APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

A3.1.1 Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are as below:

Test Name	Procedures BS1377:1990 Part:Clause
Moisture Content	2:3
Liquid Limit	2:4
Plastic Limit and Plastic Index	2:5
Linear Shrinkage	2:6
Particle Size Distribution	2:9
Loss on Ignition	3:4*
Sulphate content	3:5
Chloride Content	3:7*
pH Value	3:9
Compaction Test	4:3*
Moisture condition Value	4:5
California Bearing Ratio	4:7
Consolidation	5:3
Bulk Density	7:2*
Laboratory Vane Tests	7:3*
Shear Box	7:4*
Triaxial Compression	
Total Stress Single-Stage	7:8
Total Stress Multi-Stage	7:9
Effective Stress	Note 1*
Permeability	Note 2*
Desiccation	Note 3*
In-situ density by Sand replacement	Part 9
Core Cutter	Part 9
Nuclear density	Part 9

	BS812 Part:Clause
Ten % fines (Dry and Soaked)	111
Aggregate crushing value	110
Particle density and water absorption	2
Particle size distribution	103
Moisture content – oven drying	109
Soundness	121

Chloride Content	124:10.2
Sulphate content	124:10.3
Curing/density and compressive strength of concrete tubes	116-111-114
Location of reinforcement	204
Carbonation	Note 4
Resistivity	Note 5
Sampling of concrete dust by drilling	Note 6
Half cell potential	Note 7

Note 1 - Manual of soils laboratory testing volume 3: 1985, section 19.2 by K.H. Head
Note 2 - Manual of soils laboratory testing volume 2: 1985, section 10.7 by K.H. Head
Note 3 - BRE Information paper IP4 issued February 1993
Note 4 - BRE Information paper IP6/81
Note 5 - In-house document number 109
Note 6 - In-house document number 112
Note 7 - ASTM C876-91
* Tests are not included in UKAS accreditation

A3.1.2 Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

A3.2 MOISTURE CONTENT

A3.2.1 Unless stated to the contrary, the moisture content of a soil sample was determined by the standard oven drying method, BS 1377, Part 1, Test 3. The result is reported to an accuracy of ±0.5%

A3.3 ATTERBERG LIMITS

A3.3.1 The Liquid Limit, **LL**, is the moisture content at which the soil passes from the liquid to plastic state. Unless stated to the contrary, the Liquid Limit was determined using the four point, cone penetrometer method, Test 4. The value is reported to the nearest whole number, to an accuracy of ±0.5%.

A3.3.2 The Plastic Limit, **PL**, is the moisture content at which soil passes from the plastic to solid state and becomes too dry to remain in a plastic condition. The Plastic Limit was determined using the method described in Test 5. The value is reported to the nearest whole number, to an accuracy of ±0.5%.

A3.3.3 The Plasticity Index, **PI**, is the numerical difference between the liquid and plastic limits, corresponding to the range of moisture contents over which a soil is in a plastic state. The determination of the Plasticity Index is covered by Test 5.

A3.4 SOIL CLASSIFICATION

A3.4.1 Classification of soils is usually undertaken by means of the Plasticity Classification Chart, sometimes called the A-Line Chart. This is graphical plot of PI against LL with the A-Line defined as PI = 0.73(LL - 20).

A3.4.2 This line is defined from experimental evidence and does not represent a well defined boundary between soil types, but forms a useful reference datum. When the values of LL and PI for inorganic clays are plotted on the chart they generally lie just above the A-Line in a narrow band parallel to it, while silts and organic clays plot below this line.

A3.4.3 Clays and silts are divided into five zones of plasticity:

Low Plasticity (L)	LL less than 35
Intermediate Plasticity (I)	LL between 35 and 50
High Plasticity (H)	LL between 50 and 70
Very High Plasticity (V)	LL between 70 and 90
Extremely High Plasticity (E)	LL greater than 90

A3.4.4 In general, clays of high plasticity are likely to have a lower permeability, are more compressible and consolidate over a longer period of time under load than clays of low plasticity. Clays of high plasticity are more difficult to compact as fill material.

A3.5 TRIAXIAL TESTS

A3.5.1 The shear strength tests have been carried out in accordance with the procedures given in BS1377, Part 7.

The type of test referred to in Figure A3.1 is:

A3.5.2 U1(100) - Undrained triaxial compression test on single specimen of 100mm diameter at a lateral pressure approximately equal to overburden pressure.

A3.5.3 UM (100) - Multi-stage undrained triaxial compression test on a specimen of 100mm diameter. An initial low cell pressure is applied and the deviator stress increased until failure is imminent. The cell pressure is then increased and the procedure repeated until the failure stress at three different cell pressures have been determined.

A3.5.4 UM (38) - Multi-stage undrained triaxial compression test on a single specimen of 38mm diameter. The procedure for this test is similar to that described for a 100mm diameter specimen.

A3.5.5 U1 (38) - Undrained triaxial compression test on a single specimen of 38mm diameter at a lateral pressure approximately equal to overburden pressure.

A3.5.6 U (38) - Undrained triaxial compression test on set of three specimens of 38mm diameter at three differential lateral pressures.

A3.6 CHEMICAL TESTS

A3.6.1 The total sulphate content of soil was determined using the gravimetric method detailed in BS1377: Part 3:1990, Test 5. The results are recorded to an accuracy of ±0.1%.

A3.6.2 The water soluble sulphate content of soil was determined using the gravimetric method detailed in BS1377: Part 3: 1990, Test 5. The results are recorded to an accuracy of ±0.1g/l.

A3.6.3 The sulphate content of groundwater was determined the gravimetric method detailed in BS1377: Part 3: 1990, Test 5. The rests are record to an accuracy of ±0.1g/l.

A3.6.4 The pH value was determined electrometrically using the procedures given in BS 1377: Part 3: 1990, Test 9. The results are recorded to an accuracy of ±0.1 pH units.

A3.7 CONSOLIDATION TESTS

A3.7.1 The consolidation test covers the determination of the magnitude and rate of consolidation of a saturated or near saturated specimen of soil, BS 1377, Part 5, Test 3. The specimen is confined laterally and subjected to a vertical axial pressure and allowed to drain freely from the top and bottom surfaces.

A3.7.2 Unless the specific gravity has been measured a value has been assumed on the basis of a visual examination of the specimen. The specific gravity of most soils generally lies within the range of 2.60 to 2.80. Clays consist of various minerals, most of which are heavier than quartz (s.g. of 2.65) and typically the specific gravity of many British soils lies in the range of 2.68 to 2.72.

A3.8 COMPACTION TESTS

A3.8.1 Whenever soil is placed as fill, it is generally necessary to compact it into a dense state. Laboratory compaction tests are carried out to provide the basis for control procedures. Compaction tests provide the following information.

A3.8.2 The relationship between the dry density and moisture content for a given degree of compactive effort.

A3.8.3 The moisture content for the most efficient compaction. This is defined as the **Optimum Moisture Content, OMC**, being the moisture content of the soil at which a specified amount of compaction will produce the maximum dry density.

A3.8.4 The **Maximum Dry Density**, being the dry density obtained using a specified amount of compaction at the optimum moisture content.

A3.8.5 There are three basic laboratory compaction tests, these being as follows:

Type of test (BS1377:1990 Part 4)	Container	Rammer			
		mass (kg)	drop (mm)	No of Layers	Blows Per Layer
Light compaction	BS mould (1l) CBR mould	2.5 2.5	300 300	3 3	27 62
Heavy compaction	BS mould (1l) CBR mould	4.5 4.5	450 450	5 5	27 62
Vibrating hammer	CBR mould	32 to	vibro	3	(1 min)

IAN FARMER ASSOCIATES
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F.A.O. Mr P Challinor

TEST REPORT - 3914/2

Site :	Bolton upon Dearne
Job Number :	3914
Originating Client :	Horizon Residential Developments Ltd.
Originating Reference :	3914
Date Sampled :	Unknown
Date Scheduled :	Unknown
Date Testing Started :	03/05/06
Date Testing Finished :	16/05/06

Remarks :

- First Report for above Job Number
- Samples will be disposed of 28 days after the report is issue unless otherwise agreed
- This report may contain results from tests which are not included within the scope of the UKAS accreditation. Please see final sheet for details.

Authorised By: Jonathan Holden

Position : Laboratory Manager Date : 16/05/06

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Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd.

Job Number 3914

DETERMINATION OF NATURAL MOISTURE CONTENT

Borehole/ Trial Pit	Depth (m)	Sample	Moisture Content %	Description
TP29	2.00	B3	21	Brown slightly sandy slightly gravelly CLAY / SILT
WS2	0.40	D1	7.7	Beige weathered SANDSTONE
BH5	1.00	D2	15	Brown slightly sandy slightly gravelly CLAY / SILT
BH5	3.00	B13	16	Brown slightly sandy slightly gravelly CLAY / SILT
WS7	1.00	D3	11	Brown sandy CLAY / SILT
BH7	2.60	D13	25	Grey SILT
BH7	3.50	D16	28	Grey CLAY / SILT includes weathered SILT / STONE
TP22	2.00	B3	22	Brown orange grey mottled CLAY / SILT
TP11	2.00	B5	19	Brown slightly gravelly sandy CLAY / SILT
TP20	1.50	B2	13	Brown gravelly SILT / SAND includes cobbles
TP10	0.50	B2	17	Brown slightly gravelly slightly sandy CLAY / SILT
TP6	1.00	B2	12	Brown gravelly SAND
TP6	3.00	B6	15	Brown slightly gravelly slightly silty CLAY / SAND
WS6	0.70	D3	16	Brown orange grey slightly sandy CLAY / SILT
WS11	0.80	D2	15	Brown sandy slightly gravelly CLAY
WS15	0.50	D2	11	Brown yellow slightly gravelly slightly clayey SAND
BH3	1.20	D5	8.9	Grey CLAY / SILT
TP4	1.00	B3	23	Orange brown and grey mottled slightly gravelly slightly sandy CLAY
TP27	1.00	A1	20	Orange brown slightly sandy SILT/CLAY
WS18	1.00	D2	12	Brown sandy SILT
TP24	0.50	B2	19	Brown sandy slightly gravelly CLAY / SILT includes fibrous organic matter
TP5	0.50	B2	17	Brown slightly gravelly SILT / SAND

Method of Preparation : BS 1377:PART 1:1990 7.4 Preparation of samples for classification tests. BS 1377:PART 2:1990 4.2 & 5.2 Sample preparations

Method of Test : BS 1377:PART 2:1990:3.2 Determination of moisture content

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd

Job Number 3914

DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY AND LIQUIDITY INDEX

Borehole/ Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description
					Percentage %	Moisture Content %						
TP22	2.00	B3	Natural	22	98	23	45	21	24	0.08	CI	Brown orange grey mottled CLAY / SILT
TP11	2.00	B5	Natural	19	69	25	29	18	11	0.64	CL	Brown slightly gravelly sandy CLAY / SILT
BH7	2.60	D13	Natural	25	94	26		NP				Grey SILT
BH7	3.50	D16	Natural	28	75	36	53	28	25	0.32	CH	Grey CLAY / SILT includes weathered SILT / STONE
WS18	1.00	D2	Natural	12	98	12		NP				Brown sandy SILT
WS15	0.50	D2	Natural	11	64	14		NP				Brown yellow slightly gravelly slightly clayey SAND
TP20	1.50	B2	Natural	13	60	18		NP				Brown gravelly SILT / SAND includes cobbles
TP6	1.00	B2	Natural	12	58	18		NP				Brown gravelly SAND
TP6	3.00	B6	Natural	15								Brown slightly gravelly slightly silty CLAY / SAND
TP4	1.00	B3	Natural	23	95	24	37	24	13		CI	Orange brown and grey mottled slightly gravelly slightly sandy CLAY
WS11	0.80	D2	Natural	15	96	16	24	16	8		CL	Brown sandy slightly gravelly CLAY
BH5	1.00	D2	Natural	15	55	24		NP				Brown slightly sandy slightly gravelly CLAY / SILT
BH5	3.00	B13	Natural	16	74	20		NP				Brown slightly sandy slightly gravelly CLAY / SILT
WS6	0.70	D3	Natural	16	100	16	35	18	17	-0.12	CL/CI	Brown orange grey slightly sandy CLAY / SILT
TP29	2.00	B3	Natural	21	93	22	35	23	12	-0.08	CL/CI	Brown slightly sandy slightly gravelly CLAY / SILT
WS7	1.00	D3	Natural	11	95	11	31	17	14	-0.43	CL	Brown sandy CLAY / SILT
TP24	0.50	B2	Natural	19	88	21	27	18	9	0.33	CL	Brown sandy slightly gravelly CLAY / SILT includes fibrous organic matter

Method of Preparation : BS 1377 PART 1:1990:7.4 Preparation of samples for classification tests BS 1377:PART 2:1990:4.2 & 5.2 Sample preparations

Method of Test : BS 1377:PART 2:1990:3 Determination of moisture content 1990:4 Determination of the liquid limit BS 1377:PART 2:1990:5 Determination of the plastic limit and plasticity index

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd.

Job Number 3914

DETERMINATION OF THE pH VALUE AND THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Soluble Sulphate			Percentage of sample passing 2mm Sieve %	pH	Description
			Soil		Groundwater g /l			
			Total S04 %	S04 in 2:1 water:soil g /l				
BH4	1.00	D2	0.11	0.1		82	7.6	Brown slightly clayey SAND includes ocassional fibrous organic matter
BH5	0.50	D1		0.6		92	8.0	Brown orange very sandy gravelly CLAY / SILT
BH7	1.00	D2	0.12	0.1		89	7.8	Brown slightly sandy slightly gravelly CLAY / SILT includes fibrous organic matter
WS7	0.90	D2		0.1		96	7.6	Brown weathered SILTSTONE
TP27	1.00	A1		0.8		90	7.8	Orange brown slightly sandy SILT/CLAY

Method of Preparation : BS 1377:PART 1:1990:7.5 Preparation of soil for chemical tests BS 1377:PART 3:1990:5.2, 5.3, 5.4 & 9.4

Method of Test : BS 1377:PART 3:1990:5 Determination of the sulphate content of soil and ground water BS 1377:PART 3:1990:9 Determination of the pH value

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd.

Engineer :

Job Number 3914

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DETERMINATION OF TOTAL SULPHUR

Borehole/ Trial Pit	Depth (m)	Sample	Percentage Passing 0.150 Sieve %	Total Sulphur %	Description
BH7	1.00	D2	89	0.3	Brown slightly sandy slightly gravelly CLAY / SILT includes fibrous organic matter

Method of Preparation :

Method of Test : BRE 279 (1995) Total sulphur

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd

Engineer :

Job Number 3914

DETERMINATION OF CHLORIDE CONTENT

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Chloride in Soil		Soil to Water Ratio	Percentage of sample passing 2mm Sieve %	Description
			Acid Soluble %	Water Soluble %			
BH4	1.00	D2		0.00	2:1	78	Brown slightly clayey SAND includes ocassional fibrous organic matter
BH5	0.50	D1		0.00	2:1	92	Brown orange very sandy gravelly CLAY / SILT
TP27	1.00	A1		0.00	2:1	90	Orange brown slightly sandy SILT/CLAY
WS7	0.90	D2		0.00	2:1	96	Brown weathered SILTSTONE

Method of Preparation : BS 1377 PART 1:1990.7.5 Preparation of soil for chemical tests BS 1377 PART 3:1990.7.2.3.2 Water-soluble, 7.3.3.3 Acid-soluble

Method of Test : BS 1377 PART 3:1990.7 Determination of the cloride content

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd

Job Number 3914

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DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

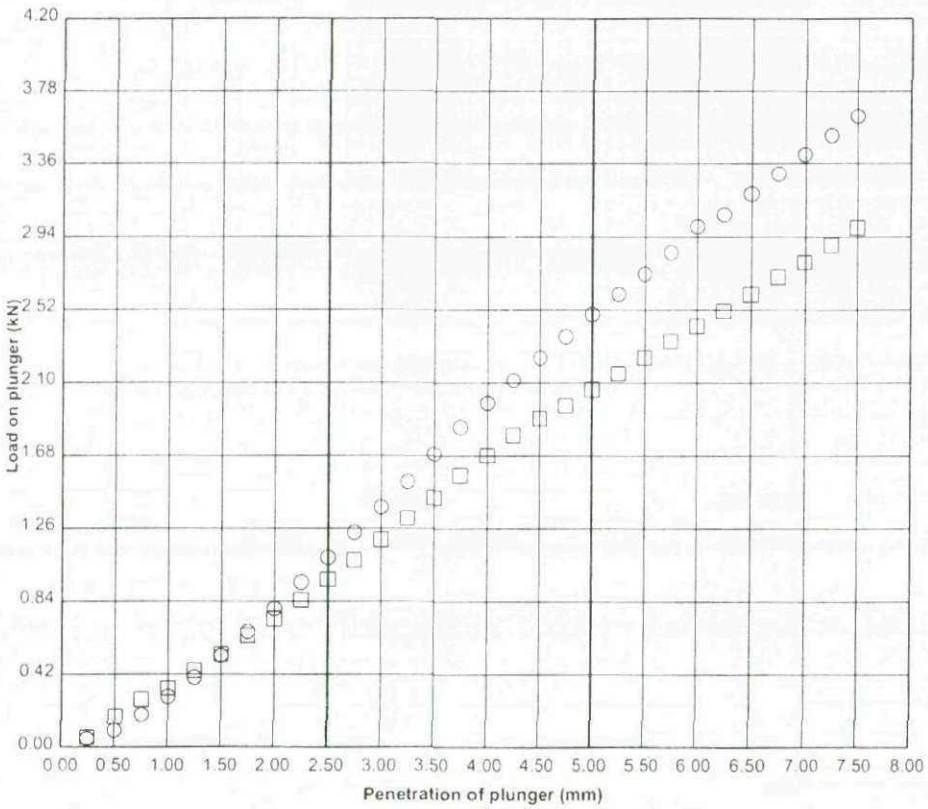
Borehole / Trial Pit	Depth (m)	Sample	% Passing 20 mm Sieve	Description
TP17	1.20	B2	99 %	Brown slightly sandy slightly gravelly CLAY / SILT

Moisture Content %	
Bulk Density Mg/m³	2.06
Dry Density Mg/m³	1.78
Soaked Test	No

Test on	☐ TOP	
Moisture Content %	16	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	0.97	2.1
Corrected CBR %	7.3	10

Test on	○ BOTTOM	
Moisture Content %	16	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	1.1	2.5
Corrected CBR %	8.3	12

Test on	TOP	BOTTOM
Reported CBR %	7.3	8.3
Mean CBR %	7.8	



Method of Preparation : The specimen was prepared by Dynamic compression using a 2.5 kg Rammer
BS 1377:PART 1:1990:7.6.1 General 1990:7.6.5 California bearing ratio test BS 1377:PART 4:1990:7.2 Preparation of test sample

Method of Test : BS 1377:PART 4:1990:7.4 Penetration test procedure

Remarks :

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Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd.

Job Number 3914

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DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

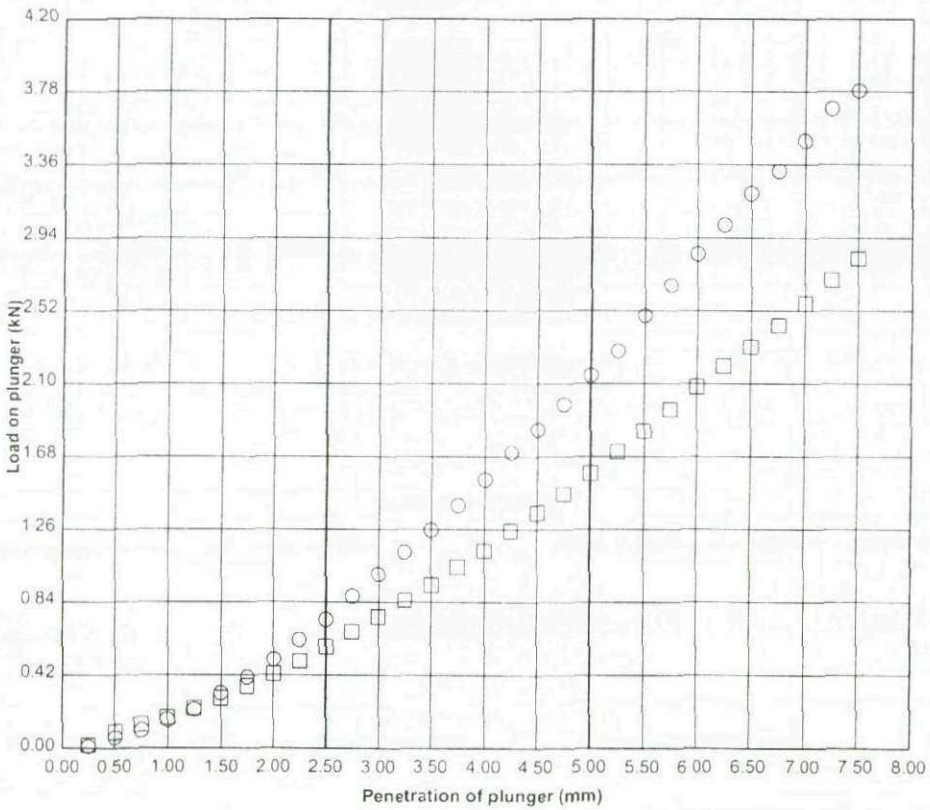
Borehole / Trial Pit	Depth (m)	Sample	% Passing 20 mm Sieve	Description
TP3	0.50	B1	75 %	Brown gravelly slightly clayey slightly silty SAND

Moisture Content %	
Bulk Density Mg/m³	2.14
Dry Density Mg/m³	1.88
Soaked Test	No

Test on	☐ TOP	
Moisture Content %	14	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	0.58	1.6
Corrected CBR %	4.4	7.9

Test on	○ BOTTOM	
Moisture Content %	14	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	0.74	2.1
Corrected CBR %	5.6	11

Test on	TOP	BOTTOM
Reported CBR %	7.9	5.6



Method of Preparation : The specimen was prepared by Dynamic compression using a 2.5 kg Rammer
BS 1377 PART 1:1990:7.6.1 General 1990 7.6.5 California bearing ratio test BS 1377 PART 4:1990 7.2 Preparation of test sample

Method of Test : BS 1377 PART 4:1990:7.4 Penetration test procedure

Remarks :

IAN FARMER ASSOCIATES

Laboratory Test Report - 3914/2

Site : Bolton upon Dearne

Client : Horizon Residential Developments Ltd.

Job Number 3914

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

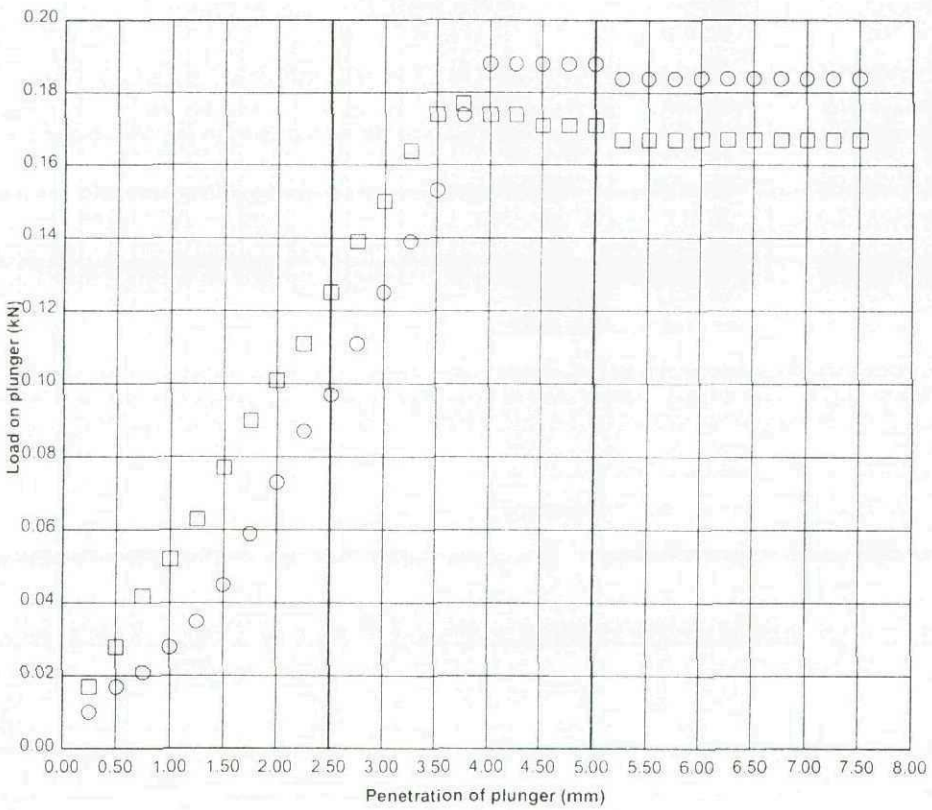
Borehole / Trial Pit	Depth (m)	Sample	% Passing 20 mm Sieve	Description
TP5	0.50	B2	95 %	Brown slightly gravelly SILT / SAND

Moisture Content %	
Bulk Density Mg/m³	2.08
Dry Density Mg/m³	1.80
Soaked Test	No

Test on	☐ TOP	
Moisture Content %	16	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	0.12	0.17
Corrected CBR %	0.95	0.86

Test on	○ BOTTOM	
Moisture Content %	15	
Surcharge weight kg		
Penetration mm	2.5	5.0
Force kN	0.10	0.19
Corrected CBR %	0.73	0.94

Test on	TOP	BOTTOM
Reported CBR %	0.95	0.94
Mean CBR %	0.94	



Method of Preparation : The specimen was prepared by Dynamic compression using a 2.5 kg Rammer
BS 1377:PART 1:1990:7.6.1 General 1990:7.6.5 California bearing ratio test BS 1377:PART 4:1990:7.2 Preparation of test sample

Method of Test : BS 1377:PART 4:1990:7.4 Penetration test procedure

Remarks :

IAN FARMER ASSOCIATES

Geotechnical Environmental

Test Report : **3914/2**

Site : Bolton upon Dearne
Job Number : 3914
Originating Client : Horizon Residential Developments Ltd.

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

The following tests contained within this report are not UKAS Accredited.
Total Sulphur

Date of Issue : 16/05/06

UKAS TESTING
2139

dets
Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number : 06-05180_M01

Client Reference:	3914	**Date of issue:**	31/05/2006
Our Reference:	06-05180	**Report no:**	06-05180_M01
Clients Name:	Ian Farmer Associates		
Clients Address:	14 Faraday Close District 15 Pattinson North Industrial Est Washington Tyne & Wear		

Contract Title:	Bolton Upon Dearne
Description:	2 soil samples
Date Received:	16/05/2006
Date Commenced:	16/05/2006
Date Completed:	31/05/2006

Notes:

Test procedures are identified by prefix DETSn (details available upon request)
Observations and Interpretations are outside the UKAS Accreditation Scope
* Denotes test not included in laboratory scope of accreditation
$ Denotes test carried out by approved subcontractor
I/S Denotes insufficient sample to carry out test
N/S Denotes that the sample is not suitable for testing
Samples will be disposed of 1 month after the date of issue if this test certificate.

Approved By:

R Bennett	R Brown	M Hopgood
Director	Business Manager	Technical Manager

Derwentside Environmental Testing Services Limited.
Unit 2a/2b, Park Road Industrial Estate South, Consett, Co Durham, DH8 5PY
Tel: 01207 582333 • Fax: 01207 582444 • Email: info@dets.co.uk • www.dets.co.uk
Registered in England No. 3705645 • VAT No. 708 978 678

Client Reference 3914

Laboratory Reference 06-05180

Bolton Upon Dearne

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 042* Magnesium mg/kg	DETS 042* Sodium mg/kg
BH4	1.00	D2	Soil	34440	2500	280
BH5	0.50	D1	Soil	34441	27000	610