PARTICLE SIZE DISTRIBUTION TEST

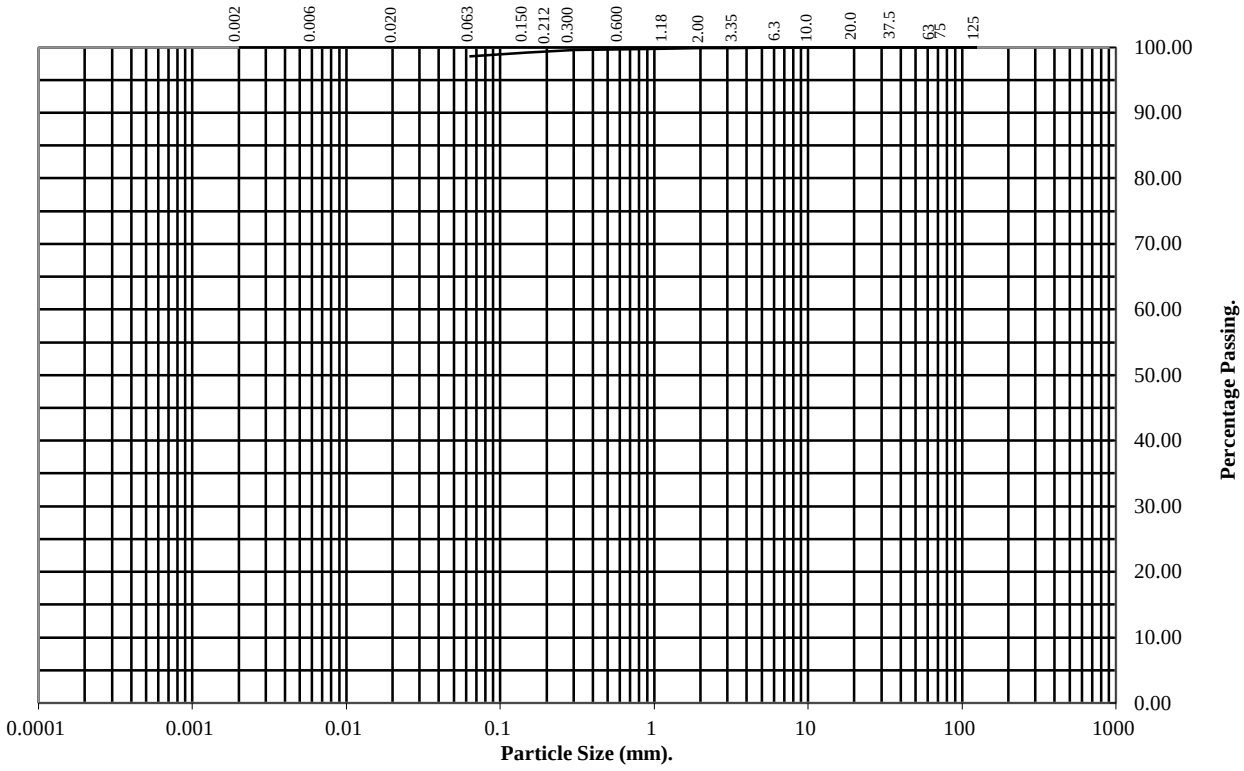
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WBH103** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **D**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	100
0.212	99
0.15	99
0.063	99

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	1
Silt/Clay	99

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

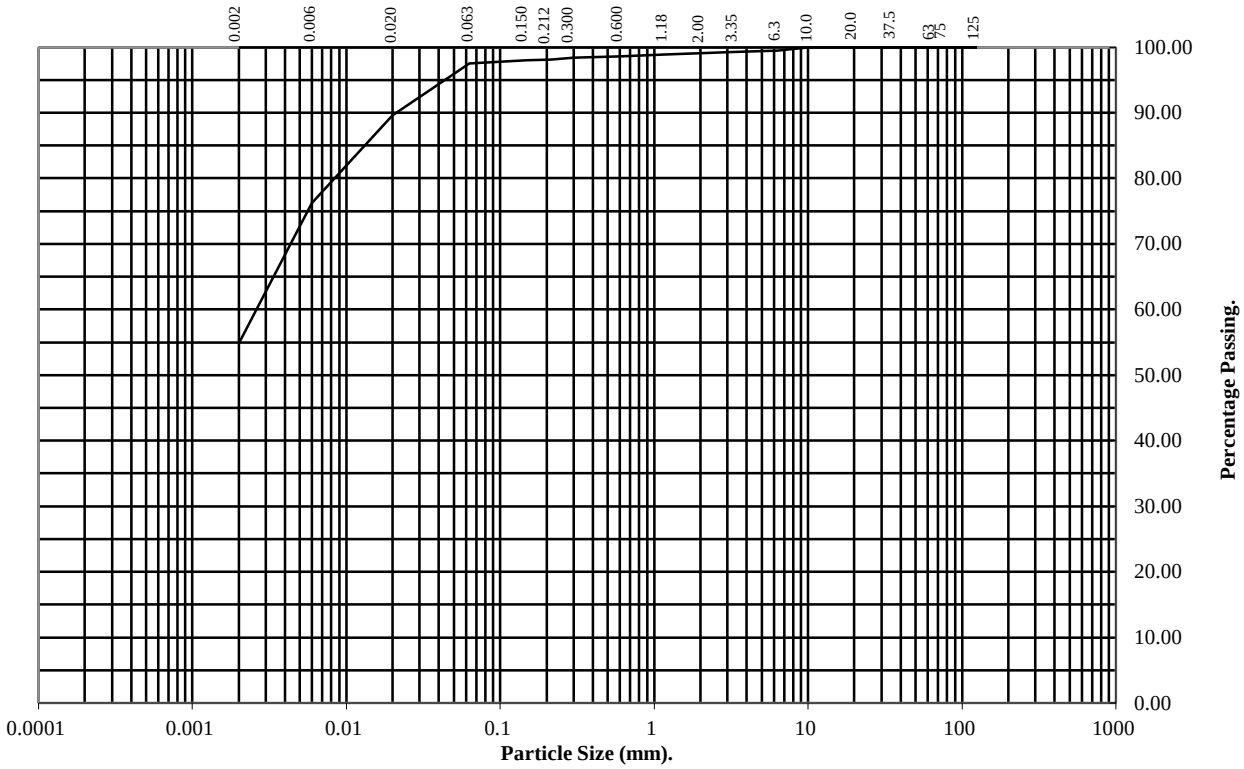
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WBH103** **Top Depth (m):** **14.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	99
2	99
1.18	99
0.6	99
0.3	98
0.212	98
0.15	98
0.063	98

Particle Diameter	Percentage Passing
0.02	90
0.006	76
0.002	55

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	1
Silt	43
Clay	55

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

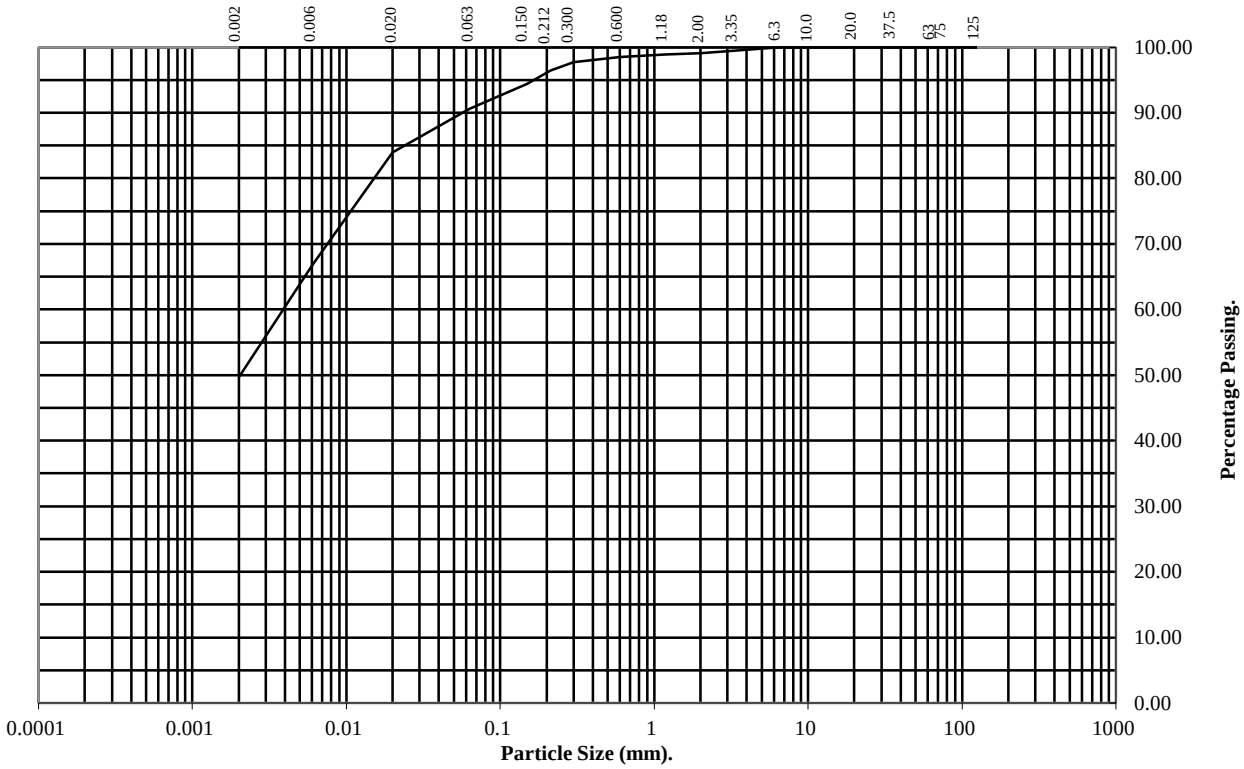
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WBH103** **Top Depth (m):** **23.00**

Sample Number: **Base Depth(m):**

Sample Type: **D**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	99
0.6	99
0.3	98
0.212	96
0.15	94
0.063	91

Particle Diameter	Percentage Passing
0.02	84
0.006	67
0.002	50

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	8
Silt	41
Clay	50

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7582
Client Ref:
WIE17469

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

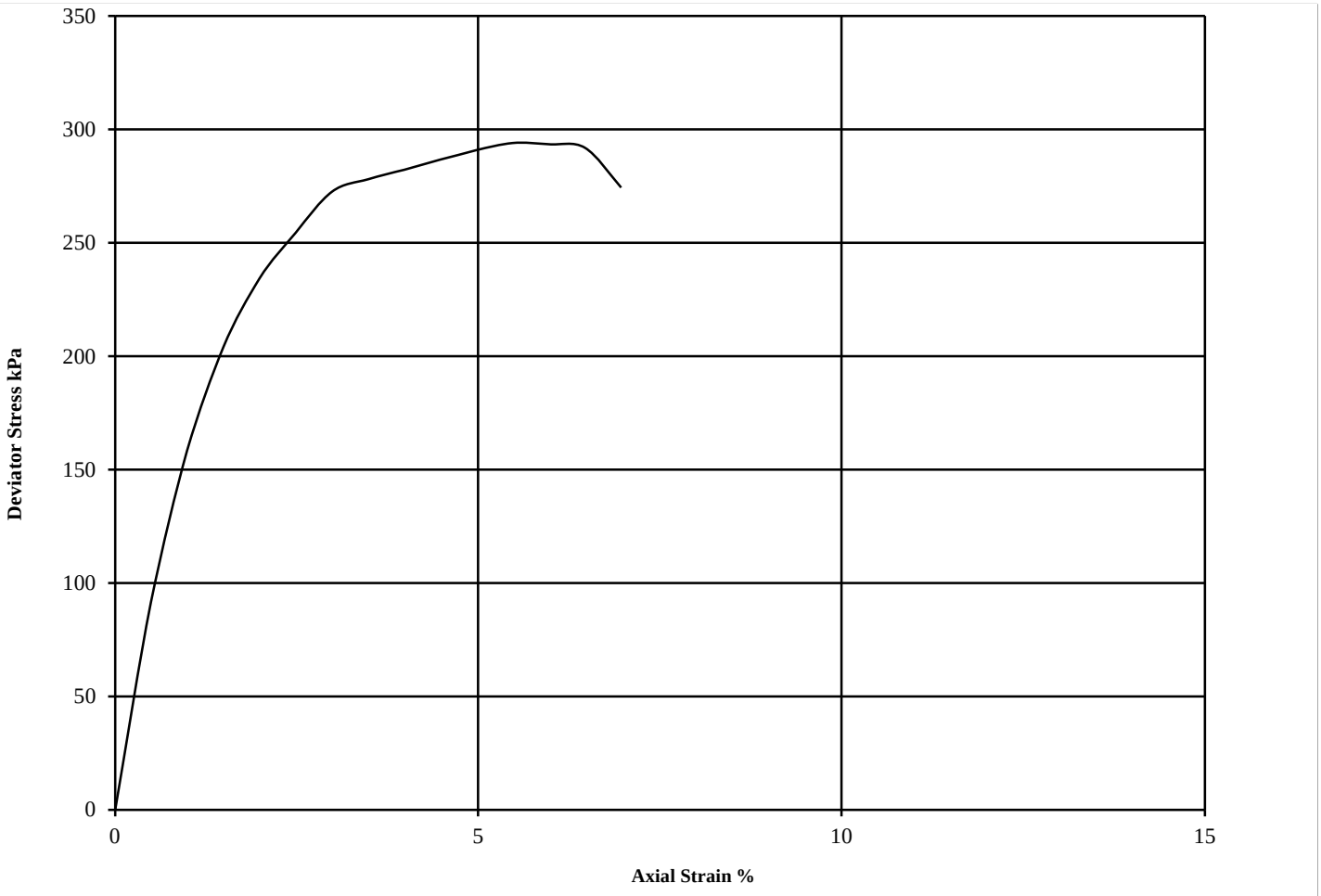
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH103** **Top Depth (m):** **13.50**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\ _1\ \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(\ _1\ \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	27	1.94	1.54	270	294	147	5.5	Brittle	See summary of soil descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

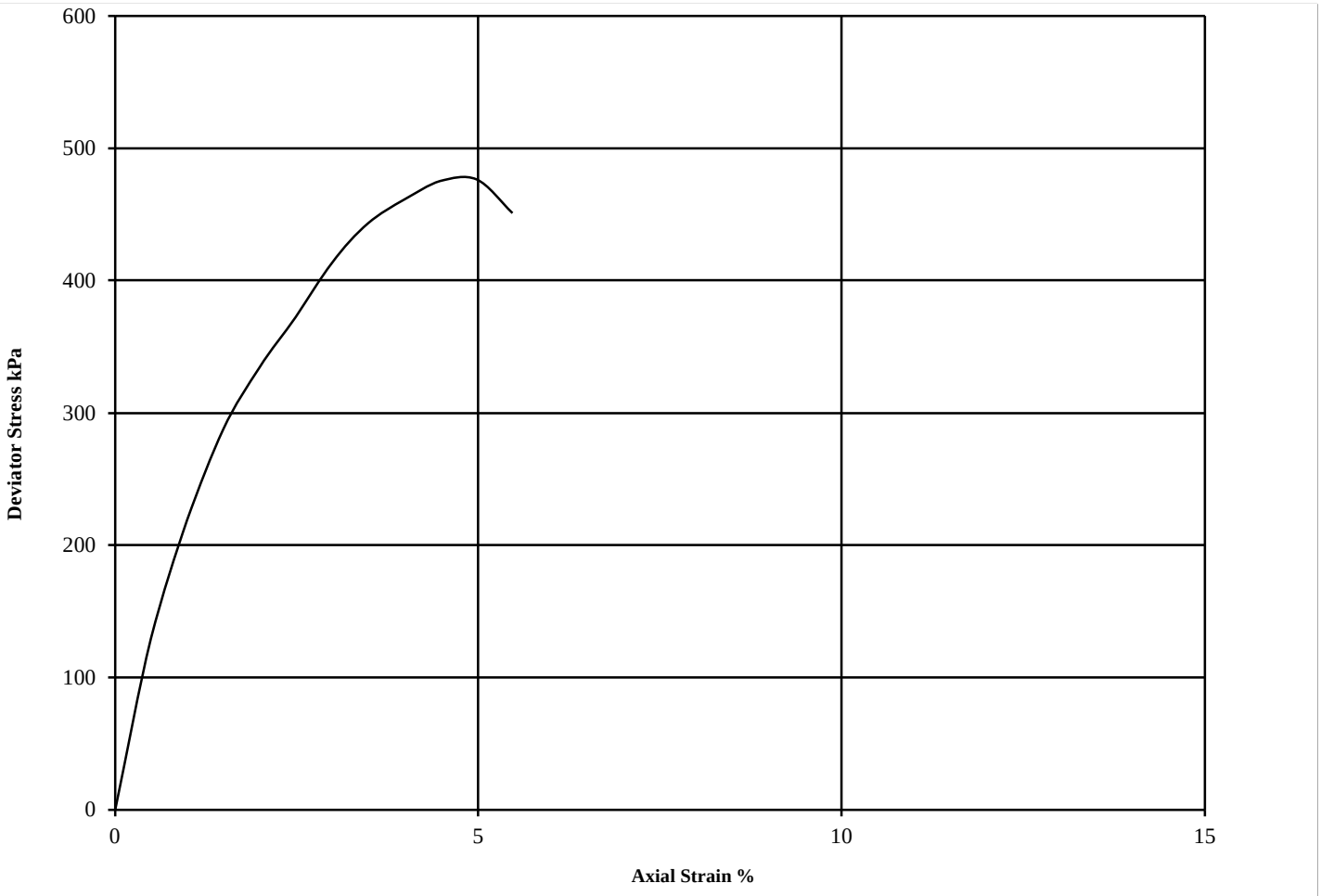
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH103** **Top Depth (m):** **22.50**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(_1 \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(_1 \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	27	1.95	1.54	450	476	238	5.0	Brittle	See summary of soil descriptions

ONE DIMENSIONAL CONSOLIDATION TEST

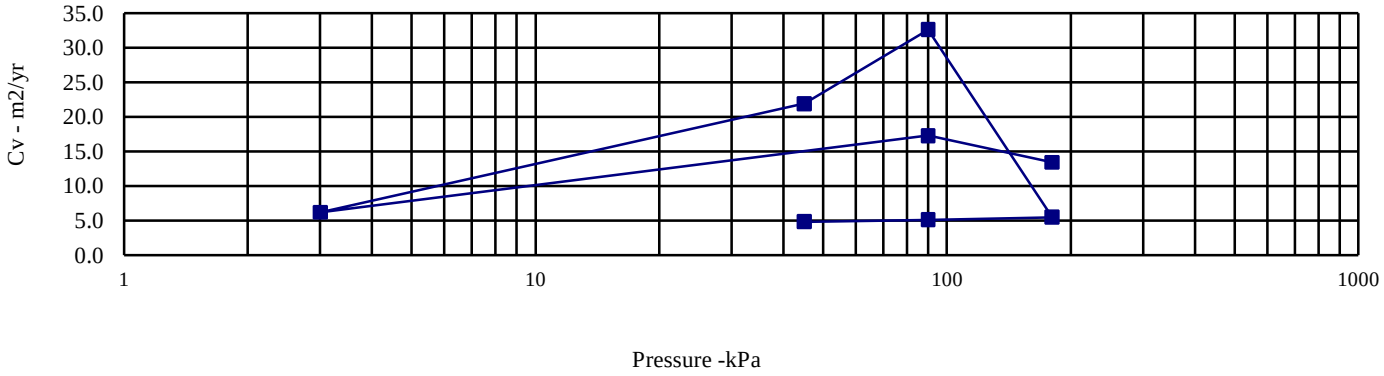
BS 1377: Part 5: 1990: Clause 3

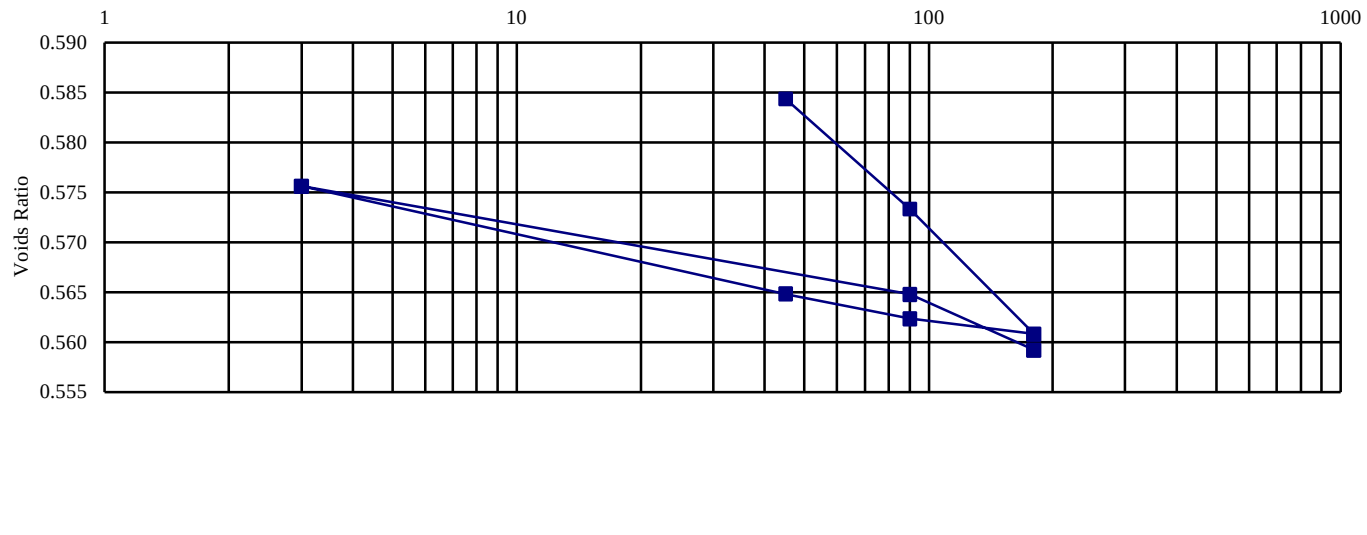
Hole Number: **WBH103** **Top Depth (m):** **4.50**

Sample Number: **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	23						
Bulk Density (Mg/m3):	2.02	0	45	0.334	4.867	Method used to	
Dry Density (Mg/m3):	1.65	45	90	0.154	5.129	determine CV:	T90
Voids Ratio:	0.609	90	180	0.088	5.488	Nominal temperature	
Degree of saturation:	98.3	180	90	0.011	32.612	during test ' C:	20
Height (mm):	20.03	90	45	0.035	21.905	Remarks:	
Diameter (mm)	75.043	45	3	0.164	6.212	See summary of soil descriptions	
Particle Density (Mg/m3):	2.65	3	90	0.079	17.278		
Assumed		90	180	0.039	13.412		





UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

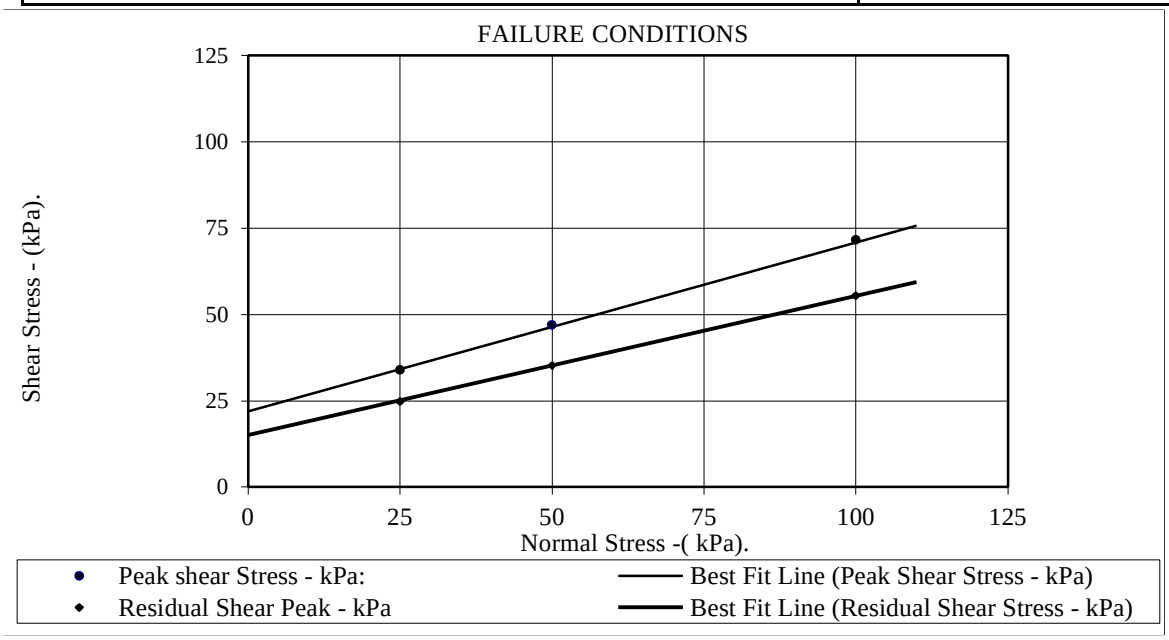
Contract No:
PSL22/7582
Client Ref:
WIE17469

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377 : 1990 Part 7 Clause 4

Hole Number:	**WBH103**		Top Depth	**2.50**
Sample Number:			Base Depth	
Sample Conditions:	Submerged		Sample Type	**U**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Specimen Preparation	Cut and trimmed Undisturbed			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.99	19.99	19.99
Length - mm:	60.05	60.05	60.05
Moisture Content - %:	25	25	25
Bulk Density - Mg/m3:	2.01	2.01	2.01
Dry Density - Mg/m3:	1.61	1.61	1.61
Voids Ratio:	0.647	0.647	0.647
Normal Pressure- kPa	25	50	100
Consolidation Stage			
Consolidated Height - mm:	19.60	19.40	19.06
Peak Shear			
Rate of Strain - mm/min	0.043	0.043	0.043
Displacement at peak shear stress - mm	3.00	3.90	5.10
Peak shear Stress - kPa:	34	47	72
Residual Shear			
Rate of Strain - mm/min	0.086	0.086	0.086
Displacement at residual shear stress - mm	29.00	28.10	30.00
Residual shear Stress - kPa:	25	35	55
Final Consolidation Conditions			
Moisture Content - %:	27	26	24
Bulk Density - Mg/m3:	2.05	2.07	2.11
Dry Density - Mg/m3:	1.62	1.65	1.70
Peak Shear			
Angle of Shearing Resistance:(0)	26		
Effective Cohesion - kPa:	22		
Residual Shear			
Angle of Shearing Resistance:(0)	22		
Effective Cohesion - kPa:	15		



UKAS TESTING 4043

PSL Professional Soils Laboratory

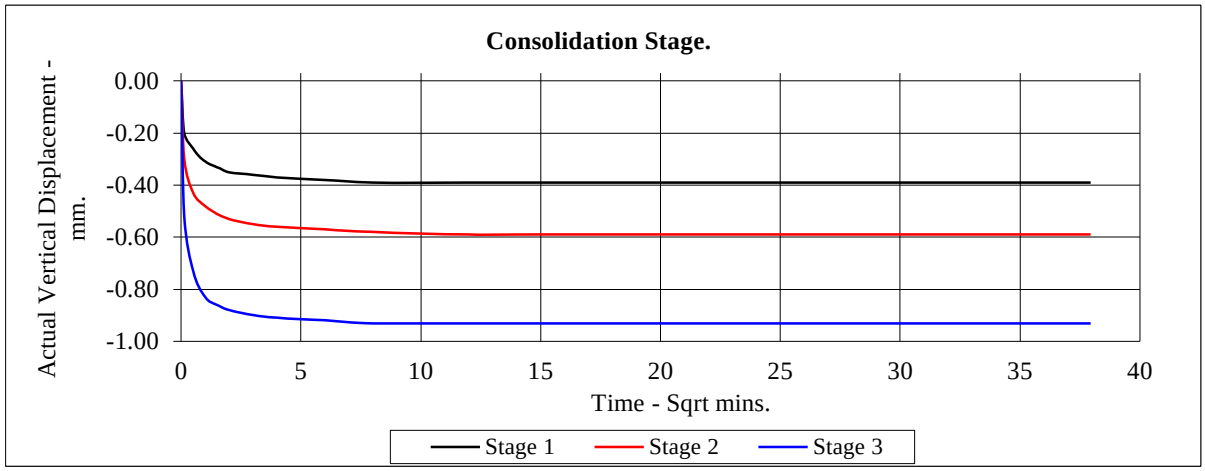
Project Otter

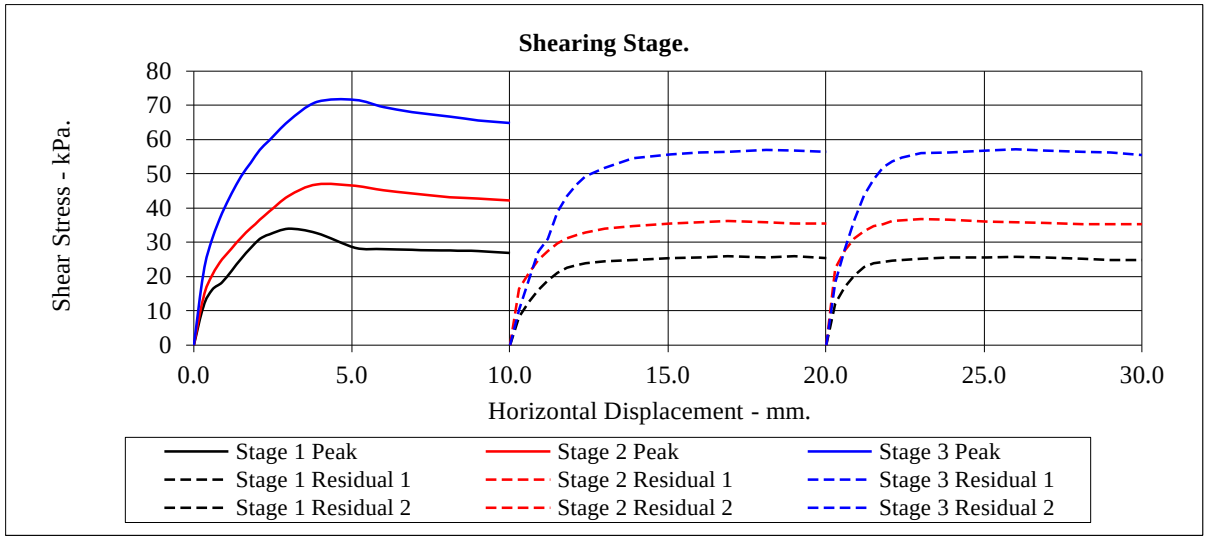
Contract No:
PSL22/7582
Client Ref:
WIE17469

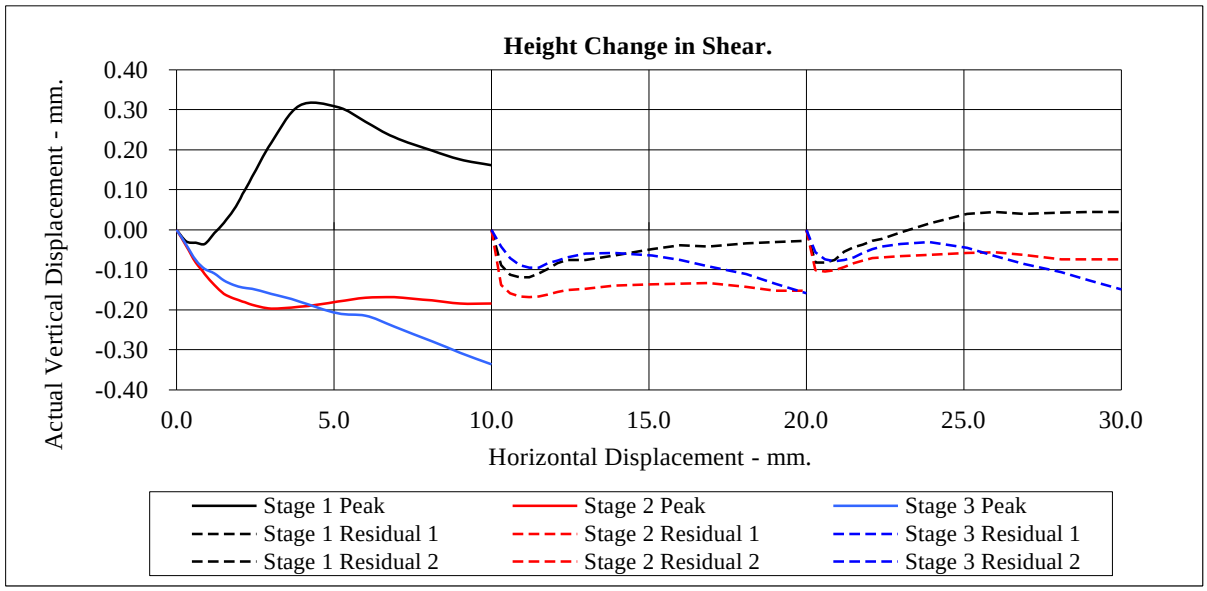
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377 : 1990 Part 7 Clause 4

Hole Number:	**WBH103**	Top Depth:	**2.50**
Sample Number:		Base Depth:	







UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7582
Client Ref:
WIE17469

Certificate of Analysis

Certificate Number	22-25486	*Issued:*	16-Dec-22

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	22-25486
Client Reference	PSL22/7304
Order No	(not supplied)
Contract Title	WIE17469: Project Otter
Description	2 Soil samples.
Date Received	09-Dec-22
Date Started	09-Dec-22
Date Completed	16-Dec-22
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By [redacted]

Kirk Bridgewood
General Manager

2139

Summary of Chemical Analysis
Soil Samples

Our Ref 22-25486
Client Ref PSL22/7304
Contract Title WIE17469: Project Otter

			Lab No	2096380	2096381
			.Sample ID	WBH113	WBH113
			Depth	11.00	24.50
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	22/11/2022	22/11/2022
			Sampling Time	n/s	n/s
Test	Method	LOD	Units		
Metals					
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	17	13
Inorganics					
pH	DETSC 2008#		pH	8.0	8.1
Chloride Aqueous Extract	DETSC 2055	1	mg/l	28	30
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	350	270
Sulphur as S, Total	DETSC 2320	0.01	%	0.26	0.16
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.26	0.18

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 22-25486
Client Ref PSL22/7304
Contract WIE17469: Project Otter

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2096380	WBH113 11.00 SOIL	22/11/22	PT 500ml	Total Sulphur ICP (7 days), pH + Conductivity (7 days)	
2096381	WBH113 24.50 SOIL	22/11/22	PT 500ml	Total Sulphur ICP (7 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

LABORATORY REPORT

4043

Contract Number: PSL22/7847

Report Date: 18 January 2023

Client's Reference: WIE17469-WBH104

Client Name: Groundtech Consulting
First Floor
Lloyd House
Orford Court
Greenfold Way
WN7 3XJ

For the attention of: Michael Berry

Contract Title: Project Otter

Date Received: 9/12/2022
Date Commenced: 9/12/2022

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

[redacted]

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

M Fennell
(Senior Technician)

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Doncaster DN4 0AR
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e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WBH104		AMAL	0.20	0.80	MADE GROUND brown very sandy clayey silty gravel.
WBH104		B	1.50		Brown slightly sandy clayey silty GRAVEL of cobbles.
WBH104		B	7.50		Brown very gravelly sandy CLAY
WBH104		B	9.00		Grey sandy clayey silty GRAVEL.
WBH104		U	18.00		Very stiff grey slightly sandy CLAY.
WBH104		B	18.50		Grey slightly sandy CLAY.
WBH104		U	21.00		Grey slightly sandy CLAY.
WBH104		D	21.50		Grey gravelly slightly sandy CLAY.
WBH104		U	24.00		Stiff grey CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WBH104		B	18.50		27			66	29	37	100	High Plasticity CH
WBH104		D	21.50		24			55	25	30	84	High Plasticity CH

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

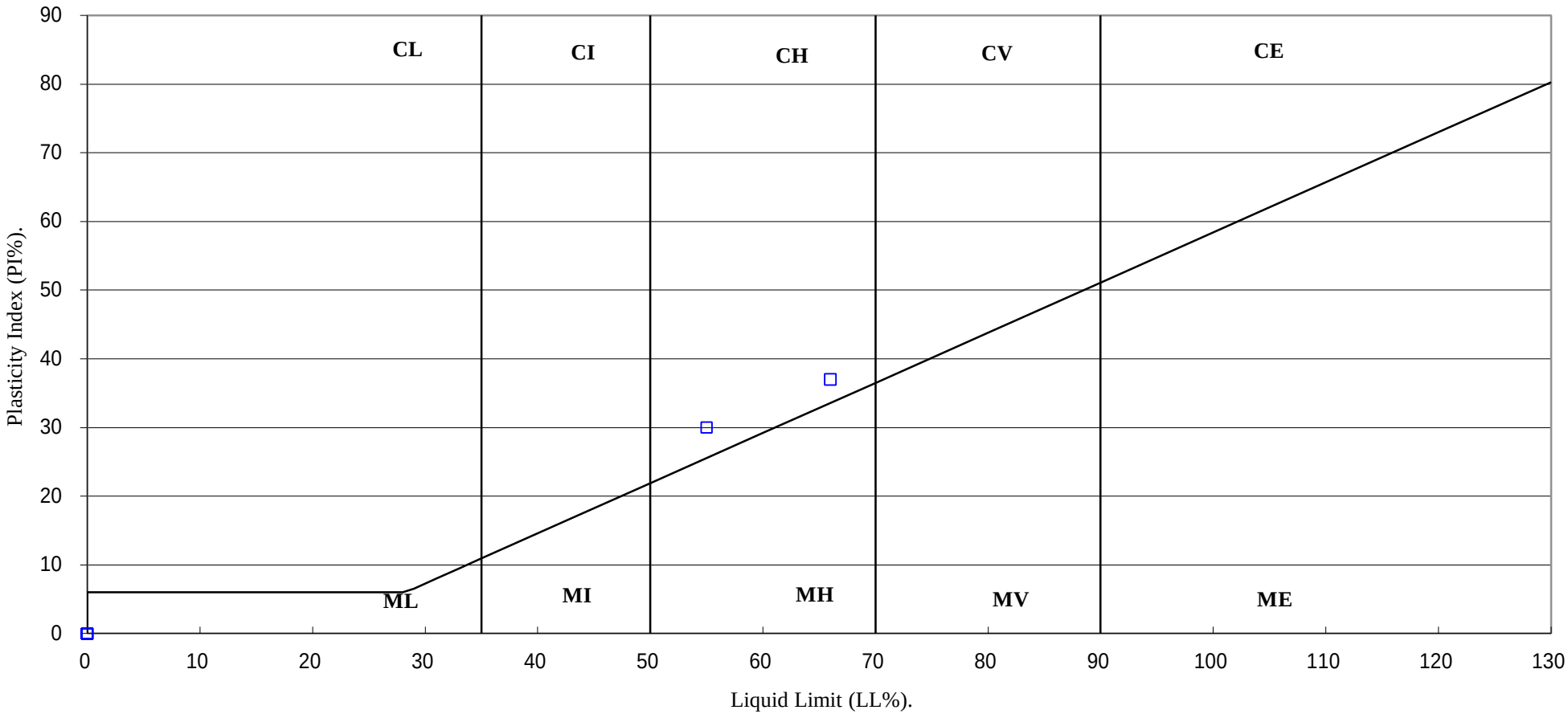
Contract No:

PSL22/7847

Client Ref:

WIE17469

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	**Project Otter**	**Contract No:**
			PSL22/7847
			Client Ref:
			WIE17469

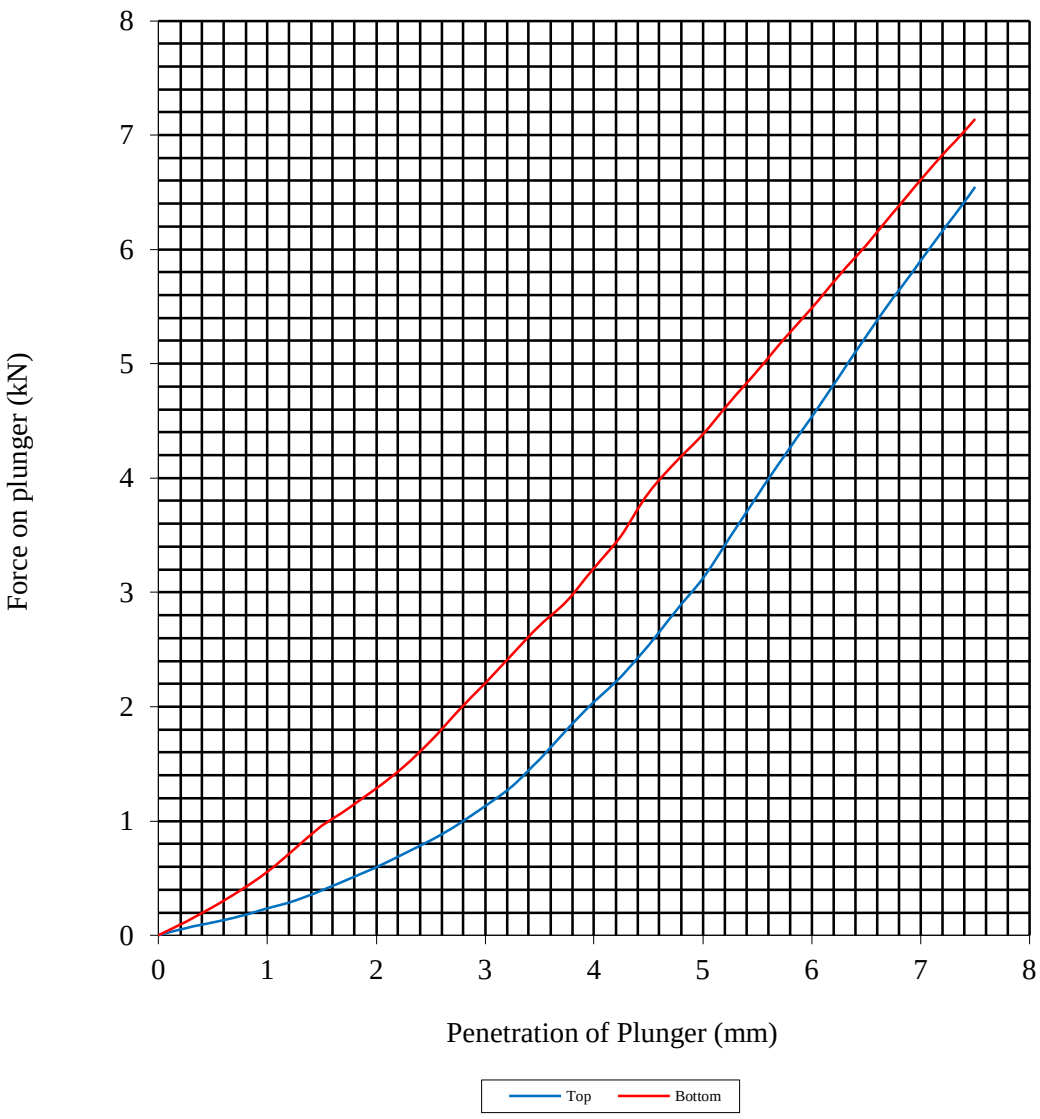
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: WBH104 **Top Depth (m):** 0.20

Sample Number: **Base Depth (m):** 0.80

Sample Type: AMAL



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	16	Surcharge Kg:	4.20	Sample Top	20	Sample Top	15.6
Bulk Density Mg/m3:	2.19	Soaking Time hrs	96	Sample Bottom	18	Sample Bottom	21.9
Dry Density Mg/m3:	1.88	Swelling mm:	2.26	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			24				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No: PSL22/7847

Client Ref: WIE17469

PARTICLE SIZE DISTRIBUTION TEST

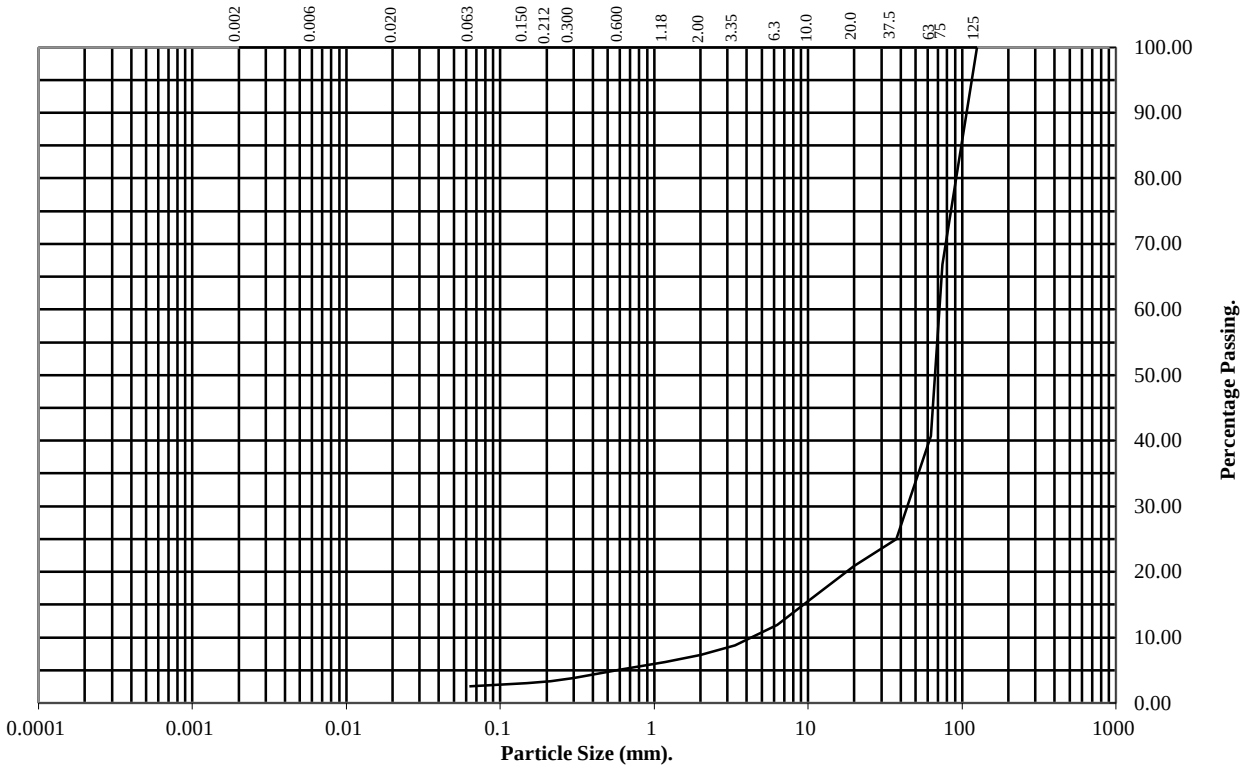
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WBH104** **Top Depth (m):** **1.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	67
63	41
37.5	25
20	21
10	15
6.3	12
3.35	9
2	7
1.18	6
0.6	5
0.3	4
0.212	3
0.15	3
0.063	3

Soil Fraction	Total Percentage
Cobbles	59
Gravel	34
Sand	4
Silt/Clay	3

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

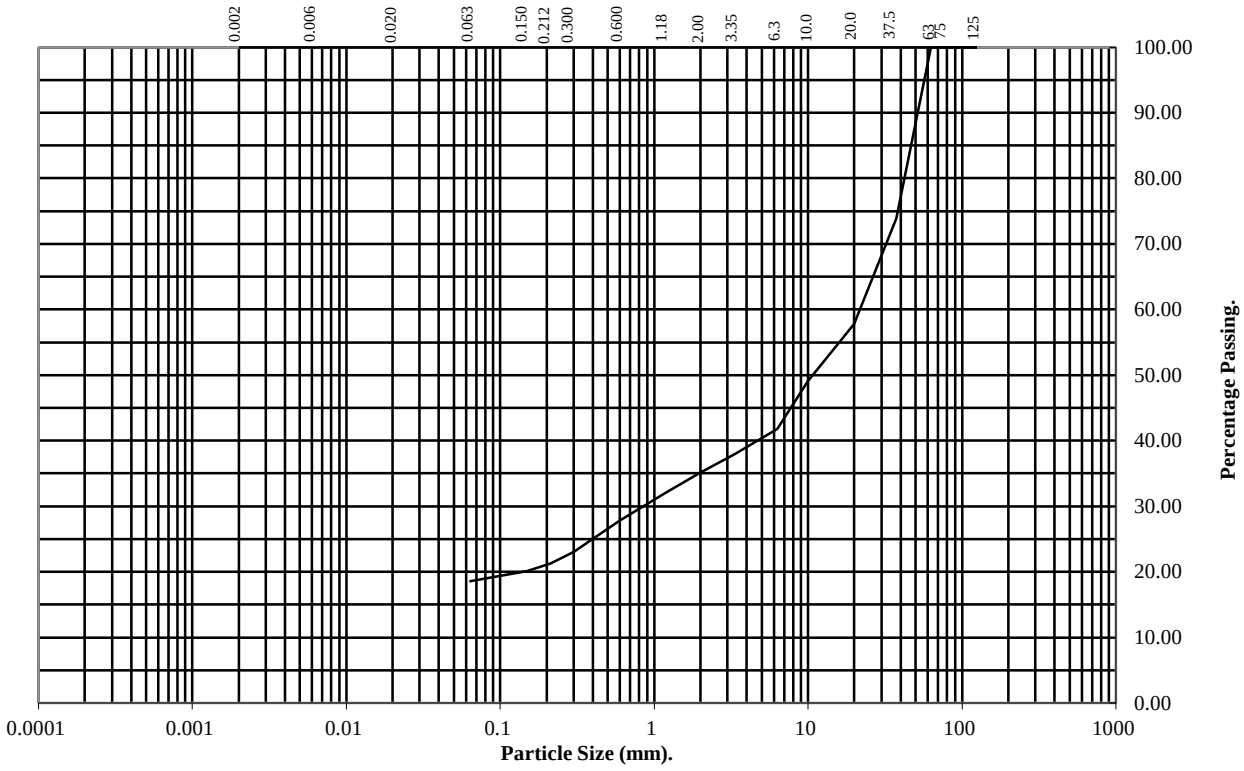
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WBH104** **Top Depth (m):** **9.00**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	74
20	58
10	49
6.3	42
3.35	38
2	35
1.18	32
0.6	28
0.3	23
0.212	21
0.15	20
0.063	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	65
Sand	16
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

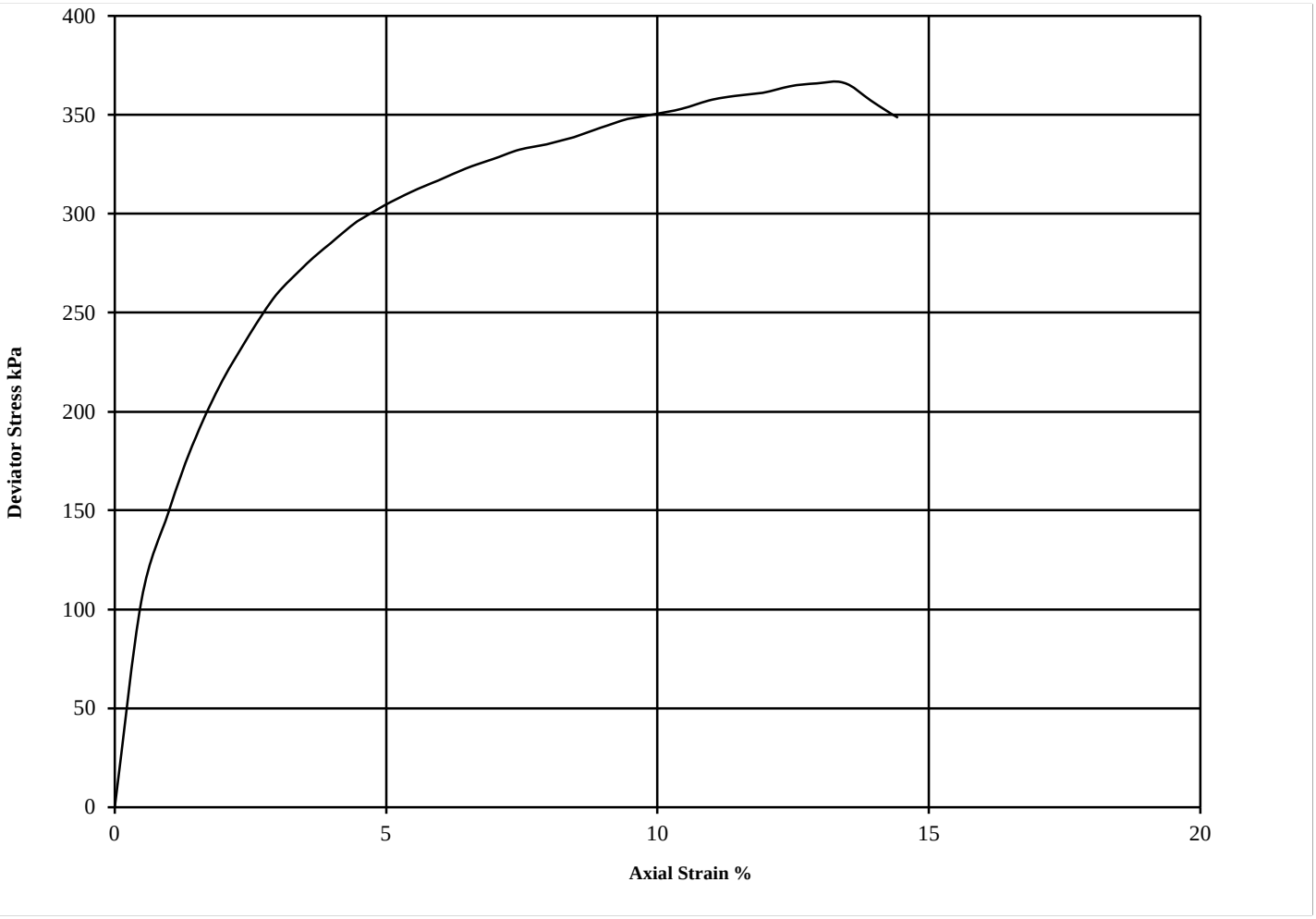
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH104** **Top Depth (m):** **18.00**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\ _1\ \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(\ _1\ \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	26	1.98	1.57	360	366	183	13.4	Brittle	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7847
Client Ref:
WIE17469

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

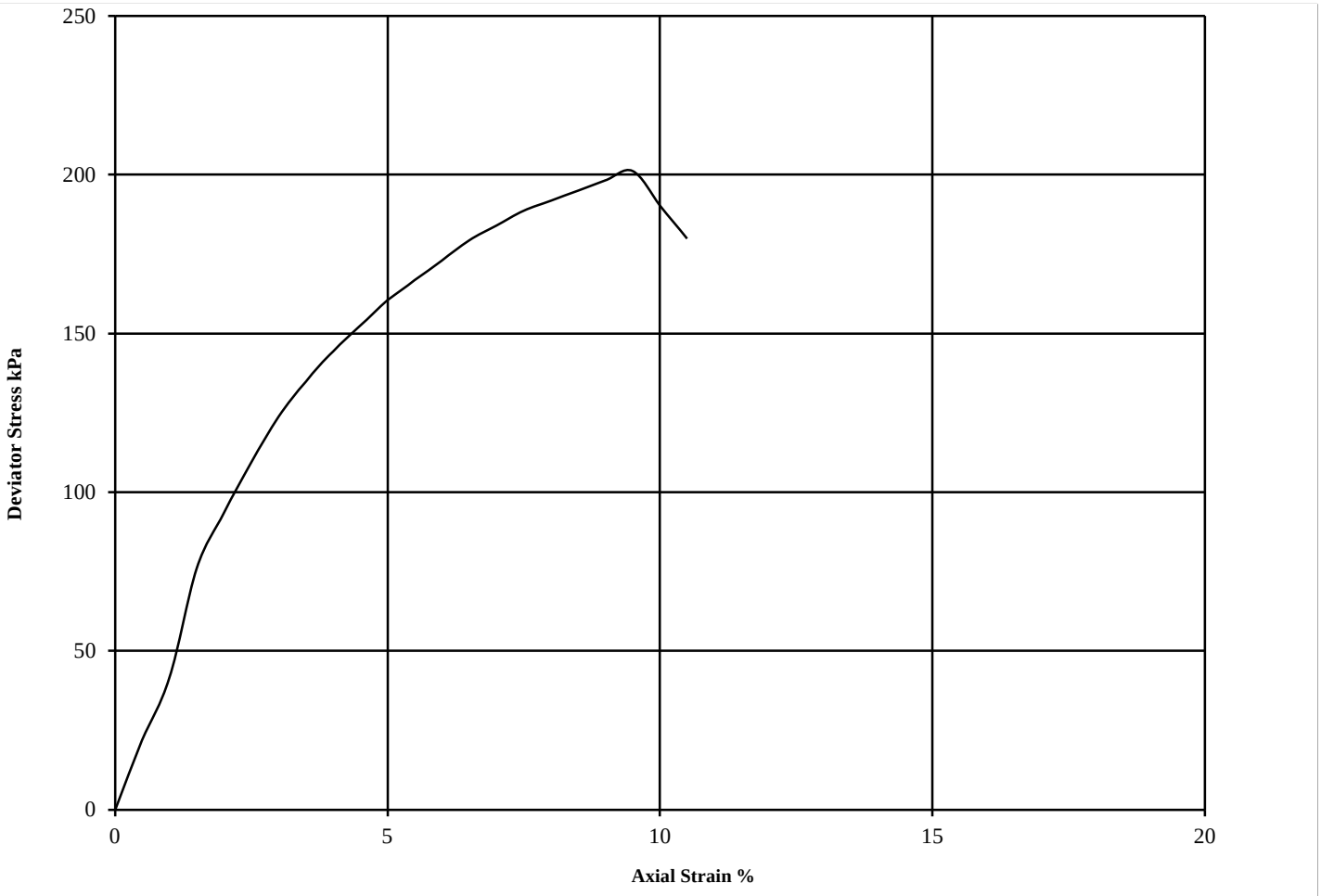
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH104** **Top Depth (m):** **21.00**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		38	Height (mm):		76	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\ _1\ \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(\ _1\ \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.87
1	28	1.79	1.40	420	201	101	9.5	Brittle	See summary of soil descriptions

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Project Otter**	**Contract No:** PSL22/7847 **Client Ref:** WIE17469

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

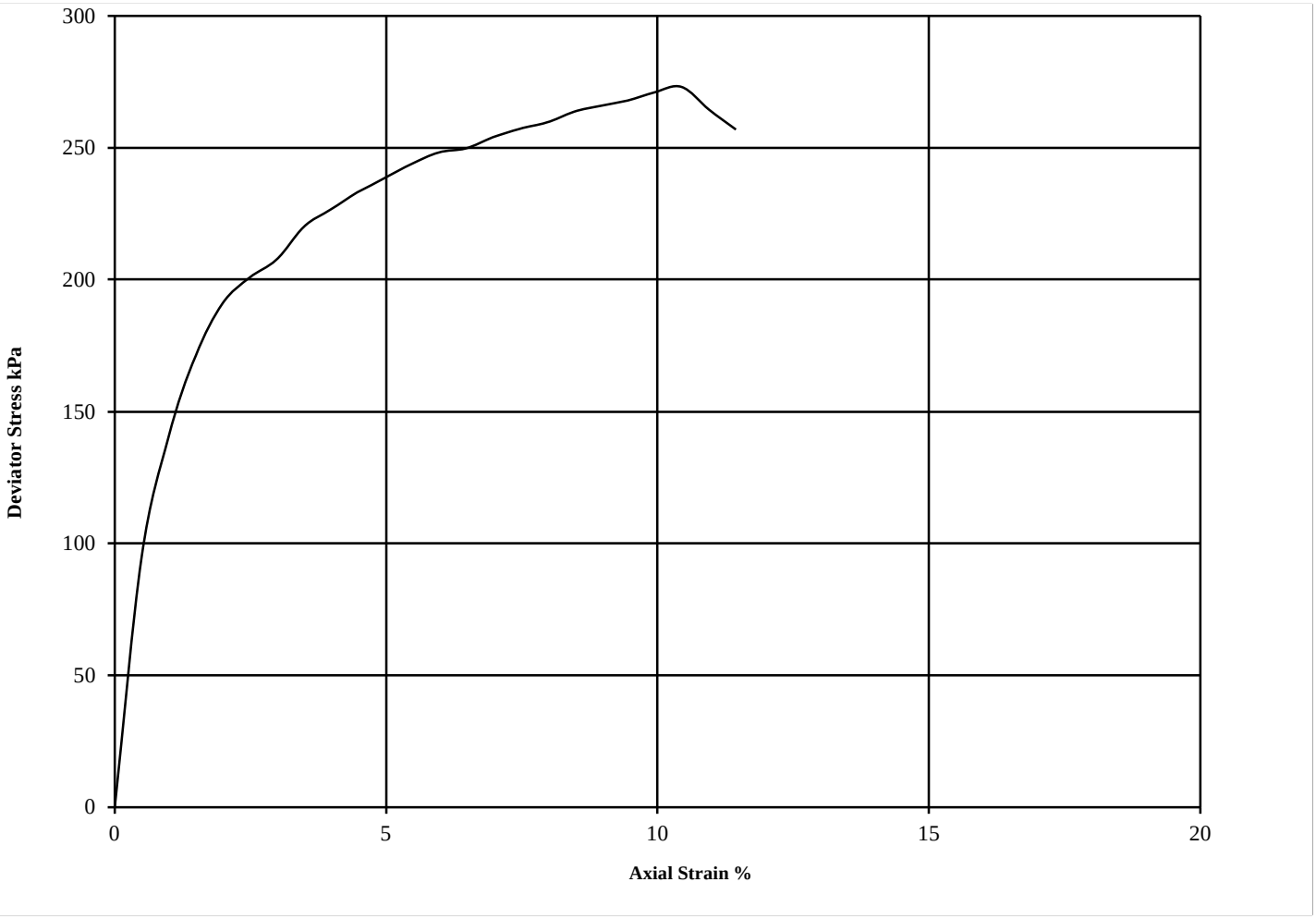
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH104** **Top Depth (m):** **24.00**

Sample Number: **Base Depth (m):**

Sample Type **U**



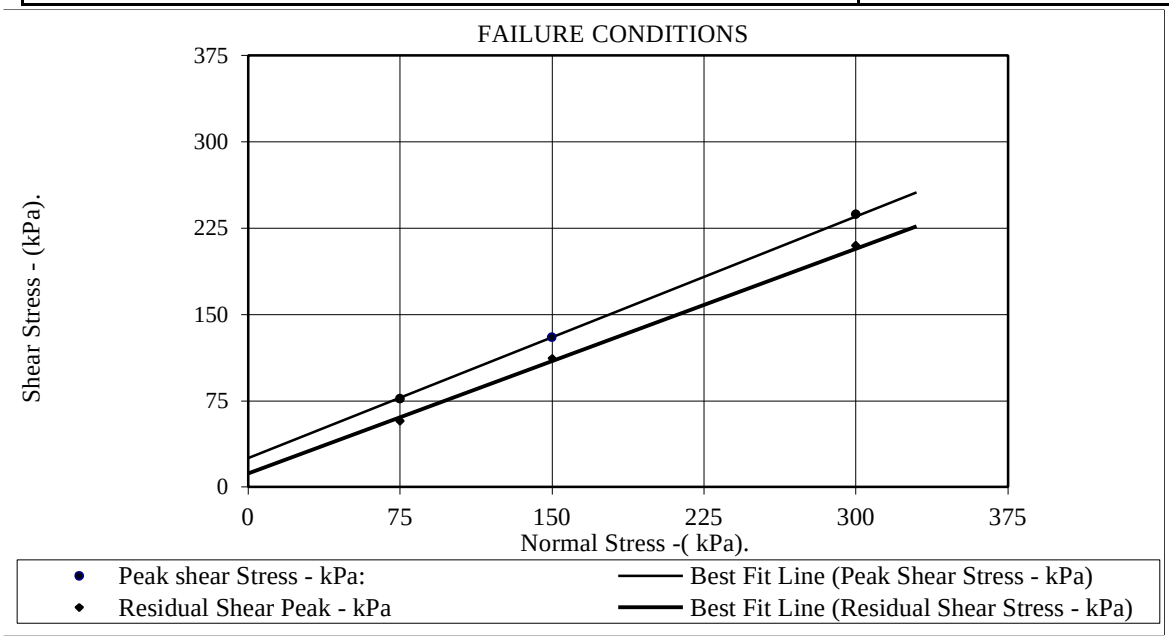
Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\sigma_1 - \sigma_3)_f$	Shear Strength Cu (kPa) $^1/_2(\sigma_1 - \sigma_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	31	1.92	1.46	480	273	137	10.4	Brittle	See summary of soil descriptions

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377 : 1990 Part 7 Clause 4

Hole Number:	**WBH104**		Top Depth	**7.50**
Sample Number:			Base Depth	
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Specimen Preparation	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.99	19.99	19.99
Length - mm:	60.05	60.05	60.05
Moisture Content - %:	48	48	48
Bulk Density - Mg/m3:	1.69	1.69	1.69
Dry Density - Mg/m3:	1.14	1.14	1.14
Voids Ratio:	1.325	1.325	1.325
Normal Pressure- kPa	75	150	300
Consolidation Stage			
Consolidated Height - mm:	15.90	15.39	14.48
Peak Shear			
Rate of Strain - mm/min	0.047	0.047	0.047
Displacement at peak shear stress - mm	10.00	10.00	5.10
Peak shear Stress - kPa:	77	130	237
Residual Shear			
Rate of Strain - mm/min	0.094	0.094	0.094
Displacement at residual shear stress - mm	30.00	30.00	30.00
Residual shear Stress - kPa:	57	112	210
Final Consolidation Conditions			
Moisture Content - %:	34	31	28
Bulk Density - Mg/m3:	2.12	2.19	2.33
Dry Density - Mg/m3:	1.59	1.68	1.82
Peak Shear			
Angle of Shearing Resistance:(0)	35		
Effective Cohesion - kPa:	25		
Residual Shear			
Angle of Shearing Resistance:(0)	33		
Effective Cohesion - kPa:	12		



UKAS TESTING 4043

PSL Professional Soils Laboratory

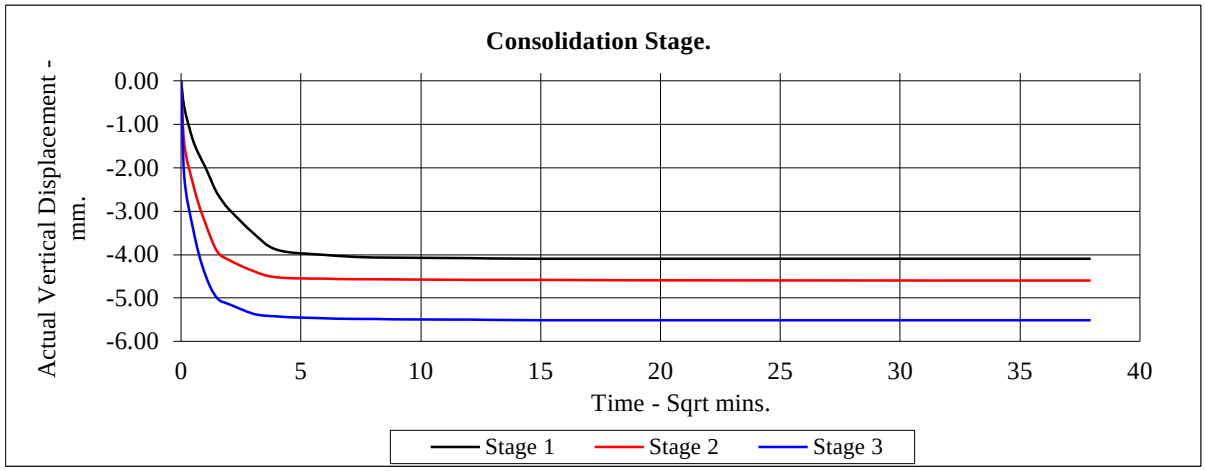
Project Otter

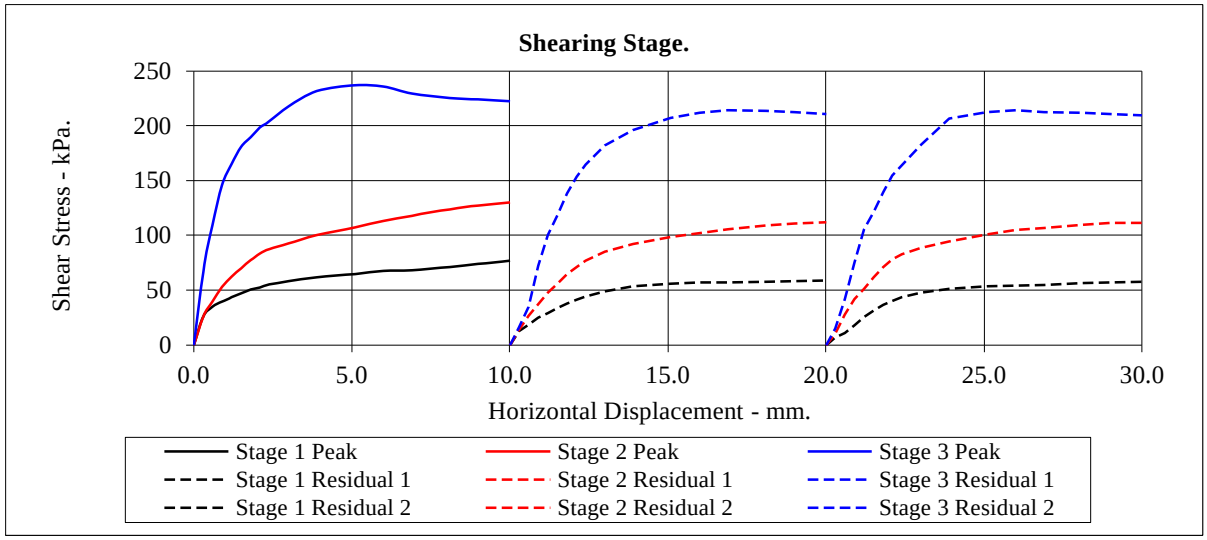
Contract No:
PSL22/7847
Client Ref:
WIE17469

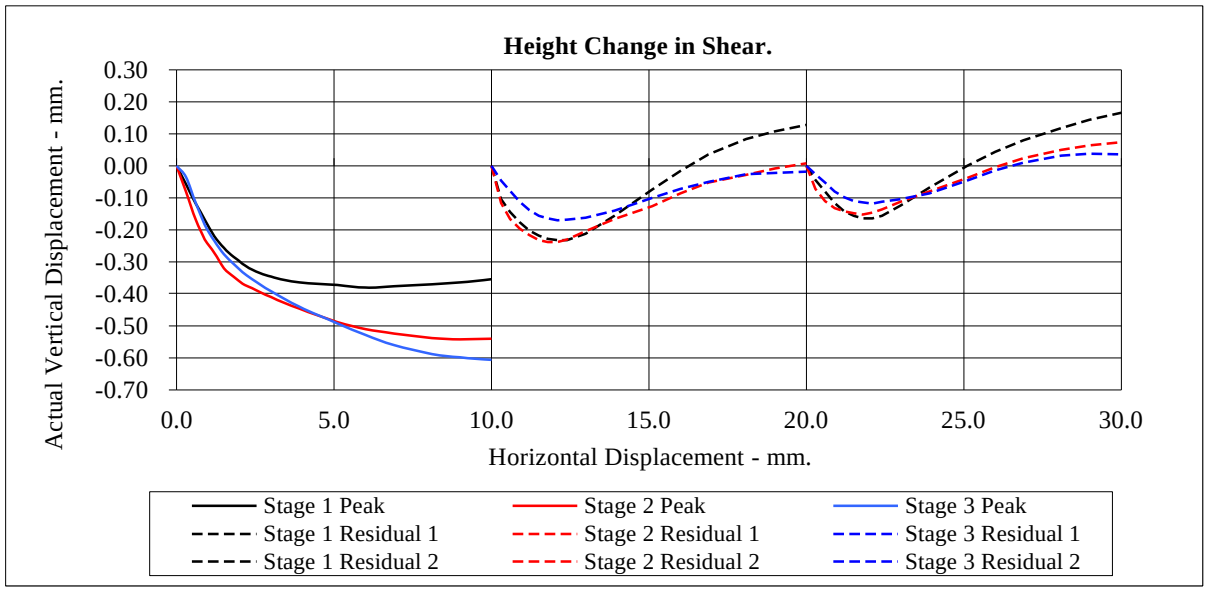
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377 : 1990 Part 7 Clause 4

Hole Number:	**WBH104**	Top Depth:	**7.50**
Sample Number:		Base Depth:	







UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7847
Client Ref:
WIE17469

UKAS TESTING
2531

CHEMTECH environmental part of Cawood

ANALYTICAL TEST REPORT

Contract no: 117338

Contract name: WIE17469: Project Otter

Client reference: PSL22/7847

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 05 January 2023

Analysis started: 05 January 2023

Analysis completed: 12 January 2023

Report issued: 12 January 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by: [redacted]
Abbie Neasham-Bourn
Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			117338-1	117338-2
Sample id			WBH104	WBH104
Depth (m)			2.50	13.50
Sample Type			B	B
Date sampled			-	-
Test	Method	Units		
pH	CE004 U	units	7.5	7.6
Magnesium (2:1 water soluble)	CE061	mg/l Mg	17	13
Chloride (2:1 water soluble)	CE049 U	mg/l Cl	71	71
Nitrate (2:1 water soluble)	CE049 U	mg/l NO_3	1.3	1.3
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	1041	523
Sulphate (acid extractable)	CE062 U	mg/kg SO_4	1438	1842
Sulphate (acid extractable)	CE062 U	% w/w SO_4	0.14	0.18
Sulphur (total)	CE119	mg/kg S	3086	2383
Sulphur (total)	CE119	% w/w S	0.31	0.24
Total Organic Carbon (TOC)	CE197	% w/w C	-	9.4
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	16.2

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	U	100	mg/kg SO4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	U	0.01	% w/w SO4
CE119	Sulphur (total)	Aqua regia digest, analysed by ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Aqua regia digest, analysed by ICP-OES	Dry		0.01	% w/w S
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
117338-1	WBH104	2.50	Y	All (NSD)
117338-2	WBH104	13.50	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones, where applicable.

LABORATORY REPORT

4043

Contract Number: PSL22/7848

Report Date: 13 January 2023

Client's Reference: WIE17469-WBH105

Client Name: Groundtech Consulting
First Floor
Lloyd House
Orford Court
Greenfold Way
WN7 3XJ

For the attention of: Michael Berry

Contract Title: Project Otter

Date Received: 9/12/2022
Date Commenced: 9/12/2022

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

[redacted]

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WBH105		B	0.50		Grey slightly gravelly slightly sandy CLAY.
WBH105		B	11.50		Grey slightly gravelly slightly sandy CLAY.
WBH105		U	15.00		Very stiff grey CLAY.
WBH105		B	15.50		Grey CLAY.
WBH105		U	21.00		Stiff grey CLAY.
WBH105		B	21.50		Grey CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WBH105		B	11.50		28			54	25	29	88	High Plasticity CH
WBH105		B	15.50		27			77	31	46	100	Very High Plasticity CV
WBH105		B	21.50		25			70	30	40	100	Very High Plasticity CV

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

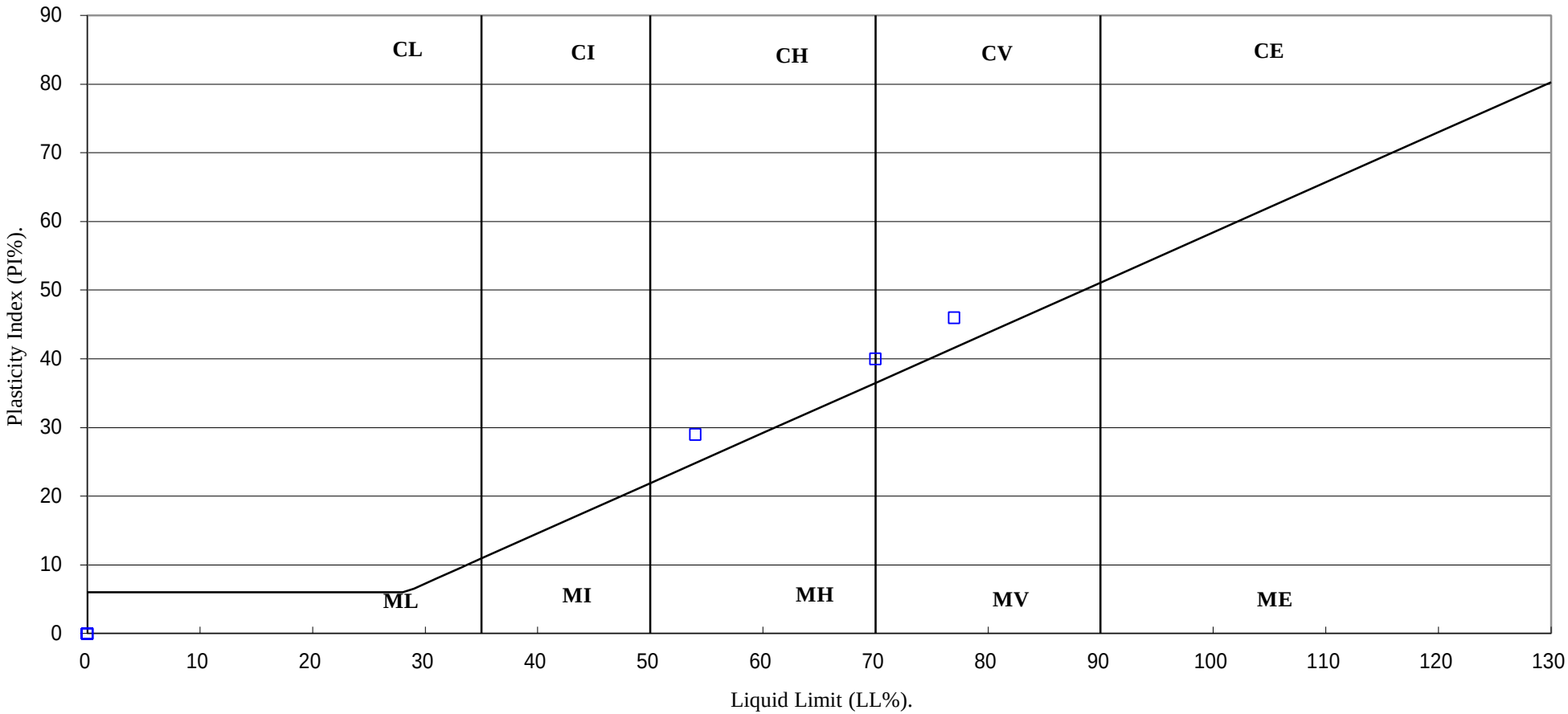
Contract No:

PSL22/7848

Client Ref:

WIE17469

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	**Project Otter**	**Contract No:** PSL22/7848
			Client Ref: WIE17469

PARTICLE SIZE DISTRIBUTION TEST

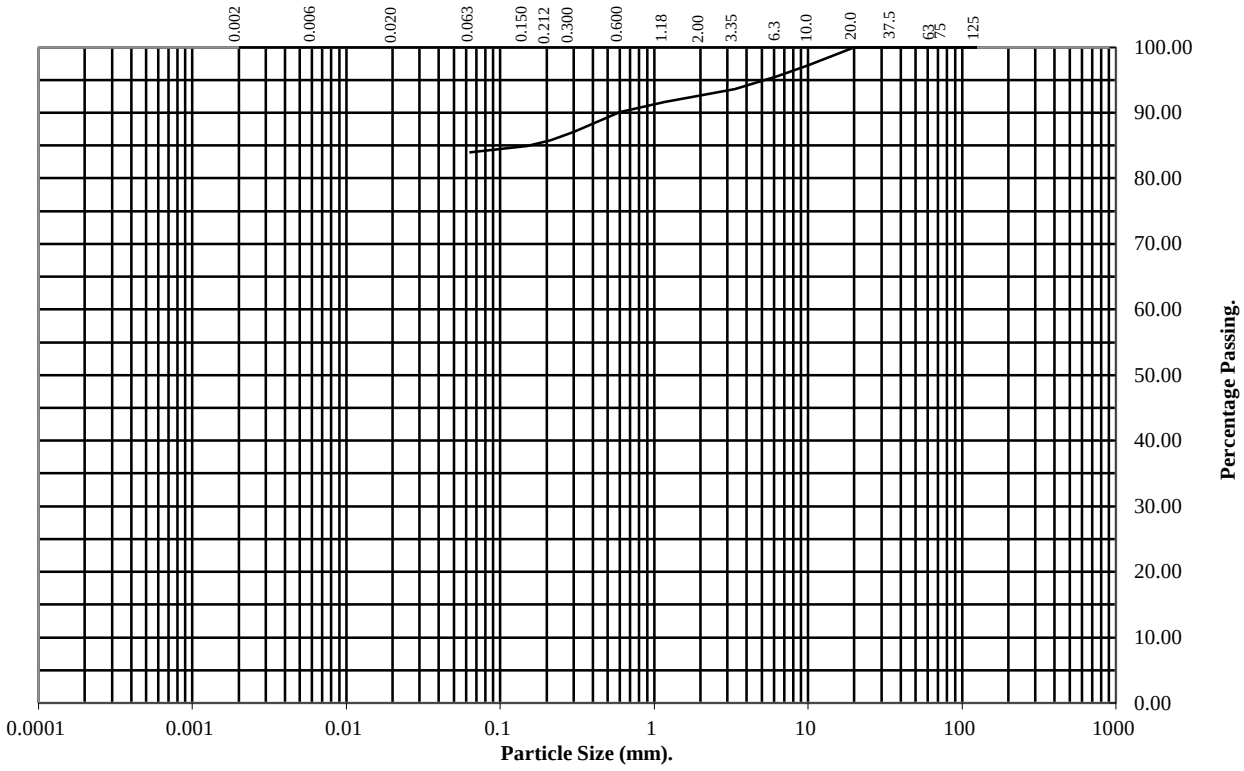
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WBH105** **Top Depth (m):** **0.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	96
3.35	94
2	93
1.18	92
0.6	90
0.3	87
0.212	86
0.15	85
0.063	84

Soil Fraction	Total Percentage
Cobbles	0
Gravel	7
Sand	9
Silt/Clay	84

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

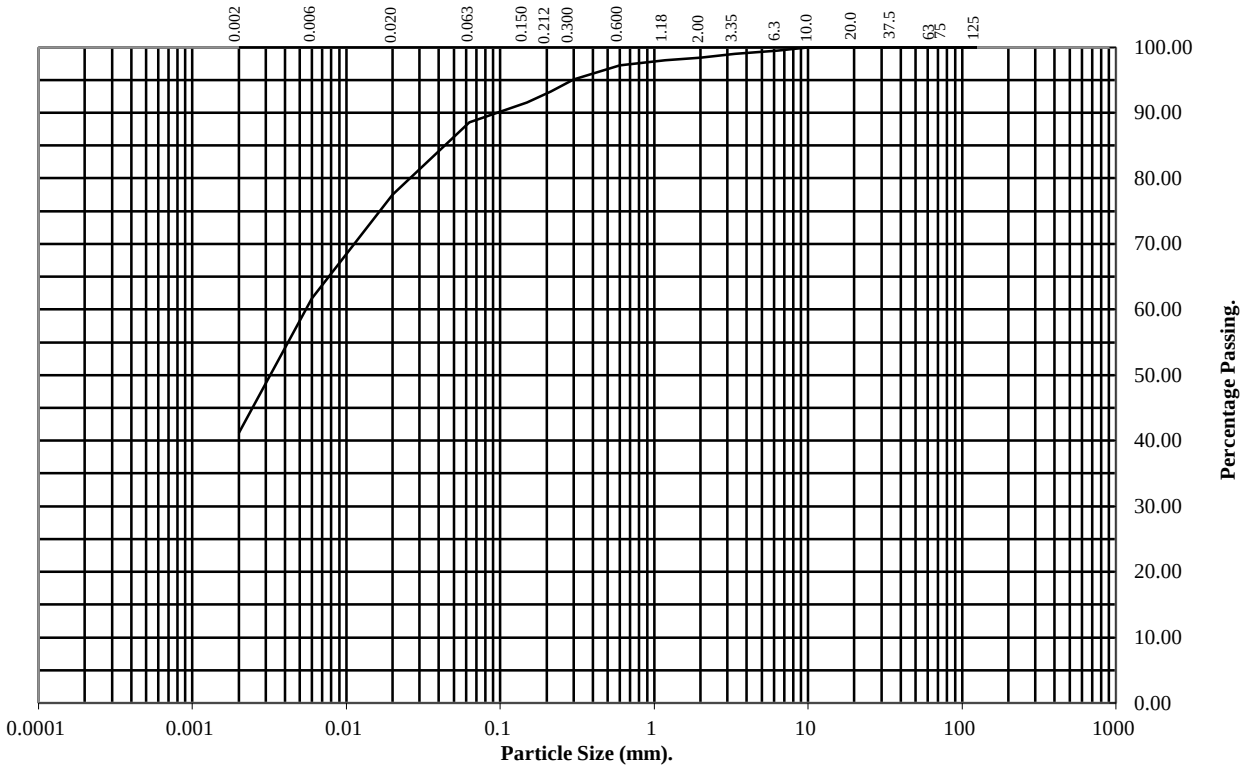
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WBH105** **Top Depth (m):** **11.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	98
0.6	97
0.3	95
0.212	93
0.15	92
0.063	89

Particle Diameter	Percentage Passing
0.02	77
0.006	62
0.002	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	9
Silt	48
Clay	41

Remarks:
See Summary of Soil Descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

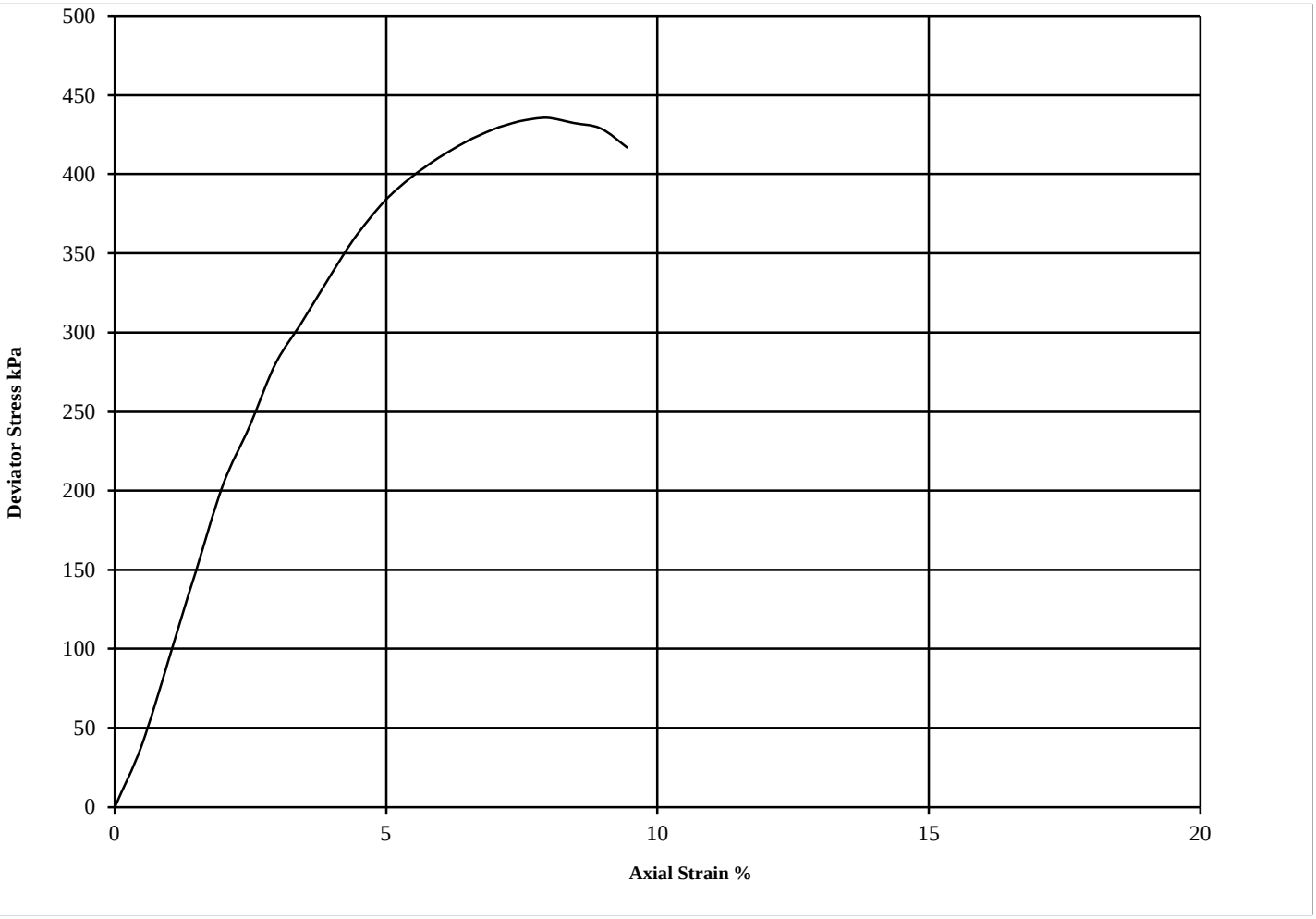
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH105** **Top Depth (m):** **15.00**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\ _1\ \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(\ _1\ \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	26	1.93	1.53	300	436	218	8.0	Brittle	See summary of soil descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

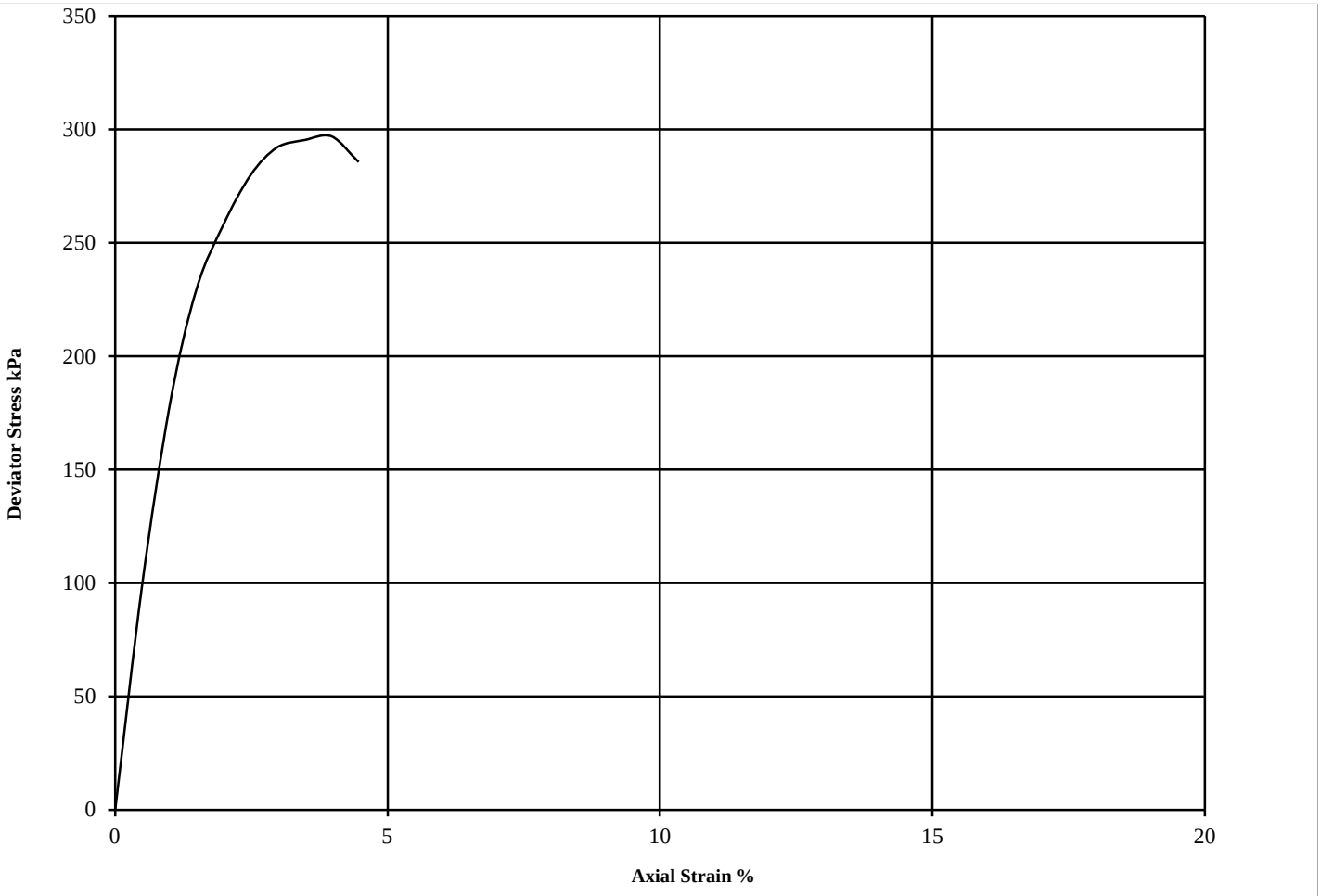
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH105** **Top Depth (m):** **21.00**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(_1 \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(_1 \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	26	1.96	1.56	420	297	148	4.0	Brittle	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7848
Client Ref:
WIE17469

UKAS TESTING
2531

CHEMTECH environmental part of Cawood

ANALYTICAL TEST REPORT

Contract no: 117333

Contract name: WIE17469: Project Otter

Client reference: PSL22/7848

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 05 January 2023

Analysis started: 05 January 2023

Analysis completed: 12 January 2023

Report issued: 12 January 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by: [redacted]

Abbie Neasham-Bourn

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			117333-1
Sample id			WBH105
Depth (m)			2.50
Sample Type			B
Date sampled			-
Test	Method	Units	
pH	CE004 U	units	7.6
Magnesium (2:1 water soluble)	CE061	mg/l Mg	44
Chloride (2:1 water soluble)	CE049 U	mg/l Cl	2689
Nitrate (2:1 water soluble)	CE049 U	mg/l NO_3	1.2
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	2141
Sulphate (acid extractable)	CE062 U	mg/kg SO_4	10215
Sulphate (acid extractable)	CE062 U	% w/w SO_4	1.02
Sulphur (total)	CE119	mg/kg S	5311
Sulphur (total)	CE119	% w/w S	0.53
Total Organic Carbon (TOC)	CE197	% w/w C	5.4
Estimate of OMC (calculated from TOC)	CE197	% w/w	9.3

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	U	100	mg/kg SO4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	U	0.01	% w/w SO4
CE119	Sulphur (total)	Aqua regia digest, analysed by ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Aqua regia digest, analysed by ICP-OES	Dry		0.01	% w/w S
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
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Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
117333-1	WBH105	2.50	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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Methods, procedures and performance data are available on request.

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Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones, where applicable.

LABORATORY REPORT

4043

Contract Number: PSL22/7849

Report Date: 06 January 2023

Client's Reference: WIE17469-WBH106

Client Name: Groundtech Consulting
First Floor
Lloyd House
Orford Court
Greenfold Way
WN7 3XJ

For the attention of: Michael Berry

Contract Title: Project Otter

Date Received: 9/12/2022
Date Commenced: 9/12/2022
Date Completed: 6/1/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)
[redacted]
L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
T Watkins (Senior Technician)

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e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WBH106		D	1.20		Light brown mottled grey slightly gravelly sandy CLAY.
WBH106		D	2.50		Light brown sandy CLAY.
WBH106		U	4.50		Grey CLAY.
WBH106		D	7.00		Grey CLAY.
WBH106		U	7.50		Stiff grey CLAY.
WBH106		D	16.00		Grey CLAY.
WBH106		U	16.50		Grey CLAY.
WBH106		D	17.00		Grey CLAY.
WBH106		U	22.50		Very stiff grey CLAY.
WBH106		D	23.00		Grey CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WBH106		D	1.20		33							
WBH106		D	2.50		20			39	22	17	100	Intermediate Plasticity CI
WBH106		D	7.00		28							
WBH106		D	17.00		27			77	31	46	100	Very High Plasticity CV
WBH106		D	23.00		27			77	31	46	100	Very High Plasticity CV

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

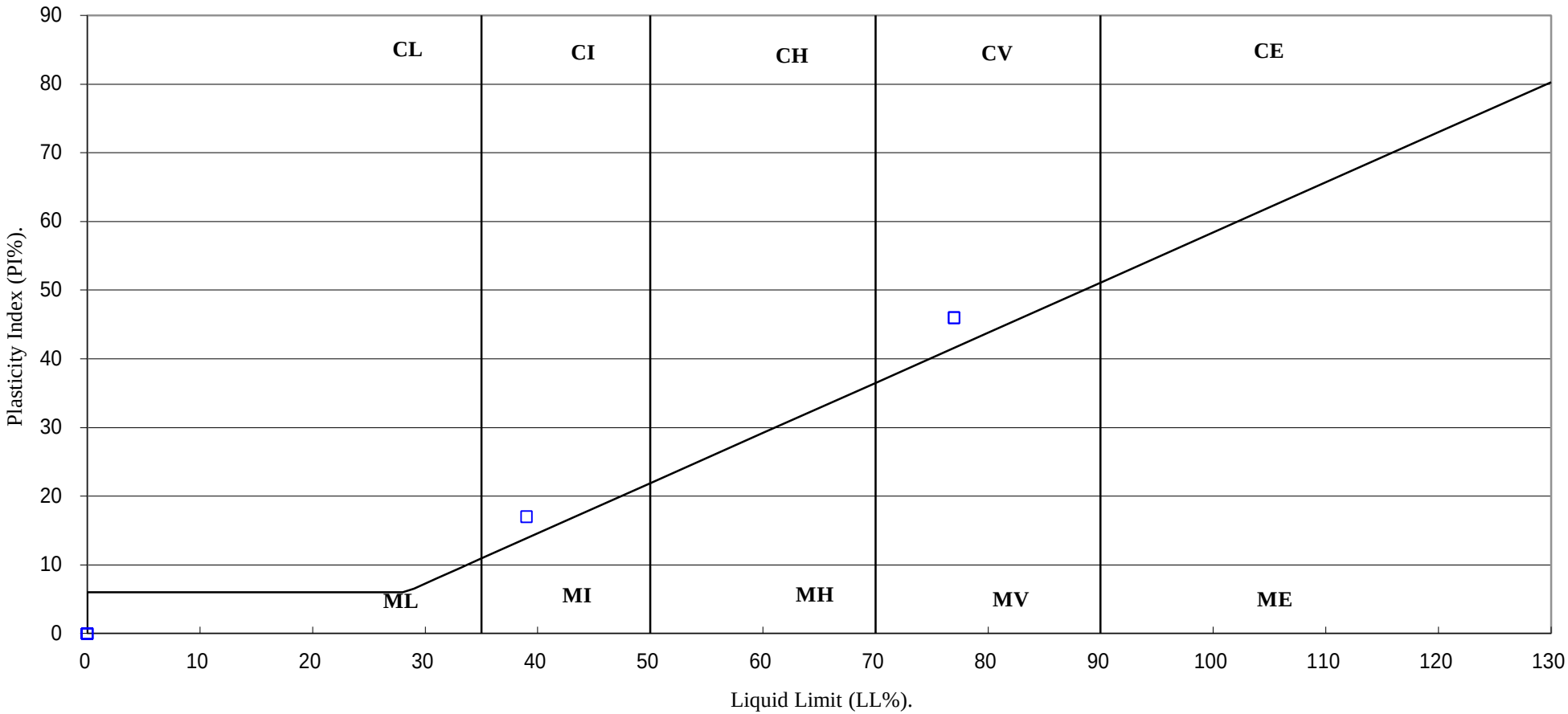
Contract No:

PSL22/7849

Client Ref:

WIE17469

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	**Project Otter**	**Contract No:**
			PSL22/7849
			Client Ref:
			WIE17469

PARTICLE SIZE DISTRIBUTION TEST

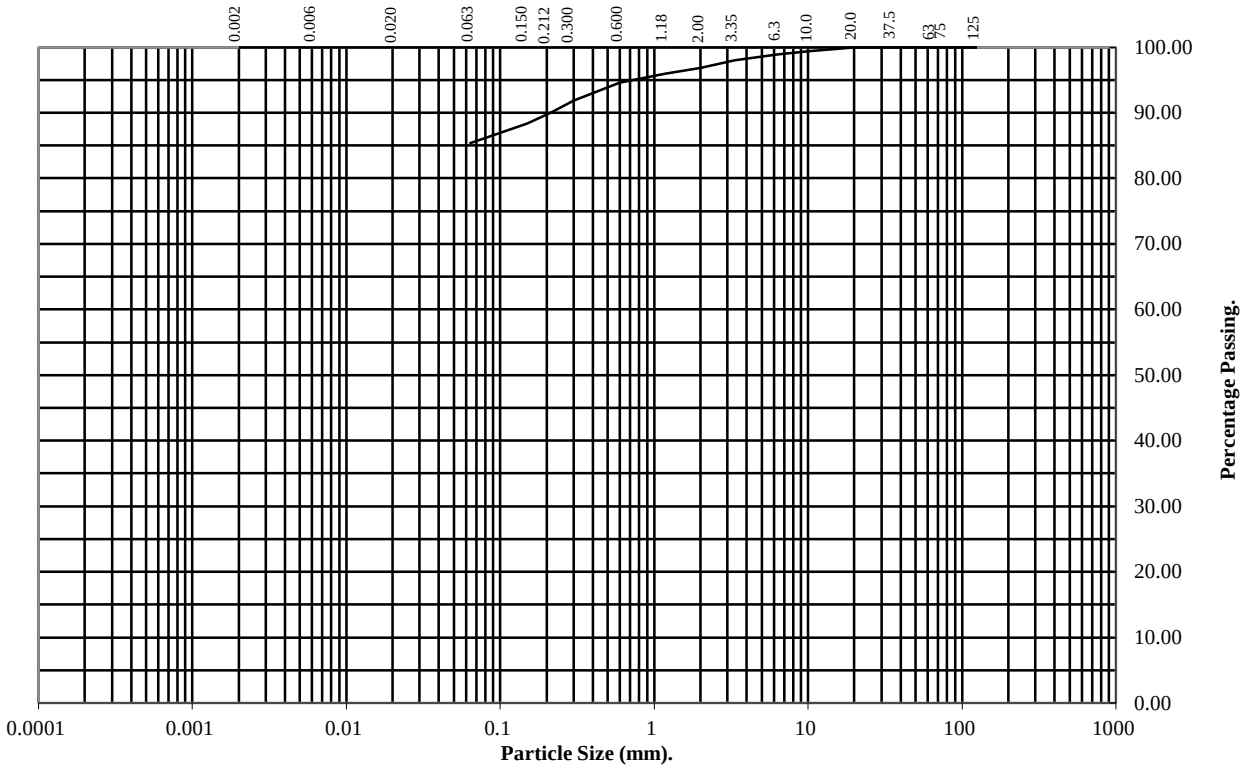
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WBH106** **Top Depth (m):** **1.20**

Sample Number: **Base Depth(m):**

Sample Type: **D**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	98
2	97
1.18	96
0.6	95
0.3	92
0.212	90
0.15	88
0.063	85

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	12
Silt/Clay	85

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

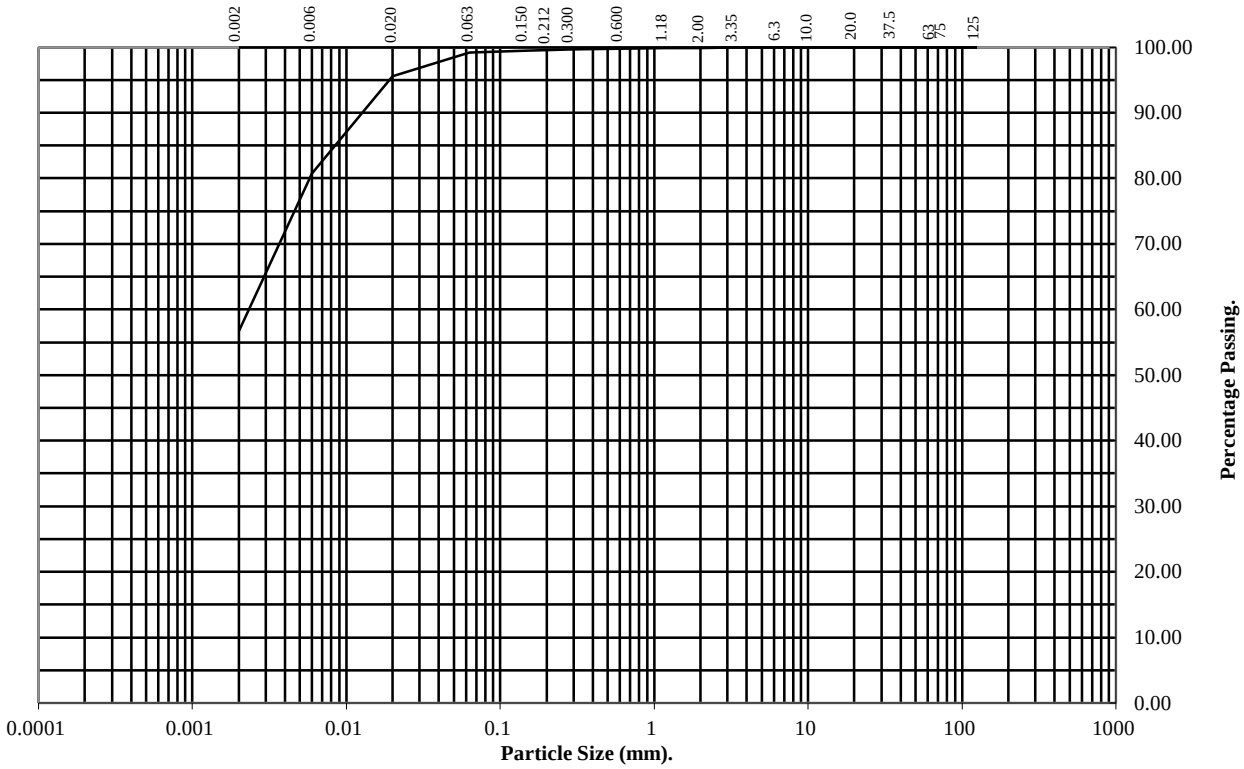
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WBH106** **Top Depth (m):** **16.00**

Sample Number: **Base Depth(m):**

Sample Type: **D**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	100
0.212	100
0.15	99
0.063	99

Particle Diameter	Percentage Passing
0.02	96
0.006	81
0.002	57

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	1
Silt	42
Clay	57

Remarks:
See Summary of Soil Descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

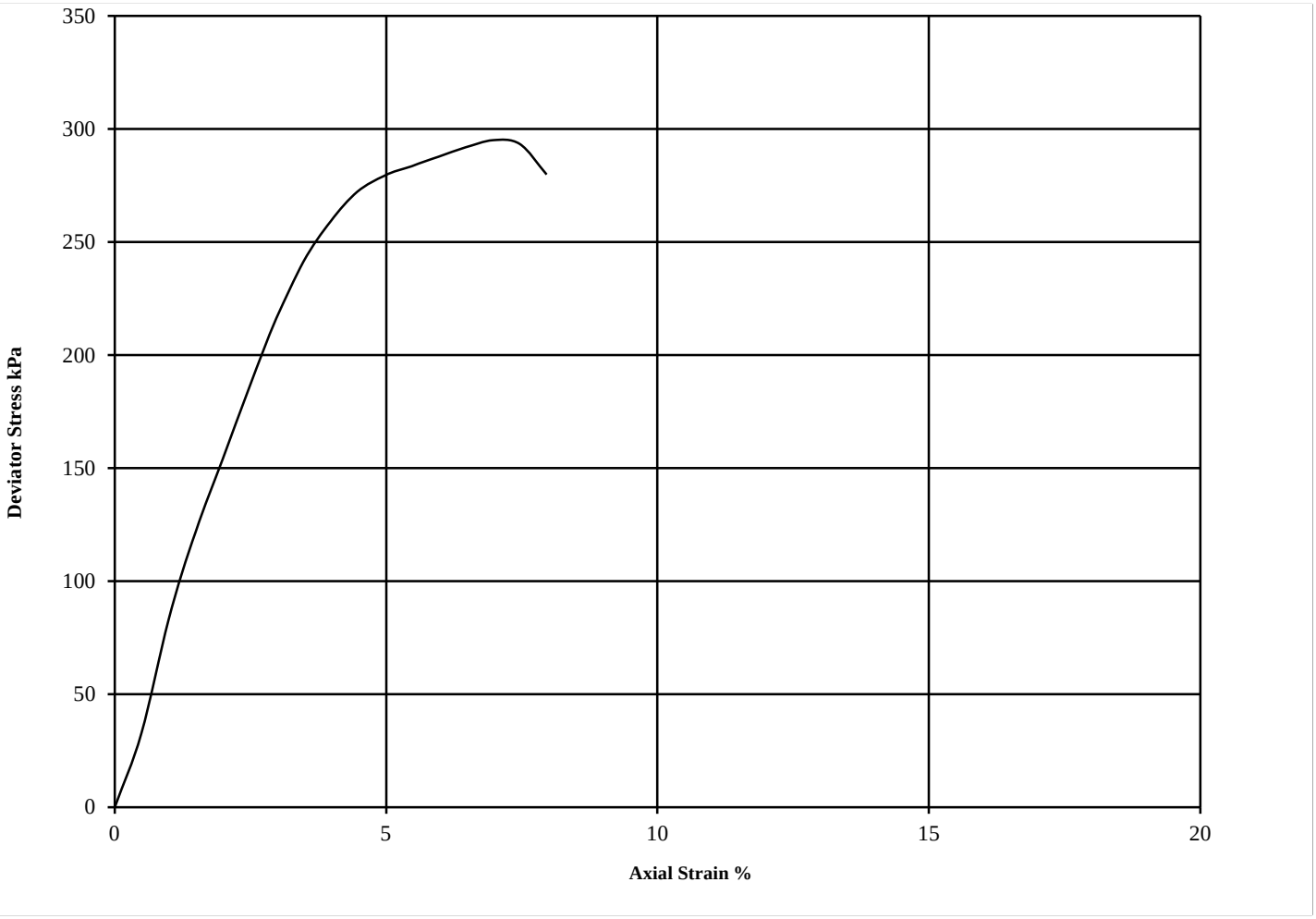
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH106** **Top Depth (m):** **7.50**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) σ_3	Corr. Max. Deviator Stress (kPa) $(\sigma_1 - \sigma_3)_f$	Shear Strength Cu (kPa) $\frac{1}{2}(\sigma_1 - \sigma_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	27	1.94	1.52	150	295	147	7.0	Brittle	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Project Otter

Contract No:
PSL22/7849
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

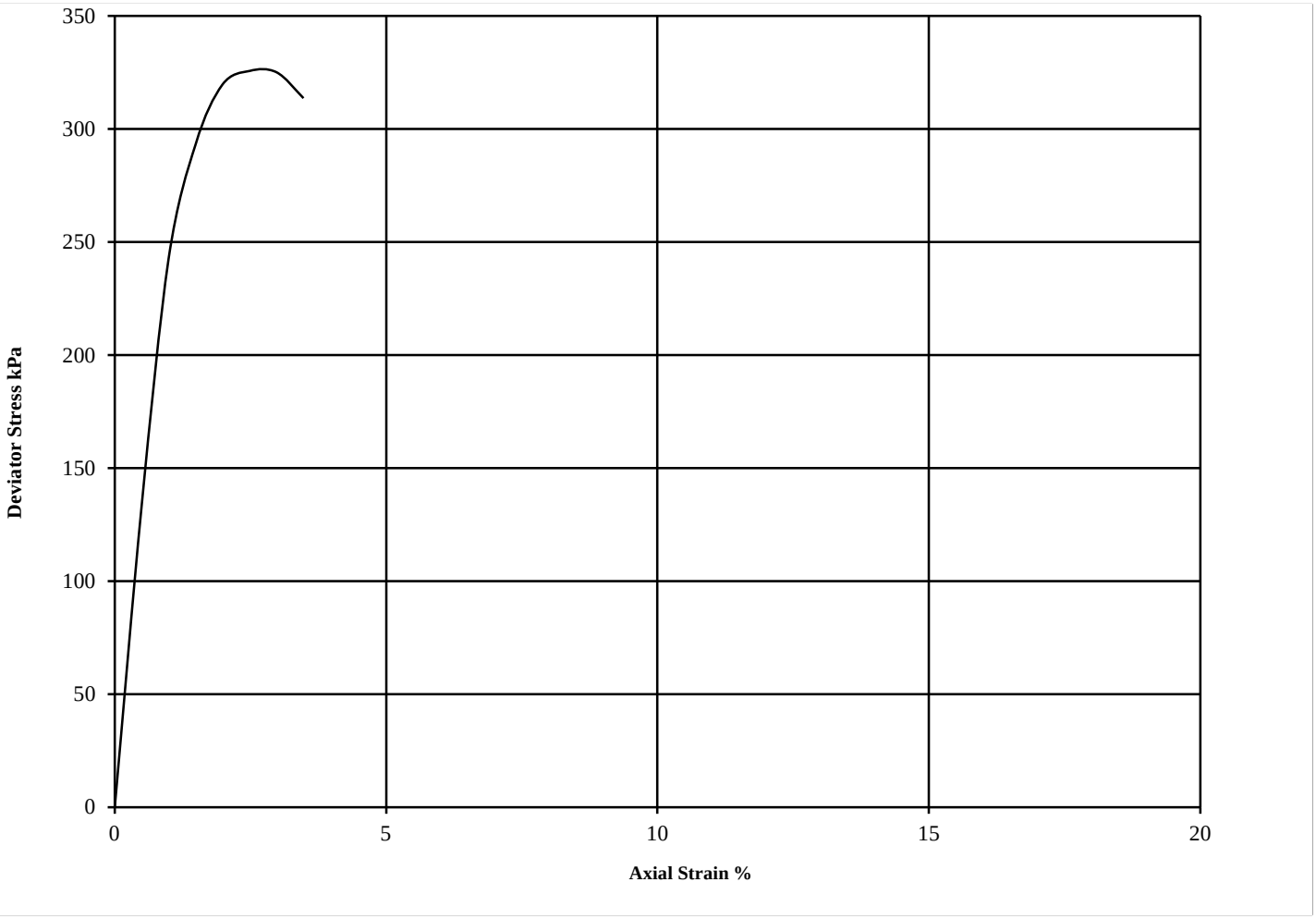
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **WBH106** **Top Depth (m):** **22.50**

Sample Number: **Base Depth (m):**

Sample Type **U**



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) $_3$	Corr. Max. Deviator Stress (kPa) $(\ _1\ \ _3)_f$	Shear Strength Cu (kPa) $^1/_2(\ _1\ \ _3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	26	1.92	1.52	450	326	163	2.5	Brittle	See summary of soil descriptions

ONE DIMENSIONAL CONSOLIDATION TEST

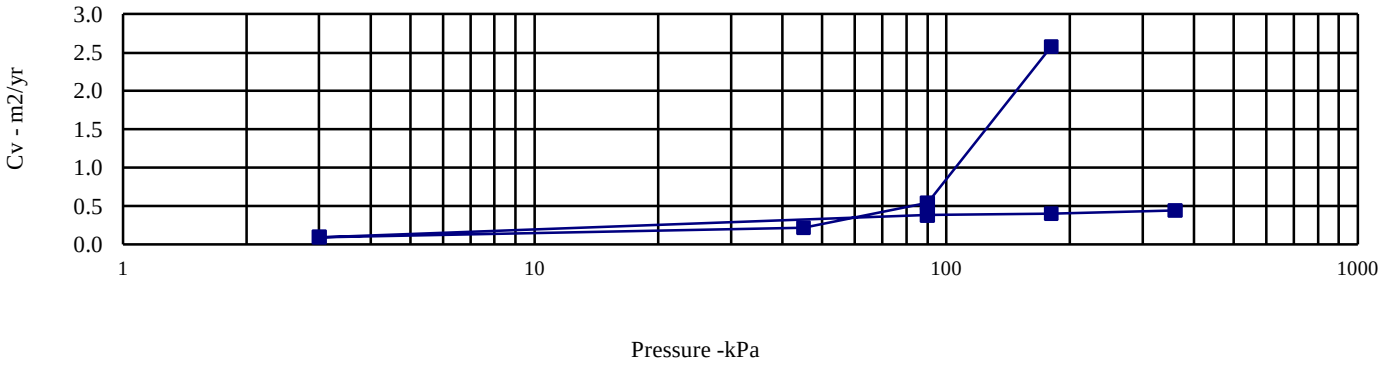
BS 1377: Part 5: 1990: Clause 3

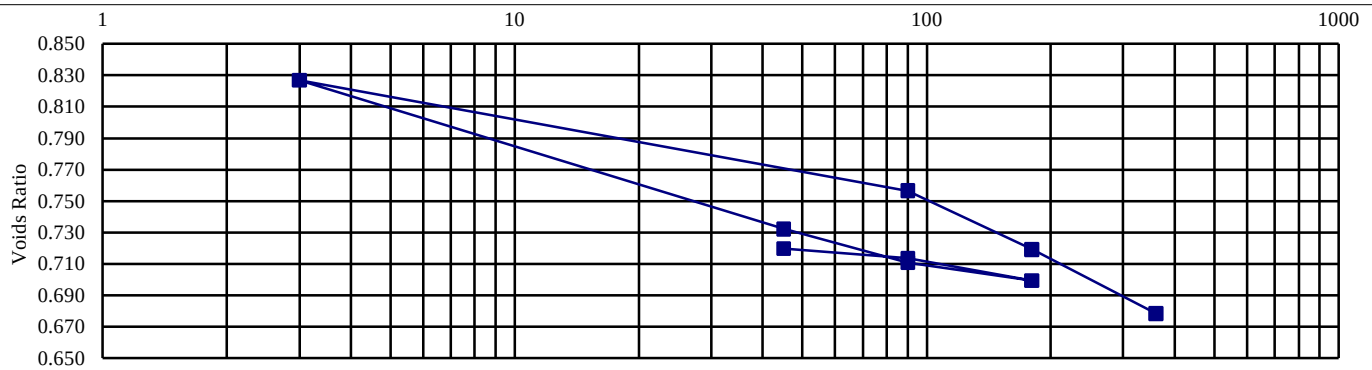
Hole Number: **WBH106** **Top Depth (m):** **4.50**

Sample Number: **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28						
Bulk Density (Mg/m3):	1.95	0	45	Swelling	Swelling	Method used to	
Dry Density (Mg/m3):	1.52	45	90	Swelling	Swelling	determine CV:	T90
Voids Ratio:	0.740	90	180	0.092	2.582	Nominal temperature	
Degree of saturation:	100.4	180	90	0.075	0.547	during test ' C:	20
Height (mm):	20.002	90	45	0.276	0.219	Remarks:	
Diameter (mm)	75.02	45	3	1.302	0.095	See summary of soil descriptions	
Particle Density (Mg/m3): Assumed	2.65	4	90	0.447	0.382		
		90	180	0.236	0.404		
		180	360	0.132	0.442		





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