215	-1.9346	-1.1257	1.9322						

Structure: H | Sub-structure:

Dist.	Co	ordinates	3				
	x	У	z	x	У	Horizontal	Horizontal
						along the	perpendicular
						Line	to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	35.08000	33.64000	-1.60000	0.0	-2.7487	0.0	-2.7487
0.79000	35.87000	33.64000	-1.60000	-0.0055168	-1.8399	-0.0055168	-1.8399
1.5800	36.66000	33.64000	-1.60000	-0.21192	-1.7451	-0.21192	-1.7451
2.3700	37.45000	33.64000	-1.60000	-0.38667	-1.6119	-0.38667	-1.6119
Chanakum		.b. at much					
Structur	e. I Su	iD=structi	ire.				
Dist.	Co	ordinates	3		Dis	placements	
	x	У	z	x	у 1	Horizontal 1	Horizontal
					d	isplacement d	isplacement
						along the p	erpendicular
						Line	to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]

	GEA LIMITED		Job No.	Sheet No.	Rev.
Oasys	(GEOTECHNIC	AL &ENV ASSC	C) J15308A		
31 Heath Drive, London NW3	7SB		Drg. Ref.		
			Made by	Date 09-Dec-2015	Checked
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement along the percendicul	t ar			
0.0 37.45000 33.64000 -1.60000 -0.38667 0.57500 37.45000 34.21500 -1.60000 -0.33150 1.1500 37.45000 34.79000 -1.60000 -0.28332	-1.6119 -1.6119 0.386 -1.5011 -1.5011 0.331 -1.3848 -1.3848 0.283	57 50 32			
Structure: J Sub-structure: Dist. Coordinates	Displacements				
x y z x	y Horizontal Horizontal displacement displacement along the perpendicul Line to Line	E ar			
[m] [m] [m] [m] [m] 0.0 37.45000 34.79000 -1.60000 -0.28332 0.97417 38.24000 35.36000 -1.60000 -0.33062	[mm] [mm] [mm] -1.3848 -1.0400 -0.957; -1.1606 -0.94722 -0.747	19 76			
Structure: K Sub-structure: Dist. Coordinates x y z x	Displacements y Horizontal Horizontal				
[m] [m] [m] [m] [mm]	displacement displacement along the perpendicular Line to Line [mm] [mm] [mm]	-			
0.0 21.34000 30.61000 -2.60000 0.85807 1.6600 21.34000 31.44000 -2.60000 0.85807 1.6600 21.34000 32.27000 -2.60000 0.67655 2.4900 21.34000 33.93000 -2.60000 0.44374	-1.9346 -1.9346 -1.121 -1.8178 -1.8178 -0.8580 -1.6994 -1.6994 -0.6765 -1.5946 -1.5946 -0.5488 -1.4637 -0.4437	5 7 5 5 4			
4.1500 21.34000 34.76000 -2.60000 0.35619 Structure: L Sub-structure:	-1.3150 -1.3150 -0.3561	9			
Dist. Coordinates x y z x y	Displacements Horizontal Horizontal displacement displacement along the permendicular				
[m] [m] [m] [m] [mm] [m 0.0 34.61000 11.24000 -2.60000 0.0 2.6 0.87500 34.61000 12.11500 -2.60000 0.0 2.9	Line to Line m] [mm] [mm] 512 2.6512 0.0 794 2.9794 0.0				
1.7500 34.61000 12.99000 -2.60000 0.0 3.3 2.6250 34.61000 13.86500 -2.60000 0.0 3.9 3.5000 34.61000 14.74000 -2.60000 0.0 4.5	308 3.3308 0.0 506 3.9506 0.0 704 4.5704 0.0				
Structure: M Sub-structure: Dist. Coordinates x y z x	Displacements y Horizontal Horizontal				
[m] [m] [m] [m] [mm]	displacement displacement along the perpendicular Line to Line [mm] [mm] [mm]				
1.9050 32.70500 14.74000 -2.60000 0.0 4 3.8100 30.80000 14.74000 -2.60000 0.0 4 5.7150 28.89500 14.74000 -2.60000 0.0 4 7.6200 26.99000 14.74000 -2.60000 0.0 4	.5704 0.0 -4.5704 .5704 0.0 -4.5704 .5704 0.0 -4.5704 .5704 0.0 -4.5704 .5704 0.0 -4.5704 .5704 0.0 -4.5704				
9.5250 25.08500 14.74000 -2.60000 0.0 4 11.430 23.18000 14.74000 -2.60000 0.23382 2	.5704 0.0 -4.5704 .9704 -0.23382 -2.9704				
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement				
[m] [m] [m] [m] [mm] 0.0 23.18000 14.74000 -2.60000 0.23382	along the perpendicular Line to Line [mm] [mm] 2.9704 -2.9704 0.23382				
0.77000 23.18000 13.97000 -2.60000 0.16916 Structure: 0 Sub-structure:	2.6314 -2.6314 0.16916				
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement along the perpendicular				
[m] [m] [m] [m] [m] [mm] 0.0 23.18000 13.97000 -2.60000 0.16916 0.96000 22.22000 13.97000 -2.60000 0.66681	Line to Line [mm] [mm] [mm] 2.6314 -0.16916 -2.6314 2.2769 -0.66681 -2.2769				
1.9200 21.26000 13.97000 -2.60000 1.0448 2.8800 20.30000 13.97000 -2.60000 1.0448 3.8400 19.34000 13.97000 -2.60000 1.0703	1.8291 -0.95376 -1.8291 1.3931 -1.0448 -1.3931 1.0938 -1.0703 -1.0938				
Specific Building Damage Results - Vertical Dispu- Structure: A Sub-structure:	lacements				
Dist. Coordinates Displ x y z z [m] [m] [m] [m]	acements				
Vertical Offset 1 0.0 19.08000 18.10000 -2.60000 1.5069 1.8689 20.94889 18.10000 -2.60000 1.9519 3.7378 22.81778 18.10000 -2.60000 2.1079					
5.6067 24.68667 18.10000 -2.60000 3.1408 7.4756 26.55556 18.10000 -2.60000 3.1408 9.3444 28.42444 18.10000 -2.60000 3.1408 11.213 30.29333 18.10000 -2.60000 3.1408 13.082 32.16222 18.10000 -2.60000 3.1408					
14.951 34.03111 18.10000 -2.60000 3.1408 16.820 35.90000 18.10000 -2.60000 1.6857					
Dist. Coordinates Disp x y z z [m] [m] [m] [m] [m]	lacements				
Vertical Offset 1 0.0 35.90000 18.10000 -2.60000 1.6857 0.84009 35.88750 18.94000 -2.60000 3.1288					
2.500 25.6530 19.78000 -2.6000 3.1240 2.5203 35.86250 20.6200 -2.6000 3.1192 3.3604 35.85000 21.46000 -2.60000 3.1142					
Structure: C Sub-structure: Dist. Coordinates Disp (lacements				
Vertical Offset 1 0 0 35 85000 21 46000 -1 60000 3 1142					

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<i>Oasys</i>	(GEOTECHNICAL & ENV ASSO	C) J15308A		
31 Heath Drive, London NW3	3 7SB	Drg. Ref.		
vvali installation and Excavati	on combined E1	Made by D	ate Che 9-Dec-2015	cked
Dist. Coordinates Dist x y z z [m] [m] [m] [mm]	placements			
Structure: D Sub-structure:				
Dist. Coordinates Dis x y z z	splacements			
[m] [m] [m] [m] [mm] Vertical Offset 1 0.0 37.52000 21.46000 -1.60000 3.1730				
0.91833 37.52000 22.37833 -1.60000 3.1730 1.8367 37.52000 32.32667 -1.60000 3.1730 2.7550 37.52000 24.21500 -1.60000 3.1730 3.6733 37.52000 25.13333 -1.60000 3.1730 4.5917 37.52000 26.05167 -1.60000 3.1730 5.5100 37.52000 26.97000 -1.60000 2.1259				
Structure: E Sub-structure:				
Dist. Coordinates Dist. x y z z [m] [m] [m] [mm]	placements			
Vertical Offset 1 0.0 37.52000 26.97000 -1.60000 2.1259 0.81333 36.70667 26.97000 -1.60000 2.1918 1.6267 35.89333 26.97000 -1.60000 2.0978				
2.4400 35.08000 26.97000 -1.60000 3.1142 Structure: F Sub-structure:				
Dist. Coordinates Disp. x y z z [m] [m] [m] [mm]	lacements			
Vertical Offset 1 0.0 35.08000 26.97000 -2.60000 3.1142 1.6675 35.08000 28.63750 -2.60000 3.1736 2.356.25 0.9000 20.35500 -2.60000 3.0736				
5.0025 35.08000 31.97250 -2.60000 2.0049 6.6700 35.08000 33.64000 -2.60000 1.3201				
Structure: G Sub-structure: Dist. Coordinates Disp X Y Z Z	placements			
Vertical Offset 1 0.0 35.08000 30.58000 -2.60000 2.5482 1.9629 33.11714 30.58429 -2.60000 2.5466				
3.9257 31.15429 30.58857 -2.6000 2.5450 5.8866 29.15143 30.59286 -2.6000 2.5434 7.8514 27.22857 30.59714 -2.60000 2.5418 9.8143 25.26571 30.60143 -2.60000 2.5402 11.777 23.30286 30.60571 -2.60000 1.6779 13.740 21.34000 30.61000 -2.60000 1.2926				
Structure: H Sub-structure: Dist. Coordinates Dis	splacements			
[m] [m] [m] [m] [m] [mm] Vertical Offset 1 0.0.35.08000.33.64000 -1.60000.1.3201				
0.79000 35.87000 33.64000 -1.60000 0.88363 1.5800 36.66000 33.64000 -1.60000 0.82731 2.3700 37.45000 33.64000 -1.60000 0.77051				
Structure: I Sub-structure: Dist. Coordinates Dis	placements			
x y z z [m] [m] [m] [m] [mm] Vertical Offset 1				
0.57500 37.45000 34.2150 -1.60000 0.64128 1.1500 37.45000 34.79000 -1.60000 0.51994				
Structure: J Sub-structure: Dist. Coordinates Dist. x y z z	placements			
[m] [m] [m] [m] [mm] Vertical Offset 1 0.0 37.45000 34.79000 -1.60000 0.51994				
0.97417 38.24000 35.36000 -1.60000 0.36631 Structure: K Sub-structure:				
Dist. Coordinates Dist x y z z [m] [m] [m] [mm]	placements			
Vertical Offset 1 0.0 21.34000 30.61000 -2.60000 1.2926 0.83000 21.34000 31.44000 -2.60000 1.1664 1.6600 21.34000 32.27000 -2.60000 1.0077				
2.4900 21.34000 33.93000 -2.60000 0.653496 4.1500 21.34000 34.76000 -2.60000 0.49056				
Structure: L Sub-structure: Dist. Coordinates Dis x y z z	placements			
[m] [m] [m] [m] [m] [mm] Vertical Offset 1 0.0 34.61000 11.24000 -2.60000 1.2168				
U.87500 34.6100 12.11500 -2.60000 1.5706 1.7500 34.6100 12.9900 -2.60000 1.9276 2.6250 34.6100 13.86500 -2.60000 2.2611 3.5000 34.61000 14.74000 -2.60000 2.6145				
Structure: M Sub-structure: Dist. Coordinates Disg x y z z	placements			
[m] [m] [m] [m] [mm] Vertical Offset 1 0.0 34.61000 14.74000 -2.60000 2.6145				
1.9050 32.70500 14.74000 -2.60000 2.6145 3.8100 30.80000 14.74000 -2.60000 2.6145 5.7150 28.89500 14.74000 -2.60000 2.6145 7.6200 26.99000 14.74000 -2.60000 2.6145				

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Oasys	(GEOTECHNICA	L &ENV A	ssocu [,]	15308A		
31 Heath Drive, London NW3	7SB		Drç	g. Ref.		
wail installation and Excavation	on complined E 1		Mad	le by D	ate	Checked
Dist. Coordinates Displ x y z z	acements			0	9-060-2013	
[m] [m] [m] [m] [mm] 9.5250 25.08500 14.74000 -2.60000 2.6145						
11.430 23.18000 14.74000 -2.60000 1.7047 Structure: N Sub-structure:						
Dist. Coordinates Disp	lacements					
[m] [m] [m] [m] [m] Vertical Offset 1 0.0 23.18000 14.74000 -2.60000 1.7047						
0.77000 23.18000 13.97000 -2.60000 1.5242						
Dist. Coordinates Disp x y z z	placements					
[m] [m] [m] [m] [m] [mm]						
0.10 23.18000 13.97000 -2.60000 1.2542 0.96000 22.22000 13.97000 -2.60000 1.3739 1.9200 21.26000 13.97000 -2.60000 1.1973 2.8800 20.30000 13.97000 -2.60000 1.063 3.8400 19.34000 13.97000 -2.60000 0.82574						
Specific Building Damage Results - All Segments	5					
Structure: A Sub-structure: Vertical Offset Segment Start Leng	th Curvature Deflection Average Ma	x. Maximum M	Maximum Min.	Damage		
from Line for Vertical Movement Calculations	Ratio Horizontal Ten Strain Str	sile Gradient of Gra ain Horizontal V Displacement Dis	adient of Radius Vertical Curvatu splacement	of Category re		
[m] [m] [m] 0.0 1 0.0 1.85	[%] [%] [79 None 0.0 0.046423 0.0	%] 46423 -464.01E-6 -	[m] -238.03E-6 6010	.8 0 (Negligible)		
2 1.8579 2.37 3 4.2368 5.10	'89 Hogging 0.0077451 -0.016033 0.00 '76 Sagging 0.010787 -0.060361 0.0	59214 0.0022557 - 13476 0.0022557 -	-553.95E-6 3229 -553.95E-6 1174	<pre>3. 0 (Negligible) 4. (Negligible)</pre>		
4 9.3444 1.86	89 None 0.0 0.0	0.0 0.0	0.0 -	(Negligible) (Negligible)		
Tensile horizontal strains are +ve, compres	sive horizontal strains are -ve.	12,05 0.00113,5	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(Negligible)		
Structure: B Sub-structure:						
Vertical Offset Segment Start Lengt from Line for Vertical Movement	h Curvature Deflection Average Max Ratio Horizontal Tensi Strain Stra	Maximum Max le Gradient of Gradi in Horizontal Ver Displacement Displ	ximum Min. ient of Radius of rtical Curvature lacement	Damage Category		
Calculations [m] [m] <t< td=""><td>[%] [%] [%] 4 Sagging 0.032245 -0.087897 0.026</td><td>Curve Cu 238 0.0035277 -0.</td><td>[m] .0017238 388.05</td><td>0</td><td></td><td></td></t<>	[%] [%] [%] 4 Sagging 0.032245 -0.087897 0.026	Curve Cu 238 0.0035277 -0.	[m] .0017238 388.05	0		
Tensile horizontal strains are +ve, compres	sive horizontal strains are -ve.			(Regrigible)		
Structure: C Sub-structure: Vertical Offset Segment Start Lengt from Line for Vertical	h Curvature Deflection Average Max Ratio Horizontal Tensi Strain Stra	Maximum Max le Gradient of Gradi in Horizontal Ver	ximum Min. ient of Radius of rtical Curvature	Damage Category		
Movement Calculations [m] [m] [m] 0.0 1 0.0 1.669	[%] [%] [%] [%] 0 Sagging 0.0075634 0.070833 0.073	Displacement Displ Curve Cu 357 -707.83E-6 -18	Iacement urve [m] 87.93E-6 2734.0	1 (Very		
Tensile horizontal strains are +ve, compres	ssive horizontal strains are -ve.			slight)		
Structure: D Sub-structure: Vertical Offset Segment Start Leng	th Curvature Deflection Average Ma	x. Maximum Ma	aximum Min.	Damage		
from Line for Vertical Movement	Ratio Horizontal Tens Strain Str	ile Gradient of Grad ain Horizontal Ve Displacement Disp	dient of Radius o ertical Curvatur placement	of Category e		
[m] [m] [m] [m] [m] 0.0 2.75	[%] [%] [%] [%]] 0.0 0.0	[m] 0.0 -	0 (Negligible)		
2 2.7550 2.75 Tensile horizontal strains are +ve, compres	40 Sagging 0.025320 0.0 0.02	4495 0.0 0	0.0011402 644.0	4 0 (Negligible)		
Structure: E Sub-structure:						
Vertical Offset Segment Start Len from Line for Vertical Movement Calculations	gth Curvature Deflection Average Ratio Horizontal Te Strain S	Max. Maximum nsile Gradient of Gr train Horizontal Displacement Di Curve	Maximum Min. radient of Radius Vertical Curvat isplacement Curve	Damage s of Category sure		
[m] [m] [0.0 1 0.0 0.6	m] [%] [%] 10967 Hogging 0.0 0.047458 0.	[%] 047458 -474.36E-6	[m] -80.908E-6 137	9.4 0 (Negligible)		
Tensile horizontal strains are +ve, compres	sive horizontal strains are -ve.	049545 0.0057745	-0.0012369 459	(Negligible)		
Structure: F Sub-structure:						
Vertical Offset Segment Start Lengt from Line for Vertical Movement	h Curvature Deflection Average Max Ratio Horizontal Tensi Strain Stra	Maximum Max le Gradient of Gradi in Horizontal Ver	ximum Min. ient of Radius of rtical Curvature	Damage Category		
Information Calculations [m] [m] [m] 0.0 1 0.0 6.669	[%] [%] [%] 0 Sagging 0.0075998 0.063740 0.070	Curve Cu 418 -707.83E-6 41	[m] 10.49E-6 3979.1	1 (Very		
Tensile horizontal strains are +ve, compres	sive horizontal strains are -ve.			Slight)		
Structure: G Sub-structure:	th Curvature Deflection Avenue	X. Mayimum -	Maximum Mi-	Damage		
from Line for Vertical Movement	Ratio Horizontal Ten Strain Str	sile Gradient of Gra ain Horizontal V Displacement Dis	adient of Radius Vertical Curvatu splacement	of Category re		
Calculations [m] [m] <t< td=""><td>[%] [%] [%] [.60 Sagging 0.0046458 -705.86E-6 0.00</td><td>Curve %] 51536 58.577E-6</td><td>Curve [m] 439.33E-6 1239</td><td>8 0</td><td></td><td></td></t<>	[%] [%] [%] [.60 Sagging 0.0046458 -705.86E-6 0.00	Curve %] 51536 58.577E-6	Curve [m] 439.33E-6 1239	8 0		
2 11.160 2.57 Tensile horizontal strains are two compros	93 Hogging 0.0044071 -0.040193 0.00	84349 510.25E-6	439.33E-6 4748	(Negligible) .4 0 (Negligible)		
Structure: H Sub-structure:	are -ve.					

$\int a$	04 1	~	GEA	LIM	TED				Job N	lo.	Sheet No.		ev.
Jas	sy:	S	(GEC	DTEC	HNIC	AL 8	ENV .	ASSO	C)J1:	5308A			
Heath Driv	ve, Lon		V3 7SB	~~d E1					Drg.	Ref.			
all Installau	on anu	EXCava	Ition combi	neu ⊏ i					Made	by	Date	Chec	ked
ertical Offset	Segment	Start 1	Length Curvature	Deflectio	n Average	Max.	Maximum	Maximum	Min.	Damage	09-Dec-2015		
rom Line for Vertical Movement				Ratio	Horizontal Strain	Tensile Strain	Gradient of Horizontal Displacement	Gradient of Vertical Displacement	Radius of Curvature	Category			
ertical Offset from Line for Vertical Movement	Segment	Start 1	length Curvatur	e Deflecti Ratio	on Average Horizonta Strain	Max. l Tensile Strain	Maximum Gradient of Horizontal Displacemen	Maximum Gradient o: Vertical t Displacemen	Min. E Radius of Curvature nt	Damage f Category e			
[m] 0.0		[m] 1 0.0	[m] 1.8957 Hogging	[%] 0.0117	[%] 50 -0.01486	[%] 3 0.008768	Curve 8 261.34E-	Curve 6 552.55E	[m] -6 1266.1	1 0 (Negligible)			
ensile horizontal	strains ar	2 1.8957 ().47334 None pressive horizon	0 tal strain	.0 -0.02212 s are -ve.	0 0.004424	0 221.25E-	6 84.582E	-6 5068.5	5 0 (Negligible)			
ructure: I Sub-	-structure:												
ertical Offset from Line for Vertical	Segment	Start L	ength Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile G Strain 1	Maximum radient of G Horizontal	Maximum radient of 1 Vertical (Min. Radius of Curvature	Damage Category			
Movement Calculations [m] 0.0		[m] 1 0.0 1	[m] .1490 Hogging	[%] 339.95E-6	[%] 0.019755	D: [%] 0.019794	-202.25E-6	isplacement Curve 224.70E-6	[m] 41867.	0			
ensile horizontal	strains ar	e +ve, com	pressive horizon	tal strain	s are -ve.				(1	Negligible)			
tructure: J Sub-	-structure: Segment	Start L	ength Curvature	Deflectio	n Average	Max.	Maximum	Maximum	Min.	Damage			
from Line for Vertical Movement Calculations				Ratio	Horizontal Strain	Tensile Strain	Gradient of Horizontal Displacement Curve	Gradient of Vertical Displacement Curve	Radius of Curvature	Category			
[m] 0.0		[m] 1 0.0 0	[m] .97317 None	[%] 0.	[%] 0 0.0095242	[%] 0.0095242	-95.233E-6	157.68E-	[m] 5 -	0 (Negligible)			
ansile horizontal	strains ar	e +ve, com	pressive horizon	tal strain	s are -ve.								
tructure: K Sub- ertical Offset from Line for	-structure: Segment	Start 1	Length Curvature	Deflectio Ratio	n Average Horizontal	Max. Tensile (Maximum Gradient of	Maximum Gradient of	Min. Radius of	Damage Category			
Vertical Movement Calculations [m]		[m]	[m]	[%]	Strain [%]	[%]	Horizontal Displacement Curve	Vertical Displacement Curve	[m]				
0.0		1 0.0	2.7578 Sagging	0.001042	3 0.013862 6 0.017044	0.014273	-157.65E-6	213.82E-6	18592.	(Negligible)			
Movement calculations [m] 0.0		[m] 1 0.0	[m] 1.1464 Hogging	[%] 65.285E-	[%] 6 0.038131	[%] 0.038137	-401.51E-6	-407.87E-6	[m] 210120.	0			
ensile horizontal	strains ar	2 1.1464	2.3526 Sagging pressive horizon	785.96E- tal strain	6 0.062965 s are -ve.	0.063230	-707.83E-6	-409.41E-6	20167. 1	(Negligible) 1 (Very Slight)			
tructure: M Sub-	-structure:												
ertical Offset from Line for Vertical	Segment	Start 1	Length Curvature	Deflectio Ratio	n Average Horizontal Strain	Max. Tensile Strain	Maximum Gradient of Horizontal	Maximum Gradient of Vertical	Min. Radius of Curvature	Damage Category			
Movement Calculations [m] 0.0		[m] 1 0.0	[m] 5.7150 None	[%]	[%] 0 0.0	[%] 0.0	Displacement Curve 0.0	Curve	[m]) -	0			
angile horigontal	strains ar	2 5.7150	5.7140 Sagging	0.01060	9 -0.0040899	0.0085381	122.75E-6	477.63E-	5 3189.9	(Negligible) 0 (Negligible)			
ensile norizontal	strains ar	e +ve, com	pressive norizon	tai strain	s are -ve.								
<pre>/ertical Offset from Line for Vertical</pre>	-structure: Segment	Start L	angth Curvature	Deflectio Ratio	n Average Horizontal Strain	Max. Tensile (Strain	Maximum Gradient of Horizontal	Maximum Gradient of Vertical	Min. Radius of Curvature	Damage Category			
Movement Calculations [m] 0.0		[m] 1 0.0 0	[m] .76900 None	[%]	[%] 0 0.044027	[%] 0.044027	Curve -440.08E-6	Displacement Curve 234.28E-6	[m] -	0			
ensile horizontal	strains ar	e +ve, com	pressive horizon	tal strain	s are -ve.					(Negligible)			
tructure: 0 Sub-	-structure:												
ertical Offset from Line for Vertical Movement	Segment	Start 1	length Curvature	Deflectio Ratio	n Average Horizontal Strain	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement	Maximum Gradient of Vertical Displacement	Min. Radius of Curvature	Damage Category			
Calculations [m] 0.0		[m] 1 0.0	[m] 2.6173 Sagging	[%] 776.71E-	[%] 6 -0.032505	[%] 0.0065159	Curve 518.65E-6	Curve 198.95E-0	[m] 5 31533.	(Negligible)			
		2 2.6173	1.2217 Hogging	180.70E-	6 -0.0041227	831.09E-6	94.885E-6	198.95E-	55647.	(Negligible)			
ensile horizontal	strains ar	e +ve, com	pressive horizon	tal strain	s are -ve.								
pecific Building Dan	mage Result	ts - Critical V	'alues for All Segn	nents withir	n Each Sub-Str	ructure							
Structure: A Sub-	-structure:	age Max	imum Maximum	Max.	Maximum	Maximum	Min.	Min.	Damage Cate	egory			
Deffect from Rati Line for Vertical Movement	io Horiz Str	contal Slo ain	ope Settlement	Tensile Strain	Gradient of Horizontal Displacement Curve	Gradient (Vertical Displaceme Curve	of Radius of l Curvature ent (Hogging)	Radius of Curvature (Sagging)	ye cače				
alculations [m] [%] 0.0 0.01] [% 17302 -0.0	;] 060361 779	[mm] 48E-6 3.1408	[%] 0.046423	0.0022557	779.48	[m] E-6 32293.	[m] 1916.8 0	(Negligible	e)			
tructure: B Sub-	-structure:												
Vertical Deflect ffset from Rati Line for Vertical Movement	ction Aver io Horiz Str	age Max contal Slo cain	imum Maximum ope Settlemen	Max. t Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximu Gradient Vertica t Displaces Curve	m Min. of Radius o al Curvatur ment (Hogging	Min. f Radius of e Curvature) (Sagging)	Damage Cat	tegory			

Movement Calculations

$\bigcap a canc$	GEA LIMITED	Job No.	Sheet No.	Rev.	
Oasys	(GEOTECHNICAL & ENV AS	SOC)J15308A			
1 Heath Drive, London NW3	3 7SB	Drg. Ref.			
vali installation and Excavati	ion complined E1	Made by	Date 09-Dec-2015	Checked	
[m] [%] [%] 0.0 0.032245 -0.087897 -0.001	[mm] [%] [m] [m] [m] 7238 3.1288 0.026238 0.0035277 -0.0017238 - 36] 8.05 0 (Negligible)			
<pre>tructure: C Sub-structure: Vertical Deflection Average Maximu ffset from Ratio Horizontal Slope Line for Strain Vertical Movement bit bit is an</pre>	um Maximum Max. Maximum Maximum Min. Mir e Setlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sagg Curve Curve	. Damage Category s of ture ing)			
[m] [%] [%] [%] 0.0 0.0075634 0.070833 -187.93	[mm] [%] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m] 34.0 1 (Very Slight)			
Vertical Deflection Average Maximu Sffset from Ratio Horisontal Slope Line for Strain Vertical Movement alculations	um Maximum Max. Maximum Maximum Min, Min, e Settlement Tensile Gradient of Gradium of Radium Strain Horisontal Vertical Curvature Curva Displacement Displacement (Hogging) (Saggi Curve Curve	Damage Category of ure ng)			
[m] [8] [8] 0.0 0.025320 0.0 0.00114 Structure: E Sub-structure:	[mm] [%] [m] [m] [m] [m] [402 3.1730 0.024495 0.0 0.0011402 - 644	.04 0 (Negligible)			
Vertical Deflection Average Maximu Offset from Ratio Horizontal Slope Line for Strain Vertical Movement Zalculations	um Maximum Max. Maximum Maximum Min. Mir e Settlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sagg Curve Curve	. Damage Category s of ture ing)			
[m] [%] [%] 0.0 0.032766 -0.22856 -0.0012	[mm] [%] [m] [m] 2569 3.1129 0.049543 0.0057743 -0.0012569 459.84] - O (Negligible)			
Vertical Deflection Average Maximu Dffset from Ratio Horizontal Slope Line for Strain Vertical Movement	um Maximum Max. Maximum Maximum Min. Min. e Settlement Tensile Gradient of Gradient of Radius of Radius Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Saggi Curve Curve	Damage Category of ure ng)			
[m] [%] [%] 0.0 0.0075998 0.063740 410.49F	[mm] [%] [m] [m] [m] E=6 3.1718 0.070418 -707.83E-6 410.49E-6 - 397	9.1 1 (Very Slight)			
tructure: G Sub-structure: Vertical Deflection Average Maximu ffset from Ratio Horizontal Slope Line for Strain Vertical Movement	um Maximum Max. Maximum Maximum Min. Mir e Settlement Tensile Gradient of Gradient of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sag Curve Curve	. Damage Category s of ture ing)			
Calculations [%] <th[]< th=""> <th[< td=""><td>[mm] [%] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m</td><td>] 398. O (Negligible)</td><td></td><td></td></th[<></th[]<>	[mm] [%] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m] 398. O (Negligible)			
Structure: H Sub-structure: Vertical Deflection Average Maxim Difset from Ratio Horizontal Slope Line for Strain Vertical Movement 21 Junctions	um Maximum Max. Maximum Maximum Min. Mir e Settlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sagg Curve Curve	. Damage Category s of ture ing)			
[m] [%] [%] 0.0 0.011750 -0.022120 552.555	[mm] [%] [m] [n E-6 1.3201 0.0087688 261.34E-6 552.55E-6 1266.1] - O (Negligible)			
Vertical Deflection Average Maximu offset from Ratio Horizontal Slope Line for Strain Vertical Hovement alculations	um Maximum Max. Maximum Maximum Min. Min. e Settlement Tensile Gradient of Gradient of Radius of Radius Strain Horizontal Vertical Curvature Curvat Displacement Displacement (Hogging) (Saggi Curve Curve	Damage Category of ure ng)			
[m] [%] [%] 0.0 339.95E-6 0.019755 224.70E	[mm] [%] [m] [m] E-6 0.77051 0.019794 -202.25E-6 224.70E-6 41867.	- 0 (Negligible)			
Vertical Deflection Average Maximu offset from Ratio Horizontal Slope Line for Strain Vertical Movement alculations	um Maximum Max. Maximum Maximum Min. Mir e Settlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sagg Curve Curve	. Damage Category s of ture ing)			
[m] [%] [%] 0.0 0.0 0.0095242 157.688	[mm] [%] [m] [m] E-6 0.51994 0.0095242 -95.233E-6 157.68E-6 -] - O (Negligible)			
Vertical Deflection Average Maximu ffset from Ratio Horizontal Slope Line for Strain Vertical Movement Joulations	um Maximum Max. Maximum Maximum Min. Min. e Settlement Tensile Gradient of Gradient of Radius of Radius Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Saggi Curve Curve	Damage Category of ure ng)			
Imi [%] <th [%]<="" td="" th<=""><td>[mm] [%] [m] [m] [m] E-6 1.2926 0.017075 -179.06E-6 213.82E-6 47719. 185</td><td>92. 0 (Negligible)</td><td></td><td></td></th>	<td>[mm] [%] [m] [m] [m] E-6 1.2926 0.017075 -179.06E-6 213.82E-6 47719. 185</td> <td>92. 0 (Negligible)</td> <td></td> <td></td>	[mm] [%] [m] [m] [m] E-6 1.2926 0.017075 -179.06E-6 213.82E-6 47719. 185	92. 0 (Negligible)		
Vertical Deflection Average Maximu ffset from Ratio Horizontal Slope Line for Strain Vortical Devletione	um Maximum Max. Maximum Maximum Min. Mir e Setlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sagg Curve Curve	. Damage Category s of ture ing)			
[m] [%] [%] [%] 0.0 785.96E-6 0.062965 -409.41	[mm] [%] [m] [m] [m] 1E-6 2.6141 0.063230 -707.83E-6 -409.41E-6 210120. 20] 167. 1 (Very Slight)			
Vertical Deflection Average Maximu ffset from Ratio Horizontal Slope Line for Strain Vertical Movement	um Maximum Max. Maximum Maximum Min. Mir e Settlement Tensile Gradient of Gradient of Radius of Radiu Strain Horizontal Vertical Curvature Curva Displacement Displacement (Hogging) (Sag Curve Curve	. Damage Category s of ture ing)			
alculations [%] [%] <th< td=""><td>[mm] [%] [m] [m] E-6 2.6145 0.0085381 122.75E-6 477.63E-6 - 31</td><td>] 89.9 O (Negligible)</td><td></td><td></td></th<>	[mm] [%] [m] [m] E-6 2.6145 0.0085381 122.75E-6 477.63E-6 - 31] 89.9 O (Negligible)			

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$ \mathcal{O}l $	isys		(GEO	TEC	:HN		L &E	NV A	SSO	C)J15	5308A	N N			
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vvali insta	illation and Ex	cavatio	n combir	ned E1						Made I	by	Da 09	te -Dec-2015	Chec	ked
Vertical Offset from Line for Vertical	Deflection Average Ratio Horizonta Strain	Maximum I Slope	Maximum Settlement	Max. Tensile Strain	Maxi Gradie Horiz Displa	mum nt of G ontal cement D	Maximum radient of Vertical isplacement	Min. Radius of R Curvature C (Hogging) (Min. adius of urvature Sagging)	Damage Cat	egory				
Vertical Offset from Line for Vertical	Deflection Average Ratio Horizonta Strain	Maximum I Slope	Maximum Settlement	Max. Tensile Strain	Maxim Gradien Horizo Displac	um t of Gr ntal ement Di	Maximum adient of 1 Vertical (splacement	Min. Radius of Ra Curvature Cu (Hogging) (S	Min. dius of rvature agging)	Damage Cate	gory				
Movement Calculations [m] 0.0	[%] [%] 0.0 0.04402'	7 234.28E-6	[mm] 5 1.7047	[%] 0.044027	Curv	e 08E-6	Curve 234.28E-6	[m] _	[m] - 0	(Negligible)				
Structure: 0	Sub-structure:														
Offset from Line for Vertical Movement	Ratio Horizonta Strain	L Slope	Settlement	Tensile Strain	Gradie Horiz Displa Cur	nt of G ontal cement D ve	radient of Vertical isplacement Curve	Radius of R Curvature C (Hogging) (adius of urvature Sagging)	Damage Cath	egory				
[m] 0.0	[%] [%] 776.71E-6 -0.03250!	5 198.95E-6	[mm] 5 1.5242	[%] 0.0065159	518	.65E-6	198.95E-6	[m] 55647.	[m] 31533. 0	(Negligibl	e)				
Specific Building	ng Damage Results - Ci e Parameter	<i>itical Segm</i> Critical	ents within Ea Critical	ich Structu Start	re End	Curvatu	re Maximum	Maximum	Max.	Min.	Min.	Damage Cate	gory		
	Menimum Clane	3ub-Structu	ire Segment	[m]	[m]	Consina	Slope	[mm]	Tensile Strain [%]	Radius of 1 Curvature (Hogging) [m]	Radius of Curvature (Sagging) [m]	(Negli sible)			
A	Maximum Slope Maximum Settlement		3	4.2368	9.3444	Sagging	553.95E-	6 3.1408 6 3.1408	0.012/85	-	1916.8 U 11744. 0	(Negligible) (Negligible)			
	Max. Tensile Strain Min. Radius of		2	2 1.8579	4.2368	Hogging	553.95E-	6 2.3837	0.0059214	32293.	- 0	(Negligible)			
	(Hogging) Min. Radius of		5	5 11.213	16.819	Sagging	779.48E-	6 3.1408	0.012785	-	1916.8 0	(Negligible)			
в	(Sagging) Maximum Slope		1	L 0.0	3.3594	Sagging	0.001723	8 3.1288	0.026238	-	388.05 0	(Negligible)			
	Maximum Settlement Max. Tensile		1	L 0.0	3.3594	Sagging	0.001723	8 3.1288	0.026238	-	388.05 0	(Negligible)			
	Strain Min. Radius of Curvature		-		-	-			-	-					
	(Hogging) Min. Radius of Curvature		1	L 0.0	3.3594	Sagging	0.001723	8 3.1288	0.026238	-	388.05 0	(Negligible)			
с	(Sagging) Maximum Slope Maximum		1	L 0.0	1.6690	Sagging Sagging	187.93E-	6 3.2703 6 3.2703	0.073357	-	2734.0 1 2734.0 1	(Very Slight) (Very Slight)			
	Settlement Max. Tensile		1	L 0.0	1.6690	Sagging	187.93E-	6 3.2703	0.073357	-	2734.0 1	(Very Slight)			
	Min. Radius of Curvature		-		-	-			-	-					
	Min. Radius of Curvature		1	L 0.0	1.6690	Sagging	187.93E-	6 3.2703	0.073357	-	2734.0 1	(Very Slight)			
D	(Sagging) Maximum Slope Maximum		2	2 2.7550 L 0.0	5.5090 2.7550	Sagging Sagging	0.001140	2 3.1730 0 3.1730	0.024495	-	644.04 0 - 0	(Negligible) (Negligible)			
	Settlement Max. Tensile Strain		2	2 2.7550	5.5090	Sagging	0.001140	2 3.1730	0.024495	-	644.04 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		-		-	-			-	-					
	Min. Radius of Curvature (Sagging)		2	2 2.7550	5.5090	Sagging	0.001140	2 3.1730	0.024495	-	644.04 0	(Negligible)			
Е	Maximum Slope Maximum		4	2 0.60967 2 0.60967	2.4390 2.4390	Hogging Hogging	0.001256	9 3.1129 9 3.1129	0.049543 0.049543	459.84 459.84	- 0 - 0	(Negligible) (Negligible)			
	Settlement Max. Tensile Strain		2	2 0.60967	2.4390	Hogging	0.001256	9 3.1129	0.049543	459.84	- 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		2	2 0.60967	2.4390	Hogging	0.001256	9 3.1129	0.049543	459.84	- 0	(Negligible)			
	Min. Radius of Curvature (Sagging)		-		-	-			-	-					
F	Maximum Slope Maximum		1	L 0.0 L 0.0	6.6690 6.6690	Sagging Sagging	410.49E- 410.49E-	6 3.1718 6 3.1718	0.070418 0.070418	-	3979.1 1 3979.1 1	(Very Slight) (Very Slight)			
	Settlement Max. Tensile Strain		1	L 0.0	6.6690	Sagging	410.49E-	6 3.1718	0.070418	-	3979.1 1	(Very Slight)			
	Min. Radius of Curvature (Hogging)		-		-	-			-	-					
	Min. Radius of Curvature (Sagging)		1	L 0.0	6.6690	Sagging	410.49E-	6 3.1718	0.070418	-	3979.1 1	(Very Slight)			
G	Maximum Slope Maximum		1	L 0.0 L 0.0	11.160 11.160	Sagging Sagging	439.33E- 439.33E-	6 2.5482 6 2.5482	0.0051536 0.0051536	-	12398. 0 12398. 0	(Negligible) (Negligible)			
	Max. Tensile Strain		2	2 11.160	13.739	Hogging	439.33E-	6 1.9492	0.0084349	4748.4	- 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		2	2 11.160	13.739	Hogging	439.33E-	6 1.9492	0.0084349	4748.4	- 0	(Negligible)			
	Min. Radius of Curvature (Sagging)		1	L 0.0	11.160	Sagging	439.33E-	6 2.5482	0.0051536	-	12398. 0	(Negligible)			
н	Maximum Slope Maximum		1	L 0.0 L 0.0	1.8957 1.8957	Hogging Hogging	552.55E-	6 1.3201 6 1.3201	0.0087688 0.0087688	1266.1 1266.1	- 0 - 0	(Negligible) (Negligible)			
	Max. Tensile Strain		1	L 0.0	1.8957	Hogging	552.55E-	6 1.3201	0.0087688	1266.1	- 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		1	L 0.0	1.8957	Hogging	552.55E-	6 1.3201	0.0087688	1266.1	- 0	(Negligible)			
	Min. Radius of Curvature (Sagging)				-	-			-	-					
I	Maximum Slope		1 1	L 0.0 L 0.0	1.1490 1.1490	Hogging Hogging	224.70E-	6 0.77051 6 0.77051	0.019794 0.019794	41867. 41867.	- 0 - 0	(Negligible) (Negligible)			
	Settlement Max. Tensile Strain		1	L 0.0	1.1490	Hogging	224.70E-	6 0.77051	0.019794	41867.	- 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		1	L 0.0	1.1490	Hogging	224.70E-	6 0.77051	0.019794	41867.	- 0	(Negligible)			
	Min. Radius of Curvature				-	-			-	-					
J	(Sagging) Maximum Slope Maximum		1	L 0.0 L 0.0	0.97317 0.97317	Sagging Sagging	157.68E-	6 0.51994 6 0.51994	0.0095242	-	- 0 - 0	(Negligible) (Negligible)			
	Settlement Max. Tensile Strain		1	L 0.0	0.97317	Sagging	157.68E-	6 0.51994	0.0095242	-	- 0	(Negligible)			
	Min. Radius of Curvature (Hogging)		-		-	-			-	-					

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Image Image <	ali instali	ation and	Excavation	i combii	ned E1						Made t	ру	D: 09	ate -Dec-2015	Chec	ked
	tructure Name	Parameter	Critical Sub-Structur	Critica e Segment	l Start	End Cu	irvature	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Min. Radius of H Curvature (Min. Radius of Curvature	Damage Cat	egory		
		Min. Radius o	f		- • • -	· ·		-			(Hogging)	(Sagging)				
		(Sagging) Maximum Slope			1 0.0	2.7578 Sa	aaina	213.82E-6	1.2926	0.014273	_	18592.0	(Negligible)			
		Maximum Settlement			1 0.0	2.7578 Sa	ugging	213.82E-6	1.2926	0.014273	-	18592. 0	(Negligible)			
		Max. Tensile Strain		:	2 2.7578	4.1490 Ho	gging	213.82E-6	0.77769	0.017075	47719.	- 0	(Negligible)			
		Min. Radius o Curvature	f	:	2 2.7578	4.1490 Ho	gging	213.82E-6	0.77769	0.017075	47719.	- 0	(Negligible)			
		(Hogging) Min. Radius o Curvature	£	:	1 0.0	2.7578 Sa	ugging	213.82E-6	1.2926	0.014273	-	18592. O	(Negligible)			
		(Sagging) Maximum Slope		-	2 1.1464	3.4990 Sa	gging	409.41E-6	2.6141	0.063230	-	20167. 1	(Very Slight)			
		Maximum Settlement			2 1.1464	3.4990 Sa	igging	409.41E-6	2.6141	0.063230	-	20167. 1	(Very Slight)			
		Max. Tensile Strain	e		2 1.1464	3.4990 Sa	igging	409.41E-6	2.6141	0.063230	-	20167. 1	(Very Slight)			
		Curvature (Hogging)	I		1 0.0	1.1464 HC	gging	407.87E-6	1.0813	0.038137	210120.	- 0	(Negligible)			
 		Min. Radius o	£	:	2 1.1464	3.4990 Sa	ugging	409.41E-6	2.6141	0.063230	-	20167. 1	(Very Slight)			
		(Sagging) Maximum Slope			2 5.7150	11.429 Sa	aaina	477.63E-6	2.6145	0.0085381	_	3189.9.0	(Negligible)			
minimum 1 </td <td></td> <td>Maximum Settlement</td> <td></td> <td></td> <td>1 0.0</td> <td>5.7150 Sa</td> <td>gging</td> <td>0.0</td> <td>2.6145</td> <td>0.0</td> <td>-</td> <td>- 0</td> <td>(Negligible)</td> <td></td> <td></td> <td></td>		Maximum Settlement			1 0.0	5.7150 Sa	gging	0.0	2.6145	0.0	-	- 0	(Negligible)			
		Max. Tensile Strain		:	2 5.7150	11.429 Sa	ugging	477.63E-6	2.6145	0.0085381	-	3189.9 0	(Negligible)			
		Min. Radius o Curvature	f					-	-	-	-					
		(Hogging) Min. Radius o	f	:	2 5.7150	11.429 Sa	ugging	477.63E-6	2.6145	0.0085381	-	3189.9 0	(Negligible)			
		Curvature (Sagging)					-						,			
		Maximum Slope Maximum			1 0.0 1 0.0	0.76900 Sa 0.76900 Sa	ugging ugging	234.28E-6 234.28E-6	1.7047 1.7047	0.044027 0.044027	-	- 0 - 0	(Negligible) (Negligible)			
		Settlement Max. Tensile		:	1 0.0	0.76900 Sa	gging	234.28E-6	1.7047	0.044027	-	- 0	(Negligible)			
		Strain Min. Radius o	f				-	-	-	-	-		,			
$ \begin{array}{ c c c c c c } \hline \left \begin{array}{cccccccccccccccccccccccccccccccccccc$		Curvature (Hogging)														
 		Min. Radius o Curvature	£					-	-	-	-					
		(Sagging) Maximum Slope		:	1 0.0	2.6173 Sa	gging	198.95E-6	1.5242	0.0065159	-	31533. 0	(Negligible)			
Are to mail in the set of 1 0.0 1.013 Bargets 10.00000000000000000000000000000000000		Maximum Settlement		:	1 0.0	2.6173 Sa	ugging	198.95E-6	1.5242	0.0065159	-	31533. 0	(Negligible)			
Min. Ratio 2 2 1.0.0 1.0.0 1.0.0 1.0.0 1.0.0 1.0.0 1.0.0 0.00 1.0.0 0.00 1.0.0 0.00 1.0.0 0.00 1.0.0 0.00 1.0.0 0.00 0		Max. Tensile Strain		:	1 0.0	2.6173 Sa	ugging	198.95E-6	1.5242	0.0065159	-	31533. 0	(Negligible)			
		Min. Radius o Curvature	£	:	2 2.6173	3.8390 Ho	gging	198.95E-6	1.0586	831.09E-6	55647.	- 0	(Negligible)			
		(Hogging) Min. Radius o	£	:	1 0.0	2.6173 Sa	gging	198.95E-6	1.5242	0.0065159	-	31533. 0	(Negligible)			
<pre>bis bis bis bis bis bis bis bis bis bis</pre>	Vertical Co fiset from Se Line for	sub-structure: ombined Start L agment	ength Curvature	Deflection Ratio	Average Horizonta Strain	Max. 1 Tensile Strain	Damag	e Category								
<pre>int in [n] [n] (1) (1) (1) (1) intuities law asgents contained. acture: 1 Sub-structure: interviere as a sgents contained. intuities law asgents contained. intuities</pre>	Movement															
A control of a barbar b	[m] o structures h	[m] have segments c	[m] ombined.	[%]	[%]	[%]										
wettiel [wettiel wettiel] wettiel [wettiel] wettiel wettiel wettiel] wettiel wettiel] wettiel wettiel] wettie																
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Nature in the final condition. (a) In (a) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b	Vertical Co ffset from Se Line for Vertical Movement	ombined Start L egment	ength Curvature	Deflection Ratio	Average Horizonta Strain	Max. 1 Tensile Strain	Damag	e Category								
atuture have segments combined. Here segments combined start Length Ourvature Deflection Average Stall Stal	[m]	[m]	[m]	[%]	[%]	[%]										
weture: C Sub-structure: rrical Combined feat Length Ourvature Deflection Average Max. (a) (a) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b	o structures h	have segments c	ombined.													
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Nation Nation Nation Nation Nation infor Strain Strain infor Strain Strain infor Information Strain information Information Information	Vertical Co	mbined Start L	ength Curvature	Deflection	Average	Max.	Damag	e Category								
<pre>kitusi womant but womant but womant but</pre>	Liset from Se Line for	sauent		katio	HOTIZONTA Strain	i rensile Strain										
runar cons [a] [a] [a] [b] [b] [b] [b] tructures have segments combined. ucture: D Sub-structure: rerical Combined Start Length Curvature Deflection Average Max. For Segment Ratio Strain Strain mi [m] [m] [m] [m] [b] [b] [b] tructure: L Sub-structure: rerical Combined Start Length Curvature Deflection Average Max. strain Strain Strain Strain Strain strain Strain	vertical Movement															
structures have segments combined.	[m]	[m]	[m]	[%]	[%]	[%]										
acture: D Sub-structure: rrical Cabined Start Length Curvature Deflection Average Max. Im for conductions Im	o structures h	ave segments c	ombined.													
ertical Combined Start Length Curvature Deflection Average Max. Strain S	tructure: D	Sub-structure:														
Set int Usgenit Anio Inie for strain	Vertical Co	ombined Start L	ength Curvature	Deflection	Average	Max.	Damag	e Category								
Surveyenent culations [m] [m] [%] [%] [%] structures have segments combined. ucture: E Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile Strain Strain Strain ertical 0mindi [m] [%] [%] [%] Strain Strain ucture: F Sub-structure: Image Category Strain Strain Strain ertical 0mindi [m] [%] [%] [%] Strain Strain ucture: F Sub-structure: Image Category Strain Strain Strain ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile Strain Strain Strain ertical 0mindi [m] [%] [%] [%] Strain Strain using (m) [m] [%] [%] [%] [%] Strain <td>Line for</td> <td>-Americ</td> <td></td> <td>RdT10</td> <td>Strain</td> <td>strain</td> <td></td>	Line for	-Americ		RdT10	Strain	strain										
Understands [m] [m] [m] [m] [k] [k] [k] structures have segments combined. [k] [k] [k] ucture: E Sub-structure: Errical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile infe for Segment Ratio Barage Category errical Ombined Start Length Curvature Deflection Average Max. Damage Category Strain Strain ordinations [m] [m] [m] [k] [k] [k] [m] [m] [m] [m] [k] [k] [k] [k] ucture: F Sub-structure: Errical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile errical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ordinations Errical Strain Strain Strain [m] [m] [m] [m] [k] [k] [k] [k] [k] [m] [m] [m] [m] [k] [k] [k] [k] [k]	vertical Movement															
auture: E Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Borizontal Tensile ertical Strain Strain mi [m] [m] [m] [k] [k] [k] structures have segments combined. uuture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile infor ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Average Max. Damage Category ertical Combined Start Length Curvature Deflection Strain Stra	[m]	[m]	[m]	[%]	[%]	[%]										
acture: E Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment E Strain Strain ertical Strain [m] [m] [m] [k] [k] [k] structures have segments combined. uucture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile infor ertical Strain Strain Strain find [m] [m] [k] [k] [k] structures have segments combined.	o acraceares f	we seyments C	undrined.													
ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ertical Strain Strain for ertical [m] [m] [m] [%] [%] [%] structures have segments combined. uuture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile inf for Strain Strain ertical comment ertical [m] [m] [%] [%] [%] structures have segments combined.	tructure: E	Sub-structure:														
Set find Segment Kallo Molfontal Immite Ime for Strain Strin Strain Strins Strain culations [%] [m] [m] [m] [%] structures have segments combined. ucture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ine for Strain ertical Ownent culations [%] [m] [m] [m] [%] [%] [%] structures have segments combined.	Vertical Co	ombined Start L	ength Curvature	Deflection	Average	Max.	Damag	e Category								
Contents culations [m] [m] [%] [%] structures have segments combined. ucture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ine for Strain Strain ertical ownent Culations [m] [m] [%] [%] structures have segments combined. [%] [%]	Line for	- 3416111		NdL10	Strain	Strain										
Underivations [m] [m] [%] [%] structures have segments combined. ucture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ine for Strain Strain ertical Owment culations [%] [m] [m] [%] [m] [m] [%]	Movement															
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ucture: F Sub-structure: ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ine for Strain Strain ertical ovement culations [m] [m] [m] [%] [%] [%] structures have segments combined.	structures h	ave segments c	umpined.													
ertical Combined Start Length Curvature Deflection Average Max. Damage Category set from Segment Ratio Horizontal Tensile ine for Strain Strain ertical ovement culations [m] [m] [m] [%] [%] [%] structures have segments combined.	ructure: F	Sub-structure:														
Ine for Strain Strain ertical ovmeent culations [m] [m] [%] [%] [%] structures have segments combined.	Vertical Co	ombined Start L	ength Curvature	Deflection	Average	Max.	Damag	e Category								
ovement culations [m] [m] [m] [%] [%] [%] structures have segments combined.	Line for Vertical				Strain	Strain										
[m] [m] [m] [%] [%] [%] structures have segments combined.	Movement															
	[m]	[m]	[m] ombined	[%]	[%]	[%]										
	. Scructures f	acyments C														

		C	GEA	LIMI	TED				Job No.		Sheet No.	R	ev.
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31 Heath	Drive, Lon	don NW3 7	'SB						Drg. Ref.				
vvali insta	allation and	Excavation		ned E1					Made by	Da	ite	Chec	ked
										09	-Dec-2015		
Vertical Offset from Line for Vertical Movement	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: H	Sub-structure:	:											
Vertical Offset from Line for Vertical Movement	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
Calculations [m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: I Vertical	Sub-structure: Combined Start I	: Length Curvature	Deflection	Average	Max.	Damage	Category						
Offset from Line for Vertical Movement Calculations	Segment		Ratio	Horizontal Strain	Tensile Strain								
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: J	Sub-structure:	ength Curvature	Deflection	lverage	Max	Damage	Category						
Offset from Line for Vertical Movement Calculations	Segment		Ratio	Horizontal Strain	Tensile Strain	Damage	caccycr)						
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: K	Sub-structure:	ength Curvature	Deflection	Average	Max.	Damage	Category						
Offset from Line for Vertical Movement Calculations	Segment		Ratio	Horizontal Strain	Tensile Strain	Damage	caccycr)						
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: L	Sub-structure:												
Vertical Offset from Line for Vertical Movement Calculations	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: M	Sub-structure:												
Vertical Offset from Line for Vertical Movement	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
Calculations [m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: N	Sub-structure:												
Vertical Offset from Line for Vertical Movement	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
[m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								
Structure: 0	Sub-structure:	:											
Vertical Offset from Line for Vertical Movement	Combined Start I Segment	Length Curvature	Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage	Category						
Calculations [m] No structure	[m] s have segments o	[m] combined.	[%]	[%]	[%]								









GEA LIMITED	Job No.	Sheet No.	Rev.
$\mathcal{J}\mathcal{U}S\mathcal{Y}S$ (geotechnical &env	ASSOC)J15308A		
1 Heath Drive, London NW3 7SB	Drg. Ref.		
	Made by	Date 09-Dec-2015	Checked
Specific Building Damage Results - Horizontal Displacements			
tructure: A Sub-structure:			
vist. Coordinates Displacements x y z x y Horizontal Horizontal displacement displacement along the perpendicular			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
tructure: B Sub-structure:			
Dist. Coordinates Displacements x y z x y Horizontal Horizontal displacement displacement along the perpendicular			
Line to Line [m] [m] [m] [m] 0.0 35.90000 18.10000 -2.60000 0.4.6200 4.6195 -0.068742 84009 35.88750 18.94000 -2.60000 0.0 5.2150 5.2144 -0.077596 1.6802 35.87500 19.74000 -2.60000 0.0 5.8100 5.8094 -0.086439 2.5203 35.86250 20.62000 0.0 6.4690 -0.095302 3.3604 35.85000 21.46000 -2.60000 0.0 4.6895 -0.069784			
tructure: C Sub-structure:			
Dist. Coordinates Displacements x y z x y Horizontal Horizontal displacement along the perpendicular			
[m] [m] [m] [mm] [m			
tructure: D Sub-structure:			
Dist. Coordinates Displacements x y z x y Horizontal displacement displacement along the perpendicular			

Structure: E | Sub-structure:

Dist.	C	ordinates	3		Di	splacements	
	x	У	z	x	У	Horizontal displacement	Horizontal displacement
						Line	to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	37.52000	26.97000	-1.60000	-0.083657	-6.9853	0.083657	6.9853
0.81333	36.70667	26.97000	-1.60000	-0.083739	-6.9922	0.083739	6.9922
1.6267	35.89333	26.97000	-1.60000	-0.083822	-6.9991	0.083822	6.9991
2 4400	35 08000	26 97000	-1 60000	4 2916	0 0	-4 2916	0.0

Structure: F | Sub-structure:

Dist.	Co	oordinates	3		Di	splacements	
	x	У	z	x	У	Horizontal displacement along the	Horizontal displacement perpendicular
						Line	to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	35.08000	26.97000	-2.60000	4.2916	0.0	0.0	-4.2916
1.6675	35.08000	28.63750	-2.60000	1.3621	-2.9498	-2.9498	-1.3621
3.3350	35.08000	30.30500	-2.60000	0.63199	-2.7372	-2.7372	-0.63199
5.0025	35.08000	31.97250	-2.60000	0.32717	-2.1256	-2.1256	-0.32717
6.6700	35.08000	33.64000	-2.60000	0.19985	-1.7312	-1.7312	-0.19985

Structure: G | Sub-structure:

Dist.	Co	ordinates	3		Dis	splacements		
	x	У	z	x	У	Horizontal displacement along the	Horizontal displacement perpendicular	
						Line	to Line	
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]	
0.0	35.08000	30.58000	-2.60000	0.56493	-2.6486	-0.57071	2.6473	
1.9629	33.11714	30.58429	-2.60000	1.1987	-1.5853	-1.2021	1.5826	
3.9257	31.15429	30.58857	-2.60000	1.2586	-0.96987	-1.2607	0.96712	
5.8886	29.19143	30.59286	-2.60000	1.1814	-0.64277	-1.1828	0.64019	
7.8514	27.22857	30.59714	-2.60000	0.93156	-0.39192	-0.93241	0.38988	
9.8143	25.26571	30.60143	-2.60000	0.59250	-0.20328	-0.59294	0.20199	
11.777	23.30286	30.60571	-2.60000	0.20404	-0.059125	-0.20417	0.058679	
13.740	21.34000	30.61000	-2.60000	0.0	0.0	0.0	0.0	

Structure: H | Sub-structure:

Dist.	Co	ordinates	3		Di	splacements	
	x	У	z	x	У	Horizontal	Horizontal
						displacement	displacement
						along the	perpendicular
						Line	to Line
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]
0.0	35.08000	33.64000	-1.60000	0.19985	-1.7312	0.19985	-1.7312
0.79000	35.87000	33.64000	-1.60000	-0.0054643	-1.8223	-0.0054643	-1.8223
1.5800	36.66000	33.64000	-1.60000	-0.032875	-2.7451	-0.032875	-2.7451
2.3700	37.45000	33.64000	-1.60000	-0.032833	-2.7415	-0.032833	-2.7415
Structur	:e: I S1	ıb-structı	ure:				
Dist.	Co	ordinates	3		Dis	placements	
	x	У	z	x	У	Horizontal displacement of along the p	Horizontal displacement perpendicular
[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]

	GEA LIMITED		Job No.	Sheet No.	Rev.
Oasys	(GEOTECHNICAL	&ENV ASSO	C) J15308A		
31 Heath Drive, London NW3 Wall Installation and Excavati	3 7SB ion combined E2		Drg. Ref.		
			Made by	Date ()9-Dec-2015	Checked
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement along the perpendicular				
0.0 37.45000 33.64000 -1.60000 -0.0328 0.57500 37.45000 34.21500 -1.60000 -0.0302 1.1500 37.45000 34.79000 -1.60000 -0.0276	833 -2.7415 -2.7415 0.032833 251 -2.5260 -2.5260 0.030251 669 -2.3104 -2.3104 0.027669				
Structure: J Sub-structure: Dist. Coordinates	Displacements				
	y Horizontal Horizontal displacement displacement along the perpendicular Line to Line				
0.0 37.45000 34.79000 -1.60000 -0.027 0.97417 38.24000 35.36000 -1.60000 -0.116	669 -2.3104 -1.3743 -1.8574 676 -1.3639 -0.89272 -1.0377				
Structure: K Sub-structure: Dist. Coordinates x y z x y	Displacements y Horizontal Horizontal				
[m] [m] [m] [m] [m] [mm] [n 0.0 21.34000 30.61000 -2.60000 0.0 0	along the perpendicular Line to Line mm] [mm] [mm] 0.0 0.0 0.0				
0.83000 21.34000 31.44000 -2.60000 0.0 (1.6600 21.34000 32.27000 -2.60000 0.0 (2.4900 21.34000 33.10000 -2.60000 0.0 (3.3200 21.34000 33.93000 -2.60000 0.0 (4.1500 21.34000 34.76000 -2.60000 0.0 (0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0				
Structure: L Sub-structure:					
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement along the perpendicular				
[m] [m] [m] [m] [mm] 0.0 34.61000 11.24000 -2.60000 0.1077 0.87500 34.61000 12.11500 -2.60000 0.14465 1.7500 34.61000 12.99000 -2.60000 0.18866	[mm] [mm] [mm] 5 0.88807 0.88807 -0.10775 9 1.0905 1.0905 -0.14469 8 1.2888 1.2888 -0.18868				
2.6250 34.61000 13.86500 -2.60000 0.24185 3.5000 34.61000 14.74000 -2.60000 0.30748	9 1.4816 1.4816 -0.24189 8 1.6663 1.6663 -0.30748				
Dist. Coordinates x y z x	Displacements y Horizontal Horizontal displacement displacement				
[m] [m] [m] [m] [m] [mm] 0.0 34.61000 14.74000 -2.60000 0.30748 1.9050 22.70500 14.74000 -2.60000 0.60172	along the perpendicular Line to Line [mm] [mm] 1.6663 -0.30748 -1.6663 1.2857 -0.60172 -1.2857				
3.8100 30.80000 14.74000 -2.60000 0.66857 5.7150 28.89500 14.74000 -2.60000 0.58805 7.6200 26.99000 14.74000 -2.60000 0.45564 9.5250 25.08500 14.74000 -2.60000 0.22881	0.88966 -0.66857 -0.88966 0.56818 -0.58805 -0.56818 0.34559 -0.45564 -0.34559 0.14284 -0.22881 -0.14284				
11.430 23.18000 14.74000 -2.60000 0.0 Structure: N Sub-structure:	0.0 0.0 0.0				
Dist. Coordinates x y z x y	Displacements y Horizontal Horizontal displacement displacement along the perpendicular				
[m] [m] [m] [m] [m] [mm] [n 0.0 23.18000 14.74000 -2.60000 0.0 0 0.77000 23.18000 13.97000 -2.60000 0.0 0	Line to Line mm] [mm] 0.0 0.0 0.0 0.0 0.0 0.0				
Structure: 0 Sub-structure: Dist. Coordinates	Displacements				
	y Horizontal Horizontal displacement displacement along the perpendicular Line to Line mul [mm] [mm]				
1.00 23.18000 13.97000 -2.60000 0.0 0.0 0.96000 22.22000 13.97000 -2.60000 0.0 0.0 1.9200 21.26000 13.97000 -2.60000 0.0 0.0 2.8800 20.30000 13.97000 -2.60000 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0				
3.8400 19.34000 13.97000 -2.60000 0.0 C	splacements				
Structure: A Sub-structure: Dist. Coordinates Dis	splacements				
x y z z [m] [m] [m] [m] [mm] Vertical Offset 1 0.0.19.08000 18 10000 -2 50000 0.0	0				
1.8689 20.94889 18.10000 -2.60000 0.0 3.7378 22.81778 18.10000 -2.60000 0.02261 5.6067 24.68667 18.10000 -2.60000 0.07091 7.4756 26.55556 18.10000 -2.60000 0.19622 7.4756 26.5556 18.10000 -2.60000 0.19622 7.4756 26.55556 18.10000 -2.60000 0.19622 7.4756 26.5556 18.10000 -2.60000 0.19622 7.4756 26.5556 18.10000 -2.60000 0.19622 7.4756 26.55556 18.10000 -2.60000 0.19622 7.4756 26.5556 18.1000 -2.60000 0.19622 7.4756 26.5556 26.5556 18.10000 -2.60000 0.19622 7.4756 26.5556	0 5 3 1				
9.3444 26.42444 18.10000 -2.60000 0.44765 11.213 30.29331 81.10000 -2.60000 0.76844 13.082 32.16222 18.10000 -2.60000 1.0256 14.951 34.03111 18.10000 -2.60000 1.3899 16.820 35.90001 81.10000 -2.60000 2.6401	8 4 6 5 1				
Structure: B Sub-structure:	anla/ements				
x y z z [m] [m] [m] [m] Vertical Offset 1					
0.0 35.90000 18.10000 -2.60000 2.6401 0.84009 35.88750 18.94000 -2.60000 2.9340 1.6802 35.87500 19.78000 -2.60000 3.1708 2.5203 35.86250 20.62000 -2.60000 3.2713 3.3604 35.85000 21.46000 -2.60000 2.0865					
Structure: C Sub-structure: Dist. Coordinates Dist.	splacements				
[m] [m] [m] [m] [m] [m] Vertical Offset 1 0.0 35.85000 21.46000 -1.60000 2.0865					
U.83500 36.68500 21.46000 -1.60000 3.1142 1.6700 37.52000 21.46000 -1.60000 2.0865					

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wair instantion and Excavat	ion combined E2	Made by D	Date Che 9-Dec-2015	cked
Dist. Coordinates Di x y z z [m] [m] [m] [m] [mm]	splacements			
Structure: D Sub-structure:				
Dist. Coordinates Di x y z z [m] [m] [m] [m] [mm]	splacements			
Vertical Offset 1 0.0 37.52000 21.46000 -1.60000 2.0865 0.91833 37.52000 22.37833 -1.60000 3.1142 1.8367 37.52000 23.29667 -1.60000 3.1142 2.7550 37.52000 24.21500 -1.60000 3.1142 3.6733 37.52000 25.13333 -1.60000 3.1142 4.5917 37.52000 26.05167 -1.60000 3.1142 5.5100 37.52000 26.97000 -1.60000 3.1221				
Structure: E Sub-structure: Dist. Coordinates Di	splacements			
x y z z [m] [m] [m] [m] [mm] Vertical Offset 1				
0.0 37.52000 26.97000 -1.60000 3.1221 0.8133 36.70667 26.97000 -1.60000 3.1183 1.6267 35.89333 26.97000 -1.60000 3.1144 2.4400 35.08000 26.97000 -1.60000 2.1742				
Structure: F Sub-structure: Dist. Coordinates Dist x Y z z [m] [m] [mm] [mm]	placements			
Vertical Offset 1 0.0 35.08000 26.97000 -2.60000 2.1742 1.6675 35.08000 28.63750 -2.60000 1.7868 3.3350 35.08000 30.30500 -2.60000 1.6068 5.0025 35.08000 31.397250 -2.60000 1.2467				
6.6700 35.08000 33.64000 -2.60000 0.83071 Structure: G Sub-structure: Dist. Coordinates Di	splacements			
x y z z [m] [m] [m] [mm] Vertical Offset 1 555 0.00 35.08000 30.58000 -2.60000 1.555	0			
1.922 33.1114 30.58429 -2.60000 0.817 3.9257 31.15429 30.58857 -2.60000 0.8517 5.8866 29.1943 30.59286 -2.60000 0.8541 7.8514 27.2857 30.59714 -2.60000 0.8542 9.8143 25.26571 30.60143 -2.60000 0.05966 13.740 21.30286 30.60571 -2.60000 0.5051	4 9 9 4 4 1 0			
Structure: H Sub-structure: Dist. Coordinates Di x y z z [m] [m] [m] [m] [m]	splacements			
Vertical Offset 1 0.0 35.08000 33.64000 -1.60000 0.8307 0.79000 35.87000 33.64000 -1.60000 0.8752 1.5800 36.66000 33.64000 -1.60000 1.315 2.2700 27.46000 32.64000 -1.60000 1.315	1 12 4 4			
Structure: I Sub-structure: Dist. Coordinates Di	splacements			
x y z z [m] [m] [m] [m] [mm] Vertical Offset 1				
0.0 37.45000 33.64000 -1.60000 1.312 0.57500 37.45000 34.21500 -1.60000 1.087 1.1500 37.45000 34.79000 -1.60000 0.8790	6 9 9			
Dist. Coordinates Di x y z z [m] [m] [m] [m] [m]	splacements			
Vertical Offset 1 0.037.45000 34.79000 -1.60000 0.8790 0.97417 38.24000 35.36000 -1.60000 0.4486	9 7			
Structure: K Sub-structure: Dist. Coordinates Dis x y z z [m] [m] [m] [m] [m]	placements			
Vertical Offset 1 0.0 0.1 34000 30.61000 -2.60000 0.0 0.0 0.3300 21.34000 31.44000 -2.60000 0.0 0.0 0.3300 21.34003 2.27000 -2.60000 0.0 0.0 0.3400 31.44000 -2.60000 0.0 0.4900 21.34003 31.0000 -2.60000 0.0 0.3200 21.34000 39.3000 -2.60000 0.0 4.1500 21.34000 34.76000 -2.60000 0.0 0.0				
Structure: L Sub-structure: Dist. Coordinates Di	splacements			
[m] [m] [m] [m] [m] [m] Vertical Offset 1 0.034,61000 11.24000 -2.60000 0.1675 0.87500 34,61000 12.11500 -2.60000 0.2713 1.7500 34,61000 12.01500 -2.60000 0.2713	16 18 2			
L.7300 34.6100 12.39000 -2.60000 0.4135 2.6250 34.61000 13.86500 -2.60000 0.5900 3.5000 34.61000 14.74000 -2.60000 0.7912 Structure: M Sub-structure:	2 3 1			
Dist. Coordinates Di [m] [m] [m] [m] [m] [m] [m] [m]	splacements			
vertical Orrset 1 0.034.61000 14.74000 -2.60000 0.7912 1.9050 32.70500 14.74000 -2.60000 0.5921 3.8100 30.80000 14.74000 -2.60000 0.3681 5.7150 28.89500 14.74000 -2.60000 0.1868	1 8 1 8 7			

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31 Heath Drive, London NW3 7	SB	Drg. Ref.			
		Made by	Date 09-Dec-2015	Checked	
Dist. Coordinates Displa x y z z	cements				
9.5250 25.08500 14.74000 -2.60000 0.037303 11.430 23.18000 14.74000 -2.60000 0.0					
Structure: N Sub-structure:					
Dist. Coordinates Displac x y z z [m] [m] [m] [m] [mm]	ements				
Vertical Offset 1 0.0 23.18000 14.74000 -2.60000 0.0 0.77000 23.18000 13.97000 -2.60000 0.0					
Structure: 0 Sub-structure:					
Dist. Coordinates Displac x y z z [m] [m] [m] [m] [m] [mm]	ements				
Ver 0: 0 3.1 18000 13.97000 -2.60000 0.0 0.96000 22.22000 13.97000 -2.60000 0.0 1.9200 21.26000 13.97000 -2.60000 0.0 2.8800 20.30000 13.97000 -2.60000 0.0 3.8400 19.34000 13.97000 -2.60000 0.0					
Specific Building Damage Results - All Segments					
Structure: A Sub-structure: Vertical Offset Segment Start Length	Curvature Deflection Average Max. Maximum M	aximum Min. Damage			
from Line for Vertical Movement Calculations	Ratio Horizontal Tensile Gradient of Gra Strain Strain Horizontal V Displacement Dis Curve	dient of Radius of Category Vertical Curvature placement Curve			
[m] [m] [m] 0.0 1 7.4756 9.3434 Tensile horizontal strains are +ve, compressi	[%] [%] <th [%]<="" td="" th<=""><td>[m] 669.55E-6 3224.9 0 (Negligible)</td><td></td><td></td></th>	<td>[m] 669.55E-6 3224.9 0 (Negligible)</td> <td></td> <td></td>	[m] 669.55E-6 3224.9 0 (Negligible)		
Structure: B Sub-structure:					
Vertical Offset Segment Start Length from Line for Vertical	Curvature Deflection Average Max. Maximum Max Ratio Horizontal Tensile Gradient of Gradi Strain Strain Horizontal Ver	imum Min. Damage ent of Radius of Category tical Curvature			
movement Calculations [m] [m] 0.0 1 0.0 3.3594	Curve Cu [%] [%] [%] Saccinc 0.031035 0.0021443 0.031141 0.0020454 0.	[m] 0014131 447.58 0			
Tensile horizontal strains are +ve, compressi	ve horizontal strains are -ve.	(Negligible)			
Structure: C Sub-structure:	Currenture Deflection Average Max Maximum Max	imum Min Damago			
Vertical Oriset Segment Start Length from Line for Vertical Movement	Ratio Horizontal Tensile Gradient of Gradi Strain Strain Horizontal Ver Displacement Displ	ent of Radius of Category tical Curvature acement			
Calculations [m] [m] [m] [m] 0.0 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 0.0 1.6690 1 1.6690 1 1.6690 1 1.6690 1 1.6690	Curve Curve <th< td=""><td>[m] 0012377 337.11 1 (Very</td><td></td><td></td></th<>	[m] 0012377 337.11 1 (Very			
Tensile horizontal strains are +ve, compressi	ve horizontal strains are -ve.	Slight)			
Structure: D Sub-structure: Vertical Offset Segment Start Length from Line for	Curvature Deflection Average Max. Maximum Ma	ximum Min. Damage			
Vertical Movement Calculations	Strain Strain Horizontal Ve Strain Strain Horizontal Ve Displacement Disp Curve C	rrical Curvature lacement			
[m] [m] [m] 0.0 1 0.0 2.7550 2.2.7550 0.0	[%] [%] [%] Sagging 0.024868 0.0 0.024058 0.0 -0	[m] .0011191 656.49 0 (Negligible)			
3 2.7550 2.7540	Hogging 191.43E-6 -0.25337 0.050674 0.0076648 -8	(Negligible) .6646E-6 84495.1 (Very Slight)			
Tensile horizontal strains are +ve, compressi	ve horizontal strains are -ve.				
Vertical Offset Segment Start Lengt from Line for Vertical Movement	h Curvature Deflection Average Max. Maximum Ratio Horizontal Tensile Gradient of G Strain Strain Horizontal Displacement D	Maximum Min. Damage radient of Radius of Category Vertical Curvature isplacement			
Calculations [m] [m] <t< td=""><td>Curve 6%] 6%] 6%] 57 Sagging 0.0 10.158E-6 10.192E-6 0.0</td><td>Curve [m] 4.6923E-6 2802.2 0 (Negligible)</td><td></td><td></td></t<>	Curve 6%] 6%] 6%] 57 Sagging 0.0 10.158E-6 10.192E-6 0.0	Curve [m] 4.6923E-6 2802.2 0 (Negligible)			
2 0.40657 2.03 Tensile horizontal strains are +ve, compressi	24 Sagging 0.027483 -0.21501 0.045795 0.0054087 ve horizontal strains are -ve.	0.0011623 560.65 0 (Negligible)			
Structure: F Sub-structure:					
Vertical Offset Segment Start Length from Line for Vertical Movement	Curvature Deflection Average Max. Maximum Ma Ratio Horizontal Tensile Gradient of Grad Strain Strain Horizontal Ve Displacement Disp	ximum Min. Damage lient of Radius of Category rrtical Curvature lacement			
[m] [m] [m] 0.0 1 0.0 2.8048	[%] [%] [%] Hogging 0.0029960 -0.10000 0.020074 0.0017721 2	[m] 32.73E-6 9107.9 0 (Negligible)			
2 2.8048 3.8642 Tensile horizontal strains are +ve, compressi	Sagging 0.0014763 0.027779 0.028579 -366.68E-6 2 ve horizontal strains are -ve.	49.43E-6 32072. 0 (Negligible)			
Structure: G Sub-structure:	Currenture Deflection business May Martin	vimm Mir			
from Line for Vertical Kovement Calculations	Ratio Horizontal Tensile Gradient of Grad Strain Strain Horizontal Ve Displacement Disp	ient of Radius of Category rtical Curvature lacement urve			
[m] [m] [m] 0.0 1 0.0 7.8514	[%] [%] [%] Hogging 986.67E-6 -0.0046068 0.0010811 321.78E-6 2	[m] 05.18E-6 29677. 0 (Negligible)			
Tensile horizontal strains are +ve, compressi Structure: H Sub-structure:	ve norizontal strains are -ve.				
Vertical Offset Segment Start Length from Line for Vertical Movement Calculations	Curvature Deflection Average Max. Maximum M Ratio Horizontal Tensile Gradient of Gra Strain Strain Rorizontal Dis Curva Curva	aximum Min. Damage dient of Radius of Category ertical Curvature placement Curve			

GEA LIMITED	Job No.	Sheet No.	Rev.
Ousys (geotechnical &env asso	C)J15308A		
1 Heath Drive, London NW3 7SB	Drg. Ref.		
vali installation and Excavation combined E2	Made by	Date 09-Dec-2015	Checked
[m] [m] [m] [%] [%] [%] 0.0 1 0.0 1.1394 Hogging 0.010578 -0.019084 0.0079449 259.96E-6 -558.53E- 2 1.1394 1.2296 Sagging 0.012846 -0.0012399 0.012286 34.699E-6 -558.53E- Tensile horizontal strains are +ve, compressive horizontal strains are -ve.	[m] -6 1027.7 0 (Negligible) -6 951.78 0 (Negligible)		
tructure: I Sub-structure: Tertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Horizontal Vertical Movement Displacement Displacement	Min. Damage Radius of Category Curvature		
Calculations Curve Curve [m] [m] [k] [k] [k] Curve Curve [m] [m] [m] [k] [k] [k] [k] 0.0 1.0 1.1490 Hogging 688.67E-6 0.037495 0.037575 -374.81E-6 390.77E-6 'ensile horizontal strains are +ve, compressive horizontal strains are -ve.	[m] 20671. 0 (Negligible)		
Structure: J Sub-structure: Vertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Horizontal Vertical Movement Displacement	Min. Damage Radius of Category Curvature		
Calculations Curve Curve [m] [m] [%] [%] [%] Curve Curve [m] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%	[m] 0 5 - 0 (Negligible)		
ttructure: K Sub-structure: Tertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Strain Horizontal Vertical Movement Displacement Displacement Displacement Displacement Curve Curve	Min. Damage Radius of Category Curvature		
<pre>[m] [m] [m] [m] [m] [m] [%] 0.0 All settlements are less than the Settlement Trough Limit Sensitivity. Tensile horizontal strains are +ve, compressive horizontal strains are -ve. Structure: L Sub-structure:</pre>	[m]		
Yertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Borizontal Tensile Gradient of Gradient of Vertical Strain Strain Norizontal Vertical Movement Calculations Curve Curve	Min. Damage Radius of Category Curvature		
[m] [m] [m] [m] [m] 0.0 1 0.0 3.4990 Hogging 0.0018733 0.02236 0.022708 -231.25E-6 -229.88E-6 Fensile horizontal strains are +ve, compressive horizontal strains are -ve.	(mj 19485. 0 (Negligible)		
Artical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Strain Horizontal Vertical Movement Displacement Displacement Displacement Displacement Displacement Durve Ourve	Min. Damage F Radius of Category Curvature tt		
[m] [m] [%] [%] [%] 0.0 1 0.0 2.2626 Sagging 174.05E-6 -0.013559 0.0027136 154.48E-6 117.63E- 2 2.2.626 3.4524 Hogging 551.86E-6 759.24E-6 0.0010164 -69.501E-6 117.63E- Tensile horizontal strains are +ve, compressive horizontal strains are -ve. -ve. -ve. -ve.	[m] -6 86415. 0 (Negligible) -6 56767. 0 (Negligible)		
Structure: N Sub-structure: /ertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Strain Horizontal Vertical Movement Displacement Dis	Min. Damage Radius of Category Curvature		
<pre>(m) m [m] [m] [m] [k] [k] [k] [k] 0.0 All settlements are less than the Settlement Trough Limit Sensitivity. ensile horizontal strains are +ve, compressive horizontal strains are -ve. structure: 0 Sub-structure:</pre>	[m]		
Vertical Offset Segment Start Length Curvature Deflection Average Max. Maximum Maximum from Line for Ratio Horizontal Tensile Gradient of Gradient of Vertical Strain Strain Horizontal Vertical Movement Displacement Displacement Calculations Curve Curve	Min. Damage Radius of Category Curvature		
[m] [*] [*] [*] 0.0 All settlements are less than the Settlement Trough Limit Sensitivity. Tensile horizontal strains are +ve, compressive horizontal strains are -ve.	[m]		
specific Building Damage Results - Critical values for All Segments within Each Sub-Structure Structure: A Sub-structure:			
Vertical Deflection Average Maximum Maximum Maximum Maximum Maximum Main. Min. Mi	Damage Category		
0.0 0.0001303 -0.0092377 -009.55E-6 2.0394 0.0058347 615.71E-6 -669.55E-6 3224.9 -	- v (Negiigibiė)		
Vertical Deflection Average Maximu	Damage Category		
tructure: C Sub-structure: Vertical Deflection Average Maximum Maximum Max. Maximum Maximum Min. Min. ffset from Ratio Horizontal Slope Settlement Tensile Gradient of Radius of Radius of Radius of Line for	Damage Category		
Default Default Disflacement bisplacement Curvature Curvature Movement Curve Curve Curve Calculations [m] [%] [m]	L (Very Slight)		

				GEA	LIM	ITED				Job No.		Sheet No.	Re	ev.
$ \mathcal{O}l $	IS	<i>yS</i>		(GEO	TEC	HNIC	AL &E	ENV	ASSC	DC)J15308	BA			
31 Heath	Drive, L	ondon	NW3	7SB		,				Drg. Ref.				
vvall Insta	allation a	ind Exc	cavatio	n combir	ned E2	2				Made by	Da 09	te -Dec-2015	Chec	ked
Vertical Offset from Line for Vertical	Deflection Ratio	Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement	Maximum Gradient of Vertical Displacement	Min. Radius of Curvature (Hogging)	Min. Radius of Curvature (Sagging)	Damage Category				
Structure: D Vertical Offset from Line for Vertical Movement	Sub-struc Deflection Ratio	ture: Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacement Curve	Min. Radius of Curvature t (Hogging)	Min. f Radius of e Curvature) (Sagging)	Damage Category				
[m] 0.0	[%] 0.024868	[%] -0.25337	-0.001119	[mm] 01 3.1221	[%] 0.050674	0.0076648	-0.001119	[m] 1 84495.	[m] . 656.49	1 (Very Slight)				
Structure: E Vertical Offset from Line for Vertical Movement Calculations	Sub-struc Deflection Ratio	ture: Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacement Curve	Min. Radius of Curvature (Hogging)	Min. Radius of Curvature (Sagging)	Damage Category				
[m] 0.0 Structure: E	[%] 0.027483	[%] -0.21501	0.0011623	[mm] 3.1221	[%] 0.045795	0.0054087	0.0011623	[m] -	[m] 560.65	0 (Negligible)				
Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacement Curve	Min. Radius of Curvature (Hogging)	Min. Radius of Curvature (Sagging)	Damage Category				
[m] 0.0	[%] 0.0029960	[%] -0.10000	249.43E-6	[mm] 2.1742	[%] 0.028579	0.0017721	249.43E-6	[m] 9107.9	[m] 32072.	0 (Negligible)				
Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacemen Curve	Min. Radius of Curvature t (Hogging)	Min. f Radius of e Curvature) (Sagging)	Damage Category				
[m] 0.0	[%] 986.67E-6	[%] -0.0046068	205.18E-6	[mm] 1.5550	[%] 0.0010811	321.78E-6	5 205.18E-	[m] 6 29677.	[m] -	0 (Negligible)				
Structure: H Vertical Offset from Line for Vertical Movement	Sub-struc Deflection Ratio	ture: Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacemen Curve	Min. Radius of Curvature t (Hogging)	Min. f Radius of e Curvature) (Sagging)	Damage Category				
Calculations [m] 0.0	[%] 0.012846	[%] -0.019084	-558.53E-	[mm] 6 1.3164	[%] 0.012286	259.96E-6	5 -558.53E-	[m] 6 1027.1	[m] 7 951.78	0 (Negligible)				
Structure: I Vertical Offset from Line for Vertical Movement	Sub-struc Deflection Ratio	ture: Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacement Curve	Min. Radius of Curvature (Hogging)	Min. Radius of Curvature (Sagging)	Damage Category				
Calculations [m] 0.0	[%] 688.67E-6	[%] 0.037495	390.77E-6	[mm] 1.3126	[%] 0.037575	-374.81E-6	390.77E-6	[m] 20671.	[m] - (0 (Negligible)				
Structure: J	Sub-struc	ture:	Maximum	Mazimum	Max	Marinum	Maximum	Min	Min	Damage Category				
Offset from Line for Vertical Movement Calculations	Ratio	Horizontal Strain	Slope	Settlement	Tensile Strain	Gradient of Horizontal Displacement Curve	Gradient of Vertical Displacement Curve	Radius of Curvature (Hogging)	Radius of Curvature (Sagging)	Jamage Category				
[m] 0.0	[%] 0.0	[%] 0.049432	441.62E-6	[mm] 0.87909	[%] 0.049432	-494.07E-6	441.62E-6	[m] -	[m] -	0 (Negligible)				
Vertical Offset from Line for Vertical	Deflection Ratio	Average Horizontal Strain	Maximum Slope S	Maximum M Settlement Te St	Max. M msile Gra crain Ho Dis	Maximum M dient of Gra prizontal M splacement Dig	Maximum I adient of Rad Vertical Cu Splacement (Ho	Min. Mins of Rad rvature Cur ogging) (Sa	Min. Da lius of rvature agging)	amage Category				
Movement Calculations [m]	[%]	[%]		[mm]	[%]	Curve	Curve	[m]	[m]					
Structure: L	Sub-struc	ture:												
Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal Displacement Curve	Maximum Gradient of Vertical Displacemen Curve	Min. Radius of Curvature t (Hogging)	Min. f Radius of e Curvature) (Sagging)	Damage Category				
0.0	0.0018733	0.022236	-229.88E-	6 0.79098	0.022708	-231.25E-6	5 -229.88E-	6 19485.	-	0 (Negligible)				
Vertical Offset from	Deflection Ratio	Average Horizontal Strain	Maximum Slope	Maximum Settlement	Max. Tensile Strain	Maximum Gradient of Horizontal	Maximum Gradient of Vertical	Min. Radius of Curvature	Min. E Radius of	Damage Category				
Vertical Movement Calculations [m] 0.0	[%] 551.86E-6	[%] -0.013559	117.63E-6	[mm] 0.79121	[%] 0.0027136	Displacement Curve	Curve	[m] 6 56767	[m] . 86415.	0 (Negligible)				
Structure: N	Sub-struc	ture:												
Vertical Offset from Line for Vertical Movement Calculations	Deflection Ratio	Average Horizontal Strain	Maximum Slope S	Maximum M Settlement Te St	Max. M ensile Gra rain Ho Dis	Maximum M dient of Gra prizontal V splacement Dis Curve	Maximum H adient of Rad Vertical Cu splacement (H Curve	Min. M dius of Rad rvature Cun ogging) (Sa	Min. Da dius of rvature agging)	amage Category				
[m] Structure: 0	[%]	[%] ture:		[mm]	[%]			[m]	[m]					
Vertical Offset from Line for Vertical	Deflection Ratio	Average Horizontal Strain	Maximum Slope S	Maximum Maximu Maximum Maximum Maximum Maximum Maximum Maximum Maximum Maximum Maxim	Max. M ensile Gra rain Ho Dis	Maximum M dient of Gra prizontal M splacement Dia	Maximum di Adient of Rad Jertical Cu Splacement (H	Min. M dius of Rad rvature Cun ogging) (Sa	Min. Da lius of rvature agging)	amage Category				

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1 Heath F	Drive. Londo	۷ n NW3 79	BB		71 IIN								
all Instal	lation and Ex	cavation	combin	ed E2	2					Dig.	Kel.		
										Made	by	Date 09-Dec-2015	Checked
Movement					Curve	Cur	ve						
[m]	[%] [%]		[mm] [8]			[1	m] [m	1				
pecific Building	g Damage Results - C	Critical Segment	s within Eac	h Structu	re								
ructure Name	Parameter	Critical Sub-Structure	Critical Segment	Start	End	Curvatur	e Maximum Slope	Maximum Settlement	Max. Tensile	Min. Radius of	Min. Damage Radius of	e Category	
				[m]	[m]			[mm]	[%]	(Hogging) [m]	(Sagging) [m]		
	Maximum Slope Maximum Sattlement		1 1	7.4756 7.4756	16.819 16.819	Hogging Hogging	669.55E-6 669.55E-6	2.6394 2.6394	0.0058347 0.0058347	3224.9 3224.9	- 0 (Negligi) - 0 (Negligi)	ble) ble)	
	Max. Tensile Strain		1	7.4756	16.819	Hogging	669.55E-6	2.6394	0.0058347	3224.9	- 0 (Negligi	ble)	
	Min. Radius of Curvature		1	7.4756	16.819	Hogging	669.55E-6	2.6394	0.0058347	3224.9	- 0 (Negligi	ble)	
	(Hogging) Min. Radius of Curvature		-	-	-	-	-	-	-	-			
	(Sagging) Maximum Slope Mawimum		1	0.0	3.3594	Sagging	0.0014131	3.2700	0.031141	-	447.58 0 (Negligi)	ble)	
	Settlement Max. Tensile		1	0.0	3.3594	Sagging	0.0014131	3.2700	0.031141	-	447.58 0 (Negligi	ble)	
	Strain Min. Radius of		-	-	-	-	-	-	-	-			
	(Hogging) Min. Radius of		1	0.0	3.3594	Sagginq	0.0014131	3.2700	0.031141	-	447.58 0 (Negligi)	ble)	
	Curvature (Sagging)		-	0.0	1 6600		0.0010075	3 1070	0.066600		227 11 1 /***	ight)	
	Maximum Siope Maximum Settlement		1	0.0 0.0	1.6690 1.6690	Sagging Sagging	0.0012377	3.1073 3.1073	u.U66688 0.066688	-	337.11 1 (Very Sl. 337.11 1 (Very Sl.	ight)	
	Max. Tensile Strain		1	0.0	1.6690	Sagging	0.0012377	3.1073	0.066688	-	337.11 1 (Very Sl	ight)	
	Min. Radius of Curvature (Hogging)		-	-	-	-	-	-	-	-			
	Min. Radius of Curvature		1	0.0	1.6690	Sagging	0.0012377	3.1073	0.066688	-	337.11 1 (Very Sl.	ight)	
	(Sagging) Maximum Slope		1	0.0	2.7550	Sagging	0.0011191	3.1142	0.024058	-	656.49 0 (Negligi)	ble)	
	Maximum Settlement Max. Tensile		3	2.7550	5.5090	Hogging	8.6646E-6	3.1221	0.050674	84495.	- 1 (Very S1	ight)	
	Strain Min. Radius of		3	2.7550	5.5090	Hogging	8.6646E-6	3.1221	0.050674	84495.	- 1 (Very Sl	ight)	
	Curvature (Hogging) Min. Radius of		1	0.0	2.7550	Sagging	0.0011191	3.1142	0.024058	_	656.49 0 (Negligi)	ble)	
	Curvature (Sagging)		-									/	
	Maximum Slope Maximum Settlement		2	0.40657	2.4390 0.40657	Sagging Sagging	0.0011623 4.6923E-6	3.1202 3.1221	0.045795 10.192E-6	-	560.65 0 (Negligi) 2802.2 0 (Negligi)	ble) ble)	
	Max. Tensile Strain		2	0.40657	2.4390	Sagging	0.0011623	3.1202	0.045795	-	560.65 0 (Negligi	ble)	
	Min. Radius of Curvature (Hogging)		-	-	-	-	-	-	-	-			
	Min. Radius of Curvature		2	0.40657	2.4390	Sagging	0.0011623	3.1202	0.045795	-	560.65 0 (Negligi	ble)	
	(Sagging) Maximum Slope Maximum		2	2.8048	6.6690	Sagging	249.43E-6	1.6641	0.028579	9107 9	32072. 0 (Negligi)	ble)	
	Settlement Max. Tensile		2	2.8048	6.6690	Sagging	249.43E-6	1.6641	0.028579	-	32072. 0 (Negligi	ble)	
	Strain Min. Radius of		1	0.0	2.8048	Hogging	232.73E-6	2.1742	0.020074	9107.9	- 0 (Negligi	ble)	
	(Hogging) Min. Radius of		2	2.8048	6.6690	Sagging	249.43E-6	1.6641	0.028579	-	32072. 0 (Negligi	ble)	
	Curvature (Sagging)		1	0.0	7 0514	Ussaina	205 197 6	1 6660	0 0010011	20677	0 (Norligi	() ()	
	Maximum Siope Maximum Settlement		1	0.0	7.8514	Hogging	205.18E-6	1.5550	0.0010811	29677.	- 0 (Negligi)	ble)	
	Max. Tensile Strain		1	0.0	7.8514	Hogging	205.18E-6	1.5550	0.0010811	29677.	- 0 (Negligi	ble)	
	Min. Radius of Curvature (Hogging)		1	0.0	7.8514	Hogging	205.18E-6	1.5550	0.0010811	29677.	- 0 (Negligi)	ble)	
	Min. Radius of Curvature		-	-	-	-	-	-	-	-			
	(Sagging) Maximum Slope Maximum		1	0.0	1.1394	Hogging Sagging	558.53E-6	1.0703	0.0079449	1027.7	- 0 (Negligi) 951.78 0 (Negligi)	ble) ble)	
	Settlement Max. Tensile		2	1.1394	2.3690	Sagging	558.53E-6	1.3164	0.012286	-	951.78 0 (Negligi	ble)	
	Strain Min. Radius of Curvature		1	0.0	1.1394	Hogging	558.53E-6	1.0703	0.0079449	1027.7	- 0 (Negligi)	ble)	
	(Hogging) Min. Radius of		2	1.1394	2.3690	Sagging	558.53E-6	1.3164	0.012286	-	951.78 0 (Negligi	ble)	
	Curvature (Sagging) Maximum Slope		,	0.0	1.1490	Hogaina	390 778-4	1 2124	0.037575	20671	- 0 /Magliai	ble)	
	Maximum Siope Settlement		1	0.0	1.1490	Hogging	390.77E-6	1.3126	0.037575	20671.	- 0 (Negligi) - 0 (Negligi)	ble)	
	Max. Tensile Strain		1	0.0	1.1490	Hogging	390.77E-6	1.3126	0.037575	20671.	- 0 (Negligi	ble)	
	Curvature (Hogging)		1	0.0	1.1490	aogging	59U./7E-6	1.3126	u.U3/575	20671.	- v (Negligi	016)	
	Min. Radius of Curvature		-	-	-	-	-	-	-	-			
	Maximum Slope Maximum		1	0.0	0.97317 0.97317	Sagging Sagging	441.62E-6 441.62E-6	0.87909 0.87909	0.049432 0.049432	-	- 0 (Negligi) - 0 (Negligi)	ble) ble)	
	Settlement Max. Tensile		1	0.0	0.97317	Sagging	441.62E-6	0.87909	0.049432	-	- 0 (Negligi	ble)	
	Strain Min. Radius of Curvature		-	-	-	-	-	-	-	-			
	(Hogging) Min. Radius of		-	-	-	-	-	-	-	-			
	Curvature (Sagging) All settlements :	are less than t	the Settler	ent Tro	gh Limi	t Sensiti	vity.						
	All settlements a All settlements a	are less than	the Settler	ent Trou	gh Limi gh Limi	t Sensiti t Sensiti	vity. vity.						
	All settlements a Maximum Slope	are less than t are less than t	the Settlen 1	ent Trou 0.0	gn Limi gh Limi 3.4990	t Sensiti Hogging	vity. 229.88E-6	0.79098	0.022708	19485.	- 0 (Negligi)	ble)	
	Maximum Settlement		1	0.0	3.4990	Hogging	229.88E-6	0.79098	0.022708	19485.	- 0 (Negligi	ble)	
	Max. Tensile Strain Min. Radius of		1	0.0	3.4990 3.4990	Hogging	229.88E-6	0.79098	0.022708	19485. 19485	- U (Negligi) - O (Negligi)	ble)	
	Curvature (Hogging)		1	5.5						105.	- (negrigi		
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Structure Nam	e Parameter Critica Sub-Struc	l Critical ture Segment	Start	End Curv	vature Maximum Slope	Maximum Settlement	Max. Tensile Strain	Min. Radius of Ra Curvature Cu (Hogging) (1	Min. adius of urvature Sagging)	Damage Cate	gory		
М	(Sagging) Maximum Slope Maximum	1	0.0	 2.2626 Sage 2.2626 Sage	ging 117.63E-6 ging 117.63E-6	0.79121 0 0.79121 0).0027136).0027136	-	86415. (86415. (0 (Negligible) 0 (Negligible)			
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Specific Buildi	ng Damage Results - All Combine	ed Segments											
Structure: A Vertical	Sub-structure: Combined Start Length Curvatu	re Deflection	Average	Max.	Damage Category								
Offset from Line for Vertical Movement Calculations	Segment	Ratio	Horizontal Strain	Tensile Strain									
[m] No structures	[m] [m] have segments combined.	[%]	[%]	[%]									
Structure: B	Sub-structure:	re Deflection	Average	Max.	Damage Category								
Offset from Line for Vertical Movement Calculations	Segment	Ratio	Horizontal Strain	Tensile Strain									
[m] No structures	[m] [m] have segments combined.	[%]	[%]	[%]									
Structure: C	Sub-structure:	na Daflashian		New	Demose Cohosen								
Vertical Offset from Line for Vertical Movement	Combined Start Length Curvatu Segment	Ratio	Horizontal Strain	Max. Tensile Strain	Damage Category								
[m] No structures	[m] [m] have segments combined.	[%]	[%]	[%]									
Vertical Offset from Line for Vertical Movement Calculations	Combined Start Length Curvatu Segment	re Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage Category								
[m] No structures Structure; E	[m] [m] have segments combined.	[%]	[%]	[%]									
Vertical Offset from Line for Vertical	Combined Start Length Curvatu Segment	re Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage Category								
Calculations [m] No structures	<pre>[m] [m] have segments combined.</pre>	[%]	[%]	[%]									
Structure: F Vertical	Sub-structure: Combined Start Length Curvatu	re Deflection	Average	Max.	Damage Category								
Offset from Line for Vertical Movement Calculations	Segment	Ratio	Horizontal Strain	Tensile Strain									
[m] No structures	[m] [m] have segments combined.	[%]	[%]	[%]									
Structure: G Vertical	Sub-structure: Combined Start Length Curvatu	re Deflection	Average	Max.	Damage Category								
Offset from Line for Vertical	Segment	Ratio	Horizontal Strain	Tensile Strain									
Movement Calculations [m] No structures	[m] [m] have segments combined.	[%]	[%]	[%]									
Structure: H	Sub-structure:	na Daflashian		More	Demose Geberen								
Vertical Offset from Line for Vertical Movement	Combined Start Length Curvatu Segment	Ratio	Horizontal Strain	Max. Tensile Strain	Damage Category								
[m] No structures Structure: T	[m] [m] have segments combined.	[%]	[%]	[%]									
Vertical Offset from Line for Vertical Movement	Combined Start Length Curvatu Segment	re Deflection Ratio	Average Horizontal Strain	Max. Tensile Strain	Damage Category								
Calculations [m] No structures Structure: J	<pre>[m] [m] have segments combined.</pre>	[%]	[%]	[%]									

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icture: K	Sub-structure:							
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tructures	have segments combin	ed.						





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