5708
Kings Cross BR3

Draft Factual Report

CONTENTS

Control Sheet

Contract No: 5708

Report Status: Draft

Issued to: 01 Carillion

Site: Kings Cross BR3
Kings Cross Central
Kings Cross
London

Client: Carillion Plc
Carillion Building
Regeneration House
Wharf Road
London
N1C 4UZ

Copy No: 01

Report Status	Prepared / Amended by:	Checked by:	Approved by:	Date:
Draft	J Clayton	R Stewart	N Greally	
Final				

1.0 Introduction

The contents of this report relate to a ground investigation completed at the BR3 site on the Kings Cross Central redevelopment in the Borough of Camden, London at National Grid Reference TQ 29933 83537.

The investigation was commissioned in order to ascertain information on ground conditions, ground contamination, substructure obstructions and infrastructure works. The scope of the works carried out included:-

- The sinking of one (1) exploratory boreholes by cable percussive method to a maximum depth of 25.00mbgl to determine the general sequence of strata and composition of any expected Made Ground and natural ground below;
- Twelve (12) window sample boreholes to a maximum depth of 6.00mbgl to determine the general sequence of strata and to collect samples for testing.
- One (1) Machine excavated trial pit to a depth of 1.95mbgl to determine the general sequence of strata and to uncover any undiscovered structures.
- laboratory testing on samples from exploratory holes to determine the geotechnical and chemical properties of the strata;
- The installation of a standpipe with a gas tap within the cable percussion boreholes to enable the long term monitoring of gas and ground water levels;
- The production of a factual report on the findings.

The investigation and report was commissioned by Carillion on behalf of Kings Cross General Partner.

2.0 Brief Description of the Site

The site is located within the King's Cross Central Development in the Borough of Camden, London. The National Grid Reference of the site is approximately TQ 29933 83537.

See Figure 1 for a Site Location Plan.

3.0 Published Geology

It is understood from the available information* that the site is underlain by the following:-

Stratum	Description
Made Ground	Variable fill material including silty clay, Gravel and possibly brick rubble. Gravel comprising brick, concrete, clinker, ash, coal and slag with glass, rootlets and woody fragments.
London Clay Formation	Firm becoming stiff grey fissured CLAY with occasional thin partings of light grey fine sandy silt.
Lambeth Group	Very stiff multi-coloured CLAY, locally silty laminations, with occasional fine to medium gravel sized shell fragments.

* British Geological Survey, North London, England and Wales Sheet 256, Bedrock and Superficial Deposits.*

4.0 Fieldwork

4.1 Introduction

All fieldwork was carried out within normal working hours between the 26th May 2015 and the 29th May 2015. The works were carried out in accordance with BS 5930:1999 'Code of practice for site investigations' and Eurocode 7 – Geotechnical design, BS EN 1997-2:2007 'Part 2: Ground investigation and testing'.

4.2 Exploratory Hole Positioning and Surveying

All exploratory holes were jointly positioned by representatives from BAM Ritchies and Carillion. Following completion of the works all exploratory holes locations were surveyed by a BAM Ritchies engineer.

The coordinates and levels for the exploratory holes are on the appropriate logs contained within Appendices 1.0 of this report.

4.3 Clearance of Services

Clearance of sub-surface utilities was carried out by Carillion. All known services were marked on the surface. The position of each exploratory hole was scanned with a Cable Avoidance Tool (CAT) in conjunction with a signal generator (Genny) prior to any form of excavation.

An inspection pit was also carried out at each borehole location where possible to locate any otherwise undetected services. The inspection pit details are noted on the corresponding borehole logs contained within Appendix 1.0 of this report.

4.4 Cable Percussive Boreholes

One (1) exploratory borehole was undertaken by means of cable percussion using Dando 1000 cut down rigs, reaching a maximum depth of 25.00mbgl.

SPTs were carried out at 1.00m intervals until 5.00mbgl where the SPTs alternated with Open U100 samples of nominal 100mm diameter at 1.5m intervals, when these were not possible bulk samples were taken at similar intervals.

Small-disturbed samples were taken every 1.00m and from the SPT split spoon sampler.

In addition, bulk and disturbed samples were taken in the inspection pit. Environmental samples were taken at 0.30m, 1.00m and 1.50m.

An engineering geologist logged the borehole arisings. Engineers' logs are presented within Appendix 1.0 of this report.

4.5 Window Sample Boreholes

A total number of twelve (12) window sample boreholes were carried out to a maximum depth of 6.00mbgl using a Terrier rig. WS1 was abandoned due to access issues. WS3 to WS8 and WS10 to WS13 all were all abandoned at varying depths due to refusing on a concrete structure.

SPTs were carried out at 1.00m intervals alternating with U samples. Small dististubed samples were taken from the shoe of the split spoon sampler. Environmental samples were taken at 0.30m, 1.00m and 1.50m. An engineering geologist logged the window samples. Engineers' logs are presented within Appendix 1.0 of this report.

4.5 Machine Excavated Trial Pit

One (1) trial pit was excavated to a depth of 1.95mbgl using a 1.5T 360. TP1 & TP3 was abandoned due to time constraints.

An engineering geologist logged the borehole arising's. Engineers' logs are presented within Appendix 1.0 of this report. The Trial pit photographs are present in Appendix 2.0.

5.0 Summary of Ground Conditions Encountered

The ground conditions encountered during the investigation can generally be summarised as follows:-

Exploratory Hole No.	MADE GROUND (mbgl)	Weathered London Clay (mbgl)	London Clay Formation (mbgl)
BH1	0.00 – 4.90	4.90 – 10.20	10.20 – 25.00
WS2	0.00 – 2.80	2.80 – 5.00	-
WS3	0.00 – 0.20	-	-
WS4	0.00 – 0.10	-	-
WS5	0.00 – 0.40	-	-
WS6	0.00 – 1.00	-	-
WS7	0.00 – 2.70	-	-
WS8	0.00 – 2.80	-	-
WS9	0.00 – 2.80	2.80 – 6.00	-
WS10	0.00 – 0.20	-	-
WS11	0.00 – 2.70	-	-
WS12	0.00 – 3.00	-	-
WS13	0.00 – 3.00	-	-

6.0 Monitoring and Instrumentation

In order for others to carry out long term groundwater and gas monitoring the following installations were put in place:

Borehole Number	Type of Installation	Depth of Installation and Response Zone
BH1	50mm Standpipe and gas tape.	Installed at 4.90mbgl, with a response zone between 1.00mbgl and 4.90mbgl.

7.0 Laboratory Work

A programme of geotechnical testing was scheduled by Ramboll and carried out on selected samples by Professional Soils Laboratory. All the geochemical testing has been scheduled and tested by Ramboll. All testing was undertaken in accordance with BS 1377:1990 'Methods of test for soils for civil engineering purposes' and other relevant, current standards as appropriate.

The laboratory testing results are presented within Appendix 3.0 of this report.

8.0 Computerised Processing Of Factual Data

A specialist computer software package was used in order to allow data logging to produce factual data in the Data Interchange Format, as specified by Association of Geotechnical & Geoenvironmental Specialists in 'The electronic transfer of geotechnical & geoenvironmental data from ground investigations', 4th Edition 2010. These include:-

- Holebase 3.1 [borehole logs]
- Pocket SI

9.0 References

[a] BS 5930:1999, +A2:2010 'Code of practice for site investigations', British Standards Institution, London.

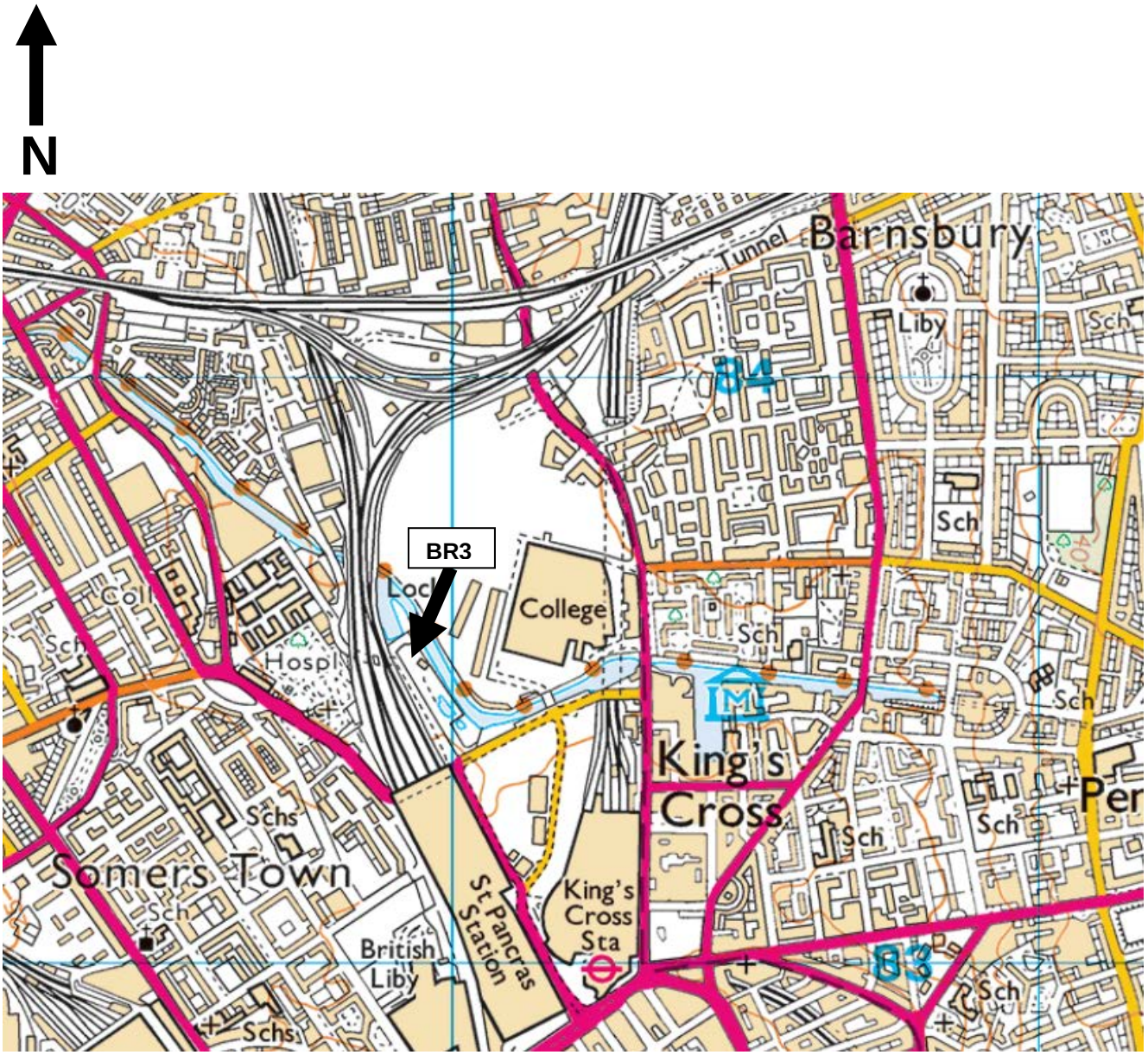
[b] BS EN ISO 22476-3: 2005 Geotechnical Investigation and testing – Field testing – Part 3 Standard penetration test, British Standards Institution, London.

[c] BS 1377:1990 'Methods of test for Soils for civil engineering purposes', Parts 1-9, British Standards Institution, London.

[d] Association of Geotechnical & Geoenvironmental Specialists, 'The Electronic Transfer of Geotechnical & Geoenvironmental Data from Ground Investigations', 4th Edition, 2010.

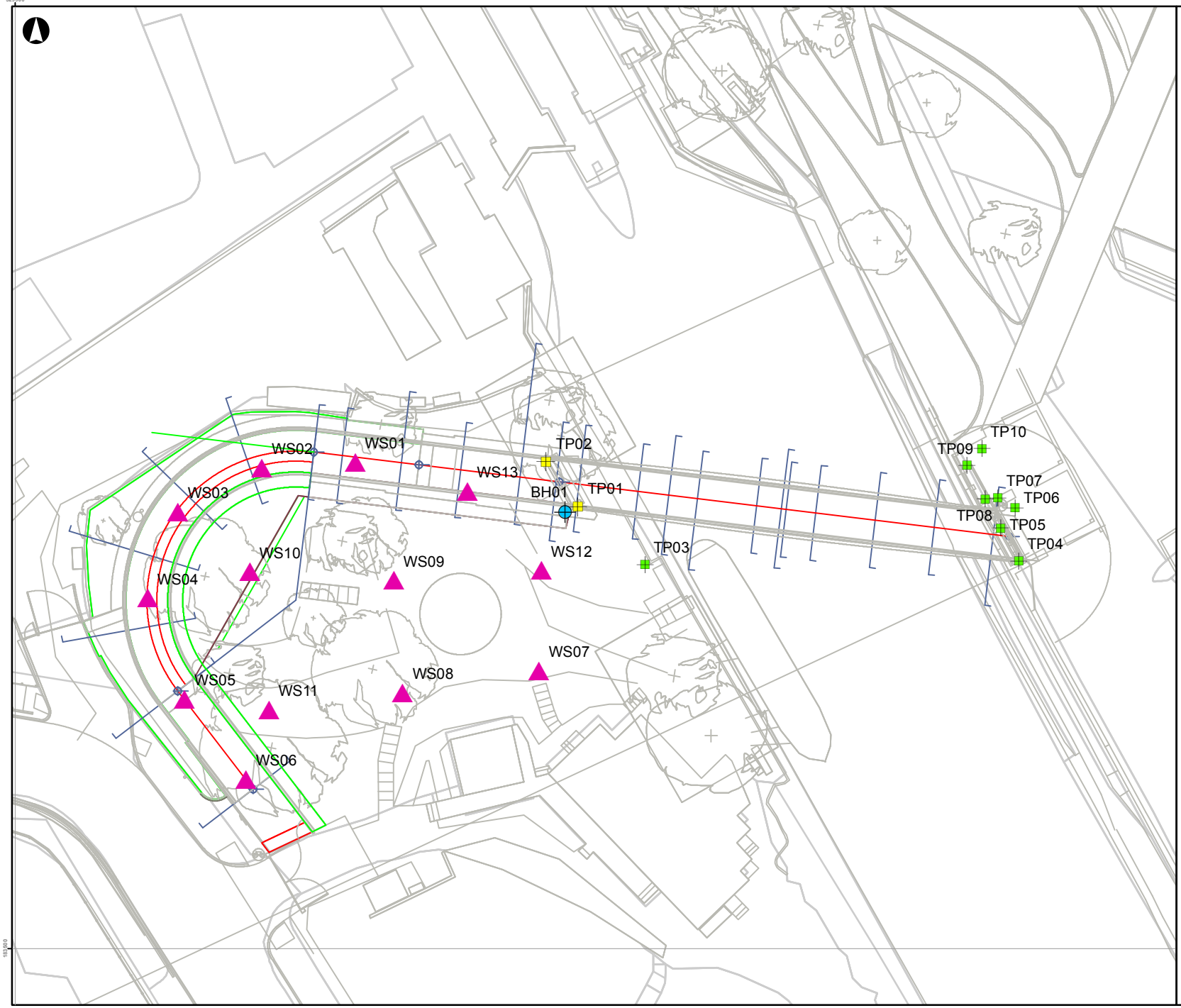
[e] Camley Street Natural Bark Bridge (BR3), Kings Cross Central Limited Partnership, Specification for Ground Investigation, 10 December 2014.

FIGURE 1.0 – Site Location Plan



Notes: Licence number 100040086 © Crown Copyright. All rights reserved.	**Figure 1 Site location drawing**	
	Drawn by: JC	**Date:** 10/06/15
	Contract: Kings Cross BR3	**Drawing number:** 5708FIG01

FIGURE 2.0 – Hole Location Plan



Legend

Proposed Locations

Type

- Cable percussive borehole
- Trial Pit (Hand Dug)
- Trial Pit (Machine Dug)
- Dynamic Sampling

Metres
0 5 10 20

ARUP

13 Fitzroy Street
London W1T 4BQ
Tel +44 20 7636 1531 Fax +44 20 7580 3924
www.arup.com

Client
Kings Cross Central Limited Partnership

Job Title
Camley Street Bridge

Proposed exploratory hole locations

Scale at A4
1:450

Job No	Drawing Status
239454	**--/--**

Drawing No	Issue
001	**P2**

APPENDIX 1.0 – Exploratory Borehole Logs

Borehole Log

Status: Draft

BH1

Sheet 1 of 3

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Depth (m)	Type	Depth (m)	Test Results	Casing (Water) Depth (m)
TOPSOIL		B	0.00-1.20		
	0.30	ES	0.30		
MADE GROUND: Brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse brick, flint, slate and concrete. Occasional terracotta pipe fragments.		ES	1.00		
	1.20	D	1.00		
MADE GROUND: Grey black slightly ashy sandy gravelly SILT. Gravel is fine to coarse angular to rounde flint and brick.		SPT(S)	1.50	N=4 (2,1,1,1,1,1)	1.50
		ES	1.50		
		B	1.50		
		D	1.50-1.95		
		D	2.00		
		SPT(S)	2.50	N=19 (10,10,5,5,4,5)	2.50
		D	2.50-2.95		
		B	2.50-3.00		
	2.90	D	3.00		
MADE GROUND: Firm brown CLAY with blue gleying. Frequent timber fragments.		SPT(S)	3.50	Error	3.00
		D	3.50-3.95		
		D	4.00		
		SPT(S)	4.50	N=13 (1,2,2,3,4,4)	4.50
		D	4.50-4.95		
	4.90	D	5.00		
Soft locally firm brown CLAY with blue gleying. (WEATHERED LONDON CLAY)		SPT(S)	6.00	N=16 (1,3,3,4,4,5)	4.50
		D	6.00		
		B	6.00		
		D	6.00-6.45		
		D	7.00		
		U	7.50-7.95		
		D	8.00		
		SPT(S)	9.00	N=18 (2,3,3,4,5,6)	4.50
		D	9.00		
		D	9.00-9.45		

Borehole continued on next sheet

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)
150	25.00	4.50

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)
2.50	2.80	1.00

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)
27/05/15	2.00	20	1.50	4.50	4.30

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks
27/05/2015	0.00	0.00	0.00	
27/05/2015	4.00	4.00	0.00	
28/05/2015	4.00	4.00	3.90	

Client:	Carillion
Consultant:	Arup
Dates Drilled:	26/05/2015-29/05/2015
Plant:	Dando 100
SPT Hammer:	008
Date Printed:	02/06/2015
Drilled By:	PM
Logged By:	DAB
Checked By:	RS

Remarks: Hole installed with a 50mm HDPE standpipe with plain pipe from GL to 1.0mbgl and slotted pipe from 1.0mbgl to 4.9mbgl. Hole backfilled with bentonite from GL to 1.0mbgl. filter gravel from 1.0mbgl to 4.9mbgl and bentonite from 4.9mbgl to 25.0mbgl.

Borehole Log

Status: Draft

BH1

Sheet 2 of 3

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Depth (m)	Type	Depth (m)	Test Results	Casing (Water) Depth (m)
Soft locally firm brown CLAY with blue gleying. (WEATHERED LONDON CLAY)	10.20	D	10.00		
		U	10.50-10.95		
Firm to stiff dark grey CLAY. (LONDON CLAY)		D	11.00		
		SPT(S)	12.00	N=23 (1,3,5,5,6,7)	4.50
		D	12.00		
		D	12.00-12.45		
		D	13.00		
		U	13.50-13.95		
		D	14.00		
		B	14.00		
		SPT(S)	15.00	N=26 (2,4,4,6,7,9)	4.50
		D	15.00		
		D	15.00-15.45		
		D	16.00		
		U	16.50-16.95		
		D	17.00		
		SPT(S)	18.00	N=32 (3,4,7,8,8,9)	4.50
		D	18.00		
		D	18.00-18.45		
		D	19.00		
		U	19.50-19.95		

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)
150	25.00	4.50

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks
28/05/2015	15.00	4.50	0.00	
29/05/2015	15.00	4.50	8.20	

Client:	Carillion
Consultant:	Arup
Dates Drilled:	26/05/2015-29/05/2015
Plant:	Dando 100
SPT Hammer:	008
Date Printed:	02/06/2015
Drilled By:	PM
Logged By:	DAB
Checked By:	RS

Remarks:

Borehole Log

Status: Draft

BH1

Sheet 3 of 3

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
Firm to stiff dark grey CLAY. (LONDON CLAY)				D	20.00			
				SPT(S)	21.00	N=35 (3,4,7,8,9,11)	4.50	
				D	21.00			
				D	21.00-21.45			
				D	22.00			
				U	22.50-22.95			
				D	23.00			
				SPT(S)	24.00	N=37 (4,5,6,8,10,13)	4.50	
				D	24.00			
				D	24.00-24.45			
Borehole Complete at 25.00 m		25.00		D	25.00			

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)
150	25.00	4.50

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks
29/05/2015	25.00	4.50	0.00	

Client:	Carillion
Consultant:	Arup
Dates Drilled:	26/05/2015-29/05/2015
Plant:	Dando 100
SPT Hammer:	008
Date Printed:	02/06/2015
Drilled By:	PM
Logged By:	DAB
Checked By:	RS

Remarks:

Borehole Log

Status: Draft

WS2

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells				B	0.00-1.20			
				ES	0.30			
				ES	1.00			
				D	1.00			
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.		1.20		SPT(S)	1.20	N=16 (3,4,4,4,4,4)		
				D	1.20-1.65			
				ES	1.50			
				U	1.65-2.00			
				SPT(S)	2.00	N=4 (1,1,1,1,1,1)		
				D	2.00-2.45			
				U	2.45-3.00			
Soft grey brown slightly sandy CLAY. (WEATHERED LONDON CLAY)		2.80		SPT(S)	3.00	N=7 (1,1,1,2,2,2)		
				D	3.00-3.45			
				U	3.45-4.00			
				SPT(S)	4.00	N=12 (2,3,3,3,3,3)		
				D	4.00-4.45			
				U	4.45-5.00			
Borehole Complete at 5.00 m		5.00						

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	27/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS3

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Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test			Casing (Water) Depth (m)	Installations
				Type	Depth (m)	Test Results		
MADE GROUND: Brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse brick, flint, and concrete. Frequent brick, concrete at base.		0.20						
Borehole Complete at 0.20 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	27/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole refused on concrete obstruction.

Borehole Log

Status: Draft

WS4

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Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Sample / Test Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse brick, flint, and concrete. Frequent brick, concrete at base.		0.10						
Borehole Complete at 0.10 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	27/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole refused on concrete obstruction.

Borehole Log

Status: Draft

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Project: King's Cross BR3

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Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test: Type	Sample / Test: Depth (m)	Sample / Test: Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse brick, flint, and concrete. Frequent brick, concrete at base.		0.40						
Borehole Complete at 0.40 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client: Carillion
Consultant: Arup
Dates Drilled: 27/05/2015
Plant: Terrier
SPT Hammer: Terrier
Date Printed: 02/06/2015
Drilled By: GT
Logged By: DAB
Checked By: RS

Remarks: Hole refused on concrete obstruction. Concrete broken out on 29/05/2015 to confirm thickness of concrete.

Borehole Log

Status: Draft

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Project: King's Cross BR3

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Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown gravelly fine to coarse sand. Gravel is fine to coarse angular wood chippings.		0.20		B ES	0.00-1.00 0.30			
MADE GROUND: Brown slightly clayey gravelly fine and medium SAND. Gravel is fine to coarse angular to rounded Flint and brick. Concrete at base		1.00		ES	1.00			
Borehole Complete at 1.00 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	27/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole refused on concrete obstruction.

Borehole Log

Status: Draft

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Project: King's Cross BR3

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Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells				B ES	0.00-1.20 0.30			
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.		1.00		ES D SPT(S) D ES U SPT(S) D U	1.00 1.00 1.20 1.20-1.65 1.50 1.65-2.00 2.00 2.00-2.45 2.45-2.70	N=12 (3,3,3,3,3,3) N=16 (2,3,4,4,4,4)		
Borehole Complete at 2.70 m		2.70						

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Client:	Carillion
Consultant:	Arup
Dates Drilled:	29/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Remarks: Hole refused on concrete/brick obstruction. Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS8

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells				B ES	0.00-1.20 0.30			
		0.80						
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.				ES D SPT(S) D ES U SPT(S) D U	1.00 1.00 1.20 1.20-1.65 1.50 1.65-2.00 2.00 2.00-2.45 2.45-2.80	 N=12 (2,3,3,3,3,3) N=12 (2,3,3,3,3,3)		
		2.80						
Borehole Complete at 2.80 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client: Carillion
Consultant: Arup
Dates Drilled: 28/05/2015
Plant: Terrier
SPT Hammer: Terrier
Date Printed: 02/06/2015
Drilled By: GT
Logged By: DAB
Checked By: RS

Remarks: Hole refused on concrete/brick obstruction. Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS9

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells				B ES	0.00-1.20 0.30			
		0.80						
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.				ES D SPT(S) D ES U SPT(S) D U	1.00 1.00 1.20 1.20-1.65 1.50 1.65-2.00 2.00 2.00-2.45 2.45-3.00	N=8 (2,2,2,2,2,2) N=12 (2,2,3,3,3,3)		
		2.80						
Soft becoming very soft light grey brown CLAY. (WEATHERED LONDON CLAY)				SPT(S) D U SPT(S) D U SPT(S) D U	3.00 3.00-3.45 3.45-4.00 4.00 4.00-4.45 4.45-5.00 5.00 5.00-5.45 5.46-6.00	N=3 (1,0,0,1,1,1) N=0 (0,0,0,0,0,0) N=0 (0,0,0,0,0,0) 		
		5.95						
Firm to stiff light brown slightly sandy CLAY. (WEATHERED LONDON CLAY)		6.00		D	6.00			
Borehole Complete at 6.00 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	28/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS10

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test: Type	Sample / Test: Depth (m)	Sample / Test: Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse brick, flint, and concrete. Frequent brick, concrete at base.		0.20						
Borehole Complete at 0.20 m								

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	27/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole refused on concrete obstruction.

Borehole Log

Status: Draft

WS11

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.				B	0.00-1.20			
				ES	0.30			
				ES	1.00			
				D	1.00			
				SPT(S)	1.20	N=12 (2,2,3,3,3,3)		
				D	1.20-1.65			
				ES	1.50			
				U	1.65-2.00			
				SPT(S)	2.00	N=32 (2,5,8,8,8,8)		
				D	2.00-2.45			
				U	2.45-2.70			
Borehole Complete at 2.70 m		2.80						

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Client:	Carillion
Consultant:	Arup
Dates Drilled:	29/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Remarks: Hole refused on concrete/brick obstruction. Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS12

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells		0.30		B ES	0.00-1.20 0.30			
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.				ES D SPT(S) D ES U SPT(S) D U	1.00 1.00 1.20 1.20-1.65 1.50 1.65-2.00 2.00 2.00-2.45 2.45-3.00	N=12 (2,3,3,3,3,3) N=3 (1,0,0,1,1,1)		
Borehole Complete at 3.00 m		3.00		D	3.00			

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Client:	Carillion
Consultant:	Arup
Dates Drilled:	29/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Remarks: Hole refused on concrete/brick obstruction. Hole backfilled with bentonite.

Borehole Log

Status: Draft

WS13

Sheet 1 of 1

Project: King's Cross BR3

Project No: 5708

Ground Level: -

Coordinates:

Description	Legend	Depth (m)	O.D. Level (m)	Sample / Test Type	Sample / Test Depth (m)	Test Results	Casing (Water) Depth (m)	Installations
MADE GROUND: Brown slightly silty gravelly fine to coarse SAND. Gravel is fine to coarse brick, flint, slate and concrete. Occasional porcelain and broken oyster shells		0.30		B ES	0.00-1.20 0.30			
MADE GROUND: Soft to firm black and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, flint and concrete.				ES D SPT(S) D ES U SPT(S) D U	1.00 1.00 1.20 1.20-1.65 1.50 1.65-2.00 2.00 2.00-2.45 2.45-3.00	 N=8 (1,1,2,2,2,2) N=8 (1,2,2,2,2,2)		
Borehole Complete at 3.00 m		2.80						

Hole Diameter Detail

Diameter (mm)	Depth (m)	Casing Depth (m)

Chiselling / Slow Progress

From (m)	To (m)	Time (hours)

Water Level Observations

Date	Water Strike (m)	Standing Time (mins)	Standing Level (m)	Casing Depth (m)	Depth Sealed (m)

Client:	Carillion
Consultant:	Arup
Dates Drilled:	28/05/2015
Plant:	Terrier
SPT Hammer:	Terrier
Date Printed:	02/06/2015
Drilled By:	GT
Logged By:	DAB
Checked By:	RS

Progress

Date	Hole Depth	Casing Depth	Water Depth	Remarks

Remarks: Hole refused on concrete/brick obstruction. Hole backfilled with bentonite.

APPENDIX 2.0 – Trial Pit Photographs

bam ritchies

Contract:	Kings Cross Plot BR3
Contract No:	5708
Borehole No:	TP2
Date :	28/05/2015
Depth:	0.00mbgl – 1.95mbgl
Notes:	See corresponding log

TP2

Photo 1 of 1

APPENDIX 3.0 – Geotechnical Testing Results

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL15/2895

Client's Reference: 5708 Report Date: 07 July 2015

Client Name: Bam Ritchies
Unit 5, Stone House Road
Martland Park
Wigan
WN5 0LE

For the attention of: Jack Clayton

Contract Title: Kings Cross BR3

Date Received: 15/06/2015
Date Commenced: 15/06/2015
Date Completed: 07/07/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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 in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
M Beastall (Laboratory Manager)

D Lambe (Senior Technician)
S Royle (Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1	CR012227	B	1.50	Dark brown gravelly very sandy CLAY.
BH1	CR012233	D	3.50-3.95	Brown CLAY.
BH1	CR012241	U	7.50-7.95	Soft brown slightly gravelly slightly sandy CLAY.
BH1	CR012246	U	10.50-10.95	Stiff brown CLAY.
BH1	CR011765	U	13.50-13.95	Very stiff brown CLAY.
BH1	CR011771	U	16.50-16.95	Stiff brown slightly sandy CLAY.
BH1	CR011776	U	19.50-19.95	Very stiff brown sandy CLAY.
BH1	CR011781	U	22.50-22.95	Very stiff brown sandy CLAY.
WS2	CR011157	B	0.00-1.20	MADE GROUND dark brown very sandy clayey gravel.
WS2	CR011160	U	1.65-2.00	MADE GROUND dark brown mottled grey gravelly slightly sandy clay.
WS2	CR011164	U	3.45-4.00	Stiff brown slightly sandy CLAY.
WS2	CR011166	U	4.45-5.00	Very stiff brown CLAY.
WS6	CR011167	B	0.00-1.00	MADE GROUND brown very gravelly very sandy clay.
WS7	CR011205	B	0.00-1.20	MADE GROUND dark brown very sandy very clayey gravel.
WS7	CR011208	U	1.65-2.00	MADE GROUND brown slightly gravelly slightly sandy clay.
WS8	CR011184	B	0.00-1.20	MADE GROUND dark brown very sandy very clayey gravel of cobbles.
WS8	CR011187	U	1.65-2.00	MADE GROUND brown gravelly slightly sandy clay.
WS9	CR011171	B	0.00-1.20	MADE GROUND dark brown very gravelly very sandy clay.
WS9	CR011174	U	1.65-2.00	Brown slightly gravelly slightly sandy CLAY.

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Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

KING'S CROSS BR3.

Contract No: PSL15/2895

Client Ref: 5708

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
WS9	CR011178	U	3.45-4.00	Soft brown slightly gravelly slightly sandy CLAY.
WS9	CR011180	U	4.45-5.00	Soft brown slightly gravelly slightly sandy very silty CLAY.
WS9	CR011182	U	5.46-6.00	Soft brown slightly gravelly slightly sandy CLAY.
WS9	CR011183	D	6.00	Brown slightly sandy very silty CLAY.
WS11	CR011214	U	1.65-2.00	MADE GROUND brown very gravelly slightly sandy clay.
WS11	CR011216	U	2.45-2.70	MADE GROUND brown gravelly sandy very silty clay.
WS12	CR011200	U	1.65-2.00	MADE GROUND brown mottled grey gravelly slightly sandy clay.
WS12	CR011202	U	2.45-3.00	MADE GROUND dark brown very sandy clayey very silty gravel.
WS13	CR011194	U	1.65-2.00	MADE GROUND brown mottled grey gravelly sandy clay.
WS13	CR011196	U	2.45-3.00	MADE GROUND brown gravelly very sandy very silty clay.

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Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

KING'S CROSS BR3.

Contract No: PSL15/2895

Client Ref: 5708

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH1	CR012227	B	1.50	18								
BH1	CR012233	D	3.50-3.95	35								
BH1	CR012241	U	7.50-7.95	29				58	26	32	95	High plasticity CH.
BH1	CR012246	U	10.50-10.95	27								
BH1	CR011765	U	13.50-13.95	29								
BH1	CR011771	U	16.50-16.95	26								
BH1	CR011776	U	19.50-19.95	22								
BH1	CR011781	U	22.50-22.95	25								
WS2	CR011157	B	0.00-1.20	12								
WS2	CR011160	U	1.65-2.00	26				53	25	28	85	High plasticity CH.
WS2	CR011164	U	3.45-4.00	26								
WS2	CR011166	U	4.45-5.00	28								
WS6	CR011167	B	0.00-1.00	14								
WS7	CR011205	B	0.00-1.20	15								
WS7	CR011208	U	1.65-2.00	24				63	28	35	95	High plasticity CH.
WS8	CR011184	B	0.00-1.20	12								
WS8	CR011187	U	1.65-2.00	20	1.78	1.48		67	29	38	85	High plasticity CH.
WS9	CR011171	B	0.00-1.20	16								
WS9	CR011174	U	1.65-2.00	22	1.88	1.54		68	29	39	90	High plasticity CH.

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

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Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

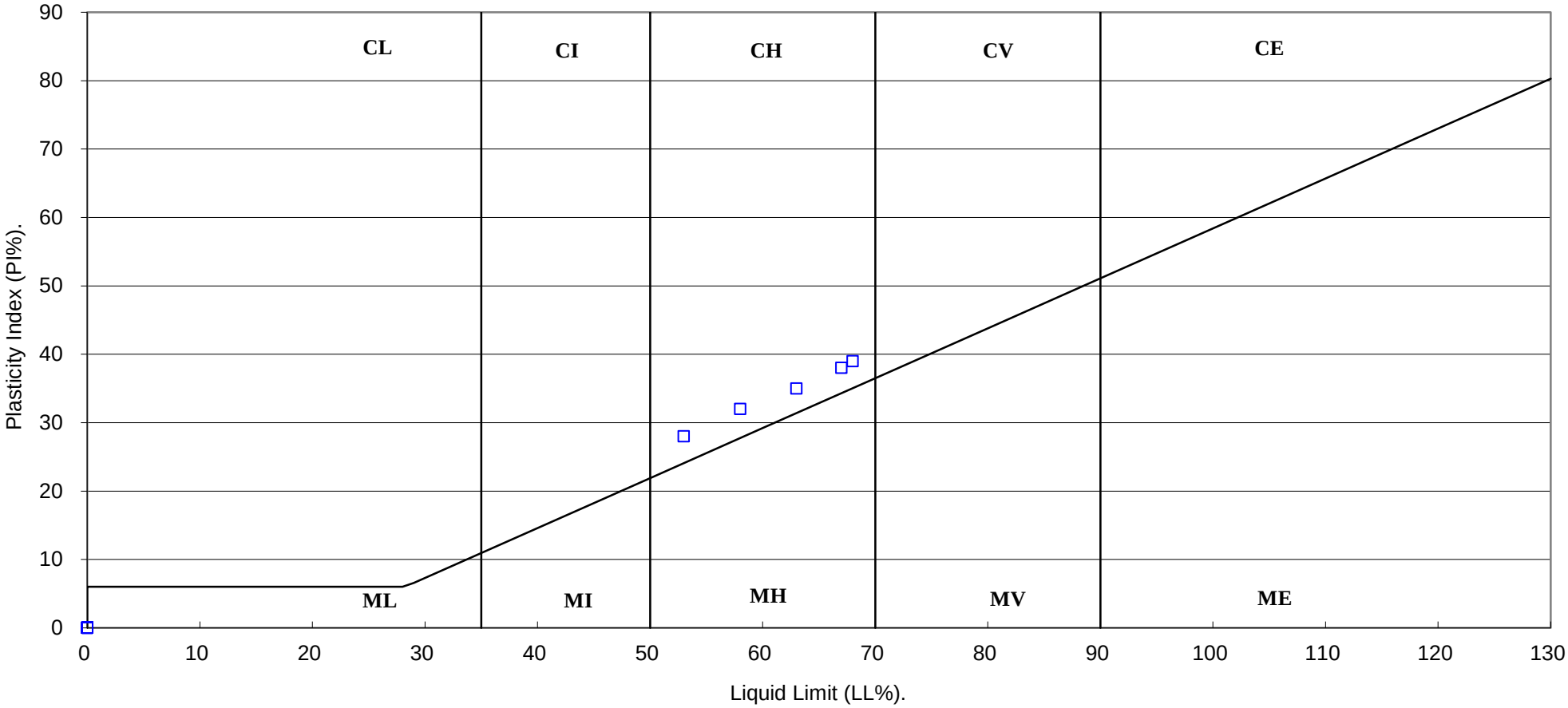
KING'S CROSS BR3.

Contract No: **PSL15/2895**

Client Ref: **5708**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



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Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

KING'S CROSS BR3.

Contract No:	**PSL15/2895**
Client Ref:	**5708**

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
WS9	CR011178	U	3.45-4.00	33				69	30	39	94	High plasticity CH.
WS9	CR011180	U	4.45-5.00	41				74	31	43	94	Very high plasticity CV.
WS9	CR011182	U	5.46-6.00	39				75	31	44	96	Very high plasticity CV.
WS9	CR011183	D	6.00	27				72	30	42	98	Very high plasticity CV.
WS11	CR011214	U	1.65-2.00	22	1.91	1.57		67	29	38	67	High plasticity CH.
WS11	CR011216	U	2.45-2.70	20								
WS12	CR011200	U	1.65-2.00	28	1.88	1.47		69	30	39	85	High plasticity CH.
WS12	CR011202	U	2.45-3.00	25								
WS13	CR011194	U	1.65-2.00	24				50	24	26	85	Intermediate plasticity CI.
WS13	CR011196	U	2.45-3.00	34								

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

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

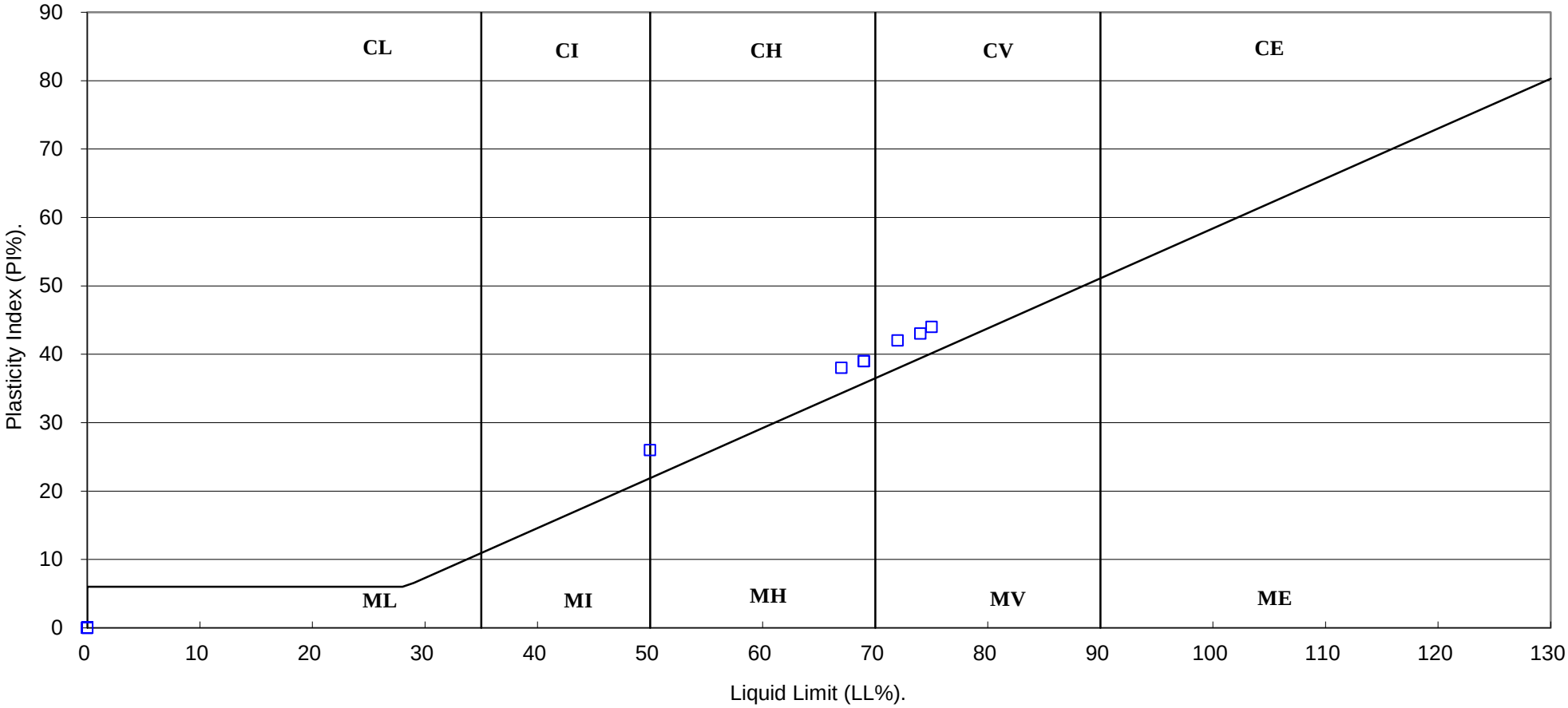
KING'S CROSS BR3.

Contract No: **PSL15/2895**

Client Ref: **5708**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	07/07/15		07/07/15		07/07/15

KING'S CROSS BR3.

Contract No: **PSL15/2895**

Client Ref: **5708**

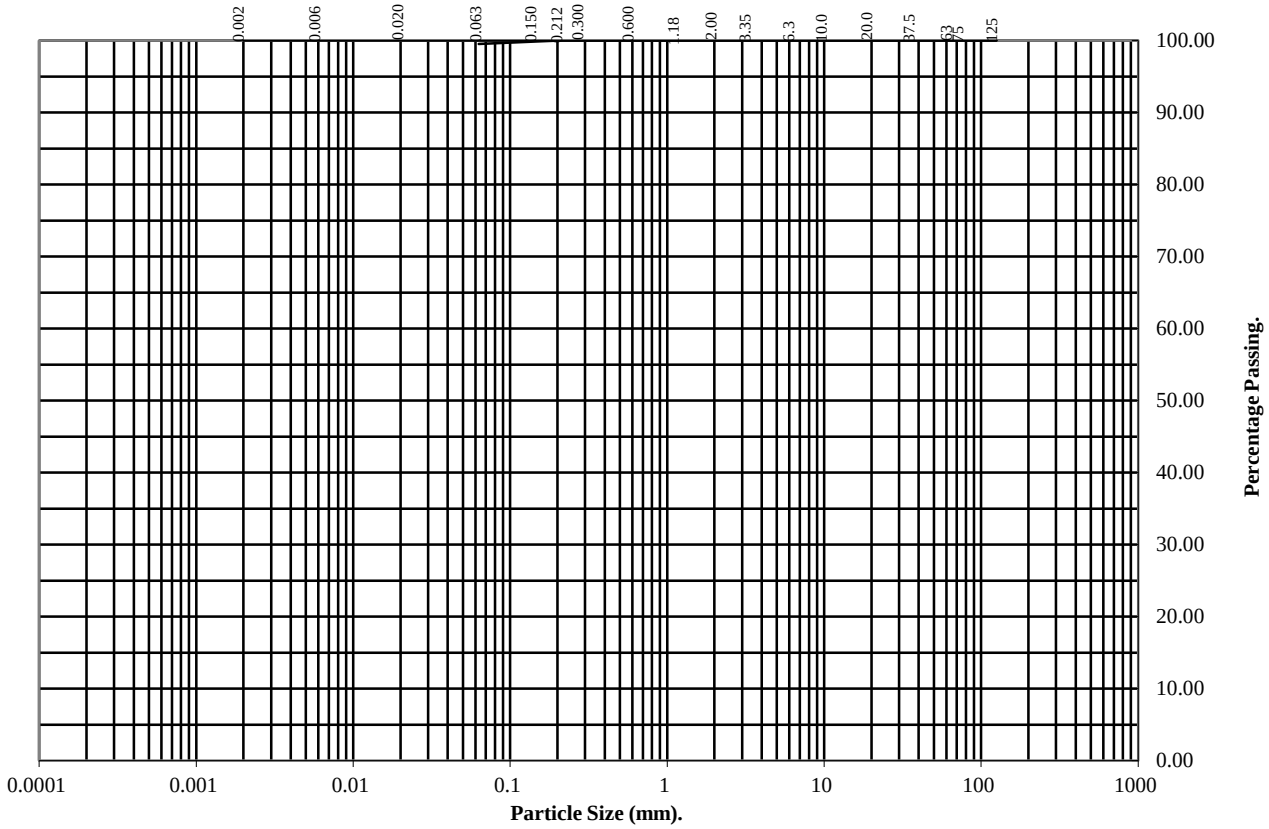
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH1** **Depth (m):** **10.50-10.95**

Sample Number: **CR012246** **Sample Type:** **U**



BS Test Sieve	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	100
0.063	100

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	0
Silt / Clay	100

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

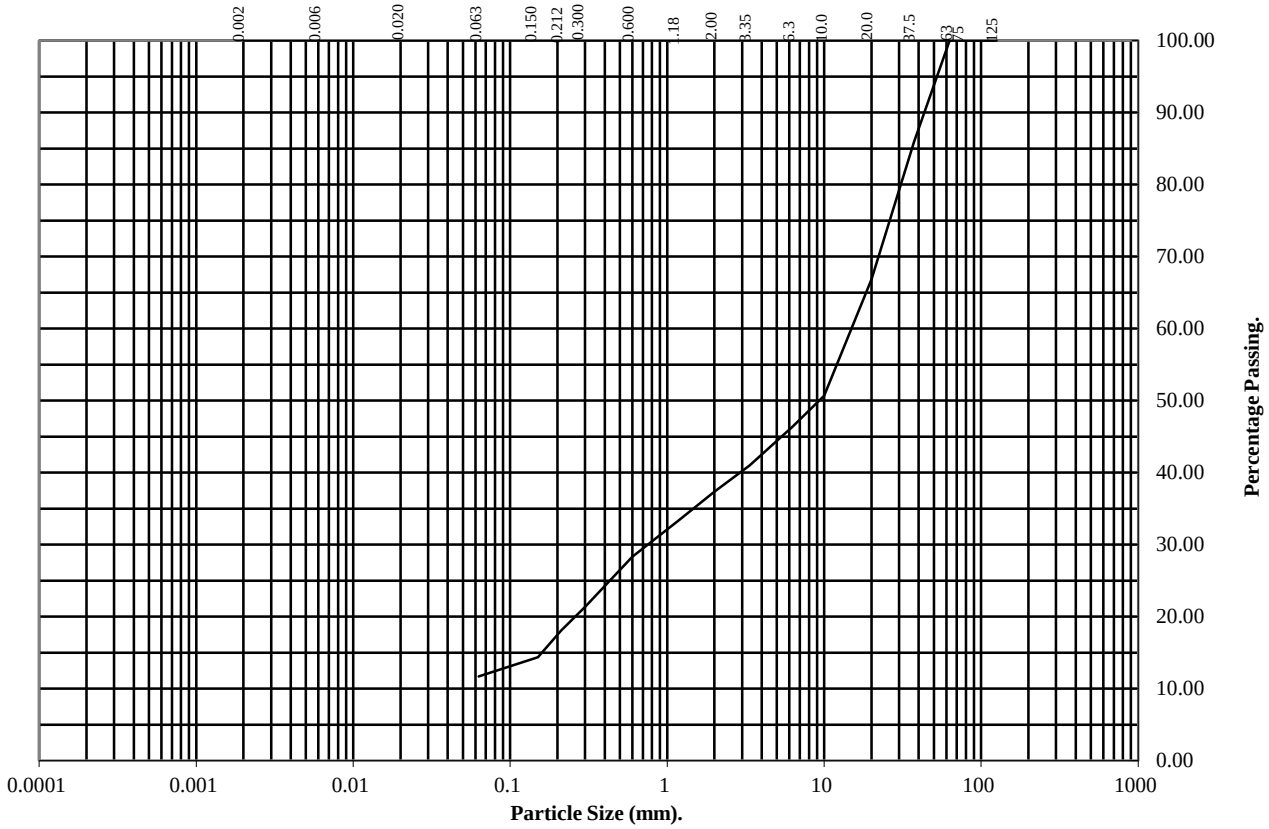
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WS2** **Depth (m):** **0.00-1.20**

Sample Number: **CR011157** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	86
20	67
10	51
6.3	46
3.35	41
2	37
1.18	33
0.6	28
0.3	21
0.212	18
0.15	14
0.063	12

Soil Fraction	Total Percentage
Cobbles	0
Gravel	63
Sand	25
Silt / Clay	12

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

PSL Professional Soils Laboratory	**KING'S CROSS BR3**	**Contract No.: PSL15/2895**

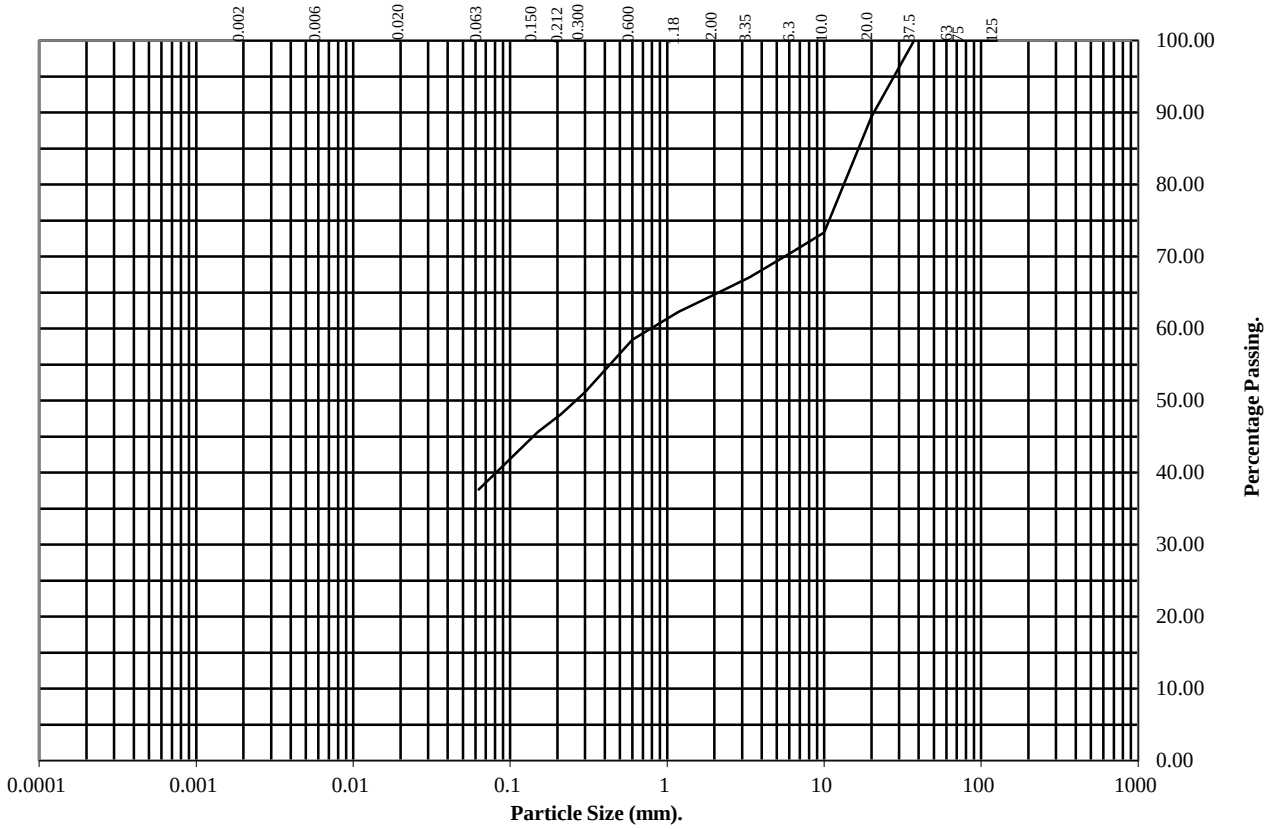
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WS6** **Depth (m):** **0.00-1.00**

Sample Number: **CR011167** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	89
10	73
6.3	71
3.35	67
2	65
1.18	62
0.6	58
0.3	51
0.212	48
0.15	46
0.063	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	27
Silt / Clay	38

Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

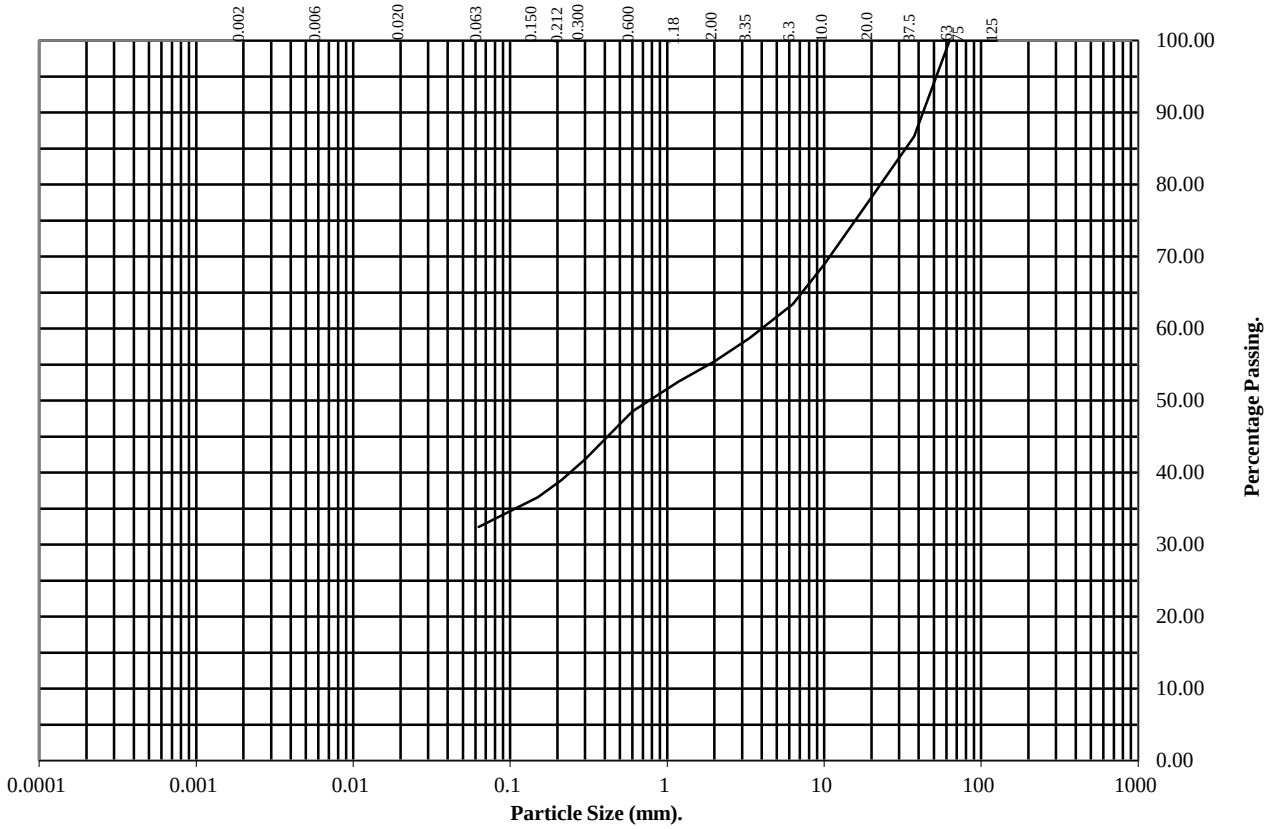
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WS7** **Depth (m):** **0.00-1.20**

Sample Number: **CR011205** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	87
20	78
10	69
6.3	63
3.35	59
2	55
1.18	53
0.6	49
0.3	42
0.212	39
0.15	37
0.063	32

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	23
Silt / Clay	32

Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

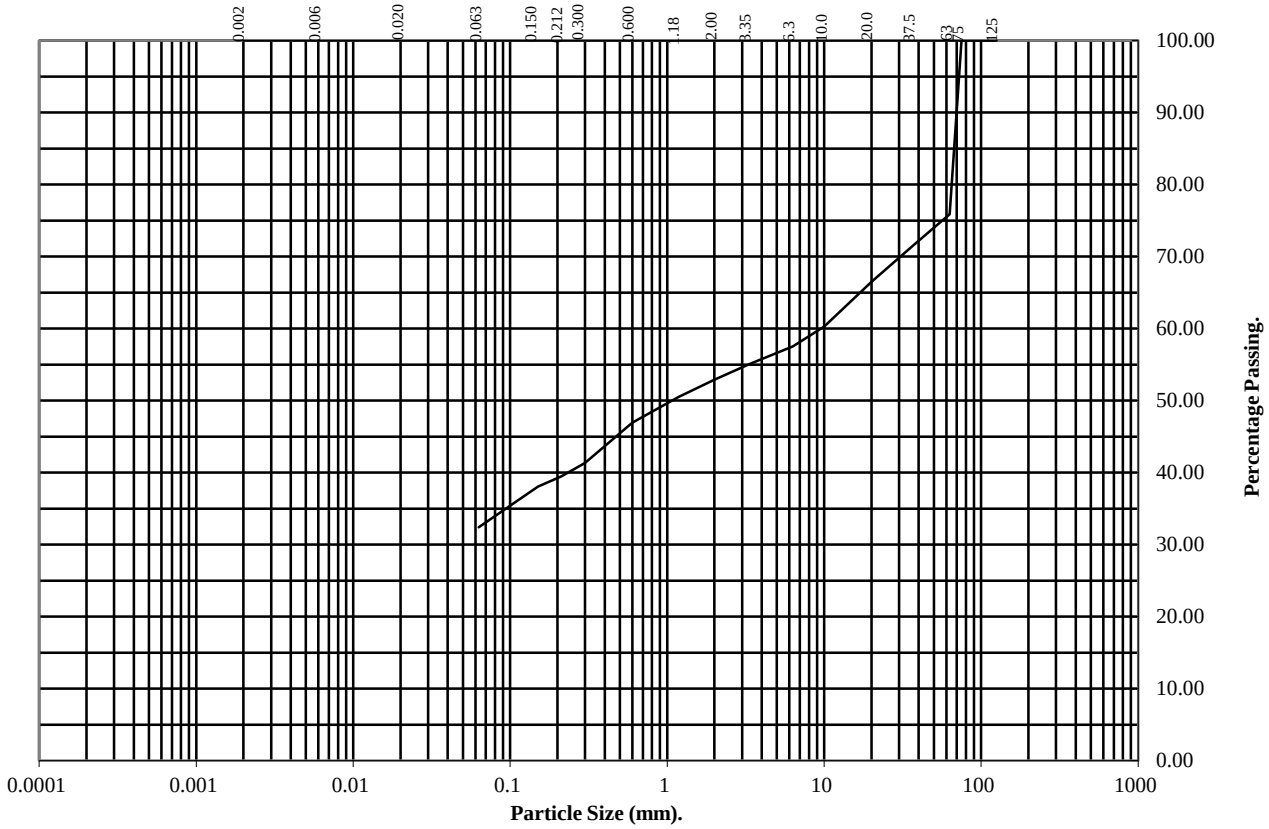
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WS8** **Depth (m):** **0.00-1.20**

Sample Number: **CR011184** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	76
37.5	72
20	66
10	60
6.3	58
3.35	55
2	53
1.18	50
0.6	47
0.3	41
0.212	39
0.15	38
0.063	32

Soil Fraction	Total Percentage
Cobbles	24
Gravel	23
Sand	21
Silt / Clay	32

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

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KING'S CROSS BR3

Contract No.: PSL15/2895

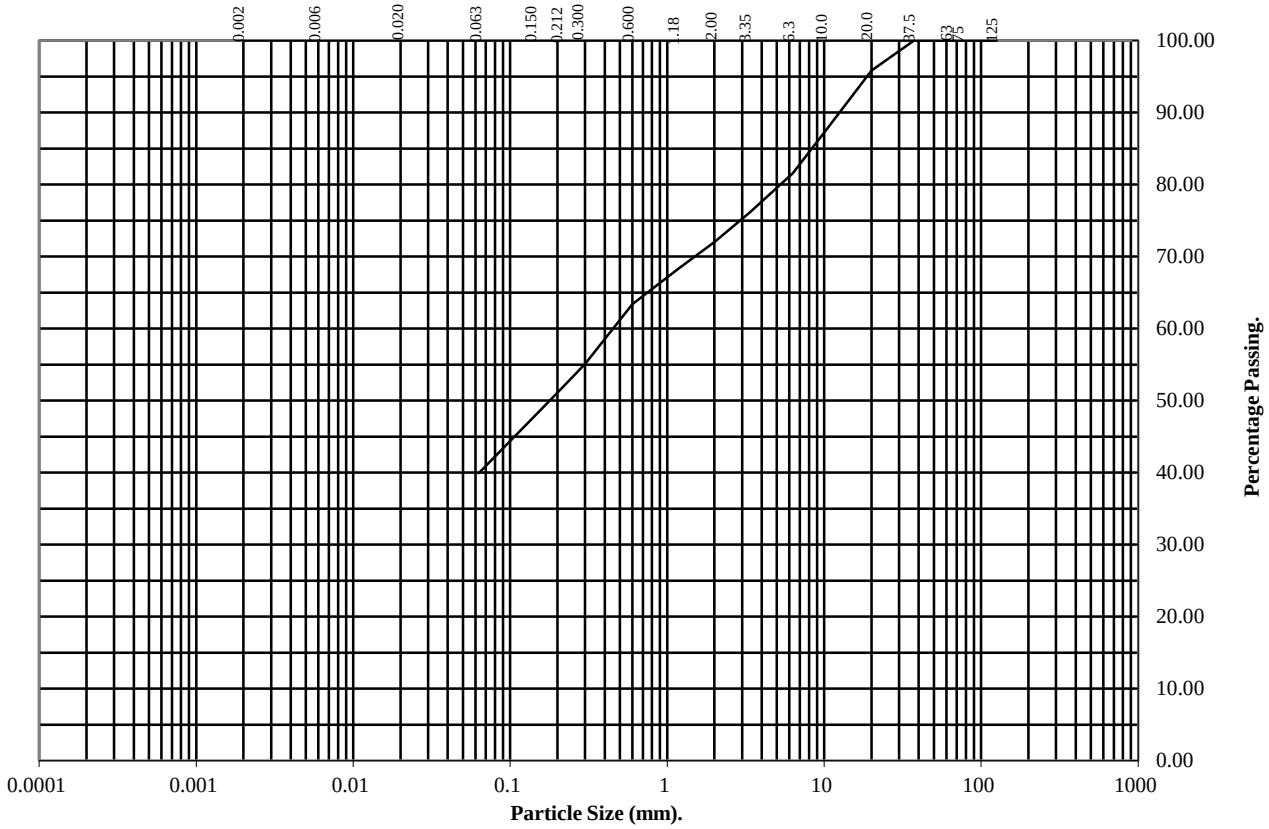
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **WS9** **Depth (m):** **0.00-1.20**

Sample Number: **CR011171** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	87
6.3	82
3.35	76
2	72
1.18	68
0.6	63
0.3	55
0.212	52
0.15	48
0.063	40

Soil Fraction	Total Percentage
Cobbles	0
Gravel	28
Sand	32
Silt / Clay	40

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

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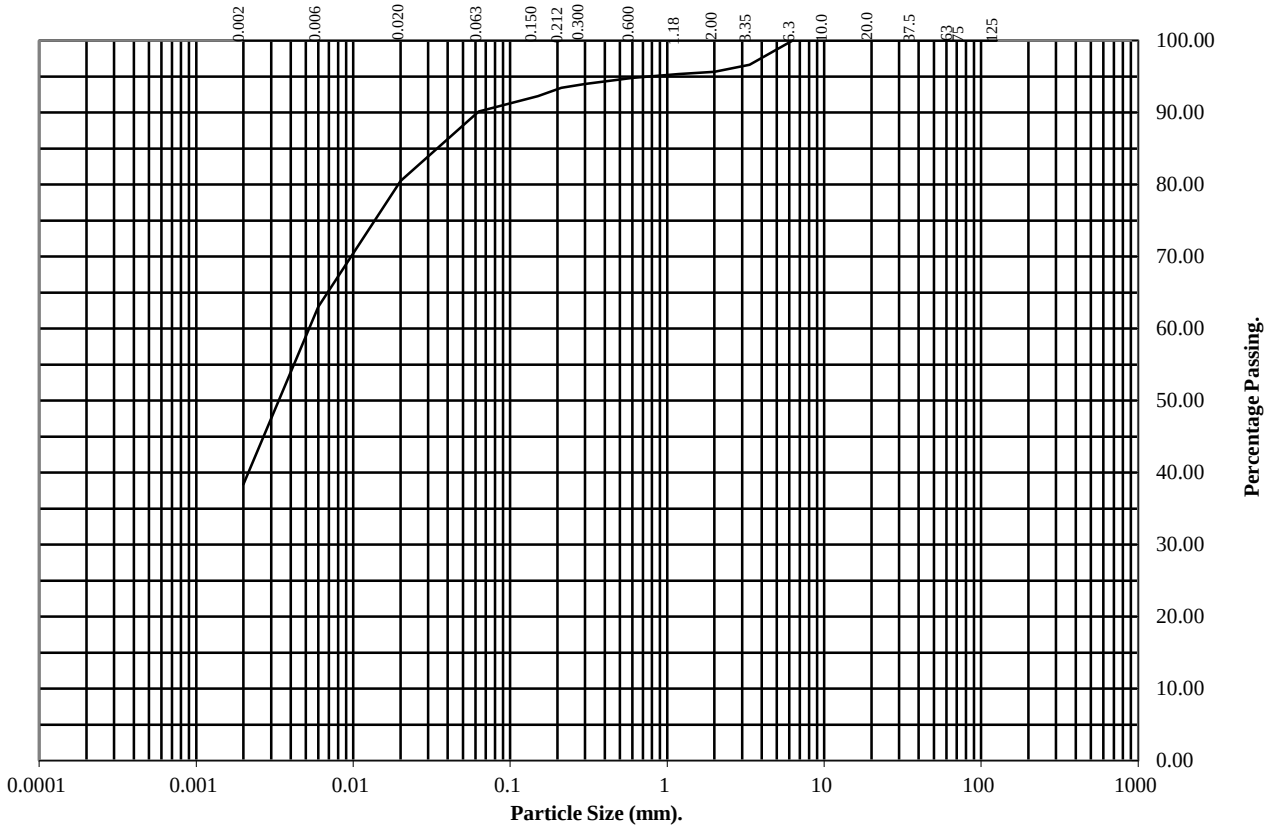
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS9** **Depth (m):** **4.45-5.00**

Sample Number: **CR011180** **Sample Type:** **D**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	97
2	96
1.18	95
0.6	95
0.3	94
0.212	93
0.15	92
0.063	90

Particle Diameter	Percentage Passing
0.02	81
0.006	63
0.002	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	6
Silt	52
Clay	38

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

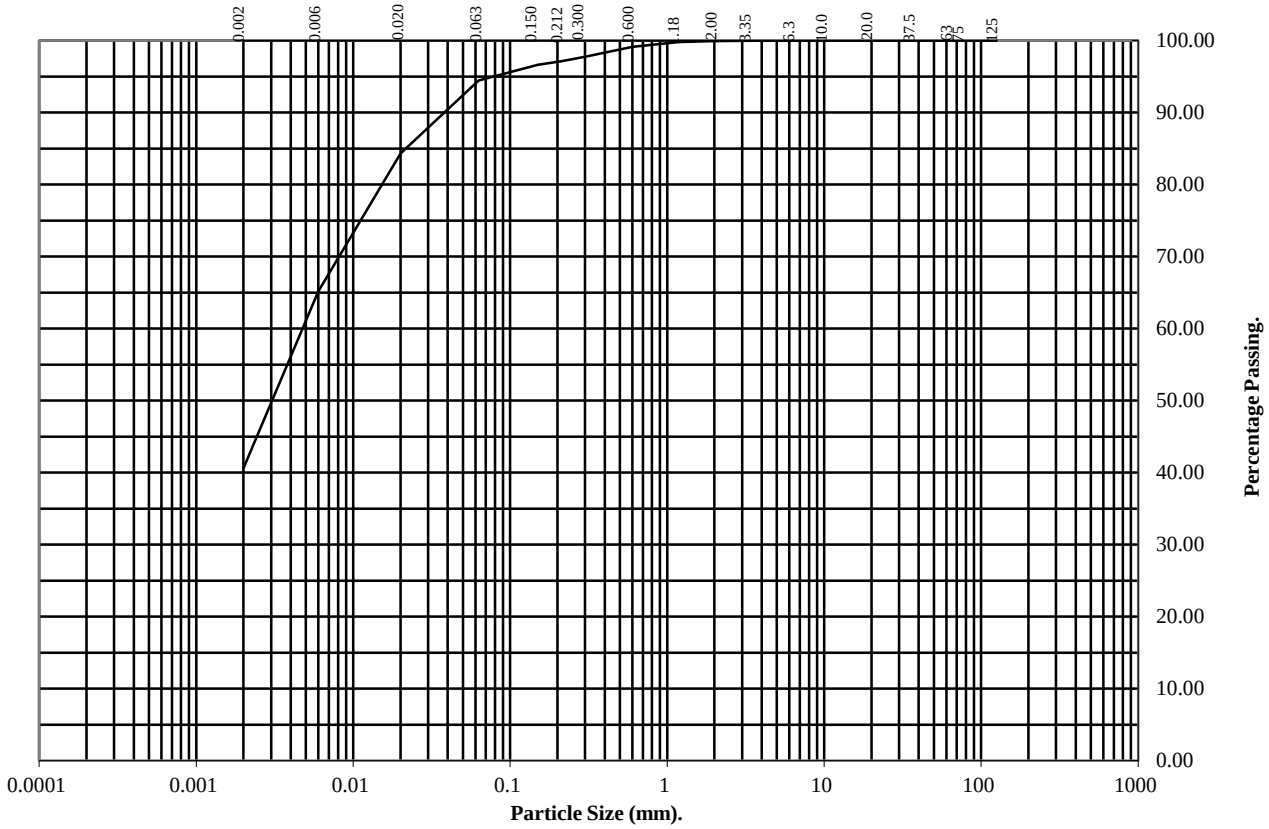
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS9** **Depth (m):** **6.00**

Sample Number: **CR011183** **Sample Type:** **D**



BS Test Sieve	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	99
0.3	98
0.212	97
0.15	97
0.063	94

Particle Diameter	Percentage Passing
0.02	84
0.006	65
0.002	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	6
Silt	53
Clay	41

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

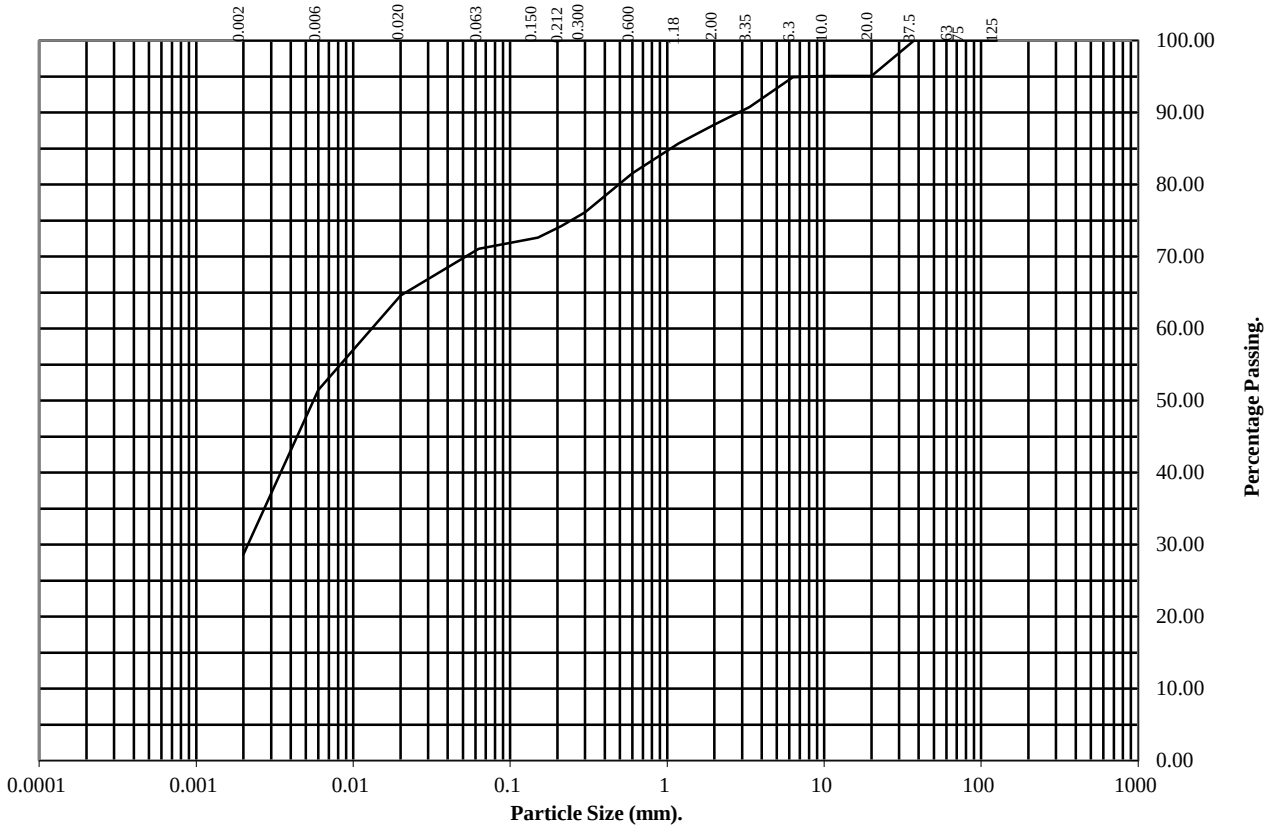
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS11** **Depth (m):** **2.45-2.70**

Sample Number: **CR011216** **Sample Type:** **U**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	95
10	95
6.3	95
3.35	91
2	88
1.18	86
0.6	82
0.3	76
0.212	74
0.15	73
0.063	71

Particle Diameter	Percentage Passing
0.02	65
0.006	51
0.002	29

Soil Fraction	Total Percentage
Cobbles	0
Gravel	12
Sand	17
Silt	42
Clay	29

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

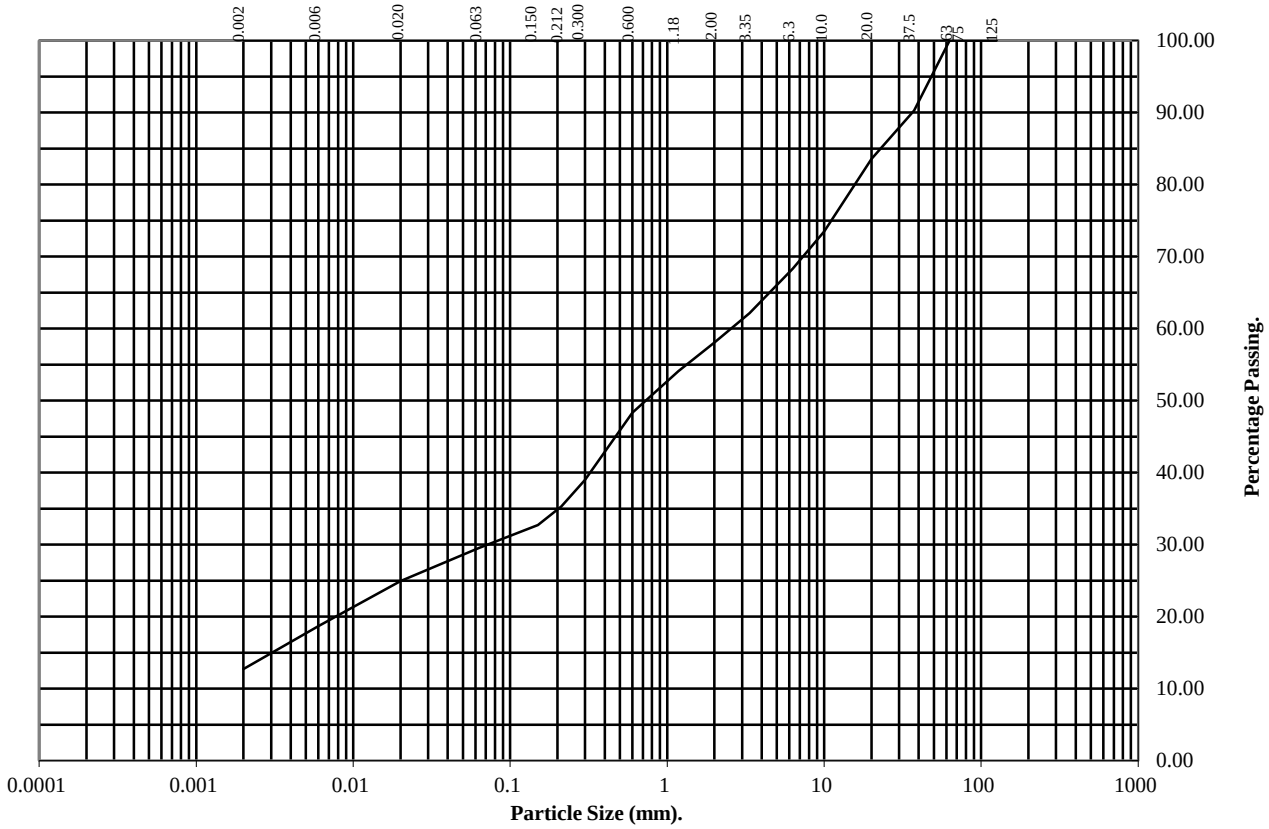
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS12** **Depth (m):** **2.45-3.00**

Sample Number: **CR011202** **Sample Type:** **U**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	90
20	84
10	73
6.3	68
3.35	62
2	58
1.18	54
0.6	48
0.3	39
0.212	35
0.15	33
0.063	30

Particle Diameter	Percentage Passing
0.02	25
0.006	19
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	42
Sand	28
Silt	17
Clay	13

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

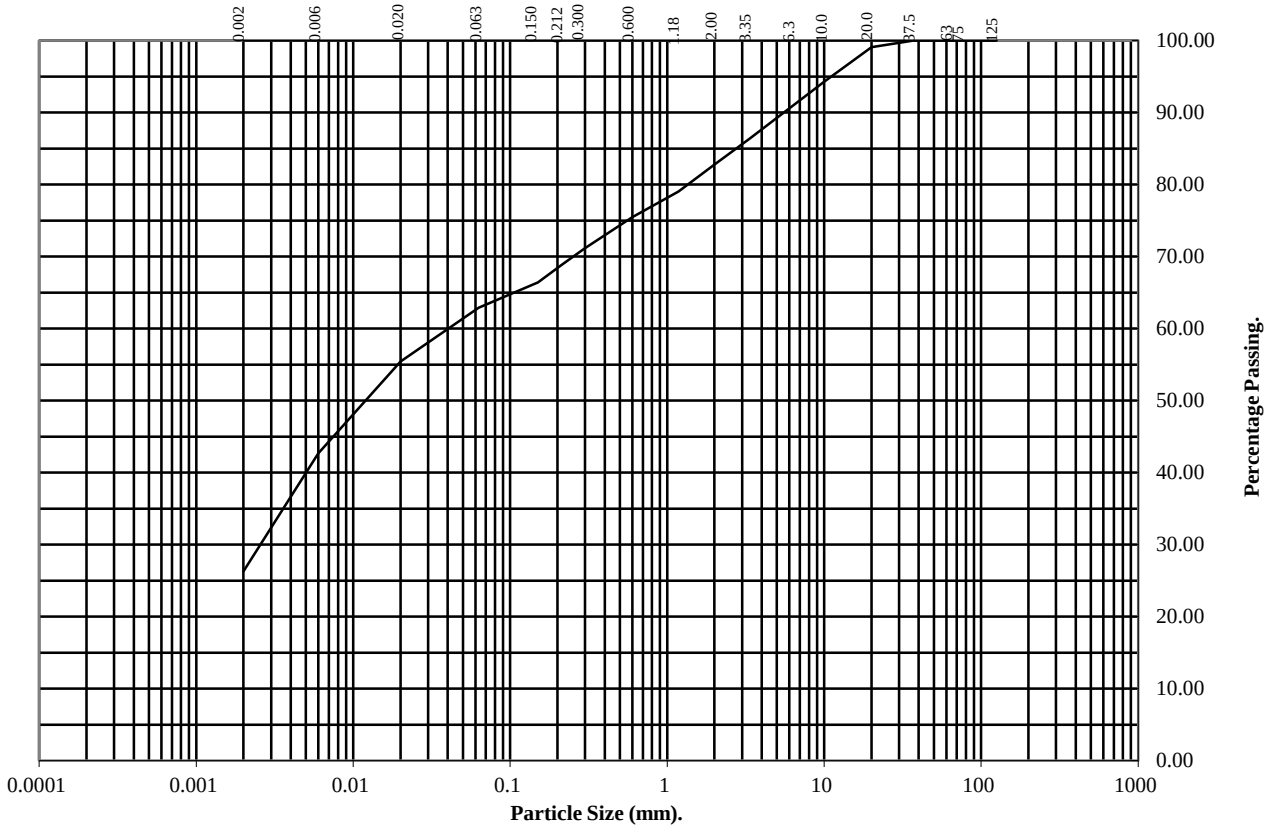
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS13** **Depth (m):** **2.45-3.00**

Sample Number: **CR011196** **Sample Type:** **U**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	99
10	94
6.3	91
3.35	86
2	83
1.18	79
0.6	75
0.3	71
0.212	69
0.15	66
0.063	63

Particle Diameter	Percentage Passing
0.02	55
0.006	43
0.002	26

Soil Fraction	Total Percentage
Cobbles	0
Gravel	17
Sand	20
Silt	37
Clay	26

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	07/07/15		07/07/15

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KING'S CROSS BR3

Contract No.: PSL15/2895

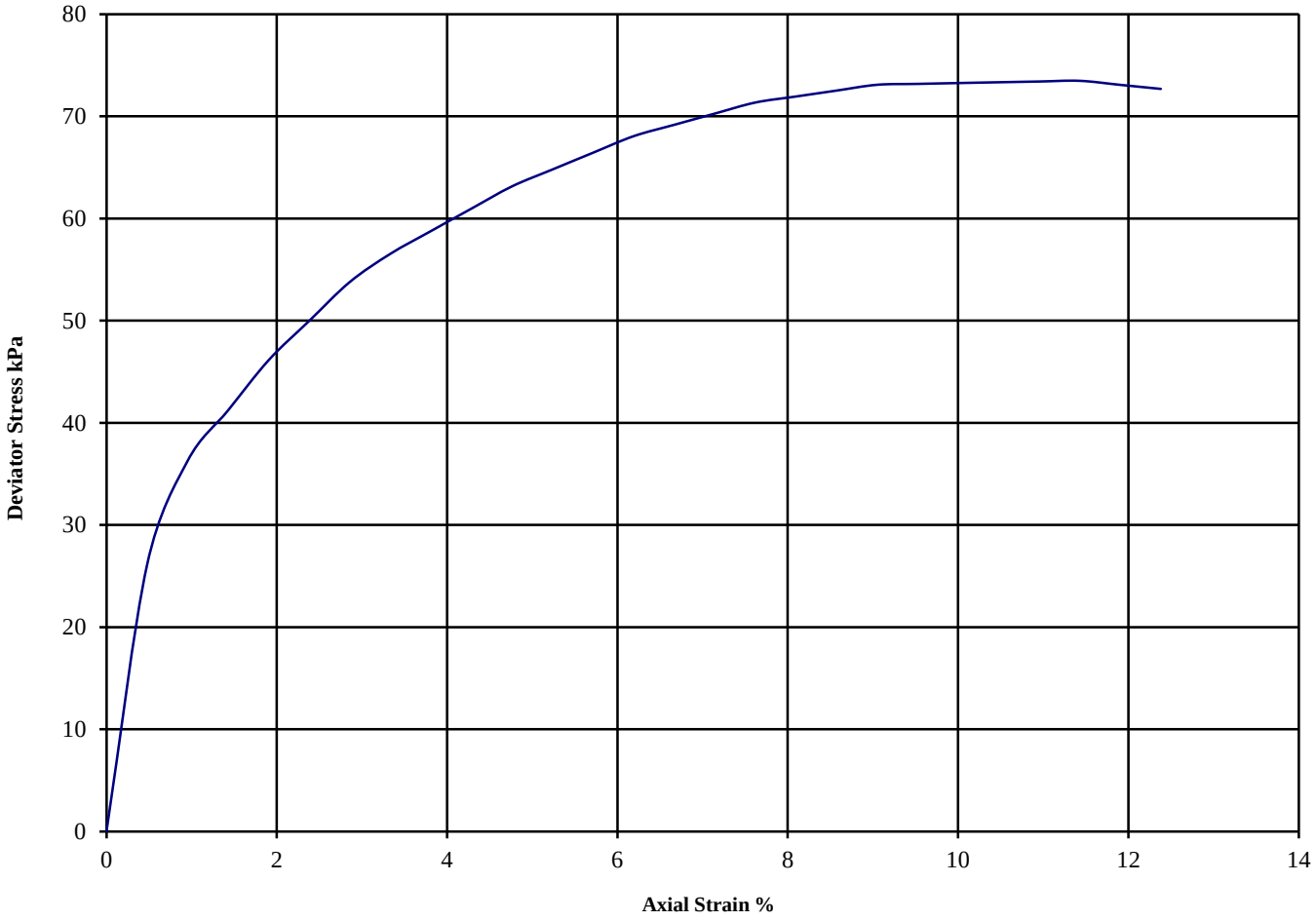
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 7.50-7.95

Sample Number: CR012241 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.93	1.49	150	73	37	11.4	Plastic	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

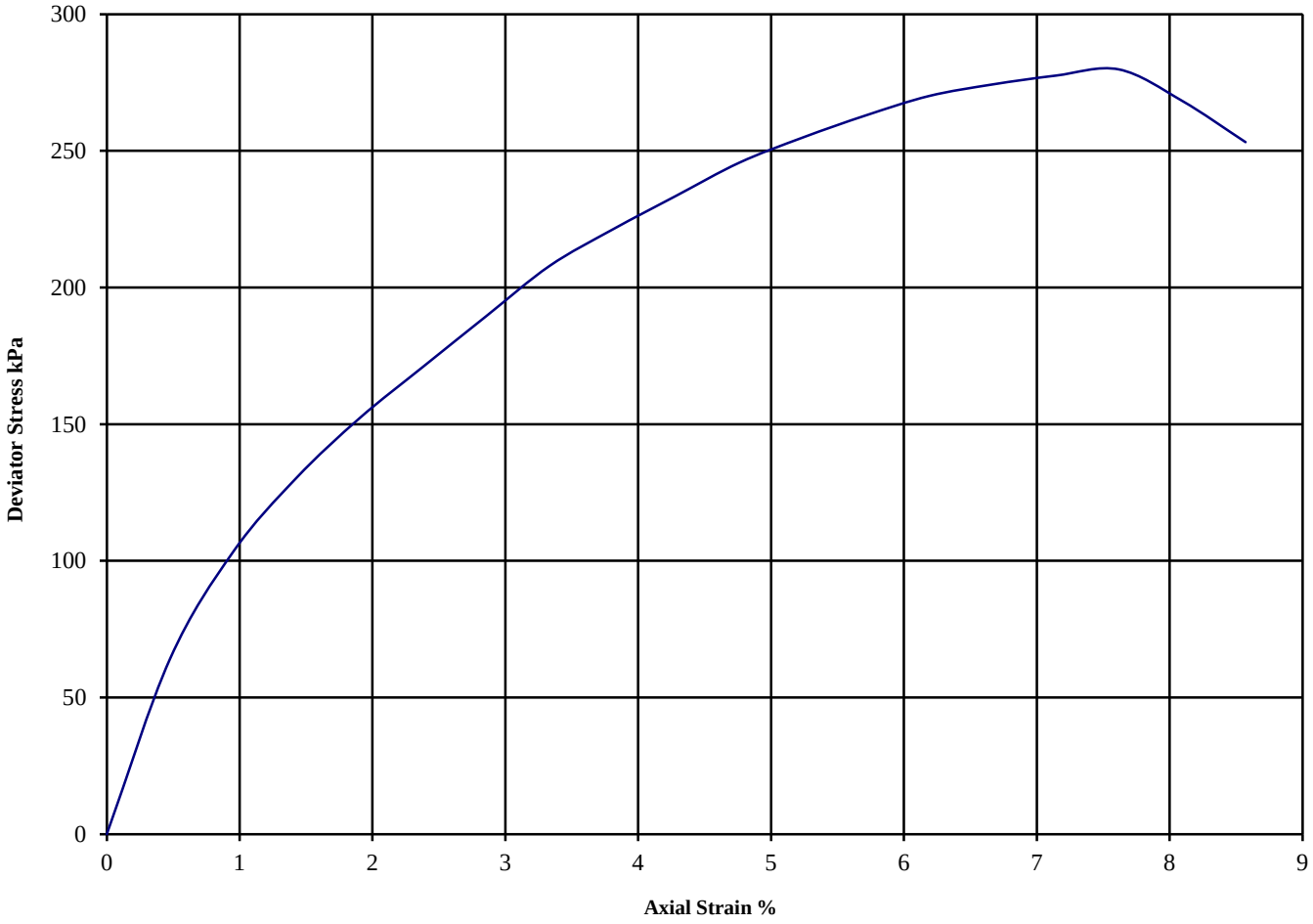
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 10.50-10.95

Sample Number: CR012246 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.00	1.57	210	280	140	7.6	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

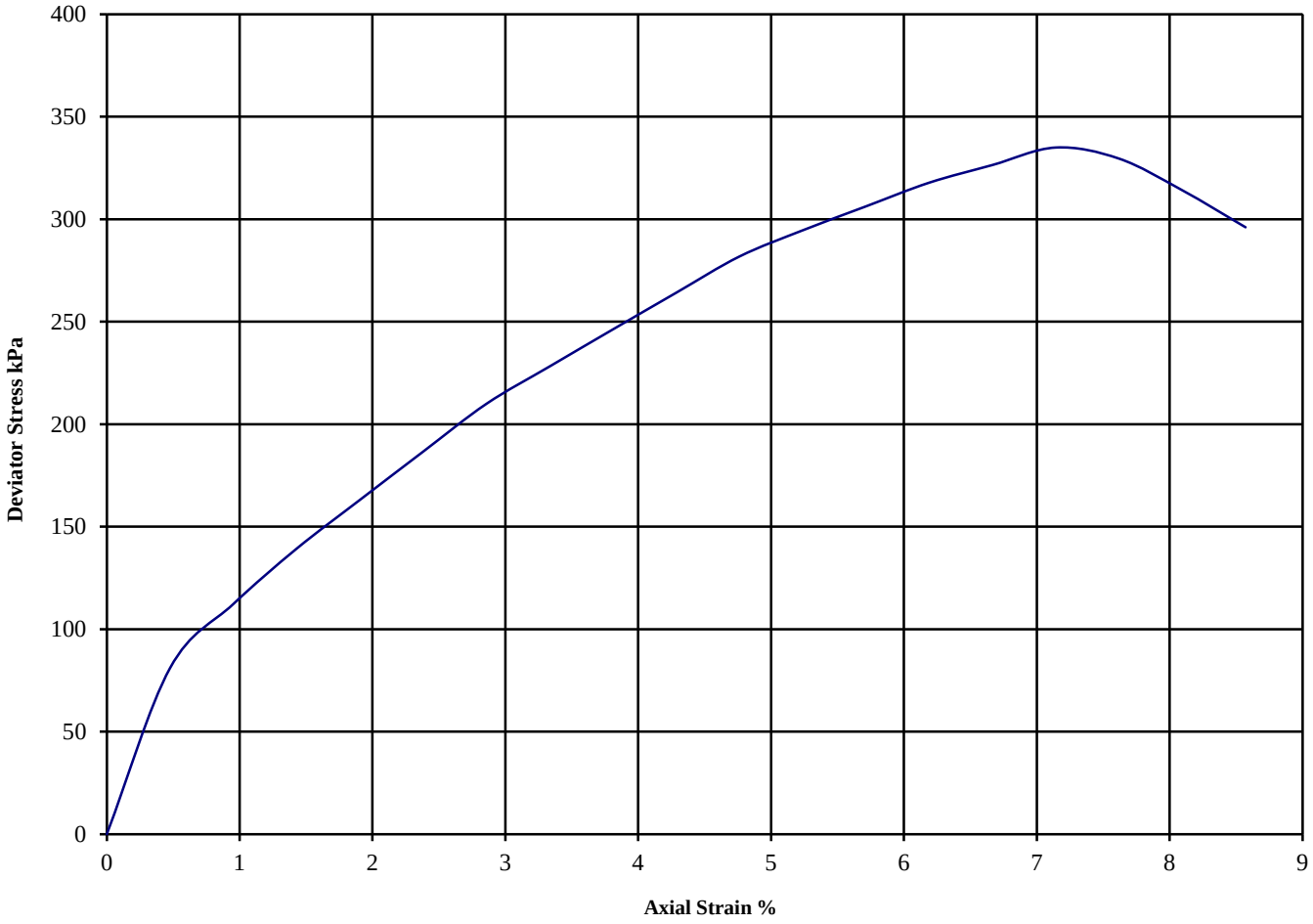
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 13.50-13.95

Sample Number: CR011765 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.91	1.48	270	335	167	7.1	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

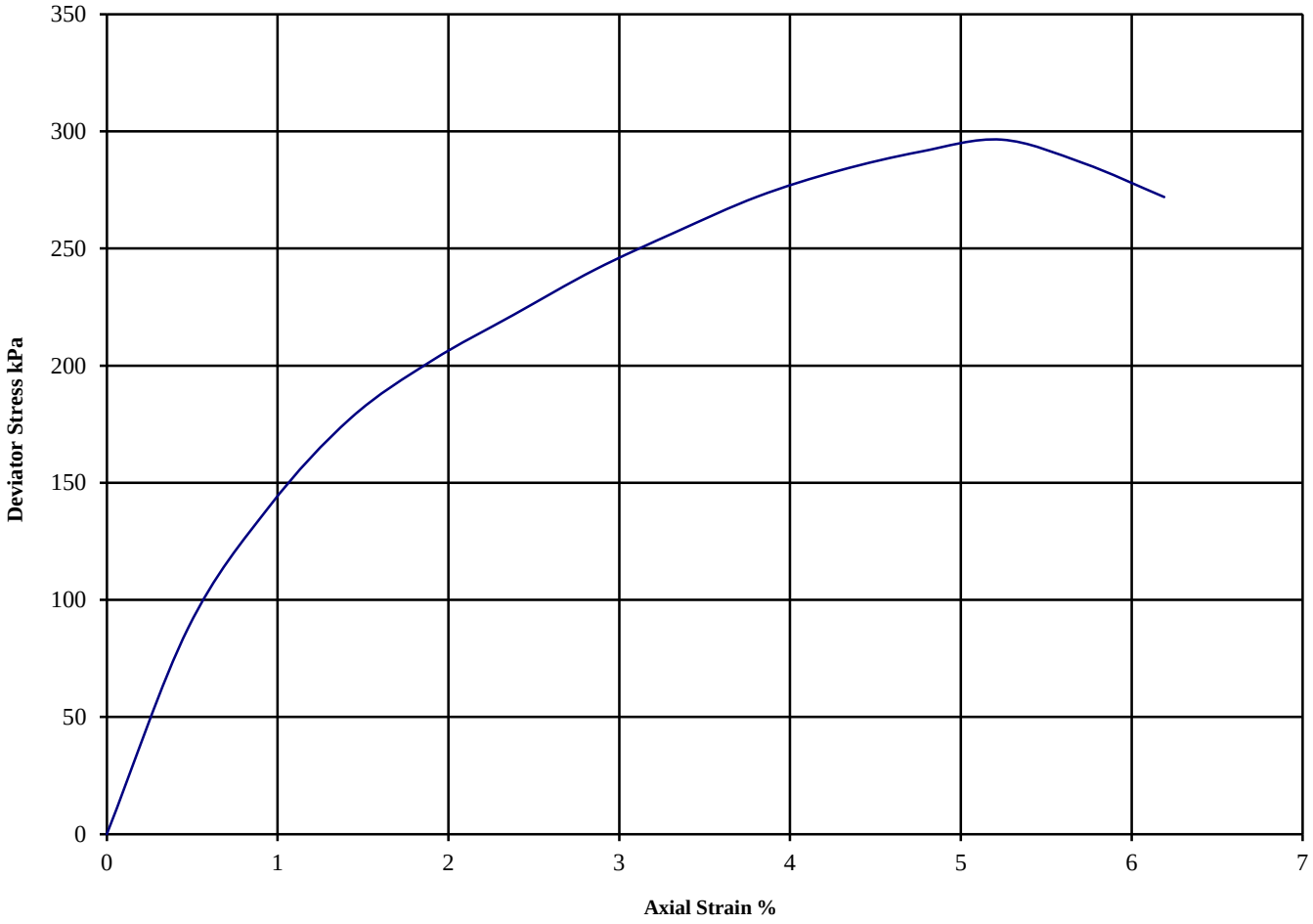
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 16.50-16.95

Sample Number: CR011771 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.06	1.64	330	296	148	5.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

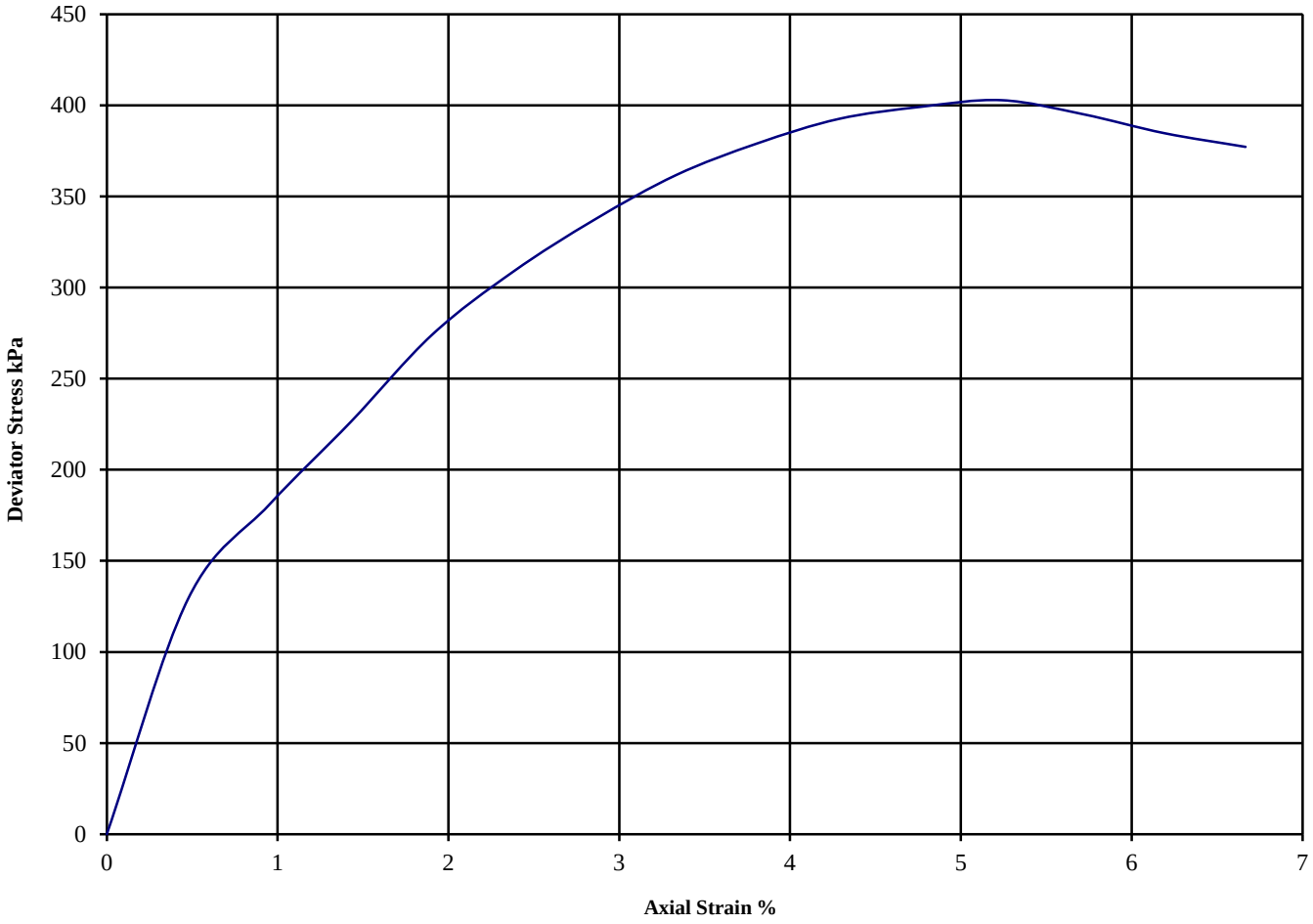
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 19.50-19.95

Sample Number: CR011776 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	22	2.15	1.75	390	403	201	5.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

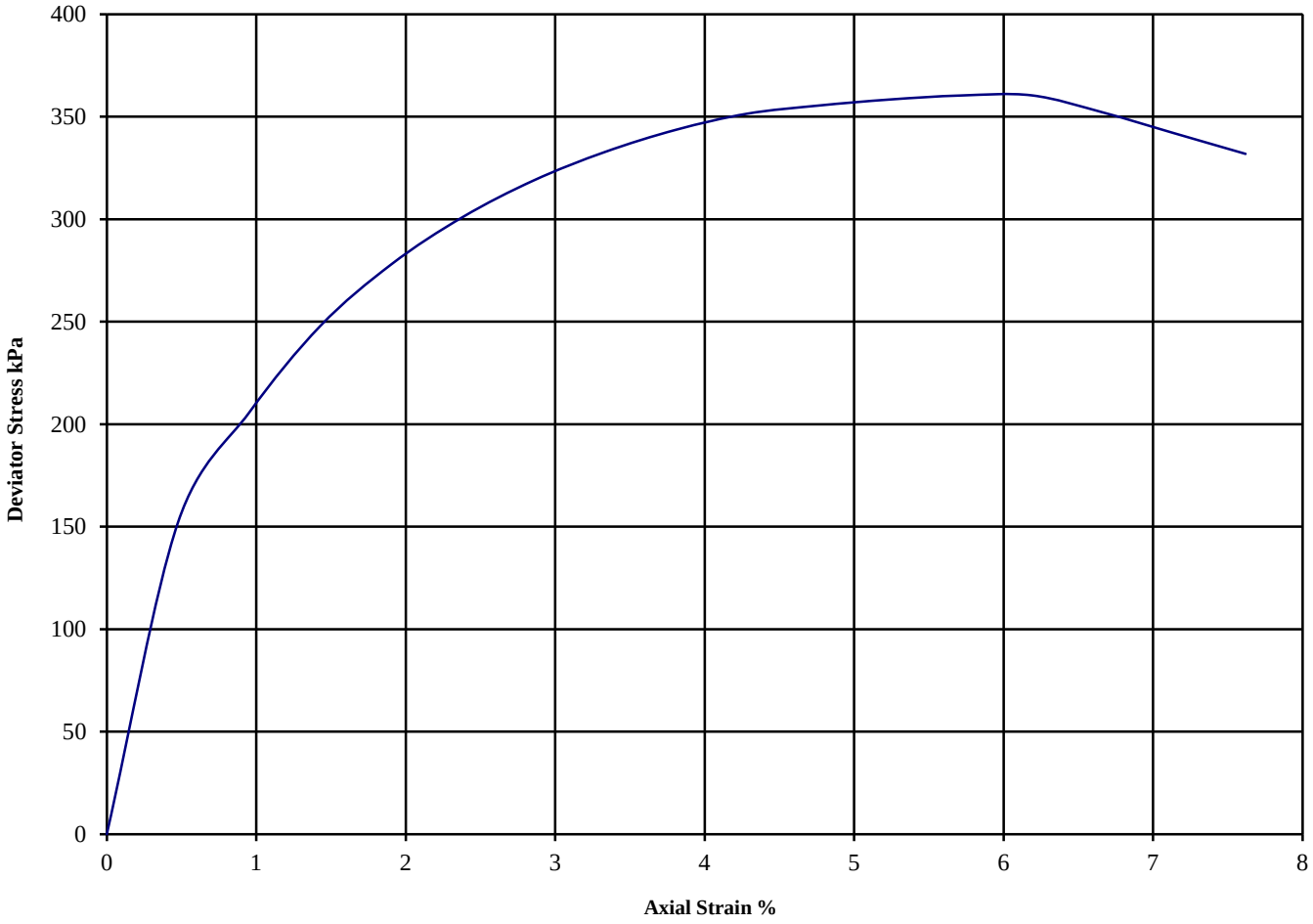
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 22.50-22.95

Sample Number: CR011781 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	25	2.09	1.67	450	360	180	6.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	07/07/15		07/07/15

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KING'S CROSS BR3.

Contract No: PSL15/2895

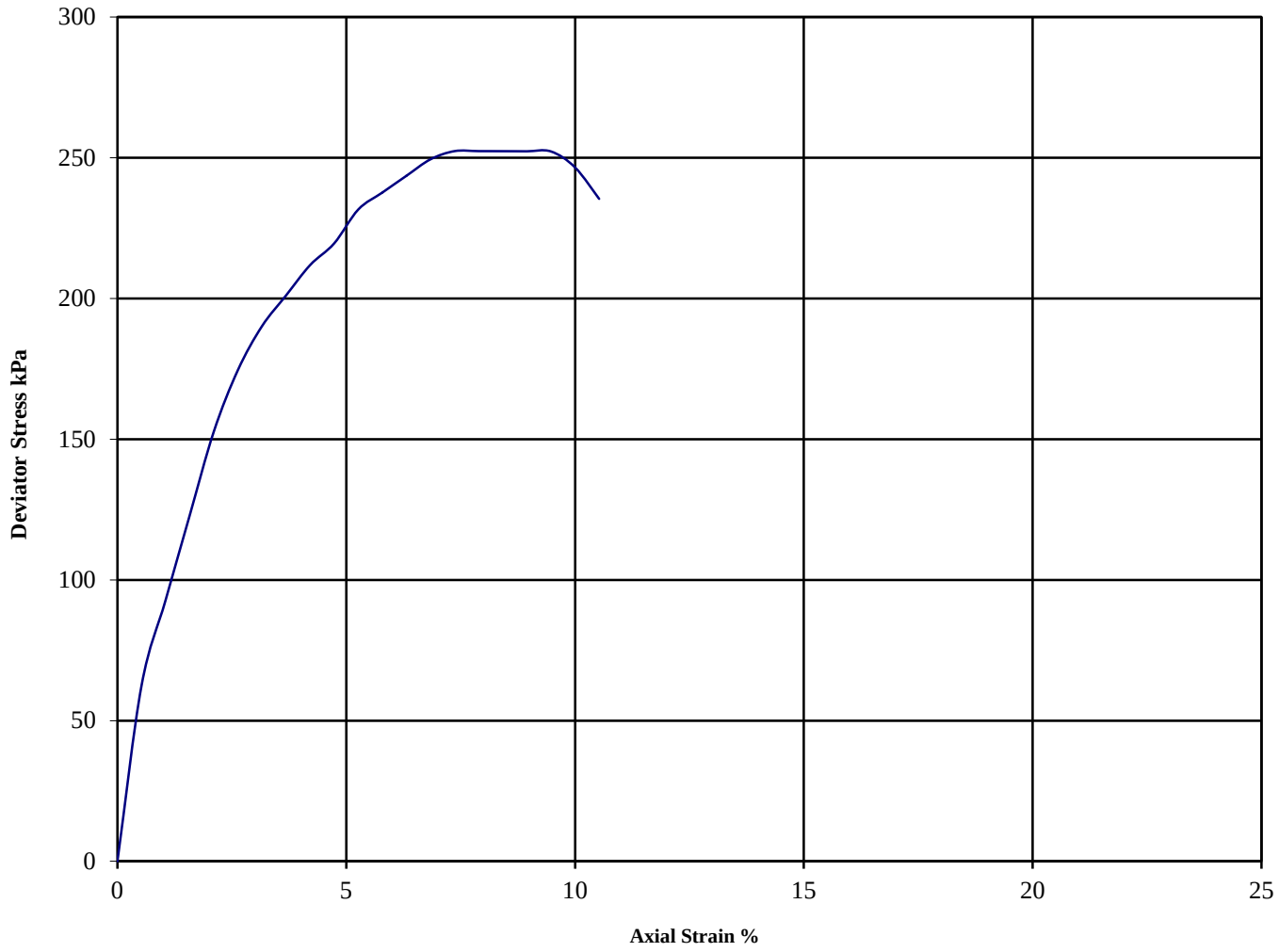
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Borehole Number: WS2 **Depth (m):** 3.45-4.00

Sample Number: CR011164 **Sample Type:** U



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Strength (kPa)	Failure Strain (%)	Mode of Failure	Remarks
A	26	1.93	1.53	69	252	126	7.4	Brittle	See summary of soil descriptions
B									
C									

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KING'S GROSS BR3. **Contract No:** **PSL15/2895**

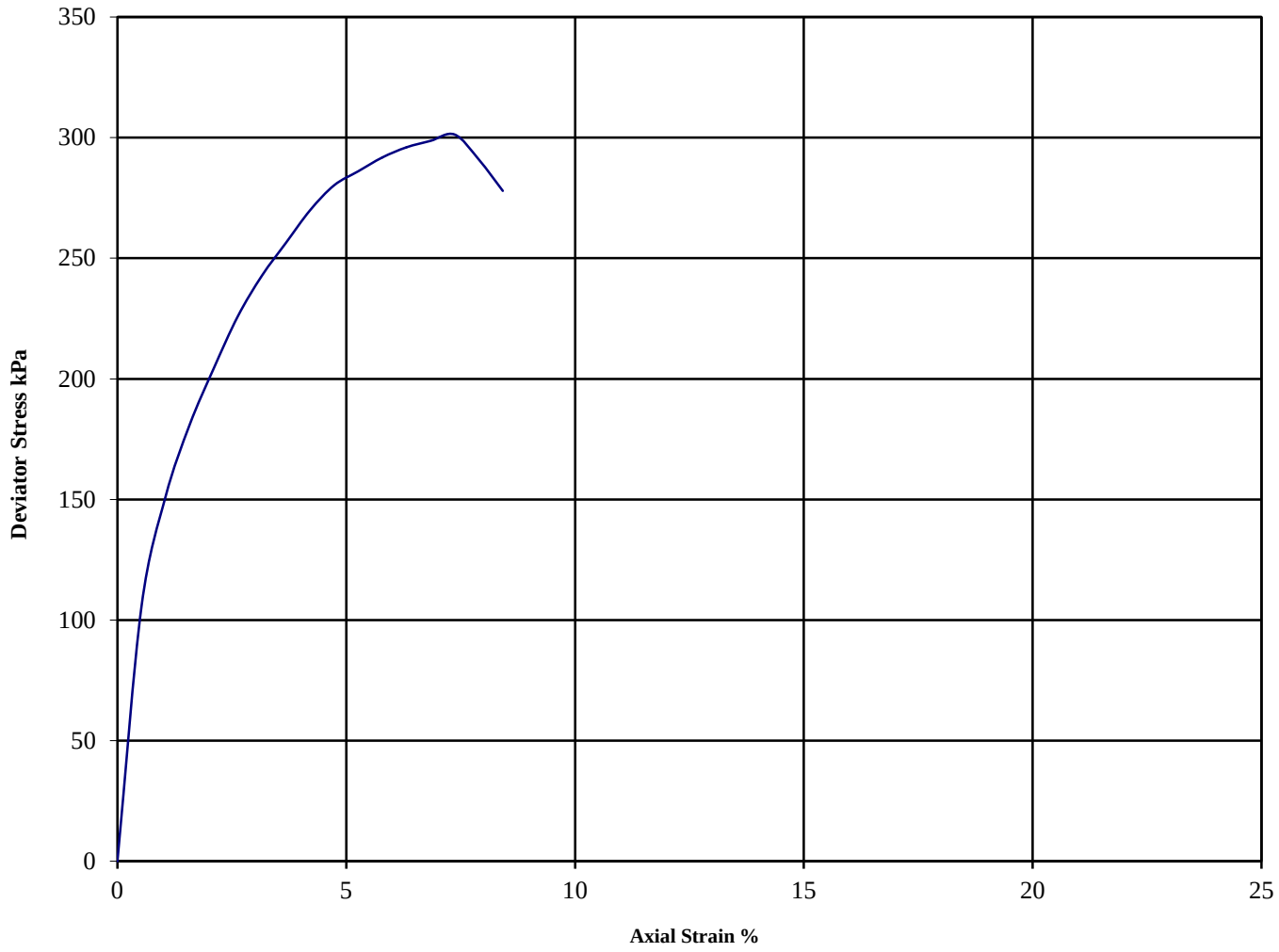
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Borehole Number: WS2 **Depth (m):** 4.45-5.00

Sample Number: CR011166 **Sample Type:** U



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Strength (kPa)	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.89	1.48	89	301	151	7.4	Brittle	See summary of soil descriptions
B									
C									

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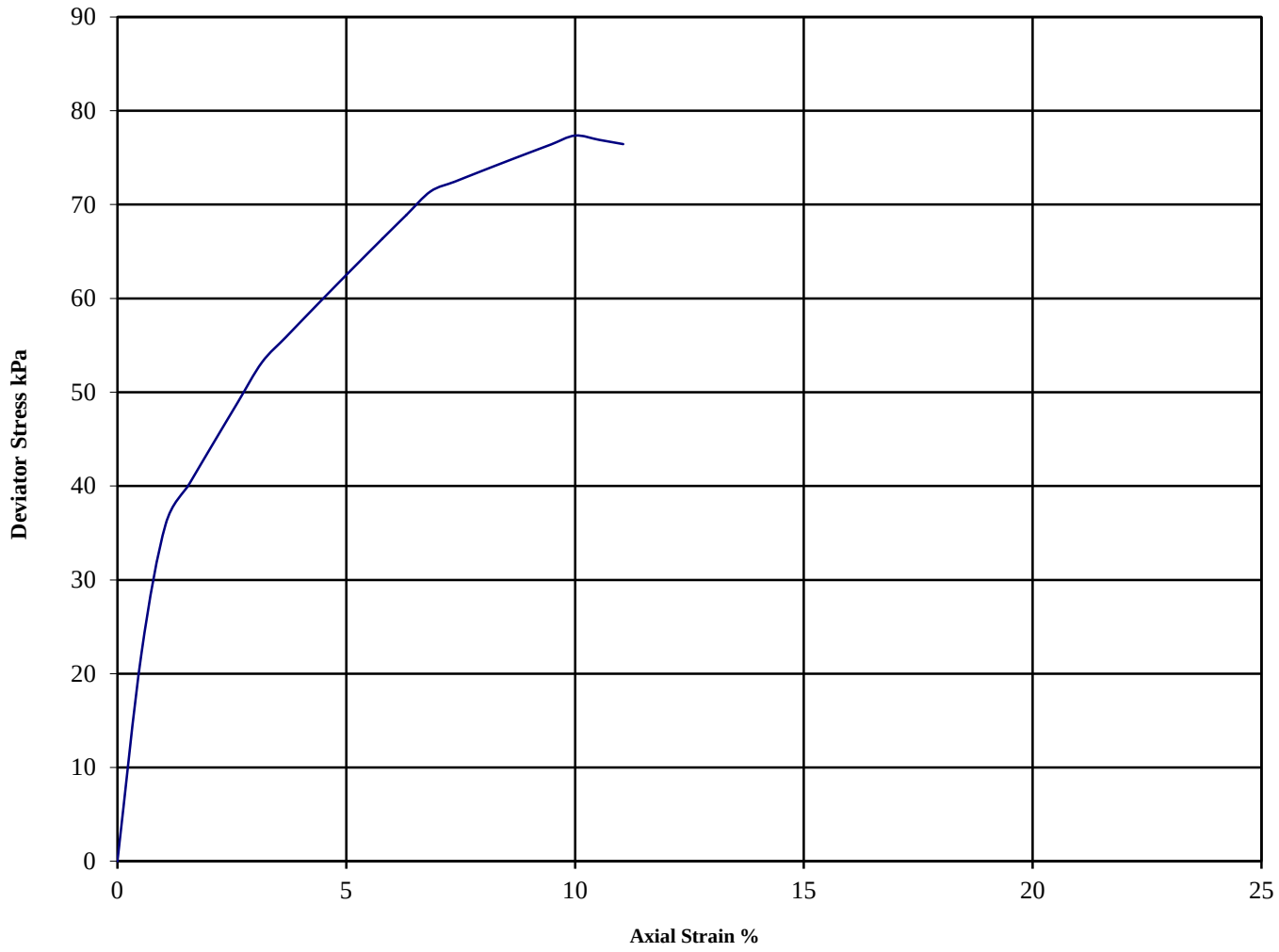
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Borehole Number: WS9 **Depth (m):** 3.45-4.00

Sample Number: CR011178 **Sample Type:** U



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Strength (kPa)	Failure Strain (%)	Mode of Failure	Remarks
A	33	1.78	1.34	69	77	39	10.0	Plastic	See summary of soil descriptions
B									
C									

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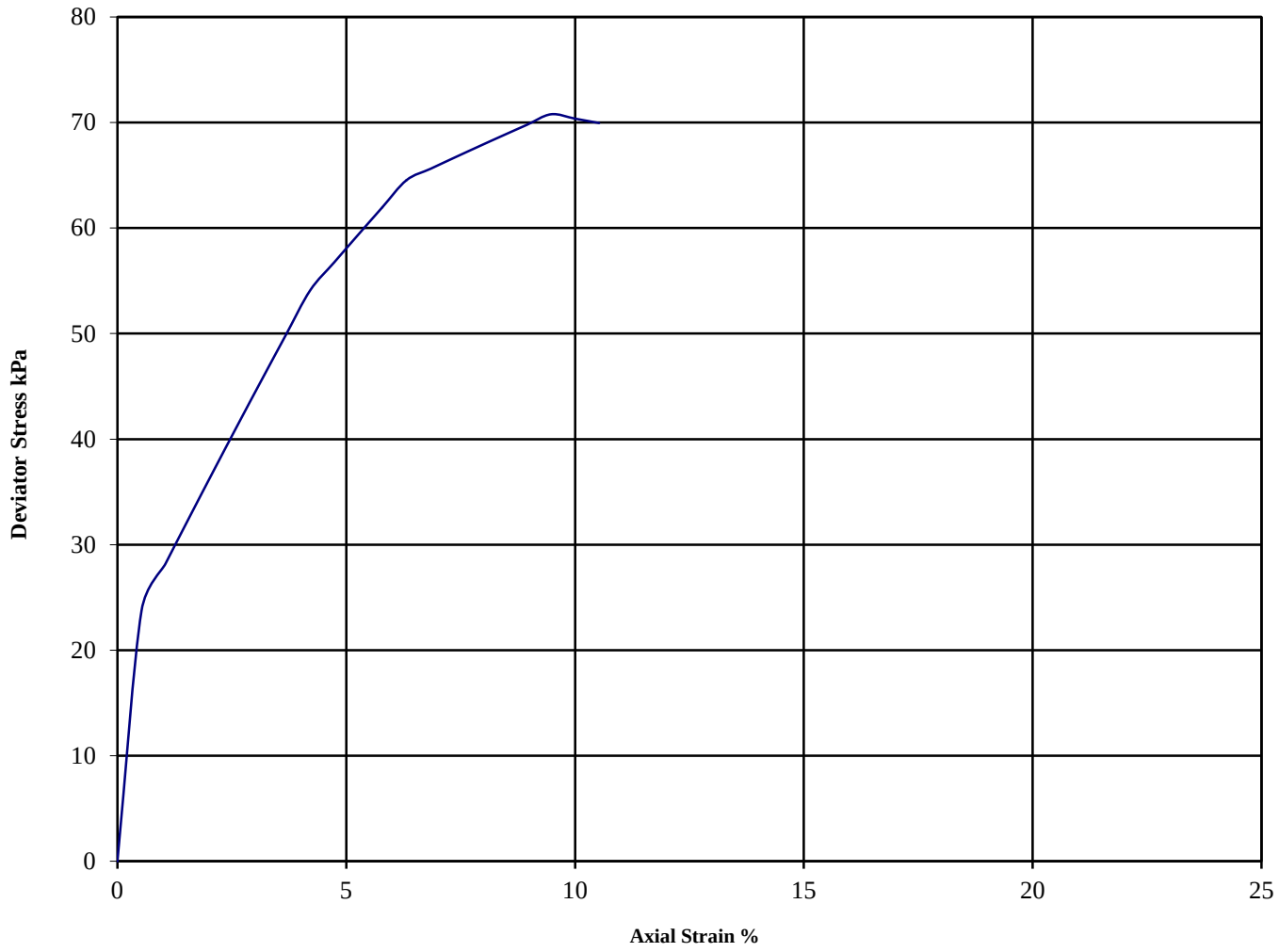
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Borehole Number: WS9 **Depth (m):** 4.45-5.00

Sample Number: CR011180 **Sample Type:** U



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Strength (kPa)	Failure Strain (%)	Mode of Failure	Remarks
A	41	1.72	1.22	89	71	35	9.5	Plastic	See summary of soil descriptions
B									
C									

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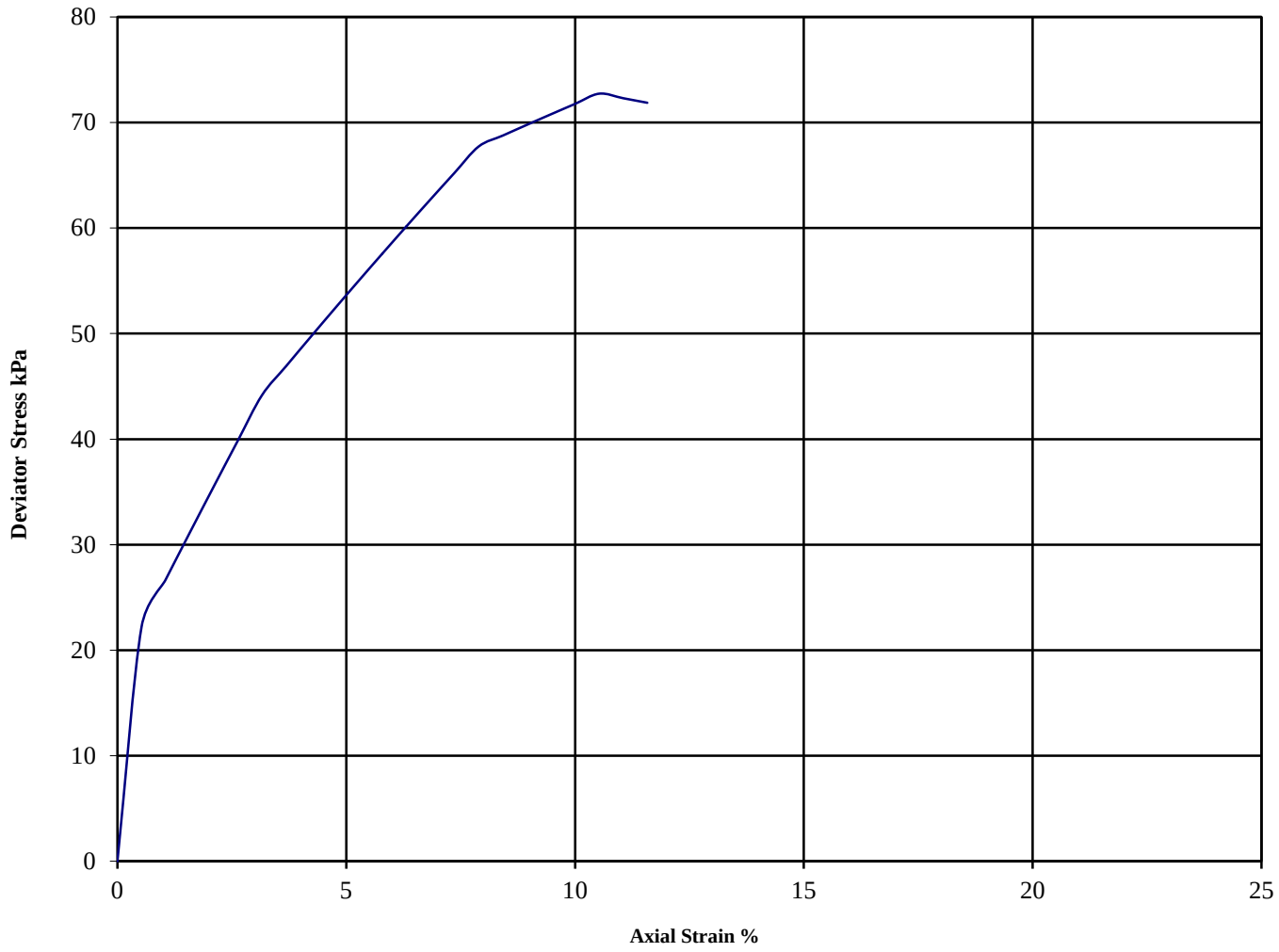
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Borehole Number: WS9 **Depth (m):** 5.46-6.00

Sample Number: CR011182 **Sample Type:** U



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Strength (kPa)	Failure Strain (%)	Mode of Failure	Remarks
A	39	1.74	1.25	110	73	36	10.5	Plastic	See summary of soil descriptions
B									
C									

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KING'S CROSS BR3. **Contract No:** **PSL15/2895**

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 15-37918

22-Jun-15

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

Our Reference	15-37918
Client Reference	PSL15/2895
Contract Title	King's Cross BR3
Description	5 Soil samples.
Date Received	17-Jun-15
Date Started	17-Jun-15
Date Completed	22-Jun-15
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 15-37918
Client Ref PSL15/2895
Contract Title King's Cross BR3

			Lab No	826891	826892	826893	826894	826895
			Sample ID	BH1	BH1	BH1	WS2	WS6
			Depth	1.50-1.95	6.00	22.50-22.95	2.45-3.00	0.00-1.00
			Other ID					
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Inorganics								
pH	DETSC 2008#			7.8	7.8	8.9	7.6	8.2
Chloride Aqueous Extract	DETSC 2055	1	mg/l	69			270	9.8
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.6			16	14
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	2500	2000	600	850	150

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

Information in Support of the Analytical Results

Our Ref 15-37918
Client Ref PSL15/2895
Contract King's Cross BR3

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
826891	BH1 1.50-1.95 SOIL		PT 1L	Sample date not supplied	
826892	BH1 6.00 SOIL		PT 1L	Sample date not supplied	
826893	BH1 22.50-22.95 SOIL		PT 1L	Sample date not supplied	
826894	WS2 2.45-3.00 SOIL		PT 1L	Sample date not supplied	
826895	WS6 0.00-1.00 SOIL		PT 1L	Sample date not supplied	

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 and/or inappropriate containers 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

APPENDIX 4.0 – SPT Calibration Sheets

SPT Hammer Energy Report

SPT Hammer Ref:	BRC008
Test Date:	20/08/2014 12:31
Report Date:	08/09/2014
File Name:	BRC008.spt
Test Operator:	A.SHAW

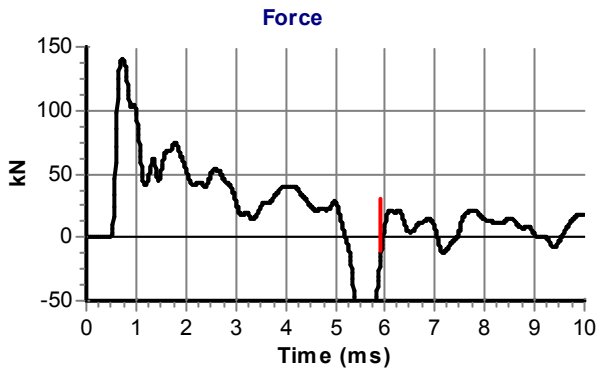
Instrumented Rod Data

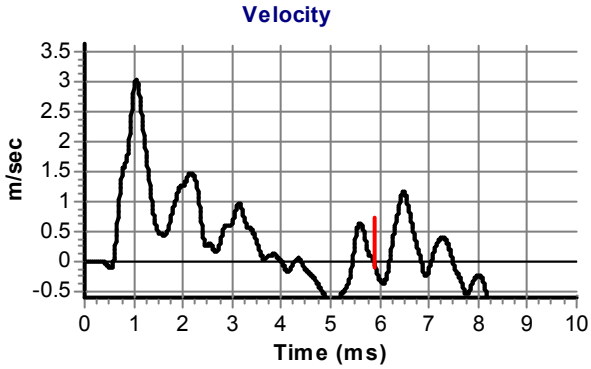
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.5
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	5844
Accelerometer No.2:	5845

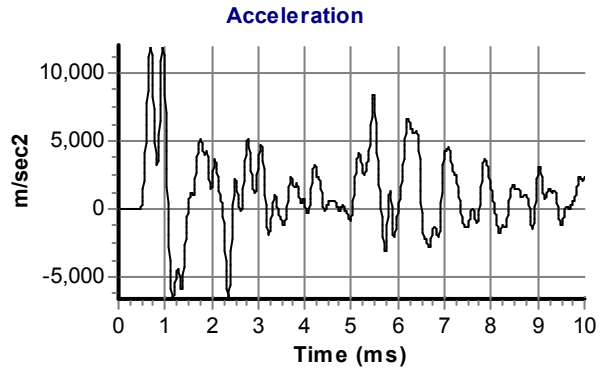
SPT Hammer Information

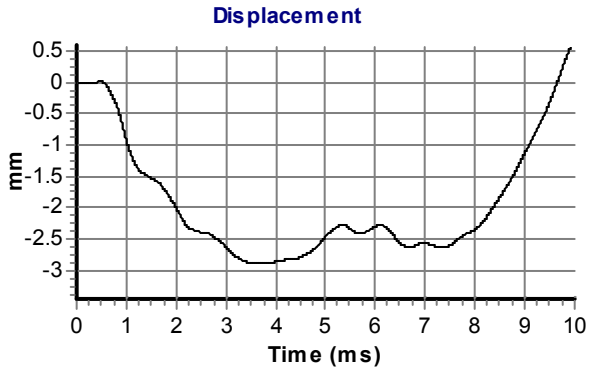
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	14.0

Comments / Location









Calculations

Area of Rod A (mm2):	970
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	291

Energy Ratio E_r (%): **61**

Signed:

Title:

SPT Hammer Energy Report

SPT Hammer Ref:	T820625
Test Date:	20/08/2014 14:47
Report Date:	08/09/2014
File Name:	T820625.spt
Test Operator:	A.SHAW

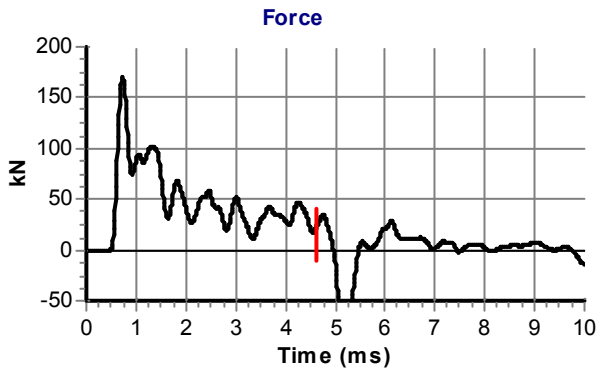
Instrumented Rod Data

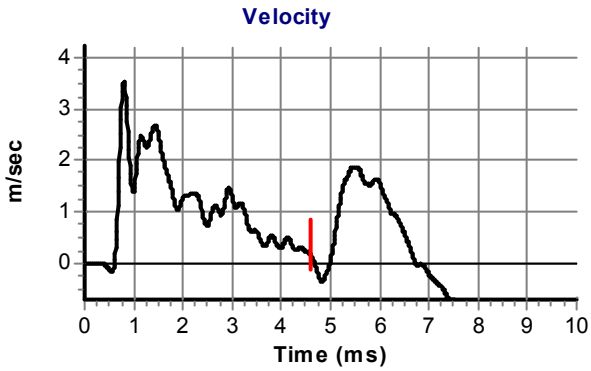
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.5
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	5844
Accelerometer No.2:	5845

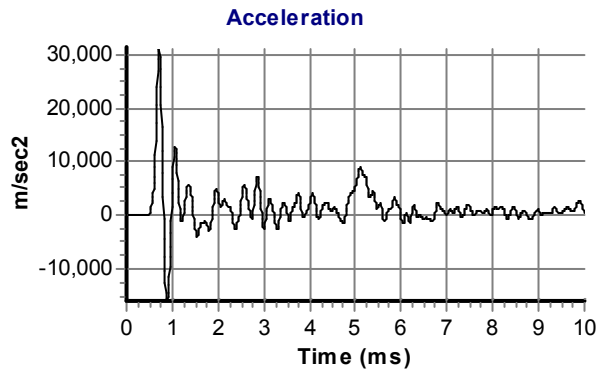
SPT Hammer Information

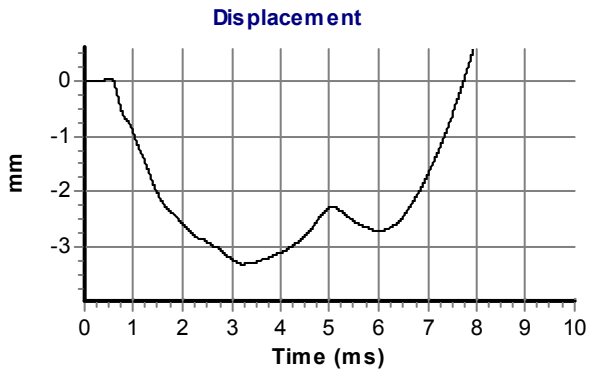
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	13.0

Comments / Location









Calculations

Area of Rod A (mm2):	970
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	325

Energy Ratio E_r (%): **69**

Signed:

Title: