

Annex:



1ST LINE DEFENCE	Client:	GEA Ltd		Approximate site boundary	Α
Unit 3 Maple Park	Project:	oject: 19-21 High Holborn		N	
Essex Road, Hoddesdon, Hertfordshire. EN11 0EX	Ref:	OPN2542	Source: National Mon	uments Record Office (Historic England)	
Tel: +44 (0)1992 245 020	Produced	l by and Copyright to 1st Line	Defence Limited. Registered in E	ngland and Wales with CRN: 7717863. VAT No: 128 8833 79	

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1ST LINE DEFENCE	Client:	GEA Ltd		Approximate site boundary	
Unit 3, Maple Park	Project:	19-21 High Holb	orn		N
Essex Road, Hoddesdon, Hertfordshire. EN11 0EX	Ref:	OPN2542	Source: National Monu	lational Monuments Record Office (Historic England)	
Email: info@1stlinedefence.co.uk Tel: +44 (0)1992 245 020	Produced	by and Convright to 1st Line	Defence Limited Registered in Fr	ngland and Wales with CRN: 7717863 VAT No: 128 8833 79	



1ST LINE DEFENCE	Client:	GEA Ltd		Approximate site boundary	A
Unit 3 Manle Park	Project:	ect: 19-21 High Holborn		N	
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# **Anti-Aircraft Projectiles**

# QF 3.7 Inch WWII Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	High Explosive Anti-Aircraft projectile. 4.5in projectiles were also used in this role.
Ceiling	30,000ft to 59,000ft





# 40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Proximity and Mechanical Time Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40mm x 310mm (1.6in x 12.2in)
Ceiling	23,000ft (7000m )





Unrotated Pr	ojectile (UP) – Z Battery	
Projectile Weight	84lb (24.5kg)	
Warhead Weight	4.28lb (1.94kg)	
Warhead	Aerial Mine with a No. 700 / 720 fuze	
Filling	High Explosive	1
Dimensions	1930mm x 82.6mm (76 x 3.25in)	
Use	As a short range rocket-firing anti- aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries.	





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Source: Various sources

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# 1<sup>ST</sup> LINE DEFENCE

Unit 3, Maple Park Essex Road Hoddesdon Hertfordshire EN11 0EX Tel: 01992 245020

www.1stlinedefence.co.uk







**Express** Preliminary

**UXO Risk Assessment** 

1st Line Defence Limited Unit 3, Maple Park, Essex Road, Hoddesdon, Herts, EN11 0EX Tel: +44 (0)1992 245 020 E-mail: <u>info@1stlinedefence.co.uk</u> Company No: 7717863 VAT No: 128 8833 79

www.1stlinedefence.co.uk

Client	GEA Ltd.
Project	Gray's Inn, Holborn
Site Address	South Square, Holborn, London, WC1R 5BH
Report Reference	EP2542-00
Date	10/03/20
Originator	OG

# **Assessment Objective**

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the Gray's Inn, Holborn site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

## Background

This assessment uses the sources of information available in-house to 1<sup>st</sup> Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1<sup>st</sup> Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1<sup>st</sup> Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.





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Risk Assessment Considera	luons
Site location and description/current use	The site is located within the London Borough of Camden, in the area of Holborn. It is located on the northern end of South Square, with Gray's Inn structures to the immediate north and east. Recent aerial imagery indicates the site to currently be occupied by hardstanding ground. The site is approximately centred on the OS grid reference: <b>TQ 31064 81724</b> .
Are there any indicators of current/historical military activity on/close to the site?	At this stage, in-house records do not indicate that the site footprint had any former military use. No features such as WWII defensive positions, encampments or firing ranges are recorded to have been located at the site. In addition, no information of ordnance being stores, produced, or disposed of within the proposed site boundary could be found. The closest Heavy Anti-Aircraft (HAA) batteries was situated approximately 3.5km to the south-west of the site. The conditions in which unexploded anti-aircraft ordnance may have fallen unrecorded are analogous to that of aerial delivered German bombs - see the sections below for further information.
What was the pre- and post- WWII history of the site?	According to pre-WWII OS mapping dated 1937, the site was occupied by open ground on the northern side of <i>South Square</i> . Large buildings surrounded the site to the north and east, including a <i>Chapel</i> and <i>Chambers</i> . Post-WWII OS mapping dated 1952-53 indicates that the site remained occupied by open ground. Significant changes are evident in the vicinity; including the Chapel to the north now labelled <i>Chapel (Remains of)</i> . The <i>Chambers</i> is no longer labelled, and an area of <i>Ruins</i> is evident to the east.
Was the area subject to bombing during WWII?	During WWII, the site was located in the Metropolitan Borough of Holborn. This borough sustained a very high density of bombing, with 921.2 items recorded per 1,000 acres according to official Home Office statistics. This included 354 high explosive bombs, 7 parachute mines, 8 oil bombs, 4 V-1 pilotless aircraft and 1 V-2 long-range rocket, culminating in 374 incidents in total. London Bomb Census mapping records a number of bomb strikes in the immediate vicinity of the site, as well as additional bombs in the surrounding area.
Is there any evidence of bomb damage on/close to the site?	London County Council (LCC) bomb damage mapping labels structures to the immediate north, east and west of the site as <i>seriously damaged; doubtful if repairable</i> . Additional buildings in the wider area are also marked as <i>total destruction</i> .
To what degree would the site have been subject to access?	Given the site's locality within the area of Holborn Court, access is anticipated to have been frequent prior to any bombing. However, post-bombing and subsequent damage, rubble and debris is likely to have defined the area. This is likely to have significantly decreased access and observation for evidence of UXO.





# **ST LINE DEFENCE**

To what degree has the site been developed post-WWII?	Little development has occurred on site post-WWII. The site still remains occupied by an area of open land.
What is the nature and extent of the intrusive works proposed?	The proposed works are understood to comprise the replacement of some existing basement vaults, with a new plant room. This will involve the deepening of the existing floor by approximately 1-1.5m.

# Summary and Conclusions

During WWII, the site was situated within the Metropolitan Borough of Holborn, which sustained an overall very high density of bombing, with an average of 921.2 items recorded per 1,000 acres according to Home Office statistics. London Bomb Census mapping for the area records a number of bomb strikes within the immediate vicinity of the site. LCC bomb damage mapping records serious levels of damage to the adjacent structures, with the northern chapel labelled as *Chapel (Remains of)* on post-WWII OS mapping.

Given this, it is not anticipated that access would have been particularly frequent within the area due to the resulting rubble and debris. As such, post-raid checks for evidence of UXO are thought to have decreased significantly.

# **Recommendations**

Given the findings of this preliminary report, it is recommended that **further research** be undertaken in the form of a **Detailed UXO Risk Assessment**. This would involve the usage of additional archival information such as written incident records and high-resolution WWII-era aerial photography.

It should be noted, given the quality of record set available at a preliminary stage, that it is not thought likely that further desktop research would mitigate the risk on site.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1<sup>st</sup> Line Defence.



$\overline{\bigcap}$	Job No.	Sheet No. Rev.
JUS	<b>J</b> 20048	
roposed Chille	er Plant Room, No 8 South Square	
Fround Movem	ent Assessment	e Checked
hort-term heav	ve due to excavation MP	
<b>T</b> '4		
Job No.:	J20048	
Job Title: Sub-title: Calculation Heading:	Proposed Chiller Plant Room, No 8 South Square Ground Movement Assessment Short-term heave due to excavation	
Initials: Checker:	MP	
Date Checked: Notes:		
File Name: File Path:	PDispl.pdd G:\CURRENT\20-\J20048 - The Honourable Society of Gray's Inn\APPENDIX\GWA	
History Date Time	By Notes	
09-Mar-2020 17:00 09-Mar-2020 17:37 09-Mar-2020 20:53	Matthew Penfold New Matthew Penfold Matthew Penfold	
09-Mar-2020 21:14 10-Mar-2020 09:27	Matthew Penfold Matthew Penfold	
Analysis Ontions		
anaryoro opuoris		
General Global Poisson's ratio Maximum allowable rati	o: 0.50 io between values of E: 1.5	
Horizontal rigid bound Displacements at load	lary level: -2.50 [m OD] centroids: Yes	
Elastic	Un	
Elastic : Yes Analysis: Boussinesq Stiffness for horizont	tal displacement calculations: Weighted average	
Using legacy heave cor	rrection factor: No	
Consolidation : No		
Soil ProfilesSoil P	rofile 1	
ref.	teveral returned to Founds founds for some for the found of the found	
1 Made Gound	[moD] [kN/m²] [kN/m²] 19.500 2 10000. 10000. 0.20000 None	
2 Hackney Gravel 3 London Clay	17.500         4         60000.         7.0000.         0.2000 None           13.000         10         52500.         135000.         0.50000 None	
Soil Zones	min X max Y min Y max Profile	
1 Soil Zone 1 -3	[m] [m] [m] [m] 30.000 30.000 -40.000 30.000 Soil Profile 1	
Polygonal Load Da	ata Position Position : Polygon : Coords. Position No. of Value :	
rer.	: Level : Polygon Rectangles Normal : Rect. (local z) tolerance	
1 Proposed Plant R	[m]         [m]         [%]         [kx/m <sup>2</sup> ]           Acom         16.50000         (0,0)         (10,2.5)         (9,2.5)         1.0000         4         -20.000           (8,4)         (0,4)         (0,4)         (0,4)         (0,4)         (0,4)         (0,4)	
Polygonal Loads' I	Rectangles	
No. Centre : Centre × y	: Angle of Width x Depth y local x from	
[m] [m] Load 1 : Proposed Plan	global X [Degrees] [m] [m] nt Room	
(Edge 2 optimal) 1 5.00000 1.2500 2 4.25000 3.2500	00 90.000 2.5000 10.000 00 90.000 1.5000 8.500	
Displacement Lines		
Name	X1 Y1 Z1 X2 Y2 Z2 Intervals Calculate Detailed Results	
10 8 SS - A	[m] [m] [m] [m] [m] [m] [No.] -6.95000 2.50000 17.00000 -0.05000 2.50000 17.00000 7 Yes No	
10 8 SS - B 10 8 SS - C 10 8 SS - D	0.05000 5.55000 17.00000 0.050000 5.55000 17.00000 3 Yes No 0.05000 5.55000 17.00000 10.45000 5.55000 17.00000 10 Yes No 10.50000 5.45000 17.00000 10.50000 4.05000 17.00000 1 Yes No	
IO 8 SS - E IO 8 SS - F IO 8 SS - G	10.55000 4.00000 17.00000 15.45000 4.00000 17.00000 5 Yes No 15.50000 12.95000 17.00000 15.50000 1.55000 17.00000 11 Yes No 15.45000 1.50000 17.00000 14.55000 1.50000 17.00000 1 Yes No	
NO 8 SS - H NO 8 SS / NO 5-7 SS - NO 8 SS - J	14.5000         1.45000         17.0000         14.5000         -5.95000         17.00000         7 Yes         No           1         14.5500         -6.00000         17.0000         24.4500         -6.00000         10 Yes         No           24.5000         -5.9500         17.00000         20 Yes         No	
io 8 SS / Chapel - K io 8 SS / Chapel - L	24.45000 14.00000 17.00000 16.55000 14.00000 17.00000 7 Yes No 16.50000 13.95000 17.00000 16.50000 13.05000 17.00000 1 Yes No 16.45000 13.00000 17.00000 0.05000 13.00000 1 Ves No	
Io 8 SS / Chapel - N Io 8 SS - O	0.00000 13.05000 17.00000 0.00000 0.05000 17.00000 17.00000 18 Yes No -0.05000 21.00000 17.00000 -6.95000 21.00000 17.00000 7 Yes No	
ao 8 SS / Hall- P Hall - A Hall - B	-7,05000 20,95000 17,0000 -7,05000 0,0000 17,00000 18 Yes No -7,0500 9,00000 17,0000 -27,9500 9,00000 17,00000 21 Yes No -28,0000 9,05000 17,00000 -28,00000 23,45000 17,00000 17 Yes No	
Jall - C Jall -D Jall - E	-27,95000 24.00000 17,00000 -24.05000 24.00000 17.00000 4 Yes No -24.00000 23.95000 17.00000 -24.05000 17.00000 3 Yes No -23.95000 21.00000 17.00000 -7.05000 21.00000 16 Yes No	
Chapel - A	0.05000 21,00000 17,00000 24,45000 21,00000 17,00000 24 Yes No 24,50000 20,95000 17,00000 24,5000 14,05000 17,00000 6 Yes No	
hapel - B 'o 5-7 SS - A	24,50000 -6,05000 17,00000 24,50000 -34,95000 17,00000 29 Yes No	

Displacement Grids

Name

1



Proposed Chiller Plant Room, No 8 South Square

Ground Movement Assessment

Short-term heave due to excavation

Job No.	Sheet No.	Rev.
J20048		
Drg. Ref.		
Made by MP	Date	Checked

	Direction	[m]	[m]	[m]	[m]	[m]	[m]	Along Line [No.]	Distance [m]	Intervals Along [No.]	Results
Displacement Grid 1	Global X	-30.00000	-40.00000	19.50000	-	30.00000	19.50000	70	60.00000	60 Yes	No
Displacement Grid 2	Global X	-30.00000	-40.00000	17.50000	-	30.00000	17.50000	70	60.00000	60 Yes	No
Displacement Grid 3	Global X	-30.00000	-40.00000	16.50000	-	30.00000	16.50000	70	60.00000	60 Yes	No

2



#### Job No. Sheet No. Rev. asys J20048 Proposed Chiller Plant Room, No 8 South Square Drg. Ref. Ground Movement Assessment Made by Date Checked Total heave MP

## Titles

Job No.: Job Title: Sub-title: Calculation Heading: Initials: Checker: Date Saved: Date Checked: Notes:	J20048 Proposed Chiller Plant Room, No 8 South Square Ground Movement Assessment Total heave MP
File Name: File Path:	PDisp2.pdd G:\CURRENT\20-\J20048 - The Honourable Society of Gray's Inn\APPENDIX\GMA

#### History

Date	Time	Ву		Notes
09-Mar-2020	17:00	Matthew 1	Penfold	New
09-Mar-2020	17:37	Matthew 1	Penfold	
09-Mar-2020	21:12	Matthew 1	Penfold	
10-Mar-2020	09:28	Matthew 1	Penfold	Open

### Analysis Options

#### General

Gelobal Poisson's ratio: 0.20 Maximum allowable ratio between values of E: 1.5 Forizontal rigid boundary level: -2.50 [m OD] Displacements at load centroids: Yes GSA piled raft data : No

## Elastic

Elastic : Yes Analysis: Boussinesq Stiffness for horizontal displacement calculations: Weighted average Using legacy heave correction factor: No

# Consolidation

#### Soil ProfilesSoil Profile 1

Laye ref	r	Name	Level at top	Number of intermediate displacement levels	Youngs Modulus : Top	Youngs Modulus : Btm.	Poissons ratio	Non-linear curve	
			[mOD]		[kN/m <sup>2</sup> ]	[kN/m <sup>2</sup> ]			
	1 Mad	e Gound	19.500	2	10000.	10000.	0.20000	None	
	2 Hac	kney Gravel	17.500	4	60000.	70000.	0.20000	None	
	3 Lon	don Clay	13.000	10	39375.	101250.	0.20000	None	

# Soil Zones

 Instruction
 Solution
 Solution

## Polygonal Load Data

Load ref.	Name Posit. : Lev		n Position : Polygon :			Coords.	Coords. Position No. of : Polygon Rectangles : Rect. tolerance			
		[m]			[m]		[%]		[kN/m <sup>2</sup> ]	
1 Propos	ed Plant Room	16.50000	(0,0) (8,4)	(10,0) (0,4)	(10,2.5)	(9,2.5)	1.0000	4	-20.000	

#### **Polygonal Loads' Rectangles**

No.	Centre : x	Centre : Y	Angle of local x from global X	Width x	Depth y
Load	[m] 1 : Propos	[m] ed Plant	[Degrees] Room	[m]	[m]
(Edge	2 optimal	.)			
1	5.00000	1.25000	90.000	2.5000	10.000
2	4.25000	3.25000	90.000	1.5000	8.5000

#### Displacement Lines

Name	<b>X1</b>	¥1	<b>Z1</b>	<b>x</b> 2	¥2	Z2	Intervals	Calculate	Detailed
	[m]	[m]	[m]	[m]	[m]	[m]	[No.]		Results
No 8 SS - A	-6.95000	2.50000	17.00000	-0.05000	2.50000	17.00000	7	Yes	No
No 8 SS - B	0.00000	2.55000	17.00000	0.00000	5.45000	17.00000	3	Yes	No
No 8 SS - C	0.05000	5.50000	17.00000	10.45000	5.50000	17.00000	10	Yes	No
No 8 SS - D	10.50000	5.45000	17.00000	10.50000	4.05000	17.00000	1	Yes	No
No 8 SS - E	10.55000	4.00000	17.00000	15.45000	4.00000	17.00000	5	Yes	No
No 8 SS - F	15.50000	12.95000	17.00000	15.50000	1.55000	17.00000	11	Yes	No
No 8 SS - G	15.45000	1.50000	17.00000	14.55000	1.50000	17.00000	1	Yes	No
No 8 SS - H	14.50000	1.45000	17.00000	14.50000	-5.95000	17.00000	7	Yes	No
No 8 SS / No 5-7 SS - I	14.55000	-6.00000	17.00000	24.45000	-6.00000	17.00000	10	Yes	No
No 8 SS - J	24.50000	-5.95000	17.00000	24.50000	13.95000	17.00000	20	Yes	No
No 8 SS / Chapel - K	24.45000	14.00000	17.00000	16.55000	14.00000	17.00000	7	Yes	No
No 8 SS / Chapel - L	16.50000	13,95000	17.00000	16.50000	13.05000	17.00000	1	Yes	No
No 8 SS / Chapel - M	16.45000	13.00000	17.00000	0.05000	13.00000	17.00000	16	Yes	No
No 8 SS / Chapel - N	0.00000	13.05000	17.00000	0.00000	20.95000	17.00000	8	Yes	No
No 8 SS - 0	-0.05000	21.00000	17.00000	-6.95000	21.00000	17.00000	7	Yes	No
No 8 SS / Hall- P	-7.00000	20,95000	17.00000	-7.00000	2.55000	17.00000	18	Yes	No
Hall - A	-7.05000	9.00000	17.00000	-27.95000	9.00000	17.00000	21	Yes	No
Hall - B	-28.00000	9.05000	17.00000	-28.00000	23.45000	17.00000	17	Yes	No
Hall - C	-27.95000	24.00000	17.00000	-24.05000	24.00000	17.00000	4	Yes	No
Hall -D	-24.00000	23.95000	17.00000	-24.00000	21.05000	17.00000	3	Yes	No
Hall - E	-23.95000	21.00000	17.00000	-7.05000	21.00000	17.00000	16	Yes	No
Chapel - A	0.05000	21.00000	17.00000	24.45000	21.00000	17.00000	24	Yes	No
Chapel - B	24.50000	20.95000	17.00000	24.50000	14.05000	17.00000	6	Yes	No
No 5-7 SS - A	24.50000	-6.05000	17.00000	24.50000	-34.95000	17.00000	29	Yes	No
No 5-7 B	24.45000	-35.00000	17.00000	14.05000	-35.00000	17.00000	10	Yes	No
No 5-7 - C	14.00000	-34.95000	17.00000	14.00000	-6.05000	17.00000	29	Yes	No
Displacement Grids									
Name Ex	trusion:	X1	¥1	z1 x:	2 ¥2	Z2	Interva	ls Extrusio	n: Extru

# Oasys

Proposed Chiller Plant Room, No 8 South Square

Ground Movement Assessment

Total heave

Job No.	Sheet No.	Rev.
J20048		
Drg. Ref.		
Made by MP	Date	Checked

	Direction	[m]	[m]	[m]	[m]	[m]	[m]	Along Line [No.]	Distance [m]	Intervals Along [No.]	Results
Displacement Grid 1	Global X	-30.00000	-40.00000	19.50000	-	30.00000	19.50000	70	60.00000	60 Yes	No
Displacement Grid 2	Global X	-30.00000	-40.00000	17.50000	-	30.00000	17.50000	70	60.00000	60 Yes	No
Displacement Grid 3	Global X	-30.00000	-40.00000	16.50000	-	30.00000	16.50000	70	60.00000	60 Yes	No

2



#### Job No. Sheet No. Rev. )asys J20048 Proposed Chiller Plant Room, No 8 South Square Drg. Ref. Ground Movement Assessment Made by MP Date Checked **RC Wall Installation** 09-Mar-2020

Job Job Sub- Calc Init Chec Date Date File File	No.: Title: title: culation Head tials: cker: a Saved: a Checked: as: a Name: a Path:	J20 Pro Gro MP 09- XDi G:\ Inn	048 posed Chill und Movement Wall Instal: Mar-2020 spl.xdd CURRENT\20-' \APPENDIX\GP	er Plant R t Assessmen lation \J20048 - 1 AA	nt No 8 Nt	South Squa cable Socie	are ety of Gra	y's				
Hist	ory											
Date 09-1	e T Mar-2020 2 Mar-2020 2	<b>Time By</b> 10:57 Matt 1:27 Matt	hew Penfold hew Penfold		Notes New							
10-1	Mar-2020 0	9:30 Matt	hew Penfold		Open							
Disp	placement Line	25										
Ref	. N	lame	xl	уl	zl	x2	у2	z2	Intervals	Surface type for	Interpolate imported displacements	Calculate
			[m]	[m]	[m]	[m]	[m]	[m]	[No.]	tunnels		
1	No 8 SS - A		[m] -6.95000	[m] 2.50000	[m]	[m] -0.05000	[m] 2.50000	[m] 17.00000	[No.]	tunnels	No	Yes
1	No 8 SS - A No 8 SS - B	L.	[m] -6.95000 0.00000	[m] 2.50000 2.55000	[m] 17.00000 17.00000	[m] -0.05000 0.00000	[m] 2.50000 5.45000	[m] 17.00000 17.00000	[No.] 7 3	tunnels Surface Surface	No	Yes Yes
1 2 3	No 8 SS - A No 8 SS - B No 8 SS - C	L 5	[m] -6.95000 0.00000 0.05000	[m] 2.50000 2.55000 5.50000	[m] 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000	[m] 2.50000 5.45000 5.50000	[m] 17.00000 17.00000 17.00000	[No.] 7 3 10	tunnels Surface Surface Surface	No No No	Yes Yes Yes
1 2 3 4	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - D	5 5 9	[m] -6.95000 0.00000 0.05000 10.50000	[m] 2.50000 2.55000 5.50000 5.45000	[m] 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 10.50000	[m] 2.50000 5.45000 5.50000 4.05000	[m] 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10	tunnels Surface Surface Surface Surface	No No No	Yes Yes Yes Yes
1 2 3 4 5	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - D No 8 SS - E		[m] -6.95000 0.00000 0.05000 10.50000 10.55000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 10.50000 15.45000	[m] 2.50000 5.45000 5.50000 4.05000 4.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5	tunnels Surface Surface Surface Surface	No No No No	Yes Yes Yes Yes
1 2 3 4 5 6	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - E No 8 SS - E		[m] -6.95000 0.00000 0.05000 10.50000 10.55000 15.50000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000 12.950000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 10.50000 15.45000 14.55000	[m] 2.50000 5.45000 5.50000 4.05000 4.00000 1.550000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5 11	tunnels Surface Surface Surface Surface Surface	No No No No	Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - E No 8 SS - F No 8 SS - F No 8 SS - F		[m] -6.95000 0.05000 10.55000 10.55000 15.50000 15.45000 14.50000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000 12.95000 1.50000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 10.50000 15.45000 14.55000 14.55000	[m] 2.50000 5.45000 5.50000 4.05000 4.00000 1.55000 1.50000 -5.95000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5 11 1 7	Surface Surface Surface Surface Surface Surface Surface	No No No No No No	Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - F No 8 SS - K		[m] -6.95000 0.05000 10.55000 15.50000 15.45000 14.550000	[m] 2.50000 5.50000 5.45000 4.00000 12.95000 1.50000 -6.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 15.50000 14.55000 14.55000 24.45000	[m] 2.50000 5.45000 4.05000 4.05000 1.55000 1.55000 -5.95000 -6.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5 11 1 7 10	tunnels Surface Surface Surface Surface Surface Surface Surface	No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - E No 8 SS - F No 8 SS - G No 8 SS - H No 8 SS - H No 8 SS - J	i i i i o 5-7 SS - I	[m] -6.95000 0.00000 10.50000 10.55000 15.50000 15.45000 14.50000 24.50000	[m] 2.50000 5.50000 5.50000 4.00000 12.95000 1.50000 -6.00000 -5.95000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 15.50000 14.55000 14.55000 24.45000 24.50000	[m] 2.50000 5.45000 4.05000 1.55000 1.55000 -5.95000 -6.00000 13.95000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5 11 1 1 7 10 20	tunnels Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - C No 8 SS - F No 8 SS - F No 8 SS - H No 8 SS - H No 8 SS / M No 8 SS / C	і і і іо 5-7 SS - I і́hapel - К	[m] -6.95000 0.00000 10.55000 15.5000 15.45000 14.55000 14.55000 24.50000 24.50000	[m] 2.50000 2.55000 5.45000 4.00000 1.50000 1.50000 1.45000 -5.95000 14.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 14.55000 14.55000 24.45000 24.50000 16.55000	[m] 2.50000 5.45000 4.05000 4.05000 1.55000 -5.95000 -6.00000 13.95000 14.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 100 1 5 11 1 7 7 10 200 7	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12	No         8         SS         -         A           No         8         SS         -         B           No         8         SS         -         D           No         8         SS         -         E           No         8         SS         -         E           No         8         SS         -         E           No         8         SS         -         G           No         8         SS         -         J           No         8         SS         /         C	i 10 5-7 SS - I 1 1hapel - K	[m] -6.95000 0.05000 10.55000 15.50000 15.45000 14.55000 24.50000 16.50000	[m] 2.50000 2.55000 5.50000 5.50000 4.00000 1.50000 1.50000 -6.00000 -5.95000 14.00000 13.95000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 10.45000 15.5000 15.50000 14.55000 14.55000 24.45000 24.45000 16.55000	[m] 2.50000 5.50000 4.05000 1.55000 1.55000 -5.95000 -6.0000 13.95000 13.05000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 1 5 11 1 1 7 10 20 7 7 1	Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13	No 8 SS - A No 8 SS - B No 8 SS - C No 8 SS - C No 8 SS - C No 8 SS - F No 8 SS - F No 8 SS - T No 8 SS - J No 8 SS / C No 8 SS / C	i io in 5-7 SS - I ihapel - K ihapel - L ihapel - M	[m] -6.95000 0.05000 10.55000 15.45000 15.45000 14.55000 24.50000 24.45000 16.45000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000 12.95000 1.50000 1.45000 -6.00000 -5.95000 13.95000 13.00000	[m] 17.000000 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 10.45000 15.50000 15.50000 14.55000 24.45000 24.45000 16.55000 0.05000	[m] 2.50000 5.50000 4.05000 4.05000 1.55000 1.55000 1.50000 1.595000 13.95000 13.05000 13.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 1 1 1 1 7 7 0 0 0 0 20 7 7 1 1 6	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 5		io 5-7 SS - I hapel - K hapel - L hapel - L hapel - N	[m] -6.95000 0.05000 10.55000 15.55000 15.45000 14.55000 24.45000 16.45000 16.45000 0.00000 0.05000	[m] 2.50000 2.55000 5.50000 5.45000 1.295000 1.45000 -6.00000 14.00000 13.95000 13.05000 21.00000	[m] 17.00000 1	[m] -0.05000 10.45000 10.50000 15.45000 14.55000 14.55000 24.50000 24.50000 16.55000 16.55000 0.055000 0.055000	[m] 2.50000 5.45000 5.50000 4.00000 1.55000 -5.95000 -6.00000 13.95000 14.00000 13.05000 13.05000 20.95000 20.95000	[m] 17.00000 1	[No.] 7 3 10 1 5 11 1 7 10 20 0 7 1 16 8 8 7	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	i io 5-7 SS - I ichapel - K hapel - L hapel - N ichapel - N	[m] -6.95000 0.00000 10.550000 15.550000 15.45000 14.55000 24.50000 16.50000 16.50000 16.50000 16.50000 16.50000 16.00000 -0.050000 -7.00000	[m] 2.50000 2.55000 5.45000 4.00000 1.50000 1.50000 1.45000 1.45000 1.45000 13.95000 13.05000 20.95000	[m] 17.00000 1	[m] -0.05000 0.00000 10.45000 15.45000 14.55000 14.55000 24.45000 24.45000 16.55000 0.05500 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.0500000000	[m] 2.50000 5.4000 5.50000 4.05000 1.55000 1.55000 -5.95000 -6.00000 13.05000 13.00000 13.00000 20.95000 21.00000 25.5000	[m] 17.00000 1	[No.] 7 3 10 15 11 1 7 7 0 20 7 7 1 1 6 8 7 7 18	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	i i o 5-7 SS - I fhapel - K hapel - M hapel - N iall- P	[m] -6.95000 0.05000 10.55000 15.55000 14.55000 14.55000 24.45000 16.45000 16.45000 0.05000 -7.05000 -7.05000	[m] 2.50000 2.55000 5.50000 5.45000 1.295000 1.450000 -5.95000 13.95000 13.95000 13.05000 21.00000 20.95000 9.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 14.55000 14.55000 24.45000 24.50000 16.55000 0.05000 0.05000 -7.00000 -27.95000	[m] 2.50000 5.45000 5.50000 4.00000 1.55000 -6.00000 13.95000 13.05000 13.05000 13.00000 21.00000 2.55000 9.00000	[m] 17.00000 1	[No.] 7 3 10 1 5 11 1 7 7 0 0 20 7 7 1 1 6 8 8 7 7 18 8 21	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	No 8 SS - A No 8 SS - C No 8 SS - S No 8 SS - S No 8 SS / C No 8 SS / C Hall - A Hall - B	ic 5-7 SS - I Khapel - K Khapel - M Khapel - N Jall- P	[m] -6.95000 0.05000 10.55000 15.55000 15.50000 14.550000 24.550000 24.550000 16.550000 16.50000 16.450000 -7.050000 -7.050000	[m] 2.50000 2.55000 5.45000 4.00000 12.95000 1.50000 14.00000 13.05000 20.95000 9.05000	[m] 17.00000 1	[m] -0.05000 0.00000 10.50000 15.50000 14.55000 14.55000 14.55000 16.55000 16.55000 16.55000 0.00000 -0.05000 -7.00000 -27.95000	[m] 2.50000 5.45000 5.50000 4.05000 4.05000 1.55000 1.55000 1.55000 13.05000 13.05000 20.95000 21.00000 2.55000 9.00000 23.45000	[m] 17.00000 1	[No.] 7 3 10 1 1 5 11 1 7 7 10 20 0 7 1 1 6 8 8 7 18 21 1 1 7	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	io 5-7 SS - I fhapel - K fhapel - L fhapel - M fhapel - M fhapel - N jall- P	[m] -6.95000 0.05000 10.55000 15.50000 14.550000 14.550000 14.550000 14.550000 16.50000 16.50000 16.450000 -7.05000 -7.05000 -22.95000	[m] 2.50000 5.55000 5.45000 4.00000 12.95000 1.45000 -6.00000 13.95000 13.95000 13.05000 21.00000 9.00000 9.05000	[m] 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.50000 14.55000 14.55000 24.45000 16.55000 0.05000 0.05000 -7.00000 -7.00000 -27.95000 -24.05000	[m] 2.50000 5.45000 4.05000 4.05000 4.05000 1.55000 1.55000 1.55000 1.55000 1.50000 1.50000 1.00000 2.55000 9.00000 2.345000 2.4.00000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 100 1 5 5 11 1 1 7 7 0 20 7 7 1 6 8 7 7 1 1 6 8 7 7 1 1 1 1 1 7 7 1 0 0 20 7 7 7 1 1 1 5 5 1 1 1 1 7 1 1 1 5 5 1 1 1 1	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	NO NO NO NO NO NO NO NO NO NO NO NO NO N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	No 8 SS - A No 8 SS - C No 8 SS / C Hall - C Hall - C	io 5-7 SS - I ichapel - K thapel - L thapel - M hapel - N hall- P	[m] -6.95000 0.05000 10.55000 15.55000 15.45000 14.55000 24.45000 16.50000 16.45000 16.50000 0.00000 -7.05000 -7.05000 -22.950000 -24.00000	[m] 2.50000 2.55000 5.45000 1.50000 1.50000 1.55000 1.45000 -6.00000 -5.55000 1.4.00000 13.05000 13.05000 20.95000 9.05000 24.00000 23.95000	[m] 17.000000 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 15.55000 14.55000 14.55000 14.55000 16.55000 0.05000 0.05000 -7.00000 -22.95000 -24.05000	[m] 2.50000 5.45000 5.50000 4.05000 1.55000 -6.00000 13.95000 13.00000 20.95000 21.00000 21.50000 21.00000 23.45000 24.00000 21.05000	[m] 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 11 5 5 11 1 7 7 7 10 20 0 7 1 1 16 6 8 8 7 7 12 12 12 12 14 4 3 3	tunnels Surface Surfac	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	o 5-7 SS - I hapel - K hapel - L hapel - M hapel - N hapel - N	[m] -6.95000 0.05000 10.55000 15.55000 15.45000 14.55000 24.45000 16.45000 0.00000 0.00000 0.05000 -7.05000 -27.95000 -23.95000	[m] 2.50000 2.55000 5.45000 4.00000 1.55000 -6.0000 -6.0000 -5.95000 13.05000 13.05000 21.00000 20.95000 2.00000 21.90000 21.90000	[m] 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 10.50000 15.45000 14.55000 14.55000 14.55000 16.55000 0.05000 0.05000 0.05000 0.05000 -27.95000 -24.5000 -24.5000 -24.5000	[m] 2.50000 5.4000 5.0000 4.05000 1.55000 -6.0000 13.95000 13.95000 13.05000 20.95000 2.500000 2.500000 2.500000 2.500000 2.500000 2.500000 2.500000 2.500000 2.500000 2.50000000000	[m] 17.000000 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 1 5 11 1 7 7 10 20 20 7 1 1 6 8 7 7 1 8 7 7 1 8 7 7 1 8 7 7 1 1 1 0 20 20 7 7 1 1 1 7 5 5 10 1 0 10 10 10 10 10 10 10 10 10 10 10	tunnels Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface Surface	NO NO NO NO NO NO NO NO NO NO NO NO NO N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	No 8 SS - A No 8 SS - C No 8 SS - C No 8 SS - C No 8 SS - F No 8 SS - F No 8 SS - F No 8 SS - J No 8 SS - J No 8 SS / C No 8 SS / C No 8 SS / C No 8 SS / C No 8 SS / C Hall - B Hall - C Hall - C Hall - C	io 5-7 SS - I hapel - K hapel - L hapel - M hapel - N hapel - N	[m] -6.95000 0.05000 15.55000 15.550000 14.50000 14.550000 14.550000 14.550000 16.550000 16.550000 -7.050000 -7.050000 -7.050000 -22.950000 0.055000 0.055000 -23.955000 0.055000 -25.95500 -25.955000 -25.955000 -25.955000 -25.955000 -25.955000 -25.955000 -25.955000000 -25.955000 -25.9550000000000000000000000000000000000	[m] 2.50000 2.55000 5.55000 5.45000 4.00000 12.95000 1.55000 1.55000 13.95000 13.95000 13.95000 13.00000 20.95000 9.00000 24.00000 21.00000 21.00000	[m] 17.000000 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000	[m] -0.05000 0.00000 10.45000 15.45000 15.45000 14.55000 14.55000 14.55000 16.55000 0.05000 0.05000 -0.05000 -2.0	[m] 2.50000 5.45000 5.55000 4.05000 4.05000 1.55000 1.55000 1.55000 1.55000 1.50000 1.50000 1.50000 2.550000 2.550000 2.550000 2.550000 2.550000 2.550000000 2.5500000000000000000000000000000000000	[m] 17.000000 17.00000 17.00000 17.00000 17.000000 17.000000 17.00000000 17.000000 17.000000 17.0000000000	[No.] 7 3 10 11 1 1 1 1 1 1 7 7 0 0 20 20 7 0 1 1 6 16 16 16 16 17 4 4 4 4 4 4 4 2 4 2	tunnels Surface Surfac	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 111 12 13 14 15 6 17 18 9 20 21 22 23	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	o 5-7 SS - I hapel - K hapel - M hapel - M hapel - N hapel - N	[m] -6,95000 0,05000 10,55000 10,55000 15,545000 24,55000 24,55000 16,55000 16,55000 16,55000 16,50000 -7,0000 -7,0000 -7,0000 -2,000000 -2,000000 -2,00000 -2,00000 -2,00000000000 -2,000000000000000000000000000000000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000 12.95000 1.55000 13.95000 13.95000 13.95000 20.95000 9.05000 20.95000 21.800000 21.80000 21.80000 21.80000 21.80000 21.80000 21.8000	[m] 17.00000 17.000000 17.00000 17.00000 17.00000 17.00000 17.000000 17.000	[m] -0.05000 0.00000 10.45000 15.45000 15.50000 14.55000 14.55000 14.55000 16.55000 0.05000 0.05000 0.05000 0.05000 0.05000 -2.95000 -2.95000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.450000 -2.500000 -2.50000 -2.500000 -2.500000 -2.500000000 -2.5000000000000000000000000000000000000	[m] 2.50000 5.50000 4.05000 4.05000 4.05000 1.55000 -5.95000 13.95000 13.05000 20.95000 2.50000 2.500000 2.50000 2.50000 2.50000 2.50000 2.500000 2.50000 2.500000 2.500000 2.500000 2.500000 2.500000 2.5000000 2.50000000 2.5000000000000000000000000000000000000	[m] 17.000000 17.000000 17.00000 17.00000 17.00000 17.00000 17.00000	[No.] 7 3 10 15 5 11 1 7 10 20 20 7 16 8 8 7 18 21 17 4 3 16 8 24 4 6 24 4 6 24 6 24 6 24 7 16 16 17 17 17 16 16 17 17 17 17 17 17 17 17 17 17	tunnels Surface Surfac	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 17 18 19 20 21 22 23 24 5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	to 5-7 SS - I hapel - K hapel - M hapel - N hapel - N hapel - N	[m] -6.95000 0.00000 0.05000 10.50000 15.50000 15.5000 14.55000 24.45000 16.45000 0.05000 -0.05000 -7.05000 -27.950000 -27.950000 -27.95000	[m] 2.50000 2.55000 5.50000 5.45000 4.00000 12.95000 1.50000 13.95000 13.05000 20.95000 9.05000 20.95000 9.05000 20.95000 9.05000 20.950000 20.95000 20.95000 20.95000 20.95000 20.95000	[m] 17.00000 17.0000 17.0000 17.0000 17.0000 17.0000 17.0000 17.000	[m] -0.05000 0.0000 10.45000 15.5000 15.5000 14.55000 14.55000 14.55000 0.05000 0.05000 -0.0000 -2.95000 -2.45000 24.45000 24.45000 24.500000 24.50000 24.50000 24.50000 24.50000 25.50000 25.5000	[m] 2.50000 5.55000 4.05000 4.05000 4.05000 1.55000 1.55000 1.55000 1.55000 1.50000 1.50000 1.50000 2.55000	[m] 17.00000	[No.] 7 3 100 1 1 1 1 1 1 1 1 7 7 0 0 70 7 1 1 1 6 8 8 7 8 18 12 11 11 1 1 7 7 7 0 0 7 0 7 0 7 0 7 0 7 0	tunnels Surface Surfac	No No No No No No No No No No No No No N	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes

#### **Displacement Grids**

Titles

Ref.	Name	Extrusion: Direction	Base line start: X	Base line start: Y	Base line start: Z(level)	Base line end: X	Base line end: Y	Base line end: Z(level)	Base line: Intervals	Extrusion: Distance	Extrusion: Intervals	Surface type for tunnels	Calculate
			[m]	[m]	[m]	[m]	[m]	[m]	[No.]	[m]	[No.]		
1	Displacement Grid 1	Global X	-30.00000	-40.00000	19.50000	-	30.00000	19.50000	70	60.00000	60	Surface	Yes
2	Displacement Grid 2	Global X	-30.00000	-40.00000	17.50000	-	30.00000	17.50000	70	60.00000	60	Surface	Yes
3	Displacement Grid 3	Global X	-30.00000	-40.00000	16.50000	-	30.00000	16.50000	70	60.00000	60	Surface	Yes

#### Polygonal Excavations

Ref. Excavation Name: Surface level [m]: Contribution: Surface movement curves which are selected are applied between surface and [m]:						1 RC Wall Installation 19,500 Positive 17,000										
Corn	er	x	У	Base Level	Arc Enabled	Stiffened	Prev. Side:	Prev. Side:	Prev. Side:	Next Side:	Next Side:	Next Side:				
		[m]	[m]	[m]			d [m]	p1 [%]	p2* [%]	d [m]	p1 [%]	p2* [%]				
	1	0.0	0.0	16.500	Yes	No	-	-	-	-	-	-				
	2	10.000	0.0	16.500	Yes	No	-	-	-	-	-	-				
	3	10.000	2.5000	16.500	Yes	No	-	-	-	-	-	-				
	4	9.0000	2.5000	16.500	Yes	No	-	-	-	-	-	-				
	5	8.0000	4.0000	16.500	Yes	No	-	-	-	-	-	-				
	6	0.0	4.0000	16.500	Yes	No	-	-	-	-	-	-				
Side		x1 [m]	y1 [m]	t	x2 m]	y2 [m]	G.M.	Curve	: Vert	ical		G.M.	Curve: Horizontal			
	1	0.0	D	0.0 1	0.000	0.0 Ins in 6.9	t. of p stiff (b))	planar clay (	diaph CIRIA	ragm w C760 F	all In ig. in 6.	st. of stiff 9(a))	planar diaphragm wall clay (CIRIA C760 Fig.			
	2	10.000	0	0.0 1	0.000	2.5000 No	vertica	al gro	und mo	vement	No	horiz	ontal ground movement			
	3	10.000	0 2.5	000 9	.0000	2.5000 No	vertic	al gro	und mo	vement	No	horiz	ontal ground movement			
	4	9.0000	0 2.5	000 8	.0000	4.0000 No	vertica	al gro	und mo	vement	No	horiz	ontal ground movement			
	5	8.0000	0 4.0	000	0.0	4.0000 No	vertic	al gro	und mo	vement	No	horiz	ontal ground movement			
	6	0.0	0 4.0	000	0.0	0.0 No	vertic	al gro	und mo	vement	No	horiz	ontal ground movement			
Circu	ılar	r Excava	tions													

### Vertical Ground Movement Curves

Curve Name: Coordinates:

No vertical ground movement [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z) (%)]

[0.000,0.000,0.000] [1.000,0.000,0.000] [0.000,1.000,0.000] [1.000,1.000,0.000] Curve Fitting Method: x Order: Polynomial

Oasys								Job No.		Sheet No.	ev.	
								J20048				
roposed Chiller	Plant Room, M	lo 8 Sout	h Squa	re				Drg. Re	f.			·
round Movemer C Wall Installati	it Assessment							Made by	Dat	e Mar 2020	Check	ed
ide x1 y1 [m] [m]	x2 y2 [m] [m]	G.M. Curve:	Vertical	G.M. C	Curve: Horizo	ontal		IVIP	09-	Mai-2020		
Order:	0 0 0x + 0 0											
beff. of Determination:	Inst. of planar dia	aphragm wall i	n stiff cl;	ay (CIRIA C760	Fig. 6.9(b))	) (						
Jordinates:	<pre>depth or max. excav depth (z) (%)] [0.000,0.000,0.050] [0.200,0.000,0.025] [0.400,0.000,0.025]</pre>	(0.050,0.000, (0.250,0.000, (0.450,0.000,	0.047][0.11 0.034][0.31 0.022][0.5	00,0.000,0.043] 00,0.000,0.031] 00,0.000,0.020]	[0.150,0.000 [0.350,0.000 [0.550,0.000	),0.040] ),0.028] 0,0.018]						
	[0.600,0.000,0.015] [0.800,0.000,0.008] [1.000,0.000,0.004] [1.200,0.000,0.002] [1.400,0.000,0.001]	[0.650,0.000, [0.850,0.000, [1.050,0.000, [1.250,0.000, [1.450,0.000,	).013][0.70 0.007][0.90 0.003][1.10 0.001][1.30 0.000][1.50	00,0.000,0.012]         00,0.000,0.006]         00,0.000,0.003]         00,0.000,0.001]         00,0.000,0.000]	[0.750,0.000 [0.950,0.000 [1.150,0.000 [1.350,0.000	0.010] 0.005] 0.002] 0.0001]						
urve Fitting Method: Order: Order: olynomial: z =	Polynomial 4 0 -1.2355E-2x <sup>4</sup> + 3.41	314E-2x <sup>3</sup> - 2.8	885E-3x <sup>2</sup> -	6.5618E-2x + 4	.9987E-2							
beff. of Determination:	1.0000	110 14 110	500 <u>2</u> 5x	0.00101 24 1 1								
prizontal Ground Moveme	nt Curves	ad morromont										
oordinates:	[Distance from wall depth or max. excav excavation depth (2	<pre>. / wall depth vation depth ( :) (%)]</pre>	or max. ex y), Horizor	xcavation depth ntal movement /	(x), Depth wall depth	/ wall or max.						
urve Fitting Method: Order: Order: olynomial: z =	Polynomial 0 0.0	[1.000,0.000,	5.0003[0.00	50,1.000,0.000]	[1.000,1.000	,0.000]						
weff. of Determination:	Inst. of planar dia	aphragm wall i	n stiff cl	ay (CIRIA C760	Fig. 6.9(a))	)						
cordinates:	[Distance from wall depth or max. excav excavation depth (2 [0.000,0.000,0.050]	<pre>/ wall depth 'ation depth ( ') (%)] [1.500.0.000.</pre>	or max. ex y), Horizor 0.0001	xcavation depth ntal movement /	(x), Depth wall depth	/ wall or max.						
rve Fitting Method: Order: Order:	Polynomial	,										
olynomial: z = peff. of Determination:	-3.33E-2x + 5.00E-2 1.00	:										
pecific Buildings - Geomet	ry ng Name	Sub-Building Name	Displac	cement Line	Distance Di Along A Line: I Start	Istance V Along Ofi Line: 1 End V	Vertical fsets from Line for Vertical	Vertical Displaceme Limit	Damage Category nt Strains	Poisson's E/G Ratio		
					[m]	M Ca! [m]	Movement lculations [m]	Sensitivit [mm]	У			
1 No 8 South Square 2 No 8 South Square 3 No 8 South Square		A B C	No 8 SS - No 8 SS - No 8 SS -	A B C	0.00000 2	3.90000 2.90000 3.39900	0.0 0.0 0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
4 No 8 South Square 5 No 8 South Square 6 No 8 South Square 7 No 8 South Square		D E F	No 8 SS - No 8 SS - No 8 SS -	D E F	0.00000 1 0.00000 4 0.00000 11 0.00000 0	1.89900 1.39900 1.39900	0.0 0.0 0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
8 No 8 South Square 9 No 8 South Square / 10 No 8 South Square /	No 5-7 South Square	H I J	No 8 SS - No 8 SS / No 8 SS -	H No 5-7 SS - I J	0.00000 1	1.40000 3.89900 3.90000	0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
11 No 8 South Square / 12 No 8 South Square / 13 No 8 South Square /	Chapel Chapel Chapel	K L M	No 8 SS / No 8 SS / No 8 SS /	Chapel - K Chapel - L Chapel - M	0.00000 7	/.89900 ).89900 S.40000	0.0 0.0 0.0	0.100 0.100 0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
14 No 8 South Square / 15 No 8 South Square 16 No 8 South Square / 17 Hall	Hall	N O P	No 8 SS / No 8 SS - No 8 SS /	Chapel - N O Hall- P	0.00000 6	3.90000 3.40000	0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
18 Hall 19 Hall 20 Hall		B C D	Hall - B Hall - C Hall -D		0.00000 14	1.39900 3.89900 2.89900	0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
21 Hall 22 Chapel 23 Chapel		E A B	Hall - E Chapel - i Chapel - i	А	0.00000 16	5.90000 1.40000 5.89900	0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
24 No 5-7 South Square 25 No 5-7 South Square 26 No 5-7 South Square		A B C	No 5-7 SS No 5-7 B No 5-7 - 1	- A C	0.00000 28	3.90000 3.39900 3.90000	0.0 0.0 0.0	0.100	00 Burland Strain Limits 00 Burland Strain Limits 00 Burland Strain Limits	0.20000 2.6000 0.20000 2.6000 0.20000 2.6000		
pecific Buildings - Bending	g Parameters											
ef. Buildi	ng Name	Sub-Building Name	Height Def	fault Hogging:	Hogging:	Hogging:	Sagging:	Sagging:	Sagging:			
				of Area (per unit width)	Bending Strain from N.A.	N.A. from Edge of Beam in Tension	of Area (per unit width)	Bending Strain from N.A.	N.A. from Edge of Beam in Tension			
1 No 8 South Square		A	[m] 10.000 ,	<b>[m³]</b> Yes 333.3	[m] 3 10.000	[m] ) 10.00(	[m³] 0 83.333	[m] 5.0000	[m] 5.0000			
2 No 8 South Square 3 No 8 South Square 4 No 8 South Square		B C D	10.000 1 10.000 1 10.000 7	Yes 333.3 Yes 333.3 Yes 333.3	3 10.000 3 10.000 3 10.000	) 10.000 ) 10.000 ) 10.000	0 83.333 0 83.333 0 83.333	5.0000 5.0000 5.0000	5.0000 5.0000 5.0000			
5 No 8 South Square 6 No 8 South Square 7 No 8 South Square		E F G	10.000 1 13.000 1 13.000 1	res 333.3 Yes 732.3 Yes 732.3	3 10.000 3 13.000 3 13.000	10.000 13.000 13.000	U 83.333 0 183.08 0 183.08	5.0000 6.5000 6.5000	5.0000 6.5000 6.5000			
8 No 8 South Square 9 No 8 South Square / 10 No 8 South Square	No 5-7 South Square	H I J	13.000 1 13.000 1 13.000 7	Yes 732.3 Yes 732.3 Yes 732.3	3 13.000 3 13.000 3 13.000	13.000 13.000 13.001	U 183.08 0 183.08 0 183.08	6.5000 6.5000 6.5000	6.5000 6.5000 6.5000			
11 NO 8 South Square / 12 No 8 South Square / 13 No 8 South Square / 14 No 8 South Square /	Chapel Chapel Chapel	r. L M	13.000 Y 13.000 Y	Yes 732.3 Yes 732.3 Yes 732.3	3 13.000 3 13.000 3 13.000	13.000 13.000 13.000	0 183.08 0 183.08 0 183.08	6.5000	6.5000 6.5000 6.5000			
14 NO 8 South Square / 15 No 8 South Square 16 No 8 South Square / 17 Well	Hall	N O P	10.000 1 10.000 1	Yes 333.3 Yes 333.3	3 10.000 3 10.000	10.000	0 183.333 0 83.333 0 83.333	5.0000	5.0000 5.0000			
18 Hall 19 Hall		A B C	10.000 10.000	res 333.3 Yes 333.3 Yes 333.3	3 10.000 3 10.000	10.000 10.000 10.000	u 83.333 0 83.333 0 83.333	5.0000	5.0000			

$\bigcap$							Job No.			Sheet No.	F	Rev.
Jasys							J20	048				
roposed Chiller Plant Ro	oom, No 8 S	outh Square					Drg. Ref					1
C Wall Installation	Made by D MP 0			e Mar-2020	ked							
Ref. Building Name	Sub-Bui Nam	lding Height Defau e	lt Hogging:	Hogging:	Hogging:	Sagging:	Sagging:	Sagging:				
20 Hall 21 Hall	D	10.000 Yes 10.000 Yes	of Area 333.33 333.33	Bending 10.000 10.000	N.A. from 10.000 10.000	of Area 83.333 83.333	Bending 5.0000 5.0000	N.A. from 5.0000 5.0000				
22 Chapel 23 Chapel 24 No 5-7 South Square 25 No 5-7 South Square	A B A B	13.000 Yes 13.000 Yes 13.000 Yes 13.000 Yes	732.33 732.33 732.33 732.33 732.33	13.000 13.000 13.000 13.000	13.000 13.000 13.000 13.000	183.08 183.08 183.08 183.08	6.5000 6.5000 6.5000 6.5000	6.5000 6.5000 6.5000 6.5000				
26 No 5-7 South Square	C	13.000 Yes	732.33	13.000	13.000	183.08	6.5000	6.5000				