

ENVIROARM LIMITED

DORRINGTON QUARRY



**CONSTRUCTION QUALITY VALIDATION REPORT
SOURCE EVALUATION REPORT
GEOLOGICAL BARRIER: PHASE 1A
REF:ARM/DQSE/CQA/1.00/2009
REVISION 1.00**

Carried out for: H Evason & Co

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DORRINGTON QUARRY

CONSTRUCTION QUALITY VALIDATION REPORT SOURCE EVALUATION REPORT GEOLOGICAL BARRIER: PHASE 1A

C O N T E N T S

- 1. INTRODUCTION**
- 2. SOURCE LOCATION SAMPLING**
- 3. SOURCE TESTING**
- 4. LABORATORY SOURCE TESTING RESULTS**
 - 4.1 Fines Content
 - 4.2 Atterberg Limits
 - 4.3 Natural Moisture Contents
 - 4.4 Moulding Properties
 - 4.5 Particle Density
 - 4.6 Dry Density: Moisture Content Relationship
 - 4.7 Shear Strength
 - 4.8 Chemical Testing
- 5. FIELD TESTING**
 - 5.1 Puddle Tests
 - 5.2 Moisture Content
- 6. CONCLUSION**

REFERENCES

APPENDICES

- | | | |
|---|---|---|
| A | - | Atterberg Limits, Natural Moisture Contents |
| B | - | Compaction Test Curves |
| C | - | Shear Box Test Results |
| D | - | UKAS Certificate for Structural Soils |
| E | - | Photographs of Puddle Tests |
| F | - | Soil Contamination Pathfinder Tests |
| G | - | Soil Contamination Leachability Tests |
| H | - | Table 6/4 |

DRAWINGS

SOURCE EVALUATION REPORT

1. INTRODUCTION

Enviroarm Limited (EL) were commissioned by H Evason & Co to:

- a. Assess results from the potential source of supply of suitable material for use in the engineered geological barrier for the initial engineering works in Phase 1A cell from An engineered source on site which had been previously screened to ensure that all large cobble size and boulder size materials had been removed and that the material had a clay content;
- b. Prepare a source evaluation report based upon the laboratory test results and field observations.

This report provides information on the laboratory results carried out on samples collected from the main stockpile of processed conditioned material in the quarry and from site testing carried out.

Screening of suitable material to be used as a geological barrier has been carried out by Corley Plant Hire Ltd using a Komatsu PC210 hydraulic excavator, a Terex Three Way Split Screen, Volvo A25 dump trucks to stockpile the material clearly separated and stored away from other wastes at the site.

Plate 1: View of separated material for use in the geological barrier materials.



The site lies within the Coalport Formation mudstone and sandstone.

2. SOURCE SAMPLING

The bulk samples have been taken from the stockpile and subjected to soils laboratory testing. The samples were collected in accordance with BS5930:1981 and tested as per BS1377:1990.

Four trial pits were taken from the stock mound. One sample was taken from each trial pit and a composite sample was also taken with an equal amount of material from each trial pit to assess the homogenous nature of the conditioned material to be used for the construction of the geological barrier.

The following testing has been carried out;

4No.	Atterberg Tests and Natural Moisture Content (NMC)
1 No.	Composite Atterberg Limits and NMC
4 No.	Specimen Description as engineering fill BS5930
1 No.	Composite Specimen Description as engineering fill
4 No.	2.5Kg Compaction with assumed Particle density
1 No.	Composite 2.5kg Compaction Test
3 No.	Consolidated Drained Shear Box Tests

Samples were collected and recorded in accordance with BS5930 - Site Investigation and submitted to Structural Soils laboratory in Bristol. The Structural Soils laboratory is UKAS accredited, No 1774. A copy of the certificate is presented at Appendix D. The total volume of clay to be used in the bund and base of the sub cell Phase 1A is approximately 15,000m³.

3. SOURCE TESTING

The samples were submitted to Structural Soils, a UKAS accredited materials testing laboratory, for the following soils testing:

Atterberg Limits and Natural Moisture Content BS1377:1990:3, 4.3, 5
Soil Description BS5930:1981:42.3
2.5 Kg Density Moisture Content Relationship BS1377:1990:3.3
Particle Density Assumed
Consolidated Shear Box Test BS1377:1990 4.5

The results are summarised in the appendices and the individual testing is discussed in Section 4.

4. SOURCE TESTING RESULTS

4.1 Fines Content

The results of all laboratory testing carried out on all the bulk samples showed the engineered processed material to consist of sandy gravelly clay, being mostly a clay material. Over 38% of material is less than 425um, indicating a high fines content.

4.2 Atterberg Limits

The clay is described of as having medium plasticity with a plastic limit of 20%-22%, and with an adjusted value based on liquidity index of 19% to 21%.

$$\text{Linear Shrinkage} = \text{PI} = 2.13 \times \text{LS} \quad 19/2.13 = 8.92$$

Table 1 presented below provides an analytical summary of all laboratory test results for the conditioning pad Atterberg limit tests. Laboratory results are contained as Appendix A.

Table 1. Atterberg Limits

:ATTERBERG LABORATORY TEST RESULTS			
TEST TYPE	RANGE OF RESULTS	AVERAGE	CLASSIFICATION
Atterberg Limits			
a. Plastic Limit	20-22	21.5	CM
b. Liquid Limit	37-40	38.2	
c. Plasticity Index	15-19	17.0	

4.3 Natural Moisture Content

Table 2 presented below provides an analytical summary of the natural moisture content tests. The average natural moisture content from the site tests was 9.7-17 %. The natural moisture content composite result was reported at 9.75% for the AL's and 16% for the 2.5 proctor samples. The overall moisture content from inside the trial pits was reported at 13%-17% and is therefore wet of optimum, reported at 12%.

The average moisture content was 15.25% from the individual trial pits and is described as a wet cohesive material.

The results are presented at Appendix A.

Table 2: Moisture Content

LABORATORY TEST RESULTS			
TEST TYPE	RANGE OF RESULTS %	AVERAGE RESULT %	CLASSIFICATION
Moisture Content	13.0- 17.0	15.25	+Optimum
Composite	9.7-16.0	12.875	+Optimum

4.4 Particle Density

Four compaction curves have been prepared and the 0%, 5% and 10% best fit lines correlate to a particle density of 2.68. The results are presented at Appendix B.

4.5 Density Moisture Content Relationship

The 2.5kg rammer method has been used to reflect the type of compaction plant to be employed for the works, and placement of the clay at or beyond the optimum moisture content. The results have showed a consistent plot with previously obtained compaction curves. The optimum moisture content range is 12%. The natural moisture content of the material is therefore above optimum. Laboratory graphs are contained as Appendix B.

Table 5: Optimum Moisture and Density Results

SAMPLE POINT	OPTIMUM MOISTURE CONTENT %	NATURAL MOISTIRUE CONTENT %	MAXIMUM DRY DENSITY Mg/m ³
TP1	12	16	1.89
TP2	12	16	1.89
TP3	12	14	1.93
TP4	12	15	1.90
Composite	12.00	16	1.93

4.6 Shear Box Tests

The material has an effective friction angle in excess of 32°, with an average value of 32.8°, and an effective cohesion of 8-9. This demonstrates that the material is cohesive and will bind together when compacted.

Shear box laboratory results are presented at Appendix C.

4.7 Chemical Testing

A series of chemical tests have been carried out on the processed materials to ensure that they will not impact on groundwater quality.

Soil samples were collected from each of the four trial pits and a 25kg composite sample was collected, labelled and sealed. Samples from each of the trial pits were submitted to a UKAS accredited laboratory (Severn Trent Laboratories) for pathfinder analysis suite, and PAH assessment to assess the level of contamination.

The following determinands were analysed: Arsenic as As, Boron as B, Cadmium as Cd, Chromium as Cr, Copper as Cu, Lead as Pb, Mercury as Hg, Nickel as Ni, Selenium as Se, Zinc as Zn, Cyanide as CN, Phenol total, Sulphate water sol as SO₄, Sulphide, Toluene Extractable Matter, pH, TPH total, PAH total and phenol

The laboratory sheets are presented at Appendix C.

Table 6 below, sets out the highest concentrations of contaminants found and are compared to the upper limits set in the former ICRCL report and the latest Soil Guideline Values where available for residential dwellings.

Table 6: Soil contamination values for geological barrier

Determinant	Highest Value on site mg/Kg	ICRCL mg/Kg	SGV mg/Kg
Arsenic	7.2	40	20
Cadmium	<0.5	3	1-8
Chromium	38	25	130
Lead	17	500	450
Mercury	<0.25	1	8
Selenium	<0.3	3	35
Copper	23	130	
Nickel	39	70	50
Zinc	66	300	
Cyanide	<2.5	25	
TPH	<50	100	100
PAH's	2.0	50	40
Phenol	<0.75		

The results showed that all the results are below the Soil Guideline Values set by DEFRA and acceptable for use in inert landfill sites for restoration and for domestic residential gardens. The results are presented at Appendix F.

Two of the trial pits were subjected to leachability testing to assess for potential leachate production from the geological barrier. The results are presented at Appendix G.

The highest results are compared to acceptable liability levels set out in Table 7.

Table 7: Soil leachability values for geological barrier

Determinant	Acceptable leachability value based on DWQS($\mu\text{g/l}$)	Highest reported value
Arsenic	50	3.3
Cadmium	5	<0.1
Chromium	250	<30
Lead	250	<0.5
Mercury	1	<0.3
Copper	100	<7.0
Nickel	200	<0.5
Zinc	500	<18
Cyanide	100	<0.05
PAH's	40	<0.35
Phenol	2(mg/l)	0.74

The results are all below the Dinking Water Quality Standard and placement of the geological barrier above the natural unsaturated zone will therefore have no impact on groundwater quality.

5. FIELD TESTING

5.1 Puddle Tests

Puddle tests were carried out on the stockpile during a further visit to the site to demonstrate that the engineered fill was at a suitable moisture content to place the material. The material was rolled in to a ball and pinched.

Photographs of the engineering puddle properties are presented at Appendix E.

5.2 Moisture Content

Some simple corroborative moisture content tests were carried out on the material from the stockpile to assess the moisture content. The moisture content from three additional trial pits was reported at 16%, 17% and 19%, further demonstrating the material to be wet cohesive fill.

Plate 2: Ashworth Speedy Moisture Gauge test on site at 19% moisture



5.3 Physical Observations

The footprint of the site has been excavated to allow for the bund to be keyed in.

The material has been processed by way of screening and is separated from other materials. No leachate or liquid was observed running out of the engineered material to be used as a geological barrier.

6. CONCLUSIONS

The material that has been processed on site by way of screening is acceptable for use as engineered fill for the dividing separation bund and for the geological barrier.

Testing has demonstrated a consistent material type with suitable fines, shear strength and is a wet cohesive fill.


The material is not contaminated and can be placed in accordance with the Highways Agency Specification for Highways Works Table 6/4, presented at Appendix G for reference.

The material complies with the acceptance criteria in Annex 1 of the Environmental Permitting Regulations: Inert Waste Guidance Standards and Measures for the Deposit of Inert Waste on Land.

Additional testing during the placement of the fill will be physical thickness measurements of each lift and photographs, permeability tests as per Annex 2 and shear strength tests using a hand shear vane to demonstrate a shear strength greater than 40kPa.

The initial tests would indicate the material is suitable for use as a engineered geological barrier at the site.

for **ENVIROARM LIMITED**



Director

28/08/2009

Date

REFERENCES

Geological and Ordnance Survey Maps

Geological Survey of Great Britain: Sheet 152: Shrewsbury
(solid) 1:50,000

Geological Survey of Great Britain: Sheet 152: Shrewsbury
(drift) 1:50,000

Ordnance Survey: Sheet 126: Shrewsbury
1:50,000 Landranger

Publications and Reports

BGS: Regional Geology: Central England 1987

APPENDIX A:

Atterberg Limits and Natural Moisture Contents

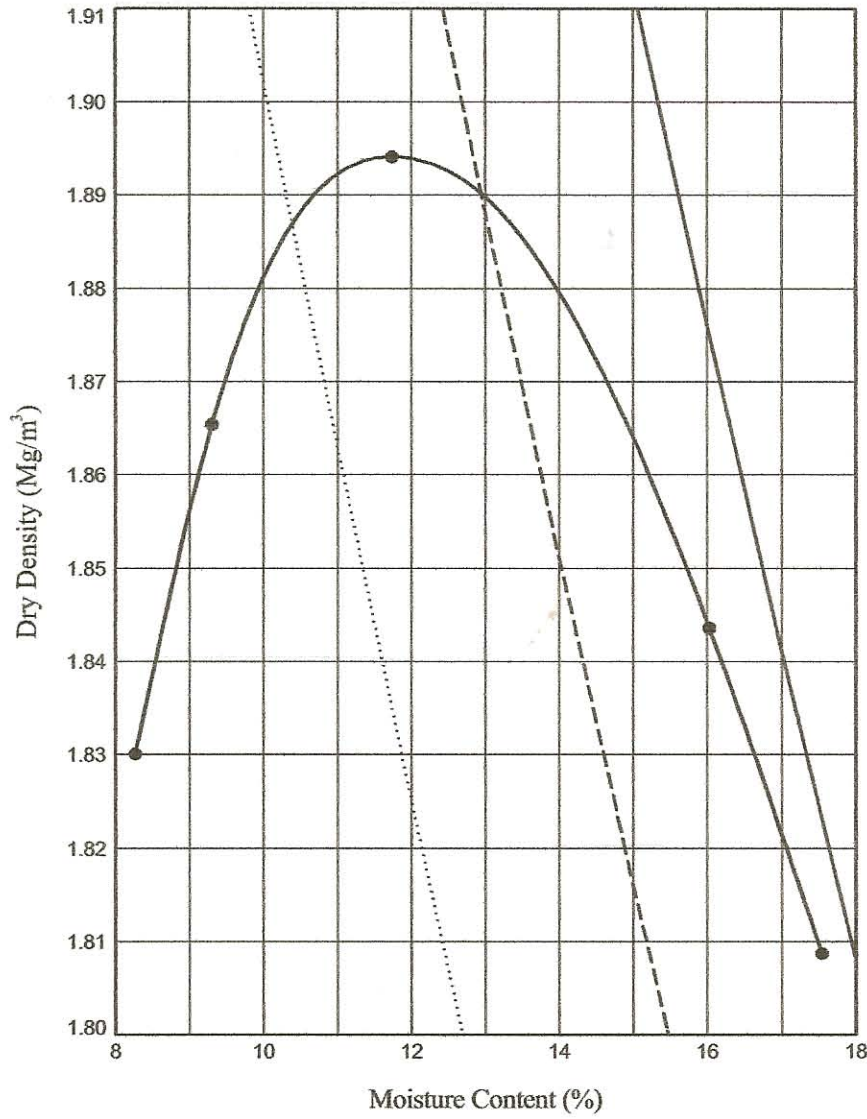
APPENDIX B:

**Compaction Test
Curves**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST


In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990
NON-STANDARD TEST

Trial Pit : TP1 Sample Ref: 1-4 Sample Type: B Depth (m): 0.50



Initial Sample Conditions		Test Details		Test Results	
Initial Moisture Content (%)	: 16	Compaction Type	: Light	Maximum Dry Density (Mg/m³)	: 1.89
% Retained on 37.5mm BS Sieve	: 14	Mass of Rammer (kg)	: 2.5	Optimum Moisture Content (%)	: 12
% Retained on 20.0mm BS Sieve	: 21	Type of Mould	: CBR	Method Used:	Clause 3.4
Particle Density - assumed (Mg/m³)	: 2.68	Separate samples were used.		Remarks:	
Size of Soil Pieces	: <20mm				
Sample Description				Key to Voids Ratio Lines	
Brown slightly sandy gravelly CLAY				——— 0% - - - - 5% ······ 10%	

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

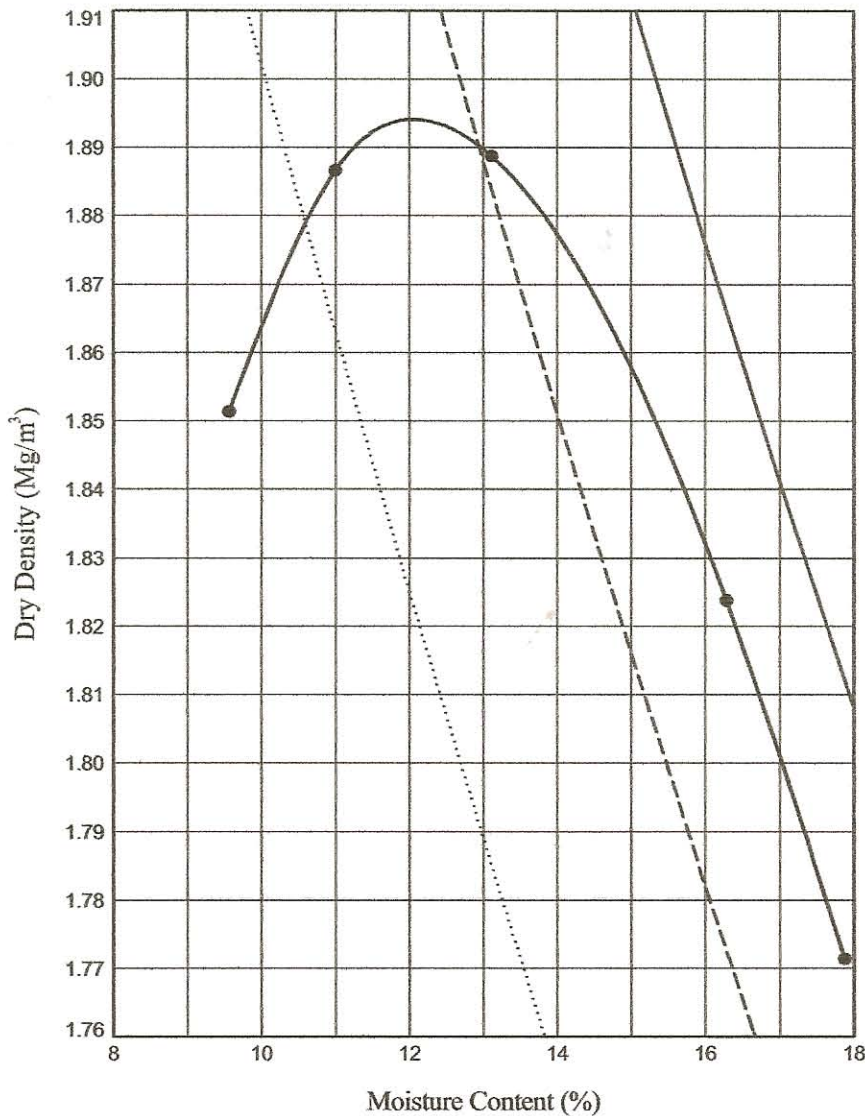
 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
		24/08/09		
	Contract	Dorrington Quarry		Job No



DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST


In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990
NON-STANDARD TEST

Trial Pit : TP2 Sample Ref: 1-4 Sample Type: B Depth (m): 1.00



Initial Sample Conditions		Test Details		Test Results	
Initial Moisture Content (%)	: 16	Compaction Type	: Light	Maximum Dry Density (Mg/m³)	: 1.89
% Retained on 37.5mm BS Sieve	: 12	Mass of Rammer (kg)	: 2.5	Optimum Moisture Content (%)	: 12
% Retained on 20.0mm BS Sieve	: 13	Type of Mould	: CBR	Method Used:	Clause 3.4
Particle Density - assumed (Mg/m³)	: 2.68	Separate samples were used.		Remarks:	
Size of Soil Pieces	: <20mm				
Sample Description				Key to Voids Ratio Lines	
Brown slightly sandy gravelly CLAY				——— 0% - - - - 5% 10%	

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

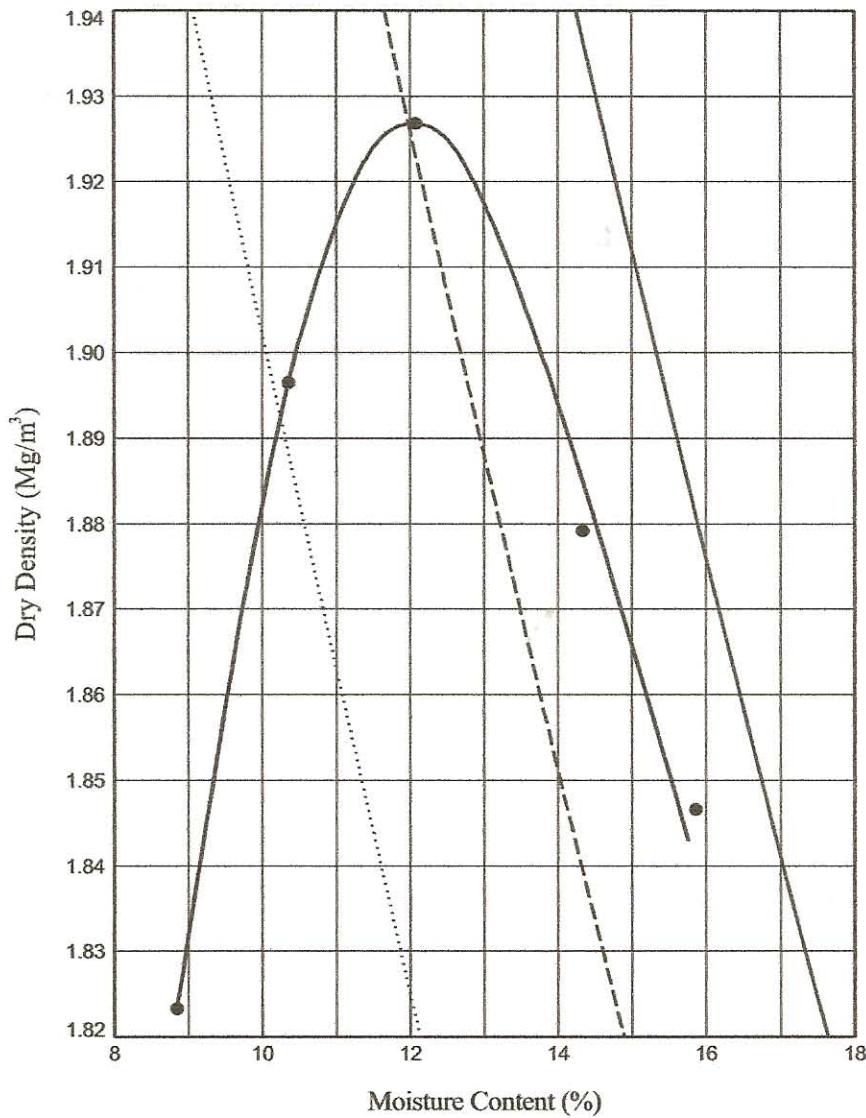
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		24/08/09		
	Contract	Dorrington Quarry		Job No



DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST



In accordance with clauses 3.3, 3.4, 3.5, 3.6, 3.7 of BS1377:Part 4:1990
NON-STANDARD TEST

Trial Pit : TP3 Sample Ref: 1-4 Sample Type: B Depth (m): 1.00



Initial Sample Conditions		Test Details		Test Results	
Initial Moisture Content (%)	: 14	Compaction Type	: Light	Maximum Dry Density (Mg/m³)	: 1.93
% Retained on 37.5mm BS Sieve	: 10	Mass of Rammer (kg)	: 2.5	Optimum Moisture Content (%)	: 12
% Retained on 20.0mm BS Sieve	: 14	Type of Mould	: CBR	Method Used:	Clause 3.4
Particle Density - assumed (Mg/m³)	: 2.68	Remarks:			
Size of Soil Pieces	: <20mm	Separate samples were used.			
Sample Description				Key to Voids Ratio Lines	
Brown slightly sandy gravelly CLAY				——— 0%	- - - - 5%
			 10%	

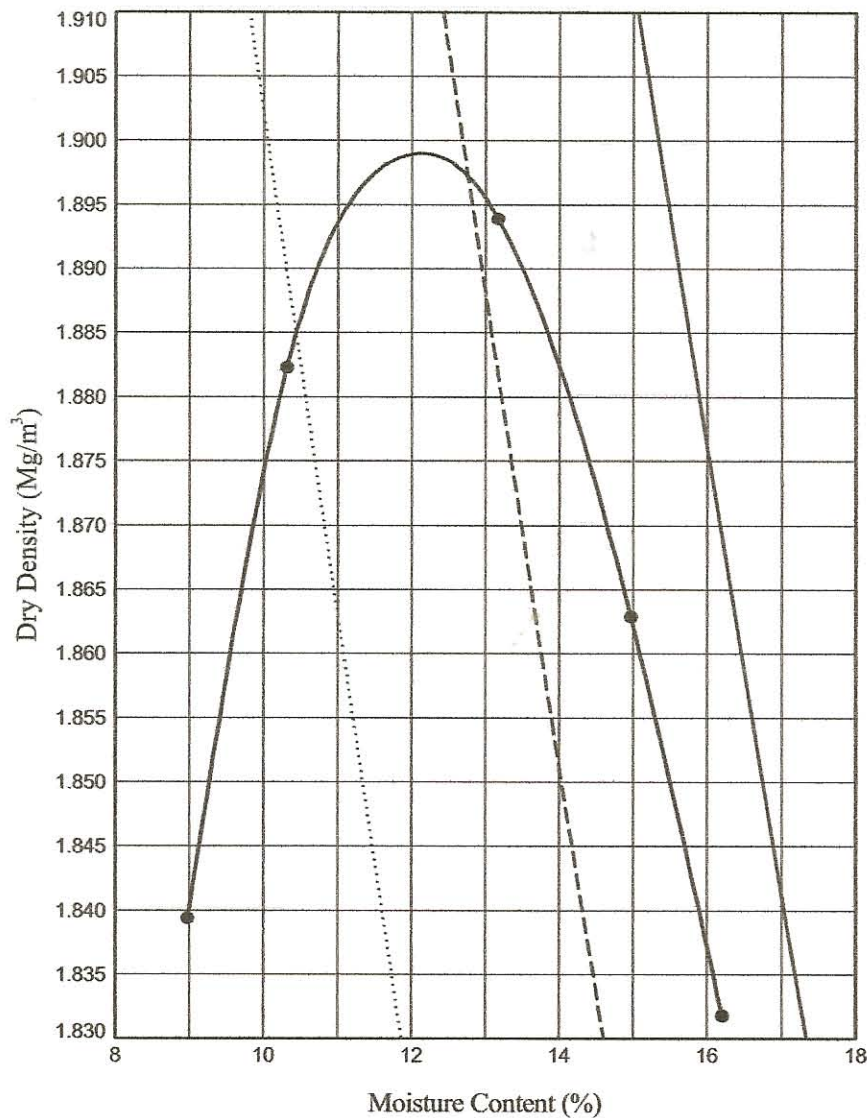
Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

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	Contract	Job No		
	Dorrington Quarry		723466	
				

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST


In accordance with clauses 3.3,3.4,3.5,3.6,3.7 of BS1377:Part 4:1990
NON-STANDARD TEST

Trial Pit : TP4 Sample Ref: 1-4 Sample Type: B Depth (m): 1.00



Initial Sample Conditions		Test Details		Test Results	
Initial Moisture Content (%)	: 15	Compaction Type	: Light	Maximum Dry Density (Mg/m ³)	: 1.90
% Retained on 37.5mm BS Sieve	: 10	Mass of Rammer (kg)	: 2.5	Optimum Moisture Content (%)	: 12
% Retained on 20.0mm BS Sieve	: 15	Type of Mould	: CBR	Method Used:	Clause 3.4
Particle Density - assumed (Mg/m ³)	: 2.68	Separate samples were used.		Remarks:	
Size of Soil Pieces	: <20mm				
Sample Description				Key to Voids Ratio Lines	
Brown slightly sandy gravelly CLAY				——— 0% - - - - 5% 10%	

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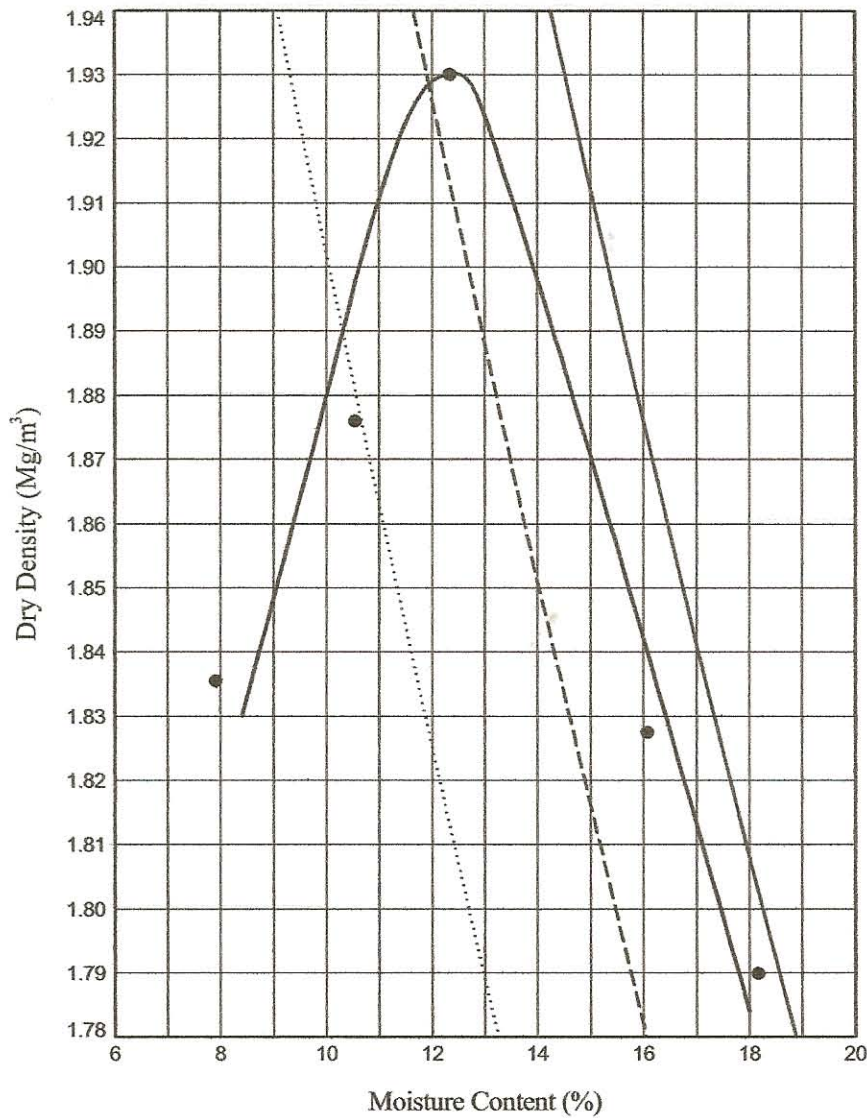
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	Contract	Dorrington Quarry		Job No



DRY DENSITY / MOISTURE CONTENT RELATIONSHIP TEST


In accordance with clauses 3.3, 3.4, 3.5, 3.6, 3.7 of BS1377:Part 4:1990
NON-STANDARD TEST

Trial Pit : TP1-4 Sample Ref: 5 Sample Type: AMAL Depth (m): 0.50+1.00



Initial Sample Conditions		Test Details		Test Results	
Initial Moisture Content (%)	: 16	Compaction Type	: Light	Maximum Dry Density (Mg/m³)	: 1.93
% Retained on 37.5mm BS Sieve	: 14	Mass of Rammer (kg)	: 2.5	Optimum Moisture Content (%)	: 12
% Retained on 20.0mm BS Sieve	: 14	Type of Mould	: CBR	Method Used:	Clause 3.4
Particle Density - assumed (Mg/m³)	: 2.68	Separate samples were used.		Remarks:	
Size of Soil Pieces	: <20mm				
Sample Description				Key to Voids Ratio Lines	
Brown slightly sandy gravelly CLAY				——— 0% - - - - 5% 10%	

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APPENDIX C:

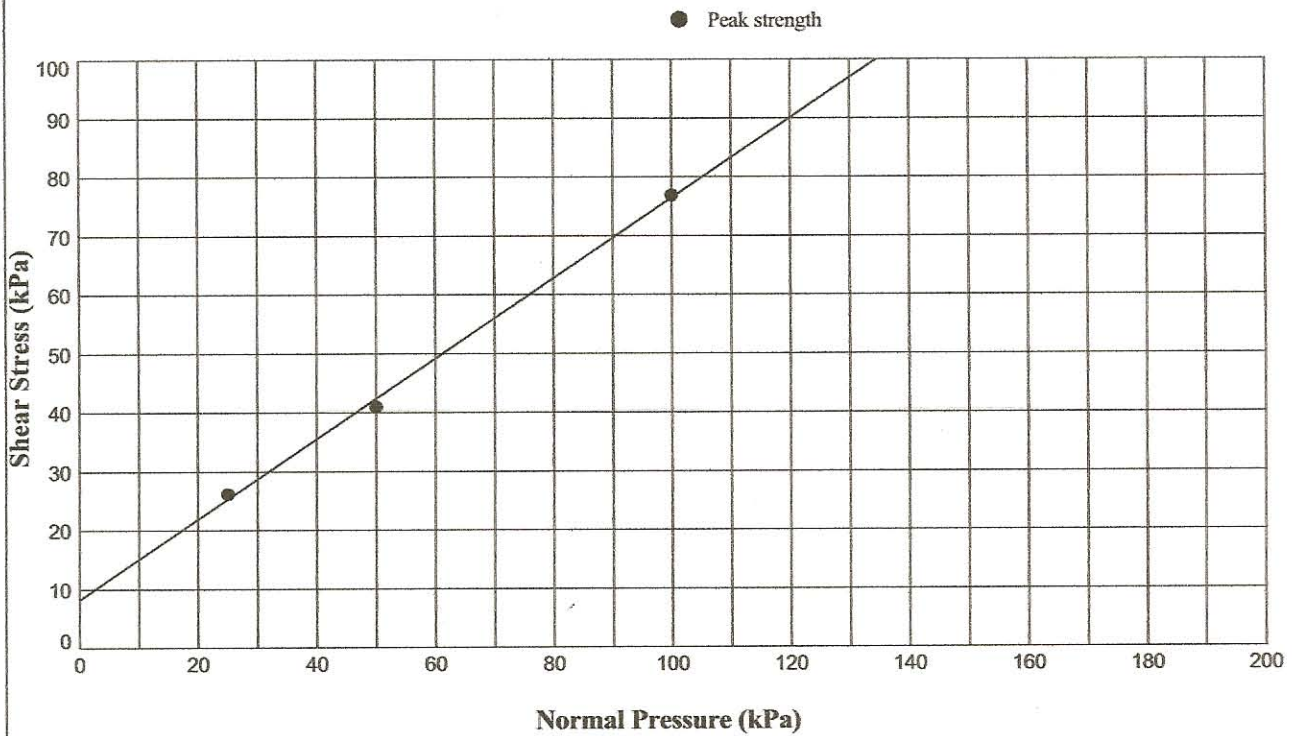
Shear Box Test Results

CONSOLIDATED DRAINED SHEAR BOX TEST

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP1** Sample Ref: **1-4** Sample Type: **B** Depth (m): **0.50**
 Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**
 Description: **Brown slightly sandy gravelly CLAY** Sample Condition: **Recompacted**

		SPECIMEN NUMBER	1	2	3	
PROPERTIES	Initial Moisture Content (%)		22	22	22	
	Initial Bulk Density (Mg/m ³)		1.93	1.95	1.94	
	Initial Dry Density (Mg/m ³)		1.59	1.60	1.60	
	Initial Voids Ratio		0.6698	0.6574	0.6599	
CONSOLIDATION	Normal Pressure (kPa)		25	50	100	
	Initial Height (mm)		19.356	19.352	19.328	
	Consolidated Height (mm)		18.878	18.470	18.229	
SHEAR	Rate of Horizontal Displacement (mm/min)		0.0078	0.0070	0.0079	
	Horizontal Displacement at Peak Shear Stress (mm)		2.8	2.9	6.7	
	Peak Shear Stress (kPa)		26	41	77	
PEAK STRENGTH	Effective Cohesion (C)	8	(kPa)	Effective Angle of Friction (ϕ)	34.5	(deg)



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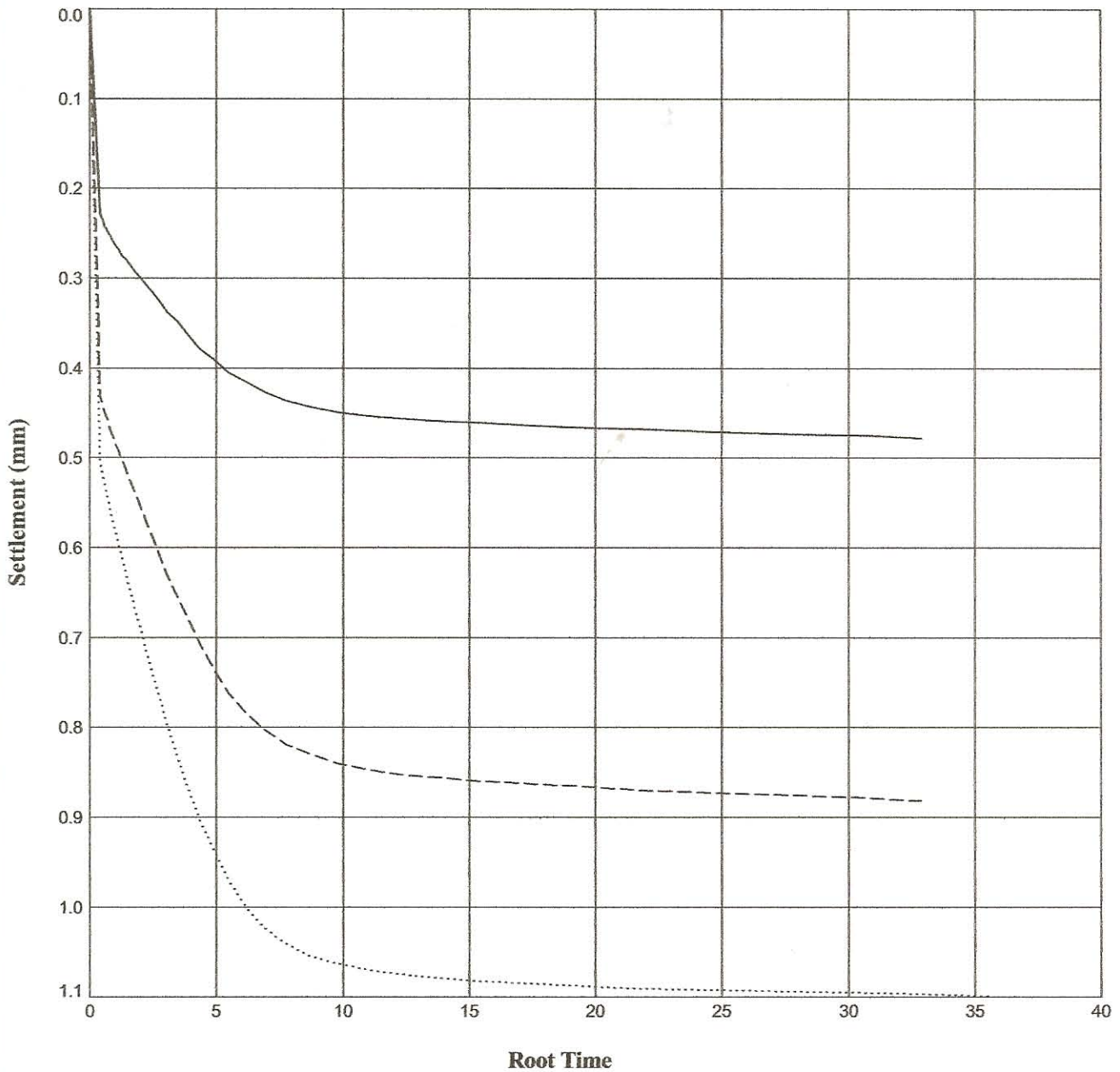
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			24/08/09		
	Contract Dorrington Quarry		Job No 723466		

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CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : TP1 Sample Ref: 1-4 Sample Type: B Depth (m): 0.50



KEY :

Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

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	24/08/09		
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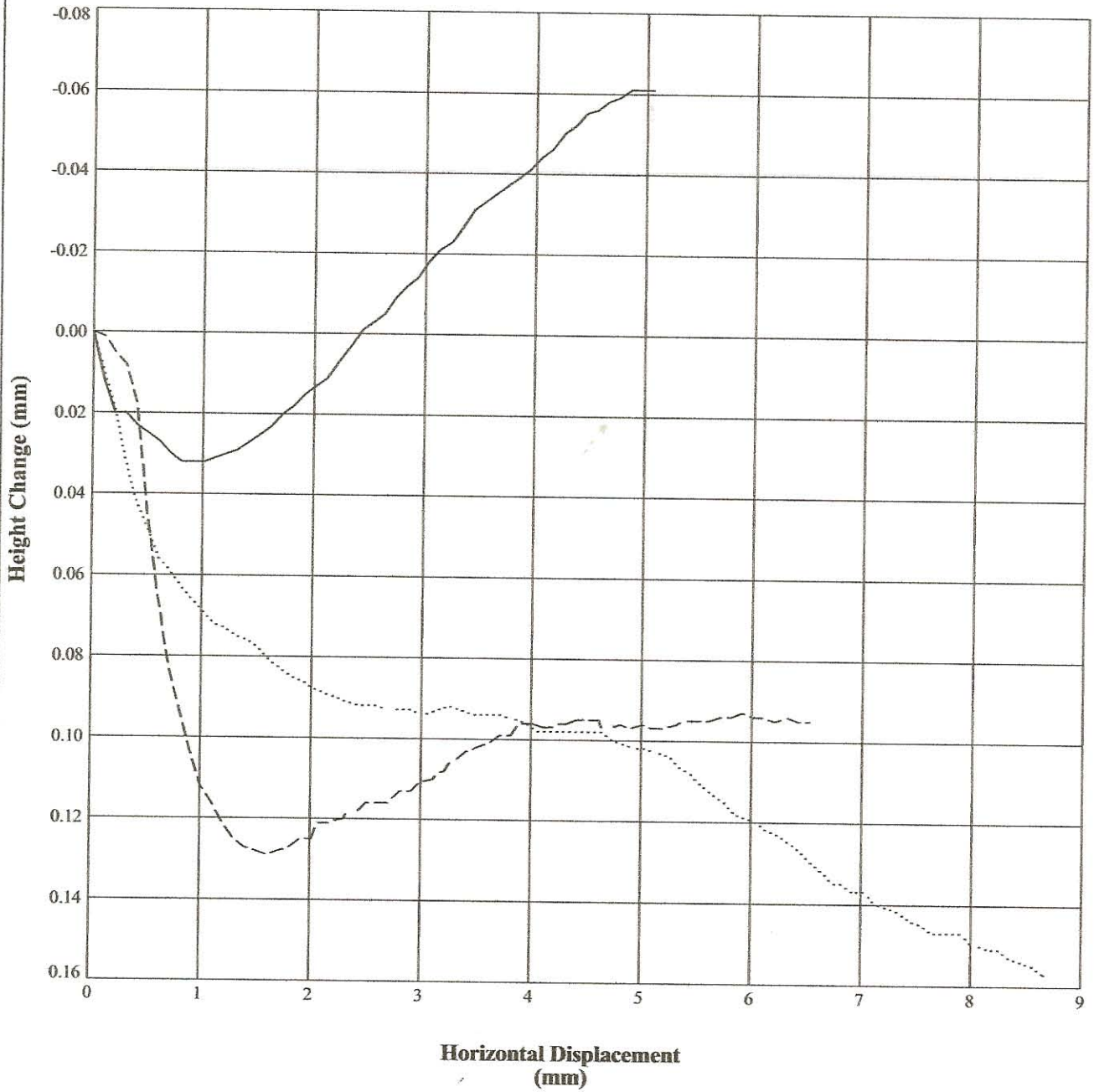


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CONSOLIDATED DRAINED SHEAR BOX HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT



In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : TP1 Sample Ref: 1-4 Sample Type: B Depth (m): 0.50



KEY :
Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

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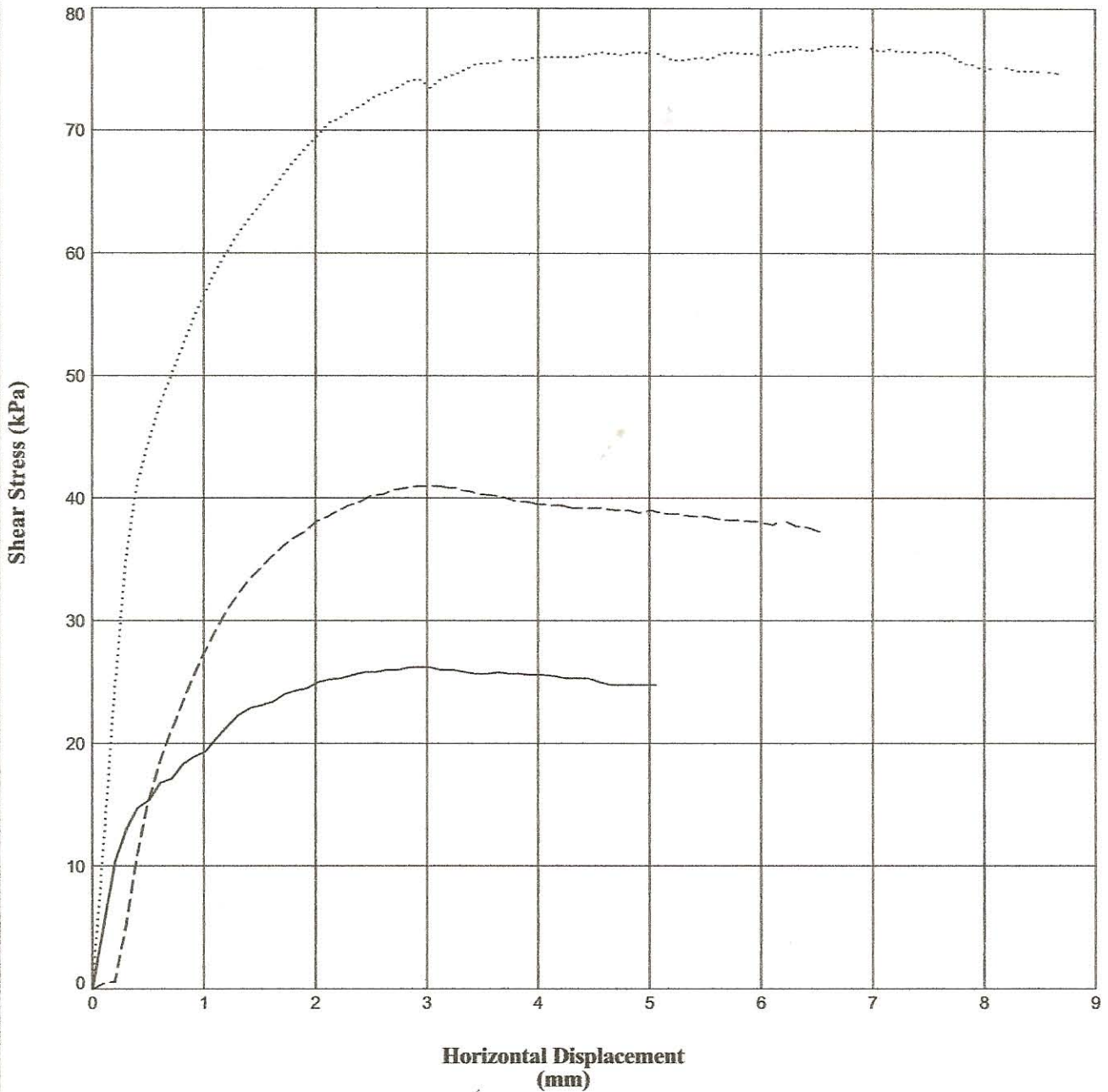
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	Contract Dorrington Quarry	Job No 723466		
				

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CONSOLIDATED DRAINED SHEAR BOX SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP1** Sample Ref: **1-4** Sample Type: **B** Depth (m): **0.50**



KEY :
Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
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CONSOLIDATED DRAINED SHEAR BOX TEST

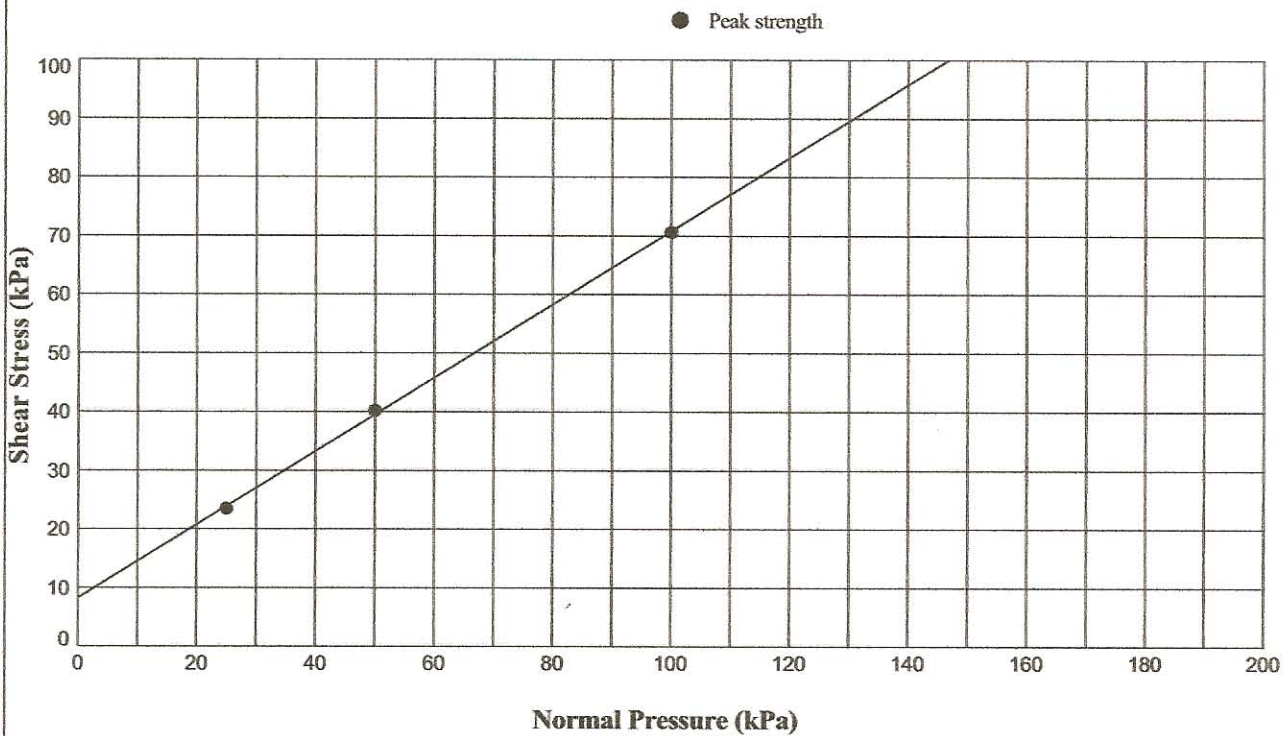
In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP2** Sample Ref: **1-4** Sample Type: **B** Depth (m): **1.00**

Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**

Description: **Brown slightly sandy gravelly CLAY** Sample Condition: **Recompacted**

		SPECIMEN NUMBER		
		1	2	3
PROPERTIES	Initial Moisture Content (%)	22	22	22
	Initial Bulk Density (Mg/m ³)	1.98	1.98	1.99
	Initial Dry Density (Mg/m ³)	1.62	1.62	1.63
	Initial Voids Ratio	0.6370	0.6351	0.6297
CONSOLIDATION	Normal Pressure (kPa)	25	50	100
	Initial Height (mm)	19.116	19.096	19.088
	Consolidated Height (mm)	18.551	18.159	17.809
SHEAR	Rate of Horizontal Displacement (mm/min)	0.0053	0.0056	0.0077
	Horizontal Displacement at Peak Shear Stress (mm)	2.8	2.8	3.3
	Peak Shear Stress (kPa)	24	40	71
PEAK STRENGTH	Effective Cohesion (C) 8 (kPa)	Effective Angle of Friction (ϕ)		32 (deg)



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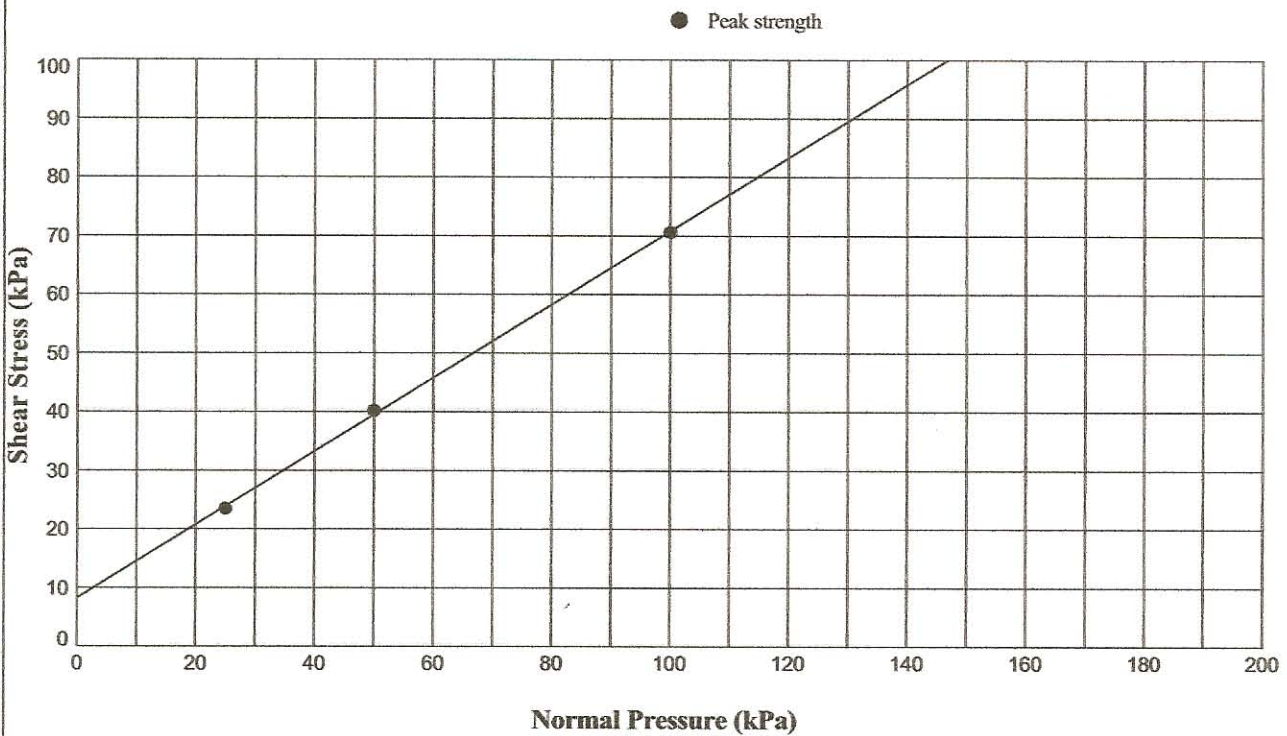
 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Contract	Dorrington Quarry		Job No

CONSOLIDATED DRAINED SHEAR BOX TEST

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP2** Sample Ref: **1-4** Sample Type: **B** Depth (m): **1.00**
 Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**
 Description: **Brown slightly sandy gravelly CLAY** Sample Condition: **Recompacted**

		SPECIMEN NUMBER	1	2	3
PROPERTIES	Initial Moisture Content (%)		22	22	22
	Initial Bulk Density (Mg/m ³)		1.98	1.98	1.99
	Initial Dry Density (Mg/m ³)		1.62	1.62	1.63
	Initial Voids Ratio		0.6370	0.6351	0.6297
CONSOLIDATION	Normal Pressure (kPa)		25	50	100
	Initial Height (mm)		19.116	19.096	19.088
	Consolidated Height (mm)		18.551	18.159	17.809
SHEAR	Rate of Horizontal Displacement (mm/min)		0.0053	0.0056	0.0077
	Horizontal Displacement at Peak Shear Stress (mm)		2.8	2.8	3.3
	Peak Shear Stress (kPa)		24	40	71
PEAK STRENGTH	Effective Cohesion (C') 8 (kPa)		Effective Angle of Friction (ϕ)		32 (deg)



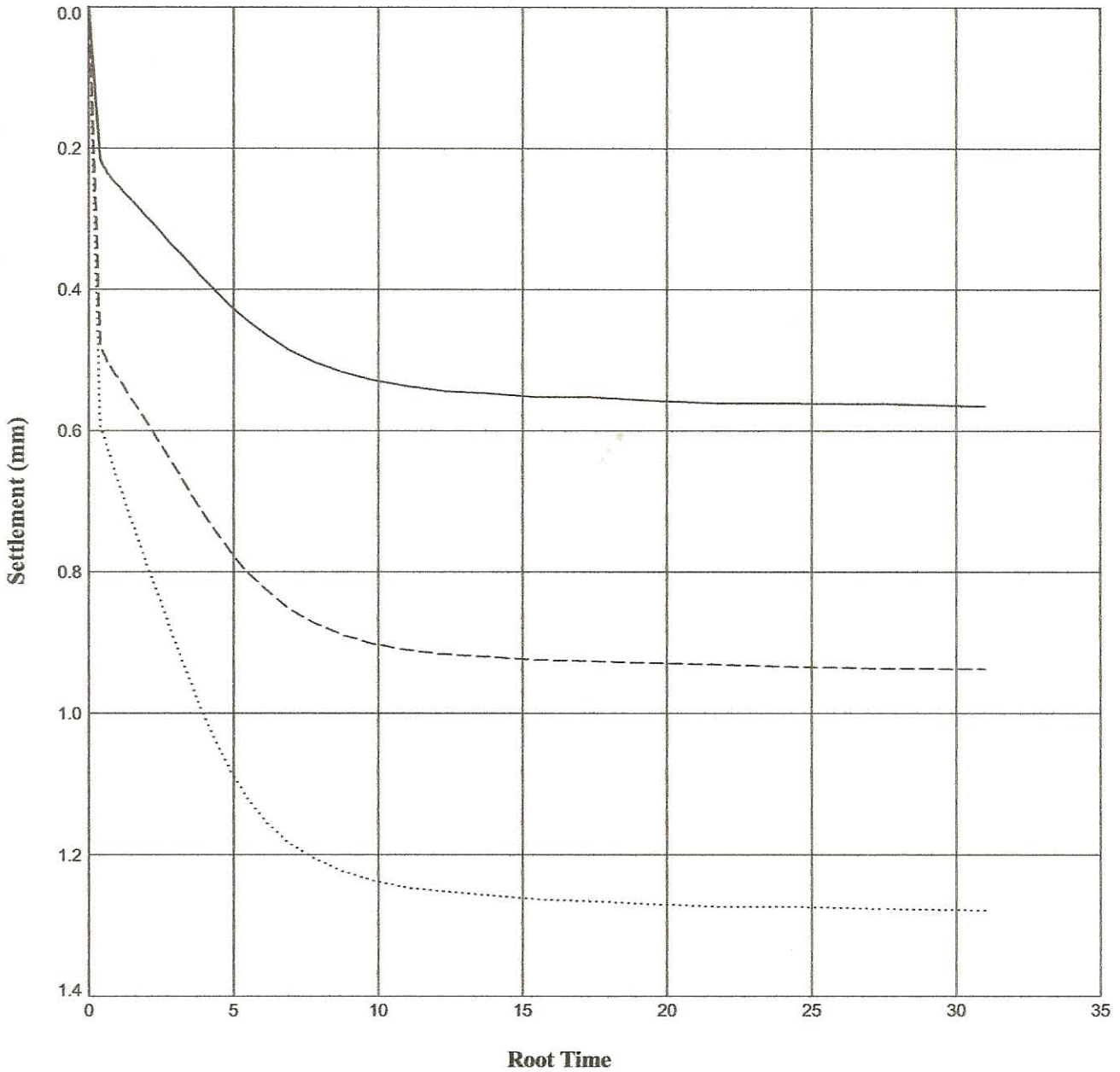
Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Contract	Dorrington Quarry		Job No

CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990


Trial Pit : TP2 Sample Ref: 1-4 Sample Type: B Depth (m): 1.00



KEY :

Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 <p>STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG</p>	Compiled By	Date	Checked By	Date
		24/08/09		
	Contract Dorrington Quarry		Job No 723466	

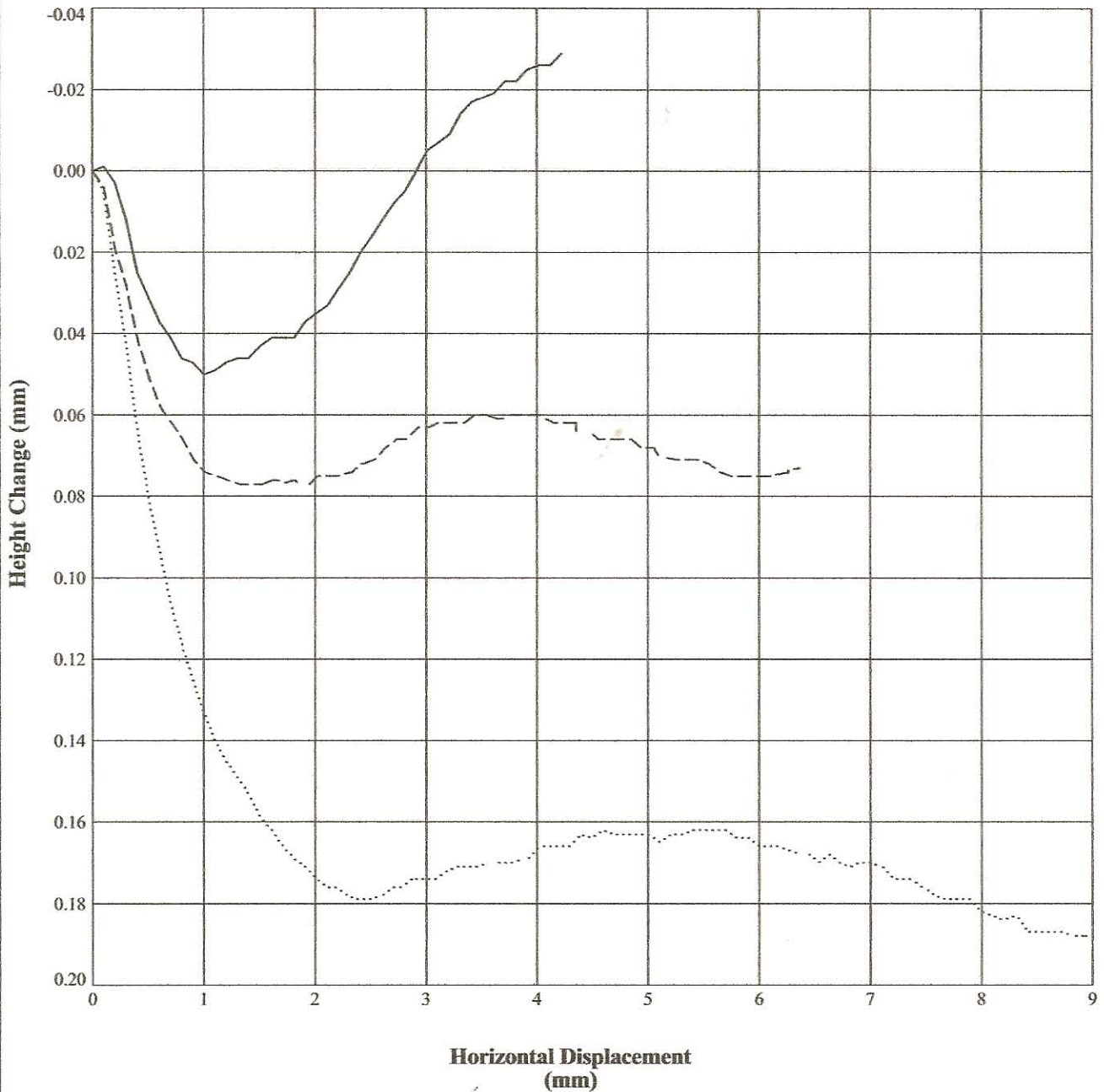


STRUCTURAL_SOILS_GINT_LIBRARY.GLBIL - SBOX - AUTO - CONSOL | 723466_DORRINGTON_QUARRY.GPJ - v8_02 | 24/08/09 - 06:23.

CONSOLIDATED DRAINED SHEAR BOX HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP2** Sample Ref: **1-4** Sample Type: **B** Depth (m): **1.00**



KEY :
Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

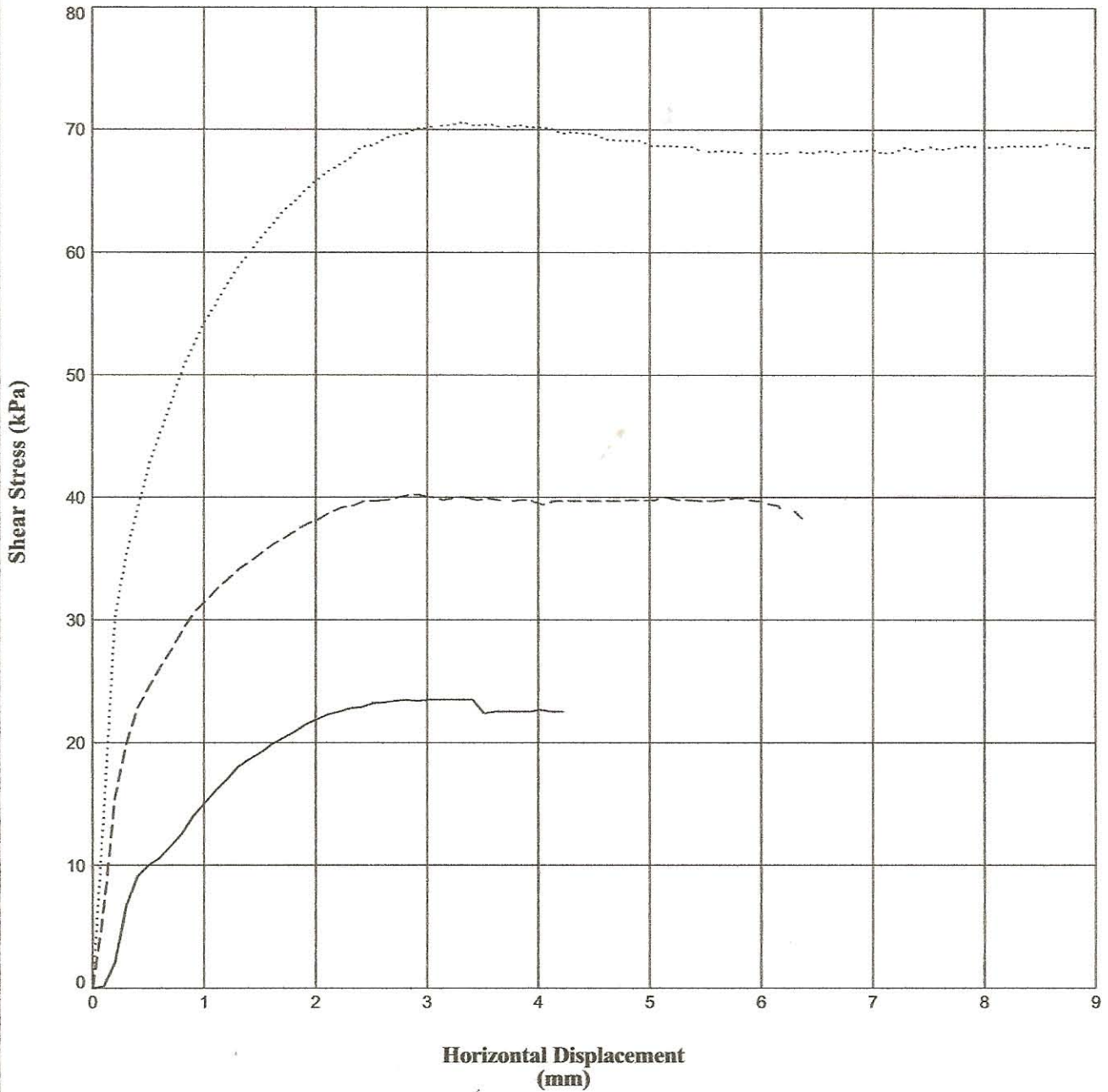
Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
		24/08/09		
	Contract Dorrington Quarry	Job No 723466		

CONSOLIDATED DRAINED SHEAR BOX SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP2** Sample Ref: **1-4** Sample Type: **B** Depth (m): **1.00**



KEY :
Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
		24/08/09		
	Contract Dorrington Quarry	Job No 723466		



STRUCTURAL_SOILS_GINT_LIBRARY.GLBIL - SBOX - AUTO - SHEAR STRESS VS STRAIN | 723466_DORRINGTON_QUARRY.GPJ - v8_02 | 24/08/09 - 06:26.

CONSOLIDATED DRAINED SHEAR BOX TEST

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP1-4** Sample Ref: **5** Sample Type: **AMAL** Depth (m): **0.50+1.00**

Width x Length (mm): **60 x 60**

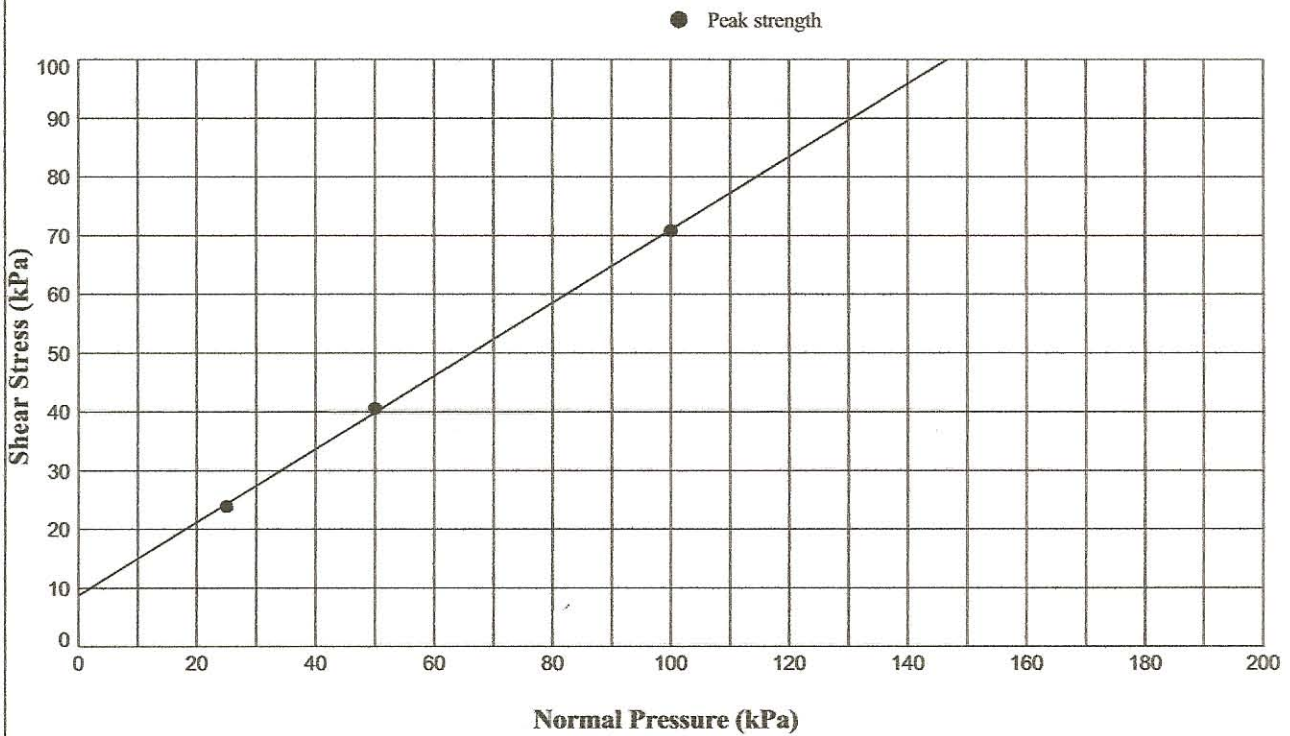
Sample Height (mm): **20.0**

Particle Density (Assumed): **2.65**

Description: **Brown slightly sandy gravelly CLAY**

Sample Condition: **Recompacted**

		SPECIMEN NUMBER		
		1	2	3
PROPERTIES	Initial Moisture Content (%)	22	22	22
	Initial Bulk Density (Mg/m ³)	2.00	1.99	1.99
	Initial Dry Density (Mg/m ³)	1.64	1.64	1.64
	Initial Voids Ratio	0.6110	0.6194	0.6166
CONSOLIDATION	Normal Pressure (kPa)	25	50	100
	Initial Height (mm)	19.300	19.232	19.202
	Consolidated Height (mm)	18.810	18.433	18.206
SHEAR	Rate of Horizontal Displacement (mm/min)	0.0051	0.0063	0.0060
	Horizontal Displacement at Peak Shear Stress (mm)	2.0	2.8	3.0
	Peak Shear Stress (kPa)	24	41	71
PEAK STRENGTH	Effective Cohesion (C') 9 (kPa)	Effective Angle of Friction (ϕ) 32 (deg)		



Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

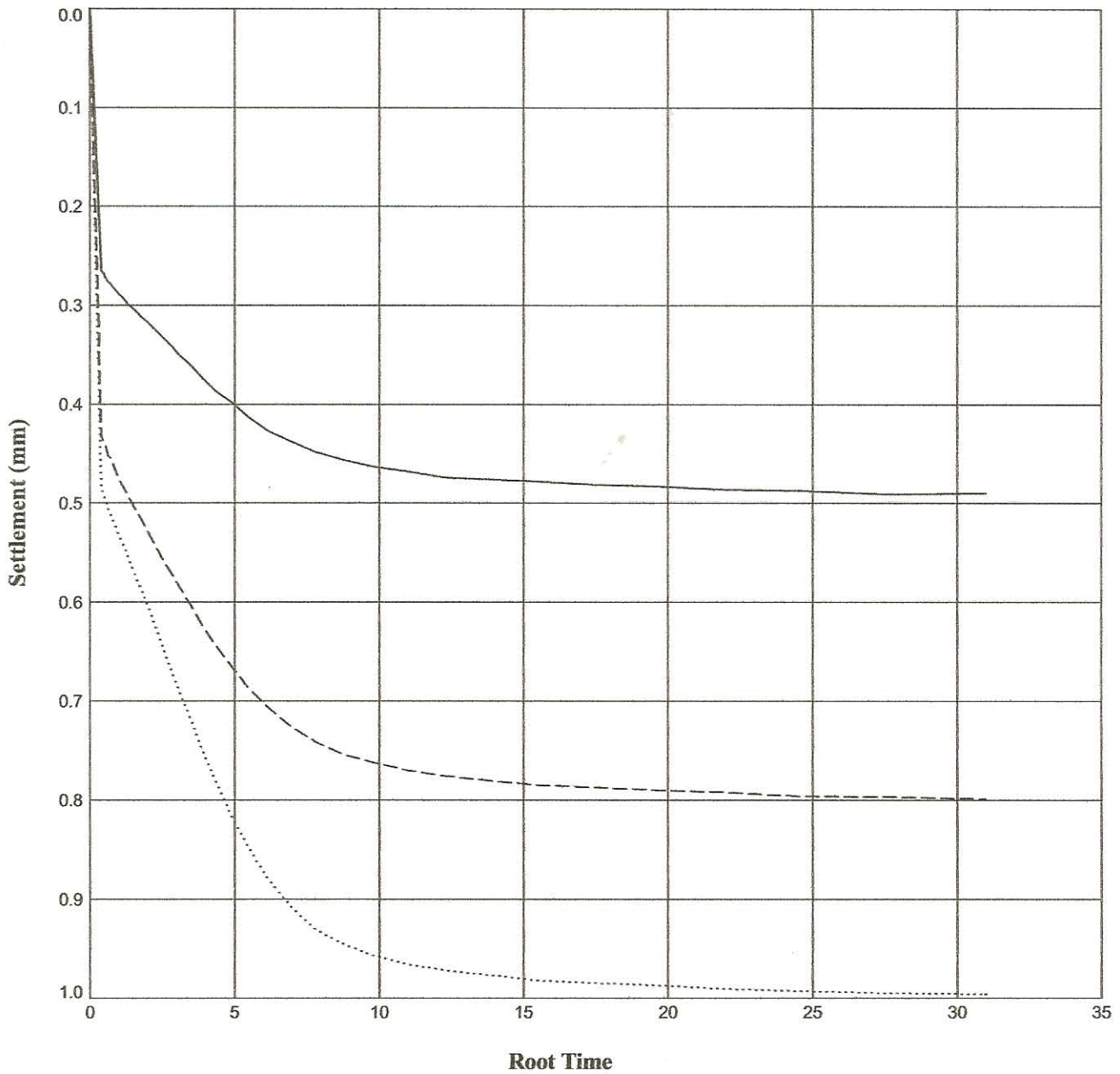
 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
		24/08/09		
	Contract Dorrington Quarry		Job No 723466	



CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : TP1-4 Sample Ref: 5 Sample Type: AMAL Depth (m): 0.50+1.00



KEY :

Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

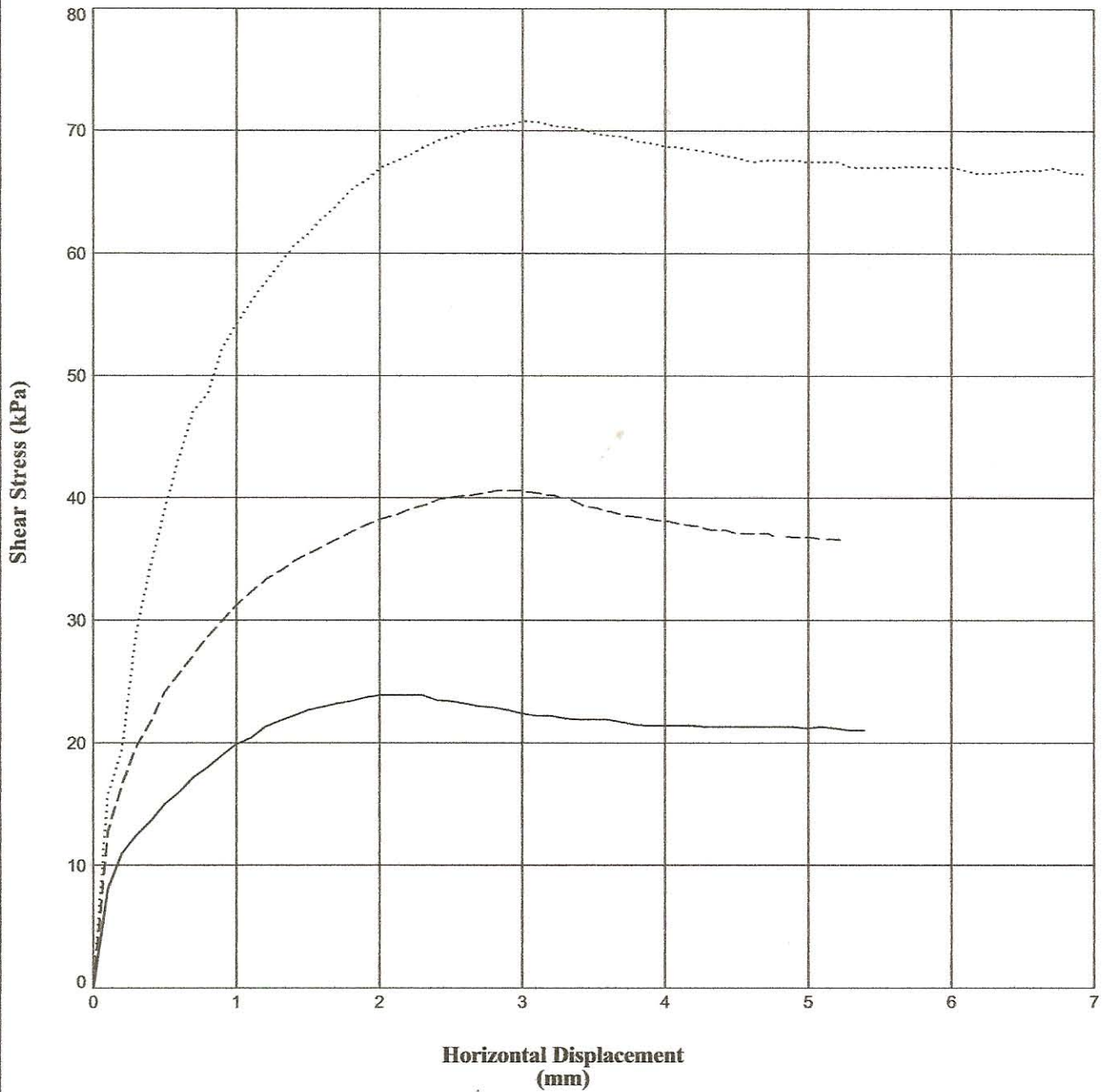
Compiled By	Date	Checked By	Date
	24/08/09		
Contract Dorrington Quarry		Job No 723466	



CONSOLIDATED DRAINED SHEAR BOX SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Trial Pit : **TP1-4** Sample Ref: **5** Sample Type: **AMAL** Depth (m): **0.50+1.00**



KEY :
Solid Line = Specimen 1 (25 kPa), *Dashed Line* = Specimen 2 (50 kPa), *Dotted Line* = Specimen 3 (100 kPa).

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Contract Dorrington Quarry	Job No 723466		



STRUCTURAL_SOILS_GINT_LIBRARY.GLBIL - SBOX - AUTO - SHEAR STRESS VS STRAIN | 723466_DORRINGTON_QUARRY.GPJ - v8_02 | 24/08/09 - 06:58.

APPENDIX D:


**UKAS Laboratory
Certificate**

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

 <p>Accredited to ISO/IEC 17025:2005</p>	Structural Soils Ltd	
	Issue No: 010 Issue date: 30 June 2008	
	The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Contact: Mr D J Trowbridge Tel: +44 (0)117-9471000 Fax: +44 (0)117-9471004 E-Mail: david.trowbridge@soils.co.uk Website: www.soils.co.uk
Testing performed by the Organisation at the locations specified below		

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details	Activity	Location code
Address The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Local contact Mr D J Trowbridge	Soils: Mechanical Tests; Physical Tests
Address The Potteries Pottery Street Castleford West Yorkshire WF10 1NJ	Local contact Mr M Athorne	Soils: Mechanical Tests; Physical Tests



1774

Accredited to
ISO/IEC 17025:2005

Schedule of Accreditation
issued by
United Kingdom Accreditation Service
21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

Structural Soils Ltd

Issue No: 010 Issue date: 30 June 2008

Testing performed by the Organisation at the locations specified

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS for civil engineering purposes	Moisture content - oven drying method	BS 1377-2:1990	Bristol Castleford
	Liquid limit - cone penetrometer	BS 1377-2:1990	Bristol Castleford
	Liquid limit - cone penetrometer - one point	BS 1377-2:1990	Bristol Castleford
	Plastic limit	BS 1377-2:1990	Bristol Castleford
	Plasticity index and liquidity index	BS 1377-2:1990	Bristol
	Plasticity index	BS 1377-2:1990	Bristol Castleford
	Density - linear measurement	BS 1377-2:1990	Bristol
	Particle density - gas jar	BS 1377-2:1990	Bristol
	Particle size distribution - wet sieving	BS 1377-2:1990	Bristol Castleford
	Particle size distribution - dry sieving	BS 1377-2:1990	Bristol Castleford
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4:1990	Bristol Castleford
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1377-4:1990	Bristol Castleford
	California Bearing Ratio (CBR) <i>(loads from 0.4 to 28kN)</i>	BS 1377-4:1990	Bristol
	Moisture condition value (MCV)	BS 1377-4:1990	Bristol
MCV - natural moisture content	BS 1377-4:1990	Bristol	



1774

Accredited to
ISO/IEC 17025:2005

Schedule of Accreditation
issued by
United Kingdom Accreditation Service
21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

Structural Soils Ltd

Issue No: 010 Issue date: 30 June 2008

Testing performed by the Organisation at the locations specified

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS for civil engineering purposes (cont'd)	MCV/moisture content relation	BS 1377-4:1990	Bristol
	Undrained shear strength in triaxial compression without measurement of pore pressure (definitive method) (loads from 0.4 to 28 kN)	BS 1377-7: 1990	Bristol
	Undrained shear strength in triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.4 to 28 kN)	BS 1377-7: 1990	Bristol
END			

APPENDIX E:

Photographs of puddle tests

APPENDIX F:

**Soil Contamination
Pathfinder Tests**

Mr Morris
Enviroarm Ltd
597 Walsall Road
Great Wyrley
Staffs WS6 6AE

03 A * * • c2009

Test Report: COV/595628/2009

Dear Mr Morris

Analysis of your sample(s) submitted on 03 A * * • c2009 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using STL and we look forward to receiving your next samples.

Yours Sincerely,

Signed: 

Name: G. Smith

Title: Contam Land Production Manager

STL Coventry
STL Business Centre, Torrington Avenue,
Coventry, CV4 9GU

Tel: +44 (0)24 7642 1213
Fax: +44 (0)24 7685 6575
www.stl-ltd.com

Severn Trent Laboratories Limited

Registered in England & Wales Registration No. 2148934 Registered Office: 2297 Coventry Road, Birmingham B26



Cert. No. 10269
Environmental Management Systems



Certificate No. FS67435



Report Summary

Mr Andy Morris
Enviroarm Ltd
597 Walsall Road
Great Wyrley
Staffs
WS6 6AE



1314
0897
1229
1510



STL

Date of Issue: **24 August 2009**

Report Number: **COV/595628/2009**

Issue **1**

Number of Samples
included in this report **4**

Number of Test Results
included in this report **76**

Site Name:

Job Received:

Analysis Commenced:

Order No:

Dorrington Quarry Liner

03 August 2009

05 August 2009

ARM/DQ/1/2009

Signed:

Name: **G. Smith**

Title: **Contam Land Production Manager**

Date: **24 August 2009**

STL was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.

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

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

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Severn Trent Laboratories Ltd.

STL Business Centre, Torrington Avenue, Coventry, CV4 9GU Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575


Certificate of Analysis



STL

Report Number: **COV/595628/2009** Issue **1**
 Site Name: **Dorrington Quarry Liner Assessment**

Group	Determinand	Unit	Method/ Accreditation	Soil			
				11123869 TP1	11123870 TP2	11123871 TP3	11123872 TP4
Metals	Arsenic as As, dry weight	mg/kg	30/30C Y Mid	6.7	6.4	6.2	7.2
	Boron as B, hot water sol dw	mg/kg	6 Y Mid	1.2	1.2	1.4	0.94
	Cadmium as Cd, dry weight	mg/kg	30 Y Mid	<0.50	<0.50	<0.50	<0.50
	Hexavalent Chromium as DW	mg/kg	30B N Mid	<0.10	<0.10	<0.10	<0.10
	Chromium as Cr, dry weight	mg/kg	30 Y Mid	38	37	29	31
	Copper as Cu, dry weight	mg/kg	30 Y Mid	24	22	23	20
	Lead as Pb, dry weight	mg/kg	30 Y Mid	17	12	14	14
	Mercury as Hg, dry weight	mg/kg	30C Y Mid	<0.25	<0.25	<0.25	<0.25
	Nickel as Ni, dry weight	mg/kg	30 Y Mid	39	37	33	32
	Selenium as Se, dry weight	mg/kg	30C Y Mid	<0.30	<0.30	<0.30	<0.30
	Zinc as Zn, dry weight	mg/kg	30 Y Mid	66	63	62	58
Inorganics	Cyanide, Total	mg/kg	14 Y Mid	<2.5	<2.5	<2.5	<2.5
	Monohydric Phenols, Total Dist.	mg/kg	40A Y Mid	<0.75	<0.75	<0.75	<0.75
	Sulphate, Total as SO3	%	45 Y Mid	0.030	0.023	<0.020	<0.020
	Sulphide	mg/kg	47 Y Mid	<7.5	<7.5	<7.5	<7.5
	pH	pH units	39 Y Mid	9.0	9.0	9.0	8.8
	Sulphur, Elemental	mg/kg	51 Y Mid	<100	<100	<100	<100
TPH	TPH >C6 - C40, Total	mg/kg	317 Y Mid	<50	<50	<50	<50
PAH	PAH, Total of 16 EPA	mg/kg	307 Y Mid	2.0	<1.0	<1.0	<1.0

Signed: 	Name: G. Smith	Date: 24 August 2009
	Title: Contam Land Production Manager	

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS, S = Sub-contracted.
 Analysed at: Bri = STL Bridgend, Cov = STL Coventry, Mid = STL Midlands, Rea = STL Reading, Run = STL Runcorn.
 For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. Relating to Legionella volume analysed 1g is approximately equivalent to 1ml. I/S=Insufficient sample

Severn Trent Laboratories Ltd.

STL Business Centre, Torrington Avenue, Coventry, CV4 9GU Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

ANALYST COMMENTS FOR REPORT

COV/595628/2009

Issue 1

Date of Issue: **24 August 2009**

Sample No

Analyst Comments

11123869

11123870

11123871

11123872

Signed:



Name: **G. Smith**

Date: **24 August 2009**


Title: **Contam Land Production Manager**

DETERMINAND COMMENTS FOR REPORT COV/595628/2009

ISSUE 1

Date of Issue: 24 August 2009

Sample No	Description	Determinand	Comments

Signed: 	Name: G. Smith	Date: 24 August 2009
	Title: Contam Land Production Manager	

APPENDIX F:

**Soil Contamination
Pathfinder Tests**

Mr Morris
Enviroarm Ltd
597 Walsall Road
Great Wyrley WS6 6AE
Staffordshire

24 August 2009

Test Report: COV/615803/2009

Dear Mr Morris

Analysis of your sample(s) submitted on 03 August 2009 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using STL and we look forward to receiving your next samples.

Yours Sincerely,

Signed: *G. Coiley*

Name: G. Coiley

Title: Contam Land Production Manager

STL Coventry

STL Business Centre, Torrington Avenue,
Coventry, CV4 9GU

Severn Trent Laboratories Limited

Registered in England & Wales Registration No. 2148934 Registered Office: 2297 Coventry Road, Birmingham B26

Tel: +44 (0)24 7642 1213

Fax: +44 (0)24 7685 6575

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1314
0897
1229
1510



Cert. No. 10269
Environmental Management Systems



Certificate No. FS67435

Report Summary

Mr Andy Morris
Enviroarm Ltd
597 Walsall Road
Great Wyrley
Staffordshire
WS6 6AE



1314
0897
1229
1510



STL

Date of Issue: **24 August 2009**

Report Number: **COV/615803/2009**

Issue **1**

Number of Samples
included in this report **2**

Number of Test Results
included in this report **34**

Site Name: **Dorrington Quarry**

Job Received: **03 August 2009**

Analysis Commenced: **04 August 2009**

Order No: **ARM/DQ/2/2009**

Signed: *G. Coiley*

Name: **G. Coiley**

Date: **24 August 2009**

Title: **Contam Land Production Manager**

STL was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.

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

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

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Severn Trent Laboratories Ltd.

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Certificate of Analysis



STL

Report Number: **COV/615803/2009** Issue **1**
 Site Name: **Dorrington Quarry Liner Assessment**

Group	Determinand	Unit	Method/ Accreditation	Leachate	
				11258209 TP 1	11258210 TP2
Sample Preparation	NRA Leachate		NRA Leachate N MID	Y	Y
Metals	Arsenic, Soluble	ug/l	56 Y MID	2.8	3.3
	Boron, Soluble	mg/l	56 Y MID	<0.020	<0.020
	Cadmium, Soluble	ug/l	56 Y MID	<0.10	<0.10
	Chromium, Soluble	ug/l	56 Y MID	<30	<30
	Copper, Soluble	ug/l	56 Y MID	<7.0	<7.0
	Lead, Soluble	ug/l	56 Y MID	<0.50	<0.50
	Mercury, Soluble	ug/l	56 Y MID	<0.30	<0.30
	Nickel, Soluble	ug/l	56 Y MID	<0.50	<0.50
	Selenium, Soluble	ug/l	56 Y MID	0.66	0.52
	Zinc, Soluble	ug/l	56 Y MID	<18	<18
Inorganics	Cyanide, Total	mg/l	14c N MID	<0.050	<0.050
	Sulphate as SO3	g/l	60 Y MID	<0.010	<0.010
	Sulphide as S	ug/l	38A Y MID	<10	<10
	pH	pH units	31 Y MID	6.3	7.1
Phenols	Phenols, Total	ug/l	338 N MID	<0.50	0.74
PAH	PAH, Total	ug/l	331 Y MID	<0.35	<0.35

Signed: <i>G. Coiley</i>	Name: G. Coiley	Date: 24 August 2009
	Title: Contam Land Production Manager	

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS, S = Sub-contracted.
 Analysed at: Bri = STL Bridgend, Cov = STL Coventry, Mid = STL Midlands, Rea = STL Reading, Run = STL Runcorn.
 For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. Relating to Legionella volume analysed 1g is approximately equivalent to 1ml. I/S=Insufficient sample

ANALYST COMMENTS FOR REPORT

COV/615803/2009

Issue 1

Date of Issue: **24 August 2009**

Sample No

Analyst Comments

11258209

11258210

Signed:



Name: **G. Coiley**

Date: **24 August 2009**

Title: **Contam Land Production Manager**

Date of Issue 24 August 2009

Sample No	Description	Determinand	Comments

Signed: <i>G. Coiley</i>	Name: G. Coiley	Date: 24 August 2009
	Title: Contam Land Production Manager	

APPENDIX G:

Soil Contamination Leachability Tests

TABLE 6/4: Method Compaction for Earthworks Materials: plant and Methods (Method 1 to Method 6)
(This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6			
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm	
Vibratory roller	1	Mass per metre width of a vibratory roll: over 270 kg up to 450 kg over 450 kg up to 700 kg over 700 kg up to 1300 kg over 1300 kg up to 1800 kg over 1800 kg up to 2300 kg over 2300 kg up to 2900 kg over 2900 kg up to 3600 kg over 3600 kg up to 4300 kg over 4300 kg up to 5000 kg over 5000 kg	unsuitable	75	16	150	16	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	
	2		unsuitable	75	12	150	12	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	3		100	12	125	10	150	6	125	10	unsuitable	16	unsuitable	unsuitable	unsuitable	unsuitable
	4		125	8	150	8	200	10*	175	4	unsuitable	6	16	unsuitable	unsuitable	unsuitable
	5		150	4	150	4	225	12*	unsuitable	unsuitable	4	6	12	unsuitable	unsuitable	unsuitable
	6		175	4	175	4	250	10*	unsuitable	400	5	3	5	11	unsuitable	unsuitable
	7		200	4	200	4	275	8*	unsuitable	500	5	3	5	10	unsuitable	unsuitable
	8		225	4	225	4	300	8*	unsuitable	600	5	2	4	8	unsuitable	unsuitable
	9		250	4	250	4	300	6*	unsuitable	700	5	2	4	7	unsuitable	unsuitable
	10		275	4	275	4	300	4*	unsuitable	800	5	2	3	6	unsuitable	unsuitable
Vibrating plate compactor	1	Mass per m ² of base plate: over 880 kg up to 1100 kg over 1100 kg up to 1200 kg over 1200 kg up to 1400 kg over 1400 kg up to 1800 kg over 1800 kg up to 2100 kg over 2100 kg	unsuitable	unsuitable	75	6	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	
	2		unsuitable	75	10	100	6	75	10	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	
	3		unsuitable	75	6	150	6	150	8	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	
	4		100	6	125	6	150	4	unsuitable	unsuitable	8	unsuitable	unsuitable	unsuitable	unsuitable	
	5		150	6	150	5	200	4	unsuitable	unsuitable	5	8	unsuitable	unsuitable	unsuitable	
	6		200	6	200	5	250	4	unsuitable	unsuitable	3	6	12	unsuitable	unsuitable	
Vibro-tamper	1	Mass: over 50 kg up to 65 kg over 65 kg up to 75 kg over 75 kg up to 100 kg over 100 kg	100	3	100	3	150	3	125	3	unsuitable	4	8	unsuitable	unsuitable	
	2		125	3	125	3	200	3	150	3	unsuitable	3	6	12	unsuitable	
	3		150	3	150	3	225	3	175	3	unsuitable	2	4	10	unsuitable	
	4		225	3	200	3	225	3	250	3	unsuitable	2	4	10	unsuitable	
Power rammer	1	Mass: 100 kg up to 500 kg over 500 kg	150	4	150	6	unsuitable	200	4	unsuitable	5	8	unsuitable	unsuitable		
	2		275	8	275	12	unsuitable	400	4	unsuitable	5	8	14	unsuitable		
Dropping-weight compactor	1	Mass of rammer over 500 kg weight drop: over 1 m up to 2 m over 2 m	600	4	600	8	450	8	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	
	2		600	2	600	8	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	

TABLE 6/4: Method Compaction for Earthworks Materials: Plant and Methods (Method 7)
(This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 7	
			N for D = 150 mm	N for D = 250 mm
Smooth wheeled roller (or vibratory roller operating without vibration)	1	Mass per metre width of roll: over 2100 kg up to 2700 kg	unsuitable	unsuitable
	2	over 2700 kg up to 5400 kg	unsuitable	unsuitable
	3	over 5400 kg	12	unsuitable
Grid roller	1	Mass per metre width of roll: over 2700 kg up to 5400 kg	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	16	unsuitable
	3	over 8000 kg	8	unsuitable
Deadweight tamping roller	1	Mass per metre width of roll: over 4000 kg up to 6000 kg	4	8
	2	over 6000 kg	3	6
Pneumatic-tyred roller	1	Mass per wheel: over 1000 kg up to 1500 kg	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	12	unsuitable
	3	over 2000 kg up to 2500 kg	6	unsuitable
	4	over 2500 kg up to 4000 kg	5	unsuitable
	5	over 4000 kg up to 6000 kg	4	16
	6	over 6000 kg up to 8000 kg	unsuitable	8
	7	over 8000 kg up to 12000 kg	unsuitable	4
	8	over 12000 kg	unsuitable	4
Vibratory tamping roller	1	Mass per metre width of vibrating roll: over 700 kg up to 1300 kg	unsuitable	unsuitable
	2	over 1300 kg up to 1800 kg	unsuitable	unsuitable
	3	over 1800 kg up to 2300 kg	16	unsuitable
	4	over 2300 kg up to 2900 kg	12	unsuitable
	5	over 2900 kg up to 3600 kg	10	unsuitable
	6	over 3600 kg up to 4300 kg	8	16
	7	over 4300 kg up to 5000 kg	7	14
	8	over 5000 kg	6	12
Vibratory roller	1	Mass per metre width of vibrating roll: over 270 kg up to 450 kg	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	unsuitable	unsuitable
	5	over 1800 kg up to 2300 kg	12	unsuitable
	6	over 2300 kg up to 2900 kg	10	unsuitable
	7	over 2900 kg up to 3600 kg	10	unsuitable
	8	over 3600 kg up to 4300 kg	8	unsuitable
	9	over 4300 kg up to 5000 kg	8	unsuitable
	10	over 5000 kg	6	12
Vibratory plate compactor	1	Mass per m ² of base plate: over 880 kg up to 1100 kg	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	10	unsuitable
	5	over 1800 kg up to 2100 kg	8	unsuitable
	6	over 2100 kg	6	unsuitable
Vibro-tamper	1	Mass: over 50 kg up to 65 kg	unsuitable	unsuitable
	2	over 65 kg up to 75 kg	unsuitable	unsuitable
	3	over 75 kg up to 100 kg	unsuitable	unsuitable
	4	over 100 kg	8	unsuitable
Power rammer	1	Mass: 100 kg up to 500 kg	8	unsuitable
	2	over 500 kg	6	10
Dropping weight compactor	1	Mass of rammer over 500 kg height drop: over 1 m up to 2 m	unsuitable	unsuitable
	2	over 2 m	unsuitable	unsuitable