Appendix 5

Site Photographs and Notes

Borehole No.
SLOPES

Details

Project Number	C3485/23/E
Date	04/05/2023
Hole Type	TP
Site Location	Draughton Quarry
Client Name	R Howson
Lead Operative	.
Assistant Operative	.
Rig Make and Model	Other
Other	.

what3words

Trial Pit

Excavator Make and Model
.

Additional Photos

Description

Description

1

Description

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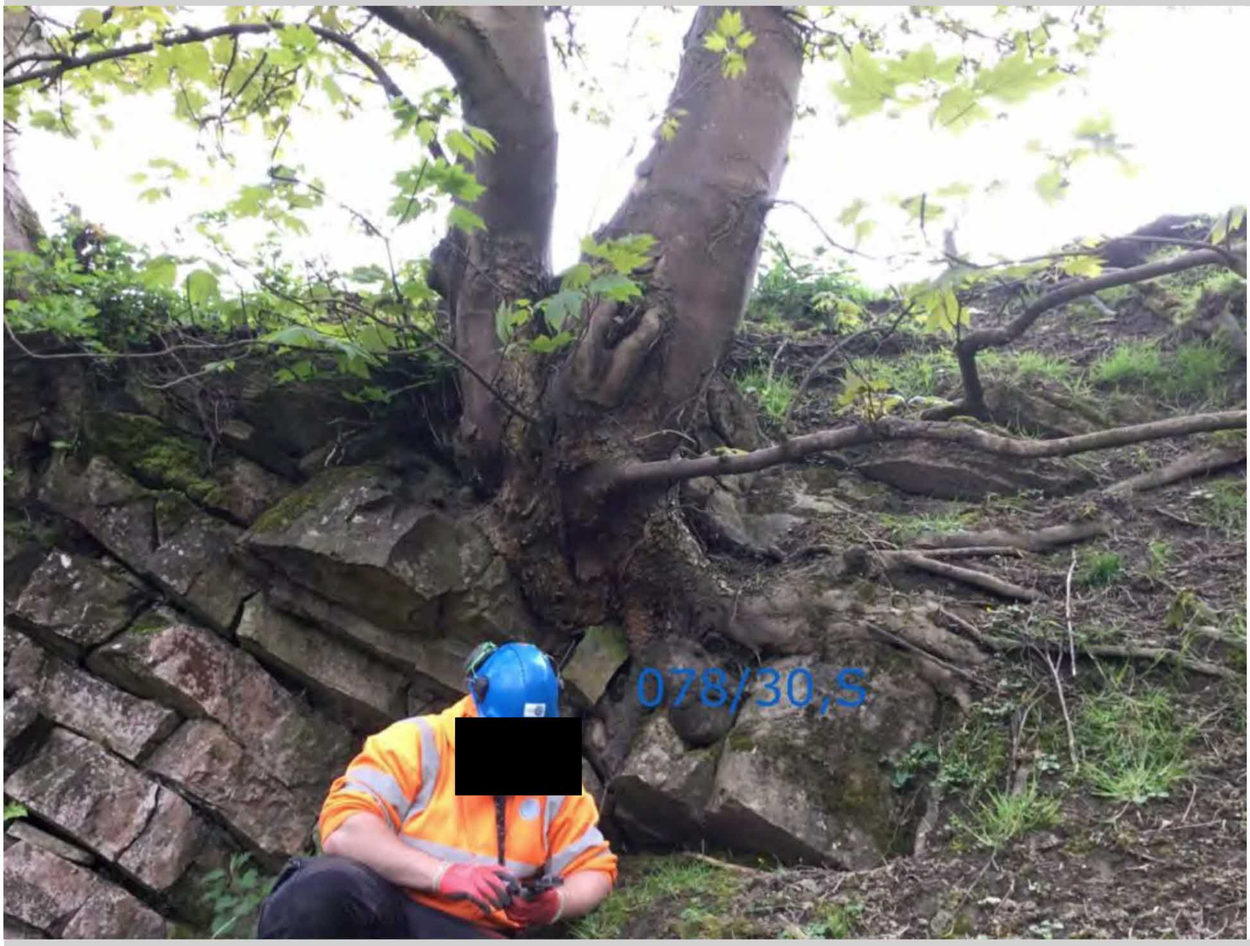
Description


083/44,S

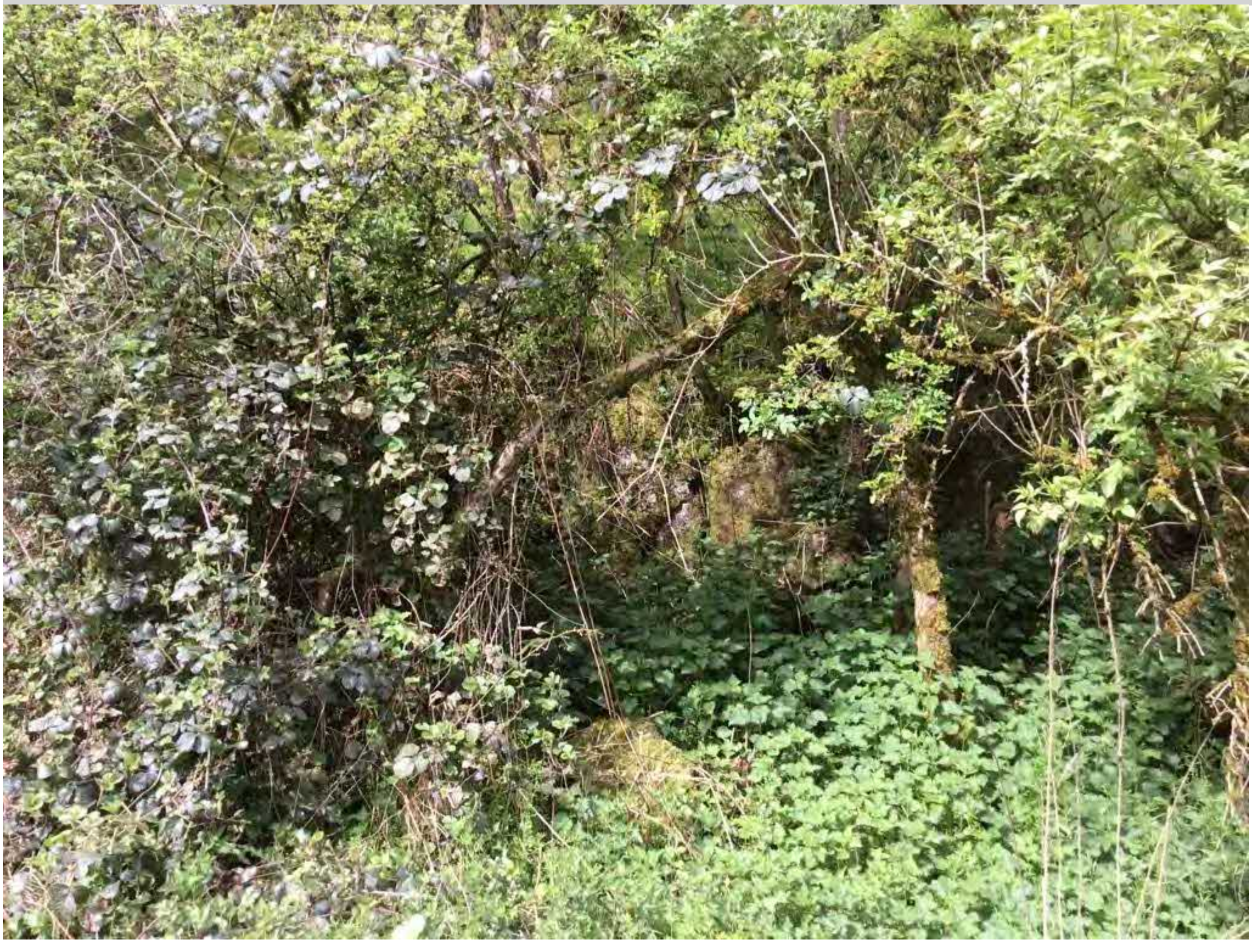

078/30,S


048/21,S


019/26 E


096/78,NW


068/52,NW



Position No.
TP01A-1,-2,-3

Details

Project Number	Date	Hole Type
C3485/23/E	04/05/2023	TP

Site Location	Client Name
Draughton	R Howson

Lead Operative	Assistant Operative
Rob	Toby

Rig Make and Model	Other
Other	.

what3words

Trial Pit

Excavator Make and Model
.


1.1m


1.1m


SPH
3)
2)
1)


073/50.SSE


1.4m


0.25m

Borehole No.
TP2A

Details

Project Number	C3485/23/E
Date	04/05/2023
Hole Type	TP
Site Location	Draughton Quarry
Client Name	R Howson
Lead Operative	Rob
Assistant Operative	Toby
Rig Make and Model	Other
Other	.

what3words

Trial Pit

Excavator Make and Model


1.1m

Position No.: TP03A

Details

Project Number	C3485
Date	04/05/2023
Hole Type	TP
Site Location	Draughton Quarry
Client Name	R Howson
Lead Operative	Rob
Assistant Operative	Toby
Rig Make and Model	Other
Other	14T Doosan

what3words:

Trial Pit

Excavator Make and Model:

Position No.
TP4A

Details

Project Number	C3485/23/E
Date	04/05/2023
Hole Type	TP
Site Location	Draughton
Client Name	R Howson
Lead Operative	Rob
Assistant Operative	Toby
Rig Make and Model	Other
Other	14T

what3words

Trial Pit

Excavator Make and Model

Position No.
SA1

Details

Project Number
C3485

Date
04/05/2023

Hole Type
TP

Site Location
Draughton

Client Name
R Howson

Lead Operative
Rob

Assistant Operative
Toby

Rig Make and Model
Other

Other
.

what3words
Evolves.sensible.grief

Trial Pit

Excavator Make and Model

Position No.
SA2

Details

Project Number	C3485
Date	04/05/2023
Hole Type	TP
Site Location	Draughton
Client Name	R Howson
Lead Operative	Rob
Assistant Operative	Toby
Rig Make and Model	Other
Other	14T

what3words
forgets.discusses.drawn

Trial Pit

Excavator Make and Model

Appendix 6

Laboratory Testing

Environmental
Geotechnical
Specialists

RGS

LABORATORY REPORT

job number	C/3485/23/E/5292	date	
site address	Former Quarry, Low Lane, Draughton, Skipton, North Yorkshire, BD23 6EA		
date scheduled	10/05/2023	date issued	26/06/2023
issued by	H J Letch		

<ENVIRONMENTAL><GEOTECHNICAL>

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8948

Schedule of UKAS Accredited Laboratory Tests

1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN ISO 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2 : 3.2	Pt 1 : 2014 Pt 12 : 2018 : 5.3 / 5.5	A	
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3		A	
ii. Plastic limit	Pt 2 : 5.3		A	
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5		A	
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2		A	
ii. Large pyknometer	Pt 2 : 8.3			U
iii. Small pyknometer	Pt 2 : 8.4	Pt 3 : 2015 : 5.1		U
1.4 Density Tests				
i. Linear measurement	Pt 2 : 7.2	Pt 2 : 2014 : 5.1	A	
ii. Immersion in water	Pt 2 : 7.3	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2 : 7.4	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9 : 2.1, 2.2			U
v. Core cutter	Pt 9 : 2.4			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2 : 9.2	Pt 4 : 2016 : 5.2	A	
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2	A	
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4	A	
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS	**BS 1377-3:2018**			
ii. Mass loss on ignition	Pt 3 : 4			U
3. COMPACTION RELATED TESTS	**BS 1377-4:1990**			
3.1 Dry density/moisture relationship				
i. 2.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
ii. 4.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
3.2 Moisture Condition Value				
i. Single point test	Pt 4 : 5.4			U
ii. MCV/moisture content relationship	Pt 4 : 5.5			U
3.3 California Bearing Ratio				
i. Undisturbed sample	Pt 5 : 7		A	
ii. Recompacted sample	Pt 5 : 7		A	
iii. Soaked, inc measurement of swell	Pt 5 : 7		A	
4. COMPRESSIBILITY OF SOIL	**BS 1377-5:1990**			
i. One dimensional consolidation	Pt 5 : 3		A	
ii. Swelling pressure test	Pt 5 : 3			U
5. SHEAR STRENGTH OF SOIL	**BS 1377-7:1990**			
i. Hand shear vane	Makers instructions			U
ii. Shear box (100mm square sample)	BS 1377 : Pt 7 : 4			U
iii. Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9		A	
6. PERMEABILITY				
i. Falling head	K. H. Head Vol 2			U
ii. Constant head	BS 1377 : Pt 6 : 6			U
iii Triaxial cell	BS 1377 : Pt 6 : 6			U
7. ROCK TESTS				
7.1 Classification Tests				
i. Natural moisture content	-			U
ii. Saturated moisture content	-			U
iii. Natural density	-			U
iv. Porosity	-			U
7.2 Strength Tests				
i. Point load index	ISRM '85			U
ii. Uniaxial compression test	ISRM '81			U

Disclaimer

The results reported herein relate only to the material supplied to the laboratory.

<ENVIRONMENTAL> <GEOTECHNICAL>

GEOTECHNICAL
TESTING
RESULTS

<ENVIRONMENTAL> <GEOTECHNICAL>

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

Citation Approved Health & Safety System Registered Member

UKAS United Kingdom Accreditation Service

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

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Summary of Classification Test Results

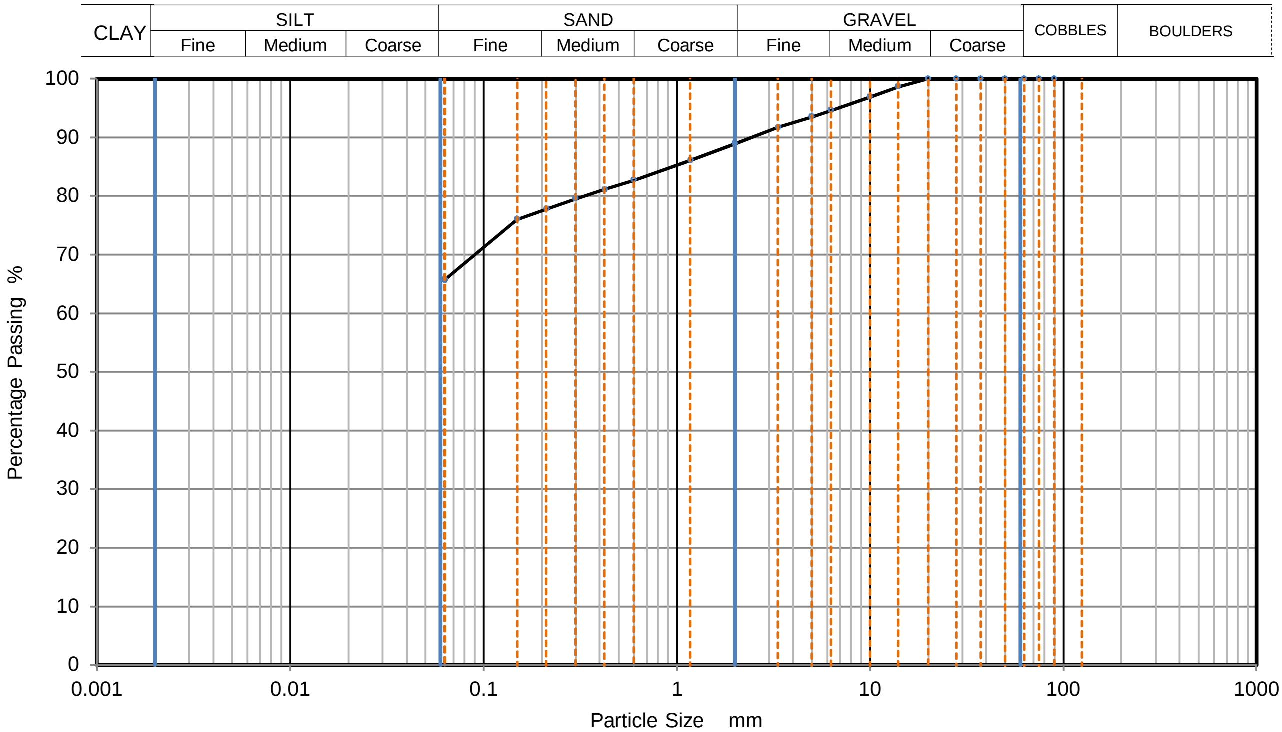
Project No.	Project Name
C3485/23/E/5292	Draughton Quarry

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Cone	Water	Date
	Ref	Top	Base	Type		bulk	dry							80g/30°	Increase	
						Mg/m3		%	%	%	%	%	Mg/m3	60g/60°	Decrease	
TP03A	1	0.50	1.00	B	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.			18.0								30-May
TP04A	B1	1.00	1.50	B	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.			9.8								30-May

All tests performed in accordance with BS EN ISO 17892 unless specified otherwise

Key			Date Printed	Approved By	Table
Density test	Liquid Limit	Particle density			1
Linear measurement unless :	4pt cone unless :	sp - small pyknometer	31/05/2023		
wd - water displacement	cas - Casagrande method	gj - gas jar			sheet
wi - immersion in water	1pt - single point test			Harry	1

	PARTICLE SIZE DISTRIBUTION	Job Ref	C3485/23/E/5292
		Borehole/Pit No.	TP03A
Site Name	Draughton Quarry	Sample No.	1
Soil Description	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.	Depth, m	0.50
Specimen Reference	1 / Specimen Depth 0.5 m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample	KeyLAB ID	RGS_202305110



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	95		
5	94		
3.35	92		
2	89		
1.18	86		
0.6	83		
0.425	81		
0.3	80		
0.212	78		
0.15	76		
0.063	66		

Dry Mass of sample, g	2841

Sample Proportions	% dry mass
Very coarse	0
Gravel	11
Sand	23
Fines <0.063mm	66

Grading Analysis		
D100	mm	20
D60	mm	
D30	mm	
D10	mm	

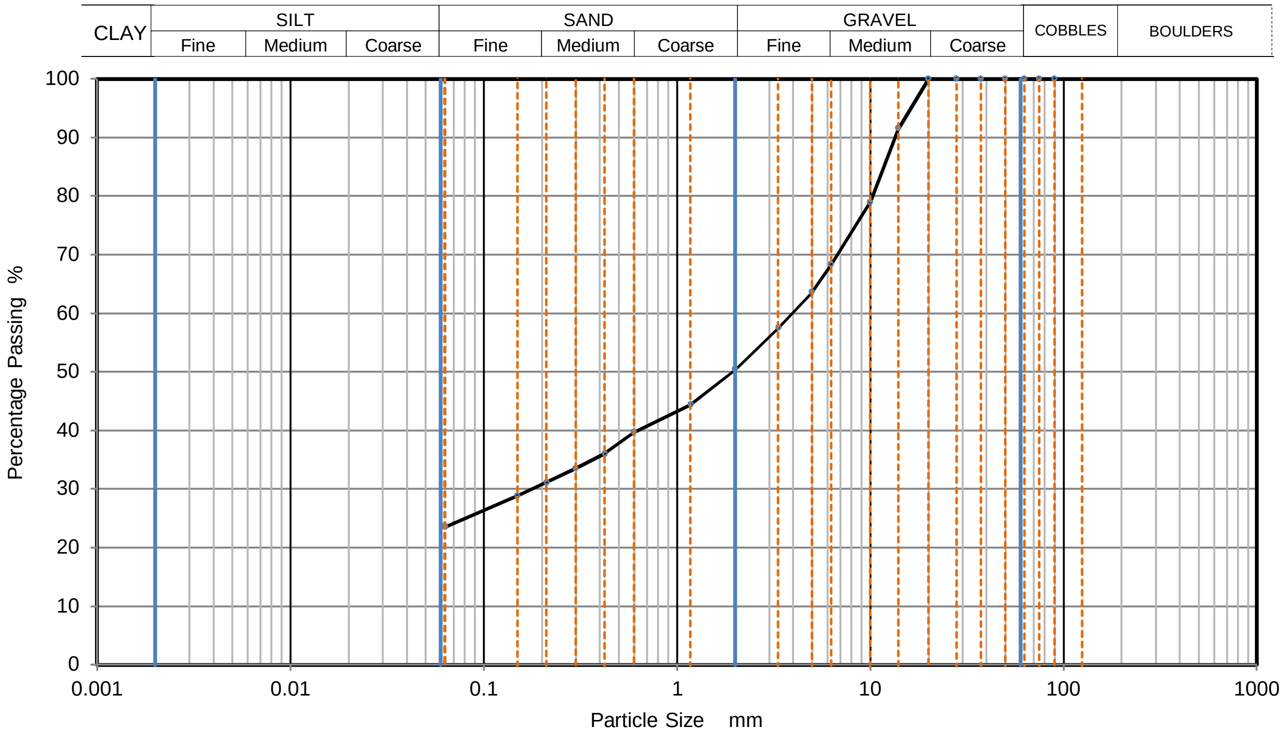
Remarks

Preparation and testing in accordance with BS EN ISO 17892 - 4, unless noted below

Test performance date: 29/05/2023

Operator	Checked	Approved	Sheet printed	Fig 2
HJL	Harry	Harry	31/05/2023	Sheet 1

	PARTICLE SIZE DISTRIBUTION	Job Ref	**C3485/23/E/5292**
		Borehole/Pit No.	TP04A
Site Name	Draughton Quarry	Sample No.	B1
Soil Description	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.	Depth, m	1.00
Specimen Reference	1	Specimen Depth	1 m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample	KeyLAB ID	RGS_202305111



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	92		
10	79		
6.3	68		
5	64		
3.35	58		
2	50		
1.18	44		
0.6	40		
0.425	36		
0.3	34		
0.212	31		
0.15	29		
0.063	24		

Dry Mass of sample, g	2119

Sample Proportions	% dry mass
Very coarse	0
Gravel	49
Sand	27
Fines <0.063mm	24

Grading Analysis		
D100	mm	20
D60	mm	3.96
D30	mm	0.179
D10	mm	

Remarks

Preparation and testing in accordance with BS EN ISO 17892 - 4, unless noted below

Test performance date: 29/05/2023

Operator	Checked	Approved	Sheet printed	**Fig 2**
HJL	Harry	Harry	31/05/2023	Sheet 2

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

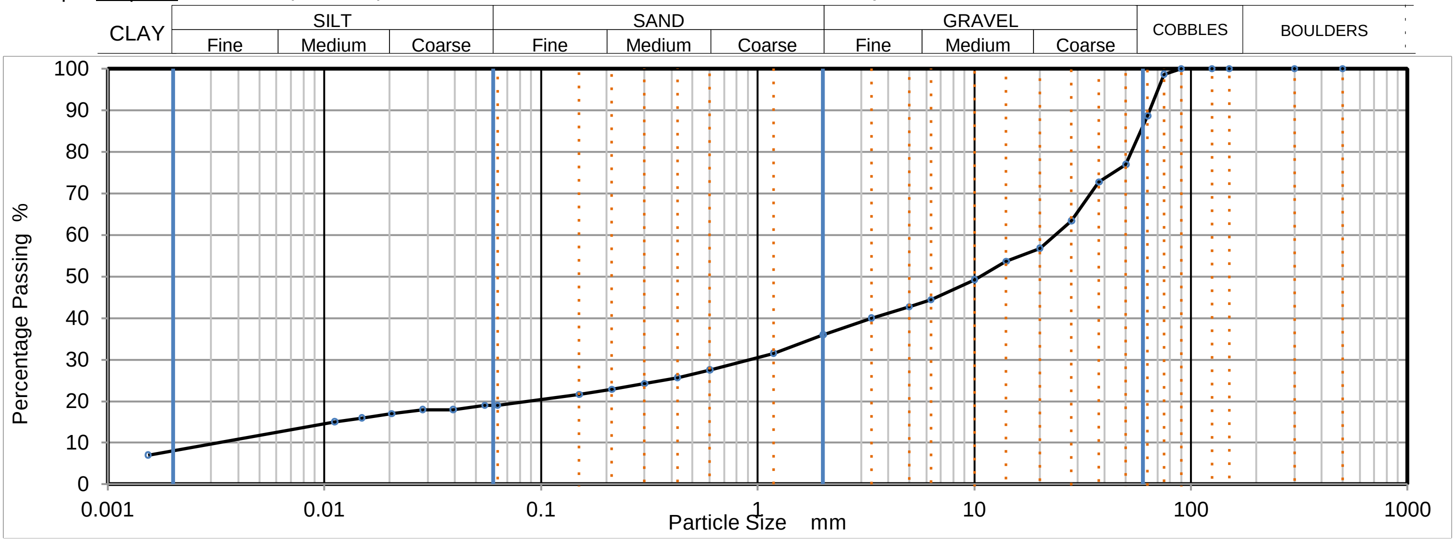
UKAS TESTING 4041

Client:	Rogers Geotechnical Services Ltd	Client Reference:	C3485
Client Address:	Offices 1&2 Barncliffe Business Pk, Near Bank, Shelley, Huddersfield, West Yorkshire, HD8 8LU	Job Number:	23-33700-1
		Date Sampled:	Not Given
		Date Received:	09/05/2023
Contact:	Harry Letch	Date Tested:	22/05/2023
Site Address:	Draughton Quarry	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2678694	Depth Top [m]:	0.50
Hole No.:	TP01A	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Greyish brown clayey GRAVEL with cobbles		
Sample Preparation:	Sample was quartered, oven dried at 106.0 °C and broken down by hand.		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0550	19
300	100	0.0393	18
150	100	0.0283	18
125	100	0.0204	17
90	100	0.0149	16
75	99	0.0112	15
63	89	0.0015	7
50	77		
37.5	73		
28	63		
20	57		
14	54		
10	49		
6.3	44		
5	43		
3.35	40	Particle density	(assumed)
2	36	2.65	Mg/m3
1.18	32		
0.6	28		
0.425	26		
0.3	24		
0.212	23		
0.15	22		
0.063	19		

Sample Proportions	% dry mass
Very coarse	11
Gravel	53
Sand	17
Silt	11
Clay	8

Grading Analysis		
D100	mm	90
D60	mm	23.5
D30	mm	0.92
D10	mm	0.00321
Uniformity Coefficient		7300
Curvature Coefficient		11

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Signed: Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 26/06/2023

GF 100.22

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

UKAS TESTING 4041

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Analytical i2 Environmental Science

Client:	Rogers Geotechnical Services Ltd
Client Address:	Offices 1&2 Barncliffe Business Pk, Near Bank, Shelley, Huddersfield, West Yorkshire, HD8 8LU
Contact:	Harry Letch
Site Address:	Draughton Quarry

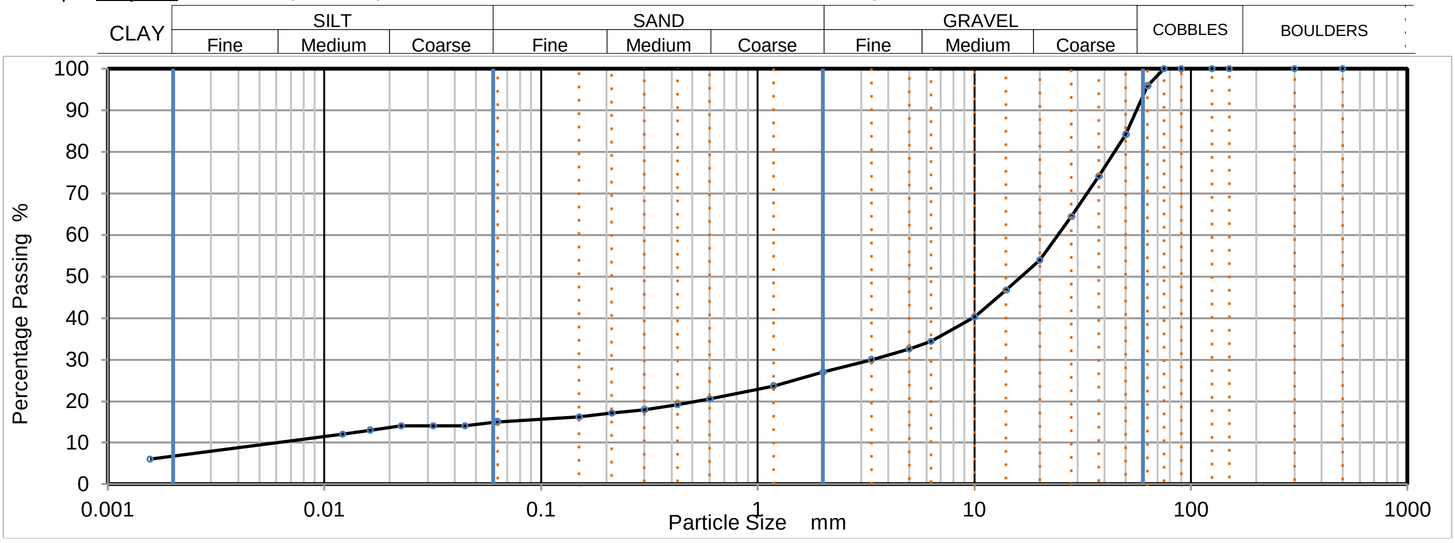
Client Reference:	C3485
Job Number:	23-33700-1
Date Sampled:	Not Given
Date Received:	09/05/2023
Date Tested:	22/05/2023
Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2678695
Hole No.:	TP02A
Sample Reference:	Not Given
Sample Description:	Greyish brown clayey GRAVEL
Sample Preparation:	Sample was quartered, oven dried at 107.0 °C and broken down by hand.

Depth Top [m]:	0.30
Depth Base [m]:	1.00
Sample Type:	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0624	15
300	100	0.0445	14
150	100	0.0317	14
125	100	0.0226	14
90	100	0.0162	13
75	100	0.0121	12
63	96	0.0016	6
50	84		
37.5	74		
28	64		
20	54		
14	47		
10	40		
6.3	34		
5	33		
3.35	30	Particle density	(assumed)
2	27	2.65	Mg/m3
1.18	24		
0.6	21		
0.425	19		
0.3	18		
0.212	17		
0.15	16		
0.063	15		

Sample Proportions	% dry mass
Very coarse	4
Gravel	69
Sand	12
Silt	9
Clay	6

Grading Analysis		
D100	mm	75
D60	mm	24.3
D30	mm	3.33
D10	mm	0.00667
Uniformity Coefficient		3600
Curvature Coefficient		68

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

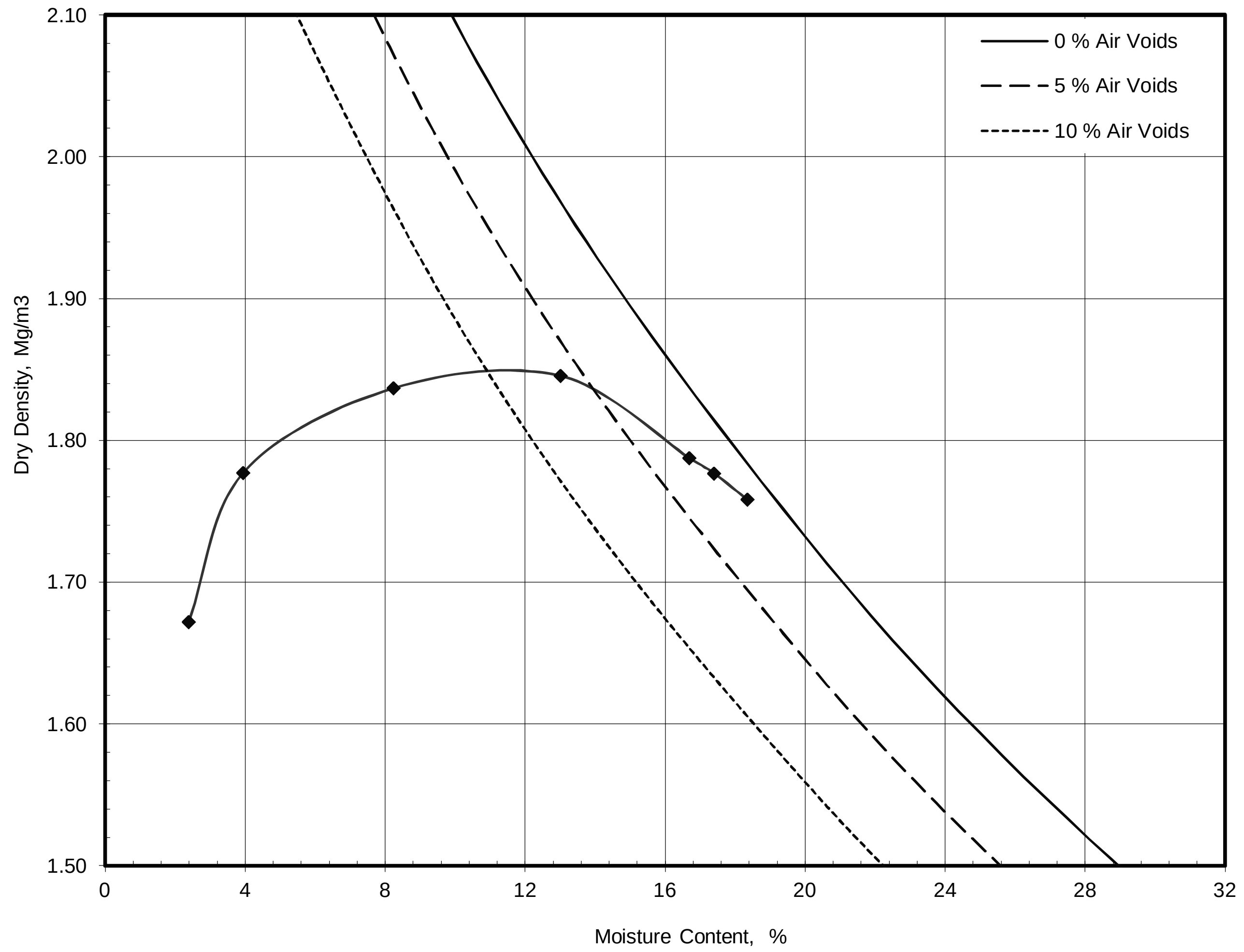
Signed: Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 26/06/2023

GF 100.22

	Dry Density / Moisture Content Relationship **Light Compaction**			Job Ref	**C3485/23/E/5292**
				Borehole / Pit No	TP03A
Site Name	**Draughton Quarry**			Sample No	1
Soil Description	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.			Depth	0.50 m
Specimen Ref.	1	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	RGS_202305110
				Compaction Test Reference/No.	1

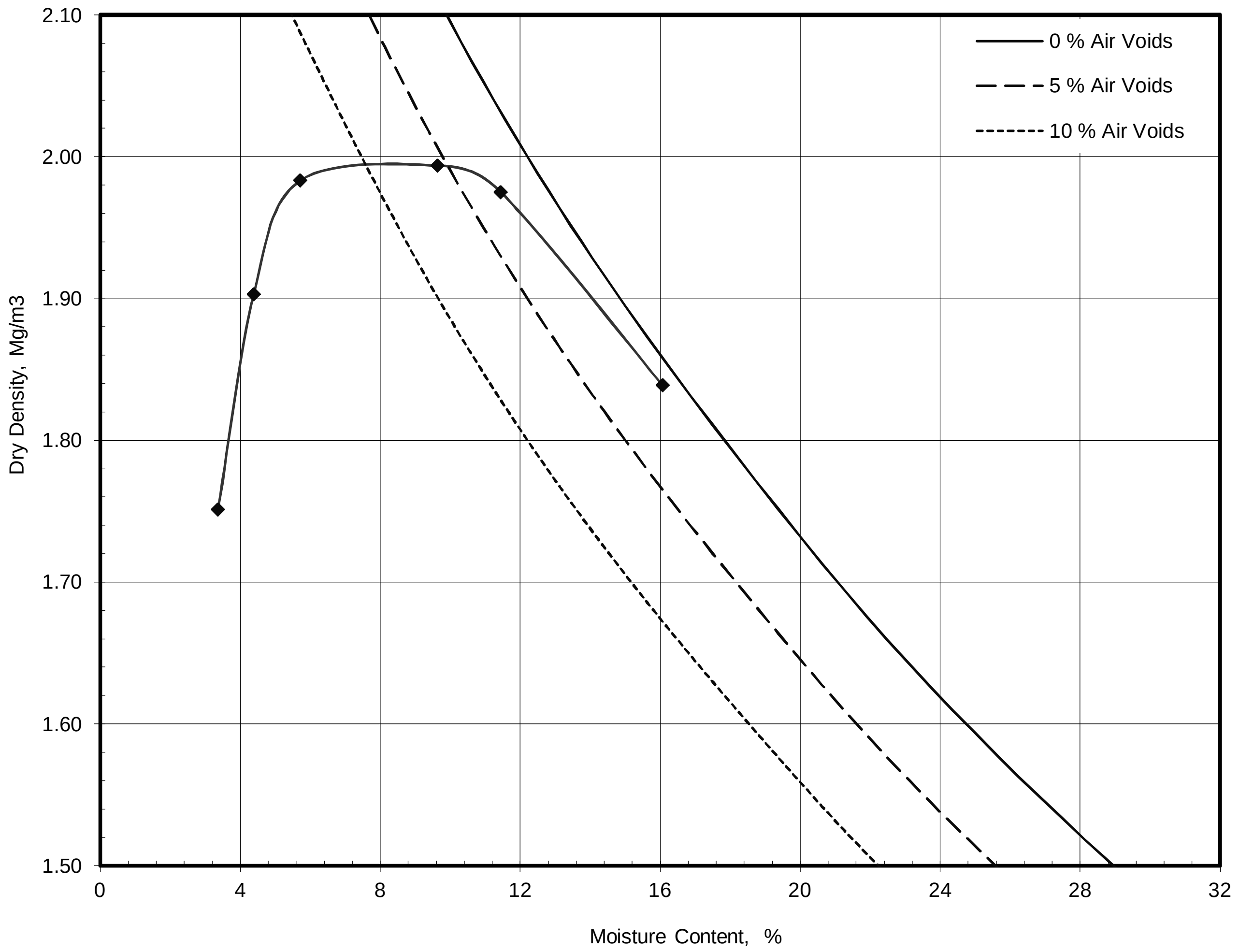


Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	4
Material Retained on 20.0 mm Sieve	%	6
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.85**
Optimum Moisture Content	%	**11**

Operator	Checked	Approved	Remarks	**Fig 3**
MT	Harry	Harry		Sheet 1 of 1

	Dry Density / Moisture Content Relationship **Light Compaction**			Job Ref	**C3485/23/E/5292**
				Borehole / Pit No	TP04A
Site Name	**Draughton Quarry**			Sample No	B1
Soil Description	Dark grey very clayey silty very sandy GRAVEL. Low cobble content.			Depth	1.00 m
Specimen Ref.	4	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	RGS_202305111
				Compaction Test Reference/No.	2



Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	3
Material Retained on 20.0 mm Sieve	%	2
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.99**
Optimum Moisture Content	%	**8.1**

Operator	Checked	Approved	Remarks	**Fig 3**
MT	Harry	Harry		Sheet 1 of 1

TEST CERTIFICATE

DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP METHOD USING 4.5 KG RAMMER

Tested in Accordance with: BS 1377-4: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

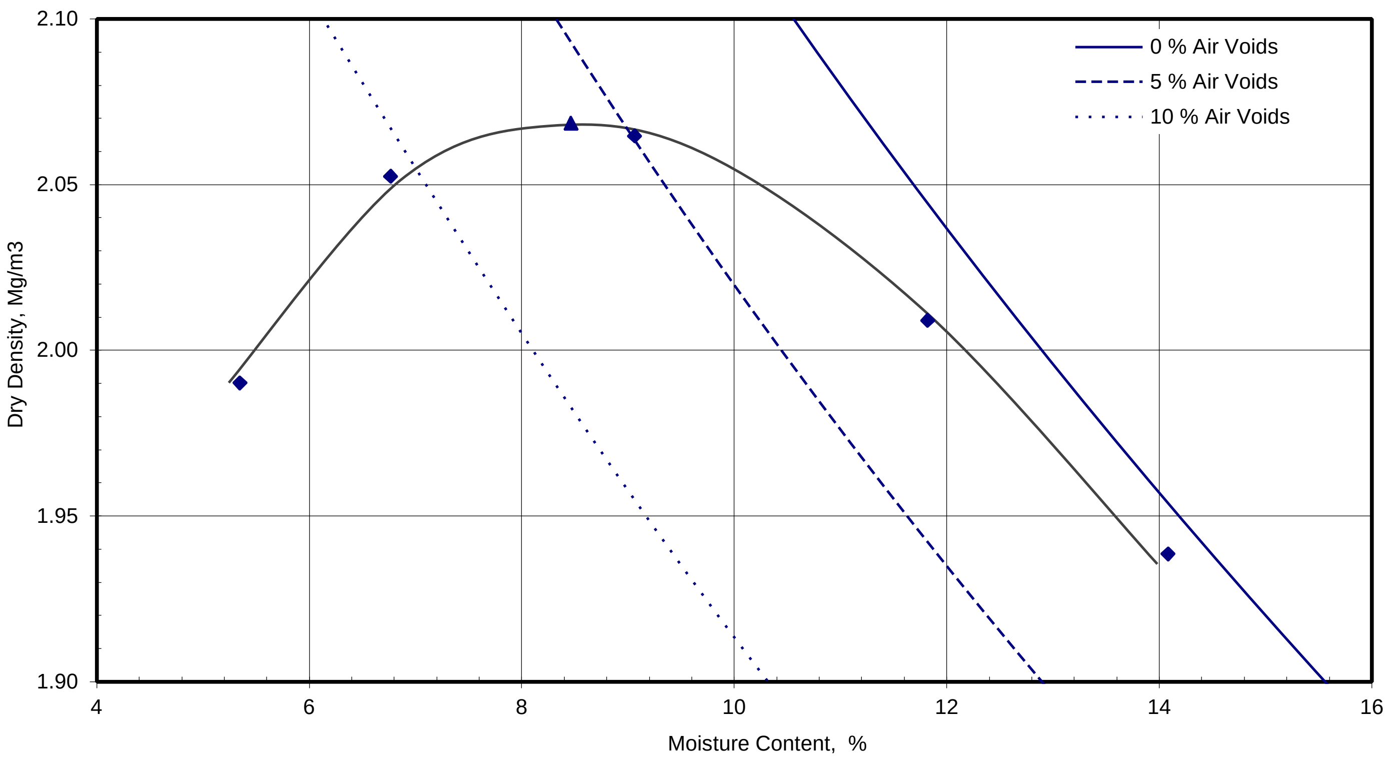
UKAS TESTING 4041

Client:	Rogers Geotechnical Services Ltd	Client Reference:	C3485
Client Address:	Offices 1&2 Barncliffe Business Pk, Near Bank, Shelley, Huddersfield, West Yorkshire, HD8 8LU	Job Number:	23-33700-1
		Date Sampled:	Not Given
		Date Received:	09/05/2023
Contact:	Harry Letch	Date Tested:	13/06/2023
Site Address:	Draughton Quarry	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2678694	Depth Top [m]:	0.50
Hole No.:	TP01A	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Greyish brown clayey GRAVEL with cobbles		
Sample Preparation:	Sample was quartered and broken down by hand. Material used was natural.		



Compaction Point No.		1	2	3	4	5
Moisture Content	%	5.3	6.8	9.1	12	14
Dry Density	Mg/m³	1.99	2.05	2.06	2.01	1.94

Mould Type		CBR
Samples Used		Separate specimens tested
Material Retained on 37.5 mm Sieve	%	27
Material Retained on 20.0 mm Sieve	%	43
Particle Density - Assumed	Mg/m³	2.70
As received Moisture Content	%	8.9
Maximum Dry Density	Mg/m³	**2.07**

Optimum Moisture Content	%	**8.5**

Note: Tested in Accordance with BS 1377-4: 1990: Clause 3.6 using 4.5kg [heavy] Rammer

Remarks: Zone X - test carried out with clients consent

Signed: Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 26/06/2023

GF 110.22

TEST CERTIFICATE

DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (LARGE SHEARBOX APPARATUS)

Tested in Accordance with:BS 1377-7:1990: Clause 5.5.4

UKAS TESTING 4041

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Analytical i2 Environmental Science

Client:	Rogers Geotechnical Services Ltd	Client Reference:	C3485
Client Address:	Offices 1&2 Barncliffe Business Pk, Near Bank, Shelley, Huddersfield, West Yorkshire, HD8 8LU	Job Number:	23-33700-1
		Date Sampled:	Not Given
		Date Received:	09/05/2023
Contact:	Harry Letch	Date Tested:	19/06/2023
Site Address:	Draughton Quarry	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2678694	Depth Top [m]:	0.50
Hole No.:	TP01A	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Greyish brown clayey GRAVEL with cobbles		

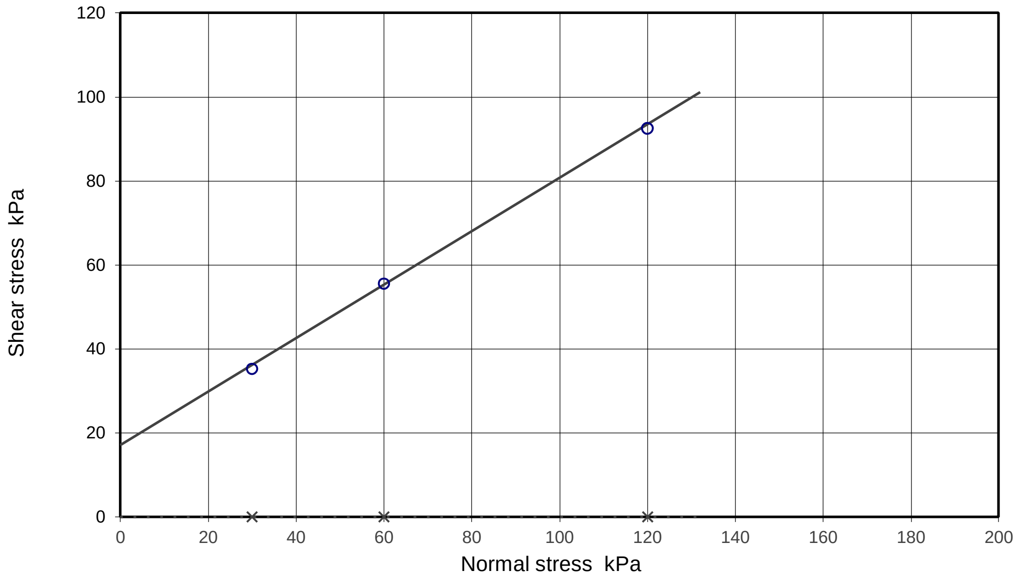
Preparation Details

Specimen Details

	Test No.	1	2	3				
Initial	Height	140.0	140.0	140.0				mm
	Length	300.0	300.0	300.0				mm
	Breadth	300.0	300.0	300.0				mm
	Particle Density - (assumed)	2.65	2.65	2.65				Mg/m³
	Bulk Density	2.08	2.08	2.08				Mg/m³
	Moisture Content	9.0	9.0	9.0				%
	Dry density	1.91	1.91	1.91				Mg/m³
	Voids ratio	0.387	0.387	0.387				
	Degree of Saturation	62	62	62				%
Consolidation	Consolidation / Normal Stress applied	30	60	120				kPa
	Change in height during consolidation	5.487	9.706	15.618				mm
	Voids ratio after consolidation	0.333	0.291	0.232				
After test	Final Moisture Content	21.0	18.9	17.6				%

Shearing stage(s)

Rate of displacement	Peak	0.10800	0.10800	0.10800				mm/min
	Residual							mm/min
Peak values, (o)	Relative horizontal displacement	42.02	44.99	44.99				mm
	Shear stress	35.2	55.5	92.5				kPa
	Vertical Movement at peak shear stress	1.41	3.36	2.38				mm
Residual values, (x)	No. of traverses (including peak run)	1	1	1				
	Relative horizontal displacement							mm
	Shear stress							kPa
	Vertical movement at residual shear stress							mm



Total test time 9 days

Shear Strength Parameters

Peak strength, (o)		Regression	Manual
c '	kPa	17	-
Ø '	degrees	32.5	-

Residual strength, (x)

c'_R	kPa	not assessed	-
$Ø'_R$	degrees	not assessed	-

Remarks: Test carried out on material passing 20 mm; Target Dry Density 1.86-1.95 Mg/m3; Target Moisture Content 9 %; Sample immersed for at least 24 h, consolidated for at least 24 h and sheared as per Specification for Highway Works Series 600 Clause 636.

Signed: Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

TEST CERTIFICATE

**DETERMINATION OF SHEAR STRENGTH
BY DIRECT SHEAR
(LARGE SHEARBOX APPARATUS)**

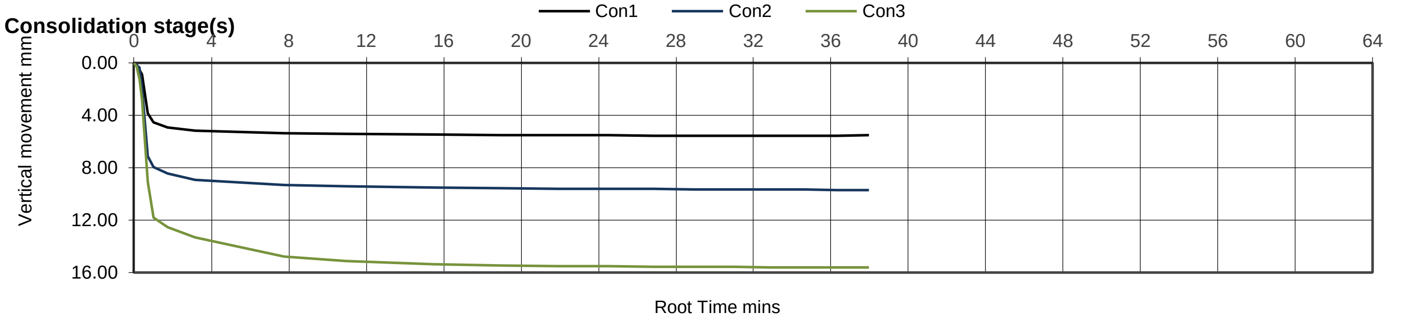
Tested in Accordance with:BS 1377-7:1990: Clause 5.5.4

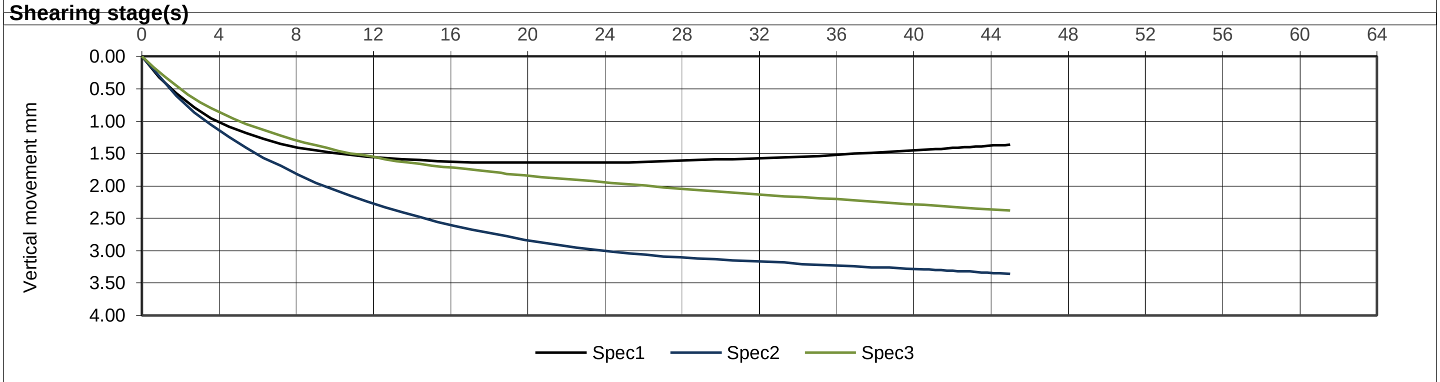
Client:	Rogers Geotechnical Services Ltd	Client Reference:	C3485
Client Address:	Offices 1&2 Barncliffe Business Pk, Near Bank, Shelley, Huddersfield, West Yorkshire, HD8 8LU	Job Number:	23-33700-1
		Date Sampled:	Not Given
		Date Received:	09/05/2023
Contact:	Harry Letch	Date Tested:	19/06/2023
Site Address:	Draughton Quarry	Sampled By:	Not Given

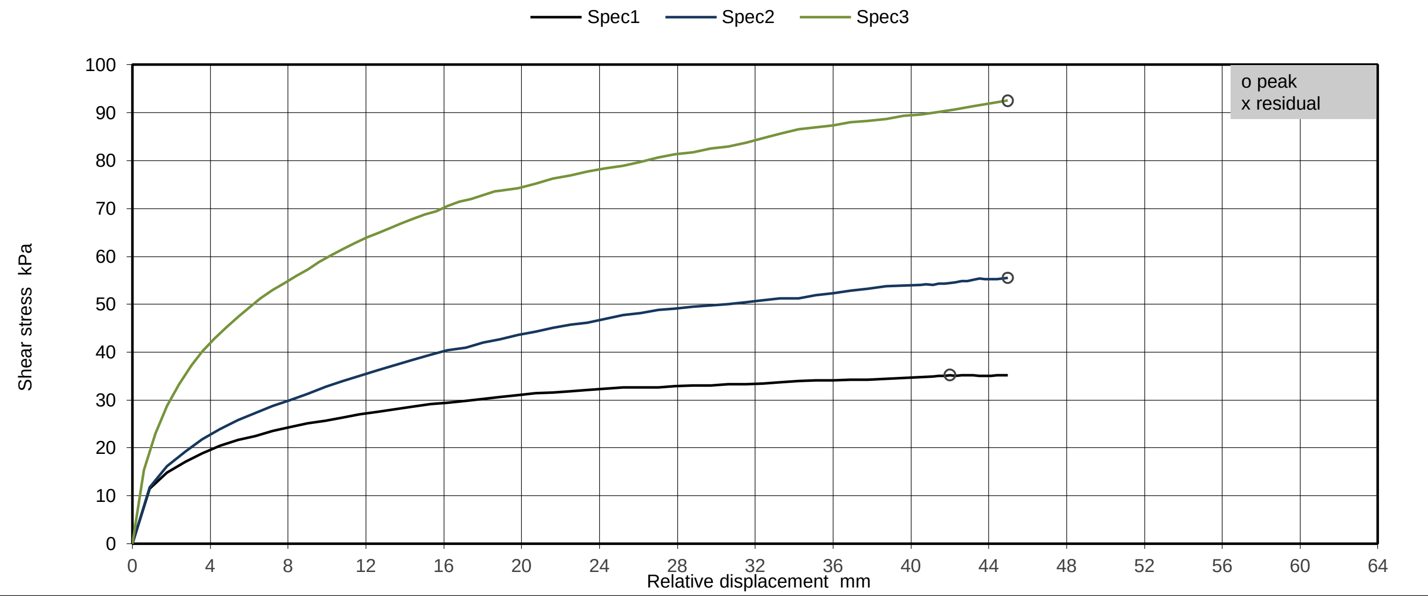
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2678694	Depth Top [m]:	0.50
Hole No.:	TP01A	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Greyish brown clayey GRAVEL with cobbles		







Remarks:	Test carried out on material passing 20 mm; Target Dry Density 1.86-1.95 Mg/m3; Target Moisture Content 9 %; Sample immersed for at least 24 h, consolidated for at least 24 h and sheared as per Specification for Highway Works Series 600 Clause 636.

Signed: Katarzyna Koziel
Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 26/06/2023

GF 402.8

ENVIRONMENTAL GEOTECHNICAL

End of Lab Report

Appendix 7

Previous RGS Slope Assessment Report

Environmental
Geotechnical
Specialists

RGS

REPORT

job number J3571/16/E	site address Draughton House
date	Low Lane,
	Darughton, Skipton
written by J. Farnsworth	BD23 6EA
checked by I. Sakoor	issued by J.Farnsworth

Rogers Geotechnical Services Ltd
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Huddersfield, West Yorkshire HD8 8LU.

GEOTECHNICAL
ENVIRONMENTAL

Contents

Appendices

Environmental Geotechnical Specialists RGS

Report on a Slope Stability Assessment

Location:	Draughton House, Low Lane, Draughton, Skipton BD23 6EA		
For:	Mr and Mrs Hargreaves		
Consultants:	Peter Harrison Architects		
Report No.	J3571/16/E	Report Date:	March 2017

For and on behalf of **Rogers Geotechnical Services Ltd**

[redacted]

James Farnsworth BEng FGS Senior Geo-environmental Engineer	**Steve Rogers** CEng, CGeol, MICE, MCIHT, FGS Technical Director

Report Summary[1]

Item	Comments	Section
Development	Two detached domestic dwellings.	1.
Geology	No superficial deposits over Worston Shale Group.	See Geotechnical Report.
Strata Conditions	Limited thickness of topsoil over predominantly made ground. • Plot 1, made ground over soft becoming firm slightly gravelly clay and weak mudstone. • Plot 2, made ground with presumed rockhead at ≈1.8m to 2.5m. • Slopes, made ground generally comprising soft slightly gravelly clay with cobbles (probable reworked/accumlated local geology).	See Geotechnical Report.
Groundwater	None recorded.	See Geotechnical Report.
Slope Stability	The current slope profiles at the site have been found to have factors of safety against instability of less than 1, suggesting that the slopes are unlikely to remain stable. In order to prevent instability, a maximum slope angle of 30° or soil nails should be employed at the site.	3.

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

Mr and Mrs Hargreaves propose to develop the old quarry adjacent to Draughton House, Low Lane, Draughton, Skipton BD23 6EA by the construction of two new detached domestic dwellings. Consequently, a site investigation was carried out by Rogers Geotechnical Services, which was presented as J3571/16/E, a *Report on a Geotechnical Investigation*, in August 2016. It should be appreciated that within this report, and following an inspection of the slopes at the site during the investigation, a concern in regard to the stability of the slopes was reported and it was recommended that stability analyses be carried out.

This report presents the stability analysis and discusses the slopes at the in relation to the proposed development.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Discussion of Ground Conditions - Geotechnical

The current site proposals indicated that two dwellings will be constructed at the site, which is the location of a former quarry. Whilst, the precise structural details are not currently known and thus the discussion below is of a generalised nature, it is apparent that there are a number of slopes present at the site which are associated with the previous site use. The slopes in and around the quarry were inspected during the site investigation and the results are annotated on the site plan included in the geotechnical report, which is also presented as Appendix 1 to this report. Moreover, the details provided by the previous geotechnical report have been used extensively in order to obtain approximate levels and profiles for the slopes at the site.

Plans indicated that Plot 1 will be constructed to the north of the site and will be situated on the higher ground with slopes grading down to the lower level. The level change is least to the north of the plot but increases through the western flank where, to the south of the plot, the level change is at its greatest. It may be appreciated that the lower ground level around Plot 1 represents the route of the access road which joins the main access that runs between the site entrance and Plot 2. Conversely to Plot 1, Plot 2 is situated to the south of the site and is situated at the lower level of the site in what would appear to be the former quarry base. As such, Plot 2 is surrounded to the north, east and south by slopes which grade down from the higher level.

In general terms, the previous investigation noted that there was evidence of active slope movement in the form of terracing, bent and inclined trees and shrubs, piling up of soil behind exposed boulders and vegetation (trees and shrubs) and uneven slope faces (possible local failure now grassed over). Furthermore, some upper slopes were considered to be formed at relatively high angles (approaching 52°), whilst lower slopes were generally, but not exclusively, formed at shallower angles.

3.1 Analyses

Slope stability analyses have been undertaken and the results are presented in Appendix 2. These analyses were undertaken using the idealised soil parameters presented in the following table. For the purpose of the design, it has been assumed that the strata underlying the site are in a similar condition throughout.

Table 1: Summary of Geotechnical Parameters

Property	Range of values			Comments
Assumed effective stress parameters	Cohesive Made Ground (on slopes)	C_u	- 35° 18kN/m^3	Based on dynamic probes, laboratory testing results, engineer inspection and typical established values.
	Mudstone	C_u	- 27°* 23kN/m^3	Based on engineer inspection and typical established values.
	Limestone	C_u	- 33°* 23kN/m^3	Based on engineer inspection and typical established values.

*It should be appreciated that that the effective friction angle within rock will be governed by the rock mass stability i.e. the friction angle on the discontinuities (bedding, joints etc) within the rock. As a consequence, the arrangement of discontinuities will govern the ultimate stability. However, the value presented in the above table is based on a typical value for a wet plane within a rock mass.

The effective friction angle provided above for the mudstone and limestone may be considered in regard to potential mass stability performance. However, in order to establish the stability of the soil present in front of the anticipated rock face, it was necessary to employ as high angle of friction as possible such that the effect of the rock on slope stability were minimised. Due to this, a friction angle of 50°, the maximum allowed by the software, has been employed in the attached calculations.

Due to the variable slope angles at the site, two analysis types have been carried out. The first type considered the most onerous slope profile at the site and attempted to establish whether this section of slope indicated that stability would be an issue for the development. Following this, a second type of analysis was carried out whereby an idealised slope was employed and various slope angles were iterated in order to ascertain a safe slope angle. It may be noted that once a slope angle with a reasonable factor of safety was established, a water profile was introduced and slope angles were then re-evaluated to determine suitable stability conditions.

Furthermore, it may be noted that the proposals for Plot 1 suggest that the dwelling will not be close enough to the crest of any slopes such that surcharge of any critical failure planes is likely, particularly as foundations are likely to be at depths of 1m to 2m below ground level. Notwithstanding this, a 10kN/m² surcharge was considered in the analyses to evaluate the effect on the factor of safety for stability.

The results of the analyses are summarised below.

Analysis 1 – Most onerous slope (i.e. slope immediately south of Plot 2). N.B. minor slip planes in the slope face discounted.

- (Analysis 1) With slip planes daylighting at the base, FoS = 0.69
- (Analysis 1-2) With slip planes daylighting at the change in gradient halfway up the slope i.e. failure within the upper section of the slope, FoS = 0.42
- The effects of the 10kN/m² surcharge were found to be negligible due to the likely presence of rockhead at shallow depths below the high level.

Analysis 2 – Idealised 10m high slope at varying slope angles with slip planes daylighting at the base N.B. minor slip planes in the slope face discounted.

- (Analysis 2-1) Slope angle of 32°; FoS = 1.20, with water profile; FoS = 1.08
- (Analysis 2-2) Slope angle of 30°; FoS = 1.35, with water profile; FoS = 1.10
- The effects of the 10kN/m² surcharge were found to be limited typically reducing the factor of safety by 0.01.

It may be noted that although the current stability of these slopes may be dependent on other effects, for instance cohesion and the action of vegetation roots, such properties cannot be relied upon in the long-term.

3.2 Discussion

From the analyses it can be seen that the most onerous slope at the site (10m high slope, lower section angle of 42°, higher section angle of 52°) has a factor of safety against instability of less than 1 (Analysis 1). The even lower factor of safety determined for the upper, steeper, section of the slope (Analysis 1-2), suggests that the upper section is less likely to maintain stability than compared to the lower gradient. In either case, this would suggest that the soil material in front of the rock faces at the site is unlikely to remain stable.

Whilst these slip planes are relatively shallow within this material, a failure within this soil would present a risk of a potentially significant mass of soil encroaching into the area around Plot 2 and the access road. Moreover, the failure of material from the slopes could encroach into the area around Plot 1, although there would appear to be significant distance from the proposed location of Plot 1 and the crest of the slopes. As such, failure of the soil on the slopes may not present an immediate issue to the stability of Plot 1. However, should the failure of soils on the slope expose the underlying rock, rock mass instability may present a secondary risk.

The second set of analyses has established that the soils present within the slopes around the site are likely to maintain stability, with a suitable amount factor of safety, if they are present at angles of no greater than 32° (Analysis 2-1). However, from the further analyses, it can be seen that the factor of safety drops to concerning values if a water profile is considered. Notwithstanding this, when a slope angle of 30° is evaluated (Analysis 2-2), a comfortable factor of safety is calculated and while the presence of a water profile still reduces the safety factor, it does rise slightly.

Although the groundwater profile of the site is not fully established, there is a potential for groundwater to ingress the slope over the life time of the structures. Therefore, it is recommended that slope angles of 30° or less are adopted at the site. This however does come with some acceptance that the presence of water may reduce the factor of safety for the slopes to low levels, albeit that the slopes should remain stable.

3.3 Remediation

In light of the above, it is recommended in the first instance that a maximum angle for the soil slopes at the site of 30° is considered. However, through the use of reinforcement within the slopes, it may be possible to maintain the current angles. These options are discussed further below.

3.3.1 Slope re-grading from the lower level

A 30° angle for the slopes at the site could be achieved by re-grading the existing slope from the toe, thus removing the soils from the upper levels of any buried rock faces. This action would of course leave any buried rock faces exposed and therefore some caution will be necessary to ensure that the stability of the rock mass is maintained. This is particularly pertinent for any slopes which face approximately to the south given that the dip of the bedding, a potential plane of sliding, is likely to be toward this direction. Moreover, the mass stability will also be governed by the presence of discontinuity sets within the rock, which will be at various angles to the bedding and could form unstable blocks or wedges within the rock mass. It will not be possible to establish the nature of the potential failures within the rock mass until a survey can be carried out, which in turn will not be possible until rock faces are exposed.

In light of the above, should this approach be adopted, it is recommended that the soil from the slopes is excavated carefully from the top downward with regular inspection by a suitably qualified engineer, along with rock mass stability assessment. It would also be prudent to ensure that any digging equipment is suitably armoured to protect the machine operator and pedestrian access to the slopes is restricted to properly briefed, authorised, personnel. It should be appreciated that should assessment of the rock mass reveal that unstable materials could present a risk to the dwellings, it may be necessary to install rock netting or rock bolts to ensure either the retardation or prevention of rock falls.

3.3.2 Slope re-grading from the higher level

As an alternative to the above, it would also be possible to re-grade the slopes at the site to 30° by taking an angle from the crest of the slope at the higher level. It may be noted that given sufficient land take, it may be possible in some areas to maintain a 30° slope from the higher to the lower level, although this would of course reduce the current useable area.

Where there is insufficient space for such a slope, it would be possible to incorporating a retaining wall at the base of the slope at the lower site level. The height of the retaining walls would be governed by the necessity to maintain the 30° slope angle and would therefore vary throughout the site.

There are a number of retaining wall construction methods that could be employed, although gravity walls, such as gabion baskets, crib or mass concrete, or cantilever walls, such as a reinforced concrete panel, are likely to be the most cost effective. The stability of retaining walls at the site should consider the recommendations given in Section 8.1 – *Foundations* of the geotechnical report and earth pressures should be determined from the material properties given in Table 1: *Summary of Geotechnical Parameters* above. Where buried concrete is to be employed as part of the retaining wall construction, Section 8.5 – *Effect of Sulphates* of the geotechnical report should also be considered.

Given that the analyses carried out in this report have demonstrated that the stability of the slopes at this site is particularly sensitive to the presence of water, care must be taken to ensure that adequate drainage is provide to the back of any retaining walls. It may be necessary to establish a maintenance regime for the walls to ensure that suitable drainage is provided throughout the life of the structures. Moreover, the egress of water from the slopes should be appropriately channelled to ensure that water does not undermine the stability of the retaining walls and slopes, and flooding of Plot 2 does not take place.

3.3.3 Soil Nails

Should the re-grading of the existing slopes be considered unfavourable, it may also be possible to maintain stability with the use of soil nails. Such a system requires the insertion of reinforcing elements into slopes on a grid spacing such that the sliding resistance of failure planes within the soil is increased. Care must be taken to ensure that soil nails are installed to beyond the potential failure slip circle, which in this case may possibly be only a few metres into the surface.

It should be appreciated that the advice of specialist contractors will be required in order to determine the length and spacing of the soil nails. However, it should be noted that rock may be present at shallow depths near the top of the slopes and care will need to be taken to ensure that the installation technique will achieve sufficient penetration.

It may be possible to install the soil nails from the lower level at the site, depending on the reach of the equipment. Alternatively, an over-reaching machine could be employed to install nails from the higher level. In either case, it will be necessary to ensure that the stability of the machinery is maintained when working near the slopes. Moreover, in view of the relatively weak near surface soils it will be necessary to construct a working platform for any plant required during the works. Such a design should be undertaken in accordance with the procedures given in the BRE publication entitled *Working platforms for tracked plant*.

In order to ensure that the ground is adequately supported between nail positons, it will also be necessary to provide a facing element. Whilst reinforced shotcrete may be considered unsightly for such a site, the use of flexible mesh and erosion control fabrics are likely to be more appropriate for the site setting. Care must be taken to make sure that the efficacy of the facing element is maintained throughout the life of the structures and this may require protection from any potential damage due to wildlife. Moreover, following the slope improvement works, it is recommended that access to the slope is restricted as it will present a steep and potentially dangerous hazard to end-users and in particular, children.

3.3.4 Comments

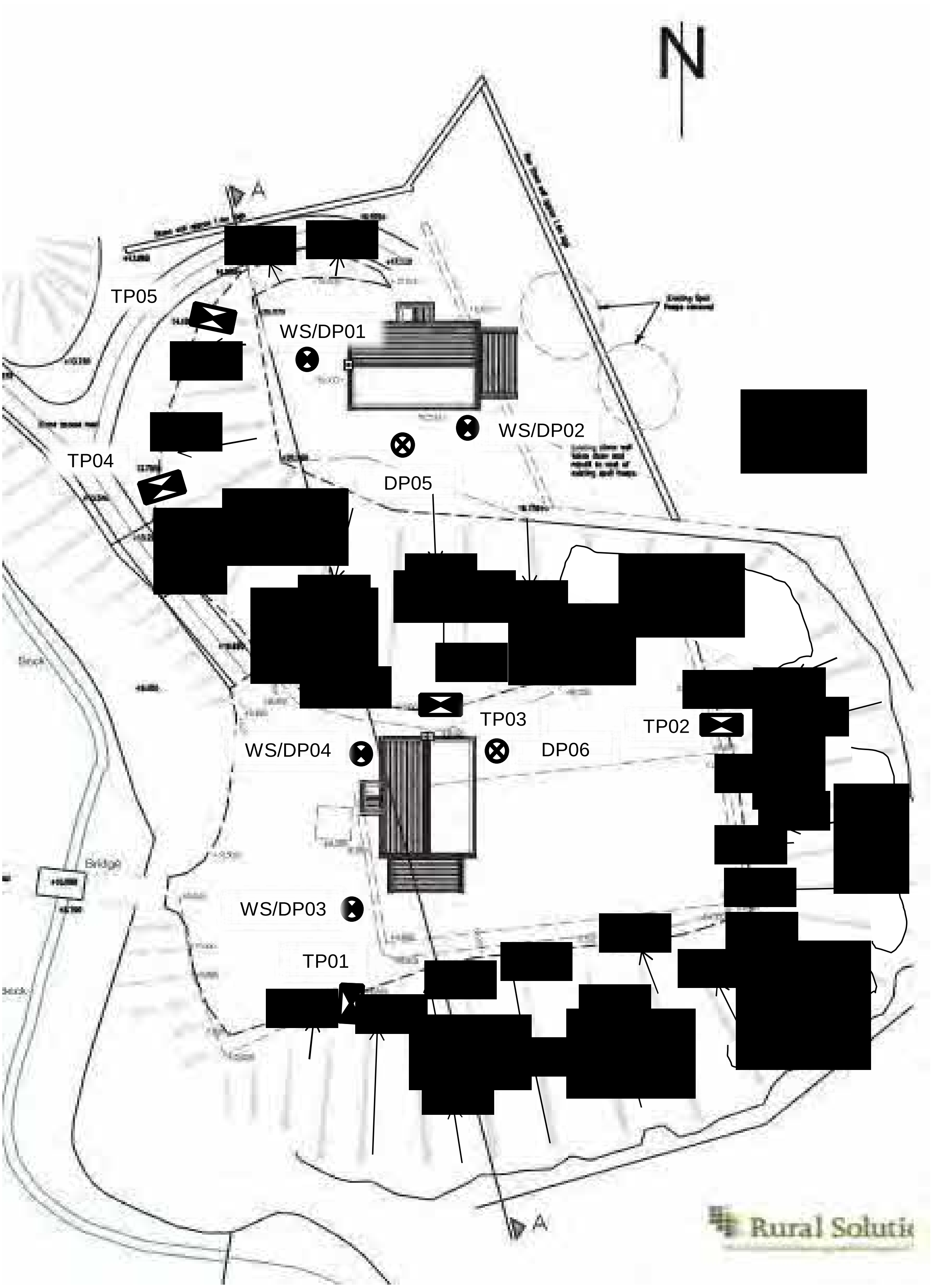
The recommendations given above are likely to require the removal of vegetation currently present on the slopes. This vegetation is likely to be assisting the stability of the over-steep existing slopes, therefore, where vegetation has been removed, inspection of the slope should take place routinely to ensure that the safety of site operatives is not compromised.

4. Recommendations For Further Work

This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
Discussions with ground-works contractors regarding appropriate methods of re-grading the slopes at the site.
Discussions with retaining wall constructors to determine suitable techniques for supporting any elevated slopes.
Discussions with suitably qualified engineers to establish proposals for rock mass stability assessment.
Discussions with soil nail contractors in relation to possible slope improvement schemes.
Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (i.e., Waste Acceptance Criteria) and the suitability of imported materials, if required.
Detailed design of the scheme.

Appendix 1

Site Plan



Plan not to scale and investigation positions approximated from site operative's notes.

Title:

Investigation Location Plan

Rogers Geotechnical Services Ltd	Site Name: **Draughton House, Draughton, Skipton BD23 6EA**	Job No: **J3571/16/E**

Appendix 2

Stability Analysis Calculations

Rogers Geotechnical Services Ltd	Page No 1 Analysis 1
CADS ReSlope, Version 1.20 Slope stability analysis and design of reinforced soil slopes	Project J3571/16/E File Name section 1.rsp
Draughton House, Low Lane, Skipton BD23 6EA Most onerous slope condition	Engineer JRF Date 08/03/2017

Partial factors

Ramifications of failiure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi)values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Soils input data

	Density kN/m3	Phi deg.	Cohesion kN/m2	Ru ratio	Suction m (max)
VS gravelly CLAY	18.0	35	0	0.00	0.0
Rock	23.0	50	0	0.00	0.0

Soil strata surface points

	X m	Y m
VS gravelly CLAY	0.00	0.00
	1.00	0.00
	6.60	5.00
	9.50	10.00
	40.00	10.00
Rock	0.00	0.00
	7.74	0.00
	9.50	10.00
	40.00	10.00

Water input data Density 9.81 kN/m3

Loading input data

Load type	Magnitude	X Min m	X Max m	Y m
Surcharge	10.0 kN/m2	9.50	40.00	Surface

No soil reinforcement was specified

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
Depth of water filled tension crack is 0.0 m
Grid of centres of circles

X Minimum value	-5.8	m
X Maximum value	-5.8	m
X Increment value	.3	m
Y Minimum value	14.5	m
Y Maximum value	14.5	m
Y Increment value	.3	m

The radius of circles is determined by passing through a common point
The common point coordinates are X = 1.00 m
Y = 0.00 m

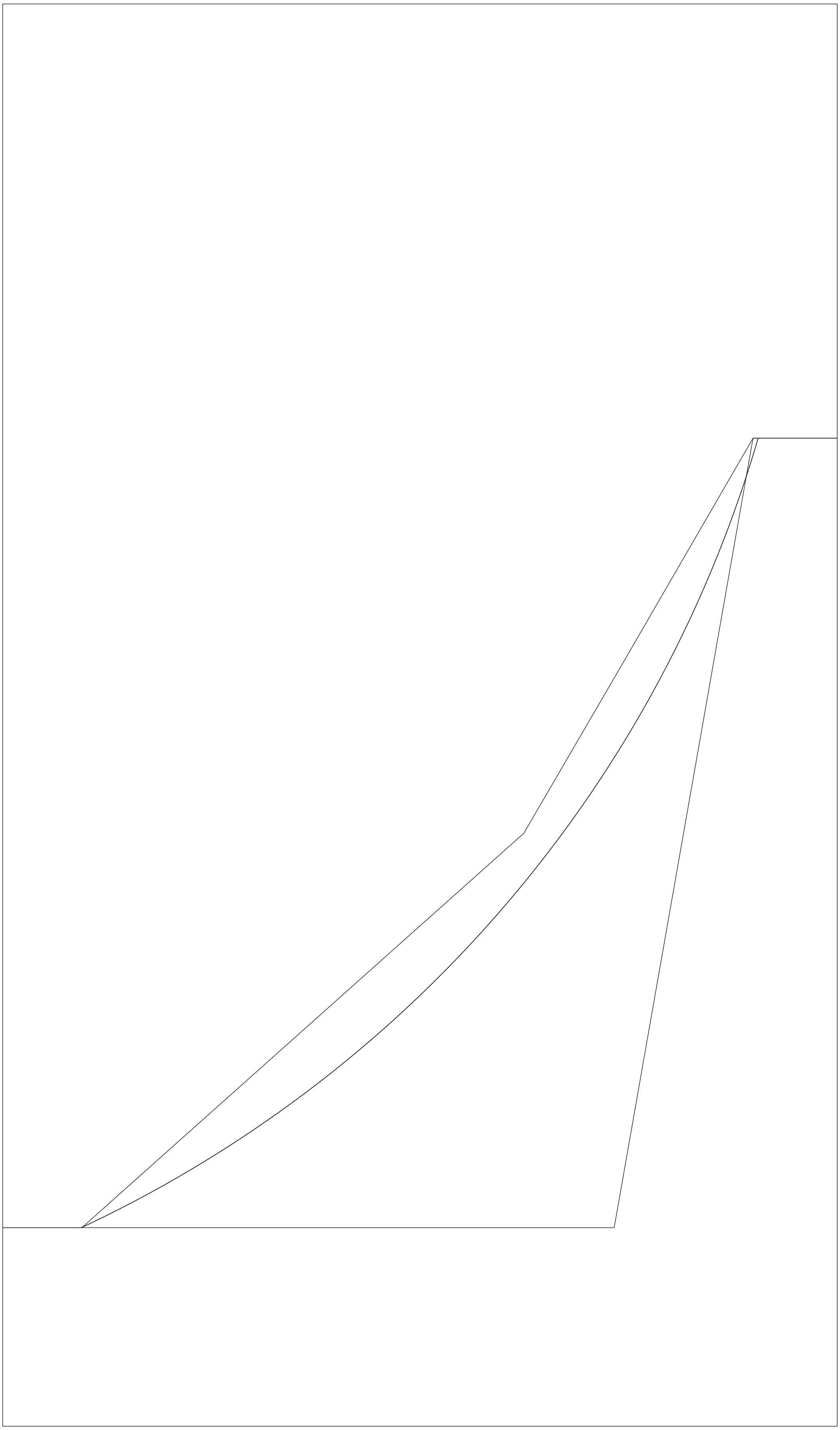
Tabular printout of circular slips

X	Y	Radius	Disturb	Restore Soil	Restore RForce	Stability Factor
m	m	m	kNm/m	kNm/m	kNm/m	-
-5.80	14.50	16.02	1264	877	0	0.69

Critical circle (minimum stability factor) details

Circle centre X coordinate	-5.80	m
Circle centre Y coordinate	14.50	m
Circle radius	16.02	m
Disturbing moment	1264	kNm/m
Restoring moment due to soil shear	877	kNm/m
Restoring moment due to reinforcement	0	kNm/m
Stability factor	0.69	

Diagram showing all circles



Partial factors

Ramifications of failiure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi)values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Soils input data	Density kN/m3	Phi deg.	Cohesion kN/m2	Ru ratio	Suction m (max)
VS gravelly CLAY	18.0	35	0	0.00	0.0
Rock	23.0	50	0	0.00	0.0

Soil strata surface points	X m	Y m
VS gravelly CLAY	0.00	0.00
	1.00	0.00
	6.60	5.00
	9.50	10.00
	40.00	10.00
Rock	0.00	0.00
	7.74	0.00
	9.50	10.00
	40.00	10.00

Water input data Density 9.81 kN/m3

Loading input data

Load type	Magnitude	X Min m	X Max m	Y m
Surcharge	10.0 kN/m2	9.50	40.00	Surface

No soil reinforcement was specified

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
Depth of water filled tension crack is 0.0 m
Grid of centres of circles

X Minimum value	-4.8	m
X Maximum value	-4.8	m
X Increment value	.3	m
Y Minimum value	15.0	m
Y Maximum value	15.0	m
Y Increment value	.3	m

The radius of circles is determined by passing through a common point

The common point coordinates are X = 6.60 m
Y = 5.00 m

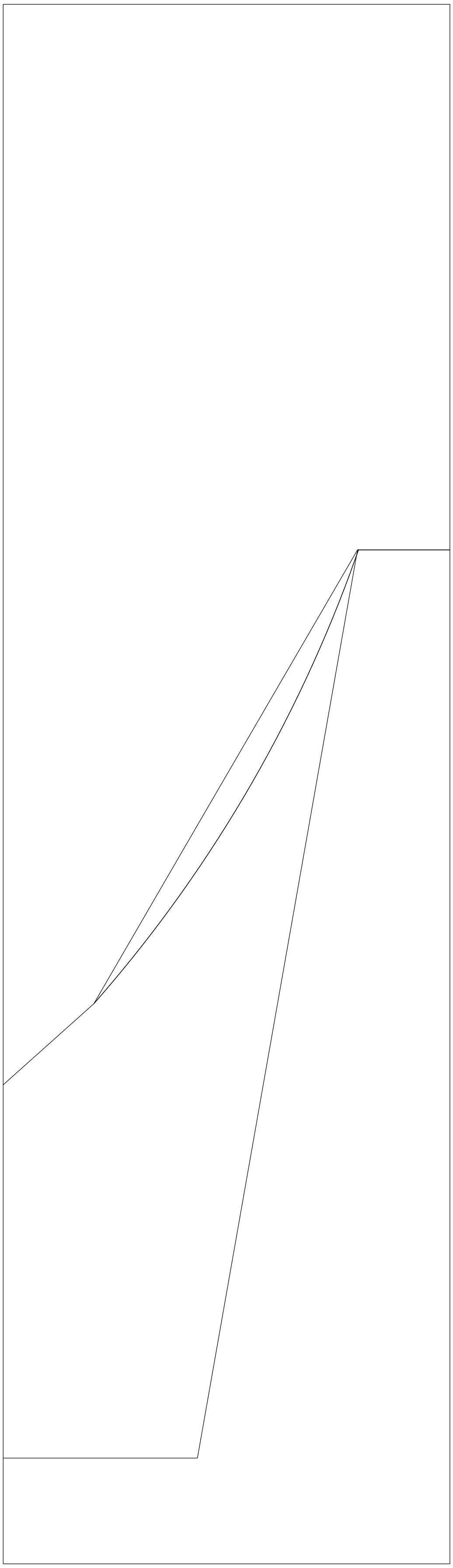
Tabular printout of circular slips

X	Y	Radius	Disturb	Restore Soil	Restore RForce	Stability Factor
m	m	m	kNm/m	kNm/m	kNm/m	-
-4.80	15.00	15.16	261	110	0	0.42

Critical circle (minimum stability factor) details

Circle centre X coordinate	-4.80	m
Circle centre Y coordinate	15.00	m
Circle radius	15.16	m
Disturbing moment	261	kNm/m
Restoring moment due to soil shear	110	kNm/m
Restoring moment due to reinforcement	0	kNm/m
Stability factor	0.42	

Diagram showing all circles



Rogers Geotechnical Services Ltd	Page No 1 Analysis 2-1
CADS ReSlope, Version 1.20 Slope stability analysis and design of reinforced soil slopes	Project J3571/16/E File Name establish phi angle.rsp
Draughton House, Low Lane, Skipton BD23 6EA Idealised section to determine safe slope angle	Engineer JRF Date 08/03/2017

Partial factors

Ramifications of failiure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi)values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Soils input data	Density kN/m3	Phi deg.	Cohesion kN/m2	Ru ratio	Suction m (max)
VS gravelly CLAY	18.0	35	0	0.00	0.0
Rock	23.0	50	0	0.00	0.0

Soil strata surface points	X m	Y m
VS gravelly CLAY	0.00	0.00
	1.00	0.00
	17.32	10.00
	40.00	10.00
Rock	0.00	0.00
	40.00	0.00

Water input data Density 9.81 kN/m3

Loading input data

Load type	Magnitude	X Min m	X Max m	Y m
Surcharge	10.0 kN/m2	17.32	40.00	Surface

No soil reinforcement was specified

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
Depth of water filled tension crack is 0.0 m
Grid of centres of circles

X Minimum value	1.0	m
X Maximum value	2.0	m
X Increment value	1.0	m
Y Minimum value	20.0	m
Y Maximum value	25.0	m
Y Increment value	1.0	m

The radius of circles is determined by passing through a common point

The common point coordinates are X = 1.00 m
Y = 0.00 m

Tabular printout of circular slips

X	Y	Radius	Disturb	Restore Soil	Restore RForce	Stability Factor
m	m	m	kNm/m	kNm/m	kNm/m	-
1.00	20.00	20.00	7108	9544	0	1.34
2.00	20.00	20.02	8738	12543	0	1.44
1.00	21.00	21.00	8104	10963	0	1.35
2.00	21.00	21.02	9736	14123	0	1.45
1.00	22.00	22.00	9103	12455	0	1.37
2.00	22.00	22.02	10733	15771	0	1.47
1.00	23.00	23.00	10102	14019	0	1.39
2.00	23.00	23.02	11722	17168	0	1.46
1.00	24.00	24.00	11099	15649	0	1.41
2.00	24.00	24.02	12721	18950	0	1.49
1.00	25.00	25.00	12096	17346	0	1.43
2.00	25.00	25.02	13720	21128	0	1.54

Critical circle (minimum stability factor) details

Circle centre X coordinate	1.00	m
Circle centre Y coordinate	20.00	m
Circle radius	20.00	m
Disturbing moment	7108	kNm/m
Restoring moment due to soil shear	9544	kNm/m
Restoring moment due to reinforcement	0	kNm/m
Stability factor	1.34	

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Draughton House, Low Lane, Skipton BD23 6EA Idealised section to determine safe slope angle	Engineer JRF Date 08/03/2017

Diagram showing all circles

Partial factors

Ramifications of failiure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi)values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Soils input data	Density kN/m3	Phi deg.	Cohesion kN/m2	Ru ratio	Suction m (max)
VS gravelly CLAY	18.0	35	0	0.00	0.0
Rock	23.0	50	0	0.00	0.0

Soil strata surface points	X m	Y m
VS gravelly CLAY	0.00	0.00
	1.00	0.00
	17.32	10.00
	40.00	10.00
Rock	0.00	0.00
	40.00	0.00

Water input data Density 9.81 kN/m3

Phreatic surface points	X m	Y m
	1.00	0.00
	10.00	3.00

Loading input data

Load type	Magnitude	X Min m	X Max m	Y m
Surcharge	10.0 kN/m2	17.32	40.00	Surface

No soil reinforcement was specified

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
Depth of water filled tension crack is 0.0 m
Grid of centres of circles

X Minimum value	1.0	m
X Maximum value	2.0	m
X Increment value	1.0	m
Y Minimum value	20.0	m
Y Maximum value	25.0	m
Y Increment value	1.0	m

The radius of circles is determined by passing through a common point
The common point coordinates are X = 1.00 m
Y = 0.00 m

Tabular printout of circular slips

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
1.00	20.00	20.00	7120	7765	0	1.09
2.00	20.00	20.02	8737	10081	0	1.15
1.00	21.00	21.00	8114	8993	0	1.11
2.00	21.00	21.02	9736	11471	0	1.18
1.00	22.00	22.00	9103	10286	0	1.13
2.00	22.00	22.02	10732	12876	0	1.20
1.00	23.00	23.00	10102	11670	0	1.16
2.00	23.00	23.02	11722	14127	0	1.21
1.00	24.00	24.00	11099	13129	0	1.18
2.00	24.00	24.02	12736	15713	0	1.23
1.00	25.00	25.00	12095	14637	0	1.21
2.00	25.00	25.02	13734	17606	0	1.28

Critical circle (minimum stability factor) details

Circle centre X coordinate	1.00	m
Circle centre Y coordinate	20.00	m
Circle radius	20.00	m
Disturbing moment	7120	kNm/m
Restoring moment due to soil shear	7765	kNm/m
Restoring moment due to reinforcement	0	kNm/m
Stability factor	1.09	

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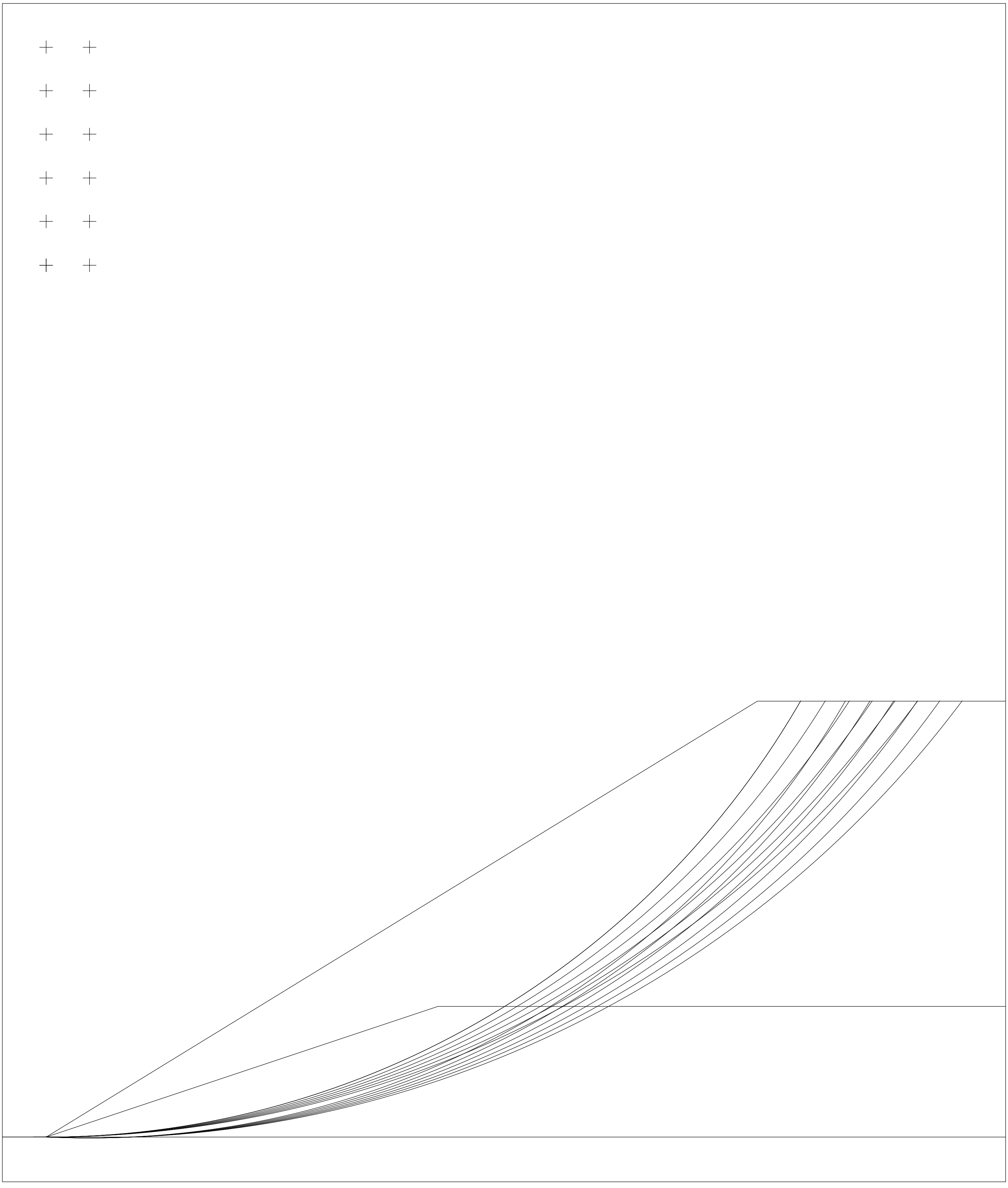
Diagram showing all circles



End of Report

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