

Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure ASTM D 5334 - 00

Borehole Number: BH11
Sample No: -
Depth (m) 1.80 - 2.20

Description:
Grey slightly sandy silty CLAY with
occasional fine gravel

Sample preparation: Sample compacted by vibrating hammer method in 5 layers
according to procedures detailed in BS1377 : Part 4 :
Clause 3.7 : 1990, to produce a cylindrical specimen

Sample diameter: 101.4 mm

Sample length: 202.7 mm

Bulk Density 1.76 Mg/m³

Dry Density 1.33 Mg/m³

Moisture Content 32 %

Thermal Conductivity **1.108** W/(m.k)

Remarks:

Checked and
Approved

Initials:
SB

Date: 08/06/2013

Project Number:

GEO / 19588

Project Name:

TOTTENHAM MARSH

Project Number 51603-00

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Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure ASTM D 5334 - 00

Borehole Number: BH7
Sample No: -
Depth (m) 1.80 - 2.20

Description:
Grey silty sandy ASH

Sample preparation: Sample compacted by vibrating hammer method in 5 layers according to procedures detailed in BS1377 : Part 4 : Clause 3.7 : 1990, to produce a cylindrical specimen

Sample diameter: 101.6 mm

Sample length: 173.8 mm

Bulk Density 1.50 Mg/m³

Dry Density 1.05 Mg/m³

Moisture Content 43 %

Thermal Conductivity **0.712** W/(m.k)

Remarks:

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Initials:
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PROJECT NAME PROJECT NO:	TOTTENHAM MARSH Project Number 51603-00 GEO / 19588	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Date</td> <td>08/06/2013</td> </tr> <tr> <td>Approved</td> <td><i>Simon Burke</i></td> </tr> <tr> <td>Page</td> <td>1 of 3</td> </tr> </table>	Date	08/06/2013	Approved	<i>Simon Burke</i>	Page	1 of 3
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Approved	<i>Simon Burke</i>							
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Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Tests			Other tests and comments
Borehole	Depth	No.	Type		MC	LL	PL	PI	<425 mic	Bulk	Dry	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	Ground Water SO4	
No.	(m)				(%)	(%)	(%)	(%)	(%)	(Mg/m³)	(Mg/m³)	(kPa)	(kPa)	(kPa)		(g/l)	(g/l)	
BH11	1.80 - 2.20	-	B	Grey slightly sandy silty CLAY with occasional fine gravel	32													Thermal Resistivity
BH11	6.30 - 3.75	A	D	Dark brownish grey silty CLAY with occasional fine to medium flint gravel	15													
BH11	9.65 - 10.10	C	D	Dark grey silty CLAY	25													
BH11	12.90 - 13.35	E	D	Dark brownish grey silty CLAY	29													
BH12	-	I	D	Dark brownish grey silty CLAY	29													
BH7	1.80 - 2.20	-	B	Grey silty sandy ASH	43													Thermal Resistivity
BH7	-	A	D	Dark grey silty SAND with rare fine gravel and pockets of orange brown silt	37													
BH7	-	C	D	Dark grey organic silty CLAY with rare fine to medium gravel	62													
BH7	-	E	D	Grey sandy flint GRAVEL	13													
BH7	-	G	D	Brownish grey silty CLAY	40													
BH7	-	I	D	Dark brownish grey silty CLAY	24													
BH7	3.65 - 3.75	T3	D	Mottled dark grey and brown silty slightly sandy clay with rare fine gravel	60													

SUMMARY OF GEOTECHNICAL TESTING



PROJECT NAME	TOTTENHAM MARSH		Date	08/06/2013
	Project Number 51603-00		Approved	<i>Simon Burke</i>
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Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Tests			Other tests and comments
Borehole No.	Depth (m)	No.	Type		MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	
BH7	3.20 - 3.65	U1	U	Very soft dark grey sandy CLAY with rare fine to medium gravel and organic matter	32					1.77	1.34	32 64 128	36 37 34	18				Insufficient sample for Hand Vane
BH7	7.40 - 7.85	U2	U	Stiff grey slightly sandy silty CLAY with rare fine to medium gravel	29					1.95	1.52	75 150 300	227 191 275	116				Hand Vane = 178, 174 180 kPa
BH7	8.90 - 9.35	U3	U	Very stiff fissured grey silty CLAY	24					2.01	1.62	90 180 360	340 328 388	176				Hand Vane = 175, 169, 175 kPa
BH7	10.40 - 10.85	U4	U	Very stiff fissured slightly sandy silty CLAY	23					2.01	1.63	105 210 420	368 515 401	214				Hand Vane = >188 kPa
BH7	11.90 - 12.35	U5	U	Very stiff fissured grey silty CLAY	33					1.96	1.47	120 240 480	295 123 358	129				Hand Vane = >188 kPa
BH9	7.70	U20	U	Very stiff fissured grey silty CLAY	24					2.00	1.61	80 160 320	342 201 323	144				Hand Vane = 132, 127, 135 kPa
BH9	9.20	U23	U	Stiff fissured grey silty CLAY	26					1.96	1.56	90 180 360	234 293 255	130				Insufficient sample for Hand Vane
BH11	7.80 - 8.25	U2	U	Stiff fissured grey silty CLAY with occasional gravel	24					2.00	1.61	80 160 320	269 316 394	163				Insufficient sample for Hand Vane
BH11	9.20 - 9.65	U3	U	Very stiff fissured grey fine sandy silty CLAY	23					2.00	1.62	90 180 360	382 250 477	185				Hand Vane = >188 kPa
BH12	7.00 - 7.45	U1	U	Stiff fissured grey silty CLAY	29					1.98	1.53	70 140 280	259 225 252	123				Insufficient sample for Hand Vane
BH12	9.00 - 9.45	U2	U	Stiff fissured grey silty CLAY	25					1.96	1.57	90 180 360	239 73 418	122				Insufficient sample for Hand Vane
BH12	-	A	D	Dark grey silty SAND with rare fine to medium gravel and concrete	18													

SUMMARY OF GEOTECHNICAL TESTING

Test Report by GEOLABS Limited Bucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX

Authorised Signatories: ☐ J R Masters (Qual Mgr) ☐ C F Wallace (Tech Mgr) ☐ J Sturges (Ops Mgr) ☒ Simon Burke (Snr Tech) ☐ J J M Powell (Tech Dir)

Client: Worley Parsons, 27 Great West Road, Brentford, Middlesex TW8 9BW

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Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Tests			Other tests and comments
Borehole No.	Depth (m)	No.	Type		MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	
BH12	-	C	D	Dark grey organic silty CLAY (With strong hydrocarbon smell)	218													
BH12	-	E	D	Brown silty SAND and flint GRAVEL	8.0													
BH12	-	G	D	Dark brownish grey silty CLAY	25													

SUMMARY OF GEOTECHNICAL TESTING

Quick Undrained Triaxial Compression Test

Borehole Number: BH7
 Sample Number: U1
 Depth (m): 3.20 - 3.65

Description:
 Very soft dark grey sandy CLAY with rare fine to medium gravel and organic matter

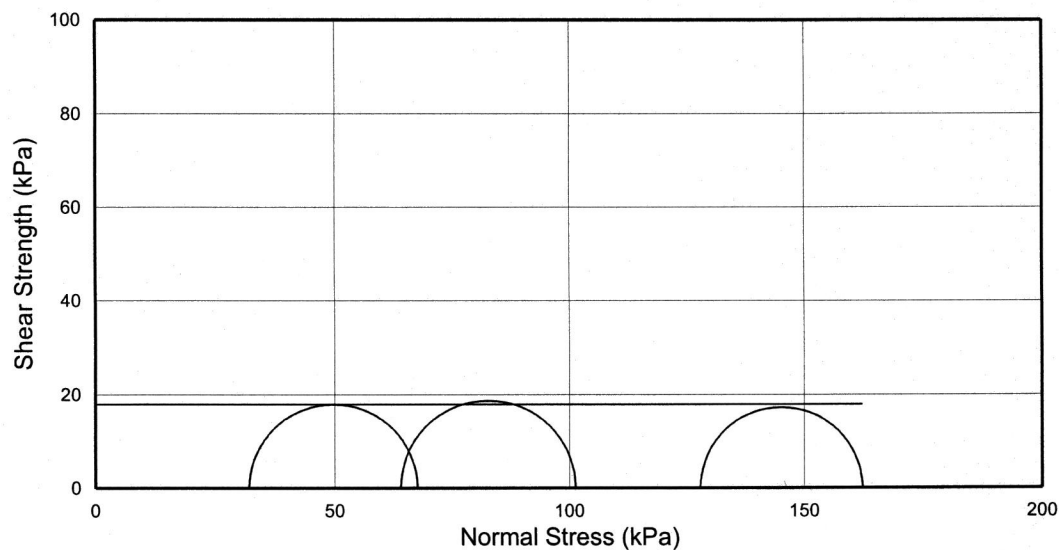
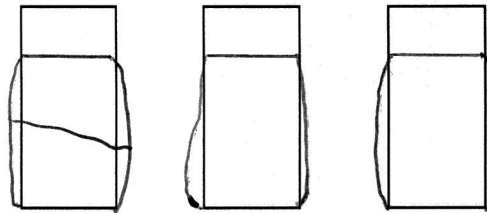
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	76.4	74.4	76.6
Diameter (mm):	37.4	38.0	37.6
Moisture Content (%):	33	31	30
Bulk Density (Mg/m ³):	1.81	1.74	1.75
Dry Density (Mg/m ³):	1.36	1.32	1.34
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	3.1	3.1	3.1
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	32	64	128
Strain at failure (%):	20.3	20.8	20.2
Maximum Deviator Stress (kPa):	36	37	34
Shear Stress C_u (kPa):	18	19	17

Orientation and
position of sample



Mode of failure:



$$c = 18 \text{ kPa} \quad \phi = 0^\circ$$

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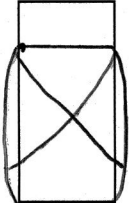
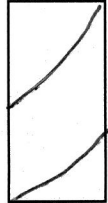
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Quick Undrained Triaxial Compression Test

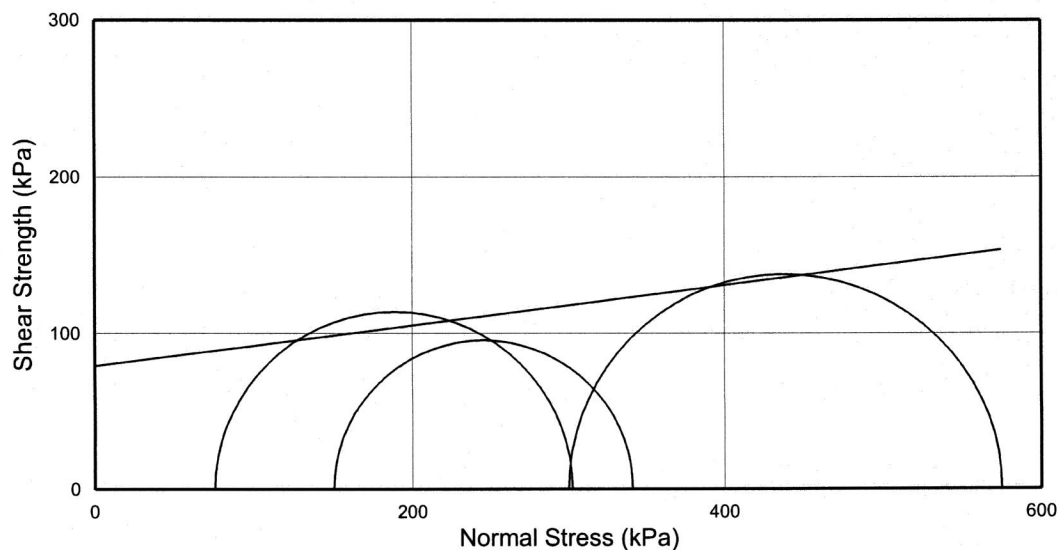
Borehole Number: BH7
 Sample Number: U2
 Depth (m): 7.40 - 7.85

Description:
 Stiff grey slightly sandy silty CLAY with
 rare fine to medium gravel

Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.2	75.7	75.3
Diameter (mm):	37.9	37.9	37.8
Moisture Content (%):	30	27	28
Bulk Density (Mg/m ³):	1.94	1.93	1.98
Dry Density (Mg/m ³):	1.49	1.52	1.54
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.4	3.0	2.0
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	75	150	300
Strain at failure (%):	7.3	19.8	12.0
Maximum Deviator Stress (kPa):	227	191	275
Shear Stress C_u (kPa):	114	95	138
Mode of failure:			

Orientation and
position of sample



$$c = 79 \text{ kPa} \quad \phi = 7.5^\circ$$

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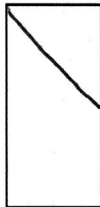
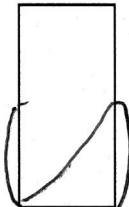
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Quick Undrained Triaxial Compression Test

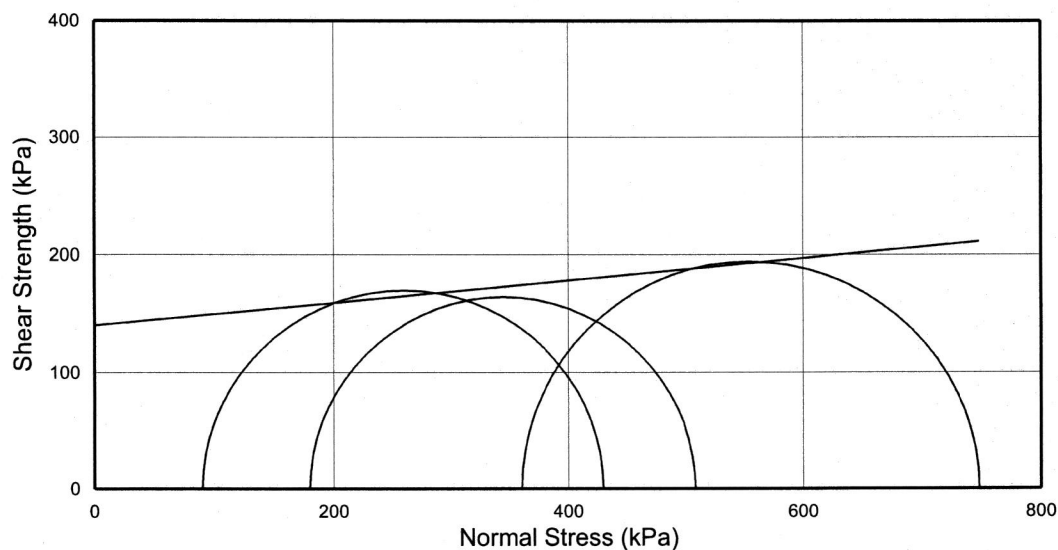
Borehole Number: BH7
 Sample Number: U3
 Depth (m): 8.90 - 9.35

Description:
 Very stiff fissured grey silty CLAY

Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.8	75.6	75.5
Diameter (mm):	37.9	37.9	38.0
Moisture Content (%):	25	23	24
Bulk Density (Mg/m ³):	2.01	2.02	1.99
Dry Density (Mg/m ³):	1.61	1.64	1.60
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.6	2.7	1.5
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	90	180	360
Strain at failure (%):	8.6	17.9	7.9
Maximum Deviator Stress (kPa):	340	328	388
Shear Stress C_u (kPa):	170	164	194
Mode of failure:			

Orientation and
position of sample



$$c = 140 \text{ kPa} \quad \phi = 5.5^\circ$$

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Quick Undrained Triaxial Compression Test

Borehole Number: BH7
 Sample Number: U4
 Depth (m): 10.40 - 10.85

Description:
 Very stiff fissured slightly sandy silty CLAY

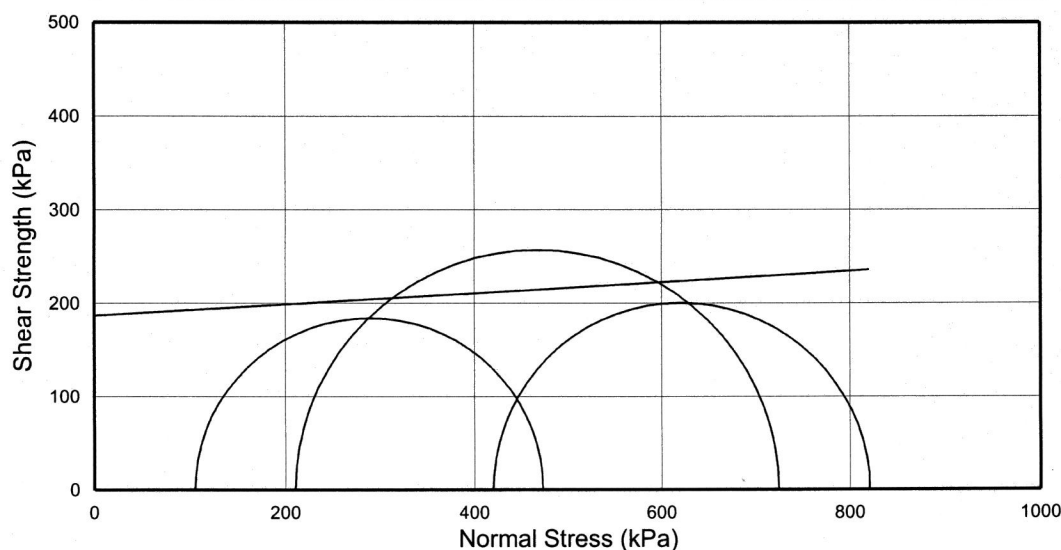
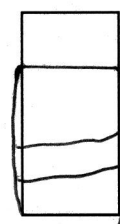
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.2	75.3	75.3
Diameter (mm):	38.0	37.9	38.0
Moisture Content (%):	22	22	25
Bulk Density (Mg/m ³):	2.05	2.04	1.94
Dry Density (Mg/m ³):	1.68	1.67	1.56
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	2.3	1.4	3.1
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	105	210	420
Strain at failure (%):	14.0	7.3	20.6
Maximum Deviator Stress (kPa):	368	515	401
Shear Stress τ_c (kPa):	184	257	200

Orientation and
position of sample



Mode of failure:



$$c = 187 \text{ kPa} \quad \phi = 3.5^\circ$$

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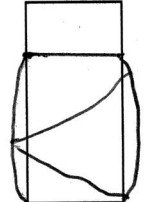
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Quick Undrained Triaxial Compression Test

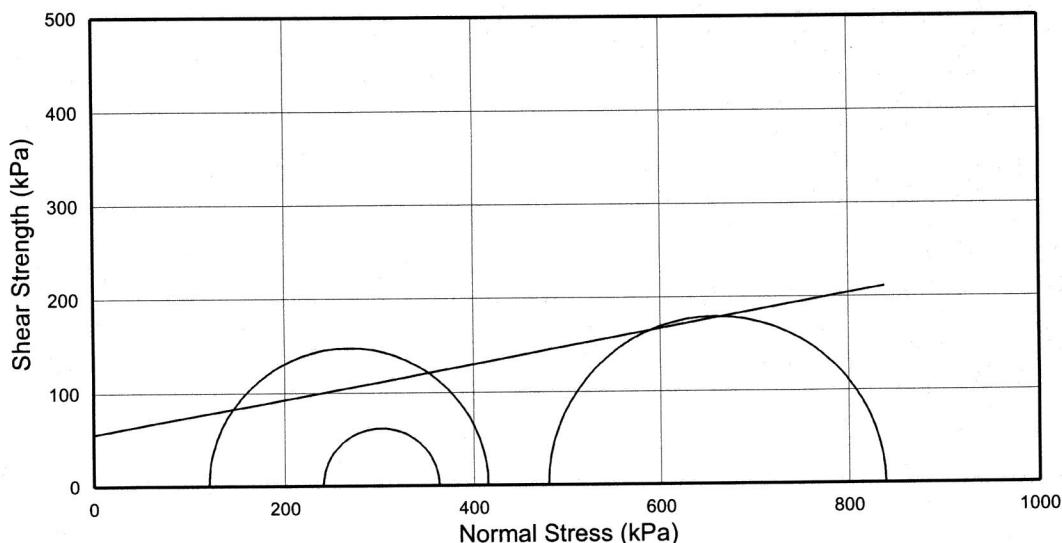
Borehole Number: BH7
 Sample Number: U5
 Depth (m): 11.90 - 12.35

Description:
 Very stiff fissured grey silty CLAY

Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.4	75.2	75.6
Diameter (mm):	37.7	38.1	37.7
Moisture Content (%):	41	31	29
Bulk Density (Mg/m ³):	1.98	1.91	1.99
Dry Density (Mg/m ³):	1.41	1.46	1.55
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.0	3.1	0.8
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	120	240	480
Strain at failure (%):	4.6	20.6	3.7
Maximum Deviator Stress (kPa):	295	123	358
Shear Stress τ_c (kPa):	148	61	179
Mode of failure:			

Orientation and
position of sample



$$c = 56 \text{ kPa} \quad \phi = 10.5^\circ$$

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Quick Undrained Triaxial Compression Test

Borehole Number: BH9
 Sample Number: U20
 Depth (m): 7.70

Description:
 Very stiff fissured grey silty CLAY

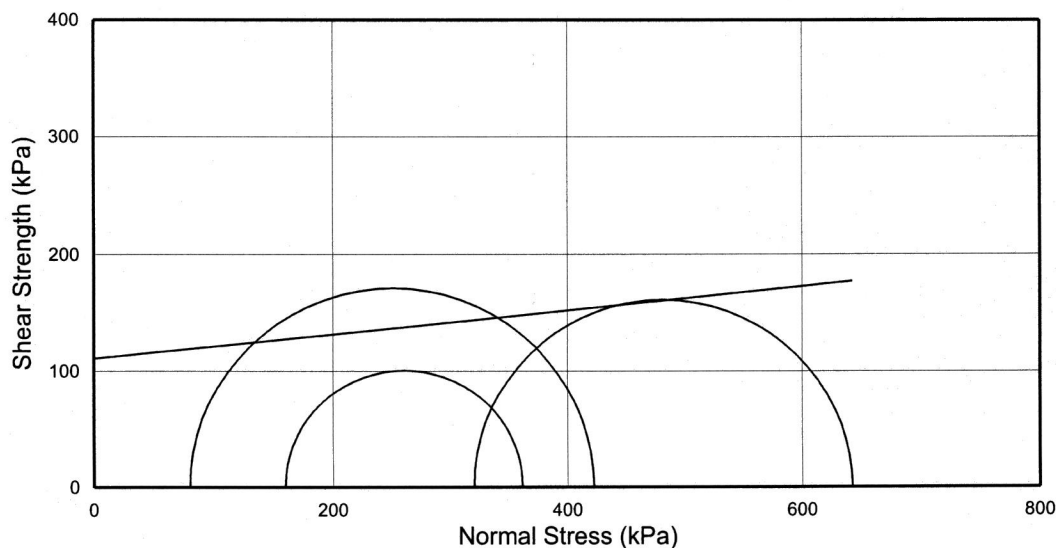
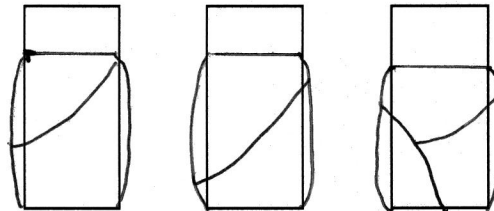
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	76.0	75.5	75.2
Diameter (mm):	37.4	38.1	38.1
Moisture Content (%):	25	25	23
Bulk Density (Mg/m ³):	2.05	1.97	1.98
Dry Density (Mg/m ³):	1.63	1.58	1.61
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	2.7	2.4	3.1
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	80	160	320
Strain at failure (%):	17.1	15.2	20.6
Maximum Deviator Stress (kPa):	342	201	323
Shear Stress τ_c (kPa):	171	101	161

Orientation and
position of sample



Mode of failure:



$$c = 111 \text{ kPa} \quad \phi = 6^\circ$$

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Quick Undrained Triaxial Compression Test

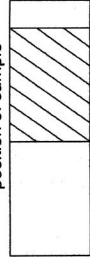
Borehole Number: BH9
 Sample Number: U23
 Depth (m): 9.20

Description:
 Stiff fissured grey silty CLAY

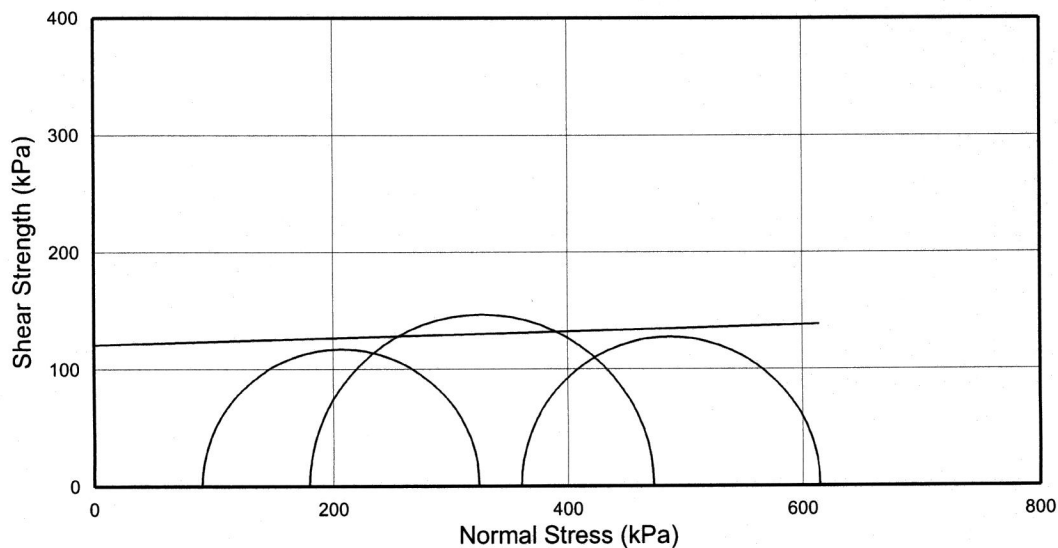
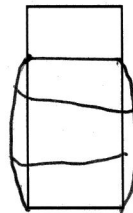
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.9	76.7	76.1
Diameter (mm):	37.9	38.2	37.8
Moisture Content (%):	26	25	27
Bulk Density (Mg/m ³):	1.98	1.94	1.97
Dry Density (Mg/m ³):	1.58	1.55	1.55
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	3.1	2.0	1.9
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	90	180	360
Strain at failure (%):	20.4	11.7	10.5
Maximum Deviator Stress (kPa):	234	293	255
Shear Stress τ_c (kPa):	117	147	127

Orientation and
position of sample



Mode of failure:



$$c = 121 \text{ kPa} \quad \phi = 1.5^\circ$$

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Quick Undrained Triaxial Compression Test

Borehole Number: BH11
 Sample Number: U2
 Depth (m): 7.80 - 8.25

Description:
 Stiff fissured grey silty CLAY with
 occasional gravel

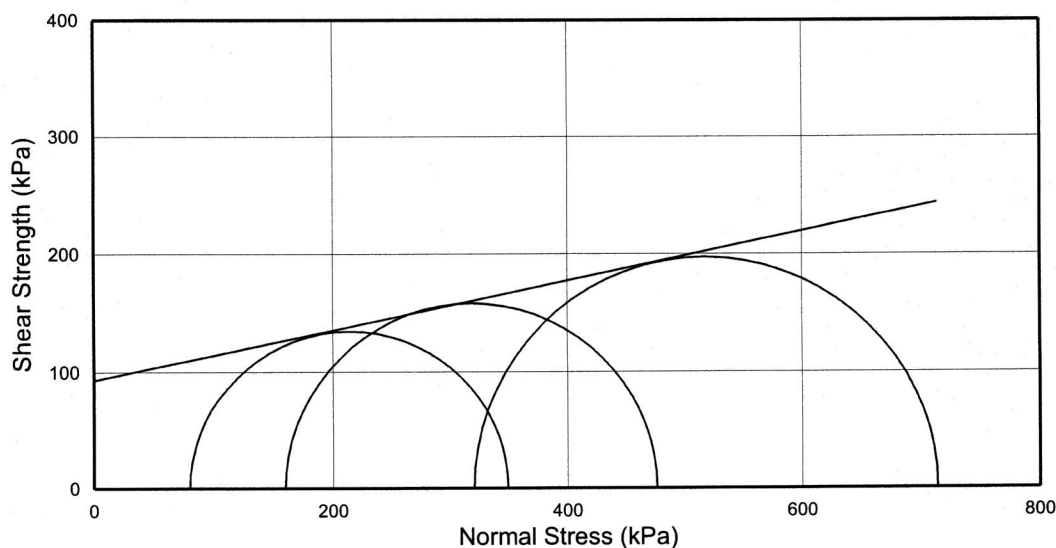
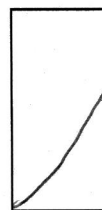
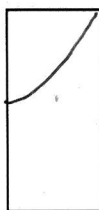
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.5	75.7	75.3
Diameter (mm):	38.0	37.7	37.8
Moisture Content (%):	24	25	24
Bulk Density (Mg/m ³):	2.00	1.97	2.04
Dry Density (Mg/m ³):	1.61	1.57	1.65
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	2.6	1.6	1.2
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	80	160	320
Strain at failure (%):	16.6	8.6	6.0
Maximum Deviator Stress (kPa):	269	316	394
Shear Stress τ_c (kPa):	134	158	197

Orientation and
position of sample



Mode of failure:



$$c = 93 \text{ kPa} \quad \phi = 12^\circ$$

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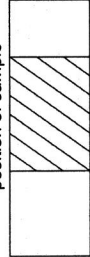
Borehole Number: BH11
 Sample Number: U3
 Depth (m): 9.20 - 9.65

Description:
 Very stiff fissured grey fine sandy silty CLAY

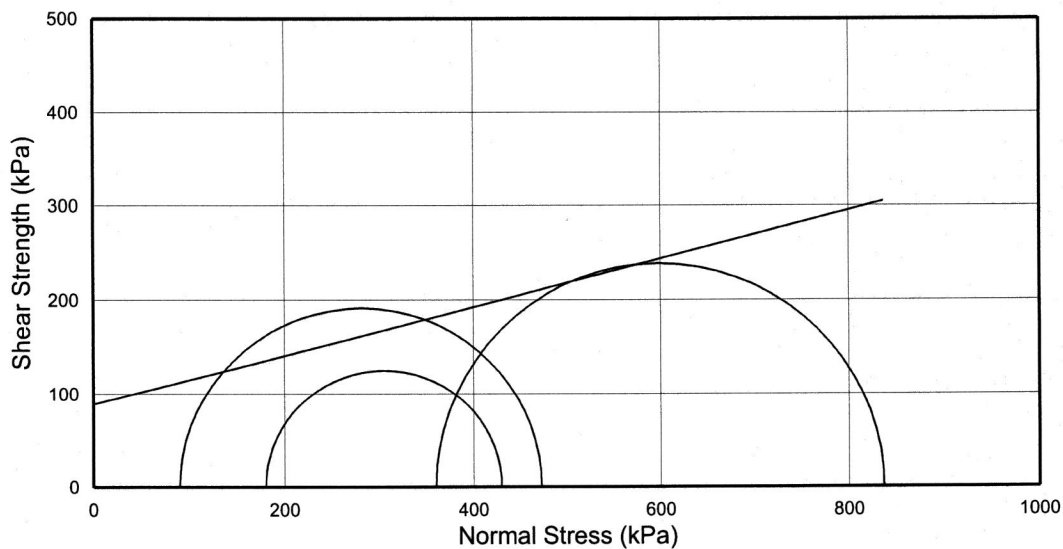
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.9	75.9	75.6
Diameter (mm):	38.2	38.1	38.3
Moisture Content (%):	23	27	20
Bulk Density (Mg/m ³):	1.99	2.00	2.00
Dry Density (Mg/m ³):	1.62	1.58	1.67
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.1	2.1	2.2
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	90	180	360
Strain at failure (%):	5.3	12.5	13.2
Maximum Deviator Stress (kPa):	382	250	477
Shear Stress C_u (kPa):	191	125	238

Orientation and
position of sample



Mode of failure:



$$c = 89 \text{ kPa} \quad \phi = 14.5^\circ$$

Checked and
Approved

Initials:

SB

Date: 08/06/2013

Project Number:

GEO / 19588

Project Name:

TOTTENHAM MARSH

Project Number 51603-00



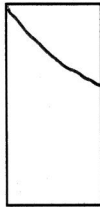
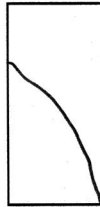
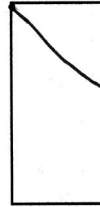
GEOLABS®

Quick Undrained Triaxial Compression Test

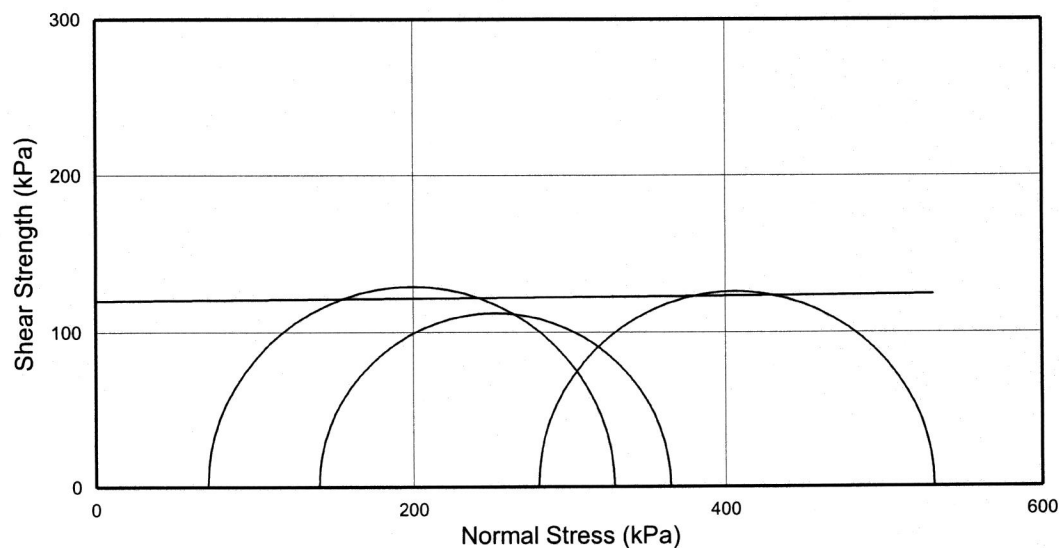
Borehole Number: BH12
 Sample Number: U1
 Depth (m): 7.00 - 7.45

Description:
 Stiff fissured grey silty CLAY

Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	75.8	75.3	75.7
Diameter (mm):	37.7	37.6	37.9
Moisture Content (%):	30	29	29
Bulk Density (Mg/m ³):	1.97	2.00	1.96
Dry Density (Mg/m ³):	1.52	1.55	1.52
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.1	1.7	1.8
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	70	140	280
Strain at failure (%):	5.3	9.3	9.9
Maximum Deviator Stress (kPa):	259	225	252
Shear Stress C_u (kPa):	129	112	126
Mode of failure:			

Orientation and
position of sample



$$c = 120 \text{ kPa} \quad \phi = 0.5^\circ$$

Checked and
Approved

Initials:

SB

Date: 08/06/2013

Project Number:

GEO / 19588

Project Name:

TOTTENHAM MARSH

Project Number 51603-00



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Quick Undrained Triaxial Compression Test

Borehole Number: BH12
 Sample Number: U2
 Depth (m): 9.00 - 9.45

Description:
 Stiff fissured grey silty CLAY

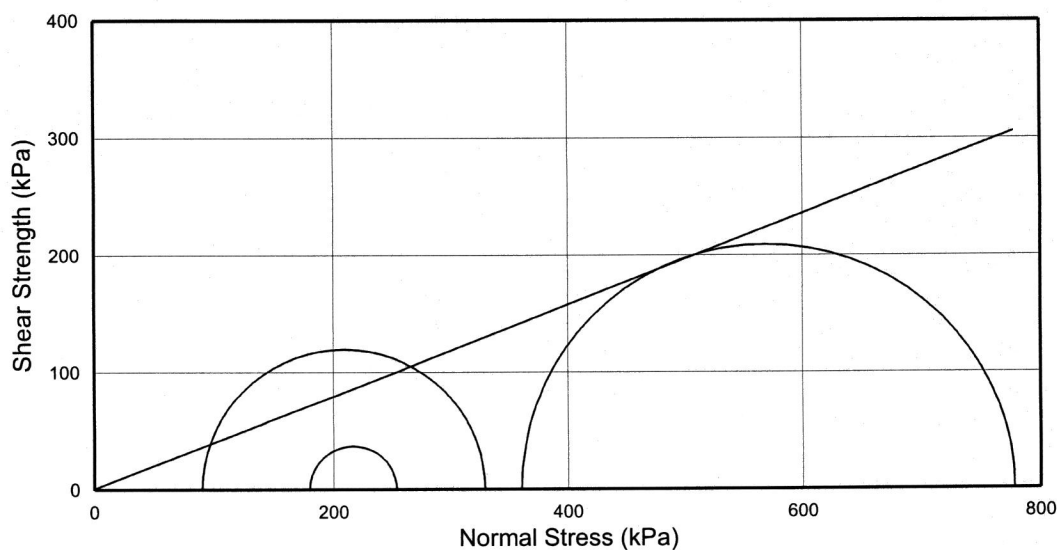
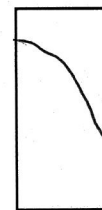
Set of 3 Specimens

Specimen details	Specimen 1	Specimen 2	Specimen 3
Specimen conditions:	Undisturbed	Undisturbed	Undisturbed
Length (mm):	76.7	75.3	75.4
Diameter (mm):	38.6	37.7	37.7
Moisture Content (%):	27	24	24
Bulk Density (Mg/m ³):	1.87	1.98	2.04
Dry Density (Mg/m ³):	1.47	1.59	1.64
Test details	Specimen 1	Specimen 2	Specimen 3
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.5	2.1	1.6
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	90	180	360
Strain at failure (%):	7.8	12.6	8.6
Maximum Deviator Stress (kPa):	239	73	418
Shear Stress C_u (kPa):	119	37	209

Orientation and
position of sample



Mode of failure:



$$c = 1 \text{ kPa} \quad \phi = 21.5^\circ$$

Checked and
Approved

Initials:

SB

Date: 08/06/2013

Project Number:

GEO / 19588

Project Name:

TOTTENHAM MARSH

Project Number 51603-00



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