

STRATA SURVEYS LIMITED

GROUND INVESTIGATION

REPORT NO. 7880

**STATION ROAD
MIRFIELD
HUDDERSFIELD**

REPORT NO. 7880

STATION ROAD, MIRFIELD

for

LIDL UK PROPERTIES GmbH
Third Floor
Westbrook House
Westbrook Centre
Warrington
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requested by

HTC PROJECT MANAGEMENT
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compiled by

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1. INTRODUCTION

This report sets out the results of the field work and laboratory testing for a ground investigation carried out by Strata Surveys Limited for Lidl UK Properties GmbH at the request of HTC Project Management.

The investigation was required in connection with a proposed Lidl Supermarket at Station Road, Mirfield, Huddersfield.

The object of the investigation was to obtain information on the ground conditions and soil properties for use in the design and construction of foundations on the site.

2. SITE DESCRIPTION

The site is bounded by Station Road to the east, a canal to the south, a brick wall to the west and a retaining wall to the north.

The site is mainly demolition rubble, on two levels. The area close to Station Road is approximately 3 metres higher than the south west part of the site. The half of the high ground nearest the canal contains infilled basements with a tarmac covering. The whole has been used for car parking. The south west area is at basement level with concrete slabs forming a majority of the ground surface.

3. SITE GEOLOGY

The 1:50,000 Series of the British Geological Survey shows the site is underlain by Alluvium over Mudstone of the Lower Coal Measures of the Upper Carboniferous.

4. FIELD WORK

The field work was carried out during the period from 10th to 22nd October 1994 and consisted of boring three 150mm diameter boreholes to depths varying between 5.00m and 7.90m below the existing ground surface level using shell, clay cutter and light cable percussion techniques. Borehole 1A was abandoned on concrete at 1.50m and redrilled as Borehole 1 a short distance away.

Undisturbed 100mm diameter samples were taken in the cohesive strata. Standard penetration tests were carried out in the granular strata and to prove bedrock. Selected disturbed samples and bulk samples were also taken and together with the undisturbed samples and samples from the standard penetration tests returned to our laboratory for inspection and testing as appropriate. Groundwater samples were obtained where ground conditions allowed.

The boreholes were extended to 40.00m below ground level using rotary open hole air flush techniques to search for mine workings.

Detailed results of the strata met, depths and levels of changes, thicknesses of strata, samples taken, groundwater observations and N values from the standard penetration tests are given on the borehole record sheets in Appendix 2.1.

Where standard penetration tests were discontinued due to hard strata the N value has been derived by arithmetically extending the blows recorded in the partial test drive.

Gas wells were installed in the boreholes. Details of their construction are given on separate sheets in Appendix 2.2. A record of the gas readings is given in Appendix 2.4.

Eight trial pits were excavated by mechanical excavator with a geologist in attendance. The results are given in Appendix 2.3.

Ground levels at the borehole and trial pit positions were not available for inclusion in this report.

Appendix 1 contains statements of the Terminology used in Soil Descriptions, the Standard Penetration Tests and Concrete in Aggressive Conditions.

The positions of the boreholes and trial pits are given on the Site Plan in Appendix 4.

5. LABORATORY TESTING

The tests were carried out as specified by B.S. 1377:1990 Methods of Test for Soils for Civil Engineering Purposes.

Triaxial Compression Tests, Particle Size Distribution Tests, Sulphate Content and pH Value Tests were performed. (The Sulphate Contents are reported as SO_4 for ease of use with BRE Digest 363).

Chemical contamination tests were carried out on selected samples by Southern Science.

The results of all the tests are given in Appendix 3.

6. SUMMARY OF GROUND CONDITIONS

The succession of strata proved by the boreholes varied from sampling point to sampling point. An irregular layer of made ground covers the site. On the high level adjacent to Station Road (the position of the proposed store) the thickness varies from 0.20m to 3.90m and in the low level area the thickness varies from 0.1m to in excess of 2.00m (Trial Pit 1).

The natural ground below the made ground varies from loose alluvial SAND with firm CLAY layers (Borehole 1A) to a weathered zone of dense SAND with stiff CLAY (Borehole 2) to bedrock (Borehole 3).

Bedrock was proved at depths of 4.20m, 4.30m and 3.90m in Boreholes 1, 2 and 3 respectively. The upper strata consisted of weathered grey MUDSTONE which became harder with depth. At depths of 17.00m to 29.00m sandstone was encountered and this was proved to 40.00m without being fully penetrated. No unusual circulation loss was experienced and no voids were encountered. A thin coal seam (0.30m) was proved at 16.70m in Borehole 3.

The highest temporary standing groundwater levels recorded in the boreholes were 2.50m, 5.10m and 5.28m in Boreholes 1A, 2 and 3 respectively. A water level of 2.35m was recorded in Trial Pit 4 – the remaining trial pits were dry.

7. GEOTECHNICAL ASSESSMENT

The ground conditions along the northern edge of the proposed store (Borehole 2, Trial Pit 6 and Trial Pit 7) are suitable for shallow foundations using an allowable bearing pressure of 150 kN/m². The loose alluvial strata at normal foundation depth at the south west corner of the building have an allowable bearing pressure of 50 kN/m² and the results of the standard penetration tests show the allowable bearing pressure at the south east corner of the building should not exceed 80 kN/m².

With these variable conditions and no ground improvement the use of shallow foundations would involve considerable risk.

The choice of foundations appears to be between ground improvement on the southern part of the building so that shallow foundations can be used throughout. Alternatively piles could be used over the area of the whole building to obtain foundations.

The ground floor can be ground supported providing any existing basement walls are removed to about 500mm below the underside of the floor slab and a 500mm layer of well compacted hardcore is laid below the slab.

CBR Tests gave results of 1.3%, 13%, 15%, 25% and 110%. The sample giving the lowest result contained clay. Providing the clay fill is removed roads and parking can be designed using a CBR of 13%.

Sulphates are present in the groundwater from Borehole 1. pH values of 7.3 to 10.0 were measured. In line with BRE Digest 363 the site should be treated as Class 3.

The boreholes proved no cavities and no loose bedrock and any subsidence due to mine workings in the area appears to be complete.

8. CHEMICAL CONTAMINATION ASSESSMENT

Methane gas monitoring recorded no methane on site.

The chemical contamination tests which analysed 5 samples for the contaminants in ICRL Table 3 and Table 4 showed that the site is uncontaminated for the proposed use.

An area of diesel contamination detected in an earlier survey has been treated. The current tests show that although there is a diesel smell the quantities present are in the 'uncontaminated' range of values.

No special precautions need be taken to protect construction personnel. No special landfill sites will be required for surplus soils from the site. No precautions are necessary to protect employees or the public after construction is complete. ↗

signed for
STRATA SURVEYS LIMITED

*Julian
Sands ok?*



A.W. WALKER BSc
Chief Soils Engineer

APPENDICES

APPENDIX 1

STANDARD

Terminology used in Soil Descriptions

Standard Penetration Tests

Concrete in Aggressive Conditions

Terminology Used In Soil Descriptions

The procedure and principles given in BS 5930 (1992) Revision Section 8 have been adopted in producing the soils description contained in this report. The classification is therefore based on the following.

In a soil description the main characteristics should be preferably given in a standard word order, the word order can be adjusted where appropriate for clarity.

- | | |
|--|--|
| <p>a) Mass characteristics</p> <ol style="list-style-type: none"> 1) Field Strength, density or compactness 2) Discontinuities 3) Bedding | <p>b) Material characteristics</p> <ol style="list-style-type: none"> 1) Colour 2) Particle shape, particle grading and composition. 3) Soil name (capital e.g. SAND), based on grading and plasticity. |
| | <p>c) Geological formations, age and type of deposit</p> |
| | <p>d) Classification/soil group (optional.)</p> |

Mass Characteristics

For clay the strength scale is used as follows:

Term	Field Identification	Undrained Shear Strength (kN/m ²)
Very soft	Fingers easily pushed in up to 25mm	20
Soft	Fingers pushed in up to 10mm	20-40
Firm	Thumb makes impression easily	40-75
Stiff	Indented slightly by thumb.	75-150
Very Stiff	Can be indented by thumb nail	150-300
Hard (or very weak mudstone)	Can be scratched	greater than 300

Clays with undrained strength greater than 300 kN/m² can be described as very weak mudstone or as hard clay (Spink and Norbury 1993)

Relative density of sands and gravel only may be determined by the standard penetration test. A scale in terms of N-Values (see BS 1377:1990) is as follows:-

Term	Field Identification	SPT N-Values blows/300mm penetration.
Very loose	Can be excavated with a spade	0 to 4
Loose	50mm wooden peg easily driven (Loose)	4 to 10
Medium dense		10 to 30
Dense	requires pick for excavation	30 to 50
Very Dense	50mm wooden peg hard to drive. (Dense)	over 50

Silts are described as fine soils (see 41.3) but depending on their grading may behave as a granular rather than cohesive material.

The terms uncompacted: -easily moulded or crush in fingers or Compacted: -can be moulded or crush by strong pressure in the fingers can be used.

Relative densities for use in field where N-values are not available are given in brackets; these terms are unquantified and should be used with caution.

Description of Discontinuities.

When describing discontinuities the type should be stated e.g. fissures, faults, shear planes and the spacing detailed as below. Their openness and surface texture eg rough, smooth, polished, striated should be described and where possible orientation and trend should be stated.

Discontinuities			Bedding		
Scale of spacing	Mean	Other qualifying terms	Scale of bedding	Mean	Other qualifying terms
Term	Spacing mm		Term	Thickness mm	
Very widely	Over 2000	Fissured:- breaks in blocks along unpolished discontinuities.	Very thickly bedded	Over 2000	Inter bedded
Widely	2000 to 600	Sheared:- breaks in blocks along polished discontinuities.	Thickly bedded	2000 to 600	Interlaminated
Medium	600 to 200		Medium bedded	600 to 200	
Closely	200 to 60	Spacing terms also used for distance between partings, isolated beds or laminae, desiccation cracks roots etc.	Thinly bedded	200 to 60	
Very Closely	60 to 20		Very thinly bedded	60 to 20	
Extremely Closely	under 20		Thickly laminated	20 to 6	
			Thinly laminated	under 6	

Material Characteristics of Soils.

Material characteristics refer to those characteristics that can be described from visual and mutual examination of disturbed or undisturbed samples. Characteristics include colour, particle shape, particle grading and particle composition.

Colour

Colour given should be an overall impression. Strata with more than one colour can be described as mottled or multicoloured. details of colours are given below:-

Red, orange, yellow, brown, green, blue, white cream, grey, black etc. and supplemented as necessary with: light dark mottled and reddish orangish brownish etc. (Changes due to oxidation, desiccation for example should be noted.)

Particle Shape:- Where appropriate, particle shape may be described. Some recommended terms are as follows.

Angularity	Form	Surface texture.	The distribution of particle sizes within sands and gravels should be described stating predominant size fraction present e.g. fine to coarse SAND.
angular	flat	rough	
subangular	elongated	smooth.	
subrounded			
rounded			

Principal Soil Type and Secondary Constituents.

The soil name is based on particle size of the coarse fraction and/or the plasticity of the fine fraction

Fines soils:- contain 35% or more of fine material (omitting boulder and cobbles) is described as CLAY or SILT dependent on plasticity.

With less than 35% fine material it is described as a coarse material SAND or GRAVEL.

For mixtures involving very coarse soils see 41.3.2.4.

The basic soil types and their subdivisions are defined by the range of their particle sizes as shown below. BS5930 Section 8 recommends that the secondary constituents can be used before or after the principal soil type to avoid ambiguity with the qualifying adjectives.

Soil Group.	Particle Size	Principal Soil	Term Before	Principal Term	Term After	Approx. % Secondary Constituent
Very Coarse	200	BOULDERS COBBLES	Slightly (sandy*) or gravelly	SAND	with a little (sand*) or occasional (cobbles+) with some(sand*)	5
	60					
Coarse Soils (over about 65% sand and Gravel)	Coarse	GRAVEL	(Sandy*) or gravelly	or	or some (Cobbles+) with much(sand*)	5-20 **
	Medium		(Very Sandy*) or gravelly	GRAVEL	or many (cobbles+) and(sand*) or and (Cobbles*)	>20 **
	Fine					
	Coarse	SAND		SAND and GRAVEL		about equal proportions
	Medium		* Fine soil type as appropriate clayey/or silty. + Very coarse soil type as appropriate.			
	Fine		** or describe as a fine soil depending on assessed engineering behaviour			
Fine Soil(over about 35% silt and clay size)	Coarse	SILT	Slightly (sandy*) or gravelly	CLAY	with a little (sand*) or occasional (cobbles+) with some(sand*) or some (cobbles+)	<35
	Medium					35-65
	Fine					
		CLAY/SILT. CLAY	(Very Sandy*) or gravelly	SILT	with much(sand*) /many (cobbles+)	>65 **
			** describe as coarse soil depending on assessed engineering behaviour.			
			* coarse soil as appropriate.			

BS5930 Section 8 indicates fine soils shall be described as either SILT or CLAY depending on plastic properties; these terms are mutually exclusive terms such as silty CLAY are not to be used. Where hand test are genuinely indecisive or ambiguous the hybrid term CLAY/SILT may be used.

This is also true for deposits containing mixtures of fine and coarse soil(see 41.3.2.6)

Minor constituents. Where soil contain minor quantities <10% in fine soil and 1% coarse, which are relevant to geology can be included using slightly or very slightly.

Organic Soils and Peats:-(see 41.3.6)

Term	Field Test	Transported Mixtures			
Firm	Fibres compressed	Fibrous	Plant remains	Slightly organic clays/silt or sand	Divided or discrete
Spongy	Very compressed and open structure	pseudo-fibrous	Plant remains recognisable	Organic clay or silt organic sand	organic odour
Plastic	can be moulded in hand and smears along fingers	amorphous	recognisable plant remains absent	Very organic clay or silt very organic sand	Describe as for inorganics soils.
				PEAT Predominantly plant remains usually dark brown black in colour distinctive smell. low bulk density	

References:

BS 5930:1992 Revision 'Code of Practice for Site Investigation.'

Norbury D.R., G.H Child and T.W Spink 1984:'A critical Review of Section 8(BS 5930)Soil and Rock Descriptions'. Proc. 20th Regional meeting of the Engineering Group of the Geological Society. Site Investigation Practice. Assessing BS5930. Univ. of Surrey pp353-369(original proceedings)

Standard Penetration Test

The full procedure of carrying out the Standard Penetration Test (SPT) is given in BS 1377:1990:Methods of Tests for Soils for Civil Engineering Purposes, Test 9:3.

Essentially the tests consists of driving a 50mm external diameter split barrel sampler into the soil using a 63kg hammer dropping 760mm. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration (test drive) below a seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows for the 300mm test drive penetration is recorded on the borehole logs as the N-value. A full record of the number of blows required to drive the sample at 75mm intervals throughout the total 450mm drive is also tabulated along with the groundwater levels at the time of test.

The test is normally performed on sands, but may also be used in gravels, weak rocks and glacial tills in which case the driving shoe may be replaced by a cone. When attempting the standard penetration tests in very dense materials or weathered bedrock it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner:

- a) Seating Drive - using standard blows the seating drive is a penetration of 150mm or 25 blows whichever is first reached.
- b) Test Drive - the number of blows required for a further penetration of 300mm. If 300mm cannot be achieved in 50 blows the test drive can be terminated.
Record the number of blows per 75mm for both seating and test drives. If either the seating drive or the test drive is terminated before full penetration record the depth of penetration for the 25 blows or 50 blows respectively.
- c) In soft rock the test drive should be terminated after 100 blows if a penetration of 300mm has not been achieved.

The N-value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels in accordance with Clause 41.2.5 of BS 5930:1981: Code of Practice for Site Investigation as follows:

Term	SPT N-values: blows/300mm Penetration
Very loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

In soft strata when the sampler assembly is lowered to the bottom of the borehole on the drive rods with the drive assembly on top the sampler may penetrate under self-weight. This initial penetration should be measured and recorded. If the initial penetration exceeds 450mm omit the seating and test drives and report the N value as zero.

Durability of Concrete in Aggressive Ground and Groundwater Conditions

Sulphate Attack

In order to assess the levels of sulphate in the ground or groundwater, which may have a deleterious effect on concrete, the sulphate content of soil and groundwater may be determined in accordance with BS 1377 (1990) Tests 3:5. The sulphate contents determined are grouped into classes in Building Research Establishment Digest 363 (1991) as follows:

Concentration of Sulphates in Soils and Groundwater			
Class	Soils Total SO ₄ 0%	SO ₄ in 2:1 Water:soil extract (g/l)	Groundwater SO ₄ (g/l)
1	<0.24	<1.2	<0.4
2	If >0.24	1.2 - 2.3	0.4 - 1.4
3	Classify on	2.3 - 3.7	1.4 - 3.0
4	basis of	3.7 - 6.7	3.0 - 6.0
5	2:1 extract	>6.7	>6.0

Based on this classification BRE Digest 363 gives recommendations for the design of suitable concrete mixes to resist sulphate attack, depending on the cement type (including cement replacements) for each class of sulphate. Recommended minimum cement contents and maximum water:cement ratios are given to ensure a durable concrete, provided that the mix is adequately compacted and cured to give a dense, low permeability product. It should be noted that the recommendations given in BRE Digest 363 relate to concrete of low workability which can be adequately compacted by normal methods e.g. precast concrete piles, pile caps or shallow footings. They do not apply to high workability concrete for use in cast-in-place piles, where reference should be made to the recommendations to Tomlinson (1980) and Bartholomew (1979).

Care should be taken in the interpretation of results over the site area. If classification is based solely on groundwater analysis, it should be based on the highest sulphate concentration recorded. Where a large number of results from soil analysis are available it should be based on the average of the highest 20 per cent of the results. If a varied set of results are recorded from a limited sampling programme it is important to carry out further analyses before a detailed classification is given.

Acid Attack

The pH value of groundwater as determined by Test 3.9 BS 1377 provides a general indication of the potential aggressiveness to concrete of acids. It is important that tests on either groundwater or soil:water suspensions are carried out on fresh samples as results may change with time. Soils and groundwater generally are near neutral (i.e. pH = 7) with a range of pH's between 6 and 9. A review of the durability of concrete in acidic soil and groundwater by W.H. Harrison of the Building Research Establishment (1987) quotes a French Standard D 18-011 (1985) "Concrete Classification of Aggressive Environments" which classifies the degree of aggressiveness of various environments as follows:

Degree of Aggressiveness	pH Range
Slightly Aggressive	6.6 - 5.5
Fairly Aggressive	5.5 - 4.5
Very Aggressive	4.5 - 4.0
Extremely Aggressive	<4.0

A series of precautions required against acid attack by organic acids in peaty soils are given by Tomlinson (1980). Where mineral acids are present special precautions will be required to protect concrete against attack. Harrison briefly describes certain of the techniques available and refers to detailed references as appropriate. Alkaline groundwater is not generally aggressive to concrete unless in relatively high concentrations (pH's above 14) or if the aggregate is of a reactive type. The pH value of soil or groundwater may also be linked to sulphate concentrations in particular in borderline cases. If the pH value is below six it is usual to group any borderline sulphate results into the higher classifications, as it is considered that acids present will tend to break down the concrete making it more susceptible to sulphate attack.

References

- Bartholomew R.F.: 1979 'The protection of concrete piles in aggressive ground conditions' Proc. Conf on Recent Developments in the Design and Construction of Piles ICE London pp99 - 109
- BS 1377:1990 'Methods of Test for Soils for Civil Engineering Purposes' British Standards Institution
- 'BRE Digest 363: 1991 'Sulphate and Acid Resistance of Concrete in the Ground': Building Research Establishment
- Harrison W.H.: 1987 'Durability of Concrete in Acidic Soils and Waters': Concrete Feb. 1987, pp18 - 24
- Tomlinson M.J.: 1980 'Foundation Design and Construction' Fourth Edition. Pitman pp 758 - 759

APPENDIX 2

RECORDS OF FIELD WORK

:

APPENDIX 2.1

BOREHOLE RECORD SHEETS

STRATA
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LIMITED

CABLE PERCUSSION RECORD SHEET

Location Proposed Lidl Supermarket, Mirfield
Client Lidl UK Properties GmbH

Borehole No. BH1A
Sheet 1 of 1

Job No:
7880
Project Ref.:

Equipment and methods
Casing Diameter (mm)
Casing Depth (m)

Drilled by RC
Ground level m AOD
Co-ordinates E N
Date 10/10/94

CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Volug				
							MADE GROUND (brick concrete and reinforcing wire)	(1.00)		
							MADE GROUND (concrete)	1.00 (0.20)		
							MADE GROUND (brown sandy gravel)	1.20 (0.20)		
							MADE GROUND (concrete)	1.40 (0.20)		

Remarks
1) Starter pit dug to 2.00m X 1.00m X 1.00m deep (3 hours).
2) Chiselling concrete (4 hours)

Logged by GH
Checked by
Approved by
FIG No.

Scale 1:50

STRATA SURVEYS LIMITED

CABLE PERCUSSION RECORD SHEET

Location Proposed Lidl Supermarket, Mirfield
Client Lidl UK Properties GmbH

Borehole No. BH1

Sheet 1 of 4

Job No:
7880

Project Ref.:

Equipment and methods Shell & Auger/Rotary Open Hole

Casing Diameter (mm) 150

100

Casing Depth (m) 5.50

19.00

Drilled by RC

Ground level

m AOD

Co-ordinates E

N

Date 11/10/94

CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Value Cu				
							MADE GROUND (ash and brick)	(0.90)		
1.20	nil		1.20	1.65	S 1	7.0	Loose brown silty fine grained SAND.	0.90 (0.60)		
1.80	nil	25	1.80	2.15	U 1	42	Firm brown mottled dark brown very sandy CLAY.	1.50 (0.80)		
2.30	damp		2.30	2.30	D 1			2.30		
2.50	wet	2.50 rise	2.50	2.50	V 1		Loose brown slightly clayey silty fine SAND	(1.10)		
2.70	wet,		2.70	3.15	S 2	5.0				
3.20	wet		3.20	3.20	D 2			3.40		
3.40	wet		3.40	3.40	D 3	10	Loose brown slightly clayey sandy fine to coarse GRAVEL with occasional cobbles.	(0.50)		
3.50	wet		3.50	3.95	S 3			3.90		
4.00	wet		4.00	4.00	D 4		Loose brown medium to coarse SAND with occasional fine to medium gravel.	(0.30)		
4.30	damp		4.30	4.75	S 4	12	Yellowish brown grey sandy CLAY with much fragments of mudstone (completely weathered mudstone)	(0.80)		
4.80	damp		4.80	4.80	D 5			5.00		
5.10	nil	130	5.10	5.30	U 2		Grey moderately weathered MUDSTONE.	(2.00)		
5.50	nil		5.50	5.60	D 6	200				
5.50	nil		5.80	6.10	S 5					
5.50	nil		6.80	7.05	S 6	300	End of Shell and Auger to 7.00m Continue with open hole rotary drilling	0 7.30		
			7.00	11.60	D 7		Grey MUDSTONE (Continued.....)			

Remarks

- 1) Starter pit dug to 1.00m X 1.00m X 1.20m deep (1 hour).
- 2) Water struck at 2.50m with no rise after 20 minutes
- 3) Rotary Open Hole Drilled from within Shell and Auger Borehole from 5.90m.
- 4) Gas monitoring well installed to 4.00m.
- 5) VL at completion of rotary drilling 2.75m.

Logged by

GH

Date

30/08

Checked by

Approved by

FIG No.

Scale 1:50

STRATA SURVEYS LIMITED			CABLE PERCUSSION RECORD SHEET Location Proposed Lidl Supermarket, Mirfield Client Lidl UK Properties GmbH					Borehole No. BH1 Sheet 3 of 4		
Job No: 7880 Project Ref.:			Equipment and methods Shell & Auger/Rotary Open Hole Casing Diameter (mm) 150 100 Casing Depth (m) 5.50 19.00					Drilled by RC Ground level m AOD Co-ordinates E N Date 11/10/94		
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Value				
							(...cont.)			
			21.6	23.60	D 11		Grey brown MUDSTONE, soft	21.6 (0.20)		
							Grey brown banded hard and soft MUDSTONE.	21.8 (0.70)		
							Grey fine to coarse SANDSTONE, hard	22.5		
							(Continued.....)			
			23.6	25.60	D 12					
			25.6	40.00	D 13					
Remarks								Logged by Checked by Approved by		Date
Scale 1:50								FIG No.		

[illegible]

STRATA SURVEYS LIMITED		CABLE PERCUSSION RECORD SHEET				Borehole No. BH2			
Job No: 7880		Location Proposed Lidl Supermarket, Mirfield				Sheet 1 of 4			
Project Ref.:		Equipment and methods Shell & Auger/Rotary Open Hole				Drilled by RC			
		Casing Diameter (mm) 150				Ground level m AOD			
		Casing Depth (m) 4.80				Co-ordinates E M			
						Date 12/10/93			
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS			Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) From	to	SAMPLE Type & No				
0.00	nil	35	0.50	0.50	U 1	MADE GROUND (concrete) Dense yellowish brown clayey fine to medium SAND with much fine to coarse gritstone.	0.20		
1.20	nil		1.00	1.00	D 1		1.50		
			1.20	1.65	S 1				
			1.70	1.70	D 2	Stiff yellowish brown slightly sandy CLAY with some sandstone fragments.	1.70		
2.20	nil	100	2.20	2.60	U 1				
			2.70	2.70	D 3				
3.50	nil	54	3.30	3.75	U 2	Grey moderately weathered SILTSTONE, very weak	4.30		
			3.80	3.80	D 4				
4.30	nil	130	4.30	4.55	U 3				
			4.80	4.80	D 5	End of Shell and Auger to 3.90m Continue with open hole rotary drilling	5.90		
4.80	nil		5.00	5.12	S 2				
			5.50	5.50	D 6				
4.80	nil		5.70	5.79	S 3	Grey MUDSTONE (Continued.....)			
			6.00	9.00	D 7				
			9.00	10.75	D 8				

Remarks

1) No water encountered during shell and auger drilling.
2) Chiselling 1 hour.
3) Drilled from within Shell and Auger Borehole from 5.90m.
4) Gas monitoring well installed to 3.90m.
5) VL at completion of rotary drilling 5.10m.

Logged by

GH

Date

30/08

Checked by

Approved by

FIG No.

Scale 1:50

tion Proposed Lidl Supermarket, Mirfield
: Lidl UK Properties GmbH

Sheet 2 of 4 .

Ground level m AOD

Co-ordinates E N

Date 12/10/93

	Logged by	Date
	Checked by	
	Approved by	
	FIG No.	

Sheet 3 of 4 .

1 level m 100

Notes E N

12/10/93

Logged by	Date
Checked by	
Approved by	
FIG No.	

STRATA SURVEYS LIMITED		CABLE PERCUSSION RECORD SHEET				Borehole No. BH3				
Location Proposed Lidl Supermarket, Mirfield		Client Lidl UK Properties GmbH				Sheet 1 of 4				
Job No: 7880		Equipment and methods Shell & Auger Rotary Open Hole				Drilled by RC				
Project Ref.:		Casing Diameter (mm) 150 100				Ground level m AOD				
		Casing Depth (m) 4.00 8.75				Co-ordinates E N				
						Date 13/10/94				
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Value				
0.50	nil	130	0.50	0.95	S 1	22	MADE GROUND (100mm tarmac over limestone hardcore)	0.20		[Cross-hatched pattern]
			1.00	1.00	D 1		MADE GROUND (brick concrete and sandstone mortar with occasional fragments of wood)			
1.50	nil		1.50	1.95	S 2	17				
			2.00	2.00	D 2			(3.70)		
2.50	nil		2.50	2.95	S 3	8.0				
			3.00	3.00	D 3					
3.50	nil		3.50	3.95	S 4	28				
			4.00	4.00	D 4		Grey laminated highly weathered MUDSTONE, with much brown staining.	3.90		
4.00	nil		4.10	4.45	U 1			(0.90)		
			4.60	4.60	D 5	248				
4.00	nil		4.70	4.93	S 5			4.80		
			4.90	4.99	S 6	999	Brown fine to medium moderately weathered SANDSTONE	(0.20) 5.00		
			5.30	7.55	D 6		Brown grey completely weathered MUDSTONE. End of Shell and Auger to 5.00m Continue with open hole rotary drilling	()		
		7.55	8.75	D 7		Grey highly weathered MUDSTONE	7.55			
		8.75	8.75	D 8		Grey MUDSTONE (Continued.....)	(1.20) 8.75			

Remarks

- 1) No water encountered during shell and auger drilling.
- 2) Chiselling 1 hour.
- 3) Drilled from within Shell and Auger Borehole from 5.90m.
- 4) Gas monitoring well installed to 3.80m.
- 5) VL at completion of rotary drilling 5.28m.

Logged by GH Date 30/08

Checked by

Approved by

FIG No.

Scale 1:50

STRATA SURVEYS LIMITED		CABLE PERCUSSION RECORD SHEET				Borehole No. BH3			
Job No: 7880		Location Proposed Lidl Supermarket, Mirfield				Sheet 2 of 4			
Project Ref.:		Equipment and methods Shell & Auger/Rotary Open Hole				Drilled by RC			
		Casing Diameter (mm) 150 100				Ground level m AOD			
		Casing Depth (m) 4.00 8.75				Co-ordinates E N			
						Date 13/10/94			
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS			Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No				
			11.7	14.75	D 10	(...cont.)			
			14.7	16.70	D 11				
			16.7	17.00	D 12				
			17.0	18.60	D 13	COAL	16.7 (0.30)		
						Dark brown grey MUDSTONE	17.0		
							(1.60)		
			18.6	24.00	D 14	Grey MUDSTONE	18.5		
						(Continued.....)			
Remarks							Logged by		Date
							Checked by		
							Approved by		
							FIG No.		

Scale 1:50

STRATA SURVEYS LIMITED			CABLE PERCUSSION RECORD SHEET				Borehole No. BH3			
			Location Proposed Lidl Supermarket, Mirfield				Sheet 3 of 4.			
Job No: 7880			Equipment and methods Shell & Auger: Rotary Open Hole				Drilled by RC			
Project Ref.:			Casing Diameter (mm) 150		100		Ground level m AOD			
			Casing Depth (m) 4.00		8.75		Co-ordinates E N			
							Date 13/10/94			
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Value				
							(...Cont.)			
			24.0	27.00	D 15			(11.0)		
			27.0	29.80	D 16					
			29.8	33.00	D 17		Grey SANDSTONE, hard	29.6		
							(Continued.....)			
Remarks								Logged by		Date
								Checked by		
								Approved by		
								FIG No.		
Scale 1:50										

STRATA SURVEYS LIMITED			CABLE PERCUSSION RECORD SHEET Location Proposed Lidl Supermarket, Mirfield Client Lidl UK Properties GmbH					Borehole No. BH3 Sheet 4 of 4		
Job No: 7880 Project Ref.:			Equipment and methods Shell & Auger-Rotary Open Hole Casing Diameter (mm) 150 100 Casing Depth (m) 4.00 8.75					Drilled by RC Ground level m AOD Co-ordinates E N Date 13/10/94		
CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS				Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
			Depth (m) from	to	SAMPLE Type & No	SPT N Value				
							(....Cont.)			
			33.4	36.50	D 18		Mudstone bands within sandstone (0.10m - 0.20m thick)	0		
			36.5	40.00	D 19			(10.4)		
								40.0		
							borehole complete			
Remarks								Logged by		Date
								Checked by		
								Approved by		
								FIG No.		
Scale 1:50										

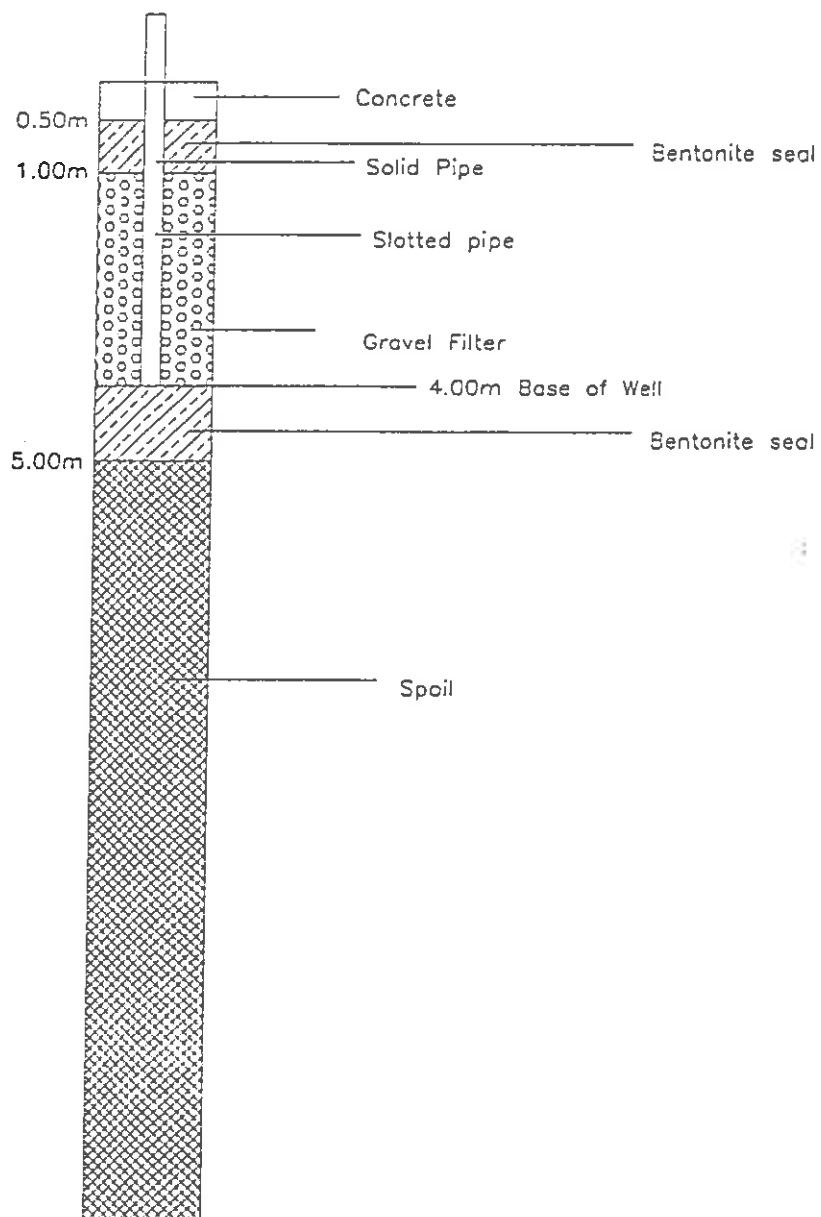
APPENDIX 2.2

METHANE WELL DETAILS

:

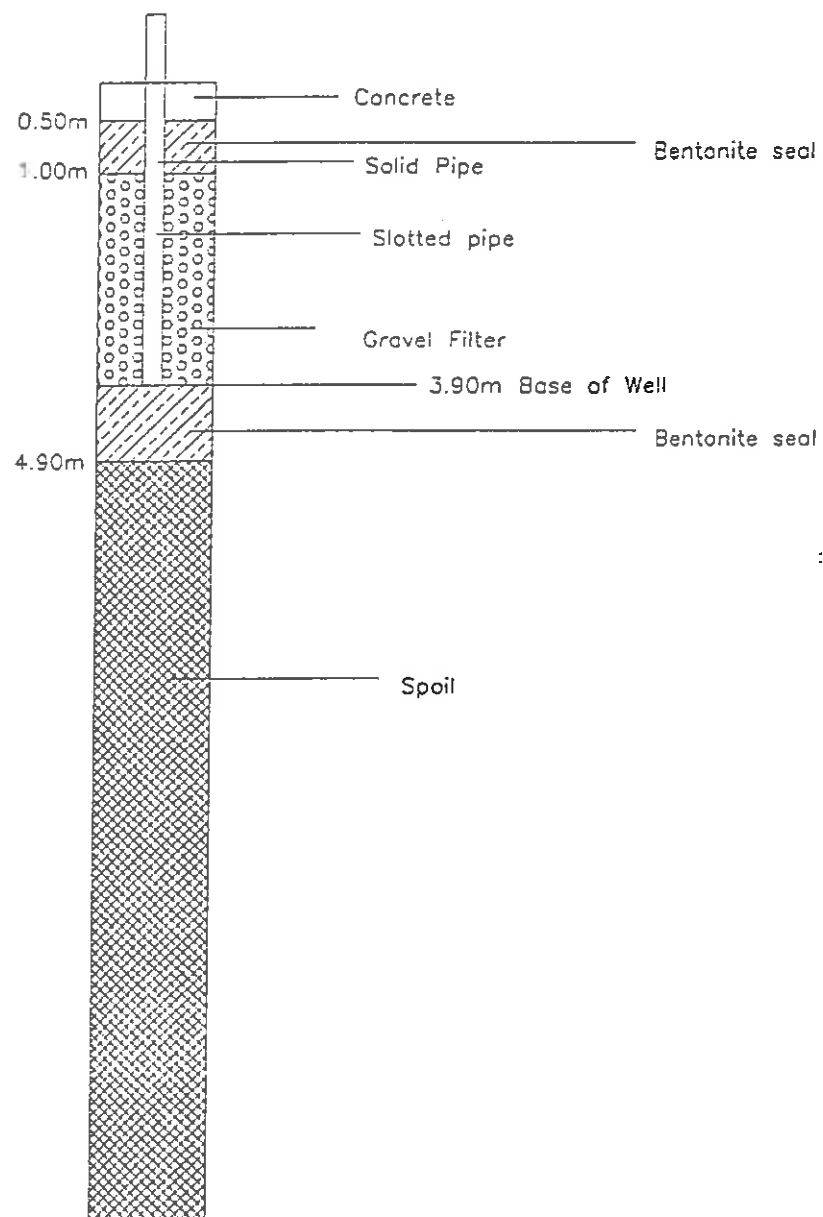
LIDL Superstores, Mirfield.
Job No 7880
HTC Management
Well Installation Details

Borehole 1



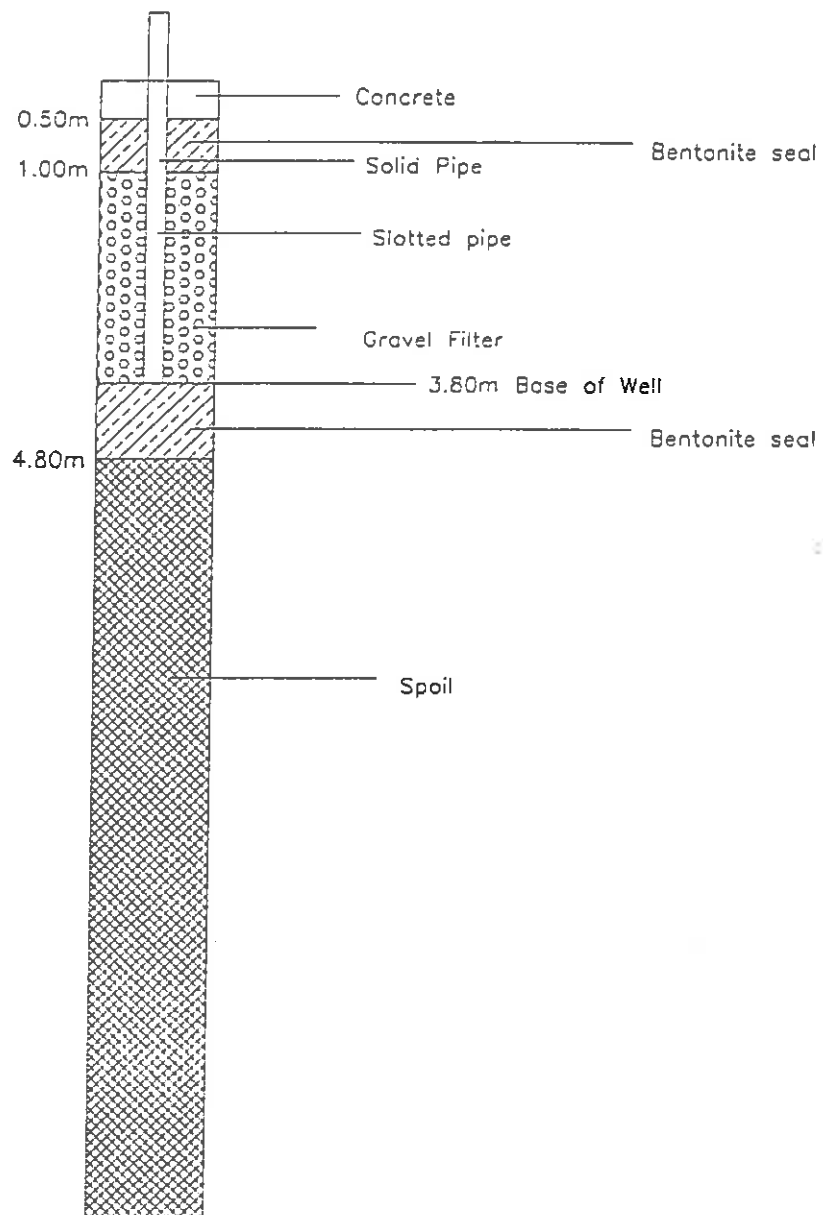
LIDL Superstores, Mirfield.
Job No 7880
HTC Management
Well Installation Details

Borehole 2



LIDL Superstores, Mirfield.
Job No 7880
HTC Management
Well Installation Details

Borehole 3



APPENDIX 2.3

TRIAL PIT RECORD SHEETS

[illegible]

Field Records		Samples		DESCRIPTION OF STRATA	Reduced Level m AOD	Strata Legend	Depth (Thickness) m
Cohesion (kN/m ²)	Depth (m)	Type	No				
	0.00		D 1	MADE GROUND (pinkish white hardcore)			0.00
	0.90		D 1	MADE GROUND (Yellowish brown sandy fine to coarse gravel)			0.90
	1.20		D 2	MADE GROUND (dark green black ash brick fill with bands of yellowish brown mottled black clay)			1.20
	1.36		V 1				1.36
	1.70		D 3	MADE GROUND (Black clay with some ash fragments with a very strong diesel odour)			1.70
	2.00		D 4	Soft grey mottled black slightly sandy CLAY with strong diesel odour.			2.00
				Trial Pit complete			

Scale 1:50

Trial Pit excavated using a mechanical excavator.

Remarks

Pipe uncovered by pit side collapse at 1.50m sloping diesel into surrounding soil which is black in colour with a large stretch of diesel coming from the stratum below.

Plan

Logged By	CH	DATE
Checked By:		
Approved By:		
FIG No.		

2

Strata Surveys Limited		Client: Ltd UK Properties GmbH Location Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL P1		Job No. 7880		Ground Level Co-ordinates E N		(m AOD)		Trial Pit No. TP4	
		Field Records Cohesion(kN/m2)		Samples Depth (m) Type & No		DESCRIPTION OF STRATA		Reduced Level m AOD		Strata Legend		Depth (Thickness) m	
												(0.88)	
												0.80	
												(0.90)	
												1.70	
						HADE GROUND (dark brown ash topsoil with brick fragments and large sandstone slabs)						(0.88)	
												0.80	
												(0.90)	
												1.70	
												(0.64)	
						Firm grey sandy CLAY, becoming brown and sandier from 1.00m						2.30	
												2.10	
												(0.90)	
												1.70	
												(0.64)	
						Compact brown clayey fine to medium SAND						2.30	
												2.10	
												(0.90)	
												1.70	
												(0.64)	
						Compact brown slightly clayey fine to medium SAND and fine to medium GRAVEL.						2.30	
												2.10	
												(0.90)	
												1.70	
												(0.64)	
						Trial Pit complete						2.30	
												2.10	
												(0.90)	
												1.70	
												(0.64)	

Scale 1:50

Trial Pit excavated using a mechanical excavator.

Remarks

Water struck at 2.25m with water standing at 2.25m and depth of hole at 2.50m.

Plan

Logged By	GH	DATE
Checked By:		
Approved By:		
FIG No.		

Strata Surveys Limited	Client: Ltd UK Properties GmbH Locallon Proposed Ltd Supermarkt, Mirfield	MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	Trial Pit No. (m AOD)	TP7	
Project Ref:		Field Records		DESCRIPTION OF STRATA		Reduced Level m AOD	Strata Legend	Depth (Thickness) m
		Cohesion(kN/m2)		MADE GROUND (brown sand brick and occasional concrete fragments)				10.34
		Depth (m)		Dense brown clayey fine to medium SAND and angular fine to coarse GRAVEL with occasional cobbles and boulders				0.50
		Type & No		Light brown CLAY with much fragments of mudstone and siltstone (completely weathered bedrock)				2.45 0.2 2.25
		0.00 1.00 2.00 2.50		0.1 0.2 0.1 0.2		Trial Pit complete		
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks No water encountered during excavation.				
						Logged By GH Checked By: Approved By: FIG No.		

Strata Surveys Limited	Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield	MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EXCAVATED TRIAL PIT		Job No. 7880	Ground Level Co-ordinates E N	(m AOD)	Trial Pit No. TP8
Field Records Sample Cohesion(kN/m²) Depth (m) Type & No		DESCRIPTION OF STRATA MADE GROUND (brown clayey topsoil with brick and concrete fragments) MADE GROUND (black cinder ash) Trial Pit complete		Reduced Level m AOD	Strata Legend	Depth (Thickness) m 0.40 0.40 41.00 0.50	
Scale 1:50		Plan		Trial Pit excavated using a mechanical excavator. Remarks Steel pipe at 1.50m no odour of diesel.			
Client: Ltd UK Properties GmbH Location: Proposed Ltd Supermarket, Mirfield		MACHINE EX					

APPENDIX 2.4

GAS READINGS

Proposed Lidl Supermarket, Mirfield, Huddersfield
Gas Monitoring Results
Job No 7880

Date	Atmospheric Pressure	Borehole1		Borehole2		Borehole3	
	mbar	%LEL	%CO2	%LEL	%CO2	%LEL	%CO2
25/10/94	994	0	0	0	0	0	0
01/11/94	1015	0	0	0	0	0	0

APPENDIX 3

LABORATORY TEST RESULTS

APPENDIX 3.1

SUMMARY OF TEST RESULTS

			Classification				Triaxial Compression								Chemical				Additional			
Location Number	Sample Type No.	Depth m	Description	LL	PL	PI	% Passing 425µm	Moisture Content %	Bulk Density Mg/m³	Size mm Type	Lateral Pressure kPa	Deviator Stress kPa	Shear Cohesion kPa	Friction Angle	pH	SO4 % D.W	SO4 g/l	Cl₂ %	Grading	Oedometer	Hand Pene.	Others
BH1	S1	1.20	Brown very sandy silty CLAY with occasional fine to medium gravel												7.6	0.05			•			
BH1	U1	1.80	brown mottled dark brown sandy CLAY.	41	22	19	98	26	1.91	100 MS	20 40 80	62 83 106	15 42	20 0								
BH1	W1	2.50	WATER												7.6		1.65		•			
BH1	S2	2.70	Brown very sandy silty CLAY																			
BH1	S3	4.30	Brown grey silty clayey fine to coarse SAND with much fine to coarse gravel																•			
BH1	S4	4.30	Grey very sandy CLAY with some fine to medium gravel	33	18	15	55	24														
BH2	D1	1.00	yellow brown sandy CLAY with much fine to coarsegravel.	26	17	9	19								7.6	0.05						
BH2	U1	2.20	yellowish brown sandy CLAY with some fine tocoarse gravel and fragments of sandstone.					11	2.22	100 MS	25 50 100	175 239 335	28 125	35 0								
BH2	U2	3.30	yellowish brown sandy CLAY with fine to coarsegravel and sandstone fragments.	28	19	9	50	14	2.22	100 MS	35 70 140	92 132 190	18 69	22 0								
BH2	U3	4.30	Orange brown grey mottled completely weathered MUDSTONE .					19	2.14	100 MS	45 90 180	148 212 281	26 107	25 0								
BH3	D1	1.00	Made Ground (brick)												8.0	0.45	0.37					
BH3	S3	2.50	Made Ground (brown sandy brick)												8.2	0.78						
TP1	B1	0.00	Dark brown fine to coarse SAND and GRAVEL.					14	2.06													CBR
TP1	D1	1.00	Made Ground (brown sand and gravel)																			
TP2	D1	0.00	Made Ground (grey fine to coarse gravel)					7.1	2.43						7.3	0.35	0.22					CBR
TP3	B1	0.00	Made Ground (Brown grey fine to coarse clay and gravel)					13	2.24						.							CBR

STRATA SURVEYS LIMITED

Client: HTC Project Management

Site Name: Proposed Lidl Supermarket, Mirfield

Job No. 7880

Laboratory Test Result Summary

Location Number	Sample Type No.	Depth m	Description	Classification			Triaxial Compression							Chemical				Additional					
				LL	PL	PI	% Passing 425µm	Moisture Content %	Bulk Density Mg/m³	Size num Type	Lateral Pressure kPa	Deviator Stress kPa	Shear Cohesion kPa	Friction Angle	pH	SO4 % D.W	SO4 g/l	Cl₂ %	Grading	Oedometer	Hand Pene.	Others	
TP4	B 1	0.00	Made Ground (Black fine to coarse gravel and cinder)					17	2.06						10.0	0.11							CBR
TP5	B 1	0.20	Made Ground (brown black fine to coarse cinder and brick)					18	2.04														CBR
TP6	B 2	1.00	Made Ground (brown sandy brick)																				
TP7	B 1	0.00	Brown clayey fine to coarse SAND with much fine to coarse gravel												8.1	0.31	0.31						
															8.1	0.03							

APPENDIX 3.2

TRIAxIAL COMPRESSION TESTS

MOHRS CIRCLES

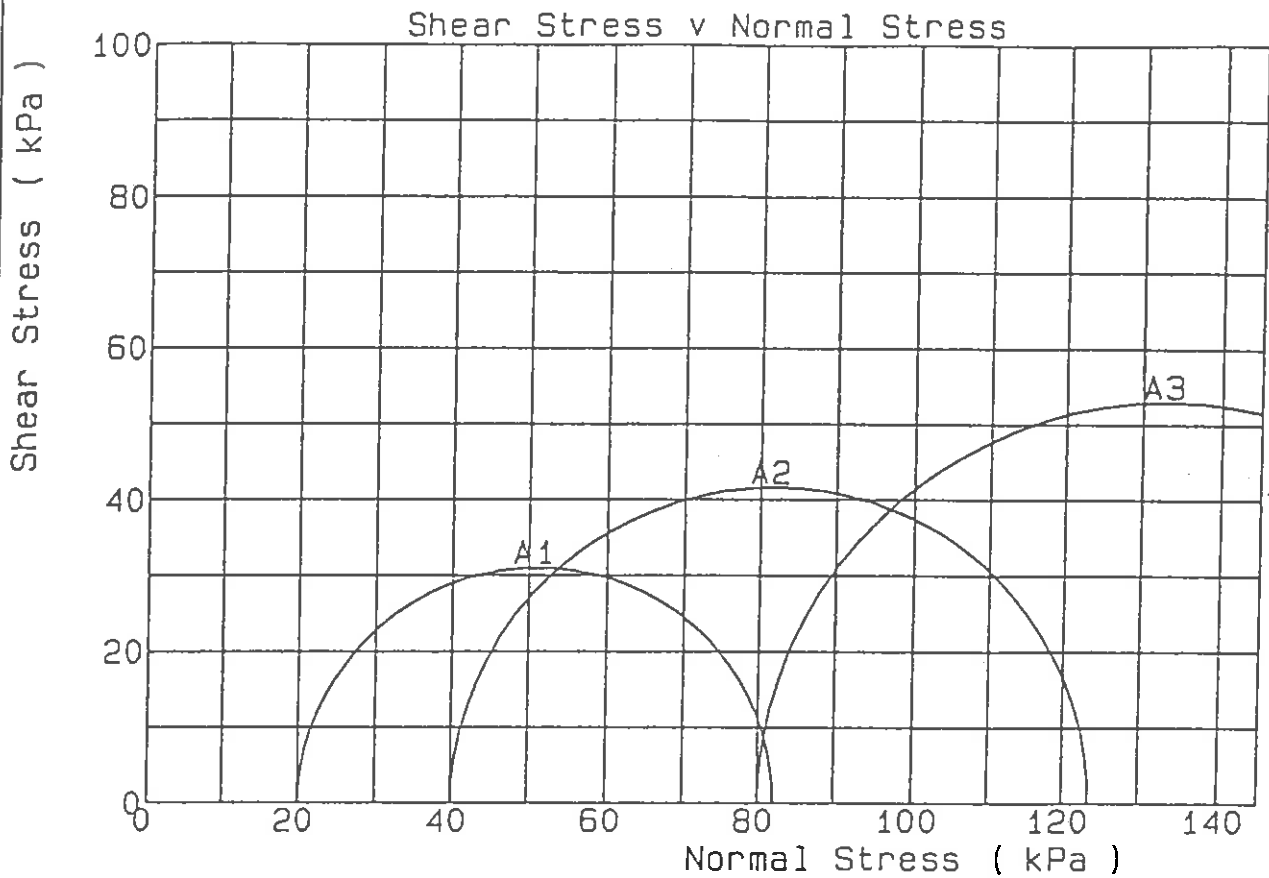
Job: 7880

Triaxial UnDrained Shear

BoreHole: 1

Sample: U1/2/A

Depth: 1.80-2.15m



<u>Reference</u>		A0	A0	A0
Height	mm	202.0	202.0	202.0
Diameter	mm	102.0	102.0	102.0
Bulk density	Mg/cum	1.906	1.906	1.906
Moisture content	%	26.00	26.00	26.00
Dry density	Mg/cum	1.513	1.513	1.513
Cell pressure	kPa	20	40	80
Loading rate	mm/min	3.901	3.810	3.768
Shear Stress *	kPa	31.0	41.7	53.1
Strain *	%	9.6	1.1	1.2

* At maximum deviator stress

Cohesion (c) 15 or 42 kPa

Angle of shear resistance (phi) 20 0 deg

Strata Surveys ltd.

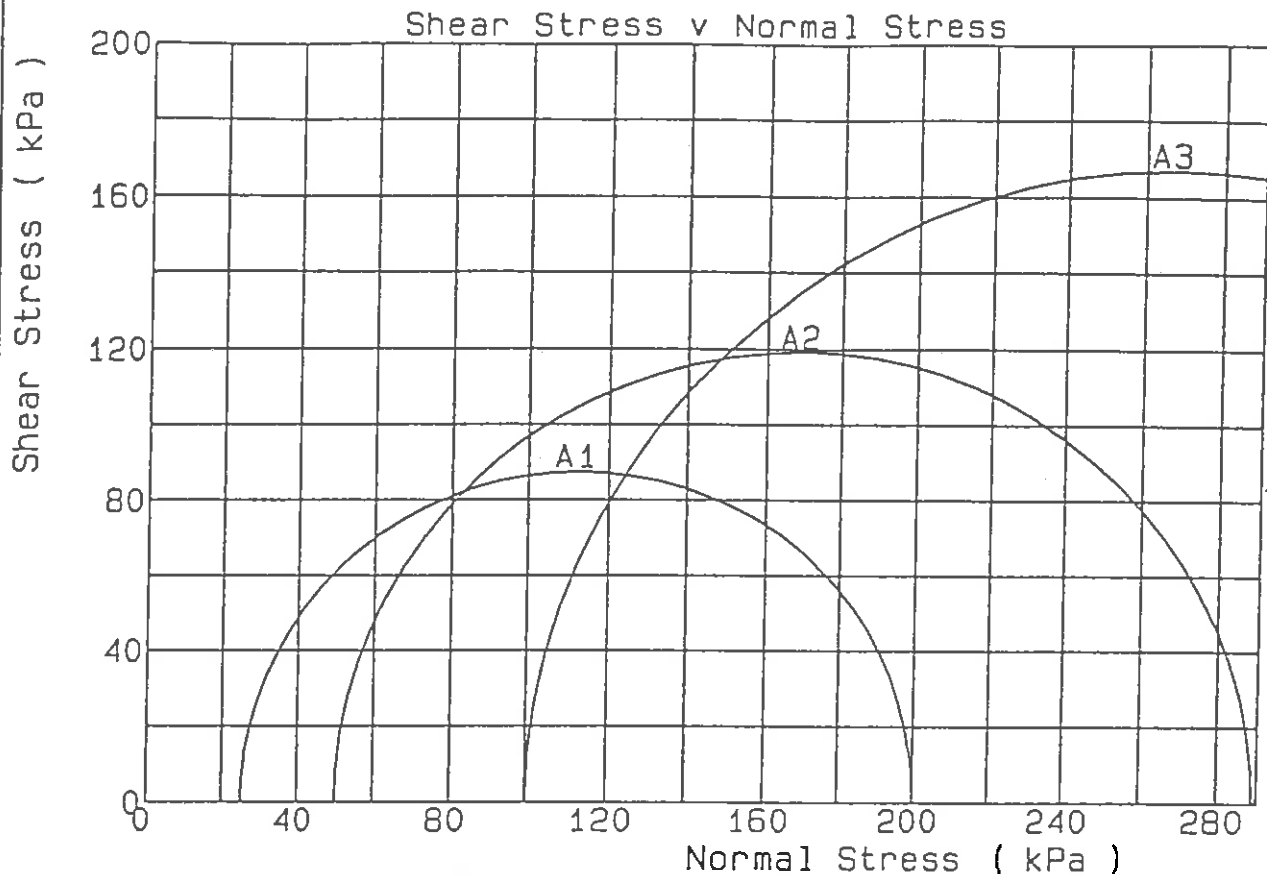
Job: 7880

Triaxial UnDrained Shear

BoreHole: 2

Sample: U1/19/A

Depth: 2.2-2.60m



Reference		A0	A0	A0
Height	mm	202.0	202.0	202.0
Diameter	mm	102.0	102.0	102.0
Bulk density	Mg/cum	2.223	2.223	2.223
Moisture content	%	11.00	11.00	11.00
Dry density	Mg/cum	2.003	2.003	2.003
Cell pressure	kPa	25	50	100
Loading rate	mm/min	3.979	3.850	3.743
Shear Stress *	kPa	87.5	119.4	167.3
Strain *	%	7.9	1.3	1.4

* At maximum deviator stress

Cohesion (c) 28 or 125 kPa

Angle of shear resistance (phi) 35 0 deg

Strata Surveys ltd.

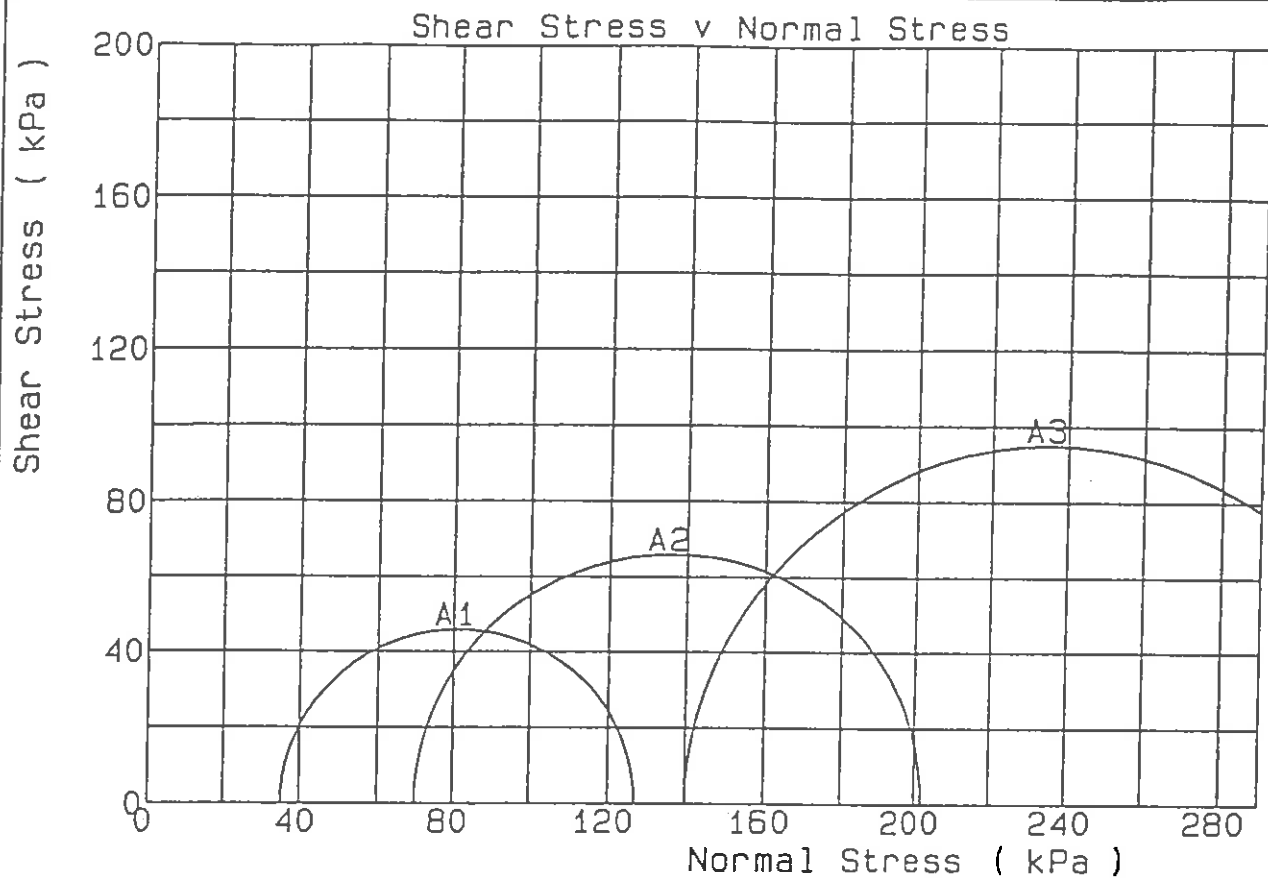
Job: 7880

Triaxial UnDrained Shear

BoreHole: 2

Sample: U2/21/A

Depth: 3.3-3.75m



Reference		A0	A0	A0
Height	mm	202.0	202.0	202.0
Diameter	mm	102.0	102.0	102.0
Bulk density	Mg/cum	2.221	2.221	2.221
Moisture content	%	14.00	14.00	14.00
Dry density	Mg/cum	1.948	1.948	1.948
Cell pressure	kPa	35	70	140
Loading rate	mm/min	3.876	3.797	3.564
Shear Stress *	kPa	46.0	66.0	95.0
Strain *	%	7.1	0.9	1.0

* At maximum deviator stress

Cohesion (c) 18 or 69 kPa

Angle of shear resistance (phi) 22 0 deg

Strata Surveys ltd.

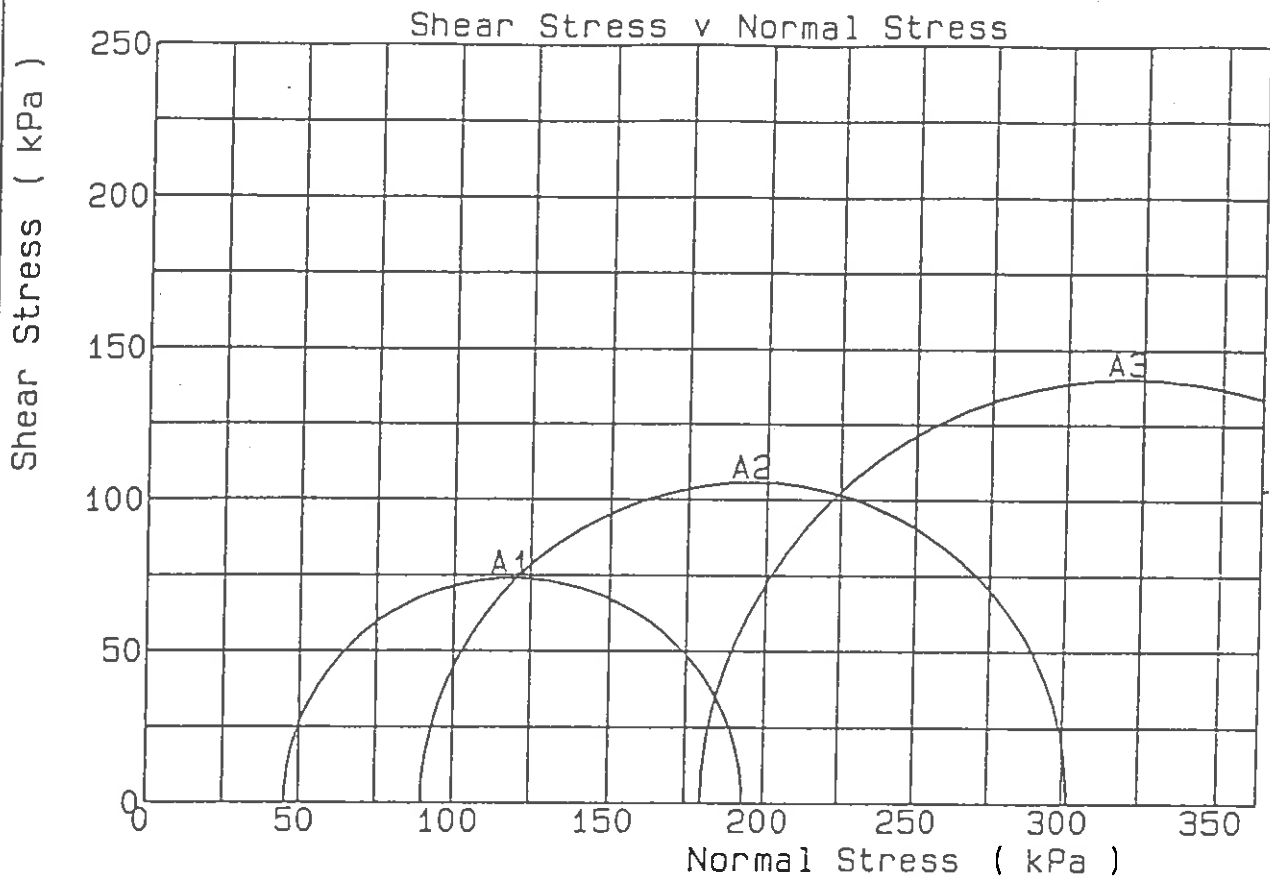
Job: 7880

Triaxial UnDrained Shear

BoreHole: 2

Sample: U3/23/A

Depth: 4.3-4.55m



Reference		A0	A0	A0
Height	mm	202.0	202.0	202.0
Diameter	mm	102.0	102.0	102.0
Bulk density	Mg/cum	2.138	2.138	2.138
Moisture content	%	19.00	19.00	19.00
Dry density	Mg/cum	1.797	1.797	1.797
Cell pressure	kPa	45	90	180
Loading rate	mm/min	4.012	3.897	3.849
Shear Stress *	kPa	74.1	105.8	140.3
Strain *	%	13.2	1.7	2.1

* At maximum deviator stress

Cohesion (c) 25 or 107 kPa

Angle of shear resistance (phi) 25 0 deg

Strata Surveys ltd.

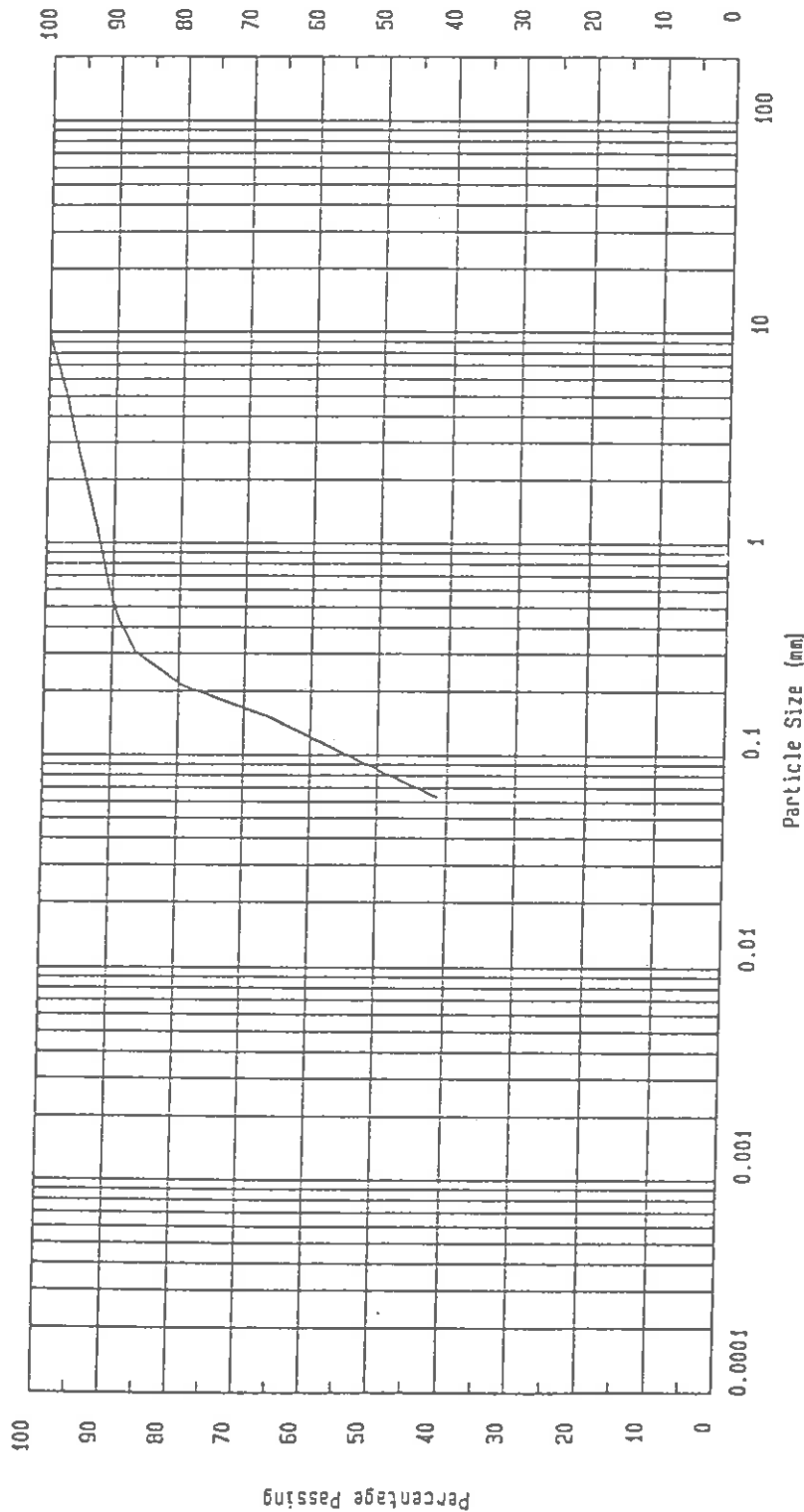
APPENDIX 3.3

PARTICLE SIZE DISTRIBUTION TESTS

Strata Surveys Limited

Particle Size Distribution

B.S.1377 (1990) Part 2 Test 9.3 : Dry sieving



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Client : HTC Project Management

Location : Mirfield

Job Number : 7880

Borehole Number : 1

Sample Number : S1

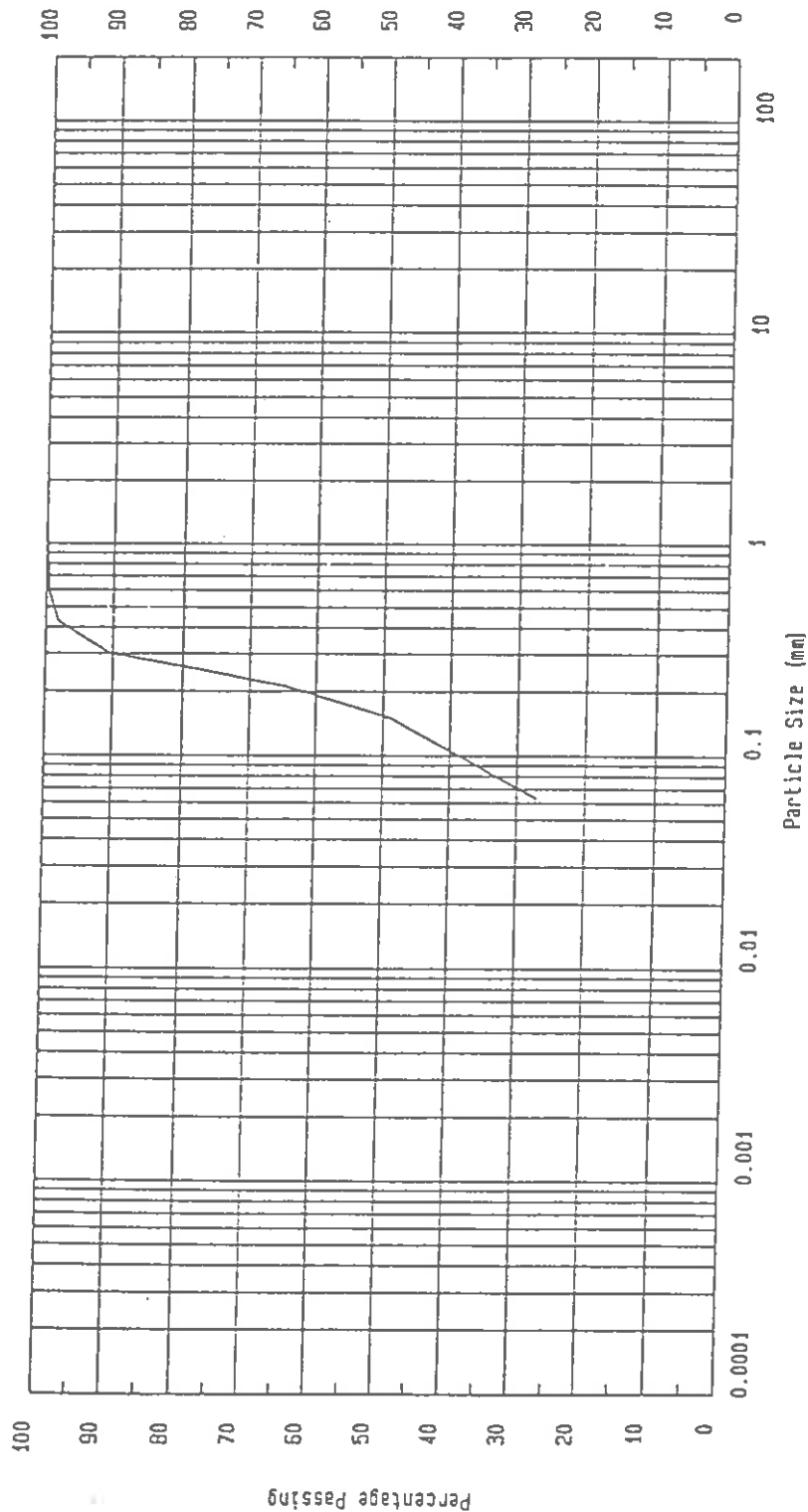
Depth : 1.20m

Sample Description :
Brown very sandy silty CLAY with occasional
fine to medium gravel.

Strata Surveys Limited

Particle Size Distribution

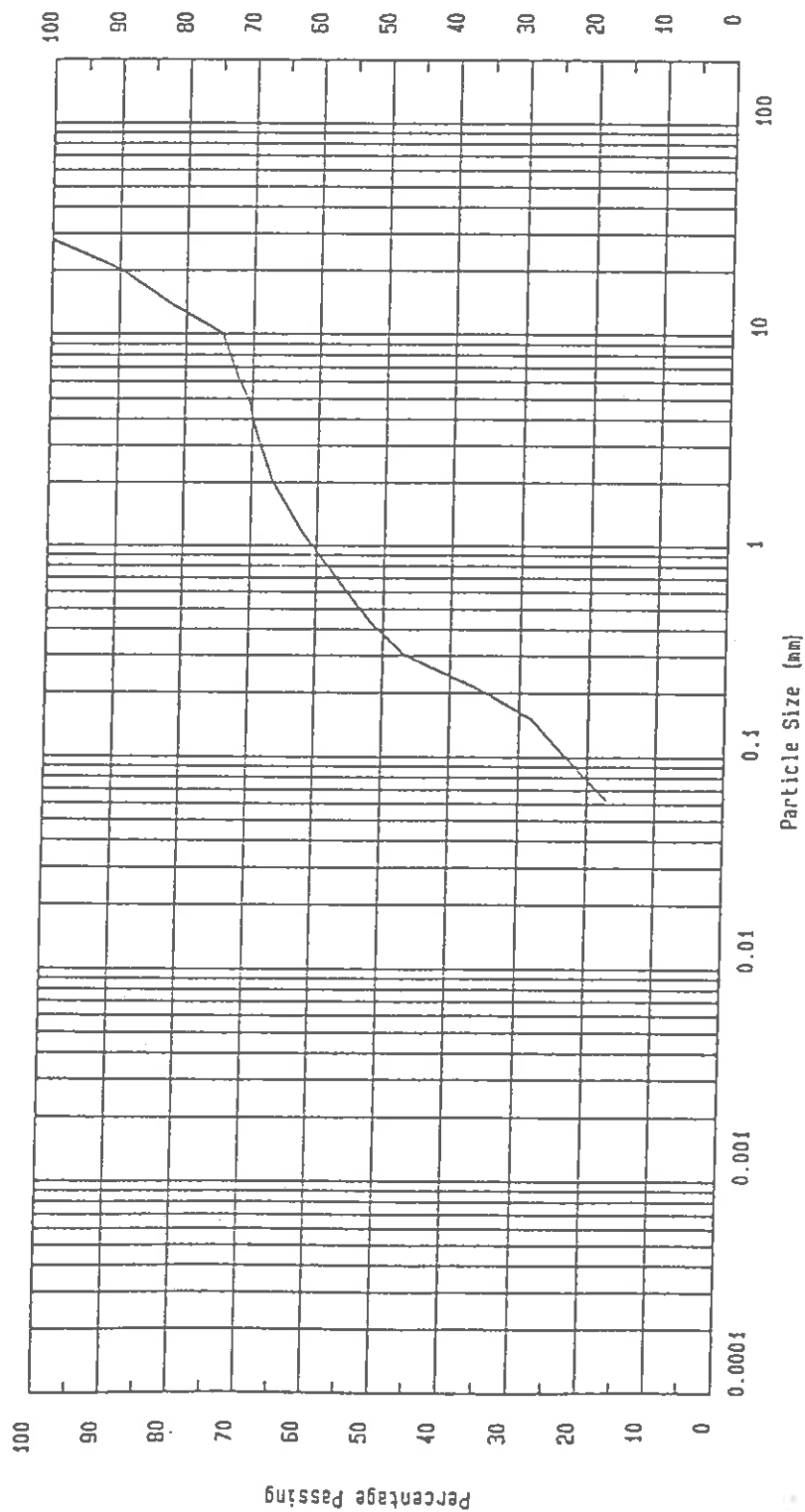
B.S.1377 (1990) Part 2 Test 9.3 : Dry sieving



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Client : HTC Project Management
 Location : Mirfield
 Job Number : 7880
 Borehole Number : 1
 Sample Number : S2
 Depth : 2.70m

Sample Description :
 Brown silty very sandy CLAY



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Client : HTC Project Management

Location : Mirfield

Job Number : 7880

Borehole Number : 1

Sample Number : S3

Depth : 3.50m

Sample Description :
Brown grey silty clayey fine to coarse SAND
with much fine to coarse gravel.

B.S.1377 TEST 7B (Dry Sieving)

Contract Name : HTC Project Management
Location : Mirfield
Job Number : 7880 Borehole Number : 1
Sample Number : S1 Depth : 1.20m
Operator : Date : 31 October 1994

Description
Brown very sandy silty CLAY with occasional fine to medium gravel.

Initial total dry weight : 131.90 gms

B.S. Sieve Size	Weight Retained gms	Total Weight Retained	Percent Retained	Cummulative Percentage Passing
28.0 mm	0	0	0.00	100.00
20.0 mm	0	0	0.00	100.00
14.0 mm	0	0	0.00	100.00
10.0 mm	0	0	0.00	100.00
6.30 mm	2.4	2	1.82	98.18
5.00 mm	1.2	1	0.91	97.27
3.35 mm	1.6	2	1.21	96.06
2.00 mm	2.3	2	1.74	94.31
1.18 mm	2.3	2	1.74	92.57
600 micron	2.70	3	2.05	90.52
425 micron	2.10	2	1.59	88.93
300 micron	3.40	3	2.58	86.35
212 micron	9.20	9	6.97	79.38
150 micron	17.70	18	13.42	65.96
63 micron	32.40	32	24.56	41.39

Sample passing B.S. 63 micron
Sample washed and / or collected in pan.)
Difference between calculated and measured weight of dry material passing
63 micron sieve is 54.60 gms

B.S.1377 TEST 7B (Dry Sieving)

Contract Name : HTC Project Management
 Location : Mirfield
 Borehole Number : 7880 Borehole Number : 1
 Sample Number : S2 Depth : 2.70m
 Operator : Date : 31 October 1994

Description
 Brown silty very sandy CLAY.

Initial total dry weight : 200.00 gms

B.S. Sieve Size	Weight Retained gms	Total Weight Retained	Percent Retained	Cummulative Percentage Passing
28.0 mm	0	0	0.00	100.00
20.0 mm	0	0	0.00	100.00
14.0 mm	0	0	0.00	100.00
10.0 mm	0	0	0.00	100.00
6.30 mm	0.0	0	0.00	100.00
5.00 mm	0.0	0	0.00	100.00
3.35 mm	0.0	0	0.00	100.00
2.00 mm	0.0	0	0.00	100.00
1.18 mm	0.0	0	0.00	100.00
600 micron	0.80	1	0.40	99.60
425 micron	3.00	3	1.50	98.10
300 micron	15.00	15	7.50	90.60
212 micron	51.70	52	25.85	64.75
150 micron	32.20	32	16.10	48.65
63 micron	42.90	43	21.45	27.20

Sample passing B.S. 63 micron
 Sample washed and / or collected in pan.)
 Difference between calculated and measured weight of dry material passing
 300 micron sieve is 54.40 gms

B.S.1377 TEST 7B (Dry Sieving)

Contract Name : HTC Project Management
Location : Mirfield
Job Number : 7880 Borehole Number : 1
Sample Number : S3 Depth : 3.50m
Operator : Date : 31 October 1994

Description
Brown grey silty clayey fine to coarse SAND with much fine to coarse gravel.

Initial total dry weight : 527.00 gms

B.S. Sieve Size	Weight Retained gms	Total Weight Retained	Percent Retained	Cummulative Percentage Passing
28.0 mm	0	0	0.00	100.00
20.0 mm	54	54	10.21	89.79
14.0 mm	38	38	7.27	82.52
10.0 mm	42	42	7.97	74.55
6.30 mm	12.8	13	2.43	72.13
5.00 mm	8.4	8	1.59	70.53
3.35 mm	7.5	8	1.42	69.11
2.00 mm	7.1	13	2.45	66.65
1.18 mm	12.6	23	4.35	62.30
600 micron	19.90	36	6.88	55.42
425 micron	10.70	19	3.70	51.73
300 micron	14.70	27	5.08	46.65
212 micron	29.70	54	10.26	36.39
150 micron	23.80	43	8.22	28.16
63 micron	31.70	58	10.95	17.21

Sample passing B.S. 3.35 mm
Sample riffled from 364.20 gms down to 200.00 gms
Difference between calculated and measured weight of dry material passing
3.35 mm sieve is 0.00 gms

Sample passing B.S. 63 micron
Sample washed and / or collected in pan.)
Difference between calculated and measured weight of dry material passing
63 micron sieve is 49.80 gms

APPENDIX 3.4

Results of Laboratory California Bearing Ratio Tests

BS1377:1990 Part 4 Method 7

Borehole No.	Depth m	California Bearing Ratio % Penetration (mm)					Moisture Content %	Bulk Density Mg/m ³
		Top		Bottom		av.		
		2.5	5.0	2.5	5.0			
TP1	0.5	61	125	125	129	110	14	2.06
TP2	0.5	24	25	26	51	25	7.1	2.43
TP3	0.5	0.9	1.6	1.2	1.6	1.3	13	2.24
TP4	0.5	9	17	11	16	13	17	2.06
TP5	0.5	12	20	13	7	15	18	2.04

APPENDIX 3.5

Chemical Contamination Tests

Description	BH 2 1.7m mg/kg	BH 3 1.2m mg/kg	TP2 1.2m mg/kg	TP2 1.7m mg/kg	TP5 2.0m mg/kg
Cadmium	0.7	0.7	0.7	0.7	0.7
Chromium	37	22	31	24	28
Copper	125	25	66	38	59
Lead	44	150	210	540	340
Nickel	100	13	25	16	24
Zinc	130	75	155	140	150
Mercury	0.27	0.27	0.27	0.27	0.27
Arsenic	4	4	5.3?	4	4
Selenium	0.1	0.1	0.1	0.1	0.1
Total Phenols	0.5	0.7	0.5	3?	0.5
Cyanide Total	1.5	1.5	3.2	16?	2.3
Sulphide	2	2	2	2	3.4
Total Extractables	130	130	130	130	130
Boron Hot Water Soluble	0.24	0.41	1.1	0.94	0.57
Solid Metal Preparation	1	1	1	1	1

*India
query with
HTC
DP.1.1*

APPENDIX 4

SITE PLAN

