



Laboratory Report



Contract Number: 10432

Client's Reference: TBC

Report Date: 05-08-2010

Client Name: Clarkebond Exeter (BRISTOL)
Malvern House
Matford Court
Yeoford Way
Exeter
EX2 8LB

Contract Title: Pinhoe Clay Pit
For the attention of: Phil Curtis

Date Received: 02-07-2010
Date Commenced: 02-07-2010
Date Completed: 05-08-2010

Test Description	Quantity	Checked	Approved
Moisture Content BS1377:1990 2/3.2 *	12		
4 Point Liquid & Plastic Limit BS1377:1990 2/4.3&5.3 *	3		
PSD Wet Sieve method BS1377:1990 2/9.2 *	5		
Vibrating Hammer	5		
CBR: Und in CBR Mould BS1377:1990 4/7 *	4		
CBR: Remoulded Specimen BS1377:1990 4/7 *	3		

Notes: Observations and Interpretations are outside the UKAS Accreditation

BRE Suite SD1 Denotes test included in laboratory scope of accreditation
- Denotes test carried out by approved contractor

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.

Approved Signatories:

D V Edwards (Managing Director), Alun Walters (Technical Manager), E Sharp (Technical Co-Ordinator).

Summary of Soil Classification Tests

BS 1377:Part 2:1990

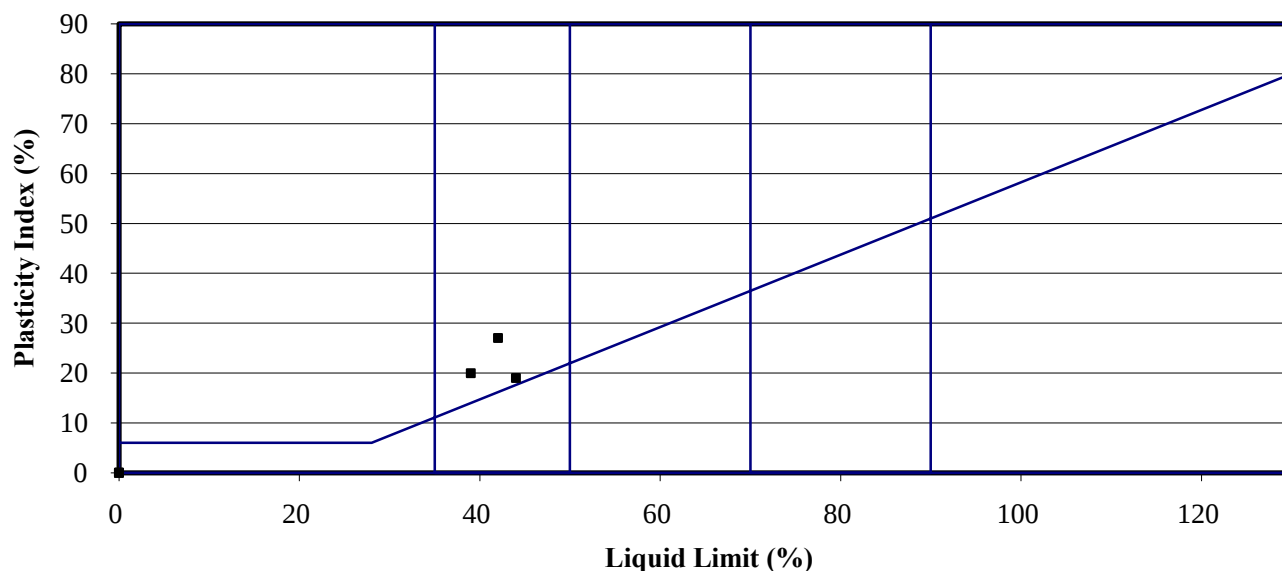
Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
Bulk 1/P2	B	n/a	9					
Bulk 2/P1	B	n/a	9					
Bulk 3/P3	B	n/a	10	42	15	27	14	CI Intermediate Plasticity
Bulk 4/P2	B	n/a	8					
Bulk 5/P3	B	n/a	11					
Bulk 6/P1	B	n/a	17	39	19	20	84	CI Intermediate Plasticity
Bulk 7/P1	B	n/a	20	44	25	19	14	CI Intermediate Plasticity
Bulk 8/P2	B	n/a	10					
CBR 1/P3	B	n/a	10					
CBR 2/P1	B	n/a	17					
CBR 3/P2	B	n/a	10					
CBR 4/P3	B	n/a	12					

Symbols:

NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

BS 5930:1999



Alan Walker 05/08/10
Checked by Date

Alan Walker 05/08/10
Approved by Date



Pinhoe Clay Pit

Contract No.:
10432-020710
Client Ref No:
0



PARTICLE SIZE DISTRIBUTION TEST

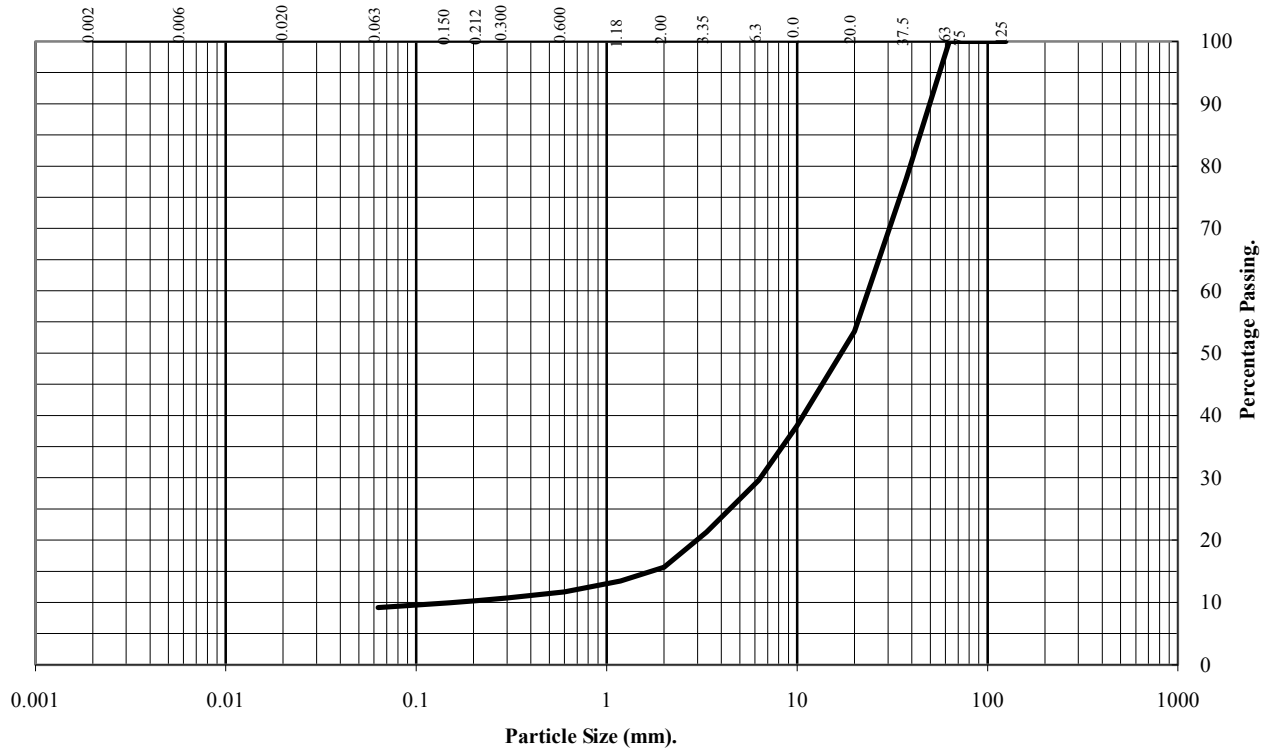
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole/Sample Number: **Bulk 1/P2**

Type: **B**

Depth (m): **n/a**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	78
20	53
10	38
6.3	30
3.35	21
2.00	16
1.18	13
0.60	12
0.300	11
0.212	10
0.150	10
0.063	9

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

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

Remarks:

#- not determined

Checked by

05/08/2010

Date

Approved by

05/08/2010

Date

PARTICLE SIZE DISTRIBUTION TEST

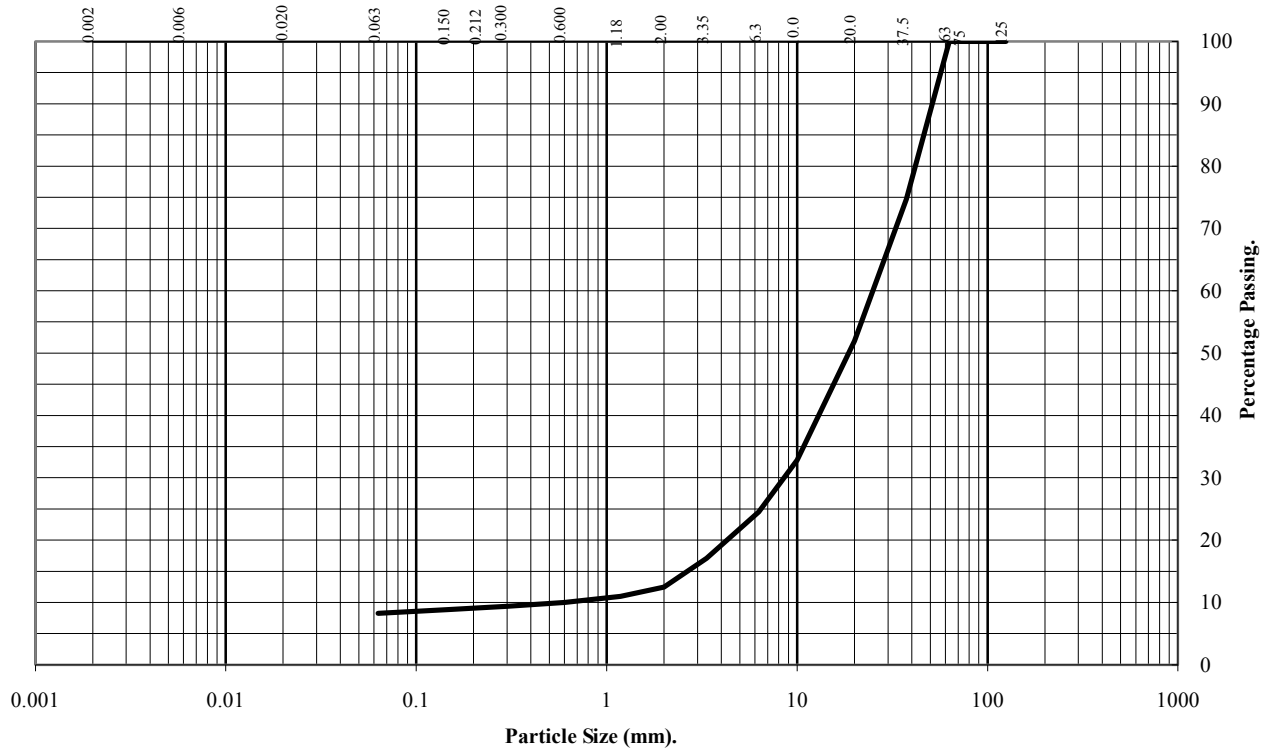
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole/Sample Number: **Bulk 2/P1**

Type: **B**

Depth (m): **n/a**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	75
20	52
10	33
6.3	25
3.35	17
2.00	12
1.18	11
0.60	10
0.300	9
0.212	9
0.150	9
0.063	8

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	88
Sand	4
Silt and Clay	8

Remarks:

#- not determined

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05/08/2010

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05/08/2010

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PARTICLE SIZE DISTRIBUTION TEST

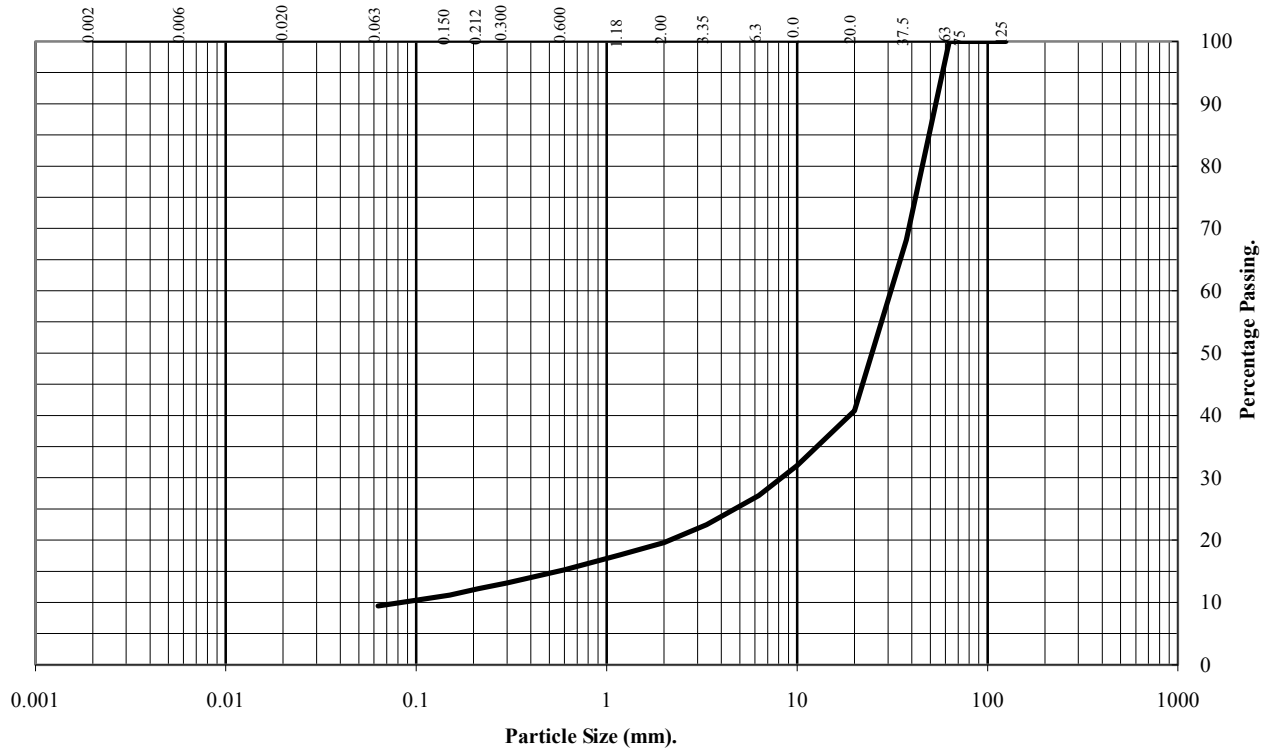
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole/Sample Number: **Bulk 3/P3**

Type: **B**

Depth (m): **n/a**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	68
20	41
10	32
6.3	27
3.35	22
2.00	20
1.18	18
0.60	15
0.300	13
0.212	12
0.150	11
0.063	9

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	80
Sand	11
Silt and Clay	9

Remarks:

#- not determined

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05/08/2010

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05/08/2010

Date

PARTICLE SIZE DISTRIBUTION TEST

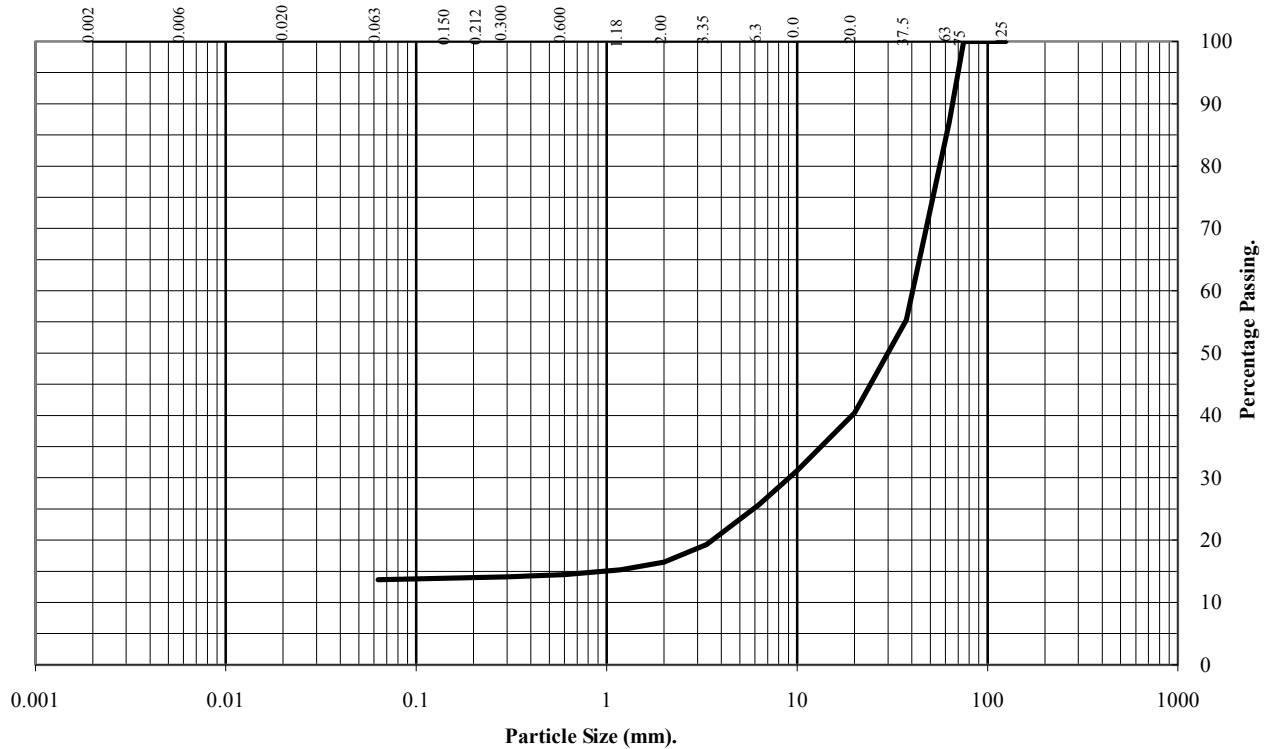
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole/Sample Number: **Bulk 7/P1**

Type: **B**

Depth (m): **n/a**



BS Test Sieve	Percentage Passing
125	100
75	100
63	87
37.5	55
20	40
10	31
6.3	26
3.35	19
2.00	16
1.18	15
0.60	14
0.300	14
0.212	14
0.150	14
0.063	14

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	13
Gravel	71
Sand	2
Silt and Clay	14

Remarks:

#- not determined

Checked by

05/08/2010

Date

Approved by

05/08/2010

Date

PARTICLE SIZE DISTRIBUTION TEST

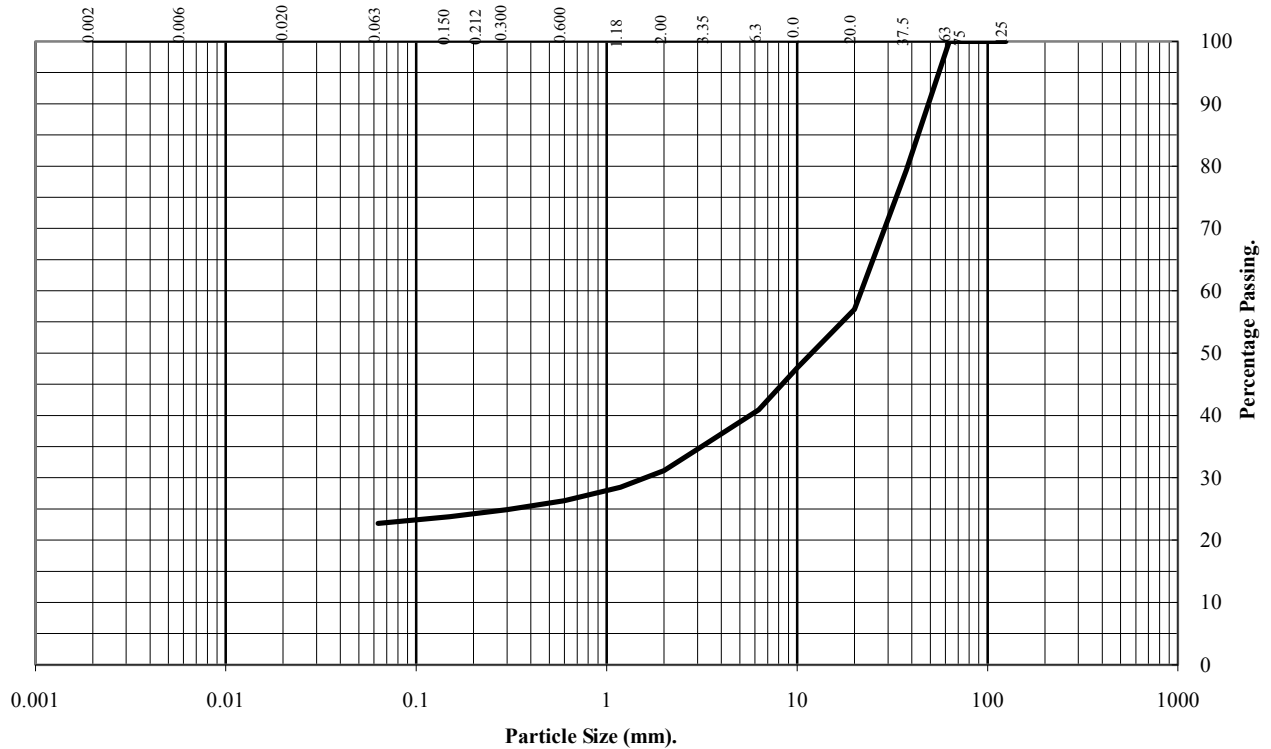
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole/Sample Number: **Bulk 8/P2**

Type: **B**

Depth (m): **n/a**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	79
20	57
10	48
6.3	41
3.35	36
2.00	31
1.18	28
0.60	26
0.300	25
0.212	24
0.150	24
0.063	23

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	69
Sand	8
Silt and Clay	23

Remarks:

#- not determined

Checked by

05/08/2010

Date

Approved by

05/08/2010

Date



Unit 24-26
The Avenue
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Llanelli
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SA15 2DS
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fax: +44 (0)1554 749845 / 775107
e-mail: info@geolab.org.uk

Certificate of Analysis

Date: 05/08/2010

Client: Clarke Bond

Our Reference: 10432-020710

Client Reference:

Contract Title: Pinhoe Clay Pit

Description: (Total Samples) 3

Date Received: 02/07/2010

Date Started: 20/07/2010

Date Completed: 21/07/2010

Test Procedures: (B.S. 1377 : PART 3 : 1990 AND BRE CP2/79)

Notes:

Solid samples will be disposed 1 month and liquids 2 weeks
after the date of issue of this test certificate

Approved By:

Authorised Signatories:

Vaughan Edwards
Managing Director

Wayne Honey
Laboratory Technician

Alun Walters
Technical Manager

Contract No: 10432-020710
Client Ref:
Location: Pinhoe Clay Pit
Date: 05/08/2010



SUMMARY OF CHEMICAL ANALYSES

(B.S. 1377 : PART 3 : 1990 AND BRE CP2/79)

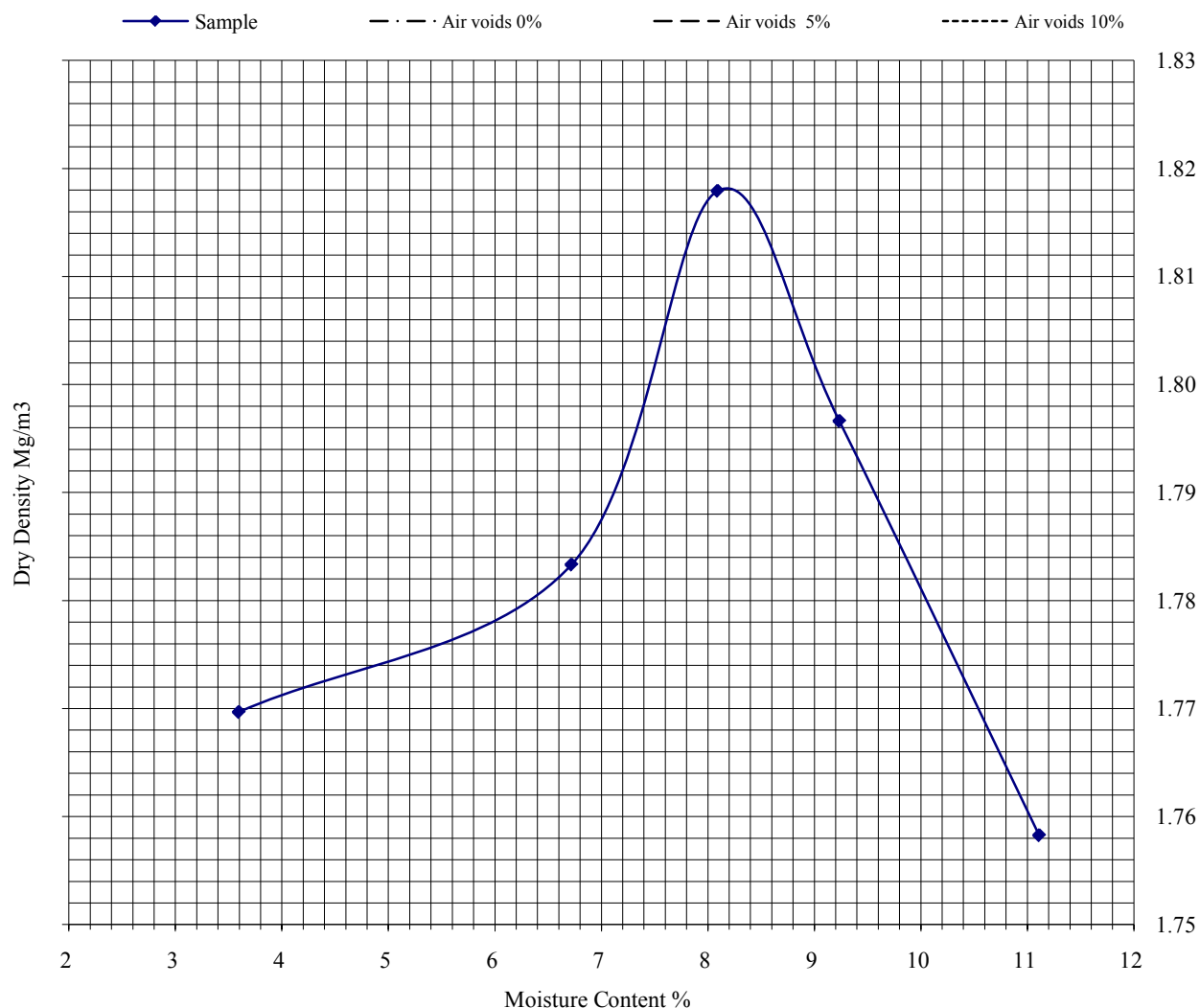
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NCP - No Chloride present

Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Borehole Number: Bulk 1 Sample Number: P2 Depth (m):



Initial Moisture Content:	9	Method of Compaction	Vibro Hammer / Single Sample
Particle Density (Mg/m3):	2.65* Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m3):	1.82	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	8.1	Sample Preparation Clause :	3.2.4.2

* - not included in laboratory scope of accreditation

Remarks

[Signature]

Checked by

05/08/10

Date

[Signature]

Approved by

05/08/10

Date

Pinhoe Clay Pit



LABORATORY TESTING SERVICES LIMITED

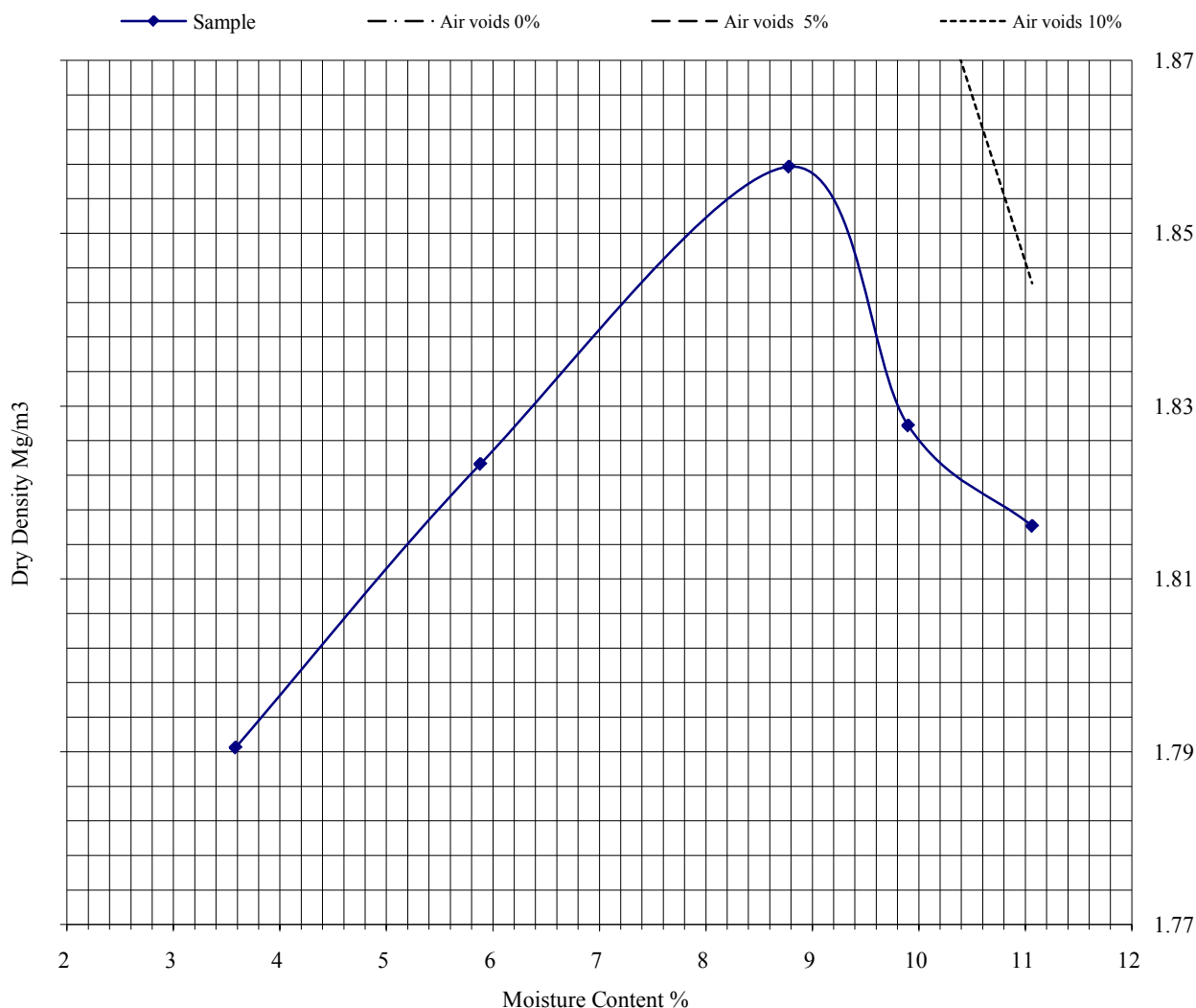
Contract No.:
10432-020710
Client Ref No:
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Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Borehole Number: Bulk 2 Sample Number: P1 Depth (m):



Initial Moisture Content:	9	Method of Compaction	Vibro Hammer / Single Sample
Particle Density (Mg/m³):	2.65* Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m³):	1.86	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	8.8	Sample Preparation Clause :	3.2.4.2

* - not included in laboratory scope of accreditation

Remarks

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05/08/10

Date



Pinhoe Clay Pit

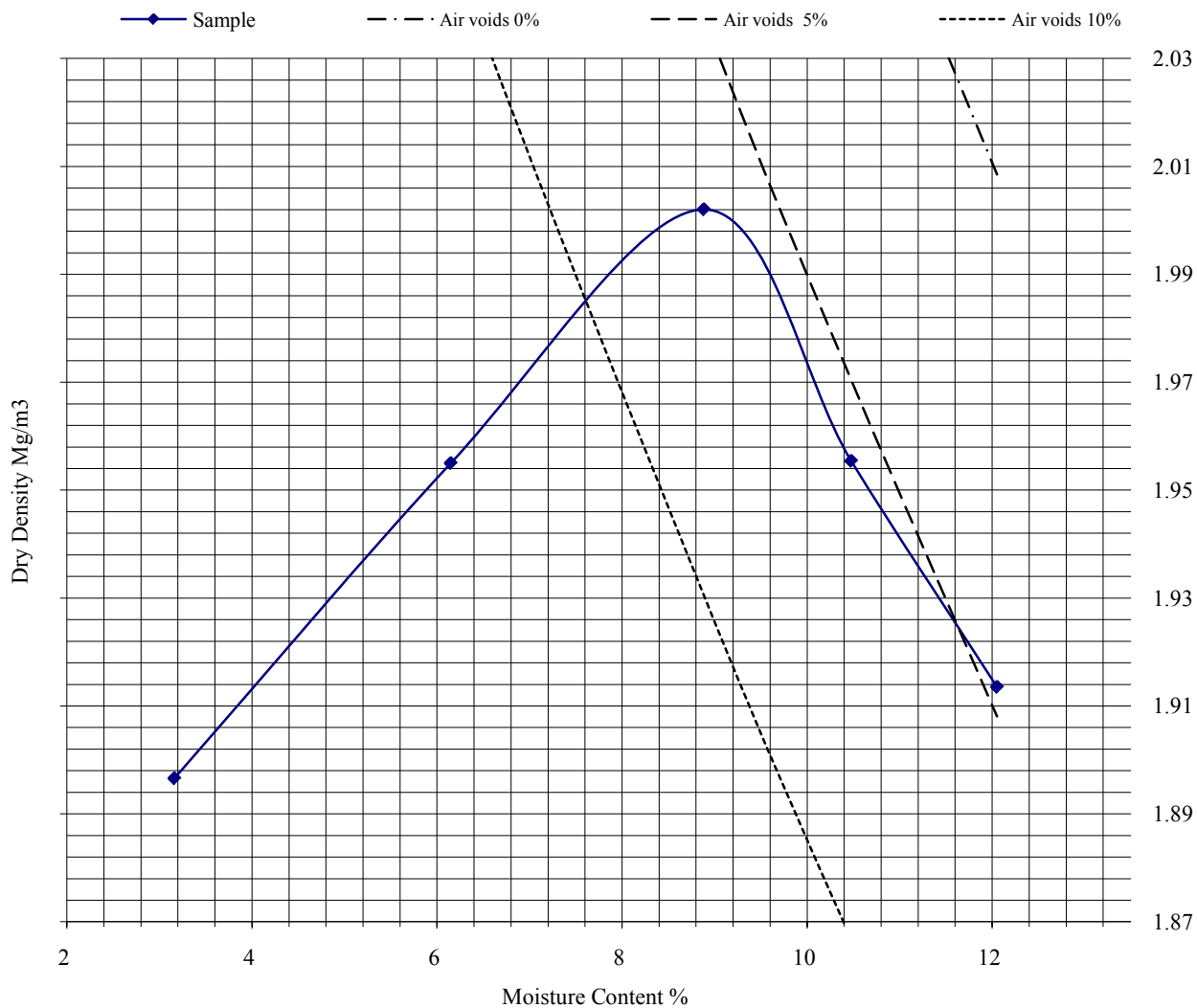
Contract No.:
10432-020710
Client Ref No:
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Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Borehole Number: Bulk 3 Sample Number: P3 Depth (m):



Initial Moisture Content:	9	Method of Compaction	Vibro Hammer / Single Sample
Particle Density (Mg/m ³):	2.65* Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m ³):	2.00	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	8.9	Sample Preparation Clause :	3.2.4.2

* - not included in laboratory scope of accreditation

Remarks

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Pinhoe Clay Pit

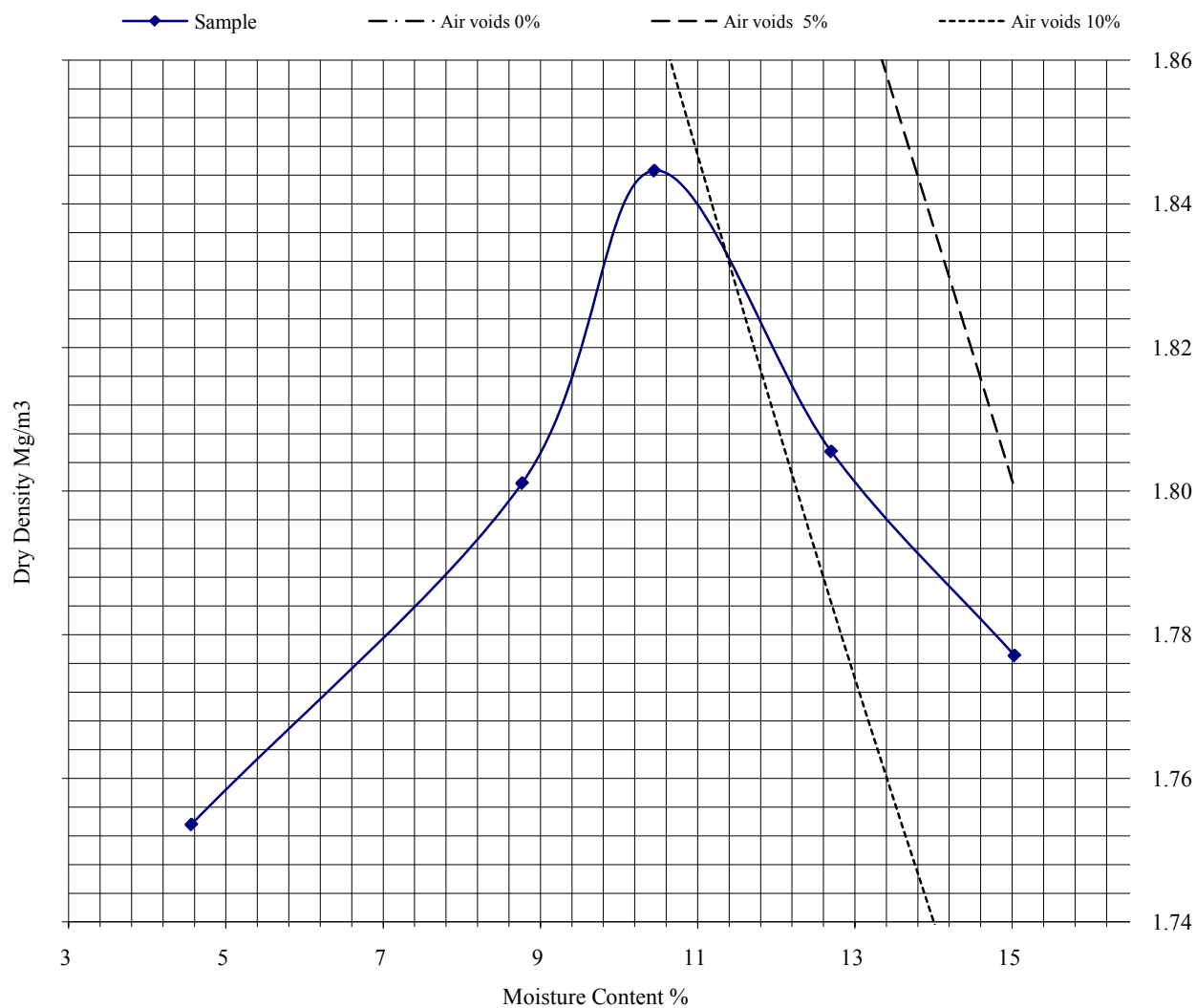
Contract No.:
10432-020710
Client Ref No:
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Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Borehole Number: Bulk 7 Sample Number: P1 Depth (m):



Initial Moisture Content:	9	Method of Compaction	Vibro Hammer / Single Sample
Particle Density (Mg/m3):	2.65* Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m3):	1.84	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	10.4	Sample Preparation Clause :	3.2.4.2

* - not included in laboratory scope of accreditation

Remarks

[Signature]

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05/08/10

Date

[Signature]

Approved by

05/08/10

Date



Pinhoe Clay Pit

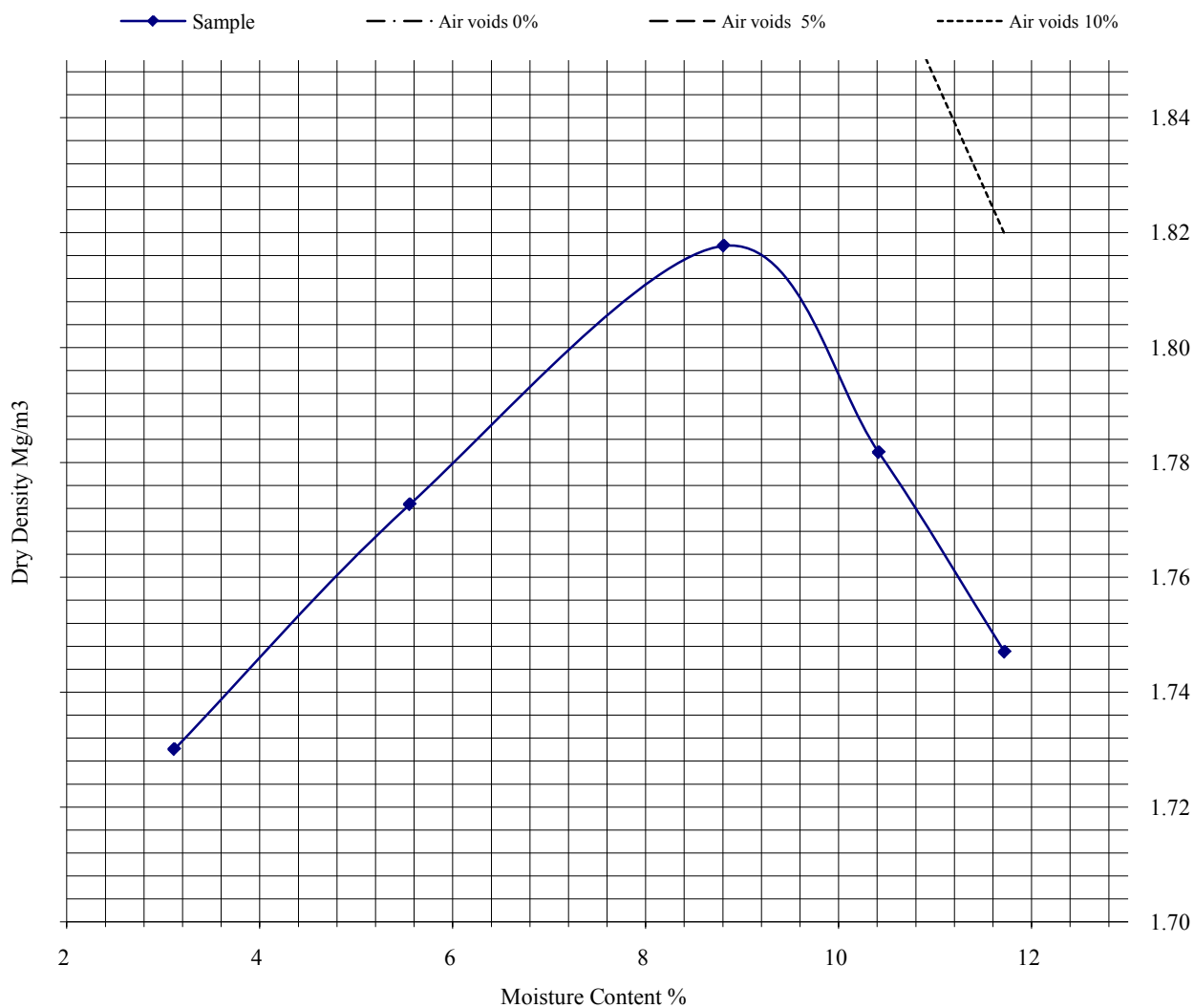
Contract No.:
10432-020710
Client Ref No:
0



Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Borehole Number: Bulk 8 Sample Number: P2 Depth (m):



Initial Moisture Content:	10	Method of Compaction	Vibro Hammer / Single Sample
Particle Density (Mg/m3):	2.65* Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m3):	1.82	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	8.8	Sample Preparation Clause :	3.2.4.2

* - not included in laboratory scope of accreditation

Remarks

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05/08/10

Date

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05/08/10

Date

Pinhoe Clay Pit



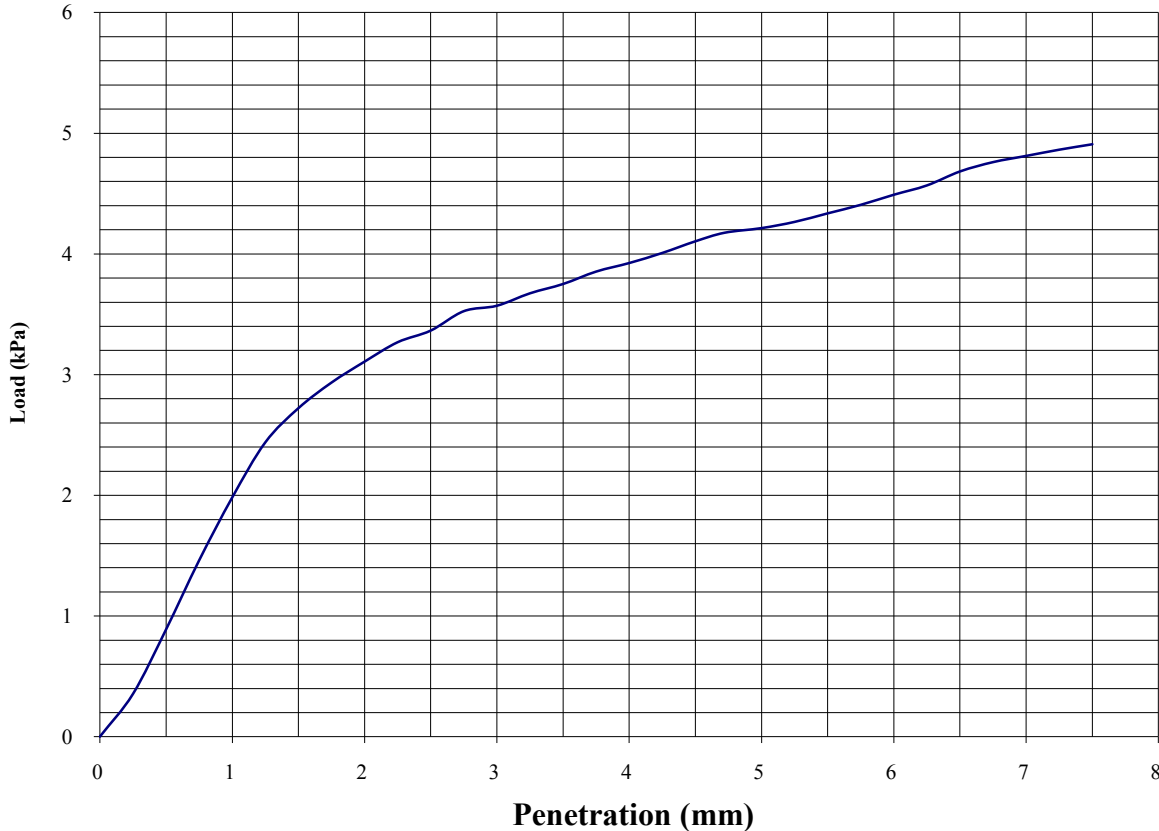
Contract No.:
10432-020710
Client Ref No:
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California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: P2 Sample Number: Bulk 1 Depth (m) n/a



Initial Sample Conditions		Test Conditions		Method of compaction : Vibro Hammer	
Moisture Content:	9	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.93	Soaking Time hrs	n/a	Sample Top	9
Dry Density Mg/m3:	1.77	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		21.1	Sample Bottom
Percentage retained on 20mm BS test sieve:		0		Remarks:	

[Signature]

Checked by

05/08/10

Date

[Signature]

Approved by

05/08/10

Date



Pinhole Clay Pit

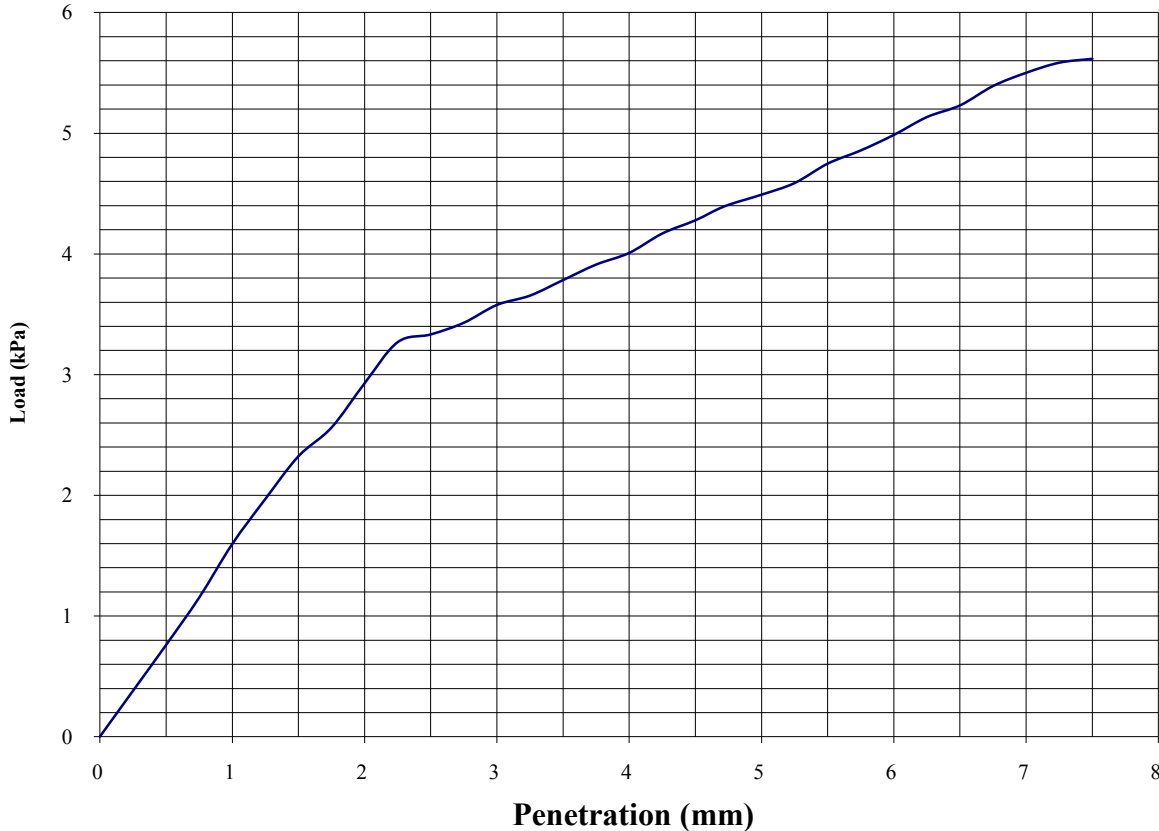
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10432-020711
Client Ref No:
n/a



California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: P1 Sample Number: Bulk 2 Depth (m) n/a



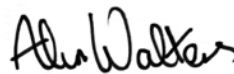
Initial Sample Conditions		Test Conditions		Method of compaction : Vibro Hammer	
Moisture Content:	9	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.90	Soaking Time hrs	n/a	Sample Top	9
Dry Density Mg/m3:	1.74	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		22.5	Sample Bottom
Sample Bottom		N/A			
Percentage retained on 20mm BS test sieve:			0	Remarks:	



Checked by

05/08/10

Date



Approved by

05/08/10

Date



Pinhole Clay Pit

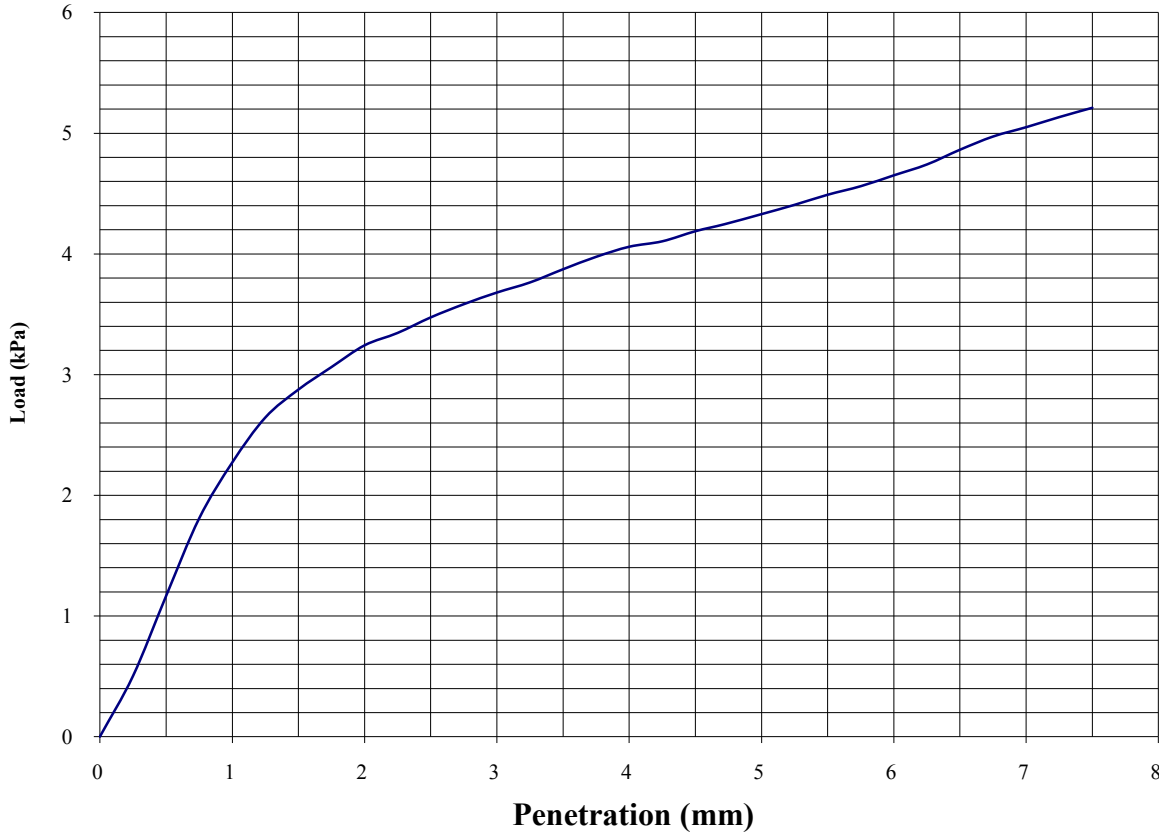
Contract No.:
10432-020711
Client Ref No:
n/a



California Bearing Ratio Test.

BS 1377:Part 4:1990

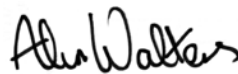
Hole Number: P3 Sample Number: Bulk 3 Depth (m) n/a



Initial Sample Conditions		Test Conditions		Method of compaction : Vibro Hammer	
Moisture Content:	9	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.90	Soaking Time hrs	n/a	Sample Top	9
Dry Density Mg/m3:	1.74	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		21.6	Sample Bottom
Percentage retained on 20mm BS test sieve:		0		Remarks:	



Checked by Date



Approved by Date



Pinhole Clay Pit

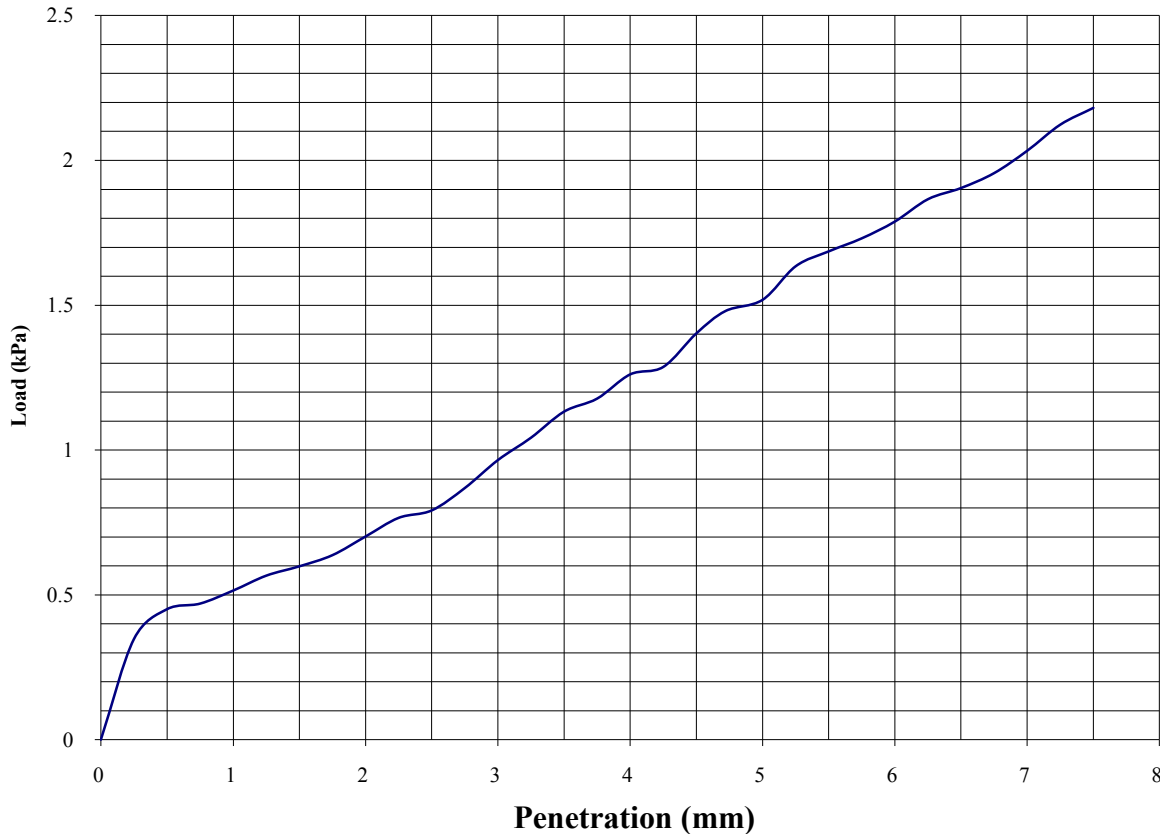
Contract No.:
10432-020711
Client Ref No:
n/a



California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: CBR1 Sample Number: P3 Depth (m) n/a



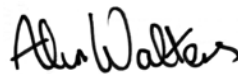
Initial Sample Conditions		Test Conditions		Method of compaction : 2.5 Kg Rammer	
Moisture Content:	10	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	2.01	Soaking Time hrs	n/a	Sample Top	9.5
Dry Density Mg/m3:	1.84	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		7.6	Sample Bottom
Sample Bottom		N/A			
Percentage retained on 20mm BS test sieve:			0	Remarks:	



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05/08/10

Date



Approved by

05/08/10

Date



Pinhoe Clay Pit

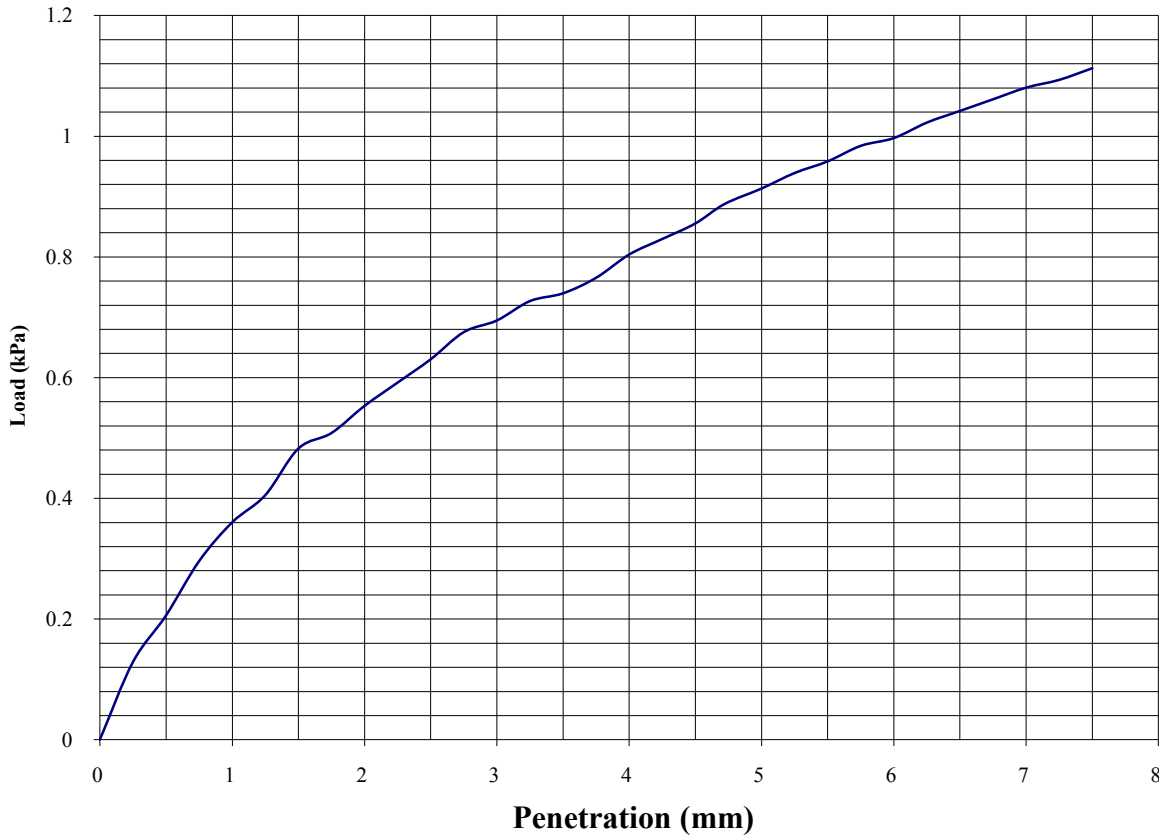
Contract No.:
10432-020710
Client Ref No:



California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: CBR2 Sample Number: P1 Depth (m) n/a



Initial Sample Conditions		Test Conditions		Method of compaction : 2.5 Kg Rammer	
Moisture Content:	17	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.98	Soaking Time hrs	n/a	Sample Top	16.6
Dry Density Mg/m3:	1.70	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		4.6	Sample Bottom
Sample Bottom		N/A			
Percentage retained on 20mm BS test sieve:			0	Remarks:	

Checked by

05/08/10

Date

Approved by

05/08/10

Date



Pinhoe Clay Pit

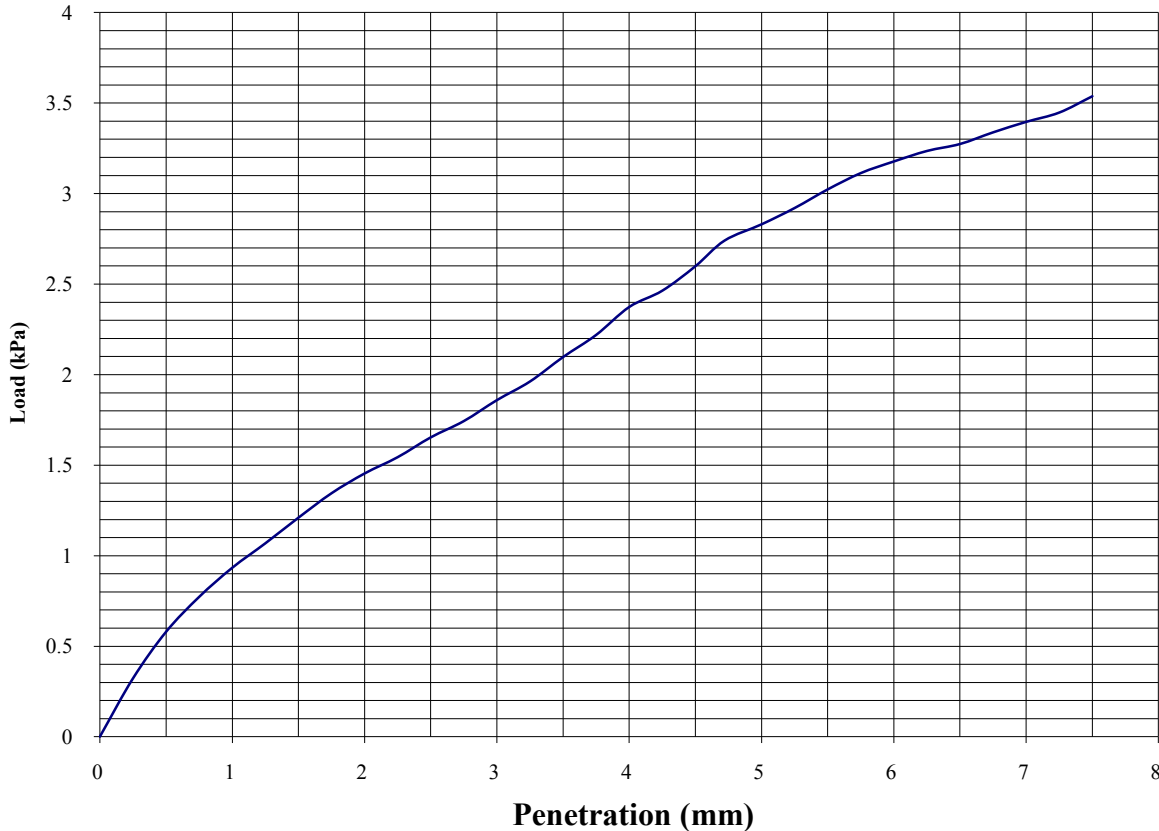
Contract No.:
10432-020710
Client Ref No:



California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: CBR3 Sample Number: P2 Depth (m) n/a



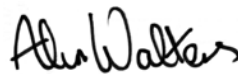
Initial Sample Conditions		Test Conditions		Method of compaction : 2.5 Kg Rammer	
Moisture Content:	10	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.98	Soaking Time hrs	n/a	Sample Top	10.3
Dry Density Mg/m3:	1.79	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		14.2	Sample Bottom
Sample Bottom		N/A			
Percentage retained on 20mm BS test sieve:			0	Remarks:	



Checked by

05/08/10

Date



Approved by

05/08/10

Date



Pinhoe Clay Pit

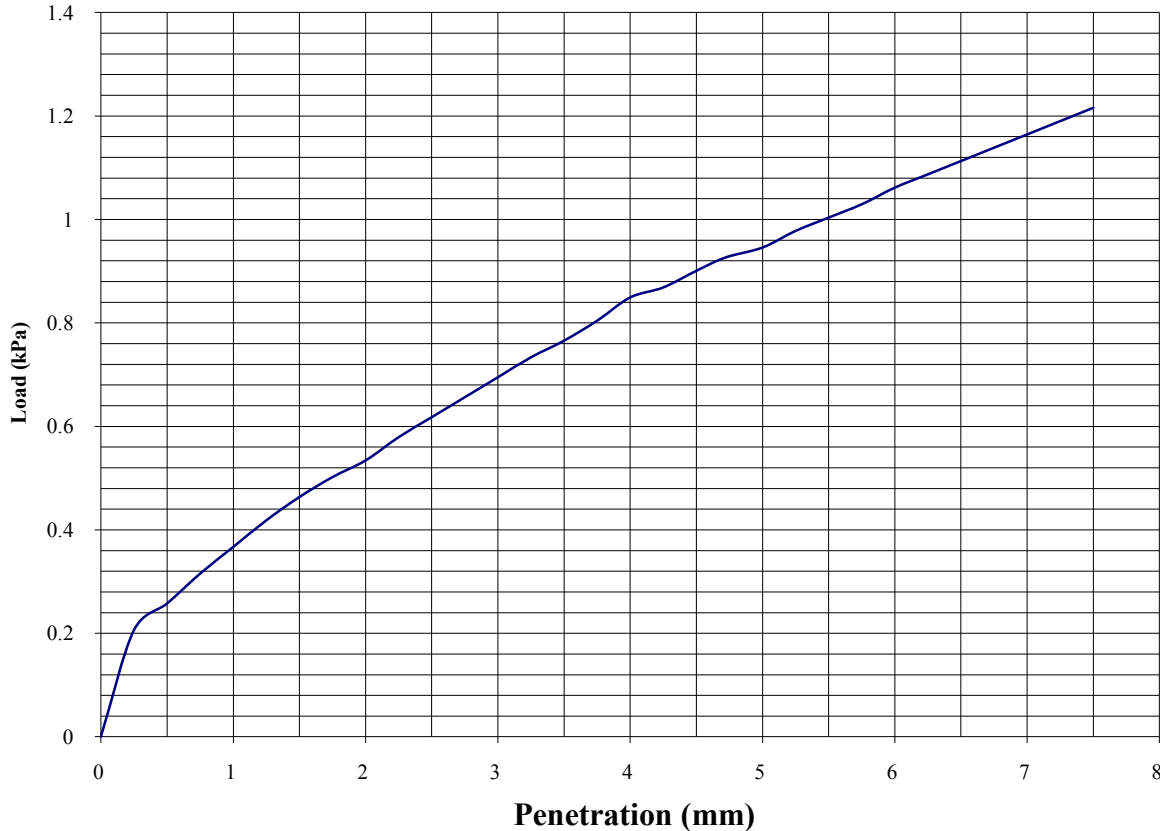
Contract No.:
10432-020710
Client Ref No:



California Bearing Ratio Test.

BS 1377:Part 4:1990

Hole Number: CBR4 Sample Number: P3 Depth (m) n/a



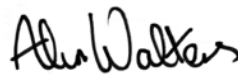
Initial Sample Conditions		Test Conditions		Method of compaction : 2.5 Kg Rammer	
Moisture Content:	13	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	2.11	Soaking Time hrs	n/a	Sample Top	12.5
Dry Density Mg/m3:	1.88	Swelling mm:	n/a	Sample Bottom	N/A
C.B.R. Value %		Sample Top		4.7	Sample Bottom
Sample Bottom		N/A			
Percentage retained on 20mm BS test sieve:			0	Remarks:	



Checked by

05/08/10

Date



Approved by

05/08/10

Date



Pinhoe Clay Pit

Contract No.:
10432-020710
Client Ref No:



DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC1 Sample No. : Sample Type : C Depth (m) : 1.24

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown grey MUDSTONE

Initial Condition	Water Content	%	1.5			
	Bulk Density	Mg/m ³	2.66			
	Dry Density	Mg/m ³	2.62			
	Height	mm	90.00			
	Diameter	mm	64.00			
	Particle Density	Mg/m ³	2.80			
	Degree of Saturation	%	61			
	Voids Ratio		0.07			
	Moisture Condition during test		As Received			
Joint Roughness Coefficient		Pre Test		Post Test		
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		01:00	01:30	03:30		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	104.2	138.9	191.0		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.1	-0.2	-0.1		
	Shear Displacement (mm)	0.2	0.6	0.4		

Cohesion (kPa)				Apparent Friction Angle (°)		
Normal Stress less than	115	kPa	69	Normal Stress less than	115	kPa 31
Normal Stress greater than	115	kPa	87	Normal Stress greater than	115	kPa 24

Residual Friction Angle (°)	-
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Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

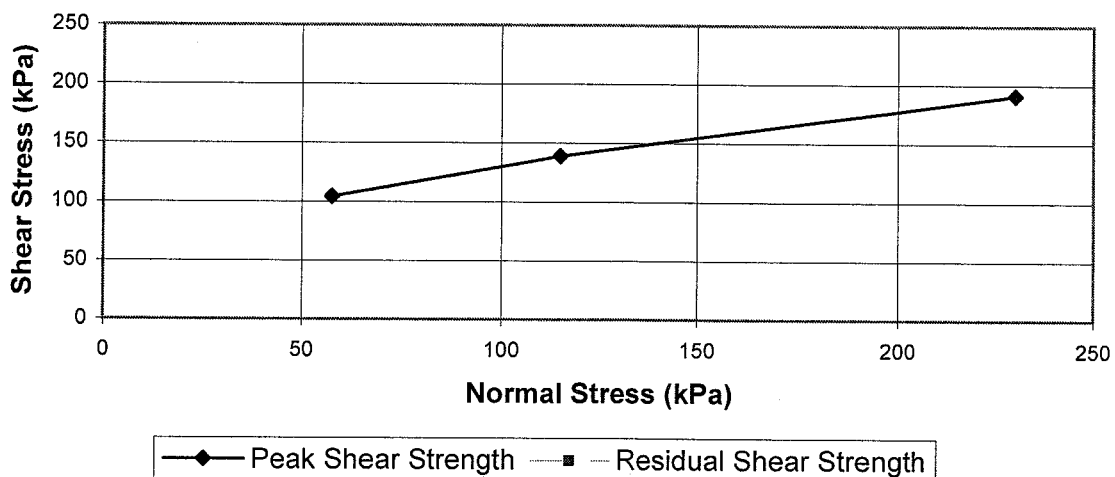
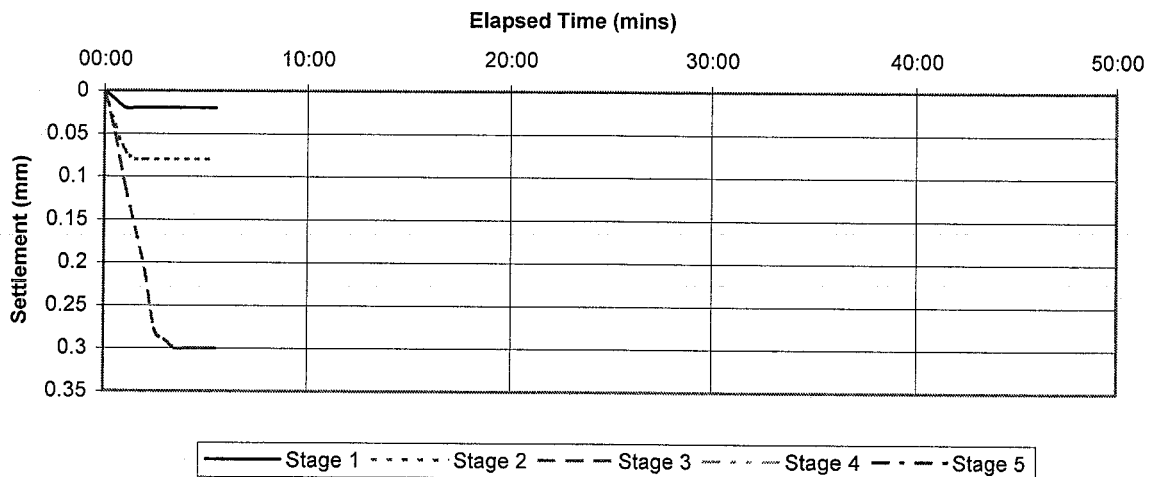
Hole No. : RC1 Sample No. : Sample Type : C Depth (m) : 1.24

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown grey MUDSTONE

Consolidation Stage



Prepared By	cal	Checked By		Date	10-5-10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

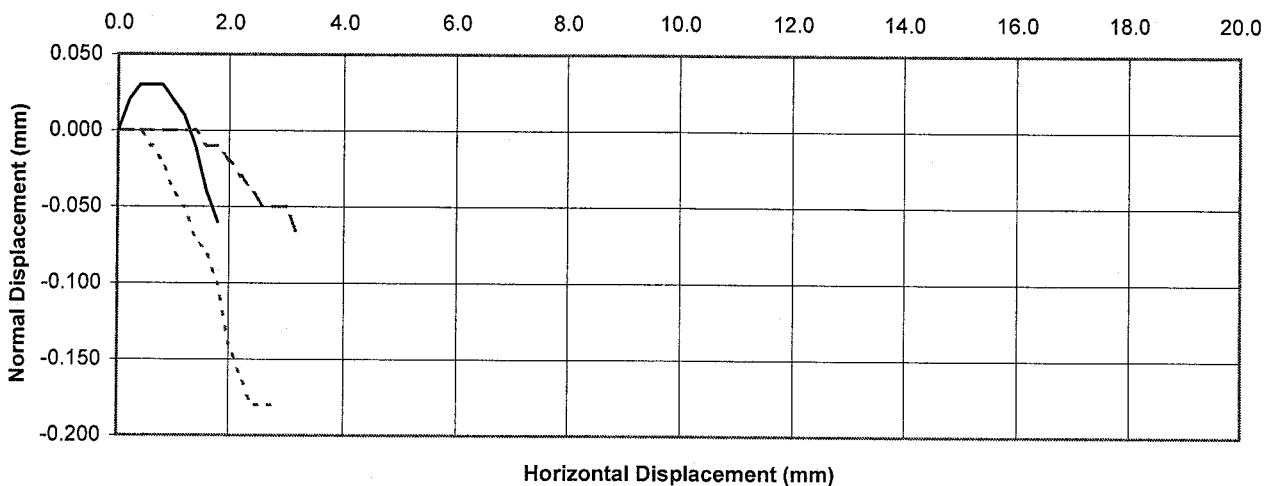
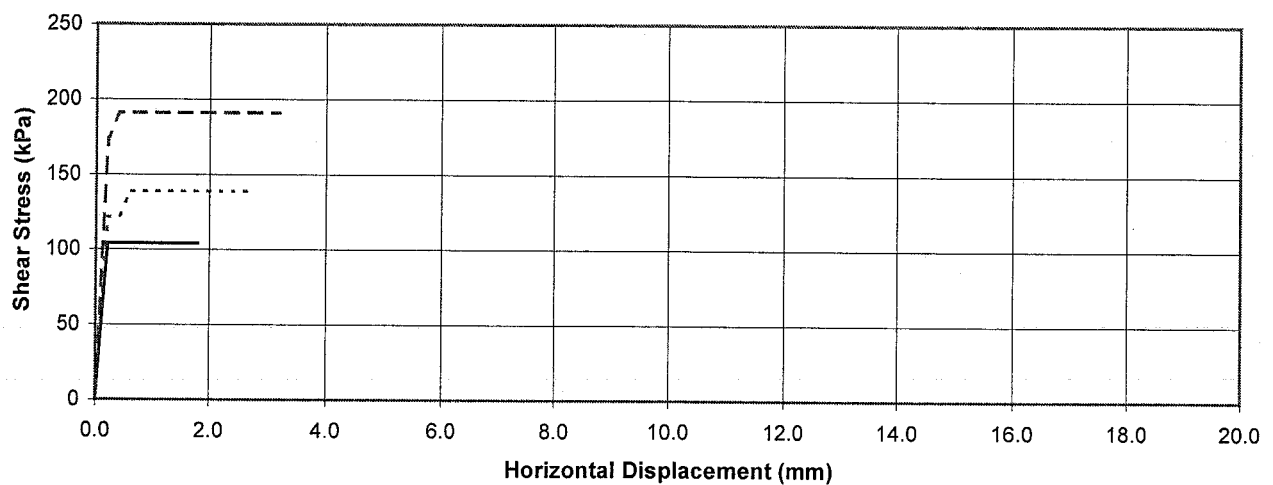
ISRM SUGGESTED METHODS

Hole No. : RC1 Sample No. : Sample Type : C Depth (m) : 1.24

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown grey MUDSTONE



Prepared By	CRH	Checked By	[Signature]	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 2.56

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown MUDSTONE

Initial Condition	Water Content	%	1.3			
	Bulk Density	Mg/m ³	2.61			
	Dry Density	Mg/m ³	2.58			
	Height	mm	88.00			
	Diameter	mm	88.00			
	Particle Density	Mg/m ³	2.80			
	Degree of Saturation	%	43			
	Voids Ratio		0.09			
	Moisture Condition during test		As Received			
Joint Roughness Coefficient		Pre Test		Post Test		
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		01:00	01:00	02:00		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	131.5	197.3	312.4		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.1	2.8	2.2		
	Shear Displacement (mm)	1.6	1.2	1.8		

Cohesion (kPa)				Apparent Friction Angle (°)		
Normal Stress less than	115	kPa	66	Normal Stress less than	115	kPa 49
Normal Stress greater than	115	kPa	82	Normal Stress greater than	115	kPa 45

Residual Friction Angle (°)	-
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Prepared By	CR	Checked By		Date	10.5.10.	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

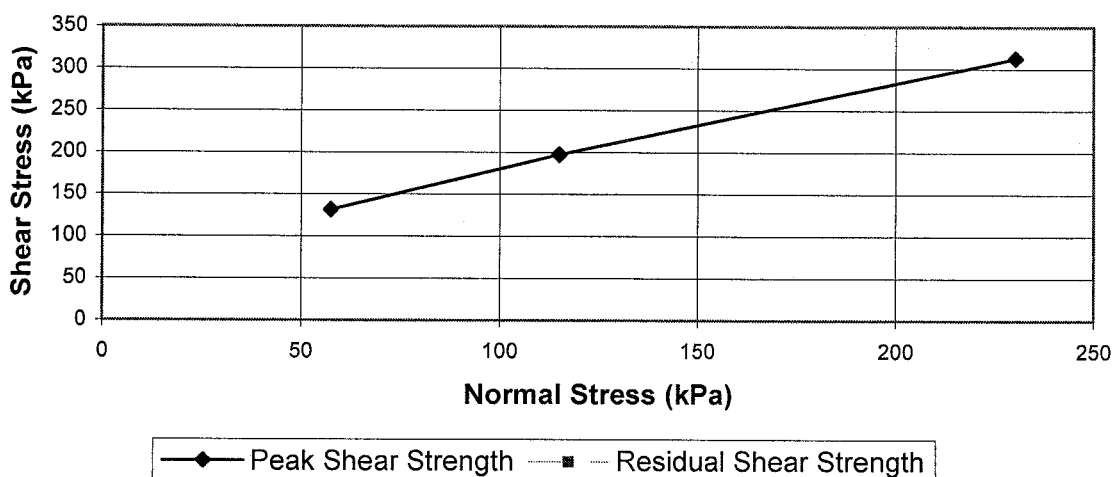
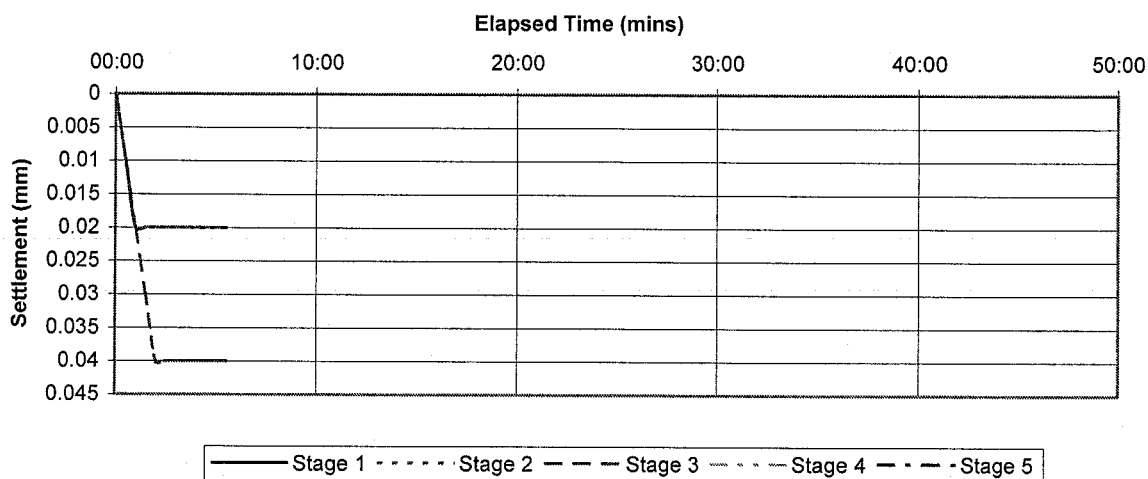
Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 2.56

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown MUDSTONE

Consolidation Stage



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10-5-10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

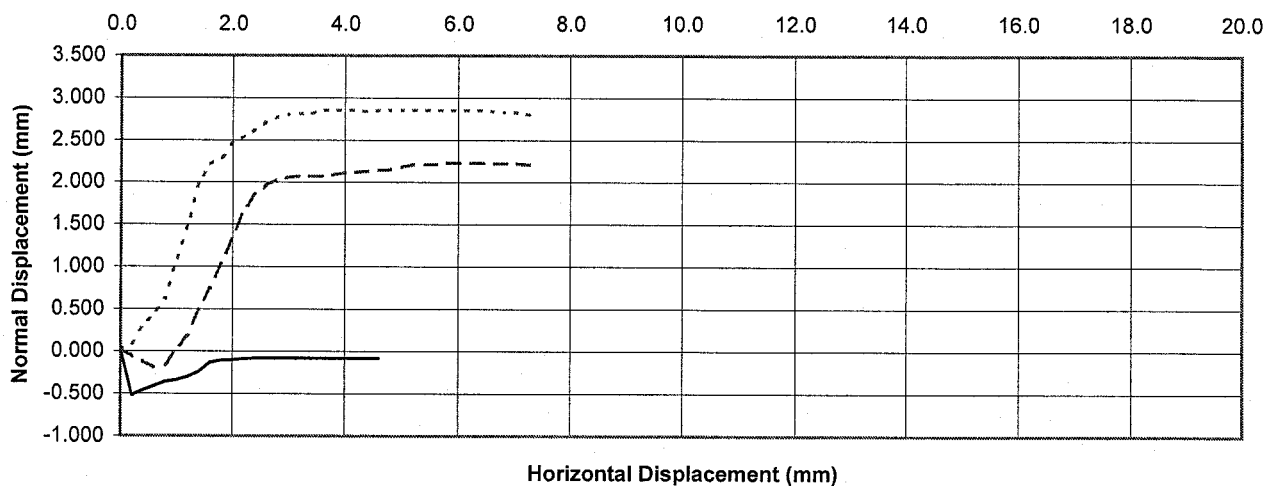
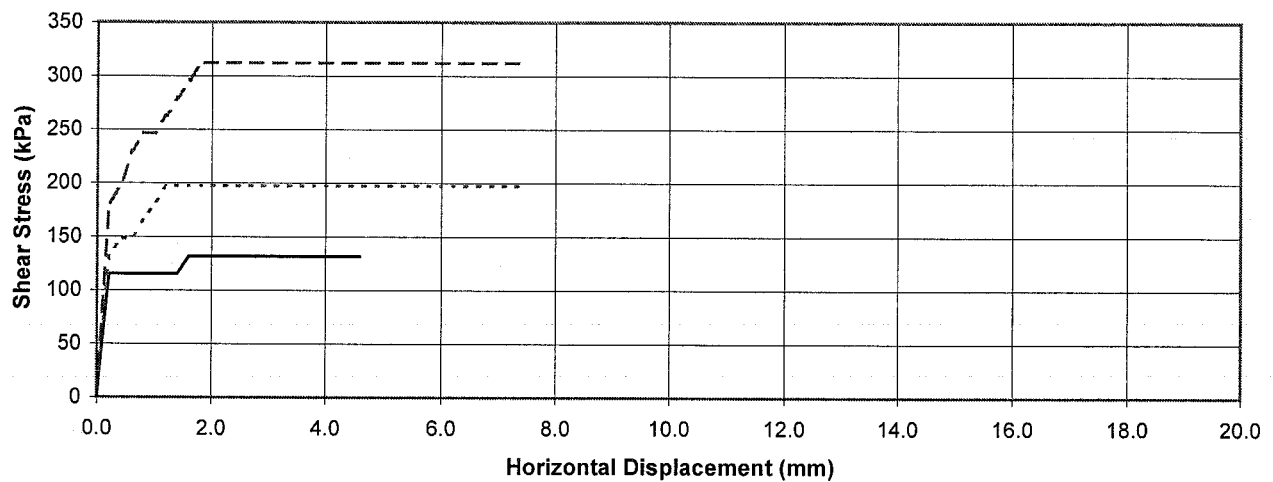
ISRM SUGGESTED METHODS

Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 2.56

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red brown MUDSTONE



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 3.40

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Initial Condition	Water Content	%	4.4			
	Bulk Density	Mg/m ³	2.55			
	Dry Density	Mg/m ³	2.45			
	Height	mm	90.00			
	Diameter	mm	65.00			
	Particle Density	Mg/m ³	2.80			
	Degree of Saturation	%	86			
	Voids Ratio		0.14			
	Moisture Condition during test		As Received			
Joint Roughness Coefficient		Pre Test		Post Test		
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	t ₁₀₀ (mins)	01:00	01:30	01:00		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	119.7	170.9	239.3		
	Residual Stress (kPa)					
	Normal Displacement (mm)	0.1	0.3	0.1		
	Shear Displacement (mm)	1.2	3.2	2.8		

Cohesion (kPa)				Apparent Friction Angle (°)		
Normal Stress less than	115	kPa	68	Normal Stress less than	115	kPa 42
Normal Stress greater than	115	kPa	103	Normal Stress greater than	115	kPa 31

Residual Friction Angle (°)	-
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Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

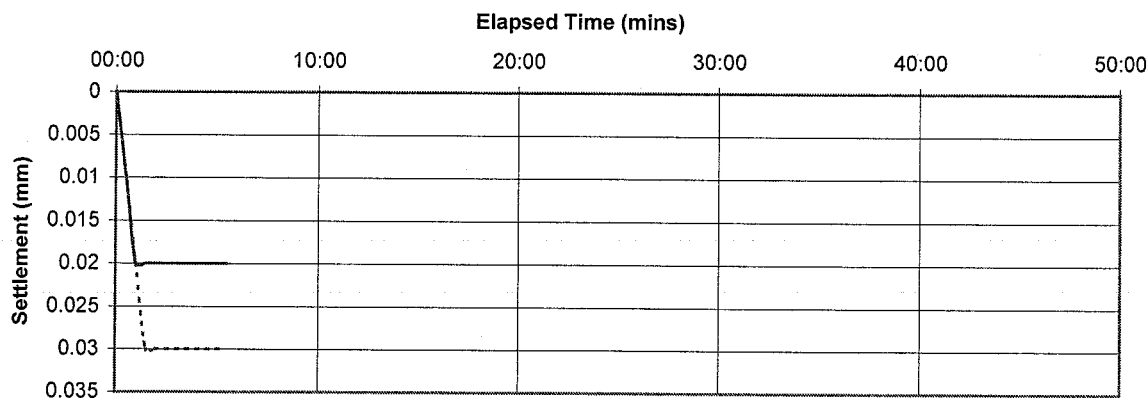
Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 3.40

Specimen Details

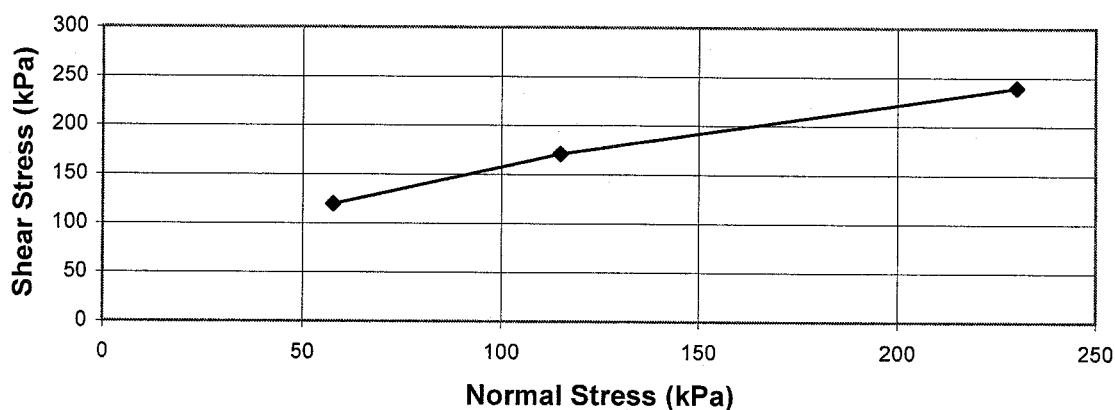
Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Consolidation Stage



— Stage 1 - - - Stage 2 - - - Stage 3 - - - Stage 4 - - - Stage 5



—◆— Peak Shear Strength —■— Residual Shear Strength

Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	6.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

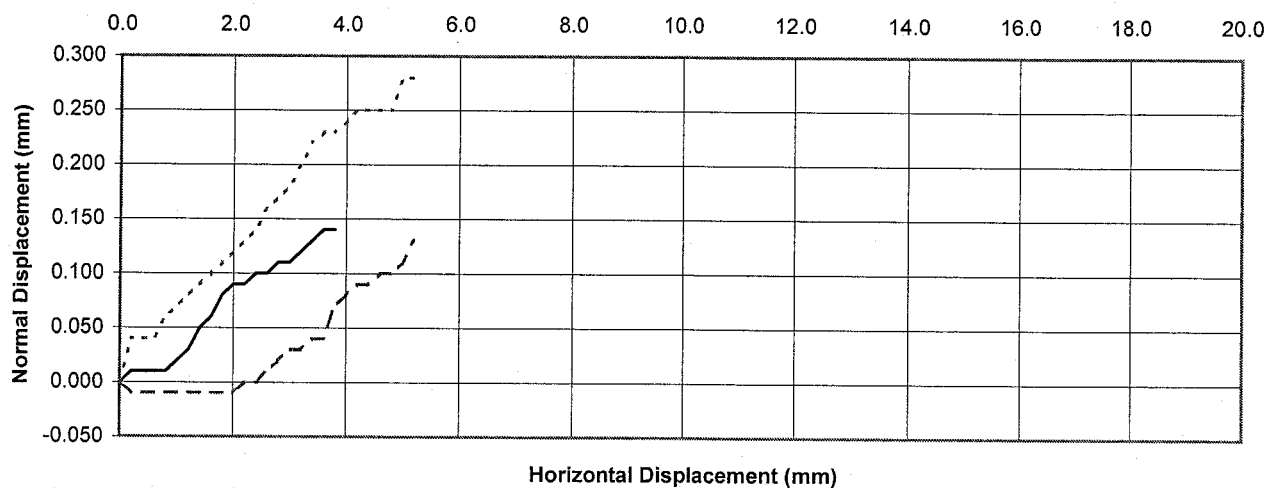
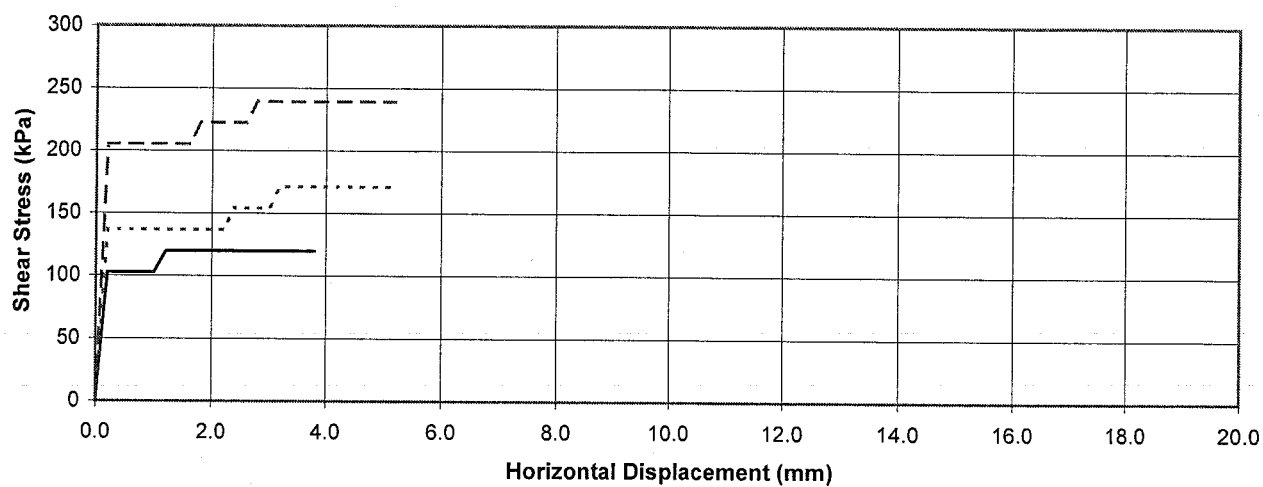
ISRM SUGGESTED METHODS

Hole No. : RC2 Sample No. : Sample Type : C Depth (m) : 3.40

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE



Prepared By	CRJ	Checked By	[Signature]	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC3 Sample No. : Sample Type : C Depth (m) : 2.38

Specimen Details

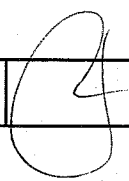
Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Initial Condition	Water Content	%	1.9			
	Bulk Density	Mg/m ³	2.65			
	Dry Density	Mg/m ³	2.61			
	Height	mm	92.00			
	Diameter	mm	85.00			
	Particle Density	Mg/m ³	2.80			
	Degree of Saturation	%	73			
	Voids Ratio		0.07			
	Moisture Condition during test		As Received			
Joint Roughness Coefficient		Pre Test		Post Test		
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		01:00	02:30	02:30		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	102.3	140.7	204.6		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.5	0.0	0.8		
	Shear Displacement (mm)	4.4	3.4	3.6		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115 kPa	64	Normal Stress less than	115 kPa	34
Normal Stress greater than	115 kPa	77	Normal Stress greater than	115 kPa	29

Residual Friction Angle (°)	-
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Prepared By	CEL	Checked By		Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

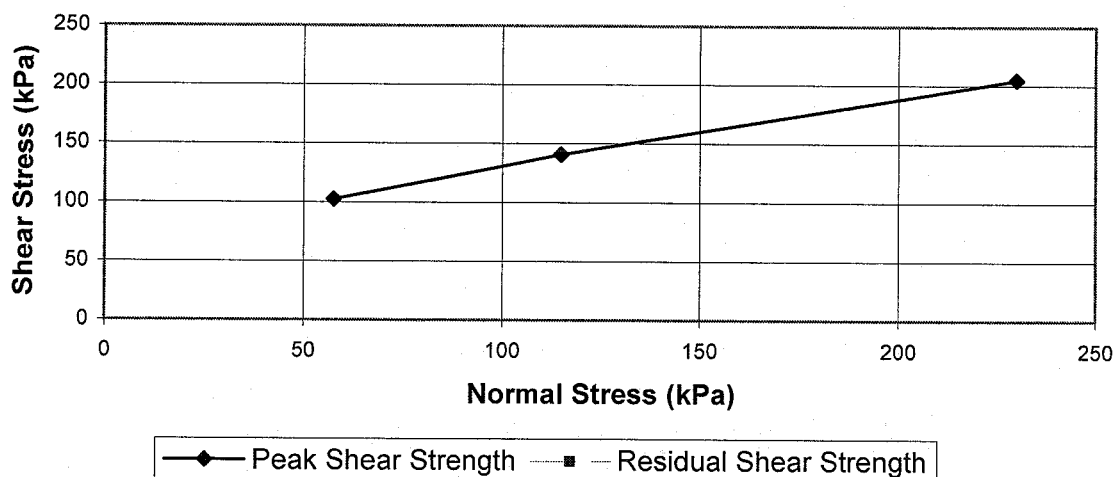
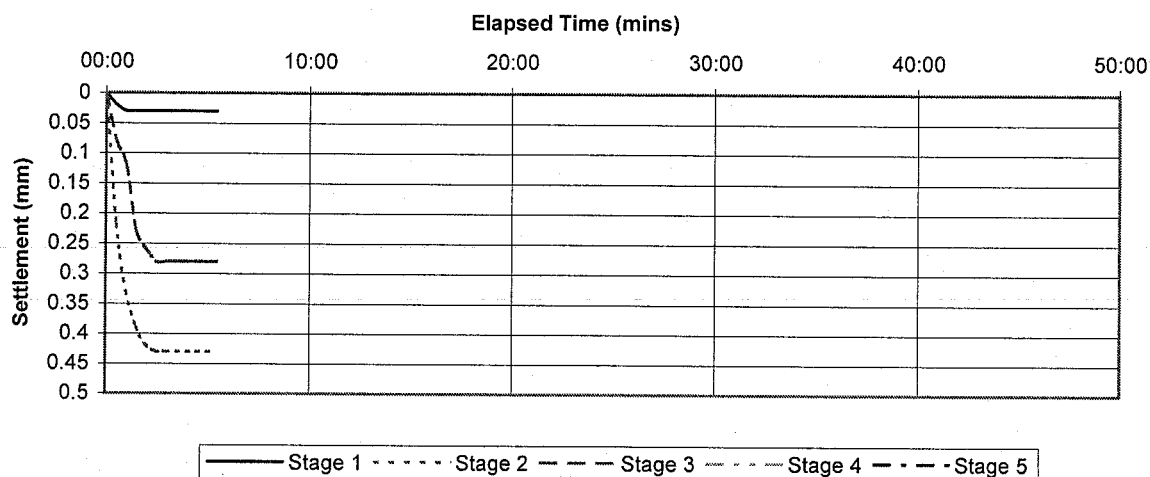
Hole No. : RC3 Sample No. : Sample Type : C Depth (m) : 2.38

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Consolidation Stage



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

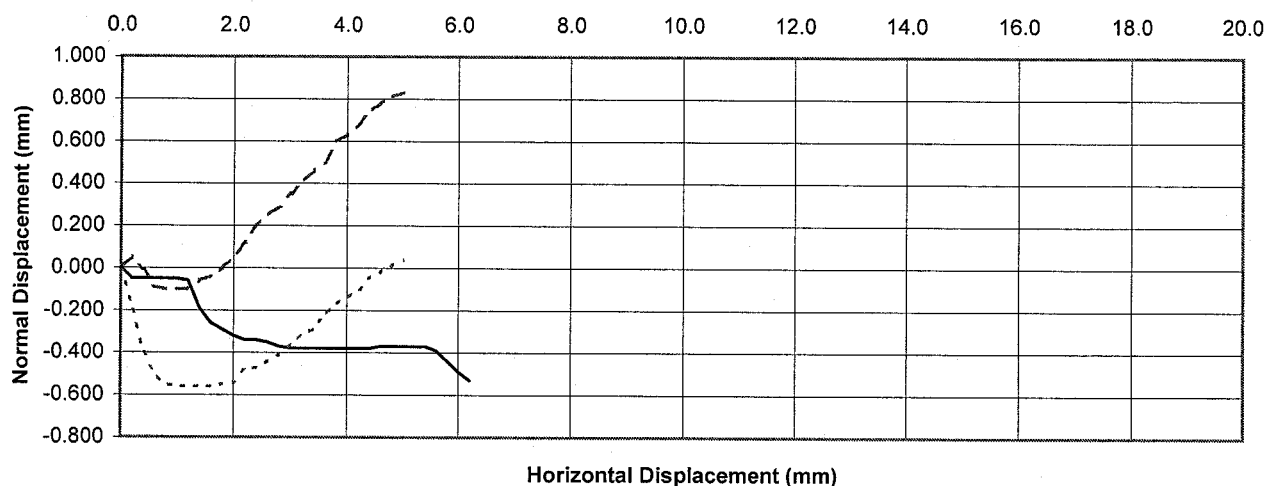
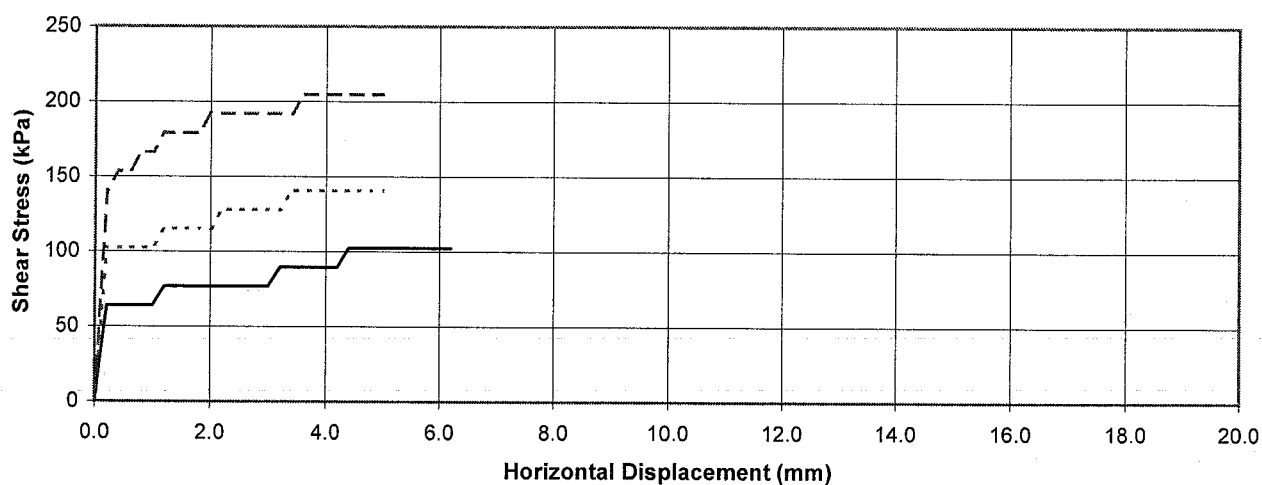
ISRM SUGGESTED METHODS

Hole No. : RC3 Sample No. : Sample Type : C Depth (m) : 2.38

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 1.88

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown grey MUDSTONE

Initial Condition	Water Content				%	1.2
	Bulk Density				Mg/m ³	2.67
	Dry Density				Mg/m ³	2.64
	Height				mm	87.00
	Diameter				mm	45.00
	Particle Density				Mg/m ³	2.80
	Degree of Saturation				%	55
	Voids Ratio					0.06
	Moisture Condition during test					As Received
Joint Roughness Coefficient			Pre Test		Post Test	
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		00:30	01:00	01:30		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	153.3	204.3	281.0		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.2	0.6	0.7		
	Shear Displacement (mm)	0.4	3.0	3.0		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115 kPa	102	Normal Stress less than	115 kPa	42
Normal Stress greater than	115 kPa	128	Normal Stress greater than	115 kPa	34

Residual Friction Angle (°)	-
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Prepared By	<i>col</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

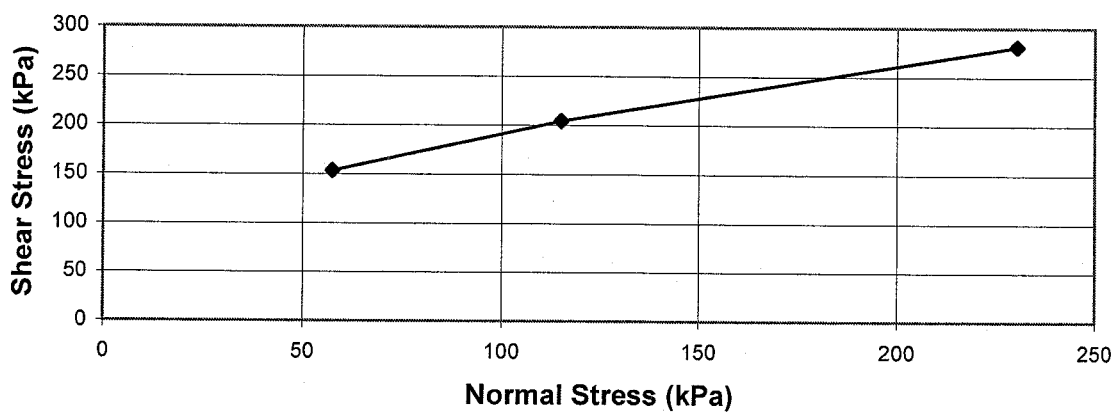
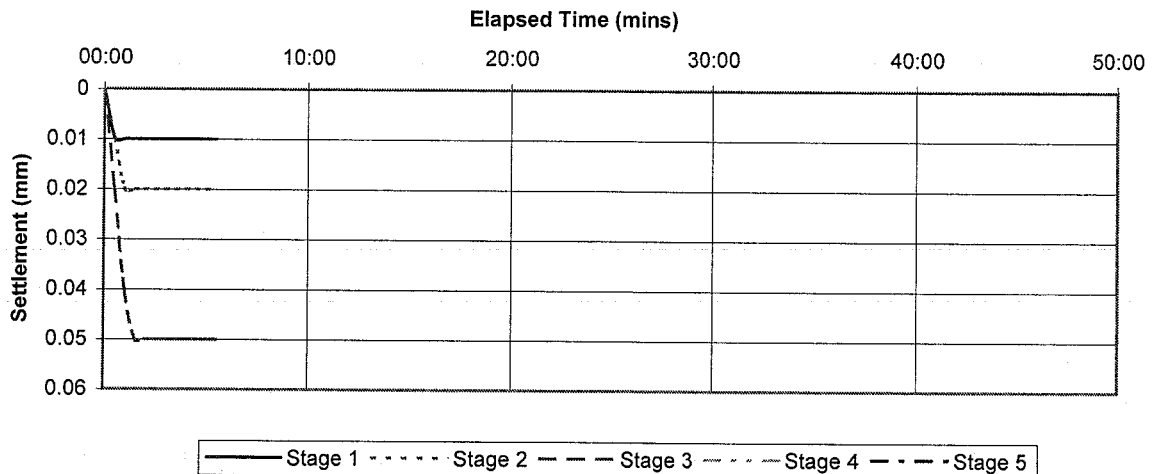
Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 1.88

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown grey MUDSTONE

Consolidation Stage



Prepared By	<i>cnl</i>	Checked By	<i>[Signature]</i>	Date	10.5.10.	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

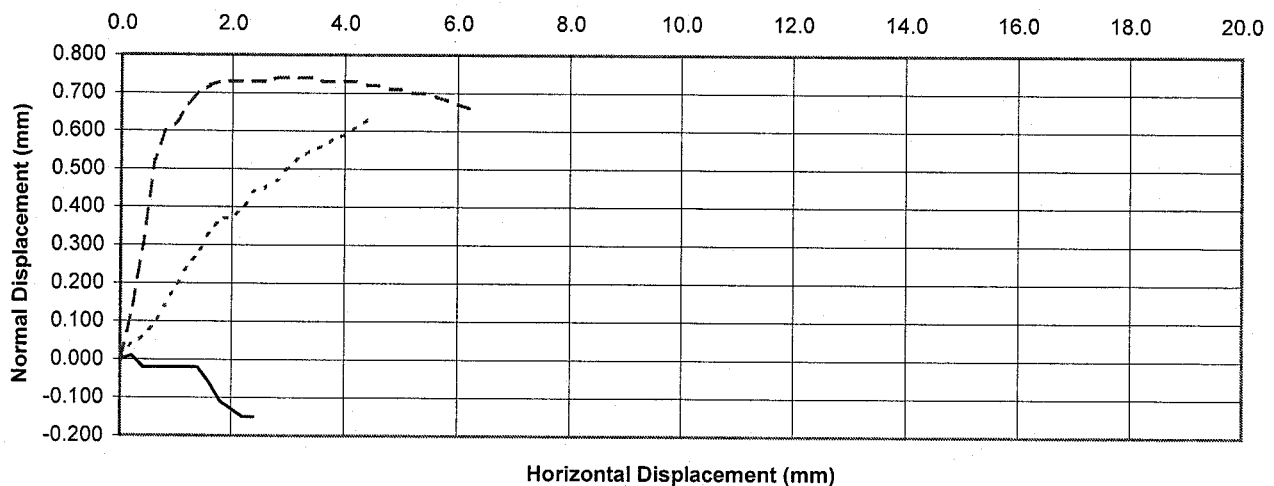
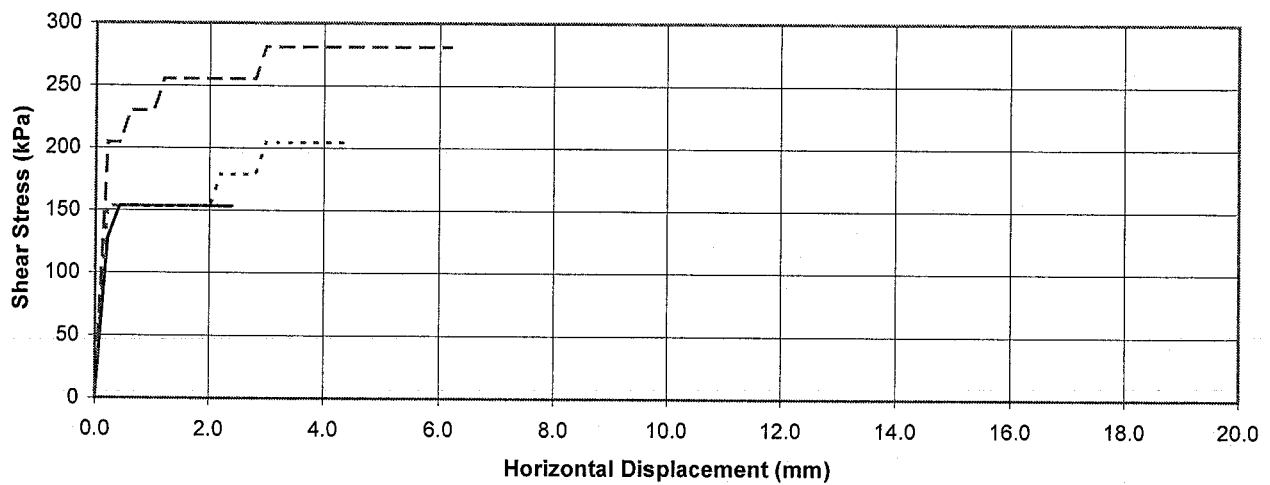
ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 1.88

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown grey MUDSTONE



Prepared By	Cal	Checked By	[Signature]	Date	6-5-10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 3.30

Specimen Details

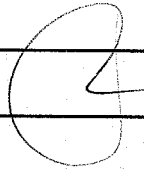
Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red MUDSTONE

Initial Condition	Water Content		%		1.5	
	Bulk Density		Mg/m ³		2.61	
	Dry Density		Mg/m ³		2.57	
	Height		mm		88.00	
	Diameter		mm		88.00	
	Particle Density		Mg/m ³		2.80	
	Degree of Saturation		%		47	
	Voids Ratio				0.09	
	Moisture Condition during test				As Received	
Joint Roughness Coefficient			Pre Test		Post Test	
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		01:30	01:00	02:30		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	65.8	98.6	148.0		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.7	-1.2	-1.0		
	Shear Displacement (mm)	1.8	4.2	4.8		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115 kPa	33	Normal Stress less than	115 kPa	30
Normal Stress greater than	115 kPa	49	Normal Stress greater than	115 kPa	23

Residual Friction Angle (°)	-
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Prepared By	cal	Checked By		Date	10.5.10.	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

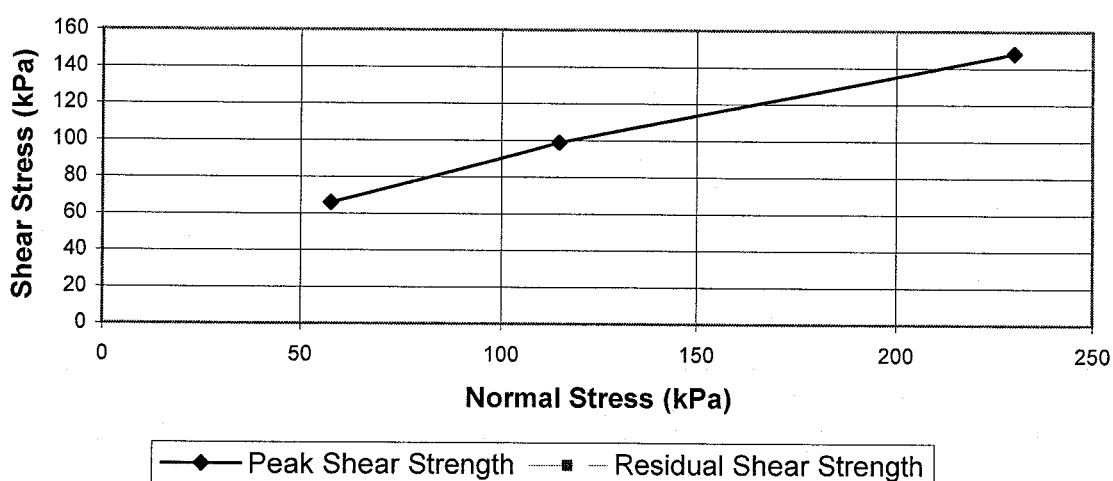
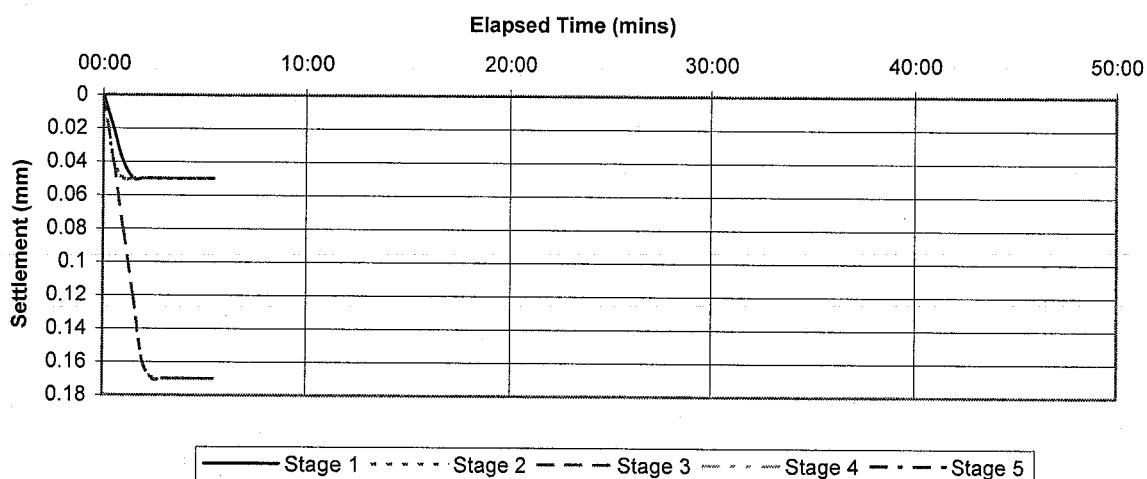
Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 3.30

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red MUDSTONE

Consolidation Stage



Prepared By	<i>ch</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTUINITIES

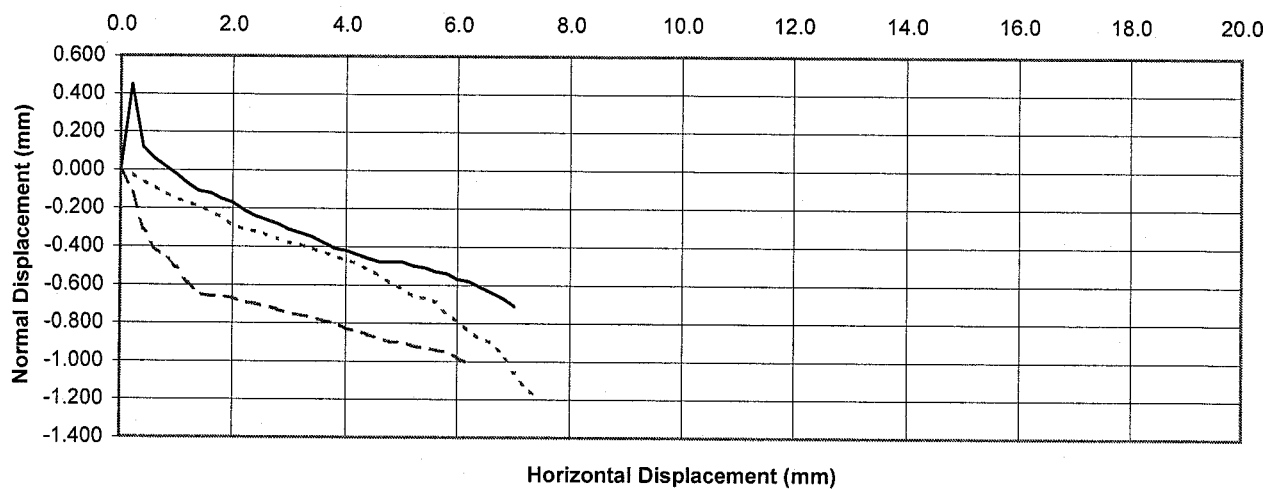
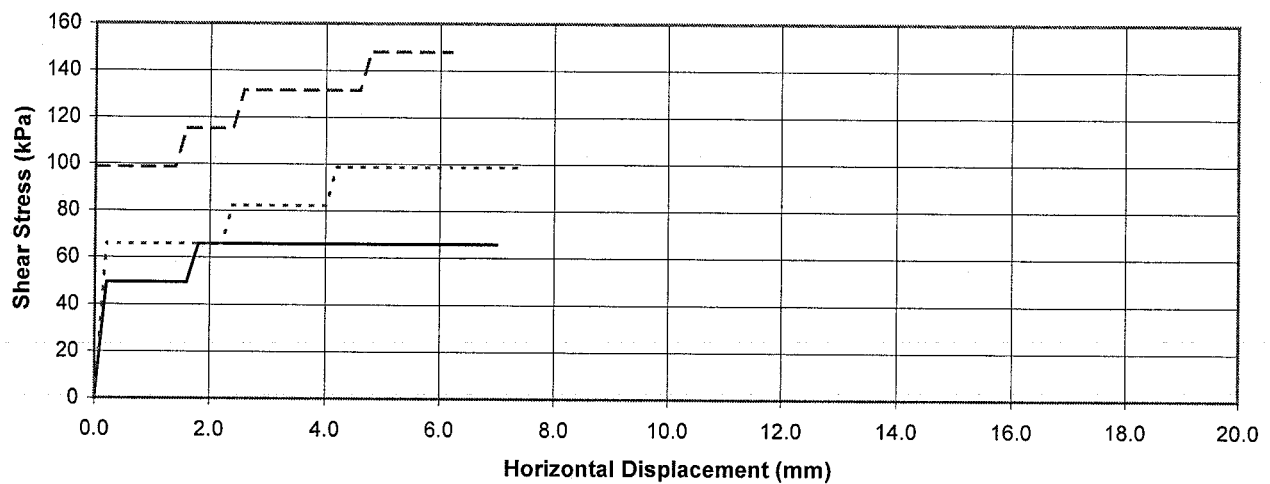
ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 3.30

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red MUDSTONE



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10.	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 6.00

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Initial Condition	Water Content		%		1.7	
	Bulk Density		Mg/m ³		2.64	
	Dry Density		Mg/m ³		2.60	
	Height		mm		82.00	
	Diameter		mm		58.00	
	Particle Density		Mg/m ³		2.80	
	Degree of Saturation		%		62	
	Voids Ratio				0.08	
	Moisture Condition during test				As Received	
Joint Roughness Coefficient			Pre Test		Post Test	
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		00:30	02:30	02:00		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	105.1	147.2	210.3		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-2.9	-2.0	-1.5		
	Shear Displacement (mm)	2.8	3.0	2.6		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115 kPa	63	Normal Stress less than	115 kPa	36
Normal Stress greater than	115 kPa	84	Normal Stress greater than	115 kPa	29

Residual Friction Angle (°)	-
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Prepared By	cal	Checked By		Date	6-5-10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

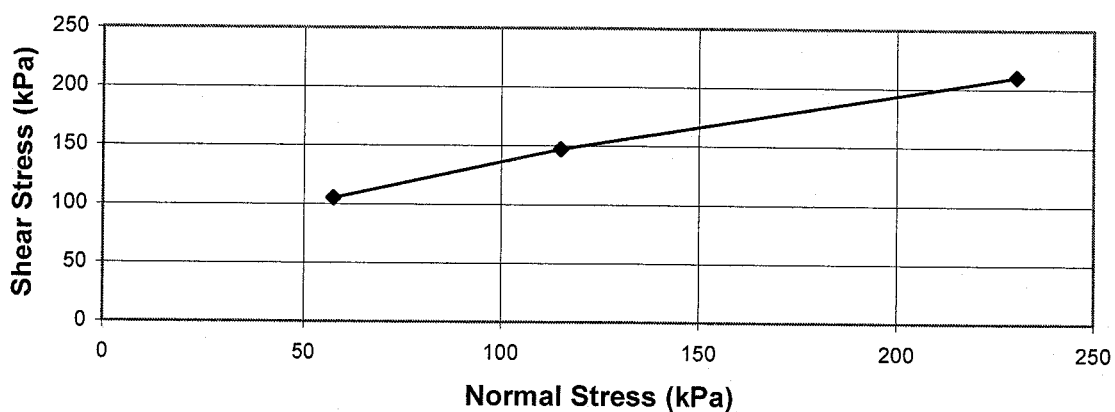
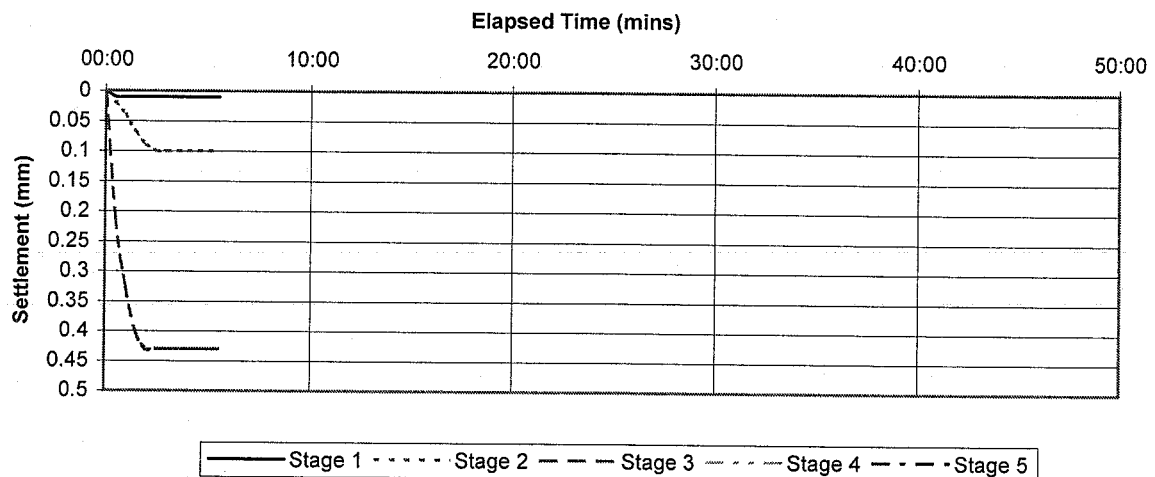
Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 6.00

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Consolidation Stage



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

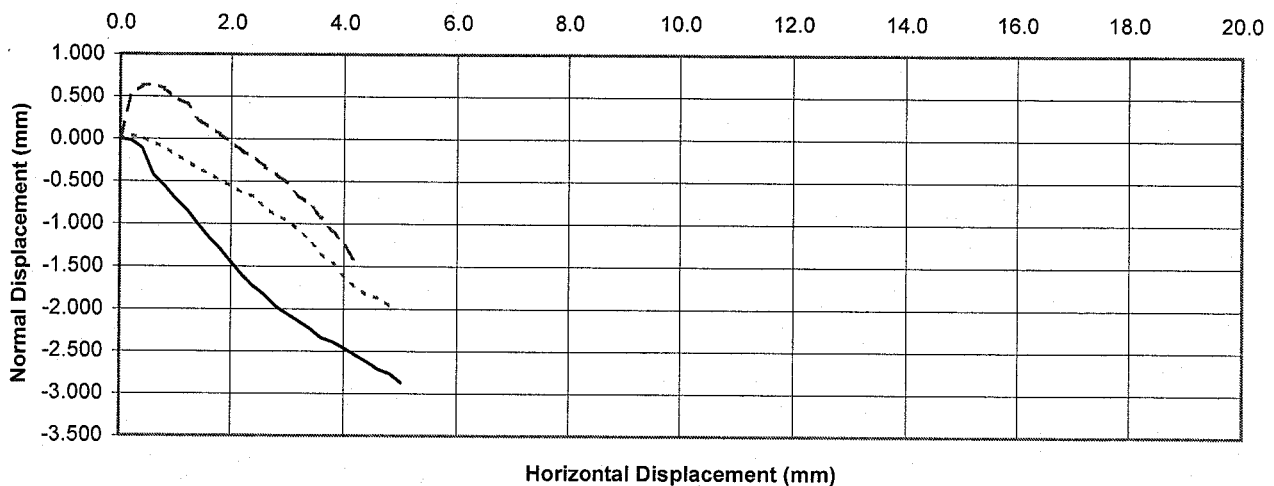
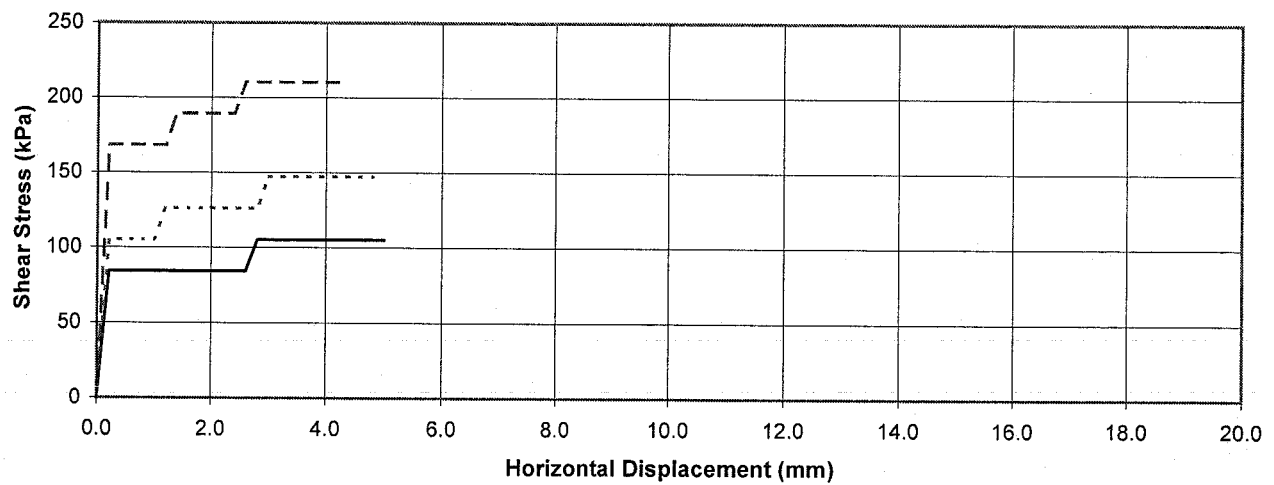
ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 6.00

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	16/5/10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 11.78

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Initial Condition	Water Content		%	4.4		
	Bulk Density		Mg/m ³	2.62		
	Dry Density		Mg/m ³	2.51		
	Height		mm	88.00		
	Diameter		mm	88.00		
	Particle Density		Mg/m ³	2.80		
	Degree of Saturation		%	107		
	Voids Ratio			0.12		
	Moisture Condition during test			As Received		
Joint Roughness Coefficient			Pre Test		Post Test	
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
		02:30	02:30	03:30		
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	131.5	164.4	230.2		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-0.6	-0.5	-0.3		
	Shear Displacement (mm)	2.2	2.8	2.2		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115	kPa	99	Normal Stress less than	115 kPa 30
Normal Stress greater than	115	kPa	99	Normal Stress greater than	115 kPa 30

Residual Friction Angle (°)	-
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Prepared By	<i>Cal</i>	Checked By	<i>[Signature]</i>	Date	10.5.10	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTUITIES

ISRM SUGGESTED METHODS

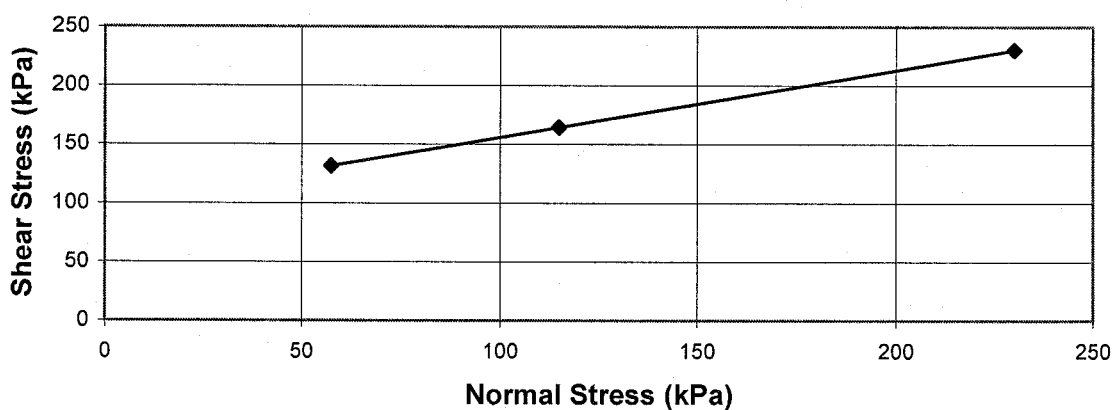
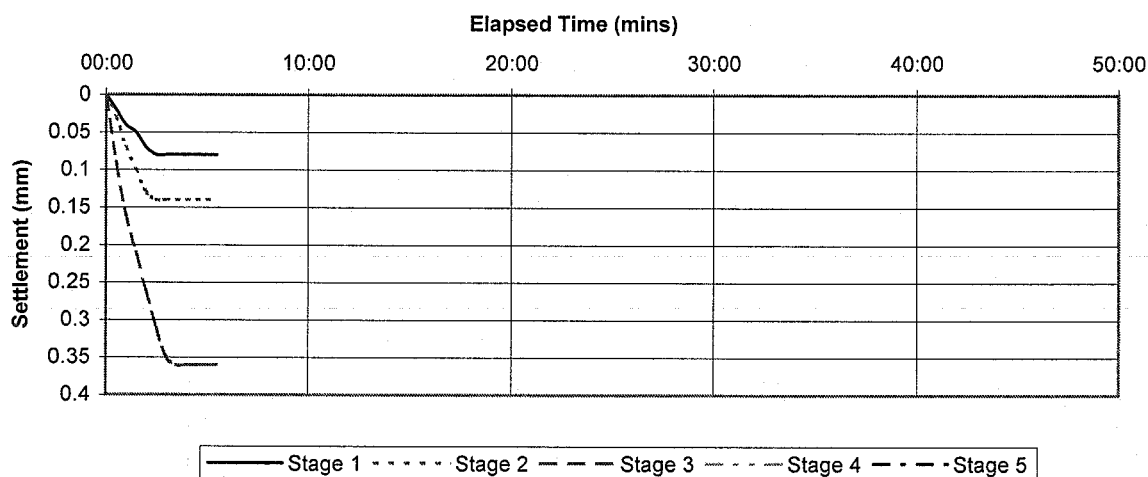
Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 11.78

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE

Consolidation Stage



Prepared By	<i>cal</i>	Checked By	<i>[Signature]</i>	Date	<i>10.5.10</i>	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

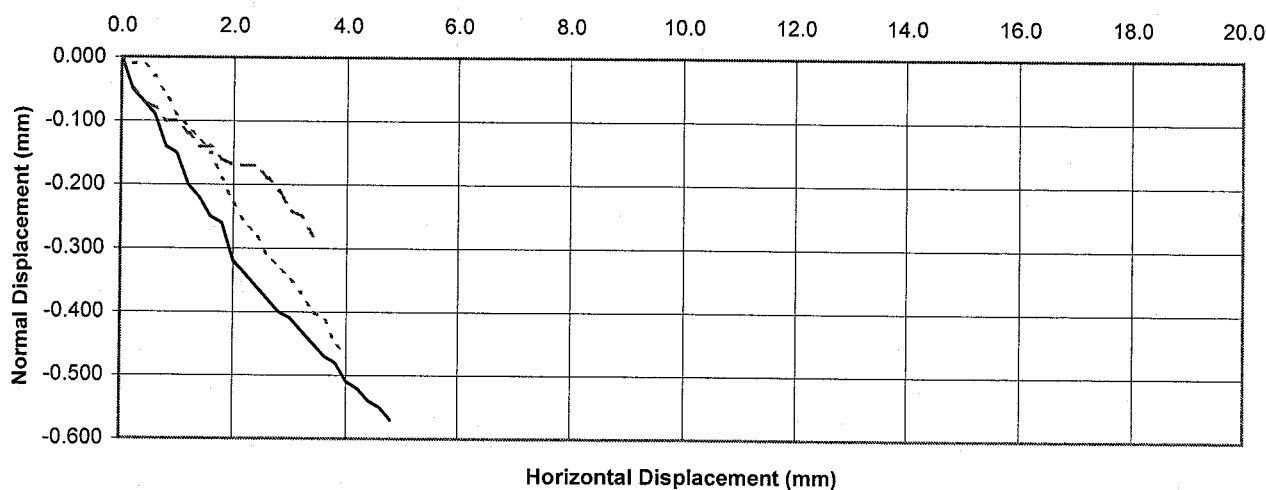
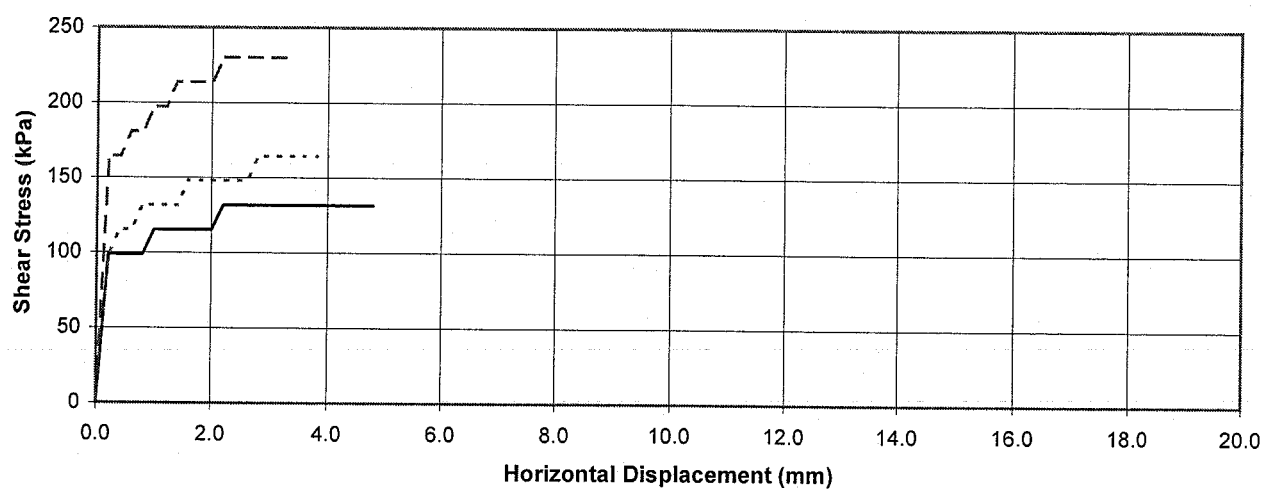
ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 11.78

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Brown red MUDSTONE



Prepared By	<i>Carl</i>	Checked By	<i>[Signature]</i>	Date	<i>10/5/10</i>	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 12.60

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red SILTSTONE

Initial Condition	Water Content		%	2.1		
	Bulk Density		Mg/m ³	2.61		
	Dry Density		Mg/m ³	2.55		
	Height		mm	88.00		
	Diameter		mm	88.00		
	Particle Density		Mg/m ³	2.80		
	Degree of Saturation		%	60		
	Voids Ratio			0.10		
	Moisture Condition during test			As Received		
Joint Roughness Coefficient			Pre Test		Post Test	
	Upper Surface of Discontinuity					
	Lower Surface of Discontinuity					
Consolidation Stage	t ₁₀₀ (mins)	Stage 1 01:30	Stage 2 01:00	Stage 3 03:00	Stage 4	Stage 5
Shearing stage		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
	Normal Stress (kPa)	57.5	115	230		
	Shear Stress (kPa)	131.5	180.9	263.1		
	Residual Stress (kPa)					
	Normal Displacement (mm)	-1.7	-0.3	0.2		
	Shear Displacement (mm)	1.4	4.0	2.8		

Cohesion (kPa)			Apparent Friction Angle (°)		
Normal Stress less than	115	kPa	82	Normal Stress less than	115 kPa
					41
Normal Stress greater than	115	kPa	99	Normal Stress greater than	115 kPa
					36

Residual Friction Angle (°)	-
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Prepared By	<i>MAH</i>	Checked By	<i>CEL</i>	Date	10/05/2010	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

ISRM SUGGESTED METHODS

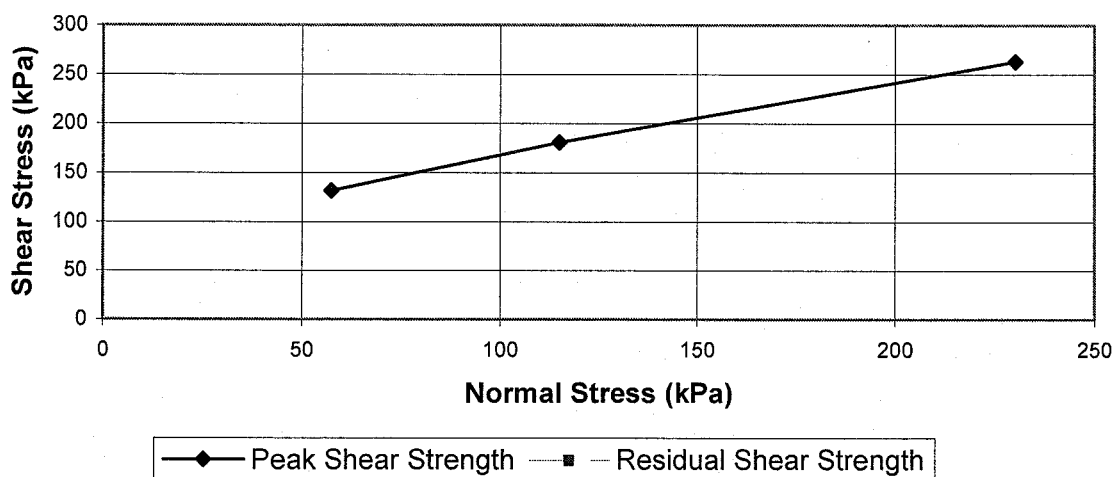
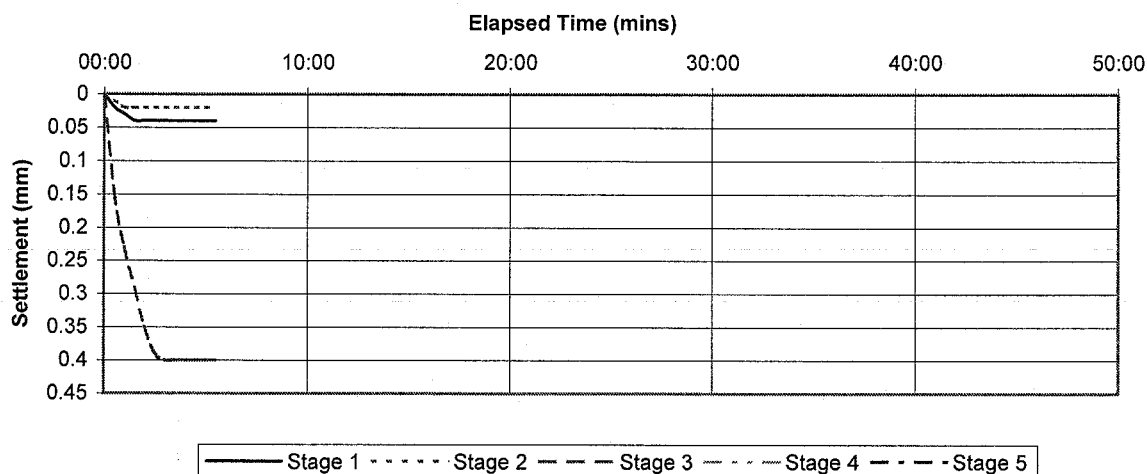
Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 12.60

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red SILTSTONE

Consolidation Stage



Prepared By	<i>msl</i>	Checked By	<i>cal</i>	Date	10/05/2010	Project No	CON103034
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DIRECT SHEAR STRENGTH OF ROCK DISCONTINUITIES

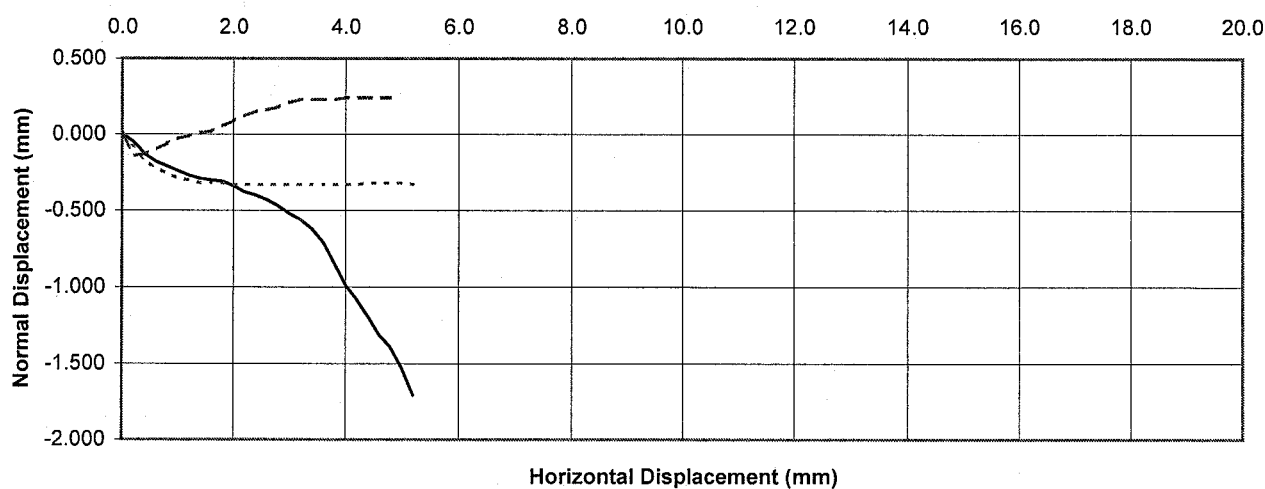
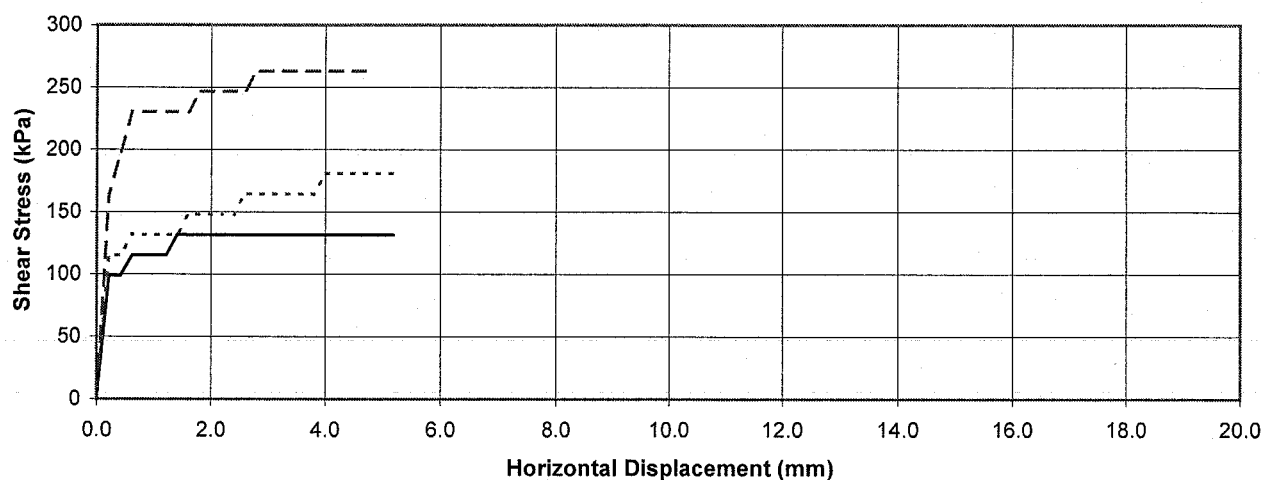
ISRM SUGGESTED METHODS

Hole No. : RC4 Sample No. : Sample Type : C Depth (m) : 12.60

Specimen Details

Source of specimen: Core Discontinuity Type: Saw Cut Encapsulating Material: Cement

Sample Description : Red SILTSTONE



Prepared By	<i>[Signature]</i>	Checked By	<i>[Signature]</i>	Date	10/05/2010	Project No	CON103034
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